

## **Biological Conservation xxxx (2015) xxx-xxx**

### **Discussion**

#### **Voluntary non-monetary approaches for implementing conservation**

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## **Abstract**

The voluntary non-monetary approach to conservation refers to actions that citizens or organizations could voluntarily implement in their area of influence without the incentive of monetary compensations. To be effectively implemented by untrained actors, actions should be clearly defined, straightforward to implement and not require specific scientific knowledge. The costs of actions should also be sufficiently affordable to be widely applied without monetary incentives. A voluntary non-monetary approach has so far not been clearly described as a distinct group of tools for nature conservation. Here we review the scarce scientific literature on the topic. To illustrate the applicability of a voluntary non-monetary approach to conservation, we then investigate its potential for farmland conservation. We considered a list of 119 actions available from “conservation-evidence”, a source of systematically collected evidence on effectiveness of conservation actions. Among 119 actions, 95 could be scored for feasibility of implementation, costs, and existence of evidence in UK, Spain and Finland. Sixteen to seventeen actions were potentially suitable for implementation by a voluntary non-monetary approach. This implies that the voluntary non-monetary approach could be widely applicable across many countries and environments. It is our hope that this study will represent a clarion call for conservation scientists to clearly recognize the voluntary non-monetary approach, its characteristics, and its potential for addressing conservation issues on private land. Adoption of such voluntary measures may be more dependent on encouragement (‘nudging’) than on the usual coercive or financial emphasis (‘shoving’).

**Key words:** citizen science, conservation action, conservation cost, conservation feasibility, evidence-based conservation, private land

## 1 Introduction

While protected areas remain the most recognized tool used for biodiversity conservation, their extent (currently around 13% of global terrestrial land) does not guarantee the future persistence of global biodiversity (Pressey 1994; Watson et al., 2014). There is an urgency to find effective ways of safeguarding nature for remaining biodiversity outside protected areas. There, expanding human presence poses a growing threat to biodiversity through increasing demand for food, fibre, fuel and other commodities (Millennium Ecosystem Assessment 2005; Vitousek et al., 1997). Urban sprawl, driven by a steadily increasing urban population (projected to increase from 50% in 2010 to 70% in 2050 globally; [www.who.int](http://www.who.int)), is expected to further boost habitat fragmentation and pose additional pressures on ecosystems and wildlife (Terando et al., 2014). Consequently, making human-dominated landscapes more hospitable for biodiversity has been recognized as a fundamental strategy to help preserve global biodiversity (Ehrlich & Pringle 2008).

Although Walton Hall, UK, which is widely considered as the first modern nature reserve, was established in the 1820s by a private individual (Charles Waterton), the role of private conservationists is poorly acknowledged despite the roles they can play outside protected areas established by governments and conservation organizations (de Snoo et al., 2013; Knight 1999; Secretariat of the Convention on Biological Diversity 2014). This is particularly so in the developed world, where private land covers large areas. For example, about half of the US federally listed species have at least part of their range within private land (Schwartz 2008). In Europe, most of the land in the Natura2000 network (a European Union (EU) -wide network of nature protection areas, the centrepiece of EU's nature and biodiversity policy; [http://ec.europa.eu/environment/nature/natura2000/index\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/index_en.htm)) is privately owned. Therefore, conservation efforts implemented on private land play a key role in biodiversity protection (Brook et al., 2003; Calhoun et al., 2014; Downsborough et al., 2011); an exceptional example is the privately funded protection of two million acres in Patagonia through Kris and Douglas Tompkins ([www.conservacionpatagonica.org/buildingthepark\\_land.htm](http://www.conservacionpatagonica.org/buildingthepark_land.htm)).

Biodiversity conservation on private land presents opportunities, but also involves challenges brought about by the social dimension that ultimately contributes to determine costs and availability of land for implementation of conservation (de Snoo et al., 2013; James 2002; Knight et al., 2010). The realization that nature conservation on private land is largely a social challenge has triggered a paradigm shift, from top-down to bottom-up approaches (Calhoun et al., 2014; Knight et al., 2010; Langpap 2006; Miller et al., 2011; Steinmetz et al., 2014). Among the latter, voluntary programmes represent a widely accepted policy tool for biodiversity conservation on private land. But, despite being voluntary, these are frequently market-based (Hanley et al., 2012; Kauneckis & York 2009; Sorice et al., 2013; Vatn 2010).

The voluntary market-based approach for conservation on private land was developed with the rationale of an equitable and fair sharing of costs borne by the individual landowner and public benefits resulting from

biodiversity conservation (Hanley et al., 2012; Jack et al., 2008). In this approach, land owners are given monetary compensations for the costs or lost benefits of implementing conservation actions. Thus, the approach entails high, and progressively increasing, costs to conservation budgets because biodiversity conservation on private land is often expensive (Lennox & Armsworth 2013; Lennox et al., 2013; Naidoo et al., 2006). Where such considerable costs have been met (e.g. the conservation-targeted agri-environment schemes of the EU), the results, in terms of ecological benefits, have been mixed (Batáry et al., 2015), partly due to the heterogeneity of landowners implementing them. A growing body of evidence suggests that market-based approaches to conservation, albeit effective and relevant in many cases, are not always sustainable in the long term (de Snoo et al., 2013; Lennox et al., 2013). On the other hand, means to induce individuals to change their behaviour based on intrinsic values and societal moral rather than coercive means or monetary incentives exist (Williamson 2000), but are less consistently considered in conservation (de Snoo et al., 2013; Knight 1999; Santangeli & Laaksonen 2015). Consideration of such a voluntary but non-monetary approach is particularly relevant for conservation in modern widely modified world, and it is in line with the strategic goal of the Convention on Biological Diversity to “enhance implementation through participatory planning, knowledge management and capacity building” (Secretariat of the Convention on Biological Diversity 2014).

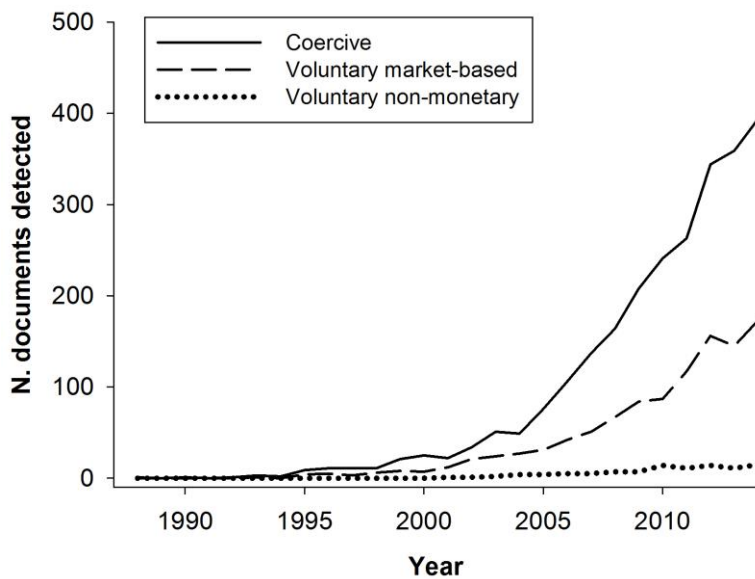
In this work, we review the scientific literature for studies where a voluntary non-monetary approach to biodiversity conservation has been applied on private land. We first compare the occurrence of this approach to two more traditional ones: coercive (i.e. fence and fines) and voluntary market-based approaches (see Table 1). This comparison aims to reveal the level of scientific interest given to these alternative approaches. We then analyse the literature to summarize key properties of voluntary non-monetary means for conservation on private land. Here, emphasis is given to constraints on implementation, potential benefits and emergent outcomes, and ways of enhancing participation. Finally, we illustrate how the voluntary non-monetary approach could be implemented in the case of farmland conservation actions.

**Table 1.** A comparison of the main reasons for carrying out conservation

	<b>Coercive</b>	<b>Voluntary monetary</b>	<b>Voluntary non-monetary</b>
<b>Principle</b>	Authorities determine actions	Individuals or companies are funded to carry out actions. May be motivated by profit or environmental concerns	Individuals decide to carry out actions at cost to themselves, i.e. based on self-motivation and self-induced values
<b>Approaches</b>	Imposed national parks Restrictive legislation	Payment for conservation actions. Payment for ecosystem services	Landowners establishing private nature reserves. Voluntary actions to improve biodiversity on private land
<b>Examples</b>	National Parks Brazilian logging Hunting limits	Agri-environment schemes Debt for Nature	The Conservation Land Trust Bird feeding and nest boxes Wildlife gardening
<b>Temporal scale</b>	Long-term	Temporary, short-term	Temporary, short- to long-term
<b>Economic costs for conservation budgets</b>	High	High	Null

## **2 Low occurrence of voluntary non-monetary approaches in the scientific literature highlights a missed opportunity**

Our search protocol (Appendix S1) shows that at least in the international scientific literature of ecology and conservation, the voluntary non-monetary approach is seldom a subject of research compared to coercive and market-based approaches (Fig. 1). Out of the searched 66,183 papers published in ecology and conservation biology during recent decades, only 101 hits (representing 0.2% of all full text documents) were for voluntary non-monetary approaches, compared to a total of 2,544 (3.8%) for coercive and 1,071 (1.6%) for voluntary market-based. Out of the 101 hits on voluntary non-monetary approaches, only 16 actually discussed the approach, and just eight explicitly studied it (i.e. tested its effectiveness; see Appendix S2 for these 16 references). We caution that our search for papers on voluntary non-monetary actions, based on our predefined keywords (see Appendix S1), might have missed some of the literature on conservation actions that do not have an economic driver. However, we consider that the voluntary non-monetary approach occurs so much less frequently in scientific literature than the two other abovementioned approaches that it must be genuinely scarcely discussed.



**Fig. 1** Trends in the number of publications per year that had at least one occurrence of the key search terms (see methods) that referred to each of the three main conservation approaches (see Table 1).

Even if rarely the subject of scientific interest, as the above search results suggest (Fig. 1), it is nevertheless plausible that the voluntary non-monetary approach is often considered by practitioners, NGOs and other organizations. Indeed, many of the studies that explicitly consider a voluntary non-monetary conservation approach indicate a willingness from people to do conservation in absence of any monetary incentives at all (Downsbrough et al., 2011; Gerhardt & Nemarundwe 2006; Hartup 1994; Raymond & Brown 2011; Santangeli et al., 2015; Santangeli & Laaksonen 2015; Santangeli et al., 2012; Vanderlaan & Taggart 2009).

### **3 Characterizing the voluntary non-monetary approach and identifying actions suitable for implementation**

Voluntary approaches for nature conservation on private land have typically been treated as a single group, including both market-based and non-monetary means. Approaches within this heterogeneous group locate along a continuum between two extremes, one where financial incentives exceed costs involved and fully drive landowner motivation towards conservation, and the other, where no monetary incentives are involved and motivation is fully driven by intrinsic reasons. As de Snoo et al., (2013) point out, there is a crucial difference between voluntary approaches that use economic incentives compared to those that completely rely on the self-motivation and intrinsic values of an individual towards conservation (de Snoo et al., 2013; Lokhorst et al., 2011). In this study we focus on the latter of these two extremes.

A voluntary non-monetary approach primarily applies to simple actions, such as nest-box provision or leaving hedgerows uncut, that private citizens, communities, non-governmental organizations, companies, enterprises (e.g. landowners, urban and sub-urban residents, fisheries, forestry companies, etc.) can implement in their area of influence (e.g. their living or working space) without the motivation or need of economic incentives. Actions may target and ultimately benefit single species, ecological communities, or entire ecosystems. In order to encourage wide participation by a diversity of actors without significant education in conservation management ("lay persons"), actions should be clearly defined, focused and justified, they must be straightforward to understand and to implement, and their implementation must require no specific scientific knowledge or new specialised equipment. Nevertheless, many volunteers may be farmers or other land managers with considerable experience and expertise in other areas and who have access to specialised equipment. Furthermore, the activity should be results-based; it should produce tangible results in a relatively short time in order to provide a non-monetary reward and a way of self-verification. In addition, overall costs of the action must be sufficiently low for them to be applicable without incentives.

From the systematic literature searches described above as well as from detected documents in the grey literature, we identified a number of cases where a voluntary non-monetary approach has been used for nature conservation. By these examples, we illustrate the limited actions documented in the scientific literature about the voluntary non-monetary approach, including their take-up by citizens, and their effectiveness when reported. This selection of examples provided is not meant to be exhaustive, rather it can help identifying the main features characterising this group of actions.

Private landowners enthusiastically joined and supported a voluntary conservation programme aimed at protecting howler monkeys in Belize (Hartup 1994). Millions of nest boxes for birds (as well as other animals including bats) have been placed in forests, farmlands and domestic gardens, and many bird populations nowadays benefit from extra food voluntarily provided at bird feeders (Davies et al., 2009; Lepczyk et al., 2004; Robb et al., 2008). Off the Atlantic coast of Canada, a voluntary initiative to reduce collision risks with whales, proposed by the International Maritime Organization, was reported to have high compliance by ship vessels (Vanderlaan & Taggart 2009). In contrast, voluntary speed reduction of commercial ships from whale watching companies, as well as other transport vessels off the coasts of Massachusetts and California, had a very low compliance rate (McKenna et al., 2012; Wiley et al., 2008). Private citizens undertook alien plant eradication on their property within conservancies of South Africa (Downsborough et al., 2011). Forest buffers of small size were retained around raptor nests by private forest owners in order to protect them from forest logging in eastern Finland (Santangeli et al., 2012). Lead is a poisonous element impacting many bird populations. Voluntary approaches to reduce its use in ammunitions and fishing tackles have achieved broad success in the US and Canada (Haig et al., 2014), although not in the UK. Voluntary guidelines for land management aimed at protecting vernal pools on private land in Maine, US, achieved mixed success (Calhoun et al., 2014). Fishermen in Namibia have been voluntarily applying a

simple and effective solution to greatly reduce incidental bycatch of seabirds ([www.birdlife.org/worldwide/news/saving-seabirds-empowering-women-albatross-task-force-gains-momentum](http://www.birdlife.org/worldwide/news/saving-seabirds-empowering-women-albatross-task-force-gains-momentum)).

A common factor linking most of the examples above is the presence of a central organisation that can reach potential actors and provide information about the application of the action. In addition, these actions were typically both easy and relatively cheap to implement. It thus appears that costs and operational feasibility may restrict the variety of actions suitable for implementation using a voluntary non-monetary approach. We therefore investigated in more detail one specific environment, farmland, which is predominantly privately owned and influenced by intensive management practises that have strong impacts on associated wildlife (Donald et al., 2001). We identified a number of actions that, within the broad context of farmland conservation, could be implemented through a voluntary non-monetary approach (see below).

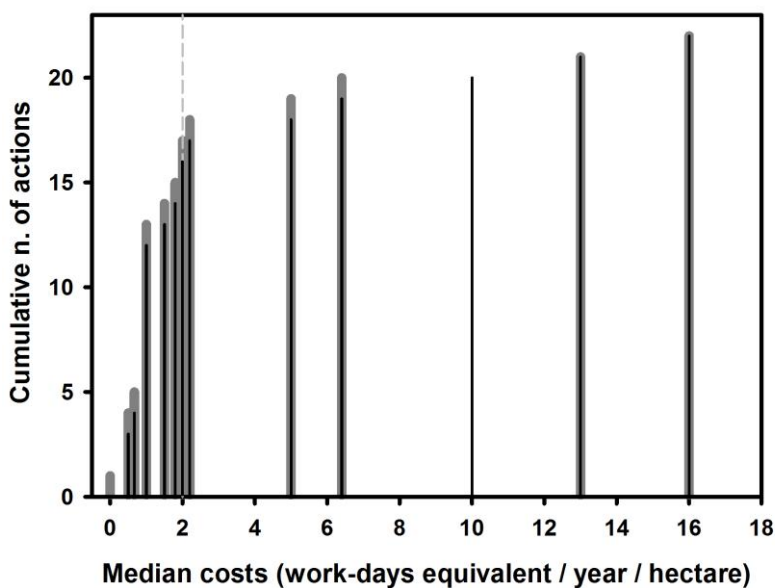
### **3.1 Actions suitable for implementation on farmland via a voluntary non-monetary approach**

We considered a list of 119 actions for farmland conservation (Dicks et al 2013 available from [www.conservationevidence.com](http://www.conservationevidence.com)), an authoritative source of evidence on actions for nature conservation. Its mission is to support practitioners in decision making. These actions are also summarised with overall effectiveness scores in Sutherland et al (2015). To assess the potential suitability for voluntary non-monetary conservation, the 119 farmland actions were scored on three criteria. The first criterion was the feasibility of private untrained citizens to implement the action (using three classes: high, medium and low feasibility). The second criterion was the estimated costs of action, including management, damage and opportunity costs (Naidoo et al., 2006; Appendix S3 gives further details of the cost estimation protocol). Costs were estimated for the implementation of the action over one hectare of land, and were converted to work-day equivalents per year. This was done in order to bring all costs, monetary (e.g. euros per hectare per year) and not (e.g. time for implementing the action), to a common unit. The third and last criterion was the existence of evidence in support of the effectiveness of the action. Feasibility and costs were independently estimated by L.V.D., B.A. and I.H., based on knowledge about practical application of the actions in UK, Spain and Finland, respectively (Appendix S3). Ultimately, an action was regarded as having good potential to be implemented via a voluntary non-monetary approach if it is cheap, relatively easy to apply and supported by some evidence about effectiveness. However, even when the last criterion is not satisfied, the action can still be tried out, and its effectiveness assessed to accumulate evidence.

Out of all 119 farmland actions considered, 108 could be assessed for their feasibility for implementation by a farmer in the UK, Spain and Finland. The 11 actions that could not be scored for feasibility were deemed not applicable for implementation via a voluntary approach by private individuals or too difficult to score



(e.g. legislation or landscape level actions). Out of the 108 actions with a feasibility score, 95 actions were estimated for their cost in all of the three countries differing in their geography and experience with conservation on farmland. The average estimated cost across all actions was 5.4 work-days equivalent per hectare per year for UK and Spain, and 3.8 for Finland. Note that this is the cost in the targeted area, rather than across the entire farm. Of the 95 actions, 21 (22%) actions were evaluated suitable for implementation (i.e. feasible) by a farmer or land owner (i.e. had high feasibility in all three countries). Arbitrarily assuming that actions requiring at maximum of two work-days equivalent per hectare per year are sufficiently cheap to be implemented without monetary incentives (see vertical reference line in Fig. 2), a total of 16 to 17 farmland actions in UK, Spain and Finland fit also this requirement (Table 2). These actions can thus be regarded to be highly feasible and sufficiently cheap for implementation, of course this is assuming the interventions will be carried out in localized patches rather than across an entire farm. Among all the 16 to 17 actions identified as suitable according to the two first criteria, 10 to 11 actions have been assessed for their effectiveness in at least one study; all of these were reported to have a positive impact (Table 2). Appendix S4 provides the full list of actions with their estimates of feasibility and costs.



**Fig. 2** Cumulative number of actions with increasing median costs across estimates given for actions in UK, Spain and Finland. Only the 22 actions deemed highly feasible for implementation by a non-trained actor are shown. (These studies fitted the selection criterion of high feasibility across all three countries). Median values for cumulative number of actions based on the minimum cost estimates are shown by the grey bars, and those based on maximum cost estimates are in black. The vertical dashed light grey line marks the cost threshold of two work-days equivalent per hectare per year value below which an action was (arbitrarily) considered sufficiently cheap for implementation via a voluntary non-monetary approach.

**Table 2.** List of 17 actions suitable for implementation through a voluntary non-monetary approach (i.e. with high feasibility in UK, Spain, and Finland, and median cost estimate  $\leq 2$  workdays equivalent per hectare per year). The number of studies testing the effectiveness of each action, as well as the impact (whether at least some evidence of positive impact was available [+]) are also reported (Material from Dicks et al 2013). Impact was reported only for actions for which evidence was available (i.e. had at least one study testing its effectiveness; in bold font).

<b>Action name:</b>	<b>N. Studies</b>	<b>Impact of action</b>
Avoid use of lead shot	0	
Buffer in-field ponds	0	
<b>Create open patches or strips in permanent grassland</b>	2	+
<b>Create uncultivated margins around intensive arable or pasture fields</b>	49	+
<b>Employ areas of semi-natural habitat for rough grazing (includes salt marsh, lowland heath, bog, fen)*</b>	8	+
Introduce nest boxes stocked with solitary bees	0	
<b>Leave overwinter stubbles</b>	20	+
<b>Leave uncut strips of rye grass on silage fields</b>	6	+
Leave unharvested cereal headlands in arable fields	0	
Maintain in-field elements such as field islands and rockpiles	0	
<b>Provide buffer strips alongside water courses (rivers and streams)</b>	7	+
<b>Provide nest boxes for bees (solitary bees or bumblebees)</b>	14	+
<b>Provide red squirrel feeders</b>	0	
<b>Provide short grass for birds</b>	1	+
<b>Provide supplementary food for birds or mammals</b>	25	+
<b>Raise mowing height on grasslands to benefit farmland wildlife</b>	7	+
<b>Take field corners out of management</b>	1	+

\* This action was suitable for implementation through a voluntary non-monetary approach only in the case when minimum cost estimates were used to calculate the median cost value.

The actions identified as suitable for a voluntary non-monetary approach are diverse, from simple and commonplace actions, such as providing nesting boxes for birds, to less known ones, such as raising the mowing height on grassland to benefit wildlife (see Table 2). Most of the suitable actions, such as creating open patches or strips in permanent grassland, may benefit a whole community of farmland fauna and flora. Many of the suitable actions identified are exclusive to farmland, such as leaving overwinter stubbles. Yet, several others, such as providing supplementary food or providing short grass for birds, may be applicable in any type of open space, including urban or suburban private and public gardens, parklands, and graveyards.

It is important to note that the cost estimations used here refer to a common unit of land of one hectare. This implies that the extent and costs of implementing an action via the voluntary non-monetary approach varies

according to the amount of land owned by the private landowner. Although we standardized our estimates for one hectare of land, it will always be up to the owner to ultimately decide how much of land can be enrolled in the action that is not supported by monetary incentives. The ultimate ecological effectiveness will most likely result from the net uptake across the landscape (e.g. one large patch on one farm vs. many small patches across many farms). The topic of spatial pattern of voluntary action, albeit relevant and interesting, requires further study beyond the scope of this work.

### **3.2 Enhancing participation to nature conservation based on voluntary non-monetary means**

While it is clear that there is a wealth of actions that could potentially be implemented using a voluntary non-monetary approach, their take-up by individual citizens may be limited by factors other than feasibility and costs. Among these, predominant factors may be lack of awareness of an action, or a lack of encouragement or role models. We suggest that there is great scope for enhancing the take-up of actions that can be implemented via voluntary non-monetary means by using, among others, the theory and operational framework recently formalized around the “nudge” approach (Thaler 2015; Thaler & Sunstein 2009). A nudge is defined as a factor that significantly alters the behaviour of people based on characteristics of human nature and psychology. Building upon the theory of “choice architecture”, nudging is a way to influence human choice towards a wealthier and better-quality life style while preserving the freedom of choice of the individual (Thaler & Sunstein 2009). This approach has received rapid acceptance, e.g. by the UK government, as an effective way to enhance the response of citizens to pay taxes or make better life choices (Halpern 2015). The application of nudging thus differs from financial or legislative approaches, also informally referred to as ‘shoving’.

Several organizations have now discovered and make full use of the great power of nudges such as “default” options and “framing” in the presentation of choices, among others (Thaler & Sunstein 2009). Typically, if an option is designated as “default” among alternative choices, it will be chosen more often than other options. Likewise, framing is relevant because the way in which an option is stated may strongly influence selection from among choices (Thaler & Sunstein 2009).

Nudging can also be used to spread the application of an action by highlighting its successful implementation among neighbours. For example, the regional forestry centre of North Karelia, eastern Finland, has successfully implemented a voluntary non-monetary approach simply by asking forest owners to retain a small forest buffer around raptor nests that would otherwise be destroyed by logging (Santangeli et al., 2012). Such a successful example could be exported to other regions of Finland, where landowners, at the time of being approached, could be made aware that their peers in North Karelia had very successfully implemented the proposed action. The number of such applications in conservation could become numerous, potentially having big positive impacts over large areas (see e.g. Santangeli et al., 2015). As an example, if

the default was set so that the most easily available longline fishery equipment sold would be design models that reduce seabird by-catch, and if these would be sold along with a best practise guides on how to reduce seabird by-catch, seabird mortality could be measurably reduced (e.g. Melvin et al., 2014). Nevertheless, nudges have rarely been considered in nature conservation (but see few examples in Thaler and Sunstein (2009).

Nudging is only one among several possible alternative models for changing behaviour in order to enhance the take-up of conservation actions via voluntary non-monetary approaches (see alternatives in Clayton & Myers [2009]). It is well known that one of the most powerful determinants of behaviour is what is allowed by the physical and social environment (Clayton & Myers 2009). That is, information on what actions can and cannot be implemented is the first step that needs to be considered, and the one that we attempted to address in this study.

Ultimately, an interdisciplinary approach could be of utmost importance for the successful implementation of conservation actions on private land using a voluntary non-monetary approach. While private landowners and other citizens will be key actors for implementing conservation, outreach and advocacy programs implemented by NGOs and other organisations can further increase the take-up of actions on private land. Conservation scientists could be responsible for gathering the necessary data and evaluating the effectiveness of actions, and the results would then be fed back to private landowners via NGOs and other organisations. Although challenging to achieve, such a collaborative effort could have important large-scale benefits for conservation. A successful example of such positive interdisciplinary collaboration between conservation citizens, conservation scientists and NGOs is provided by the French national program for protecting Montagu's harrier (*Circus pygargus*) nests in farmlands of France (Santangeli et al., 2015). There, different nest protection interventions are implemented using a voluntary non-monetary approach each year throughout France by volunteer conservationists, nationally coordinated by the LPO (Ligue pour la Protection des Oiseaux). This effort was coupled in more recent years with survey data (also collected by volunteer conservationists, but coordinated by French scientists) on breeding parameters of protected nests. The resulting major survey data were used by scientists to evaluate the effectiveness of interventions and their overall impact on the harrier populations (Santangeli et al., 2015). Such scientific feedback is currently being returned by the LPO to the network of volunteer conservationists, which hopefully leads to increased participation in implementation of the most effective actions. Knowledge about the success of this scheme has in turn motivated discussion in neighbouring Spain about how to improve volunteer participation in nest protection there.

Another successful example of positive interdisciplinary collaboration between conservation citizens, conservation scientists and local organizations is represented by a voluntary conservation programme for protecting nests of forest hawks under threat from logging in private forests of North Karelia, Finland (Santangeli et al., 2012). There, 97% of private forest owners accepted to voluntarily participate, without any

financial incentives, in the programme when asked by a representative of a regional forest management organisation. The programme resulted in a very large decrease in nests being lost to logging. Moreover, the small forest buffer retained around the nests was found effective in maintaining nest occupancy by the raptors (Santangeli et al., 2012). Volunteers have also been successfully engaged to restore coastal meadow habitat on islands in Estonia (Rannap 2004). Actions such as reed and scrub removal, mowing and implementation of grazing, pond restoration and educational activities were implemented there by 200 volunteers. As a result of these efforts, numbers of the natterjack toad (*Bufo calamita*) increased on one of the islands, and its decline was halted in other two islands, suggesting that the programme was also biologically effective (Rannap 2004). Similarly, a project was initiated by scientists with the aim to eradicate a harmful invasive species, the American mink (*Neovison vison*) in Scotland (Bryce et al., 2011). A large number of different local stakeholders (including landowners), when asked, joined the project on a voluntary basis whereby no financial incentives were provided. The created coalition of volunteers, trained to detect and trap mink, successfully eradicated the invasive species from large areas under the scope of the program (Bryce et al., 2011).

#### **4 Conclusions**

We contend that a voluntary non-monetary approach may represent a missed opportunity that the conservation community, including researchers and conservation managers, should both address. We show that there are examples where this approach has been successful. We show that while diverse actions are potentially suitable for implementation through a voluntary non-monetary approach, the approach and its scale and ecological impact have been mostly neglected by conservation scientists. The work of conservation scientists is needed for evaluating conservation interventions and their societal acceptability, and for providing lists and descriptions of actions that are feasibly applicable in different environments. Ultimately, it is our hope that this study will represent a clarion call for conservation scientists to clearly recognize the value of voluntary non-monetary approaches, their characteristics, and their potential for facilitating conservation on private land.

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**Appendix A. Supplementary data. Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.biocon.2016.03.013>.**

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