# Voluntary Nonmonetary Conservation Approaches on Private Land: A Review of Constraints, Risks, and Benefits for Raptor Nest Protection

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## Abstract

Biodiversity conservation on private land of the developed world faces several challenges. The costs of land are often high, and the attitudes of landowners towards conservation are variable. Scientists and practitioners need to scan for and adopt cost-effective solutions that allow for the long-term sustainability of conservation measures on private land. In this study, we focus on one of such possible solutions: Working with landowners to implement voluntary nonmonetary conservation. We restrict our focus to protection of raptor nests, but the ideas can be applied to other taxa as well. Through a literature review, we show that a voluntary nonmonetary approach for protecting raptor nests has been so far largely neglected and/or rarely reported in the scientific literature. However, results of a questionnaire sent to BirdLife partners across Europe indicate that this approach is more widely used than it appears from the literature. We show that voluntary nonmonetary approaches may represent useful tools to protect raptor nests on private land. We provide a workflow for

implementation of such an approach in raptor nest protection, highlighting benefits, potential risks, and constraints in the application of the strategy. We suggest that a voluntary nonmonetary approach may have great potential for cost-effective conservation, but the risks it may entail should be carefully assessed in each case. There is an urgent need to consider and evaluate novel approaches, such as the one described here, which may constitute missed opportunities for cost-effective conservation.

**AQ1**

## Keywords

Voluntary-entry scheme
Bird of prey
Intensive land-use
Noneconomic approach
Nonfinancial approach
Public participation

### Electronic supplementary material

The online version of this article (doi:10.1007/s00267-014-0385-9) contains supplementary material, which is available to authorized users.

# Introduction

The intensification of resource extraction activities in recent decades has in many ways transformed the landscape in which wildlife thrives (Millennium Ecosystem Assessment 2005). Anthropogenic changes such as habitat loss, degradation, and fragmentation are recognized as perhaps the most important drivers of species extinctions on Earth (Millennium Ecosystem Assessment 2005; Pimm et al. 2006).

Conservation biology has seen a tremendous shift toward the end of the twentieth century from top-down fence-and-fine means to a more recent view based on bottom-up voluntary participatory approaches that also embrace the social dimension in conservation policy (Miller et al. 2011). The shift was mostly dictated by the realization that conservation, particularly on private land and land otherwise used by humans, is no longer exclusively about protecting natural systems, but it entails huge socio-political challenges (Knight et al. 2010; de Snoo et al. 2013). As a consequence, a wide array of

different conservation strategies have been developed within the range from top-down to bottom-up approaches (Doremus 2003).

Several successful examples of voluntary approaches to conservation have been reported in areas of the developed world where most of the land is privately owned (Frank and Müller 2003; Langpap and Wu 2004; Mönkkönen et al. 2009; Reed 2008; Whittingham 2007). However, so far, most such voluntary participatory approaches involved some monetary compensation to the landowners (hereafter called market-based; such as the agri-environment schemes of the European Union). Far fewer are the reported cases where voluntary nonmonetary means, which only rely on the self-motivation of single individuals, have been used. From a search of over 44,000 published articles in conservation from Web of Science (from the 1970s to 2012), less than 0.1 % included the words “voluntary” and “participation” close to each other within the article. In all of these, voluntary nonmonetary participation approaches were only discussed, but not explicitly and directly addressed by the studies (Santangeli et al. unpublished data). This so far largely unexplored and unexploited potential represents a missed opportunity for low-cost conservation in light of the known limited resources available for nature protection.

A voluntary nonmonetary approach may be a valuable tool for the conservation of nest sites of raptor species. Raptors are charismatic species that have often been used as flagships (Sergio et al. 2006) and have attracted a large share of resources that enabled different conservation actions to be implemented. Many raptor species worldwide suffer from intensive persecution, poisoning, toxic chemicals, indirect human disturbance, and loss and/or degradation of their primary habitat (Newton 1979; Fuller 1996; Martinez-Abrain et al. 2010). Despite the numerous and diverse conservation efforts so far implemented, a voluntary approach that would involve the landowners for protecting raptor nest sites has seldom been implemented and/or reported. It may be that such an approach is perceived as a risk by raptor conservationists because disclosing information of the nest location to landowners might facilitate persecution. However, thanks to the abolition of bounty schemes to kill raptors, as well as enforced protective legislation and education campaigns to change the public attitude, the occurrence of persecution on some raptor species has apparently decreased in recent decades (Rutz et al. 2006; Newton 1998), although this varies spatially and by taxon (see e.g., Smart et al. 2010; Newton 1998; Amar et al. 2012; Etheridge et al.

1997). We thus believe that a review of voluntary nonmonetary approaches for raptor nest protection is timely and relevant in order to understand the fundamental properties of this approach.

The general aim of this study is to improve our understanding regarding the scale of implementation of voluntary nonmonetary approaches for raptor nest protection, and clarifies their fundamental properties, such as costs, risks, and unexpected consequences in the use of the approach, as well as its potential benefits for cost-effective conservation. We first review the published scientific and gray literature (that was written in English) to quantify how widely a voluntary nonmonetary participation of landowners has been used to protect raptor nests on private land of the developed world. Second, given the scarce number of detected documents (see "Results" section), we complement the above-mentioned literature search with information derived from a targeted questionnaire delivered to Birdlife partner organizations across Europe. The questionnaire aims to elucidate important properties related to implementation of the strategy, such as the risks and unexpected consequences in the use of the strategy (e.g., disclosing the location of a nest site to a landowner), as well as potential benefits to raptor populations. It also allows quantifying the availability of volunteers' work force, which is necessary for on-the-ground implementation of the strategy (e.g., for locating nests). We finally investigate emergent properties of a voluntary nonmonetary approach by taking advantage of the key literature available on social-psychological principles toward conservation motivation (see e.g., Lokhorst et al. 2011; DeCaro and Stokes 2008; Clayton and Myers 2009). A key issue here concerns the long-term sustainability of the strategy based on conservation motivation of individual stakeholders for protecting raptor nests.

## Methods

We made a wide search of information about protection of nest areas for raptors within Europe and North America. Although we primarily focused on peer-reviewed material, we also considered unpublished documents relevant to our review topic (but were restricted to documents written in English). We first attempted to identify documents through extensive web searches of electronic databases (ISI web of Knowledge, Scopus, CAB abstracts, Science Direct, ProQUEST digital dissertations online, CSA illumina, Google scholar, Academic search complete) and for books and other reports from the databases of British library and Library of congress using the following boolean search terms: (raptor* OR "bird*-of-prey") AND ("Nest stand" OR

"Nest location" OR "Forest management" OR "Habitat management" OR "Conservation" OR "Protection" OR "Preservation" OR "Nest site" OR "Strategy" OR "Action plan" OR "Land-use change" OR "Land-use" OR "Forest stand" OR "Forestry" OR "forest* practice*" OR "clear-cut*" OR "Human disturbance" OR "Persecution" OR "Legislation" OR "Man made" OR "Human-activity*" OR "Disturb*" OR "Impact*"). We purposely searched multiple databases using multiple and rather general keywords aiming to locate as many documents as possible that would later be carefully screened (see below). We believe that this allowed reducing the risk of missing key documents useful for our purpose.

The initial search, performed between 23rd and 25th February 2010, produced a total of 3,471 different documents that were then sorted based on two key elements for inclusion: The study focused on European and/or North American breeding diurnal birds of prey, and it reported impacts of any kind of human activity at the level of raptor nest site with implications for conservation. The selection was first done by title and abstract to remove all irrelevant documents, while documents for which the title and abstract were of ambiguous content or abstract was missing were screened through the full text. The final number of relevant documents (i.e., fitting above criteria) retained after the screening was 54. To this number, an additional 18 documents were added afterward as a result of newly published studies or studies cited in one of the previously found documents that were not detected by our initial search. From the resulting 72 documents reporting impacts of human activities on nesting diurnal raptors of Europe and North America with implications for conservation, we detected those where nest protection interventions were implemented on a voluntary nonmonetary basis. We, however, make extensive use of the information from the 72 documents to review relevant aspects of raptor nest protection measures. Despite our extensive search effort, we note that we may have still missed some documents which could be relevant to our review topic.

Additionally, in order to explore the potential for developing and practically implementing effective conservation of raptor nest sites through the active voluntary participation of landowners, we also sent out a questionnaire to most BirdLife International partner organizations in Europe which we could reach ($n$ = 43). We aimed to obtain responses from as many countries of Europe as possible. In the case of Bulgaria, the questionnaire was filled in by an employee of an NGO (Green Balkans Federation of Nature Conservation)

which is not a BirdLife partner organization. For most countries, the questionnaire was filled by one single respondent person. We consider that this type of data is not sufficient for making reliable comparisons between countries, but that it gives an overall Europe-wide view on the study questions. In this study, we treated England and Scotland separately, as the two countries have different wildlife legislations and different statutory agencies implement the nature conservation.

Overall, 21 countries, out of the 43 that were sent the questionnaire, have responded. These countries were homogeneously distributed in latitude and longitude across Europe and vary in terms of their wealth. Not all respondents answered all questions, thus the total number of responses (Table S1) for some questions may be lower than 21. The questionnaire [see Appendix A1—(Electronic supplementary material) for the complete form] consisted of six targeted questions. Question 1 asked whether and which conservation measures are implemented in the country. Question 2 asked about the occurrence of conflicts between raptors and local interest groups, and aimed to identify which those groups are (if any). Question 3 investigated what is the typical raptor conservationist attitude toward disclosing nest site location to the landowners in light of possible consequences of this action. Question 4 tried to reveal the potential interest and attitude of landowners toward voluntary participation into conserving raptor nests. Question 5 aimed to quantify the share of volunteers' work into raptor monitoring and conservation. Question 6 aimed to assess the potential contribution of conservation on private land to national raptor populations.

# Results and Discussion

## Voluntary Nonmonetary Raptor Nest Protection in the Literature

Through the extensive literature search, we could identify only four documents reporting the effectiveness of voluntary nonmonetary approaches for protecting raptor nests (Witiw and Gordey Unpublished report; Koks and Visser 2002; Santangeli et al. 2012; Fatér et al. 2004). The very low number of detected voluntary conservation initiatives is puzzling, because this approach has been often advocated in the past to protect raptor nests on private land (Cline 1985; Call 1979; Blum 1989). Two reasons may explain this outcome. First, the approach has been largely overlooked and disregarded by raptor scientists and practitioners, likely because of the fear that disclosing

the information on nest location may increase the rate of persecution and disturbance on the species (Koskimies 2006). Second, it has been implemented but very seldom reported, or it was reported only in very local magazines and journals that we were not able to access. In particular, there may be the local gray literature written in other languages than English that is missing from this review of literature. However, it is clear that there is a lack of scientific studies evaluating the usefulness of the approach or the potential it may hold. We therefore want to describe the properties and possible potential of the voluntary approach as an additional conservation tool. Our search result could be also be affected by a publication bias whereby successful examples are more likely reported and widely distributed compared to unsuccessful cases that might have been more easily disregarded. The low number of published studies does not yet enable evaluating whether this is the case. Nevertheless, the detected documents may contain interesting information that can help understanding the conditions in which a voluntary approach may succeed.

Two of the four documents report successful conservation of Montagu's harrier (*Circus pygargus*) nests in arable farmland of The Netherlands (Koks and Visser 2002) and Hungary (Fatér et al. 2004). In both cases, harrier nests were located on private farmed land, and in the absence of protection they would likely have been destroyed by harvesting operations (Arroyo et al. 2002). In both environments, the authors report a generally positive attitude of the farmers toward the conservation measures on their farm without financial compensation. In Hungary, protection involved setting a fence of 4–5-m diameter around a nest and a further 100-m wide buffer of standing crop (Fatér et al. 2004), while in The Netherlands an electric fence of $11 \times 11$ $m^2$ was used (Koks and Visser 2002). As a result, the productivity of the species could be increased at virtually no cost. The other two case studies report successful voluntary conservation of raptor nests in boreal forests of Finland (Santangeli et al. 2012) and North America (Witiw and Gordey Unpublished report; from a study commissioned by a private forestry company). Many forest raptors commonly nest in the oldest patches of commercial forests. As such, they are often destroyed by clear-cutting if they remain unprotected/unknown. Therefore, efforts to inform forest owners and ask them to participate in setting aside a small forest buffer around a raptor nest were made (average buffer size of 0.24 and 0.28 ha for the Finnish and North American case, respectively). In both cases, the owners were generally highly cooperative (e.g., 97 % of approached owners joined the program in

the Finnish case study; Santangeli et al. 2012). This allowed low-cost retention of many nest sites that would otherwise have been destroyed by forest harvest. In the Finnish case, protected nests were also found to be used with similar frequency before and after the surrounding forest was harvested, and they were also reported to be highly used by the raptor species in the American case study (Santangeli et al. 2012; Witiw and Gordey Unpublished report). This suggests that the programs were effective also from an ecological perspective.

## Constraints, Risks, and Benefits of Voluntary Nonmonetary Raptor Nest Protection

From the answers to the questionnaire, we found that voluntary nonmonetary conservation programs to protect raptor nests are being implemented in 12 out of 19 countries of Europe, where raptor nest conservation is carried out (Table S1). This result is very interesting, as it suggests that the approach is more widely adopted than it appears from the literature. Because of this pervasive lack of reported scientific studies, the potential effectiveness of this approach, and its associated limitations, remains largely unknown and untested.

One primary obstacle that may deter conservation practitioners from implementing a voluntary conservation approach involving the active participation of landowners may stem from existing conflicts between the interests of local groups (such as farmers, forest owners, hunters, among others) and raptor conservation (Redpath et al. 2013). The outcomes from our questionnaire indicate that this may in fact be the case in the majority of the countries from which we obtained a response, and in most cases the conflict involved hunters (Table S1). This result is not surprising (see e.g., Redpath et al. 2013), and strongly calls for caution in the use of a strategy that involves local landowners in conservation. A thorough understanding of the local context in which a voluntary approach is intended to be implemented should be achieved. Illegal killing of birds in general (BirdLife International 2011), and of several raptor species in particular (Amar et al. 2012; Etheridge et al. 1997; Smart et al. 2010; Redpath et al. 2013), is still pervasive particularly in Europe. A long history of raptor persecution has largely contributed to strengthen a sense of fear and caution in raptor conservation practitioners with regards of sharing sensitive information, such as nest location, to local landowners. We acknowledge and share this perception. However, we also believe that caution should not preclude action, such as implementation of novel approaches wherever they can prove cost-effective for protecting raptor

nest sites. Disclosing the location of a raptor nest should be done with great care, and only in those cases where a practitioner has robust confidence that the risk of backfire (i.e., nest destruction and/or disturbance) from a landowner is relatively low. In the latter case, involving landowners into conservation may represent a much more viable strategy compared to inaction dictated by traditional fear, as the Finnish case study demonstrates (Santangeli et al. 2012).

In this light, we asked a question to investigate what was the typical attitude of practitioners toward revealing the location of a raptor nest to a landowner (Question 3 in Appendix A1—Electronic Supplementary Material). The attitude of raptor conservation practitioners in terms of informing the landowners of the location of a raptor nest was ranked as highly positive in 8 out of 18 countries, but highly negative in 3 out of 15 countries where a response was obtained (Table S1). This result is encouraging, as it indicates that there can be potential for implementing conservation of raptor nests with the participation of landowners, at least in some countries and for some but not all of the raptor species present. Additionally, for 11/18 (61 %) of the countries, the respondent considered that a voluntary conservation program based on actively approaching landowners and revealing them the nest location could succeed (Table S1). Where the approach was considered not to be applicable, the possible reasons provided were the following: The landowners only care for profit; they are not adequately informed about raptor conservation; they cannot afford any profit loss; or they believe the approach is relevant but they do not want it to be done on their land.

However, even in situations where conflicts do not constrain the use of voluntary nonmonetary approaches, other important issues may arise that limit implementation. A common feature linking the four successful examples detected in the literature (see above) was the relatively small area that each owner had set aside for conservation. This is perhaps one of the key factors for gaining large participation to conservation through nonmonetary means on private land. If the costs of protection are low for an individual landowner, they can be outweighed by the personal motivation and willingness to contribute to conservation (DeCaro and Stokes 2008). This aspect may however clash with the ultimate goal of the program, which is to preserve a nest so that its use by a raptor species would not be reduced. Obviously, the effectiveness of retaining a small set-aside area will vary by the species and landscape under study. For example, this approach was effective for the

species considered in the four documents, we could identify (e.g., *Accipiter gentilis*, *Pernis apivorus*, *Buteo buteo*, *Circus pygargus*, *Buteo jamaicensis*), because they may have relatively low nesting habitat requirements (see e.g., La Sorte et al. 2004; Santangeli 2013; Santangeli et al. 2014), particularly in the landscapes under study.

We thus caution that conserving small areas used for nesting should by no means be considered as a panacea for raptor conservation, because factors limiting populations may often act at much wider scales. The multitude of other factors should be carefully identified in each case and effectively addressed with other appropriate evidence-based interventions (Newton 1998). Nevertheless, voluntary conservation of nest sites may represent a low-cost complementary solution that contributes to ameliorate the status of raptor populations where their nesting habitat is under immediate threat (Suter and Jones 1981; Santangeli et al. 2012). Focusing the conservation effort to a small area of suitable nesting habitat can in fact provide a disproportionately large benefit at the population level (Newton 1979; Sergio and Bogliani 1999; Arroyo et al. 2002; Santangeli et al. 2014). This approach may be particularly relevant for raptors, because many of the species re-use the same nest site for many years and suitable nest trees may be scarce (Saga and Selas 2012; Newton 1979; Suter and Jones 1981; Mahon and Doyle 2005; Santangeli et al. 2013). Clearly, destruction of a large proportion of nests in a region would most likely carry important population consequences on territorial species with high nest site fidelity (Newton 1979, 1998).

## Potential Benefits of Nest Conservation on Private Land to National Raptor Populations

Conservation on private land may only be relevant for countries where the extent of this land is large enough and at the same time supports a large share of breeding raptor populations. We investigated this aspect through a specific question in the questionnaire. We found that, according to the local experts, in 13 out of 16 countries responding to the question, conservation of raptor nests on private land could in fact contribute substantial benefits to the national populations (see Table S1). These latter results suggest that in Europe, similarly to the USA (where up to 80 % of federally protected species occur on private land; Schwartz 2008), many countries support important biodiversity on private land, and in these conservation of raptors should be given high consideration.

## Volunteers' Force to Implement Nonmonetary Nest Protection

Practical implementation of a voluntary approach involving landowners may be often constrained by the massive amount of fieldwork required (e.g., to locate nests; Santangeli et al. 2012, 2014; Santangeli 2013). According to the results of our questionnaire, volunteers contributed to raptor monitoring in 19 out of the 20 countries for which a response was available (the only exception being Spain where fieldworkers are mostly paid employees from NGOs or regional government administrations). Moreover, the relative effort of volunteers in most countries amounted to over half of the total fieldwork required by each conservation program being implemented (see Table S1). Such a massive work force has made it possible to implement successful nest protection schemes, such as the one run in eastern Finland in collaboration with local landowners and a network of volunteer raptor ringers (Santangeli et al. 2012), or the national program for monitoring and protection of harriers (e.g., *Circus pygargus*) nests in France (Santangeli 2013). However, the work does not end in finding nests. Thereafter, the landowners must be identified and individually approached. This could also be done by volunteers, but particularly approaching the landowners and discussing about the conservation plan might best be done by professionals.

Indeed, a crucial factor affecting the success of voluntary participation to conservation revolves around the question of who is approaching the landowner in the first place. When landowners are approached by a representative of an institution that they perceive as trustful and close to their interests, they are more likely to show a positive initial response toward the conservation program being offered (Doremus 2003; Santangeli et al. 2012).

## Determinants of Participation into Voluntary Nonmonetary Conservation

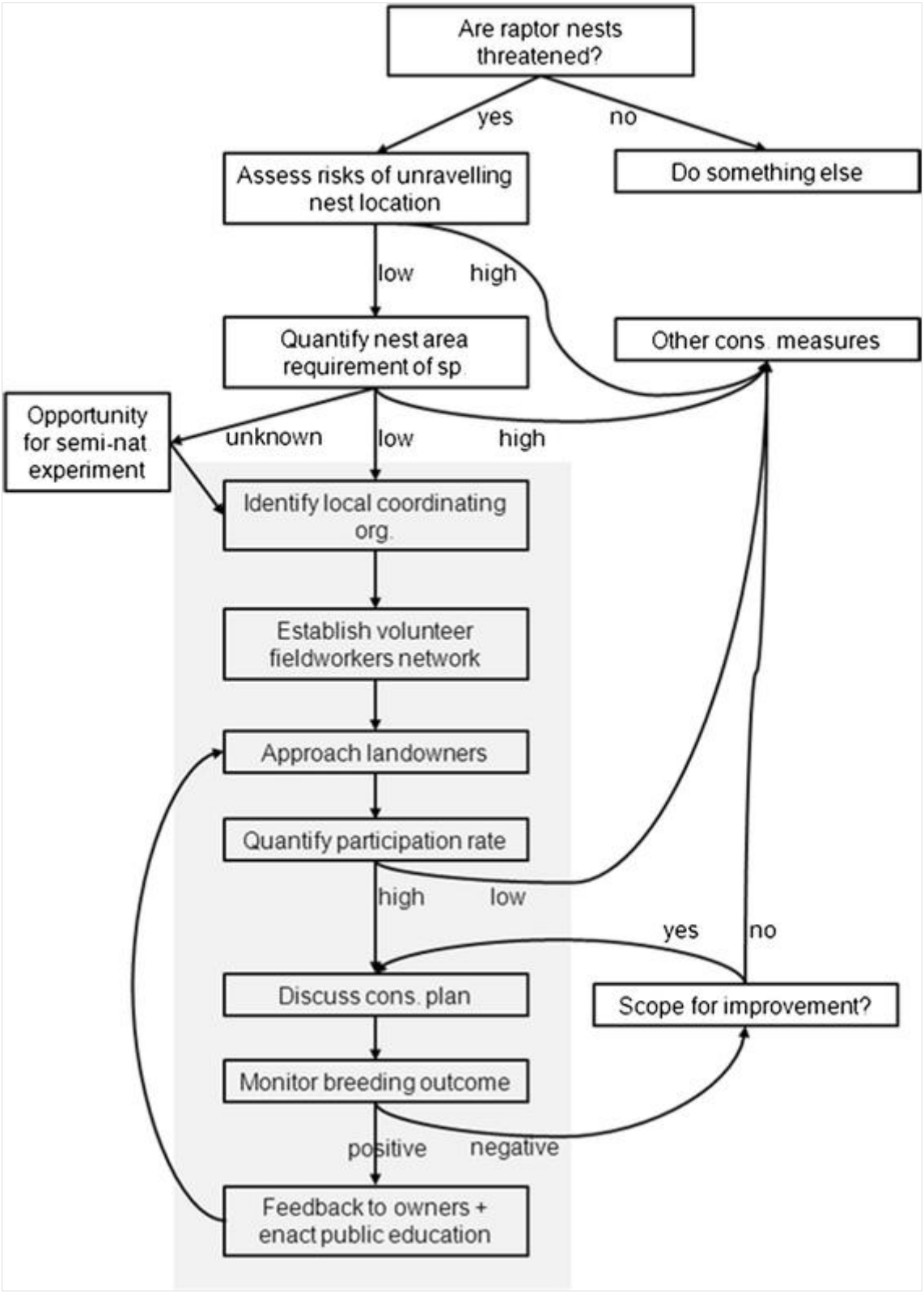
In the case of applied conservation for raptor nest sites, many authors have previously stressed the importance of working closely with landowners and involving local groups with competing interests at the early stages of the process (Call 1979; Cline 1985; Blum 1989; Stjernberg et al. 2003; Fatér et al. 2004; Zuberogoitia et al. 2008; Redpath et al. 2013). This should enhance discussion and share of views. When engaging stakeholders into voluntary conservation for raptor nests, they should be proposed but let free to decide whether to participate in the first place, and then how to participate (e.g., how big an area around a nest they would voluntarily set aside). This process will

leave full responsibility of the causes of events on landowner's own actions and preferences, while remaining free of any external pressure. In their own choice, landowners will mainly be driven by their internal self-motivation and self-induced values toward conservation on their land (Lokhorst et al. 2011; DeCaro and Stokes 2008).

Unfortunately, there is a pervasive lack of knowledge about the conditions in which the protection of a small area may benefit a specific raptor species (see e.g., Squires and Kennedy 2006; Naylor 2009). This may impede on-the-ground implementation of nest protection in the first place. However, some raptor species are recently shown to be relatively resilient to human activities in the proximity of their nest site (Santangeli et al. 2012; Lõhmus 2005; Santangeli et al. 2013; Penteriani and Faivre 2001), although this depends on population development and type of threat. This is encouraging in light of the potential for implementing nonmonetary voluntary nest protection based on a small area. Nevertheless, lack of ecological knowledge on the species should not result in lack of action. In such situations, practitioners have a great opportunity to develop semi-natural field experiments, testing the effectiveness of set-aside areas with a different size in order to find the minimum amount required for protection. This info should then be fed into an adaptive management process which would ultimately result in evidence-based conservation (Fig. 1; see also Sutherland et al. 2004; Salafsky et al. 2002).

**Fig. 1**

Flow chart showing the different steps and multiple paths to consider in order implement voluntary nonmonetary nest site conservation by means of asking landowners to retain a small habitat area at no costs. The *gray-shaded* area depicts the section of the process directly relevant to voluntary conservation




When scientific evidence is gathered, a practitioner could implement a voluntary nonmonetary conservation strategy, provided that the area required for protection is relatively small (see above and also e.g., Koks and Visser 2002; Santangeli et al. 2012; Fatér et al. 2004). Conversely, if the required protection area is large, e.g., for more sensitive species, this would result in too large a profit loss to the landowner. In this case, other voluntary market-based approaches may be considered (see e.g., Suvantola 2013; and

Fig. 1). However, we propose that a possible alternative is to compensate for the forgone profit loss via a tax deduction or tax exemption scheme. This would be calibrated according to the amount of land area devoted for protection. For example, in Finland forest, owners pay a fixed tax amount of 30 or 32 % of the logging profit. Thus, if a proportion of the forest is retained for conservation, the forgone loss could be compensated by a reduction in the tax percentage associated with the income of the harvested forest. Ideally, the tax reduction would be progressive, according to the proportion of the forest put under protection over the overall forest area owned. The owner would thus always maintain the same profit irrespective of whether he/she cuts the forest or leaves a wider buffer for conservation.

## Conclusion and Future Directions

In the developed world, large tracts of high-nature value biodiversity still persist on vast privately owned land (Schwartz 2008). There is a rapidly growing attention for conserving wildlife in such complex socio-ecological landscapes. Raptor biologists will have to find novel strategic solutions that embrace the ecological, social, and political dimensions to address new conservation challenges in a man-dominated landscape. They also need to use solid science and good communication skills in order to forge public attitude toward more sustainable land-use practices (Galbraith et al. 2003; Bird and Bildstein 2007). Therefore, it is of crucial importance to scan for solutions and consider options that have been less popular in the past, such as voluntary nonmonetary conservation, but that may reveal highly cost-effective. This vision extends far beyond raptor conservation, as solution scanning and evaluation of effectiveness are needed across the whole wealth of taxa and ecosystems requiring conservation interventions for their long-term persistence (Sutherland et al. 2014).

Over half a century has passed since the release of the seminal view on the land ethic by Aldo Leopold (1949). There, the importance of society as a focal player for conserving nature was strongly highlighted (Leopold 1949). We argue that the time is now ripe for giving greater and wider consideration to voluntary nonmonetary approaches at all levels, from conservation practice to policy. This approach, besides allowing for cost-effective protection, will also help to forge citizens that will become conservationists in the front line for implementing actions (de Snoo et al. 2013). Ultimately, this change will result in long-lasting positive effects for the future sustainability of management practices on private land.

## Acknowledgments

We thank all the respondents to the questionnaire for devoting time that made this study possible. We are also grateful to Irina Herzon, Vincenzo Penteriani, and two anonymous referees for insightful comments on this paper. A.S. was supported by the Finnish School in Wildlife Biology, Conservation and Management (LUOVA) and the Kone Foundation, T.L. by Academy of Finland.

## Electronic supplementary material

Below is the link to the electronic supplementary material.

Supplementary material 1 (DOC 112 kb)

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