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Research Article

A step towards a greener green? Investigating golfers' relationships with nature and attitudes about biodiversity conservation in golf courses

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ABSTRACT

In the context of the biodiversity crisis and in spite of known negative impacts on natural environment, golf courses can play a role in the conservation of biodiversity both for the surface of natural spaces they offer when managed ecologically and for the number of golfers who frequent them. Finding ways to get this large community interested and involved in biodiversity conservation is needed. Research shows that experiencing nature, such as green exercise, fosters a strong connection to nature. It highlights the health and psychological benefits to people but also the positive implications for conservation. However, there is a lack of studies on regular golfers and their relationship with nature. In this national-scale study in France, we used a mixed quantitative/qualitative methodology applied to an online survey ($N = 913$) to assess golfers' relationship with nature, their perception of biodiversity, their attitudes towards conservation issues, and their intention to get involved in pro-biodiversity activities on golf courses. Not surprisingly, golfers' main motivation for visiting a golf course was to play golf. Golfers had a strong connection to nature and were aware of conservation issues, but few were willing to actively participate in pro-biodiversity activities on their regular golf course. Golfers' intention to get involved in pro-biodiversity activities was determined by a strong connection to nature, a positive attitude towards eco-friendly management of golf courses, and a sense of personal satisfaction in working for biodiversity. To our knowledge, this is the first study to address issues of biodiversity conservation and the relationship with nature in the specific context of golf, highlighting the untapped potential of golf courses to make a significant and large-scale contribution to nature conservation.

Management implications: This article investigates golfers' relationships with nature and their perceptions of biodiversity on golf courses. Those courses can play a role in nature conservation but there is a need to support the golf industry in its ecological transition, particularly towards eco-responsible course management, and by educating and involving golfers in pro-biodiversity activities.

The study highlights 4 profiles of golfers (Opposed, Neutral, Supportive and Engaged) for which different strategies could be implemented:

- "Feeling" strategy: promoting links between golfers and nature by increasing experiences in off-course areas on golf courses, especially for the "opposed" profile
- "Thinking" strategy: raising awareness of the ecological management of golf courses by providing golfers with knowledge of eco-management issues and human-nature interactions, especially for the "neutral" profile
- "Acting" strategy: proposing meaningful activities by emphasizing the personal actions benefits to motivate golfers to get involved in conservation, especially for the "supportive" profile.

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1. Introduction

Although golf has become increasingly popular over the last 40 years, it has come under criticism for its ecological impact. For example, the golf industry is accused of destroying large natural areas through the construction of golf courses. This destruction is especially problematic because it contributes to fragmentation and loss of wildlife habitat, which are two of the main causes of biodiversity depletion (Díaz et al., 2019; IUCN, 2022). In addition, golf course maintenance requires regular mowing and significant use of agrochemicals. These products, particularly fertilisers and pesticides, are likely to contaminate air, soil, surface water and groundwater. Ultimately, this contamination creates areas that are unfavourable for biodiversity (Petrosillo et al., 2019; Wheeler & Nauright, 2006). In addition, there is strong pressure on water resources, particularly from the tourism sector (Sax et al., 2016). This includes golf (Berghammer et al., 2016), particularly for watering greens.

In this environmental context, the golf industry has initiated a dynamic towards more sustainable management of golf courses (Minoli & Smith, 2011), such as reducing the use of water and chemical products and the frequency of mowing (Roquinarc'h et al., 2019; Wheeler & Nauright, 2006). In addition, the creation of golf courses in urban and peri-urban areas contributes to limiting the expansion of urbanization and intensive agriculture (Gange et al., 2003), two other major factors in the erosion of biodiversity (IUCN, 2022). Golf courses also provide ecosystem services such as cooling effects in the urban environment through the presence of trees and other green spaces (Nguyen, 2022). While half of the golf course area consists of managed playing surfaces (including tees, greens, fairways, and roughs - see Fig. 1), the other half generally consists of semi-natural areas (Fédération Française de Golf, 2013). Because of these semi-natural areas, golf courses can provide a variety of habitats (e.g., meadows, woodlands, water features, sandy areas and rocky areas) and maintain functional ecological features that are favourable to diverse species (Hodgkison et al., 2007; Tanner & Gange, 2005), including rare and threatened ones (Green & Marshall, 1987). For example, extensively managed roughs can play a role in preserving grasslands, which are in decline in Europe, serving as corridors for insects, spiders, or plant species (Roquinarc'h et al., 2019). This connectivity role can be even more important in urban areas (Nguyen et al., 2020).

Fig. 1. Different sectors of a hole on a golf course. A tee (departure), a fairway, and a green (with the hole marked with a flag) are actual playing areas. They are grassy and often monospecific areas and are generally not very favourable to biodiversity. Turf is mowed at different heights depending on the areas of the course: the greens require daily management while the roughs may not. A golf course is made up of 9–18 (or more) holes.

The transition to more sustainable management requires the support and commitment of all stakeholders at the national and international levels. This includes golfers, whose expectations as consumers can have a strong influence on the management of golf courses, particularly in terms of quality of play and aesthetics (e.g., a uniform and green lawn). This in turn may be incompatible with some biodiversity conservation objectives and policies (Hammond & Hudson, 2007; Wheeler & Nauright, 2006). Indeed, the literature highlights that many golfers do not adopt environmental management programs for golf courses because they do not recognise the need for change, possibly due to a lack of understanding of environmental issues (Minoli et al., 2018). Golf tourists are not willing to pay more to play on an eco-friendly golf course, even if they acknowledge the importance of making a golf course environmentally friendly (De Klerk & Haarhoff, 2015). Based on a survey, Keast (2001) showed that most golfers like to encounter wildlife while playing and would like golf courses to increase natural areas for wildlife, but half of them say they prefer playing areas to be impeccably green. Studies have thus advocated the need to educate golfers about the sustainability of golf (i.e. biodiversity conservation and resource preservation) for them to understand and accept pro-environmental management (Hammond & Hudson, 2007; Roquinarc'h et al., 2019).

One approach used in conservation science to increase public concern and engagement regarding biodiversity issues is to encourage people to have more direct and meaningful experiences of nature (Colléony et al., 2020; Zylstra et al., 2014). Experiences of nature have been shown to foster a strong connection to nature, which helps people engage in pro-environmental behaviours (Whitburn et al., 2018), and provide psychological and physical benefits, such as increased happiness and fulfilment (Zylstra et al., 2014).

This approach can be relevant on golf courses for several reasons. Golf associations occupy and manage the vastest green spaces of all outdoor sports (Albort-Morant & Leal-Rodriguez, 2020; Gange et al., 2003). In mainland France, the golf areas cover 33,000 ha, which include a substantial amount of semi-natural spaces (Fédération Française de Golf, 2017). With 66.6 million practitioners worldwide in 2021 (R&A, 2021), including over 400,000 registered golfers in France (European Golf Association, 2022; Fédération Française de Golf, 2021), golf is also one of the most practiced individual sports in the world. Encouraging nature experiences on golf courses could thus lead golfers to engage in pro-biodiversity activities and accept new management. To do so, it is necessary to study golfers' perceptions of biodiversity, their interactions with nature, and their attitudes toward conservation issues on golf courses (Clayton & Myers, 2015; Mascia et al., 2003; Minoli et al., 2018). Golf practice may also provide social interactions, health-enhancing physical activity, and green exercise for persons of all ages (Murray et al., 2018). Experiences of nature can range from a simple "contact" with nature (Soga & Gaston, 2016) to spending time in a more or less man-made natural space (e.g., an urban park) (Rosa & Collado, 2019). These nature-based experiences enable people to restore and strengthen their connection to nature (Clayton & Myers, 2015; Cosquer et al., 2012). Connection to nature can be defined as a stable state of consciousness comprising three dimensions of psychological inclusion in nature, respectively: an affective representation which refers to an individual's emotional bond with nature; a cognitive representation of the interrelation between self and the rest of nature; and a behavioural component which refers to an individual's commitment to

protecting the natural environment (Schultz, 2002; Schultz et al., 2004).

Promoting experiences of nature can be done through outdoor recreation and nature-based exercise (Larson et al., 2011), as practitioners of outdoor sports may have benefits from several outcomes, including physical health, mental health and wellbeing, and lifelong learning (Eigenschenk et al., 2019; Gladwell et al., 2013). Through their regular proximity to the natural environment, sports practitioners also have the opportunity to maintain a privileged relationship with nature. Regular interactions can foster a strong connection with nature, which is the basis of many pro-environmental behaviours (Clayton & Myers, 2015). Moreover, the degree of engagement with nature may play a central role in choosing to practice green exercise, so that people who show active participation in nature activities (e.g., gardening or participating in pro-biodiversity activities) report a higher quality of life and well-being as well as pro-environmental stewardship (Han, 2021; Holland et al., 2018).

While some recent studies have primarily investigated golf tourists' attitudes towards the sustainability of golf and their environmental responsibility (e.g., López-Bonilla et al., 2018, 2020), we focus on biodiversity conservation issues at the national level and address regular golfers about their daily golf. In contrast to studies on golfers' attitudes towards water and chemical product issues, this study is the first to investigate golfers' relationship with nature, their pro-conservation attitudes, and their intention to engage in pro-biodiversity activities on their regular golf course. Pro-environmental attitudes refer to the "collection of beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues" (Schultz et al., 2005). We thus defined pro-conservation attitudes among golfers as the set of beliefs, affects, and behavioural intentions a person holds regarding activities or issues related to the conservation of biodiversity. In the current study, we explore the extent to which golfers are connected to nature and willing to engage in pro-biodiversity activities on their golf course.

For this purpose, we aim to test the following hypotheses:

- Golfers are a group that can be engaged on conservation issues;
- Golfers' intention to get involved in pro-biodiversity activities in their golf depends on their connection to nature and their attitudes towards conservation issues.

2. Material and method

We conducted this research using an online survey addressed to French adult golfers. We paired statistical modelling with a qualitative approach to explore their relationship with nature and their attitudes towards conservation issues in the golf course they attend the most and in their daily life.

2.1. Study design

We conducted this study nationwide in France as part of a partnership with the French Golf Federation (ffgolf hereafter). From April to May 2021, we distributed an anonymous online survey via the ffgolf mailing list to 15,000 randomly selected adults among French registered golfers, as well as via websites and social media. We received 913 completed questionnaires from more than 350 golf courses. This survey met the ethical standards required by the National Commission for Information Technology and Civil Liberties (CNIL, 2018) and therefore did not require ethical approval.

2.2. Survey design

The survey itself was presented as a study of golfers' relationship with nature while playing golf, in order to develop ways to preserve and enhance biodiversity on golf courses. It contained 13 questions and was designed to explore four themes. To ensure that the questions were understandable and nothing seemed out of place, the survey was pretested with fifteen people, including academics, golfers, and non-golfers. This led to changes in the wording of some questions. See Appendix A for a summary of all the questions, variables, modalities, and corresponding acronyms.

2.2.1. Golfers' socio-demographic characteristics and their sport practice

We collected the gender (*sex*: Male, Female, Other), age category (*age*: (18,39); (40,59); (60+)) and socio-professional category (*SPC:* executive, craftsman, interm., retired, employee, not working, student, worker, farmer, artist) of the respondents. We also asked them to specify how often they play golf (*gamefrequency:* annually, monthly, weekly, daily) and to rank the six following motivations to play golf from the most important to the least (*motivation*: the sport itself; spending time outdoors; social moments; relaxation; nature immersion; the beauty of the golf environment).

2.2.2. Relationship with nature

We asked golfers to indicate the frequency of their visits to natural places - other than golf courses and outside their home - such as urban parks, gardens, forests, or the countryside (*natfrequency*: annually, monthly, weekly, and daily). We also used the Inclusion-of-Nature-in-Self (INS) scale (Schultz, 2002) to assess their connection to nature. The INS has been widely used in research in the field of environmental and conservation psychology (Liefländer et al., 2013). It consists of seven pairs of overlapping circles labelled 'nature' and 'self', and respondents were asked to choose the figure that best represented their relationship with nature. The lowest connection to nature was attributed to respondents who selected the picture with no overlapping circles, and the highest connection was attributed to respondents who selected the one with 100% overlapping circles. Responses were coded from 1 for the pair with two circles not overlapping to 7 for the circles completely overlapping.

2.2.3. Perception of biodiversity

Perception of biodiversity refers to one's subjective assessment of the biodiversity they believe is present in an environment (Marselle et al., 2021). After defining biodiversity as "the diversity of animal and plant species", we asked golfers to describe golf courses' biodiversity using three words.

2.2.4. Attitudes towards conservation issues and pro-biodiversity activities

We asked golfers for their opinion on the current impact of golf course management and maintenance on biodiversity (*golfimpact*: negative, do not know, positive and negative, positive). We also asked whether it was important to them to conserve biodiversity on golf courses (*preservimp*: no, do not know, yes) and whether they thought there was a need for more environmentally friendly management of golf courses, such as late mowing of roughs and providing more space for biodiversity on golf courses (*ecomanagement*: no, do not know, yes).

We also asked golfers if they intended to participate in any pro-biodiversity activities, such as discovering nature on their golf course, learning about it through information boards, participating in nature events to recognise biodiversity, or contributing financially to a program to preserve or restore natural areas on their golf course (*invol*: no, maybe, curious to learn more, yes). Finally, we asked them if they would be satisfied if their golf course undertook such pro-biodiversity activities (*satisfaction*: no, do not know, yes).

2.3. Data analysis

All variables were considered as factors.

2.3.1. Qualitative analysis

2.3.1.1. Perception of biodiversity. The answers to the open question: "Give three words to describe biodiversity present within your golf course" were qualitatively analysed. Using an inductive process, we defined thematic categories and subcategories (Braun & Clarke, 2006) using a randomly selected sample of 100 answers given to this question. We then assigned each word of all the 913 answers to these categories. We finally measured the importance of each category and sub-category counting the number of words assigned to each of them.

2.3.1.2. Multiple Correspondence Analysis (MCA). We performed a Multiple Correspondence Analysis (MCA) to explore relationships between golfers' connection to nature, attitudes towards conservation issues, and their intention to get involved in pro-biodiversity activities on golf courses. MCA is widely used in survey analysis and allows easy visual interpretation of modalities that cluster together. The MCA enables summarising the links between qualitative variables, their modalities and the individuals analysed in graphs (for more details, see Greenacre and Blasius, 2006).

The active variables were the frequency of visits to natural places (*natfrequency*), the connection to nature (*INS*), the perceived impact of golf course management on biodiversity (*golfimpact*), the importance given to the preservation of biodiversity within golf courses (*preservimp*), the opinion on the need for eco-friendly management (*ecomanagement*), the satisfaction they could receive from pro-biodiversity activities implemented into golf courses (*satisfaction*) and their intention to get involved in pro-biodiversity activities (*invol*).

We included gender, age, SPC, game frequency, and the first motivation for which they play golf as supplementary variables. Then we removed them from the analysis since they did not provide relevant information (the deviation between the coordinates of the modalities on each axis was <0.5; Le Roux & Rouanet, 2004).

Low-frequency modalities (below 2% of responses) were randomly reassigned in other ones by using the ventilation function to control the so-called "rare statistic modality". A scree test was applied to determine the number of dimensions to retain in the analysis (Cattell, 1966). Finally, we explored the distribution of the respondents.

The analyses were performed using R 4.0.5 (R Core Team, 2020) with the package "FactoMineR" (Lê et al., 2008).

2.3.2. Quantitative analysis: logistic regression model

Based on the results of the MCA, we performed an ordinal logistic regression (ordered logit) to assess which variables influence golfers' intention to get involved in pro-biodiversity activities within golf courses (*invol*).

To simplify the interpretation of the model, the modality *invol_curious* was grouped with *invol_maybe* so that the variable to explain *invol* was coded as a polytomous ordinal response item with three modalities instead of four (no; maybe; yes).

The explanatory independent variables were the frequency of visits to natural places (*natfrequency*), the connection to nature (*INS*), the perceived impact of golf course management on biodiversity (*golfimpact*), the importance given to the preservation of biodiversity within golf courses (*preservimp*), the opinion on the need for eco-friendly management (*ecomanagement*) and the satisfaction they could receive from pro-biodiversity activities (*satisfaction*). We also considered interactions between all these variables (See Appendix B). We did not include the gender, age, SPC, game frequency, and the first motivation for which they play golf since these variables did not provide any relevant information in the MCA.

We then carried out a stepwise model selection based on the Akaike Information Criterion (AIC; Burnham & Anderson, 2002), following the principle of parsimony (Vandekerckhove et al., 2015). Lastly, we conducted a Type III ANOVA on the best model (Fox & Weisberg, 2019).

The analyses were performed using R 4.0.5 (R Core Team, 2020) with the packages "MASS" (Venables & Ripley, 2002) and "car" (Fox & Weisberg, 2019).

3. Results

3.1. Description of the sample

3.1.1. *Golfers'* socio-demographic characteristics and their sport practice

We collected 913 completed questionnaires on 1490 questionnaires collected from more than 350 golf courses. Descriptive statistics for all variables can be found in Appendix A. Of these participants aged from 18 to 82, 76.6% were men (n = 699) and 23.4% were women (n = 214). These results are representative of the population of registered golfers aged from 18 to 82 (73% of men, 27% of women, ffgolf, 2021). The average age of respondents is 50 years old (registered golfers' average age: 53 years old; ffgolf, 2021). 40–59 years old were over-represented in the sample compared to the population of registered golfers (74.9% and 46% respectively) and those aged 60+ were under-represented (9.2% and 39% respectively; ffgolf, 2021). Half of the respondents were executive managers (50.9%), whereas retirees and students represented a minority (8.4% and 1.8% respectively). More than 70% of golfers played golf at least once a week, which is also representative of the population of registered golfers (75%; ffgolf, 2018). The primary motivation to play was the sport itself (38.0%), followed by spending time outdoors (13.9%), social moments (13.7%), relaxation (12.6%), nature immersion (11.6%), and beauty of the golf environment (10.2%).

3.1.2. Relationship with nature

The frequency of visits to natural places was highly variable among golfers: 22.4% visited a natural place annually, 27.5% monthly, 18.2% weekly, and 31.9% daily. Compared to the French population, fewer golfers visited a nature spot at least once a week (76% and 50.1% respectively; SDES, 2020). More than 34% of respondents had an INS score of 5 (on the INS scale, 1 being a very weak connection, and 7 being a very strong connection to nature), with an average of 5.3/7.

3.1.3. Perception of biodiversity

The classification of the words used to describe biodiversity at their golf course highlighted three thematic categories:

a. Description (51%)
   Golfers mainly described biodiversity in an objective way by quoting the flora and fauna present on their golf course, such as "trees; birds" (36%). They also mentioned landscape features that included elements of the golf course, such as "lake; rough" (15%).
b. Characterization and management practices related to conservation (39%)
   Golfers described biodiversity with positive characterizations such as "protected; essential" (20%) or negative ones such as "fragmented; fragile" (10%). In addition, golfers mentioned some golf course management practices as "managed; natural treatment" and issued some judgments and injunctions for changes in practices such as "can do better; to preserve" (9%).
c. Physical and mental effects (10%)
   Few golfers described biodiversity through their emotions such as "intriguing; soothing" (7%). In addition, the lexical field related to aesthetics such as "beautiful; sublime" was rarely used (2%). Finally, we got a marginal response from golfers describing biodiversity through their senses and their sensations by mentioning for example the "birdsong" or "the smell of the undergrowth" when they are on the course (1%).

3.1.4. Attitudes towards conservation issues and pro-biodiversity activities

For almost half of golfers (49.9%), golf course management and maintenance had both positive and negative impacts on biodiversity.

Only 5.8% of the respondents thought that the impact was overall negative whereas 32.5% thought it was overall positive. Most golfers recognized the importance of preserving biodiversity on their golf course (95.7%) and stated that eco-friendly management was needed to preserve it (86.9%).

Finally, a high percentage of golfers conceived the implementation of pro-biodiversity activities as a source of satisfaction (77.5%) and some of them seemed curious (32.1%) or even ready (10.2%) to get involved in pro-biodiversity activities on their golf course.

3.2. Profiles among golfers according to their pro-conservation attitudes

Using the scree test criterion, MCA results showed a two-dimensional solution from the sample. The first axis accounts for 11.61% of the inertia while the second axis contributes a further 7.76%, giving cumulative inertia of 19.37% to the model (see Appendix C for the contributions of active modalities).

Fig. 2a gives a graphical representation of the MCA displaying the positions of the modalities in the two major axes. The horizontal axis can be interpreted as the level of pro-conservation attitudes (strongly concerned to strongly unconcerned) and the vertical axis can be interpreted as the level of certainty concerning answers (undecided to resolved). We highlighted four distinct groups among golfers, where the variables *invol*, *satisfaction*, *ecomanagement,* and *INS* are related and determining in the construction of the profiles. These four profiles – named *opposed/neutral/supportive/engaged* - among golfers are distributed along an increasing gradient of levels of connection to nature, pro-conservation attitudes and intention to get involved in pro-biodiversity activities.

"*Opposed*" corresponds to golfers not in favour of biodiversity conservation efforts: they are unfavourable to eco-friendly management of the courses (*ecomanagement_no*), they do not wish to get involved in pro-biodiversity activities (*invol_no*) and the implementation of pro-biodiversity activities is not perceived as a source of satisfaction (*satisfaction_no*). They also do not have a strong relationship with nature (*INS_123*).

"*Neutral*" corresponds to golfers with neutral opinion towards conservation issues: they are undecided on the importance of preserving biodiversity (*preservimp_dnk*), on the impact of golf on it (*golfimpact_dnk*), and whether the implementation of pro-biodiversity activities would be a source of satisfaction (*satisfaction_dnk*). They are not sure they want to get involved in pro-biodiversity activities either (*invol_maybe*) and show neither a weak nor a strong connection to nature (*INS_4*).

"*Supportive*" corresponds to golfers with favourable attitudes towards conservation issues: they are favourable to a change in golf management (*ecomanagement_yes*), curious about pro-biodiversity activities in which they could get involved in pro-biodiversity activities (*invol_curious*) and think that these would receive satisfaction from them (*satisfaction_yes*). They also display a strong connection to nature (*INS_6*).

Finally, "*engaged*" corresponds to committed golfers who show a very strong relationship with nature (*INS_7*) and are ready to get involved in pro-biodiversity activities (*invol_yes*). Fig. 2b shows the golfers' individual positions according to their coordinates in the two main MCA axes. We can see that supportive and engaged profiles tend to gather more respondents than opposed and neutral profiles.

3.3. Factors determining the intention to get involved in pro-biodiversity activities

We used a logistic regression to assess the impact of golfers' relationship with nature and their pro-conservation attitudes on their intention to get involved in pro-biodiversity activities, as well as the interactions between all variables. According to the best model from the stepwise model selection (see Appendix B), the intention to get involved in pro-biodiversity activities (*invol*) was significantly and positively associated with *INS* scores (*INS_6*: OR = 2,52, p < 0,01; *INS_7*: OR = 4,15, p < 0,001), *satisfaction* (*satisfaction_dnk*: OR = 2,42, p < 0,01; *satisfaction_yes*: OR = 10,88, p < 0,001) and *ecomanagement* (*ecomanagement_yes*: OR = 3,68, p < 0,001).

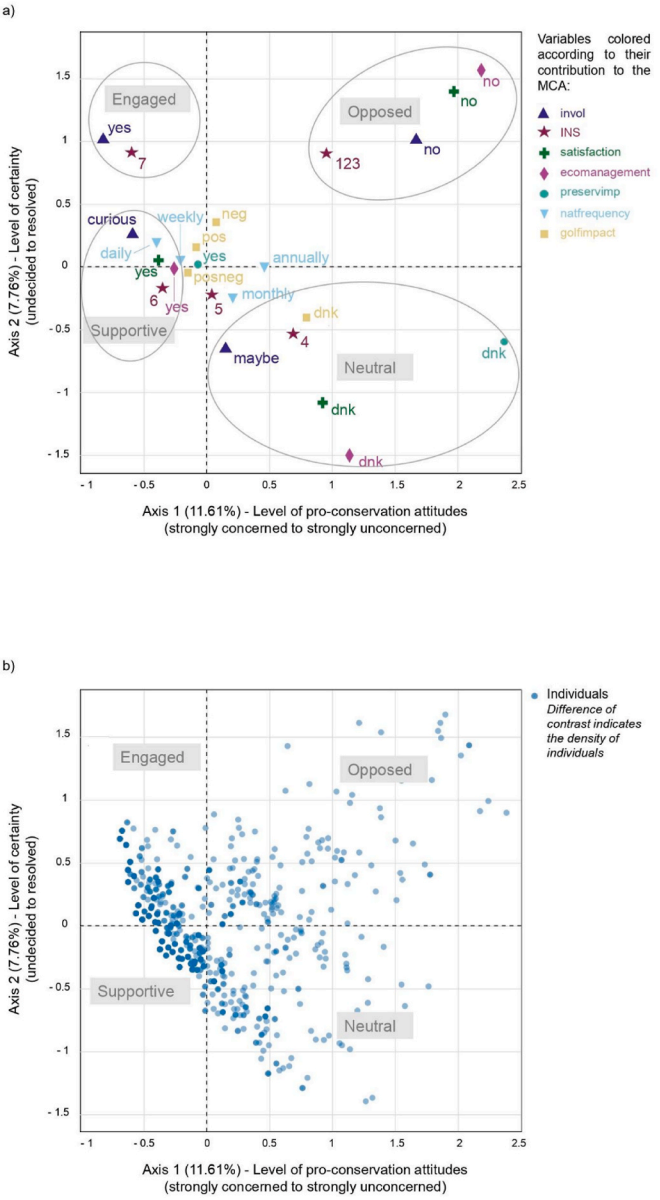

Fig. 2. Multiple Correspondence Analysis (MCA)'s plots with active variables (a) and respondents' individual positions (b) according to a level of certainty and a level of pro-conservation attitude. Four profiles emerged from the MCA: engaged, supportive, neutral, and opposed toward pro-conservation attitudes. *invol:* the intention to get involved in pro-biodiversity activities; *INS*: the connection to nature; *satisfaction*: the individual satisfaction that golfers could receive from pro-biodiversity activities implemented into their golf course; *ecomanagement*: the opinion on the need for eco-friendly management; *preservimp*: the importance given to the preservation of biodiversity on golf courses; *natfrequency*: the frequency of visits to natural places; *golfimpact*: the perceived impact of golf course management on biodiversity; *dnk*: do not know; *pos*: positive; *neg*: negative; *posneg*: positive and negative. The modality *preservimp_no* was submitted to ventilation (n < 2%) and thus did not appear.

However, the intention to get involved in pro-biodiversity activities *(invol)* was not significantly related to the frequency of visits to natural places (*natfrequency*), the perceived importance of preserving biodiversity on golf courses (*preservimp*), and the perceived impact of the golf course on biodiversity (*golfimpact*).

See Table 1 for the full results of the final ordinal logistic regression

Table 1
Results of the final ordinal logistic regression model investigating variation in the intention to get involved in pro-biodiversity activities on golf courses (*invol*).

Predictors	OR[1]	95% CI[2]	p-Value[3]
INS			
123	–	–	–
4	1.35	0.65–2.80	0.43
5	1.42	0.73–2.75	0.30
6	**2.52**	**1.28–4.99**	**0.008** **
7	**4.15**	**1.98–8.72**	**0.000** ***
Satisfaction			
No	–	–	–
Do not know	**2.42**	**1.29–4.56**	**0.006** **
Yes	**10.88**	**6.02–19.75**	**0.000** ***
Ecomanagement			
No	–	–	–
Do not know	2.31	0.99–5.41	0.053
Yes	**3.68**	**1.86–7.29**	**0.000** ***
Intercepts	β (SE) [4]		
invol_no | invol_maybe	**1.36 (0.43)**	-	**0.002** **
invol_maybe | invol_yes	**6.33 (0.49)**	-	**0.000** ***

INS: connection to nature; *satisfaction*: the satisfaction that golfers could receive from pro-biodiversity activities implemented on the golf course; *ecomanagement:* the opinion on the need for eco-friendly management of golf course. The significant modalities are in bold characters.
[1]Odd Ratio, [2]Confidence Intervals, [3]Significance codes: *: <0.05; **: <0.01; ***: <0.001, [4]Coefficients (Standard Errors).

model.

4. Discussion

To our knowledge, this study is the first one focusing on conservation issues and nature relationships in the specific context of golf, providing some innovative perspectives in understanding French golfers' connection to nature and their pro-conservation attitudes. As such, it could help explore how to involve golfers in pro-biodiversity activities on their golf course, which may be a key point to foster support for biodiversity conservation measures implemented by the golf industry.

4.1. The golf course as a space to promote meaningful experiences of nature

By enabling strong relationships with nature, nature experiences lead to a greater understanding and appropriation of biodiversity issues and more pro-biodiversity behaviour (Soga & Gaston, 2016). Indeed, nature experiences are more than simple contact with natural elements, as they can enable the acquisition of new skills, knowledge, or behavioural changes (Clayton et al., 2017).

In the context of golf, this transformative dimension is not initially apparent, as French golfers' top motivation for going to a golf course was to play golf, and only 11.6% of respondents ranked immersion in nature as their main one. Moreover, the way some golfers described golf courses' biodiversity was closely associated with their sport: the evocation of golf courses' features and management practice suggests a utilitarian vision of this space designed to play (part 3.1.3a). In this sense, the golf course remains above all a place of leisure and sport, so that the nature experience could be described as incidental, i.e., felt as a by-product of the sport practice (Keniger et al., 2013).

However, the use of the lexical field related to aesthetics, positive emotions, and well-being (part 3.1.3.c) highlighted recreational and restorative experiences that golfers can have with nature on their golf course (Kaplan, 1995). These multiple, positive, and intentional interactions with nature may underlie the pro-conservation attitudes of many golfers (Zelenski & Nisbet, 2014). Conscious interactions with nature are indeed crucial for the experience to translate into conservation benefits (Colléony et al., 2019).

4.2. An encouraging trend towards pro-conservation attitudes among golfers

Our survey indicates that respondents have a high average level of awareness and interest in conservation issues on their regular golf course, with a majority acknowledging the importance of preserving biodiversity (95.7% of the sample) and the need for ecological management of golf courses (86.9%). This pro-biodiversity trend is encouraging in comparison to the work of Minoli et al. (2018) which highlights limited environmental awareness among golfers and significant opposition to change management in golf clubs. French golfers frequently identify biodiversity by assessing its current status and referring to specific conservation actions (see part 3.1.3.b - Perception of biodiversity). Such a normative evaluation has been found in previous investigations on the perception of biodiversity by the general public (Fischer & Young, 2007; Levé et al., 2019). This confirms that many golfers may constitute a substantial group of people who could take part in biodiversity conservation (see "*Engaged*" and "*Supportive*" profiles in MCA, Fig. 2). Similarly, a European Commission report (2019) states that 71% of EU citizens know or have heard of biodiversity but don't know what it means, and 96% of them believe that citizens have a responsibility to look after nature.

Regarding socio-demographic variables, previous studies have shown that pro-biodiversity attitudes towards sustainability issues are related to age (Bruni et al., 2021) gender, education level, and economic factors, (Kollmuss & Agyeman, 2002; Xiao & Hong, 2018). It has also been highlighted in the context of golf (Kahri, 2021). In our results, though, the intention to get involved, the relationship with nature, or the pro-conservation attitudes were not related to any of these variables. This may be because our sample, the French golfer population, shows little variability in age and socio-professional category. This also suggests that outreach strategies should focus on golfers' relationships with nature and their pro-conservation attitudes, rather than on golfers' socio-demographic characteristics.

This general trend in favour of biodiversity must however be interpreted with caution. First, similarly to other studies based on voluntary participation (e.g., Kaplan, 2007), some sampling bias exists as a large proportion of the golfers who responded to our nature-related survey are likely to be more concerned with biodiversity conservation. Self-assessments of pro-conservation attitudes can be subject to desirability bias although anonymous online surveys reduce this risk compared to interviews (Ball, 2019). In our results, this bias seems to be limited, as suggested by the presence of the "opposed" profile in the MCA, which shows no interest in biodiversity issues.

Our sample also showed an under-representation of older age groups. This may be related to the way the questionnaire was distributed online, as older people may be less used to using digital tools or less willing to respond in this way.

Finally, our results should be interpreted with caution, particularly in the fact that attitudes do not always translate into behaviour (Kollmuss & Agyeman, 2002). However, previous studies such as Davis et al. (2009) show that intention to engage in pro-biodiversity activities can be a significant indication of actual engagement in the future if an outreach program is implemented. In our study, only 10.2% were willing to commit to them (Section 3.1.4) although more than 75% of golfers expressed interest or curiosity in biodiversity activities.

4.3. Strong ties between connection to nature, pro-conservation attitudes and intention to undertake pro-biodiversity activities on golf courses

Beyond the general pro-biodiversity attitude trend, our results show four distinct profiles - *opposed/neutral/supportive/engaged* – among French golfers (see Fig. 2).

We thus noticed that pro-conservation attitudes and connection to nature are closely linked, as the opposed profile includes golfers who are not concerned about biodiversity issues and not connected to nature while the committed profile includes those who are very concerned about biodiversity and strongly connected to nature. This result is consistent with previous studies showing that connection to nature translates into pro-environmental attitudes (Zylstra et al., 2014). However, while most of our sample declared high pro-conservation attitudes (notably *supportive*), only a few respondents expressed a real commitment to biodiversity (*engaged*). Such a gap between attitudes and behaviour (or behavioural intention here) is frequently reported in studies on environmental psychology (Koger & Winter 2010). Yet, being committed to conservation activities may lead to greater contact with and appreciation of biodiversity. This, in turn, may foster greater engagement in policy and practice to support biodiversity conservation in everyday life (Clayton et al., 2017). Thus, knowing which factors could lead to golfers wishing to get involved would provide a better understanding of how to make golfers conservation actors (Kleespies et al., 2021).

4.4. A strong connection to nature as the primary driver to get involved in pro-biodiversity activities

Our results indicate that a strong individual connection to nature, favourable views of eco-friendly golf course management, and a sense of personal satisfaction in acting for biodiversity were more likely to lead to golfers' willingness to get involved in pro-biodiversity activities (Table 1). In addition, only golfers declaring the highest INS score (i.e. 7 on the INS, see "*engaged*" profile in Fig. 2 and Table 1) are the only ones who declare to be ready to support conservation efforts by engaging in pro-biodiversity activities. Here, we can assume that the golfers having this strong relationship with nature were already aware of ecological issues and therefore had understood the need for ecological management of golf courses. This could explain why the intention to get involved variable in our model is linked to a strong connection to nature, to a favourable view of eco-friendly golf course management but also adding a sense of satisfaction in their golf practice (Table 1). This finding is consistent with previous studies showing that people who feel connected to nature are more likely to be motivated to protect it (Mackay & Schmitt, 2019; Whitburn et al., 2020). In addition to feeling connected to nature, getting involved in conservation activities could be perceived as a self-esteem enhancement and contribution to personal growth, contributing to a sense of life satisfaction (Krasny, 2020). This in turn could be an intrinsic motivation factor that triggers golfers to take action in support of biodiversity (Zelenski & Nisbet, 2014).

4.5. Conclusion and perspectives

To our knowledge, this study is the first to focus on people's connection to nature and pro-conservation attitudes in a golf context with the goal of finding triggers to engage them in pro-biodiversity activities at their sports venue. We showed that French golfers reported a strong connection to nature. While most respondents to our survey recognise the importance of addressing environmental issues on golf courses, including eco-friendly management of the areas, those willing to get involved in biodiversity conservation activities are in the minority. Thus, while our study has highlighted the potential of golfers as stakeholders in biodiversity conservation, it also emphasizes the fact that there is still a step to take to truly engage them. As customers, golfers can be a barrier to change in management practices. Their engagement and pro-conservation attitudes are therefore a prerequisite for implementing the changes needed to address environmental issues and ensure a transition to more sustainable golf course management. Given the large amount of green space they cover and the daily interactions with biodiversity that they can provide to millions of golfers worldwide (R&A, 2021), golf courses appear to be an appropriate setting to:

a. Provide spaces to raise awareness and engage a significant number of people in biodiversity conservation, as well as opportunities to reconnect them with nature.
b. Allow changes to be implemented in practices that are more favourable to biodiversity as well as conservation and biodiversity study measures (Roquinarc'h et al., 2019).

We therefore encourage conservation scientists and environmental educators to work with golf course managers to implement specific strategies suited to golfers and based on local biodiversity (Ardoin et al., 2020). Based on our results and the literature, we propose three strategies that can be applied on their own or in combination (Chawla, 2020; West et al., 2018):

- "Feeling" strategy: Promoting a rich and strong connection between golfers and nature by increasing opportunities for golfers to discover out-of-play areas of golf courses could foster a feeling of kinship and an affective individual experience of nature (Krasny, 2020; Mayer & Frantz, 2004). This strategy is particularly aimed at golfers who have a weak or very weak connection with it (such as "*opposed*" golfers).
- "Thinking" strategy: Raising awareness of the need for ecological golf course management by providing golfers with specific knowledge about eco-friendly management issues and human interdependencies with nature (Ardoin et al., 2020). Such strategy should particularly be addressed to "*neutral*" golfers who are undecided golfers concerning conservation issues - so that they understand the need for eco-friendly management (Schultz, 2002).
- "Acting" strategy: Establishing attractive and rewarding conservation activities (e.g., planting trees; collective and competitive actions) by insisting on the personal benefits of acting for biodiversity (i.e., a sense of personal satisfaction) to motivate golfers to engage in conservation (Krasny, 2020; Zelenski & Nisbet, 2014). Such a strategy should be particularly targeted to "*supportive*" golfers who already report a strong connection with nature and pro-conservation attitudes, but who are still reluctant to actually get involved in conservation, even if they can imagine the satisfaction they could gain from doing so.

Consequently, by implementing strategies that foster a positive connection to nature, French golf courses can provide a venue for meaningful experiences leading to greater understanding and appropriation of biodiversity issues which consequently lead to golfers' engagement in biodiversity conservation (Richardson et al., 2020; Rosa & Collado, 2019). Implementing such strategies could also define new social norms regarding management practices and the perception of biodiversity. This could encourage golfers to accept changes in golf management and even to commit to actions favourable to biodiversity on their regular golf course but also in their daily life (Lacoeuilhe et al., 2017).

Finally, as it was an exploratory study, our study focused on golfers in mainland France. As such, our findings may be quite specific to the French socio-cultural context and be very different or not transferable to other contexts or countries. Golf, however, is played around the world in very different socio-cultural contexts, relationships with nature, and natural environments with very diverse ecological characteristics (Lindemann-Matthies et al., 2014). To consider this diversity, we encourage further studies in other contexts, which may provide additional insights. The United Kingdom, Asian and American contexts might then be of particular interest, as they gather a significant share of the world's golfers (R&A, 2021). We also encourage future studies to look at new generations of golfers and to see how environmental awareness of the sport may change from one generation to the next (Chawla, 2020).

CRediT authorship contribution statement

Alice Fouillouze: Formal analysis, Investigation, Data curation, Writing – original draft. **Aurélie Lacoeuilhe:** Conceptualization, Methodology, Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Minh-Xuan A. Truong:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jort.2023.100659.

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