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The social value of conservation initiatives in the workplace

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HIGHLIGHTS

- We explored how biodiversity-friendly initiatives at work can influence employees.
- Biodiversity knowledge, perception, connectedness to nature and behaviour were explored.
- Initiatives can have small but significant impact on conservation awareness and behaviour.
- Initiatives can help connect people to nature averting the extinction of experience.
- Benefits of conservation action at work are thus two-fold (social and ecological).

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ABSTRACT

The success of conservation efforts largely depends on broad-based public support. However, the growing separation between people and elements of nature, due to global processes such as urbanization, may decrease individual connection with nature and public support for conservation. Encouraging interactions between people and nature becomes, therefore, of major importance. As people spend most of the daily time at work, enhancing the interaction between people and biodiversity in their work places could sustainably benefit people and conservation directly (protecting biodiversity) and indirectly (via people's actions). Yet, to date, little effort has been made to explore biodiversity in workplaces and its influence on the knowledge, perception and behavior of employees.

In this study, we explored how top-down biodiversity-friendly initiatives (management of the outdoor areas, communication campaign with signs, exhibitions of nature photography) at work (power plant in rural France) can influence employees' biodiversity-related knowledge, attitudes and behaviors, using a before-after survey. We showed that the influence of such initiatives in the workplace can have small but significant impacts on awareness and behavior of employees in their private everyday life. By implementing new settings in the everyday life of the employees, the studied company (the French electricity company EDF) may have defined new social norms in the workplace. Thus conserving biodiversity in workplaces may mutually benefit conservation directly through preserving local biodiversity and indirectly by influencing and strengthening people's relationship to it.

1. Introduction

Biodiversity continues to decline, despite the increase in conservation efforts (Rands et al., 2010). Halting or decelerating this decline will largely depend on people's daily actions and on the ability to generate strong public support for encouraging governments to implement effective conservation policies (Keniger, Gaston, Irvine, & Fuller, 2013). The support and enthusiasm of people are therefore essential (Ehrlich, 2002). Yet, although most people are increasingly aware and concerned about environmental issues, very few do modify their behaviors accordingly (Koger & Winter, 2010). One reason invoked to explain this gap between awareness and actions is related to the decreased feeling of interconnections between people and nature, resulting from an increased separation due to global processes such urbanization (Turner, Nakamura, & Dinetti, 2004; Miller, 2005; Strohbach, Haase, & Kabisch, 2009). This issue is profoundly concerning, given the mounting evidence regarding the positive health and wellbeing outcomes of interact-

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ing with nature (Bratman, Hamilton, & Daily, 2012; Keniger et al., 2013; Shanahan et al., 2015), but mostly since these interactions may influence the way people value nature and its conservation (Fuller & Irvine, 2010).

Today, the majority of the world's population lives in cities and spend most of their time indoors (Koger & Winter, 2010), in particular at work, with limited interaction with elements of nature in their daily life (Miller & Hobbs, 2002). This life style gradually separates people from the biological reality and contact with flora and fauna, resulting in an "extinction of experience" (Pyle, 1978; Miller, 2005). This extinction of experience is a major environmental and societal issue, because it can modify the way people value nature and, therefore, undermine conservation efforts (Soga & Gaston, 2016). Indeed, some evidence already demonstrates that the experience of nature during childhood was (1) influential for those active in conservation (Chawla, 1999); (2) related to people's affinity for biodiversity (Lindemann-Matthies, Junge, & Matthies, 2010; Shwartz, Cheval, Simon, & Julliard, 2013) and also that this nature-deficit (Louv, 2008) could (3) influence the construction of individual environmental identity (Clayton, 2003), which consequently may decrease individual awareness and support for conservation (Noss et al., 2012). This extinction of experience is not merely an environmental concern, because it is well established that interaction with nature leads to a multitude of health and wellbeing benefits for people (reviewed by Keniger et al., 2013).

Averting this extinction of experience involves increasing both the *opportunity* to directly experience nature and the *orientation* towards engaging with nature (Lin, Fuller, Bush, Gaston, & Shanahan, 2014; Soga & Gaston, 2016). One straightforward way to achieve this goal is to promote daily interaction with biodiversity in the places where people live and work (Miller & Hobbs, 2002). Urban policies and practices have already started to enhance biodiversity in urban areas (e.g., Skandrani & Prévot, 2015), which in turn may increase individual health and wellbeing (Maas, Verheij, Groenewegen, De Vries, & Spreeuwenberg, 2006; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007). Today, an average person spends much of his/her live at work (on average 8.0 h per day during weekdays for Americans; BLS, 2012), making the workplace the most dominate everyday life surrounding. It is therefore important to understand to what extent interaction between people and biodiversity can be enhanced in the workplace and how this interaction could influence individual attitudes and behaviors.

To date, little effort was made to explore biodiversity in the workplace (Snep, WallisDeVries, & Opdam, 2011) and its influence on the perception of the employees (Kaplan 2007). Workplaces often consist of a mixture between grey and green infrastructures (e.g., buildings, private gardens). From ecological perspective, these green spaces could increase connectivity (Snep, Van Ierland, & Opdam, 2009; Löfvenhaft, Björn, & Ihse, 2002), host diversity of common species and sometimes offer refuges for endangered species (Snep et al., 2011). Moreover, the roofs and balconies of many workplaces could be converted to green roofs that can create several microhabitats (Bates, Sadler, & Mackay, 2013) and enhance biodiversity (Madre, Vergnes, Machon, & Clergeau, 2013). These "living roofs and walls" are designed as opportunities to reconcile humans and biodiversity in the urban environment (Francis & Lorimer, 2011). From the social perceptive, Kaplan (1993) pioneering study has pointed out that proximity and availability of nature in the workplace can foster many desired outcomes and even the simplest contact with nature (i.e., nature views from the office window) provides significant psychological benefits for employees. In a more recent work, she further demonstrated that employees preferred nature settings to places with major buildings areas (Kaplan, 2007). A recent study covering over seven thousand participant from 16 countries has demonstrated that having internal green spaces in the workplace can increase happiness and inspiration of employees and reduce boredom and anxiety (Human Spaces, 2015). Yet, it is not clear to what extent efforts to conserve biodiversity at the workplace could influence employees' relationship with nature and conservation.

In this study, we explored how the implementation of biodiversity-friendly initiatives in a workplace (a power plant) influenced employees' relationship with biodiversity. From January 2012, the management team of the studied power plant in the west of France implemented several biodiversity-friendly practices in outdoor areas within the site. Together with these initiatives, a communication campaign (i.e., signs and exhibition of nature photography) was conducted, in order to inform employees in those practices. We explored the outcomes of these initiatives on employees' relations to biodiversity by conducting a before-after survey. Specifically, we aimed to understand (1) how those initiatives influenced biodiversity-related perceptions, knowledge and connectedness of employees with nature, and (2) to what extent these initiatives were translated into individual nature-related behavioral changes.

2. Material and methods

2.1. Study area

The study was conducted in an industrial site, a power plant that produces electricity using coal and fuel oil in the western France. The power plant is located on the estuary of the Loire River to the Atlantic Ocean, about 30 km west of the Nantes metropolis (one of the largest metropolis in France with about 900,000 inhabitants). The power plant and the small town adjacent to it 'Cordemais' (3000 inhabitants) are located within the European network of protected areas 'Natura 2000'. This protected area is mainly composed of extensively managed grassland and wet meadows grazed by cattle and surrounded by a dense network of hedgerows.

The industrial site is managed by the French electricity company EDF. During the recent years EDF has adopted a biodiversity-friendly approach for the management of its sites. This approach primarily aims at gathering environmental knowledge to better assess potential impacts on nature of EDF sites, so as to minimize those impacts by protecting ecosystems and the services they provide. More specifically, practices were selected to increase the diversity of local flowering species in order to promote the presence of pollinating insects and insectivore fauna. EDF started implementing the program in the Cordemais power plant from January 2012, introducing five practices as following: (1) creating flower-meadows using over 38 local species in three separated locations (near the reception, administrative and cafeteria buildings); (2) late mowing of remnant meadows located near the reception and cafeteria buildings; (3) identifying non-indigenous plant species in order to remove them; (4) reducing the use of pesticides; and (5) using mulching by leaving behind mowed grass to allow natural soil enrichment and creating a composting platform for valuing green waste of the site, which was commissioned in January 2013.

The change toward more sustainable management of open spaces within the power plant was accompanied with a communication campaign aiming to explain the implemented actions process and to increase conservation awareness of employees and visitors. Two photo exhibitions about nature were installed, the first in summer 2012 and the second in summer 2013. They were both installed in two areas: one on the access road to the power plant and the other within the site. In addition, educational panels were placed in the power plant: two about the overall approach for biodiversity-friendly management and one near each flowering meadow areas or late mowing areas. Employees were also encouraged to read some informative articles and explanations about these actions on the EDF website and on the power plant internal pages.

2.2. Study design

During July-September 2011, before the initiatives were implemented, we used the power plant mailing list to send online questionnaires to the 400 employees (Survey 1). The email contained the questionnaire and a few words about the study context. The questionnaire was filled out online using an internal software tool that employees knew and used regularly to give their opinion on different subjects and it was strictly anonymous. The questionnaires were first sent in early July 2011, a revival took place in August 2011, and the survey was stopped on the 15th September 2011. Two years later, after the pro-biodiversity initiatives were implemented, we passed exactly the same questionnaire by email to the employees, in July-September 2013 (Survey 2).

2.3. Questionnaire design and measures

We constructed a questionnaire based on previously developed and tested tools (Cosquer, 2012; European Commission, 2013; Simon & Goeldner-Gianella, 2012) that were used to explore the relationship between individuals and biodiversity in Europe and France (see Appendix A for a translated version of the questionnaire). For each of the respondents we collected few socio-professional details including the gender [*gender*], age (categorical: <30, 31–49 and 50< years old [*age*]) and profession (workers, employees with master's degrees equivalent and managers [*profession*]). The central part of our survey was set to measure changes in four main topics: biodiversity knowledge, biodiversity perception, connectedness to nature and nature-related behavior. The questionnaire contained 20 questions aiming to explore these themes (Appendix A).

2.3.1. Individual awareness to biodiversity

2.3.1.1. Biodiversity knowledge. Biodiversity knowledge was measured following the Euro-Barometer of the European Commission (2013) and Simon and Goeldner-Gianella (2012): Familiarity with the concept of biodiversity [*biodiversity definition*] was assessed by summing the scores of two items. The first item explored whether the respondent knows the meaning of term "biodiversity" (yes/no); if s/he answered "yes", the respondent was asked to write a definition of the term. We scored the answer as following: no point for a negative answer, one point for a positive answer without definition, two points for a positive answer with definition referring to the diversity of plants and animals and three points for a positive answer with definition referring to interactions between all components of nature in the ecosystems. The second item asked respondents whether they think that ecosystems provide services to people (yes/no/don't know) [*ecosystem services*]. Again, if the respondent answered "yes", s/he was asked to give examples. Respondents got no point for negative answer, one point if they did not know, two points for positive answer and three points if s/he gave a scientifically validated example according to the Millennium Ecosystem Assessment (MEA, 2005).

2.3.1.2. Perception of the state of local biodiversity. The perception of the state of local biodiversity was assessed by three different items. The first (termed [*perception* of *main threats*]) asked respondents to identify the main threats for biodiversity in the town of the power plant. This multiple selection item included a list of ten potential threats (IUCN, 2011) and answers were scored based on expert's opinion on the local threats. Three points were given to respondents who identified "urbanization" or "industry" as potential threats followed by "agriculture", "transports", or "global change" (two points), "invasive species" or "hunting" (one point) and no points were given for other answers (e.g., "hikers"). We considered the sum of each respondent's scores. The second item (termed [*local biodiversity perception*]) assessed in the 1–5 Likert scale (from "very bad" to "very good") the state of biodiversity within the power plant. The higher the score, the better respondent perceived the state of biodiversity. In the third item (termed [*local biodiversity assessment*]) respondents were asked to identify important areas for biodiversity within the power plant. Respondents could choose between 13 areas (e.g., cafeteria building) within the power plant and its immediate proximity. The importance for biodiversity of these 13 sites was independently ranked (0–3 points) by experts, based on local biological reality and biodiversity surveys. Since biodiversity initiatives increased the biodiversity value of some sites (e.g., flowering meadows near reception building), this expert-based ranking changed between the two questionnaires surveys. To score the answers, we assigned to each site quoted by the respondent the biodiversity score assessed by the expert. We summed all these scores for all the sites quoted by the respondent, to compute a final score for [*local biodiversity assessment]* for each respondent.

2.3.2. Connectedness to nature

We assessed the connectedness to nature using a derived version of the Inclusion of Nature in Self (INS) scale developed by Schultz (2002). This graphical measure examines to what extent an individual includes nature in cognitive representations of the self. Respondents were asked to choose out of six overlapping circles representing "nature" and "self", which picture best describes their relationship with the nature. The lowest connectedness to nature was attributed to respondents who selected the graphic with no overlap between circles and the highest connectedness was attributed to respondents who selected the graphic with 100% overlap between circles.

2.3.3. Individual practices towards biodiversity

We surveyed two specific individual behaviors: (i) the use of public green spaces and (ii) ecological management of private gardens. People have multiple reasons for visiting public green spaces and recent studies demonstrated that interacting with nature was not the only one (Irvine, Warber, Devine-Wright, & Gaston, 2013; Shwartz et al., 2013). Therefore, we explored declared motivation of visiting green spaces as an indicator of individual practices that could be influenced due to the program implemented. The [*motivations for visiting green spaces*] was assessed using two related questions exploring: (1) the frequency of visits to public green spaces (never, rarely, occasionally, frequently, and very frequently) and (2) the motivations for those visits. Respondents were asked to select three from a list of twelve possible answers. Answers were classified into four groups according to the strength of interaction with nature in the *motivations* of the respondents for visiting public green spaces. The final score for each respondent was computed by multiplying the answer of the two questions (see Appendix B).

The second practice was related to the ecological management of private gardens. Private gardens evoke strong sense of place feelings (Gross & Lane, 2007) and can generate meaningful connection with nature that could facilitate nature-related behaviors (Goddard, Dougill, & Benton, 2010). Enhancing biodiversity in domestic gardens is one of the objectives of many gardens owners (Davies et al., 2009). Thus, we explored nature-related practices conducted by the respondents in their private gardens [*practices in private gardens*] using two complementary questions (respondents that did not have any garden were excluded from this analysis): first, respondents were asked on the percentage of their garden surface that is kept un-managed (one point for 0%, two points for less than 5%, three points for 5%–15%, four points for 15%–40% and five points for more than 40%) (Following Cosquer, 2012). Second, respondents were asked to choose their main motivation in a 7-items list. We scored their answer as following: zero when the motivation mentioned was related to laziness (convenience/lack of maintenance), one for reasons related to fear of nature (not to attract wild animals, fear of insects) or for aesthetical reasons (not aesthetic), two for positive aesthetic reason and three for reasons related to environmental awareness (for pollinators and for wild fauna and flora). The final individual score concerning practices in the private garden was computed by multiplying these two items.

2.4. Data analysis

Seven separate linear models (LMs) were built to explore the influence of the biodiversity-friendly initiatives on employees' knowledge about biodiversity, perception of the state of local biodiversity and individual practices toward biodiversity. We first used five LMs to explore changes in *biodiversity definition*, *ecosystem services*, *perception of main threats*, *local biodiversity perception* and *assessment* before and after the initiatives (dummy variable named *survey*). All non-categorical variables were scaled to standardise the effect sizes by subtracting the mean from each value and dividing by the standard deviation. Socio-demographic variables and connectedness to nature were added to the models to account for their potential effect. However, since 39.2% of respondents did not mention their *profession*, this variable was excluded from all models. We then built two additional LMs to explore the effects of *survey*, *biodiversity definition, ecosystem services, perception of main threats, local biodiversity perception, local biodiversity assessment* and *connectedness to nature* on the two nature-related behaviours separately (*motivations for visiting green spaces* and *practices in private gardens*). In these models, we included main effects and interactions between *survey* and other explanatory variables (excluding socio-demographic variables), to exhaustively investigate the potential mechanisms underlying changes in behavior. We checked for the absence of collinearity between the independent variables (variance inflation factors values < 2; Zuur, Ieno, & Smith, 2007) and the impact of potential outliers using R packages AER (Kleiber & Zeileis, 2008) and car (Fox & Weisberg, 2011). We tested the model's assumptions for normality and non-constant error in variance using Shapiro–Wilk and Breusch–Pagan tests (respectively).

For model selection, we used the model-averaging approach, i.e., linear regression with multimodel inference (Burnham & Anderson, 2002) with the MuMIn package (Barton, 2013). Following this method, all models are ranked on the basis of the Akaike's information criterion corrected for small sample size (AICc) (Burnham & Anderson, 2002). For variables from the most parsimonious models (i.e., ΔAICc < 10), we averaged their estimates and standard errors weighted by each model's AICc (Burnham & Anderson, 2002). Model averaging yielded the post-probability (hereafter PP) of an explanatory variable affecting the dependant variable and took into account the number of times the term appeared as significant in the selected models. A rule of thumb for using these post-probabilities was to consider that PP >0.95, 0.95–0.5, and <0.5 corresponded roughly to the classical p-values <0.01, 0.01–0.05, >0.05 (see Shwartz et al., 2013 and refs within for more details). Thus, we identified those variables for which PP > 0.95 as being "strongly" supported by the model and variables for which PP > 0.5 "moderately" supported.

3. Results

Response rates were similar before and after the initiatives: 37.25% of employees responded before (n = 149) and 30% (n = 119) after. Men represented 82.5% of the respondents, which is similar to the proportion of men among the power plants employees (i.e., 90%). Respondents were distributed rather evenly among the three age groups with a small bias toward younger employees (<30 years old represented 35.3% of respondents when this age group represented 23.1% of the power plant employees). The second group (31–49 years old) represented 38.6% of the respondents when they represented 43.8% of employees and the older employees (50 < years old) represented 25.0% of the respondents when they represented 33.1% of employees. We found no significant difference in socio-professional variables between the two surveys (before and after the power plant initiatives on biodiversity). The distributions of age groups (χ^2 = 0.45, 2df, p = 0.80), genders (χ^2 = 1.70, 1df, p = 0.19) and professions (χ^2 = 0.23, 2df, p = 0.89) were similar the two parts of the survey.

3.1. Impact of the initiatives on biodiversity knowledge and perception

The vast majority of respondents were familiar with the concept of biodiversity and ecosystem services and the initiatives did not influence degree of familiarity. Of the respondents 93% and 84% had already heard the word "biodiversity" and thought that the natural spaces and greenspaces can give "services" to the society (respectively), but only 44% and 25% gave a scientifically-relevant definition and relevant examples for services (respectively). However, this knowledge did not change significantly after the initiatives. We also found that men demonstrated lower knowledge compare to women (Table 1).

The majority of respondents were aware of the state of biodiversity in their local territory. Of the respondents 78% gave at least one item among the most threats on biodiversity based on the IUCN. Moreover, 90% of the respondents listed one out of the five expert-based biodiversity richest areas among the 13 proposed locations within the power plant. However, neither the *perception of main threats* nor the *local biodiversity assessment* within the power plant changed significantly after the initiatives (Table 1). On the other hand, the perception of biodiversity status within the power plant (*local biodiversity perception*) was higher after the initiatives (Table 1). Finally, individual connectedness to nature was positively and significantly correlated to most biodiversity knowledge and perception variables, excluding *perception of main threats*, for which we found that older employees were better aware of the main threats for biodiversity conservation in the town (Table 1).

3.2. Impact of biodiversity initiatives on individual practices towards biodiversity

Motivations for visiting green spaces were best explained by respondents' *local biodiversity assessment and perception*, the knowledge variables and by the interaction between *survey* and *connectedness to nature* (Table 2). In more details, respondents that visit public green spaces to interact with nature were: (1) those with higher level of biodiversity knowledge; (2) those who assessed the biodiversity-rich locations in the power plant more accurately; and (3) those who perceived the state of biodiversity in the power plant to be poor. More interestingly, the initiatives seemed to have a complex influence on the declared motivation to visit public green spaces. In general, both before and after the initiatives, we recorded a positive relationship between connectedness to nature and participants' nature-related motivations for visiting public green spaces. However, this relationship was stronger after the initiatives (Fig. 1). Thus connectedness to nature had a stronger influence on the declared motivation after the initiatives (Fig. 1).

The variable *Practices in the private gardens* was explained by all three biodiversity perception variables, *connectedness to nature* and the survey dummy variable (Table 2). Respondents who kept larger unmanaged area for biodiversity in their garden were the ones providing more accurate assessment of threats and biodiversity-rich

Table 1
Results of four linear models exploring knowledge (biodiversity definition and ecosystem services) and perception (main threats, local biodiversity perception and assessment) before and after the implementation of the biodiversity initiatives in the power plant, while accounting for three profile variables (gender, age and connectedness to nature). Estimated average coefficients ± S.E. are presented for all variables. Important (PP > 0.95) and moderately important (0.5 < PP < 0.94) variables are flagged with * or ** respectively and PP is presented in parentheses.

Variables	Biodiversity knowledge		Biodiversity perception		
	Biodiversity definition	Ecosystem services	Perception of main threats	Local biodiversity perception	Local biodiversity assessment
Intersect	0.34 ± 0.26	−0.01 ± 0.30	−0.26 ± 0.24	−0.43 ± 0.23	−0.59 ± 0.24
Survey (before)	–	–	–	–	–
Survey (after)	0.08 ± 0.12	−0.01 ± 0.07	0.00 ± 0.06	0.52± 0.12** (1.00)	0.05 ± 0.06
Age (<30)	–	–	–	–	–
Age (31–49)	−0.00 ± 0.06	0.12 ± 0.15* (0.67)	0.37 ± 0.20* (0.84)	0.07 ± 0.13	0.01 ± 0.06
Age (50<)	−0.02 ± 0.08	−0.11 ± 0.17* (0.67)	0.32 ± 0.21* (0.84)	0.19 ± 0.22	0.00 ± 0.06
Gender (female)	–	–	–	–	–
Gender (man)	−0.66 ± 0.16** (1.00)	−0.29 ± 0.21* (0.81)	−0.09 ± 0.15	−0.03 ± 0.10	0.01 ± 0.09
Connectedness to Nature	0.06 ± 0.06* (0.62)	0.08 ± 0.07* (0.71)	0.03 ± 0.05	0.05 ± 0.06* (0.56)	0.15 ± 0.06** (0.96)

Table 2
Results of two linear models exploring respondents' practices towards biodiversity before and after the implementation of the biodiversity initiatives in the power plant, while accounting for three profile variables (gender, age and connectedness to nature). Estimated average coefficients ± S.E. are presented for all variables. Important (PP > 0.95) and moderately important (0.5 < PP < 0.94) variables are flagged with * or ** respectively and PP is presented in parentheses.

Variable type	Variable	Motivations for visiting green spaces	Practices in private gardens
Socio-economic	Intercept	0.07 ± 0.13	0.02 ± 0.19
	Gender (female)	–	–
	Gender (male)	0.02 ± 0.09	−0.10 ± 0.17
	Age (18–30)	–	–
	Age (31–49)	−0.02 ± 0.09	−0.02 ± 0.01
	Age (50 and more)	0.04 ± 0.12	0.06 ± 0.15
Context	Survey (before)	–	–
	Survey (after)	−0.17 ± 0.13** (0.97)	0.10 ± 0.14*(0.81)
Relation to nature	Connectedness to nature	0.11 ± 0.09** (1.00)	0.24 ± 0.08**(1.00)
Biodiversity knowledge	Biodiversity definition	0.14 ± 0.09* (0.86)	−0.03 ± 0.06
	Ecosystem services	0.06 ± 0.08* (0.63)	0.05 ± 0.06
Biodiversity perception	Perception of main threats	3.9E-3 ± 0.06	0.06 ± 0.09* (0.50)
	Local biodiversity perception	−0.03 ± 0.07* (0.57)	−0.16 ± 0.10* (0.86)
	Local biodiversity assessment	0.20 ± 0.08** (0.98)	0.08 ± 0.09* (0.84)
Interactions	Context & Biodiversity definition	−0.02 ± 0.07	−9.2E-3 ± 0.56
	Context & Ecosystem services	9.2E-3 ± 0.06	0.01 ± 0.06
	Context & Perception of main threats	0.04 ± 0.09	−0.04 ± 0.10
	Context & Local biodiversity perception	−0.04 ± 0.10	0.04 ± 0.11
	Context & Local biodiversity assessment	−0.06 ± 0.11	0.12 ± 0.17
	Context & Connectedness to nature	0.26 ± 0.17* (0.85)	−0.01 ± 0.07

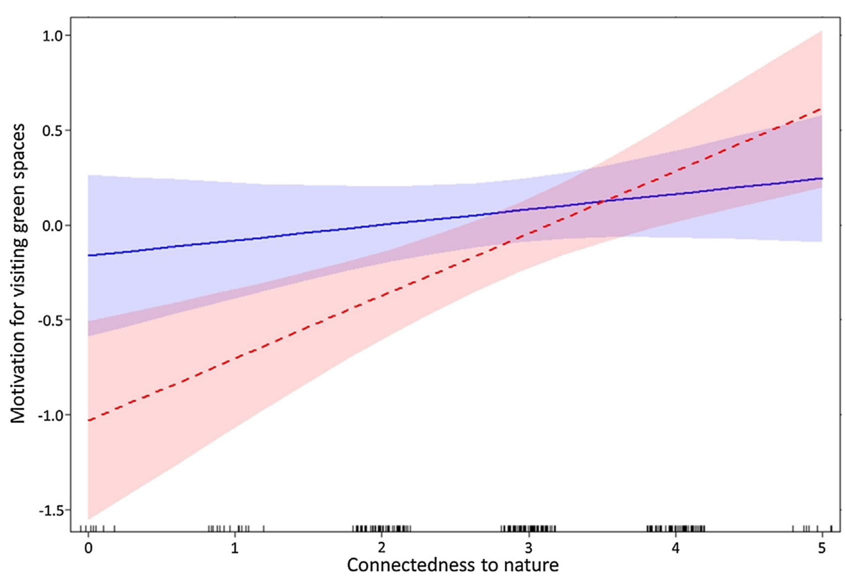

Fig. 1. The significant interaction between employees' motivations for visiting public green spaces and connectedness to nature before (unbroken blue line) and after (dashed red line) the implementation of the biodiversity initiatives in the power plant. The bands indicate the confidence intervals and the ticks the density of the data (respondents). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

locations in the power plant, more connected with nature and perceived the state of biodiversity in the power plant lower. Finally, respondents declared they keep more unmanaged area in their gardens for biodiversity oriented motivations after the initiatives than before.

4. Discussion

Conserving biodiversity in the places where people live and work was proposed as a mean to provide opportunities for meaningful interactions with the natural world (Dunn, Gavin, Sanchez, & Solomon, 2006; Kowarik, 2011; Miller, 2005). In this study, we showed that the implementation of biodiversity-friendly initiatives in a workplace (here a power plant) by the management team has complex consequences on employees' knowledge, attitudes and declared behaviors. Contrary to our expectations, these initiatives did not have a significant impact on either employees' biodiversity assessment or their knowledge about biodiversity and ecosystem services. However, after the initiatives, employees seem to perceive correctly the better status of biodiversity in their workplace and the initiatives also seem to have affected employees' declared practices towards biodiversity in their private lives, in direct and indirect manners. Indeed, after the initiatives, respondents were more likely to leave unmanaged areas in their gardens for biodiversity purposes than before. In a more indirect way, initiatives may have influenced participants' connectedness to nature in a way that enhanced them to seek more interaction with nature when visiting public green spaces. Thus, conserving biodiversity at work may mutually benefit conservation directly through preserving local biodiversity and indirectly by providing more opportunities for people to interact with nature and potentially strengthening people's relationship with it (Miller & Hobbs, 2002).

The biodiversity-friendly initiatives provided by the company demonstrated an interesting influence on individual declared behaviors. This result can be interpreted as an effect of the new social norms defined by the company when implementing new settings in everyday life of the employees (Cialdini, Reno, & Kallgren, 1990). These norms were both descriptive (flowering sites, meadows, photo exhibitions) and injunctive (education flyers explaining why the company was involved in this campaign). Following the theory of planned behavior (Ajzen, 1991), norms (defined as "perceived social pressure to perform or not to perform the behavior", p. 188) impact the intention to act (and eventually action) at the same level as attitudes (which themselves are linked with values and identity). Indeed, social norms have been shown to have a prominent effect on individual behaviors (e.g., Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007), even without being recognized as having a role by individuals who actually changed their behavior (e.g., Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). In our case, the fact that these new social norms were proposed by a personality with a high status (i.e. the employer) may have increased their effects on the employees (see Cialdini & Goldstein, 2004). Indeed, the importance of the source credibility in the trust and adhesion to a world vision is prominent in environmental communication (Koger & Winter, 2010). Our results propose further that social norms and individual attitudes are interrelated in individual actions. We showed that initiatives have encouraged individuals already connected to nature to be even more prone to set nature-related behaviors (Fig. 1). Attitude and social norms are two out the three categories of motivation factors of individual actions in the theory of planned behavior (Ajzen, 1991). We provided here new evidence that these factors can be related at the individual level.

Note that these small behavioral changes can further impact individual attitudes, following cognitive dissonance theory (Festinger, 1957). Following this theory, when confronted with a disjunction between their behaviors and their attitudes, individuals tend to modify one of them in order to fill the gap between their thoughts and their actions (Osbaldiston & Schott, 2012). Concerning environment, Thøgersen (2004) proposed that small behavioral changes could affect environmental attitudes and become, therefore, more sustainable. We thus provided some evidence that conserving biodiversity in workplaces may mutually benefit conservation indirectly, by influencing and strengthening people's relationship to it. Furthermore, there is growing body of evidence that the interaction with nature could have several other benefits for people, such as improving wellbeing (e.g. Balmford & Bond, 2005; Kaplan & Kaplan, 1989; Ulrich, 1984). Enhancing biodiversity in the workplace could therefore serve as a "win–win" solution that benefits both employees and biodiversity conservation (but see, Pett, Shwartz, Irvine, Dallimer, & Davies, 2016 for the people-biodiversity paradox).

However, we should be aware of some limitations of our study and their potential implications. First, according to all questionnaire surveys, we assumed that declared behaviors reflect actual respondents' behaviors, ignoring potential discrepancies between declarations and facts. These potential biases could have been addressed by asking more questions to the respondents to add internal consistency to the data (Yin, 2003), or by observing actual behaviors. We also did not measure whether people notice the changes in biodiversity, or took part in the proposed activities, quantifying this aspect could have strengthened our understanding and conclusions. Other studies have demonstrated some contradicting results regarding lay people assessment of species diversity (Fuller et al., 2007; Lindemann-Matthies et al., 2010; Shwartz, Turbé, Simon, & Julliard, 2014; Pett et al., 2016). Although we did not ask people to estimate species richness or diversity, we did investigate their perception about the state of biodiversity within and in the near vicinity of the power plant. In accordance, we found that employees perceived that state of biodiversity was better after the initiatives, only in the power plant. These results correspond with the results of the ecological surveys conducted. Furthermore, we also found that the vast majority of the respondents (90%) identified specific biodiversity-rich areas in the same way as experts. These results coincide with Bayne, Campbell, and Haché (2012) who demonstrated a positive and strong correlation between people's ranking of disturbance levels (aerial photos) in boreal forest areas and measures of disturbance and the diversity of forest specialist birds.

Alternatively and similarly to another study (Kaplan, 2007), these results could also indicate a pro-environmental skewed study population, due to our obligation to introduce the research subject (i.e., biodiversity) in the request email sent to the employees. Thus, while respondents were representative of all the employees in age, gender and profession, the surveyed population could have been biased toward employees with pro-environmental profile. Indeed, the panel of respondents, who live near or within a Natura 2000 protected area, showed a relatively high knowledge and affinity to biodiversity compared to general French public. For instance, 93% of our respondents have heard the word "biodiversity" compared to 78% (2010) and 87% (2013) of general French public (Euro-Barometer, European Commission, 2013). This potential bias can explain the high level of knowledge and correct assessment biodiversity rich areas, but also the lack of straightforward influence of the initiatives on employees' knowledge, perception and declared behavior. Moreover, we cannot determine whether the differences in the answers to the questionnaire after the initiatives were due to real changes in perception, or simply since employees were more aware of the project and that resulted in a response bias. More qualitative in-depth interviews could have shed light on this important bias. Future research should aim to compliment such quantitative approach with more qualitative interview that may help validate the results and better understand mechanisms (see Shwartz et al., 2012).

Finally, all our results have been achieved in the French (and more broadly western cultural context). Yet, several studies underlined the variations in attitudes to nature across cultures (e.g. Buijs, Elands, & Langers, 2009; Corral-Verdugo, Carrus, Bonnes, Moser, & Sinha, 2008) and cannot be generalized to other cultures without caution.

5. Conclusions

Although we cannot overrule the influence of these potential biases, our results are consistent with theories and models developed in conservation psychology to explain individual attitudes and behaviors toward the environment (see Stern, 2000; Clayton, 2012). We showed that biodiversity-friendly initiatives provided by the company were not sufficient to have strong influence on people's knowledge and attitudes towards biodiversity, but did influence declared pro-environmental behaviors. However, we believe it is highly important to keep on exploring the social personal benefits, in terms of wellbeing of employees for instance. A recent multi-cultural study demonstrated the benefits both employers and employees can gain from enhancing green infrastructure in the workplace (Human Spaces, 2015). For instance, when exploring the elements most wanted in the office, presence of nature (indoor plants) came second in importance (mentioned by 20% interviewees) after having natural light (44%). Therefore, a number of leading organizations are now providing employees opportunities to interact with nature at work such initiative can also enhance employees' creativity and happiness sat work (Human Spaces, 2015). The context of our study was different than the study describe above (office vs. open power plant), but future research could benefit from further investigation of how enhancing nature in different type of workplaces could help aligning the agendas of employers, employees and conservation directly (protecting biodiversity) and indirectly (through enhancing the connection between people and nature). Our results present a new call for employers to take into account the environments they offer to their employees, including green spaces, and provide elements for further discussion on the importance of Biophilia in the workplace.

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Appendix A. The main domains and questions and associated scores used in this study.

Domains and questions	Format	Scoring range
Socio-professional details		
– gender	Dichotomous closed-ended	male/female
– age	Multiple-choice closed-ended	1–3 classes
– profession	Multiple-choice closed-ended	1–3 classes
Familiarity biodiversity definition[a,b]		
–Have you ever heard the word "biodiversity"	Dichotomous closed-ended	Yes/No
If yes, can you give your definition in a few words?	Open-ended question	0–3 points
Familiarity ecosystem services[a,b]		
– In your opinion, the natural spaces and greenspaces can provide "services" to the society?	Dichotomous closed-ended	Yes/No/Don't know
If yes what services do you think?	Open-ended question	0–3 points
Local Knowledge[a]		
– In your opinion, what could threaten biodiversity at the town of Cordemais?	Multiple-choice closed-ended (11 choices; more than one selection possible)	0–3 points
– Can you identify areas of the workplace and its proximity where biodiversity is most important to you?	Multiple-choice closed-ended (13 choices more than one selection possible)	1–16 points
Connectedness to nature[c]		
– please choose the design that best describes your relationship to nature	Multiple-choice closed-ended (6 choices)	0–5
Biodiversity perception[b]		
– In your opinion, what is the state of biodiversity in your workplace?	Multiple-choice closed-ended (5 options)	1–5
Use of public green spaces[c]		
– How frequently do you visit public green spaces? (never, rarely, occasionally, frequently, and very frequently)	Multiple-choice closed-ended (5 choices)	1–5 points
– Why?	Multiple-choice closed-ended (12 choices more than one selection possible; Appendix B)	Classified to 0–4 points
Practices in the private gardens[c]		
– Do you have a private garden?	Dichotomous closed-ended	NA/1
If yes, what is the percentage of your garden surface that you kept un-managed?	Multiple-choice closed-ended (5 choices)	1–5
– Why?	Multiple-choice closed-ended (7 choices)	Classified to 0–3 points
Other questions (no taken into account for this study)		
– Within the power plant, the nature is present.	Likert	1–5
– Can you identify areas of the workplace and its proximity where you would like to see more biodiversity?	Multiple-choice closed-ended (choices 13)	1–16

[a]Borrowed or adapted from European Commission (2013).
[b]Borrowed or adapted from Simon and Goeldner-Gianella (2012).
[c]Borrowed or adapted from Cosquer (2012).

Appendix B.

Use of public greenspaces (Borrowed or adapted from Cosquer (2012))

a. "Do you visit green spaces and natural areas?"

Multiple-choice closed-ended coded 1–5: never, rarely, occasionally, frequently, and very frequently

b. "Why?" to evaluate the motivation for visiting public greenspaces

Respondents were asked to select maximum three out a list of twelve possible answers and answers were classified into five groups according to the strength of interaction with nature in the motivation of the respondents for visiting green spaces. We kept the maximum scores for each respondent.

Possible answers	Reason was linked to nature	Temporary scoring range
1. I do not see the point	No, absence of interest	0
2. There are no park near my home	Weak, other	1
3. I do not have time	Weak, other	1
4. The parks are too crowded	Weak, other	1
5. Activities with the kids	Medium, social activity	2
6. Walking a pet	Medium, social activity	2
7. Relaxing with family/friends	Medium, social activity	2
8. Outdoor recreation	Strong, activities in nature	3
9. Picnic	Strong, activities in nature	3
10. Relaxation/breathing	Strong, activities in nature	3
11. Sport	Strong, activities in nature	3
12. Observe nature	Very strong, explicitly	4

The final score for each respondent was computed by multiplying the answers of the two questions (a. and b.). For example, if a respondent choose "never" because "The parks are too crowded" and "Walking a pet", for this question, the final score is: $1 \times 2 = 2$.

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