Do citizens in Leiden intend to increase biodiversity in their gardens? The predictive value of the Norm Activation Model

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Abstract

The municipality of Leiden wants to gain more insight into how to motivate its citizens to increase biodiversity in their gardens, since biodiversity on earth has decreased drastically. The current research will investigate the predictive value of the Norm Activation Model (Schwartz, 1977) to determine when citizens have a stronger intention. By examining the relationships between awareness of consequences, ascription of responsibility, and perception of the appearance of a biodiverse garden, the current study will provide valuable insights into citizens' intentions, which have been little researched. The results of an online questionnaire ($N = 129$) showed that citizens who are more aware of the consequences of biodiversity loss have a higher intention and feel more co-responsible (as citizens). However, as a whole, the conceptual framework appears to be unsuccessful in predicting intention. Nevertheless, these findings show that raising awareness can be an important first step to increase intention.

Introduction

The European Parliament (2020) states that biodiversity, defined as the coherence and balance of all life on earth, the diversity within and between species, and the variation in habitats, has been drastically reduced in recent years (DeLong, 1996; Kloek et al., 2020). The Deltaplan Biodiversiteitsherstel (n.d.), a foundation consisting of nature and farmers' organisations, knowledge institutions, governments, banks and companies, also expresses great concern. According to the Deltaplan, there are about 8 million plant and animal species living on earth. Of those 8 million, 1 million species will become extinct within a few decades. The European Parliament (2020) states that this loss of biodiversity is mainly due to human behavior, such as changes in land use and pollution. However, when a few plant and animal species are lost, it is a big problem for all species, including humans (Deltaplan Biodiversiteitsherstel, n.d.). Trees, for example, convert carbon dioxide into oxygen and greenery. Fish and water plants prevent algae growth and keep our water clean. All the food humans consume comes directly or indirectly from nature. So, all life around us maintains our supply of oxygen, water and food. In addition, biodiversity is very important for climate adaptation (Gemeente Leiden, n.d.). Unfortunately, many plant and animal species in the Netherlands are threatened with extinction. Once a species is extinct, nothing can be done about it, which is why Deltaplan (n.d.) believes that now is the time for action.

The municipality of Leiden takes this matter very seriously. Their ambition is to be a climate resilient and biodiverse city that is visibly greener by 2050 (Gemeente Leiden, personal communication, November 23 2020). Leiden aims at taking every opportunity to green the city and is already showing many green initiatives. However, half of the city's area is privately owned (Gemeente Leiden, n.d.). Leiden therefore needs the help of its citizens to work towards a more

sustainable city that remains pleasant to live in for future generations. There are many ways to increase biodiversity, but if one looks at the level of a citizen, the environmentally friendly actions in one's own garden are of great value, such as planting native plants, placing nesting sites for bees and wasps or dead wood for fungi, or building a small pond to attract other animals and insects (Gaston et al., 2005). The more citizens take such actions, the more will be achieved. It is therefore important for the municipality of Leiden to gain more insight into the factors that may play a role in the intention of citizens to increase biodiversity in their gardens.

A model that has been particularly successful in predicting a wide range of pro-environmental intentions and behaviors is the Norm Activation Model of Schwartz (1977). For example, in research on predicting energy conservation (Black, Stern, & Elworth, 1985; Tyler, Orwin, & Schurer, 1982), willingness to pay for environmental protection (Guagnano, 2001; Guagnano, Dietz, & Stern, 1994), recycling (Bratt, 1999; Hopper & Nielsen, 1991; Vining & Ebreo, 1992), and general pro-environmental behavior (Nordlund & Garvill, 2002; Schultz et al., 2005). According to the model, people need to be aware of the consequences of their behavior before they feel responsible for engaging in it or recognize that their own contribution may be helpful (De Groot & Steg, 2009). Feelings of responsibility, in turn, strengthen the sense of moral obligation to act in an environmentally friendly way, and these feelings lead to environmentally friendly actions. This makes the Norm Activation Model a valuable model to understand, explain and predict pro-environmental intentions and behaviors.

Previous research has shown that people's perceptions of a biodiverse environment can influence their position on biodiversity-friendly management of public green spaces (Fischer et al., 2020). In particular, people who are aware of the meaning of biodiversity and who feel responsible for its conservation are in favour, but only if the public green spaces have a tidy and

neat appearance. The perceptions that people have of biodiverse environments, for example if they find them messy, dirty or unattractive, could discourage them from increasing biodiversity in their own gardens. Therefore, the current study also examines whether such perceptions can hinder the effect of awareness of consequences and ascription of responsibility on the intention to increase biodiversity in one's own garden.

Theoretical framework

The Norm Activation Model

As stated earlier, the Norm Activation Model of Schwartz (1977) proves successful in predicting various environmentally friendly intentions and behaviors. The model includes three variables to make these predictions (De Groot & Steg, 2009). The first one is awareness of consequences and is defined as whether someone is aware of the negative consequences for others or for other things when not acting pro-environmentally. The second one is ascription of responsibility and is described as feeling responsible for the negative consequences of not acting pro-environmentally. The final one is personal norms, which refers to the sense of moral obligation to perform or refrain from performing certain actions.

Research has investigated the role of awareness of consequences, ascription of responsibility and personal norms in various prosocial and pro-environmental contexts, such as acceptability of energy policies to reduce emissions of CO_2 by households, car-use reduction, and blood donation (De Groot & Steg, 2009). The results support the Norm Activation Model as a mediator model, as they show that awareness of consequences and ascription of responsibility activate personal norms, which, in turn, results in prosocial and pro-environmental behavior. It indeed seems difficult to feel responsible for environmentally friendly actions or to think about the effectiveness of certain actions, without being aware that non-environmentally friendly

actions are a problem. Moreover, it seems unlikely that people will act according to their personal norms if they do not feel personally responsible for the problem or solution. This leads to the conclusion that promoting prosocial or pro-environmental behavior is most successful when the policy is aimed at raising awareness of the consequences of the problem first, before focusing on ascription of responsibility and personal norms.

Biodiversity and intention

It seems that little research has been done specifically on people's intention to increase biodiversity in their own gardens, however, several important insights have already been obtained. Research one people's opinions about biodiversity-friendly management of public green spaces revealed that people who are aware of the meaning of biodiversity and feel responsible for its conservation, are in favour (Fischer et al., 2020). However, this says nothing about people's intention to increase biodiversity in their gardens themselves.

Research on the preferences for native plant landscaping in urban areas revealed that people developed a weaker preference for native plant landscaping when they saw a trend of non-native plants, such as turf grass, amongst their neighbours (Peterson et al., 2012). Such a trend seems to have a negative influence on the intention and actual behavior to design the garden in a different, more biodiverse, way. Although most Dutch citizens say they are inspired by green and wildflower gardens, the majority do not have them (Beumer, 2018). Low maintenance, time efficient, easy to keep clean and predominantly paved gardens are a much more popular concept among Dutch citizens than (wild lush) green gardens. However, these low maintenance gardens contribute little to nothing to increasing biodiversity or creating sustainable urban environments.

Perhaps the Norm Activation Model (Schwartz, 1977) can be used here to predict when people have stronger intentions to increase biodiversity in their garden. Research that supports this idea shows that values of conservation and biodiversity increase awareness of the consequences of biodiversity loss and the attribution of responsibility for these consequences to oneself, which, in turn, leads to the moral obligation to do something for nature and biodiversity conservation (Fornara et al., 2020). However, the actions in this study were measured very generally, such as "My actions to protect the plant world involve many different species" and "I am very active in the protection of nature and biodiversity". These statements do not specify the actions that should be taken to increase biodiversity in gardens, but the processes in the general context of nature and biodiversity conservation are expected to be fairly similar to those in the context of increasing biodiversity in gardens. However, these actions need to be made more specific.

Perception

It is possible that there are other factors that influence the positive effect of awareness of consequences and ascription of responsibility on the intention to increase biodiversity in one's own garden. Research shows that biodiverse environments are often considered messy and unattractive (Qiu et al., 2013). For example, maintained lawns are more often considered to be beautiful, but are of little ecological value, while a biodiverse wetland is more often considered to be unattractive (Gobster et al., 2007). Research shows that people who are aware of the meaning of biodiversity and who feel responsible for its conservation are in favour of biodiversity-friendly management of public greenspace, but only if the public green spaces have a tidy and neat appearance (Fischer et al., 2020). The positive effect of ascription of responsibility on the preference for biodiversity apparently depends on the perception of the

appearance of these biodiverse greenspaces. It is possible that this is also the case for gardens: Even if people feel personally responsible for the consequences of biodiversity loss, they might not be willing to make changes to their garden if they feel it is too big a sacrifice, for example if they find a biodiverse garden dirty, messy or unattractive.

Hypotheses

The current study will investigate the Norm Activation Model (Schwartz, 1977) in the context of increasing biodiversity in gardens, using the conceptual framework shown in Figure 1. Because research suggests that being aware of the consequences and feeling responsible for these consequences usually leads to a higher sense of moral obligation, the decision was made to remove personal norms from the model. Based on the mentioned arguments and findings, the following hypotheses have been formulated:

H1. It is expected that the effect of awareness of consequences on the intention to increase biodiversity in garden is mediated by the ascription of responsibility. That is, being more aware of the consequences of biodiversity loss will lead to the ascription of responsibility for the consequences and, in turn, to having a higher intention to increase the biodiversity in one's own garden.

H2. The perception of the appearance of a biodiverse garden is expected to moderate the relationship between the ascription of responsibility and the intention to increase biodiversity in garden. The relationship between feeling personally responsible for the consequences of biodiversity loss and the intention to increase the biodiversity in one's garden is weaker when citizens perceive the appearance of a biodiverse garden as more negative.
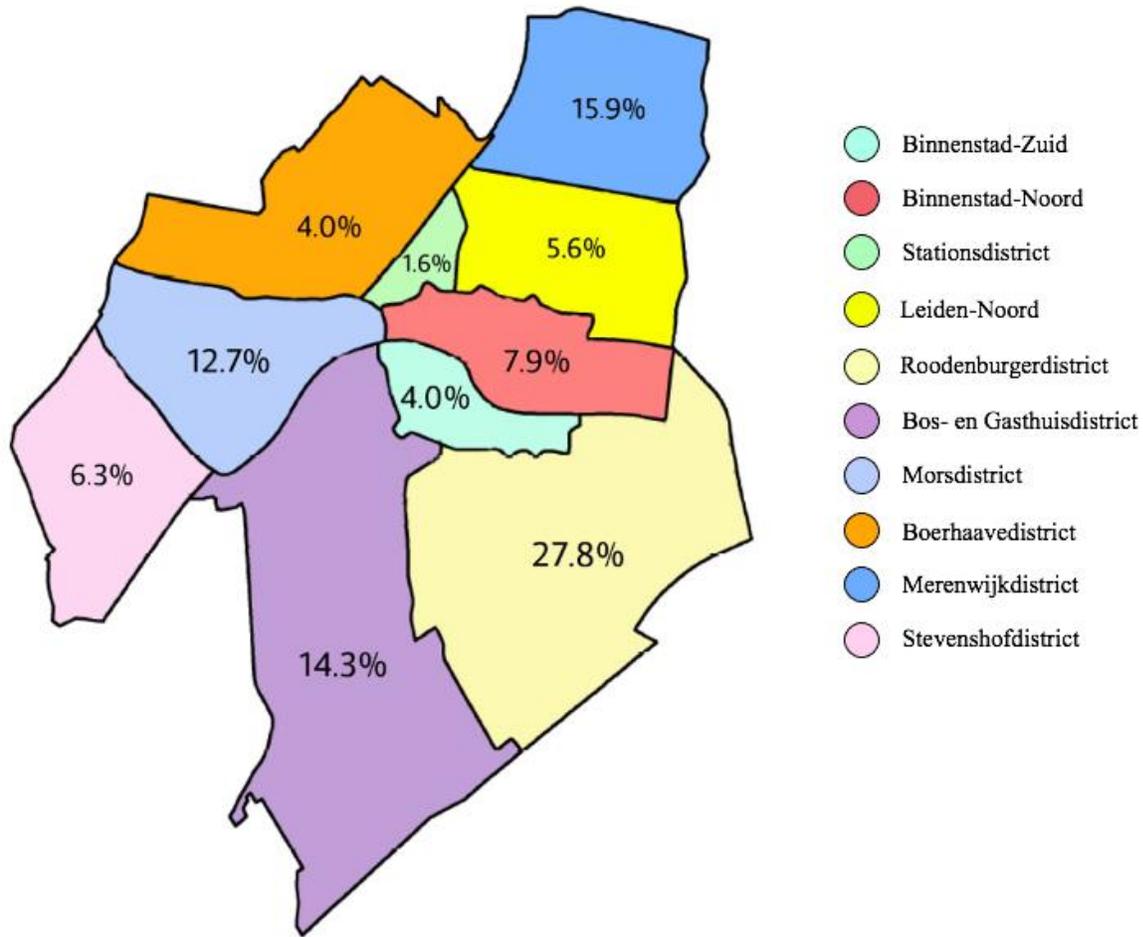
Figure 1

Conceptual framework
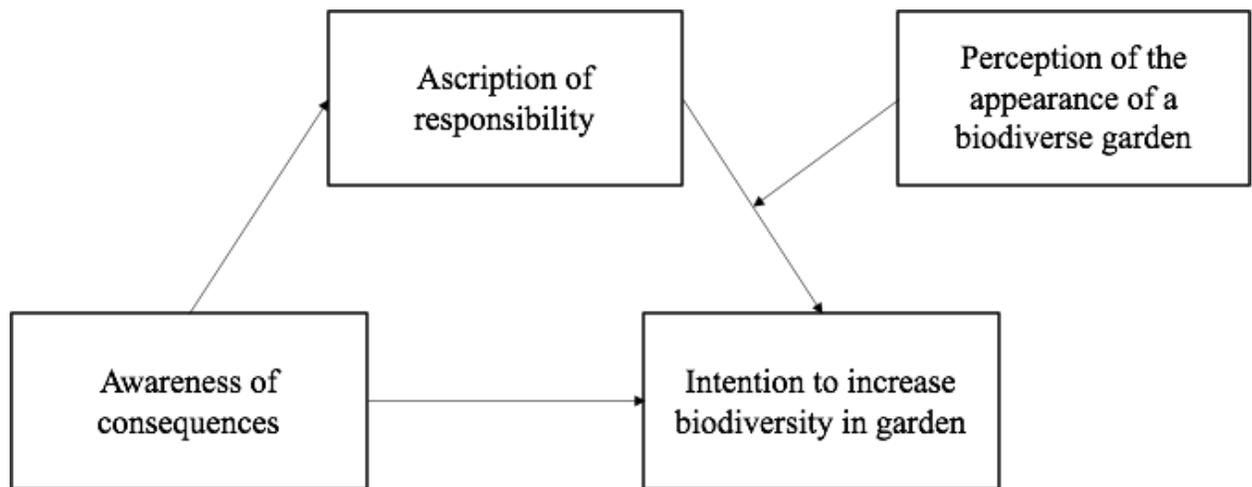
Method

Participants

  The current study had 299 responses, of which 170 participants dropped out or did not answer all the questions on biodiversity. When investigating where the participants dropped out, it appears that 91 participants closed the questionnaire immediately after opening it or stopped right after answering the informed consent questions. The remaining 79 participants did start the questionnaire but dropped out at various points during the questionnaire. Ultimately, a total of 129 Leiden citizens with a garden participated by completing the biodiversity questions in an online questionnaire. Two participants did not fill in the demographic data, which was a possibility as the demographic questions were not required to be answered in order to complete the questionnaire. This dataset consists of 30 males, 96 females and 1 other than above. The mean age of the sample is 54.44 years ($SD = 14.67$), with a range of 23 to 100 years. The majority of the participants have a university degree (44.9%), followed by a higher vocational education (37.8%), a secondary vocational education (9.4%), and secondary school (4.7%). When it comes to income in 2020, the majority of the participants (35%) had a modal income of

between 30.000 and 40.000 euros. The second largest group (34.1%) had a modal income between 40.000 and 70.000 euros. The same percentage of participants had a below modal income of under 30.000 euros or more than twice the modal income of above 70.000 euros (15.4%). As shown in Figure 2, the majority of people who participated in this survey live in the Roodenburg District, followed by the Merenwijkdistrict and the Bos- en Gasthuisdistrict. The districts with the lowest percentage of participants are the Stationdistrict, Binnenstad-Zuid, and Boerhaavedistrict, but these districts consist mainly of office buildings, monuments and the Bio Science Park. The questionnaire was offered in Dutch and English, but out of 129 participants who answered the biodiversity questions, none chose the English version. The highest percentage of participants encountered the questionnaire through the LeidenPanel (42.9%), consisting of Leiden citizens who regularly participate in research for the municipality. The second largest group of participants spotted the questionnaire in an article in the local newspaper the Stadskrant (22.2%). 14.4% of the participants filled in other, and wrote that they had seen the questionnaire on Facebook, LinkedIn, or on the GaGoed website (a website that helps Leiden citizens to make better choices when it comes to energy and nature), or that they know one of the master students involved in the study.

Figure 2

Percentage of participants by district

Binnenstad-Zuid
Binnenstad-Noord
Stationsdistrict
Leiden-Noord
Roodenburgerdistrict
Bos- en Gasthuisdistrict
Morsdistrict
Boerhaavedistrict
Merenwijkdistrict
Stevenshofdistrict

Design

  The current research used a descriptive research design. The municipality of Leiden and Naturalis wish to gain more insight into the citizens' understanding of the concept of biodiversity by means of several open questions, therefore the research design includes both quantitative and qualitative aspects. The qualitative aspects, however, will not be used to test the hypotheses of the current research. The independent variables used in this study were awareness of consequences, ascription of responsibility and perception of the appearance of a biodiverse garden, of which ascription of responsibility was examined as a mediator and the perception of the appearance of a biodiverse garden as a moderator. The dependent variable was the intention to increase biodiversity in garden. All variables are of a ratio measurement level.

Procedure

The present study was part of a larger study, as the data collection was carried out in collaboration with three other master's students. The questionnaires used in the other studies were therefore merged with the questionnaire of the current study to form a single questionnaire. The link of this questionnaire was shared with the LeidenPanel, in the local newspaper the Stadskrant, on the GaGoed website and on various social media platforms. In addition, the researchers also forwarded the link to acquaintances. The introductory text used for the LeidenPanel and the social media platforms can be found in Appendix A. After opening the link of the questionnaire participants had to choose their preferred language, Dutch or English. After that, the participants had to agree to the informed consent (see Appendix B). This part gave more information about the requirements of the study (18 years or older, living in Leiden and in possession of a garden), the duration of the study and contact details if one had questions, followed by more information on the subject of the study.

The first question was about the surface of the garden, followed by questions about the constructs of the other students, namely barriers, intention and behavior to green the garden, attitudes and motivation towards greening, perceived individual impact, and knowledge about greening. The biodiversity construct of the current study came second last in the questionnaire (see Appendix C), followed by questions about group membership and norms. At the end of the questionnaire demographic questions such as gender, age, income, neighbourhood of residence were asked. After this, participants were asked to indicate how they had arrived at the questionnaire. The last part of the questionnaire was a debriefing (see Appendix D). In total, the questionnaire contained 111 items, of which 30 were related to the biodiversity concept of the current study.

Measures

Awareness of consequences

      The three items of this variable are based on the research of Steg et al. (2005) but are adapted to the current context of increasing biodiversity in gardens ($\alpha = .70$). The statements used are as follows: 'Loss of biodiversity means that, in the long run, I will have less to eat', 'Loss of biodiversity has, in the long run, negative consequences for the production of medicines', and 'It is not certain that biodiversity loss is a real problem'. The last statement was recoded. The participants had to indicate on a scale of 1 [*strongly disagree*] to 5 [*strongly agree*] to what extent they agreed with these statements ($M = 4.06$, $SD = .66$).

Ascription of responsibility

      The three items used for this variable were also based on the study by Steg et al. (2005) but were again adapted to the current context. However, the Cronbach's Alpha for this scale was too small ($\alpha = .35$), even if the second statement would be removed ($\alpha = .48$), it would still not be enough for scientific purposes ($\alpha < .70$). Therefore, a separate analysis has to be done for the three statements 'I feel jointly responsible for the loss of biodiversity', 'In principle, individuals cannot solve the problem of biodiversity loss on their own', which has been recoded, and 'Not only the government is responsible for increasing biodiversity, I am too'. For this purpose, the items have been given new names based on content differences. For the first statement, the name sense of co-responsibility ($M = 3.66$, $SD = .91$) was chosen because this statement appeals to the general feeling of co-responsibility for the consequences of the loss of biodiversity. For the second statement, the name individual problem solving ability ($M = 3.18$, $SD = 1.14$) was chosen, because this statement seems to appeal more to the feeling of being able to solve the problem of the loss of biodiversity on one's own. Finally, the third statement was chosen to be

named sense of responsibility as citizen ($M = 4.20$, $SD = .79$) because this statement is more about the sense of co-responsibility in the role as a citizen, as opposed to the more general sense of co-responsibility expressed in the first statement. The participants had to indicate on a scale of 1 [*strongly disagree*] to 5 [*strongly agree*] to what extent they agreed with these statements.

Perception of the appearance of a biodiverse garden

This scale was developed together with a biologist who is specialized in biodiversity. The different aspects of the appearance of a biodiverse garden used for this variable are based on the knowledge of the biologist, as well as on the studies of Gobster et al. (2007), Qiu et al. (2013) and Fischer et al. (2020). The five statements used are bipolar with the negative description on one side and the positive on the other. Participants had to indicate on a 7-point scale the extent to which they thought the appearance of a biodiverse garden was, for example, 1 [*messy*] to 7 [*orderly*]. The values in between were not named. The five statements used for this scale were unattractive/attractive, messy/orderly, ugly/beautiful, dirty/clean, and frightening/calming ($\alpha = .78$, $M = 5.55$, $SD = .92$).

Intention to protect biodiversity in garden

This is the second scale developed together with a biologist who is specialized in biodiversity. Based on her knowledge and research by Gaston and colleagues (2005) on what one can do to increase biodiversity in a garden, the following six statements have been developed: 'I am willing to add flowering plants to my garden', 'I am willing to put up a bee hotel or birdhouse in my garden', 'I am willing to leave weeds in my garden', 'I am willing to mow my lawn less often', 'I am prepared to give up my tiled patio for more greenery in my garden', and 'I am willing to get rid of tiles in my garden to build a pond' ($\alpha = .74$). The statements include small and large actions, where one has to add or leave something in the garden to increase

biodiversity. The participants had to indicate on a scale of 1 [*strongly disagree*] to 5 [*strongly agree*] to what extent they agreed with these statements (*M* = 3.62, *SD* = .65).

Understanding of biodiversity

The questions that belong to this scale were created with the aim of giving the municipality of Leiden more insight into the understanding of the concept of biodiversity among its citizens. The questions therefore do not belong to the theoretical framework of the present study and the analysis is considered an exploratory one. First of all, with the open-ended question 'What is biodiversity to you?' the participants were asked what they understood by biodiversity. Secondly, the participants were asked, on the basis of four pictures of gardens, to what extent they thought the garden was 1 [*not at all biodiverse*] to 7 [*very biodiverse*]. The scores were not combined into one score, as the exploratory analysis will compare the average scores on the different pictures.

Analyses

The statistical analyses were carried out with IBM SPSS Statistics (Version 26). The model of the current study was tested using the PROCESS Macro (Hayes, 2017) extension. Model 14, the moderated mediation model, is in line with the conceptual framework of the current study, shown in Figure 1. This model uses regression analysis to analyse three different paths. The first path examines the relationship between the independent variable awareness of consequences and the mediator ascription of responsibility. The second path examines 1) the relationship between the mediator ascription of responsibility and the dependent variable intention to increase biodiversity in garden with and without the moderator perception of the appearance of a biodiverse garden and 2) the relationship between the independent variable awareness of consequences and the dependent variable intention to increase biodiversity in

garden. The last and third path examines the relationships between the independent variable awareness of consequences and the dependent variable intention to increase biodiversity in garden, with the mediator ascription of responsibility, and with and without the moderator perception of the appearance of a biodiverse garden.

For the variable understanding of biodiversity, the open answers will be looked at in a qualitative way to see if certain themes will emerge. In addition, a repeated measures analysis will be done for the answers on the pictures of the gardens to see if the average scores differ significantly. If that is the case, the answers to the follow-up open questions will be used to describe why participants find a particular garden more or less biodiverse than other gardens.

Results

Assumptions

In order to perform reliable analyses to test the conceptual framework of the current research, the assumptions of a regression analysis were tested first. The assumptions of linearity, normality, multicollinearity and independent errors are met. There might be some doubt about the homoscedasticity assumption, however, as it is not a clearly formed horn, the advice not to worry too quickly is followed and it is concluded that this assumption is also met (Field, 2013, p 175). After that, the data was checked for outliers on the dependent variable, the independent variables and for influential data points. One outlier was found on the dependent variable, namely the standardized residual of case 123 (-3.98) is outside the criterion of > 3 and < -3. This case is only different on the dependent variable, as this participant scores approximately 4 *SD* below the mean for intention to increase biodiversity in garden. This outlier has not been excluded as it is theoretically possible to score average to high on the other constructs, but low on intention. In addition, ten outliers were found on the independent variables, as their leverage

value exceeded the criterion of .093 (3(3+1)/129). However, when examining the scores on the various independent variables, no unusual things were discovered. For that reason, these outliers will remain in the data set. In addition, the duration of filling in the questionnaire was also taken into account, as well as high or low scores on both negatively and positively worded statements within one construct. Again, no unusual things were discovered.

Correlations

Table 2 shows the relationships between the variables used in this study. Almost all relationships are significantly positively related to each other (all $p's < .05$), except for the relationships between individual problem solving ability and the other variables.

Table 2

Correlations between the variables

Variable	1	2	3	4	5	6
1. Awareness of consequences	-					
2. Sense of co-responsibility	.42**	-				
3. Individual problem solving ability	.12	.07	-			
4. Sense of responsibility as citizen	.36**	.32**	.12	-		
5. Intention to increase biodiversity in garden	.54**	.37**	.01	.27**	-	
6. Perception of the appearance of a biodiverse garden	.23**	.24**	-.06	.22*	.29**	-

**. Correlation is significant at the .01 level (2-tailed)

*. Correlation is significant at the .05 level (2-tailed)

The regression analyses

Because the Cronbach's Alpha for the variable ascription of responsibility is insufficient for scientific purposes, Model 14 of Hayes (2017) was tested separately for sense of co-responsibility (Model 1), individual problem solving ability (Model 2), and sense of responsibility as citizen (Model 3). Bootstrapping with 5,000 resamples was used to correct for a potential non-normal distribution of the outcome variable.

All statistics of the three models can be seen in Table 3. Results showed that citizens who are more aware of the consequences of biodiversity loss will have a higher intention to increase the biodiversity in their gardens. Results also showed that citizens who are more aware of the consequences of biodiversity loss feel more co-responsible for these consequences and will also have a greater sense of responsibility as citizens, but do not have a greater sense of individual problem solving ability. However, results showed that ascription of responsibility has no effect on the intention to increase biodiversity in one's garden. Therefore, in contrast to the first hypothesis, results showed that there is no mediating effect of ascription of responsibility on the relationship between awareness of the consequences and the intention to increase biodiversity in one's garden, as the value of zero falls into the confidence intervals.

The perception of the appearance of a biodiverse garden also seems to have no effect on the intention to increase biodiversity in one's own garden. The final result is therefore not in line with the second hypothesis, showing that there is no moderation effect, as the perception of the appearance of a biodiverse garden has no effect on the relationship between ascription of responsibility and the intention to increase biodiversity in one's garden.

Table 3

Statistics of the regression analyses of Hayes' model 14

Tested relationships	Model 1: Sense of co-responsibility					Model 2: Individual problem solving ability					Model 3: Sense of responsibility as citizen				
	b	t	p	LLCI	ULCI	b	t	p	LLCI	ULCI	b	t	p	LLCI	ULCI
Awareness of consequences on intention	.44	3.25	.001	-	-	.47	6.00	< .001	-	-	.46	5.68	< .001	-	-
Awareness of consequences on ascription of responsibility	.57	3.81	< .001	-	-	.21	1.41	.162	-	-	.43	4.29	< .001	-	-
Ascription of responsibility on intention	.11	1.55	.124	-	-	-.03	-.66	.513	-	-	.04	.69	.494	-	-
Awareness of consequences on intention, mediated by ascription of responsibility	.06	-	-	-.008	.125	-.01	-	-	-.045	.018	-.02	-	-	-.055	.131
Perception on intention	.11	.84	.404	-	-	.09	1.60	.113	-	-	.10	1.83	.069	-	-
Ascription of responsibility on intention, moderated by perception	.02	.04	.966	-	-	-.05	-1.10	.274	-	-	-.02	-.60	.552	-	-

Exploratory analysis

In order to gain further insight into the understanding of Leiden citizens regarding the concept of biodiversity, an open question was asked, namely 'What is biodiversity to you?'. The answers were examined in a qualitative way to see if certain themes emerged. Most participants mentioned the variation of plants and animals in their answer, for example "the presence of many different plant and animal species in an area", "all the different things that live and breathe on earth", and "as much natural diversity of plants, animals, insects etc. as possible". Some participants also mentioned the coherence and balance of this life, for example "that different species of plants and animals live on a piece of land and that they live in coherence (it is one big system)", "the whole range of plants and animals, as varied as possible, for the balance on earth", and "diversity in living organisms, and the interaction between them". A few participants

included the word native in their answer, such as "various (native) animals, insects, plants", and "many different (native) plants and animals". One participant mentioned "being environmentally aware" as an answer, and another participant was the only one to mention "diversity, health and future". Finally, a total of 5 participants said they did not know what biodiversity meant to them or did not know how to describe it.

Looking at the perception of biodiversity in the four garden pictures, the results of the repeated measures ANOVA indicated a significant effect of the means on the four gardens, Wilk's Lambda = .59, $F(3, 131) = 29.84$, $p < .001$, $\eta2 = .41$. The garden with native wild growing plants was seen as the most biodiverse garden ($M = 5.67$, $SD = 1.11$), closely followed by the garden with a small pond and a few animals and insects ($M = 5.61$, $SD = 1.19$). The garden with native plants and a neat appearance ($M = 5.35$, $SD = 1.14$) and the garden with mainly plants from the garden centre ($M = 4.81$, $SD = 1.19$) were seen as the least biodiverse of all gardens.

Follow-up comparison showed that the means of the garden with native wild growing plants and the garden with a pond, animals and insects are significantly higher than the means of the garden with native plants and a neat appearance ($p = .018$ and $p = .038$ respectively) and the garden with mainly garden centre plants ($p < .001$ and $p < .001$ respectively). The mean of the garden with mainly garden centre plants is significantly lower than the means of all the other gardens (all p's $< .001$).

When looking at the answers to the follow-up question 'Explain why', participants indicated that they find the garden with native wild growing plant very biodiverse because there is "nothing but greenery", "no tiles", "many different kinds of flowers and plants that attract insects", "it looks nice and wild", and "it has native plants". Similar reasons were mentioned for

the garden with a pond, animals and insects, but now many participants also said that they found the garden biodiverse because there was a pond in the garden. However, a few participants also stated that they did not find this garden very biodiverse because there are tiles in the garden. The garden with native plants and a neat appearance was found to be reasonable, but less biodiverse than the two gardens described above. The participants' explanations varied from "many different plants on different levels", "nice messy garden" to "few diverse plants", "one-sided choice of flowers" and "many tiles". The garden with mainly plants from the garden centre seems to be considered the least biodiverse by the participants because it "mainly contains plants from the garden centre that blossom at the same time", as well as" a lot of tiles" and "only a few native species".

Discussion

The current study aims to gain more insight into the factors that may play a role in the intention of citizens to increase biodiversity in their gardens by testing the Norm Activation Model (Schwartz, 1977). Results showed that citizens who are more aware of the consequences of biodiversity loss have a higher intention to increase the biodiversity in their gardens. This finding is consistent with research by De Groot and Steg (2009), as awareness of consequences seems to be an important first step in increasing environmentally friendly intentions or behavior. Results also showed that awareness of consequences seems to have positive effects on ascription of responsibility. However, this is only reflected in the sense of co-responsibility and the sense of responsibility as a citizen, not in the individual problem solving ability. One explanation for the difference in these results is that individual problem solving ability seems to measure something slightly different than the other two statements, which will be discussed in more detail later.

In contrast to the first hypothesis, results showed that there is no mediating effect of the ascription of responsibility on the relationship between awareness of consequences and the intention to increase biodiversity in one's garden. The fact that the current study did not find similar results as previous research, could possibly mean that ascription of responsibility is only related to intention to increase biodiversity in garden when awareness of consequences is high and not when awareness of consequences is low: Citizens who are not aware of the consequences will show little intention, regardless of their ascription of responsibility. The ascription of responsibility could therefore moderate the relationship between awareness of consequences and intention. Research that supports this idea shows that the relationship between personal norms and prosocial behavior is particularly strong among people who feel a high level of responsibility for the consequences, but when the ascription of responsibility is low, personal norms is less likely to influence behavior as people may deny their responsibility to respond (Schwartz & Howard, 1980). Since the present study found a direct effect of awareness of consequences on intention, it can be assumed that in this context personal norms are most likely also activated. Although research into the relationships between the variables of the Norm Activation Model (Schwartz, 1977) in various pro-social and environmentally friendly contexts found more evidence for a mediation model (De Groot & Steg, 2009), it is possible that in the current context of increasing biodiversity in gardens, a moderation model is a better predictor of intention.

The final result, which is not in line with the second hypothesis, showed that there is no moderation effect, as the perception of the appearance of a biodiverse garden has no effect on the relationship between the ascription of responsibility and the intention to increase biodiversity in one's garden. Because there has been no previous research into the role of the perception of the appearance of a biodiverse garden on the intention to increase biodiversity in the garden, many

explanations for the results of the current study are possible. It could be, for example, that in the present context the perception of the appearance of a biodiverse garden explains the relationship between ascription of responsibility and the intention to increase biodiversity in one's garden, and thus serves as a mediator. Ascription of responsibility would cause a positive perception of the appearance of a biodiverse garden and this, in turn, influences intention. It, however, could also be the case that the perception moderates the relationship between awareness of consequences and intention, rather than the relationship between ascription of responsibility and intention. This could mean that people with a high awareness of consequences show a higher intention, and a positive perception would strengthen this relationship and/or a negative perception would weaken this relationship. It could also be, of course, that the perception of the appearance of a biodiverse garden has no effect in the current context the intention to increase biodiversity in gardens. Because no research has been done on the role of perception on intention, these possible explanations cannot be supported by findings from previous research.

Strengths and limitations

The demographic data showed that most of the Leiden citizens who participated in the current research are somewhat older, have a high level of education and a relatively high income. Figures by Leiden in Cijfers (2021) show that in general the citizens of Leiden are indeed highly educated and have an average to high income, however, figures also show that a larger percentage of citizens fall into the age group 18 - 39 (39%) than into the age group 40 - 64 (29.8%). The latter, however, is more in line with the average age of this sample, but this age group is also more likely to own a garden than the younger age group due to costs, for example. The distribution of participants per district also seems to correspond well with the figures of the distribution of all Leiden citizens per district (Leiden in Cijfers, 2021). The mentioned factors

seem to indicate that the sample of the current study is representative for the citizens of Leiden, which positively influences the generalizability of the results. However, it should also be mentioned that a large percentage of the participants (42.9%) came to the questionnaire via the LeidenPanel, a panel in which about 600 citizens of Leiden are involved and who are asked for their opinion a few times a year (LeidenPanel, 2019). Although the members are selected randomly, these inhabitants are generally motivated to participate in surveys. It could be that these motivated citizens are more likely to have higher intentions in the first place. However, since many participants also arrived at the questionnaire through other channels, this effect will not have a great impact on the results.

The insufficient Cronbach's Alpha of ascription of responsibility is seen as a limitation of the present study. Despite the fact that the internal validity of all items was insufficient, it can be argued that the statement about individual problem solving ability differs too much in content from the statements about the sense of co-responsibility and sense of responsibility as a citizen. Some scholars define ascription of responsibility as the feeling of responsibility for the consequences of the problem, which corresponds to the statements about the sense of co-responsibility and sense of responsibility as a citizen (De Groot & Steg, 2009). Other scholars describe ascription of responsibility as the degree to which a person believes he can make a useful contribution to the solution of the problem, which corresponds more to the statement about individual problem solving ability. In the study by Steg and colleagues (2005), on which the statements of the present study are based, both aspects of ascription of responsibility were included, whereas in other research it was decided to test only one of the aspects (De Groot & Steg, 2009). Because the internal validity of ascription of responsibility statements used by Steg and colleagues (2009) is sufficient ($\alpha = .80$), the low internal validity of ascription of

responsibility in the current study could be due to the reduced number of statements. If both aspects of ascription of responsibility are to be measured, multiple statements should be devoted to both aspects to ensure sufficient internal validity.

A strength of the current research is that together with a biologist who is specialized in biodiversity, a reliable measure of the intention to increase biodiversity in the garden has been developed. Based on her knowledge and other research on what one can do to increase biodiversity in a garden, a number of statements have been developed. These statements include small and large actions, where one has to add or remove something from the garden. This measure can be used to theoretically distinguish between the different actions that contribute to increasing biodiversity in the garden. In addition, this measure can be used in future research not only to measure intention, but also to measure actual biodiverse friendly behavior.

Practical implications

It is becoming increasingly clear to the municipality of Leiden that they need to make their city more biodiverse and climate adaptive. In order to achieve this, the municipality needs the help of its citizens, and will therefore need to gain more insight into the intention of citizens to increase biodiversity in their gardens. These insights can be translated into a campaign in which they can encourage citizens to display this environmentally friendly behavior. The current study contributes to this understanding by showing that citizens who are more aware of the consequences of biodiversity loss have a higher intention to increase biodiversity in their garden. Therefore, the current study advises the municipality to raise awareness among its citizens, as this proves to be an important step in increasing intention. Efforts to raise public awareness of the consequences of biodiversity loss should use a broader context which makes biodiversity relevant to all people who depend on biological resources to meet their basic needs (Union of

International Associations, n.d.). A website made by the foundation Deltaplan

Biodiversiteitherstel (n.d.) already shows this broader context in answering the question 'Why

greener?. This information can be used by the municipality of Leiden to raise awareness in

different settings and by different means. Which approach would be most successful, however,

will have to be answered or investigated by experts.

Directions for future research

To further and better investigate whether or not the Norm Activation Model (Schwartz,

1977) is successful in predicting the intention to increase biodiversity in the garden, future

research could investigate the model with ascription of responsibility as a moderator for the

relationship between awareness of consequences and intention. Although more research in the

pro-social and pro-environmental context has found evidence for the Norm Activation Model as

a mediating model, there is also research that found evidence for a moderating effect of

ascription of responsibility on the relationship between personal norms and intentions. As this

has not been tested before in the current context of intentions to increase biodiversity in the

garden, this will provide valuable insights.

Because the perception of the appearance of a biodiverse garden may affect the

relationships in the model in a different way, future research may consider perception as a

mediator between the relationship of ascription of responsibility on intention, or as a moderator

between the relationship of awareness of consequences on intention. Once this has been

explored, a better answer can be given to the question of whether and how the perception of the

appearance of a biodiverse garden affects the intention to increase biodiversity in one's garden.

Finally, because the statements used in the current study to measure ascription of

responsibility are not reliable enough for scientific purposes, future research should increase the

number of statements. All six statements in the study by Steg and colleagues (2005) can be adapted in future research to the context of increasing biodiversity in gardens. These statements address both aspects of ascription of responsibility: The sense of responsibility for the consequences of the problem and the extent to which a person believes he can make a useful contribution to the solution of the problem. These adjustments will contribute to a more reliable measure of ascription of responsibility.

Conclusion

To make Leiden a climate resilient and biodiverse city, the municipality needs the help of its citizens to increase the biodiversity in their gardens. Raising awareness among citizens about the consequences of biodiversity loss for climate change and humans themselves could be an important first step for the municipality, as citizens who are more aware of these consequences also show a higher intention to increase biodiversity in their gardens. It also appears that citizens who are more aware of the consequences of biodiversity loss also feel more co-responsible (as citizens) for these consequences. However, future research will need to re-examine the relationships of the various variables of the Norm Activation Model (Schwartz, 1977) and the perception of the appearance of a biodiverse garden with a more reliable measure of ascription of responsibility. Nevertheless, the current study does provide valuable information in the context of increasing biodiversity and offers interesting opportunities for follow-up research.

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Appendix A

Introductory text

Hoe gebruikt u uw tuin?
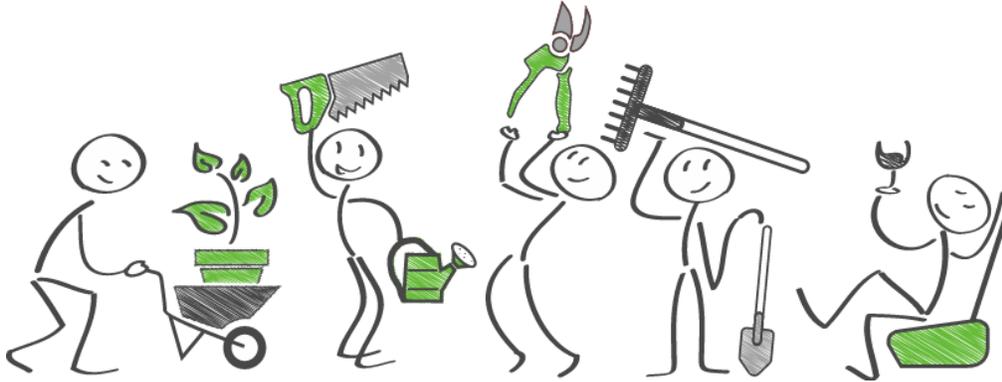
Veel Leidenaren hebben een tuin, die op een verschillende manier wordt gebruikt en er bij iedereen weer anders uit ziet. In samenwerking met gemeente Leiden onderzoekt de Universiteit Leiden de tuinen van Leidenaren. Dit onderzoek is gericht op uw tuingebruik en wat uw doelen en voorkeuren zijn. Wij horen graag uw mening!

Wilt u bijdragen aan het onderzoek? Vul dan deze vragenlijst in. Deelname zal ongeveer 20 minuten van uw tijd in beslag nemen.

Door op onderstaande link te klikken komt u direct bij de vragenlijst uit.

https://leidenuniv.eu.qualtrics.com/jfe/form/SV_cIp7EKGVIXGZpEq

Appendix B

Informed consent

Beste Leidenaar,

Woont u in Leiden, heeft u een tuin op de begane grond én bent u 18 jaar of ouder? Dan komen we graag meer te weten over hoe u deze heeft ingericht en welke overwegingen daarbij een rol hebben gespeeld. We zouden u daarom willen vragen om onze vragenlijst (van ongeveer 20 minuten) in te vullen. Het maakt niet uit hoe uw tuin er uit ziet, elke tuin draagt bij aan ons onderzoek!

Meer informatie:

Dit onderzoek is goedgekeurd door de Psychologie Ethiek Commissie van de Universiteit Leiden. Deelname aan dit onderzoek is geheel vrijwillig. Als u van uw deelname af wilt zien, kunt u dat op ieder moment doen. Hiervoor hoeft u geen reden op te geven.

Wat gebeurt er met mijn gegevens? Uw antwoorden zullen worden gekoppeld aan een unieke code. Uit onderzoeksverslagen kan dus niet worden herleid op wie de gegevens betrekking hebben.

Heeft u nog vragen? Als u verdere vragen heeft over dit onderzoek of uw rechten, of een klacht of zorg wilt uiten over dit onderzoek, dan kunt u contact opnemen via a.van.der.weiden@fsw.leidenuniv.nl. Heeft u vragen over uw privacy? Dan kunt u contact opnemen met onze privacy officer via privacy@fsw.leidenuniv.nl.

Met vriendelijke groet,

Anouk van der Weiden

Hoofdonderzoeker "Buitenruimtes in Leiden"

Afdeling Sociale, Economische en Organisatiepsychologie

Ik verklaar dat:

(alle antwoord opties moeten worden aangevinkt om deel te nemen aan het onderzoek)

- Ik de informatie over dit onderzoek begrijp, en dat ik de mogelijkheid heb gehad om vragen te stellen over het onderzoek (per e-mail);

- Ik begrijp dat mijn gegevens gecodeerd zullen worden verzameld en verwerkt;

- Ik begrijp dat ik mijn deelname op elk moment kan stoppen, zonder daarvoor een reden te hoeven geven;

- Ik een tuin heb;

- Ik 18 jaar of ouder ben;

- Ik toestemming verleen om mee te doen aan dit onderzoek.

Dear Sir/ Madam,

Do you live in Leiden? Do you have an outdoor area on the ground floor? And are you at least 18 years of age? Then we would like to know more about how you have arranged your garden and the considerations that played a role in this arrangement. We would like to ask you to fill in our questionnaire (of approximately 20 minutes). It does not matter what your garden looks like. Every garden is valuable to our research!

More information:

This study has been approved by the Psychology Ethics Committee of Leiden University. Participation in this study is completely voluntary. You can renounce your participation at any given time, without having to give any explanation.

What will happen with my data? Your answers will be linked to a unique code. Our research reports will not allow anyone to trace the data back to whom they relate.

Do you have any further questions? If you have further questions regarding this research, your rights, or if you want to express any complaints or worries regarding this study, you can contact a.van.der.weiden@fsw.leidenuniv.nl. Do you have any questions regarding your privacy? Then you can contact our privacy officer at privacy@fsw.leidenuniv.nl.

Kind regards,

Anouk van der Weiden

Principal investigator "Outdoor spaces in Leiden"

Department of Social, Economic, and Organisational Psychology

I declare that:

(all answer options must be checked to participate in this research)

- I understand the given information regarding this research, and I have been given the opportunity to ask questions (by e-mail);

- I understand that my answers will be collected and processed in a coded manner;

- I am aware that I can renounce my participation at any given time without having to give any explanation;

- I possess an outdoor area on the ground floor;

- I am at least 18 years old;

- I consent to participate in this research.

Over het onderzoek

Dit onderzoek gaat over het gebruik van uw tuin. Ons doel is om een zo compleet mogelijk overzicht te krijgen van het tuingebruik van de inwoners van Leiden, waaronder die van u. Uw bijdrage aan dit onderzoek is heel waardevol. Houd bij het beantwoorden van de vragen in gedachten dat er geen goede of verkeerde antwoorden zijn.

De vragenlijst is op de volgende manier opgebouwd. Allereerst vragen we u naar uw tuingebruik en naar hoe u tegen uw tuin aankijkt. Hierna volgen er vragen over de biodiversiteit in uw tuin. De vragenlijst eindigt met algemene vragen over uw demografische gegevens (leeftijd, geslacht, wijk in Leiden etc.).

About the research

This research investigates your garden usage. Our goal is to gain as much insight as possible about the garden practices of the residents of Leiden, including your garden. Your contribution to this research is very valuable. While answering the questions, please keep in mind that all answers are valuable to us: there are no right or wrong answers.

This survey has the following structure. First, we will ask you about how you use and perceive your garden. This is followed by questions about the biodiversity in your garden. The questionnaire ends with general questions about your demographics (age, gender, neighbourhood in Leiden etc).

Appendix C

Questionnaire on biodiversity

Het volgende onderdeel gaat over de biodiversiteit in Leidse tuinen.

The following questionnaire is about biodiversity in Leiden gardens.

Understanding of biodiversity open answer (UO)

Wat verstaat u onder biodiversiteit?

What is biodiversity to you?

U krijgt nu een aantal tuinen te zien met steeds de vraag hoe biodivers u deze tuin vindt.

You will now be shown a number of gardens and asked how biodiverse you think they are.

Understanding of biodiversity pictures (UP)

Hoe biodivers vindt u deze tuin?

Helemaal niet biodivers - Heel erg biodivers

Licht toe waarom.

How biodiverse do you think this garden is?

Not at all biodiverse - Very biodiverse

Please explain why.

	UP1 Garden with native plants and a neat appearance.
	UP2 Garden with native wild growing plants.
	UP3 Garden with pond, animals and insects.

	UP4
	Garden with mainly plants from the garden centre.

Definitie biodiversiteit

Voor het beantwoorden van de volgende vragen, vragen we u uit te gaan van de volgende omschrijving:

Biodiversiteit gaat over al het leven op aarde: over de variatie van planten- en diersoorten, over micro-organismen die zo klein zijn dat je ze met het blote oog niet kunt zien, over de diversiteit binnen soorten en over de gebieden waarin deze soorten voorkomen. Biodiversiteit gaat ook over de samenhang en het evenwicht van dit leven, veel Nederlandse insectensoorten zijn bijvoorbeeld afhankelijk van Nederlandse planten.

Als we het hebben over de **biodiversiteit in uw tuin**, dan hebben we het, kort gezegd, over de planten, de dieren, de micro-organismen in uw grond en de samenhang van al dit leven.

Definition biodiversity

To answer the following questions, please use the following definition:

Biodiversity is about all life on earth: about the variety of plant and animal species, about micro-organisms that are so small that you cannot see them with the naked eye, about the diversity within species and about the areas in which these species live. Biodiversity is also about the coherence and balance of this life; for example, many Dutch insect species are dependent on Dutch plants.

When we talk about **biodiversity in your garden**, we are, in short, talking about the plants, the animals, the micro-organisms in your ground and the cohesion of all this life.

De volgende vraag gaat over wat u vindt van een biodiverse tuin.

The next question is about what you think of a biodiverse garden.

Perception of the appearance of a biodiverse garden (PAB)

Ik vind het uiterlijk van een biodiverse tuin

Onaantrekkelijk - Aantrekkelijk

Rommelig - Ordelijk

Lelijk - Mooi

Vies - Schoon

Eng - Rustgevend

I find the appearance of a biodiverse garden

Unattractive - Attractive

Messy - Orderly

Ugly - Beautiful

Dirty - Clean

Frightening - Calming

U krijgt nu verschillende stellingen te zien. Geef steeds aan in hoeverre u het eens bent met de stelling. Helemaal mee oneens, mee oneens, niet mee eens/oneens, mee eens, helemaal mee eens.

You will now see various statements. Please indicate to what extent you agree with the statement. Strongly disagree, disagree, neither agree or disagree, agree, strongly agree

Awareness of consequences (AC)

Biodiversiteit is belangrijk voor het tegengaan van de klimaatverandering.

Verlies van biodiversiteit betekent dat ik op termijn minder te eten heb.

Verlies van biodiversiteit heeft op termijn negatieve gevolgen voor de productie van medicijnen.

Ik ben mij niet zeker of het verlies aan biodiversiteit een echt probleem is.

Biodiversity is important in mitigating climate change.

Loss of biodiversity means that, in the long run, I will have less to eat.

Loss of biodiversity has, in the long run, negative consequences for the production of medicines.

It is not certain that biodiversity loss is a real problem.

Geef aan in hoeverre u het eens bent met de volgende stellingen.

Please indicate to what extent you agree with the following statements.

Ascription of responsibility (AR)

Ik voel me medeverantwoordelijk voor het verlies aan biodiversiteit.

In principe kunnen individuen op eigen houtje niet het probleem van biodiversiteitsverlies

oplossen.

Niet alleen de overheid is verantwoordelijk voor het vergroten van de biodiversiteit, ik ben dat

ook.

I feel jointly responsible for the loss of biodiversity.

In principle, individuals cannot solve the problem of biodiversity loss on their own.

Not only the government is responsible for increasing biodiversity, I am too.

Geef aan in hoeverre u het eens bent met de volgende stellingen.

Please indicate to what extent you agree with the following statements.

Personal norm (PN)

Ik zou een beter mens zijn als ik een biodiverse tuin zou hebben.

Ik voel me persoonlijk verplicht om de biodiversiteit in mijn tuin te vergroten.

Ik voel me niet schuldig omdat ik vind dat ik veel grondbedekking in mijn tuin heb.

Mensen zoals ik zouden alles moeten doen wat ze kunnen om de biodiversiteit in hun tuin te

vergroten.

I would be a better person if I had a biodiverse garden.

I feel personally obliged to increase the biodiversity in my garden.

I don't feel guilty because I think I have a lot of ground cover in my garden.

People like me should do everything they can to increase biodiversity in their garden.

Geef aan in hoeverre u het eens bent met de volgende stellingen.

Please indicate to what extent you agree with the following statements.

Intention to increase the biodiversity in own garden (INT)

Ik ben bereid om bloeiende planten aan mijn tuin toe te voegen.

Ik ben bereid om een bijenhotel of vogelkastje in mijn tuin op te hangen.

Ik ben bereid om onkruid in mijn tuin te laten staan.

Ik ben bereid om mijn gras minder vaak te maaien.

Ik ben bereid om mijn versteende terras op te geven voor meer groen in mijn tuin.

Ik ben bereid om tegels in mijn tuin weg te halen voor de aanleg van een vijver.

I am willing to add flowering plants to my garden.

I am willing to put up a bee hotel or birdhouse in my garden.

I am willing to leave weeds in my garden.

I am willing to mow my lawn less often.

I am prepared to give up my tiled patio for more greenery in my garden.

I am willing to get rid of tiles in my garden to build a pond.

Appendix D

Debriefing

Beste Leidenaar,

Ten eerste willen we u van harte bedanken voor het meedoen aan ons onderzoek. In deze brief zullen we u iets meer uitleg geven over waarom we dit onderzoek doen.

Leiden bestaat voor ongeveer 40% uit tuinen. Met dit onderzoek hopen we er achter te komen waarom Leidenaren hun buitenruimte hebben ingericht zoals die is. Uit onderzoek blijkt namelijk dat tuinen een grote rol kunnen spelen bij het oplossen van een aantal (klimaat)problemen:

- Een van die problemen is de afvoer van regenwater. Bij grote hoeveelheden regen raken de riolen overbelast en kunnen er waterproblemen ontstaan. Een belangrijke oplossing voor dit probleem is meer natuurlijke ondergrond (zoals gras, planten, bomen, aarde, of water). Via een natuurlijke ondergrond kan het water beter worden opgenomen en ontstaan er minder problemen in het riool (zie bijv.: Galderisi & Treccozzi, 2017; Offermans, 2012).
- Een ander voordeel van een tuin met veel natuurlijke ondergrond is dat dieren meer kansen hebben om te overleven (zie bijv.: Goddard and colleagues., 2013; Smith, 2006).
- Ook inwoners van Leiden zelf kunnen voordelen ervaren van groenere tuinen. In de stad is het over het algemeen een aantal graden warmer dan in omliggende gebieden. Dit wordt het hitte-eiland effect genoemd. Hoe meer natuurlijke bodem, hoe minder hitte er wordt opgenomen door bijvoorbeeld stenen terrassen. Groenere tuinen kunnen dus voor verkoeling zorgen in warme zomers (zie bijv.: Bowler, 2010; Zwaagstra, 2014).

Daarnaast heeft onderzoek laten zien dat natuur goed is voor gezondheid en welzijn (zie bijv.: Twohig-Bennett & Jones, 2018).

De resultaten van dit onderzoek zullen alleen in gecodeerde vorm (dus nooit in relatie tot uw persoonsgegevens) worden gedeeld. We zijn onder andere van plan de resultaten (dus niet uw gegevens) te delen met de gemeente Leiden. Mocht u hier bezwaar tegen hebben, dan kunt u dit aan ons laten weten en zullen wij uw gegevens niet meenemen in onze analyses.

Heeft u nog meer vragen of wilt u op de hoogte worden gehouden van het onderzoek, dan kunt u contact opnemen via a.van.der.weiden@fsw.leidenuniv.nl.

Als u uw eigen gegevens wilt inzien, dan kan dat onder vermelding van uw deelnemerscode: [*code*].
We kunnen uw persoonlijke gegevens niet achterhalen zonder deze code. Bewaar deze code daarom goed!

We hopen dat u het leuk vond om mee te doen. Uw bijdrage aan ons onderzoek wordt zeer gewaardeerd. Nogmaals bedankt voor uw deelname!

Met vriendelijke groet,
Anouk van der Weiden
Hoofdonderzoeker "Buitenruimtes in Leiden"
Afdeling Sociale, Economische en Organisatiepsychologie

Dear sir / madam,

First, we would like to thank you for participating in our study. In this short letter we will explain a little more about why we are conducting this research.

Leiden consists of approximately 40% gardens. With this research we hope to find out why Leiden residents have designed their outdoor space as it is. Research shows that gardens can play a major role in solving a number of (climate) problems:

- One of those problems is the drainage of rainwater. Large amounts of rain can overload the sewers and cause water problems. An important solution to this problem is more natural surface (such as grass, plants, trees, soil, or water). The water can be absorbed better via a natural subsoil and fewer problems arise in the sewer system (see for example: Galderisi & Treccozzi, 2017; Offermans, 2012).
- Another advantage of an outdoor space with a lot of natural surface is that animals have a better chance of survival (see eg: Goddard and colleagues., 2013; Smith, 2006).
- Leiden residents themselves can also experience benefits from greener outdoor spaces. In the city it is generally several degrees warmer than in surrounding areas. This is called the heat island effect. The more natural soil, the less heat is absorbed by stone terraces, for example. Greener outdoor spaces can therefore provide cooling in hot summers (see for example: Bowler, 2010; Zwaagstra, 2014).

In addition, research has shown that nature is good for health and well-being (see for example: Twohig-Bennett & Jones, 2018).

The results of this research will only be shared in coded form (so never in relation to your personal data). We intend to share the results (not your data) with the municipality of Leiden. If you object to this, you can let us know and we will not include your data in our analyses.

If you have any further questions or if you would like to be kept informed of the research, please contact a.van.der.weiden@fsw.leidenuniv.nl.

If you want to view your own data, you can do so by specifying your participant code: [*code*]. Keep this code safe!

We hope you enjoyed participating. Your contribution to our research is greatly appreciated.

Thanks again for your participation!

Sincerely,

Anouk van der Weiden

Principal researcher "Outdoor spaces in Leiden"

Department of Social, Economic and Organizational Psychology