

DEVELOPMENTS IN BIODIVERSITY-RELATED KNOWLEDGE, ATTITUDES AND WILLINGNESS TO CHANGE BEHAVIOUR FROM 2018 TO 2021 Comparing the Societal Biodiversity Indicator in Africa, Asia and Latin America This report compares the means of the knowledge, attitudes and behavioural indicators that constituted the former Societal Biodiversity Indicator and were assessed in 10 countries around the world in 2018 and 2021. The results indicate significant differences between countries and across the two time points. Overall, almost all countries show an increase in biodiversity-friendly behavioural intention: Brazil, Vietnam, India, Peru, China, Indonesia, South Africa, Colombia and Mexico. An increase in knowledge can be found in Peru, Indonesia, India and Mexico; there was a decrease in knowledge in Kenya and Colombia. The value for attitudes towards biodiversity rose in Brazil, India, Indonesia and Vietnam and fell in Peru.

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# **1. INTRODUCTION**

The loss of biodiversity exceeds the planetary boundaries of a safe operating space many times over.

Steffen et al., 2015

The Earth's biodiversity is in a dire state, and is deteriorating every year (IPBES, 2019). In fact, the loss of biodiversity exceeds the planetary boundaries of a safe operating space many times over (Steffen et al., 2015). Awareness of the loss of biodiversity, however, leaves much to be desired. This was recognized when the 20 Aichi Targets were agreed in 2010; the first of these targets is to increase public awareness about the value of biodiversity and the steps people can take to conserve and use it sustainably. Increased public awareness of biodiversity could have an effect on decisions – both private and societal, resulting from political pressure – that support the conservation of biodiversity (Phillis et al., 2013). Evaluation of this target is therefore of great interest to policy-makers and decision-makers. It is important for communication and education purposes, and for everyone who works in the field of biodiversity conservation and whose work is interlinked with human behaviour.

In order to monitor Aichi Target 1, a comparable indicator is necessary. To this end, the Societal Biodiversity Indicator was developed in 2009 by Kuckartz and Rädiker for the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) (Mues et al., 2017; BfN, 2017). The indicator was initially developed to provide information on the extent to which the German National Strategy on Biological Diversity had achieved its targets (Mues et al., 2017). The Societal Biodiversity Indicator is conceptually based on the idea that a change in society's awareness of biodiversity can be operationalized by assessing three elements in a representative sample: *knowledge* about biodiversity, *attitudes* towards political measures to protect biodiversity. For this reason, the first Societal Biodiversity Indicator version includes three sub-indicators (Mues et al., 2017), which are in part based upon the influential Theory of Planned Behaviour (Ajzen, 1991).



# **01 KNOWLEDGE**

The sub-indicator *knowledge about biodiversity* (knowledge indicator) focuses on knowledge of the term "biodiversity". This sub-indicator is used to test the extent to which participants are familiar with the term. Knowledge is necessary for changing (environmental) behaviour. Hence, it is no surprise that it is the basis of many campaigns and interventions on this topic. However, the empirical evidence is clear that knowledge alone is far from sufficient to actually lead to behavioural change. (e.g. Staats et al., 1996; Preisendörfer, 1999).



# **02 ATTITUDES**

The sub-indicator *attitudes towards biodiversity* (attitudes indicator) investigates the respondents' appreciation of biodiversity (Mues et al., 2017).



# **03 WILLINGNESS**

The sub-indicator *willingness to act in favour of biodiversity* conservation (behavioural indicator) measures the willingness to make one's own contribution to the protection of biodiversity (Mues et al., 2017). Behavioural intention is considered the greatest predictor of real behaviour (Ajzen, 1991).

The Societal Biodiversity Indicator is therefore suited to "informational strategies" that change behaviour by changing knowledge, awareness, norms and attitudes, as opposed to "structural strategies" that aim to change the conditions in which behavioural decision-making takes place (Steg & Vlek, 2009).

The path model presented in Figure 1 graphically depicts the causal relationships of the three sub-indicators. Knowledge of biodiversity therefore influences attitudes positively. With attitudes being key to a person's intention to change, they are at the centre of the model and the predictor of behavioural intention. The willingness to act is the final predictor of behaviour (with actual behaviour not being measured); it is located as the dependent variable at the end of the path

#### Figure 1.

Path model underlying the indicator



The aim was to assess citizens' knowledge of biodiversity, their attitude towards biodiversity-related issues and their intention to perform certain behaviours that would conserve biodiversity.

Both the WWF and the German Federal Agency for Nature Conservation used the Societal Biodiversity Indicator in 2018 and 2021 in 3 continents and 10 countries: Latin America (Brazil, Colombia, Mexico, Peru), Africa (Kenya, South Africa,) and Asia (China, India, Indonesia, Vietnam). The aim was to assess citizens' knowledge of biodiversity, their attitude towards biodiversity-related issues and their intention to perform certain behaviours that would conserve biodiversity. At both times a representative sample (N = 1,000) of citizens participated in each country. This report presents the results of analyses comparing citizens' outcomes in these sub-sectors at country level.





# 2. METHODOLOGY

An online survey was conducted by an international market research institute on behalf of WWF Germany in 2018 and 2021 in the 10 countries (Brazil, China, Colombia, India, Indonesia, Kenya, Mexico, Peru, South Africa and Vietnam) in the respective national language. Each time, the aim was to reach 1,000 participants per country.

The *knowledge* indicator was measured using two items: one assessed participants' knowledge of the term "biodiversity" ("I've heard about it and know what it means", "I've heard about it, but I don't know what that means", "I've never heard of it"). The second item ("Which of these do you associate with the term 'biodiversity'?") consisted of a multiple-choice question assessing participants' association with the term "biodiversity". In the survey conducted in 2021, the second question was removed from the questionnaire. Consequently, we can only compare the 2018 participants' response to the first item with the 2021 participants' responses to the same question.

The *attitudes* indicator was measured with seven items. Six of the items (e.g. whether or not a person is convinced of the decline in biodiversity), were measured with 4-point Likert scales ranging from (1) "Not willing to do" to (4) "Very willing to do". The question on whether biodiversity conservation should be a social priority was measured using a 5-point Likert scale from (1) "Yes, it's a social priority" to (5) "Definitely not a social priority". The latter was adjusted to a 4-point scale for better calculations (Cronbach's alpha ( $\alpha$ )  $\alpha$ 2018= .55;  $\alpha$ 2021= .60).<sup>1</sup>

The *behavioural* indicator was measured with six items asking whether participants were willing to perform biodiversity protection behaviours, for example using a practical guide when shopping or participating actively in a nature conservation organization. Participants provided their answers on the 4-point Likert scale from (1) "Not willing to do" to (4) "Very willing to do" (Cronbach's alpha  $\alpha 2018 = .86$ ;  $\alpha 2021 = .79$ ).

Table 2 shows the formulation of all 14 items in the Societal Biodiversity Indicator that were used in the 2018 and 2021 surveys.<sup>2</sup>

<sup>1</sup> Cronbach's alpha ( $\alpha$ ) is a widely used statistical tool that indicates the internal consistency of a scale. This means that the correlation of the items on a scale is calculated. A high internal consistency indicates that the items that are combined here also measure the same indicator. The higher the alpha, the better. An alpha above .7 is aimed for.

<sup>2</sup> It should be mentioned that the questionnaire included a lot more questions in both 2018 and 2021. However, this report concentrates only on the questions that are relevant to the indicator.

Sub-indicator	Item					
Knowledge indicator	How familiar are you with the term biodiversity?					
	How convinced are you that biodiversity on Earth is in decline?					
	To what extent do you consider biodiversity conservation to be a social priority?					
	I feel personally responsible for protecting biodiversity and nature					
Attitudes indicator	The amount of land used for homes, industry, factories, mining and roads should be reduced to protect biodiversity and nature					
	Biodiversity in nature promotes my well-being and my quality of life					
	Poorer countries should receive financial support from richer countries in order to protect biodiversity and nature					
	It will affect me personally if biodiversity disappears					
	Switch my brand of cosmetics or pharmacy products if I discover that their manufacturing jeopardises biodiversity					
	Donate money to the care and maintenance of a protected area					
Debauiaural indiantar	Participate actively in a nature conservation organization in order to help conserve nature and biodiversity					
Benavioural Indicator	Use a practical guide when shopping, for example one advising about endangered fish species					
	Draw the attention of my friends and acquaintances to biodiversity conservation					
	Keep informed about current developments regarding biodiversity					

#### **Table 1.** Items in the Societal Biodiversity Indicator used in 2018 and 2021

To ensure comparability of the 2018 and 2021 participants, both data sets first had to be harmonised with one other, as the selection criteria for the participants were stricter in 2018. Participants in the 2021 data set who did not meet the selection criteria that had to be met in 2018 for inclusion in the sample were excluded from further analyses. In the survey conducted in 2018, respondents who were in the following (socio-demographic) categories were excluded from further participation in the survey:

- Age >66
- Industry: Market research, paid charity work, NGO, paid fundraising
- Attitudes towards the environment: No interest whatsoever

Of the 10,260 people who took part in the 2021 survey, 1,067 (10.4%) met these selection criteria and were excluded from following analyses. This means that 9,193 people were available for comparison in 2021. The exact number of participants for each country and year can be seen in Table 1.

Continent and country		N per year				
Contin		2018	2019			
	Brazil	1,031	927			
Latin	Mexico	1,044	951			
America	Peru	1,031	915			
	Colombia	1,052	896			
Africa	South Africa	1,031	905			
Africa	Kenya	1,020	802			
Asia	Indonesia	1,024	967			
	India	1,014	886			
	Vietnam	1,039	945			
	China	1,042	999			
	TOTAL	10,328	9,193			

### Table 2. Number of participants per country and year

To compare the biodiversity-related knowledge, attitudes and behavioural intention reported by the participants in 2018 versus 2021, the mean scores for the sub-indicators were calculated. To do this, the items in each sub-indicator were added up and then divided by the number of items. This was done for each country.



# **3. RESULTS**

The mean scores and standard deviations (SD) for the three sub-indicators can be found in Table 3. Note that the total scores are based on different numbers of items using 4-point or 5-point Likert scales. Therefore, the mean scores cannot be compared directly between the indicators (e.g. a statement such as "the attitudes indicator is greater than the knowledge indicator" is not permissible in this table).

Table 3. Mean scores and standard deviations for each sub-indicator in each country

Country	Know	/ledge	Atti	tudes	Behaviour		
	Max	<. = 3	Max	k. = 4	Max. = 4		
	2018	2021	2018	2021	2018	2021	
Brazil	2.80	2.79	3.49	3.59	2.53	2.53	
	(0.44)	(0.42)	(0.38)	(0.39)	(0.77)	(0.77)	
Mexico	2.74	2.84	3.57	3.55	3.37	3.37	
	(0.499)	(0.369)	(0.36)	(0.39)	(0.57)	(0.57)	
Peru	2.58	2.88	3.61	3.47	3.34	3.34	
	(0.584)	(0.349)	(0.34)	(0.44)	(0.59)	(0.59)	
Colombia	2.79	2.88	3.65	3.58	3.41	3.41	
	(0.446)	(0.344)	(0.31)	(0.39)	(0.54)	(0.54)	
South Africa	2.62	2.60	3.45	3.53	3.28	3.28	
	(0.557)	(0.551)	(0.41)	(0.39)	(0.59)	(0.59)	
Kenya	2.85	2.63	3.53	3.48	3.53	3.53	
	(0.379)	(0.556)	(0.37)	(0.41)	(0.52)	(0.52)	
Indonesia	2.68	2.85	3.48	3.59	3.29	3.29	
	(0.506)	(0.37)	(0.39)	(0.32)	(0.57)	(0.57)	
India	2.68	2.84	3.56	3.62	3.34	3.34	
	(0.527)	(0.406)	(0.36)	(0.36)	(0.54)	(0.54)	
Vietnam	2.56	2.67	3.50	3.59	3.28	3.28	
	(0.609)	(0.539)	(0.36)	(0.37)	(0.6)	(0.6)	
China	2.70	2.77	3.45	3.42	3.28	3.28	
	(0.52)	(0.47)	(0.34)	(0.35)	(0.54)	(0.54)	

To ensure a better comparison between the sub-indicators, the percentage score for each sub-indicator and for each country was calculated separately. To this end, the percentage achieved in this indicator was calculated.<sup>3</sup> The results are presented in Table 4 for all constructs for both surveys across all 10 countries. This also offers the possibility of looking at the "room for improvement" until the maximum score is reached.<sup>4</sup> This format also allows for comparisons between indicators within countries.

Country	Knov	vledge	Atti	tudes	Behaviour		
Country	2018	2021	2018	2021	2018	2021	
Brazil	93.33	93.00	86.86	89.69	63.21	85.00	
Mexico	91.33	94.67	88.90	88.34	84.12	88.42	
Peru	93.00	96.00	90.97	89.28	85.29	89.96	
Colombia	86.00	96.00	89.97	86.45	83.54	90.17	
South Africa	87.33	86.67	86.03	87.90	82.00	87.37	
Kenya	95.00	87.67	88.03	86.79	88.29	89.08	
Indonesia	89.33	94.67	89.17	90.59	83.54	89.62	
India	89.33	95.00	86.79	89.55	82.12	88.58	
Vietnam	85.33	89.00	87.66	89.79	81.96	89.96	
China	90.00	92.33	86.31	85.28	82.00	87.96	

#### Table 4. Score in %

For each of the 10 countries we also conducted a statistical test of difference for the 2018–2021 sub-indicators' mean scores using one sample t-tests. Results can be found in Table 5. From an analytical point of view, however, these statistical tests are of limited informative value because the large sample size means that even minimal changes that are uninteresting for the purpose of the study are significant. In the context of large sample sizes, standardized effect sizes such as Cohen's d (Cohen, 1988) are more meaningful. They convert scale-dependent means into

<sup>3</sup> The actual mean (e.g. attitudes indicator in Brazil in 2018 = 25.19) is divided by the maximum attitudes score that could be achieved using the respective measurement instrument (25.19 / 29 = 0.8686 = 86.86%). Practically, this means that in 2018, Brazil already achieved an attitudes score that covers 86.86% of the value of 29 which would be the maximum score that could be achieved in the attitudes indicator.

<sup>4</sup> This is also interesting because it allows the "saturation" of the scales to be observed. If the mean value (and thus a large number of participants) is already very high, only small increases in the mean value can be expected for subsequent years, if any at all. This would pose a problem for the purpose of the indicator, which is to observe the development of nature awareness.

standardized, scale-independent effect sizes by dividing the mean difference by the pooled standard deviations of the compared samples.

This standardized effect size, known as Cohen's d, always has the same meaning:

- |d| = 0.2 small effect size
- |d| = 0.5 medium effect size
- |d| = 0.8 large effect size

The calculated effect size is presented in Table 5. It relates to the significance of the t-test.

**Table 5.** Standardized effect size (Cohen's d) for the 2018–2021 differences between the three societal biodiversity indicators.

Note: Results of undirected t-test for independent sumples. $p=0.05, p=0.07, p=0.07$	Note.	Results o	of und	irected	t-test f	or ina	lepend	ent so	amples:	* p<.	05, <sup>s</sup>	** p<.0	1, ***	p<.001
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Country	Knowledge	Attitudes	Behaviour
Brazil	-0.030	0.247***	1.254***
Mexico	0.228***	-0.047	0.333***
Peru	-0.222***	-0.184***	0.374***
Colombia	0.619***	-0.356***	0.521***
South Africa	-0.051	0.193***	0.399***
Kenya	-0.456***	-0.115*	0.063
Indonesia	0.343***	0.168***	0.602***
India	0.387***	0.297***	0.511***
Vietnam	0.189***	0.249***	0.614***
China	0.131**	-0.102*	0.512***





# 4. DISCUSSION

As can be seen in Table 5, our analyses indicate some substantial positive (up to d = 0.619, medium effect size) and negative (up to d = -0.820, large effect size) changes from 2018 to 2021.

This data can be compared in two ways, both of which are used in this section. First, the development over time of each of the three indicators will be compared separately. For example, the development of knowledge is compared between the 10 countries. To illustrate the comparison of these changes in a simple way, a graphical format is used (see Figure 2, world maps showing the different positive and negative changes in different colours for each of the10 countries). Second, each of the 10 countries will be subject to a specific comparison that shows the development of all indicators in the particular country.

### 4.1 DEVELOPMENT OF THE THREE INDICATORS

#### Knowledge

The results concerning the item on *knowledge* seem to differ during 2018 and 2021. A large increase in knowledge could be seen in Peru (0.619\*\*\*). Small increases were calculated for Indonesia (0.387\*\*\*), India (0.343\*\*\*) and Mexico (0.228\*\*\*). Small decreases were calculated for Kenya (-0.456\*\*\*) and Colombia (-0.222\*\*\*). No significant differences could be found in Vietnam (0.189\*\*\*), China (0.131\*\*), Brazil (-0.030) or South Africa (-0.051) (see Figure 2).



**Figure 2.** Change in knowledge about biodiversity in Cohen's d Figure 3.

in Cohen's d

Change in attitudes

towards biodiversity

#### Attitudes

The differences measured in *attitudes* towards biodiversity were very small around the globe, with no significant differences measured over time in Mexico (-0.047), China (-0.102\*), Kenya (-0.115\*) or Colombia (-0.184\*\*\*). Small increases in attitudes could be found in Indonesia (0.297\*\*\*), Vietnam (0.249\*\*\*), Brazil (0.247\*\*\*) and India (0.168\*\*\*). Peru showed a small decrease (-0.356\*\*\*) (see Figure 3).



#### **Behavioural intention**

The willingness to change *behaviour* towards a more biodiversity-friendly approach increased in all countries from 2018 to 2021. However, no significant changes were found in Kenya (0.063). Large increases were found in Brazil (1.254\*\*\*). However, when the mean aggregated scores in Table 3 are examined, it can be seen that Brazil had a remarkably low score for behavioural intention in 2018. It aligned more to the other countries in 2021, while still having the lowest score. Medium increases could be found in Vietnam (0.614\*\*\*), India (0.602\*\*\*), Peru (0.521\*\*\*), China (0.512\*\*\*) and Indonesia (0.511\*\*\*). Small increases could be found in South Africa (0.399\*\*\*), Colombia (0.374\*\*\*) and Mexico (0.333\*\*\*). Figure 4 shows these results.

Figure 4.

Change in behavioural intention towards more biodiversity-friendly behaviour in Cohen's d



# 4.2 DEVELOPMENT IN THE DIFFERENT COUNTRIES

In **Brazil** there was already a comparably high level of knowledge about biodiversity and this did not change from 2018 to 2021. The same applied to attitudes. Most interesting is the behavioural indicator, which was remarkably low in 2018 and increased to a value that was on a par with international values in 2021.

In **China** there is a negligible increase in knowledge. However, there was a negligible decrease in the attitudes indicator. The value for behavioural intention increased from 2018 to 2021.

**Colombia** ranks first among the countries for knowledge, even though it decreased slightly between 2018 and 2021. The country ranks second in behavioural intention (together with Vietnam) following a substantial increase from 2018 to 2021. There was a slight decrease in relation to attitudes.

**India** shows a small increase in knowledge and ranks first in Asia. There was a small increase in attitudes and a medium increase in behavioural intention. **Indonesia** is the only country with an increase in all sub-indicators. In the case of attitudes, it moved to second place among all countries that were compared.

**Kenya** is the only country with no increase in any of the sub-indicators. In fact, knowledge decreased substantially, with the result that Kenya went from being in first place to being second last in 2021. The decrease in attitudes was negligible and there was no change in behavioural intention.

In Mexico the level of knowledge rose slightly. There was no change in attitudes. The behavioural intention showed a small increase.

In **Peru** knowledge increased to such an extent that it ranked first with Colombia in 2021 when comparing the countries. Surprisingly, attitudes decreased at the same time, albeit only to a small extent. Behavioural intention also rose to the extent that the country now ranks first on this sub-indicator.

**South Africa** does not show a difference in knowledge and still ranks lowest. There was a very small increase in attitudes and an increase in the behavioural indicator.

**Vietnam** shows a negligible increase in knowledge. There was a small increase in attitudes and a medium increase in behavioural intention, which led to the second-highest score, together with Colombia.

At a **global level**, some developments and specific countries stand out. There is no country in which a decrease across all factors can be seen. However, in Kenya, there was a decrease in knowledge with no significant difference in attitudes or behavioural intention. Indonesia was the only country with an increase in all dimensions. At a global level, it is remarkable that the behavioural intention increased in all countries except Kenya. One reason for this could be a regression to the middle. As can be seen in Table 2, there was more room for development on the behavioural indicator scale in 2018 (M=18.39%, SD=6.41) than for example on the attitudes indicator scale in 2018 (M=11.93%, SD=1.56). For future research, consideration should be given to adjusting the items so that the means are usually located in the middle of the scale and thus allow more room for improvement (e.g. higher scores). However, other (sociological, political, psychological) explanations should be considered as well. It must be kept in mind that the three years between the cohorts were shaped by the COVID-19 pandemic and by a general worsening of the climate and the continuous loss of biodiversity.

At a global level, it is remarkable that the behavioural intention increased in all countries except Kenya. The increasing willingness to change behaviour towards a more biodiversityfriendly lifestyle (behavioural intention), as observed in the data across all countries, is a reason for hope.

# 4.3 RELEVANCE OF THE RESULTS

The increasing willingness to change behaviour towards a more biodiversity-friendly lifestyle (behavioural intention), as observed in the data across all countries, is a reason for hope. However, this positive development should not distract from the fact that consistent behavioural change is a long process that is influenced by a number of factors, including predictability, self-efficacy, beliefs, resilience and, last but not least, external (political, infrastructural, economic and social) circumstances (e.g. Bamberg, 2013).

Nevertheless, an increase in all the indicator values would be desirable. However, this could not be observed in all countries. Developments in the other two indicators (knowledge and attitudes) differ from country to country. Country-specific experts should be consulted for further analysis of these developments. The following questions are of interest for future research:

- What can we learn from Indonesia, the only country to report an increase on all indicators?
- What can we learn from Kenya, the only country that did not report an increase on any indicator?
- Why does Kenya show such a comparatively large drop in knowledge about biodiversity, while this indicator increased in almost all the other countries?
- Why did attitudes towards biodiversity drop in Peru, while they rose in neighbouring Brazil at the same time?
- Apart from the statistical explanation already attempted here, is there another explanation for the extreme increase (or the extremely low initial value) in behavioural intention in Brazil?

Answering these questions could provide valuable information for policymakers and decision-makers. This information is also important for communication and education purposes, and for everyone who works in the field of biodiversity conservation and whose work is interlinked with human behaviour, as understanding both cultural differences and commonalities is vital to the success of the global effort for biodiversity conservation.

### 4.4 LIMITATIONS OF THE STUDY

The low internal consistency (Cronbach's alpha) of the attitudes indicator and the assessment of the knowledge indicator with only one item is problematic for the evaluation of the results. This finding was taken into account when developing the new indicator (Bamberg et al., 2022), leading to a reformulation of several items and the corresponding indicators in the questionnaire.

Two details need to be considered. First, it is unclear whether the items are understood in a similar way in the different countries. For example, does *"I feel personally responsible for protecting biodiversity and nature"* mean the same in Peru as it does in Kenya or Vietnam? For this reason, the analysis focused primarily on the development of the indicators from 2018 to 2021 and less on the comparisons between countries. Second, only correlational data was used in this study. This means that the postulated relation between the constructs is only theoretically backed, but is not experimentally proven. It also means that the reason for the changes in the indicators cannot be stated precisely.

As mentioned at the beginning of this paper, a substantial number of survey participants had to be excluded to ensure comparability between the years and the groups. The composition of participants can hardly be considered representative: people older than 66, employees of NGOs and people who have no interest in the environment, for example, were excluded from participating in the survey in 2018 and from the calculations in 2021.

There is a broader discussion around the general assumptions of the Societal Biodiversity Indicator, as it assumes that a change in society's awareness of biodiversity can be operationalized by assessing participants' knowledge about biodiversity, their attitudes towards biodiversity policies and their intentions to perform certain behaviours to protect biodiversity. These assumptions are subject to criticism after empirical studies (e.g. Preisendörfer, 1999) showed that knowledge is necessary but not sufficient for changing behaviour. Furthermore, Hoppe et al. (2019) reanalysed the Societal Biodiversity Indicator and found that the items used for attitudes did not represent the attitudes construct but rather problem awareness, attribution of responsibility or personal norm. This is the reason why the former indicator used in this analysis was replaced in the second analysis by a new indicator developed by Bamberg et al. (2022) on behalf of the German Federal Agency for Nature Conservation – the New Societal Biodiversity Indicator.

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#### Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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