SAFEGUARD

Report on the relevance of pollinators across SDGs

Deliverable D6.4

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Safeguard
Safeguarding European wild pollinators

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Summary

Pollinators are vital components of biodiversity; their value goes beyond the ecosystem service which they provide yet they remain highly threatened. Finding synergies between pollinators and existing policies can strengthen the rationale for why their protection should be prioritised. The United Nations' Sustainable Development Goals (SDGs), provide a framework to assess the progress humanity makes towards a sustainable future. One way to assess the relevance of pollinators for society is to evaluate them within the context of the SDG framework. Pollinators may contribute to successfully achieving the SDGs, and vice versa any progress or inaction towards the achievement of these SDGs may in turn have impacts on pollinators.

The aim of this report is to communicate results and outline the methods used in a study that assessed the importance of pollinators to the success of the SDGs and vice versa. A key objective of this work is to help strengthen pollinator-relevant policy and proactively engage in the science-policy interface, by identifying direct links between pollinators and the SDGs, a UN global policy framework. Previous research suggests that bees may contribute to the success of a limited number of SDGs, and that pollination is a key ecosystem service that may support to the achievement of SDG 15 Life on Land. We aimed to build on these qualitative studies by applying a quantitative approach to understanding links between pollinators and SDGs at target-level and considering all pollinators rather than a single taxonomic group, i.e., bees, which was the focus of earlier work.

As the SDGs contain a vast number of targets (169 in total), a key first step in this study involved a shortlisting process carried out by authors of this report. The resulting shortlist of 58 targets across 14 SDGs were included in an online expert elicitation exercise carried out with 17 global pollinator experts. Data were gathered to quantify the strength of relationship between pollinators and the shortlist of SDG targets, and the degree of relevance to society that this link has (both measured on a 0-100 scale). Experts also indicated their level of confidence (low, medium or high) in each score based on their knowledge of existing evidence to support their arguments. Following the first round of scoring, experts were invited to attend two online consensus-building workshops and given the opportunity to explain their reasoning and rescore based on discussions of particular targets that showed relatively low consensus. Expert scores post consensus workshops were used in analyses to explore relationships between pollinators and SDGs.

Of the 58 shortlisted targets, 39 were found to have strong links to pollinators indicated by a median strength score over 20. Bidirectional relationships were identified for 10 targets while the remaining 29 targets were associated with strong unidirectional relationships. Of these unidirectional targets, 24 strong relationships were identified in the direction of SDGs impacting pollinators and 5 were found to represent the contribution that pollinators may have to SDG targets. Targets under SDG 2 Zero Hunger illustrated the potential contributions pollinators might make towards achieving sustainable development. They were also scored relatively highly in the direction of SDG's impact on pollinators, indicating that policies related to this SDG may also have consequences for pollinators. Targets under SDG 15 Life on Land showed the highest strength of relationship score in this direction, signalling that progress or inaction towards these targets might impact pollinators. These relationships also showed high scores in relation to relevance to society, suggesting they are important to many people over a large geographic area. Experts also identified strong relationships between pollinators and

specific targets under SDG 6 Clean Water and Sanitation and SDG 12 Responsible Consumption and Production.

Based on our analysis, a policy brief, produced to disseminate early results of this study, was distributed at the UN Biodiversity Conference - Fifteenth meeting of the Conference of the Parties (COP-15) to the Convention on Biological Diversity (CBD COP 15), which took place in December 2022.

List of abbreviations

CBD	Convention on Biological Diversity
COP	Conference of the Parties
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IDEA	“Investigate”, “Discuss”, “Estimate” and “Aggregate”
IQR	Interquartile Range
ODA	Official Development Assistance
SDG	Sustainable Development Goal
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UREAD	University of Reading
WHO	World Health Organisation
WTO	World Trade Organisation

1. Introduction

1.1. The Sustainable Development Goals

First adopted by UN member states in 2015, the SDGs provide a framework to guide and measure progress towards the 2030 Agenda for Sustainable Development. There are 169 targets organised under 17 overarching goals, with aims ranging from alleviating poverty (SDG 1), ensuring healthy lives (SDG 3), to supporting sustainable urbanisation (SDG 11) and protecting biodiversity on land (SDG 15) and in water (SDG 15). Progress or inaction towards the achievement of these goals can be evaluated through an extensive list of 231 specific indicators linked to each of the 169 targets.

As of yet, conserving pollinators or pollination services is not mentioned specifically as a priority under any of the SDGs, although in the UN SDG Report 2022[1], loss of pollination services was recently cited as a potential consequence of climate change and thus impacted by any failure to achieve SDG 13 Climate Action.

Figure 1 The United Nations Sustainable Development Goals. The SDGs comprise 17 goals under which further targets can be found.
Source: https://www.un.org/sustainabledevelopment/news/communications-material/

1.2. Placing Pollinators in the Context of Sustainable Development

Pollinators are key components of biodiversity, and their importance in food provisioning, maintaining healthy ecosystems, providing non-food related crops as well as supporting stable economies are well established (IPBES, 2016). They are also highly threatened (IPBES, 2016), leading to renewed efforts to monitor trends and identify threats in order to implement effective conservation strategies (Breeze et al.,

[1] https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf

2021). Progress has been made through initiatives such as national pollinator action plans which place pollinators in a clear policy framework. However, finding synergies between pollinators and existing broader policy objectives is also vital (Dicks et al., 2016). The UN SDG framework provides an opportunity to map the importance of pollinators in the context of sustainable development.

Previous research has attempted to this, but a consistent and quantitative approach has been lacking. Some have limited their scope to focus purely on bees and found that they may contribute to a minimum of 30 targets under 15 of the 17 SDGs (Patel et al., 2021). The authors list specific targets and outline how bees are important through their ecological roles such as in food security, diversifying income streams and supporting biodiversity; however this study does not systematically evaluate the evidence against relevant SDG targets and instead uses examples found in evidence to illustrate the links between the importance of bees for specific targets. A similar review style paper has highlighted the important contributions that biodiversity can make to the SDGs, and highlights pollination as a key ecosystem service (Blicharska et al., 2019). Others have taken a more quantitative approach through a large-scale survey to link ecosystem services (including pollination) to the SDGs (Yang et al., 2020), and found that pollination can make a significant contribution to SDG 15 Life on Land but did not consider specific SDG targets.

We wished to build upon these approaches and apply a more quantitative approach, at target-level, to place pollinators in the context of sustainable development. To do this, we designed an expert elicitation exercise where pollinator experts focus their knowledge towards quantitatively assessing whether pollinators are relevant to the SDGs. We also add directionality, considering that pollinators may play a role in contributing to the SDGs but also quantifying how they may be impacted by them. Through their delivery of vital ecosystem services we hypothesise that pollinators might play important roles for certain SDG targets, but also as key components of biodiversity they need to be conserved and/or managed sustainably, and they should therefore be taken under consideration during any planning or progress towards sustainable development.

2. Expert elicitation exercise

An expert elicitation exercise was carried out using a modified Delphi technique to gather quantitative data on the importance of pollinators to the UN SDGs. This largely followed the IDEA protocol outlines by Hemming et al., 2018, involved a pre-elicitation phase consisting of a detailed scoping document and online briefings, next the expert elicitation phase included an initial scoring exercise, followed by two consensus-building workshops during which summary data were presented and discussed as a group before a second round of data collection which are used for analyses. Details of the process are presented in the following sections.

2.1. Shortlisting process

As the SDG framework comprises 169 targets under 17 goals associated with 231 indicators, an initial shortlisting process was conducted to ensure targets that are very unlikely to be linked to pollinators were not presented to our pool of pollinator experts as part of the scoring exercise. This step was carried out by Simon Potts (Professor of Biodiversity and Ecosystem Services, UREAD and Co-Chair of the Thematic Assessment of Pollinators, Pollination Services and Food Production for the UN), Deepa Senapathi (Associate Professor at UREAD), Lois Kinneen (Postdoctoral

researcher and lead of the study) and Hien Ngo (FAO, Biodiversity and Pollinator expert). The process involved reading through a collated list of targets and their indicators, and assigning each a status of “Relevant”, “Not Relevant” or “Unsure” (in instances where it was felt there may be a link, but it might be weak or indirect, or that evidence may not exist to prove such a link). If two or more of the panel scored a target as “Relevant” or “Unsure”, it remained in the shortlist. This resulted in a **shortlist of 58 targets across 14 of the SDGs** that had the potential to be linked to pollinators (See Appendix A for the full shortlist). No targets under SDG 4 Quality Education, SDG 5 Gender Equality, or SDG 16 Peace, Justice and Strong Institutions, made the shortlist. A full list of excluded targets under all 17 SDGs can be found in Appendix B.

The full list of all SDG targets and indicators was provided to our experts during the pre-elicitation phase and they were given the opportunity to add targets back into the shortlist if they felt strongly that they should be reinstated. Despite this step, the shortlist remained the same and was formed the basis of the formal elicitation phase of the project.

2.2. Selecting experts and online briefings

We invited a total of 24 pollinator experts from around the world to take part in this study and gave careful consideration to geographic coverage, gender balance, career stage and their career sector (academic, policy or in industry). The initial invitation contained a scoping document providing background information, outlining the aims and establishing the expected time commitments for participation. It was explained that participation in this study involved the following;

(i) attending an online briefing session,

(ii) the actual SDG-scoring exercise which we anticipated would take approximately 2 hours to complete,

(iii) attending a minimum of one 2-hr online workshop during which experts could discuss the preliminary results and rationales before been given an opportunity to amend their data in light of any new evidence,

(iv) writing an illustrative case study to support relationships between pollinators and specific SDG targets.

Participant information and consent forms were also attached to the email and **17 experts agreed to participate in the study**. These experts represent 10 countries of affiliation across six continents (Figure 2) however everyone has extensive knowledge of pollination ecology beyond their country of affiliation at regional and global scales.

A key part of the pre-elicitation phase includes comprehensive briefing of participants. Experts were given time to read through the scoping document and were then invited to attend an online briefing session. To accommodate time differences across the broad geographic spread of our experts five of these meetings were held. Briefings were structured to include a transparent overview of the shortlisting process, full and clear definitions of the metrics, and a run-through of the Excel spreadsheet that would be used to collect data during the scoring exercise so that everyone understood how to input their data.

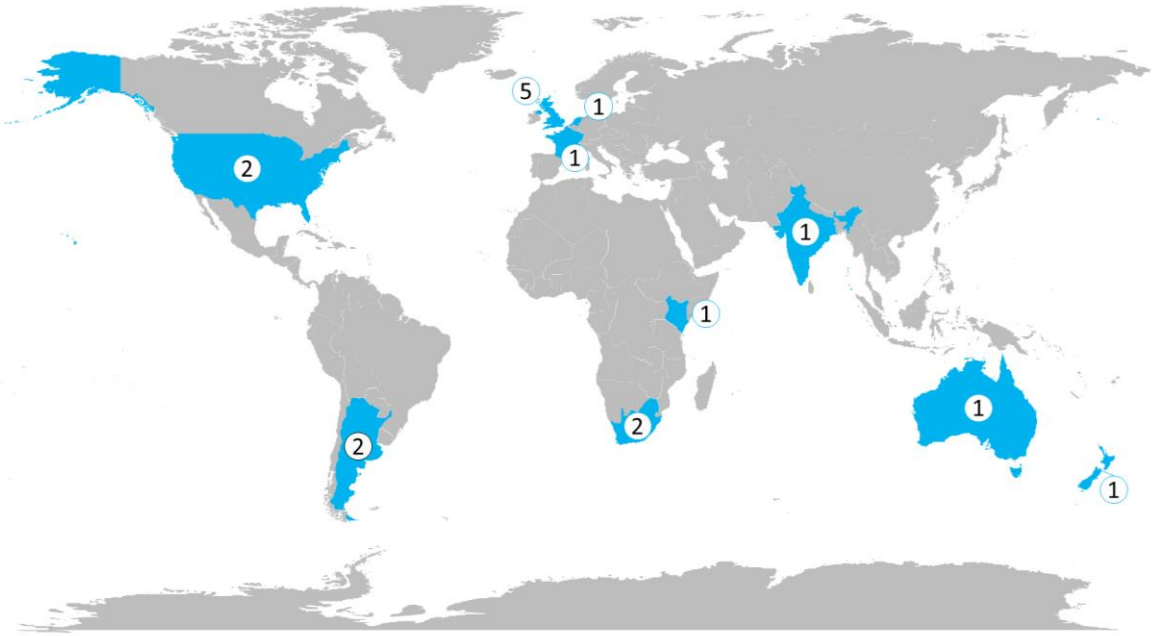

Figure 2 Global map illustrating the number of participants representing the 10 countries of affiliation of our pollinator experts.

2.3. Chosen metrics and data collection

It is possible that pollinators contribute to the success of SDGs or are impacted by actions taken to achieve each goal or both, therefore experts could decide whether relationships were uni- or bi-directional by indicating the direction that their scores applied to. The first metric asked experts to quantify the **strength of relationship(s)** on a scale of 0-100, where zero indicated no link, a low score suggested a weak or indirect relationship with pollinators and a high score indicated a high and direct link between the target and pollinators. Experts were also asked to score each relationship in terms of its **relevance to society**, in this case a low score suggested that a change in the relationship would impact few people over a restricted geographic area and a high score indicated that a change would impact many people across a large geographic area. For each identified link, experts were also asked to assign a **confidence score** (low, medium or high) depending on the level of certainty they felt applied their strength of relationship and relevance to society scores based on their individual knowledge of existing evidence that supported their scores.

Data were collected using an Excel spreadsheet sent to each pollination expert. The file was designed to include instructions on the first sheet containing definitions for each of the metrics, and a brief introduction asking experts to consider all pollinators (both invertebrate and vertebrate species across all taxa) and at a global geographic scale. A further 14 data sheets presented the shortlisted targets and their indicators under each separate SDG with a series of columns that were formatted to restrict data entry to the specific scaled responses for each metric.

2.4. Online consensus workshops

Experts were given a two-week period to carry out the initial scoring exercise before they were invited to attend a minimum of one of two online consensus-building workshops. All experts attended at least one of these sessions, with two experts attending both.

Both workshops followed the same structure, there was an initial introduction during which experts were reminded of the aims of the study and of the metrics and definitions. A summary of the first round of data was then reported back to the experts as a series of three sets of boxplots depicting the following;

I. the relevance to society scores,

II. the strength of relationship in the direction of each target's impact on pollinators, and

III. the strength of relationship scores in the direction of pollinators impact on the success of each target.

Boxplots were chosen as an appropriate method of reporting the first-round data as they clearly present the median value as a horizontal line, give a visual representation of the spread of the data in terms of their interquartile range and allow for quick identification of outliers in a dataset (Zuur et al., 2010). If a target showed high spread of responses relative to other targets, that target's definition and indicators were read out and experts were invited to discuss their rationale behind extreme scores.

Once the workshops had been completed, a time-stamped summary was sent to the group alongside recordings of both meetings, this enabled experts to watch and listen to other expert's justifications behind their scoring of targets. This also allowed experts who could not attend both sessions to watch the discussions that took place in the workshop that they could not attend. Experts were then given another two weeks to carry out a second round of scoring based on any new evidence or sound logic they had heard but hadn't previously considered.

2.5. Data Analyses and visualisation

As described above, first round data were used to frame discussions during the consensus building workshops. The final analyses presented in the Results section of this report were based on second round data only, collected after the consensus-building workshops had taken place.

To visualise the **directionality** of the relationships between the shortlisted SDG targets and pollinators, a stacked bar chart was produced and colour-coded to indicate the direction of confirmed links (Figure 3). Experts were asked to score the relationship between pollinators and each shortlisted SDG in both directions, however, during the first round of scoring several scores were left blank in one direction. This was addressed in consensus workshops and experts were given opportunity to enter values if they felt relationships existed and it was agreed by the group that blanks in the second-round data should be replaced by zeroes for analysis. A link was between pollinators and a target was confirmed to exist if the median strength of relationship score was greater or equal to 20.

To explore and understand the scores for **Strength of Relationship** (in both directions) and **Relevance to Society,** a series of boxplots were produced based on the second-round data. These figures visually present the data indicating the median score and interquartile ranges. These data are also presented in tables located in the

in-depth analyses of targets under each SDG, these tables are also used to illustrate the levels of consensus amongst our experts for each score. Consensus is reflected by the IQR, for each metric the IQR across all SDG targets was calculated, and this was divided by five to create a five-point scale of consensus. Targets with low IQRs, where scores varied little amongst the 17 experts were deemed to show high consensus.

Network maps were used to visualise the relationships identified between each shortlisted SDG target and pollinators. To produce these, standardised (divided by 10) median values of the strength of relationship scores were calculated and used to weight the 'edges' (arrows) connecting pollinators as a central node with external nodes labelled according to specific targets. Arrows indicate the direction of each relationship score. All network maps were produced using the R package igraph in R version 4.2.2 (R Core Team, 2022).

3. Results

The following Results section initially presents an overview of these data at SDG level, followed by more in-depth analyses of the shortlisted targets organised according to their overarching SDG.

Overall Patterns and Trends

Directionality of relationships

Experts were asked to score the strength of relationship between pollinators and SDG targets in both directions, allowing us to explore whether pollinators might be impacted by progress/inaction towards a particular target (SDG → Pollinators) or if they might play a role in contributing to the success of the target (Pollinators → SDG). The directionality of our shortlisted targets is depicted in Figure 3. Of our 58 shortlisted targets 19 had a median value under 20 and are therefore considered unlikely to be strongly linked to pollinators. We used this threshold median value of 20 to identify connections between pollinators and specific shortlisted targets. 11 targets had median scores of over 20 in both directions and these relationships were therefore considered bidirectional. The remaining 30 targets had medians scores of over 20 in just one of the directions and were therefore considered to be associated with unidirectional relationships. 24 of these unidirectional targets were thought to primarily have an impact on pollinators (SDG → Pollinators) and 4 targets were considered to be potentially impacted by pollinators in some way (Pollinators → SDG).

Of the four targets which might be impacted by pollinators in some way, two were found under SDG 2 Zero Hunger, one under SDG 8 Decent Work and Innovation and one under SDG 10 Reduced Inequalities. This reflects the important role pollinators play in food provisioning, and their role in producing non-crop products as a way of diversifying income streams, as well as the importance of these different income streams for women.

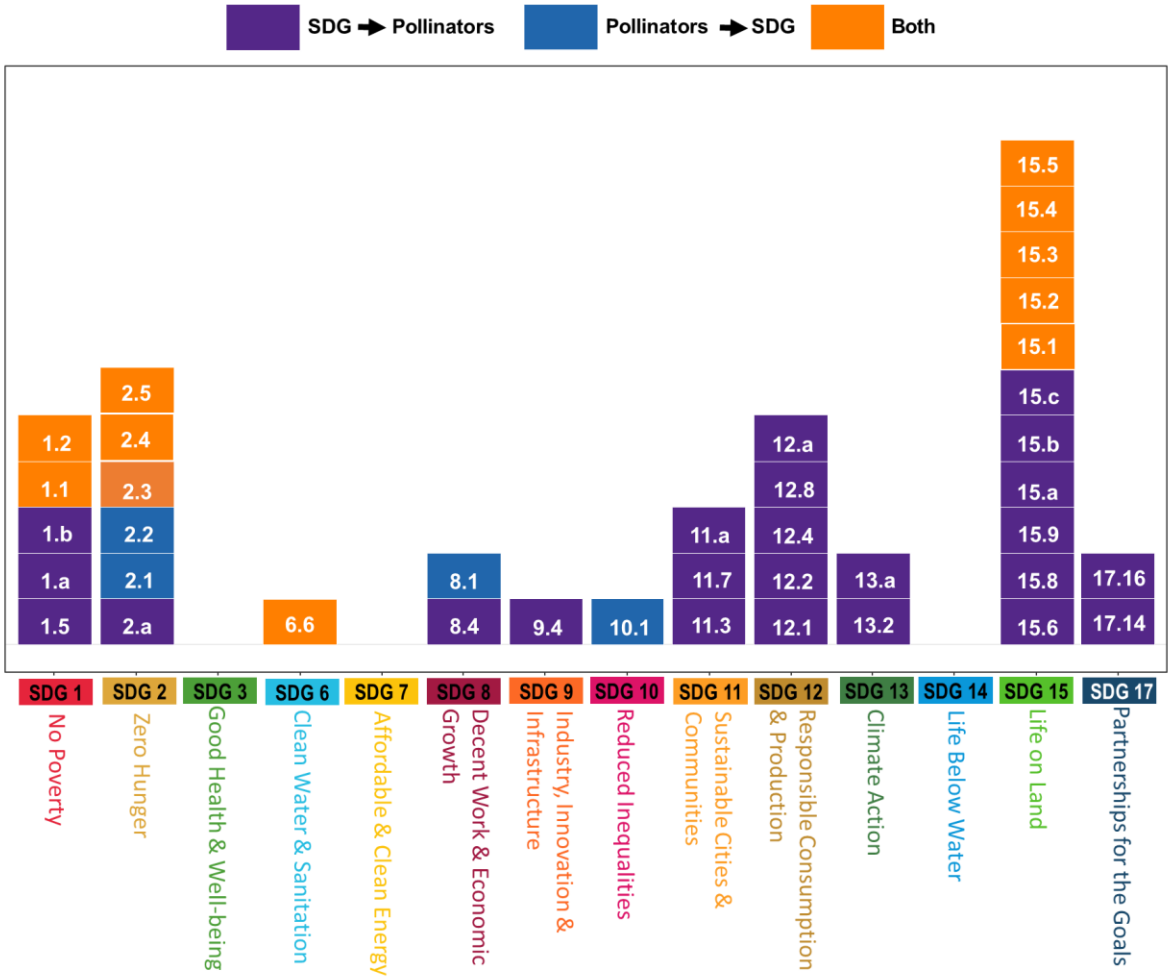

Figure 3 Directionality of the links between short-listed SDG targets and pollinators scored by 17 global pollinator experts. Experts were asked to quantify the relationship between pollinators and each shortlisted target in both directions on a scale of 0-100, a link was confirmed if the median "strength of relationship" score was ≥20. If median scores in both directions were ≥20 the link was considered bi-directional (orange). Shortlisted targets associated with a median value less than 20 are not presented in this figure but can be found in Appendix A.

Strength of relationships

SDG → Pollinators

Considering the impacts of progress or inaction towards SDG targets on pollinators, targets under SDG 15 Life on Land demonstrated the highest median scores (Figure 4). Strong relationships in this direction were also found under SDG 2 Zero Hunger, SDG 6 Clean Water and Sanitation and SDG 12 Responsible Consumption and Production.

Pollinators → SDG

The strongest links identified in this direction were found under SDG 1 No Poverty and SDG 2 Zero Hunger with some targets under SDG 15 Life on Land also associated with relatively high median values (Figure 5).

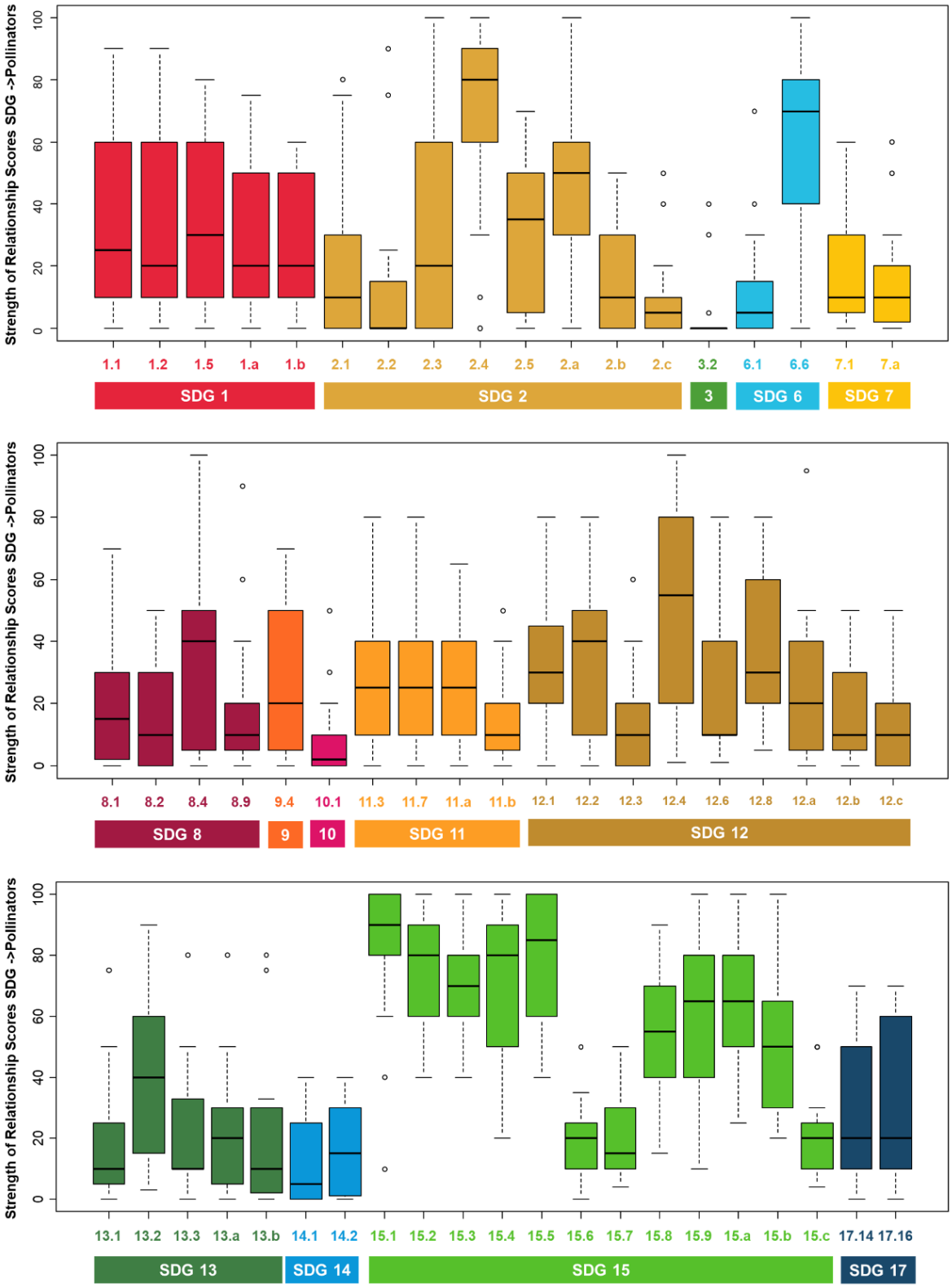

Figure 4 Boxplots showing the median value (horizontal bold line) and interquartile ranges of expert scores for strength of relationship in the direction of SDG → Pollinators.

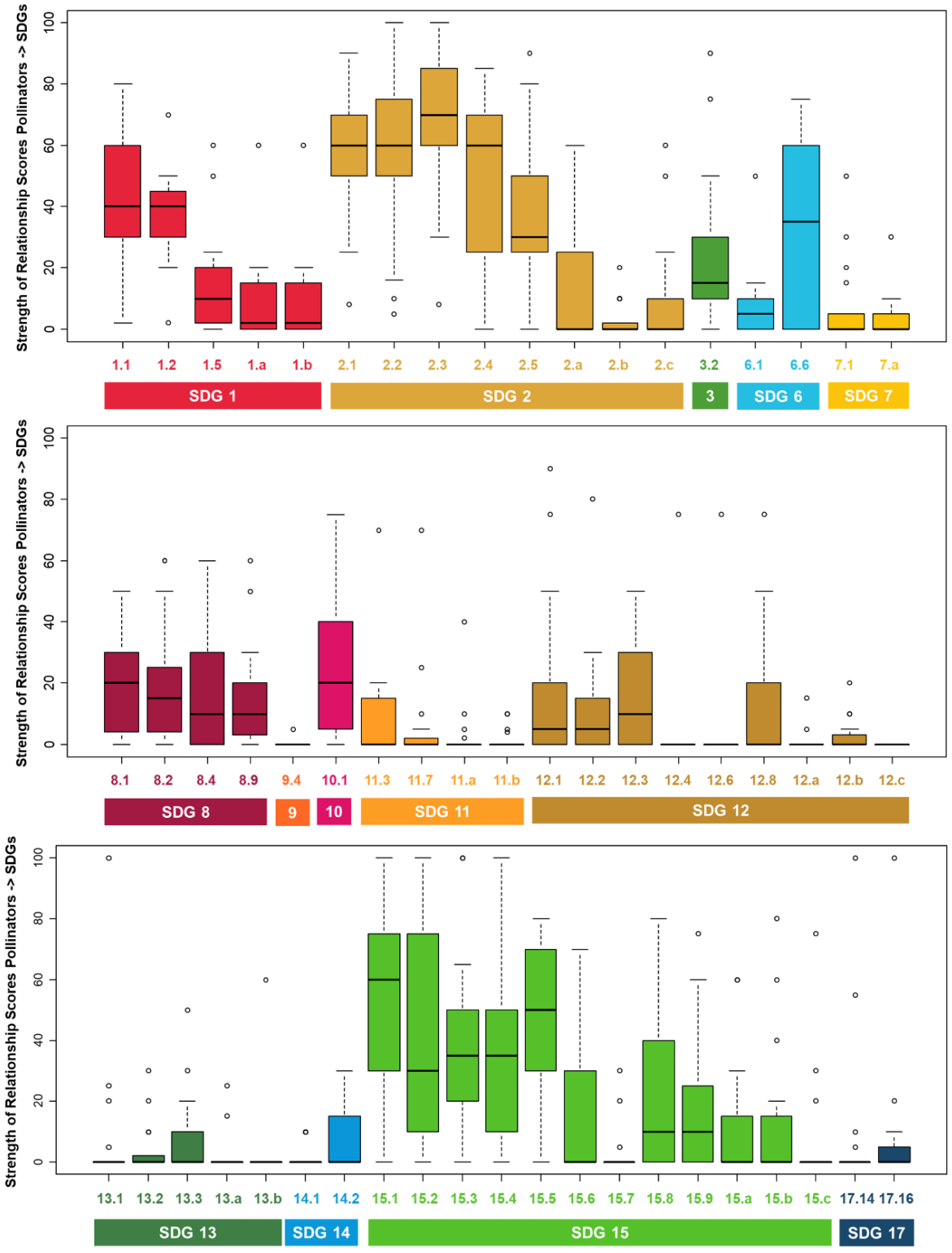

Figure 5 Boxplots showing the median value (horizontal bold line) and interquartile ranges of expert scores for strength of relationship in the direction of Pollinators → SDG.

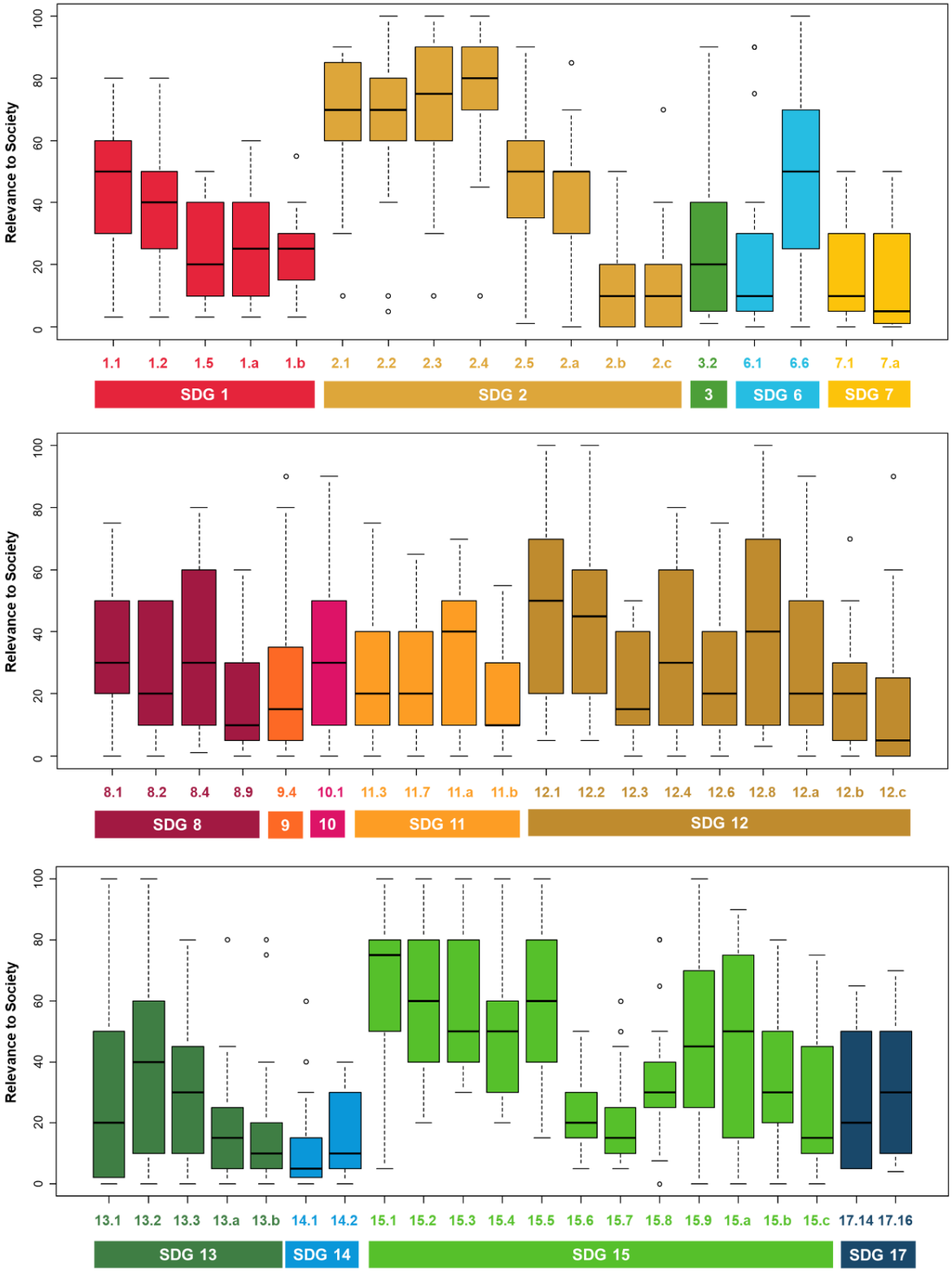

Figure 6 Boxplots showing the median value (horizontal bold line) and interquartile ranges of expert scores for relevance to society of relationships between pollinators and each shortlisted target.

Relevance to Society

Experts scored the links identified under SDG 2 Zero Hunger and SDG 15 Life on Land as the most relevant to society, indicating that these relationships stand to have consequences for many people across a large geographic scale (Figure 6). Certain links associated with targets under SDG 1 No Poverty and SDG 6 Clean Water and Sanitation also exhibited relatively high relevance to society scores.

SDG-level analyses

The following sections present a more in-depth analysis of the data at target-level organised under their overarching SDG.

SDG 1 - No Poverty

Targets under SDG 1 all aim to contribute to "Ending poverty in all its forms everywhere"[2]. The UN acknowledges that sustainable development is impossible without poverty eradication and identifies it as one of the greatest challenges globally. To help achieve this goal, seven targets were proposed which include:

(i) Eradicating extreme poverty (defined as people living on less than $1.25 per day),

(ii) Halving the number of people living under nationally defined poverty lines,

(iii) Implementing social protection systems,

(iv) Ensuring equal access to economic resources across gender and socio-economic groups,

(v) Building resilience amongst the poor to reduce their vulnerability to climate-related extreme events and economic, social and environmental disasters,

(vi) Ensuring resources can be mobilised to implement poverty-ending programmes and policies, and,

(vii) To establish a policy framework at different scales that incorporates pro-poor development strategies and accelerates investment in poverty eradication.

The shortlisting process resulted in 5 of the 7 targets under SDG 1 being included in the exercise (Appendix A). Figure 7 shows the median strength of relationship between these shortlisted targets and pollinators. The highest median relationship scores were associated with Targets 1.1 and 1.2 both in the direction of pollinators → SDG (Median = 40, IQR = 30 & 15 respectively). This reflects the experts' opinion that pollinators may contribute to alleviating poverty through their potential to support alternative income streams through activities such as beekeeping (Abro et al., 2022) and also pollinator's role in the production of high value crops(Klatt et al., 2013)

In terms of the relevance to society, Targets 1.1 and 1.2 also scored relatively highly for SDG 1 (Figure 8) indicating that the identified relationship might have consequences

[2] https://sdgs.un.org/topics/poverty-eradication

for many people over a large geographic scale compared to other relationships between pollinators and targets under SDG 1.

Table 1 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 1 No Poverty and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

Target	SDG-> Pollinators		Pollinators -> SDG			
	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
1.1	25	50	40	30	50	30
1.2	20	50	40	15	40	25
1.5	30	50	10	18	20	30
1.a	20	40	2	15	25	30
1.b	20	40	2	15	25	15

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

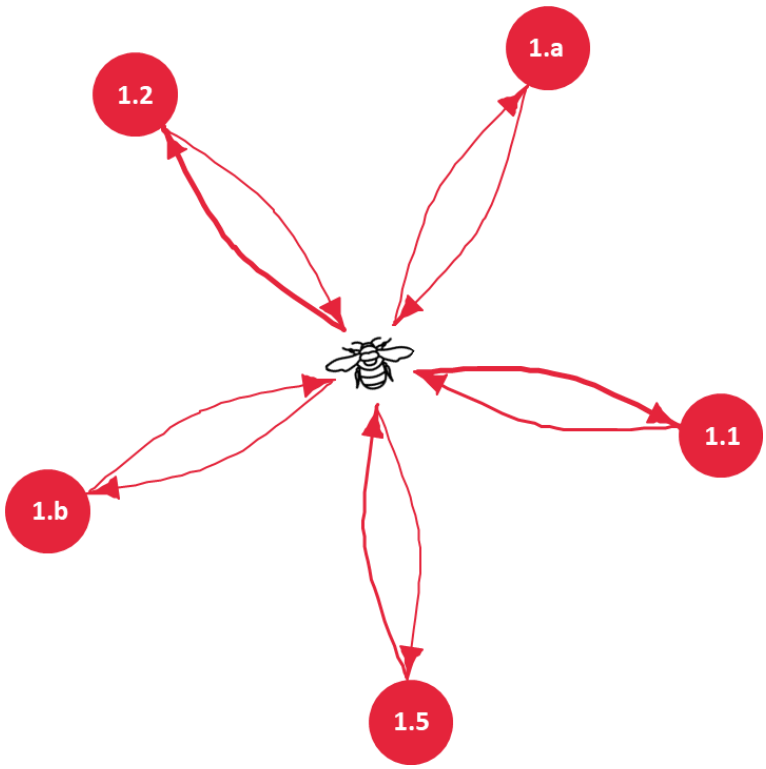

Figure 7 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 1 No Poverty.

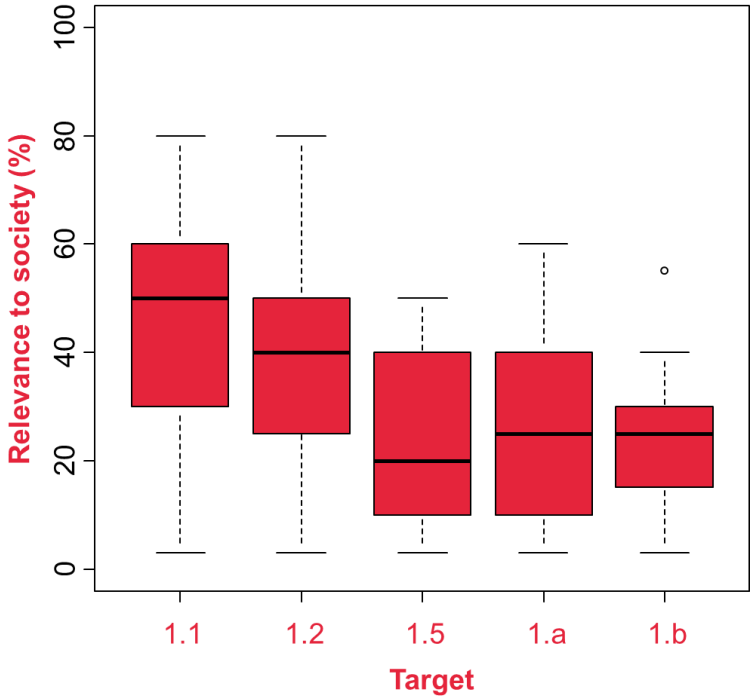

Figure 8 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 1 No Poverty.

SDG 2 - Zero Hunger

There are eight targets under SDG 2 which all aim to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture"[3]. These targets include the following aims:

(i) Ensuring access for all people to safe and nutritious food,

(ii) Ending malnutrition,

(iii) Doubling agricultural productive and income of small-holder farmers,

(iv) Ensuring sustainable and resilient food production systems that help maintain ecosystems,

(v) Maintaining genetic diversity of seeds, cultivars and related wild species,

(vi) Increasing investment in rural infrastructure, agricultural research, technology development and gene banks,

(vii) Revising and preventing trade restrictions,

(viii) Supporting functioning food commodity markets.

All eight of these targets remained in the shortlist presented to experts during the scoring exercise (See Appendix A for full definitions of each target). In general, strength of relationship scores were higher in the direction of Pollinators → SDG, indicating that pollinators might play an important role in the success of targets under this SDG (Table 2). The strongest link, however, was found in the opposite direction (SDG → Pollinators) for Target 2.4 (Median = 80, IQR 30) highlighting that maintaining

[3] https://sdgs.un.org/goals/goal2

ecosystems by guaranteeing sustainable food production stands to have an impact on pollinators.

Table 2 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 2 Zero Hunger and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
2.1	10	30	60	20	70	25
2.2	0	15	60	25	70	20
2.3	20	60	70	25	75	30
2.4	80	30	60	45	80	20
2.5	35	45	30	25	50	25
2.a	50	30	0	25	50	20
2.b	10	30	0	2	10	20
2.c	5	10	0	10	10	20

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

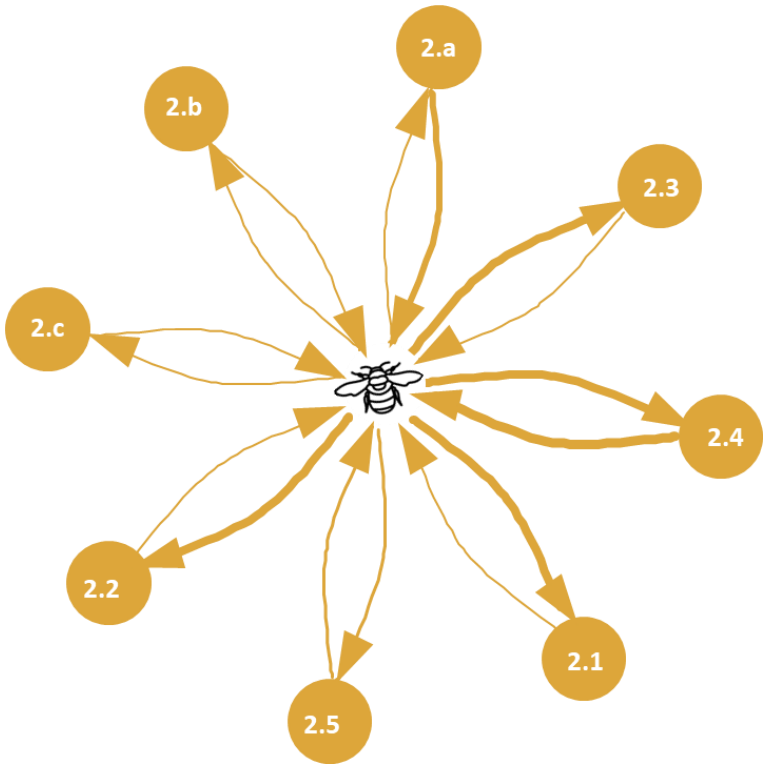

Figure 9 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 2 Zero Hunger.

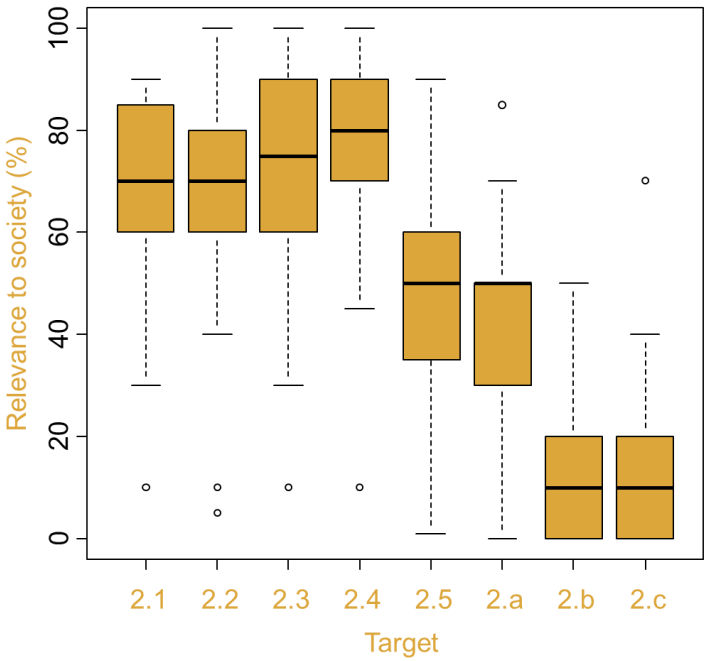

Figure 10 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 2 Zero Hunger.

SDG 3 - Good Health and Well-being

There are 13 targets under SDG 3 which all aim to ensure healthy lives and promote well-being for everyone at all stages of their lives[4]. Targets under this SDG include the following:

(i) Reducing maternal mortality;

(ii) Ending preventable deaths of newborns and children under five;

(iii) Ending epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combating hepatitis, water-borne diseases and other transmissible diseases;

(iv) Reducing by a third premature deaths resulting from non-communicable diseases through prevention, treatment and promoting mental health and well-being;

(v) Strengthening the prevention and supporting treatment of substance abuse;

(vi) Halving the number of deaths and injuries resulting from road accidents;

(vii) Ensuring universal access to sexual and reproductive health-care services;

(viii) Improving access to quality health care, medicines and vaccines;

[4] https://sdgs.un.org/goals/goal3

(ix) Reducing the number of deaths that result from hazardous pollutants and environmental contamination;

(x) Strengthening the implementation of the WHO's Organization Framework Convention on Tobacco Control;

(xi) Supporting further research and development of vaccines and medicines for diseases that primarily occur in developing nations and ensuring access to affordable medicines and vaccines;

(xii) Increasing financial investment in health, through recruitment, development, training and retention of health workers in developing countries;

(xiii) Building capacity of all nations for early warning, reduction of risks and management of national and global health risks

A single target under SDG 3 remained in our shortlist presented to pollinator experts, Target 3.2 which aims to end preventable deaths of new-borns and children under 5. The median score relating to the impact of progress towards this target on pollinators was zero with an interquartile range of 0 (Table 3), illustrating that there was high consensus among the experts that this target was unlikely to impact on pollinators. Strength of relationship in the other direction, relating to how pollinators might contribute to the success of this target had a median value of 15 and an IQR of 20 (Table 3). This relatively low score reflects a potentially indirect link between pollinators and this SDG target. Pollinator-dependent crops are a source of key nutrients required during pregnancy and to maintain good health. A key example of this is folic acid which is required in higher levels during pregnancy to prevent neural tube defects in infants, and 55% of which is provided by pollinator-dependent crops globally (Eilers et al., 2011).

Table 3 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 3 Good Health and Well-being and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
3.2	0	0	15	20	20	35

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

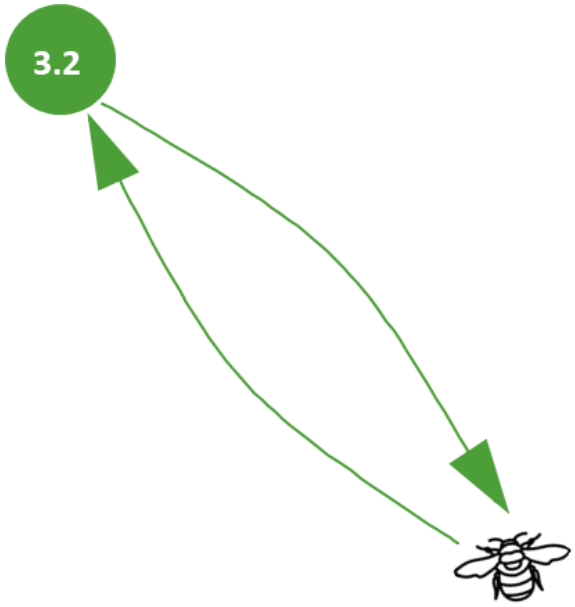

Figure 11 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted target for SDG 3 Good Health and Well-being.

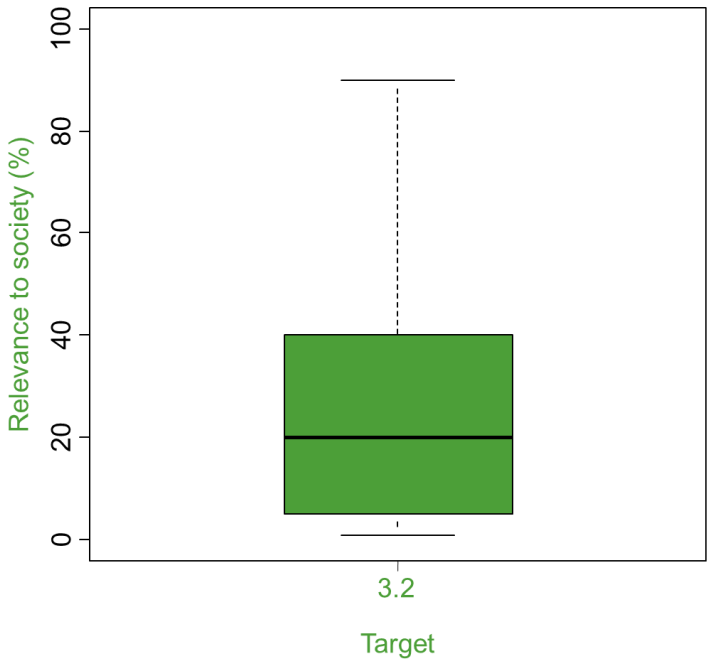

Figure 12 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted target under SDG 3 Good Health and Wellbeing.

SDG 6 - Clean Water and Sanitation

SDG 6 focuses on ensuring the safe provision of clean water and sanitation[5], to achieve this, the following eight targets have been proposed;

(i) Guaranteeing safe and affordable drinking water;

(ii) Ensuring good sanitation and hygiene with a focus on women and girls in vulnerable situations;

(iii) Reducing pollution with the aim of improving water quality, and halving the proportion of untreated wastewater;

(iv) Reducing the impacts of water shortages on vulnerable people by increasing water-use efficiency;

(v) Improving water resource management;

(vi) Protecting and restoring water-related ecosystems;

(vii) Building capacity in developing countries to establish and promote water- and sanitation- related activities and programmes;

(viii) Supporting local communities with the aim of improving their water and sanitation management.

Two targets were included in our shortlist. These included safeguarding access to safe and affordable drinking water, which was associated with relatively low median scores and therefore unlikely to have a direct link to pollinators (strength of relationship median values = 5 in both directions, Table 4). The second shortlisted Target, 6.6, which involves protecting and restoring water-related ecosystems was associated with relatively high strength of relationship scores. In the direction of the SDG target impacting on pollinators the median strength of relationship was 70 (Table 4), highlighting the experts' opinions that these water-related ecosystems might be important to pollinators. Considering the contribution that pollinators might have on this target, the median score was 35 but this was associated with a high IQR of 60 (Table 4). This reflects the relatively low consensus amongst our expert panel, and some experts felt pollinators could play an important role in achieving this target due to their part in plant reproduction and the maintenance of healthy ecosystems.

Table 4 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 6 Clean Water and Sanitation and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

Target	SDG-> Pollinators		Pollinators -> SDG			
	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
6.1	5	15	5	10	10	25
6.6	70	40	35	60	50	45

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

[5] https://sdgs.un.org/goals/goal6

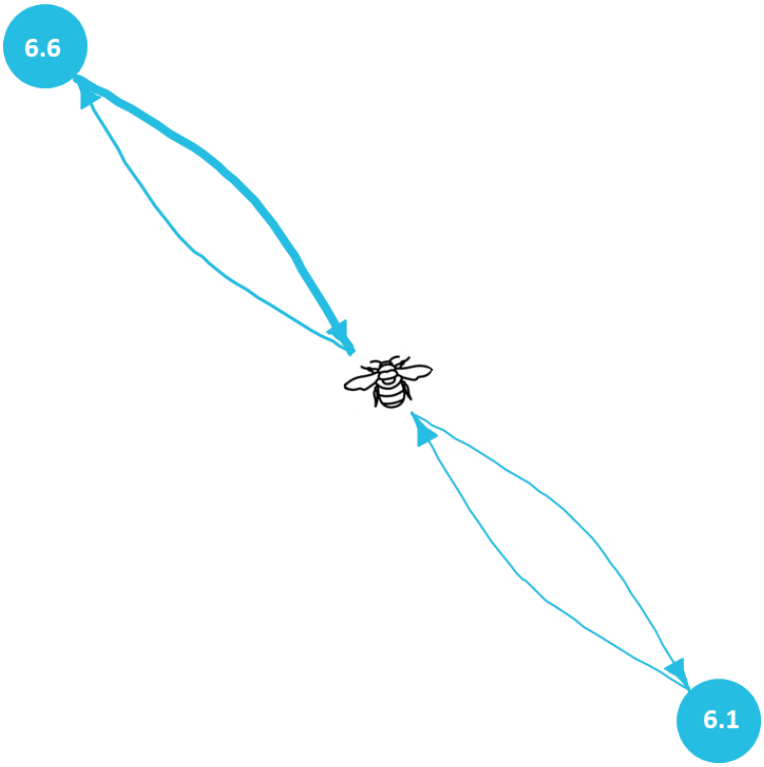

Figure 13 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 6 Clean Water and Sanitation.

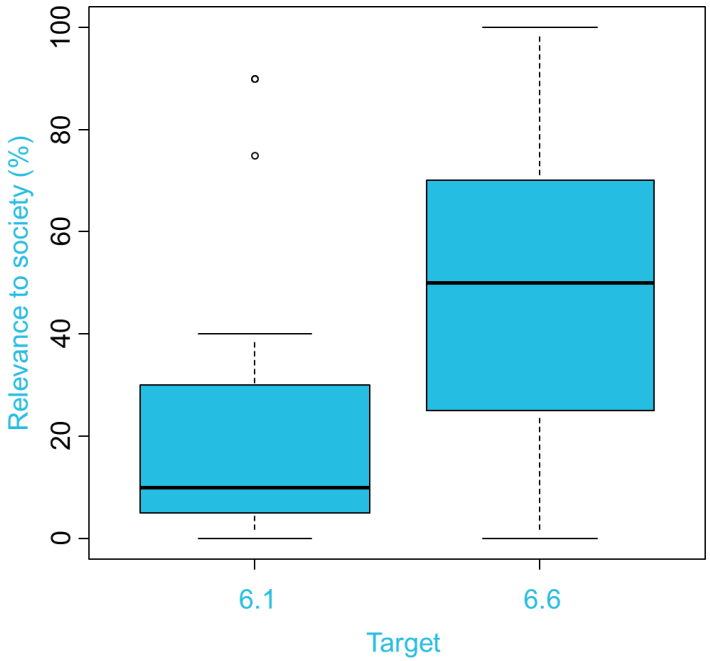

Figure 14 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 6 Clean Water and Sanitation.

SDG 7 – Affordable Clean Energy

There are five targets under SDG 7 which all contribute to the provision of clean and safe energy that everyone can afford[6].

(i) Guaranteeing access to affordable, reliable and sustainable energy;

(ii) Increasing the proportion of renewable energy globally;

(iii) Doubling the rate of improvement in energy efficiency;

(iv) Facilitating access to clean energy research and technology, and promoting investment in clean energy technologies and infrastructure;

(v) Expanding infrastructure and upgrading technologies to supply modern and sustainable energy in developing countries.

Two of these targets remained in our shortlist, however neither were associated with high strength of relationship scores in either direction, IQRs were also relatively low indicating that there was good consensus amongst experts that these targets are unlikely to be linked directly to pollinators (median scores all lower than 20, Table 5).

Table 5 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 7 Affordable Clean Energy and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

Target	SDG-> Pollinators		Pollinators -> SDG			
	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
7.1	10	25	0	5	10	25
7.a	10	18	0	5	5	29

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

[6] https://sdgs.un.org/goals/goal7

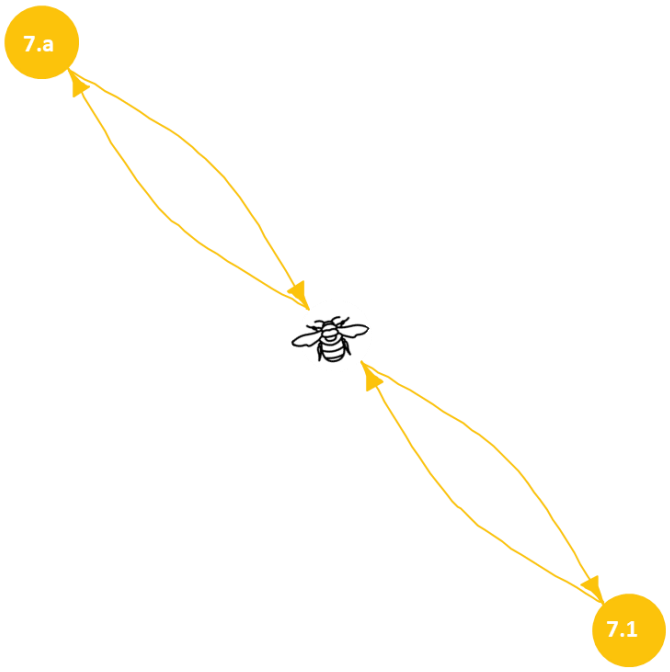

Figure 15 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 7 Affordable Clean Energy.

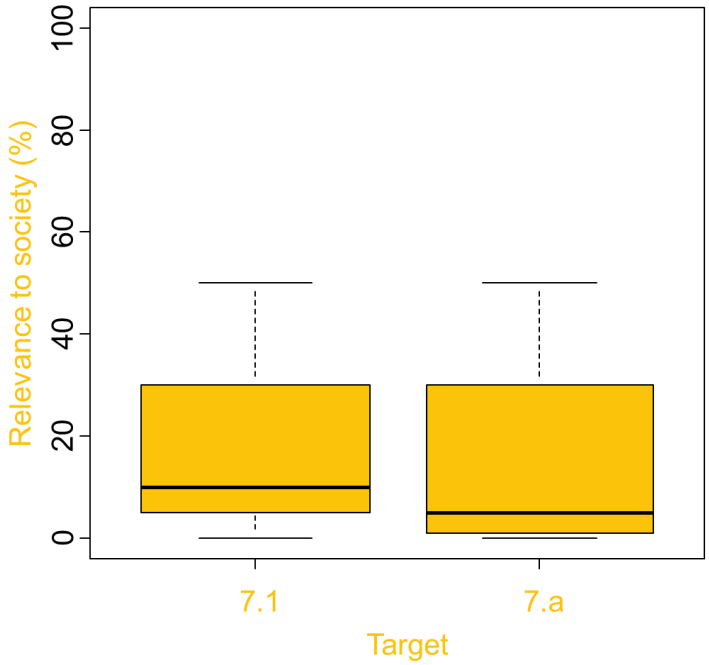

Figure 16 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 7 Affordable Clean Energy.

SDG 8 - Decent Work and Economic Growth

SDG 8 aims to promote economic growth that is both inclusive and sustainable and to ensure decent work is available to all[7]. To achieve this, the UN have set the following 12 targets:

(i) Sustaining economic growth in accordance with individual State's circumstances, with a specific aim of at least a 7% increase in GDP in least developed countries;

(ii) Achieving higher levels of economic growth through diversification, technological advances and innovation;

(iii) Promoting policies focused on development;

(iv) Decoupling economic growth and environmental degradation by improving global resource efficiency in consumption and production in accordance with the 10-year Framework of Programmes on Sustainable Consumption and Production;

(v) Offering full and productive employment and decent work opportunities for all women and men including young people and those with disabilities while ensuring equal pay for equal work;

(vi) Reducing the number of young people not in employment, training or education;

(vii) Eradicating forced labour, modern slavery and human trafficking and ending child labour by 2025;

(viii) Protecting labour rights and ensuring safe working conditions for all workers;

(ix) Designing policies to promote sustainable tourism which promotes local culture and products;

(x) Building capacity of financial institutions to expand access to banking, insurance and financial services;

(xi) Increasing Aid for Trade support in developing countries;

(xii) Developing and employing a global strategy for youth employment.

Four of these targets were kept in our shortlist of SDG targets, but all received relatively low strength scores, with the exception of Target 8.4 which aims to dissociate economic growth and environmental degradation (SDG → Pollinators median strength= 40 IQR= 45, Table 6). It was generally agreed among our experts that achieving progress towards this goal might have positive impacts on pollinators, which are currently threatened by industrial activities.

[7] https://sdgs.un.org/goals/goal8

Table 6 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 8 Decent Work and Economic Growth and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

Target	SDG-> Pollinators		Pollinators -> SDG			
	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
8.1	15	28	20	26	30	30
8.2	10	30	15	21	20	40
8.4	40	45	10	30	30	50
8.9	10	15	10	17	10	25

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

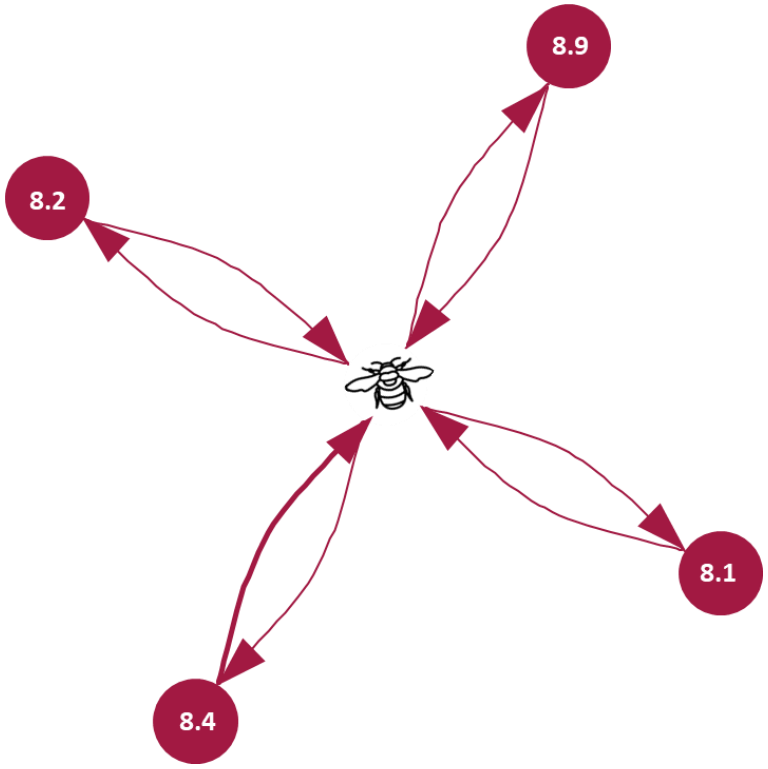

Figure 17 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 8 Decent Work and Economic Growth.

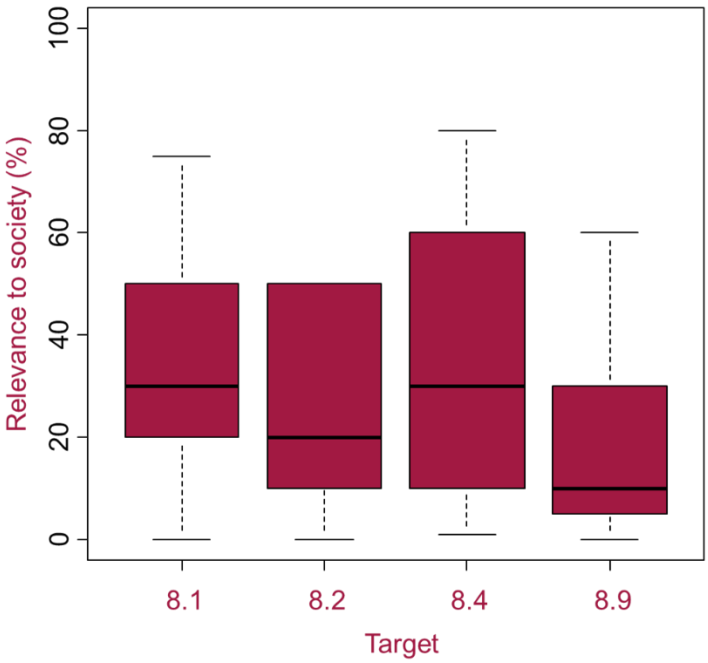

Figure 18 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 8 Decent Work and Economic Growth.

SDG 9 - Industry, Innovation, and Infrastructure

There are eight targets under SDG 9 which all aim to work towards building resilient infrastructure, promoting inclusive and sustainable industrialisation and fostering innovation[8]. Targets include;

(i) Improving infrastructure to support economic development and human well-being;

(ii) Promoting inclusive and sustainable industrialisation and raising employment and GDP;

(iii) Increasing access to small-scale industry to financial services;

(iv) Upgrading infrastructure and retrofitting industries to ensure they are sustainable, and increasing adoption of clean an environmentally sound technologies;

(v) Encouraging innovation and enhancing scientific research, upgrading technological capabilities of all industries;

(vi) Supporting the development of sustainable and resilient infrastructure for developing countries;

(vii) Furthering the development of domestic technologies, research and innovation in developing nations;

(viii) Increasing access to information and communications technologies and providing affordable access to the Internet in least developed countries;

[8] https://sdgs.un.org/goals/goal9

Of these targets, only Target 9.4 remained in our shortlist which involves improving infrastructure and retrofitting industries to ensure sustainability. There was strong consensus that there was no link between pollinators and this target in the direction of pollinators impacting its success, but a median strength score of 20 was associated with the other direction, suggesting that any actions or inactions towards this goal may have consequences for pollinators (Table 7).

Table 7 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 7 Industry, Innovation and Infrastructure and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
9.4	20	45	0	0	15	30

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

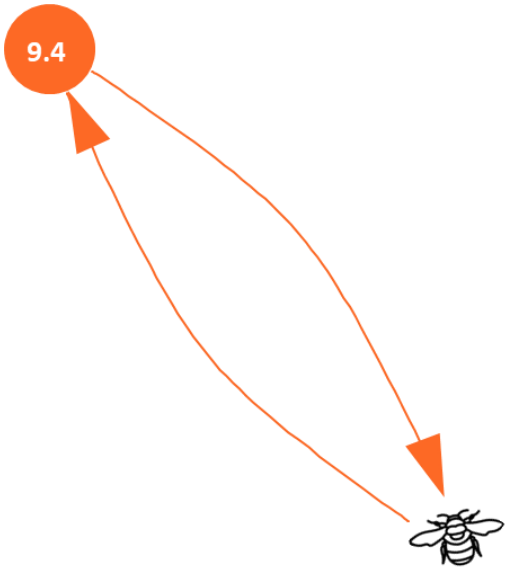

Figure 19 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted target for SDG 9 Industry, Innovation and Infrastructure.

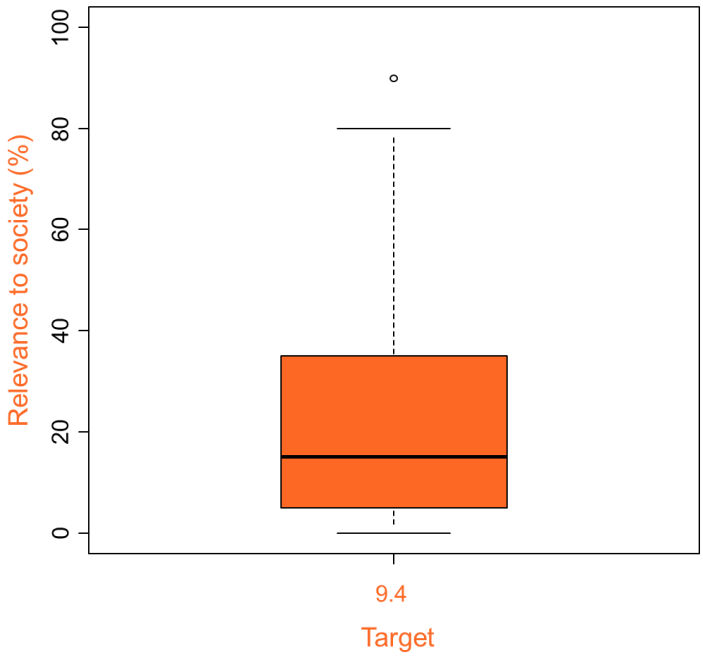

Figure 20 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted target under SDG 9 Industry, Innovation and Infrastructure.

SDG 10 - Reduced Inequalities

SDG 10 aims to reduce inequality within and between nations[9]. To do this, ten targets have been set which involve the following;

(i) Achieving and sustaining a higher income growth for the bottom 40% of the population than the national average;

(ii) Promoting social, economic and political inclusion and empowering all irrespective of age, sex, disability, race, ethnicity, origin, religion or economic status;

(iii) Ensuring equal opportunities for all by reviewing and eliminating discriminatory laws, policies and practices;

(iv) Adopting policies to achieve greater equality;

(v) Regulating and monitoring global financial markets;

(vi) Enhancing representation and voice for developing countries;

(vii) Improving migration policies and ensuring safe, regular and responsible migration and/or mobility of people;

(viii) Implementing the principle of special and differential treatment for developing countries in accordance with WTO agreements;

(ix) Ensuring official development assistance (ODA) and financial flows where it is needed most;

(x) Reducing the transaction costs of migrant remittances to less than 3%

[9] https://sdgs.un.org/goals/goal10

Only Target 10.1 remained in our shortlist of targets, which aims to improve income growth of the bottom 40% of populations to higher than national averages. A potential link was identified by experts in the direction of pollinators → SDGs (median =20, IQR= 35, Table 8), as it was thought that pollinators might provide opportunities for people to diversify their income streams through activities such as beekeeping or by converting to higher value pollinator-dependent crops.

Table 8 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 10 Reduced Inequalities and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
10.1	2	10	20	35	30	40

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

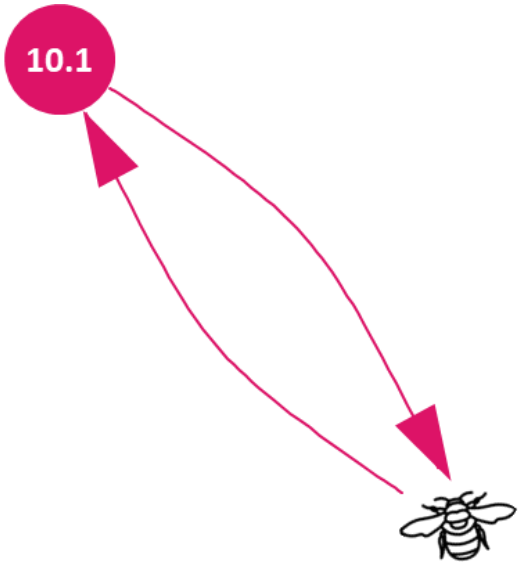

Figure 21 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted target for SDG 10 Reduced Inequalities.

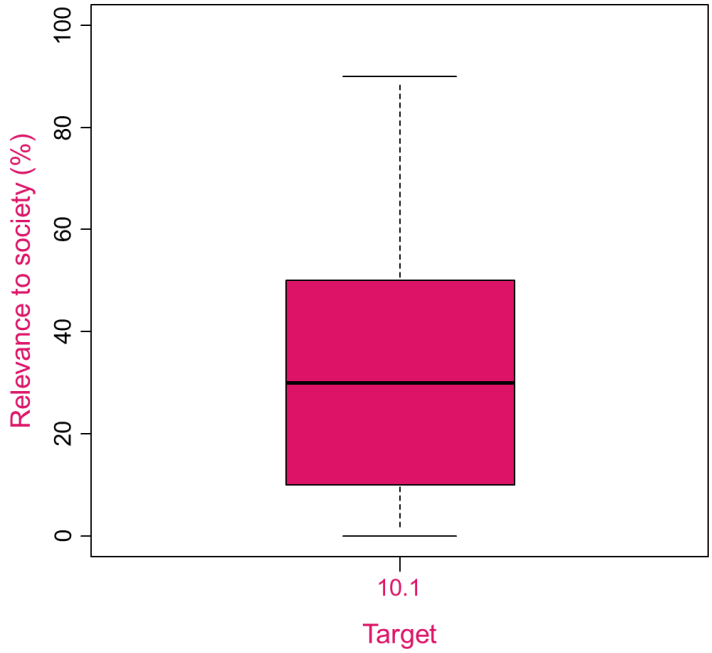

Figure 22 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted target under SDG 10 Reduced Inequalities.

SDG 11 - Sustainable Cities and Communities

SDG 11 aims to make cities and human settlements inclusive, safe, resilient and sustainable[10]. There are ten targets under this goal which involve the following;

(i) Ensuring access to safe and affordable housing and basic services;

(ii) Providing access to safe, affordable and sustainable transport systems and improving road safety;

(iii) Enhancing inclusive and sustainable urbanisation;

(iv) Safeguarding cultural and natural heritages;

(v) Reducing the number of deaths, the number of people affected and the economic impacts of disasters;

(vi) Reducing the adverse environmental impacts of cities;

(vii) Providing access to safe, inclusive and accessible green and public spaces;

(viii) Supporting positive, economic, social and environmental links between urban, per-urban and rural areas;

(ix) Increasing the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change and resilience to disasters;

(x) Supporting least developed countries in building sustainable and resilient buildings using local materials

[10] https://sdgs.un.org/goals/goal11

Four targets remained in the shortlist, and unidirectional links were identified for three of these (Targets 11.3, 11.7 & 11.a, median strength of relationship scores =25, Table 9). These relationships were all scored in the direction of the SDG having an impact on pollinators, indicating that experts felt building sustainable cities, creating and ensuring access to green space and strengthening links between different areas could all have implications for pollinators.

Table 9 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 11 Sustainable Cities and Communities and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
11.3	25	30	0	15	20	30
11.7	25	30	0	2	20	30
11.a	25	30	0	0	40	40
11.b	10	15	0	0	10	20

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

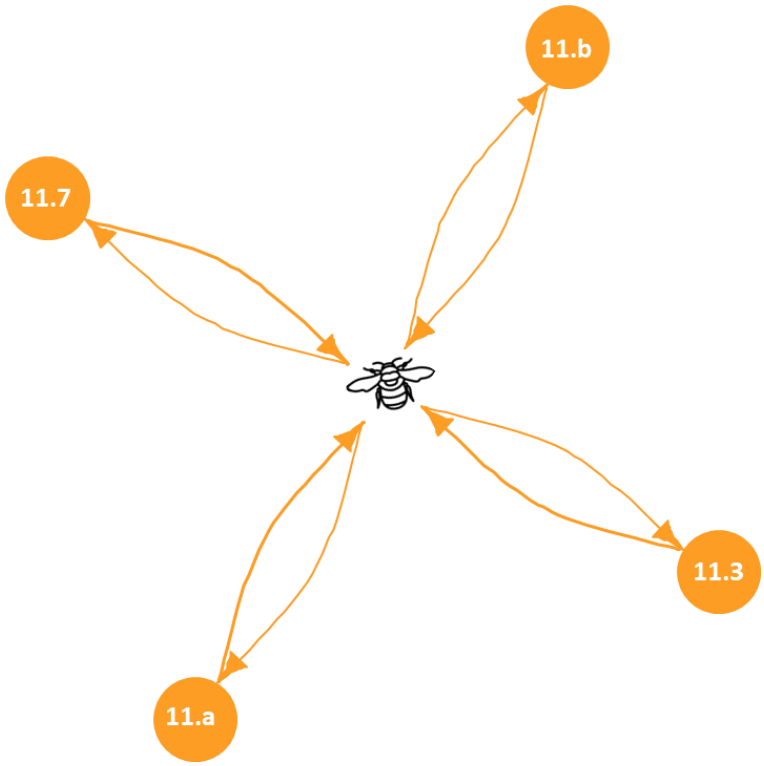

Figure 23 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 11 Sustainable Cities and Communities.

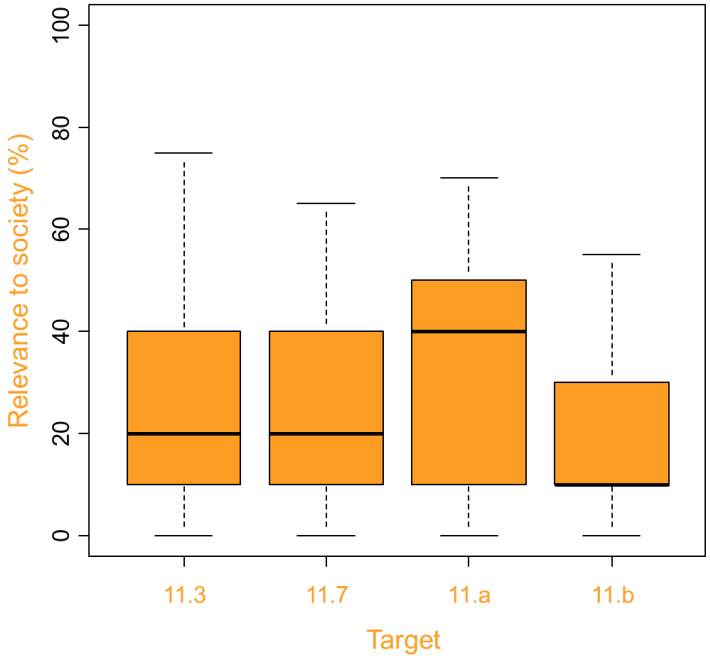

Figure 24 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 11 Sustainable Cities and Communities.

SDG 12 - Responsible Consumption and Production

SDG 12 aims to ensure sustainable consumption and production patterns[11] and includes 11 targets.

(i) Implementing the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns in all countries accounting for the development and capabilities of developing nations;

(ii) Achieving sustainable management and efficient use of natural resources;

(iii) Halving per capita food waste at the retail and consumer levels;

(iv) Achieving environmentally sound management of chemicals and other wastes to minimise negative impacts on human health and the environment;

(v) Reducing the production of waste;

(vi) Encouraging companies to adopt sustainable practices and report their sustainability information;

(vii) Promoting sustainable public procurement;

(viii) Ensuring everyone has information and are aware of sustainable development and lifestyles in harmony with nature;

(ix) Strengthening scientific and technological capacity to move towards sustainable consumption and production in developing countries;

(x) Monitoring sustainable development impacts for sustainable tourism;

[11] https://sdgs.un.org/goals/goal12

(xi) Rationalising inefficient fossil-fuel subsidies that encourage wasteful consumption including restructuring taxation and phasing out harmful subsidies

With the exception of 12.5 and 12.7 all targets remained in our shortlist (see Appendix A for full definitions), the two excluded targets aim to reduce waste production and promote sustainable public procurement and were thought unlikely to be related to pollinators in a direct way. A further four Targets (12.3, 12.6, 12.b and 12.c) were associated with low median strength scores, suggesting that they are also unlikely to be linked strongly to pollinators (Table 10). The strongest link was identified with target 12.4, which aims to reduce the release of environmental pollutants through sound waste management. Experts thought that Target 12.4 could have consequences for pollinators as they are susceptible to environmental pollutants (Ryalls et al., 2022; Stanley et al., 2015) (median strength score SDG → Pollinators = 55, IQR=60, Table 10). Achieving sustainable management of natural resources (Target 12.2) may also impact pollinators (median strength score SDG → Pollinators = 40, IQR = 40, Table 10).

Table 10 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 12 Responsible Consumption and Production and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
12.1	30	25	5	20	50	50
12.2	40	40	5	15	45	40
12.3	10	20	10	30	15	30
12.4	55	60	0	0	30	50
12.6	10	30	0	0	20	30
12.8	30	40	0	20	40	60
12.a	20	35	0	0	20	40
12.b	10	25	0	3	20	25
12.c	10	20	0	0	5	25

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

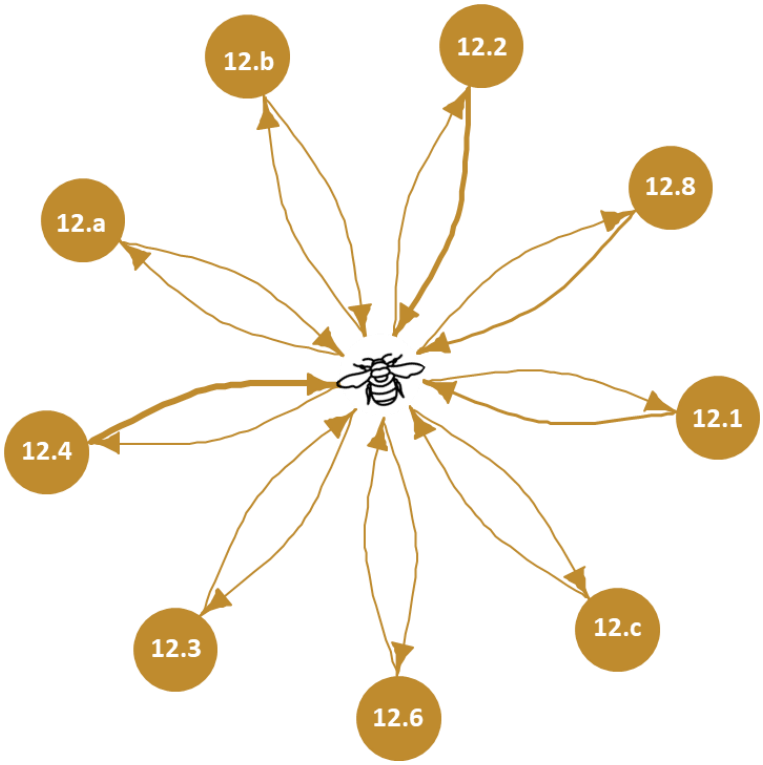

Figure 25 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 12 Responsible Consumption and Production.

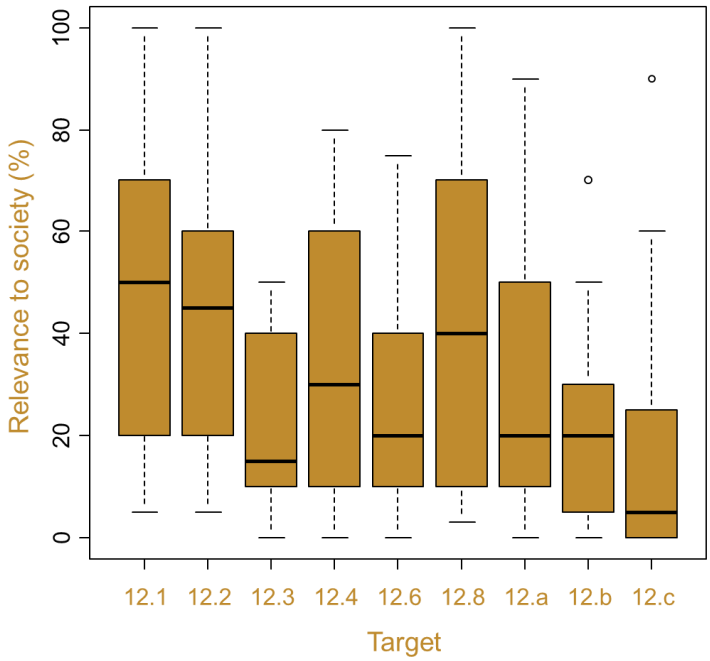

Figure 26 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 12 Responsible Consumption and Production.

SDG 13 - Climate Action

SDG 13 aims to take urgent action to combat climate change and its impacts [12] and includes five targets, all of which remained in the shortlist and were scored by our pollinator experts. These targets involve:

(i) Strengthening resilience and ability to adapt to climate-related hazards and disasters;

(ii) Integrating climate change measures into national polices and strategies;

(iii) Improving education and awareness on climate change mitigation, adaptation and impact reduction;

(iv) Ensuring commitments made by developed countries to the UNFCCC are met and $100 billion is mobilised annually to address the needs of developing countries

(v) Building capacity for effective climate change planning and management in least developed countries.

Only two Targets (13.2 and 13.a) were found to be linked to pollinators and both in the direction of SDG → Pollinators (median strength of relationship >20, Table 11). The first target aims to integrate climate change measures into national policies and experts felt that this was an opportunity to ensure pollinators are included in these policies. The second relationship was not as strong and relates the mobilisation of resources to help mitigate against climate change in developing nations in line with commitments made to the UNFCCC.

Table 11 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 13 Climate Action and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
13.1	10	20	0	0	20	48
13.2	40	45	0	2	40	50
13.3	10	23	0	10	30	35
13.a	20	25	0	0	15	20
13.b	10	28	0	0	10	15

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

[12] https://sdgs.un.org/goals/goal13

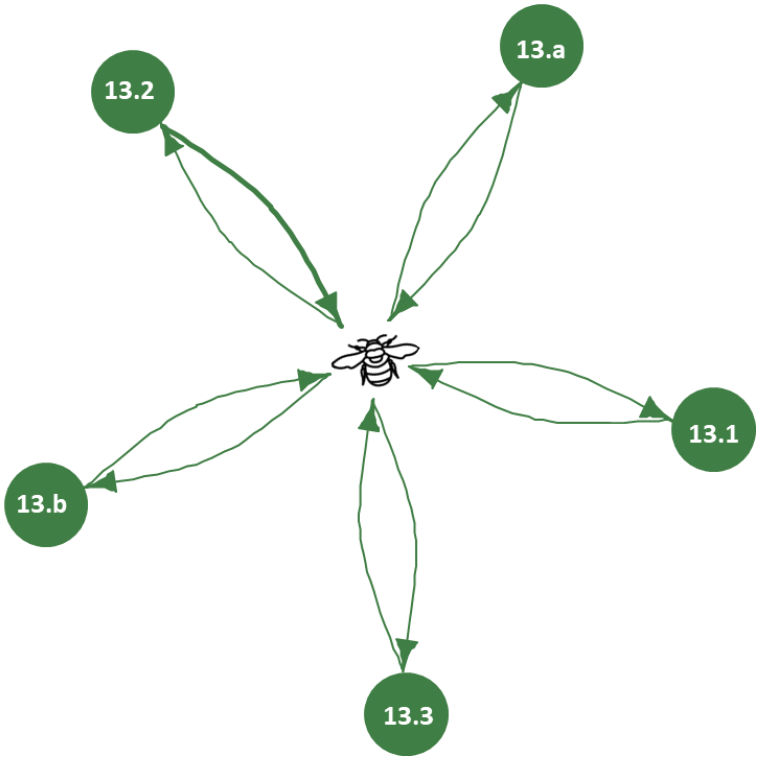

Figure 27 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 13 Climate Action.

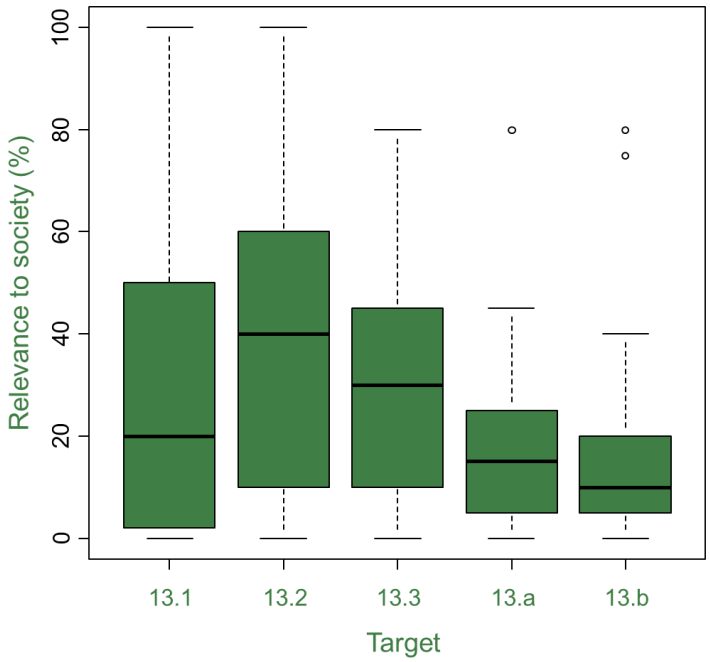

Figure 28 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 13 Climate Action.

SDG 14 - Life Below Water

SDG 14 aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development[13] and includes ten targets;

(i) Preventing and reducing marine pollutants;

(ii) Managing and protecting marine and coastal ecosystems;

(iii) Minimising the impacts of ocean acidification;

(iv) Ending overfishing and illegal unreported and unregulated fishing and destructive fishing practices;

(v) Conserving at least 10% of coastal and marine areas;

(vi) Prohibiting certain types of fisheries subsidies which contribute to overfishing;

(vii) Increasing economic benefits to Small Island developing States and least developed countries from sustainable use of marine resources (such as sustainable management of fisheries, aquaculture and tourism);

(viii) Increasing scientific knowledge and building research capacity for marine technology;

(ix) Providing access for small-scale fishers to marine resources and markets;

(x) Implementing international law as reflected by the United Nations Convention on the Law of the Sea

Two Targets (14.1 & 14.2) remained in the shortlist, however neither were associated with median strength of relationship scores over 20, and so it is unlikely that they can be directly linked to pollinators.

Table 12 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 14 Life Below Water and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

Target	SDG-> Pollinators		Pollinators -> SDG			
	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
14.1	5	25	0	0	5	13
14.2	15	29	0	15	10	25

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

[13] https://sdgs.un.org/goals/goal14

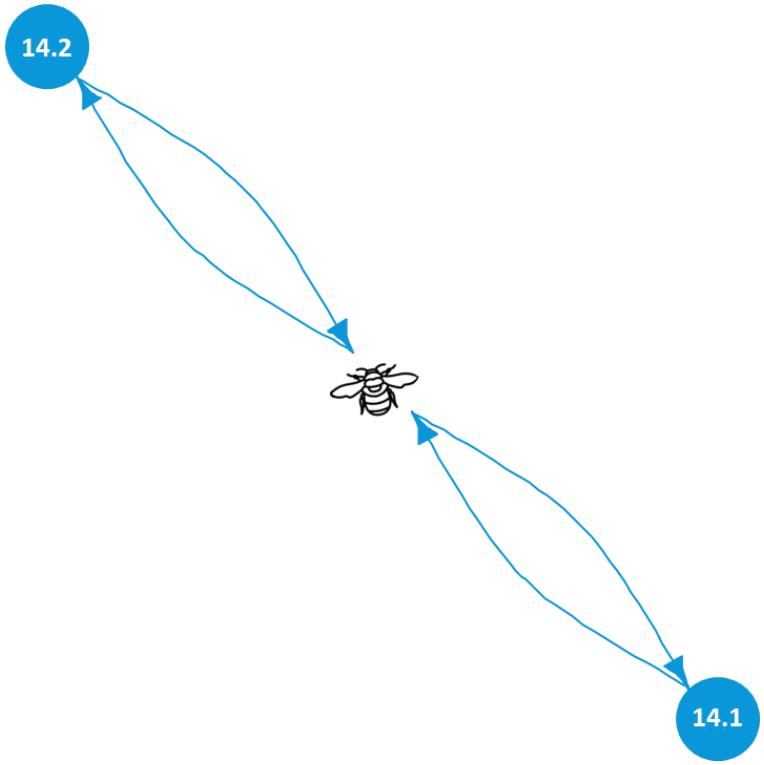

Figure 29 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 14 Life Below Water.

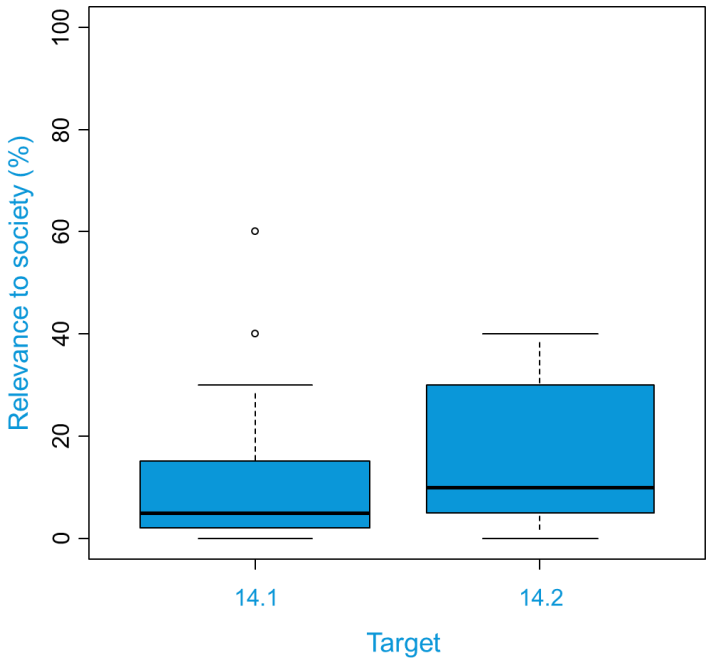

Figure 30 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 14 Life Below Water.

SDG 15 - Life on Land

SDG 15 surrounds Life on Land and aims to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss[14]. There are twelve targets under this goal, all of which remained in the shortlist for this expert elicitation exercise. They targets involve;

(i) Conserving, restoring and ensuring sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands;

(ii) Promoting sustainable management of all type of forests, halting deforestation, restoring degraded forests and increasing afforestation and reforestation;

(iii) Combatting desertification, restoring degraded land and soil and striving to achieve a land degradation-neutral world;

(iv) Conserving mountain ecosystems, including their biodiversity in order to build their capacity to provide benefits that are essential to sustainable development;

(v) Take urgent action to reduce degradation of natural habitats, and halting the loss of biodiversity to prevent the extinction of threatened species;

(vi) Promoting fair and equitable sharing of benefits that arise from the use of genetic resources;

(vii) Ending poaching and trafficking of protected species of flora and fauna;

(viii) Introducing measures to prevent the introduction and reducing the impact of invasive alien species on land and water ecosystems;

(ix) Integrating ecosystem and biodiversity values into local and national planning;

(x) Mobilising and increasing financial resources to conserve and support the sustainably use biodiversity;

(xi) Mobilising significant resources to finance sustainable forest management and providing incentives to developing nations to advance management including conservation actions and reforestation;

(xii) Combating poaching and trafficking of protected species by increasing the capacity of local communities to adopt sustainable livelihood opportunities.

Links between pollinators and SDG 15 Life on Land have previously been drawn (Patel et al., 2021; Yang et al., 2020), and our results support these through high median strength of relationship scores associated with most targets under this goal (Table 13). The strongest relationship was found between pollinators and targets which involves conserving and restoring ecosystems (Targets 15.1, 15.2, 15.3, 15.4 & 15.5). These were some of the most important links found in the direction of pollinators → SDG, suggesting that pollinators can make contributions to these targets. Pollinators play an important role in conserving terrestrial biodiversity, with almost 90% of wild plant species relying on some form of animal pollination ((IPBES, 2016). They are also an important component of these ecosystems in themselves and therefore stand to be impacted by any progress towards these targets, reflected in high median strength of relationship scores in the other direction too (Pollinators → SDGs).

[14] https://sdgs.un.org/goals/goal15

Some strong unidirectional relationships were also identified, in the direction of the SDG target having an impact on pollinators. One such example was Target 15.8 which involves preventing the spread of invasive alien species and reducing their impacts was also relatively strongly linked to pollinators (median strength value SDG → Pollinators =55, Table 13). This reflects existing evidence that pollinators can be impacted by invasive species, and how humans have translocated pollinator species beyond their natural ranges to areas where they themselves have become invasive and have impacts on behaviour and success of native pollinating species (Vanbergen et al., 2018).

Table 13 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 15 Life on Land and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
15.1	90	20	60	45	75	30
15.2	80	30	30	65	60	40
15.3	70	20	35	30	50	40
15.4	80	40	35	40	50	30
15.5	85	40	50	40	60	40
15.6	20	15	0	30	20	15
15.7	15	20	0	0	15	15
15.8	55	30	10	40	30	15
15.9	65	40	10	25	45	45
15.a	65	30	0	15	50	60
15.b	50	35	0	15	30	30
15.c	20	15	0	0	15	35

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

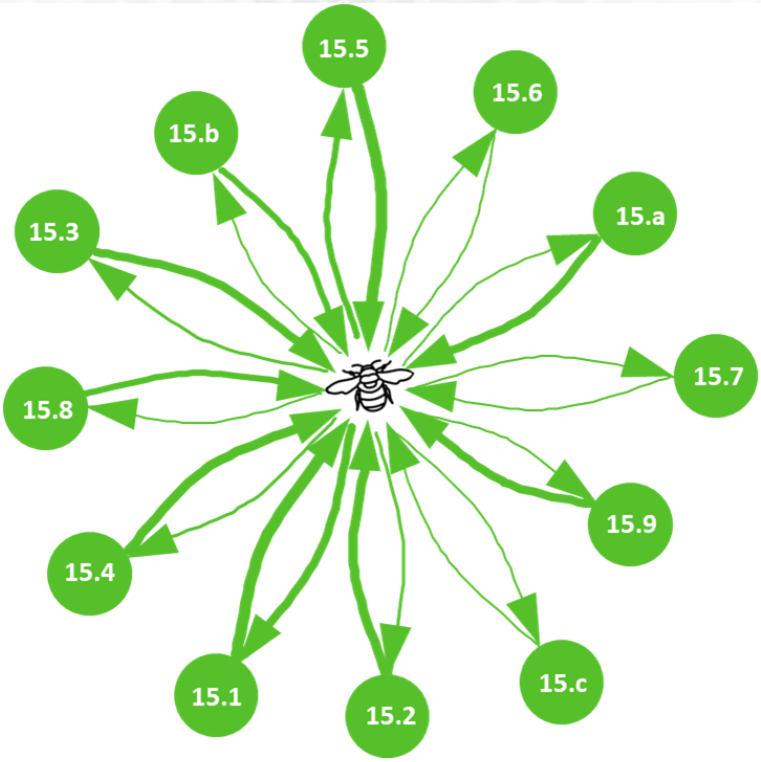

Figure 31 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 15 Life on Land.

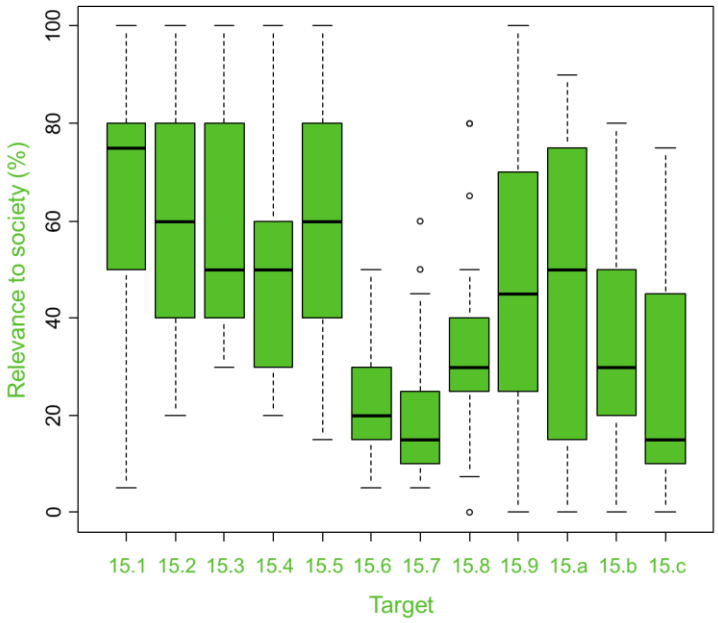

Figure 32 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 15 Life on Land.

SDG 17 - Partnership for the Goals

SDG 17 aims to strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development[15]. It includes 19 specific targets to help achieve this, including the following;

(i) Mobilising resources to improve the domestic capacity for tax and other revenue collection;

(ii) Ensuring ODA commitments are met in developed countries;

(iii) Mobilising additional financial resources for developing countries;

(iv) Assisting developing countries in achieving long-term debt sustainability;

(v) Adopting and implementing investment promotion regimes for least developed countries;

(vi) Enhancing North-South, South-South and triangular regional and international cooperation on access to science, technology and innovation, enhancing knowledge sharing;

(vii) Promoting the development, transfer and communication of environmentally sound technologies to developing countries;

(viii) Operationalising the technology bank and science, technology and innovation capacity-building mechanism for least developed countries;

(ix) Building capacity in developing countries to support national plant to implement SDGs;

(x) Promoting universal, rules-based, open, non-discriminatory and equitable multilateral trading agreements under the WTO;

(xi) Increasing exports of developing countries;

(xii) Implementing duty-free and quota-free market access on a lasting basis for all least developed countries;

(xiii) Enhancing global macroeconomic stability;

(xiv) Enhancing policy coherence for sustainable development;

(xv) Respecting each country's policy space and leadership to establish and implement policies to alleviate poverty and achieve sustainable development;

(xvi) Mobilising and sharing knowledge, expertise, technologies and financial resources to support progress towards the SDGs;

(xvii) Promoting effective partnerships;

(xviii) Building capacity for developing countries to increase the availability of high-quality, timely and reliable data;

(xix) Developing measurements of the progress on sustainable development that complement GDP and statistical capacity building in developing countries.

Two of these goals remained in the shortlist and were included in our study , 17.14 and 17.16, both were associated with unidirectional scores by expert suggesting there might be an impact of progress towards these goals on pollinators.

[15] https://sdgs.un.org/goals/goal17

Table 14 Median values for strength of relationship between pollinators and the shortlisted targets under SDG 17 Partnership for the Goals and median relevance to society scores of these relationships. Interquartile ranges (IQRs) are provided and have been used as a measure of consensus amongst the panel of global pollinator experts, low IQRs indicate high consensus whereas high IQRs reflect median scores that show poor consensus.

	SDG-> Pollinators		Pollinators -> SDG			
Target	Median **Strength** of Relationship Score	IQR	Median **Strength** of Relationship Score	IQR	Median **Relevance** to Society Score	IQR
17.14	20	40	0	0	20	45
17.16	20	50	0	5	30	40

Consensus Thresholds 0-15 16-30 31-45 46-60 61-75

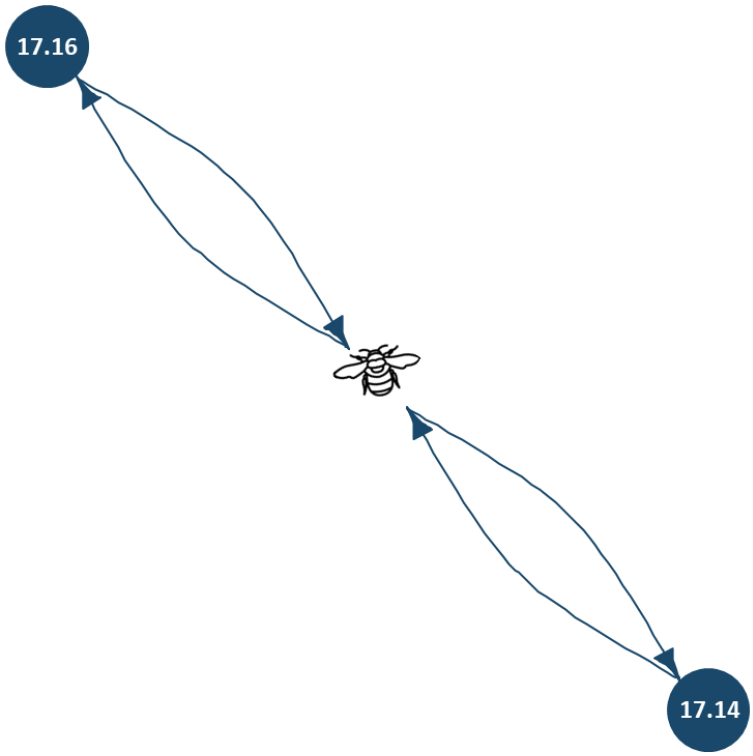

Figure 33 Network diagram depicting **median strength of bidirectional relationships** between pollinators (centre) and the shortlisted targets for SDG 17 Partnership for the Goals.

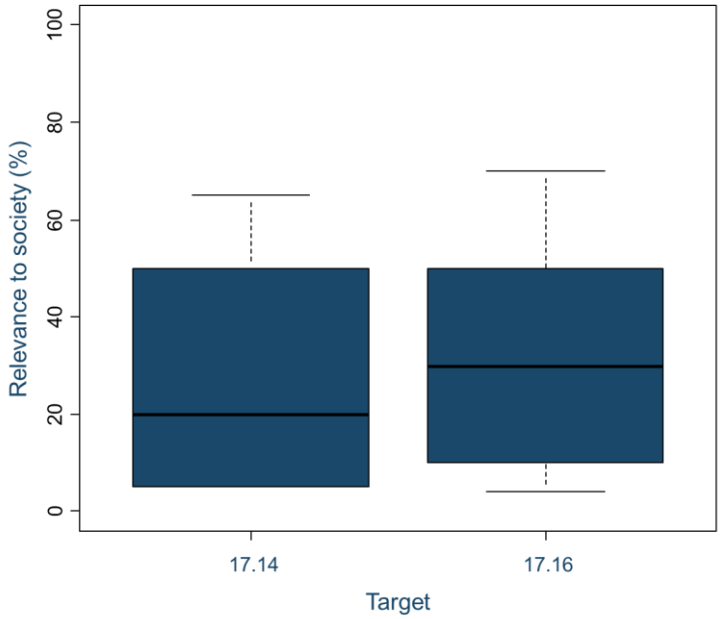

Figure 34 Boxplots showing the **relevance to society** scores provided by the experts for the shortlisted targets under SDG 17 Partnership for the Goals.

4. Discussion

This study is the first to apply such a quantitative approach to determining the importance of pollinators to the UN SDGs. We have gathered valuable data from seventeen global pollinator experts, and through a rigorous scoring exercise have been able to identify key linkages between pollinators and sustainable development. Through these data we have explored not solely the strength of these relationships but also the directionality, a key novel component, and finally the impact that any decoupling of these connections may have on society. Results presented in this report underpin the development of a full manuscript to be submitted for publication in 2023.

A key aim of Safeguard is to strengthen pollinator-relevant policy and further inform decision making, and here we have carried out a study to map the importance of pollinators to a well-established global policy framework. Our results based on expert opinion suggest pollinators can be linked to 39 UN SDG targets. These relationships include 11 bi-directional interactions and a further 28 unidirectional connections. 24 in the direction of SDG → Pollinators and 4 in the direction of Pollinators → SDG. By carrying out this analysis at a target level and considering two-way interactions, it allows us to explore the impacts that SDG targets might have on pollinators (SDGs → Pollinators) but also the potential contributions pollinators might make towards the success of specific targets and thus sustainable development (Pollinators → SDGs). We acknowledge that impacts may be positive or negative and that there may be trade-offs between different sub targets and SDGs when implemented.

The impacts that connections between pollinators and SDG targets have on society

Considering the relevance to society scores, which capture the severity of any changes in relationships between pollinators and SDGs, the geographic extent of impact and the number of people involved. Fifteen of our identified links were associated with relevance to society scores ≥ 50, highlighting that any changes to these relationships stand to have impacts on many people over large geographic scales. All ten bi-directional relationships identified in this study are found to be strongly related to society. In general, relevance to society scores mirrored the strength of relationship scores, if a target had a high median relevance score it was usually associated with a high strength of relationship value in one or both directions. There were very few exceptions to this. One such decoupling occurred with target 12.1[16] which concerns policies to promote sustainable consumption, this target had a relevance to society score of 50 but strength of relationship did not exceed 30 (in the direction SDG → Pollinators). Experts felt this target could have a moderate impact on pollinators through promotion of sustainable production systems and responsible consumption, but that this connection could have a wider impact on society.

Synergies between nature's contribution to people (ecosystem services) and the SDGs have previously been identified (McElwee et al., 2020), and pollinators may provide a vital link, particularly considering targets under SDG 2 – Zero Hunger (McElwee et al., 2020). In our study, our highest relevance to society scores were also found under this SDG, emphasizing the important contribution that pollinators can make to society through food provisioning.

High relevance to society scores were also found under SDG 15 – Life on Land, and again in most cases the magnitude of scores closely matched those for the strength of relationship. For example, considering Target 15.1[17] which aims to conserve and restore ecosystems. It is associated with the indicators (i) Forest area as a proportion of total land area, and (ii) Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type. Experts felt that not only are there strong bi-directional relationships, but also assigned a high relevance to society score of indicating that interruptions to these relationships and degradation of healthy ecosystems may have consequences for many people over a large geographic scale (Isbell et al., 2023).

Drawing links between pollinators and SDG targets

This study builds on previous work, which has suggested pollinators can contribute to sustainable development through their role in crop production (Borges et al., 2020), and as key components of biodiversity whose loss would undermine progress towards goals such as SDG 2 Zero Hunger (Krause and Tilker, 2022; McElwee et al., 2020) and SDG 15 Life on Land (Dangles and Casas, 2019; Yang et al., 2020). However, this study goes well beyond the previous qualitative approaches to establish a much more rigorous and quantitative assessment of both the direction and the strength of links at target-level.

It is estimated that 78% of temperate and 94% of tropical wild flowering plants depend on pollinators for reproduction (Ollerton et al., 2011). Without them the maintenance of

[16] ***Target 12.1:*** *Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries.*

[17] ***Target 15.1:*** *By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreement.*

wild plant communities and healthy ecosystems would be impossible. It is therefore clear that SDG 15 – Life on Land cannot be achieved without their consideration. All twelve targets under Life on Land remained in our shortlist and were scored by our panel of pollinator experts, and with the exception of one, all were associated with a median score of 20 or more, a threshold chosen to identify a tenable relationship between targets and pollinators. Targets under this SDG were associated with the highest median strength of relationship scores across this study, particularly considering the impact of action or inaction towards each target on pollinators. This brings a clear message that pollinators should be given careful consideration when planning strategies to achieve these targets. Conversely, considering the contributions that pollinators can make towards the success of SDG targets, SDG 2 – Zero Hunger exemplified this through high strength of relationship scores in the other direction (Pollinators → SDGs). Pollination has been identified previously as a key biodiversity-mediated process without which it might be impossible to achieve SDG 2 (Blicharska et al., 2019). Our experts agreed with this, and this study has highlighted that several targets under this goal depend on and benefit from the vital role pollinators play in producing reliable and healthy food.

Beyond these, we found important links that may not be as obvious initially. For instance, considering SDG 6 – Clean Water and Sanitation, experts agreed that pollinators might be impacted as they are a component of biodiversity in water-related ecosystems that should be considered and that they might contribute to the provision of clean water by playing a role in the reproduction of vital plants needed to maintain these ecosystems. Similarly, it might not appear to be immediately evident that pollinators might be impacted by targets under SDG 12 – Responsible Consumption and Production. However, evidence shows the impact that pollutants have on pollinators, and they are therefore impacted by progress towards specific targets under this goal.

While the resulting median scores across this study could be seen to be generally low on a scale of 0 to 100, this reflects the range in responses provided by the diverse pool of experts who participated in this study and includes a number of factors. Firstly, each expert brought different priorities and perspectives based on their geographic locations, their sector of origin (science, policy) and variety of pollinator expertise. We found relatively low consensus amongst our responses, reflected by the large interquartile ranges associated with many of our links, despite holding workshops in which experts actively engaged and gave justification for their range in scores. It may reflect uncertainty and outstanding gaps in the existing knowledge base.

Secondly, another factor that might have led to lower-than-expected consensus scores was that experts were asked to consider the indicators assigned to each target. This often led to discussions about the strength of relationships and relevance to society amongst the experts. For example, under Target 1.5 under No Poverty[18] which concerns climate resilience, one could argue that pollinators are vital for green infrastructure which in turn can play a crucial role in climate resilience. However, indicators for this target include (i) the number of deaths, missing persons and persons affected by disaster per 100,000 people, (ii) the direct disaster economic loss in relation to global gross domestic product (GDP), (iii) the number countries with national and local disaster risk reduction strategies, and (iv) the proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies. Reflecting on not just the target text, but these

[18] ***Target 1.5:*** *By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters.*

indicators, the link between pollinators and the target becomes more tenuous. Throughout the study it was often difficult to argue direct relationships between pollinators and a set of rigid indicators which have yet to consider pollinators explicitly, which could indicate that pollinators are not currently a priority to the SDGs. This may be an important result of our work and in conjunction with higher median scores associated with specific targets, highlights the need to integrate pollinators into the SDG framework in the form of specific indicators or vocabulary that shines a light on their importance.

Despite these reasons why median scores may be considered relatively low for many SDG targets, overall, the process has highlighted that pollinators are important to the success of the SDGs. They are, however, just one key component and other factors may also need to be considered in order to reach targets. This study has also found that progress towards sustainable development might have consequences for pollinators, reflected through the 24 unidirectional relationships (SDGs → Pollinators), they should therefore be a key consideration when developing policies surrounding the SDGs.

Policy implications

Identifying opportunities to engage in the science-policy interface is a priority for the Safeguard project, and roadmaps to do so have been produced and can be found elsewhere[19]. This study, however, could provide an exciting chance to cross this divide. The results have highlighted potential synergies through which biodiversity, ecosystem services and sustainable development could be aligned. Preliminary results have already been presented through a policy brief (Section 5 of this report) circulated at the UN Biodiversity CBD COP 15 (December 2022). The brief included specific recommendations highlighting that many SDGs cannot be achieved without the sustainable management and conservation of pollinators. We state that based on our evidence:

- many SDGs cannot be achieved without careful consideration of pollinators,
- that pollinators and sustainable development go hand-in-hand, so policies need to be synergised to account for this,
- pollinators are a critical agricultural input and require sustainable management to ensure food security,
- restoration and maintenance of many terrestrial ecosystems depends, at least in part, on the role pollinators play in plant reproduction. Policy should therefore provide concrete actions to protect and enhance wild pollinator communities,
- pollinators can make an indirect but important contribution to many SDGs beyond SDG 2 Zero Hunger and SDG 15 Life on Land, so policymakers should consider their conservation when formulating policies to achieve these SDGs.

As we enter a more comprehensive analysis phase for this study in which we will build evidence for the links that have been identified further policy recommendations may come to light.

[19] https://www.safeguard.biozentrum.uni-wuerzburg.de/FileSystem/document/deliverables/D6.1_131222.pdf
https://www.safeguard.biozentrum.uni-wuerzburg.de/FileSystem/document/deliverables/D6.3_150922.pdf

5. Policy brief

The results of this study, along with specific policy recommendations were presented as a **policy brief** at the UN Biodiversity Conference CBD COP 15 which took place in Montreal in December 2022. This brief was circulated during a pollinator-focused side event '*Pollinator protection: strengthening policies, knowledge exchange and engagement'* hosted by Safeguard partners from FAO and Promote Pollinators.

A press release was also produced by project partners at Pensoft publishers and published in early January 2023 on the Safeguard project website and social media channels.

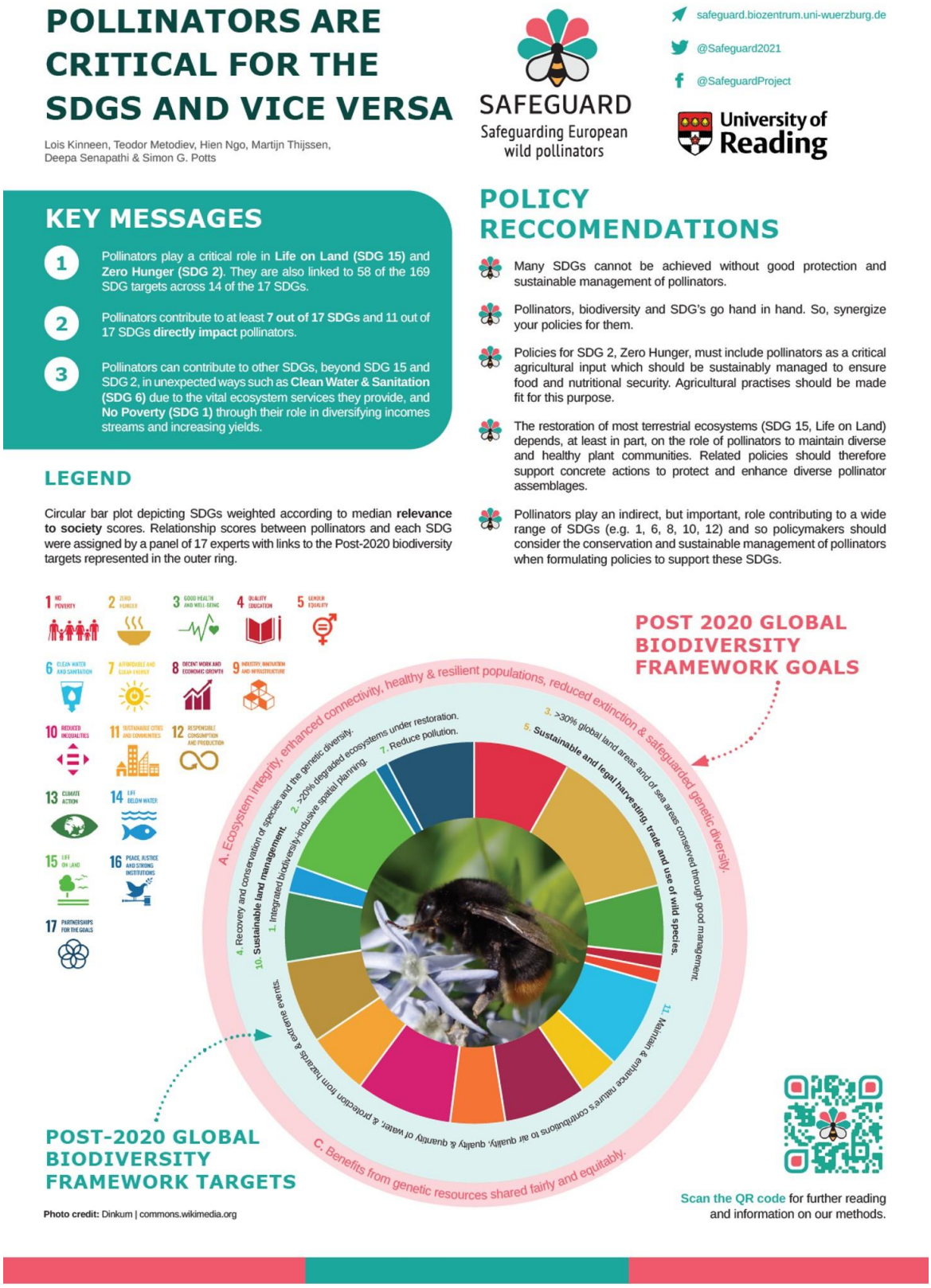

Figure 35 The front page of a policy brief which was distributed at a pollinator-focused side-event at the UN biodiversity COP 15 in Montreal, December 2022. Context and methodology for the study can be found via the QR code. Some key messages and policy recommendations are proposed based on preliminary results of the study. The circular bar plot indicates the median **relevance to society** scores for each SDG.

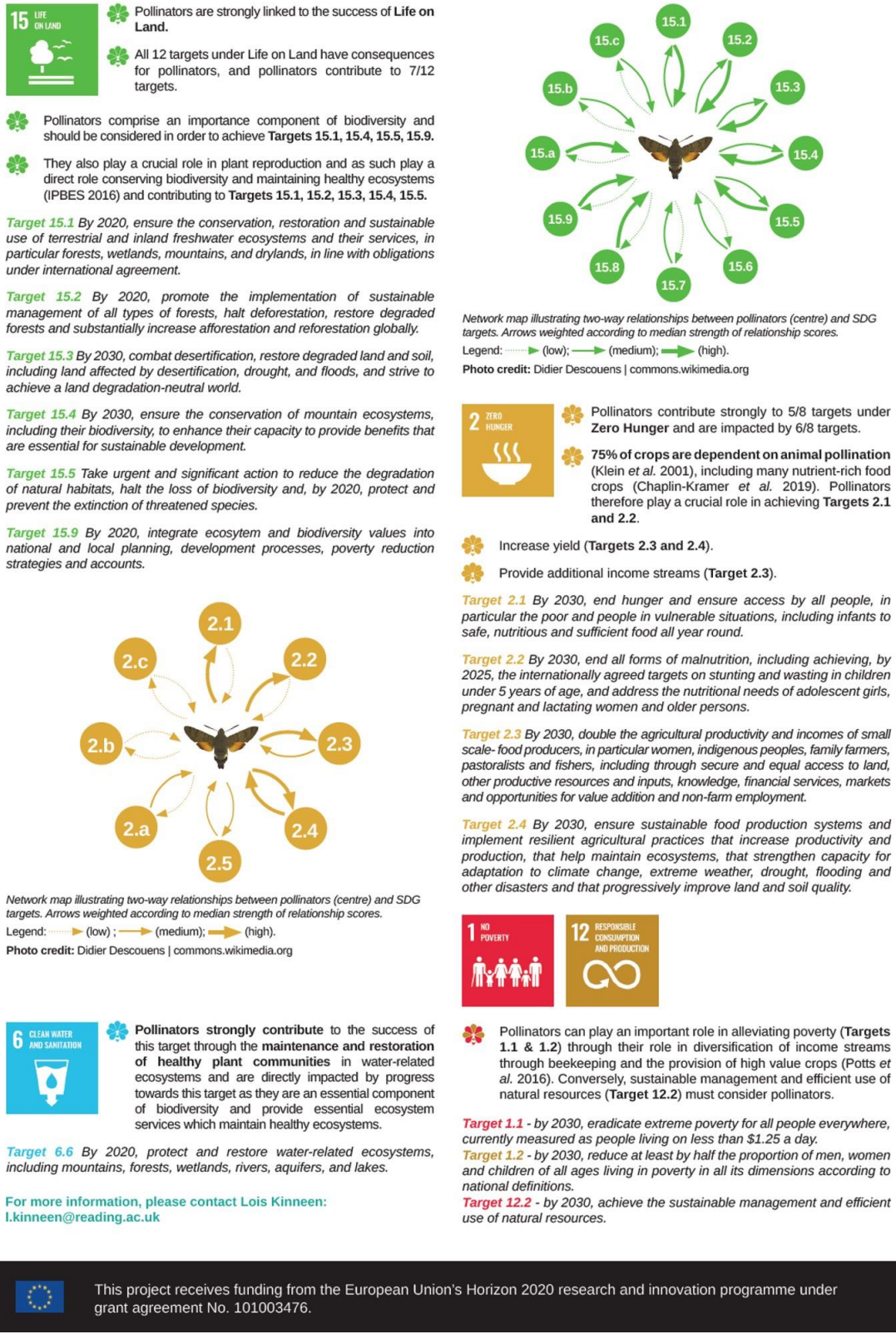

Figure 36 The back page of a policy brief which was distributed at a pollinator-focused side-event at the UN biodiversity COP 15 in Montreal, December 2022. Here we present two network graphs depicting the **strength of relationship** between pollinators and shortlisted targets under SDG 2 Zero Hunger and SDG 15 Life on Land. We also highlight other links that were relatively strong e.g. Target 6.6 under Clean Water and Sanitation.

6. Acknowledgements

We appreciate and are thankful for the participation of the 17 pollinator experts from around the globe whose data formed the backbone of this study. Specific thanks to Hien Ngo and Martijn Thijssen for their advice in creating the policy brief and for contributing to synthesis of our policy recommendations. We also thank colleagues at Pensoft, Teodor Metodiev and Monika B. Kumanska who co-designed the policy brief under tight timeframes and Gergana Karaboycheva for producing the supporting Safeguard press release.

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Appendix A – Shortlisted SDG targets

Table 15 Full list of the 58 shortlisted SDG targets and their definitions.

1. No Poverty
1.1: By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day.
1.2: By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.
1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters.
1.a: Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions.
1.b: Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions.
2. Zero Hunger
2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants to safe, nutritious, and sufficient food all year round.
2.2: By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons.
2.3: By 2030, double the agricultural productivity and incomes of small scale- food producers, in particular women, indigenous peoples, family farmers, pastoralists, and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters and that progressively improve land and soil quality.
2.5: By 2020, maintain the genetic diversity of seeds, cultivated plants, and farmed and domesticated animals and their related will species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.
2.a: Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries.

2.b: Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round.

2.c: Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.

3. Good Health and Well-being

3.2: By 2030, end preventable deaths of newborns, and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality at least as low as 25 per 1,000 live births.

6. Clean Water and Sanitation - Ensure availability and sustainable management of water and sanitation for all.

6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

7. Affordable and Clean Energy - Ensure access to affordable, reliable, sustainable, and modern energy for all.

7.1: By 2030, ensure universal access to affordable, reliable, and modern energy services.

7.a: By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

8. Decent Work and Economic Growth - Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

8.1: Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries.

8.2: Achieve higher levels of economic productivity through diversification, technological upgrading, and innovation, including through a focus on high value added and labour-intensive sectors.

8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead.

8.9: By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.

9. Industry, Innovation and Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.

9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally

sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

10. Reduced Inequalities - reduce inequality within and among countries.

10.1: By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average.

11. Sustainable Cities and Communities - Make cities and human settlements inclusive, safe, resilient, and sustainable.

11.3: By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries.

11.7: By 2030, provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

11.a: Support positive economic, social, and environmental links between urban, per-urban and rural areas by strengthening national and regional development planning.

11.b: By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.

12. Responsible Consumption and Production - Ensure sustainable consumption and production patterns.

12.1: Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries.

12.2: by 2030, achieve the sustainable management and efficient use of natural resources.

12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.

12.8: By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.

1**2.a:** Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production.

12.b: Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products.

12.c: Rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimising the possible adverse impacts on their development in a manner that protects the poor and the affected communities.

13. Climate Action Take urgent action to combat climate change and its impacts.

13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

13.2: Integrate climate change measures into national policies, strategies and planning.

13.3: Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

13.a: Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilising jointly $100billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalise the Green Climate Fund through its capitalisation as soon as possible.

13.b: Promote mechanisms for raising capacity for effective climate change-related planning and management in lease developed countries and small island developing States, including focusing on women, youth and local and marginalised communities *Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

14. Life Below Water - Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

14.2: By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening, their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

15. Life on Land - Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreement.

15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought, and floods, and strive to achieve a land degradation-neutral world.

15.4: By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

15.5: Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.

15.6: Promote fair and equitable sharing of the benefits arising from the utilisation of genetic resources and promote appropriate access to such resources, as internationally agreed.

15.7: Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products.

15.8: By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.

15.9: By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.

15.a: Mobilise and significantly increase financial resources from all sources to conserve and sustainable use biodiversity and ecosystems.

15.b: Mobilise significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation.

15.c: Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

17. Partnerships for the Goals - Strengthen the means of implementation and revitalise the global partnership for sustainable development.

17.14: Enhance policy coherence for sustainable development.

17.16: Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilise and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries.

Appendix B – SDG targets excluded from the shortlist.

Table 16 The 111 excluded SDG targets that were considered unlikely to be linked to pollinators during the shortlisting process

1. No Poverty
1.3: Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable.
1.4: By 2030, ensure that all men and women, in particular the poor and the vulnerable have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.
3. Good Health and Well-being
3.1: By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births.
3.3: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases.
3.4: By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
3.5: Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.
3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents.
3.7: By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.
3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality, and affordable essential medicines and vaccines for all.
3.a: Strengthen the implementation of the World Health Organisation Framework Convention on Tobacco Control in all countries, as appropriate.
3.b: Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all.
3.c: Substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in least developed countries and small island developing States.

3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

4. Quality Education

4.1: By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.

4.2: By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education.

4.3: By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.

4.4: By 2030, substantially increase the number of youths and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

4.5: By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.

4.6: By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy.

4.7: By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of pace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

4.a: Build and upgrade education facilities that are child, disability, and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all

4.b: By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African counties, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries.

4.c: By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States.

5. Gender Equality - achieve gender equality & empower all women and girls.

5.1: End all forms of discrimination against all women and girls everywhere.

5.2: Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.

5.3: Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation.

5.4: Recognise and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.

5.5: Ensure women's full and effective participation and equal opportunities for the leadership at all levels of decision-making in political, economic, and public life.
5.6: Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences.

5.a: Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance, and natural resources, in accordance with national laws.

5.b: Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.

5.c: Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.

6. Clean Water and Sanitation - Ensure availability and sustainable management of water and sanitation for all.

6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

6.3: By 2030, improve water quality by reducing pollution, eliminating dumping, and minimizing release of hazardous chemicals and materials halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

6.a: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling, and reuse technologies.

6.b: Support and strengthen the participation of local communities in improving water and sanitation management.

7. Affordable and Clean Energy - Ensure access to affordable, reliable, sustainable and modern energy for all.

7.2: By 2030, increase substantially the share of renewable energy in the global energy mix.

7.3: By 2030, double the global rate of improvement in energy efficiency.

7.b: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.

8. Decent Work and Economic Growth - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and

growth of micro-, small-, and medium-sized enterprises, including through access to financial services.

8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.

8.6: By 2020, substantially reduce the proportion of youth not in employment, education or training.

8.7: Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms.

8.8: Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment.

8.10: Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.

8.a: Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries.

8.b: By 2020, develop and operationalise a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organisation.

9. Industry, Innovation, and Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.

9.1: Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

9.2: Promote inclusive and sustainable industrialisation and, by 2030, significantly raise industry's share of employment and gross domestic product, in live with national circumstances, and double its share in least developed countries.

9.3: Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.

9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, including by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

9.a: Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.

9.b: Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.

9.c: Significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020.

10. Reduced Inequalities - reduce inequality within and among countries

10.2: By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.

10.3: Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard.

10.4: Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality.

10.5: Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations.

10.6: Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions.

10.7: Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies.

10.a: Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organisation agreements.

10.b: Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes.

10.c: By 2030, reduce to less than 3 per cent the transaction of costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent.

11. Sustainable Cities and Communities - Make cities and human settlements inclusive, safe, resilient, and sustainable.

1.1: By 2030, ensure access for all to adequate, safe, and affordable housing and basic services and upgrade slums.

11.2: By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

11.5: By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

11.a: Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.

12. Responsible Consumption and Production - Ensure sustainable consumption and production patterns.

12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse.

12.7: Promote public procurement practices that are sustainable, in accordance with national policies and priorities.

14. Life Below Water - Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

14.3: Minimise and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

14.4: By 2020, effectively regulate harvesting and end overfishing, illegal, unreported, and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to the levels that can produce maximum sustainable yield as determined by their biological characteristics.

14.5: By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

14.6: By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies recognising that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organisation fisheries subsidies negotiation.

14.7: By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism.

14.a: Increase scientific knowledge, develop capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries.

14.b: Provide access for small-scale artisanal fishers to marine resources and markets.

14.c: Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want.

16. Peace, Justice and Strong Institutions - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

16.1: Significantly reduce all forms of violence and related death rates everywhere.

16.2: End abuse, exploitation, trafficking, and all forms of violence against and torture of children.

16.3: Promote the rule of law at the national and international levels and ensure equal access to justice for all.

16.4: By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organised crime.

16.5: Substantially reduce corruption and bribery in all their forms.

16.6: Develop effective, accountable, and transparent institutions at all levels.

16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels.

16.8: Broaden and strengthen the participation of developing countries in the institutions of global governance.

16.9: By 2030, provide legal identity for all, including birth registration.

16.10: Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.

16.a: Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime.

16.b: Promote and enforce non-discriminatory laws and policies for sustainable development.

17. Partnerships for the Goals - Strengthen the means of implementation and revitalise the global partnership for sustainable development.

17.1: Strengthen domestic resource mobilisation, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection.

17.2: Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7% of ODA/GNI to developing countries and 0.15 to 0.20% of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20% of ODA/GNI to least developed countries.

17.3: Mobilize additional financial resources for developing countries from multiple sources.

17.4: Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress.

17.5: Adopt and implement investment promotion regimes for least developed countries.

17.6: Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the UN level, and through global technology facilitation mechanism.

17.7: Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed.

17.8: Fully operationalise the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology.

17.9: Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation.

17.10: Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organisation, including through the conclusion of negotiations under its Doha Development Agenda.

17.11: Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020.

17.12: Realise timely implementation of duty-free and quota-free market access on a lasting basis for all developed countries, consistent with World Trade Organisation decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access.

17.13: Enhance global macroeconomic stability, including through policy coordination and policy coherence.

17.15: Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development multi-stakeholder partnerships.

17.17: Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships Data, monitoring and accountability.

17.18: By 2020, enhance capacity-building support to developing countries, including least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.

17.19: By 2030, build on existing initiatives to develop measurement of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries.