D 4.4 | List of KPIs to measure, analyse and compare solutions

WP4 – Land use-based Adaptation and Mitigation Solutions (LAMS) catalogue

Version 1.1 | February 2025

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List of Organizations

	Participant Name	Short Name	Country	Logo
1	Fundación CARTIF	CARTIF	Spain	
2	University of Valladolid	UVa	Spain	
3	IVL Swedish Environmental Research Institute	IVL	Sweden	
4	RINA Consulting	RINA-C	Italy	
5	Euro-Mediterranean Center of Climate Change	CMCC	Italy	
6	Climate Media Factory	CMF	Germany	
7	National Observatory of Athens	NOA	Greece	
8	GMV Aerospace and Defence SAU	GMV	Spain	
9	FCiências.ID - Associação para a Investigação e Desenvolvimento de Ciências	FC.ID	Portugal	
10	ICLEI - Local Governments for Sustainability e.V. (World Secretariat) 10 A | ICLEI European Secretariat GmbH	ICLEI	Germany	
11	United Nations University - Institute for Environment and Human Security	UNU-EHS	Japan	
12	Geonardo Environmental Technologies Ltd.	GEO	Hungary	
13	Institut National de la Recherche pour l'Agriculture, l'Alimentation et l'Environnement	INRAE	France	

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Abbreviation and Acronyms

Acronym	Description
EUC	End-User Community
KPIs	Key Performance Indicators
LAMS	Land-based Adaptation and Mitigation Solutions
MCDA	Multi-Criteria Decision Analysis
NEVERMORE	New Enabling Visions and tools for End-useRs and stakeholders thanks to a common MOdeling appRoach towards a climatE neutral and resilient society
SDGs	Sustainable Development Goals
UNGA	United Nations General Assembly
WP	Work Package

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Executive summary

This deliverable describes the process to establish a framework of Key Performance Indicators (KPIs) as part of the Work Package 4 (Land use-based Adaptation and Mitigation Solutions (LAMS)). These KPIs will assess the performance of the LAMS to adapt and mitigate climate change at different scales: at the global, European and the case study levels.

Under RethinkAction project, KPIs are defined as "measures that are used to assess essential factors related to a given objective, such as reducing the effects of climate change" (Schokker, 2021). The list of KPIs in the project was established based on a literature review on climate change KPIs' and on a participative and iterative approach, with the partners of the project and the End-User Community (EUC), to ensure the relevance of the list.

The list comprises 55 KPIs covering environmental, social and economic aspects as the three main pillars of sustainable development (32 for Environment, 7 for Social and 11 for Economy). The KPIs have been divided into 20 categories such as climate, deforestation, land use, pollution, resource use, soil quality and water quality.

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1 Introduction

1.1 Purpose of the document

Subtask 4.3.2 (Co-creation of an understandable and delimited set of KPIs), is part of the Work Package (WP) 4 that develops a catalogue of Land-Based Adaptation and Mitigation Solutions (LAMS). It aims to establish a set of Key Performance Indicators (KPIs) to evaluate the solutions of the catalogue to be simulated in the system dynamic modelling activities under WP5 (Modelling framework and policy recommendations) and WP6 (Case studies – local evaluation).

Under the RethinkAction project, the Key Performance Indicators (KPIs) for climate change are defined as "measures that are used to assess essential factors related to a given objective, such as reducing the effects of climate change" (Schokker, 2021, p274). This definition comes from "the review on key performance indicators for climate change" which aims to list indicators to calculate the performance of cities, regions and countries to adapt and mitigate climate change.

Subtask 4.3.2 focuses strictly on the establishment of the set of KPIs but does not include aspects related to the modelling framework, which is currently being developed under WP5. The objective of the subtask is to provide a specific framework of KPIs to assess the performance of one or several LAMS at different scales (case study level, European and global).

The defined list of KPIs needs to cover the three pillars of sustainable development, which are Environment, Social and Economy and different categories such as biodiversity, land use, pollution, health, and agriculture, as it is required by the grant agreement. In addition, the KPIs will be linked to the Sustainable Development Goals (SDGs), established by the United Nations General Assembly (UNGA) in 2015 as the 2030 Agenda resolution, which will help us to understand the contribution of the LAMS implementation towards SDGs.

The set of KPIs was developed based on a literature review refined with a participatory and iterative approach with the partners of the project and the End-User Community (EUC) to make sure that they are relevant to the project and reflect the concerns of the EUC.

The establishment of the list of KPIs was iterative and this report aims to provide an evaluation framework to be followed in the evaluation of LAMS implementation. Therefore, only relevant KPIs will be selected from the present list and implemented in the system dynamic models, according to the ongoing model framework and methodology development (WP5).

Finally, each KPI is associated with specific SDGs and current and target values were defined based on a literature review.

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1.2 Structure of the document

The document is structured as follows:

- Section 1 introduces the content of the document, in the context of RethinkAction project and explains its main purpose.
- Section 2 presents the methodology adopted to establish a list of KPIs.
- Section 3 provides a short literature review which supports the KPIs list establishment.
- Section 4 describes the participative and iterative approach followed.
- Section 5 provides the categorization of the KPIs and SDGs contribution.
- Section 6 concludes.

Additionally, two annexes are provided to complement the information in the main sections.

2 Methodology

A literature review was conducted to understand what KPIs are used in climate change science. Regular meetings were arranged with partners to collect their feedback on the approach adopted and to ensure the alignment of the KPIs with the models. Local stakeholder experts were then consulted through a questionnaire to collect their views on a sample of KPIs and on potential KPIs of interest for assessing the LAMS. An iterative approach was necessary to adjust the list according to the needs of the project (Figure 1).

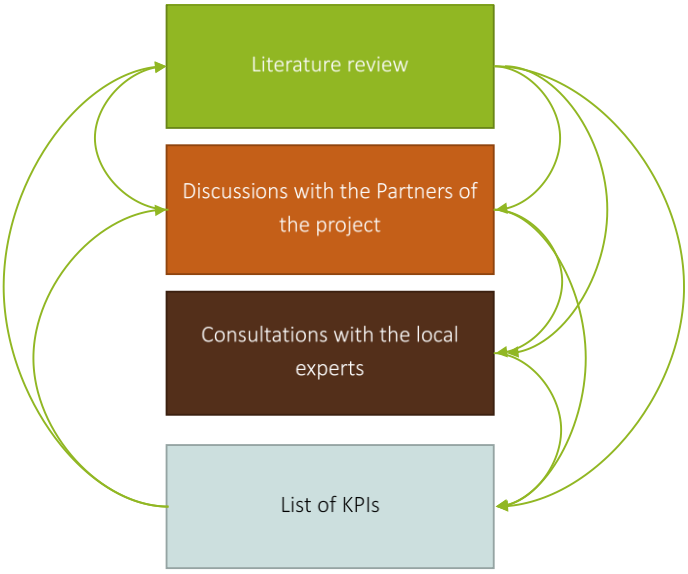

Figure 1: Methodology adopted to establish a list of KPIs.

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3 Literature review

3.1 Key considerations to establish the list of KPIs

Based on discussions with the partners and on the Grant Agreement, key considerations were suggested to define the list of KPIs. The list of KPIs needs to be:

- Holistic

The list of KPIs will cover the three pillars of sustainable development, which are Environment, Social and Economy. Key sectors such as Climate, Energy, Agriculture, Biodiversity, Water, Pollution and Society shall be addressed as required by the Grant Agreement.

- Multiscale

KPIs will be used under different scales: at the case study level, at the European and Global levels. Therefore, they should be relevant at each of these scales.

- Feasible and realistic

The KPIs represent fundamental indicators to assess the quality of the LAMS and hence the modeller partners will make an effort to include most of the KPIs in the models in the form of outputs of the system dynamic models, currently being developed under Work Package 5 and 6. Hence, KPIs need to be calculated from other internal (endogenous) variables of the models and/or from exogenous inputs.

- Credible for the End-Users Community

KPIs need to be easily useable and understandable by the EUC and reflect their concerns as much as possible. In addition, the number of KPIs shall be reasonable to make sure the EUC can use and interpret the results.

- Relevant

The list of KPIs shall be closely linked to the objectives of RethinkAction project for the LAMS, which is about identifying synergies, co-benefits and trade-offs among the LAMS, proposing a group of integrated LAMS that show benefits and avoid unexpected consequences and maladaptation. In addition, the KPIs must reflect the changes brought about by the LAMS.

3.2 Approaches reviewed to set the list of KPIs

The purpose of this literature review is to understand what KPIs exist for climate change.

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A review of **Key Performance Indicators for Climate Change** was published in 2022, to "identify and list 63 relevant KPIs, together with suggested units and metrics associated to them, divided into eight different thematic areas" (Schokker, 2021, p.273). These indicators support the calculation of the performance of cities, regions and countries to fight against climate change and "set goals for better performance shortly". The list of KPIs was established based on a literature review about the way countries currently assess their performance to adapt and mitigate climate change. However, and according to the author, the list used did not identify all the relevant KPIs.

The list of KPIs suggested by Schokker et al.(2021) aimed to "quantify climate change, environmental performance and sustainability at local and global level in a more complete, inclusive, and transparent and fair manner". In this paper, the KPIs were grouped under eight categories such as Pollution, Resource use, Climate hazards, Biodiversity, Transport, Private transport, Land use, Health, Other, and an additional set of 25 topics.

Another important source is the **"Global indicator framework for the sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development"** document, published by the United Nations General Assembly first in 2017 and updated in 2023 (United Nations, 2023). This report disaggregates the 17 Sustainable Development Goals into 169 targets and each target has one or several indicators (231 in total). It covers the Environmental, Social and Economic pillars.

We also found a European Project called **NEVERMORE, (New Enabling Visions and Tools for End-useRs and stakeholders thanks to a common MOdeling appRoach towards a ClimatE neutral and resilient society)** which is currently ongoing and is developing a set of indicators covering Environmental, Social and Economic Pillars. Their set of KPIs aims to "present multi-impact indicators to assess the effect of measures in terms of efficiency and effectiveness, in line with the European Environment Agency framework" (NEVERMORE, 2023). This project has already developed an extensive list of KPIs for the Environmental, Social and Economic pillars that supported the process of developing the list for RethinkAction project. This list is available on the NEVERMORE *website* and is public.

This literature review supported the development of the list of KPIs under RethinkAction project. The KPIs were extracted if: the indicator could be quantified by the project, the LAMS can influence the indicators (ex: marine animal biodiversity indicators were not taken because the marine ecosystems are not addressed in the scope of the RethinkAction project), the indicators could be modelled in the system dynamic model and be influenced by the different scenarios.

The list of KPIs with associated current and target values and the relevant literature where they were drawn from, are in Annex 2.

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3.3 Challenges to establish a list of KPIs

Through the literature review and discussions, several challenges were identified for the realisation of subtask 4.3.2:

- The high diversity, number, and broad scope of the LAMS

The first challenge is the large number of LAMS that belong to very different sectors such as tourism, agriculture, water or society. One of the difficulties will be to identify indicators that are relevant and can be applied to the maximum number of LAMS in the catalogue.

- Data availability and accessibility

The access and availability of data to model the KPIs at different scales could be an issue in the future.

- Iterative approach

The system dynamic models are under development so the list of KPIs will be reviewed in the future to be aligned with WP5 and WP6.

Moreover, it is not yet known how the KPIs will be presented on the platform or how the EUC will use the KPIs. Discussions are planned in the future under WP7.

4 Participative and iterative approach

The establishment of the KPIs was based on a participative and iterative approach. Partners of the project and the End-Users Community (EUC) were consulted to ensure the consistency of the approach.

4.1 Meetings conducted to collect feedback and input from the partners

Meetings were arranged to discuss with the partners the progress of the task and collect their feedback and recommendations. Partner engagement was essential to enable the development of the most relevant and appropriate KPIs set possible. Furthermore, the KPIs will be used in other project WP (especially the WP5), so it is fundamental that the project partners can participate in their design. The interactions of subtask 4.3.2 with the other tasks of the project are in Figure 2.

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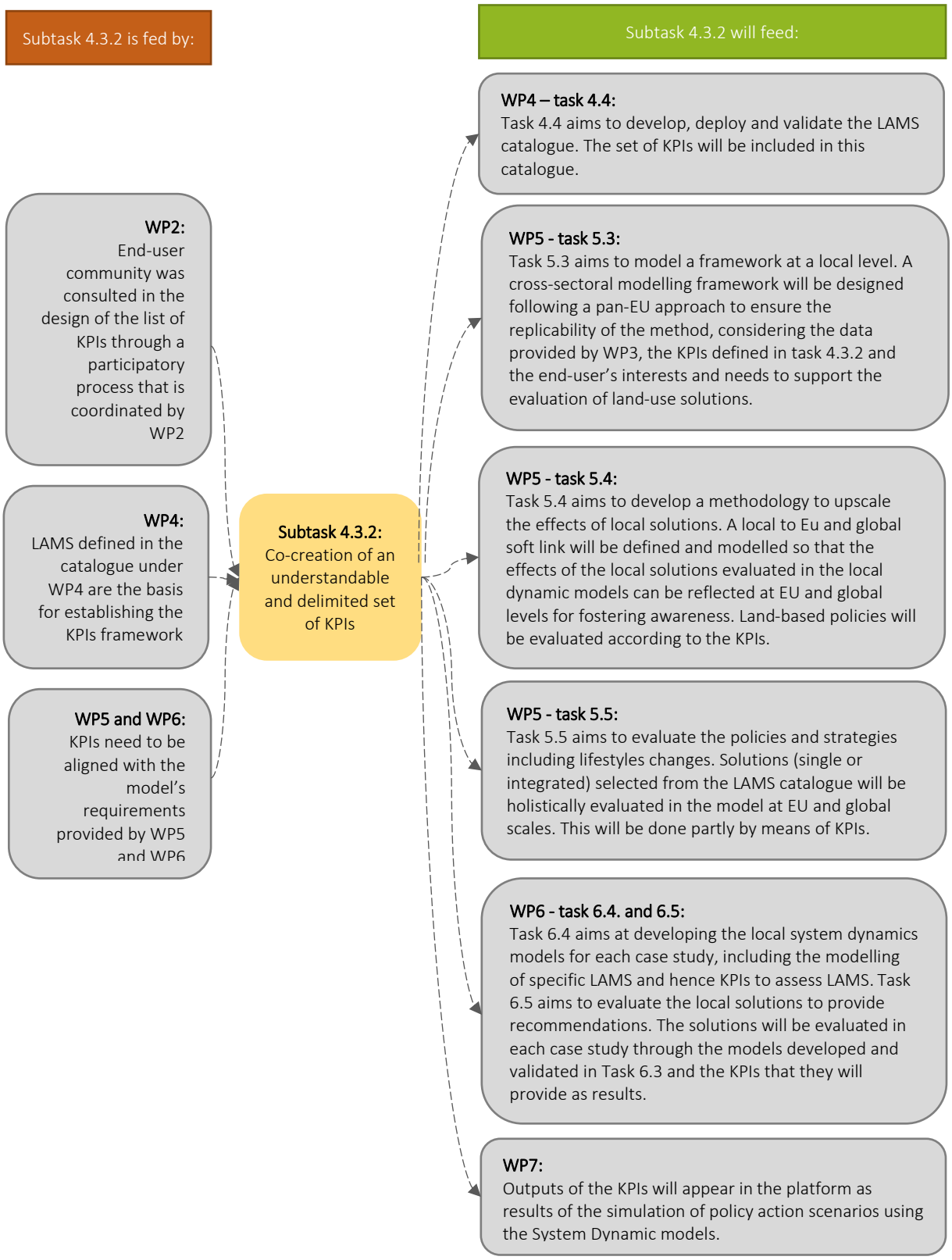

Figure 2: Inter-relations of task 4.3.2 and the other WP and tasks of the project.

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4.2 Online questionnaire

4.2.1 Objectives and design of the questionnaire

An online questionnaire was co-developed with the partners and more specifically with the case studies leaders and the local experts, to support the development of a list of KPIs. The questionnaire was designed on Google form to provide a user-friendly tool to the local experts and to help the data collection (
Annex 1).

The questionnaire aimed to collect feedback from the local experts and had a representative sample of eleven (11) KPIs from an early provisional list[1] (Table 1), which was shorter than the main list due to the constraints associated to the length of the questionnaire and the availability of the local experts. They were asked to tick boxes that state if each KPI was a relevant one to assess the LAMS (LAMS that was selected by the local experts beforehand) and if the data was available and accessible at their scale. Local experts had the opportunity as well to comment the exercise and share their thoughts. The questionnaire was sent by email to the case studies leaders on the 3rd of March (2023), who then sent the questionnaire to the local experts. The deadline was on the 24th of March (2023).

The select KPIs covered the three pillars (environment, social and economic) and various topics. Table 1 lists the KPIs included in the questionnaire.

Table 1: The sample of KPIs submitted to the local experts in the questionnaire

Pillar	Category	Topic	Indicators	Units
Economic	Economy	Economy	Costs	euros/ha/year
Economic	Economy	Economy	Creation of jobs	jobs created/ha/year
Environment	Environment	Soil	Soil quality (content in organic matter)	g/kg or %
Environment	Pollution	Greenhouse gases	Greenhouse gases emissions	kg CO2 eq /ha/year
Environment	Resource Use	Energy	Energy use	kWh/ha/year
Environment	Resource Use	Water	Water use	L/ha/year

[1] This list was designed in the beginning of the year 2023 and has evolved through time

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Pillar	Category	Topic	Indicators	Units
Environment	Land use	Soil	Land degradation	ha/year
Environment	Biodiversity	Terrestrial and marine diversity	Contribution to biodiversity conservation	Yes/No
Social	Health	Public health	Identification of risks to public health or health systems	Yes /No
Social	Society	Society	Social acceptance	n/a
Social	Society	Well-being	Human wellbeing	n/a
Social	Agriculture	Agriculture	Agricultural yield	tons/ha/year

4.2.2 Results of the questionnaire

4.2.2.1 Characterisation of the respondents

- Organisations

Twelve respondents participated in the questionnaire. Two participants filled in twice the survey. They belonged mainly to the public administrations (4 respondents), universities (3) followed by a public institute (2) (Figure 3).

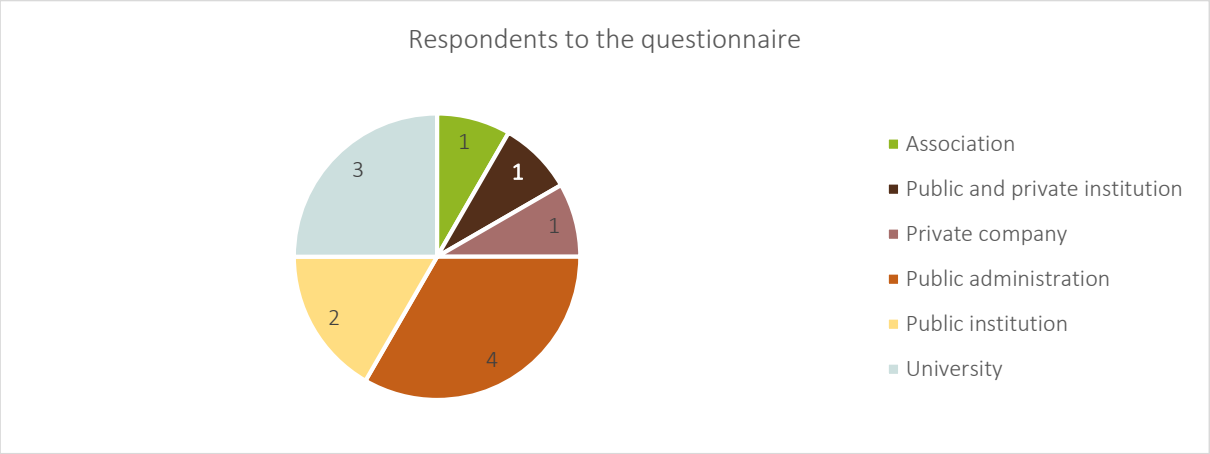

Figure 3 : Respondents to the questionnaire per type of organisation (number of respondents).

- Areas of interest

Among the participants, eight were interested in Azores (Portugal, CS6). Gotland, (Sweden, CS1), Tarn-et-Garonne (France, CS2), Valle d'Aosta (Italy, CS) and Almeria (Spain, CS5) were represented by only one participant.

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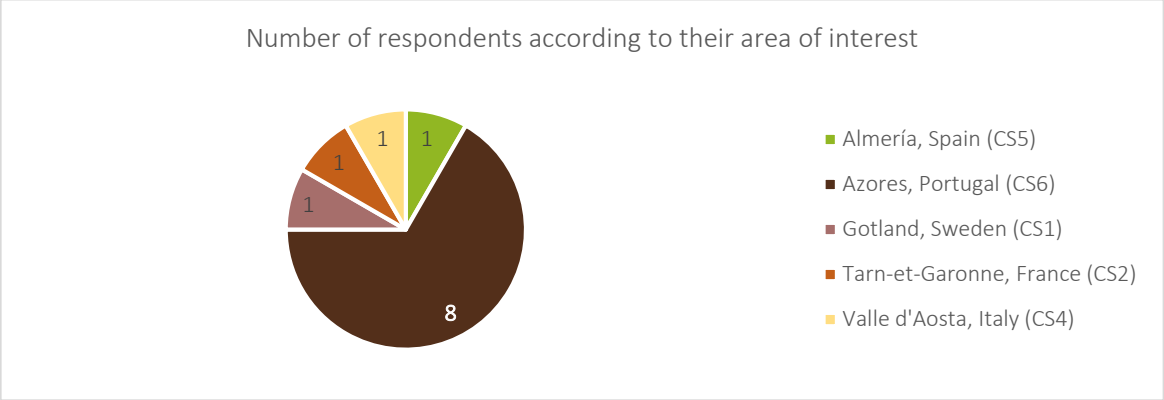

Figure 4 : Areas of interest of the respondents (number of respondents).

4.2.2.2 Key Performance Indicators review

More than 50% of the respondents qualified the KPIs (except soil quality and agricultural yield) as relevant to assess the LAMS. Some KPIs that were very specific to one sector such as "Soil quality" and "Agricultural yield" and were classified as relevant by only 36% of the respondents (Figure 5). However, the data was considered rather unavailable by the participants. The three most relevant KPIs according to the respondents are related to the economic and energy sectors: costs, creation of jobs and energy use (Figure 5).

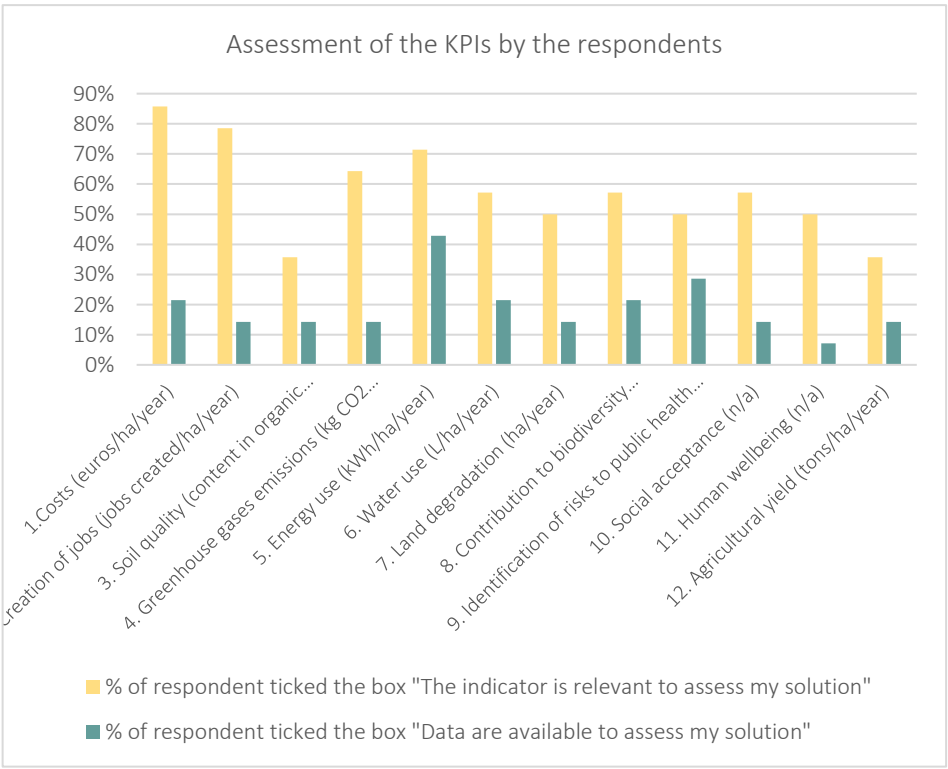

Figure 5 : KPIs review by the respondents.

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4.2.2.3 Thoughts from the respondents shared in the questionnaire

One respondent suggested adding these KPIs:

- CO_2 concentration in the atmosphere.
- Solar irradiance.
- Cloudiness.

These indicators (or climate variables) will be included in the provisional list and then reviewed as to decide according to several criteria (feasibility, access to data, etc.) whether they should be selected or not.

4.2.3 Action points

Action points were suggested based on the data analysis of the questionnaire:

- Economic and Energy sectors seem to be important for the local experts. RethinkAction project has to ensure the inclusion of indicators for the Economy and Energy sectors and reflect their concern.
- Data availability is a criterion to take into account to select the KPIs considering the difficulties shared by the local experts. The data availability is crucial when modelling a specific KPI, as without the essential data, the models cannot be simulated.

4.2.4 Allocating thresholds to KPI

Each KPI has its own units to represent a biophysical or socio-economic value. However, whenever possible, each KPI should be measurable and comparable to a target value based on the literature. Since KPIs are designed to be applicable across different scales, thresholds may vary between scales and case studies. For example, while agricultural production can be measured and calculated, applying a universal threshold may not be feasible. Additionally, thresholds must account for whether a KPI reflects a positive or negative impact, which can be highly subjective (e.g., "Population living below the national poverty line" vs. "Population covered by social protection systems"). While certain climate variables or planetary boundaries have well-defined thresholds that must not be exceeded, KPIs are often multidisciplinary, highly variable in definition, and challenging to standardize with clear thresholds. However, whenever it is feasible we added a threshold in the table of KPI. For this exercise, we choose to define whenever possible current and target values at the European scale.

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Here is shown an example of current and target values that were defined for air quality KPIs: PM2.5 and PM10. The World Health Organization (WHO, 2021) has established guidelines to limit exposure to these pollutants:

- PM2.5: Annual mean not to exceed 5 µg/m³; 24-hour mean not to exceed 15 µg/m³.
- PM10: Annual mean not to exceed 15 µg/m³; 24-hour mean not to exceed 45 µg/m³.

These values are compared to current exposure levels in Europe: In 2021, 97% of the urban population was exposed to PM2.5 concentrations above the WHO's annual guideline of 5 µg/m³ (European Environment Agency).

Achieving these targets requires coordinated efforts to reduce emissions from various sources, including transportation, industry, and residential heating. Monitoring and enforcing air quality standards are essential to protect public health and the environment.

As a second example we present current and target value for the Land protection KPI defined by biodiversity. As of 2020, approximately 25% of the European Union's land area was designated as protected, positioning the EU among the regions closest to achieving the global target of protecting 30% of land by 2030. The EU's current target is to legally protect 30% of both land and sea areas by 2030, as outlined in the EU Biodiversity Strategy for 2030 and the Kunming-Montreal Global Biodiversity Framework. To meet this target, the EU plans to expand its terrestrial protected areas by approximately 4% and strictly protected areas by about 7% by 2030. Achieving these targets will require continued commitment to expanding and effectively managing protected areas across the EU.

5 List of Key Performance Indicators (KPIs)

This section aims to present the list KPIs for RethinkAction project to assess the LAMS. This list is the result of the literature review (cf. Section 3 of the report), the consultation of the EUC (through the questionnaire) and the partner's expertise.

5.1 Breakdown of the list of KPIs

The list includes the following columns:

- Category of the indicator
- Indicator
- The unit of the indicator
- The description of the indicator

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- The references to describe the indicator
- The Sustainable Development goals –target - indicators contribution
- The policy sectors of RethinkAction concerned by the indicator
- The current value at the EU level (and/or world average depending on the type of KPI)

5.2 The list of KPIs

The lists of KPIs are in Annex 2. Table 2 gives information about the number of KPIs identified per pillar (environmental, social and economic) and per category (20 in total). Fifty KPIs have been identified, 32 for the environment, 7 for the social aspects and 11 for the economy pillar.

Table 2: Number of KPIs per pillar and per category.

Pillar	Category	Number of KPIs
Economic	Agriculture	3
	Economic growth	1
	Energy	4
	Labour	2
	Water use	1
Total Economic		**11**
Environment	Air pollution	2
	Biodiversity	1
	Climate hazards	1
	Deforestation	1
	Land use	5
	Soil pollution	3
	Soil quality	13
	Water pollution	2
	Water quality	3
	Temperature	1
Total Environment		**32**
Social	Diet	2
	Health	2
	Migration	1
	Poverty	1

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Pillar	Category	Number of KPIs
	Social protection	6
Total Social		12
Total		55

5.3 SDGs contribution

The Figure 6 shows the contribution of the KPIs towards the Sustainable Development Goals. It can be noted that many KPIs contribute to the "life on land" goal. This is because of one of the main objectives of the RethinkAction project, is to study the effects of Land-Use Adaptation and Mitigation Solutions (LAMS).

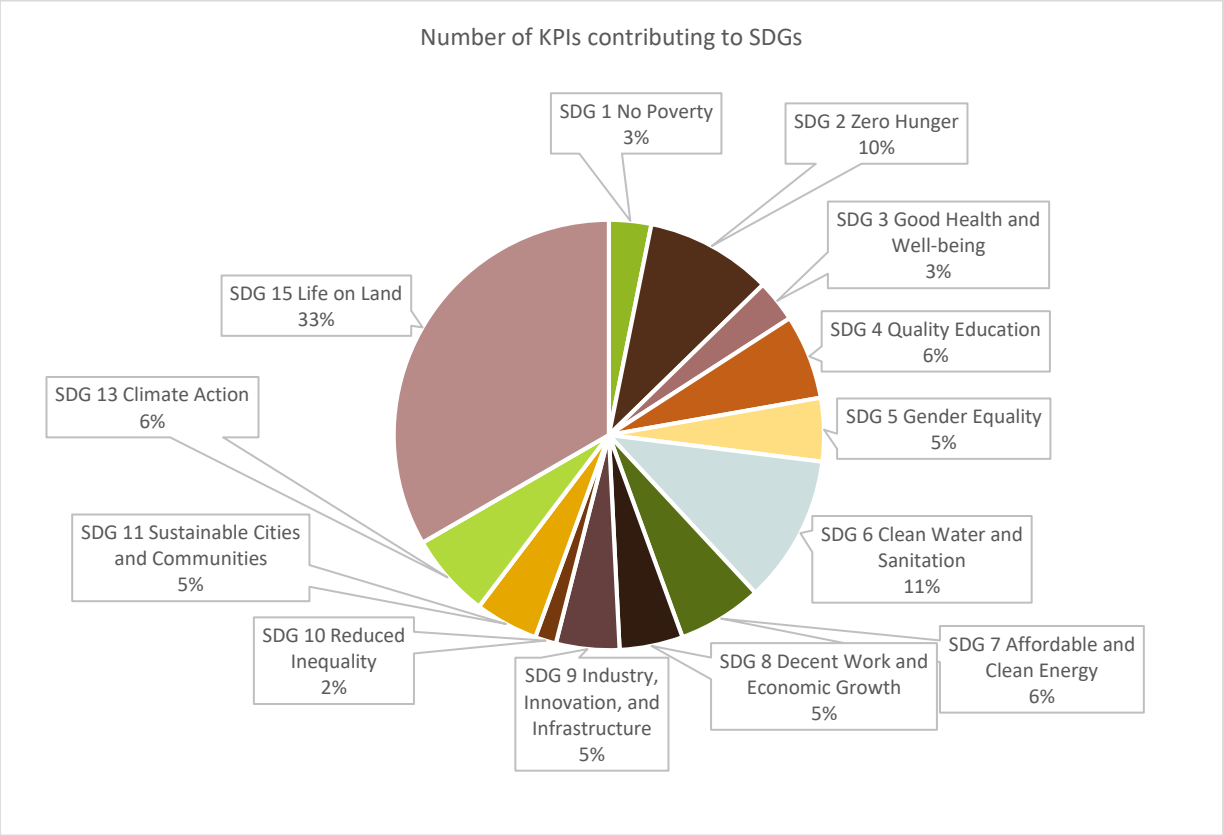

Figure 6: KPIs contributing to the Sustainable Development Goals (SGDs).

6 Conclusions

Under subtask 4.3.2, we have set a list of 55 KPIs, 32 for Environment, 12 for Social and 11 for Economy using a participative and iterative approach. The KPIs have been divided into 3 pillars and 20 categories.

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This list will be revised and can be further improved and/or enlarged throughout the project to make sure the KPIs are aligned with the other work packages and activities of the project.

The EUC will be approached one more time to weigh the importance of the KPIs according to their context. The list of KPIs will be displayed in the Integrated Assessment Platform to simulate and assess the effects of LAMS before their real implementation. The EUC could interact with the Platform by changing the LAMS applied in a case study and assess the impact of the selected solution through the KPIs values to improve the decision-making processes and take better informed decisions.

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Annexes

Annex 1: Link and screenshots of the questionnaire shared with the local experts

Link to access the Google form: https://docs.google.com/forms/d/e/1FAIpQLSflJefCQ8dEXhGCa55ZNrhOIYTJshYSOjf-90ue4KtgUD7Hog/viewform

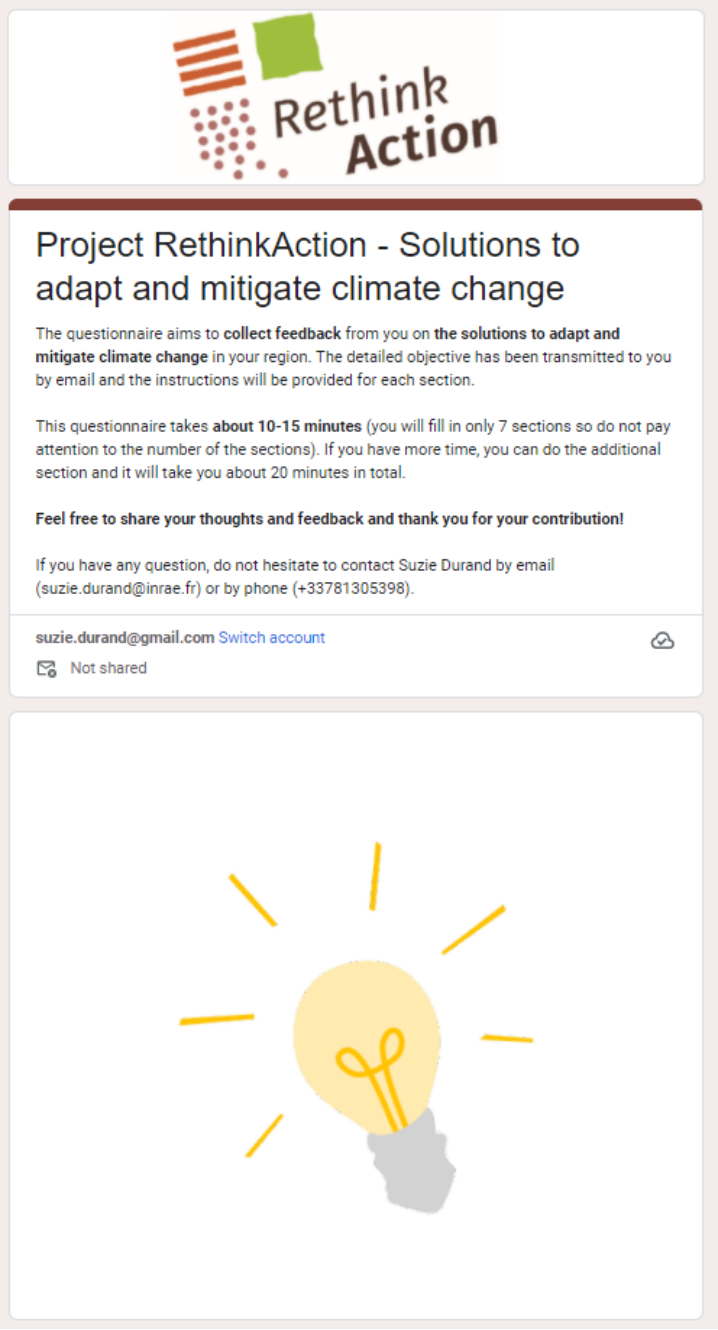

Figure 7: Main page of the questionnaire developed in Google form.

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Evaluation of the Key Performance Indicators (KPIs)

The project aims to co-create a set of indicators that will help to **assess the performance of the solutions to adapt and mitigate climate change**. The evaluation will support the end-users of the decision-making tool to select the **best solutions adapted to their local context**.

You will be asked below to assess **the relevance and feasibility** of the indicators to evaluate your solution (the same solution that you selected in the beginning) in your region.

Please tick the boxes only if the indicators listed to the right are relevant to assess the solution and if the data are available and accessible in your region to measure them.
If you think that they are not relevant, do not tick the boxes.

	The indicator is relevant to assess my solution	Data are available to assess my solution	I don't know if the data are available
1. Costs (euros/ha/year)	☐	☐	☐
2. Creation of jobs (jobs created/ha/year)	☐	☐	☐
3. Soil quality (content in organic matter) (g/kg or %)	☐	☐	☐
4. Greenhouse gases emissions (kg CO2 eq /ha/year	☐	☐	☐
5. Energy use (kWh/ha/year)	☐	☐	☐
6. Water use (L/ha/year)	☐	☐	☐
7. Land degradation (ha/year)	☐	☐	☐
8. Contribution to biodiversity conservation (Yes/No)	☐	☐	☐
9. Identification of risks to public health or health systems (Yes /No)	☐	☐	☐

Figure 8: Questions 1 to 9 to evaluate the KPIs during the consultation.

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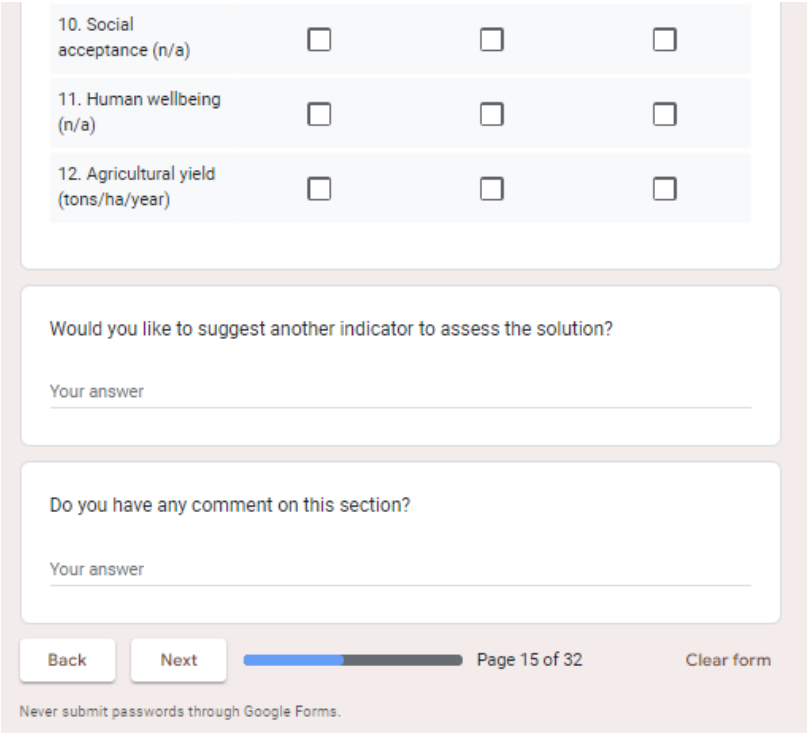

Figure 9: Questions 10 to 12 to evaluate the KPIs during the consultation.

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Annex 2: List of KPIs.

Table 3: List of KPIs per pillar and category including thresholds for their evaluation.

Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
1	Economy	Agriculture	Agricultural production	tons/year	Number of tons of agricultural products harvested per year including annual and perennial crops	(Eurostat, 2022)	(United Nations - Statistics division, 2023)	2	-	-	https://www.europarl.europa.eu/RegData/etudes/STUD/2024/747272/IPOL_STU%282024%29747272_EN.pdf?
2	Economy	Agriculture	Meat production	tons/year	Number of tons of carcass weight per year including pig meat, poultry meat, bovine meat, sheep and goat meat	(Eurostat, 2022)	Partners' expertise	2	current livestock density = 0,7 LSU	Directive 2007/43/EC sets a maximum stocking density of 33 kg/m2	https://www.fas.usda.gov/data/european-union-poultry-and-products-annual-3? https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=331576&title=Agri-environmental_indicator_-_livestock_patterns https://ahdb.org.uk/news/how-much-beef-did-the-eu-trade-in-2021?
3	Economy	Agriculture	Proportion of agricultural area under ecological / organic agriculture	%	Proportion of agricultural area under ecological / organic agriculture	(United Nations - Statistics division, 2023)	(United Nations - Statistics division, 2023)	2	Current value is for 10.5% of the European Union's total agricultural land	Target value is to reach 20% of organic agricultural land by 2025	https://www.euractiv.com/section/agriculture-food/news/eu-organic-area-reaches-10-5-of-agricultural-land-but-falls-short-of-2030-target/? https://www.eea.europa.eu/en/analysis/indicators/agricultural-area-used-for-organic?
4	Economy	Economic growth	Gross Value Added per sector:	MEuros/ha/year	Gross value added (GVA) is defined as output (at basic prices) minus intermediate consumption (at purchaser prices)	(Eurostat, 2019)	(United Nations - Statistics division, 2023)	8	As of September 2024, the European Union's GVA was approximately €4.04 trillion	-	https://www.eea.europa.eu/en/analysis/indicators/gross-value-added-of-the
5	Economy	Energy	Energy production	kWh/ha/year	Renewable energy produced per year	(United Nations - Statistics division, 2023)	Partners' expertise	7	see below	see below	https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from?
6	Economy	Energy	Renewable energy share	%	Renewable energy share in the total final energy consumption	(United Nations - Statistics division, 2023)	(United Nations - Statistics division, 2023)	7	24.1%	42.5% share of renewable energy sources in its energy mix by 2030	https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from?
7	Economy	Energy	Energy consumption/use	kWh/ha/year	The average amount of energy consumed per year	(Schokker, 2021)	(Schokker, 2021)	7	131 GJ/ Capita in 2022	Reduce GHG by at least 55% by 2030	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_statistics_-_an_overview
8	Economy	Energy	Fossil fuels saved	PET/ha/year	The average amount of fossil fuels saved	Partners' expertise	Partners' expertise	7	Hard Coal Consumption decreased from 176,019 thousand tonnes in 2019 to 127,998 thousand tonnes in 2023, a 27.3% reduction.	2030 Emission Reduction: reduce GHG by at least 55% by 2030.	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_statistics_-_latest_trends_from_monthly_data
9	Economy	Labour	Creation of jobs	Jobs created/ha/year changed to employment rate in %	Job creation refers to the process of providing new jobs, especially for people who were previously unemployed or inactive.	(Eurofound, 2023)	Partners' expertise	1, 8, 9	In 2023, the EU's employment rate stood at 75.3%	Achieve an employment rate of 78% by 2030	https://op.europa.eu/webpub/empl/lmwd-annual-review-report-2023/?utm_source=chatgpt.com https://www.staffingindustry.com/news/global-daily-news/eu-employment-rate-hits-record-high-in-2023?utm_source=chatgpt.com

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Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
10	Economy	Labour	Unemployment rate by gender	%	The unemployment rate represents unemployed persons as a percentage of the labour force.	(Eurostat, 2023)	(United Nations - Statistics division, 2023)	5, 8	Overall Unemployment Rate: 5.9% in 2024.	Unemployment rate target = 6% by 2025	https://www.destatis.de/Europa/EN/Topic/Population-Labour-Social-Issues/Labour-market/EULabourMarketCrisis.html? https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Gender_statistics
11	Economy	Water use	Water consumption/use	L/ha/year	Indicator of the relative amount of water used per year	(Schokker, 2021)	(Schokker, 2021)	6	On average, 144 water L/day/capita - EU consumption = 44.7 billion m3/year.	By 2030, the EU targets to support the access of 70 million individuals	https://www.eea.europa.eu/signals-archived/signals-2018-content-list/articles/water-use-in-europe-2014?
12	Environment	Air pollution	Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) (population weighted)	PM2.5 and PM10	The mean annual concentration of fine suspended particles of less than 2.5 microns in diameter (PM2.5) aims to measure air quality.	(United Nations, 2023)	(United Nations - statistics division, 2023)	11	Current PM2,5 value 11.8 µg/m³ - PM10 value = 20.6 µg/m³ (in Paris)	PM2,5 conventration < 5 µg/m³ - PM10 concentration < 40 µg/m³.	https://www.eea.europa.eu/publications/europes-air-quality-status-2023? https://www.iqair.com/us/france/ile-de-france/paris?srsltid=AfmBOooNiXai4ceDCb3wVyCHTrBAd9Wztvoly9vm_Ym3skuByBO6sQDb&
13	Environment	Air pollution	Greenhouse gases emissions for different sectors of RethinkAction.	kg CO2-eq/ year	Indicator of potential global warming due to emissions of greenhouse gases to air.	(Schokker, 2021)	(Schokker, 2021)	13	Current CO2 emission = 2.5 billion metric tonnes	Target = <+2°C target by 2050	https://commission.europa.eu/news/climate-report-shows-largest-annual-drop-eu-greenhouse-gas-emissions-decades-2024-11-05_en
14	Environment	Biodiversity	Terrestrial protected land area	% of the total land	Percentage of land surface area that is protected	(Schokker, 2021)	(Schokker, 2021)	15	25% of land is protected in the EU	Target is set to reach 30% by 2030	https://www.unep.org/news-and-stories/press-release/world-met-target-protected-area-coverage-land-quality-must-improve
15	Environment	Climate hazards	Number of days per annum with fire danger	Number of days	The Fire Weather Index (FWI) system provides fire danger information following the European Forest Fire Information System (EFFIS) classification	(European Commission - Copernicus, 2023)	Partners' expertise	13	Current FWI value is highly variable in the EU (between 40-50 in Mediterrenean countries)	FWI target is set below FWI < 70	https://climate-adapt.eea.europa.eu/en/metadata/indicators/fire-weather-index https://iopscience.iop.org/article/10.1088/1748-9326/ad5b09?utm_campaign=Daily+Briefing+17+07+2024&utm_medium=email&utm_term=2024-07-18
16	Environment	Deforestation	Deforestation rate	Ha/year	Reduction in forest cover in ha per year	(Actu-environnement, 2023)	(Schokker, 2021)	15	Current EU deforestation due to imports = 190,000 Ha/Year	Target is set to 0 + EU's Biodiversity Strategy for 2030	https://www.sei.org/features/eu27-countries-in-the-spotlight-for-deforestation-exposure/?
17	Environment	Land use	Agricultural areas	% of the total land	Agricultural areas as a proportion of the total land area	(Schokker, 2021)	(Schokker, 2021)	2	Total Agricultural Land: 157 MHa (38% of the EU's total land area).	No Net Land Take by 2050	https://www.eea.europa.eu/airs/2018/natural-capital/urban-land-expansion?
18	Environment	Land use	Artificial areas	% of the total land	Artificial area as a proportion of total land area	(European Environment Agency, 2019)	(European Environment Agency, 2019)	15	Artificial surfaces=4.2% of the EU total land area in 2018.	No Net Land Take by 2050	https://www.eea.europa.eu/airs/2018/natural-capital/urban-land-expansion?
19	Environment	Land use	Forest and semi-natural areas	% of the total land	Forest areas as a proportion of total land area	(European Environment Agency, 2019)	(European Environment Agency, 2019)	15	Forests cover = 40% of the EU total land area in 2022	Biodiversity Strategy: protect 30% of its land and sea territories by 2030,	https://tradingeconomics.com/european-union/forest-area-percent-of-land-area-wb-data.html

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Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
20	Environment	Land use	Water bodies	% of the total land	Water bodies as a proportion of total land area	(European Environment Agency, 2019)	(European Environment Agency, 2019)	15	EU water bodies = 3.2% of the total land area	Water Framework Directive (WFD): achieve good ecological and chemical status.	https://www.eea.europa.eu/en/topics/in-depth/water
21	Environment	Land use	Wetlands	% of the total land	Wetlands as a proportion of total land area	(European Environment Agency, 2019)	(European Environment Agency, 2019)	15	1.7% of the EU total land area, (73,000 km²). 80% loss in a century	EU Nature Restoration Law: restore > 20% of its land and sea areas by 2030, and all ecosystems by 2050.	https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20180201-1
22	Environment	Soil pollution	Percentage of heavy metal concentration in river and lake water bodies	%	Heavy metal concentration in global river and lake water bodies as a cause of water pollution	(Schokker, 2021)	(Schokker, 2021)	6	Concentrations of lead decreased by 44%, mercury by 53%, and cadmium by 39% between 2005 and 2022.	-	https://eur-lex.europa.eu/EN/legal-content/summary/environmental-quality-standards-applicable-to-surface-water.html?utm_source=chatgpt.com
23	Environment	Soil pollution	Heavy metal content in the soil	mg/ha	Heavy metals are common pollutants in the soil environment, namely arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), lead (Pub), copper (Cu), zinc (Zn), nickel (Ni).	(Haodong Zhao, Y. W, 2022)	(European Environment Agency, 2022)	15	-	Cadmium (Cd): 1–3 mg/kg Lead (Pb): 50–300 mg/kg Zinc (Zn): 150–300 mg/kg	https://www.eea.europa.eu/data-and-maps/data/external/concentrations-of-heavy-metals-in
24	Environment	Soil pollution	Area of contaminated sites	% of the total area	Soils affected by heavy metal content	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	36% of agricultural soil samples exceeded the strictest heavy metal content limits.	no specific target	https://www.eea.europa.eu/data-and-maps/data/external/concentrations-of-heavy-metals-in
25	Environment	Soil quality	Available water capacity in the soil	mm	Soil hydraulic property that governs soil functioning in ecosystems and greatly affects soil management.	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	highly variable depending on soil type	EU targets: improve soil quality and SOC	https://www.nrcs.usda.gov/sites/default/files/2023-05/AvailableWaterStorage_0-150.pdf https://bsssjournals.onlinelibrary.wiley.com/doi/full/10.1111/ejss.12475?
26	Environment	Soil quality	Soil organic carbon (SOC)	C/kg soil or %	SOC is expressed as the concentration of organic carbon in fine soil (fractions <2mm), per mass of soil (expressed as grams C/kg soil, or a percentage)	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	EU SOC stock = 9.3 gigatonnes (Gt). Average SOC decline of 0.75% in 10y.	EU Mission for Soil Health and Food targets an annual SOC increase of 0.1–0.4% by 2030.	https://esdac.jrc.ec.europa.eu/themes/soil-organic-carbon-content
27	Environment	Soil quality	Soil erosion or soil loss	tons/ha/year	The main indicator for soil erosion is the rate of loss of topsoil mass, which is usually expressed in tonnes per hectare per year	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	Average rate of soil erosion is 2.5 t/ha/year.	Sustainable soil erosion rate <= 1.4 t/ha/year, aligning with natural soil formation rates.	https://esdac.jrc.ec.europa.eu/themes/erosion-europe-projections-2050

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Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
28	Environment	Soil quality	Soil sealing	% of the total area	Soil covered by impermeable materials	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	2.7% of the European Union's land area	No Net Land Take by 2050	https://esdac.jrc.ec.europa.eu/themes/erosion-europe-projections-2050
29	Environment	Soil quality	Earthworm abundance	Number of individuals/m²	Total abundance of earthworms to report on the biological/ecological state of the soil	(NOE, 2022)	(European Environment Agency, 2022)	15	highly depends on soil type and agricultural land - 61% of EU soils are unhealthy	The initiative of soil biodiversity atlas has defined 3 values for earthworm abundance: low < 150, medium: 150-250, high > 250 individuals per m3	https://nora.nerc.ac.uk/id/eprint/509711/1/N509711PO.pdf? https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/new-tool-maps-state-soil-health-across-europe-2023-03-13_en?
30	Environment	Soil quality	Area affected by salinization	% of the total area	Salt-affected soils include those affected by salinity, where the electrical conductivity of the soil exceeds 4dSm–1	(FAO, 2015)	(European Environment Agency, 2022)	15	Currently, ~4.3% of EU farmland is salt-affected.	EU Soil Strategy for 2030 aims to ensure all soils are in healthy condition by 2050	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/global-map-of-salt-affected-soils/en/ https://www.aquacombine.eu/?page_id=110 https://esdac.jrc.ec.europa.eu/content/saline-and-sodic-soils-european-union
31	Environment	Soil quality	Topsoil pH	-	Acidic soil, i.e. pH<5.5	(FAO,2015)	(European Environment Agency, 2022)	15	Mean pH values around 5.9 for agricultural lands	The EU Soil Strategy aims that all soils are healthy by 2050	https://environment.ec.europa.eu/topics/soil-and-land/soil-strategy_en? https://onlinelibrary.wiley.com/doi/10.1002/jpln.202100063?
32	Environment	Soil quality	Area affected by acidification	% of the total area	Acidic soil include those affected by acidity, when the pH<5.5	(FAO, 2015)	(European Environment Agency, 2022)	15	pH is between 5-7 (pH is lower in Northern countries of the EU)	Achieving 100% healthy soils by 2050 under the EU Soil Strategy for 2030.	https://esdac.jrc.ec.europa.eu/Library/Data/PH/Documents/pH_Pub.pdf? https://www.sciencedirect.com/science/article/pii/S0883292714001802?via%3Dihub
33	Environment	Soil quality	Nutrient balances (N/P)	kg/ha	Nutrient balances provide information about environmental pressures. A nutrient deficit (negative value) indicates declining soil fertility. A nutrient surplus (positive data) indicates a risk of polluting soil, water and air.	(OECD, 2023)	(European Environment Agency, 2022)	15	The EU's average GNB is approximately 50 kg/Ha/year of unit	The European Green Deal aims to reduce nutrient losses by at least 50% by 2030	https://ec.europa.eu/eurostat/databrowser/view/aei_pr_gnb/default/table?lang=en https://pmc.ncbi.nlm.nih.gov/articles/PMC8386246/?
34	Environment	Soil quality	Area affected by compaction	% of the total area	Soil compaction harms the physical structure of soils and thus affects important ecological and economic soil functions, by reducing pore volume and pore continuity as well as particle surface accessibility	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	61% of soils are in a unhealthy state	The EU Soil Strategy for 2030 sets a vision to ensure that, by 2050, all EU soil ecosystems are healthy and more resilient.	https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/new-tool-maps-state-soil-health-across-europe-2023-03-13_en?
35	Environment	Soil quality	Soil density	g/cm3	Soil density is the relation between the mass and the volume of a dry soil sample	(Rubens Alves de Oliveira et al. 2015)	(European Environment Agency, 2022)	15	EU mean bulk density of 1.26 g/cm³ (1.5 times woodlands)	EU Soil Strategy aims that soil ecosystems are healthy and more resilient by 2050	https://ui.adsabs.harvard.edu/abs/2024AgEE..36408907P/abstract

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Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
36	Environment	Soil quality	Area affected by water logging	% of the total area	Area that is saturated with water	(European Environment Agency, 2022)	(European Environment Agency, 2022)	15	Between 60-80mm	-	https://www.eea.europa.eu/publications/europes-changing-climate-hazards-1/wet-and-dry-1/wet-and-dry-heavy?
37	Environment	Soil quality	Occurrence of landslides	Number of landslides per year	Number of landslides, defined as the movement of a mass of rock, debris, or earth down a slope per year	(USGS, 2023)	(European Environment Agency, 2022)	15	The European Landslide Susceptibility Map version 2 (ELSUS v2) has 5 levels: very low, low, moderate, high, and very high.	-	https://esdac.jrc.ec.europa.eu/themes/landslides? https://esdac.jrc.ec.europa.eu/content/european-landslide-susceptibility-map-elsus-v2?
38	Environment	Temperature	Annual rise in global temperature	°C	Rise in global temperature per year	(Schokker, 2021)	(Schokker, 2021)	13	Annual Increase 0.06°C per decade since 1850	Paris Agreement Goal: limit global T to 2°C above pre-industrial levels	https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202313? https://climate.copernicus.eu/copernicus-2024-first-year-exceed-15degc-above-pre-industrial-level
39	Environment	Water pollution	Biochemical Oxygen Demand	mg/L	Measurement of nontoxic organics in water	(Schokker, 2021)	(Schokker, 2021)	6	EU BOD concentration = 2.9 mg/l	BOD limit to 25 mg/l and to 10 mg/l for plants serving populations exceeding 100,000	https://www.researchgate.net/post/What-are-the-recommended-EU-WHO-values-for-BOD-COD-Tot-N-Tot-P-for-effluent-discharge-into-water-bodies https://www.eea.europa.eu/en/analysis/indicators/oxygen-consuming-substances-in-european-rivers?
40	Environment	Water pollution	Chemical Oxygen Demand	mg/L	Measurement of total toxic and nontoxic organics in water	(Schokker, 2021)	(Schokker, 2021)	6	After treatment, COD = 75–100 mg/l, aligning with European standards.	Achieve a COD concentration of no more than 125 mg/l	https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX%3A52019SC0700&utm_source=chatgpt.com
41	Environment	Water quality	Temperature of the water	°C	Temperature of the water bodies in °C	(Climate Data Store, 2023)	(Climate Data Store, 2023)	6	European average SST for 2019–2023 being about 1.1°C above the 1880–1900 average.	Depends on the type of waterbody	https://climate.copernicus.eu/climate-indicators/sea-surface-temperature?utm_source=chatgpt.com
42	Environment	Water quality	Nitrogen concentrations in water	µg/l	Mass of nitrogen divided by the volume of water.	(Climate Data Store, 2023)	(Climate Data Store, 2023)	6	-	Nitrate Concentration set at 50 mg/L.	https://www.europarl.europa.eu/RegData/etudes/STUD/2022/734713/IPOL_STU%282022%29734713_EN.pdf?utm_source=chatgpt.com
43	Environment	Water quality	Phosphorus concentration in the water	µg/l	Mass of phosphorus divided by the volume of water.	(Climate Data Store, 2023)	(Climate Data Store, 2023)	6	-	Phosphate concentrations < 0.1 mg/L in rivers and < 10 to 60 µg/L in lakes	https://www.eea.europa.eu/en/analysis/indicators/nutrients-in-freshwater-in-europe?
44	Finance	Economy	Economic Losses Due to Hydro-Meteorological Hazards	€	The financial losses incurred due to hydro-meteorological hazards such as floods, storms, and droughts. It is typically expressed as a percentage of national GDP or in monetary units.	https://www.emdat.be/		9	0,3% of GDP worldwide	< 1% of GDP (worldwide target)	https://www.emdat.be/
45	Recovery and Resilience	Environment	Post-Disaster Recovery Time	months	The time taken for a community or country to recover to pre-disaster levels	https://www.undrr.org/		11	12 months	< 6 months (target)	https://www.undrr.org/

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Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
					after a hydro-meteorological event, reflecting the effectiveness of recovery efforts.						
46	Resilience and Emergency Response	Environment	Response Time to Hydro-Meteorological Hazards	Hours/day	Time (in hours/days) between hazard detection and the initiation of response actions.	https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/civil-protection-performance_en?utm_source=chatgpt.com		11	4 hours	3 hours	https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/civil-protection-performance_en?utm_source=chatgpt.com
47	Social	Diet	Meat consumption per capita	Kg/person/year	Number of kilos of meat consumed per person per year	(European Commission, 2021)	(European Commission, 2021)	2	Current meat consumption = 67.9 kg/person/year	various EU laws targeting decline in meat consumption	https://ourworldindata.org/grapher/global-meat-projections-to-2050 https://agriculture.ec.europa.eu/data-and-analysis/markets/overviews/market-observatories/meat_en
48	Social	Diet	Organic food consumption per capita	kg/person/year	Number of kilos of organic food consumed per person per year	Partner's expertise	Partner's expertise	2	Current consumption = 102€/capita	EU Farm to Fork Strategy aims at +25% of organic agricultural lands by 2030	https://www.organicresearchcentre.com/news-events/news/the-eus-organic-area-grew-by-5-in-2022-more-than-10-percent-of-farmland-was-organic/
49	Social	Environment	Population Vulnerability Reduction Index	Percentage	A measure of the effectiveness of strategies designed to reduce the vulnerability of populations to climate-related hazards and natural disasters.	https://www.undrr.org/		9	Variable	>10% reduction (target per year)	https://www.undrr.org/
50	Social	Environment	Percentage of Area Covered by Early Warning Systems	Percentage	The percentage of hazard-prone areas equipped with early warning systems that provide timely alerts to mitigate the impact of natural disasters.	WMO site		13	85%	100% (target in hazard-prone areas)	WMO site
51	Social	Health	Life expectancy at birth	Year	The life expectancy indicator reports the mortality conditions over the given year and helps assessing the level of social and economic development of a region.	(INSEE, 2023)	(United Nations - statistics division, 2023)	3	80.6 years in 2022.	No specific target but related measures to protect health	https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240314-1?utm_source=chatgpt.com
52	Social	Health	Extreme mortality caused by extreme heat	%	Number of people that die from extreme heat	(Schokker, 2021)	(Schokker, 2021)	3	In 2023, over 47,000 people in Europe	Several measure to mitigate climate change to 2°C	https://www.reuters.com/business/environment/more-than-47000-people-died-europe-last-year-due-heat-report-says-2024-08-12/?utm_source=chatgpt.com
53	Social	Migration	Immigrant per year	Number of immigrant per year	Number of immigrant per year (per sex)	(Cambridge dictionnary,2023)	(NEVERMORE, 2023)	5, 10	5.1 million immigrants entered the EU from non-EU countries in 2022	EU Relocation Mechanism	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics https://www.politico.eu/article/eu-migration-deal-asylum-seekers-relocation/?

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Number	Pillar	Category	Indicator	Unit	Description	References definition of the indicator	Origin of the indicator	SDG	Current value at the EU level	Target value	Sources
54	Social	Poverty	Population living below the national poverty line	%	Proportion of population living below the national poverty line, by sex	(United Nations - statistics division, 2023)	(United Nations - statistics division, 2023)	1, 5	17.1% of the EU population in 2022.	Lift at least 15 million people out of poverty by 2030	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Living_conditions_in_Europe_-_poverty_and_social_exclusion
55	Social	Social protection	Population covered by social protection floors/systems	%	Proportion of population covered by social protection floors/systems, by sex	(United Nations - statistics division, 2023)	(United Nations - statistics division, 2023)	1, 5	EU social protection expenditure = 29.9% of GDP in 2021	European Pillar of Social Rights Action Plan, lift 15 million out of poverty	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Social_protection_statistics_-_overview

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