Last updated: February 2018  
  
Goal 13: Take urgent action to combat climate change and its impacts  
  
Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries  
  
Indicator 13.1.3: Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
United Nations Office for Disaster Reduction (UNISDR)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted by UN Member States in March 2015 as a global policy of disaster risk reduction. One of the targets is: “Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020”.  
  
In line with the Sendai Framework for Disaster Risk Reduction 2015-2030, disaster risk reduction strategies and policies should mainstream and integrate disaster risk reduction within and across all sectors, across different timescales and with targets, indicators and time frames. These strategies should be aimed at preventing the creation of disaster risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience.  
  
  
  
The open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction (OIEWG) established by the General Assembly (resolution 69/284) has developed a set of indicators to measure global progress in the implementation of the Sendai Framework, which was endorsed by the UNGA (OIEWG report A/71/644). The relevant SDG indicators reflect the Sendai Framework indicators.  
  
  
  
Rationale:  
  
Increasing the proportion of local governments that adopt and implement local disaster risk reduction strategies, which the Sendai Framework calls for, will contribute to sustainable development and strengthen economic, social, health and environmental resilience. Their economic, environmental and social perspectives would include poverty eradication, urban resilience, and climate change adaptation.  
  
  
  
Comments and limitations:  
  
  
  
The Hyogo Framework for Action Monitor (HFA Monitor) started in 2007 and over time, the number of countries reporting to UNISDR increased from 60 in 2007 to approximately 100 countries in 2015 undertaking voluntary self-assessment of progress in implementing the HFA. During the four reporting cycles the HFA Monitor has generated the world’s largest repository of information on national disaster risk reduction policy inter alia. In 2018 the Sendai Framework Monitor system will launch and all Member States are expected to report data of the previous year(s).   
  
  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
Member States count the number of local governments that adopt and implement local DRR strategies in line with the national strategy and express it as a percentage of the total number of local governments in the country.  
  
  
  
Local governments are determined by the reporting country for this indicator, considering sub-national public administrations with responsibility to develop local disaster risk reduction strategies. It is recommended that countries report on progress made by the lowest level of government accorded the mandate for disaster risk reduction, as the Sendai Framework promotes the adoption and implementation of local disaster risk reduction strategies in every local authority.  
  
  
  
Each Member State will calculate the ratio of the number of local governments with local DRR strategies in line with national strategies and the total number of local governments.  
  
  
  
Global Average will then be calculated as below through arithmetic average of the data from each Member State.  
  
  
  
 Further information of the methodology can be obtained in the Technical Guidance (see reference).  
  
  
  
Disaggregation:  
  
By country  
  
By local government (applying sub-national administrative unit)  
  
  
  
Treatment of missing values:  
  
At country level  
  
If a country does not report (missing Value), it will be considered to be 0 or null as same as the HFA Monitor.  
  
  
  
At regional and global levels  
  
NA  
  
  
  
Regional aggregates:  
  
It could be calculated as an arithmetic average of reports by Member States.  
  
  
  
Sources of discrepancies:  
  
  
  
N/A (There is no global database collecting DRR policy information besides the HFA Monitor and the succeeding Sendai Framework Monitor.)  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction   
  
http://www.preventionweb.net/events/view/55594   
  
(The latest version will be uploaded on this site in early November)  
  
  
  
Quality assurance  
  
Description of practices and guidelines for quality assurance followed at your agency.   
  
  
  
UNISDR Regional Office will have a regular contact with National Sendai Framework Focal Points (data providers).   
  
  
  
  
  
Data Sources  
  
  
  
Description:  
  
Sendai Framework Monitor, reported to UNISDR  
  
  
  
Collection process:  
  
The national Sendai Framework Focal Points will compile all inputs from their line ministries, NSO, and other entities, if appropriate, and report through the Sendai Framework Monitoring System.  
  
  
  
Data Availability  
  
  
  
Description:  
  
UNISDR conducted the Sendai Framework Data Readiness Review which 87 Member States responded between February and April in 2017.   
  
  
  
In Q1 2018 all Member States will be invited to start reporting. Since in the previous monitoring approximately 100 countries reported their National HFA Monitor in each cycle, we expect the similar number of reporting.  
  
   
  
Time series:  
  
from 2015  
  
  
  
Calendar  
  
  
  
Data collection:  
  
2015 -   
  
  
  
Data release:   
  
Every year from Q2 2018   
  
  
  
Data providers  
  
  
  
National Sendai Framework Focal Points usually represent the coordinating lead institution chairing the National DRR platform which is comprised of special purpose agencies including national disaster agencies, civil protection agencies, and meteorological agencies.  
  
  
  
Data compilers  
  
UNISDR  
  
  
  
References  
  
  
  
URL:  
  
  
  
http://www.preventionweb.net/files/50683\_oiewgreportenglish.pdf  
  
http://www.preventionweb.net/english/hyogo/progress/  
  
http://www.preventionweb.net/events/view/55594 <uploaded soon>  
  
  
  
References:  
  
  
  
Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction [A/71/644]  
  
The IAEG-SDGs and the UN Statistical Commission deferred the responsibility for the further refinement and development of the methodology for disaster-related SDGs indicators to the OIEWG and formally adopted the OIEWG Report.  
  
  
  
Hyogo Framework for Action Progress Reports  
  
During the four reporting cycles the HFA Monitor has generated the world’s largest repository of information on national DRR policy inter alia.  
  
  
  
Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction (Draft)  
  
The latest version will be available on-line in early November  
  
  
  
  
  
Related indicators as of February 2020  
  
  
  
1.5; 11.5; 11.b; 13.1; 2.4; 3.6; 3.9; 3.d; 4.a; 6.6; 9.1; 9.a; 11.1; 11.3; 11.c; 13.2; 13.3; 13.a; 13.b; 14.2; 15.1; 15.2; 15.3; 15.9.

Last updated: March 2018  
  
  
  
Goal 13: Take urgent action to combat climate change and its impacts  
  
Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries  
  
Indicator 13.1.1: Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
  
  
United Nations Office for Disaster Reduction (UNISDR)  
  
  
  
Definition and Rationale   
  
Definition:  
  
This indicator measures the number of people who died, went missing or were directly affected by disasters per 100,000 population.   
  
  
  
Concepts:  
  
Death: The number of people who died during the disaster, or directly after, as a direct result of the hazardous event.  
  
Missing: The number of people whose whereabouts is unknown since the hazardous event. It includes people who are presumed dead, for whom there is no physical evidence such as a body, and for which an official/legal report has been filed with competent authorities.  
  
Directly affected: The number of people who have suffered injury, illness or other health effects; who were evacuated, displaced, relocated or have suffered direct damage to their livelihoods, economic, physical, social, cultural and environmental assets. Indirectly affected are people who have suffered consequences, other than or in addition to direct effects, over time, due to disruption or changes in economy, critical infrastructure, basic services, commerce or work, or social, health and psychological consequences.  
  
  
  
Rationale and Interpretation:  
  
The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted by UN Member States in March 2015 as a global policy of disaster risk reduction. Among the global targets, “Target A: Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared with 2005-2015” and “Target B: Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared with 2005-2015” will contribute to sustainable development and strengthen economic, social, health and environmental resilience. The economic, environmental and social perspectives would include poverty eradication, urban resilience, and climate change adaptation.  
  
The open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction (OIEWG) established by the General Assembly (resolution 69/284) has developed a set of indicators to measure global progress in the implementation of the Sendai Framework, which was endorsed by the UNGA (OIEWG report A/71/644). The relevant global indicators for the Sendai Framework will be used to report for this indicator.   
  
Disaster loss data is greatly influenced by large-scale catastrophic events, which represent important outliers. UNISDR recommends countries report the data by event, so that complementary analysis can be undertaken to obtain trends and patterns in which such catastrophic events (that can represent outliers) can be included or excluded.  
  
  
  
  
  
Method of Computation and Other Methodological Considerations  
  
Computation Method:  
  
Related indicators as of February 2020  
  
  
  
  
  
  
  
Where:  
  
A2 Number of deaths attributed to disasters;   
  
A3 Number of missing persons attributed to disasters; and   
  
B1 Number of directly affected people attributed to disasters.   
  
\* Detailed methodologies can be found in the Technical Guidance (see below the Reference section)  
  
  
  
Comments and limitations:  
  
The Sendai Framework Monitoring System has been developed to measure the progress in the implementation of the Sendai Framework by UNGA endorsed indicators. Member States will be able to report through the System from March 2018. The data for SDG indicators will be compiled and reported by UNISDR.  
  
   
  
Proxy, alternative and additional indicators:  
  
In most cases international data sources only record events that surpass some threshold of impact and use secondary data sources which usually have non uniform or even inconsistent methodologies, producing heterogeneous datasets.  
  
  
  
Data Sources and Collection Method  
  
Data sources and collection method:  
  
Data provider at national level is appointed Sendai Framework Focal Points. In most countries disaster data are collected by line ministries and national disaster loss databases are established and managed by special purpose agencies including national disaster management agencies, civil protection agencies, and meteorological agencies. The Sendai Framework Focal Points in each country are responsible of data reporting through the Sendai Framework Monitoring System.  
  
  
  
  
  
Data Disaggregation  
  
Number of deaths attributed to disasters;   
  
Number of missing persons attributed to disasters; and   
  
Number of directly affected people attributed to disasters.   
  
  
  
 [Desirable Disaggregation]:  
  
Hazard  
  
Geography (Administrative Unit)  
  
Sex  
  
Age (3 categories)  
  
Disability  
  
Income  
  
  
  
References  
  
Official SDG Metadata URL: https://unstats.un.org/sdgs/metadata/files/Metadata-01-05-01.pdf <to be updated with new docs>  
  
  
  
Internationally agreed methodology and guideline URL:   
  
Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction (UNISDR 2017)  
  
https://www.preventionweb.net/files/54970\_collectionoftechnicalguidancenoteso.pdf  
  
  
  
Other references:  
  
Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction (OEIWG). Endorsed by UNGA on 2nd February 2017. Available at: https://www.preventionweb.net/publications/view/51748  
  
  
  
  
  
Country examples:  
  
  
  
Contact International Organization for Global Monitoring  
  
United Nations Office for Disaster Risk Reduction (UNISDR)

Last updated: 20 April 2020  
  
Goal: 13 Take urgent action to combat climate change and its impacts  
  
  
  
Target: 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning  
  
  
  
Indicator: 13.3.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
UNESCO Institute for Statistics (UNESCO-UIS)  
  
UNESCO Education Sector, Division for Peace and Sustainable Development, Section of Education for Sustainable Development (UNESCO-ED/PSD/ESD)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
Indicator 4.7.1/12.8.1/13.3.1 measures the extent to which countries mainstream Global Citizenship Education (GCED) and Education for Sustainable Development (ESD) in their education systems. This is an indicator of characteristics of different aspects of education systems: education policies, curricula, teacher training and student assessment as reported by government officials, ideally following consultation with other government ministries, national human rights institutes, the education sector and civil society organizations. It measures what governments intend and not what is implemented in practice in schools and classrooms.   
  
  
  
For each of the four components of the indicator (policies, curricula, teacher education, and student assessment), a number of criteria are measured, which are then combined to give a single score between zero and one for each component. (See methodology section for full details.)  
  
  
  
The indicator and its methodology have been reviewed and endorsed by UNESCO’s Technical Cooperation Group on the Indicators for SDG 4-Education 2030 (TCG), which is responsible for the development and maintenance of the thematic indicator framework for the follow-up and review of SDG 4. The TCG also has an interest in education-related indicators in other SDGs, including global indicators 12.8.1 and 13.3.1. The TCG is composed of 38 regionally representative experts from UNESCO Member States (nominated by the respective geographic groups of UNESCO), as well as international partners, civil society, and the Co-Chair of the Education 2030 Steering Committee. The UNESCO Institute for Statistics acts as the Secretariat.  
  
  
  
Rationale:  
  
In order to achieve SDG targets 4.7, 12.8 and 13.3, it is necessary for governments to ensure that ESD and GCED and their sub-themes are fully integrated in all aspects of their education systems. Students will not achieve the desired learning outcomes if ESD and GCED have not been identified as priorities in education policies or laws, if curricula do not specifically include the themes and sub-themes of ESD and GCED, and if teachers are not trained to teach these topics across the curriculum.   
  
  
  
This indicator aims to give a simple assessment of whether the basic infrastructure exists that would allow countries to deliver quality ESD and GCED to learners, to ensure their populations have adequate information on sustainable development and lifestyles in harmony with nature. Appropriate education policies, curricula, teacher education, and student assessment are key aspects of national commitment and effort to implement GCED and ESD effectively and to provide a conducive learning environment.  
  
  
  
Each component of the indicator is assessed on a scale of zero to one. The closer to one the value, the better mainstreamed are ESD and GCED in that component. By presenting results separately for each component, governments will be able to identify in which areas more efforts may be needed.  
  
  
  
In 1974, UNESCO Member States adopted the Recommendation concerning Education for International Understanding, Co-operation and Peace and Education relating to Human Rights and Fundamental Freedoms, which encapsulates many of the aims of SDG targets 4.7, 12.8 and 13.3. Every four years countries report on the implementation of the Recommendation. This well-established formal mechanism will be the data source for indicator 4.7.1/12.8.1/13.3.1. The seventh quadrennial reporting round is scheduled to take place in 2020.  
  
  
  
Concepts:  
  
Global Citizenship Education (GCED) and Education for Sustainable Development (ESD) nurture respect for all, build a sense of belonging to a common humanity, foster responsibility for a shared planet, and help learners become responsible and active global citizens and proactive contributors to a more peaceful, tolerant, inclusive, secure and sustainable world. They aim to empower learners of all ages to face and resolve local and global challenges and to take informed decisions and actions for environmental integrity, economic viability and a just society for present and future generations, while respecting cultural diversity.  
  
Comments and limitations:  
  
The indicator is based on self-reporting by government officials. However, countries will be asked to provide supporting evidence in the form of documents or links (e.g. education policies or laws, curricula, etc.) to back up their responses. In addition, UNESCO will compare responses with available information from alternative sources and, if appropriate, raise queries with national respondents. At the end of the reporting cycle, country responses and the supporting documents will be made publicly available.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
Information collected with the questionnaire for monitoring the implementation by UNESCO Member States of the 1974 Recommendation concerning Education for International Understanding, Co-operation and Peace and Education relating to Human Rights and Fundamental Freedoms will be used for the construction of the global indicator. For each of the four components of the indicator (policies, curricula, teacher education, and student assessment), a number of criteria are measured, which are then combined to give a single score between zero and one for each component. Only information for primary and secondary education will be used for calculation of indicator 4.7.1/12.8.1/13.3.1.  
  
  
  
Laws and policies  
  
  
  
The following questions are used to calculate the policies component of the indicator:  
  
  
  
A2: Please indicate which GCED and ESD themes are covered in national or sub-national laws, legislation or legal frameworks on education.   
  
There are eight GCED/ESD themes (cultural diversity and tolerance, gender equality, human rights, peace and non-violence, climate change, environmental sustainability, human survival and well-being, and sustainable consumption and production) and two levels of government (national and sub-national) = 16 responses.  
  
Response categories are no = 0, yes = 1, and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank the component score is not calculated.   
  
Note that ‘not applicable’ is used where only one level of government is responsible for education.  
  
  
  
Question score = simple mean of the 0 and 1 scores, excluding not applicables (i.e., if eight of the 16 responses are ‘not applicable’, the sum of the 0 and 1 scores is divided by 8 to get the mean and not by 16).  
  
  
  
A4. Please indicate which GCED and ESD themes are covered in national or sub-national education policies, frameworks or strategic objectives.   
  
There are eight GCED/ESD themes (cultural diversity and tolerance, gender equality, human rights, peace and non-violence, climate change, environmental sustainability, human survival and well-being, and sustainable consumption and production) = 8 responses.   
  
Response categories are no = 0, yes = 1, unknown (treated as zero), and not applicable, which is ignored. Blanks are also treated as zeros.   
  
If more than half of responses excluding not applicables are unknown or blank, the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
A5. Please indicate whether national or sub-national education policies, frameworks or strategic objectives on education provide a mandate to integrate GCED and ESD.   
  
  
  
There are two levels of government (national, sub-national) and five areas of integration (curricula, learning objectives, textbooks, teacher education, and student assessment) = 10 responses.   
  
Response categories are no = 0, yes = 1, unknown (treated as zero), and not applicable, which is ignored. Blanks are also treated as zeros.   
  
If more than half of responses excluding not applicables are unknown or blank, the component score is not calculated.   
  
Note that ‘not applicable’ is used where only one level of government is responsible for education.  
  
  
  
Question score = simple mean of the 0 and 1 scores, excluding not applicables (i.e., if five of the 10 responses are ‘not applicable’, the sum of the 0 and 1 scores is divided by 5 to get the mean and not by 10).  
  
  
  
E1. Based on your responses to questions in the previous section (laws and policies) please indicate to what extent global citizenship education (GCED) and education for sustainable development (ESD) are mainstreamed in education laws and policies in your country.   
  
  
  
There are two levels of government (national, sub-national) = 2 responses.   
  
Response categories are not at all = 0, partially = 1, extensively = 2, unknown (treated as zero), and not applicable, which is ignored. Blanks are also treated as zeros.   
  
If more than half of responses excluding not applicables are unknown or blank, the component score is not calculated.   
  
Note that ‘not applicable’ is used where only one level of government is responsible for education.  
  
  
  
Question score = half the simple mean of the 0, 1 and 2 scores, excluding not applicables (i.e., if one of the two responses is ‘not applicable’, the sum of the 0, 1 and 2 scores is divided by 2 to get half the mean and not by 4). The score is half the mean in order to ensure it lies between 0 and 1 as do the scores for the other three questions in this section.  
  
  
  
Policy component score = simple mean of the scores for questions A2, A4, A5 and E1 (except where the component score should not be calculated because too many responses were unknown or blank).  
  
  
  
Curricula  
  
  
  
The following questions are used to calculate the curricula component of the indicator:  
  
  
  
B2: Please indicate which GCED and ESD themes are taught as part of the curriculum.   
  
  
  
There are eight GCED/ESD themes (cultural diversity and tolerance, gender equality, human rights, peace and non-violence, climate change, environmental sustainability, human survival and well-being, and sustainable consumption and production) = 8responses.  
  
Response categories are no = 0, yes = 1, and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.   
  
Note that responses to ‘other subjects, please specify’ in the question are ignored. If appropriate, during quality assurance answers in this category may be recoded to one of the other 12 subjects.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
B4. Please indicate the approaches used to teach GCED and ESD in primary and secondary education.   
  
  
  
There are four teaching approaches (GCED/ESD as separate subjects, cross-curricular, integrated, whole school) = 4 responses.   
  
Response categories are no = 0, yes = 1, and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
E1. Based on your responses to questions in the previous section (curricula) please indicate to what extent global citizenship education (GCED) and education for sustainable development (ESD) are mainstreamed in curricula in your country.   
  
  
  
There are two levels of government (national, sub-national) = 2 responses.  
  
Response categories are not at all = 0, partially = 1, extensively = 2, unknown (treated as zero), and not applicable, which is ignored. Blanks are also treated as zeros.   
  
If more than half of responses excluding not applicables are unknown or blank, the component score is not calculated.  
  
Note that ‘not applicable’ is used where only one level of government is responsible for education.  
  
  
  
Question score = half the simple mean of the 0, 1 and 2 scores, excluding not applicables (i.e., if one of the two responses is ‘not applicable’, the sum of the 0, 1 and 2 scores is divided by 2 to get half the mean and not by 4). The score is half the mean in order to ensure it lies between 0 and 1, as do the scores for the other three questions in this section.  
  
  
  
Curricula component score = simple mean of the scores for questions B2, B3, B4 and E1 (except where the component score should not be calculated because too many responses were unknown or blank).  
  
  
  
Teacher education  
  
  
  
The following questions are used to calculate the teacher education component of the indicator:  
  
  
  
C2: Please indicate whether teachers, trainers and educators are trained to teach GCED and ESD during initial or pre-service training and/or through continuing professional development.   
  
  
  
There are two types of training (initial/pre-service and continuing professional development) and two types of teachers (of selected subjects in which ESD/GCED are typically taught, and of other subjects) = 4 responses.   
  
Response categories are no = 0, yes = 1, and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
C3. Please indicate on which GCED and ESD themes pre-service or in-service training is available for teachers, trainers and educators.   
  
  
  
There are eight GCED/ESD themes (cultural diversity and tolerance, gender equality, human rights, peace and non-violence, climate change, environmental sustainability, human survival and well-being, and sustainable consumption and production) = 8 responses.  
  
Response categories are no = 0, yes = 1 and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
C4. Please indicate whether teachers, trainers and educators are trained to teach the following dimensions of learning in GCED and ESD.   
  
  
  
There are four learning dimensions (knowledge, skills, values, and attitudes/behaviours) = 4 responses.   
  
Response categories are no = 0, yes = 1, and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
C5. Please indicate whether teachers, trainers and educators are trained to use the following approaches to teach GCED and ESD in primary and secondary education.   
  
  
  
There are four teaching approaches (GCED/ESD as separate subjects, cross-curricular, integrated, whole school) = 4 responses.   
  
Response categories are no = 0, yes = 1 and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
E1. Based on your responses to questions in the previous section (teacher education), please indicate to what extent global citizenship education (GCED) and education for sustainable development (ESD) are mainstreamed in teacher education in your country.   
  
  
  
There are two levels of government (national, sub-national) = 2 responses.   
  
Response categories are not at all = 0, partially = 1, extensively = 2, unknown (treated as zero), and not applicable (which is ignored). Blanks are also treated as zeros.   
  
If more than half of responses excluding not applicables are unknown or blank, the component score is not calculated.  
  
Note that ‘not applicable’ is used where only one level of government is responsible for education.  
  
  
  
Question score = half the simple mean of the 0, 1 and 2 scores, excluding not applicables (i.e., if one of the two responses is ‘not applicable’, the sum of the 0, 1 and 2 scores is divided by 2 to get half the mean and not by 4). The score is half the mean in order to ensure it lies between 0 and 1, as do the scores for the other three questions in this section.  
  
  
  
Teacher education component score = simple mean of the scores for questions C2, C3, C4, C5 and E1 (except where the component score should not be calculated because too many responses were unknown or blank).  
  
  
  
Student assessment  
  
  
  
The following questions are used to calculate the student assessment component of the indicator:  
  
  
  
D2: Please indicate whether the GCED and ESD themes below are generally included in student assessments or examinations.   
  
  
  
There are eight GCED/ESD themes (cultural diversity and tolerance, gender equality, human rights, peace and non-violence, climate change, environmental sustainability, human survival and well-being, and sustainable consumption and production) = 8 responses.   
  
Response categories are no = 0, yes = 1 and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.  
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
D3. Please indicate which of the dimensions of learning in GCED and ESD below are generally included in student assessments or examinations.   
  
  
  
There are four learning dimensions (knowledge, skills, values, and attitudes/behaviours) = 4 responses..  
  
Response categories are no = 0, yes = 1 and unknown, which is treated as zero. Blanks are also treated as zeros.   
  
If more than half of responses are unknown or blank, the component score is not calculated.   
  
  
  
Question score = simple mean of the 0 and 1 scores.  
  
  
  
E1. Based on your responses to questions in the previous section (student assessment), please indicate to what extent global citizenship education (GCED) and education for sustainable development (ESD) are mainstreamed in student assessment in your country.   
  
  
  
There are two levels of government (national, sub-national) = 2 responses.   
  
Response categories are not at all = 0, partially = 1, extensively = 2, unknown (treated as zero), and not applicable, which is ignored. Blanks are also treated as zeros.   
  
If more than half of responses excluding not applicables are unknown or blank, the component score is not calculated.   
  
Note that ‘not applicable’ is used where only one level of government is responsible for education.  
  
  
  
Question score = half the simple mean of the 0, 1 and 2 scores, excluding not applicables (i.e., if one of the two responses is ‘not applicable’, the sum of the 0, 1 and 2 scores is divided by 2 to get half the mean and not by 4). The score is half the mean in order to ensure it lies between 0 and 1, as do the scores for the other three questions in this section.  
  
  
  
Student assessment component score = simple mean of the scores for questions D2, D3 and E1 (except where the component score should not be calculated because too many responses were unknown or blank).  
  
  
  
The component scores all lie between zero and one and are presented as a dashboard of four scores. They are not combined to create a single overall score for the indicator. The higher the score, the more GCED and ESD are mainstreamed in the given component. In this way, users can make a simple assessment in which component area more efforts may be needed.   
  
  
  
Disaggregation:  
  
None.  
  
  
  
Treatment of missing values:  
  
  
  
 At country level  
  
A small number of missing values – unknown responses and/or blanks – are treated as zeros in the calculation of the question scores. Where they represent more than 50% of the responses to a single question, the component score is not calculated. In such cases, the component score will be presented as missing when results are disseminated.  
  
  
  
 At regional and global levels  
  
Regional and global values are not calculated.  
  
  
  
Regional aggregates:  
  
Regional aggregates are not calculated.  
  
  
  
Sources of discrepancies:  
  
There should be no difference as the indicator values are calculated from the responses submitted by countries. If any changes are proposed to responses as a result of quality assurance procedures, these will be communicated to and verified with countries.  
  
  
  
Methods and guidance available to countries for the compilation of the data at the national level:  
  
Countries wishing to calculate this indicator for themselves should follow the steps described in the ‘Computation Method’ section above.  
  
The questionnaire for the monitoring of the implementation of the 1974 Recommendation concerning Education for International Understanding, Co-operation and Peace and Education relating to Human Rights and Fundamental Freedoms is approved by the Member States of the Executive Board of UNESCO. The questionnaire contains guidelines for completion and a glossary of key terms. In addition, UNESCO provides direct support to Member States in completing the questionnaire and responds to queries in a quality and timely manner.   
  
  
  
Quality assurance  
  
UNESCO will review country responses for consistency and credibility and, if necessary, queries will be raised with national respondents. To assist with this, from 2020, countries will be asked to provide, in addition to completed questionnaires, supporting evidence of their responses in the form of documents or links (e.g. to education policies, laws, curricula, etc.). These will be made publicly available along with completed questionnaires after results are published. UNESCO will also take into account alternative sources of information, where available. These may include national responses to similar intergovernmental consultation processes, such as the Council of Europe’s consultations on the Charter on Education for Democratic Citizenship and Human Rights Education, the UN Economic Commission for Europe’s consultations on the Strategy for Education for Sustainable Development, or other information on ESD and GCED in countries’ national education systems.   
  
Any proposed changes to response values in the questionnaire as the result of quality assurance procedures will be communicated to and verified with countries by UNESCO. Final results will be shared with countries before publication (i) by UNESCO with the national data providers and (ii) by the UIS with education statistics and SDG indicator focal points as part of its annual SDG indicator verification exercise.   
  
  
  
Data Sources  
  
  
  
Description:  
  
Responses to the quadrennial reporting by UNESCO Member States on the implementation of the 1974 Recommendation concerning Education for International Understanding, Co-operation and Peace and Education relating to Human Rights and Fundamental Freedoms. The next round of reporting is scheduled to take place in 2020. (See methodology section for details of questions asked.)  
  
  
  
Collection process:  
  
Responses are submitted by national governments, typically by officials in Ministries of Education. Respondents are asked to consult widely across other government ministries, with national human rights institutes, the education sector and civil society organizations in compiling their responses. Respondents are also asked to submit supporting evidence in the form of documents or links (e.g. to education policies or laws, curricula, etc.), which will be made publicly available at the end of the reporting cycle.  
  
  
  
Responses will be reviewed by UNESCO for consistency and credibility and, if necessary, queries will be raised with national respondents. Where feasible, reference will be made to national documents and links supplied by respondents and to available alternative sources of information.   
  
  
  
Any proposed changes in response values in the questionnaire as the result of quality assurance procedures will be communicated and verified with countries by UNESCO. Final results will be shared with countries before publication (i) by UNESCO with the national data providers and (ii) by the UIS with education statistics and SDG indicator focal points as part of its annual SDG indicator verification exercise.  
  
  
  
Data Availability  
  
  
  
Description:  
  
During the last consultation on the implementation of the 1974 Recommendation concerning Education for International Understanding, Co-operation and Peace and Education relating to Human Rights and Fundamental Freedoms carried out in 2016, 83 countries provided reports: Central and Southern Asia (6), Eastern and South-Eastern Asia (8), Europe and Northern America (29), Latin America and the Caribbean (14), Northern Africa and Western Asia (10), Oceania (4), and sub-Saharan Africa (12).  
  
  
  
Time series:  
  
The first data will be available for 2020. It may be possible to produce estimates for some countries for 2016 but this work has not yet been carried out.  
  
  
  
Calendar  
  
Data collection:  
  
 Next round in 2020, followed by 2024.  
  
   
  
Data release:  
  
Q2 of 2021 (from 2020 reporting round).  
  
  
  
Data providers  
  
Requests for reports are submitted to Ministers Responsible for Relations with UNESCO who are typically Education Ministers. Reports are usually completed by government officials in Ministries of Education. Countries are requested to consult widely before submitting their reports. To assist with this, requests for reports are also copied to NGOs in official partnership with UNESCO and to OHCHR. Prior to release of the results, national data providers and national statistical offices are invited to review the results and, if appropriate, raise any concerns.  
  
  
  
Data compilers  
  
UNESCO’s Sections for Education for Sustainable Development and Global Citizenship and Peace Education.  
  
  
  
References  
  
URL: To be provided later when links to the 2020 round of reporting are available.   
  
  
  
References: To be provided later when links to the 2020 round of reporting are available.  
  
  
  
  
  
10

Last updated: 07 July 2017  
  
Goal 13: Take urgent action to combat climate change and its impacts  
  
Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries  
  
Indicator 13.1.2: Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies  
  
  
  
Institutional information  
  
  
  
Organization(s):  
  
  
  
United Nations Office for Disaster Reduction (UNISDR)  
  
  
  
Concepts and definitions  
  
  
  
Definition:  
  
  
  
NA  
  
  
  
[a] An open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction established by the General Assembly (resolution 69/284) is developing a set of indicators to measure global progress in the implementation of the Sendai Framework. These indicators will eventually reflect the agreements on the Sendai Framework indicators.  
  
  
  
Rationale:  
  
  
  
The indicator will build bridge between the SDGs and the Sendai Framework for DRR. Increasing number of national governments that adopt and implement national and local DRR strategies, which the Sendai Framework calls for, will contribute to sustainable development from economic, environmental and social perspectives.  
  
  
  
Comments and limitations:  
  
  
  
The HFA Monitor started in 2007 and over time, the number of countries reporting to UNISDR increased from 60 in 2007 to 140+ countries now undertaking voluntary self-assessment of progress in implementing the HFA. During the four reporting cycles to 2015 the HFA Monitor has generated the world’s largest repository of information on national DRR policy inter alia. Its successor, provisionally named the Sendai Monitor, is under development and will be informed by the recommendations of the OEIWG. A baseline as of 2015 is expected to be created in 2016-2017 that will facilitate reporting on progress in achieving the relevant targets of both the Sendai Framework and the SDGs.  
  
  
  
Members of both the OEIWG and the IAEG-SDGs have addressed that indicators that simply count the number of countries are not recommended, instead that, indicators to measure progress over time have been promoted. Further to the deliberations of the OEIWG as well as the IAEG, UNISDR has proposed computation methodologies that allow the monitoring of improvement in national and local DRR strategies over time. These methodologies range from a simple quantitative assessment of the number of these strategies to a qualitative measure of alignment with the Sendai Framework, as well as population coverage for local strategies.  
  
  
  
Methodology  
  
  
  
Computation Method:  
  
  
  
Note: Computation methodology for several indicators is very comprehensive, very long (about 180 pages) and probably out of the scope of this Metadata. UNISDR prefers to refer to the outcome of the Open Ended Intergovernmental Working Group, which provides a full detailed methodology for each indicator and sub-indicator.  
  
  
  
The latest version of these methodologies can be obtained at:  
  
  
  
http://www.preventionweb.net/documents/oiewg/Technical%20Collection%20of%20Concept%20Notes%20on%20Indicators.pdf  
  
  
  
A short summary:  
  
  
  
Summation of data from National Progress Reports of the Sendai Monitor  
  
  
  
Disaggregation:  
  
  
  
By country  
  
  
  
By city (applying sub-national administrative units)  
  
  
  
Treatment of missing values:  
  
  
  
At country level  
  
  
  
In the Sendai Monitor, which will be undertaken as a voluntary self-assessment like the HFA Monitor, missing values and 0 or null will be considered equivalent.  
  
  
  
At regional and global levels  
  
  
  
NA  
  
  
  
Regional aggregates:  
  
  
  
See under Computation Method.  
  
  
  
It will be calculated, at the discretion of the OEIWG, as either a linear average of the index described in Computation Method, or as a weighted average of the index times the population of the country, divided by global population.  
  
  
  
Sources of discrepancies:  
  
  
  
There is no global database collecting DRR policy information besides the HFA Monitor and the succeeding Sendai Monitor.  
  
  
  
Data Sources  
  
  
  
Description:  
  
  
  
National Progress Report of the Sendai Monitor, reported to UNISDR  
  
  
  
Collection process:  
  
  
  
The official counterpart(s) at the country level will provide National Progress Report of the Sendai Monitor.  
  
  
  
Data Availability  
  
  
  
Description:  
  
  
  
Around 100 countries  
  
  
  
The HFA Monitor started in 2007 and over time, the number of countries reporting to UNISDR increased from 60 in 2007 to 140+ countries now undertaking voluntary self-assessment of progress in implementing the HFA. Given the requirements for disaster risk reduction strategies enshrined in reporting on the SDGs and the targets of the Sendai Framework, it is expected that by 2020, all member states will report their DRR strategies according to the recommendations and guidelines by the OEIWG.  
  
  
  
Time series:  
  
  
  
2013 and 2015: HFA monitor   
  
  
  
Calendar  
  
  
  
Data collection:  
  
  
  
2017-2018   
  
  
  
Data release:  
  
  
  
Initial datasets in 2017, a first fairly complete dataset by 2019  
  
  
  
Data providers  
  
  
  
Name:  
  
  
  
The coordinating lead institution chairing the National DRR platform which is comprised of special purpose agencies including national disaster agencies, civil protection agencies, and meteorological agencies.  
  
  
  
Description:  
  
  
  
The coordinating lead institution chairing the National DRR platform which is comprised of special purpose agencies including national disaster agencies, civil protection agencies, and meteorological agencies.  
  
  
  
Data compilers  
  
  
  
UNISDR  
  
  
  
References  
  
  
  
URL:  
  
  
  
http://www.preventionweb.net/documents/oiewg/Technical%20Collection%20of%20Concept%20Notes%20on%20Indicators.pdf  
  
  
  
References:  
  
  
  
The Open-ended Intergovernmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction (OEIWG) was given the responsibility by the UNGA for the development of a set of indicators to measure global progress in the implementation of the Sendai Framework, against the seven global targets. The work of the OEIWG shall be completed by December 2016 and its report submitted to the General Assembly for consideration. The IAEG-SDGs and the UN Statistical Commission formally recognizes the role of the OEIWG, and has deferred the responsibility for the further refinement and development of the methodology for disaster-related SDGs indicators to this working group.  
  
  
  
http://www.preventionweb.net/drr-framework/open-ended-working-group/  
  
  
  
The latest version of documents are located at:  
  
  
  
http://www.preventionweb.net/drr-framework/open-ended-working-group/sessional-intersessional-documents  
  
  
  
Related indicators as of February 2020  
  
  
  
1.5; 11.5; 11.b; 13.1; 2.4; 3.6; 3.9; 3.d; 4.a; 6.6; 9.1; 9.a; 11.1; 11.3; 11.c; 13.2; 13.3; 13.a; 13.b; 14.2; 15.1; 15.2; 15.3; 15.9.

**Climate change**



**Climate change** occurs when changes in Earth's [climate system](https://en.wikipedia.org/wiki/Climate_system) result in new [weather](https://en.wikipedia.org/wiki/Weather) patterns that remain in place for an extended period of time. This length of time can be as short as a few decades to as long as millions of years. The climate system comprises five interacting parts, the [atmosphere](https://en.wikipedia.org/wiki/Atmosphere) (air), [hydrosphere](https://en.wikipedia.org/wiki/Hydrosphere) (water), [cryosphere](https://en.wikipedia.org/wiki/Cryosphere) (ice and [permafrost),](https://en.wikipedia.org/wiki/Permafrost) [biosphere](https://en.wikipedia.org/wiki/Biosphere) (living things), and [lithosphere](https://en.wikipedia.org/wiki/Lithosphere) (earth's crust and [upper mantle)](https://en.wikipedia.org/wiki/Upper_mantle). The climate system receives nearly all of its energy from the sun, with a relatively tiny amount from earth's interior. The climate system also gives off energy to [outer space.](https://en.wikipedia.org/wiki/Outer_space) The balance of incoming and outgoing energy, and the passage of the energy through the climate system, determines [Earth's energy budget.](https://en.wikipedia.org/wiki/Earth's_energy_budget) When the incoming energy is greater than the outgoing energy, earth's energy budget is positive and the climate system is warming. If more energy goes out, the energy budget is negative and earth experiences cooling.



The energy moving through Earth's climate system finds expression in [weather,](https://en.wikipedia.org/wiki/Weather) varying on geographic scales and time. Long-term averages of weather in a region constitute the region's [climate.](https://en.wikipedia.org/wiki/Climate) Climate change is a long-term, sustained trend of change in climate. Such changes can be the result of "internal variability", when natural processes inherent to the various parts of the [climate system alter Earth's energy budget. Examples include cyclical ocean patterns such as the well-known El Niño–Southern](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) [Oscillation and less familiar](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) [Pacific decadal oscillation](https://en.wikipedia.org/wiki/Pacific_decadal_oscillation) [and](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) [Atlantic multidecadal oscillation.](https://en.wikipedia.org/wiki/Atlantic_multidecadal_oscillation) [Climate change can also result from](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) *external forcing*, when events outside of the climate system's components nonetheless produce changes within the system.Examples include changes in solar output and volcanism.



[Human activities](https://en.wikipedia.org/wiki/Human_impact_on_the_environment) can also change climate, and are presently driving climate change through [global warming.](https://en.wikipedia.org/wiki/Global_warming)[[1]](#page10) There is no general agreement in scientific, media, or policy documents as to the precise term to be used to refer to [anthropogenic](https://en.wikipedia.org/wiki/Human_impact_on_the_environment) forced



change; either "global warming" or "climate change" may be used.[[2]](#page11) The first describes the average effect on a global scale, whilst the second describes how different geographical regions are affected differently.

The field of [climatology](https://en.wikipedia.org/wiki/Climatology) incorporates many disparate [fields of research.](https://en.wikipedia.org/wiki/Natural_science) For ancient periods of climate change, researchers rely on



[evidence preserved in climate proxies, such as ice cores,](https://en.wikipedia.org/wiki/Glaciology)[[3]](#page11) [ancient tree rings, geologic records of changes in sea level, and glacial](https://en.wikipedia.org/wiki/Glaciology) [geology. Physical evidence of current climate change covers many independent lines of evidence, a few of which are temperature](https://en.wikipedia.org/wiki/Temperature_records) [records, the disappearance of ice, and](https://en.wikipedia.org/wiki/Temperature_records) [extreme weather events.](https://en.wikipedia.org/wiki/Extreme_weather_events)



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**Terminology**



The most general definition of climate change is a change in the statistical properties (principally its [mean](https://en.wikipedia.org/wiki/Central_tendency) and [spread)](https://en.wikipedia.org/wiki/Statistical_variability)[[4]](#page11) of the



[climate system](https://en.wikipedia.org/wiki/Climate_system) when considered over long periods of time, regardless of cause.[[5]](#page11) Accordingly, fluctuations over periods shorter than a few decades, such as [El Niño,](https://en.wikipedia.org/wiki/El_Niño) do not represent climate change.



The term "climate change" is often used to refer specifically to anthropogenic climate change (also known as [global warming)](https://en.wikipedia.org/wiki/Global_warming). Anthropogenic climate change is caused by human activity, as opposed to changes in climate that may have resulted as part of Earth's natural processes.[[6]](#page11) In this sense, especially in the context of [environmental policy,](https://en.wikipedia.org/wiki/Environmental_policy) the term climate change has become synonymous with [anthropogenic](https://en.wikipedia.org/wiki/Human_impact_on_the_environment) [global warming.](https://en.wikipedia.org/wiki/Global_warming) Within scientific journals, global warming refers to surface temperature



increases while climate change includes global warming and everything else that increasing [greenhouse gas](https://en.wikipedia.org/wiki/Greenhouse_gas) levels affect.[[7]](#page11)



A related term, "climatic change", was proposed by the [World Meteorological Organization](https://en.wikipedia.org/wiki/World_Meteorological_Organization) (WMO) in 1966 to encompass all forms of climatic variability on time-scales longer than 10 years, but regardless of cause. During the 1970s, the term climate change replaced climatic change to focus on anthropogenic causes, as it became clear that human activities had a potential to drastically alter the climate.[[2]](#page11) Climate change was incorporated in the title of the [Intergovernmental Panel on Climate Change](https://en.wikipedia.org/wiki/Intergovernmental_Panel_on_Climate_Change) (IPCC) and the [UN Framework Convention on Climate Change](https://en.wikipedia.org/wiki/UN_Framework_Convention_on_Climate_Change) (UNFCCC). Climate change is now used as both a technical



description of the process, as well as a noun used to describe the problem.[[2]](#page11)

**Earth's energy budget and climate system**



Prior to the 18th century, scientists had not suspected that prehistoric climates were different from the modern period. By the late [18th century, geologists found evidence of a succession of geological ages with changes in climate. In the years since, a great deal](https://en.wikipedia.org/wiki/History_of_climate_change_science) [of scientific progress has been made understanding the workings of the climate system.](https://en.wikipedia.org/wiki/History_of_climate_change_science)



**Causes**



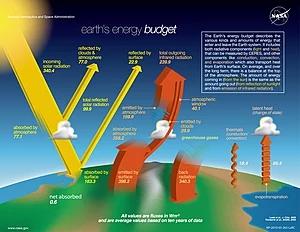
On the broadest scale, the rate at which energy is received from the [Sun](https://en.wikipedia.org/wiki/Sun) and the rate at which it is lost to space determine the equilibrium temperature and climate of Earth. This energy is distributed around the globe by winds, ocean currents,[[9][10]](#page11) and other mechanisms to affect the climates of different regions.[[11]](#page11)



Factors that can shape climate are called [climate forcings](https://en.wikipedia.org/wiki/Climate_forcing) or "forcing mechanisms".[[12]](#page11) These include processes such as variations in [solar radiation,](https://en.wikipedia.org/wiki/Solar_radiation) variations in the Earth's orbit, variations in the [albedo](https://en.wikipedia.org/wiki/Albedo) or reflectivity of the continents, atmosphere, and oceans, [mountain-building](https://en.wikipedia.org/wiki/Orogeny) and [continental drift](https://en.wikipedia.org/wiki/Continental_drift) and changes in [greenhouse gas](https://en.wikipedia.org/wiki/Greenhouse_gas) concentrations. There are a variety of [climate change feedbacks](https://en.wikipedia.org/wiki/Climate_change_feedback) that can either amplify or diminish the initial forcing. Some parts of the climate system, such as the oceans and ice caps, respond more slowly in reaction to climate forcings, while others respond more quickly. There are also key [threshold factors](https://en.wikipedia.org/wiki/Ecological_threshold) which when exceeded can produce rapid change.



Earth's climate is largely determined by the planet's [energy](https://en.wikipedia.org/wiki/Energy) budget, *i.e.*, the balance of incoming and outgoing [radiation.](https://en.wikipedia.org/wiki/Radiation) It is measured by satellites and shown in W/m².[[8]](#page11)



Climate change can either occur due to external forcing or due to internal processes. Internal unforced processes often involve changes in the distribution of energy in the ocean and atmosphere, for instance changes in the [thermohaline circulation.](https://en.wikipedia.org/wiki/Thermohaline_circulation) External forcing mechanisms can be either anthropogenic (e.g. increased emissions of greenhouse gases and dust) or natural (e.g., changes in solar output, the earth's orbit, volcano eruptions).[[13]](#page11)

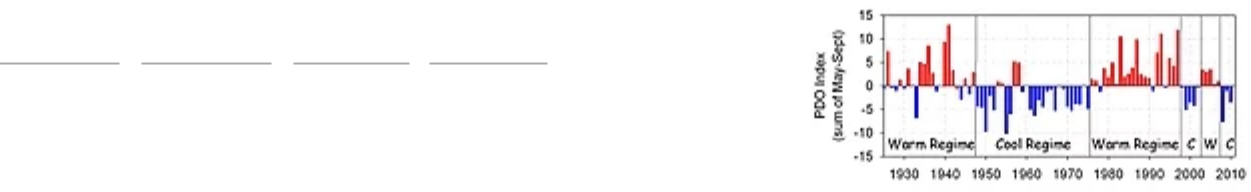


Whether the initial forcing mechanism is internal or external, the response of the climate system might be fast (e.g., a sudden cooling due to airborne [volcanic ash](https://en.wikipedia.org/wiki/Volcanic_ash) reflecting sunlight), slow (e.g. [thermal expansion](https://en.wikipedia.org/wiki/Thermal_expansion) of warming ocean water), or a combination (e.g., sudden loss of [albedo](https://en.wikipedia.org/wiki/Albedo) in the Arctic Ocean as sea ice melts, followed by more gradual thermal expansion of the water). Therefore, the climate system can respond [abruptly,](https://en.wikipedia.org/wiki/Abrupt_climate_change) but the full response to forcing mechanisms might not be fully developed for centuries or even longer.



**Climate variability**

Scientists generally define the five components of earth's climate system to include [atmosphere,](https://en.wikipedia.org/wiki/Earth's_Atmosphere) [hydrosphere,](https://en.wikipedia.org/wiki/Hydrosphere) [cryosphere,](https://en.wikipedia.org/wiki/Cryosphere) [lithosphere](https://en.wikipedia.org/wiki/Lithosphere) (restricted to the



surface soils, rocks, and sediments), and [biosphere.](https://en.wikipedia.org/wiki/Biosphere)[[14]](#page11) Natural changes in the



climate system result in internal "climate variability".[[15]](#page11) Examples include the type and distribution of species, and changes in ocean-atmosphere circulations.

**Ocean-atmosphere variability**

[Pacific decadal oscillation](https://en.wikipedia.org/wiki/Pacific_decadal_oscillation) 1925 to

2010

The ocean and atmosphere can work together to spontaneously generate internal

[climate variability that can persist for years to decades at a time.](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation)[[16][17]](#page11) [Examples of this type of variability include the El Niño–](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) [Southern Oscillation, the](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) [Pacific decadal oscillation,](https://en.wikipedia.org/wiki/Pacific_decadal_oscillation) [and the](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation) [Atlantic Multidecadal Oscillation.](https://en.wikipedia.org/wiki/Atlantic_multidecadal_oscillation) [These variations can affect global](https://en.wikipedia.org/wiki/El_Niño–Southern_Oscillation)



average surface temperature by redistributing heat between the deep ocean and the atmosphere[[18][19]](#page12) and/or by altering the cloud/water vapor/sea ice distribution which can affect the total energy budget of the earth.[[20][21]](#page12)

The oceanic aspects of these circulations can generate variability on centennial timescales due to the ocean having hundreds of times more mass than in the [atmosphere,](https://en.wikipedia.org/wiki/Atmosphere_of_Earth) and thus very high [thermal inertia.](https://en.wikipedia.org/wiki/Volumetric_heat_capacity) For example, alterations to ocean processes such as thermohaline circulation play a key role in redistributing heat in the world's oceans. Due to the long timescales of this circulation,



ocean temperature at depth is still adjusting to effects of the [Little Ice Age](https://en.wikipedia.org/wiki/Little_Ice_Age)[[22]](#page12) which occurred between the 1600 and 1800s.



**Life**

Life affects climate through its role in the [carbon](https://en.wikipedia.org/wiki/Carbon_cycle) and [water cycles](https://en.wikipedia.org/wiki/Water_cycle) and through such mechanisms as [albedo,](https://en.wikipedia.org/wiki/Albedo) [evapotranspiration,](https://en.wikipedia.org/wiki/Evapotranspiration) [cloud formation,](https://en.wikipedia.org/wiki/Cloud) and



[weathering.](https://en.wikipedia.org/wiki/Weathering)[[23][24][25]](#page12) Examples of how life may have affected past climate include:



[glaciation](https://en.wikipedia.org/wiki/Glaciation) 2.3 billion years ago triggered by the evolution of oxygenic [photosynthesis,](https://en.wikipedia.org/wiki/Photosynthesis) which depleted the atmosphere of the greenhouse gas carbon dioxide and introduced free oxygen[[26][27]](#page12)



another glaciation 300 million years ago ushered in by long-term burial of [decomposition-resistant](https://en.wikipedia.org/wiki/Lignin) [detritus](https://en.wikipedia.org/wiki/Detritus) of vascular land-plants (creating a [carbon sink](https://en.wikipedia.org/wiki/Carbon_sink) and [forming coal)](https://en.wikipedia.org/wiki/Coal" \l "Formation)[[28][29]](#page13)



termination of the [Paleocene–Eocene Thermal Maximum](https://en.wikipedia.org/wiki/Paleocene–Eocene_Thermal_Maximum) 55 million years ago by flourishing marine [phytoplankton](https://en.wikipedia.org/wiki/Phytoplankton)[[30][31]](#page13)



[A schematic of modern thermohaline](https://en.wikipedia.org/wiki/Thermohaline_circulation) [circulation. Tens of millions of years](https://en.wikipedia.org/wiki/Thermohaline_circulation) ago, continental-plate movement formed a land-free gap around Antarctica, allowing the formation of the [ACC,](https://en.wikipedia.org/wiki/Antarctic_Circumpolar_Current) which keeps warm waters away from Antarctica.



reversal of global warming 49 million years ago by [800,000 years of arctic azolla blooms](https://en.wikipedia.org/wiki/Azolla_event)[[32][33]](#page13)



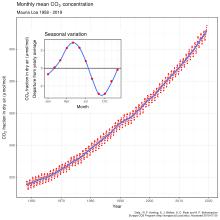
global cooling over the past 40 million years driven by the expansion of grass-grazer [ecosystems](https://en.wikipedia.org/wiki/Ecosystem)[[34][35]](#page13)



**External forcing mechanisms**

**Greenhouse gases**

Whereas greenhouse gases released by the biosphere is often seen as a feedback or internal climate process, greenhouse gases emitted from volcanoes are typically classified as external by climatologists.[[36]](#page13) Greenhouse gases, such as CO2, methane and nitrous oxide, heat the climate system by trapping infrared light.



The [scientific consensus on climate change](https://en.wikipedia.org/wiki/Scientific_consensus_on_climate_change) is "that climate is changing and that these changes are in large part caused by human activities",[[37]](#page13) and it "is largely irreversible".[[38]](#page13)



... there is a strong, credible body of evidence, based on multiple

lines of research, documenting that climate is changing and that Increase in atmospheric CO2 levels these changes are in large part caused by human activities. While

much remains to be learned, the core phenomenon, scientific questions, and hypotheses have been examined thoroughly and have stood firm in the face of serious scientific debate and careful evaluation of alternative explanations.

— [United States National Research Council,](https://en.wikipedia.org/wiki/United_States_National_Research_Council) *Advancing the Science of Climate Change*



Human's main impact is by emitting CO2 from [fossil fuel](https://en.wikipedia.org/wiki/Fossil_fuel) combustion, followed by [aerosols](https://en.wikipedia.org/wiki/Particulate) (particulate matter in the atmosphere), and the CO2 released by [cement](https://en.wikipedia.org/wiki/Cement) manufacture.[[39]](#page13) Other factors, including land use, [ozone depletion,](https://en.wikipedia.org/wiki/Ozone_depletion) animal husbandry [(ruminant](https://en.wikipedia.org/wiki/Ruminant) animals such as [cattle](https://en.wikipedia.org/wiki/Cattle) produce [methane](https://en.wikipedia.org/wiki/Methane)[[40]](#page13)), and [deforestation,](https://en.wikipedia.org/wiki/Deforestation) are also play a role.[[41]](#page13)