2014 EPI – Indicator Metadata

Contents:

Indicator: Child Mortality *(CHMORT)*

Objective / Issue Category: Environmental Health - Heath Impacts

What it Measures: Child Mortality measures the probability of a child dying between his/her first and fifth birthdays.

Rationale for Inclusion: Environmental factors like polluted air and water are major causes of death for children between the ages of one and five. This indicator is a useful proxy for the effects of pollution and poor sanitation on human health. Reducing child mortality is the fourth Millennium Development Goal (MDG-4). MDG-4 also includes infant mortality, whereas our indicator is focused solely on children between the ages of one and five. Neonatal care, infrastructure, hospitals, and health care are more responsible for the deaths of children under the age of one, than the environmental factors responsible for the deaths of children between the ages of one and five. Achieving MDG-4 will require great improvements to environmental performance along with access to improved health care.

INDICATOR CREATION

Unit of Measurement: Probability of dying between ages 1 and 5.

Method / Description: The probability is obtained by using probability data of dying for a child alive at his/her first birthday before reaching his/her fifth birthday. The formula used with UN Population Division's data is: 4q1 = (1-((1-5q0)/(1-1q0))). 1q0 is the infant mortality rate (interpolated 1q0), Medium variant; 5q0 is the under-five mortality (interpolated 5q0), Medium variant; and 4q1 is the child mortality (interpolated 4q1), Medium variant. Data are divided by 1,000 to estimate the probability of a child dying between his/her first and fifth birthdays.

Additional Notes: Taiwan data are provided by Taiwan's Ministry of Environment. Data for Dominica and Palau were imputed based on a regional averages.

Transformation Needed for Aggregation: Logarithmic (alpha value of 0.00048524 added before transformation applied)

Target - High Performance Benchmark (raw data): 0.00075676 (5th percentile)
Low Performance Benchmark (raw data): 0.137
Target Source: Expert opinion. The target represents the 5th percentile of 2000-2013 data, owing to natural background rates of child mortality not necessarily the result of environmental factors. The low performance benchmark represents the maximum value of 2000-2013 EPI data.

DATA SOURCE(S)

Variables / Units: Infant mortality rate (interpolated 1q0) per 1,000 live births - Medium variant; Under-five mortality rate (interpolated 5q0) per 1,000 live births - Medium variant
Method: These data are derived from country statistics, migration reports, and censuses. These sources vary depending on the country. Estimates are made to fill in deficiencies and inconsistencies from official statistics.

Citation: United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision.

Year of Publication: 2013

Covered Time: 1990-2013

URL: http://esa.un.org/wpp/Excel-Data/mortality.htm

Date Data Obtained: October 12, 2013

Data Type: Tabular

Indicator: Air Pollution - Average Exposure to PM2.5 *(PM25)*

Objective / Issue Category: Environmental Health - Air Quality

What it Measures: Average Exposure to $PM_{2.5}$ (fine particulate matter) is a population-weighted measurement of exposure to $PM_{2.5}$ in micrograms per cubic meter ($\mu g/m^3$).

Rationale for Inclusion: Suspended particulates contribute to acute lower respiratory infections and other diseases such as cancer. Fine particulates or PM2.5 (particulates with a diameter of 2.5 microns and smaller) lodge deep in lung tissue and are far more injurious to health than coarser particulates. Average annual concentrations of greater than 10 micrograms per cubic meter are known to be injurious to human health.[1]

INDICATOR CREATION

Unit of Measurement: Population weighted exposure to $PM_{2.5}$ in $\mu g/m^3$.

Method / Description: Global surface $PM_{2.5}$ concentration grids were resampled to match a population grid. Three-year rolling population-weighted average of the $PM_{2.5}$ values were used to calculate indicators for national annual average exposure to $PM_{2.5}$ in micrograms per cubic meter.

Additional Notes:

Transformation Needed for Aggregation: Logarithmic (alpha value of 0.03 applied before transformation)

Target - High Performance Benchmark (raw data): 10 ug/m^3

Low Performance Benchmark (raw data): 49.92 ug/m^3

Target Source: World Health Organization

DATA SOURCE(S)

Variable / Units: Global surface $PM_{2.5}$ concentrations in micro-grams per cubic meter (three-year average)
Method: These data were derived from a model that was parameterized by data on Aerosol Optical Depth (AOD) from NASA's MODIS, SeaWiFS, and MISR satellite instruments, and the GEOS-Chem chemical transport model. The model covered all areas south of 70 degree north Latitude and north of 70 degree south latitude. van Donkelaar et al. estimated annual global surface $PM_{2.5}$ concentrations at a 10 x 10 km spatial resolution, and then created three year moving averages from 2000 to 2012. Population-weighted average exposure values were calculated using population data from the Global Rural Urban Mapping Project (2011) database.
Citation: Aaron van Donkelaar, January 2015 (embargoed). For additional details, see the publications below.

Covered Time: 1998-2012 (central years for three-year rolling averages)

URL: --

Date Data Obtained: September 18, 2013

Related Publications:
[1] van Donkelaar et al. 2010. Global estimates of ambient fine particulate matter concentrations from satellite-based aerosol optical depth: Development and application. Environmental Health Perspectives. 118(6): 847-855.

[2] van Donkelaar et al. 2013. Optimal estimation for global ground-level fine particulate matter concentrations. Journal of Geophysical Research. 118(11): 5621-36.

[3] Boys et al., in prep.

[4] van Donkelaar et al., in prep

Data Type: Tabular

Variable / Units: Population count (in persons)

Method: An algorithm was used with more than 1,000,000 national and sub-national geographic units, to proportionally assign population counts (in persons) to 1 km grid cells for the year 2000.

Citation: Global Rural Urban Mapping Project, v.1 (2011). NASA Socioeconomic Data and Applications Center, hosted by the Center for International Earth Science Information Network (CIESIN).

Covered Time: 2000

URL: http://sedac.ciesin.columbia.edu/data/set/grump-v1-population-count

Date Data Obtained: 2013

Data Type: ESRI GRID

[1] World Health Organization (2006). WHO air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: Global 2005 Update.

Indicator: Air Pollution - PM2.5 Exceedance *(PM25EXBL)*

Objective / Issue Category: Environmental Health - Air Quality

What it Measures: $PM_{2.5}$ Exceedance measures the average percentage of the population exposed to $PM_{2.5}$ levels at 10, 15, 25, and 35 micrograms per cubic meter ($\mu g/m^3$).

Rationale for Inclusion: Suspended particulates contribute to acute lower respiratory infections and other diseases such as cancer. Fine particulates or $PM_{2.5}$ (particulates with a diameter of 2.5 microns and smaller) lodge deep in lung tissue and are far more injurious to health than coarser particulates. Average annual concentrations of greater than 10 micrograms per cubic meter are known to be injurious to human health.[1] The World Health Organization has also set three interim health targets of 15, 25 and 35 ($\mu g/m^3$).

INDICATOR CREATION

Unit of Measurement: Average percentage of the population whose exposure to $PM_{2.5}$ is above interim health targets of 10, 15, 25, and 35 $\mu g/m^3$.

Method / Description: Global surface $PM_{2.5}$ concentration grids were resampled to match a population grid. The proportion of the population per grid cell exposed to each of the four WHO thresholds were then calculated and averaged together using an arithmetic mean.

Additional Notes:

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 0

Low Performance Benchmark (raw data): 0.695 (1st percentile)

Target Source: World Health Organization

DATA SOURCE(S)

Variable / Units: Population weighted exposure to $PM_{2.5}$ in micro-grams per cubic meter
Method: These data were derived from a model that was parameterized by data on Aerosol Optical Depth (AOD) from NASA's MODIS, SeaWiFS, and MISR satellite instruments, and the GEOS-Chem chemical transport model. The model covered all areas south of 70 degree north Latitude and north of 70 degree south latitude. van Donkelaar et al. estimated annual global surface $PM_{2.5}$ concentrations at a 10 x 10 km spatial resolution.
Citation: Aaron van Donkelaar, January 2015 (embargoed). For additional details, see the publications below.

Covered Time: 1998-2012 (central years for three year rolling averages)

URL: --

Date Data Obtained: September 18, 2013

Related Publications:

[1] van Donkelaar et al. (2010). Global estimates of ambient fine particulate matter concentrations from satellite-based aerosol optical depth: Development and application. Environmental Health Perspectives. 118(6): 847-855.

[2] van Donkelaar et al. 2013. Optimal estimation for global ground-level fine particulate matter concentrations. Journal of Geophysical Research. 118(11): 5621-36.

[3] Boys et al., in prep.

[4] van Donkelaar et al., in prep

Data Type: Tabular

Variable / Units: Population count (in persons)

Method: An algorithm was used with more than 1,000,000 national and sub-national geographic units, to proportionally assign population counts (in persons) to 1 km grid cells for the year 2000.

Citation: Global Rural Urban Mapping Project, v.1 (2011). NASA Socioeconomic Data and Applications Center, hosted by the Center for International Earth Science Information Network (CIESIN).

Covered Time: 2000

URL: http://sedac.ciesin.columbia.edu/data/set/grump-v1-population-count

Date Data Obtained: 2013

Data Type: ESRI GRID

[1] World Health Organization (2006). WHO air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: Global 2005 Update.

Indicator: Household Air Quality *(HAP)*

Objective / Issue Category: Environmental Health - Air Quality

What it Measures: Household Air Quality measures the percentage of the population burning solid fuel (biomass such as wood, crop residues, dung, charcoal and coal) for cooking.

Rationale for Inclusion: Cooking with solid fuels (biomass such as wood, crop residues, dung, charcoal and coal) over open fires or in simple stoves exposes household members to daily pollutant concentrations that lie between those of second-hand smoke and active smoking. The 2010 Global Burden of Disease (often referred to as GBD 2010) project found household air pollution to be responsible for around 3.5 million premature deaths worldwide, in addition to leading to other health outcomes such as cataracts and cardiovascular disease.[1] The use of solid fuels in households is associated with increased mortality from pneumonia and other acute lower respiratory diseases among children, as well as increased mortality from chronic obstructive pulmonary disease and lung cancer (where coal is used) among adults. This indicator, which is a proxy measure of household air quality in that it assesses indoor solid fuel use, serves as an input for estimation of health impacts in the GBD 2010. Until 2007, solid fuel use was also a Millennium Development Goal indicator for environmental sustainability.

INDICATOR CREATION

Unit of Measurement: Percentage of population using solid fuel use as the primary cooking fuel.

Method / Description: These data are estimates for primary cooking fuel use only, not secondary cooking fuel. They only present solid cooking fuel use (e.g., biomass and coal) and do not specify other less-than-clean fuels such as kerosene. They do not cover fuel used for space heating, although this is sometimes difficult to separate from cooking in countries such as China.

Additional Notes: Taiwan data are provided by Taiwan's Ministry of Environment.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 0

Low Performance Benchmark (raw data): 100

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Percentage of population using solid fuel use as the primary cooking fuel.
Method: Data from the World Health Organization's Household Energy Database (World Health Organization (2012). WHO Household Energy Database) were used by Bonjour et al. (2013) for estimates of the percentages of households using solid fuels (coal, wood, charcoal, dung, and crop residues), liquid fuels (kerosene), gaseous fuels (liquefied petroleum gas, natural gas, biogas), and electricity. These data were collected from a total of 586 national country-year data points from household surveys in 155 countries. The remaining data are generated from models predicting solid fuel use. The fraction of people exposed to household air pollution was assumed to be the same as the fraction of households using solid fuels. Bonjour et al. (2013) no longer refer to this risk factor as "indoor" since cooking is not always done indoors and pollution exposure never occurs only indoors. People are exposed to the surroundings of the house, not just indoors, and the smoke adds to village, local, regional, and global outdoor air pollution. The problem is dirty consumption, which has negative consequences for human health wherever it is done. Bonjour et al. (2013) now measure total personal exposure when they can or rely on type of fuel as the risk factor, which indicates the total pollution released.

Citation: Bonjour et al. (2013). Solid fuel use for household cooking: Country and regional estimates for 1980-2010. *Environmental Health Perspectives.* 121(7): 784-790.

Year of Publication: 2013

Covered Time: 1990-2010 (in decades)

URL: http://apps.who.int/gho/indicatorregistry/App_Main/view_indicator.aspx?iid=2267
Date Data Obtained: April 17, 2013
Data Type: Tabular

[1] Global Burden of Disease 2010 (2012). The Lancet. Available: http://www.thelancet.com/themed/global-burden-of-disease.

Indicator: Access to Drinking Water *(WATSUP)*

Objective / Issue Category: Environmental Health - Water and Sanitation

What it Measures: Access to Drinking Water measures the proportion of a country's total population with access to an improved drinking water source as a main source of drinking water.

Rationale for Inclusion: Access to Drinking Water is the best currently available proxy for access to clean drinking water. Access to reliable, safe water reduces exposure to pollution, disease, and harmful contaminants, thereby promoting health and wellbeing. For example, diarrhea is the leading cause of death among children, and is directly caused by consumption of contaminated water.

INDICATOR CREATION

Unit of Measurement: Percentage of population with access to improved drinking water source.

Method / Description: The indicator is computed as the number of people using improved sanitation facilities in relation to the total population, expressed as a percentage. An "improved" drinking water source" is defined as a facility or delivery point that protects water from external contamination - particularly fecal contamination. This includes piped water into a dwelling, plot or yard; public tap or standpipe; tubewell or borehole; protected spring; and rainwater collection.

Additional Notes: Some of the countries exceed 100% access to drinking water. These values are set to 100. Countries reported as having 0% coverage are not actually 0 according to our evaluation of the data, so all 0 cells are treated as missing data. Taiwan data are provided by Taiwan's Ministry of Environment. Bermuda's value is from the year 2010, Bermuda Department of Statistics, 2013 Environmental Statistics Compendium. Brunei's value is for the year 2010, "Brunei Darussalam's Long Term Development Plan for Water & Wastewater" by HE Yang, Minister of Development, Brunei at Singapore International Water Week, 2010. Poland's value is from 2011 estimates by the JMP.

Transformation Needed for Aggregation: Inverse, logarithmic (alpha = 1)

Target - High Performance Benchmark (raw data): 100

Low Performance Benchmark (raw data): 36.21 (1st percentile)

Target Source: Expert opinion, Millennium Development Goal-7.C

DATA SOURCE(S)

Variable / Units: Percentage of population with access to improved drinking water source.
Method: Estimates are based on data from nationally representative household surveys and national censuses, which are generally conducted every 3-4 years globally. In the past data were reported by JMP in 5-year intervals. According to the JMP methodology, yearly data are interpolated by using linear regression to compute values for all years.

Citation: WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation

Year of Publication: 2012

Covered Time: 1990-2011 (yearly values)

URL: http://www.wssinfo.org/data-estimates/table/

Date Data Obtained: May 14, 2013

Data Type: Tabular

Indicator: Access to Sanitation *(ACSAT)*

Objective / Issue Category: Environmental Health - Water and Sanitation

What it Measures: Access to Sanitation measures the percentage of the population that has access to an improved source of sanitation.

Rationale for Inclusion: Access to adequate sanitation is vital for maintaining healthy drinking water supplies, minimizing contact with dangerous bacteria and viruses, and minimizing environmental threats associated with improper waste management.

INDICATOR CREATION

Unit of Measurement: Percentage of population with access to improved sanitation.

Method / Description: "Improved" sanitation sources include connection to a public sewer, connection to a septic system, pour-flush latrine, simple pit latrine, or ventilated pit latrine. The system is considered "improved" if it hygienically separates human excreta from human contact and is not public, meaning that it can either be private or shared. "Not improved" are: service or bucket latrines (where excreta are manually removed), public latrines, and latrines with an open pit. The total population of a country may comprise either all usual residents of the country (de jure population) or all persons present in the country (de facto population) at the time of the census.[1] For purposes of international comparisons, the de facto definition is recommended.

Additional Notes: Taiwan data are provided by Taiwan's Ministry of Environment. The most recent year available for Italy's data was from the JMP for 1995. New Zealand's data were also missing, and only available for 1988 from the World Development Index, 1996. Brunei and Bermuda's values were imputed based on a regional GDP model.

Transformation Needed for Aggregation: Inverse logarithmic (alpha = 1)

Target - High Performance Benchmark (raw data): 100

Low Performance Benchmark (raw data): 0

Target Source: Expert opinion, Millennium Development Goals-7.C

DATA SOURCE(S)

Variable / Units: Percentage of population with access to improved sanitation.
Method: The indicator is computed as the number of people using improved sanitation facilities in relation to the total population, expressed as a percentage. Estimates are based on data from nationally representative household surveys and national censuses, which are generally conducted every 3-4 years globally. In the past data were reported by JMP in 5-year intervals, but they are currently reported in 1-year intervals. According to the JMP methodology, yearly data are interpolated by using linear regression to compute values for all years.

Citation: WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation

Year of Publication: 2013

Covered Time: 1990-2011 (yearly values)

URL: http://www.wssinfo.org/data-estimates/table/

Date Data Obtained: June 12, 2013

Data Type: Tabular

[1] United Nations. Multilingual Demographic Dictionary, English Section. Department of Economic and Social Affairs, Population Studies, No. 29 (United Nations publication, Sales No. E.58.XIII.4).

Indicator: Wastewater Treatment *(WASTECXN)*

Objective / Issue Category: Ecosystem Vitality - Water Resources

What it Measures: The percentage of collected wastewater that is treated.

Rationale for Inclusion: Wastewater from industrial or household sources can contain a variety of contaminants that are detrimental to both human and ecosystem health. Wastewater treatment is a measure of what percentage of wastewater is treated before it is released back into ecosystems. The percentage of wastewater treated represents a measure of largely urban waste collection and treatment, since few rural areas are connected to sewage systems.

INDICATOR CREATION

Unit of Measurement: Percentage of wastewater that receives treatment weighted by connection to wastewater treatment rate.

Method / Description: Source data were collated with these other datasets to create a country-year time series. A source-type hierarchy was used to find a value for each data point: 1) Country-level statistical data and reports; 2) OECD values were then used (OECD variable extracted: "Connected to wastewater treatment plant without treatment" and the inverse of the percentage was taken); 3) United Nations Statistics Division's "Population connected to wastewater treatment" variable; 4) secondary treatment levels from the Pinsent-Masons Water Yearbook; 5) FAO-AQUASTAT values ("Total volume of wastewater treated" / "Total volume of wastewater collected"*100) for a given year, country. Due to sparse and inconsistent time-series data, the decadal averages were then taken within the dataset to produce summary values. The final wastewater treatment performance scores were determined by multiplying the wastewater treatment summary values with the sewerage connection values to arrive at an overall total percentage of wastewater treated.

Additional Notes: Datapoints were averaged from the last decade (2000 to 2012). If no data were available in past 10 years, then an average was used from all prior years available. Taiwan data are provided by Taiwan's Ministry of Environment. Data for Antigua and Barbuda, Bahamas, Barbados, Comoros, Grenada, Kiribati, Seychelles, Somalia, and Vanuatu were imputed using a regional GDP model.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 100
Low Performance Benchmark (raw data): 14.09 (5th percentile))

Target Source: Expert opinion

DATA SOURCE(S)

Variables / Units: Treatment rate in percentage; Connection rate in percentage
Method: The performance of wastewater treatment is measured by volume of wastewater treated over time, and performance metrics are established by public or privately owned or operated utilities for a municipal area. Surveys of utilities are often a source of performance data, as well as estimated volumes of water discharged into the environment with or without treatment, and volumes receiving treatment before being reused in the local water supply. The research team collected country-level official statistical records and reports. Where country-level data were not available, city-level data were sought, along with peer-reviewed literature for a given country's performance. If the data source was considered to be reputable, the values were recorded as national percentages for urban or combined urban/rural areas. The definitions on performance vary with the reporting, but we checked to verify the comparability by running correlations against similar datasets on wastewater treatment performance. In parallel, values were extracted for sewerage connection rates using the source data spreadsheet for the Pinsent-Masons Water Yearbook 2012-2013, with supplementary data points supplied by country-level research.
Citation: Malik, O. (2013). Global database of National Wastewater Treatment. New Haven: Yale Center for Environmental Law and Policy.

Year of Publication: 2013

Covered Time: 2012 (averaged from 1995-2012, see methods for notes)
URL: --
Date Data Obtained: 10/20/13
Data Type: Tabular

Indicator: Critical Habitat Protection *(AZE)*

Objective / Issue Category: Ecosystem Vitality - Biodiversity and Habitat

What it Measures: Percentage of sites identified by the Alliance for Zero Extinction (AZE) that have partial or complete protection.

Rationale for Inclusion: The Alliance for Zero Extinction (AZE) has identified more than 500 sites that represent the last refuge of one ore more of the world's most highly threated species. From the perspective of biodiversity conservation, protection of these sites is of the highest priority.

INDICATOR CREATION

Unit of Measurement: Percentage of protected critical habitat sites as designated by the Alliance for Zero Extinction.

Method / Description: The Center for International Earth Science Information Network (CIESIN) developed a time series from 2010 to 2011 of protected area (PA) coverage based on the date of establishment field in the World Conservation Monitoring Centre's (WCMC) World Database on Protected Areas (WDPA). Where boundaries were missing, we drew circles around PA centroids (buffered points) based on the PA area. We exclude proposed sites that are not yet officially designated as well as internationally designated protected areas (e.g., Ramsar and World Heritage sites), except where they are also listed as nationally designated PAs. We removed all overlaps between different PAs by dissolving the boundaries so as to create a PA mask, and then buffered the mask by 1 km. The final step of buffering was performed to take into account spatial mismatches in global scale data sets; we consider any site protected if it falls within 1 km of the boundary of a protected area. We overlaid the PA mask on the AZE site point shape file generated in 2005 and calculated the percentage of AZE sites under protection by the country. We use the 2005 AZE sites on the basis that countries need at least five years to plan for the establishment of a protected area that encompasses the AZE biodiversity hotspot. The 2005 data identify 595 sites and 794 species. Because not all countries have AZE sites we have scores for 91 countries; other countries did not receive a score for AZE.

Additional Notes: The delineation of AZE sites may have uncertainties. Countries with no AZE sites were averaged around for EPI calculations.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 100

Low Performance Benchmark (raw data): 0

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Alliance for Zero Extinction (AZE) sites

Method: AZE site locations are identified through consultation with regional experts, as well as experts in the six AZE taxa (mammals, birds, reptiles, amphibians, conifers, and corals) from around the world. Sites are identified based on three criteria: endangerment (a site must contain an endangered or critically endangered species); irreplaceability (the site is either the sole area for the species or contains an overwhelmingly significant known population); and discreteness (the area must have a definable boundary).

Citation: Alliance for Zero Extinction

Year of Publication: 2005

Covered Time: 2005

URL: http://www.zeroextinction.org/

Date Data Obtained: October 2, 2013

Data Type: GIS point shapefile

Variable / Units: Protected Areas
Method: Information is gathered from several resources to create this interactive database, including species data from the Global Biodiversity Information Facility and protected areas descriptions from Wikipedia. The database also expands on the World Database on Protected Areas from the UNEP-WCMC, which includes key attributes or field information - such as name, designation, area, establishment data, IUCN protected area management category, establishment data - as well as the delineated boundary or location (latitude/longitude) for the site.
Citation: UNEP-WCMC. (2013). The World Database on Protected Areas (WDPA) June Release. Cambridge, UK: UNEP-WCMC.

Year of Publication: 2013

Covered Time: 1990-2012

URL: http://www.protectedplanet.net

Date Data Obtained: June 20, 2013

Data Type: GIS polygon shapefile

Indicator: Terrestrial Protected Areas (National Biome Weights) *(PACOVD)*

Objective / Issue Category: Ecosystem Vitality - Biodiversity and Habitat

What it Measures: The Terrestrial Protected Areas (National Biome Weight) indicator assesses the protection of biomes weighted by the proportion of a country's territory the biome occupies.

Rationale for Inclusion: This indicator measures the degree to which a country achieves the target of protecting 17% of each terrestrial biome within its borders, weighted by the domestic contribution of each terrestrial biome. The Convention on Biological Diversity (CBD) established the 17% target at its 10th Conference of the Parties in Nagoya, Japan.[1] We treat protected status as a necessary but not sufficient condition for an ecological region to be "effectively conserved." How well protected areas are managed, the strength of the legal protections extended to them, and the actual outcomes on the ground, are all vital elements of a comprehensive assessment of effective conservation. Such measures are not available on a widespread basis, though there are efforts underway to fill critical gaps.

INDICATOR CREATION

Unit of Measurement: Percentage of terrestrial biome area that is protected, weighted by domestic biome area.

Method / Description: The Center for International Earth Science Information Network (CIESIN) developed a time series protected area (PA) coverage based on the date of establishment field in the World Conversation Monitoring Centre's World Database on Protected Areas. Where boundaries were missing, we drew circles around PA centroids (buffered points) based on the PA area. We exclude proposed sites that are not yet officially designated as well as internationally designated protected areas (e.g., Ramsar and World Heritage sites) except where they are also listed as nationally designated protected areas. We removed all overlaps between different protected areas by dissolving the boundaries so as to create a PA mask. We overlaid the PA mask on biome data from Olson et al. (2001) and a CIESIN generated country-level administrative boundary file, and we calculated the percentage of each biome under protection by country. All biome protection percentages were capped at 17% so that higher protection in one biome cannot be used to offset lower protection in another. The final indicator is a weighted average of the percentage of land area protected in each biome, with weights derived from the proportion of the national territory falling in each biome.

Additional Notes: The weighted percentage of biomes under protected status, where the weight is determined by the relative size of biomes within a country. Countries are not rewarded for protecting beyond 17% of any given biome (i.e., scores are capped at 17% per biome) so that higher levels of protection of some biomes cannot be used to offset lower levels of protection of other biomes.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 17

Low Performance Benchmark (raw data): 0

Target Source: Convention on Biological Diversity

DATA SOURCE(S)

Variable / Units: Protected Areas

Method: Information is gathered from several resources to create this interactive database, including species data from the Global Biodiversity Information Facility and protected areas descriptions from Wikipedia. The database also expands on the World Database on Protected Areas from the UNEP-WCMC, which includes key attributes or field information - such as name, designation, area, establishment data, IUCN protected area management category, establishment data - as well as the delineated boundary or location (latitude/longitude) for the site.

Citation: UNEP-WCMC (2013), The World Database on Protected Areas (WDPA) June Release. Cambridge, UK: UNEP-WCMC.

Year of Publication: 2013

Covered Time: 1990-2012

URL: http://www.protectedplanet.net

Date Data Obtained: June 20, 2013

Data Type: GIS polygon shapefile

Variable / Units: WWF Ecoregions of the World

Method: The global dataset was built on previous biogeographical studies and synthesized information from regional workshops. The ecoregions fall under two higher-order classifications: biomes and biogeographic realms, which provide a framework for making comparisons among units and identifying representative habitats and species assemblages.

Citation: Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N. D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P., Kassem, K.R. (2001). Terrestrial ecoregions of the world: a new map of life on Earth. Bioscience 51(11):933-938.

Year of Publication: 2001

Covered Time: circa 2000

URL: http://worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

Date Data Obtained: 2003

Data Type: ESRI Shapefile

[1] Convention on Biological Diversity (2010). *Strategic plan for biodiversity 2011–2020 and the Aichi Targets*.

Indicator: Terrestrial Protected Areas (Global Biome Weights) *(PACOVW)*

Objective / Issue Category: Ecosystem Vitality - Biodiversity and Habitat

What it Measures: Terrestrial Protected Areas (Global Biome Weight) reflects the protection of biomes weighted by their globally proportional abundance.

Rationale for Inclusion: This indicator measures the degree to which a country achieves the target of protecting 17% of each terrestrial biome within its borders, weighted by the global contribution of each terrestrial biome. The Convention on Biological Diversity (CBD) established the 17% target at its 10th Conference of the Parties in Nagoya, Japan.[1] We treat protected status as a necessary but not sufficient condition for an ecological region to be "effectively conserved." How well protected areas are managed, the strength of the legal protections extended to them, and the actual outcomes on the ground, are all vital elements of a comprehensive assessment of effective conservation. Such measures are not available on a widespread basis, though there are efforts underway to fill critical gaps.

INDICATOR CREATION

Unit of Measurement: Percentage of terrestrial biome area that is protected, weighted by global biome area.

Method / Description: The Center for International Earth Science Information Network (CIESIN) developed a time series protected area (PA) coverage based on the date of establishment field in the World Conversation Monitoring Centre's World Database on Protected Areas. Where boundaries were missing, we drew circles around PA centroids (buffered points) based on the PA area. We exclude proposed sites that are not yet officially designated as well as internationally designated protected areas (e.g., Ramsar and World Heritage sites) except where they are also listed as nationally designated protected areas. We removed all overlaps between different protected areas by dissolving the boundaries so as to create a PA mask. We overlaid the PA mask on biome data from Olson et al. (2001) and a CIESIN generated country-level administrative boundary file, and we calculated the percentage of each biome under protection by country. All biome protection percentages were capped at 17% so that higher protection in one biome cannot be used to offset lower protection in another. The final indicator is a weighted average of the percentage of land area protected in each biome, with weights derived from the proportion of the world's land surface falling in each biome.

Additional Notes: The weighted percentage of biomes under protected status, where the weight is determined by the relative size of biomes within a country. Countries are not rewarded for protecting beyond 17% of any given biome (i.e., scores are capped at 17% per biome) so that higher levels of protection of some biomes cannot be used to offset lower levels of protection of other biomes.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 17

Low Performance Benchmark (raw data): 0

Target Source: Convention on Biological Diversity

DATA SOURCE(S)

Variable / Units: Protected Areas

Method: Information is gathered from several resources to create this interactive database, including species data from the Global Biodiversity Information Facility and protected areas descriptions from Wikipedia. The database also expands on the World Database on Protected Areas from the UNEP-WCMC, which includes key attributes or field information - such as name, designation, area, establishment data, IUCN protected area management category, establishment data - as well as the delineated boundary or location (latitude/longitude) for the site.

Citation: UNEP-WCMC (2013), The World Database on Protected Areas (WDPA) June Release. Cambridge, UK: UNEP-WCMC.

Year of Publication: 2013

Covered Time: 1990-2012

URL: http://www.protectedplanet.net

Date Data Obtained: June 20, 2013

Data Type: GIS polygon shapefile

Variable / Units: WWF Ecoregions of the World

Method: The global dataset was built on previous biogeographical studies and synthesized information from regional workshops. The ecoregions fall under two higher-order classifications: biomes and biogeographic realms, which provide a framework for making comparisons among units and identifying representative habitats and species assemblages.

Citation: Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N. D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P., Kassem, K.R. (2001). Terrestrial ecoregions of the world: a new map of life on Earth. Bioscience 51(11):933-938.

Year of Publication: 2001

Covered Time: circa 2000

URL: http://worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

Date Data Obtained: 2003

Data Type: ESRI Shapefile

[1] Convention on Biological Diversity (2010). *Strategic plan for biodiversity 2011–2020 and the Aichi Targets*.

Indicator: Marine Protected Areas *(MPAEEZ)*

Objective / Issue Category: Ecosystem Vitality - Biodiversity and Habitat

What it Measures: Marine Protected Areas measures the percentage of country's exclusive economic zone (EEZ) that is under protection.

Rationale for Inclusion: Marine Protected Areas (MPAs) are an essential insurance policy for the future of both marine life and local people. They safeguard the ocean's rich diversity of life and provide safe havens for endangered species, as well as commercial fish populations. Well-designed networks of ecologically representative MPAs can also allow better security against environmental change, such as global warming.

INDICATOR CREATION

Unit of Measurement: The percentage of each country's exclusive economic zone (EEZ, 0-200 nautical miles) that is under protection by a nationally-designated marine protected area (MPA).

Method / Description: CIESIN developed a time series marine protected area (MPA) coverage based on the date of establishment field in the World Conversation Monitoring Centre's World Database on Protected Areas. Where boundaries were missing, we drew circles around PA centroids (buffered points) based on the PA area. We exclude proposed sites that are not yet officially designated as well as internationally designated protected areas (e.g., Ramsar and World Heritage sites) except where they are also listed as nationally designated protected areas. We removed all overlaps between different protected areas by dissolving the boundaries so as to create a MPA mask. We overlaid the MPA mask on the EEZ area from the VLIZ Maritime Boundaries Geodatabase, and we calculated the percentage of the EEZ that is protected. For landlocked countries and countries with very high ratios of land area to coastline (Slovenia, Bosnia, Democratic Republic of the Congo, Iraq, Jordan), we do not include a score for MPAEEZ in the calculation of their Biodiversity & Habitat policy category scores.

Additional Notes:

Transformation Needed for Aggregation: Logarithmic (alpha value of 0.000255309 applied prior to transformation)

Target - High Performance Benchmark (raw data): 10

Low Performance Benchmark (raw data): 0

Target Source: Convention on Biological Diversity

DATA SOURCE(S)

Variable / Units: Protected Areas

Method: Information is gathered from several resources to create this interactive database, including species data from the Global Biodiversity Information Facility and protected areas descriptions from Wikipedia. The database also expands on the World Database on Protected Areas from the UNEP-WCMC, which includes key attributes or field information - such as name, designation, area, establishment data, IUCN protected area management category, establishment data - as well as the delineated boundary or location (latitude/longitude) for the site.

Citation: UNEP-WCMC (2013), The World Database on Protected Areas (WDPA) June Release. Cambridge, UK: UNEP-WCMC.

Year of Publication: 2013

Covered Time: 1990-2012

URL: http://www.protectedplanet.net

Date Data Obtained: June 20, 2013

Data Type: GIS polygon shapefile

Variable / Units: World EEZ Shapefile

Method: Boundaries are calculated from the baseline on offshore using different types of baselines.
Citation: VLIZ Maritime Boundaries Geodatabase VLIZ (2012). Maritime Boundaries Geodatabase, version 6.

Year of Publication: 2012

Covered Time: 2012

URL: http://www.marineregions.org/

Date Data Obtained: November 1, 2013

Data Type: Shapefile

Indicator: Agricultural Subsidies *(AGSUB)*

Objective / Issue Category: Ecosystem Vitality - Agriculture

What it Measures: Agricultural Subsidies is a proxy measure for the degree of environmental pressure exerted by subsidizing agricultural inputs.

Rationale for Inclusion: According to a report by the OECD, public subsidies for agricultural protection and agrochemical inputs exacerbate environmental pressures through the intensification of chemical use, the expansion of farmland into sensitive areas, and the overexploitation of resources like water and soil nutrients.[1]

INDICATOR CREATION

Unit of Measurement: Subsidies are expressed in price of their product in the domestic market (plus any direct output subsidy) less its price at the border, expressed as a percentage of the border price (adjusted for transport costs and quality differences).

Method / Description: This indicator seeks to assess the magnitude of subsidies to assess the degree of environmental pressure they exert. Where available, we used data on the Nominal Rate of Assistance (NRA) from the World Bank's Estimates of Distortions to Agricultural Incentives. The NRA is defined as the price of their product in the domestic market (plus any direct output subsidy) less its price at the border, expressed as a percentage of the border price (adjusting for transport costs and quality differences).[2] The source of these data is a product database from World Bank's research project "Distortions to Agricultural Incentives", led by Kym Anderson. The values for variable “nratott” represent nominal rates of assistance (NRA) in all primary agriculture, total for covered and non-covered products, and non-product-specific assistance (NPSA) value of production-weighted average. If 'nra_tott' was not available, we used one of the following variables: 'nra_totp' (NRA in all primary agriculture, total excluding NPSA), 'nra_totm' (NRA in all primary agriculture, value of production-weighted average, importables), 'nra_totx' (NRA in all primary agriculture, value of production-weighted average, exportables), or 'nra_toth' (NRA in all primary agriculture, value of production-weighted average, nontradables). NRA to covered products can be decomposed into: (a) NRA to output conferred by border market price support, value of production-weighted average of covered products; (b) NRA to output conferred by domestic market price support, value of production-weighted average of covered products; and (c) NRA to inputs, value of production-weighted average of covered products.

Additional Notes: Negative subsidies were set to 0. For missing countries, we did not score countries with negligible agriculture (agriculture GDP <5%), and imputed the value of "0" to lower and middle income countries (GNI per capita <$4,085). For higher income countries (GNI per capita > $12,616 PPP), we imputed a value based on regional GDP model if agricultural GDP is > 5% of a country's total GDP. Taiwan data are provided by Taiwan's Ministry of Environment.

Transformation Needed for Aggregation: Logarithmic (alpha value of 0.0005669 applied prior to transformation)

Target - High Performance Benchmark (raw data): 0

Low Performance Benchmark (raw data): 0.856

Target Source: Expert opinion

DATA SOURCE(S)

Variables / Units: Nominal Rate of Assistance (NRA)
Method: The sum of domestic and border price support provides the total Nominal Rate of Assistance (NRA).
Citation: Kym Anderson and Signe Nelgen, "Updated National and Global Estimates of Distortions to Agricultural Incentives, 1955 to 2011", Washington, D.C., June 2013. (Available at www.worldbank.org/agdistortions website).

Year of Publication: 2013
Covered Time: 1955-2011
URL: www.worldbank.org/agdistortions
Date Data Obtained: September 1, 2013
Data Type: Tabular

[1] Organization for Economic Cooperation and Development Working Group on Environmental Information and Outlook (2004). OECD Workshop on Material Flows and Related Indicators: Chair's Summary. ENV/EPOC/SE(2004)2. Paris, France.
[2] World Development Report 2009: Reshaping Economic Geography. Washington, DC: The World Bank, 2009.

Indicator: Pesticide Regulation *(POPS)*

Objective / Issue Category: Ecosystem Vitality - Agriculture

What it Measures: Pesticide Regulation assesses the status of countries' legislation regarding the use of chemicals listed under the Stockholm Convention on Persistent Organic Pollutants (POPs). Pesticide Regulation also scores the degree to which these countries have followed through on limiting or outlawing these chemicals.

Rationale for Inclusion: Pesticides are a significant source of pollution in the environment, affecting both human and ecosystem health. Pesticides damage ecosystem health by killing beneficial insects, pollinators, and fauna they support. Human exposure to pesticides has been linked to increases in headaches, fatigue, insomnia, dizziness, hand tremors, and other neurological symptoms. The pesticides included in this indicator are persistent organic pollutants (POPs), which are endocrine disruptors, or carcinogens.

INDICATOR CREATION

Unit of Measurement: Pesticide Regulation examines the adoption and legislative status of countries on one landmark agreements on POPs usage, the Stockholm Convention, and also scores the degree to which these countries have followed through on the objectives of the conventions by limiting or outlawing the use of certain toxic chemicals.

Method / Description: The criteria for the adoption status include the year of signature and/or ratification of the Stockholm Convention for each country. By year, countries that have 1) ratified but not signed the Convention are given three points; 2) signed and ratified the Convention are given three points; 3) signed but not ratified the Convention are given one point; or 4) neither signed nor ratified the Convention are given no points. The criteria for the legislation status of each of the "dirty dozen" pesticide banned, restricted and allowed in the country, by year. For each of the following POPs: Aldrin, Chlordane, DDT, Dieldrin, Dioxins & Furans, Endrin, Heptachlor, Hexachlorobenzene, Mirex, PCB, and Toxaphene, we assign two points in the year that were banned, one point when they are restricted and we penalize two points (given zero points) for any POPs allowed (all time series). However, we do not penalize countries that permit the use of DDT (that is, partial banning) for the use of medical or public health services such as the in prevention of malaria. Countries who have signed on or ratified the Stockholm Convention but do not provide a report on chemicals restricted or banned receive 0 points for legislation status.

Additional Notes: Taiwan data was provided by Taiwan's Environmental Protection Agency.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 25
Low Performance Benchmark (raw data): 0
Target Source: Expert opinion

DATA SOURCE(S)

Variables / Units: Stockholm Convention Adoption Status; Persistent Organic Pollutants Legislation Status
Method: Data were collected from national reports to the Stockholm Convention to determine which countries have signed and/or ratified the Convention, and the status of regulation or use (i.e., banned, restricted, or allowed) on each of the "dirty dozen" persistent organic pollutants.
Citation: Johnson, L. 2013. National Status of the Dirty Dozen POPs Regulation through the Stockholm Convention. New Haven: Yale Center for Environmental Law and Policy.
Year of Publication: 2013
Covered Time: 1960-2013
URL: --
Date Data Obtained: November 4, 2013
Data Type: Tabular

Indicator: Change in Forest Cover *(FORCH)*

Objective / Issue Category: Ecosystem Vitality - Forests

What it Measures: Change in Forest Cover measures the percent change in forest cover between 2000 and 2012 in areas with greater than 50 percent tree cover. It factors in areas of deforestation (forest loss), reforestation (forest restoration or replanting) and afforestation (conversion of bare or cultivated land into forest).

Rationale for Inclusion: Reduction in the extent of forest cover has significant negative implications for ecosystem services and habitat protection.

INDICATOR CREATION

Unit of Measurement: The indicator represents the change in forest cover from 2000 to 2012.

Method / Description: We directly used data from Table S2 in the Supplementary Materials of Hansen et al. (2013). Countries with less than 200 sq. km. of >50% tree cover in 2000 were not given a score for this category. These countries include: Burkina Faso, Gambia, Oman, Yemen, Niger, Mauritania, Eritrea, United Arab Emirates, Djibouti, Saudi Arabia, Qatar, Falkland Islands, Kuwait, Iceland, Western Sahara, Mali, Palestine, Lesotho, Namibia, Sudan, Botswana, Jordan, Libya, Senegal, Cape Verde, Turkmenistan, Iraq, Chad, Benin, Egypt, Somalia, Israel, Tajikistan.

Additional Notes: According to Hansen et al. (2013), there are discrepancies between the FAO Forest Resource Assessment country statistics when compared to the satellite-derived estimates. These discrepancies are due to: (i) inconsistent methods between countries; (ii) defining "forest" based on land use instead of land cover, thereby obscuring the biophysical reality of whether tree cover is present; (iii) forest area changes reported only as net values; and (iv) forest definitions used in successive reports have changed over time.

Transformation Needed for Aggregation: Logarithmic (alpha value of 0.1 applied prior to transformation)

Target - High Performance Benchmark (raw data): 0

Low Performance Benchmark (raw data): 7.75 (5th percentile)

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Forest loss (minus) Forest gain in > 50% tree cover, as compared to 2000 levels (unitless).
Method: Hansen et al. (2013) used 650,000 Landsat 7, 30-meter resolution satellite images to quantify the area of forest loss. As defined in Hansen et al. (2013), trees were defined as all vegetation taller than 5m in height. Forest loss was defined as a stand-replacement disturbance or the complete removal of tree cover canopy at the Landsat pixel scale. Results were disaggregated by reference percent tree cover stratum (e.g. >50% crown cover to ~0% crown cover) and by year. Gain was defined as the inverse of loss, or a non-forest to forest change; longer-lived growing stands of tree cover that did not begin as non-forest within the study period were not mapped as forest gain. Gain was related to percent tree crown cover densities >50% and reported as a 12-year total. Net change in forest cover was calculated by subtracting column p (Total gain / year 2000 >50% tree cover) from column n (> 50% tree cover loss / Year 2000 >50% tree cover).

Citation: M. C. Hansen, P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. Science 15 November 2013: 342 (6160), 850-853.

Year of Publication: 2013

Covered Time: 2000-2012

URL: http://www.sciencemag.org/lookup/doi/10.1126/science.1244693

Date Data Obtained: November 15, 2013
Data Type: Tabular/PDF

Indicator: Fish Stocks *(FSOC)*

Objective / Issue Category: Ecosystem Vitality - Fisheries

What it Measures: Fish Stocks measures the percentage of a country's total catch — within its exclusive economic zone — that is comprised of species listed as overexploited or collapsed.

Rationale for Inclusion: Overfishing is harmful to marine life. Overfishing occurs in fisheries that have been exploited at levels that exceed the capacity for replacement by reproduction and growth of the exploited species.[1,2]

INDICATOR CREATION

Unit of Measurement: Fraction of fish stocks overexploited and collapsed by exclusive economic zone (EEZ).

Method / Description: For the 2014 EPI, the Sea Around Us Project removed several EEZs that previously had catch data for the 2012 EPI, but the data were deemed too low of quality and based on low catch data. We penalized countries that do not have adequate catch data as evaluated by Sea Around Us. For 57 countries (including Australia, France, the Netherlands, Russia, South Africa, Saudi Arabia, the United Kingdom, and the United States) with bad (i.e., incomplete or inconsistent reporting, deliberate underreporting, and poor monitoring) data for one or more EEZ, we used the lowest FSOC value for a given year, out of all countries to calculate an EEZ weighted-average national aggregation.

Additional Notes: Based on global catch data, which may not accurately track declines in abundance in certain cases. For example, changes in the price of fish, consumer preferences, or management strategies can all result in catches that decline while biomass does not. Small island states were aggregated to the countries under administration.

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 0

Low Performance Benchmark (raw data): 0.2 (95th percentile)

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Fraction of EEZ with overexploited and collapsed fish stocks.

Method: Species that are being overfished are producing catches that are below the level that could be sustainably derived. As a result of intense exploitation, most fisheries generally follow sequential stages of development: undeveloped, developing, fully exploited, overfished, and collapsed. Grainger and Garcia (1996) conceived the first version of the Stock Status Plots (SSP) by defining development phases of marine fisheries landings as part of a trend analysis of global marine fisheries landings.[3] Their analysis used curves fitted to the time series of landings and classified the slopes of the curves as:

1. flat slope at a minimum: undeveloped;
2. increasing slopes: developing fisheries;
3. flat slope at a maximum: fully exploited;
4. decreasing slopes: senescent fishery (collapsed).

To simplify the approach of Grainger and Garcia (1996), Froese and Kesner-Reyes (2002) used designations for stock status that were based on the level of catch relative to the maximum catch during the time that the stock had been exploited.[4] As this approach did not involve fitting polynomials to the catch time series, many more species could be evaluated. They defined the status of over 900 stocks as undeveloped, developing, fully exploited, overfished, or collapsed. The SSPs presented here and on the Sea Around Us (SAU) website build on the work of Grainger and Garcia (1999) and Froese and Kesner-Reyes (2002), but address several criticisms of the original approaches. First, the original plots did not account for the fact that newly exploited stocks might be considered developing if their landings have not reached a peak by the most recent year of exploitation. Therefore, SAU counts all stocks that have a peak in catch (maximum catch) in the final year of the time series as developing. Secondly, SAU merges the undeveloped and developing categories, as we assume that any fishery undergoing even low exploitation as being developed. Finally, we account for stock recovery, which has occurred in well-managed fisheries, through an additional category called rebuilding.

The SAU SSPs are created in four steps.[5] The first step is the definition of a stock. SAU defines a stock to be a taxon (either at species, genus or family level of taxonomic assignment) that occurs in the catch records for at least 5 consecutive years, over a minimum of a 10 years time span, and which has a total catch in an area of at least 1,000 tonnes over the time span. Secondly, SAU assesses the status of the stock for every year, relative to the peak catch. SAU defines five states of stock status for a catch time series. This definition is assigned to every taxon meeting the definition of a stock for a particular spatial area considered (e.g., EEZ, LME).
1. Developing - before the year of peak catch and less than 50% of the peak catch;
2. Exploited - before or after the year of peak catch and more than 50% of the peak catch;
3. Overexploited - after the year of peak catch and less than 50% but more than 10% of the peak catch;
4. Collapsed - after the year of peak catch and less than 10% of the peak catch;
5. Rebuilding - occurs after the year of peak catch and after the stock has collapsed (after the post-maximum minimum catch, Figure 3), when catch has recovered to between 10% and 50% of the peak.
Thirdly, SAU creates the graph of number of stocks by status by tallying the number of stocks in a particular state in a given year, and presenting these as percentages. Finally, the cumulative catch of stock by status in a given year is summed over all stocks and presented as a percentage in the catch by stock status graph. The combination of these two figures represents the complete Stock Status Plot. The numbers for this indicator are taken from the overexploited and collapsed numbers of stocks over total numbers of stocks per EEZ.

Methods to determine stock status vary for years 2007-2011. These data are based on an ad hoc method to extend the Sea Around Us allocated catches from 1950-2006 through to 2011 using the current FAO data.

Citation: Sea Around Us Project, University of British Columbia Fisheries Centre
Year of Publication: 2013
Covered Time: 1950-2011
URL: http://seaaroundus.org/
Date Data Obtained: September 20, 2011
Data Type: Tabular

[1] Ricker, WE (1975). Computation and interpretation of biological statistics of fish popluations. Bulletin. Fisheries Research Board of Canada. 191:1-382.
[2] Grainger, RJR (1999). Global trends in fisheries and aquaculture. In: Trends and future challenges for U.S. national ocean and coastal policy: proceedings of a workshop organized by the National Ocean Service, NOAA, Center for the Study of Marine Policy at the University of Delaware, The Ocean Governance Group on 22 January 1999 in Washington, D.C.
[3] Grainger, RJR and Garcia, S. (1996). Chronicales of marine fisheries landings (1950-1994): trend analysis and fisheries potential. FAO fish. Tech. Pap. 359, 51 p.

[4] Froese, R, Kesner-Reyes, K. (2002). Impact of fishing on the abundance of marine species. ICES CM 2002/L: 12, 15 p.
[5] Kleisner, K, and Pauly D. (2011). Stock catch status plots of fisheries for regional seas. *In* Christensen, V, Lai, S, Palomares, MLD, Zeller, D, and Paul, D. (Eds). The State of Biodiversity and Fisheries in Regional Seas. Fisheries Centre Research Reports.

Indicator: Coastal Shelf Fishing Pressure *(TCEEZ)*

Objective / Issue Category: Ecosystem Vitality - Fisheries

What it Measures: Coastal Shelf Fishing Pressure assesses the total catch from trawling and dredging equipment divided by the total area of each country's exclusive economic zone.

Rationale for Inclusion: Volume of fish caught is not the only potential risk to fisheries. Ocean ecosystems are significantly affected by the way in which aquatic species are harvested. Bottom or benthic trawling and dredging are used heavily in fisheries and leave widespread, lasting damage. This category reflects overall fishery health by showing whether countries are harvesting fish and invertebrates at unsustainable rates or through practices that significantly harm the coastal shelf ecosystem. This indicator reveals the level of fishing pressure within each coastal country's exclusive economic zone.

INDICATOR CREATION

Unit of Measurement: The percentage of a country's total catch from trawling and dredging gears (mostly bottom trawls) divided by total area of exclusive economic zone (EEZ) area.

Method / Description: We penalized countries that do not have adequate catch data as evaluated by Sea Around Us. For 57 countries (including Australia, France, the Netherlands, Russia, South Africa, Saudi Arabia, the United Kingdom, and the United States) with bad (i.e., incomplete or inconsistent reporting, deliberate underreporting, and poor monitoring) data for one or more EEZ, we used the lowest TCEEZ value for a given year out of all countries to calculate an EEZ weighted-average national aggregation.

Additional Notes: Small island states were aggregated to the countries under administration. Landlocked countries are averaged around for this indicator for the calculation of the EPI.

Transformation Needed for Aggregation: Logarithmic (alpha value of 1.47E-06 applied prior to transformation)

Target - High Performance Benchmark (raw data): 0.0000161

Low Performance Benchmark (raw data): 1.86 (95th percentile)

Target Source: Expert opinion

DATA SOURCE(S)

Variables / Units: Catch from trawling and dredging gears (mostly bottom trawls) (Tonnes), EEZ Area (sq. km)

Method: The Sea Around Us spatial database is based on several major data sources such as the FAO capture fisheries and its regional bodies, the International Council for the Exploration of the Seas (ICES) STATLANT database (www.ices.int/fish/statlant.htm), the Northwest Atlantic Fisheries Organization (NAFO; www.nafo.ca/), as well as data provided from the Canadian, United States, and other governments. The catches in each spatial cell is associate with the appropriate fishing gear code to determine the catch from trawling and dredging gears. This total metric tonnes of catch is divided to the area of EEZ.

Citation: Sea Around Us Project, University of British Columbia Fisheries Centre

Year of Publication: 2011

Covered Time: 1950-2006

URL: http://seaaroundus.org

Date Data Obtained: August 31, 2011

Data Type: Tabular

Indicator: Trend in Carbon Intensity *(CO2GDPd1)*

Objective / Issue Category: Ecosystem Vitality - Climate and Energy

What it Measures: This indicator measures countries' abilities to reduce the intensity of carbon emissions per unit GDP from 2000 to 2010. Countries with a GNI per capita of $12,616 US international dollars or greater receive a greater proportion of their score in the Climate and Energy category based on this indicator.

Rationale for Inclusion: Climate change is among the direst environmental challenges. Still, too little progress has been made to mitigate its effects, aid vulnerable populations to adapt, account for loss and damage already experienced, or to move the policy conversation toward consensus on the problem's scope, origins, or potential solutions. Because of the absence of internationally-agreed upon national targets for CO_2 emission reductions, indicators in the Climate and Energy issue category are not proximity-to-target performance indicators like others in the EPI. Instead, they are relative measures of how well countries are reducing carbon intensity of emissions over roughly the last decade (2000 to 2010) relative to each other. Carbon dioxide emissions contribute to climate change. CO_2 per unit GDP is a common metric employed in countries to assess the intensity in the output of carbon dioxide emissions.

INDICATOR CREATION

Unit of Measurement: Change in CO_2 emissions per unit GDP from 1990 to 2010.

Method / Description: All data were log-transformed. The Trend in Carbon Intensity was calculated by dividing CO_2 emissions from 2000 to 2010 by GDP PPP in constant international dollars for each year. Data was interpolated to fill in gaps and extrapolated when necessary to reach the time series endpoints. A regression was used to calculate the slope (trend) over the 10-year period of 2001-2010.

Additional Notes: The indicator was constructed using the standard 0-100 scale, but was then multiplied by 0.9 to restrict countries from reaching the full score, since all countries contribute to CO_2 emissions.

Transformation Needed for Aggregation: Logarithmic

Target - High Performance Benchmark (raw data): -0.0781

Low Performance Benchmark (raw data): 0.0014

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Carbon dioxide emissions (kg CO_2)

Method: WRI CAIT's database of CO_2 emissions is compiled from several sources: Carbon Dioxide Information Analysis Center (CDIAC), International Energy Agency (IEA), Energy Information Agency (EIA), Food and Agriculture Organization (FAO), and the U.S. Environmental Protection Agency (U.S. EPA). Detailed methods are described at http://cait2.wri.org/docs/CAIT2.0_CountryGHG_Methods.pdf.

Note: Emissions data for 2010 were from IEA and not WRI's CAIT database for 138 countries available. Detailed methods are described at http://wds.iea.org/wds/pdf/CO2_Documentation.pdf.

Citation: World Resources Institute - Climate Analysis Indicators Tool (CAIT), v. 2.0

Year of Publication: 2013

Covered Time: 1990-2010

URL: http://cait2.wri.org/wri

Date Data Obtained: November 4, 2013

Data Type: Tabular

Variable / Units: Gross Domestic Product Purchasing Power Parity (GDP PPP) (current international dollars, in millions US dollars)

Citation: World Bank

Year of Publication: 2012

Covered Time: 1960-2012

URL: http://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD

Date Data Obtained: October 17, 2013

Data Type: Tabular

Variable / Units: Gross Domestic Product Purchasing Power Parity (GDP PPP) (current international dollars, in millions US dollars)
Note: This source was used for the following countries and years: Cambodia (1990-1992), Croatia (1992-1994), Estonia (1993-1994), Haiti (1990), Jamaica (1990-2004), Kuwait (1990-1994), Libya (1990-1998), Maldives (1990-2000), Myanmar (1998-2012), Qatar (1990-1999), Saint Kitts and Nevis (1990-2012), Saint Lucia (1990-2012), Saint Vincent and the Grenadines (1990-2012), Sao Tome and Principe (1990-2000), Taiwan (1990-2012), Zimbabwe (2000-2012).

Citation: International Monetary Fund - World Economic Outlook

Year of Publication: 2013

Covered Time: 1980-2012

URL: http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx

Date Data Obtained: November 6, 2013

Data Type: Tabular

Variable / Units: Gross Domestic Product Purchasing Power Parity (GDP PPP) (current international dollars, in millions US dollars)
Note: This source was used for the following countries and years: Cuba (2012), Cook Islands (2005), Nauru (2005), Niue (2003), North Korea (2011).

Citation: CIA World Factbook

Year of Publication: 2013

Covered Time: 1980-2012

URL: https://www.cia.gov/library/publications/the-world-factbook/

Date Data Obtained: November 6, 2013

Data Type: Tabular

Indicator: Change of Trend in Carbon Intensity *(CO2GDPd2)*

Objective / Issue Category: Ecosystem Vitality - Climate and Energy

What it Measures: This indicator measures countries' abilities to reduce the rate of carbon intensity from 2000-2005 and 2006-2010. Countries with a GNI per capita between $1,036 and $12,615 US international dollars or higher receive a greater proportion of their score in the Climate and Energy category based on this indicator.

Rationale for Inclusion: Climate change is among the direst environmental challenges. Still, too little progress has been made to mitigate its effects, aid vulnerable populations to adapt, account for loss and damage already experienced, or to move the policy conversation toward consensus on the problem's scope, origins, or potential solutions. Because of the absence of internationally-agreed upon targets for CO_2 emission reductions, indicators in the Climate and Energy issue category are not proximity-to-target performance indicators like others in the EPI. Instead, they are relative measures of how well countries are reducing the rate of carbon intensity growth over roughly the last decade (2000 to 2010) relative to each other. Carbon dioxide emissions contribute to climate change. CO_2 per unit GDP is a common metric employed in countries to assess the intensity in the output of carbon dioxide emissions.

INDICATOR CREATION

Unit of Measurement: Change in Trend of CO_2 emissions per unit GDP from 2001 to 2005; 2006 to 2010.

Method / Description: The Change of Trend in Carbon Intensity was calculated by dividing CO_2 emissions from 2000 to 2010 by GDP PPP in constant international dollars for each year. Data was interpolated to fill in gaps and extrapolated when necessary to reach the time series endpoints. A regression was used to calculate two slopes (trends) for 2001-2005 and 2006-2010.

Additional Notes: The indicator was constructed using the standard 0-100 scale, but was then multiplied by 0.9 to restrict countries from reaching the full score, since all countries contribute to CO_2 emissions.

Transformation Needed for Aggregation: Log

Target - High Performance Benchmark (raw data): -0.122

Low Performance Benchmark (raw data): 0.06

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Carbon dioxide emissions (kg CO2)

Method: WRI CAIT's database of CO_2 emissions is compiled from several sources: Carbon Dioxide Information Analysis Center (CDIAC), International Energy Agency (IEA), Energy Information Agency (EIA), Food and Agriculture Organization (FAO), and the U.S. Environmental Protection Agency (U.S. EPA). Detailed methods are described at http://cait2.wri.org/docs/CAIT2.0_CountryGHG_Methods.pdf.
Note: Emissions data for 2010 were from IEA and not WRI's CAIT database for 138 countries available. Detailed methods are described at http://wds.iea.org/wds/pdf/CO2_Documentation.pdf.

Citation: World Resources Institute - Climate Analysis Indicators Tool (CAIT), v. 2.0

Year of Publication: 2013

Covered Time: 1990-2010

URL: http://cait2.wri.org/wri

Date Data Obtained:

Data Type: Tabular

Variable / Units: Gross Domestic Product Purchasing Power Parity (GDP PPP) (current international dollars, in millions US dollars)

Citation: World Bank

Year of Publication: 2012

Covered Time: 1960-2012

URL: http://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD

Date Data Obtained: October 17, 2013

Data Type: Tabular

Variable / Units: Gross Domestic Product Purchasing Power Parity (GDP PPP) (current international dollars, in millions US dollars)

Note: This source was used for the following countries and years: Cambodia (1990-1992), Croatia (1992-1994), Estonia (1993-1994), Haiti (1990), Jamaica (1990-2004), Kuwait (1990-1994), Libya (1990-1998), Maldives (1990-2000), Myanmar (1998-2012), Qatar (1990-1999), Saint Kitts and Nevis (1990-2012), Saint Lucia (1990-2012), Saint Vincent and the Grenadines (1990-2012), Sao Tome and Principe (1990-2000), Taiwan (1990-2012), Zimbabwe (2000-2012).

Citation: International Monetary Fund - World Economic Outlook

Year of Publication: 2013

Covered Time: 1980-2012

URL: http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx

Date Data Obtained: November 6, 2013

Data Type: Tabular

Variable / Units: Gross Domestic Product Purchasing Power Parity (GDP PPP) (current international dollars, in millions US dollars)

Note: This source was used for the following countries and years: Cuba (2012), Cook Islands (2005), Nauru (2005), Niue (2003), North Korea (2011).

Citation: CIA World Factbook

Year of Publication: 2013

Covered Time: 1980-2012

URL: https://www.cia.gov/library/publications/the-world-factbook/

Date Data Obtained: November 6, 2013

Data Type: Tabular

Indicator: Access to Electricity *(ACCESS)*

Objective / Issue Category: Ecosystem Vitality - Climate and Energy

What it Measures: For some countries, such as Least Developing Countries (LDCs), emissions are not as important as transitioning people to more sustainable and accessible forms of energy.

Rationale for Inclusion: In 2012 the UN General Assembly declared that year the International Year of Sustainable Energy for All. Three global objectives, to be achieved by 2030, were established: to ensure universal access to modern energy services (including electricity and clean, modern cooking solutions), to double the global rate of improvement in energy efficiency, and to double to share of renewable energy in the global energy mix. Together, these goals comprise the Sustainable Energy for All initiative, and around 70 countries have formally embraced these goals. As 2012 drew to a close, the UN General Assembly announced a "Decade of Sustainable Energy for All" stretching from 2014 to 2024."

INDICATOR CREATION

Unit of Measurement: Percent of population with access to electricity.

Method / Description: This indicator is not included in the calculation of the EPI. It is only displayed for reference to the calculation of Climate and Energy for LDCs.

Additional Notes:

Transformation Needed for Aggregation: n/a

Target - High Performance Benchmark (raw data): 100

Low Performance Benchmark (raw data): 0

Target Source: UN General Assembly - Sustainable Energy Access for All

DATA SOURCE(S)

Variable / Units: Percent of population with access to electricity.
Method: This initiative uses two datasets: the World Bank's Global Electrification Database and the World Health Organization's (WHO) Global Household energy Database - both of which gathered data from household sources (e.g., surveys and censuses). To provide a more complete dataset, modeling was used to fill in missing data points.

Citation: World Bank, Sustainable Energy for All Initiative
Year of Publication: 2013
Covered Time: 1990-2010

URL: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/05/28/000112742_20130528084417/Rendered/PDF/778890GTF0full0report.pdf

Date Data Obtained: November 10, 2013

Data Type: PDF

Indicator: Trend in CO2 Emissions per kWh *(CO2KWH)*

Objective / Issue Category: Ecosystem Vitality - Climate and Energy

What it Measures: Trend in CO_2 Emissions per kilowatt hour (kWh) of electricity produced, determined for most countries as a trend from 2000 to 2010. For those countries that already perform at the lowest levels of carbon intensity per kWh of electricity produced, a score is calculated as an absolute level of CO_2 emissions per kWh of electricity and heat produced, divided by the total amount of electricity and heat production.

Rationale for Inclusion: Because the power sector is the largest contributor to CO_2 emissions, in most countries responsible for well over half of emissions, the CO_2 per kWh indicator measures the carbon intensity of electricity and heat production in a country.

INDICATOR CREATION

Unit of Measurement: Change in CO_2 emissions from electricity and heat production.

Method / Description: CO_2 emissions per kilowatt hour represents the ratio of CO_2 emissions to the electricity and heat generated by thermal power plants, including conventional electricity plants and combined heat and power, nuclear, hydro (excluding pumped storage production), waste, geothermal, and all other renewables.

Additional Notes: The indicator was constructed using the standard 0-100 scale, but was then multiplied by 0.9 to restrict countries from reaching the full score, since all countries contribute to CO2 emissions. Emissions per kWh should be used with caution due to data quality problems relating to electricity efficiencies for some countries (IEA documentation). This indicator represents a blend of CO2KWH and Trend in CO2KWH depending on performance. Top performers' (Iceland, Albania, Paraguay, Switzerland, Norway, Portugal, Qatar, Moldova, Spain, Armenia) scores are primarily based on CO_2 emissions per kWh, while all others represent a trend in CO_2 emissions per kWh. For countries that do not have CO2KWH data, they did not receive a score for this category.

Transformation Needed for Aggregation: Logarithmic

Target - High Performance Benchmark (raw data): -0.06

Low Performance Benchmark (raw data): 0.068

Target Source: Expert opinion

DATA SOURCE(S)

Variable / Units: Main activity producer electricity and heat (Mt of CO2)

Method: This variable contains the sum of emissions from main activity producer electricity generation, combined heat and power generation and heat plats.

Citation: International Energy Agency (IEA), CO2 Emissions form Fuel Combustion, 2013 Edition.

Year of Publication: 2013

Covered Time: 1960-2011

URL: http://data.iea.org

Date Data Obtained: October 14, 2013

Data Type: Tabular

Variables / Units: Electricity and heat output (TWh)

Method: This variable includes electricity and heat generated in the transformation sector using fossil fuels, nuclear, hydro (excluding pumped storage), geothermal, solar, biofuels, etc.

Citation: International Energy Agency (IEA), CO2 Emissions from Fuel Combustion, 2013 Edition.

Year of Publication: 2013

Covered Time: 1960-2011
URL: http://data.iea.org
Date Data Obtained: October 14, 2013
Data Type: Tabular