Appendix I: Indicator Profiles

The following indicator profiles provide metadata on data sources, methods, transformations, and targets. The profiles are organized alphabetically by indicator code as follows:

Objective	Policy Category	Indicator	Indicator code
Environmental Health	Air pollution (effects on human health)	Indoor air pollution	INDOOR
		Particulate matter	PM25
	Water (effects on human health)	Access to drinking water	WATSUP
		Access to sanitation	ACSAT
	Environmental burden of disease	Child mortality	CHMORT
Ecosystem Vitality	Air pollution (effects on ecosystem)	Sulfur dioxide emissions per capita	SO2CAP
		Sulfur dioxide emissions per GDP	SO2GDP
	Water (effects on ecosystem)	Change in water quantity	WATUSE
	Biodiversity and habitat	Biome protection	PACOV
		Marine protection	MPAEEZ
		Critical habitat protection	AZE
	Forests	Forest loss	FORLOSS
		Forest cover change	FORCOV
		Growing stock change	FORGROW
	Fisheries	Coastal shelf fishing pressure	TCEEZ
		Fish stocks overexploited	FSOC
	Agriculture	Agricultural subsidies	AGSUB
		Pesticide regulation	POPs
	Climate change	CO2 emissions per capita	CO2CAP
		CO2 emissions per GDP	CO2GDP
		CO2 emissions per electricity generation	CO2KWH
		Renewable electricity	RENEW

Indicator: Access to Sanitation

Objective / Policy: **Environmental Health - Water**

Code: *ACSAT*

Description: Access to adequate sanitation measures the percentage of a country's population that has access to an improved source of sanitation. "Improved" sanitation technologies are: connection to a public sewer, connection to septic system, pour-flush latrine, simple pit latrine, ventilated improved pit latrine. The excreta disposal system is considered adequate if it is private or shared (but not public) and if hygienically separates human excreta from human contact. "Not improved" are: service or bucket latrines (where excreta are manually removed), public latrines, 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. For purposes of international comparisons, the de facto definition is recommended. Source: 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).

Rationale: Access to adequate sanitation is not only a public health concern, but also a threat to the environment in countries where human waste is not adequately disposed of or treated.

SOURCE(S)

Variable: Access to sanitation
Citation: WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation
Year of publication: 2011
Covered time: 1990-2005 (5 year values), 2008
URL: http://www.wssinfo.org/data-estimates/table/
Date data obtained: 8/23/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation 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 in some cases are adjusted by the Joint Monitoring Program to improve comparability among data over time.

Additional notes:

0 values are not actually 0 according to our evaluation of the data; so all 0 cells are treated as missing data and displayed with -8888. The countries not included in WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation list are coded with -9999. Taiwan's data are provided from Taiwan's Ministry of Environment. For countries with at least 2 data points, the data were imputed based on linear interpolation (between the first and last data point). All other missing are coded as following: -8888 for countries with published data, and -9999 for countries not included in WHO/UNICEF data. Data for Lithuania and Brunei were imputed based on regional averages. Singapore's data came from the World Bank's World Development Indicators (WDI) database.

Transformation needed for aggregation: Inverse, logarithmic

Target: 100
Low Performance Benchmark: 13
Source: Millennium Development Goals. The low performance benchmark is based on the 5th percentile of the data time series.

Indicator: Agricultural Subsidies

Objective / Policy: Ecosystem Vitality - Agriculture and Land Management

Code: *AGSUB*

Description: This indicator seeks to evaluate the magnitude of subsidies in order to assess the degree of environmental pressure they exert. 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) (WDR 2009).

Rationale: According to a report by the OECD (2004), public subsidies for agricultural protection and agrochemical inputs exacerbate environmental pressures through the intensification of chemical use, the expansion of land into sensitive areas, and overexploitation of resources.

SOURCE(S)

Variable: Nominal Rate of Assistance (NRA)
Citation: Anderson, K. (ed.), Distortions to Agricultural Incentives: A Global Perspective, 1955 to 2007, London: Palgrave Macmillan and Washington DC: World Bank, October 2009.
Year of publication: 2009
Covered time: 1955-2007
URL: www.worldbank.org/agdistortions
Date data obtained: 8/24/2011
Data type: tabular

Variable: Producer Support Estimates(PSE) and Producer Nominal Assistance Coefficient (NAC)
Citation: OECD (2011), Agricultural Policy Monitoring and Evaluation 2011: OECD Countries and Emerging Economies, OECD Publishing. http://dx.doi.org/10.1787/agr_pol-2011-en
Year of publication: 2011
Covered time: 1986-2010
URL: http://stats.oecd.org/Index.aspx?DataSetCode=MON20113_1
Date data obtained: 11/22/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Nominal Rate of Assistance (NRA)

Indicator creation method:
Where available, we used data on the Nominal Rate of Assistance (NRA) from the World Development Report, 2008.

Additional notes:
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. For OECD countries, we converted their Producer Nominal Assistance Coefficient (NAC) values to NRA by subtracting a unit from the NAC values (Anderson, 2008). The Producer Nominal Assistance Coefficient (NAC) is the ratio of gross farm receipts including support, to farm receipts measured at border prices. The NAC for European Union countries was assigned to missing EU27 countries. The negative subsidies were set to 0 because negative NRA values correspond to taxation rather than subsidies. For missing countries, we conducted research to determine evidence of whether a country has subsidies for agriculture. If we found evidence of subsidies, we used a model based on GDP per

capita and the regional average NRA to impute a value. All others were imputed as 0.

Transformation needed for aggregation: logarithmic

Target: 0
Low Performance Benchmark: 1.408903
Source: Expert opinion. The low performance benchmark is based on the 95th percentile of the 2000-2010 data.

Indicator: Critical Habitat Protection

Objective / Policy: **Ecosystem Vitality - Biodiversity and Habitat**

Code: *AZE*

Description: Percentage of the total AZE site area that is within protected areas.

Rationale: The Alliance for Zero Extinction (AZE) has identified 587 sites that each represents the last refuge of one or more of the world's most highly threatened 920 species. From the perspective of biodiversity conservation, protection of these sites is of the highest priority.

SOURCE(S)

Variable: AZE sites
Citation: Alliance for Zero Extinction
Year of publication: 2011
Covered time: 2011
URL: http://www.zeroextinction.org/
Date data obtained: 10/6/2011
Data type: GIS polygon shapefile obtained from the American Bird Conservancy.

Variable: World Database of Protected Areas (WDPA)
Citation: UNEP-World Conservation Monitoring Centre
Year of publication: 2011
Covered time: 1990-2011
URL: http://www.wdpa.org/
Date data obtained: 10/6/2011
Data type: GIS polygon shapefile

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

A time series version of the World Database of Protected Areas (WDPA) from 1990-2011 was obtained from the World Conservaiton Monitoring Centre. For each country, the percentage area of AZE site(s) that fell within protected areas was calculated.

Additional notes:

The delineation of AZE sites may have uncertainties. Countries with no AZE sites were averaged around for EPI calculations, and are coded -7777.

Transformation needed for aggregation: none

Target: 100

Low Performance Benchmark: 0
Source: Expert opinion. The low performance benchmark is the minimum of the 2000-2010 dataset.

Indicator: Child Mortality

Objective / Policy: **Environmental Health - Health**

Code: *CHMORT*

Description: Probability of dying between a child's first and fifth birthdays per 1,000 children aged 1.

Rationale: Because the causes of child mortality among 1–4 year olds are strongly influenced by environmental causes, this indicator is considered to be a useful proxy for underlying environmental conditions. The target was set in such a way as to give the best performing countries a score of 100, since at the higher levels of development the causes of child mortality are least likely to be environmental.

SOURCE(S)

Variable: Probability of dying by age (qx) - Medium variant

Citation: United Nations, Department of Economic and Social Affairs, Population Division: World Population Prospects DEMOBASE, 2010 revision

Year of publication: 2010

Covered time: 1990-2011

URL: http://esa.un.org/unpd/wpp

Date data obtained: 8/1/2011

Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: probability of dying between age 1 and 5

Indicator creation method:

The probablility is obtained by using probability data for a child alive at his/her first birthday of dying before reaching his/her fifth birthday. The formula is used from UN Population Divisions data: 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:

Transformation needed for aggregation: logarithmic

Target: 0.0007

Low performance benchmark: 0.113

Source: Expert opinion. The target represents the 5th percentile of 2000-2010 data, owing to natural background rates of child mortality not necessarily the result of environmental factors.The low performance benchmark respresents the maximum value of 2000-2010 EPI data;

Indicator: CO2 Emissions Per Capita

Objective / Policy: **Ecosystem Vitality - Climate Change**

Code: *CO2CAP*

Description: The ratio has been calculated using the Sectoral Approach CO2 emissions and population data from the IEA.

Rationale: Carbon dioxide emissions contribute to climate change. We use three denominators - population, GDP, and electricity generation - in order to assess the relative carbon efficiency of economies in these three aspects.

SOURCE(S)

Variable: Carbon Dioxide Emissions
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1960-2009
URL: http://data.iea.org
Date data obtained: 10/27/2011
Data type: tabular

Variable: Population
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1960-2009
URL: http://data.iea.org
Date data obtained: 10/27/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: kg CO2 per person

Indicator creation method:

The sectoral Approach contains total CO2 emissions from fuel combustion as calculated using the IPCC Tier 1 Sectoral Approach and corresponds to IPCC Source/Sink Category 1 A. Emissions calculated using a Sectoral Approach include emissions only when the fuel is actually combusted.

Additional notes:

According to IEA documentation, "The main source of the 1970 to 2007 population data for the OECD member countries is National Accounts of OECD Countries, Volume 1, OECD, Paris, 2009. Data for 1960 to 1969 have been estimated using the growth rates from the population series published in the OECD Economic Outlook No. 76. For the Czech Republic, Hungary and Poland (1960 to 1969) and Mexico (1960 to 1962), the data are estimated using the growth rates from the population series from the World Bank published in the World Development Indicators CD-ROM. For the Slovak Republic, population data for 1960 to 1989 are from the Demographic Research Centre, Infostat, Slovak Republic. The main source of the population data for the OECD non-member countries is World Development Indicators, World Bank, Washington D.C., 2009. Population data for Chinese Taipei, Gibraltar, Iraq and a few countries within the regions Other Africa, Other Latin America and Other Asia are based on the CHELEM-CEPII online database, 2009. Due to lack of complete time series, figures for population of Other Latin America do not include British Virgin Islands, Cayman Islands, Falkland Islands, Martinique, Montserrat, Saint Pierre and Miquelon, and Turks and Caicos Islands; and figures for population and GDP of Other Asia do not include Cook Islands". For countries with at least 2 data points, the data were imputed based on linear interpolation (between the first and last data point) and constant values outside this time frame. All other missing are coded as following: -8888 for countries with data from the source, and -9999 for countries not included in source country list.

Transformation needed for aggregation: logarithmic

Target: 1,262
Low Performance Benchmark: 19588.3305865
Source: The IPCC indicates that emissions would need to be cut by one-half of year 2000 levels by 2050; target per capita emissions are based on half of 2000 emissions divided by the projected 2050 population. The low performance benchmark is based on the 95th percentile of the distribution of the data over the time series from 2000-2010.

Indicator: CO2 Emissions Per GDP

Objective / Policy: Ecosystem Vitality - Climate Change

Code: *CO2GDP*

Description: This ratio has been calculated using the Sectoral Approach CO2 emissions and the GDP using purchasing power parities data from the IEA.

Rationale: Carbon dioxide emissions contribute to climate change. CO2 per unit GDP is a common metric employed in countries to assess the intensity in the output of carbon dioxide emissions. The IPCC indicates that emissions need to be cut by 50 percent from 2000 levels by 2050 to contain global temperature rise within 2 degrees Celsius.

SOURCE(S)

Variable: Carbon Dioxide Emissions
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1960-2009
URL: http://data.iea.org
Date data obtained: 10/27/2011
Data type: tabular

Variable: GDP PPP (2000 US dollars)
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1960-2009
URL: http://data.iea.org
Date data obtained: 10/31/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: kg CO2 per US dollar GDP PPP (in year 2000 constant US dollars)

Indicator creation method:

Sectoral Approach contains total CO2 emissions from fuel combustion as calculated using the IPCC Tier 1 Sectoral Approach and corresponds to IPCC Source/Sink Category 1 A. Emissions calculated using a Sectoral Approach include emissions only when the fuel is actually combusted.

Additional notes:

As per IEA documentation, "The main source of the 1970 to 2007 GDP series for the OECD member countries is National Accounts of OECD Countries, Volume 1, 2009. GDP data for 1960 to 1969 have been estimated using the growth rates from the series in the OECD Economic Outlook No 76 and data previously published by the OECD Secretariat. Data prior to 1990 for the Czech Republic and Poland, prior to 1991 for Hungary, and prior to 1992 for the Slovak Republic are IEA Secretariat estimates based on GDP growth rates from the World Bank. The main source of the GDP series for the non-OECD member countries is World Development Indicators, World Bank, Washington D.C., 2009. GDP figures for Bosnia and Herzegovina, Brunei Darussalam, Chinese Taipei, Cuba, Gibraltar, Iraq, Democratic People's Republic of Korea, Libyan Arab Jamahiriya, Myanmar, Namibia (1971-1979), Netherlands Antilles (available from 1980), Qatar, Turkmenistan, Former Soviet Union (before 1990), Former Yugoslavia (before 1990) and a few countries within the regions Other Africa, Other Latin America and Other Asia are from the CHELEM-CEPII online databases 2008, 2009. GDP figures for Albania (1971-1979), Angola (1971-1984), Bahrain (1971-1979, 2006-2007), Bulgaria (1971-1979), Ethiopia (1971-1980), Jordan (1971-1974), Kuwait (1990-1991, 2006-2007), Lebanon (1971- 1987), Malta (2007), Mozambique (1971-1979), Oman (2006-2007), Romania (1971-1979), Serbia (1990-1998), United Republic of Tanzania (1971-1987), the United Arab Emirates (1971-1972 and 2006-2007), Vietnam (1971-1983), Yemen (1971-1989) and Zimbabwe (2006-2007) have been estimated based on the growth rates of the CHELEM-CEPII online database, 2009. The GDP data have been compiled for individual countries at market prices in local currency and annual rates. These data have been scaled up/down to the price levels of 2000 and then converted to US dollars using purchasing power parities (PPPs). Purchasing power parities are the rates of currency conversion that equalise the purchasing power of different currencies. A given

sum of money, when converted into different currencies at the PPP rates, buys the same basket of goods and services in all countries. In other words, PPPs are the rates of currency conversion which eliminate the differences in price levels between different countries. Due to lack of complete time series, figures for GDP of Other Latin America do not include British Virgin Islands, Cayman Islands,Falkland Islands, Martinique, Montserrat, Saint Pierre and Miquelon, and Turks and Caicos Islands; and figures for population and GDP of Other Asia do not include Cook Islands. Data for GDP for Serbia include Montenegro until 2004.". For countries with at least 2 data points, the data were imputed based on linear interpolation (between the first and last data point) and constant values outside this time frame.All other missing are coded as following: -8888 for countries with data from the source, and -9999 for countries not included in source country list.

Transformation needed for aggregation: logarithmic

Target: 0.07842

Low performance benchmark: 1.5328231159

Source: The IPCC indicates that emissions would need to be cut by one-half of year 2000 levels by 2050; target per GDP emissions are based on half of 2000 emissions divided by the projected 2050 GDP. The low performance benchmark is based on the 95th percentile of the distribution of the data over the time series.

Indicator: CO2 Emissions Per kWh

Objective / Policy: Ecosystem Vitality - Climate Change

Code: *CO2KWH*

Description: Carbon dioxide emissions per kilowatt hour represents the ratio of CO2 emissions to the electricity generated by thermal power plants separated into electricity plants and CHP plants, as well as production by nuclear and hydro (excluding pumped storage production), geothermal, etc. (IEA documentation).

Rationale: Carbon dioxide emissions contribute to climate change. We use three denominators - population, GDP, and electricity generation - in order to assess the relative carbon efficiency of economies in these three aspects.

SOURCE(S)

Variable: Carbon Dioxide Emissions from electricity and heat
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1960-2009
URL: http://data.iea.org
Date data obtained: 11/1/2011
Data type: tabular

Variable: Total electricity output
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1960-2009
URL: http://data.iea.org
Date data obtained: 11/1/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: grammes of CO2 per kWh

Indicator creation method:
According to IEA documentation, the indicator has been calculated using CO2 emissions from electricity and heat ("Main Activity Producer" and "Autoproducer"). The CO2 emissions include emissions from fossil fuels, industrial waste and non-renewable municipal waste that are consumed for electricity and heat generation in the transformation sector and the output includes electricity and heat generated from fossil fuels, nuclear, hydro (excluding pumped storage), geothermal, solar, biomass, etc. In the ratios of CO2 emissions per kWh by fuel, coal includes primary and secondary coal, peat and manufactured gases (excluding gas works gas);oil includes petroleum products (and small amounts of crude oil for some countries) and gas includes natural gas and gas works gas.

Additional notes:
Emissions per kWh should be used with caution due to data quality problems relating to electricity efficiencies for some countries (IEA documentation). For countries with at least 2 data points, the data were imputed based on linear interpolation (between the first and last data point) and constant values outside this time frame. All other missing are coded as following: -8888 for countries with data from the source, and -9999 for countries not included in source country list.

Transformation needed for aggregation: logarithmic

Target: 0
Low performance benchmark: 845.32897222
Source: Expert opinion. The target represents the ideal state of non CO2 emissions from electricity and heat. The low performance benchmark was based on the 95th percentile of the 2000-2010 data..

Indicator: Change in Forest Cover

Objective / Policy: **Ecosystem Vitality – Forest**

Code: *FORCOV*

Description: The 2012 EPI measures the change in area between time periods (2005 to 2010 for the most recent time period), and considers the target to be no change. Thus, countries that are actively afforesting are not explicitly rewarded, but countries that are losing forest cover are penalized.

Rationale: Forest cover change is an important and widely used measure of the change in forest extent, which has important implications for ecosystem services and habitat protection. Reduction in extent of forests can be related to agricultural and urban expansion, and is generally considered negative for forest ecosystem health.

SOURCE(S)

Variable: Trends in Extent of Forest 1990-2010
Citation: FAO, Global Forest Resources Assessment 2010
Year of publication: 2011
Covered time: 1990, 2000, 2005 and 2010
URL: http://www.fao.org/forestry/fra/fra2010/en/
Date data obtained: 12/13/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Percent change from period 1 to period 2

Indicator creation method:

This measure represents the percent change in forest area, applying a 10% crown cover as the definition of forested areas, between time periods. We used total forest extent, rather than the extent of primary forest only. The change measure is calculated from forest area data in 1995, 2000, 2005, and 2010. The data are reported by national governments, and therefore methods and data sources may vary from contry to country. Positive values indicate aforestation or reforestation, and negative values represent deforestation.

Additional notes:

Countries with less than 100 sq. km in forest area in the year 2000 as defined by the forest cover component of FORLOSS were averaged around.

Transformation needed for aggregation: Inverse, logarithmic

Target: 0.998781808
Low performance benchmark: 0.8871099213
Source: Expert opinion. The target was chosen slightly below 1 for mathematical purposes based on the distribution of 2000-2010 data and expert judgment. The low performance benchmark is based on the 5th percentile of the 2000-2010 data.

Indicator: Forest Loss

Objective / Policy: **Ecosystem Vitality – Forest**

Code: *FORLOSS*

Description: The indicator represents the loss of forest area owing to deforestation from either human or natural causes, such as forest fires.

Rationale: Forest cover loss is a measure that reflects the decline of forest biodiversity, forest ecosystem services, and forest carbon emissions within a country. Although it would be desirable to measure forest health and species composition, or alternatively forest management, comparable data on these parameters are not available consistently across countries.

SOURCE(S)

Variable: Forest cover loss
Citation: University of Maryland
Year of publication: 2011
Covered time: 2000-2005, 2005-2010
URL:
Date data obtained: 12/13/2011
Data type: GIS grids

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

The University of Maryland researchers used MODIS 500-meter resolution satellite data to identify areas of forest disturbance, then used Landsat data to quantify the area of forest loss. This indicator uses a baseline forest cover layer (forest cover fraction with a 30% forest cover threshold) to measure the area under forest cover in the year 2000. It then combines forest loss estimates from Landsat for the periods 2000-2005 and 2005-2010 to arrive at a total forest cover change amount for the decade. This total is then divided by the forest area estimate for 2000 to come up with a percent change in forest cover over the decade. Further details on the methods used are found in the following publication: Hansen, M., et al. 2010. Quantification of global gross forest cover loss. *Proceedings of the National Academies of Science*. Available at www.pnas.org/cgi/doi/10.1073/pnas.0912668107.

Additional notes:

This indicator is derived from satellite data and therefore may have inaccuracies in forest delineation in the two time periods. In addition, no credit is given to countries for aforestation during the two time periods. Countries with less than 100 sq.km of forest area were averaged around in the calculation of the EPI.

Transformation needed for aggregation: logarithmic

Target: 0.015
Low performance benchmark: 1.07
Source: Expert opinion. The target was chosen based on the distribution of the indicator values, as a value between two spikes in data (one spike at .01 and another at 0.02). The low performance benchmark is the maximum value of 2000-2010 dataset.

Indicator: Forest Growing Stock

Objective / Policy: **Ecosystem Vitality – Forest**

Code: *FORGRO*

Description: Growing stock is a volumetric measure that measures the cubic meters of wood over bark of all living trees more than X cm in diameter at breast height. The definition of X may vary by country.

Rationale: Growing stock is defined as the standing tree volume of the forest resources. An increase in growing stock usually means higher quality forests, whereas a decrease in growing stock generally indicates degrading forest conditions.

SOURCE(S)

Variable: Growing stock in forest
Citation: FAO, Global Forest Resources Assessment 2010
Year of publication: 2011
Covered time: 1990, 2000, 2005 and 2010
URL: http://www.fao.org/forestry/fra/fra2010/en/
Date data obtained: 12/13/2011
Data type: tabular

Variable: Forest area
Citation: FAO, Global Forest Resources Assessment 2010
Year of publication: 2011
Covered time: 2000, 2005
URL: http://www.fao.org/forestry/fra/fra2010/en/
Date data obtained: 12/13/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Ratio of period 2 to period 1

Indicator creation method:

Growing stock includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm. Countries indicate the three thresholds (X, Y, W in cm) and the parts of the tree that are not included in the volume. Countries must also indicate whether the reported figures refer to volume above ground or above stump. The diameter is measured at 30 cm above the end of the buttresses if these are higher than 1 meter. Growing stock includes windfallen living trees but excludes smaller branches, twigs, foliage, flowers, seeds, and roots.

Additional notes:

Approximately 15-17% of countries for any given reporting period show no change in total growing stock. It is not possible to ascertain which countries really had no change as measured on the ground and which countries may simply repeat values from one period to the next. Countries with less than 100 sq. km in forest area in the year 2000 as defined by the forest cover component of FORLOSS were averaged around. The 1990-2000 growth was split into two time periods: 1990-1995 and 1995-2000. The original data included the total growing stock for Serbia and Montenegro for years 1990, 2000 and 2005 the growing stock was split between the two countries based on the FAO forest area. The following additional imputations were also made: Germany: value of 0.638388626 replaced 0 (year 2005); Micronesia: value of 0.664012678 replaced 0 (year 2000); Palau: value of 0.664012678 replaced 0 (year 2000).

Transformation needed for aggregation: Inverse, logarithmic

Target: 0.99047619
Low performance target: 0.860946986
Source: Expert opinion. The targets represent non decline in forest growth. The target was chosen slightly below 1 for

mathematical purposes based on the distribution of 2000-2010 data and expert judgment. The low performance benchmark is based on the 5th percentile of the 2000-2010 data.

Indicator: Fish Stocks Overexploited

Objective / Policy: **Ecosystem Vitality – Fisheries**

Code: *FSOC*

Description: This is the fraction of species that are fished in each country's exclusive economic zone (EEZ) that are overexploited or collapsed. The definition of overexploited is catches that are less than 50% and greater than 10% of the maximum catch over the time series and the definition of collapsed is catches less than 10% of the maximum catch over the time series.

Rationale: 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 (Ricker 1975, Grainger 1999).

SOURCE(S)

Variable: Fraction of EEZ with overexploited and collapsed stocks
Citation: Sea Around Us Project, University of British Columbia Fisheries Centre
Year of publication: 2010
Covered time: 1950-2006
URL: http://seaaroundus.org/
Date data obtained: 9/20/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Fraction

Indicator creation 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 (Figure 2). 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. 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 (Kleisner and Pauly, 2011). 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 10 years time span, and which has a total catch in an area of at least 1000 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.

Additional notes:

The FSOC indicator is 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. Landlocked countries are averaged around in calculation of the EPI.

Transformation needed for aggregation: logarithmic

Target: 0

Low performance benchmark: 1

Source: Expert opinion. The target and the low performance benchmark represent the minimum and the maximum value of the 2000-2010 dataset, respectively.

Indicator: Indoor Air Pollution

Objective / Policy: **Environmental Health - Air Quality**

Code: *INDOOR*

Description: Solid fuels include biomass fuels, such as wood, charcoal, crops or other agricultural waste, dung, shrubs and straw, and coal. 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 (WHO 2007).

Rationale: 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 (WHO 2011).

SOURCE(S)

Variable: Percentage of population using solid fuel as the primary cooking fuel
Citation: World Health Organization's Indicator and Measurement Registry, version 1.6.0
Year of publication: 2011
Covered time: 1974-2008
URL: http://apps.who.int/gho/indicatorregistry/App_Main/view_indicator.aspx?iid=2267
Date data obtained: 12/5/2011
Data type: tabular

Variable: Proportion of population using solid fuels
Citation: Millennium Development Goals, Indicator 29 (non-MDG)
Year of publication: 2010
Covered time: 1990-2007
URL: http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=712
Date data obtained: 12/5/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

These data were collected from nation-wide household surveys in 52 countries. The rest of the data are generated from models predicting solid fuel use. The model used solid fuel use values from the household fuel use database, and assumed that as countries develop economically, people gradually shift up an energy ladder from solid fuels to cleaner fuels. The final exposed population is calculated as: Household equivalent solid fuel exposed population = population using solid fuel × ventilation factor. Information of the main type of fuel used for cooking are collected at the national and sub national levels in most countries using censuses and surveys.
According to WHO, the household surveys used include: DHS survey, MICS survey, WHS survey and other reliable and nationally representative country surveys.

Additional notes:

WHO notes that there may be discrepancies between the various internationally reported and nationally reported figures for the same year because of the following factors: (1) use of different definitions of solid fuel (wood only or wood and any other biomass, e.g. dung residues), (2) use of different total population estimates, and (3) different denominators (estimates are expressed as percentage of population using solid fuels (as per MDG indicator) as compared to percentage of household using solid fuels (as assessed by surveys such as DHS or MICS). Taiwan's data are provided from Taiwan's Ministry of Environment. Where data were missing from WHO, we used MDG data, mostly for years 2003 and 2007. The minimum value of 5 from MDG dataset was set to the minimum value for WHO dataset, which is 0.

Transformation needed for aggregation: logarithmic

Target: 0
Low performance benchmark: 100
Source: Expert opinion. The target represents the minimum value of 2000-2010 dataset. The low performance benchmark is the maximum value of 2000-2010 data.

Indicator: Marine Protected Areas

Objective / Policy: **Ecosystem Vitality - Biodiversity and Habitat**

Code: *MPAEEZ*

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

Rationale: 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.

SOURCE(S)

Variable: Percentage of EEZ area protected
Citation: IUCN and UNEP-WCMC (2011) The World Database on Protected Areas (WDPA): January 2011. Cambridge, UK: UNEP-WCMC.
Year of publication: 2011
Covered time: 1990-2010
URL: http://www.unep-wcmc.org/
Date data obtained: 9/20/2011
Data type: tabular

Variable: World EEZ Shapefile, v.6.0
Citation: VLIZ Maritime Boundaries Geodatabase
Year of publication: 0
Covered time: 2011
URL: http://www.vliz.be/vmdcdata/marbound/
Date data obtained: 12:00:00 AM
Data type: Shapefile

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

The January 2011 version of the World Database on Protected Areas was used by the UNEP World Conservation Monitoring Centre for a spatial time series analysis of protected area coverage from 1990 to 2010. WCMC considered all nationally designated protected areas whose location and extent is known. They used polygons where available, otherwise they used buffered points. WCMC removed all overlaps between different designations and categories, buffered points and polygons, and dissolved the boundaries so as to create a protected areas mask. The time series was generated based on the date of gazetting of the protected areas. Dated and undated protected areas were used; protected areas with unknown year of establishment were assumed to have been established before 1990.

Additional notes:

Landlocked countries are averaged around in calculation of the EPI.

Transformation needed for aggregation: logarithmic

Target: 10

Low performance benchmark: 0.00000117
Source: Convention on Biological Diversity. The low performance benchmarkis the minimum non–zero value of the 2000-2010 data.

Indicator: Biome Protection

Objective / Policy: Ecosystem Vitality - Biodiversity and Habitat

Code: *PACOV*

Description: 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.

Rationale: This indicator measures the degree to which a country achieves the target of protecting 17% of each terrestrial biome within its borders. The Convention on Biological Diversity (CBD) established the 17% target at its 10th Conference of the Parties in Nagoya, Japan (2010). 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.

SOURCE(S)

Variable: World Database of Protected Areas
Citation: UNEP World Conservation Monitoring Centre
Year of publication: 2011
Covered time: 1990-2010
URL: http://www.protectedplanet.net
Date data obtained: 10/1/2011
Data type: ESRI file geodatabase

Variable: WWF Ecoregions of the World
Citation: World Wildlife Fund USA
Year of publication: 0
Covered time: circa 2000
URL: http://www.worldwildlife.org/science/ecoregions/delineation.html
Date data obtained: 12:00:00 AM
Data type: ESRI Shapefile

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

CIESIN used a time series version of the World Database on Protected Areas (WDPA) developed by UNEP World Conservation Monitoring Centre in 2011, which provides a spatial time series of protected area (PA) coverage from 1990 to 2010. WCMC considered all nationally designated protected areas whose location and extent is known. Boundaries were defined by polygons where available, and where they were not available protected area centroids were buffered to create a circle in accordance with the the PA size. WCMC removed all overlaps between different protected areas by dissolving the boundaries so as to create a protected areas mask. The time series was generated based on the date of gazetting of the protected areas. Dated and undated protected areas were used; protected areas with unknown year of establishment were assumed to have been established before 1990. To calculate this indicator CIESIN overlayed the protected area mask on biome data developed by WWF's Terrestrial Ecoregions of the World (Olson et al. 2001) for each country. Because we are measuring the extent of terrestrial protected areas, biome 98 (water) was excluded. The area and percentage of each biome under protected status was calculated, and the weighted percentage, based on size of biome, was used to calculate the ecoregion protection indicator. All biome protection percentages were capped at 17% so that higher protection in one biome cannot be used to offset lower protection in another. Details on the methodology can be obtained by reading the document "Eco-Region Protection Indicator for the 2011 release of the Natural Resources Management Index of the Millennium Challenge Corporation: Data and Methodology", available at http://sedac.ciesin.columbia.edu/es/papers/ecoregion_protection_methodology_2011.pdf

Additional notes:
Protected Areas Boundary data may have inaccuracies, and for many countries no boundary data may exist for certain protected areas and bufferred points were used instead. In overlaying two global data sets with different scales and resolutions, there will inevitably be a certain degree of spatial error in the analysis. To reduce the spatial error, however, CIESIN took precautions to improve the biome data set from Olsen et al. (2001) with better coastline delineations.

Transformation needed for aggregation: none

Target: 17
Low performance benchmark: 0
Source: Convention on Biological Diversity. The low performance benchmark represents the minimum values in 2000-2010 dataset.

Indicator: Particulate Matter

Objective / Policy: **Environmental Health - Air Quality**

Code: *PM25*

Description: These data are derived from a model that was parameterized by MODIS Aerosol Optical Depth (AOD) data. The model covered all areas south of 60 degree North latitude and north of 60 degree South latitude.

Rationale: Suspended particulates contribute to acute lower respiratory infections and other diseases such as cancer. Finer particulates (such as PM2.5) lodge deeper in lung tissue, causing greater damage than coarser particulates. Annual average concentrations of greater than 10 micro-grams per cubic meter are known to be injurious to human health.

SOURCE(S)

Variable: Population-weighted exposure to PM2.5 in micro-grams per cubic meter

Citation: van Donkelaar, A., R. V. Martin, M. Brauer, R. Kahn, R. Levy, C. Verduzco, and P. J. Villeneuve, 2010. Global Estimates of Exposure to Fine Particulate Matter Concentrations from Satellite-based Aerosol Optical Depth, Environ. Health Perspect., 118(6): 8

Year of publication: 2010

Covered time: 2002-2009 (central years for three year rolling averages)

URL:

Date data obtained: 10/27/2011

Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: micrograms per cubic meter

Indicator creation method:

This indicator was developed by Battelle Memorial Institute in collaboration with CIESIN and funding from the NASA Applied Sciences Program. Using relationships between MODIS Aerosol Optical Depth (AOD) and surface PM2.5 concentrations that were modeled by van Donkelaar et al. (2010), annual average MODIS AOD retrievals were used to estimate surface PM2.5 concentrations from 2001 to 2010. These were averaged into three year moving averages from 2002 to 2009 to generate global grids of PM2.5 concentrations. The grids were resampled to match CIESIN's Global Rural-Urban Mapping Project (GRUMP) 1km population grid. The population weighted average of the PM2.5 values were used to calculate the country's annual average exposure to PM2.5 in micrograms per cubic meter.

Additional notes:

For countries with at least 2 data points, the data were imputed based on linear interpolation (between the first and last data point) and constant values outside this time frame. All other missing are coded as following: -8888 for countries with data from the source, and -9999 for countries not included in source country list.

Transformation needed for aggregation: logarithmic

Target: 10

Low performance benchmark: 48.7916

Source: World Health Organization recommendation for PM 2.5 concentrations. The low performance benchmark is the maximum value of the of distribution of the available time series data from 2000 to 2010.

Indicator: Pesticide Regulation

Objective / Policy: **Ecosystem Vitality - Agriculture and Land Management**

Code: *POPs*

Description: The POPs indicator examines the legislative status of countries on one of the landmark agreements on POPs usage, the Stockholm Convention, and also rates 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.

Rationale: 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 inicator are persistent organic pollutants (POPs), which are endocrine disruptors, or carcinogens.

SOURCE(S)

Variable: POPs regulation

Citation: UNEP Chemicals, "Master List of Actions on the Reduction and/or Elimination of the Releases of Persistent Organic Pollutants, Fifth edition", June 2003

Year of publication: 2003

Covered time: 1960-2006

URL: http://www.chem.unep.ch/pops/; and http://www.pops.int/documents/meetings/inc7/mastlist5/ml5.pdf, page 243 onward

Date data obtained: 12/6//2011

Data type: pdf

INDICATOR SUMMARY

Unit of Measurement: 22 Point Scale

Indicator creation method:

The criteria for indicator calculation is the number of the "dirty dozen" pesticide banned, restricted and allowed in the country, by year. For each of the following POPs: Aldrin, Chlordane, DDT, Dieldrin, Dioxin_Furan, Endrin, Heptachlor, Hexachlorobenzene, Mirex, PCB, Toxaphene, we assign 2 points in the year that were banned, 1 point when they are restricted. See http://www.pops.int/documents/meetings/inc7/mastlist5/ml5.pdf, page 243 onward.

Additional notes:

Taiwan's data were provided by Taiwan's Environmental Protection Agency. For countries with at least 2 data points, the data were imputed based on linear interpolation (between the first and last data point) and constant values outside this time frame. All other missing are coded as following: -8888 for countries with data from the source, and -9999 for countries not included in source country list.

Transformation needed for aggregation: none

Target: 22

Low performance benchmark: 0

Source: Stockholm Convention. The low preformance benchmark represents the minimum values in 2000-2010 dataset.

Indicator: Renewable Electricity

Objective / Policy: **Ecosystem Vitality - Climate Change**

Code: *RENEW*

Description: The percentage of the total renewable electricity net generation in total electricity net generation.

Rationale: Renewable electricity production reduces reliance on fossil fuels, which produce greenhouse gases and pollute the atmosphere.

SOURCE(S)

Variable: Renewable electricity production as a percentage of total electricity production
Citation: International Energy Agency (IEA)
Year of publication: 2011
Covered time: 1980-2009
URL: http://data.iea.org
Date data obtained: 12/23/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

This indicator was calculated by dividing the renewable electricity production by total electricity production. The renewable electricity production includes biodiesel, biogasoline, other biogas, charcoal, geothermal, hydro, other liquid biofuels, sludge gas, solarphotovoltaics, solar thermal, tide wave & ocean, and wind.

Additional notes:

Transformation needed for aggregation: none

Target: 100
Low performance benchmark: 0
Source: Expert opinion. The target and low performance benchmarks represent the maximum and minimum value of 2000-2010 dataset, respectively.

Indicator: SO2 Emissions Per $ GDP

Objective / Policy: **Ecosystem Vitality - Air Quality**

Code: *SO2GDP*

Description: Sulfur dioxide emissions per GDP represents the ratio of SO2 emissions to GDP in 2005 constant international prices PPP.

Rationale: Sulfur dioxide (SO2) deposition has detrimental impacts on aquatic and terrestrial ecosystems, and it is also harmful to human health. SO2 is produced by the energy sector, industry, transportation, and agricultural waste burning (Smith et al, 2011).

SOURCE(S)

Variable: Sulfur Dioxide Emissions
Citation: Smith, S.J., J. van Aardenne, Z. Klimont, R.J. Andres4, A. Volke, and S. Delgado Arias. (2011). Anthropogenic sulfur dioxide emissions: 1850–2005, Atmos. Chem. Phys., 11, 1101–1116.
Year of publication: 2011
Covered time: 1850-2005
URL: http://dx.doi.org/10.5194/acp-11-1101-2011
Date data obtained: 10/27/2011
Data type: tabular

Variable: GDP, PPP (constant 2005 international $)
Citation: World Development Indicators, The World Bank
Year of publication: 2011
Covered time: 1980-2010
URL: http://databank.worldbank.org/ddp/home.do
Date data obtained: 4/11/2011
Data type: tabular

Variable: GDP, PPP (constant international $)
Citation: CIESIN calculations based on Per capita GDP (WDI and CIA Factbook) and Population (WDI and CIA Factook)
Year of publication: varies
Covered time: 1995-2009
URL: http://databank.worldbank.org/ddp/home.do; https://www.cia.gov/library/publications/the-world-factbook/
Date data obtained: 4/11/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: grammes SO2 per US dollar PPP (in 2005 constant US dollars)

Indicator creation method:

The full method for this variable is described in Smith et al. 2011. In summary, estimates of anthropogenic global sulfur dioxide emissions were calculated using a bottom-up mass balance method which was calibrated to country-level inventory data. The 5 steps in the calculation are: (1) development of an inventory by sector and fuel for three key years, (2) development of detailed estimates for smelting and international shipping, (3) calculation of a default set of emissions by interpolating emissions factors from the key years, (4) calculation of final annual emissions values by fuel that match inventory values, and (5) estimate sectoral emissions (Smith et al 2011,pag.1102). The country totals are then divided by GDP in constant 2005 US dollars.

Additional notes:

A systemic uncertainty component was added to account for uncertainty assumptions in different regions. Petroleum products are often quantified in ranges of sulfur content, which inherently includes some uncertainty. Where there are emission controls, how well the controls are monitored will also impact measurements. The original data included the total SO2 for Serbia and Montenegro, thus the SO2 was split between the two countries based on the denominator.

Transformation needed for aggregation: logarithmic

Target: 0

Low performance benchmark: 11.38625

Source: Expert opinion. The target represents the ideal state of non SO2 pollution. The low performance benchmarks are based on the 95th percentiles of the 2000-2010 data.

Indicator: SO2 Emissions Per Capita

Objective / Policy: **Ecosystem Vitality - Air Quality**

Code: *SO2CAP*

Description: Sulfur dioxide emissions per capita represents the ratio of SO2 emissions to population.

Rationale: Sulfur dioxide (SO2) deposition has detrimental impacts on aquatic and terrestrial ecosystems, and it is also harmful to human health. SO2 is produced by energy sector, industry, transportation, domestic and AWB (Smith et al, 2011).

SOURCE(S)

Variable: Sulfur Dioxide Emissions
Citation: Smith, S.J., J. van Aardenne, Z. Klimont, R.J. Andres4, A. Volke, and S. Delgado Arias. (2011). Anthropogenic sulfur dioxide emissions: 1850–2005, Atmos. Chem. Phys., 11, 1101–1116.
Year of publication: 2011
Covered time: 1850-2005
URL: http://dx.doi.org/10.5194/acp-11-1101-2011
Date data obtained: 10/27/2011
Data type: tabular

Variable: Population
Citation: World Development Indicators, The World Bank
Year of publication: 2011
Covered time: 1960-2010
URL: http://databank.worldbank.org/ddp/home.do
Date data obtained: 4/11/2011
Data type: tabular

Variable: Population
Citation: CIA Factbook
Year of publication: varies
Covered time: 2000-2010
URL: https://www.cia.gov/library/publications/the-world-factbook/
Date data obtained: 4/11/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: kg SO2/person

Indicator creation method:

The full method for this variable is described in Smith et al. 2011. In summary, estimates of anthropogenic global sulfur dioxide emissions were calculated using a bottom-up mass balance method which was calibrated to country-level inventory data. The 5 steps in the calculation are: (1) development of an inventory by sector and fuel for three key years, (2) development of detailed estimates for smelting and international shipping, (3) calculation of a default set of emissions by interpolating emissions factors from the key years, (4) calculation of final annual emissions values by fuel that match inventory values, and (5) estimate sectoral emissions (Smith et al 2011,pag.1102). The country totals are then divided by population.

Additional notes:

A systemic uncertainty component was added to account for uncertainty assumptions in different regions. Petroleum products are often quantified in ranges of sulfur content, which inherently includes some uncertainty. Where there are emission controls, how well the controls are monitored will also impact measurements. The original data included the total SO2 for Serbia and Montenegro, thus the SO2 was split between the two countries based on the denominator.

Transformation needed for aggregation: logarithmic

Target: 0
Low performance benchmark: 105.63159516
Source: Expert opinion..The target represents the ideal state of non-SO2 pollution. The low performance benchmark is the 95th percentile of the 2000-2010 data.

Indicator: Coastal Shelf Fishing Pressure

Objective / Policy: **Ecosystem Vitality - Fisheries**

Code: *TCEEZ*

Description: This is the catch from trawling and dredging gears divided by the EEZ area by country and year.

Rationale: Benthic trawling is a fishing method that targets fish and invertebrates that inhabit ocean floor (or benthic) ecosystems. These include cod, scallops, shrimp, and flounder. This type of trawling comes at a heavy environmental cost. Bottom trawling and dredging equipment have been described as the most destructive fishing gear in use today (Watson, 2004 and 2006). Benthic trawls are boats equipped with large heavy nets that are dragged across the living seafloor. The nets are held open at the front by a metal beam or by large "doors," which can weigh several tons, and which are designed to scour the bottom as the trawl is dragged along, forcing the fish and invertebrates up into the net. This process exerts a heavy toll on the natural habitats of the sea floor, breaking off brittle bottom flora and fauna such as sponges and corals. Marine species such as turtles that try to escape the gear suffer stress, injury, and quite frequently, death (FAO, 2005). This indicator is an attempt to measure the intensity of gears such as trawlers that operate on the coastal shelf.

SOURCE(S)

Variable: Catch from trawling and dredging gears (mostly bottom trawls) (Tonnes)
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: 8/31/2011
Data type: tabular

Variable: EEZ area
Citation: Sea Around Us Project, University of British Columbia Fisheries Centre based on FAO data
Year of publication: 2011
Covered time: 1950-2006
URL: http://seaaroundus.org/
Date data obtained: 8/31/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Tonnes per square km

Indicator creation 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.

Additional notes:

Small island states were aggregated to the countries under administration. Landlocked countries are averaged around in calculation of the EPI.

Transformation needed for aggregation: logarithmic

Target: 0.000016
Low performance benchmark: 1
Source: Expert opinion. The target is based on 5th percentile of 2000-2010 data, rounded at 6 digits. The low performance benchmark is based on the 95th percentile of the 2000-2010 data, rounded at 1 digit.

Indicator: Access to Drinking Water

Objective / Policy: **Environmental Health - Water quantity**

Code: *WATSUP*

Description: The percentage of a country's population that has access to an improved source of drinking water.

Rationale: Diarrheal disease is a leading causes of death among children and is contracted through contaminated water sources.

SOURCE(S)

Variable: Access to drinking water
Citation: WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation
Year of publication: 2011
Covered time: 1990-2005 (5 year values), 2008
URL: http://www.wssinfo.org/data-estimates/table/
Date data obtained: 8/23/2011
Data type: tabular

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

The WHO defines an improved drinking water source as piped water into dwelling, plot or yard; public tap/standpipe; tubewell/borehole; protected dug well; protected spring; and rainwater collection (UNICEF and WHO 2008).

Additional notes:

Some of the countries exceed the 100 percent target. We set these values 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. The countries not included in WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation list are coded with "-9999". Taiwan's data are provided from Taiwan's Ministry of Environment. Data for Lithuania and Brunei were imputed based on regional averages. Singapore's data came from the World Bank's World Development Indicators (WDI) database.

Transformation needed for aggregation: inverse, logarithmic

Target: 100
Low performance benchmark: 36
Source: Millennium Development Goals. The low performance benchmark was based on the first percentile of the 2000-2010 data.

Indicator: Change in Water Quantity

Objective / Policy: **Ecosystem Vitality - Water resources**

Code: *WATUSE*

Description: Area-weighted percent reduction of mean annual river flow from "natural" state owing to water withdrawals and reservoirs.

Rationale: Water withdrawals and reservoir construction and management have negative impact on river ecosystems, wetlands and floodplains, affecting the biodiversity of aquatic ecosystems (Döll et al. 2009).

SOURCE(S)

Variable: Water use

Citation: Döll, P., K. Fiedler, and J. Zhang. Global-scale analysis of river flow alterations due to water withdrawals and reservoirs, Hydrol. Earth Syst. Sci., 13, 2413–2432, 2009

Year of publication: 2009

Covered time: 2005

URL:

Date data obtained: 11/10/2011

Data type:

INDICATOR SUMMARY

Unit of Measurement: Percentage

Indicator creation method:

Water withdrawals and consumptive water use is estimated separately for the irrigation, livestock, household and industrial sectors. Water impoundment is based on the Global Reservoir and Dam version 1.1 data set (GRanD). The percent change in river flow owing to both factors was calculated on a 0.5 degree grid cell basis. CIESIN used the data developd by Döll et al. (2009) to calculate an area weighted average of the percent change by country.

Additional notes:

These data represent a relatively conserative estimate of human impacts on natural water flows. The impact of reservoirs is probably underestimated by the study as small reservoirs are not taken into account. Data for Singapore, Serbia, and Montenegro were imputed based on regional averages.

Transformation needed for aggregation: inverse, logarithmic

Target: 0

Low performance benchmark: -44.38354001

Source: Expert opinion. The low performance benchmark is the minimum value of the 2000-2010 data.