EVI: Description of Indicators

20 December 2004

evi

Environmental
Vulnerability Index

UNEP

SOPAC

Vulnerability Inherent characteristics of a country + Forces of nature + Human use + Climate change

The overall vulnerability of a country is the result of a large number of interacting forces. Some of these can be influenced by our policies and actions. Others, like the forces of nature, cannot be directly changed by our choices. Where we have no power to change a factor, such as the weather or volcanoes, we can still improve our overall position by increasing resilience or reducing vulnerability in seemingly-unrelated aspects of our environment. In the indicator descriptions that follow, we highlight some of the direct and indirect approaches that could be used to respond to vulnerability issues.

Contents

HIGH WINDS

Average annual excess wind over the last five years (summing speeds on days during which the maximum recorded wind speed is greater than 20% higher than the 30 year average maximum wind speed for that month) averaged over all reference climate stations.

Categories	Data sources
Hazards / Weather & Climate	NOAA GHCN

Vulnerability to cyclones, tornadoes, storms, erosion, habitat damage, disturbance. This indicator captures the likelihood of damage from frequent and severe wind that can affect forests, fan fires, create storm surges, dry soils, spread air pollution, and interact with other stressors. Because this indicator is expressed in relation to the 30 year monthly means, a high score could indicate shifts in weather patterns and climate, and could negatively affect a country's resilience to other hazards. The signal generated captures not only the frequency of high winds, but also their strength.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, CCD, ISDR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover).

Indicator scaling: (cut-off values are knots of excess wind annually)

1 148 2 200 3 270 4 365 5 445 6 601 7

DRY PERIODS

Average annual rainfall deficit (mm) over the past 5 years for all months with more than 20% lower rainfall than the 30 year monthly average, averaged over all reference climate stations.

Categories	Data sources
Hazards / Weather & Climate	NOAA GHCN

Vulnerability to drought, dry spells, stress on surface water resources. This indicator captures not only the number of months with significantly lower rainfall, but also the strength of the deficit. Two countries could have the same average number of months over the past 5 years with less than 20% lower than the monthly average rainfall, with one only having a small deficit, while another a very large one. This indicator ensures that the amount of rain 'missed' is captured. Frequent and severe drought months could indicate shifts in weather patterns and climate, and could negatively affect a country's resilience to other hazards (e.g. fires, water movements, ability of ecosystems to attenuate pollution).

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, CCD, ISDR, RAMSAR, World water Forum, Regional Strategies, National Plans, SOE

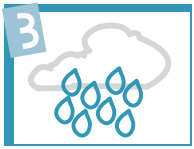
Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover; improve water management)

Indicator scaling: (cut-off values are mm annual rainfall deficit)

Indicator scaling: (cut-off values are mm annual rainfall deficit)

1 10.9 2 18.0 3 29.7 4 48.9 5 80.7 6 133.0 7

WET PERIODS



Average annual excess rainfall (mm) over the past 5 years for all months with more than 20% higher rainfall than the 30 year monthly average, averaged over all reference climate stations

Categories	Data sources
Hazards / Weather & Climate	NOAA GHCN

Vulnerability to floods, cyclones, wet periods, stress on land surfaces and ecosystems subject to flooding and disturbance. This indicator captures not only the number of months with significantly higher rainfall, but also the amount of the excess. Two countries could have the same average number of months over the past 5 years with more than 20% higher rainfall than the monthly average, with one only having a small excess, while another a very large one. This indicator ensures that the amount of rain 'in excess' is captured. Frequent and severe wet months could indicate shifts in weather patterns and climate, and could negatively affect a country's resilience to other hazards (e.g. water movements, the spread of and ability of ecosystems to attenuate pollution)

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, CCD, ISDR, World Water Forum, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover; promote good landuse practices)

Indicator scaling: (cut-off values are mm annual rainfall excess)

1 5.0 2 9.8 3 16.2 4 24.2 5 33.8 6 45.0 7

HOT PERIODS

Average annual excess heat (degrees) over the past 5 years for all days more than 5°C (9˚F) hotter than the 30 year mean monthly maximum, averaged over all reference climate stations.

Categories	Data sources
Hazards / Weather & Climate	NOAA GHCN

Vulnerability to heat waves, desertification, water resources, temperature stress, bleaching. This indicator is designed to capture stress on land surfaces and nearshore or shallow aquatic environments to periods of high temperatures that can affect productivity, oxygen levels, pollution, reproduction and symbiotic relationships and lead to mass mortality. On land, periods of high temperatures can also lead to interactive effects such as fires. This indicator captures not only the number of days with significantly higher temperatures, but also the amount of the excess. Two countries could have the same number of days with more than 5ºC higher temperatures than the monthly average, with one only having a small excess, while another a very large one. Frequent and severe hot days could also indicate shifts in weather patterns and climate, and could negatively affect a country's resilience to other hazards (e.g. ability of forests to regenerate if disturbed).

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, IPCC, CCD, ISDR

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover; reduce other stresses on fragile ecosystems such as forests, steppes, wetlands and coral reefs)

Indicator scaling: (cut-off values are degrees Celsius of excess heat annually)

1 18 2 30 3 50 4 82 5 135 6 224 7

COLD PERIODS

Average annual heat deficit (degrees) over the past 5 years for all days more than 5°C (9˚F) cooler than the 30 year mean monthly minimum, averaged over all reference climate stations.

Categories	Data sources
Hazards / Weather & Climate	NOAA GHCN

Vulnerability to cold snaps, unusual frosts, effects on water resources, temperature stress, pollution attenuation rates, reproductive success. This indicator is designed to capture stress on land surfaces and near-shore or shallow aquatic environments to periods of low temperatures that can affect productivity, oxygen levels, pollution, reproduction and symbiotic relationships and lead to mass mortality. This indicator captures not only the number of days with significantly lower temperatures, but also the amount of the "heat deficit". Two countries could have the same number of days with more than 5ºC lower temperatures than the monthly average, with one only having a small deficit, while another a very large one. Frequent and severe cold days could also indicate shifts in weather patterns and climate, and could negatively affect a country's resilience to other hazards (e.g. ability of lakes and rivers to attenuate pollutants).

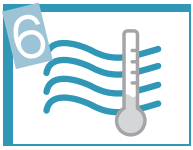
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, CCD, ISDR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover; reduce other stresses on fragile ecosystems such as forests and steppes)

Indicator scaling: (cut-off values are degrees Celsius of heat deficit annually)

1 18 2 30 3 50 4 82 5 135 6 224 7

SEA TEMPERATURES



Average annual deviation in Sea Surface Temperatures (SST) in the last 5 years in relation to the 30 year monthly means (1961-1990).

Categories	Data sources
Hazards / Weather & Climate	University of British Columbia

This indicator captures vulnerability to fluctuations in productivity, fisheries, currents, eddies, ENSO, cyclones & storms, blooms and coral bleaching. The indicator captures the total amount of the anomalies in SST, either as excess or deficit (using absolute values). Frequent and severe deviations from the 30 year moving average could herald shifts in currents, upwelling, weather patterns and climate, and could negatively affect a country's resilience to other hazards (e.g. for water movements, the spread of and ability of ecosystems to attenuate pollution). Effects would be especially important when other stresses have already driven populations to low levels.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, CCD, ISDR, GOOS, Regional Strategies, National Plans, SOE

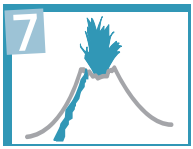
Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. build coastal resilience by controlling pollution, types of developments and resource use; maintain / improve forest cover).

Indicator scaling: (cut-off values are average degrees/year)

1 3.7 2 5 3 6.7 4 9 5 12.2 6 16.4 7

This indicator is not applicable to land-locked countries unless they have inland seas.

VOLCANOES



Cumulative volcano risk as the weighted number of volcanoes with the potential for eruption greater than or equal to a Volcanic Explosively Index of 2 (VEI 2) within 100km of the country land boundary (divided by the area of land).

Categories	Data sources
Hazards / Geology	NOAA / NESDIS / National Geophysical Data Centre / World Data Centre-A / Colorado USA

Vulnerability to Eruptions, landslides, geysers, gas (e.g. SO2 and CO2), fires, ash, dust, marine kills, biodiversity of habitat & species, potential for repeated and long term habitat disturbance. This indicator captures the risk of damage to ecosystems from the physical, chemical and biological disturbances associated with volcanic eruptions. Because the risk associated with volcanoes varies according to size and type, the signal incorporates the number of volcanoes capable of affecting a country, and its potential for damage.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, ISDR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover; promote good landuse practices; create reserves)

Indicator scaling: (cut-off values are weighted numbers of volcanoes VEI 2+)

1 — 1 — 2 — 5 — 3 — 10 — 4 — 15 — 5 — 20 — 6 — 35 — 7

EARTHQUAKES

Cumulative earthquake energy within 100km of country land boundaries measured as Local Magnitude (ML) ≥ 6.0 and occurring at a depth of less than or equal to fifteen kilometres (≤15km depth) over 5 years (divided by land area).

Categories	Data sources
Hazards / Geology	NOAA / NESDIS / National Geophysical Data Centre / World Data Centre-A / Colorado USA

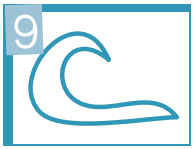
Vulnerability to habitat disturbance through movements of land, water and slides. This indicator captures the risks of damage to the environment from large-scale disturbances such as fluidisation of soils and muds, diversion of rivers and other water bodies, tsunamis, slides, and direct damage to organisms associated with earth movements.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement and which reduce the impacts of development activities (e.g. maintain / improve forest cover; promote good landuse practices).

Indicator scaling: (cut-off values are number of earthquakes of ML ≥ 6, Depth ≤ 15 km)

TSUNAMIS



Number of tsunamis or storms surges with run-up greater than 2 metres above Mean High Water Spring tide (MHWS) per 1000 km coastline since 1900.

Categories	Data sources
Hazards / Weather & Climate	Tsunamis: NOAA/NESDIS/ NGCC; Length maritime coast from WRI 2000-2001 and CIA 2001

This indicator captures the potential loss of shorelines, coastal ecosystems and resources, and loss of species due to catastrophic run up of seawater onto coastal lands. Countries with frequent and severe tsunamis are at risk of severe or permanent damage to biodiversity, productivity and the ability to recover from other stressors.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, ISDR, Regional Strategies, National Plans, SOE

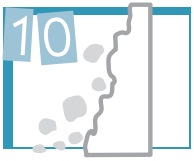
Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve coastal forest cover; careful design of coastal structures and developments; promote good landuse practices)

Indicator scaling: (cut-off values are number of tsunamis / surges with run-up >2m above MHWS (years 1900-2000) / length of coastlines (maritime) * 1000)

1 0 2 1 3 2 4 5 5 10 6 15 7

This indicator is not applicable to land-locked countries

SLIDES



Number of slides recorded in the last 5 years (EM-DAT definitions), divided by land area

Categories	Data sources
Hazards / Weather & Climate	EMDAT OFDA/CRED International Disaster Database 2001

Vulnerability to habitat disturbance and persistence of ecosystems and species from catastrophic shifts in the land surface. The primary and cumulative effects of slides would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts

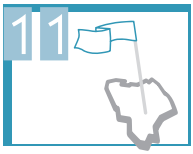
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, but resilience against effects could be built up in other areas which are amenable to improvement (e.g. maintain / improve forest cover; promote good landuse practices)

Indicator scaling: (cut-off values are Number of slides recorded between 1996-2000, divided by area of land (km2))

1 0 2 0.5 3 1 4 1.5 5 2 6 2.5 7

LAND AREA



Total land area (km2).

Categories	Data sources
Resistance / Geography	WRI 2000-2001; CIA Fact sheets 2001

This indicator captures the richness of habitat types and diversity, availability of refuges if damage is sustained or for protection, and species and habitat redundancy. It is generally considered that larger countries will have more options and the 'critical mass' required for ecological systems to persist and re-seed each other in the face of ecosystem stressors. There will also be more options for the human populations to allow areas that have been damaged to recover.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, MDG, CBD, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, and is part of the inherent characteristics of a country. General environmental resilience could be built up by improving resource use; appropriate developments and increasing the area under reserves.

Indicator scaling: (cut-off values are square kilometres of land area

1 1.2M 2 163K 3 22K 4 3K 5 403 6 55 7

M=millions; K=thousands

COUNTRY DISPERSION

Ratio of length of borders (land and maritime) to total land area.

Categories	Data sources
Resistance / Geography	WRI 2000-2001; CIA Fact sheets 2001, 2002

This indicator captures the degree to which a country's land area is fragmented and 'thin'. Countries which are highly fragmented, comprised of many islands, or which have many peninsulas or land areas in thin strips are likely to be prone to more transboundary effects. The land areas may also be more exposed to damage from natural disasters and human impacts (e.g. cyclones, fires, effects of war) in such areas, because the presence of refuges and ecosystem types that may form breaks are likely to be limited. Although fragmentation may also bring with it the possibility that damage could be limited by intervening areas of land or sea, there are likely to be higher risks that ecosystems and species (particularly if many are endemic) will not persist. This could be especially true if there are interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, MDG, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, and is part of the inherent characteristics of a country. General environmental resilience could be built up by improving resource use; increasing the area under reserves.

Indicator scaling: (cut-off values are total length of land and sea borders (km) / land area of country (accumulated across islands, if present) (1000 sq km))

1 7.4 2 20.1 3 54.6 4 148.4 5 403.4 6 1096.6 7

ISOLATION

Distance to nearest continent (km)

Categories	Data sources
Resistance / Geography	Times Comprehensive World Atlas 2000

This indicator captures the proximity of a country to the nearest continent. Note that if a country is within a continent, this value is zero. Isolated countries may have a greater risk of loss of ecosystem types and species during periods of stress if they are far away from refuges and sources of recolonisation. Isolated countries also likely to support fewer species than those which are close to large continents, or biogeographic centres of radiation. Additionally, there is less chance of genetic interchange (part of genetic resilience) in isolated areas. The likelihood of isolation being an important part of a country's ecological resilience would be especially important if there are interactions with on-going human impacts. Countries close to sources of recolonisation are likely to be less at risk of permanent species losses, compared with those far away, particularly if they are small or fragmented.

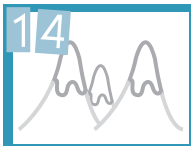
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, MDG, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, and is part of the inherent characteristics of a country. General environmental resilience could be built up by maintaining forest cover, improving land and resource use and increasing the area under reserves.

Indicator scaling: (cut-off values are distance (km) to the nearest continent)

1 0 2 50 3 100 4 400 5 800 6 1600 7

RELIEF



Altitude range (highest point subtracted from the lowest point in country)

Categories	Data sources
Resistance / Geography	CIA World Fact Book 2001

This indicator examines the vulnerability of a country related to biodiversity of habitats and species and the potential for habitat disturbance through movements of water and slides. A country with a large altitude range is likely to have a greater variety of ecosystems, which in very high altitude areas, or very low ones (e.g. the Black Sea) leads to the formation of "endemic habitat types". These can be an integral part of the character of a country, and if lost, the same arguments as for endemic species applies.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, UNFCC, MDG, CBD, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, and is part of the inherent characteristics of a country. General environmental resilience could be built up by maintaining / improving forest cover, improving land use patterns, and increasing the area under reserves.

Indicator scaling: (cut-off values are altitude range in metres)

1 1500 2 3000 3 4500 4 6000 5 7000 6 8000 7

LOWLANDS

Percentage of land area less than or equal to 50m above sea level

Categories	Data sources
Resistance / Geography	Encarta 2004 World Atlas

The final form of this indicator will be: Percentage of land area less than or equal to 10m above sea level. Data are currently being developed for this indicator, and are expected to become available within a short period of time.

This indicator focuses on the presence of lowlands in a country with implied impacts associated with pollution, ecosystem disturbance, flooding and coastal vulnerability. Areas of lowlands are those that will tend to be the first to flood, will tend to accumulate pollution that is mobilised by surface run-off, provide an important entry point (and extraction point) for groundwaters and if on the coasts of the sea or lakes may be subject to storm surges, tsunamis or sea level rise. They tend to be areas of high biodiversity and/or form critical habitats. They may also be critical areas for productivity, soil formation, erosion, natural resources and pollution attenuation. A country's resilience to future hazards will be related to risks on lowland areas. This would be especially important if there are many sensitive ecosystems susceptible to the loss of key species and interactions with on-going human impacts.

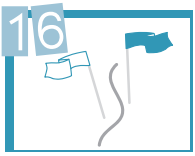
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, MDG, CBD, UNFCC, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue cannot be directly influenced by human actions, and is part of the inherent characteristics of a country. General environmental resilience could be built up by maintaining / improving forest cover, through good land use practices, reducing pressures on lowlands and increasing the area under reserves.

Indicator scaling: (cut-off values are percent of land area less than or equal to 50m above sea level)

1 0 2 15 3 30 4 45 5 60 6 75 7

BORDERS



Number of land and sea borders (including EEZ) shared with other countries.

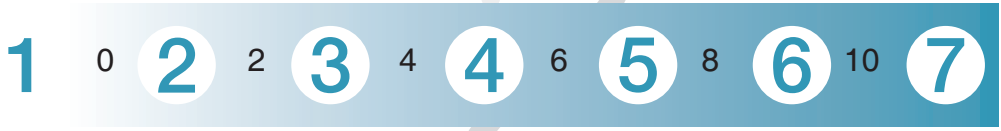
Categories	Data sources
Resistance / Geography	CIA Fact file 2000; Encarta World Atlas 1999, 2000; SOPAC EEZ Maps for the Pacific

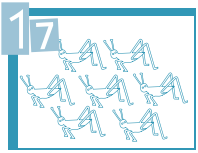
This indicator captures the risk to terrestrial and aquatic ecosystems from transboundary risks including species introductions, lack of control of effects from neighbouring countries, lack of control of straddling stocks of resources, and uncontrolled migrations of humans (e.g. refugees). We consider that the greater the number of different jurisdictions bordering a country by land or sea, the greater the risks of neighbour effects – that is risks to the environment caused by the policies and behaviours of other countries. The effects of these factors would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, MDG, CBD, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue can be directly influenced by human actions though agreements designed to reduce transboundary risks such as pollution, movements of migratory species and use of shared resources.

Indicator scaling: (cut-off values are number of other countries connecting with the borders of a country)





Weighted average change in trophic level since fisheries began (for trophic level slice ≤3.35).

Categories	Data sources
Damage / Resources & services	University of British Columbia, Fisheries Centre, Lower Mall Research Station

This indicator captures the risk of ecosystem stress, loss of diversity, damage to the trophic structure of ecosystems, and loss of balance. It focuses on the risk to aquatic ecosystems associated with shifting the natural relationships, diversity and energy-flows within and among ecosystems. Although fisheries data are used, the indicator is more generally concerned with the downstream effects on habitats and other organisms. The greater the downward (negative) trend in trophic level change, the more likely that the marine biomass and trophic structures have been damaged. Such changes could lead to outbreaks or overgrowth of unexpected or pest organisms, monopolies of certain species, and losses of ecosystem elements that may be dependent on the behaviour or populations of others. The effects of these factors would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, ISDR, MDG, CBD, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue can be directly influenced by human actions though the adoption of ecosystem approaches to management of aquatic and terrestrial areas, and the use of their resources.

Indicator scaling: (cut-off values are trophic level change values)

1 0 2 -0.02 3 -0.04 4 -0.06 5 -0.08 6 -0.10 7

Average annual USD freight imports over the past 5 years by any means per km2 land area

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001

The final form of this indicator will be: Average annual tonnage of freight imported per year over the past 5 years by any means / sq km land area. Tonnage rather than USD will provide a better signal for this indicator focusing on amounts of materials moved rather than their value. It is expected that data for this indicator will become available.

This indicator captures the risk of damage to a country through the importation of foreign materials (physical, chemical and biological) by land, air or sea through the large volumes of freight that move around the globe annually. Countries with large amounts of freight moving into them are considered more at risk of inadvertent introductions of diseases, species and genetically modified organisms, than those with lower levels of freight movements. The likelihood of such introductions negatively affecting a country's resilience would be especially important if there are many endangered species, sensitive ecosystems that could be affected by key species, and interactions with on-going human impacts. This includes the importing of hazardous wastes. Freight imports may also be a mechanism for the introduction of pollution risks not normally found in a country – e.g. the import of radioactive substances, oil, chemicals.

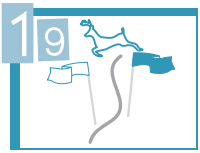
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Basel Convention, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue can directly influenced by quarantine control of freight movements and limiting or eliminating waste trading. Mechanisms could be put in place to contain accidental introductions where possible. General resilience building through management of rare and endangered organisms and establishing more reserves could also be undertaken.

Indicator scaling: (cut-off values are average annual freight density as thousands of USD of freight moved into the country per sq km of land)

1 2.72 2 4.48 3 7.34 4 12.18 5 20.09 6 33.12 7

MIGRATIONS



Number of known species that migrate outside the territorial area at any time during their life spans (including land and all aquatic species) / area of land

Categories	Data sources
Resistance / Resources & services	GROMS Database (includes: IUCN Red Book of Endangered Organisms 2000; African mammal database (AMD) 1998; Erasien Anatidae Atlas; Artic Bird Database 1998; WCMC Turtle Database 1999; Fishbase 1998; Slender-billed curlew database 2000; Maps of non passerine birds 1992-2001)

This indicator focuses of species which pass outside of the control of the country and which during that time may be affected by actions of surrounding countries, or distant nations utilising them as a resource. It focuses on biodiversity, resilience and persistence of species with large variances in population numbers and or /that are susceptible to local extinctions. Straddling stocks of migrating mammals and fishes may also be key species in determining ecosystem conditions in a country, and damage to these while they are outside the country may lead to indirect effects on ecosystems within the country (e.g. migrating mammals as determinants of grasslands in Africa and America). Species could become endangered or threatened in a country, despite good internal management, with implied impacts on biodiversity, ecosystem integrity and resilience to future hazards. This would be especially important if there are many sensitive ecosystems susceptible to the loss of keystone species and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue can be influenced through bilateral and multilateral treaties designed to reduce transboundary risks such as pollution, movements of migratory species and use of shared resources. General resilience building through management of rare and endangered organisms and establishing more reserves could also be undertaken.

Indicator scaling: (cut-off values are density of migratory species expressed as number of species per 1000 sq km land area under various categories of GROMS migrants)

1 1.72 2 3.48 3 6.39 4 11.18 5 19.09 6 32.12 7

ENDEMICS

Number of known endemic species per million square kilometre land area

Categories	Data sources
Resistance / Resources & services	WRI 2000-2001

This indicator focuses biodiversity and the risk of losing unique species. The more endemic species a country has, the more vulnerable it is because localised extinction cannot be re-supplied from elsewhere by natural or augmented recolonisation. Losses of key species can affect ecosystem function and the goods and services they provide.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue can be influenced through identification and preservation of species and habitats unique to a country. General resilience building could be achieved through creating more reserves in terrestrial and aquatic habitats.

Indicator scaling: (cut-off values are species per million sq km land area)

1 — 0 — 2 — 6.39 — 3 — 53.60 — 4 — 402.43 — 5 — 2972 — 6 — 22025 — 7

Number of introduced species per 1000 square kilometre of land area

Categories	Data sources
Damage / Resources & services	FAO 2002

This indicator captures past species introductions to a country with implied impacts on biodiversity and ecosystem integrity. This may include impacts at the levels of populations, genetics, species and ecosystems through complex ecological interactions. Past introductions of species could negatively affect a country's resilience to future hazards. This would be especially important if there are many endangered species, sensitive ecosystems that could be affected by key species, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue is difficult to rectify once introductions have occurred and exotic species have become established. This issue can directly influenced by quarantine control of freight movements and mechanisms could be put in place to contain accidental introductions where possible. General resilience building through management of rare and endangered organisms and establishing more reserves could also be undertaken.

Indicator scaling: (cut-off values are species per 1000 sq km land area)

1 0 2 1.72 3 3.48 4 6.39 5 11.18 6 19.09 7

ENDANGERED SPECIES

Number of endangered and vulnerable species per 1000 sq km land area (IUCN definitions)

Categories	Data sources
Degradation / Resources & services	IUCN Red Book 2000

This indicator focuses on those species that have become endangered or threatened in a country with implied impacts on biodiversity and ecosystem integrity. These are the species most likely to next become extinct, and may already be resulting, by their reduced numbers, in impacts at the levels of populations, genetics, species and ecosystems through complex ecological interactions. The reduction of populations of species could negatively affect a country's resilience to future hazards. This would be especially important if there are many sensitive ecosystems susceptible to the loss of key species and interactions with on-going human impacts.

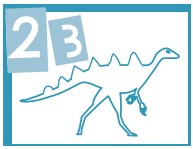
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This issue can be influenced through identification and preservation of species and habitats under threat in a country. General resilience building could be achieved through reducing pressure on threatened environments and species and by creating more reserves in terrestrial and aquatic habitats.

Indicator scaling: (cut-off values are species per 1000 sq km land area)

1 0 2 1 3 2 4 3 5 4 6 5 7

EXTINCTIONS



Number of species known to have become extinct since 1900 per 1000 sq km land area (IUCN definitions).

Categories	Data sources
Degradation / Resources & services	IUCN Red Book 2000

This indicator focuses on those species that have become extinct in a country with implied impacts on biodiversity and ecosystem integrity. The loss of these species has resulted in a loss of biodiversity, and may also have resulted in impacts on ecosystem structure and function through complex ecological interactions. The loss of species could negatively affect a country's resilience to future hazards. This would be especially important if there are many sensitive ecosystems susceptible to the loss of keystone species and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: Extinctions that have already occurred. Most actions will be concerned with preventing further extinctions through management of rare and endangered organisms and habitats under threat in a country. General resilience building could also be achieved through creating more reserves in terrestrial and aquatic habitats.

Indicator scaling: (cut-off values are species per 1000 sq km land area)

1 | 0 | 2 | 0.25 | 3 | 0.5 | 4 | 0.75 | 5 | 1 | 6 | 1.25 | 7

VEGETATION COVER

Percentage of natural and regrowth vegetation cover remaining (include forests, wetlands, prairies, tundra, desert and alpine associations).

Categories	Data sources
Degradation / Resources & services	WRI 2000-2001; FAO State of the World's Forests, 1995, 2000

This indicator focuses on the loss of natural vegetation cover in a country with implied impacts on biodiversity and ecosystem integrity. The loss of natural vegetation has resulted in a loss of biodiversity, and may also have resulted in impacts on ecosystem structure and function through complex ecological interactions. Areas of natural vegetation are viewed as refuges for threatened species, those unknown to science, or those which may act as a future resource (e.g. for biochemical applications). Natural forests and vegetated areas are also likely to be important areas for groundwater intake, soil production, CO2 – oxygen relationships and attenuating air and water pollution. A country's resilience to future hazards will be related to the rate and total loss of naturally vegetated areas. This would be especially important if there are many sensitive ecosystems susceptible to the loss of keystone species and interactions with on-going human impacts.

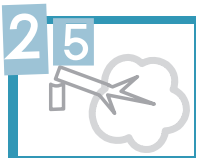
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, UNFCC, World Water Forum, Regional Strategies, National Plans, SOE

Reducing vulnerability: The first action will be to prevent further losses of whatever natural vegetation cover remains in a country. General resilience building could also be achieved through rehabilitation of degraded habitats, allowing areas to regenerate, better land use and creating more reserves in terrestrial habitats.

Indicator scaling: (cut-off values are percent of land area under natural original or regrowth vegetation cover)

1 80 2 20 3 40 4 20 5 10 6 0 7

LOSS OF COVER



Net percentage change in natural vegetation cover over the last five years

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001; FAO State of the World's Forests, 1995, 2000

This measures the rate of loss or gain of natural vegetation cover in countries. It focuses on biodiversity, ecosystem resilience, the capacity of a country to attenuate pollution, prevention of soil loss and on-going soil development, reduction of runoff, recharging of ground waters and soil formation.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, World Water Forum, Regional Strategies, National Plans, SOE

Reducing vulnerability: The first action will be to prevent further losses of whatever natural vegetation cover remains in a country. General resilience building could also be achieved through rehabilitation of degraded habitats, allowing areas to regenerate, better landuse and creating more reserves in terrestrial habitats.

Indicator scaling: (cut-off values are percent net change in forest cover over the last 5 years)

1 >0 2 None 3 None 4 0 5 -1 6 -2 7

HABITAT FRAGMENTATION

Total length of all roads in a country divided by land area.

Categories	Data sources
Damage / Resources & services	World Bank World Development Indicators 2001

This is a proxy measure for pressure on ecosystems resulting from fragmentation into discontinuous pieces. It also relates to habitat disturbance and degradation. Fragmentation is likely to affect biodiversity, affecting species with variability in population numbers, keystones, those susceptible to local extinctions, those that use migration corridors and the persistence of species with large home ranges. For many large mammals and some birds viable fragments of habitat are size-dependent, despite the fact that the overall area available in a country may still sum to a relatively large area. This indicator measures a specific aspect of habitat availability that relates to size and quality of patches. The effects of fragmentation would be particularly important if there are other natural and human stresses operating on susceptible organisms and ecosystems.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: Mechanisms that reduce fragmentation of the land area would include the use of wildlife corridors, and planning to build the road network in ways that maximise uninterrupted space in non-urban areas. General resilience building could also be achieved through improvements in related issues, such as rehabilitation of degraded habitats, allowing deforested areas to regenerate, and creating more reserves in terrestrial habitats.

Indicator scaling: (cut-off values are latest measure of length of all roads in the country (km) / land area (sq km).

1 0.2 2 0.4 3 0.6 4 0.8 5 1.0 6 1.2 7

DEGRADATION

Percent of land area that is either severely or very severely degraded (FAO/AGL Terrastat definitions)

Categories	Data sources
Damage / Resources & services	FAO / AGL Terrastat: Severity of human induced degradation

This indicator captures the status of loss of ecosystems in a country. Degraded land means that which can no longer revert to its natural ecosystem without active and costly rehabilitation by humans to reverse permanent damage, if at all. Types of degradation include water and wind erosion, chemical and physical deterioration, agriculture, deforestation and grazing. These can be associated with salinisation and desertification. This indicator highlights the breakdown of ecosystems which leads to decreasing biodiversity, soil quality, resilience against natural events and the assimilative capacity of the environment.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, World Water Forum, Regional Strategies, National Plans, SOE

Reducing vulnerability: Mechanisms that are degrading the land should be identified and arrested as soon as possible. Programmes for rehabilitation and/or allowing natural regeneration could be put in place. General resilience building could also be achieved through improvements in land use and other related issues, such as creating more reserves in terrestrial habitats.

Indicator scaling: (cut-off values are percent of land area that is severely or very severely degraded FAO/AGL Terrastat definitions - lighter forms of degradation are not included).

1 5 2 10 3 15 4 20 5 25 6 50 7

TERRESTRIAL RESERVES

Percent of terrestrial land area legally set aside as no take reserves

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001

Data refer to area of land especially dedicated to the protection and maintenance of biological diversity, of natural and associated cultural resources, and which are managed through legal or other effective means. This indicator captures the increase in resilience, function of pollution attenuation, groundwater recharge, limits to losses of biodiversity and refuges afforded by the presence of adequate terrestrial reserves (including aquatic ecosystems located within the land area) in a country. The indicator focuses on areas with the most intact terrestrial environments and the level of environmental management. The benefits of areas set aside as terrestrial reserves increase with increasing area, increasing representation of ecosystem types, increasing degree of protection and period of time of protection. Permanent no-take reserves that are representative of major ecosystem types and occupy 20% of the land area would be considered ideal. Reserves would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts in the country. Reserves may be one of the few ways managers could off-set some other environmental damage and build resilience against natural events that can damage the environmental support system.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, World Water Forum, Regional Strategies, National Plans, SOE

Reducing vulnerability: This is one of the few general resilience building indicators. Setting aside reserves of 20% of the land area is probably the most powerful action that could be taken to build resilience against all other pressures on the environment. Terrestrial reserves can be used as water catchment areas.

Indicator scaling: (cut-off values are percent of total land area legally set aside as reserves)

1 20 2 15 3 10 4 5 5 None 6 0 7

MARINE RESERVES

Percentage of continental shelf legally designated as marine protected areas (MPAs).

Categories	Data sources
Hazards / Resources & services	UNEP WCMC 1999 (Using IUCN categories Ia to VI); WRI 2000-2001 (for area of continental shelf)

This indicator captures the increase in resilience, function of pollution attenuation and fisheries production, limits to losses of biodiversity and refuges afforded by the presence of adequate marine reserves in a country. The indicator focuses on areas with the most intact marine environments and the level of environmental management. The benefits of areas set aside as marine and coastal reserves increase with increasing area, increasing representation of ecosystem types, increasing degree of protection and period of time of protection. Permanent no-take reserves that are representative of major ecosystem types and occupy 20% of the shelf area would be considered ideal. Reserves would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts in the country. Reserves may be one of the few ways managers could off-set some other environmental damage and build resilience against natural events that can damage the environmental support system.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: This is one of the few general resilience building indicators. Setting aside reserves of 20% of the marine area is probably the most powerful action that could be taken to build resilience against all other pressures on the environment.

Indicator scaling: (cut-off values are percent of total area of the continental shelf legally set aside as reserves)

1 20 2 15 3 10 4 5 5 None 6 0 7

This indicator is not applicable to land-locked countries.

INTENSIVE FARMING

Annual tonnage of intensively farmed animal products (includes aquaculture, pigs, poultry) produced over the last five years per square kilometre land area.

Categories	Data sources
Hazards / Resources & services	FAO 1996-2000

This indicator captures the risk of pollution, eutrophication, ecosystem loss or damage and the risk of diseases and plagues. It focuses on lands being used for intensive agriculture, which we define as those in which the wastes produced over the land are in excess of the ability of that same land area to attenuate them. Intensive farming includes the farming of poultry, pigs, aquaculture, and some farming of cattle and other animals where kept in feed lots. Intensive farming usually involves clearing of land, feeding, heavy use of pesticides and other medications and a concentrated production of wastes. It concentrates the environmental requirements of farmed animals into a small area, and wastes often find their way into the surrounding water table, waterways and land areas. Countries with a large production through intensive farming methods are also considered more at risk of inadvertent introductions of diseases, species and genetically modified organisms. The effects of intensive farming would be especially important if there are many endangered species, sensitive ecosystems that could be affected by key species, and interactions with on-going human impacts.

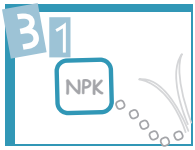
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, UNFCC, Regional Strategies, National Plans, SOE

Reducing vulnerability: The main risks of intensive agriculture and aquaculture relate to use of medicines, pesticides and other chemicals and production of concentrated wastes. Mechanisms for reducing their use and/or impacts on the environment through better husbandry and treatment of wastes would reduce risks associated with this issue.

Indicator scaling: (cut-off values are tonnes / sq km of land area)

1 6.4 2 19.1 3 53.6 4 147.4 5 402.4 6 1095.6 7

FERTILISERS



Average annual intensity of fertiliser use over the total land area over the last 5 years.

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001; OECD 1999

This indicator captures the risk to terrestrial, aquatic ecosystems and ground waters from the use of chemical NPK fertilisers. This indicator is a measure of damage to ecosystems, water and soil quality, coral reefs and other sensitive organisms through eutrophication, pollution, soil damage and salinisation. The effects of using NPK fertilisers depends on the intensity of application and time and space needed for natural attenuation. The effects of releasing large amounts of fertilisers into the environment would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

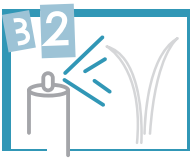
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, Regional Strategies, National Plans, SOE

Reducing vulnerability: Systems of agriculture that do not require large applications of NPK fertilisers should be explored, this might include mechanisms for recycling organic wastes. General resilience building would be through reducing other pressures on the receiving environments that could interact with large inputs of fertilisers.

Indicator scaling: (cut-off values are kg/yr/km2 of land area)

1 6.4 2 53.6 3 402.4 4 1095 5 2980 6 8102 7

PESTICIDES



Average annual pesticides used as kg/km2/year over total land area over last 5 years.

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001; OECD 1999

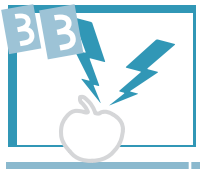
This indicator captures the risk to terrestrial, aquatic ecosystems and ground waters from heavy use of pesticides. The indicator focuses on damage and pollution of ecosystems, soil damage, damage to reproductive systems of organisms, loss of species, and damage to aquatic organisms including fisheries and coral reefs. Pesticides need time and a suitable area of land or volume of water for their attenuation. High loads of mobile pesticides present risks to all aspects of the environment. The effects of introducing pesticides into the environment where they can accumulate would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: Systems of agriculture that do not require large applications of pesticides should be explored, e.g. using integrated pest management. General resilience building would be through reducing other pressures on the receiving environments that could interact with large inputs of pesticides.

Indicator scaling: (cut-off values are kg/yr/km2 of land area)

1 0 2 0.7 3 1.7 4 6.4 5 19.1 6 53.6 7



Cumulative number of deliberate field trials of genetically modified organisms conducted in the country since 1986.

Categories	Data sources
Hazards / Resources & services	OECD Sept 2000 database; ISAAA International Services for the acquisition of agribiotech applications, 1997, 2002; BINAS; BIOTECH 1991-1999; Information Systems for Biotechnology (ISB), 2002.

This indicator captures the risk to genetic diversity, genetic pollution and unpredictable ecosystem effects of introducing incompletely tested and/or unpredictable bioengineered organisms into the environment. This includes new toxin-producing organisms, terminators (the use of deliberately sterile organisms is often used as a biological control method for pests) or organisms with new ecological behaviours. This indicator operates under the precautionary principle. The effects of releasing organisms developed under laboratory conditions into the environment are unknown until they are tested in the environment. We have used data on deliberate field trials of GMOs for this indicator. It is likely that the risks of GMOs are less dependent on the area used, and more dependent on the different types of GMOs being either tested or grown. That is, we see risk increasing more with exposure to increasing numbers of GMOs, rather than the number of instances of any one type because of the capacity to spread once a gene 'escapes'. Although operating at the genetic rather than species level, we see some of the risks of GMOs to ecosystems as being similar to those associated with introduced species.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, RAMSAR, Regional Strategies, National Plans, SOE

Reducing vulnerability: Deliberate introductions of organisms that may have unpredictable interactions with the environment should not be undertaken. Any single organism may have far-reaching effects that could not be reversed, in the same way that species introductions have in the past. Laboratory tests are not the same as field tests and cannot predict outcomes in the environment. Each GMO introduced into the environment carries a similar risk to an introduced species.

Indicator scaling: (cut-off values are cumulative number of deliberate field trials)

1 0 2 None 3 None 4 None 5 20 6 50 7

PRODUCTIVITY OVERFISHING

Average ratio of productivity : fisheries catch over the last 5 years

Categories	Data sources
Hazards / Resources & services	FAO 1993-1998 (fisheries); University of British Columbia (productivity)

This indicator captures the risk of damage to fisheries stocks by examining rates of extraction in relation to the potential for the environment to replenish those stocks (productivity). We term this "productivity overfishing" or fishing beyond the capacity of the environment to replenish stocks through primary production and biomass transfer. If the catch is high and productivity low, there is a higher risk that overall fisheries stocks can be depleted (all other factors being equal) than if the converse were the case. This indicator should be read in combination with Indicator 39 which focuses on catch per human effort. The effects of ecological overfishing would be especially important if there are interactions with other on-going human and natural impacts. A small P:C ratio means greater vulnerability of fisheries.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, Regional Strategies (e.g. Fisheries Agreements), National Plans, SOE

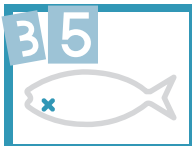
Reducing vulnerability: Fisheries policy that keeps catches within overall sustainable limits of the country's productivity. General resilience can be built by creating marine reserves.

Indicator scaling: (cut-off values are tonnes carbon/km2 EEZ/yr : tonnes fisheries/km2 shelf / yr)

1 3.2M 2 1.2M 3 442K 4 163K 5 60K 6 22K 7

M=millions; K=thousands

FISHING EFFORT



Average annual number of fishers per kilometre of coastline over the last 5 years

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001

This indicator captures the risk of damage to fisheries stocks through overcapacity of human effort. In this indicator we have tried to capture all fishers, not just the commercial fleet. Countries with large densities of fishers working their coastlines, including freshwater coasts such as lakes, are more likely to overfish their resources than those with lower densities. This indicator should be read in combination with Indicator 24, which focuses on ecological overfishing. The effects of overfishing would be especially important if there are interactions with other on-going human and natural impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CBD, Regional Strategies (e.g. Fisheries Agreements), National Plans, SOE

Reducing vulnerability: Fisheries policy that keeps catches within overall sustainable limits of the country's productivity. General resilience can be built by creating marine reserves.

Indicator scaling: (cut-off values are average number of fishers / km coastline)

1 6.4 2 11.2 3 19.1 4 32.1 5 53.6 6 89.0 7

RENEWABLE WATER

Average annual water usage as percentage of renewable water resources over the last 5 years

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001

This indicator captures the risk to terrestrial environments, aquatic ecosystems and ground waters from over-extraction of freshwater resources. It focuses on sustainable use of surface free water and groundwater and damage through salinisation, extraction of functionally non-renewable groundwater, and damage to rivers, lakes and other habitats. Renewable water is that which is caught in rain tanks and reservoirs, or collected from streams, rivers, lakes, ice or groundwater sources that are not being diminished or salinised as a result of the extraction. The effects of over-extraction would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, CCD, World Water Forum, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure extractions of water from the environment are within sustainable limits. Water usage should be from renewable sources and should not use all of the available renewable water so that other elements of the environment can function. General resilience can be built by managing watersheds, wetlands, groundwater and forests which are important elements of how ecosystems interact with the hydrological cycle.

Indicator scaling: (cut-off values are water usage as a percent of available renewable resources)

1 10 2 20 3 40 4 60 5 80 6 100 7

SULPHUR DIOXIDE EMISSIONS

Average annual SO2 emissions over the last 5 years

Categories	Data sources
Hazards / Resources & services	GEO-3 Data Compendium 2002; OECD 1999; WRI 2000-2001; HDR 1999; WDI 2001

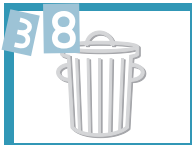
This indicator captures the risk to ecosystem health from air pollution, including its downstream effects. High rates of emissions of gases from industry present risks to all aspects of the environment through diffuse pathways, including deposition by rain. The effects of air pollution (of which SO2 is only one indicator and only one of the gases of concern) into the environment and beyond its capacity to attenuate them would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, UNFCC, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure managed emissions or clean industry should be examined and implemented. General resilience can be built by maintaining and restoring wetlands, forests and other ecosystems that encourage biodegradation of industrial wastes.

Indicator scaling: (cut-off values are tonnes/km2/year)

1 0.28 2 0.65 3 1.12 4 1.72 5 3.48 6 6.39 7



Average annual net amount of generated and imported toxic, hazardous and municipal wastes per square kilometre land area over the last 5 years

Categories	Data sources
Hazards / Resources & services	EEA 2001 European Environment Agency; UNEP 1998; USA EPA; MZPSR Ministry of Environment of Slovak Republic 2000

This indicator captures the risk to terrestrial, aquatic ecosystems and ground waters from toxic and municipal wastes. All such wastes need a suitable area of land or volume of water for their eventual attenuation. High waste loads present risks to all aspects of the environment. The effects of dumping large amounts of wastes into the environment and beyond its capacity to attenuate them would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Basel Convention, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure wastes are minimised and used efficiently through recycling. Waste importation should be reduced or stopped. General resilience can be built by maintaining and restoring forests and other ecosystems that encourage biodegradation of wastes.

Indicator scaling: (cut-off values are tonnes/km2/year)

1 | 1.7 | 2 | 6.4 | 3 | 19.1 | 4 | 53.6 | 5 | 147.4 | 6 | 402.4 | 7

WASTE TREATMENT

Mean annual percent of hazardous, toxic and municipal waste effectively managed and treated over the past 5 years.

Categories	Data sources
Hazards / Resources & services	Data are not generally available

This indicator captures the proportion of wastes rendered less harmful. Vulnerability is in relation to risk to terrestrial, aquatic ecosystems and ground waters from toxic and municipal wastes and how they are treated. All wastes need a suitable area of land or volume of water for their eventual attenuation, but treatment and recycling are effective means of reducing the overall waste load in a country. High waste loads present risks to all aspects of the environment. The effects of dumping large amounts of wastes into the environment and beyond its capacity to attenuate them would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

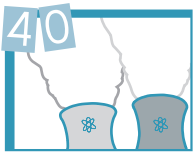
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Basel Convention, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure wastes are minimised and used efficiently through recycling. Waste importation should be reduced or stopped. General resilience can be built by maintaining and restoring forests and other ecosystems that encourage biodegradation of wastes.

Indicator scaling: (cut-off values are percent of waste treated)

1 100 2 80 3 60 4 50 5 40 6 30 7

INDUSTRY



Average annual use of electricity for industry over the last 5 years per square kilometre of land

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001

This indicator captures all major potential chemical and other industrial polluters that could cause significant environmental damage from accidents and diffuse pollution, including acid rain, not normally recorded as part of waste streams. It also captures electricity generation and/or use specifically for purposes of industry, which in itself has ecological consequences. This indicator is used to take into account accidents such as the Bhopal chemical explosion in India, as well as incidents such as the Chernobyl and more recently the Japanese nuclear disaster. The effects of industrial accidents and diffuse pollution would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Basel Convention, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure clean industry with rapid and effective response to accidents, waste minimisation and recycling. General resilience can be built by maintaining and restoring forests and other ecosystems that encourage biodegradation of wastes.

Indicator scaling: (cut-off values are toe/km2/year)

1 5 2 10 3 20 4 50 5 100 6 200 7

toe=tonnes of oil equivalent

SPILLS

Total number of spills of oil and hazardous substances greater than 1000 litres on land, in rivers or within territorial waters per million km maritime coast during the last five years

Categories	Data sources
Hazards / Resources & services	ITOPF 2002 International Tanker Owners Federation; SPILLS 2000; CRED 2000; OFDA/CRED International disaster database

This indicator captures the risk to marine, estuarine, riverine, lake, ground water and terrestrial ecosystems from spills of hydrocarbons and other toxic fluids. Only spills greater than 1,000 litres are included. The effects of spills of toxic chemicals are of special significance for endangered species, sensitive ecosystems, and interactions with on-going human impacts.

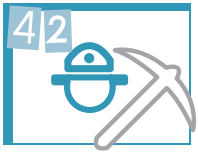
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Basel Convention, MARPOL, GPA, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that promote safe handing of hazardous substances and ensure rapid and effective response to accidental spills. General resilience can be built by maintaining and restoring coasts, wetlands and forests as well as other ecosystems that encourage biodegradation of wastes.

Indicator scaling: (cut-off values are number of spills/million km)

1 0 2 50 3 100 4 150 5 200 6 250 7

MINING



Average annual mining production (include all surface and subsurface mining and quarrying) per km2 of land area over the past 5 years.

Categories	Data sources
Hazards / Resources & services	USGS 1996-2000; World Nuclear Association 2003; Diamond Registry 2002; Salt Institute 2002

This indicator captures the risk to terrestrial, aquatic ecosystems and ground waters from the effects of ecosystem disturbance, accidents, oil spills and toxic leachates, and processing from mining of all kinds. All disturbance can lead to vulnerability to other processes, human and natural, and wastes need a suitable area of land or volume of water for their eventual attenuation or long term deposition. High levels of mining activity present risks to all aspects of the environment. The effects of mining would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Basel Convention, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure whole life management of mines, including waste minimisation, stablisation and rehabilitation. Waste importation through bringing of ores should be minimised. General resilience can be built by maintaining and restoring forests and other ecosystems that encourage biodegradation of wastes.

Indicator scaling: (cut-off values are tonnes/km2/year)

1 | 1.7 | 2 | 6.4 | 3 | 19.1 | 4 | 53.6 | 5 | 147.4 | 6 | 402.4 | 7

SANITATION

Density of population without access to safe sanitation (WHO definitions)

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001

'Safe sanitation' is normally an issue seen from a human perspective. It deals with hygiene, disease control and direct quality of life for humans. We are using this information for the EVI from and environmental perspective. This indicator is a proxy measure for how human waste is treated before it enters the environment. We are taking safe sanitation as an indication of at least some pre-treatment of sewage before it enters stream, groundwater recharge, coastal and land areas. If sanitation is of a low standard, ecosystems downstream have a higher risk of being polluted with sewage that has not been broken down and which will contain high levels of urea, ammonia, nitrites, pharmaceuticals and pathogens. The WHO definition of safe sanitation used here is the percentage of the human population with sewage disposal facilities that can effectively prevent human, animal, and insect contact. This includes connections to public sewers, household systems such as pit and pour-flush latrines, septic tanks, communal toilets, and other such facilities.

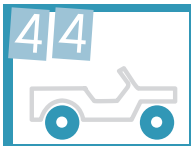
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, MDG, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that ensure human wastes are treated to secondary or higher levels before being released to the environment. Human wastes may not need such high levels of treatment if they can be disposed of into receiving environments that are large enough to attenuate them without damage (e.g. small island states with large ocean areas may be able to dispose of sewage into the ocean is dilution and attenuation can occur without significant damage to the environment). General resilience can be built by maintaining and restoring forests and other ecosystems that encourage biodegradation of wastes.

Indicator scaling: (cut-off values are human population without safe sanitation /km2)

1 3.5 2 6.4 3 11.2 4 19.1 5 32.1 6 53.6 7

VEHICLES



Number of vehicles per square kilometre of land area (most recent data)

Categories	Data sources
Hazards / Resources & services	WRI 2000-2001, OECD 1999

This indicator captures the risk to terrestrial ecosystems in the form of habitat damage, habitat fragmentation, loss of biodiversity, pollution hazardous wastes and industries, including air and lead pollution on land and in waterways. Of particular concern is fragmentation of the countryside which can interfere with normal movements and/or migration of terrestrial mammals. The definition of vehicles used here is from the World Bank. The effects would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

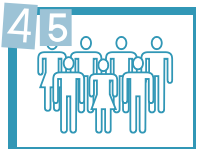
Policy / reporting relevance: e.g. BPoA, WSSD, CSD, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that promote public and clean transport options and good waste management, including efficient use of wastes through recycling. General resilience can be built by maintaining and restoring forests and creating reserves.

Indicator scaling: (cut-off values are vehicles/km2)

1 1.7 2 3.5 3 6.4 4 11.2 5 19.1 6 32.1 7

POPULATION



Total human population density (number per km2 land area)

Categories	Data sources
Damage / Human populations	WRI 2000-2001; CIA Fact sheets 2001

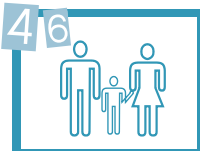
This is a proxy measure for pressure on the environment resulting from the number of humans being supported per unit of land. The greater numbers of people increases pressure on the environment for resources, for the attenuation of wastes and physical disturbance of the environment.

Policy / reporting relevance: e.g. BPoA, WSSD, MDG, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that keep human population pressures within sustainable limits. This includes lifestyle choices and minimising the ecological footprint and levels of consumption. General resilience can be built by maintaining and restoring damaged ecosystems, minimising wastes and creating terrestrial and aquatic reserves.

Indicator scaling: (cut-off values are people/km2)

1 19.1 2 32.1 3 53.6 4 89.0 5 147.4 6 243.7 7



Annual human population growth rate over the last 5 years

Categories	Data sources
Hazards / Human populations	WRI 2000-2001; U.S. Bureau of Census International Data Base

This indicator focuses on the potential for damage relating to expanding human populations. It signals increasing rates of habitat damage, exploitation of natural resources and disposal of wastes that will need to be assimilated into the environment. It also captures the risk of infrastructure not being able to keep up with demand for issues such as waste treatment.

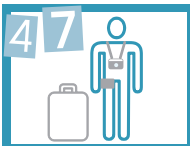
Policy / reporting relevance: e.g. BPoA, WSSD, MDG, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that keep human population pressures within sustainable limits. This includes lifestyle choices and minimising the ecological footprint and levels of consumption. General resilience can be built by maintaining and restoring damaged ecosystems, minimising wastes and creating terrestrial and aquatic reserves.

Indicator scaling: (cut-off values are average yearly % change in population)

1 <0 2 0 3 0.5 4 1 5 1.5 6 2 7

TOURISTS



Average annual number of international tourists per km2 land over the past 5 years.

Categories	Data sources
Hazards / Human populations	WTO

The correct form of this indicator when data become generally available: Average annual number of international tourist-days per km2 of land over the last five years.

This is a measure for the additional load of all human impacts associated with international visitors and not reported in human population statistics. Tourists place additional pressure on the environment through increasing demands on local resources and through creation of pollution as well as physical disturbances of the environment. It is possible that their environmental burden is greater than that of residents.

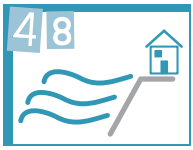
Policy / reporting relevance: e.g. BPoA, WSSD, MDG, Regional Strategies, National Plans, SOE

Reducing vulnerability: Options for ecotourism could be examined. Policies that ensure that capital damage to the environment and wastes are minimised. General resilience can be built by maintaining and restoring forests and other ecosystems and creating terrestrial and aquatic reserves.

Indicator scaling: (cut-off values are knots of excess wind annually)

1 19.1 2 32.1 3 53.6 4 89.0 5 147.4 6 243.7 7

COASTAL SETTLEMENTS



Density of people living in coastal settlements (i.e. with a city centre within 100km of any maritime or lake* coast).

(* To be included, lakes must have an area of at least 100 sq km)

Categories	Data sources
Damage / Human populations	WRI 2000-2001; CIA Fact sheets 2001

This indicator captures the focus of stress on coastal ecosystems, often the most productive living areas in a country, through pollution, eutrophication, resource depletion and habitat degradation. The adjacent water areas are capable of spreading pollution widely in aquatic habitats and will not tend to allow for attenuation over upland areas. Countries with heavy densities of human populations living on their coastal areas are likely to be damaging some of their most productive and diverse areas and negatively affecting the resilience of the country to natural disasters such as cyclones, tsunamis etc.

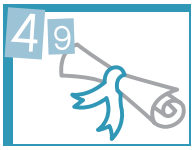
Policy / reporting relevance: e.g. BPoA, WSSD, MDG, UNFCC, Regional Strategies, National Plans, SOE

Reducing vulnerability: Policies that manage ecosystems and their use at the interface between land and sea, lakes or rivers. Emphasis should be on fragile habitats such as swamps, mangroves, estuaries, lakes. General resilience can be built by maintaining and restoring damaged ecosystems and creating reserves.

Indicator scaling: (cut-off values are people/km2 coastal land)

1 19.1 2 32.1 3 53.6 4 89.0 5 147.4 6 243.7 7

ENVIRONMENTAL AGREEMENTS



Number of environmental treaties in force in a country.

Categories	Data sources
Hazards / Human populations	SEDAC / CIESIN 2003

This indicator captures the level of management and stewardship of the environment in a country. Two aspects of legislation are needed: the message to the public that environmental management is essential, and the effectiveness of controls. The benefits of good management would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.

Policy / reporting relevance: None

Reducing vulnerability: Becoming party to agreements that help the country to address its most significant issues as identified by the EVI. Use assistance in the form of information, technology, and others to formulate and implement national-level actions to address environmental concerns.

Indicator scaling: (cut-off values are number of treaties in force)

1 60 2 50 3 40 4 30 5 20 6 10 7

CONFLICTS

Average number of conflict years per decade within the country over the past 50 years.

Categories	Data sources
Hazards / Human populations	EM-DAT: The OFDA/CRED International Disaster Database

This indicator captures the risk to terrestrial, aquatic ecosystems and ground waters related to human conflicts. Conflicts can result in habitat disturbance and degradation, pollution and a complete breakdown in environmental management. The direct effects include degradation through bombing, land mines, and chemicals left in the environment, temporary camps and vehicle disturbances, and damage caused by displaced people who need to support themselves under emergency conditions. This is also a proxy for the lack of environmental management during those years. The effects of civil unrest would be especially important if they were on-going, repeated, or occurring as separate events in more than one part of a country. Effects would be amplified if there are many endangered species, sensitive ecosystems, and interactions with other on-going human impacts. The time frame used reflects the long term nature of conflict-related damage to the environmental support system.

Policy / reporting relevance: e.g. BPoA, CSD, WSSD, CCD, CBD

Reducing vulnerability: Policies that reduce and clean up pollution and war-related hazards, rehabilitate damaged areas and ensure people in affected areas are given relief so that they do not need to make inefficient emergency use of resources and services.

Indicator scaling: (cut-off values are knots of excess wind annually)

1 0 2 None 3 None 4 None 5 2 6 5 7

ACRONYMS

AGL	FAO Land and Water Development Division
BINAS	Biosafety Information Network and Advisory Service
BPoA	Barbados Programme of Action
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CIA	US Central Intelligence Agency Fact Book
CIESIN	Centre for International Earth Science Information Network
CO2	Carbon dioxide
CRED	Centre for Research on Epidemiology of Disasters
CSD	UN Commission on Sustainable Development
EEZ	Exclusive Economic Zone
EMDAT	Emergency Events Database (CRED, OFDA, OECD, WHO)
ENSO	El Nino / Southern Oscillation
EVI	Environmental Vulnerability Index and Profiles
FAO	UN Food & Agricultural Organisation
GEO3	Global Environment Outlook 3
GHCN	NOAA Global Historical Climatology Network
GMO	Genetically-Modified Organism
GOOS	Global Oceans Observing System
GPA	UN Global Programme of Action on Land Based Sources of Pollution in the marine Environment
GROMS	Global Register of Migratory Species
ISAAA	International Service for the Acquisition of Agri-Biotech Applications
ISDR	International Strategy for Disaster Reduction
ITOPF	International Tanker-Owners Pollution Federation Ltd
IUCN	World Conservation Union
MARPOL	International Convention for the Prevention of Pollution from Ships
MDG	Millennium Development Goals
MHWS	Mean High Water Spring (tides)
NESDIS	NOAA National Environmental Satellite Data and Information Service
NOAA	US National Oceanic & Atmospheric Administration
NPK	Nitrogen, Phosphate, Potassium
OECD	Organisation for Economic Cooperation & Development
RAMSAR	Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat
SEDAC	Social Economic Data Applications Centre
SIDS	Small Island Developing States
SIS	Small Island States

SO2	Sulphur dioxide
SOE	State of the Environment
SOPAC	South Pacific Applied Geoscience Commission
SPILLS	Worldwide Tanker Spill Database (etcentre.org)
SST	Sea Surface Temperature
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	UN Framework Convention on Climate Change
USGS	US Geological Survey
VEI	Volcanic Explosivity Index (see definitions)
WCMC	World Conservation Monitoring Centre
WDI	World Development Indicators
WHO	UN World Health Organisation
WMO	World Meteorological Organisation
WRI	World Resources Institute
WSSD	World Summit on Sustainable Development
WTO	World Tourism Organisation

INDICATOR DEFINITIONS

Wind Speed refers to the rate at which air is moving horizontally past a given point. It may be a 2-minute average speed (reported as wind speed) or an instantaneous speed (reported as a peak wind speed, wind gust, or squall).
http://weather.gov/glossary/index.php?word=wind+speed

Rainfall refers to the amount of precipitation of any type, primarily liquid. It is usually the amount that is measured by a rain gauge.
http://weather.gov/glossary/index.php?word=rainfall

Maximum Temperature: The highest temperature recorded during a specified period of time. Common time periods include 6, 12 and 24 hours. The measure used here refers to the daily maximum temperature, or "high." http://weather.gov/glossary/index.php?word=temperature Values used in the EVI are referenced against 30-year means of daily maxima calculated separately for different months and climate stations.

Minimum Temperature: This is the lowest temperature recorded during a specified period of time. The time period can be 6, 12 or 24 hours. The measure used here refers to the daily minimum temperature, or "low."
http://weather.gov/glossary/index.php?word=temperature Values used in the EVI are referenced against 30-year means of daily maxima calculated separately for different months and climate stations.

Sea Surface Temperatures: The term refers to the mean temperature of the ocean in the upper few meters. http://weather.gov/glossary/index.php?word=temperature

The Volcanic Explosivity Index or VEI - is based on a number of things that can be observed during an eruption. VEI scores can vary between 0 and 8, with VEI=0 being non-explosive small volcanoes, and VEI=8 being large and very destructive. http://volcano.und.nodak.edu/vwdocs/eruption_scale.html

ML = Local ("Richter") Magnitude ML = log A - log Ao defined by Richter (1935) where A is the maximum trace amplitude in mm recorded on a standard short-period seismometer and log Ao is a standard value as a function of distance where distance 600 km. http://wwwneic.cr.usgs.gov/neis/phase_data/mag_formulas.html

A tsunami is a series of waves generated by an impulsive disturbance in the ocean or in a small, connected body of water. http://www.ngdc.noaa.gov/seg/hazard/tsu.html Mean High Water Springs (MHWS): the average height of the high waters of spring tides. Also called spring high water. (IHO Dictionary, S-32, 5th Edition, 3144) (http://www.caris.com/S-57/attribut/def/d-verdat.htm). Coast: The place where the waters of the seas meet the land. (http://icm.noaa.gov/story/icm_coast.html)

Slide: Disaster type term used in EM-DAT comprising the two disaster subsets - avalanche and landslide (http://www.em-dat.net/glossary.htm). Avalanche: Rapid and sudden sliding and flowage of masses of usually unsorted mixtures of snow/ice/rock material (http://www.em-dat.net/glossary.htm). Landslide: In general, all varieties of slope movement, under the influence of gravity. More strictly refers to down-slope movement of rock and/or earth masses along one or several slide surfaces. (http://www.em-dat.net/glossary.htm)

Land Area: Is the aggregate of all surfaces delimited by international boundaries and/or coastlines, excluding inland water bodies (lakes, reservoirs, rivers) (http://www.cia.gov/cia/publications/factbook/docs/notesanddefs.html)

Land Boundary: This entry contains the total length of all land boundaries and the individual lengths for each of the contiguous border countries. (http://www.cia.gov/cia/publications/factbook/docs/notesanddefs.html)

Continent - land mass: any one of the seven large continuous land masses that constitute most of the dry land on the surface of the earth. They are Africa, Antarctica, Asia, Australia, Europe, North America, and South America. (Microsoft® Encarta® Premium Suite 2003. ©).
Space extended upward; height; the perpendicular elevation of an object above sea level. Values may be negative (below sea level) or positive. The difference between the highest and lowest points in a country is relief.

Lowland: low-lying or flat land: land that is less than or equal to a certain height above sea level. This indicator refers to heights of 10 and 50m above sea level

Border: line dividing two areas: the line that officially separates two countries or regions. For the EVI this definition includes land and sea borders, where sea borders are defined as the line between two or more EEZs (200 nautical mile exclusive economic zones).

Ecosystem imbalance refers to the loss of or damage to any of the elements of ecosystems that are required for proper function. Elements may include species, changes in biomass or trophic relationships, productivity, reproduction or other aspects. This indicator shows a positive or negative change in trophic level calculated by weighting each trophic level present in the national fish catch by the tonnes reported. This indicator includes only those species with a trophic level of 3.35 or below. This constitutes a trophic slice, intended to exclude large pelagic fisheries usually caught offshore. A positive (+) change indicates an increase in trophic level present in the catch, which would be consistent with an increase in the larger fish-eating fishes. This is usually associated with an expansion of the fishery and a move to greater use of large pelagic species. A negative (-) change is usually associated with loss of fishes in the higher trophic levels and indicates fishing down of the food web, ecosystem damage and overfishing.

Freight Imports refer to imports of goods and services represented by the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude labor and property income (formerly called factor services) as well as transfer payments. Data are in million current US dollars. (http://earthtrends.wri.org/searchable_db/index.cfm?theme=5)

The entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. (http://www.biologie.uni-freiburg.de/data/zoology/riede/groms/Getting_started/) (Convention on the conservation of Migratory Species of Wild Animals)

Endemic species : A species which is found in a given region or location and nowhere else in the world.

Introduced species: Means the movement, by human agency, of a species, subspecies, or lower taxon (including any part, gametes or propagule that might survive and subsequently reproduce) outside its natural range (past or present). This movement can be either within a country or between countries. http://iucn.org/themes/ssc/pubs/policy/invasivesEng.htm

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild. (IUCN, 2001- http://www.iucn.org/themes/ssc/red-lists.htm)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form. (IUCN, 2001- http://www.iucn.org/themes/ssc/red-lists.htm)

Natural Forest: A forest composed of indigenous trees, and not classified as forest plantation. http://www.fao.org/docrep/003/y0900e/y0900e11.htm. Data from WRI (WRI 2000-2001) refer to original forest cover about 8,000 years ago assuming current climatic conditions. The definition of regrowth forest is one in which regrowth is unsupported by human (other than in allowing natural regeneration) and results in a forest community that is self-sustaining indefinitely (not withstanding climatic changes).

Total forest area, average annual percent change, as defined by the Food and Agriculture Organization of the United Nations, is the average annual percent change in both natural forests and plantations between 1990 and 2000. Total Forest is defined as land with tree crown cover of more than 10 percent of the ground and area of more than 0.5 hectares. Tree height at maturity should exceed 5 meters. (http://earthtrends.wri.org/)

Fragmentation refers to the division of habitats or ecosystems into discontinuous pieces. It also relates to habitat disturbance and degradation. Fragmentation is likely to affect biodiversity, affecting species with variability in population numbers, keystones, those susceptible to local extinctions, those that use migration corridors and the persistence of species with large home ranges. For many large mammals and some birds, viable fragments of habitat are size-dependent, despite the fact that the overall area available in a country may still sum to a relatively large area. This indicator measures a specific aspect of habitat availability that relates to size and quality of patches.

The degrees of degradation are defined in terms of reduction in land productivity. In abbreviated form, these definitions are as follows: (i) Light: somewhat reduced agricultural suitability. (ii) Moderate: greatly reduced agricultural productivity. (iii) Strong: biotic functions largely destroyed; non-reclaimable at farm level. (iv) Extreme: biotic functions fully destroyed, non-reclaimable. The severity of land degradation is then obtained by combining the degree of degradation with its spatial extent. With four classes for degree, and five for extent, twenty combinations are possible. These were grouped into four degradation severity classes: light, moderate, severe, and very severe (Figure 13). A very severely degraded area can mean, for example, either that extreme degradation affects 10-25% of a mapping unit, or that moderate degradation affects 50-100% of the unit. FAO Terrastat http://www.fao.org/ag/agl/agll/terrastat/

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural associated cultural resources, and managed through legal or other effective means. (IUCN World Commission on Protected Areas, 1994).

Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment. (http://www.mpa.gov/mpadescriptive/whatis.html) (IUCN, 1988; Kelleher, 1999).

Farming characterised by high input use and that strives for maximum production. http://glossary.eea.eu.int/EEAGlossary/I/intensive_farming. For the EVI we define intensive farming as any farming that either uses inputs or produces pollution that cannot be obtained or attenuated over the land or water area over which the farming occurs.

Fertiliser use refers to nutrients in terms of nitrogen (N), potash (K2O), and phosphate (P2O5). Food and Agriculture Organization of the United Nations (FAO). 2004. FAOSTAT on-line statistical service. http://apps.fao.org.

Refers to the per hectare use / sale to the agricultural sector of substances that reduce or eliminate unwanted plants or animals, especially insects. They include major groups of pesticides such as insecticides, mineral oils, herbicides, plant growth regulators, bacteria and seed treatments, and other active ingredients (WRI 2000-2001). See also Food and Agriculture Organization of the United Nations (FAO). 2004. FAOSTAT http://apps.fao.org.

Genetic modification is a process whereby a gene for a desired trait or characteristic is inserted into a plant instead of acquiring it through the natural process of pollination. The inserted gene may come from another unrelated plant or from a different species. (http://www.searca.org/~bic/FAQs/FA_Questions.htm) (Bi Tech Information Center). Genetically modified organism - an organism whose genetic make-up has been changed by any method, including natural processes, genetic engineering, cloning or mutagenesis. http://www.nature.ca/genome/02/022_efg_e.cfm

Overfishing refers to the taking out of the sea more than natural population growth can sustain. Overfishing has a number of causes, including 'chronic over capacity' of modern fishing fleets to effectively take far more fish than can be replaced. (http://glossary.eea.eu.int/EEAGlossary/O/overfishing). See also (http://www.seafoodchoices.com/resources/glossary.shtml)

Fishers include people employed in commercial and subsistence fishing (both, personnel on fishing vessels and on shore), operating in freshwater, brackish and marine areas, and in aquaculture production activities. "Fishery vessel" refers to "mobile floating objects of any kind and size, operating in freshwater, brackish and marine areas, and used for catching, harvesting, searching, transporting, landing, preserving and/or processing fish, shellfish and other aquatic animals, residues and plants." Food and Agriculture Organization of the United Nations (FAO). Fishers http://www.fao.org/fi/statist/fisoft/fishers.asp

Average annual water usage as percentage of renewable water resources over the last 5 years. (i) Internal renewable water resources (IRWR) include the average annual flow of rivers and the recharge of groundwater (aquifers) generated from endogenous precipitation (occurring within a country's borders). IRWR are measured in km3/year. Data may have been collected in different years for different countries. (ii) Total internal renewable water resources is the sum of surface and groundwater resources minus overlap; in other words IRWR = Surface water resources + Groundwater recharge – Overlap. Natural incoming flow, originating outside a country's borders are not included in the total. (iii) Annual water withdrawals, measured in million m3 refers to total water removed for human uses in a single year, not counting evaporative losses from storage basins. Water withdrawals also include water from non-renewable groundwater sources, river flows from other countries, and desalination plants http://earthtrends.wri.org. (iv) Actual Renewable Water Resources gives the maximum theoretical amount of water actually available for each country, although in reality a portion of this water may be inaccessible to humans. Actual renewable water resources are defined as the sum of internal renewable resources (IRWR) and external renewable resources (ERWR), taking into consideration the quantity of flow reserved to upstream and downstream countries through formal or informal agreements or treaties and possible reduction of external flow due to upstream water abstraction. Average annual groundwater recharge is the amount of water that is estimated to annually infiltrate soils, including water from rivers and streams that lose it to underlying strata. In general, this figure would represent the maximum amount of water that could be withdrawn annually without ultimately depleting the groundwater resource. Annual Total Water Withdrawals is the gross amount of water extracted from any source, either permanently or temporarily, for a given use. It can be either diverted towards distribution networks or directly used. It includes consumptive use, conveyance losses, and return flow.

Sulphur dioxide: Is an air pollutant produced when fossil fuels containing sulphur are burned. It contributes to acid rain and can damage human health, particularly that of the young and elderly. (World Development Indicators, 2001).

Waste refer here to materials that are not prime products (i.e. products produced for the market) for which the generator has no further use for production, transformation or consumption, and which he discards, or intends, or is required to discard. Wastes may be generated during the extraction of raw materials during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. (http://waste.eionet.eu.int/definitions/waste) (European Environment Agency).

Effectively managed wastes are composted, reused, recycled, subjected to controlled incineration (including temperature control, retention time control and control of emissions), and/or placed in controlled landfill (involving treatment of leachate, containment, gas management, aftercare and rehabilitation i.e. recovery, planting and post management) Eurostat http://www.waste.eionet.eu.int

The industry sector is defined as the combination of all industrial sub-sectors, such as mining and quarrying, iron and steel, construction, etc. Energy used for transport by industry is not included here but is reported under transportation. Energy Consumption by Source refers to the total amount of primary energy consumed by each country in the year specified, and is reported in thousands of metric tons of oil equivalent (toe). Primary energy also includes losses from transportation, friction, heat loss, and other inefficiencies. Specifically, consumption equals indigenous production plus imports, minus exports plus stock changes, minus international marine bunkers. IEA calls this value Total Primary Energy Supply (TPES). (http://pdf.wri.org/wr2002fulltxt_230-283_datatables.pdf). toe = tonnes oil equivalent (includes energy from solid fuels, liquid fuels, gaseous fules, nuclear fuels, other sources).

Total number of spills of oil and hazardous substances greater than 1000 litres on land, in rivers or within territorial waters per million km maritime coast during the last five years. (i) ITOPF 2002 International Tanker Owners Federation - Refers to oil spills at sea only. (ii) SPILLS 2000 www.etcentre.org/spills . The source of the spill must be a vessel, generally a tanker or barge on which a petroleum product was cargo, and must involve at least 1000 barrels (42,000 gallons). (iii) CRED 2000 The OFDA/CRED International disaster database: data source derived from LLOYDS CAS

Average annual mining production (include all surface and subsurface mining and quarrying) per km2 of land area over the past 5 years. Data are on average annual production between 1996-2000 for most products, except Uranium for which data for only the year 2000 were available. Data includes 81 types of mining, including clays, gravels, cement, gems, radioactive materials, metals, petroleum and gas. Data from USGS - US Geological Survey as mean annual production 1996-2000; World Nuclear Association 2003 web site - http://www.world-nuclear.org/info/inf23.htm ; Diamond Registry 2002 http://www.diamondregistry.com/News/2002/production.htm ; Salt Institute 2002 http://www.salt.org.il/frame_prod.html .

Density of population without access to safe sanitation (WHO definitions). Improved sanitation includes any of the following excreta disposal facilities: connection to a public sewer, connection to a septic tank, pour-flush latrine, simple pit latrine, and ventilated improved pit latrine. WHO emphasizes that these data measure access to an improved excreta disposal system - access to a sanitary system cannot be adequately measured on a global scale. A poor water supply and sanitation system can lead to a number of diseases, including diarrhoea, intestinal worms, and cholera. Examples of an unimproved sanitation system include: open pit latrines, public or shared latrines, and service or bucket latrines (where excreta are manually removed).

Refers to the number of individual four-wheel vehicles per 1,000 people. These numbers exclude buses, freight vehicles and two-wheelers such as mopeds and motor-cycles. (WRI, 2000-2001)

Average number of conflict years per decade within the country over the past 50 years. Conflict: Use of armed force between the military forces of two or more governments, or of government and at least one organized armed group, resulting in the battle-related deaths of at least 10 deaths or 100 affected in one year. EM-DAT, conflict includes the disaster types intrastate conflict and international conflict. Intrastate conflict: CRED has adopted the simple Project Ploughshares typology of modern armed conflict based on three overlapping types of intrastate conflict: state control, state formation and state failure. (i) State control conflicts obviously centre on struggles for control of the governing apparatus of the state. State control struggles have typically been driven by ideologically defined revolutionary movements, decolonization campaigns or one set of elites seeking power in place of another. (ii) State formation conflicts centre on the form or shape of the state itself and generally involve particular regions of a country fighting for a greater measure of autonomy or for outright secession. Ethnicity, communal identity and religion are prominent in state formation conflicts. (iii) Failed state conflicts are conflicts about local issues and disputes involving violence in the absence of effective government control. The primary failure is an incapacity to provide minimal human security for individual citizens, compounded by weak governance and politics of exclusion that deny the majority of citizens any significant engagement in the political process. In the emerging chaos and lost confidence in public institutions, individuals and groups seek new political entities or social groupings, often regionally or ethnically based, sometimes ideologically defined, through which to pursue their interests and to try to ensure the well-being of their particular families and communities. International conflict: It include border disputes, foreign invasion and other cross-border attacks (Project Ploughsharesí). EM-DAT: The OFDA/CRED International Disaster Database. http://www.cred.be/cedat/index.htm