

Key Environmental Indicators Identified by the Asian Development Bank for Inclusion in the SDBS

Indicators	Unit
I. BY PHYSICAL ENVIRONMENT	
A. Atmospheric Environment	
Global Level - Emission of	
1. Carbon dioxide (CO ₂)	net CO ₂ kg/cap net CO ₂ kg/GDP
2. Methane (CH ₄)	gross CH ₄ kg/cap gross CH ₄ kg/GDP
3. Chlorofluorocarbons (CFC _S)	total CFC kg/cap total CFC kg/GDP
Regional Level (Transboundary Impacts) - Emission of	
1. SO _x	total SO _x kg/GDP total SO _x kg/TOE ³ of primary energy use
2. NO _x total NO _x kg/GDP	total NO _x kg/ TOE ³ of primary energy use
Local Level - Concentration in two largest cities of	
1. Carbon monoxide (CO)	8- hour, ppm
2. Sulfur dioxide emissions, SO ₂	1-hour/μg/cu m
3. Lead (Pb)	3-month average μg/cu m
4. Suspended particulate matter (SPM)	
5. Average number of times WHO standards are exceeded in a year:	
a. short-term (1-hour average)	frequency of exceedance
b. long-term (8-hour average)	frequency of exceedance
B. Aquatic Environment	
1. In three major rivers	
a. Dissolved oxygen level	mg/l

Appendix 1
(continued)

Indicators	Unit
b. Biological oxygen demand (5-day average)	mg/l
c. Turbidity (suspended solids)	mg/l
2. Water resources withdrawal	annual withdrawal as percentage of total water resources
3. Annual per capita withdrawal	
a. Total	cu m/cap
b. Domestic	cu m/cap
c. Industrial	cu m/cap
d. Agricultural	cu m/cap
C. Terrestrial Environment	
Forest	
1. Total forest area	million hectares as percentage of total land area
2. Primary forest area	
a. Annual deforestation	million hectares as percentage of total forest area
b. Reforestation rate	hectares per year
c. Annual timber harvest	volume cu m/total forest area
- for export	volume cu m/year
- for domestic use	volume cu m/year
d. Fuelwood use	as percentage of total primary energy use (TOE units)
3. Species	
a. Endemic plants	Number
b. Plants in Red Delta Book	Number
c. Endemic animal species	Number
d. World megadiversity country?	Yes/No
4. Protected Areas	
a. Total coverage	sq km
b. Marine	sq km
c. Terrestrial	sq km
- Terrestrial coverage	as percentage of total land area
- Sites in UN list	number
- Marine sites	number
- Terrestrial sites	number

Appendix 1
(continued)

Indicators	Unit
5. Coastal Areas	
a. Population density	person per sq km in coastal area
b. Total coastline	sq km
c. Total coral coverage	sq km
d. Total mangrove coverage	sq km
e. Annual rate of mangrove deforestation	as percentage of the total mangrove
f. Total coverage of shrimp ponds or aquaculture	sq km
g. Unit value of fish	\$/kg
h. Catch/unit effort	kg/person-time

II. BY SECTOR**A. Agriculture**

1. Agricultural land area	million hectares as percentage of total land area
2. Fertilizer consumption	
a. Nitrogen	kg N/ha
b. Phosphorus	kg P/ha
3. Pesticide consumption	metric tons
4. FAO-banned pesticides used	number
5. Soil erosion	mm/year
6. Livestock density	
a. Cattle	head/area of rangeland (ha)
b. Sheep/goats	head/area of rangeland (ha)
c. Horses/mules	head/area of rangeland (ha)
d. Camels/dromedaries	head/area of rangeland (ha)
7. Rangeland	as percentage of total land area
8. Cases of pesticide poisoning	number

B. Industry

1. Nonhazardous, hazardous and toxic wastes generated	tons/year
2. Industrial wastewater treated	as percentage of industrial wastewater generated

Appendix 1
(continued)

Indicators	Unit
3. Industrial pollution control per industrial input (percentage)	\$ invested in pollution control \$ invested in total industrial projects
4. Industries generating hazardous and toxic wastes	
- Treated	number
- Untreated	number
5. Industries generating wastewater	
- Treated	number
- Untreated	number
6. Industries with gaseous emissions	
- Treated	number
- Untreated	number
7. Pb level in blood of children	µg/l
8. Accidents related to chemical or oil spills	number

C. Urban Environment

1. Urban pollution	urban pollution/total population
2. Urban land use area	as a percentage of total land area
3. Green parks or open space	area/capita
4. Vehicles/caps	
a. Total	number
b. Diesel	number
c. Gasoline	number
5. Area served by sewer	as a percentage of total land area
6. Urban area with sanitary facilities	as a percentage of total land area
7. Solid waste collected (percentage)	as a percentage of total waste generated
8. Garbage (solid waste)	
a. Generated	Commercial-tons/capita/year Domestic-tons/capita/year
b. Collected	Commercial-tons/capita/year Domestic-tons/capita/year

Appendix 1
(continued)

Indicators	Unit
III. OTHER INDICATORS	
A. Demographic and Economic Data	
1. Population growth	
2. Population density	
a. Gross	
b. Urban (in key cities)	
3. GDP/cap growth	
a. Industry	% GDP/cap
b. Agriculture	% GDP/cap
4. GDP/cap in PPP terms	
B. Government Budget/Expenditures	
1. Annual budget of environment regulatory agency	\$ amount
2. Environmental expenditures	\$ amount as percentage of GNP
3. Annual budget of protected areas	as percentage of total budget for Department of Forest
4. Budget for pollution	
a. Municipal wastewater treatment	\$ amount
b. Solid waste management	\$ amount
C. Others	
1. Comprehensive environment policy	Yes/No (list year)
2. Environmental acts promulgated	
a. Water	Yes/No (list year)
b. Air	Yes/No (list year)
c. Protected area	Yes/No (list year)
3. Formalized EIA requirement	Yes/No (list year)

cap = capita, cu m = cubic meter, EIA = environmental impact assessment, GDP = gross domestic product, GNP = gross national product, ppm = parts per million, PPP = purchasing power parity, SDBS = statistical database system, TOE = ton of oil equivalent.

AIR AND WATER QUALITY INDEXES

Air Quality Index

$$AQI = \sum_{I=1}^3 W_i * I_i$$

Where: AQI = air quality of the metropolitan area
 I_1 = estimated CO subindex
 I_2 = estimated TSP subindex
 I_3 = estimated SO₂ subindex
 W_i = weight assigned to pollution type I

MITRE Air Quality Index

$$MAQI = \sqrt{\sum_{I=1}^5 I_i^2}$$

Where: MAQI = MITRE Air Quality Index
 I_i = air quality subindex for pollutant i

Horton's Water Quality Index

$$QI = \frac{\sum_{i=1}^n W_i I_i}{\sum_{i=1}^n W_i} * M_1 M_2$$

Where: Q_1 = water quality index
 W_i = weight
 I_i = subindex calculated for pollution variable i
 M_1 = 1 if water temperature is below a specific value; 0.5 otherwise
 M_2 = 1 if there is no "obvious pollution," 0.5 otherwise

"Obvious pollution" can include sludge deposits, oil, debris, foam, scum, odor, colored water, etc. M_1 and M_2 are designed to be tailored to fit individual situations.

ECOSYSTEM STRUCTURE INDICES

1. Niche Breadth Index

$$\text{NicheBreadth}(B) = \frac{1}{\sum_{i=1}^S P_i^2}$$

Where: P_i = frequency of utilization of the i th resource category,
 S = number of different resources.

2. Niche Overlap Index

$$O_{jk} = \frac{\sum P_{ij} P_{ik}}{\sqrt{(\sum P_{ij}^2 \sum P_{ik}^2)}}$$

Where: O_{jk} = niche overlap between the species,
 P_{ij} , P_{ik} = niche breadth values for the species j and k .

3. Species Richness Indices (D)

$$D = \frac{S}{\sqrt{N}} \text{ (Menhinick 1964)}$$

$$D = \frac{S-1}{\log N} \text{ (Magalef 1951)}$$

Where: S = number of species,
 N = total number of individuals.

4. Universal Soil Loss Equation

$$A = R * K * L * S * C * P$$

Where: A = soil loss in the field,
R = rainfall,
K = soil erodibility,
L = length of slope,
S = slope steepness,
C = cropping system, and
P = support practice factor.