

# Indicators

are needed because

**complexity requires structuring and simplification**



possible definitions of indicators

a **variable** hypothetically linked to the variable studied  
which itself cannot be directly observed

a **measure** that summarizes information on a phenomenon,  
or a reasonable proxy for such

a **parameter** that points to the state of a phenomenon or environment  
with a significance extending beyond that directly associated with a  
parameter value



most definitions of environmental indicators  
are restricted to **numerical** variables  
and rule out **qualitative** indicators

often it is thought that indicators must be aggregated from lower-level data

- not so

a classic simple qualitative indicator is the 'indicator species'



**indicators** may be variables or vectors

indicators may be aggregated into an **index**

indices are rarely useful for understanding early warning or forecasting

a set of indicators with assumed relations among them constitute a **model**

models may be used to construct plausible **scenarios**



## major uses of indicators

- assess conditions and trends
- compare across places and situations
- assess conditions and trends in relation to goals and targets
- provide early warning information
- anticipate future conditions and trends



## desirable properties of indicators

- values must be measurable or observable
- data must be available or obtainable
- methodologies for data gathering, processing, and construction must be clear, transparent and standardized
- financial, human, and technical means for building and monitoring must be available
- should be cost effective
- should be politically acceptable locally, nationally, internationally
- participation the public in their use is desirable



Indicators are combined into **analytical frameworks** by:

**media** (air, water, land, and living resources)

**goals** (according to legal and administrative mandates)

economic **sectors** (transportation, industry, urbanization, agriculture)

or **functionally**:

Pressure (driving forces, human activities, natural change)

State (environment, resource)

Response (of ecosystems or societies)

important:

it is dangerous (invalid inferences) to assume a (linear) causal chain such as CO<sub>2</sub> emissions (pressure), atmospheric CO<sub>2</sub> (state), energy intensity (response)



## Indicator examples from Agenda 21



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## ENVIRONMENTAL:

Protection of quality and supply of freshwater resources

### **DRIVING FORCE INDICATORS**

- Annual withdrawals of ground and surface water
- Domestic consumption of water per capita

### **STATE INDICATORS**

- Groundwater reserves -Concentration of faecal coliform in freshwater
- Biochemical oxygen demand in water bodies

### **RESPONSE INDICATORS**

- Waste-water treatment coverage
- Density of hydrological networks



## ENVIRONMENTAL:

Integrated approach to planning and management of land resources

### **DRIVING FORCE INDICATORS**

- Land use change

### **STATE INDICATORS**

- Changes in land condition

### **RESPONSE INDICATORS**

- Decentralized local-level natural resource management



## INSTITUTIONAL:

Integrating environment and development in decision-making

## RESPONSE INDICATORS

- Sustainable development strategies
- Programme of integrated environmental and economic accounting
- Mandated Environmental Impact Assessment
- National councils for sustainable development



indices or highly aggregated indicators face a dilemma:

- a high level of aggregation is necessary to increase problem awareness
- desegregated values are essential to draw actionable conclusions



indicators are important

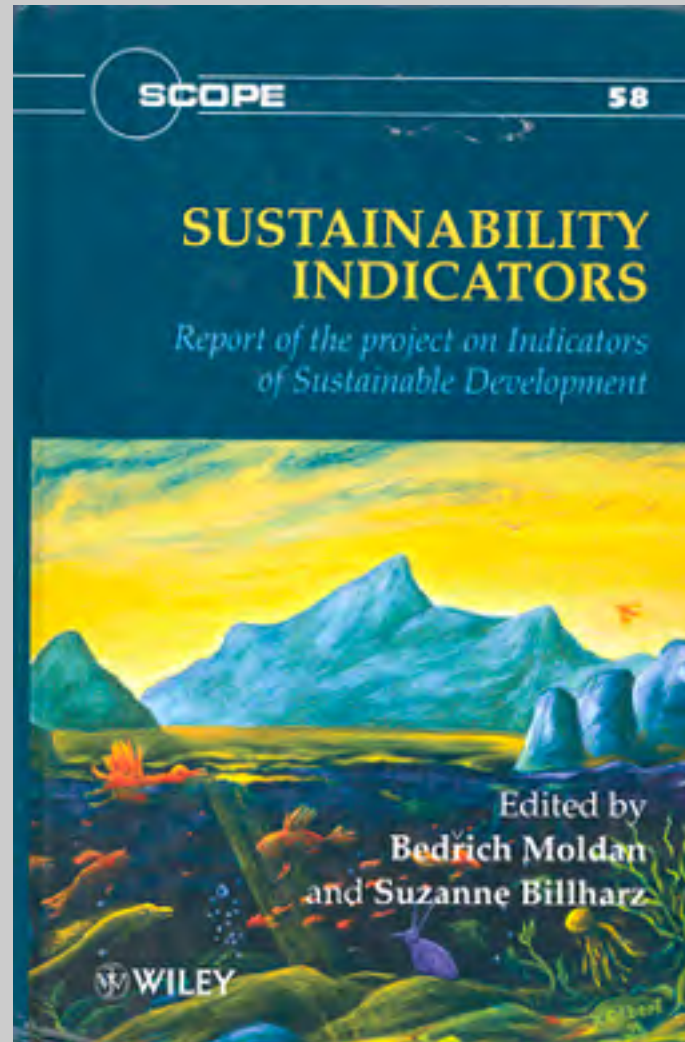
- because, ultimately, all indicators are used normatively
- often they have associated value judgement:  
standard, preference, target, sustainability, human development

and, as a consequence

- **indicator sets are always biased**



source:



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