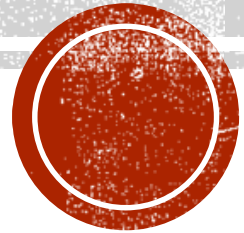
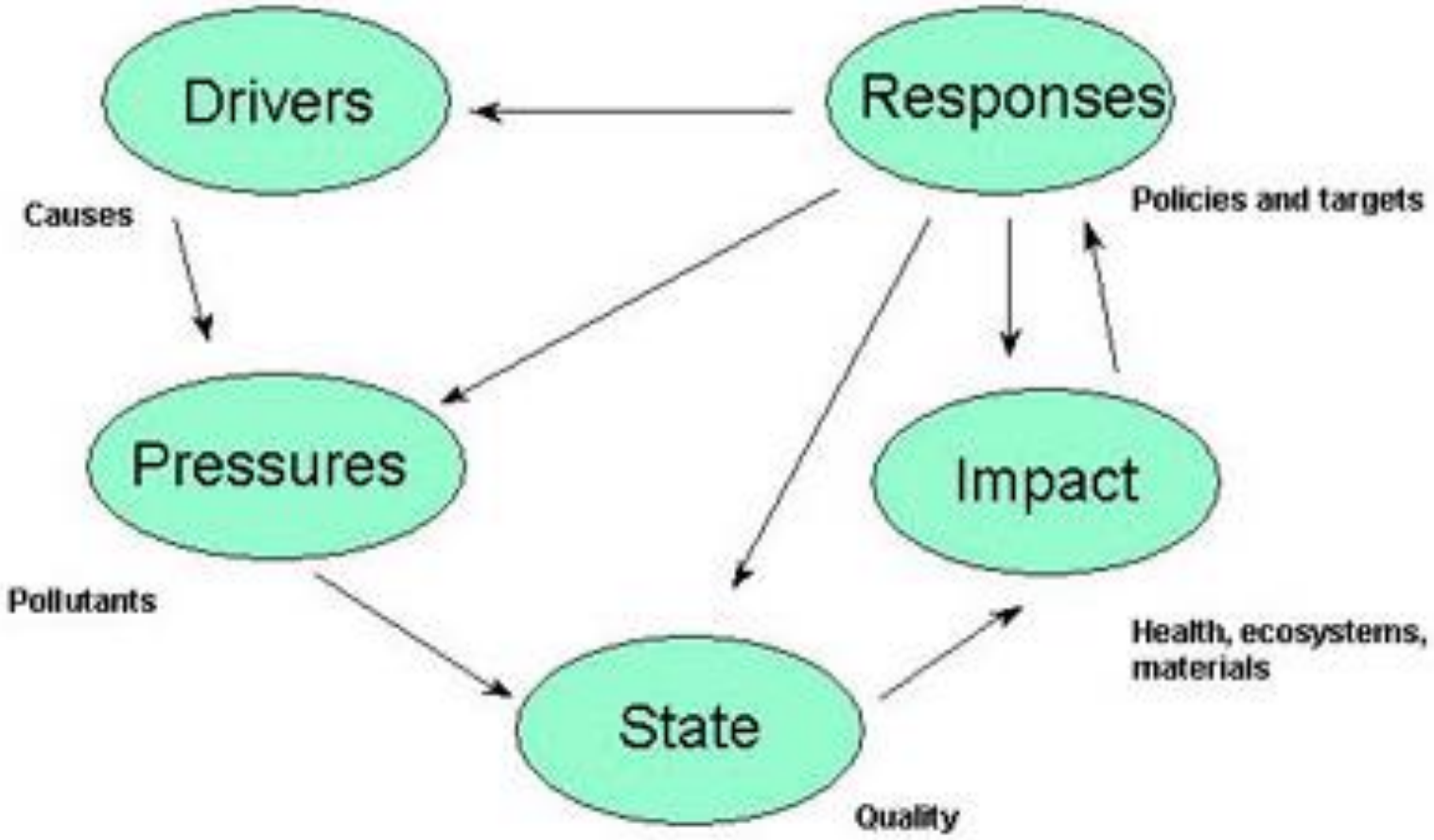
DPSIR



What is the DPSIR?

- is a causal framework for describing the interactions between society and the environment (a tool for structuring our thinking)
- this framework has been adopted by the European Environment Agency

- the framework is seen as giving a structure within which to present the indicators needed to enable feedback to policy makers on environmental quality and the resulting impact of the political choices made, or to be made in the future



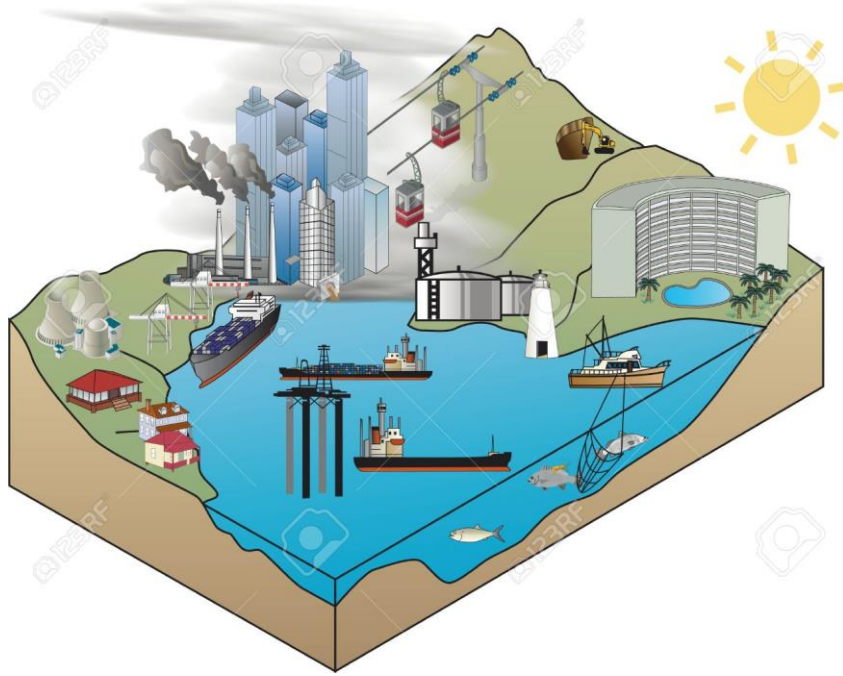
The DPSIR assessment framework *(Kristensten, 2004)*

- '*driving forces*' (economic sectors, human activities) through
- '*pressures*' (emissions, waste) to
- '*states*' (physical, chemical and biological) and
- '*impacts*' on ecosystems, human health and functions, eventually leading to
- political '*responses*' (prioritisation, target setting, indicators)

1. **Driving forces** (is a need)**:**

- sometimes referred to as indirect or underlying drivers or driving forces and refer to fundamental processes in society, which drive activities having a direct impact on the environment

  - population (number, age structure, education levels, political stability)
  - transport (persons, goods; road, water, air, off-road)
  - energy use (energy factors per type of activity, fuel types, technology)
  - power plants (types of plants, age structure, fuel types)
  - industry (types of plants, age structure, resource types)
  - refineries/Mining (types of plant/minings, age structure)
  - agriculture (number of animals, types of crops, stables, fertilisers)
  - landfills (type, age)
  - sewage systems (types)
  - non-industrial sectors
  - land use



2. Pressures

- these human activities *(driving forces)* exert 'pressures' on the environment, as a result of production or consumption processes, which can be divided into three main types: (i) excessive use of environmental resources, (ii) changes in land use, and (iii) emissions (of chemicals, waste, radiation, noise) to air, water and soil

  - use of resources
  - emissions (per driving force for numerous compounds)
  - direct emissions to air, water and soil
  - indirect emissions to air, water and soil
  - production of waste
  - production of noise
  - radiation
  - vibration
  - hazards (risks)

3. State:

- the condition of the environment resulting from the pressures outlined above, e.g. polluted water resources, degraded land, deforested areas
- is important in affecting human health and well-being, and socioeconomic activities either directly or indirectly, e.g. degraded land → reduced food production → increased food insecurity → malnutrition

- knowledge about the **"state" and "pressures"** is the **staring point for planning** how the environment can be influenced to improve human well-being

- also includes trends, that may reveal environmental change, which could be both natural and human induced. One form of change, such as climate change, may lead to other forms of change, such as biodiversity loss (a secondary effect of climate gas emissions)

  - air quality (national, regional, local, urban, etc.)
  - water quality (rivers, lakes, seas, coastal zones, groundwater)
  - soil quality (national, local, natural areas, agricultural areas)
  - ecosystems (biodiversity, vegetation, soil organisms, water organisms)
  - humans (health)
  - soil use

The ‘state of the environment’ is thus the combination of the physical, chemical and biological conditions.

4. Impacts:

- changes in the state may have environmental or economic ‘impacts’ on the functioning of ecosystems, their life-supporting abilities, and ultimately on human health and on the economic and social performance of society

e.g. in deforestation:

- the “State” of the forest may change to a forest with reduced canopy cover
- a rise in the price of fuelwood resulting from this change would be an “impact”
- in ecological aspects, *e.g.* loss of biodiversity

- may be environmental, social or economic, contributing to the vulnerability of both people and the environment

- for people, the magnitude of impact may depend on a society’s vulnerability
- vulnerability to change varies among social groups depending on their geographic, economic and social location, exposure to change and capacity to mitigate or adapt to change

5. Responses:

- **societal or individual actions** taken to overcome, **reduce**, **correct** or **prevent** negative environmental impacts; **correct** environmental damage; or **conserve** natural resources

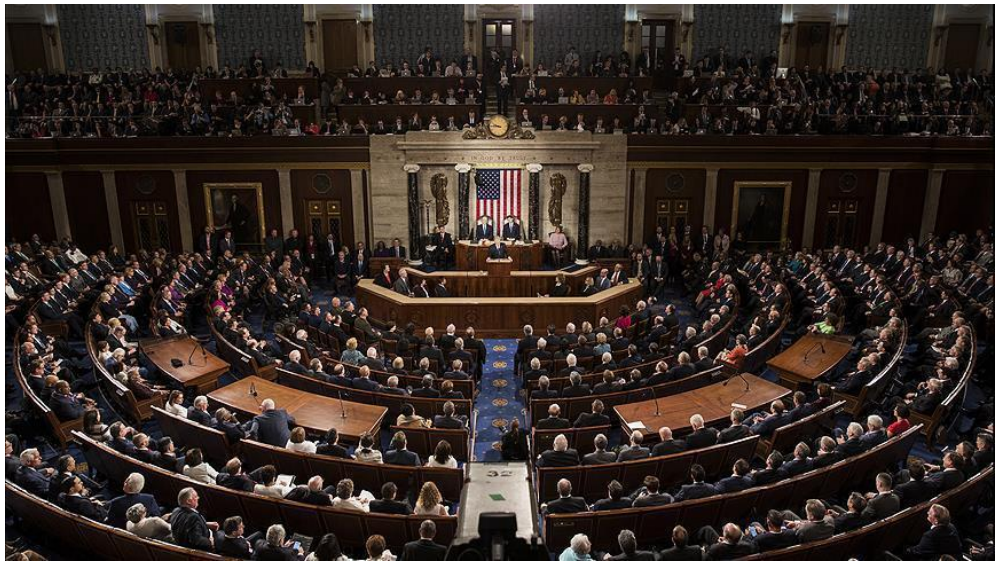
- may include regulatory action, environmental or research expenditures, public opinion and consumer preferences, changes in management strategies, and the provision of environmental information

- satisfactory indicators of societal response tend to be the most difficult to develop and interpret

- may be made as elements among the drivers, pressures, or impacts which may be used for managing society in order to alter the human-environment interactions

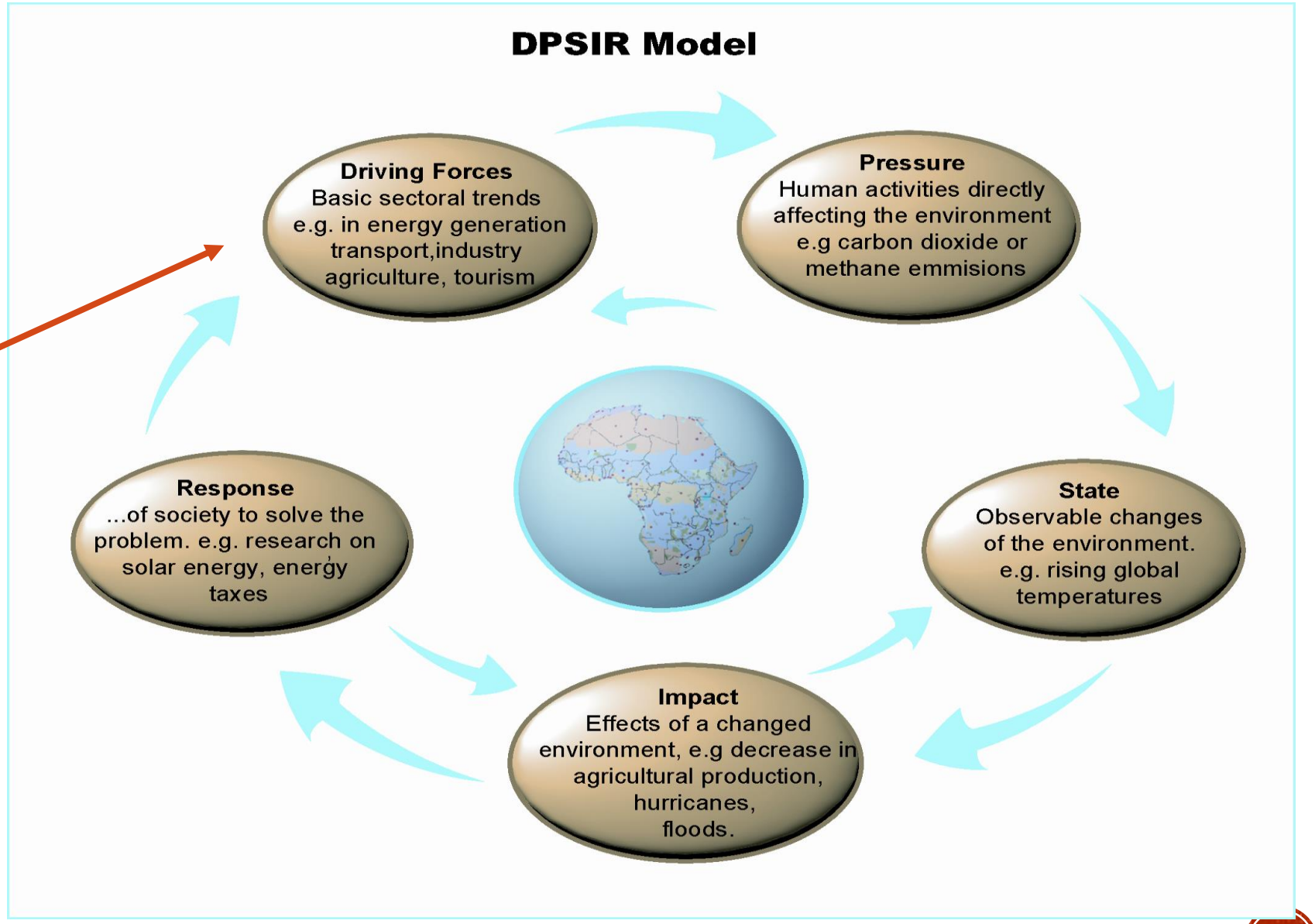
- may be made at different levels, for example, environmental laws and institutions at national level

  - e.*g.* new management criteria, new infrastructure, new policy, taxes, environmental laws



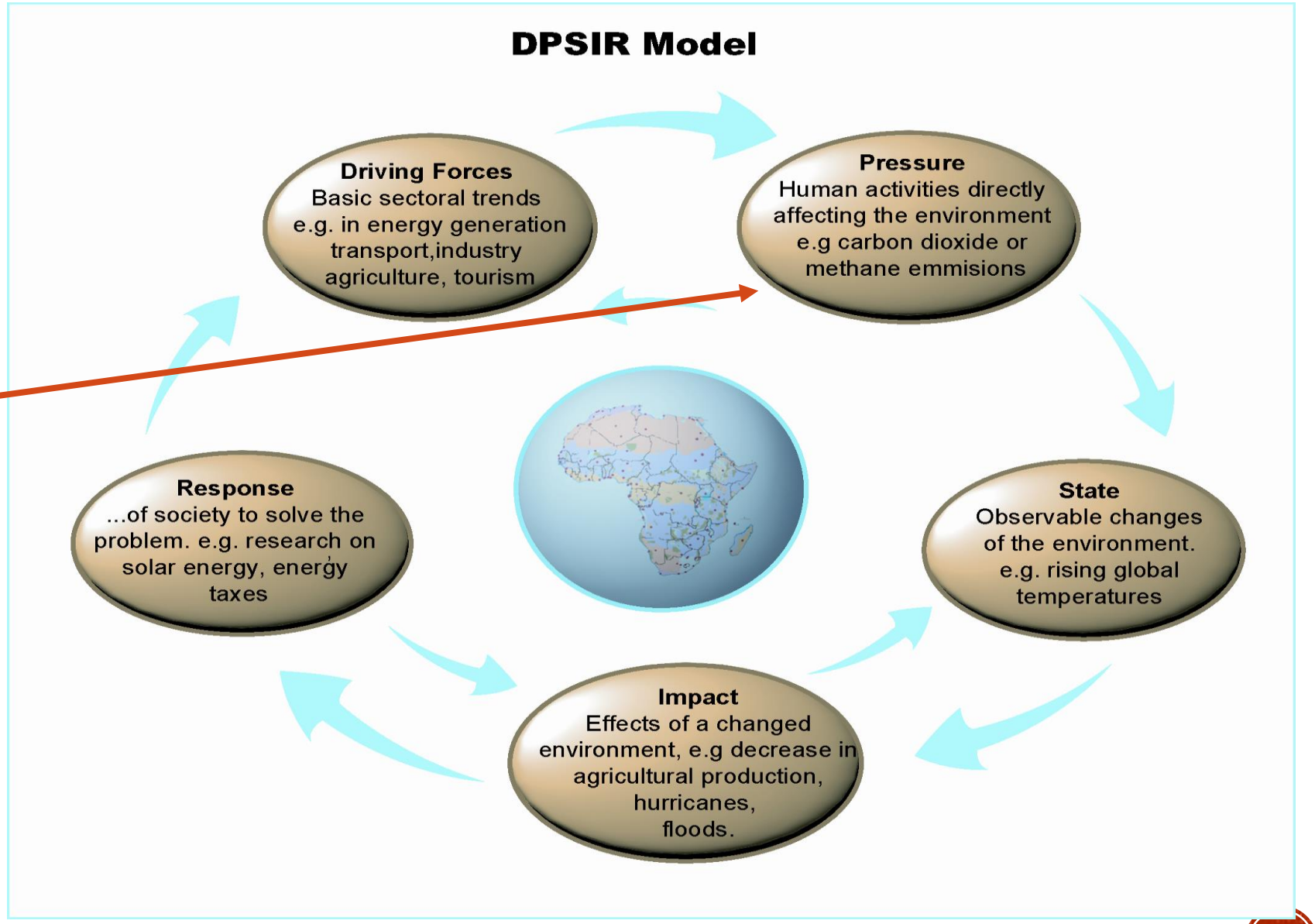
DPSIR MODEL

Social and economic developments which exert or mitigate pressures on the environment



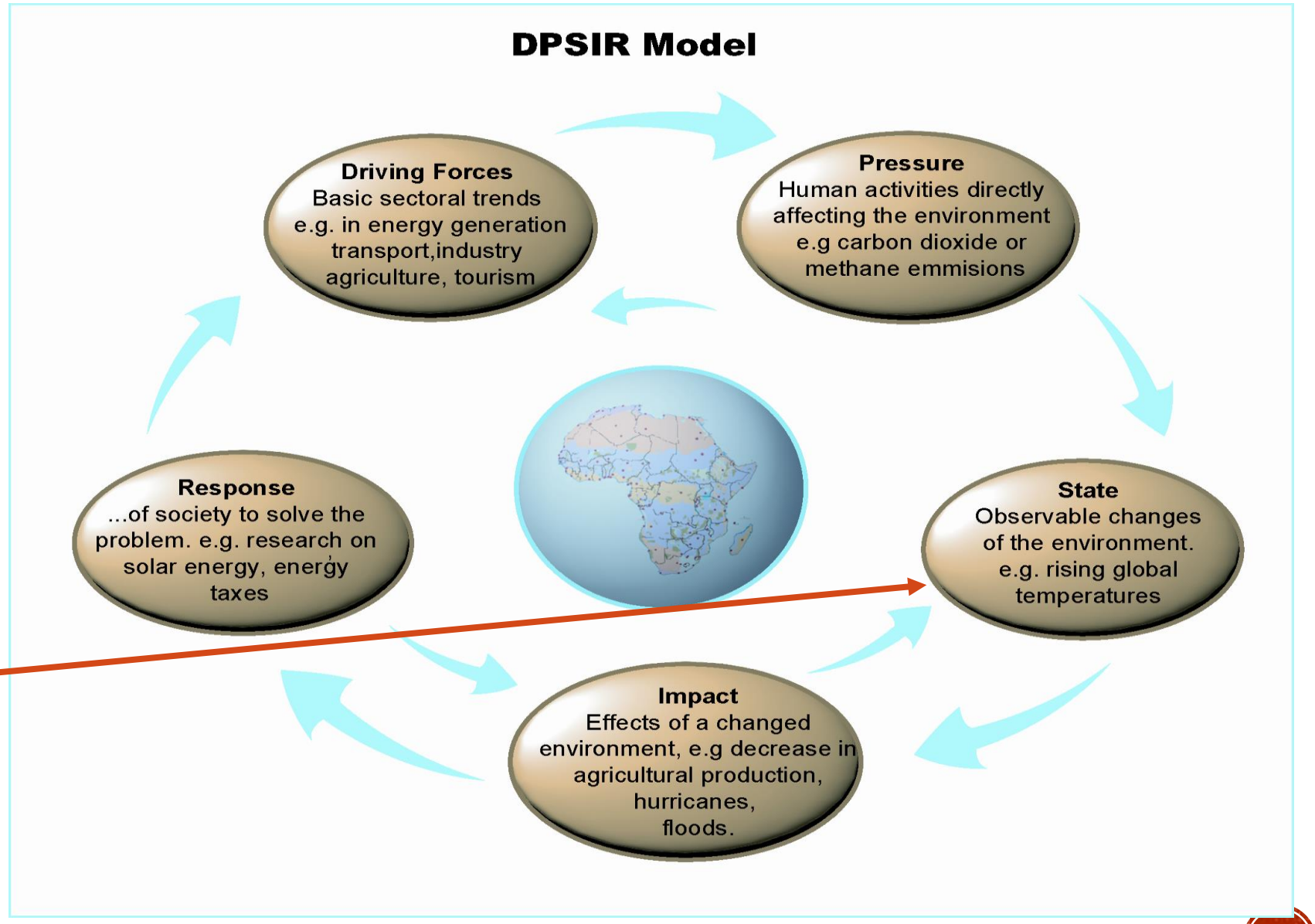
DPSIR MODEL

Stresses that human activities put on the environment, stemming from socio-economic activities



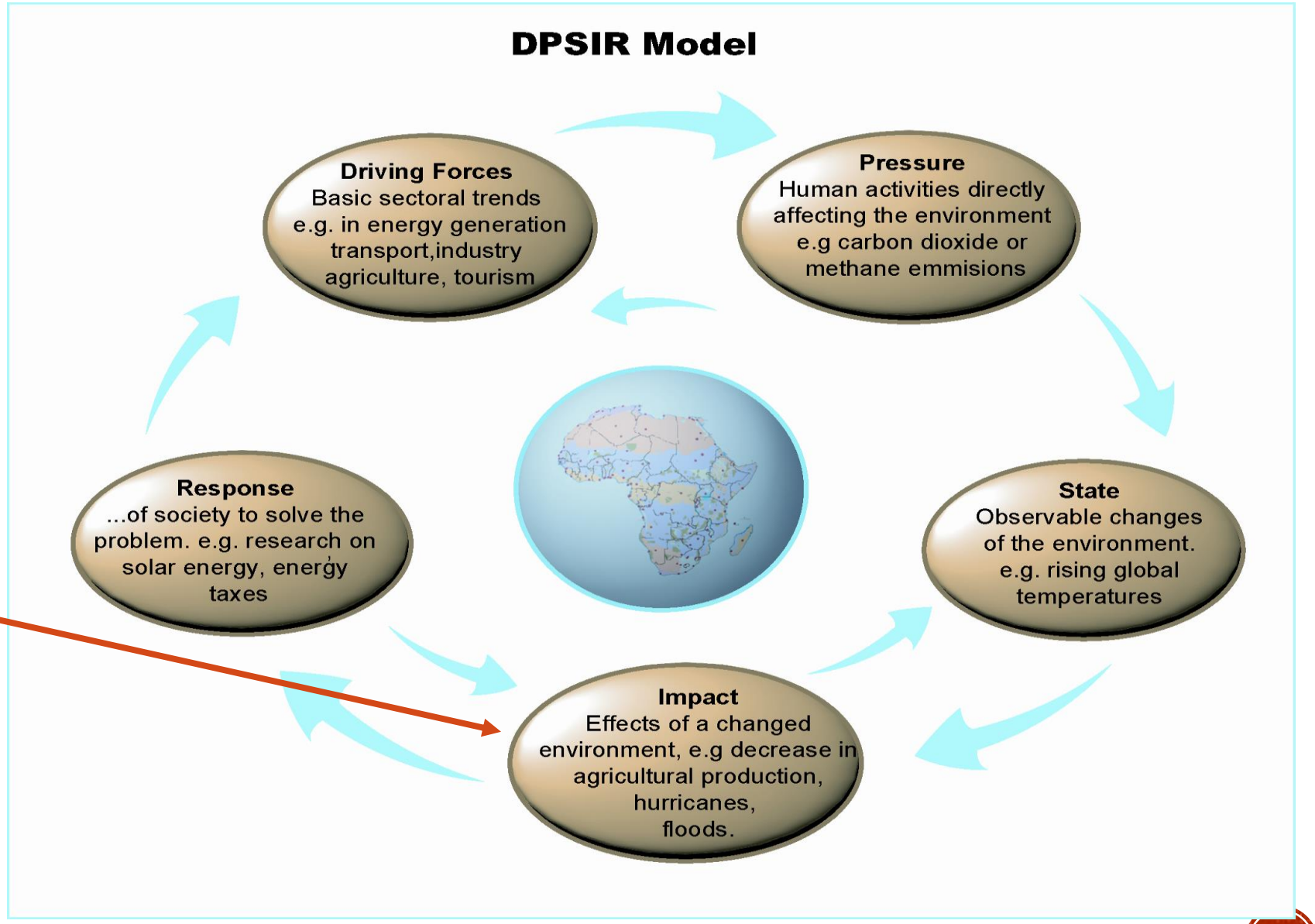
DPSIR MODEL

State of the environment, i.e. the present condition in terms of quantity and quality of resources



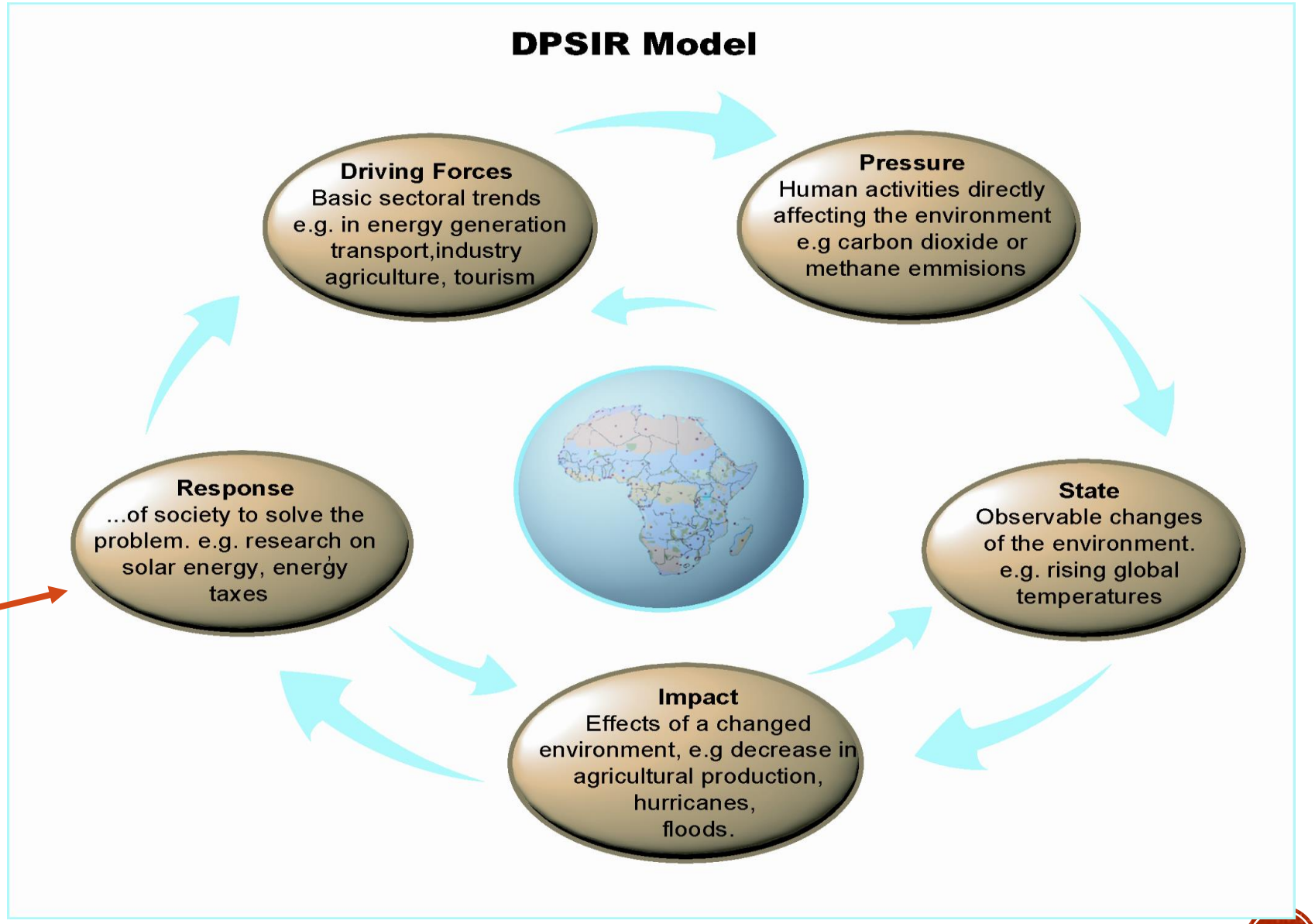
DPSIR MODEL

Effects of a changed environment and the consequences for human health, the economy, etc.

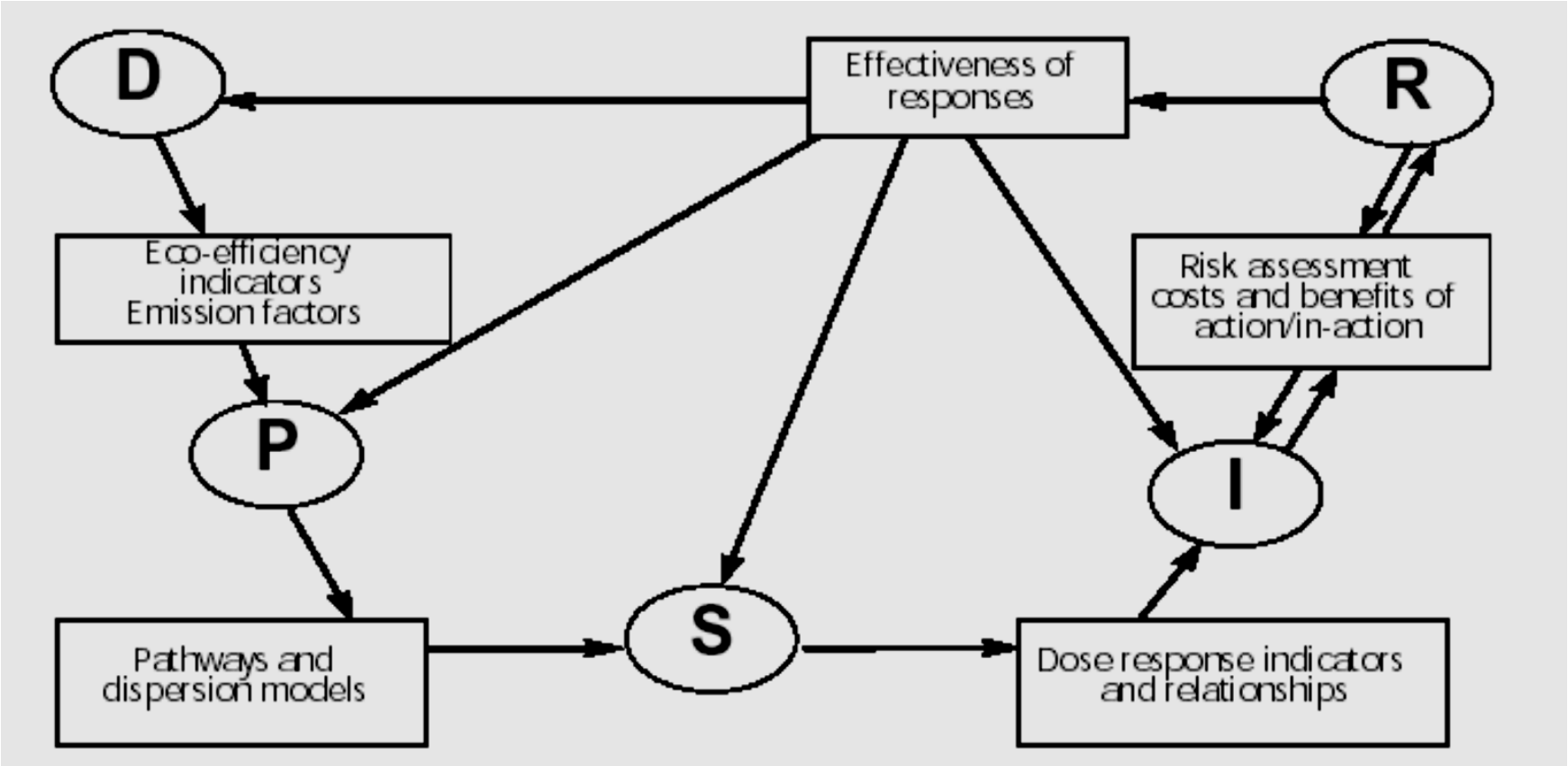


DPSIR MODEL

Measures and responses undertaken by society to address environmental concerns



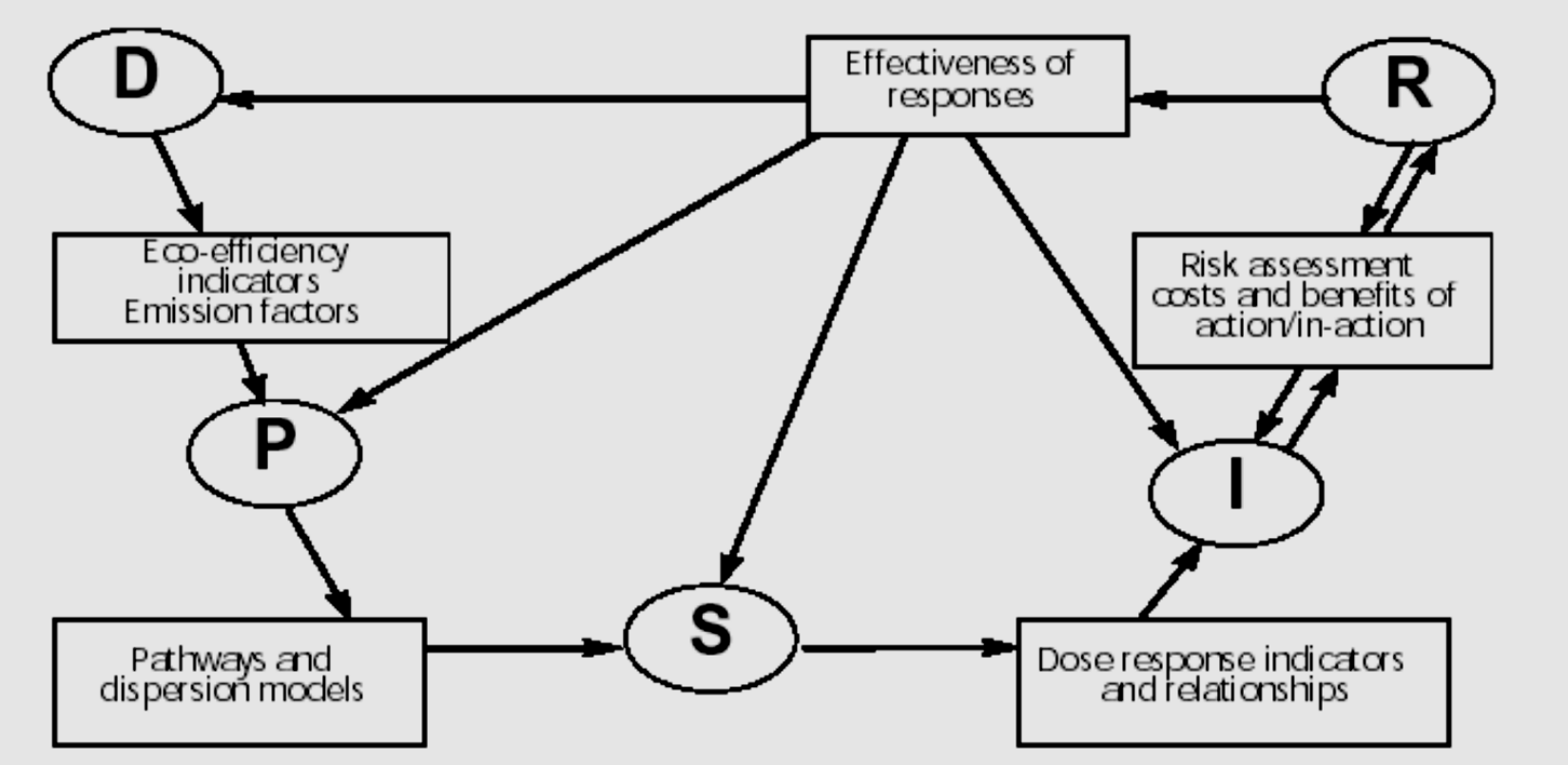
Linking DPSIR elements



- the relationship between the 'D' and the 'P' by economic activities is a function of the eco-efficiency of the technology and related systems in use
- with less 'P' coming from more 'D' if eco-efficiency is improving

Indicators and information linking DPSIR elements
(Source: EEA 1999)

Linking DPSIR elements



Indicators and information linking DPSIR elements
(Source: EEA 1999)

- the relationship between the 'I' on humans or ecosystems and the 'S' depends on the carrying capacities and thresholds for these systems
- whether society 'Respons' to impacts depends on how these impacts are perceived and evaluated; and the results of 'R' on the 'D' depends on the effectiveness of the 'R'

DPSIR framework in relation to water issues

(Based on the European Environment Agency's work on water)

The aim of:

- managing water resources is to safeguard human health whilst maintaining sustainable aquatic and associated terrestrial ecosystems

State of waters

- how is it? (Nutrients, pesticides, heavy metals, ecological quality.....)
- how much is there? (Runoff, availability, demands, water stress.....)

Time trends

- getting better or worse?
- within or outside agreed limits?

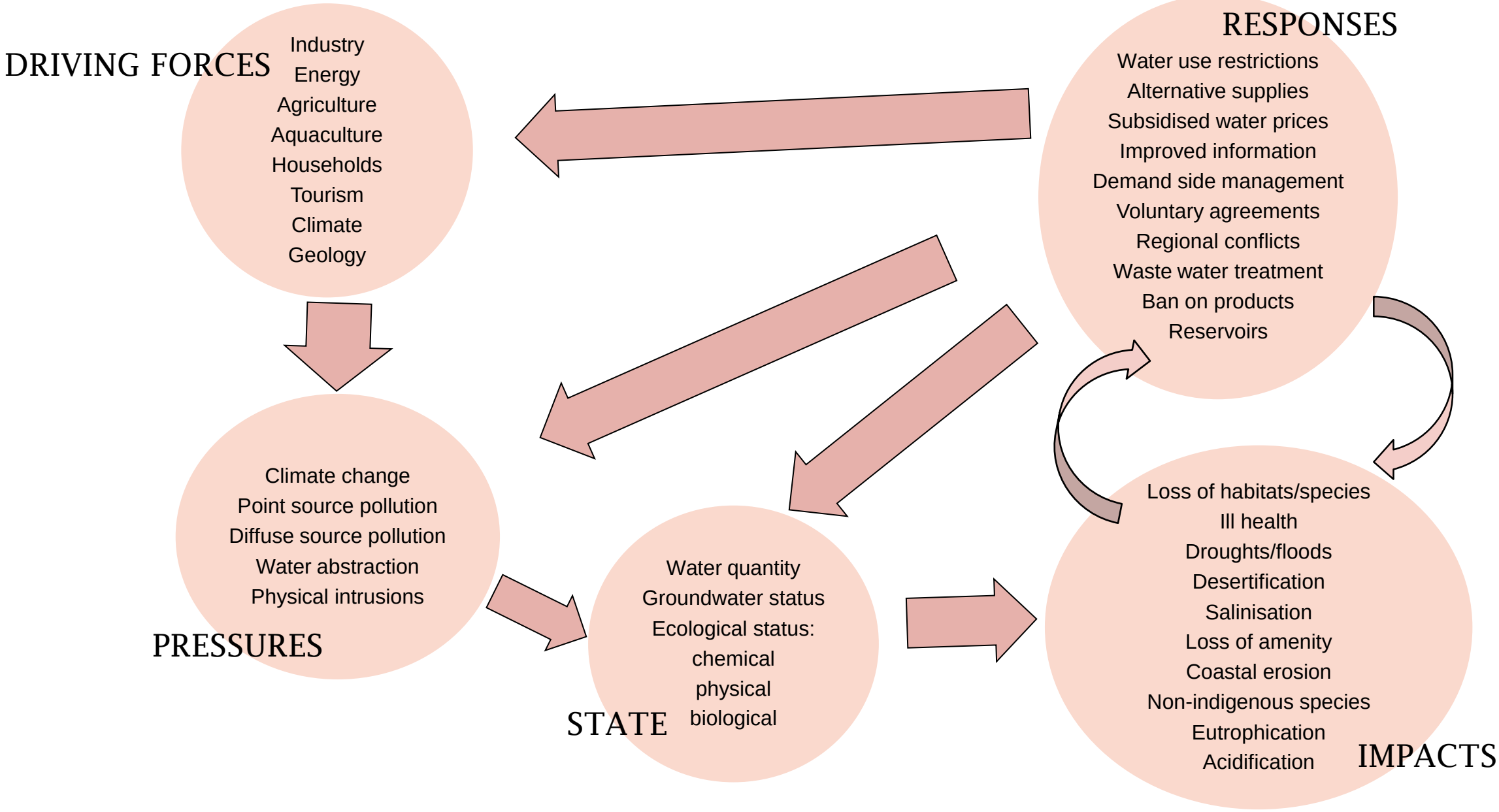
What is causing the problems? - Pressures on the environment

- human - domestic
- industrial
- agricultural

State of Action on policies

- are they working towards targets?

SO: the DPSIR model can be used as an analytical framework for assessing water issues.



A generic DPSIR framework for water *(Kristensten 2004)*

driving forces – pressures – state – impacts – responses (DPSIR) model

(Source: Meeting on climate change related statistics Geneva, 19-20 november 2012)

- Snapshot of the situation - the state of the climate system and the environment as affected by climate change

- Key information on **(3.) State** of the climate system can include:

  - concentrations of GHGs in the atmosphere (atmospheric composition)
  - surface temperature change
  - changes in weather patterns (winds, precipitation, extreme events)
  - changes in oceans (salinity, currents, ocean colour, sea level rise)
  - changes in cryosphere (glaciers, ice caps and ice sheets, etc.)
  - terrestrial and biosphere changes (impacts on biodiversity, species movements, crops, insects, etc.)

1. Driving forces

- higher population
- higher energy demand
- higher wealth of nations
- higher migration (travel)
- more trade, globalisation of economy
- different household structure (less inhabitants per household)
- more intensive agriculture, diets including more meat
- increased levels of waste

Driving forces – relevant statistics

- relevant statistics can comprise:
  - population, demography, migration statistics
  - household statistics (type, size, etc.)
  - international trade statistics
  - energy statistics
  - agriculture and food statistics, including on agricultural production
  - economic and business statistics, including GDP, income, employment, output, etc.
  - waste statistics
  - tourism, consumption and time use statistics

2. Pressures

- principally the core pressure for climate change are the **greenhouse gas emissions** and the underlying activities that produce them, such as:
    - combustion of fossil fuels (e.g. for electricity generation)
    - industrial activities and their output
    - transport
    - production/extraction of fossil fuels
    - livestock and soils in agriculture
    - waste and waste treatment
    - land use, land use change and forestry
- other aspects: emission factors, production of ozone depleting substances

4. Impacts – two-fold view

- natural phenomena:

  - storms, sea level rise, ocean salinity, species movement, floods, droughts, extreme temperatures (heat waves/cold spells), etc.

- socio-economic impacts on human life:

  - on food: changes in crop patterns, water availability

  - on human health: mortality due to extreme events; vector-borne diseases (e.g. malaria) and food-/waterborne diseases

  - economic impacts:
    - loss of wealth and competitiveness
    - damages (e.g. after a hurricane)
    - forced migration and poverty
    - conflict

5. Responses

- measures taken to address the causes of climate change and provide curative action, e.g. replacing fossil fuels with renewable energy
- not always easy to express in quantitative terms
- often linked to official political targets, e.g. in the European Union under the Europe 2020 Strategy
- should address not only measures to tackle climate change but also economic opportunities generated as a result of climate change like eco-industries, green jobs and green growth

- relevant statistics can include:

  - environmental protection expenditure and investment statistics
  - taxes and subsidies statistics and statistics covering other economic instruments such as tradable permits, green certificates, etc.
  - turnover and market output of "green" sectors
  - price statistics (e.g. oil prices, energy prices, etc.)
  - renewable energies statistics (e.g. as an important mitigation measure)
  - energy, material and emissions efficiency indicators
  - recycling and other waste statistics
  - employment statistics
  - government finance statistics and other finance statistics
  - education statistics

DPSIR MODEL - CONCLUSIONS

- a good tool for structuring the relevant information, allowing for a good coverage of climate-relevant information
- intuitively appealing categories
- only a framework, it does not necessarily define what should be included, but

- danger of misinterpreting inter-relations and causality links
- difficulties in perfectly attributing variables to DPSIR categories

The model is good for presenting a complex problem from the starting point to the end, and the results and processes are understood not only by the specialists, but also by the participants of economic and political life.

„How do you see it and use it?”

1. described **‚D’** and **‚P’** problems, eg.

- Ahmad: Matabari coal-power plant: air + water + soil pollution

- Akos: water pollution in USA: many people and companies do not dispose of their waste in the correct ways which leads to that toxic waste seeping into the ground and into the water supply to cites and towns

- Boniface: drought in Kenya: a lack of seasonal rains in the expected time

- Adel: Ekibastuz is well-known for being the biggest open-cast coal field in Kazakhstan - 42 million tonnes of coal per year are produced; groundwater pollution; air pollution: hydrogen sulfide, manganese oxides, silicon compounds, fluorides, and vanadium pentoxide are observed in emissions from coal mines; spontaneous combustion: carbon monoxide, nitrogen and sulfur dioxide

2. described the **„I”**

- Ahmad: Matarbari coal-power plant – (i.) Local people will become jobless by losing their lands; (ii.) Health Problems; (iii.) Natural Disasters; (iiii.) Break down of normal social structure

- Akos: since the water is becoming more and more polluted the water purification centres are not able to clean the water as well and there are some toxins that are left in that water which goes to peoples houses. If comsumed, it can cause health problems

- Boniface: a lack of seasonal rains which in turn leads to water scarcity, high rates of famine led to deaths due to hunger and lack of water, animals have also lost their lives

- Adel: environmental condition of the town is deteriorating rapidly; deterioration of the health of the population of Ekibastuz

3. described the **„R”** - what is the solution?

- Ahmad: (i) consulting with the government to reduce the problems & to be strict on the rules of environmental protection rules (ii) government is also want to continue this project so, they promised to make enough job sectors for local people AND HIS QUESTION

Will the Government of BANGLADESH keep their promise or they will betray with people by giving them a shorttime/temporary job ?

- Akos: (i) make the rules of disposal of toxic waste even more strict than they were before to try and minimise the amount of the toxic waste being disposed of wrongfully; (ii) make each city go to their water purification sites, and impose a more strict water purification standard for that site; (iii) the government to put more money into the water filtration systems; (iiii) instal a home water filtration system

- Boniface: (i) **planting drought-resistant trees,** (ii) **stop overgrazing,** (iii) **climate change education,** (iiii) **political tools** - the adverse problems that people have been facing have encouraged the government to partner with other non-governmental organizations to invest in projects like community water sources, eg. the government dug a vast number of boreholes in the semi-arid areas**,** (iiiii) **technology and research** - adopted the strategies of other countries that have been facing similar problems and the problem has been improving with time

- Adel: government should implement a program of mine reclamation which is a process of **land restoring** through the creation of useful landscapes such as parks; **law** should be introduced to make enterprises **reduce the volume of slag dumps; technology -** factories must implement a vortex precipitators for cleaning of the air from dust

- Sultan: „In conclusion, all the decisions made by the state were taken, and in order to avoid these problems it is necessary to **TEACH people to take care of the environment from childhood**, that is, **to explain the importance of the environment for humanity**."

https://www.youtube.com/watch?v=abWpEh-ueM4

- please, use the short video for a better understanding of DPSIR model and for easier learning

Learning:

http://www.sze.hu/~radicsa/Dr_Kozma_Katalin/Environmental_protection/

presentations and a book to learn from:

Michael Allaby: Basics of Environmental Science, pp.1-135