UNEP

Integrated Environmental Assessment Training Manual for the Arab Region

Module 4

Monitoring, Data and Indicators

Sessions at a Glance

Session 1: Introduction

Session 2: Developing Data for IEA

Session 3: Information Systems

Session 4: Indicators and Indices

Session 5: Data Analysis

Introduction

Knowledge gained from data is fundamental to our understanding of environmental issues as well as for communicating information to policy makers and other groups in society.

However, without good quality, relevant data and indicators, the assessment loses not only valuable communication tools, but also credibility and the ability to measure progress towards sustainability goals and objectives.

Objectives of Module 4

- Understand the roles and uses of data, indicators and indices in integrated environmental assessment
- Know how to develop strategies for collecting and validating data
- Understand how indicators and indices are developed and used
- Be able to analyze indicators and index outcomes
- Be able to communicate and present statistical and map-based data visually

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Session 1: Introduction

Session 2: Developing Data for IEA

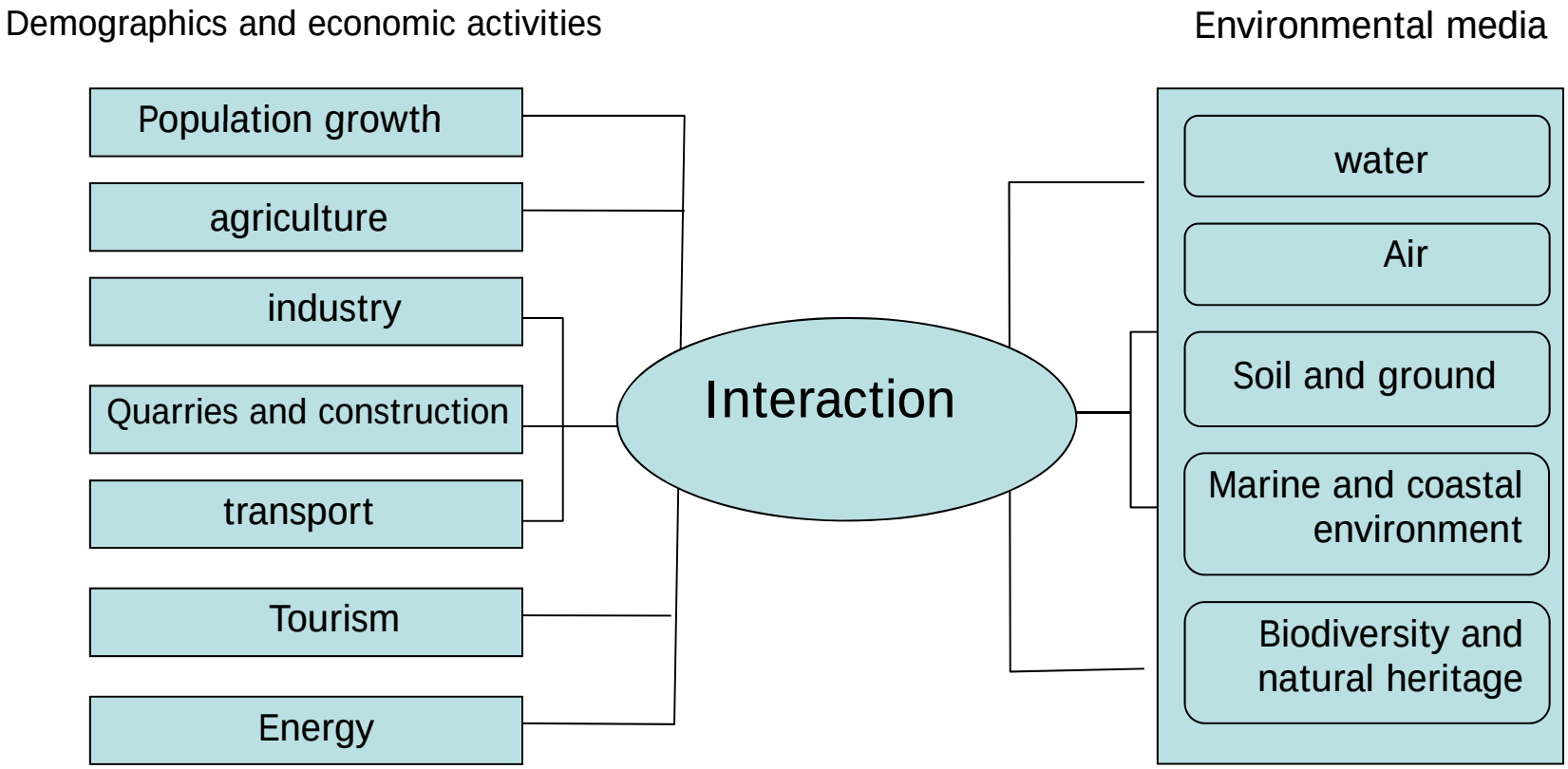
Session 3: Information Systems

Session 4: Indicators and Indices

Session 5: Data Analysis

The IEA concept is based on a new view of environmental issues that include:

- Description of a country's state of the environment (SoE).
- Explanation of the SoE trends.
- Linking SoE with the root causes and pressures of the problem.
- Description of the impacts of such SoE.
- Relationship between SoE and current policies aiming at improving or aggravating such state in the future.
- Providing decision makers and relevant communities with a complete view of the environmental conditions, trends, and pressures, in addition to the root causes and policies, as well as solutions.



- Integrated analysis of links between development activities and environmental media.
- Analysis of environmental policies and their impact on the state of the environment.
- Prediction of future scenarios for the state of the environment and their impact on development plans and programs via a participatory approach.

IEA requires tools to monitor and measure change, perform the assessment, and conduct follow-up:
Environmental indicators help shape those tools.

- Summarizes environmental state and trends.
- Identifies environmental problems
- Enables comparison across space and time
- Assists in identification of priorities
- Indicators are a means to follow-up on the implementation of particular policies and to measuring progress towards goals.
- Future prediction
- Provision of early warning information

Data is complied into indicators

Data are neutral facts

Knowledge gained from data is fundamental to our understanding of environmental issues as well as for communicating information to policy makers and other groups in society.

However, without good quality, relevant data and indicators, the assessment loses not only valuable communication tools, but also credibility and the ability to measure progress towards sustainability goals and objectives.

In the IEA process we need first to know :

What are the environmental issues?

What are the indicators that reflect that issues?

What are the data needed for calculating those indicators?

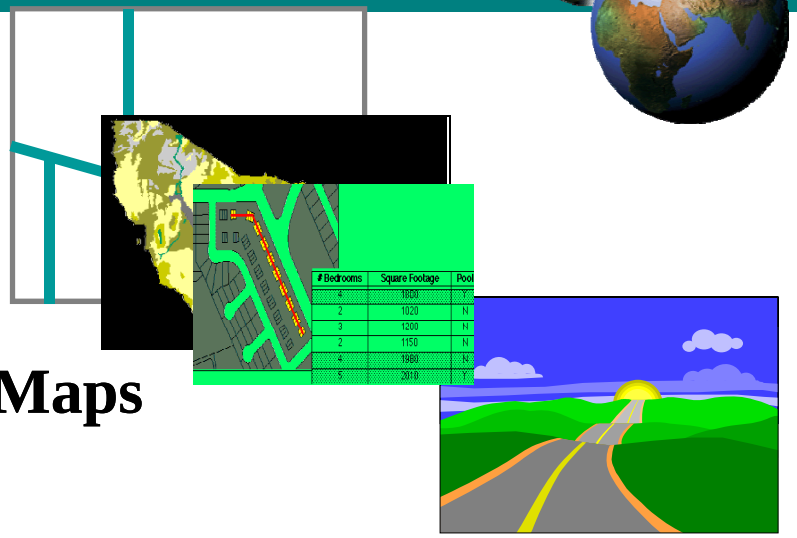
Data and Indicators

- Data are **neutral facts**.

Why Measure?

Societies measure what they care about on the basis that:

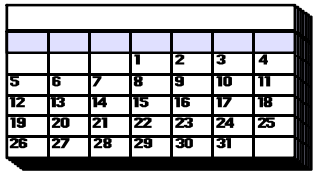
If you can't measure it, you can't manage it !!

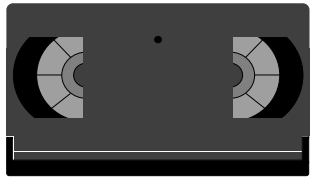


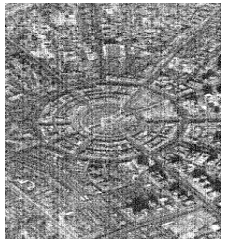
Maps

Tables

Pictures



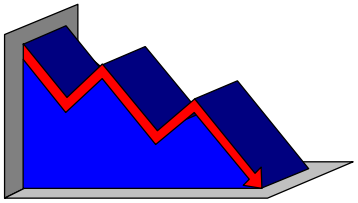




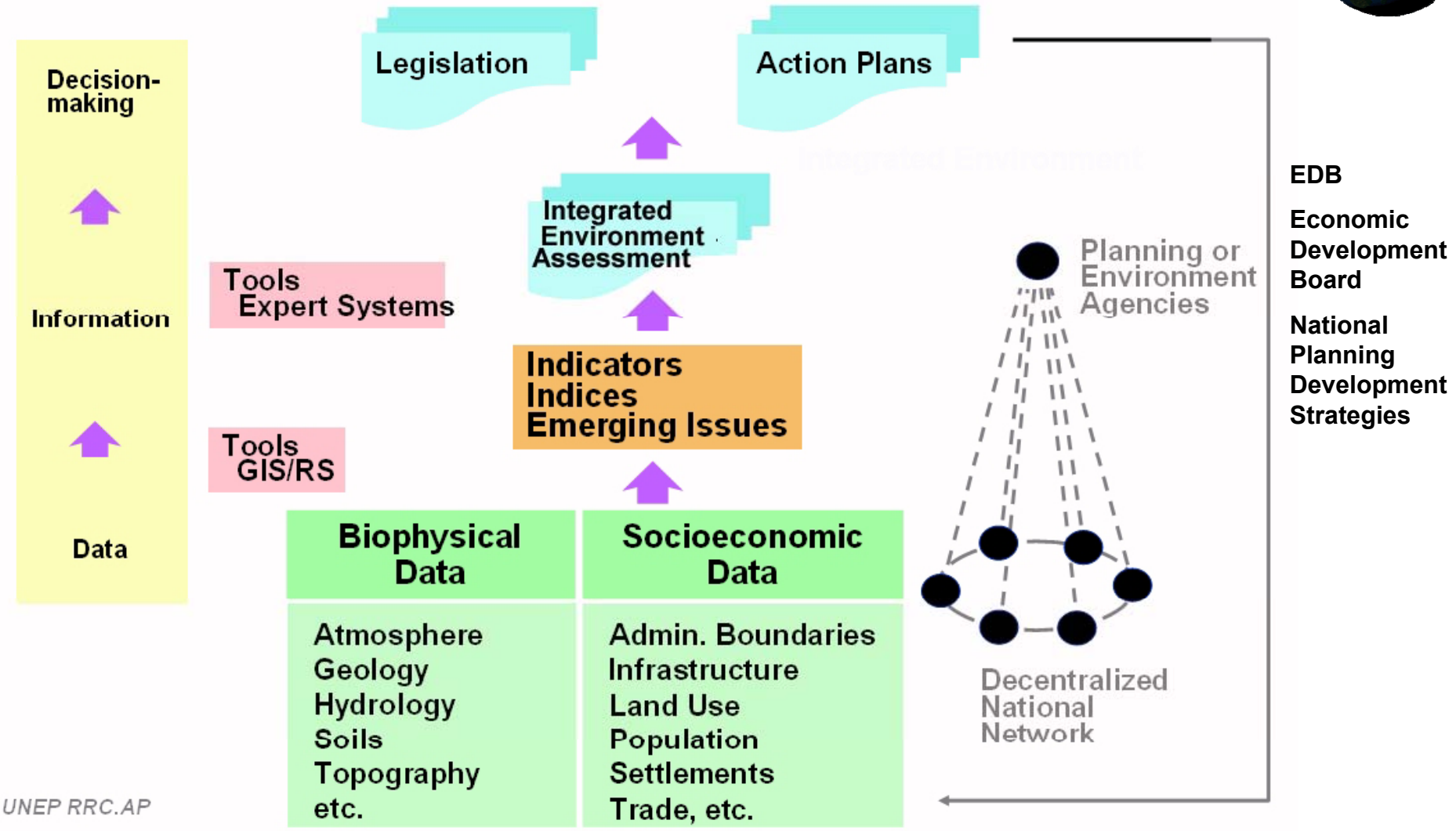
Images

Videos

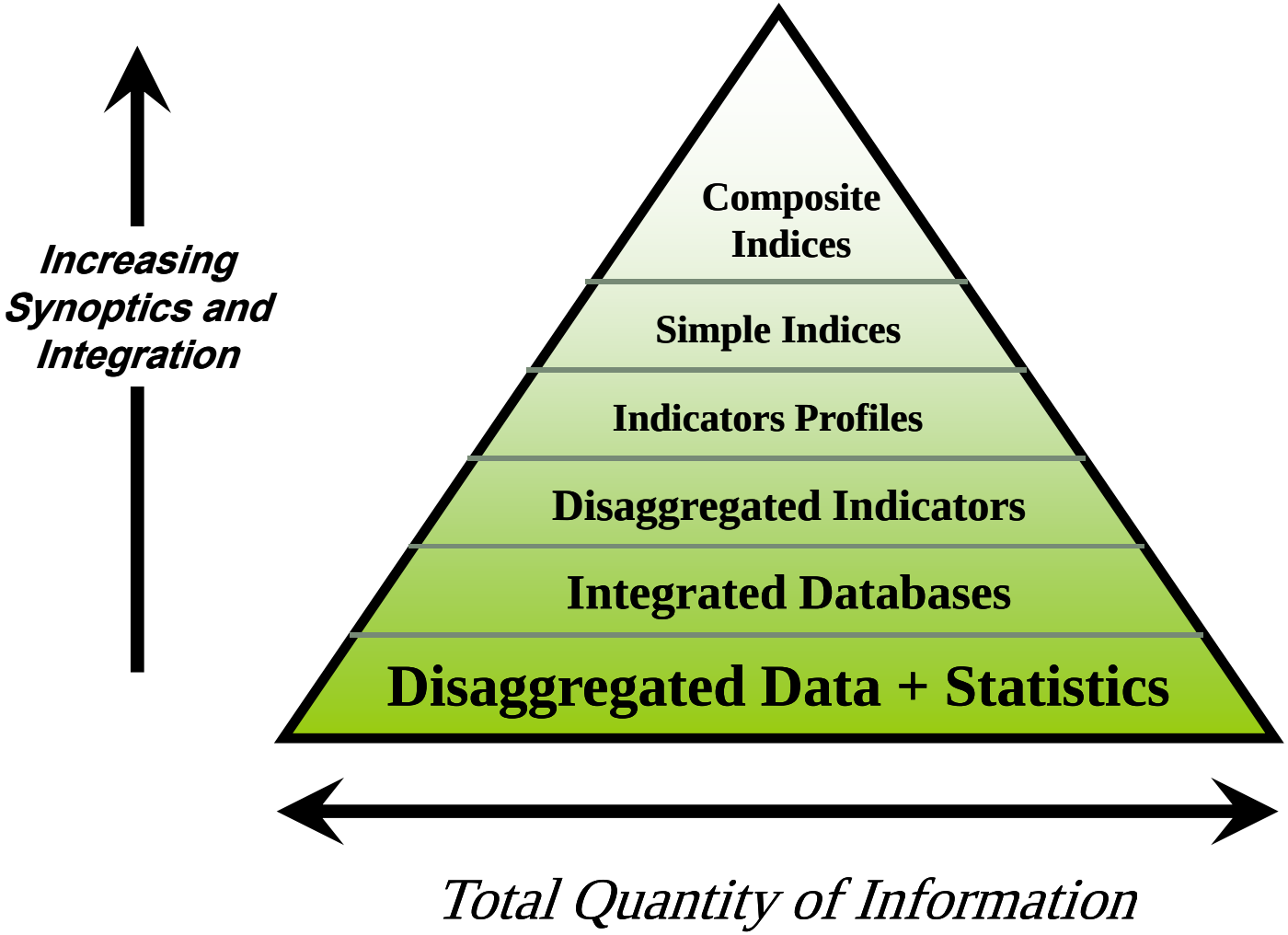
Graphs



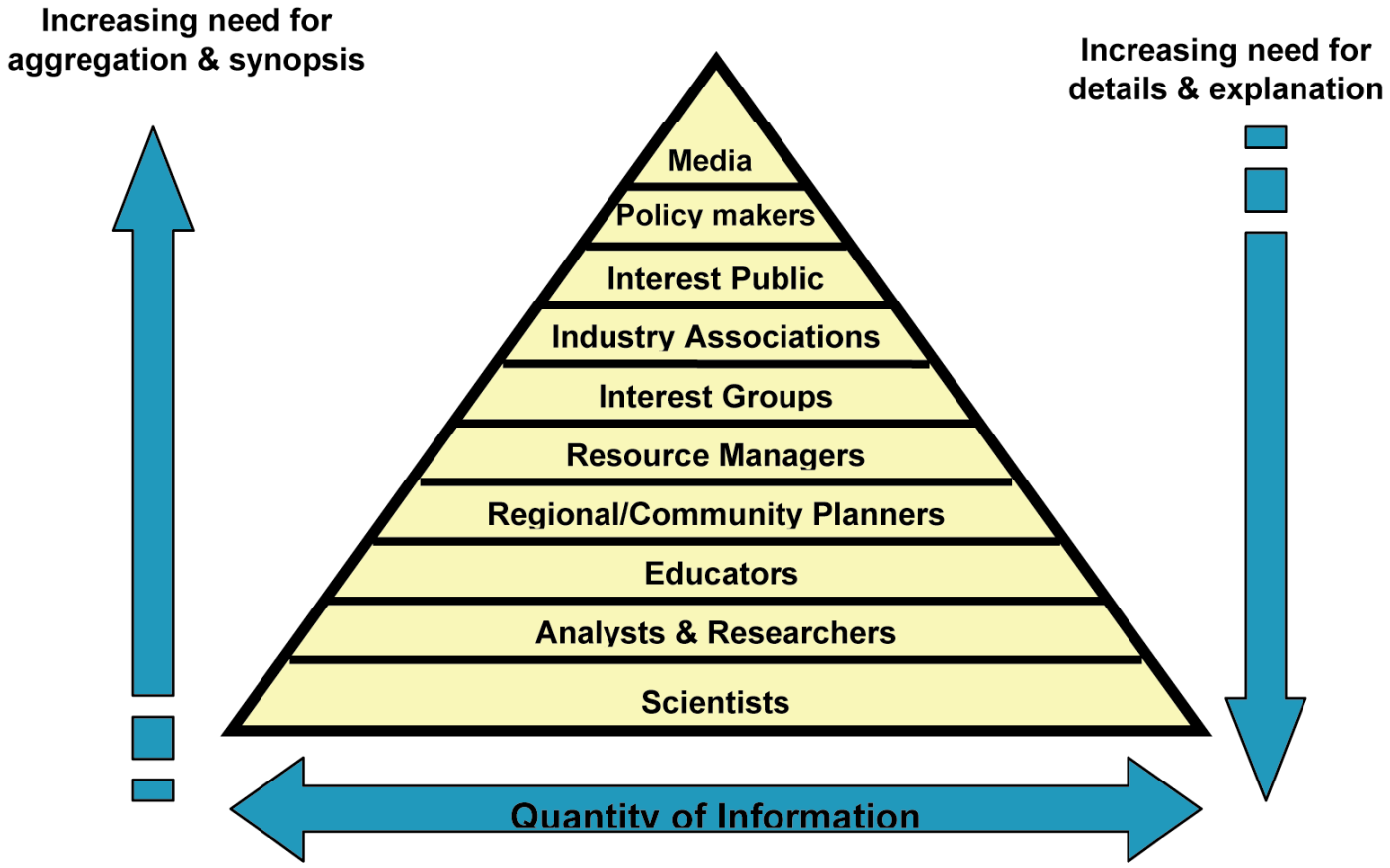
A Framework for Data Flows



Continuum from Data to Indices: From narrow to broad views



Information Requirements for Various Users



What are the relevant issues?

- Desertification
- Water resources
- Climate change
- Quality of the urban environment
- Eutrophication
- Biodiversity
- Fish resources
- Toxic contamination
- Forest resources
- Oil resources
- Disposal of waste
- Depletion of the ozone layer
- Acidification etc.

Stage 3: Scoping and Design

STAGES	ACTIVITIES	OUTPUTS
Stage 3 Scope and design	*Clarify methodological issues. *Establish geographic boundary and timescale for producing the report. *Identify key environmental issues. *Draft an outline of the report. *Identify the target audience. *Develop the impact strategy. *Discuss the elements for a a communications and outhreach strategy.	*Design document (including annotated structure or outline). *Impact strategy

Stage 5: Implementation

STAGES	ACTIVITIES	OUTPUTS
Stage 5 Implementation	*Validate priority environment/development issues and their connection according to the GEO framework. *Identify indicators, data requirements and sources of information. *Collect, process and analyze information. *Interact with organizations to discuss preliminary results (workshops). *Write the report and adjust drafts. *Translation and publication (hardcopy, CD, etc).	*Report and complementary results, in different media.

Prioritize the issues

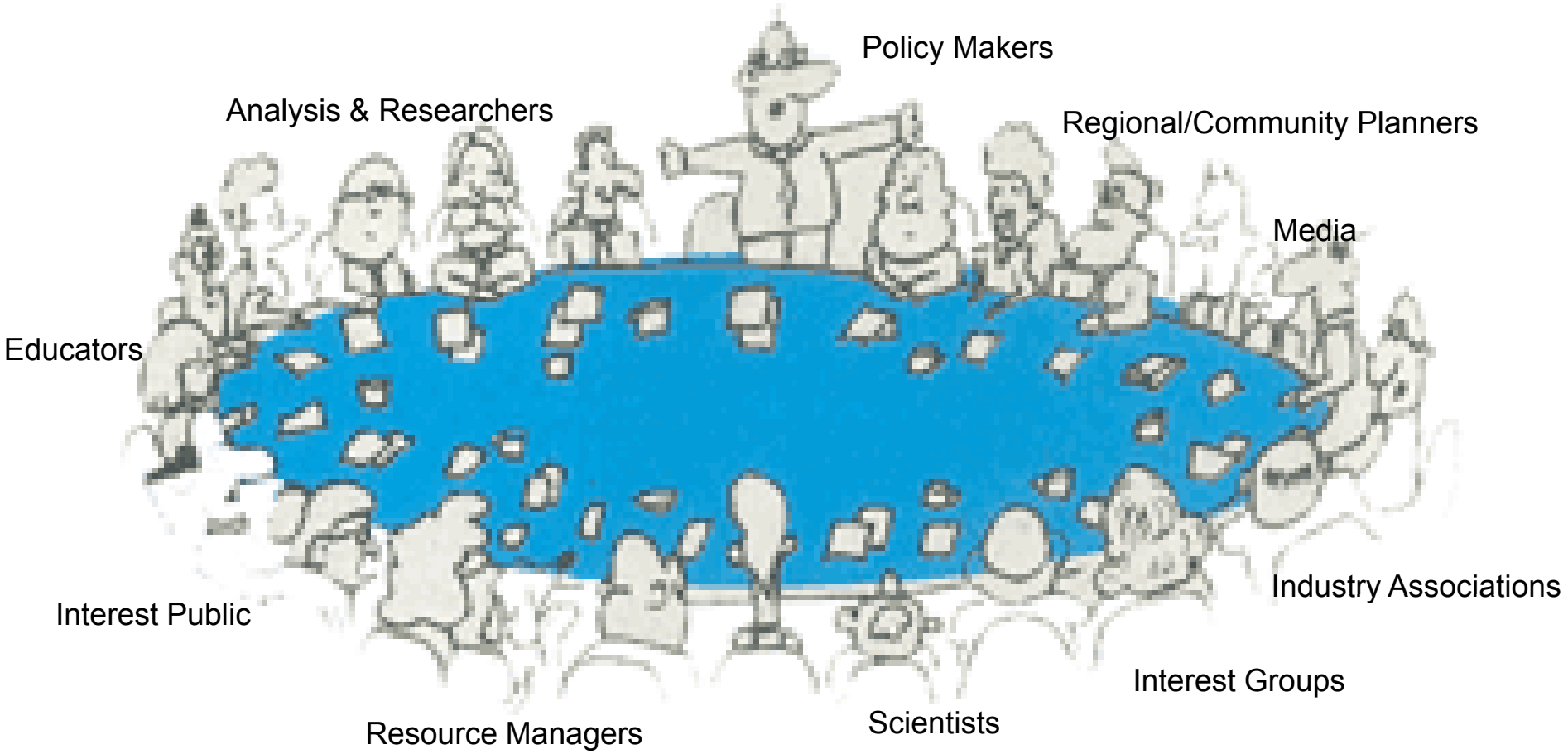
Criteria for Issue Selection

- Urgency & immediate impact
- Irreversibility
- Effects on human health
- Effects on economic productivity
- Number of people affected
- Loss of aesthetic values
- Impacts on cultural and historical heritages

Theme & Issue

What is the general theme	What is the environment issue	What is the geographical scale/ coverage of the problem?	What priority should be given to the problem?		
			Low	Medium	High

Who needs to be consulting when collecting data and developing indicators?



Stakeholders are individual and groups that include governmental, non-governmental institutions, communities, universities and research institutions, development agencies and banks, donors, and the business community

Participatory Process

Questions to Ask:

Who needs to be consulted?

What are the most appropriate levels of participation?

What are the most relevant stages of the process?

What are the most efficient and effective mechanisms, given available resources?

How will input from those consulted be used and reported?

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Session 5: Data Analysis

In this session…

- **Types of data**
  - Quantitative
  - Qualitative
  - Spatial data
  - Non-spatial data
- **Data monitoring, collection and storage**
- **GEO Data Portal**

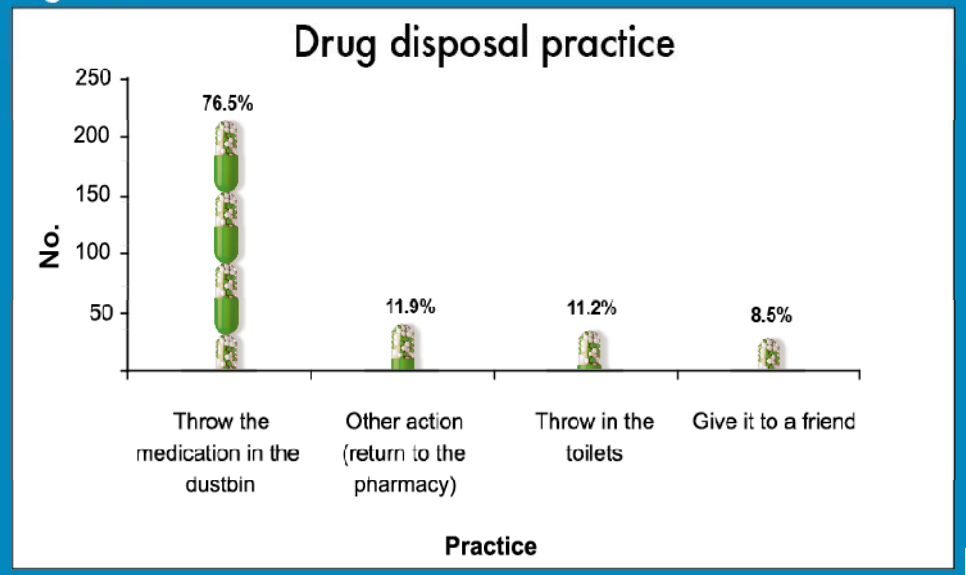
Qualitative Data

Socially-derived information strengthens EIA by relating to the practical "real-world" dimension of the environment.

Qualitative methods can include:

- Field observation;
- Interviews with people who live in local environments;
- Narrative, descriptive, oral histories, and interpretive sources

Figure 1

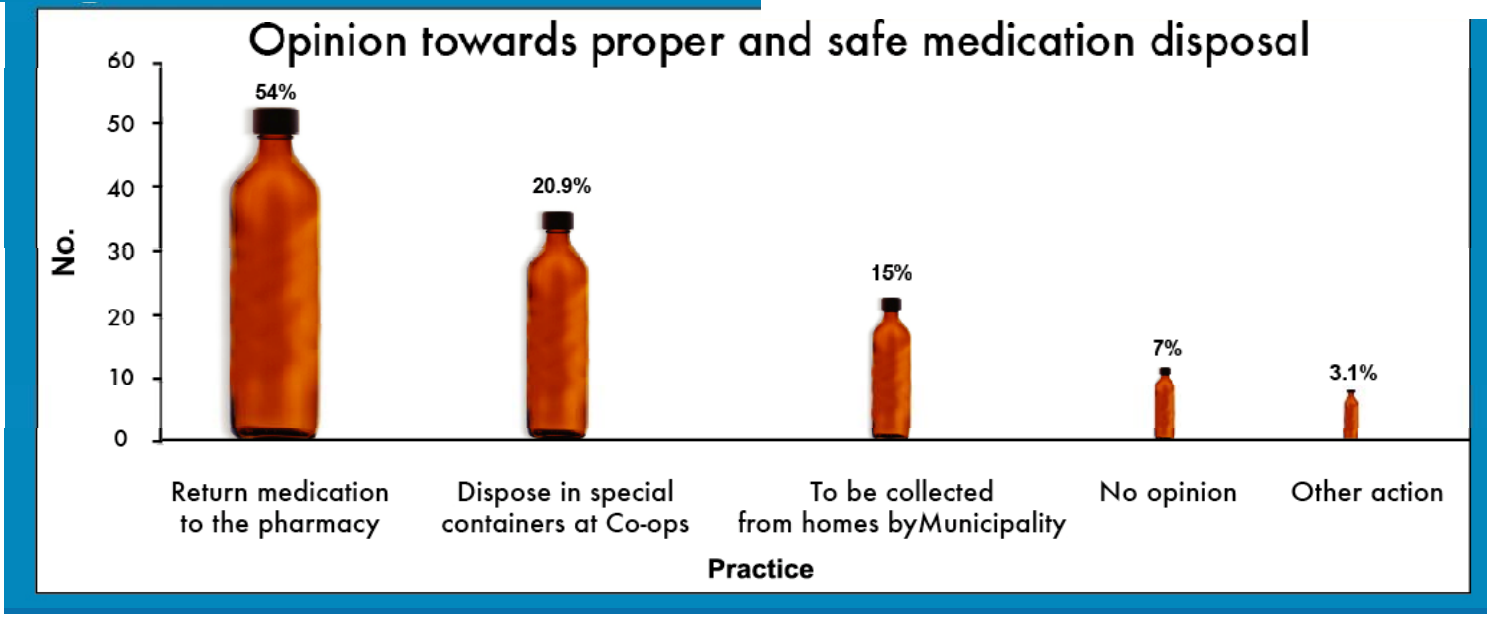


State..

Practice and opinion towards disposal of unused medication in Kuwait.

"Integrated Environmental Assessment Reporting "and Household Pharmaceutical Waste in Kuwait

Eman A. Abahussain & Asma Abahussain(2006)



Step1:**What is happening to the Household Pharmaceutical Waste (HPW) in Kuwait** and why?

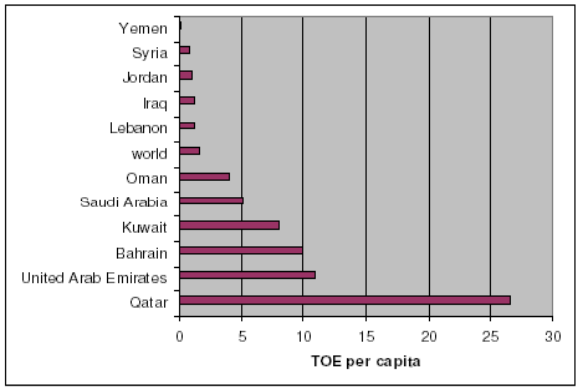
Qualitative Data as a Complement to Quantitative Data

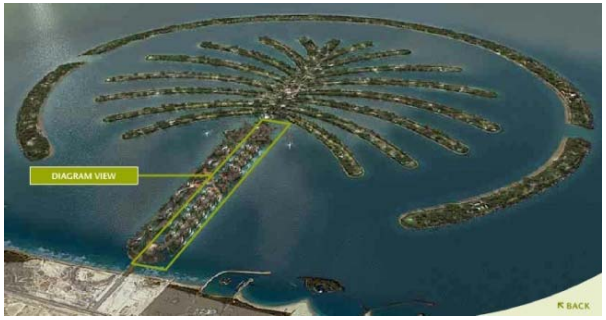
- **Broadens the scope** of environmental inquiry to include people's experiences, perspectives and perceptions;
- **Makes use of critical environmental information** before it shows up on the scientific or public radar;
- **Integrates indigenous or other groups** into formal environmental discussions and decision-making; and
- **Acknowledges the role of perception** in human response to environmental conditions.

Quantitative Data

Possible characteristics:

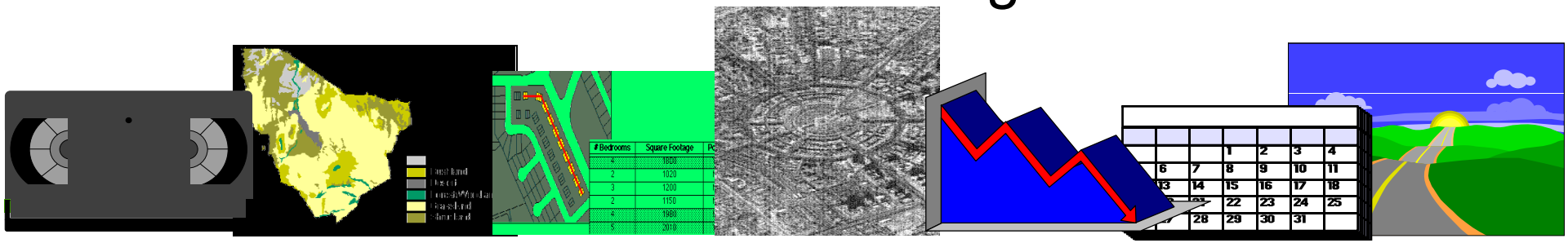
- Geographic locations (coordinates);
- Large in volume (databases, reports, etc.);
- From a variety of often heterogeneous sources ;
- Variability of resolution (details) and scales;
- A high degree of complexity;
- Are needed at varying temporal frequency (e.g., Hourly, daily, monthly, yearly;
- Available in varying forms and formats; and
- Available in digital or electronic versions.





Forms of Quantitative Data

- Maps
- Remotely sensed data such as satellite imagery, aerial photographs, or other forms of data
- Computer data files
- Drawings
- Reports and documents
- Bibliographies
- Videos and films
- Graphs and charts
- Tables
- Computer animated images



Primary vs. Secondary Data

- Very few assessment process have the **mandate, resources and capacity** to collect primary data.

- Many processes relay on **data collected by others.**

- Compiling data usually means collecting data from **many different sources**.

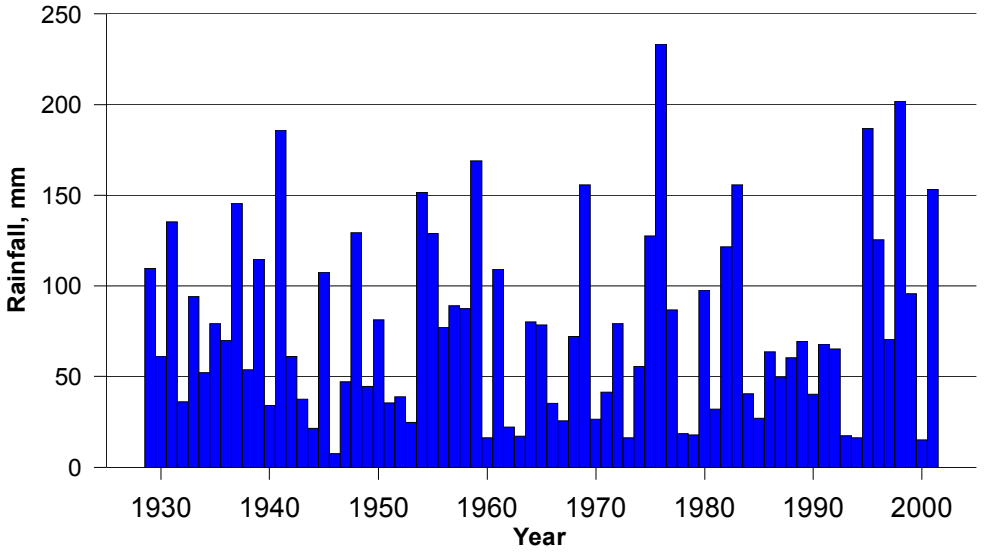
Characteristics of Non-spatial data…

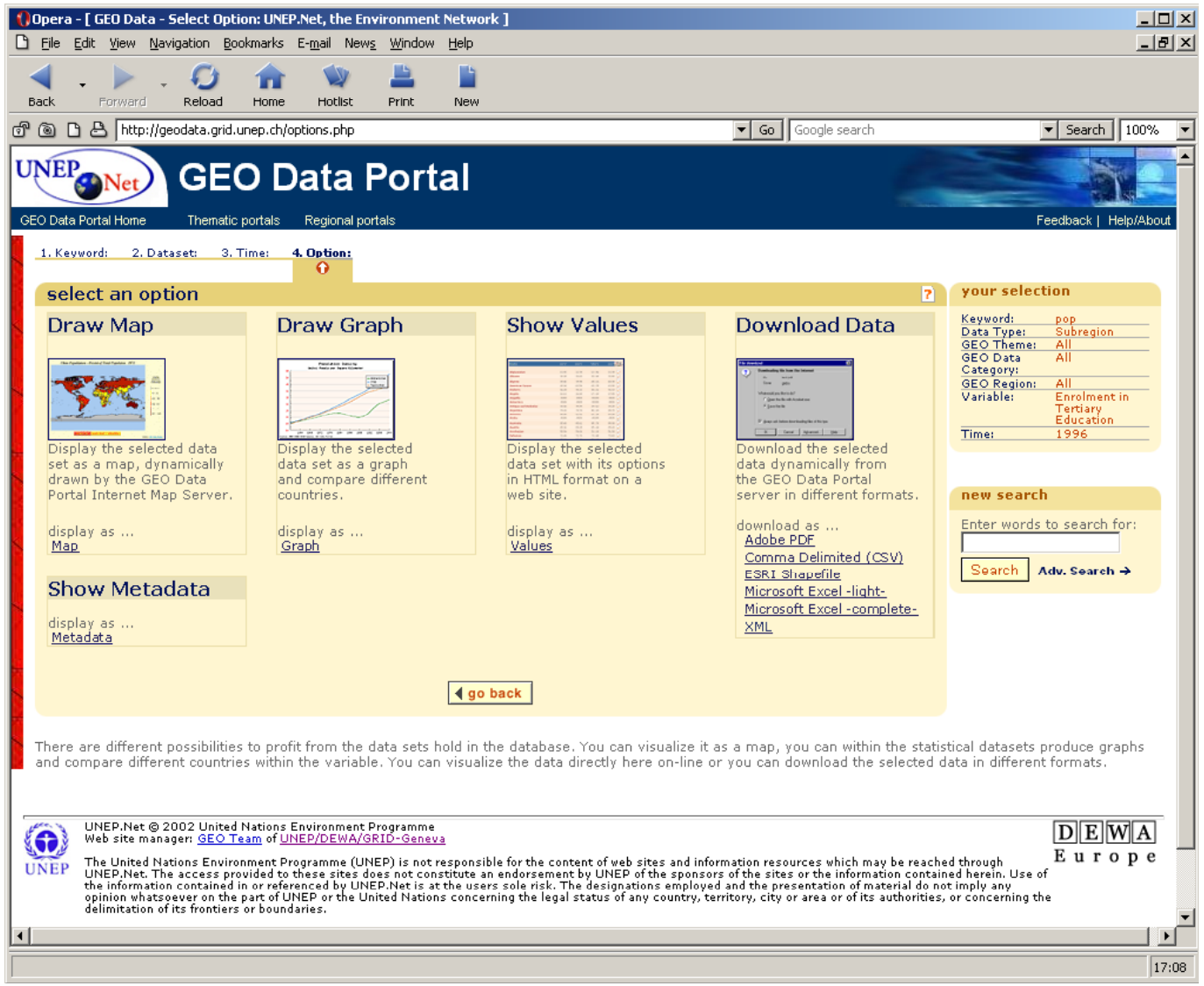
…collected for **one point** and result in a single number;

…can not be further broken down;

…can have **temporal resolution** if collected continuously over a period of time from a specific geographical point;

…can be obtained from **statistical sources** or isolated research.




Opera - [GEO Data - Select Option: UNEP.Net, the Environment Network]
File Edit View Navigation Bookmarks E-mail News Window Help
Back Forward Reload Home Hotlist Print New
http://geodata.grid.unep.ch/options.php
Go
Google search
Search
100%
UNEP Net
GEO Data Portal
GEO Data Portal Home
Thematic portals
Regional portals
Feedback | Help/About
1. Keyword: 2. Dataset: 3. Time: 4. Option:
select an option
Draw Map
Display the selected data set as a map, dynamically drawn by the GEO Data Portal Internet Map Server.
display as ...
Map
Draw Graph
Display the selected data set as a graph and compare different countries.
display as ...
Graph
Show Values
Display the selected data set with its options in HTML format on a web site.
display as ...
Values
Download Data
Download the selected data dynamically from the GEO Data Portal server in different formats.
download as ...
Adobe PDF
Comma Delimited (CSV)
ESRI Shapefile
Microsoft Excel -light-
Microsoft Excel -complete-
XML
Show Metadata
display as ...
Metadata
go back
your selection
Keyword: pop
Data Type: Subregion
GEO Theme: All
GEO Data Category: All
GEO Region: All
Variable: Enrolment in Tertiary Education
Time: 1996
new search
Enter words to search for:
Search
Adv. Search
There are different possibilities to profit from the data sets hold in the database. You can visualize it as a map, you can within the statistical datasets produce graphs and compare different countries within the variable. You can visualize the data directly here on-line or you can download the selected data in different formats.
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Web site manager: GEO Team of UNEP/DEWA/GRID-Geneva
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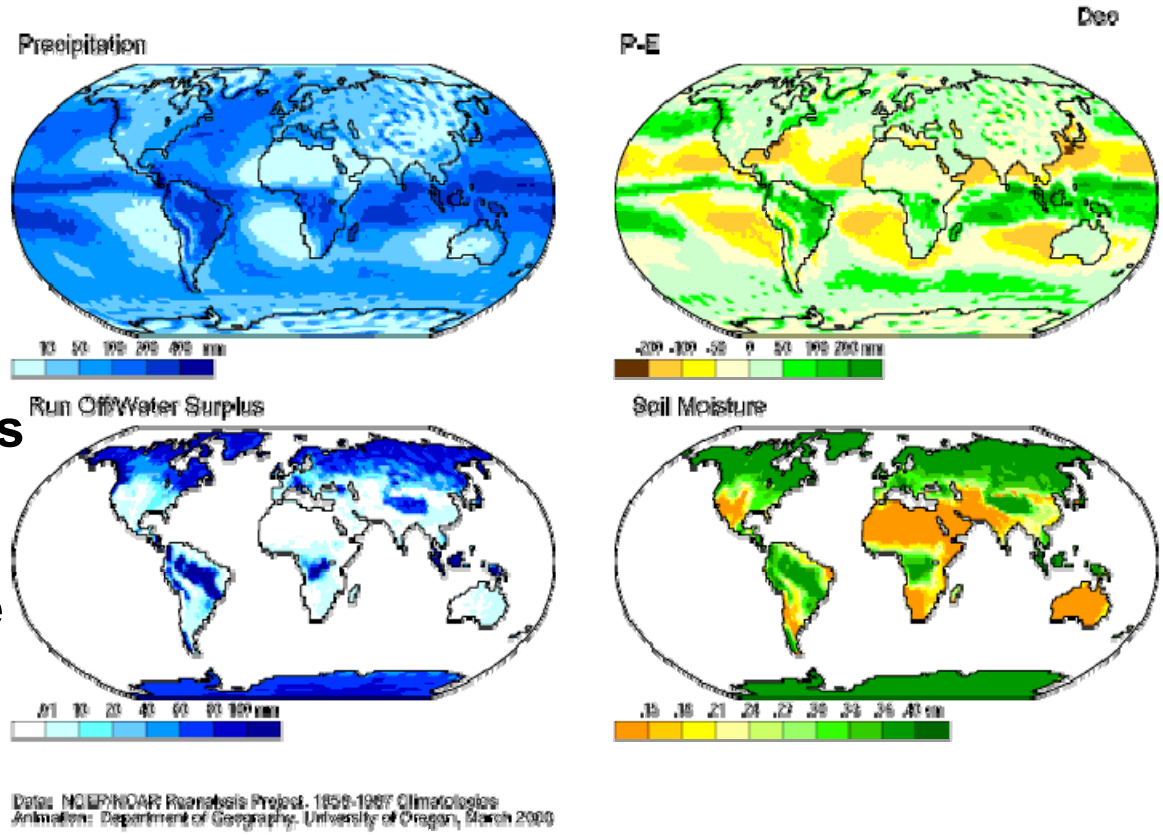
UNEP
DEWA Europe
17:08

Spatial Data…

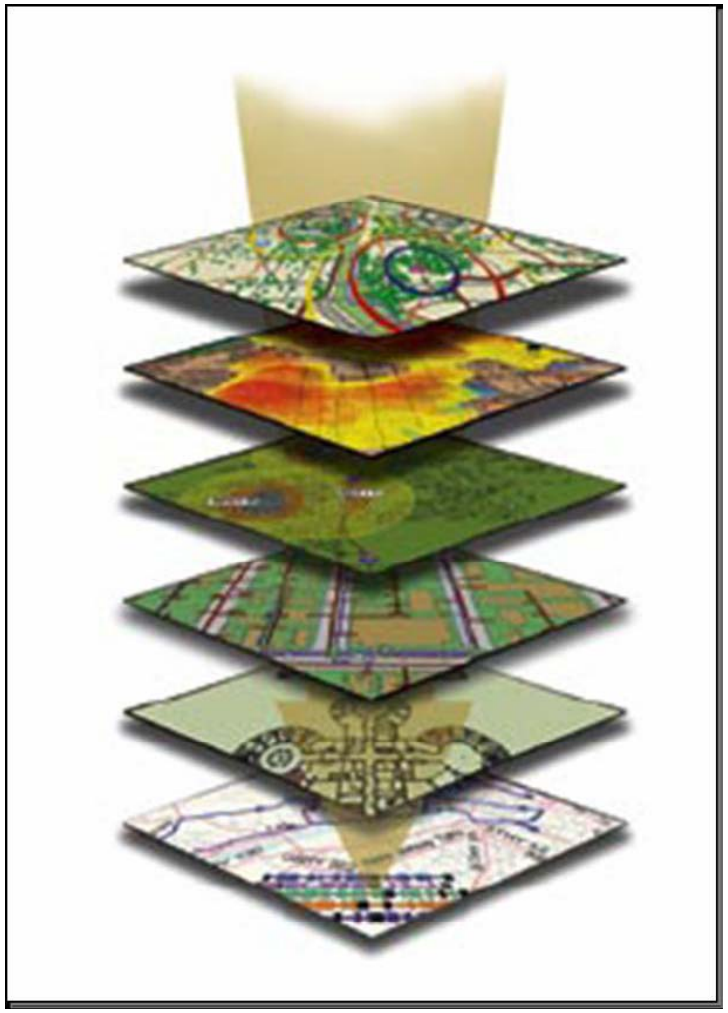
- Describes the **distribution of phenomena** and artefacts;
- Is used to identify the location and shape of, and relationships among, **geographic features** and boundaries;
- Is often **displayed as layers of data;**
- Presents a **very immediate and visual message** regarding environmental issues and management.



Georeferenced Data or Indicators

Examples of Layers you might use:

- Aerial photography
- Satellite imagery
- Country boundaries
- Local administrative boundaries
- Streets
- Cities
- Utilities
- Protected natural areas
- Habitat regions
- Lakes and rivers
- Elevation contours
- Climate data
- Soil layer data
- Wildlife populations



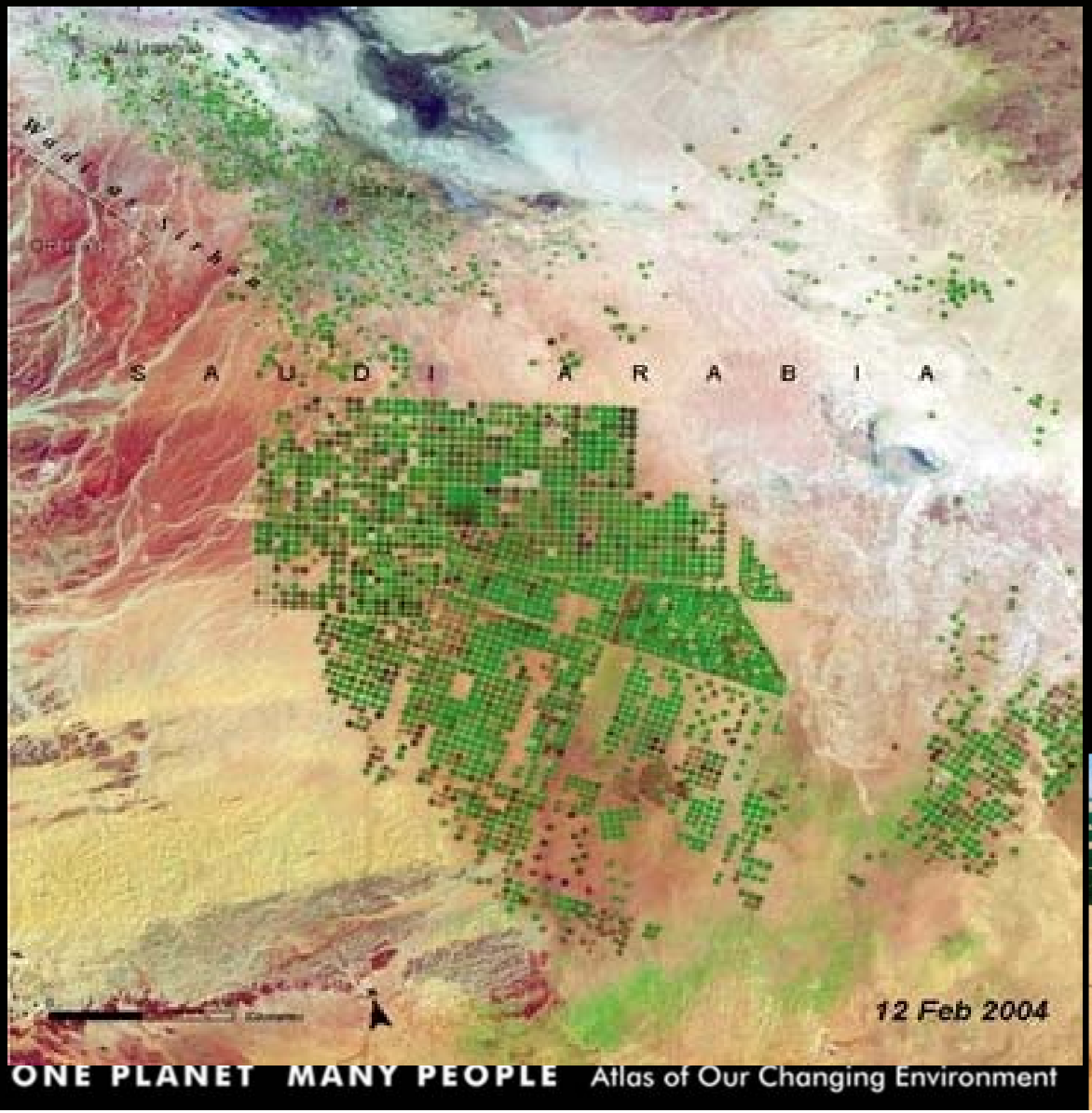
Layers of Spatial Data

Destruction of largest date palm forest - Shatt al-Arab, Iran/Iraq

1975-2002: Destruction of the largest date palm forest in the world, bordering Iraq and Iran

By 2002, more than 80% of palms were wiped out due to war, salt and pests

Greening of Al' Isawiyah desert Saudi Arabia



- 1991 – Irrigation in the desert begins
- 2000 – Irrigation transforms the desert
- 2004 – Irrigation intensity increases

Aerial Photography ?

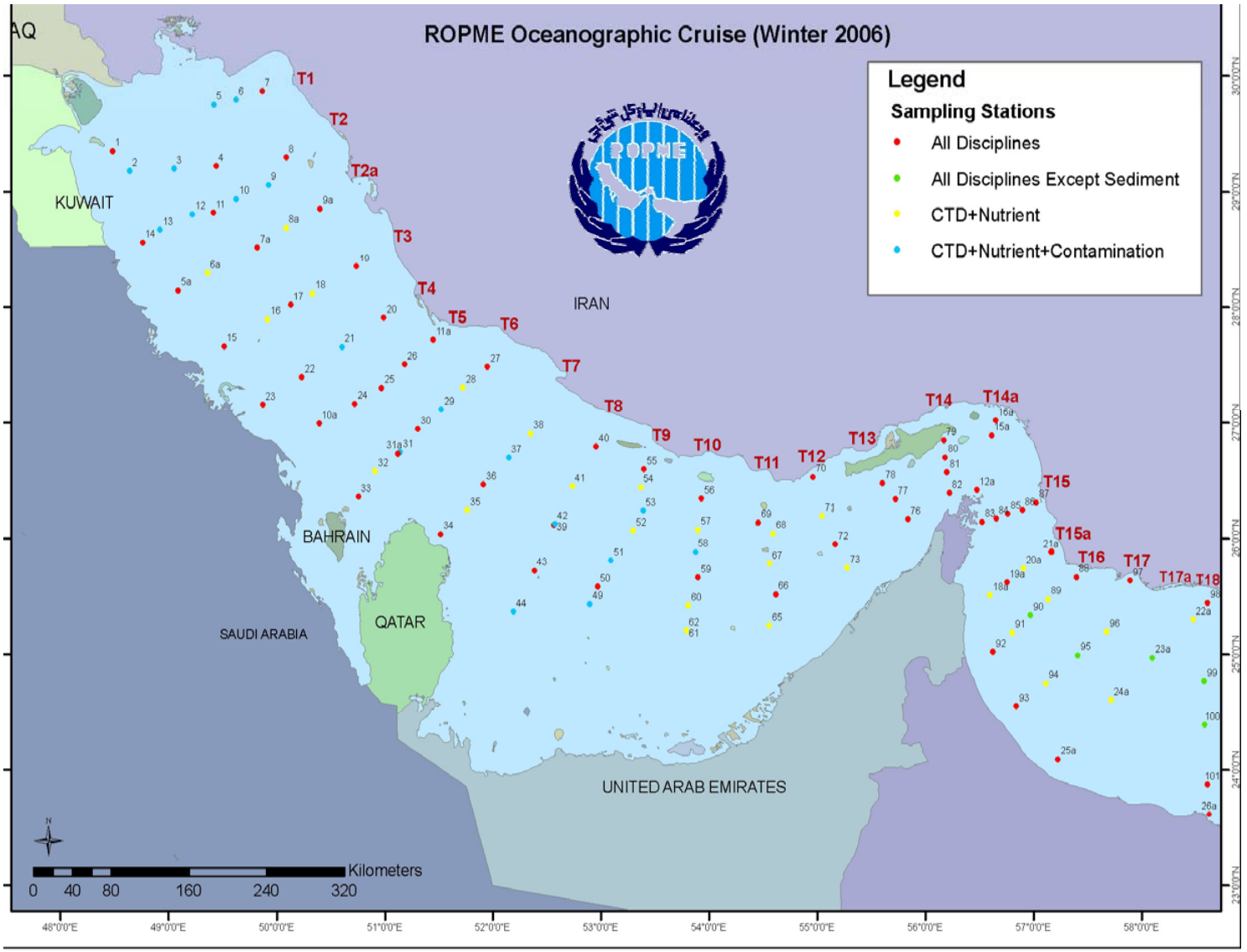
Spring Camping

Kuwait

Monitoring and Data Collection of Environmental Trends and Conditions

- Monitoring provides **tangible information** on a regular basis over an extended period of time about **past and present conditions** of the environment.

- Monitoring can be used to **evaluate** the performance and effectiveness of policies implemented and actions taken.



Opportunities utilized

The Challenge of Coordinated Monitoring Systems

- There is a **critical shortage** of comprehensive, harmonized, high quality data that are readily available for analysis of environmental issues.

- IEAs can have an important role in **identifying** the most important data gaps, and **providing feedback** to monitoring and observation programmes.

Data Collection Steps

1) Develop a plan for data collection, considering,
   a. What **type** of data is needed?
   b. What data needs are **higher priority**?
   c. What are the criteria for data collected, including **quality and cost**?

2) **Survey data availability** for the different components of your assessment.

Steps for Data Collection and Compilation

Source: UNEP/DEIA, Rump, P.C. (1996). *State of the Environment Reporting: Source Book of Methods and Approaches*. UNEP/DEIA/TR.96-1, UNEP, Nairobi.

Data Quality Considerations

- Data quality must be **sufficient** to satisfy objectives.
- Use **proxies** (imperfect approximations) if no direct data can be obtained (E.G. CO2 emissions to show climate change).
- Use **best available, scientifically sound data** from widely recognized sources.

Storing Data in an Indicator Database

- A database is an organized **collection of data**.
- To keep the database up to date, link it electronically to **monitoring systems**.
- A database can be used to **prepare reports** for use by policy-makers and the public.
- Building a database can be a **collaborative effort.**

Finding Data Online

- Some **Environmental and socio-economic data** is available for free on the Internet.

- Many online data and map services are **simple to use** with most Internet browser programs.

- The **GEO Data Portal** provides data from authoritative international sources to the assessment community. (http://geodata.grid.unep.ch)

GEO Data Portal

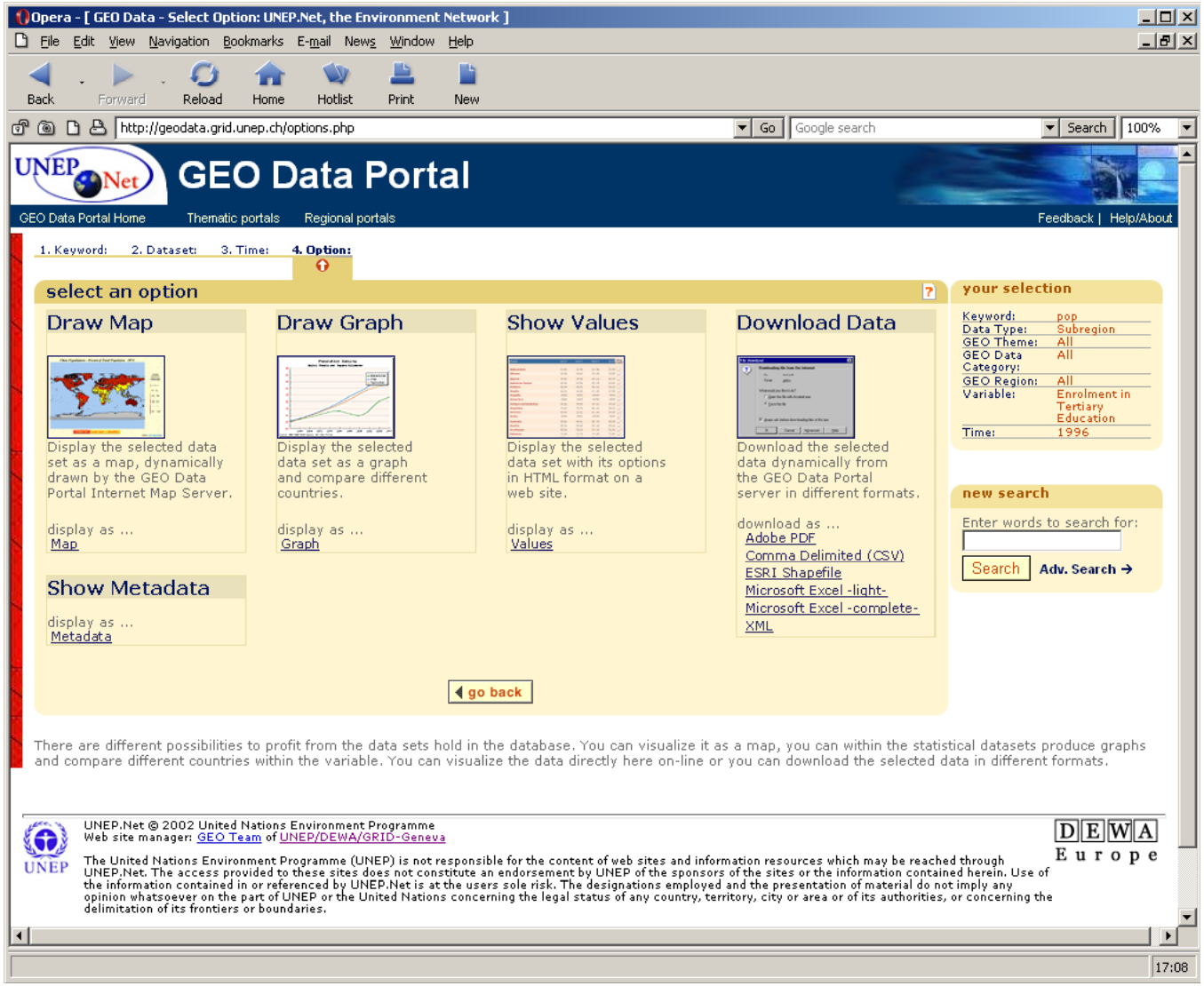
What is GEO Data Portal?

An authoritative source of data used by UNEP and partners in the GEO reporting process and other integrated environmental assessments.

What does the GEO Data Portal do?

- Gives access to a broad collection of harmonized environmental and socio-economic data sets from authoritative sources from global, regional, sub-regional and national levels.

- Enables mapping and analysis.


Opera - [GEO Data - Select Option: UNEP.Net, the Environment Network]
File Edit View Navigation Bookmarks E-mail News Window Help
Back Forward Reload Home Hotlist Print New
http://geodata.grid.unep.ch/options.php
Go
Google search
Search
100%
UNEP Net
GEO Data Portal
GEO Data Portal Home
Thematic portals
Regional portals
Feedback | Help/About
1. Keyword: 2. Dataset: 3. Time: 4. Option:
select an option
Draw Map
Display the selected data set as a map, dynamically drawn by the GEO Data Portal Internet Map Server.
display as ...
Map
Draw Graph
Display the selected data set as a graph and compare different countries.
display as ...
Graph
Show Values
Display the selected data set with its options in HTML format on a web site.
display as ...
Values
Download Data
Download the selected data dynamically from the GEO Data Portal server in different formats.
download as ...
Adobe PDF
Comma Delimited (CSV)
ESRI Shapefile
Microsoft Excel -light-
Microsoft Excel -complete-
XML
Show Metadata
display as ...
Metadata
go back
your selection
Keyword: pop
Data Type: Subregion
GEO Theme: All
GEO Data Category: All
GEO Region: All
Variable: Enrolment in Tertiary Education
Time: 1996
new search
Enter words to search for:
Search
Adv. Search
There are different possibilities to profit from the data sets hold in the database. You can visualize it as a map, you can within the statistical datasets produce graphs and compare different countries within the variable. You can visualize the data directly here on-line or you can download the selected data in different formats.
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GEO Data Portal

What themes are present?

- Climate, disasters, forests, freshwater
- Education, health economy, population, environmental policies

Who uses the GEO Data Portal?

- UNEP Offices, GEO Collaborating Centres, contributors
- Universities, schools, civil society and general public

GEO Data Portal

Who provides data to the Portal?

- FAO, UNEP, UNESCO, UN Statistical Division, World Bank, OECD

Are there regional versions of the Portal?

- Yes, in Latin America and Africa
- Soon to follow are Asia Pacific and West Asian

Where can I access the Portal?

By website: http://geodata.grid.unep.ch/

By CD-Rom: http://www.grid.unep.ch/wsis/

Exercise (20 min) : Visualizing data needs and uses

- In groups of 3-5, discuss how each person has used spatial data to describe an environmental issue.
- Describe the data analyses that were conducted and the uses of those analyses.
- What worked well and what did not in that process?

Indicators and Indices

- Session 1: Introduction
- Session 2: Developing Data for IEA
- Session 3: Information Systems
- Session 4: Indicators and Indices
- Session 5: Data Analysis

In this session…

- Selecting good indicators
- Participatory processes
- Indicator frameworks
- Indicator development
- Core indicator sets
- Indices

What is indicator?

- The term indicator comes from the Latin indicate, which means to point out. **Indicator** could also be defined as a parameter, or a value derived from parameters, which points to, provides information about, and describes the state of a phenomenon/ environment/ area.
- **Environmental indicators** : are scientific measurements that track environmental conditions over time.

Why indicators?

- Indicators make data **relevant** for society and policy making.
- They help us understand what is happening around us.
- As a society, we tend to choose measures that **reflect** our values.
- At the same time, information we receive also **shapes** what we value.

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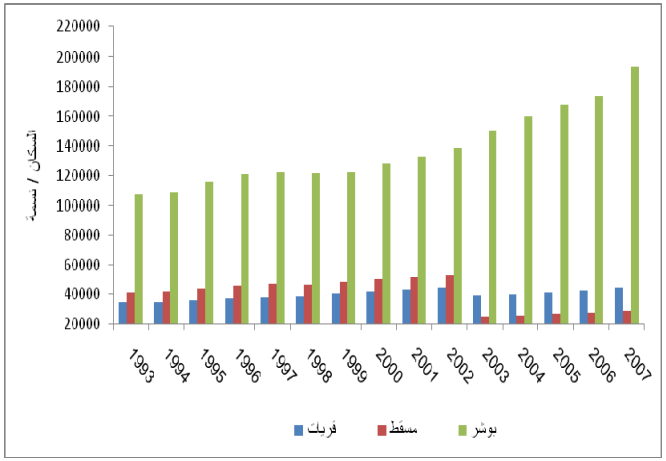
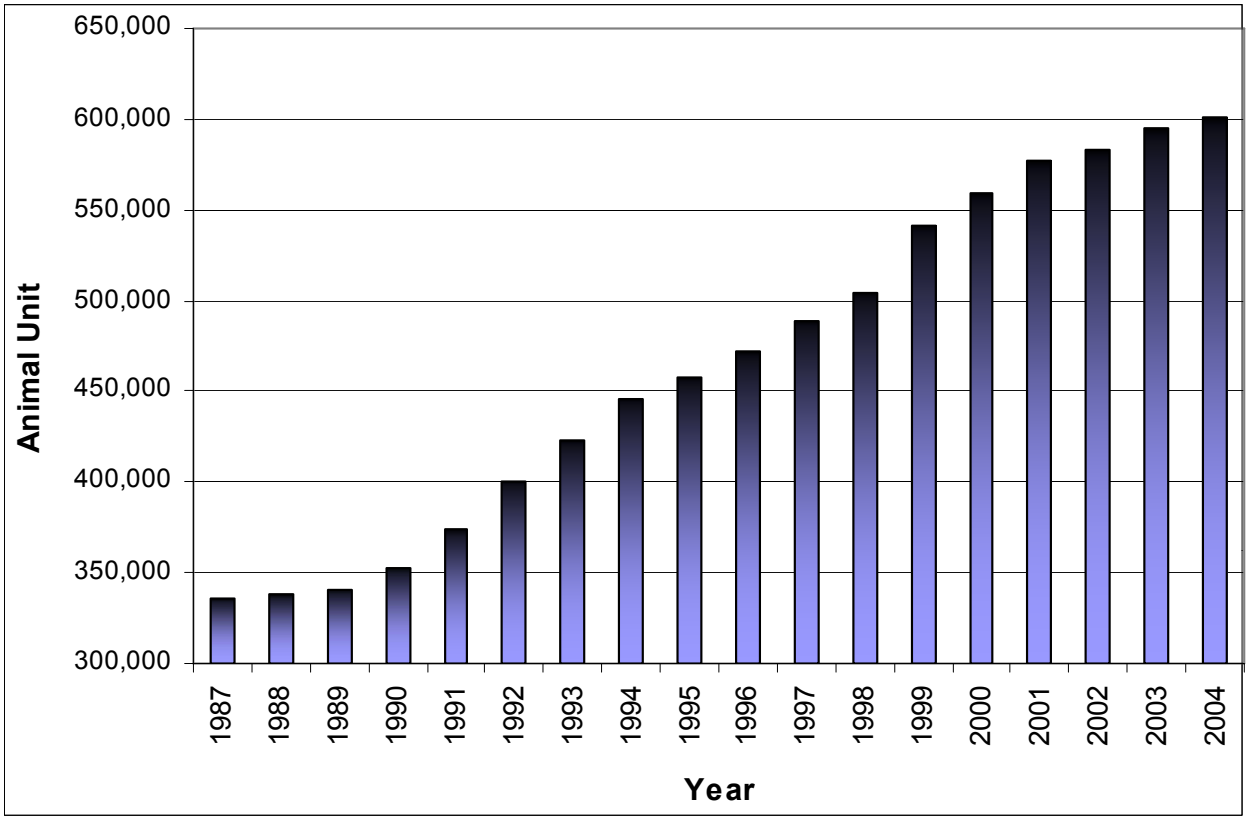
The major functions of indicators are:

1.To assess conditions and trends



	Animal unit	
Local Cattle	البقرة المحلية	0.7
Cattle	البقرة الاجنبية	1
Camel	الناقة	1
Sheep	النعجة	0.2
Goat	الماعز	0.166
Hours	الخيل	0.6
Hen	الدجاجة	0.004



Increase trends in animal units in the Sultanate of Oman

2. Compare across places

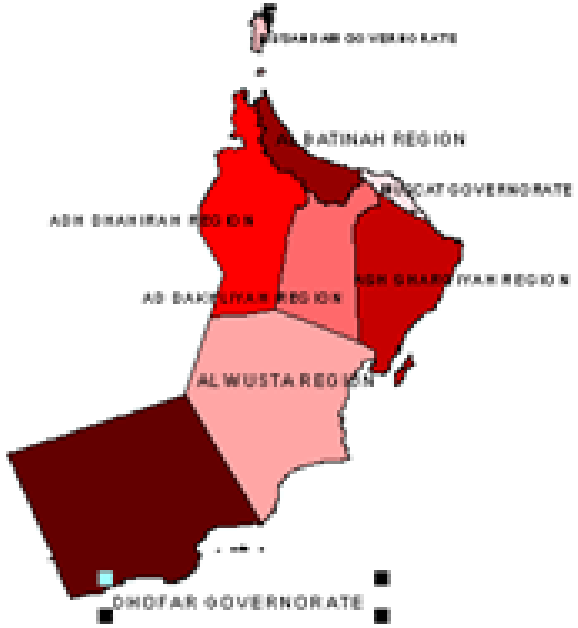


Figure 3a: distrubution of animal units in the different governorates of Oman 2005

Legend:
Darker areas – higher numbers of animal units
Lighter areas – lower numbers of animal units

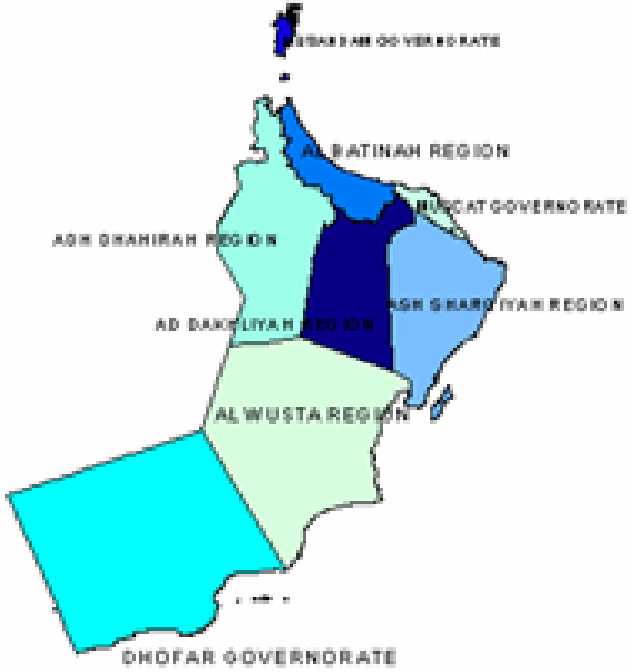
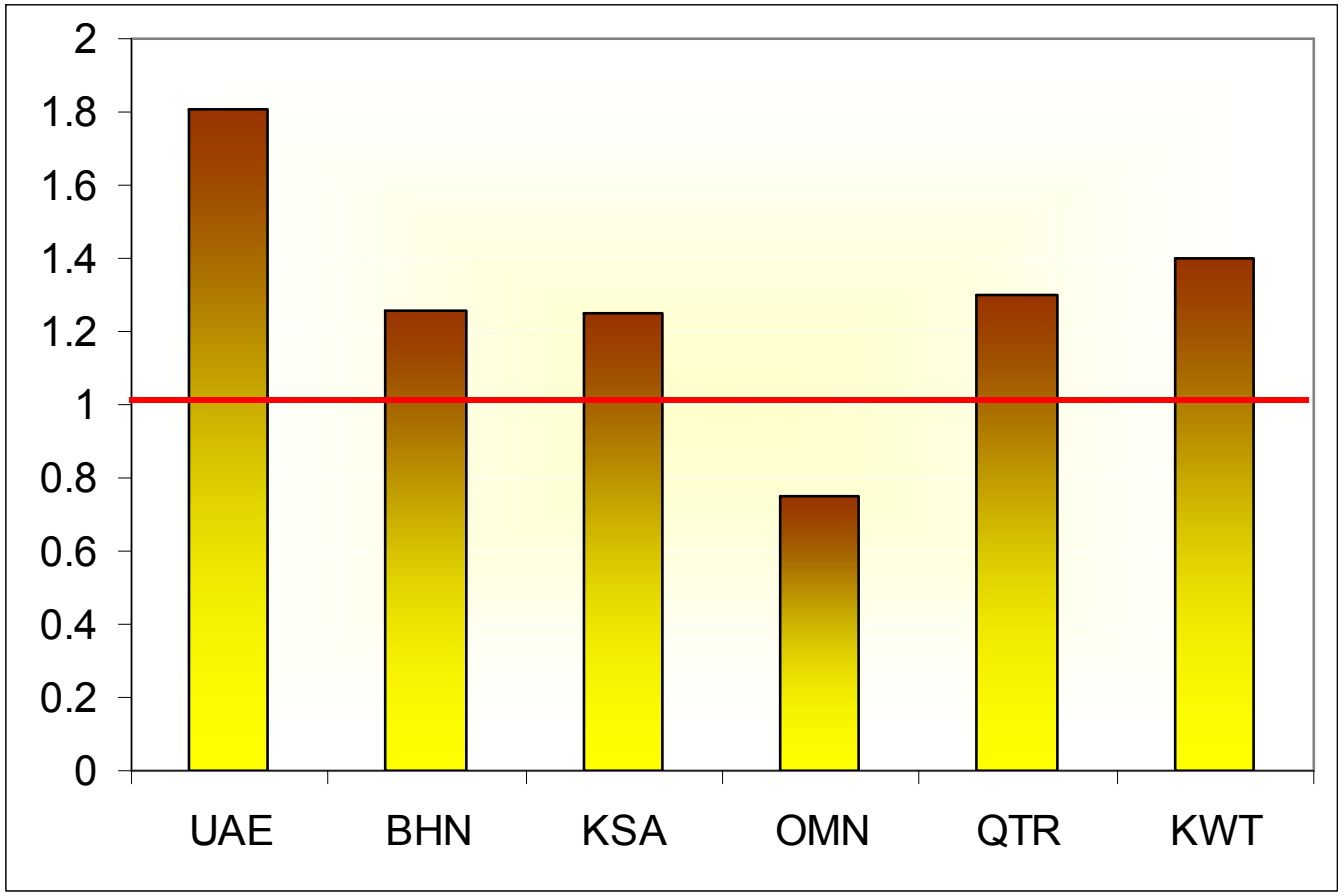


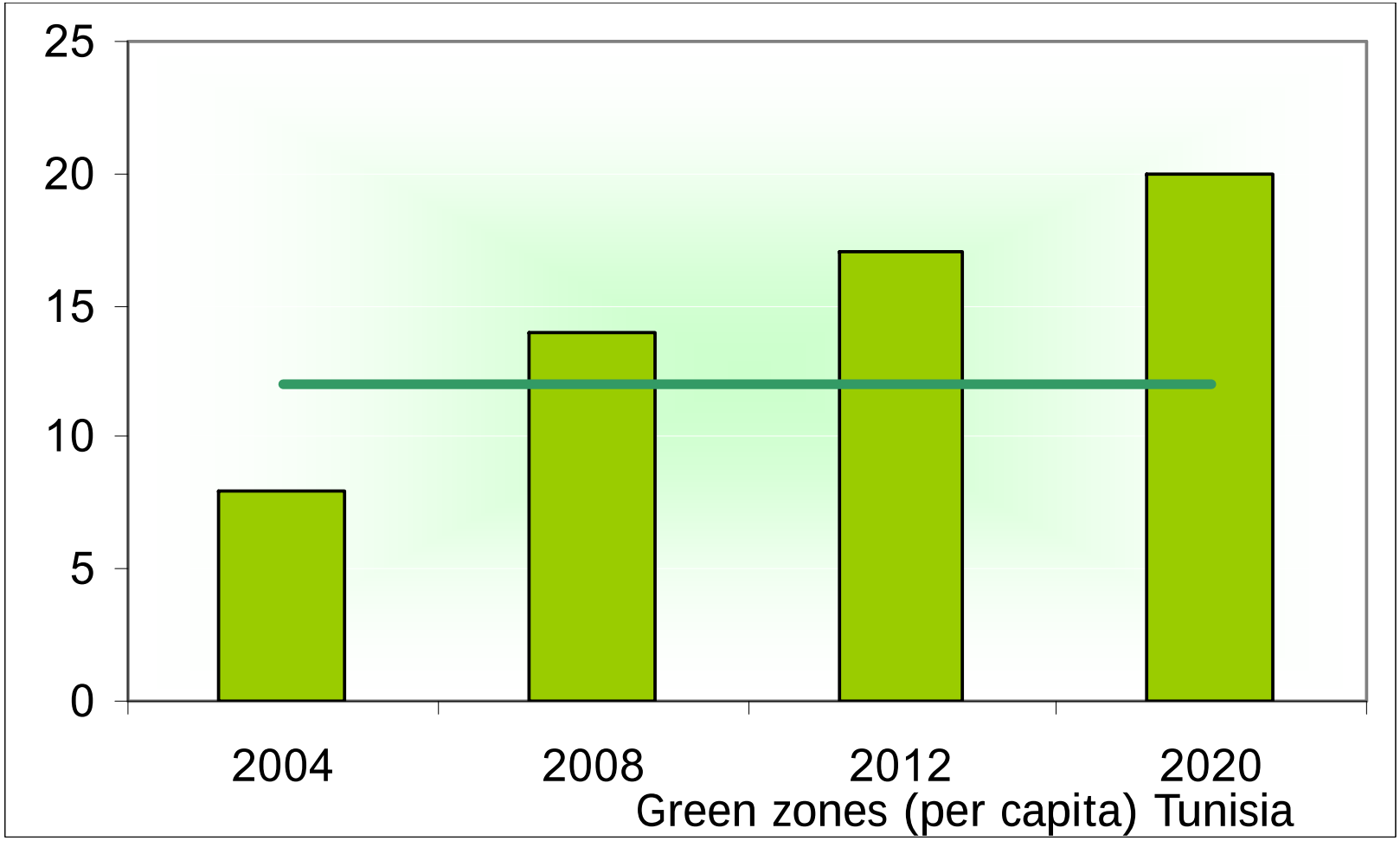
Figure 3b: Rainfall in the different governorates of Oman 2005

Legend:
Darker areas – higher rainfall.
Lighter areas – lower rainfall.

3. Assess conditions and trends in relation to goals and targets

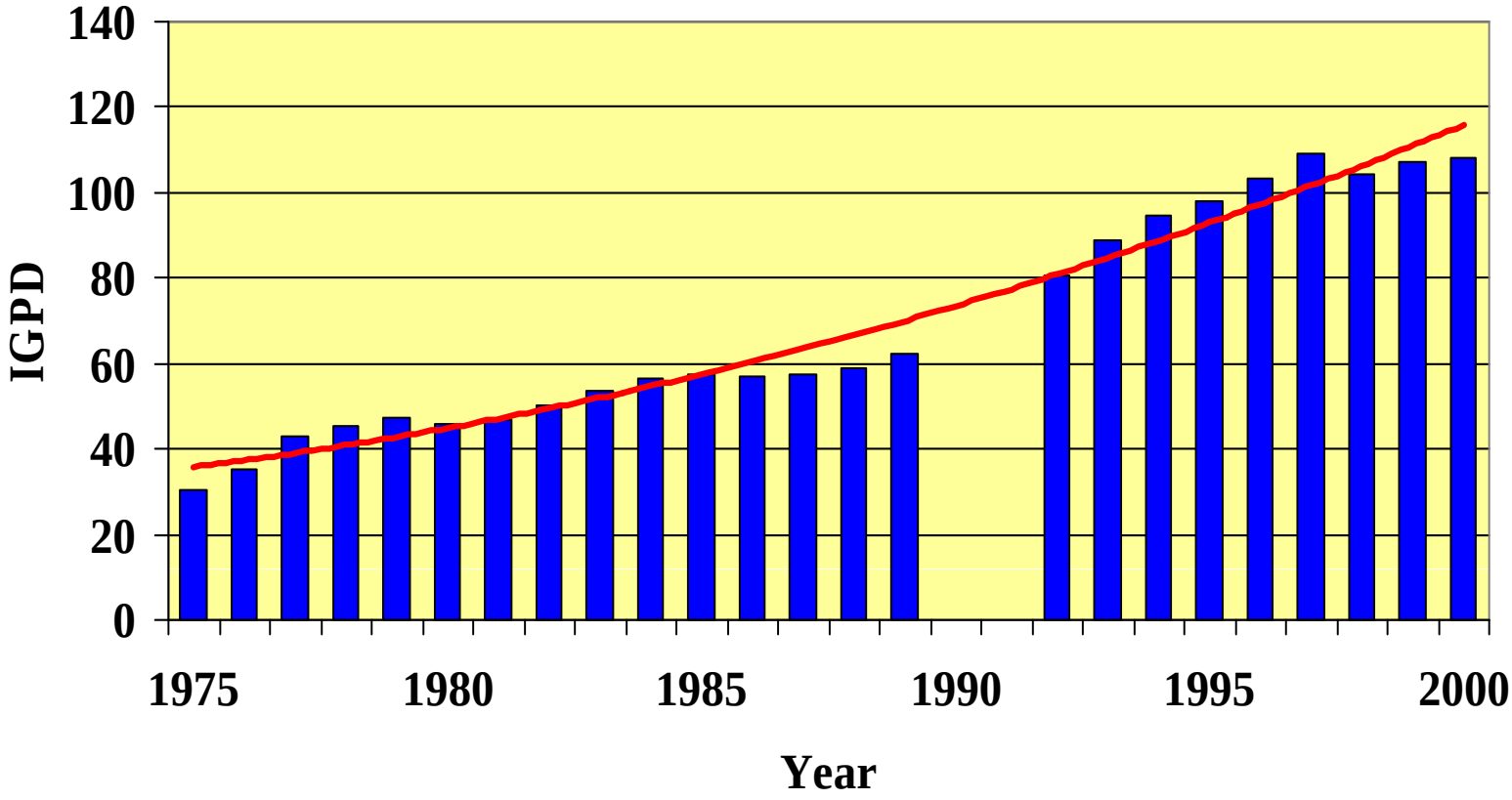


- Amount of waste produced kg/capita/day GCC (2005، الحمود)

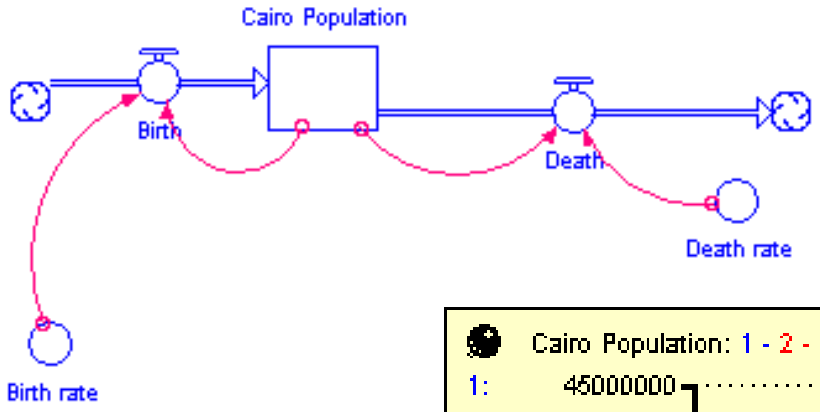

25
20
15
10
5
0
2004
2008
2012
2020
Green zones (per capita) Tunisia

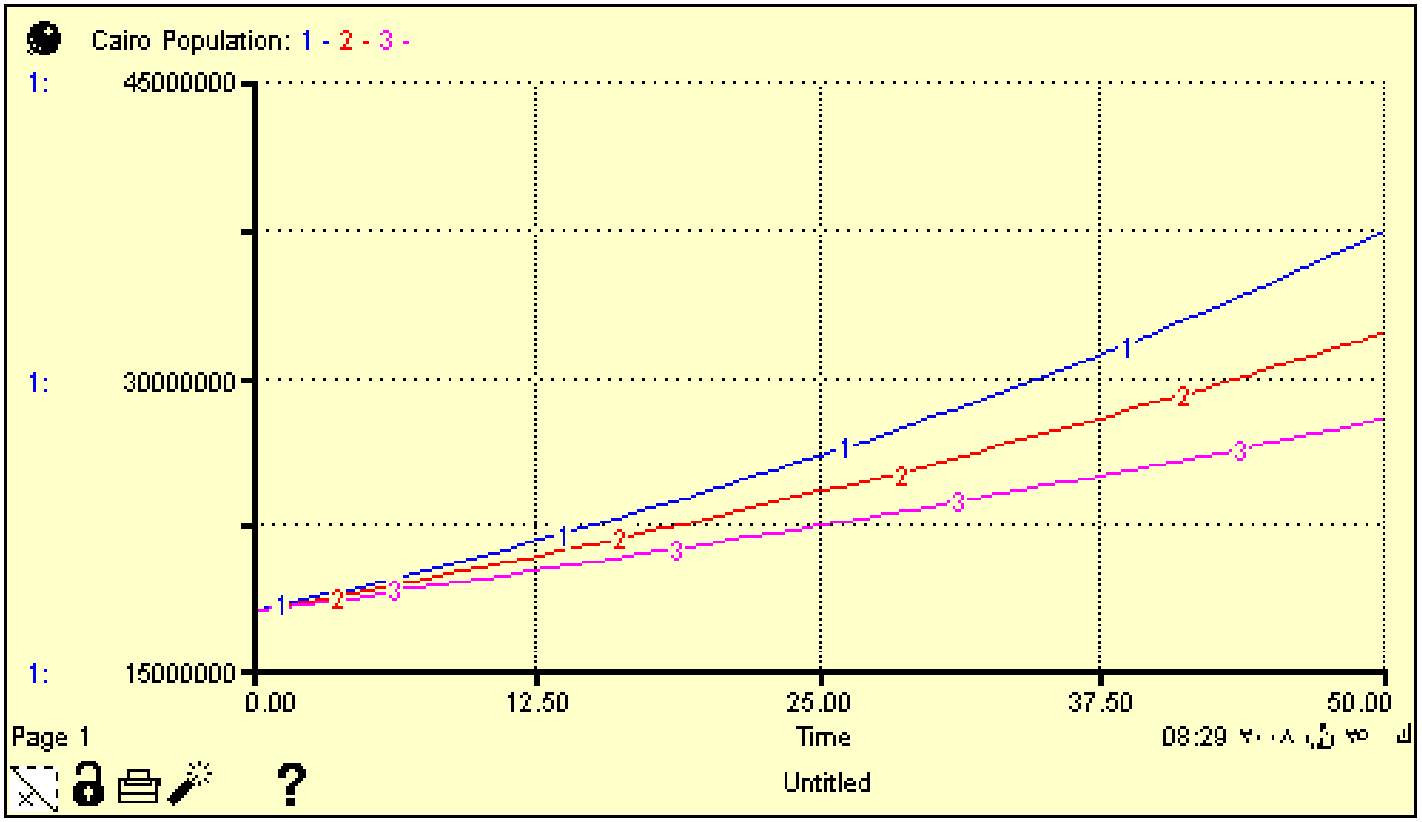
Providing Early Warning Data

Example: Trends in municipal per capita water use in the State of Kuwait, 1975-2000



Anticipate future conditions and trends





Indicators are definitely important!

Yet, which indicators should be included in our reports?

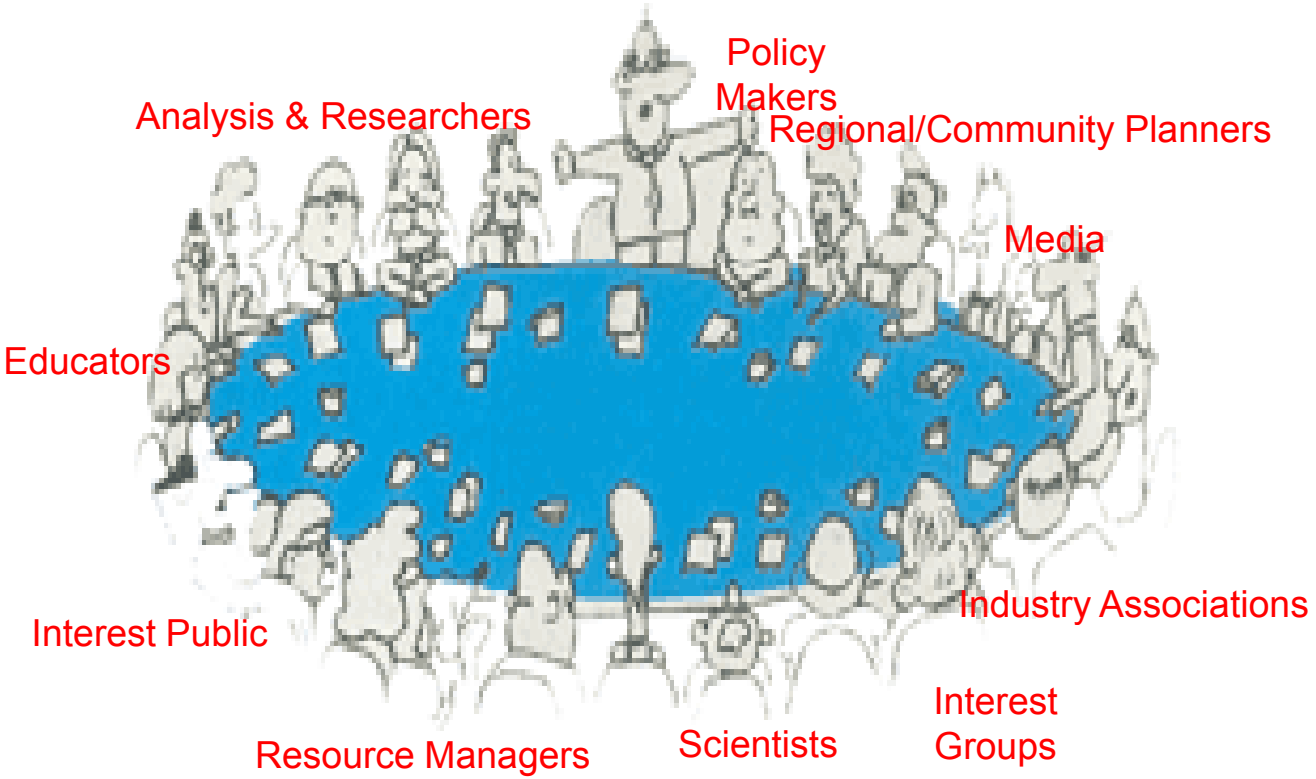
The following is necessary:

- Identifying priority environment and development issues;
- Prioritizing the issues relevant to different sectors and media;
- Identifying indicators needed;
- Identifying data available and data gaps relevant to these issues;
- Identifying responsible institutions for data that is available;
- Assessing the possibilities of generating data, where and when needed, to fulfill data gaps;
- Identifying tentative list of indicators relevant to your city;
- Collecting data and calculating indicators.

The following is needed:

- Agreement on environmental issues to be included in the report.
- What is DPSIR for each issue?
- Which scientifically-acceptable indicators reflect DPSIR ? (SoE in cities, sustainable development indicators, etc)
- What data is needed in the calculation of each indicator?
- How is each indicator measured?
- What is the significance of the indicator?

Who needs to be consulting when collecting data and developing indicators?



Indicators used are selected from a whole group of urban environment indicators by specialized technical assessment teams.

Stakeholders are individual and groups that include governmental, non-governmental institutions, communities, universities and research institutions, development agencies and banks, donors, and the business community

Participatory Process

Questions to Ask:

Who needs to be consulted?

What are the most appropriate levels of participation?

What are the most relevant stages of the process?

What are the most efficient and effective mechanisms, given available resources?

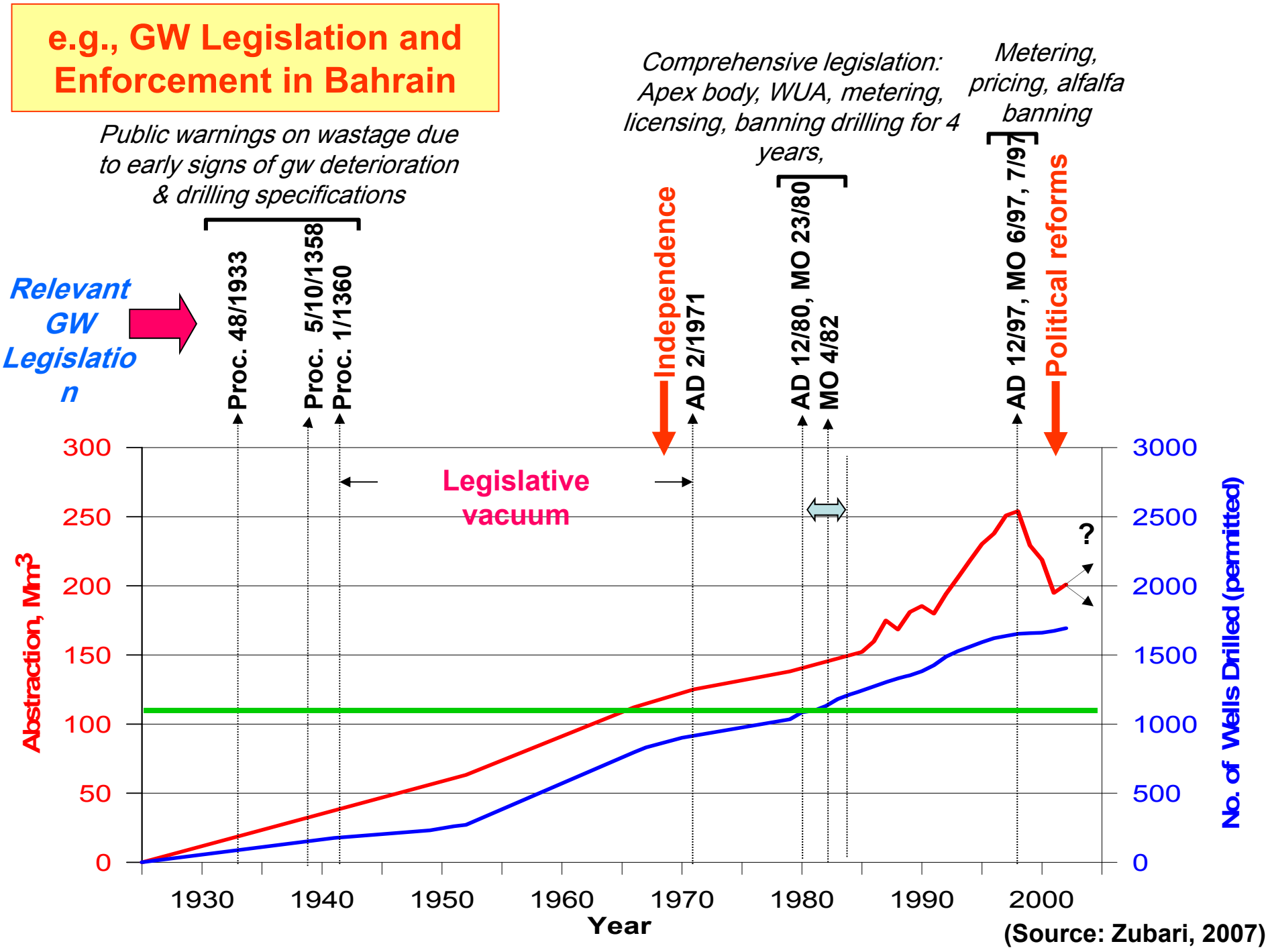
How will input from those consulted be used and reported?

The value of indicators in policy making

Indicators have the potential to…

- ✓ Provide feedback on system behaviour and policy performance;
- ✓ Improve chances of successful adaptation;
- ✓ Ensure movement toward common goals;
- ✓ Improve implementation; and
- ✓ Increase accountability.

e.g., GW Legislation and Enforcement in Bahrain

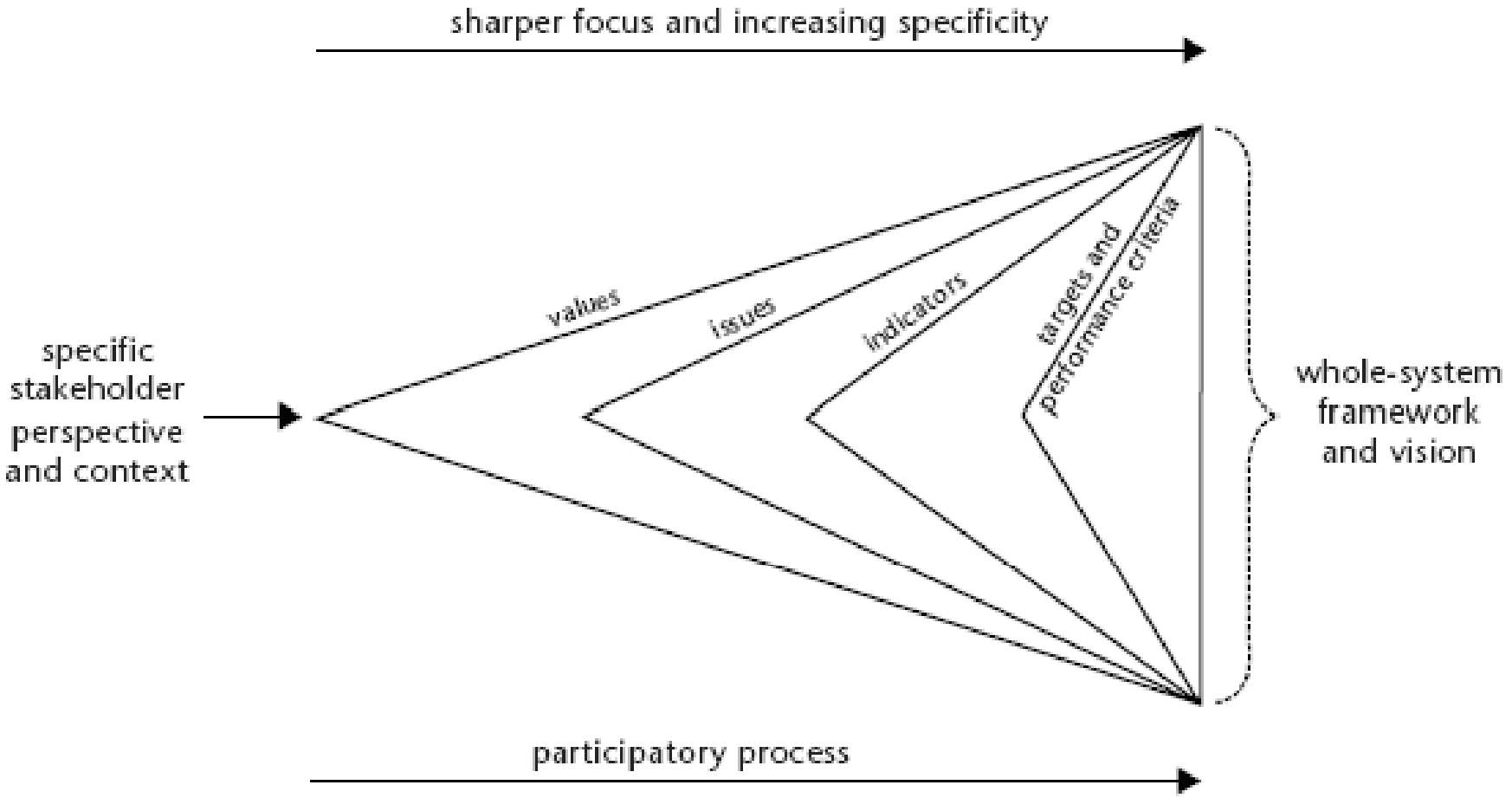


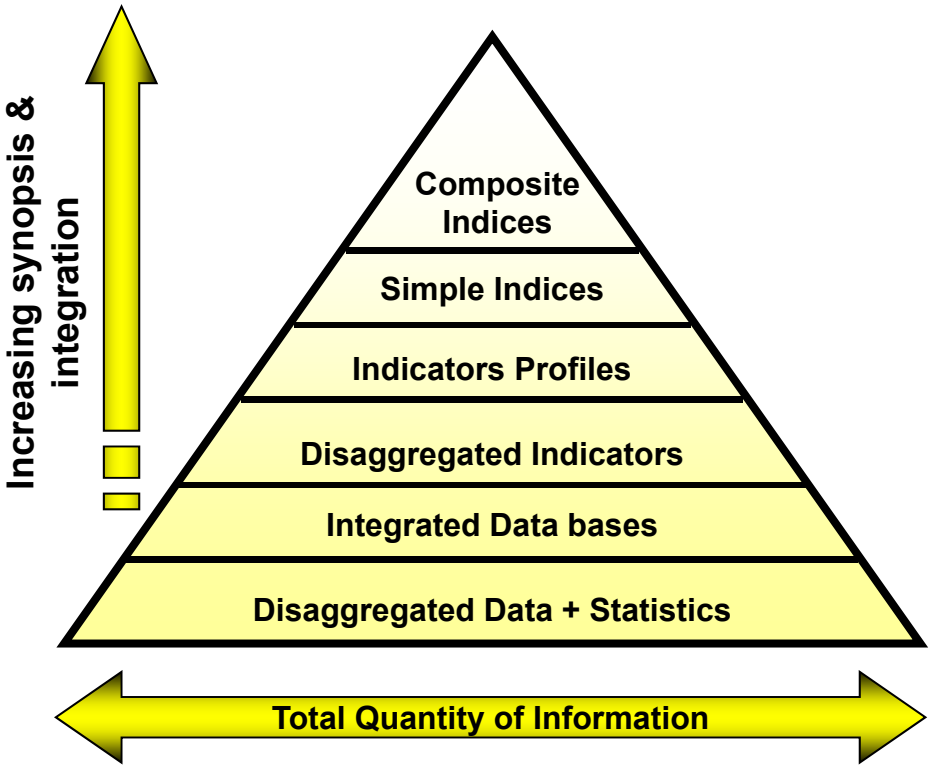
(Source: Zubari, 2007)

The challenge of selecting good indicators

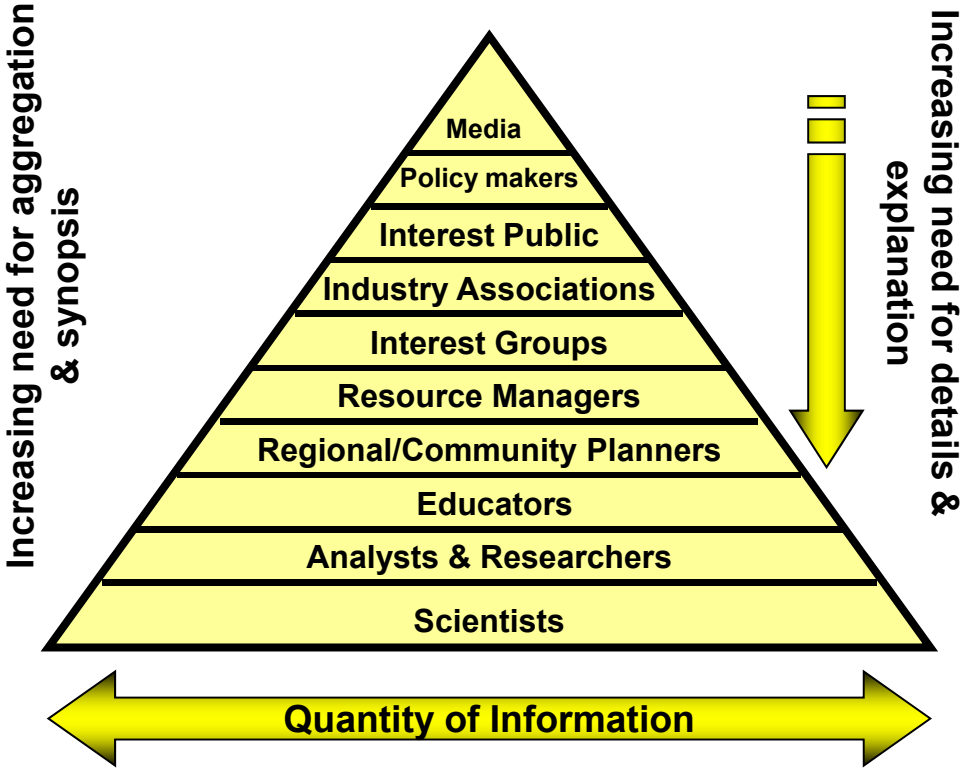
Selecting indicators can be a balancing act, with trade-offs such as **ensuring relevance** to society and policy-makers, using data that is **scientifically sound and accurate**, and relaying data in a way that is **easily interpreted**.

Participatory Process at Multiple Stages of Indicator Development





Continuum from Data to Indices
From narrow to broad views



Information Requirements for Various Users

Orienting Indicators to Conceptual Frameworks

The **orientation** of indicators to issues as well as **relationships** among indicators (such as cause and effect relationships) is often structured using **conceptual frameworks.**

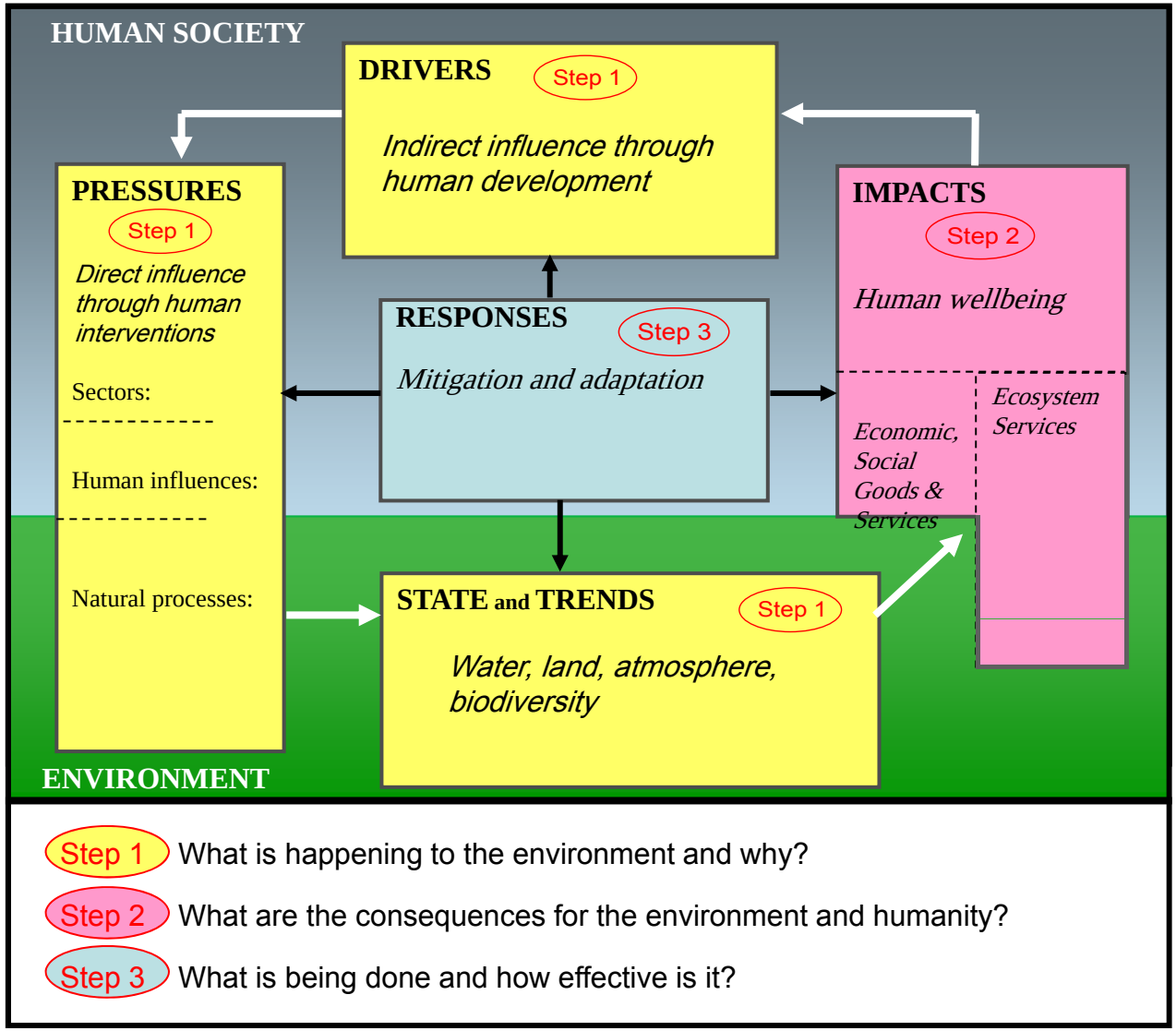
Benefits of Using an Analytic Framework

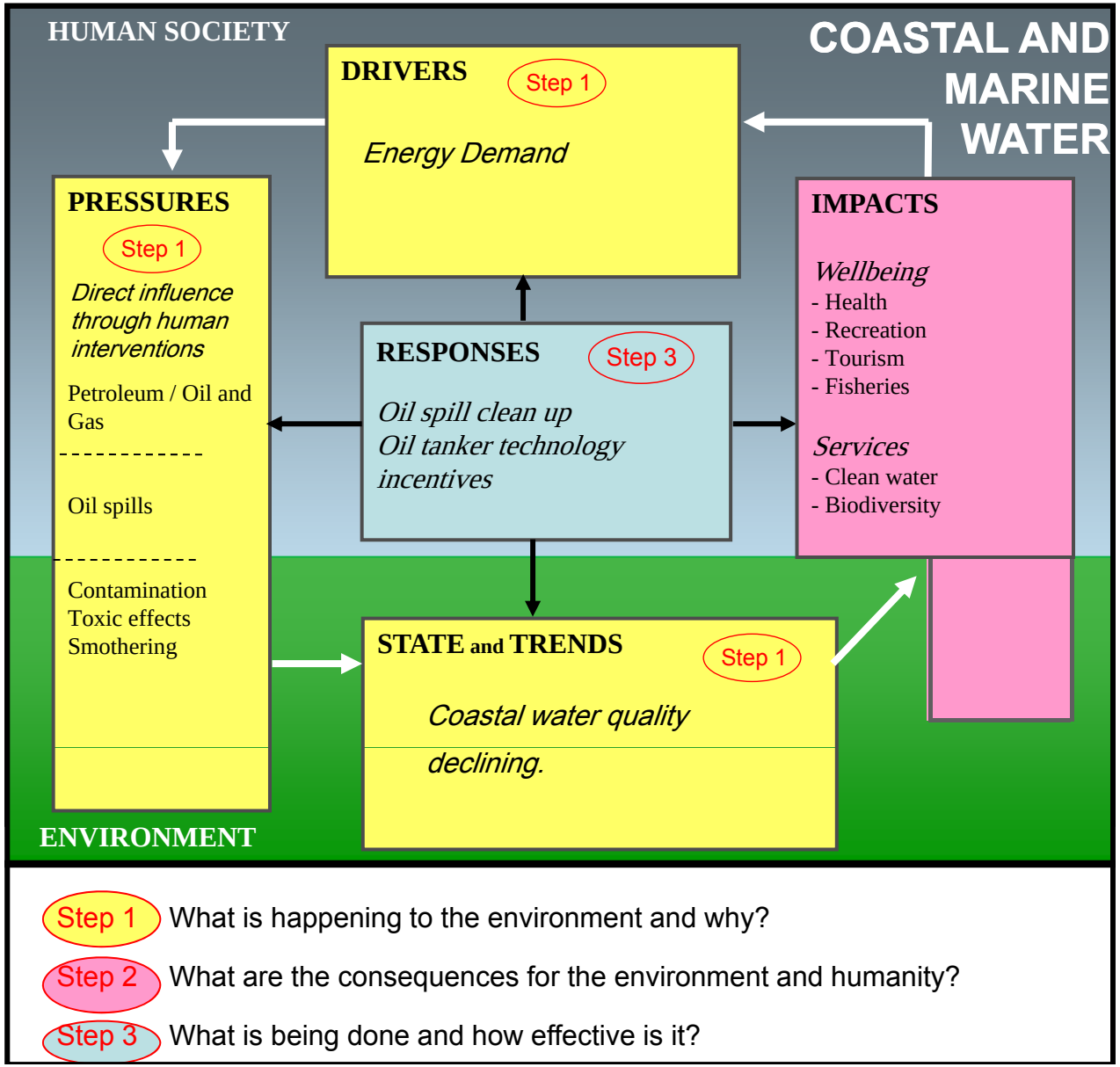
- ✓ Helps **position the environment** in relation to issues of (sustainable) development;
- ✓ Helps establish **cause-effect relationships**;
- ✓ Becomes a **communication tool** for engaging a multi-sectoral and multidisciplinary group;
- ✓ Provides a roadmap and **systematic checklist** for the report writer.

DPSIR Framework

- Driver – Pressure – State – Impact - Response

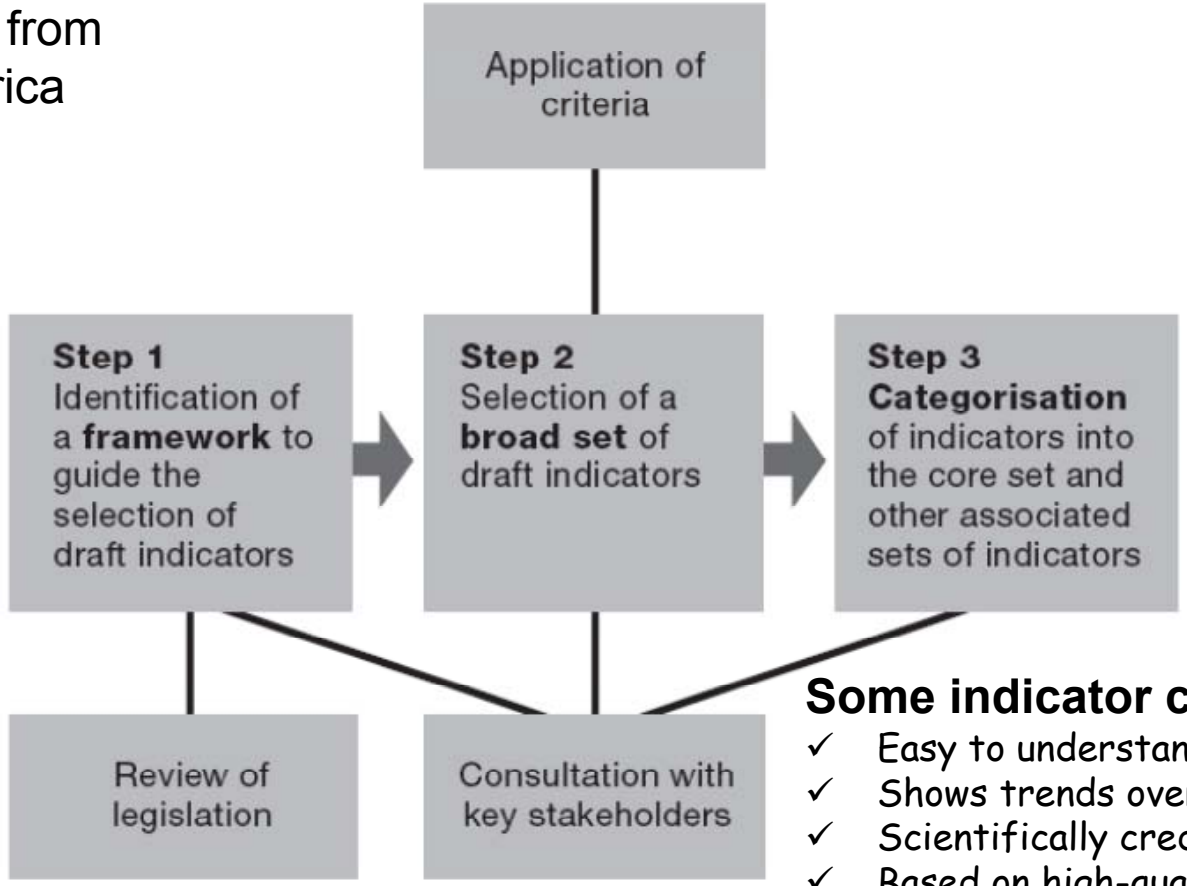
- Shows relationships between human activity and ecosystem well-being and is used for **GEO - 4**.


HUMAN SOCIETY
DRIVERS
Step 1
Indirect influence through human development
PRESSURES
Step 1
Direct influence through human interventions
Sectors:
Human influences:
Natural processes:
RESPONSES
Step 3
Mitigation and adaptation
IMPACTS
Step 2
Human wellbeing
Economic, Social Goods & Services
Ecosystem Services
STATE and TRENDS
Step 1
Water, land, atmosphere, biodiversity
ENVIRONMENT
Step 1 What is happening to the environment and why?
Step 2 What are the consequences for the environment and humanity?
Step 3 What is being done and how effective is it?


HUMAN SOCIETY
COASTAL AND MARINE WATER
DRIVERS
Step 1
Energy Demand
PRESSURES
Step 1
Direct influence through human interventions
Petroleum / Oil and Gas
Oil spills
Contamination
Toxic effects
Smothering
RESPONSES
Step 3
Oil spill clean up
Oil tanker technology
incentives
IMPACTS
Wellbeing
- Health
- Recreation
- Tourism
- Fisheries
Services
- Clean water
- Biodiversity
STATE and TRENDS
Step 1
Coastal water quality
declining.
ENVIRONMENT
Step 1 What is happening to the environment and why?
Step 2 What are the consequences for the environment and humanity?
Step 3 What is being done and how effective is it?

Indicator Development

Example from South Africa



Some indicator criteria…

- ✓ Easy to understand and interpret
- ✓ Shows trends over time
- ✓ Scientifically credible
- ✓ Based on high-quality data
- ✓ Policy relevant
- ✓ Politically acceptable

Source: Palmer Development Group 2004

Core Indicator Sets

- Core indicators sets are **limited in number** and clustered around themes;
- They provide **clear and straightforward** information to decision makers;
- They **do not provide a comprehensive picture** or show relationships between indicators;
- Examples include OECD, UNEP (UNCSD), EU structural indicators, and **GEO core data matrix**.

Themes from the GEO Core Data Matrix

- Land
- Forests
- Biodiversity
- Fresh water
- Atmosphere
- Coastal and marine areas
- Disasters
- Urban areas
- Socio-economic
- Geography

Sample Indicators from the GEO Core Indicator Data Matrix

Theme	Issue	Potential Data Variables	Proposed Lead and Key Indicators
Land	Soil	Water erosion (000 tonne/ha) Wind erosion (000 tonne/ha)	Average annual soil erosion rate
	Erosion	Area affected by desertification (000 ha and %) of rain-fed croplands, irrigated land, forest and woodlands	Total land affected by desertification
	Land saliniza-tion	Areas affected by salinization and waterlogging (000 ha and and change)	Total area affected by salinization

UN DSD Indicator Framework

- Developed in response to **Agenda 21** (Chapter 40)
- Original workplan included a list of **130 indicators** organized using the **Driver – State – Response framework**
- As a result of testing the indicators, the number of indicators was **reduced to 58** and the DSR framework was replaced by a thematic **"four pillars" framework**.

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Priority Environmental Indicators in West Asia, Arab Africa Regions

Indicators Of Water, Energy, Health, Agriculture (And Land), Biodiversity, Coastal and Marine Environment

The Report

- Priority Environmental Indicators in West Asia, Arab Africa Regions:

1. Chapter 1: Priority Environmental Indicators in West Asia, Arab Africa Regions
2. Chapter 2: Theme Matrices and Methodology Sheets
3. Chapter 3: Energy
4. Chapter 4: Health
5. Chapter 5: Agriculture/Land
6. Chapter 6: Biodiversity
7. Chapter 7: Coastal & Marine Environment

Download the full report here [Word file]

Theme: Coastal And Marine Environment

ISSUE

- Coastal Degradation
- Marine Pollution

THEME : COASTAL AND MARINE ENVIRONMENT

ISSUE	INDICATORS	TYPE (DPSIR)
Coastal Degradation	Percent of Total Population Living in Coastal Areas	D
	Development along shore	S
	Annual Catch by Major Species	D
Marine Pollution	Releases of nitrogen and phosphorus to coastal waters	D
	Algae Concentration in Coastal Waters	D
	Oil pollution at coast & at sea	S

Indicator Methodology Sheets

…developed for each selected indicator

Definition of indicator	
Type of indicator	
Underlying Definitions and Concepts	
Unit of Measurement	
Measurement methods	
Data needed to compile indicator	
Data sources	
References	

Theme: Water

Issue: Water Pollution

Indicator: Percent of Population with Adequate Sanitary Facilities.

Definition of indicator	Proportion of population with access to a sanitary facility in the dwelling or immediate vicinity.
Type of indicator	State
Underlying Definitions and Concepts	Sanitary Facility: (definition of a suitable sanitary facility) Population: (i.e. includes rural and urban)
Unit of Measurement	%
Measurement methods	May be calculated as: # people with improved disposal facilities available (X 100) / total population
Data needed to compile indicator	The number of people with access to improved sanitary facilities and total population.
Data sources	Routinely collected at national and sub-national levels in most countries. Include administrative bodies where information can be found.
References	Key references for indicator development.

Exercise : (30 minutes)
Identifying Indicators and Data Sets

- **Step 1.** In plenary, develop a list of short themes required to develop the assessment report.
  - ➢ Prioritize the themes according what might be most relevant for GEOLand at this time.
  - ➢ Form smaller groups, and assign each group a theme.

Exercise *(Cont.)*

- **Step 3.** In sub-groups, prepare a list of issues related to the theme of your group.

- **Step 4.** Identify indicators that correspond to each issue.

  - Brainstorm a larger list, and then narrow down your list using indicator criteria.

  - Indicate whether the indicator is a driver, pressure, state, impact or response in the DPSIR framework.

Exercise *(Cont.)*

- **Step 5.** Identify the data you will need for the indicator. There are a number of data sources you may wish to consult.
  - o GEO Data Portal.
  - o FAO Statistical databases (FAOSTAT, Aquastat, Fishstat, Terrastat).
  - o ESCWA Statistical databases
  - o Others listed in the database section of this report.
  - o Materials: A sample of the question completed to help orient participants and trainers.

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Indices

What are Indices?

- Consist of **multiple indicators** combined into a composite or aggregated unit

- Are often used to assess and **compare performance** against benchmarks or among performers

- If using to inform policy, it is paramount that that the indicators are **well constructed and accurately interpreted**

Considerations about Indices

- Indices have a **broad scope** and can result in **overlooking specific issues** that are reflected in specific indicators.
- An index is based on the **best available data**, which means that indicators for which there is no data will not be included.
- **Correlation** among different indicators **should be avoided** so that certain issues are not amplified in the index.

Constructing an Index

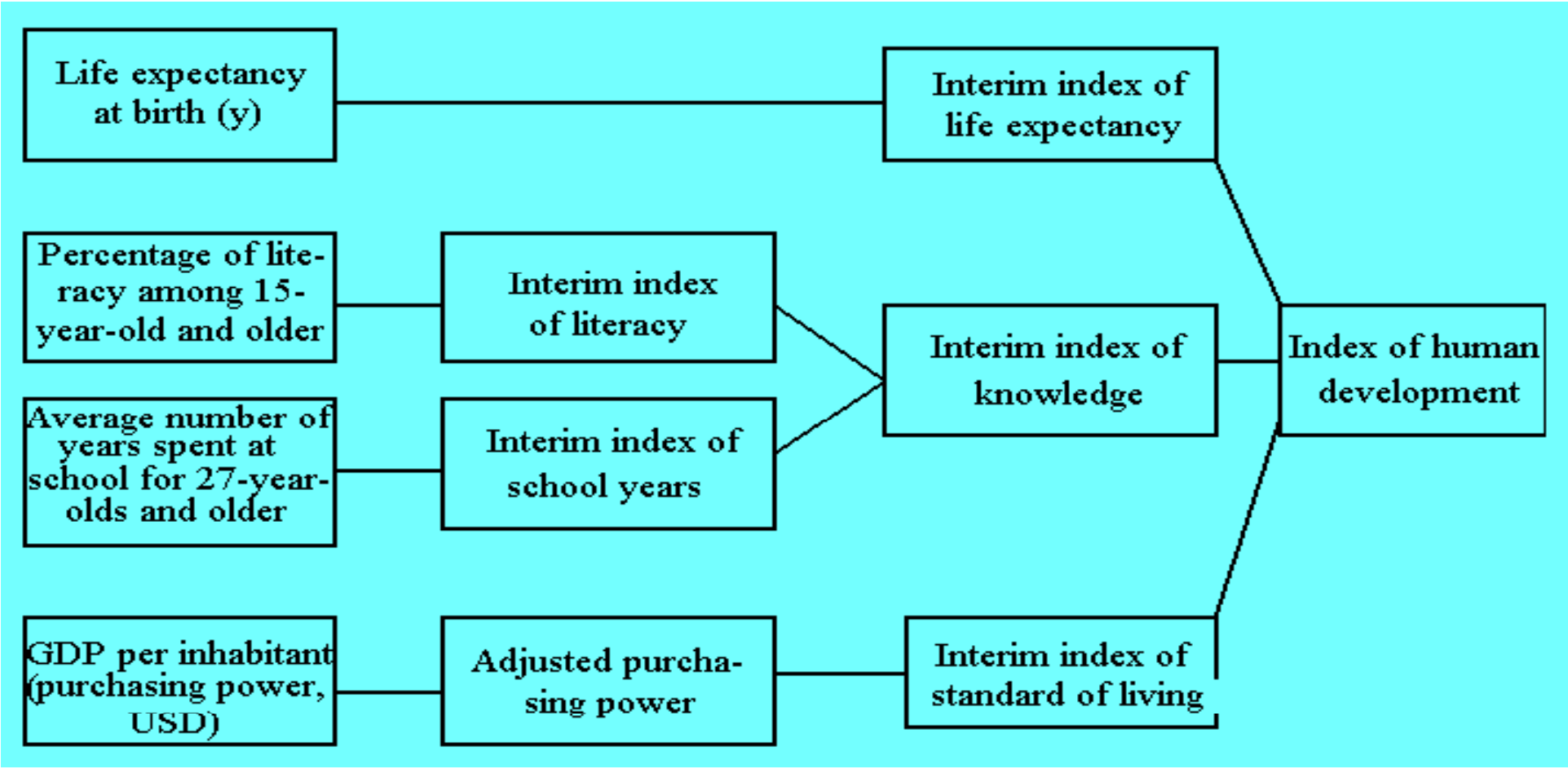
- Indicator data is **standardized**, such as converting all indicators to a scale of 0-100, so they can be aggregated;
- Indicators are sometimes assigned **relative weights** so that some indicators are given more emphasis in the index;
- Assigning weights can be based on **policy relevance, societal values or on quality and quantity of data.**

Examples of Well-Known Indices

- Human Development Index
- Air Quality Index
- Environmental Performance Index

The calculation of the human development index

The human development index is a figure which express the development standard of a society (country, region). which combines judgments on the health, knowledge and standard of living of the society's members, and thus also indirectly on all the factors which have an influence on these elements. The index is calculated as follows:



Sources: Human Development Reports 1991-1994. UNDP
http://www.undp.ee/nhdr/Box21.html

Air Quality Index

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*...air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Discussion: An Air Quality Index

(10 minutes)

In plenary,

- How do you feel a policy maker or manager might need to communicate about air quality?
- What indicators would be appropriate to include in an Air Quality Index?
- Based on the air quality indicators in the module, what indicators would you have included or excluded?

Exercise: Calculating a model

Air Quality Index for countries

- Background:
  - Often a single air quality index is a composite of many indicators on air quality
  - When direct measurements are not available, proxies are used, such as the use of emissions when air concentrations are not available.

Discussion: (10 min)

Communicating an index

- In groups of 3-5, envision an effort to communicate a trend in one environmental issue (e.g., air quality).

- Describe three approaches you might use and describe the strengths and weaknesses of each.

Further questions for discussion

- Who are the different audiences that would see the indicators?
- What information needs does each audience have?
- What are some ways you can provide the technical information needed while at the same time making the indicators visually captivating?

Sessions at a Glance

Session 1: Introduction

Session 2: Developing Data for IEA

Session 3: Information Systems

Session 4: Indicators and Indices

Session 5: Data Analysis

Data Analysis

- Non-spatial data analysis
- Spatial data analysis
- Linkages to Module 7 on physical presentation of data

Non-Spatial Analysis

- Performance evaluation
  - Baseline
  - Targets
  - Thresholds

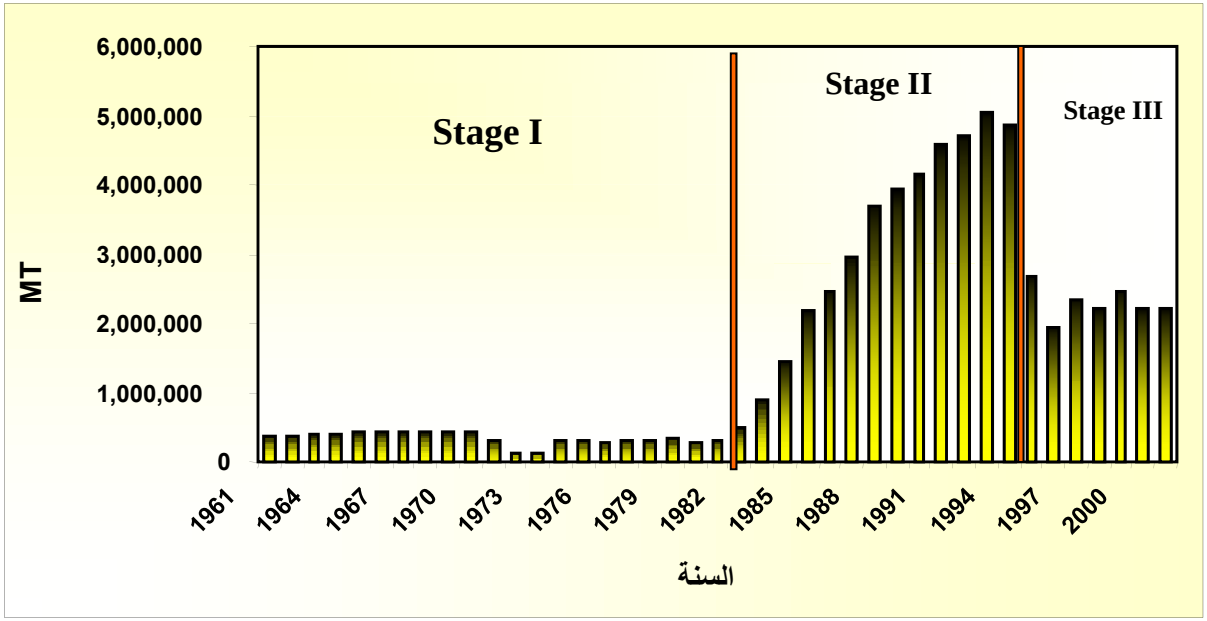
- Science, policy and societal values all influence the development of performance indicators, making it a challenging task.

National Ambient Air Quality Standards

POLLUTANTS	AVERAGE TIME	CONCENTRATION
Sulphur dioxide (SO2)	Annual average	60 µg/m^3
	24 hour	80 µg/m^3
Oxides of Nitrogen (NO2)	A.A	60 µg /m^3
	24H	80 µg /m^3
Suspended Particulate Matter (SPM)	A.A	140 µg/m^3
	24H	200 µg/m^3
Lead	A.A	0.75 µg/m^3
	24H	1.0 µg/m^3
Carbon Monoxide	A.A	2.0 µg/m^3
	24H	4.0 µg/m^3
Respirable Particulate Matter (RPM)	A.A	60 µg/m^3
	24H	100 µg/m^3

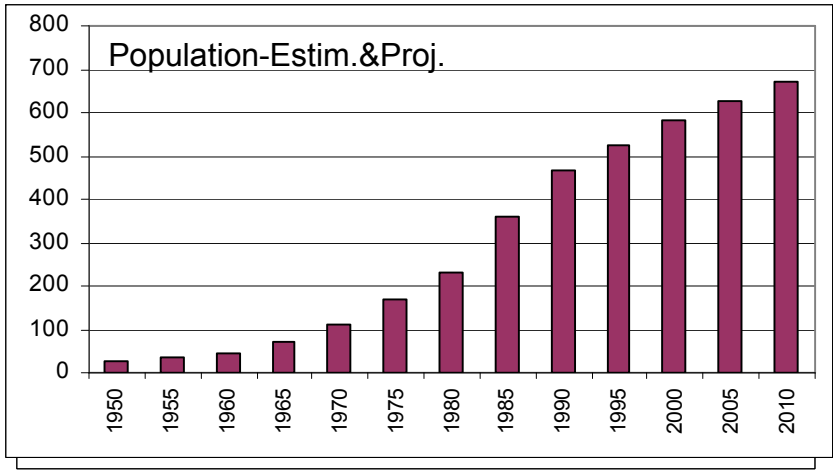
Trend Analysis: What it is?

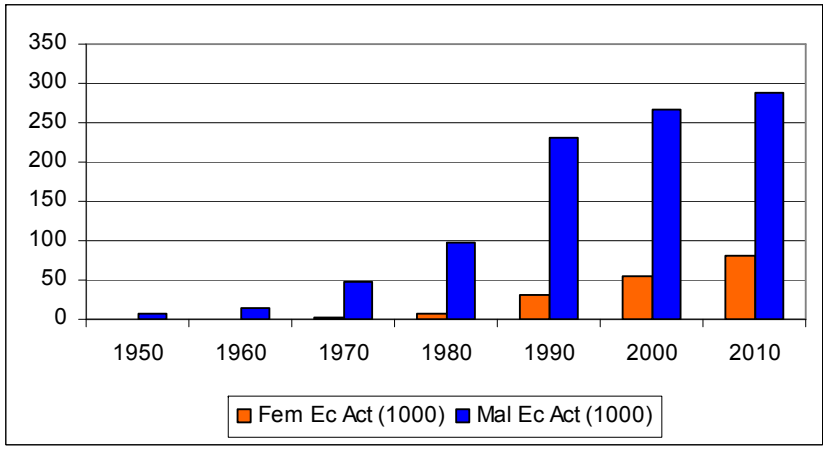
- Allows us to understand changes in **performance** over time
- Trends can be presented in ways that result in different interpretations, such as:
  - indicators presented as an absolute value, a percentage or an index
  - difference in scale on the Y-axis

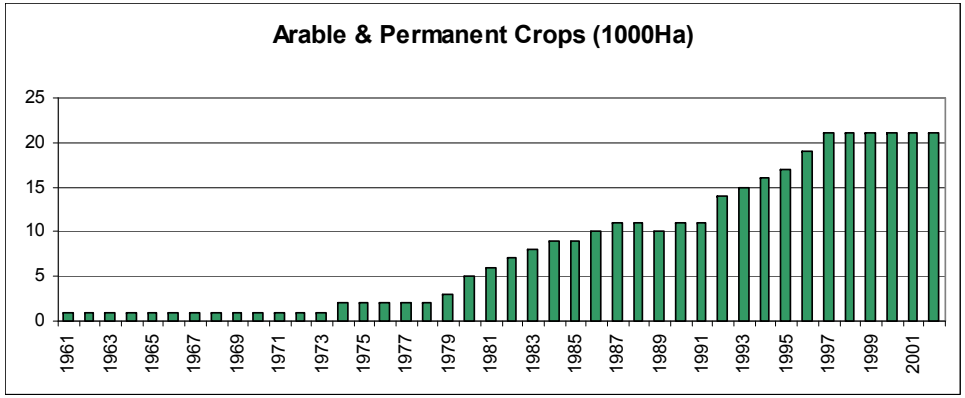


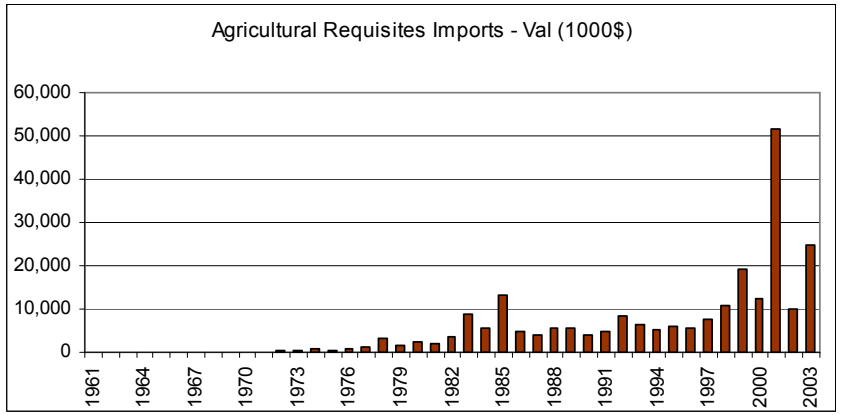
Impact of deterioration of groundwater on cereal production in the GCC

Trend Analysis: Examples





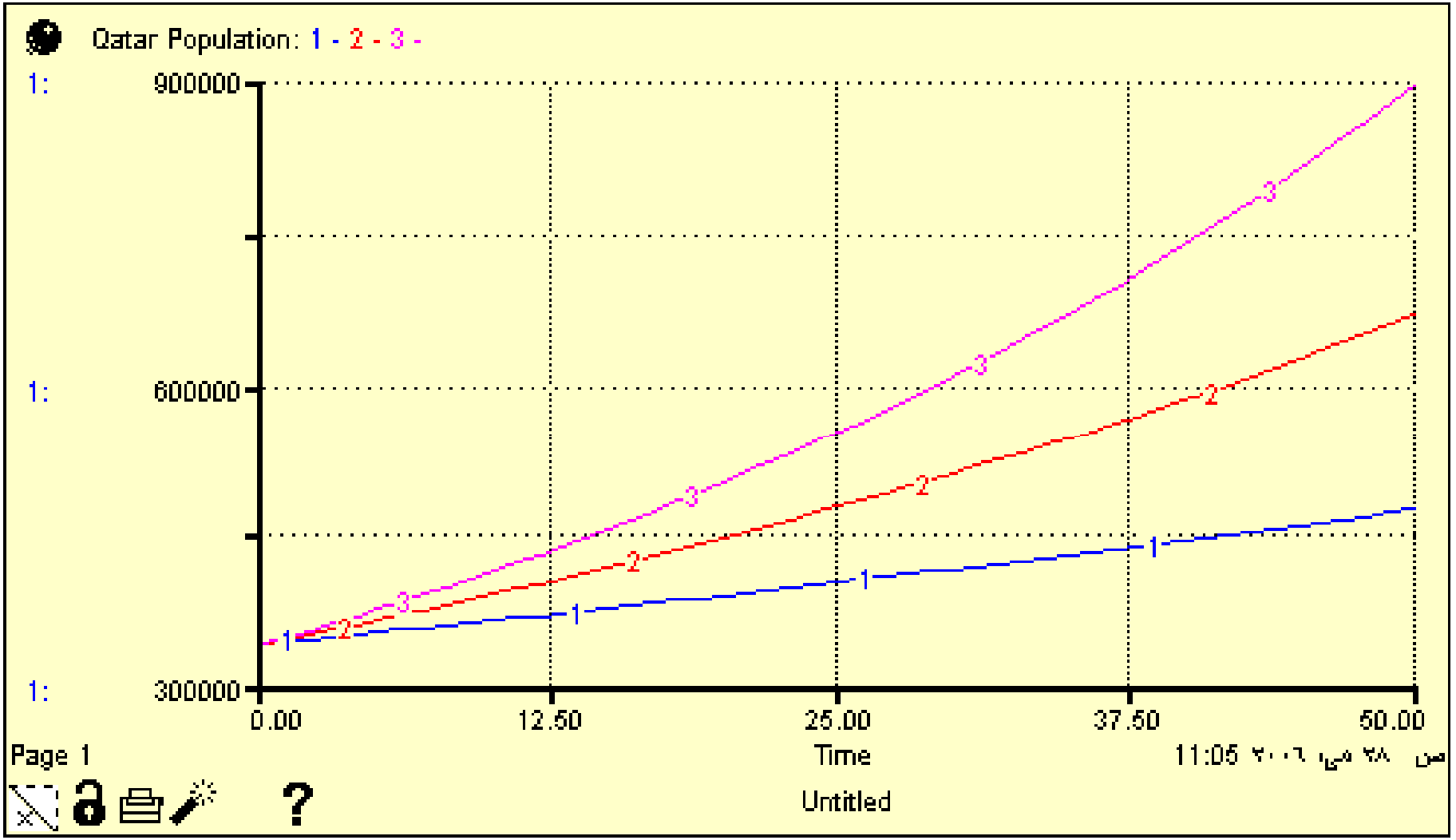




Source: FAOSTAT, 2005

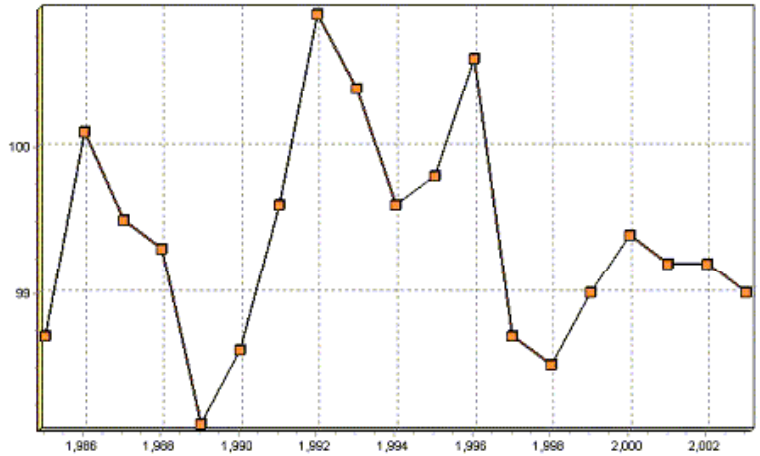
Qatar

Looking Back to Think Ahead

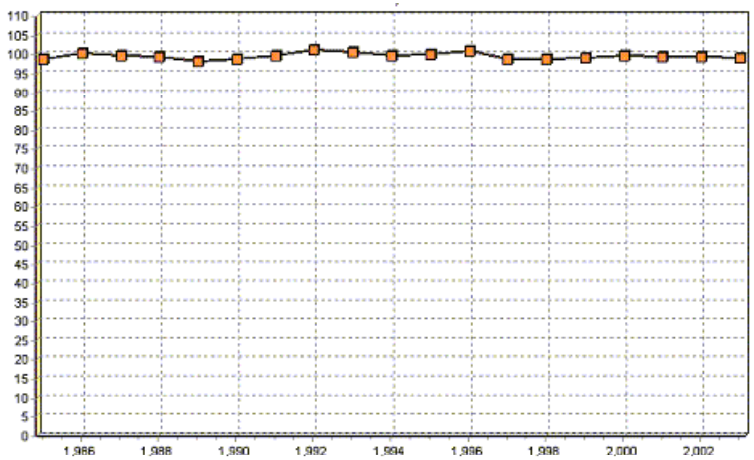


Trend Analysis: Patterns

Graph 1: Erratic Pattern



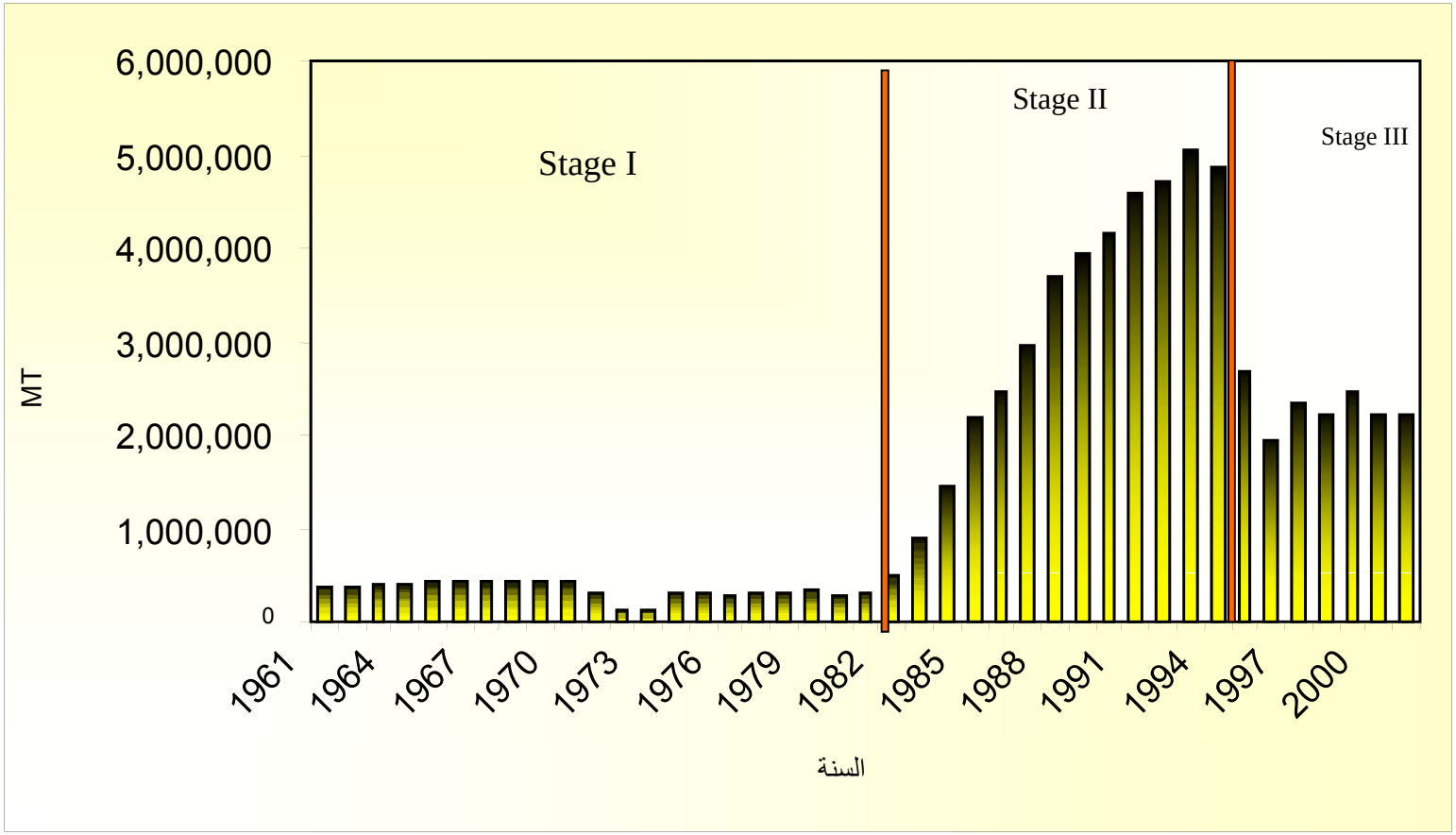
Graph 2: Stable Pattern



The data is the same for both graphs…

the difference is the scale on the Y-axis.

Trend analysis



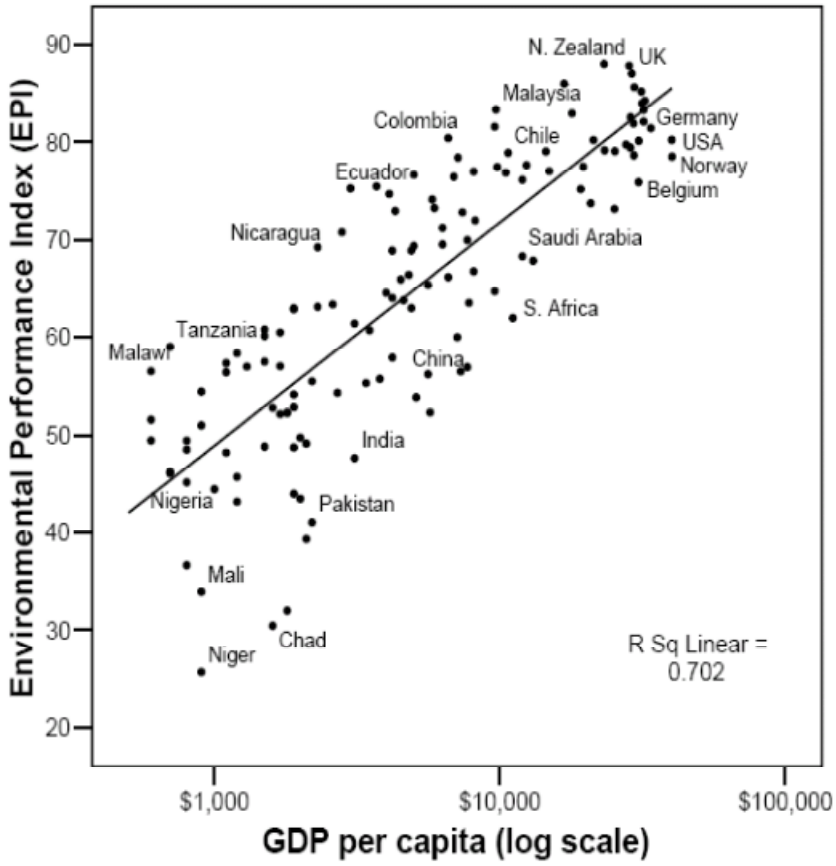
Impact of ground water deterioration on grain productivity (metric tons) GCC

Correlation Analysis

…identifies degree of similarity among variables using statistics

…does not imply cause and effect

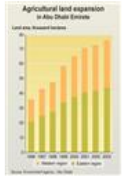
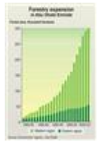
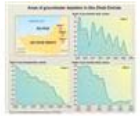
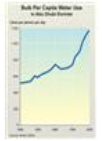
…can be positive or negative



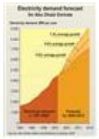
Presenting Indicators Using Symbols

Visually show performance of an indicator using easily understood symbols.

Water

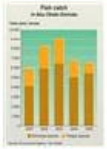
Indicator	Trend	Status
Agricultural expansion		
Forestry expansion		
Groundwater levels		
Groundwater management		
Water consumption		

Atmosphere

Indicator	Trend	Status
Electricity demand		

Marine

Marine

Indicator	Trend	Status
Fish catch		
Fish species exploited		
Loss of coral reef habitat		

Geographic Information Systems …Applications in IEA

- ✓ View & analyse data from global perspective;
- ✓ Overlay data layers for analysis and mapping;
- ✓ Provide framework for studying complex systems;
- ✓ Powerful tool for analysing changes in landscapes and human impacts;
- ✓ Create simulations and models to predict possible future conditions and effects;
- ✓ Have a a powerful visual and universal language.

Spatial Analysis

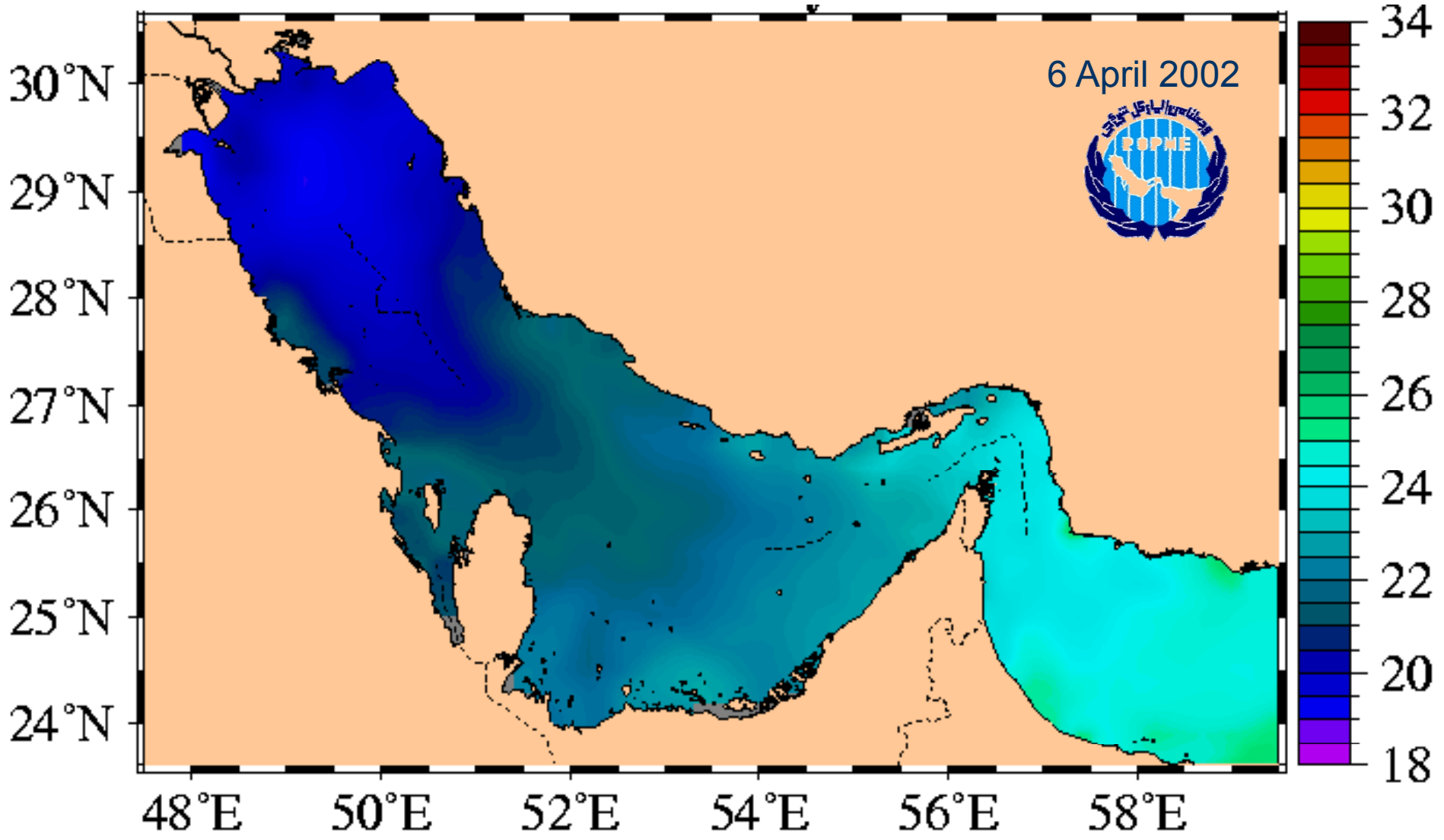
What is spatial analysis?

It is the process of **modelling, examining and interpreting** spatial data and any associated databases.

Spatial analysis is a powerful and useful tool for interpreting and understanding **geographic areas**, evaluating suitability and capability of **natural areas**, or for estimating and predicting impacts of **human development**.

C&O Hot-spots

Sea Surface Temperature progression during this decade in the RSA



C&O Hot-spots

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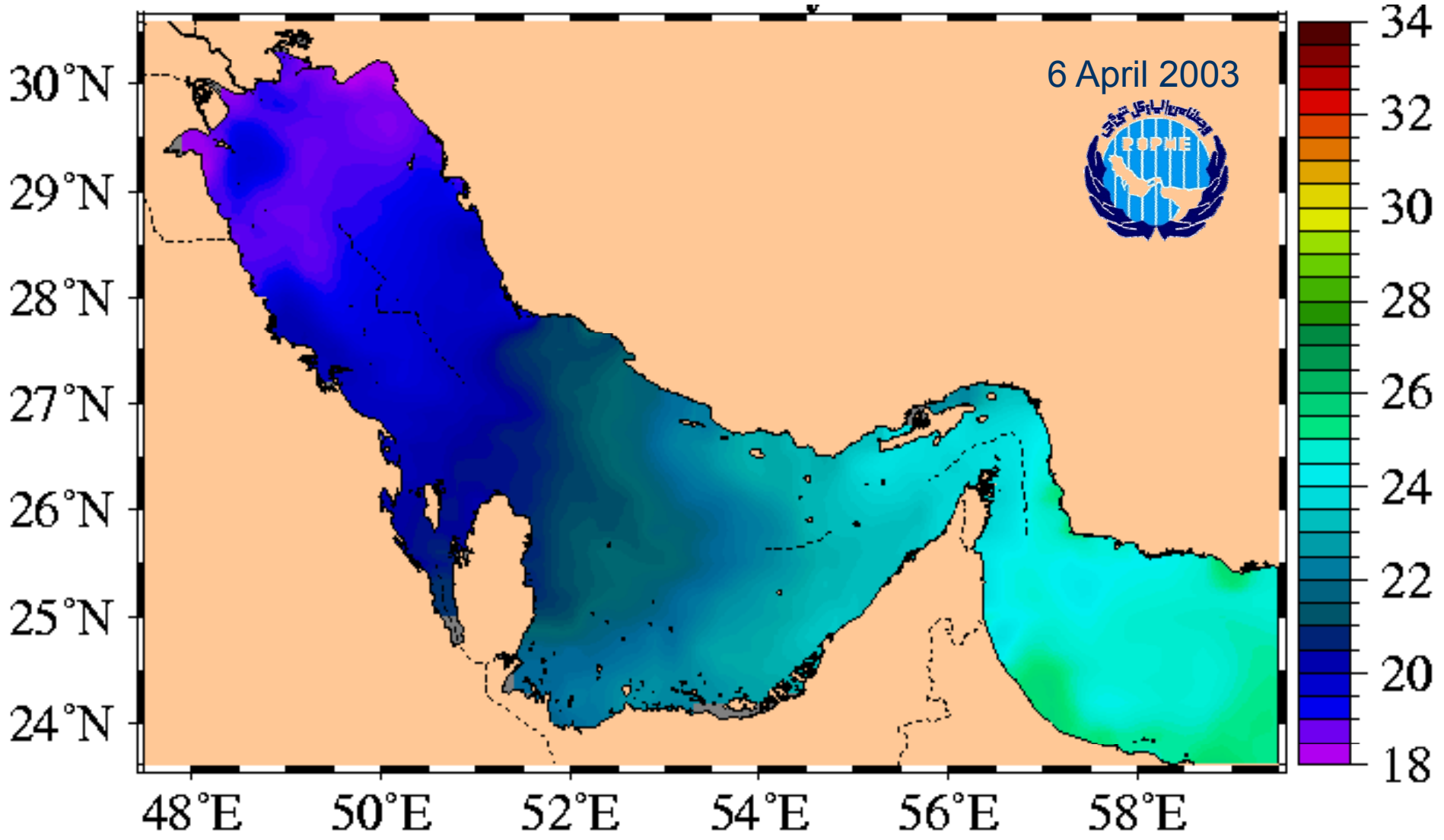

C&O Hot-spots

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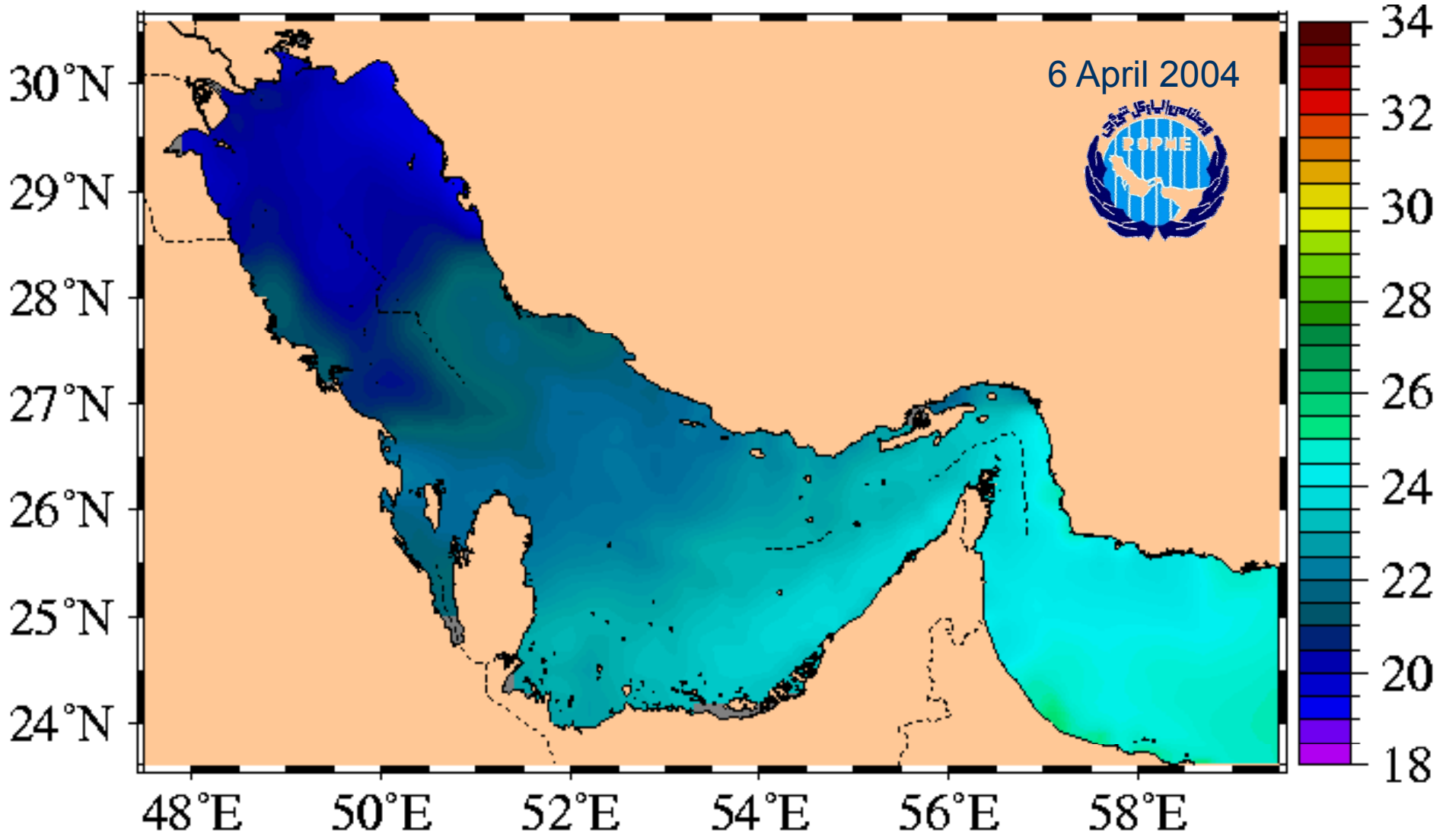

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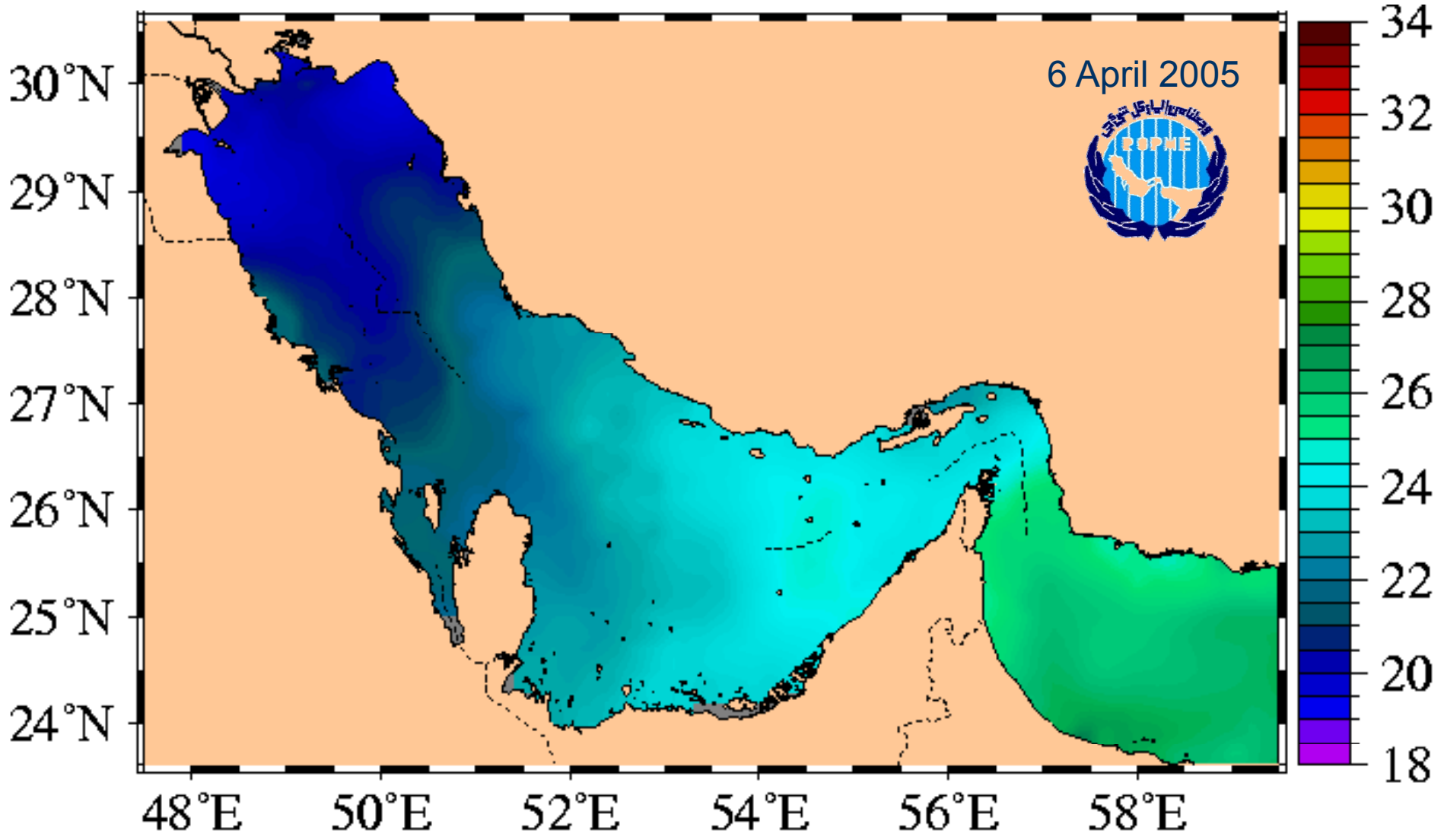

C&O Hot-spots

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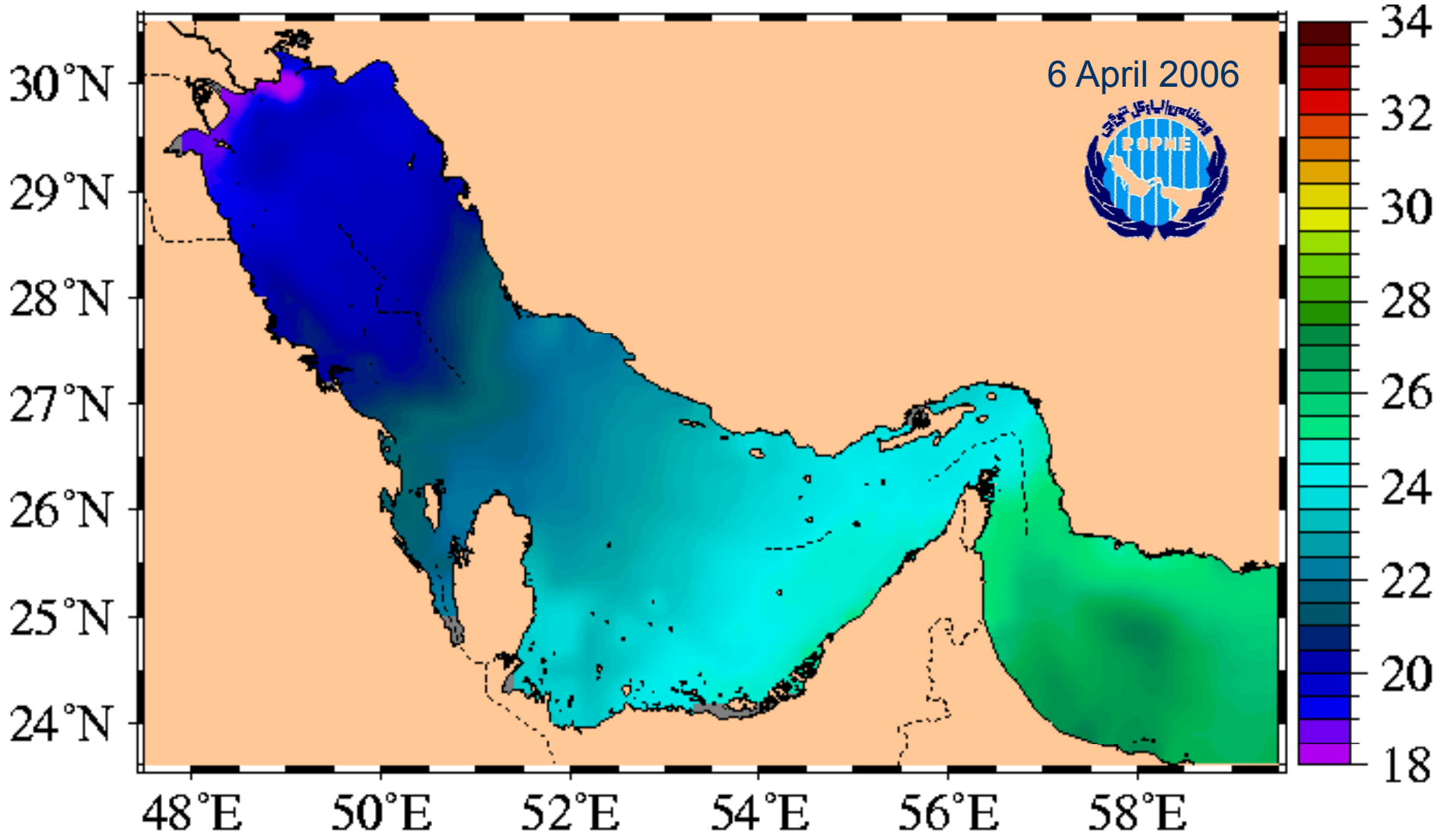

C&O Hot-spots

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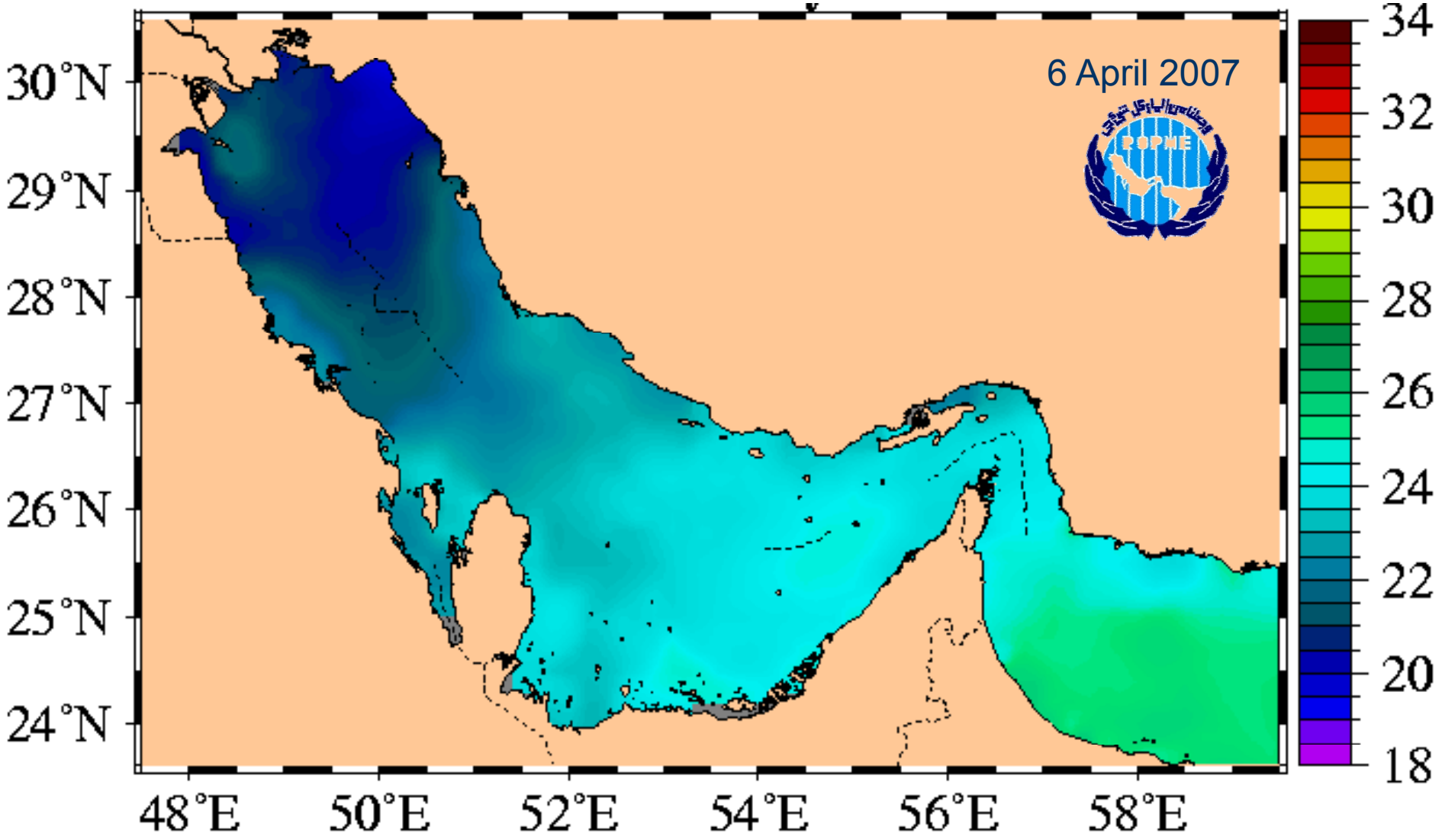

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24 January 1973
ROPME
challenges

28 August 1990
ROPME
Challenges

11 October 2006
Challenges

Discussion: (10 minutes)

Spatial Maps

1. Give examples of other spatial data layers that could be overlaid and integrated for further analysis.

2. Describe how these time series maps can be used and integrated into an SOE report, and the information they provide.

System for Integrated Environmental and Economic Accounting (SEEA)

- An **integrated framework** for economic and environmental data
- Developed by the **united nations** as a satellite database to the system of national accounts (SNA)
- Developed to enable **incorporation of environmental data** into economic decision-making
- Enables measurement of the **contribution of the environment to the economy** and visa versa
- Provides policy-makers with indicators and **descriptive statistics** to monitor these interactions, as well as a database for **strategic planning and policy analysis** to identify more sustainable paths of development.

System for Integrated Environmental and Economic Accounting (SEEA)

- Flow accounts for pollution, energy and materials
- Environmental protection and resource management expenditure accounts
- Natural resource asset accounts
- Valuation of non-market flows and environmentally -adjusted aggregates

UNEP

تقرير حالة البيئة لإمارة أبوظبي
State of the Environment Abu Dhabi
بحث
هيئة البيئة-أبوظبي
Environment Agency-ABU DHABI
مبادرة ابوظبي
العالمية للبيانات البيئية
Zayed: An Inspiration to the World
المواضيع
المياه
الغلاف الجوي
التنوع البيولوجي
الموروث الثقافي
استخدامات الأراضي
الموارد البحرية
النفايات
التنمية
الجغرافيا الطبيعية
الوضع الصحي
المؤشرات
الغلاف الجوي
التنوع البيولوجي
الاراضي
البحرية
النفايات
الإدارة البيئية
بناء القدرات
الإعلام
التوقعات المستقبلية
السيناريوهات
الأعمال المطلوبة
القضايا الرئيسة
حكايات نجاح
Thank You
الدوحة
قطر
الخليج العربي
عجمان
الشارقة
دبي
أبوظبي
العين
المملكة
العربية
السعودية
إمارة أبوظبي
عُمان
ابرز المؤشرات
حرق الغاز انخفض بنسبة 71 في المئة
ابرز المواضيع
استنزاف المياه الجوفية