## THE CROPPER FOUNDATION

# Pilot Tutorial for CAPE Science Teachers

**Wednesday 10th June 2009**
**8:00 a.m. – 2:30 p.m.**

**Venue: The Cropper Foundation Meeting Room**
**Building # 7, Fernandes Industrial centre**
**Laventille, Port of Spain**

***Agenda***

| | |
|---|---|
| 7:45 a.m. | Registration and tour of The Cropper Foundation's Library |
| 8:00 a.m. – 8:10 a.m. | Welcome and opening remarks |
| 8:10 a.m. – 8:20 a.m. | Launch of a sustainable development reference handbook developed by The Cropper Foundation entitled 'Sustainable Development Terms and Concepts: A Reference for Teachers and Students' *(The Cropper Foundation)* |
| 8:20 a.m. – 8:25 a.m. | Objectives of the Tutorial *(The Cropper Foundation)*<br>To:<br>- launch the publication of a handbook on Sustainable Development Terms and Concepts;<br>- provide guidance to teachers on the application of selected information from the handbook in teaching;<br>- discuss approaches to teaching sustainable development<br>- discuss main needs and expectations in terms of an ongoing tutorial-based training series; and on this basis<br>- agree on a programme of tutorials over a one-year period that will help to address these needs. |
| 8:25 a.m. – 8:45 a.m. | Warm up exercise for teachers *(Keston Finch – The Cropper Foundation)*<br>- How well do you know your sustainable development terms and concepts? |
| 8:45 a.m. – 9:15 a.m. | Introductory presentation:<br>- Key Issues Involved in Addressing Sustainable Development *(Maurice Rawlins – The Cropper Foundation)* |
| 9:15 a.m. – 10:00 a.m. | Discussion on Key Issues Involved in Addressing Sustainable Development |
| 10:00 a.m. – 10:15 a.m. | ***Coffee Break*** |

# THE CROPPER FOUNDATION

10:15 a.m. – 11:00 a.m. Presentation:

- How Conceptual Frameworks help us to understand Sustainable Development issues and challenges *(Maurice Rawlins – The Cropper Foundation)*

11:00 a.m. – 12:00 p.m. Working Group session: Applying conceptual frameworks to the sustainable development requirements of the CAPE science curricula:

- from an ecosystem standpoint
- from an issue-based (air/water/land/biodiversity) standpoint
- from a driving force standpoint
- from a response (policy/law/action etc) standpoint

12:00 p.m. – 1:30 p.m.

- Presentations from working groups *(5 - 10 minutes each)*
- ***Short Coffee Break***
- Discussion:
  - Strengths and weaknesses of conceptual frameworks from a teaching/ learning standpoint
  - Aspects of the CAPE science syllabi which would benefit from the use of conceptual frameworks

1:30 p.m. – 2:30 p.m. Closing discussion:

- Guidance on using the reference handbook on sustainable development in teaching
- Assessment of the outcome of the day's tutorial session
  - feedback from teachers on the usefulness of the tutorial
  - discussion of ideas a programme for an ongoing series of tutorials

2:30 p.m. ***Adjourn with Lunch***

***The Cropper Foundation***
***9 June 2009***

**THE CROPPER FOUNDATION**

# Pilot Tutorial for CAPE Science Teachers

**Venue: The Cropper Foundation Meeting Room**
**Wednesday 10th June 2009**
**8:00 a.m. – 2.30 p.m.**

# Note of the Pilot Tutorial[1]

***Chair: Maurice Rawlins[2]***
***Facilitator: Robyn Cross[3]***

## Overview

In 2007, The Cropper Foundation (TCF), under its Programme for Environment and Resource Education (IERE), and the Ministry of Education (MOE) embarked on a Three Year Joint Programme in support of various aspects of the school curricula related to environment/sustainable development. This joint Programme includes a combination of activities and products geared specifically at the Caribbean Advanced Proficiency Examinations (CAPE) and Caribbean Secondary Education Certificate (CSEC) levels, especially in the subject areas of Environmental Science, Geography, Biology, Caribbean Studies and Communication Studies. One of the activities designed under this Three Year Programme was a pilot tutorial for CAPE Environmental Sciences and Biology teachers which was held on Wednesday 10th June 2009 (see Agenda enclosed as Attachment 1) . The objectives of the tutorial were to:

1. launch the publication of a handbook of Sustainable Development Terms and Concepts;
2. provide guidance to teachers on the application of selected information from the handbook in teaching;
3. discuss approaches to teaching sustainable development;
4. discuss main needs and expectations in terms of an ongoing tutorial-based training series; and on this basis
5. agree on a programme of tutorials over a one year period that will help to address these needs.

The meeting was led by The Cropper Foundation (Mr. Maurice Rawlins – IERE Programme Officer), and Ms. Robyn Cross (The Environmental Management Authority) A total of seventeen teachers attended the tutorial – the list of participants including contact information is provided as Attachment 2.

The current document synthesizes the main issues and discussion points which resulted from this tutorial.

## Introductory Session

Maurice Rawlins welcomed participants and provided an overview of the objectives of the tutorial.

Opening remarks were provided by Mr. Dalton Ramsubeik[4] on behalf of the Ministry of Education: Mr. Ramsubeik highlighted the growing number of students now pursuing CAPE Environmental Science (ES) and the resultant need for capacity development activities – such as the tutorial – that would

[1] The agenda for the tutorial is attached as Attachment 1.
[2] IERE Programme Officer, The Cropper Foundation
[3] Member of IERE Advisory Committee
[4] Science Curriculum Officer – Ministry of Education

support delivery of the syllabus. He acknowledged the efforts being made by The Cropper Foundation to support Science teachers at the CAPE and CSEC levels, and pledged the continued support of the Ministry of Education in these efforts.

Following the opening remarks, a warm-up exercise for teachers was led by Mr. Keston Finch[5]. This exercise, which divided teachers into two competing teams, involved a timed-race in which the teams were required to identify as many sustainable development terms as possible corresponding to letters of the alphabet. The purpose of this exercise was to demonstrate to teachers an idea for facilitating the active involvement of students in learning about terms and issues involved in sustainable development.

***Presentations and Associated Discussions***

Following the warm up exercise, two presentations were made to identify some key issues involved in addressing sustainable development, and to discuss how challenges arising from these issues could be overcome. The presentations, delivered consecutively, gave way to a discussion period which was led by Robyn Cross. The main points arising from these presentations and associated discussion are given below.

**Presentation 1: Key Issues Involved in Addressing Sustainable Development (SD).** This presentation, made by Maurice Rawlins, is provided in PDF format in Attachment 3. The main points highlighted by the presentation were:

- In addressing the concepts and issues associated with sustainable development, a useful starting point is the identification of human needs. However, this in itself poses a challenge because needs vary based context and situation.
- Developing sustainably requires balancing economic, social and environmental needs – and this is not always easy
- Needs also vary from one person to another (intragenerational), and so in setting needs at a national level for example, how do we rationalise all of the needs under consideration?
- Another layer of complexity involved in defining needs is the consideration of intergenerational equity – thinking about future generations and their needs. How can the present generation know what will be important to future generations?
- To assist in the definition of needs, it may be important to distinguish between needs and wants
- We could also use the constituents of human well-being as defined in the Millennium Ecosystem Assessment Conceptual Framework to assist in defining and packaging needs
- The Millennium Development Goals are also very useful for defining human priorities and needs
- Changing attitudes and behaviour to reflect the understanding of sustainable development is a daunting undertaking. It involves firstly understanding what is SD; understanding the impact of personal actions; and recognising what options are available to make alternate choices.

**Presentation 2: How Conceptual Frameworks help us to understand Sustainable Development issues and challenges.** This presentation was made by Maurice Rawlins. The full presentation (in PDF format is provided in Attachment 4. The main points highlighted by the presentation were:

- The Millennium Ecosystem Assessment[6] (MA) conceptual framework (CF) was presented as a useful tool for understanding SD issues and challenges in a number of contexts
- For the purpose of explaining the MA CF and its uses, the framework was broken down into its main components:
    - ecosystem services – the goods and services that humans derive from ecosystems, which according to the MA framework are sub-divided into four categories –

[5] Volunteer, The Cropper Foundation
[6] See www.maweb.org

provisioning, cultural, regulating and supporting. Services derived from natural systems (ecosystems) vary from tangible services such as food and water (provisioning), to the more abstract and generally less understood services such as climate control and water quality regulation (regulating services).
    - human well-being – as defined by the MA, the constituents of human well-being are basic material for a good life; health; good social relations; security; and freedom of choice and action.
    - drivers – the natural and anthropogenic impacts of events and activities on ecosystems. In the course of the presentation, a number of anthropogenic impacts were considered, especially those associated with development-related activities
- The Buccoo Reef ecosystem was used as an example to explain how the MA conceptual framework could be applied to an ecosystem to understand the challenges and issues of sustainable development.

In the discussion following the presentations, the following problems were expressed by teachers:

- Newer teachers often lack the experience to help students understand what sustainable development means, as they themselves do not clearly understand it. Even with the theoretical understanding of SD, applicability is difficult because of the lack of practical examples of sustainable development. The general consensus among the teachers was that SD can easily become an abstract concept when teaching.
- Teachers suggested several ways of trying to apply the concept of SD:
    - through personal actions, such as leaving classrooms clean, and turning off lights when exiting a room
    - looking for non-local examples of countries that are demonstrating some of the practices associated with SD, such as Bahamas and Dominica with respect to sustainable tourism, or countries like Sweden and Switzerland who lead the way in SD practices and technology.
    - Internal assessments (IAs) provide an avenue for activities that apply sustainable development. One of the teachers described an IA she undertook with her students to clean-up a beach as an example of applying the SD concept.
- Defining development poses a significant challenge. Several questions relating to development were posed. These included:
    - What does development mean?
    - Is development always progressive?
    - Development for whom?
- Several definitions of development were suggested, but no clear consensus for a definition could be achieved. One teacher suggested that perhaps development is meant to have multiple definitions because it is defined based on situation and context. He suggested that an issue such as the building of the smelter plants in Chatham be used to show the various views that people have of development. Teachers expressed their willingness to attend a tutorial session where defining and understanding development is a major focus.
- Further challenges specifically related to students included:
    - A general negative attitude towards the government: lack of confidence and trust in the government to develop in a manner that is sustainable.

  One suggestion for responding to this challenge is to present alternative methods of governance, such as individual responsibility and self-empowerment. Projects for IAs could be designed to incorporate these elements, and these projects should include some aspect of information dissemination to other students in the school.

***Working Group Sessions***

Following the presentations and discussion, a working group session on applying the MA conceptual framework to the sustainable development requirements of the CAPE science curricula was conducted. Teachers were sub-divided into three working groups and each group was required to use a different entry point into the MA Conceptual framework to highlight and provide some theoretical soluation for some development-related problems The three different entry points are were given as: a selected ecosystem, issue-based (air/water/land/biodiversity), and driving forces.

Presentations were made by the groups after the working-group session, and these gave way to a discussion led by Robyn Cross. The main points arising from these presentations and associated discussions are given below:

Strengths and weaknesses of conceptual frameworks from a teaching/ learning standpoint

- Teachers generally found the MA conceptual framework useful for teaching multi-issue and multi-scalar topics such as sustainable development, climate change and biodiversity. With the conceptual framework, teachers can break down a topic into smaller parts which are easier to deliver, and also easier for students to understand.
- The MA conceptual framework is also useful for bridging together separate topics within the syllabus such as sustainable agriculture, pollution and the environment and human health. It is also useful for bridging topics across syllabi which can give the students a more holistic approach.
- Some teachers expressed concern about the time it would take to develop and teach conceptual frameworks, and that the MA conceptual framework may in fact exceed the requirements of the syllabus.

Aspects of the CAPE syllabi that would benefit from the use of conceptual frameworks

- Teachers suggested several topics within the geography, environmental science and biology syllabi where conceptual frameworks could be used for teaching/ learning. These included:
    - energy;
    - pollution;
    - natural resource use locally and regionally;
    - agriculture;
    - population growth studies;
    - disparity and development;
    - vegetation;
    - soils;
    - tourism;
    - hydrological systems;
    - climate change and global warming;
    - natural hazards;
    - poverty and social equity;
    - consumption patterns

***Session to provide guidance on using the Handbook of Sustainable Development Terms and Concepts***

This session was led by Maurice Rawlins and focused on how a handbook of Sustainable Development Terms and Concepts[7] could be used as a source of information for addressing various parts of the CAPE science syllabi. He highlighted the various sections of the handbook, and gave a brief explanation of each section:

[7] This Handbook was developed by The Cropper Foundation as another activity under the Three Year Joint Programme in collaboration with the Ministry of Education.

1. A running Glossary of terms related to environment and sustainable development. These terms were sourced from credible materials such as the Environmental Management Authority State of Environment Reports, the Millennium Ecosystem Assessment and the Global Environmental Outlook reports.
2. Regional organisations that are involved in sustainable development. The section provides a brief summary of each organisation in terms of its mandate, organisational structure and the work that it undertakes.
3. Selected conferences, conventions and agreements involved in sustainable development. This section provides a brief description of the conferences, conventions and agreements, and a synopsis of the objectives and major outcomes and activities of these.
4. Selected projects and reports involved in sustainable development. This section provides a brief description of some of the major declarations and reports that influence environmental and SD discourse.
5. Conceptual frameworks and expanded terms. Select conceptual frameworks and terms are described in detail in this section.
6. An extensive bibliography which is meant to provide an extensive source of information for use by students and teachers, and is also meant to outline the proper approach to scientific research referencing

The handbook is also meant to complement other educational materials produced by the Foundation such as a case study booklet for CAPE Science Teachers, and brochures and posters on the Caribbean Sea and Northern Range assessments.

***Closing session***

Teachers were presented with certificates of participation, and closing remarks were made by Robyn Cross. In closing, it was noted that:

- Teachers were generally pleased with the tutorial session.
- For continuity, teachers suggested that the same teachers - with some new additions – be invited to subsequent workshops to develop capacity which would enable them in turn to lead tutorials with other teachers
- TCF remains committed to assisting science teachers and students at the CAPE and CSEC level in meeting the requirements of the syllabus.
- TCF will explore the topics suggested for future tutorials.

**Attachment 1: Agenda for Pilot Tutorial**

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2:30 p.m. ***Adjourn with Lunch***

***The Cropper Foundation***
***9 June 2009***

**Attachment 2: List of participants**

| Name | School | Address | Telephone | E-mail |
|---|---|---|---|---|
| Ms. Risha Alleyne | St. Francois Girls' College | St. Francois Valley Road, Belmont | 624-3468<br>621-3711 | Risha_alleyne@msn.com |
| Ms. Linda Atwaroo-Ali | St. Joseph's Convent, St. Joseph | Richmond Stree, St. Joseph | 665-7353<br>662-4580 | lindageeta@yahoo.com |
| Ms. Carleen Blackman | Tranquillity Government Secondary | 5-7 Victoria Avenue, Port of Spain | 625-3264<br>776-5555 | Crdvi8@yahoo.com |
| Ms. Gabrielle Cayenne-Francis | Tranquillity Government Secondary | 5-7 Victoria Avenue, Port of Spain | 625-3264 | Gabby_cay98@hotmail.com |
| Mr. Joseph Cazabon | St. Mary's College | 75 Frederick Street, Port if Spain | 682-3084 | joecazabon@yahoo.com |
| Mrs. Melissa Dubarry | Fyzabad Anglican Secondary | Guapo Road, Fyzabad | 677-7439 | mdubry@hotmail.com |
| Ms. Tracey Elcock | San Fernando (Central) Government Secondary | Todd Street, Les Efforts West, San Fernando | 792-6904 | tgelcock@yahoo.com<br>telcock@hotmail.com |
| Ms. Myrna Ellis | Arima Government Secondary | 24 Ajim Baksh Street, Malabar, Arima | 717-7381 | naturegirltours@yahoo.com |
| Ms. Beverley Gulston | Sixth Form Gov't School/ Polytechnic Institute | 2 Ethel Street, St. James | 622-2186<br>395-9806 | beverleygulston@hotmail.com |
| Ms. Neisha Hutton | Bishop Anstey and Trinity College | 1 College Avenue, Trinicity | 640-8685 | Neish_19@yahoo.com |
| Ms. Yema Jaikaran | Hillview College | Corner College and El Dorado Roads, Tunapuna | 662-4314 | Yema.jaikaran@gmail.com<br>Hillviewcollege@tstt.net.tt |
| Ms. Sandra Latchman | St. Augustine Secondary School | 4 Clarke Road, Chaguanas | 389-7801 | Alisandra95@yahoo.com |
| Mrs. Shanti Maharaj | Moruga Secondary | 12 Tompierre Trace, Basse Terre Moruga | 656-4014 | |
| Mrs. Anika Michael | St. Augustine Secondary School | | | Judettew2002@yahoo.com |
| Mrs. Camille Mohammed | Holy Faith Convent, Penal | Clarke Road, Penal | 647-8834 | camilleim@hotmail.com |
| Ms. Haseena Mohammed | Arima North Secondary | Arima Old Road, Arima | 667-2309 | ascs@tstt.net.tt |

| | | | | |
|---|---|---|---|---|
| | (formerly Arima Senior Comprehensive | | | |
| Mrs. Salisha Mohammed Ali | ASJA Girls' College, Barrackpore | G.P. Road, Barrackpore | 654-5339 | Salishamohammed@hotmail.com |

# Key issues involved in addressing Sustainable Development

**The Cropper Foundation**

**June 10, 2009**

# Sustainable Development – defn.

development that
meets the needs of the
present without
compromising the
ability of future
generations to meet
their own needs …

(Brundtland Report, 1987)

# Issues involved in addressing Sustainable Development

Defining and prioritizing needs: current and future

Ensuring Intragenerational and Intergenerational equity

Changing attitudes and behaviour

Developing sustainably…

# Defining and prioritising needs: current and future

Needs differ by region, country, culture, age, sex, from person to person…

With 6 billion people in the world… ok let's think locally….1.3 million people in T&T each with 5 sets needs… that's 6.5 million sets needs.

Who defines needs?

How do we start prioritising these needs?

Is it necessary to prioritise all of these needs?

How do we separate needs from wants?

# Defining and prioritising needs: current and future

The reality is that it is impossible to prioritise the needs of everyone in an equitable way

One approach is to start looking at what are the things that are absolutely necessary

**Cell phone… hmm no I need to reach my daughter**

**Car…hmm no I need to look after my safety**

**Buy another car… well my husband uses this one and I the other**

**….And the list goes on…**

# Defining and prioritising needs: current and future

- Another approach is to look at the things which are necessary to ensure human well-being and our collective needs

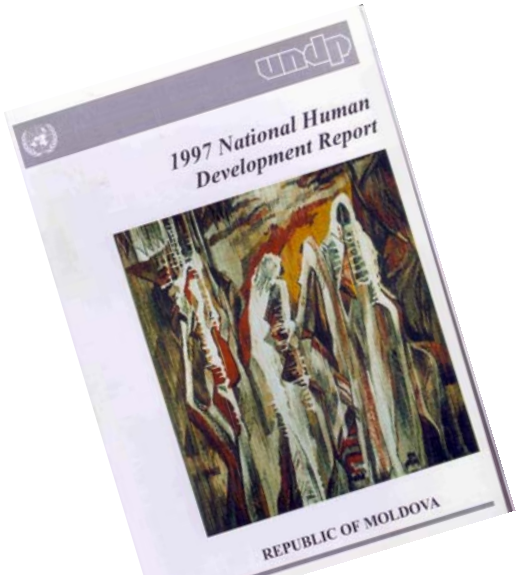
- Human well-being – A context – and situation dependent – state, comprising basic material for good life, freedom and choice, health and bodily well-being, good social relations, peace of mind and spiritual experience (MA, 2005)

# CONSTITUENTS OF WELL-BEING

Source: Millennium Ecosystem Assessment

# Defining and prioritising needs: current and future

- So we have the needs… but how do we ensure that needs are met.
  - The Millennium Development Goals
  - Human Development Reports



| Millennium Development Goals |
| --- |
| 1. Eradicate extreme poverty and hunger – **Basic material for good life; Health** |
| 2. Achieve universal primary education – **Freedom of Choice and action; Health** |
| 3. Promote gender equality and empower women – **Freedom of Choice and action;** |
| 4. Reduce Child mortality - **Health** |
| 5. Improve maternal health - **Health** |
| 6. Combat HIV/ AIDS, malaria and other diseases – **Health; Security** |
| 7. Ensure environmental sustainability – **Basic material for good life; Health; Security; Freedom of choice and actions; Good social relations; Security** |
| 8. Develop a global partnership for development – **Basic material for good life; Health; Security; Freedom of choice and actions; Good social relations; Security** |

# Intergenerational and Intragenerational Equity

- Intragenerational equity - fairness of rights, distribution, and access to resources, services or power between or across generations (MA 2005)
- Intergenerational equity – fairness of rights, distribution, and access to resources, services or power among individuals in a single generation (MA 2005)

# Intergenerational and Intragenerational Equity

- Equity has:

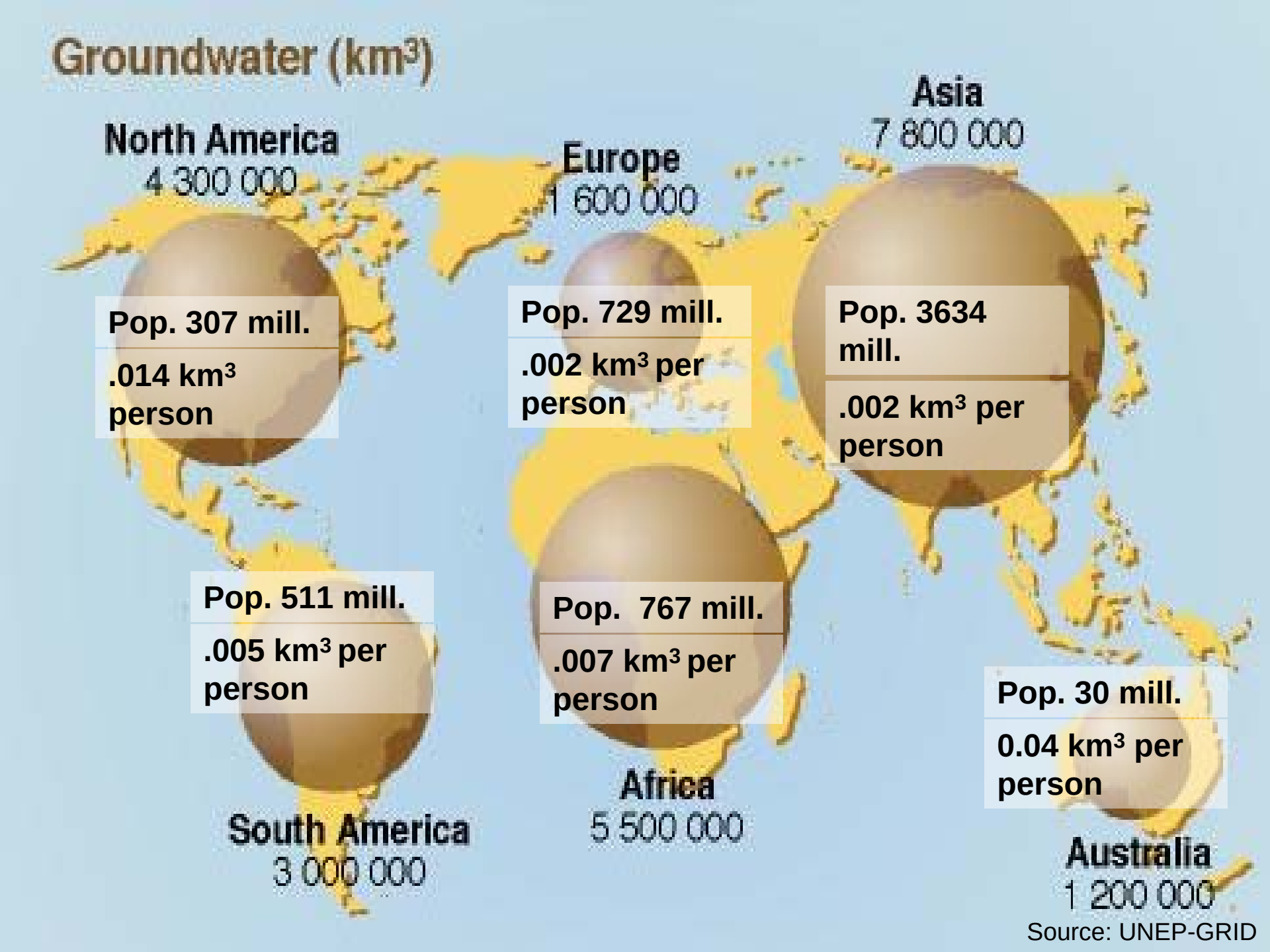
  Environmental dimension – access to ecological goods and services…

  Social dimension – access and availability of education, health care facilities…,

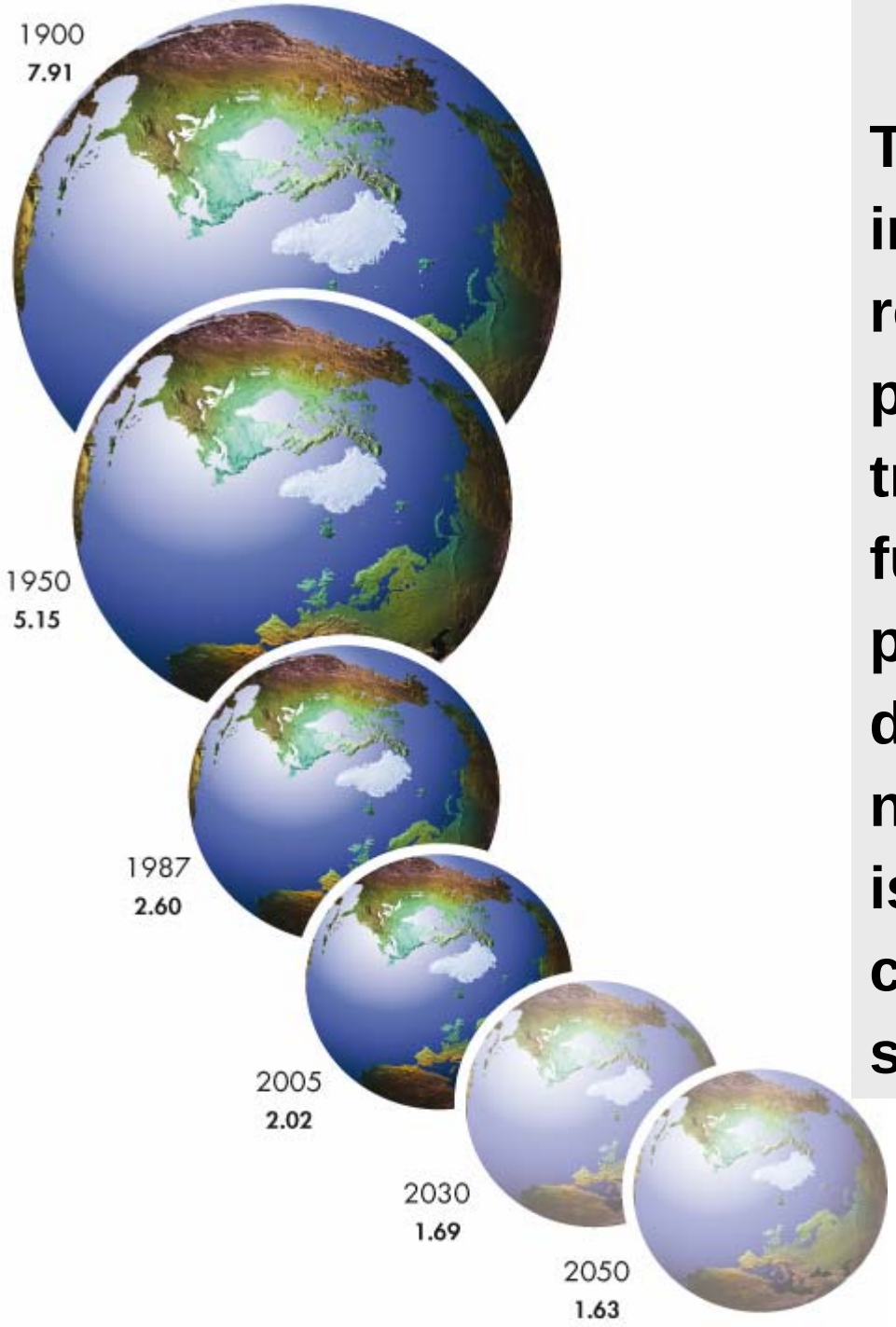
  Economic dimension – access to capital to purchase goods, services, education etc.

# Intergenerational and Intragenerational Equity

- Challenges
  - Ecological goods are not uniformly distributed
  - The ability to guarantee all individuals access to necessary resources is not possible at current global population levels




Source: UNEP-GRID




**The numbers next to the images of the earth reflect hectares of land per capita. The current trends show that in the future the amount of land per capita will continue to decrease. What this does not show is at what point is the amount of land per capita no longer sufficient.**

# Intergenerational and Intragenerational Equity

- Can we ensure that future needs (intragenerational equity) are met?
- No…we cannot predict future needs but we can ensure that ecosystems are left intact so that they can continue providing goods and services

- By whom?

# Intergenerational and Intragenerational Equity

- How?

**Vision 2020** **CITES**
**Ramsar Convention** **Cartagena Convention**
**UNFCCC** **CBD**
**Kyoto Protocol** **BPoA**

- By whom?

**Individuals; NGOs; Organisations; Governments; CARICOM, ACS; AOSIS; OECS; IUCN WHO; UN and agencies;**

# Changing Attitudes and Behaviour

- Not an easy task! But it is necessary if we hope to develop sustainably.
- It is about helping people to understand:
  - what sustainable development means and why it is necessary
  - the impacts of their actions on each other and on the environment
  - the options and alternatives available to make different choices

# Developing sustainably

- Sustainability is about living in ways that meet and balance existing environmental, economic and social needs without compromising the well-being of future generations
- Balancing all of these needs is possibly the greatest challenge in working towards sustainable development.

# Discussion

# How Conceptual Frameworks help us to understand Sustainable Development issues and challenges

**The Cropper Foundation**

**June 10, 2009**

# Conceptual Framework (CF)

- A CF is a dynamic tool that can be used to organise a set of coherent ideas, topics or concepts around a central theme.
- CFs help to connect various aspects of any one issue so that the ‘big picture’ becomes clear.
- No set CF, it is designed based on context, situation, etc. .
- Used to guide studies, assessments etc.

# Conceptual Framework

- Common conceptual frameworks include:
  - MA Conceptual Framework used in the Millennium Ecosystem Assessment (MA) Conceptual Framework
  - DPSIR (Driver-Pressure-State-Impact-Response) Framework used in the Global Environment Outlook Assessment.
    - Many iterations, for example the PSR (Pressure State Response) Framework can be used

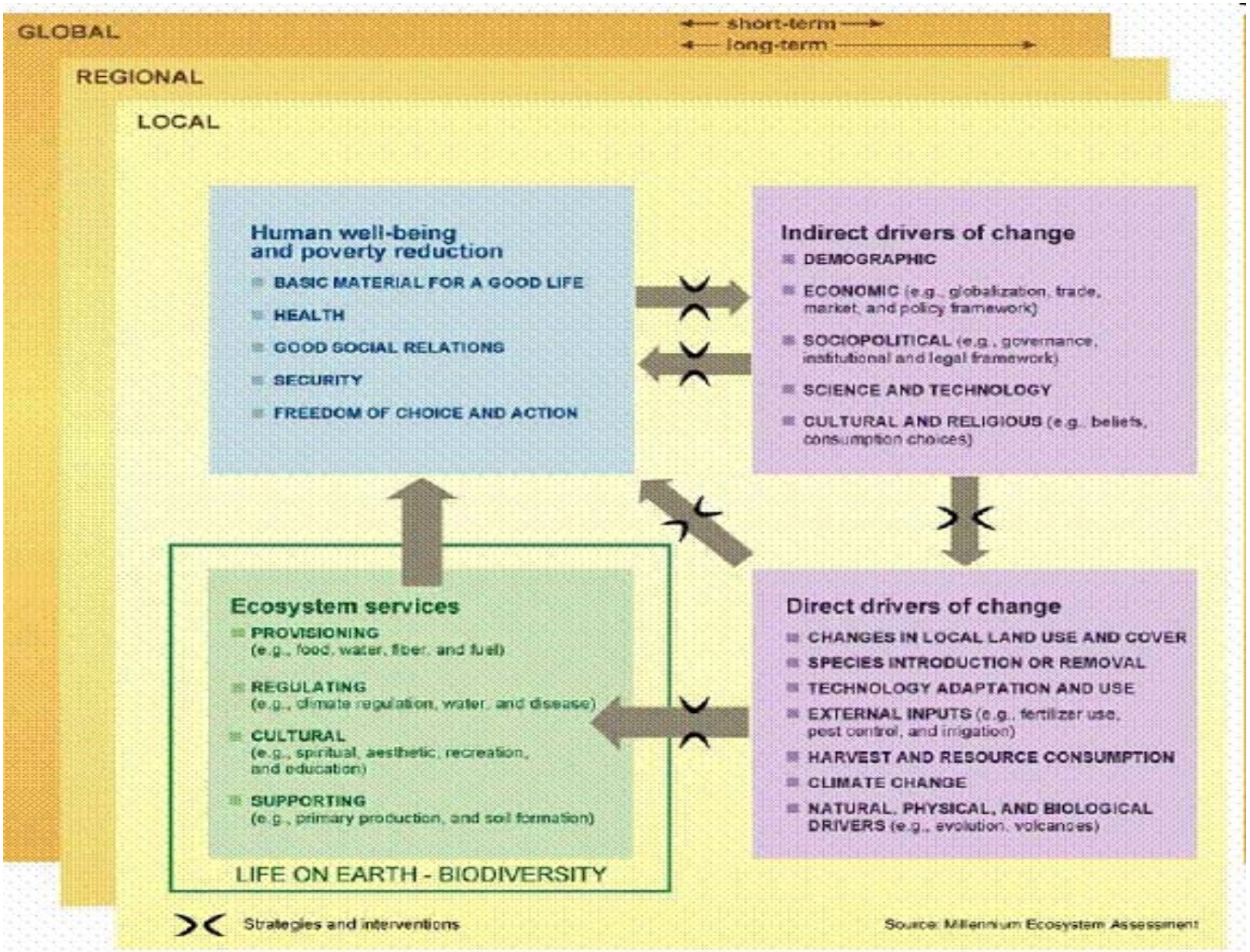
# MA Conceptual Framework

- Overview of MA:
  - A global ecosystem assessment undertaken by UNEP between 2001 and 2005
  - Assessed the consequences of ecosystem change for human well-being
  - Established a scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being
  - First attempt to bring environment and development together in an assessment
  - The focus of the assessment  was on the linkages between ecosystem services and human well-being

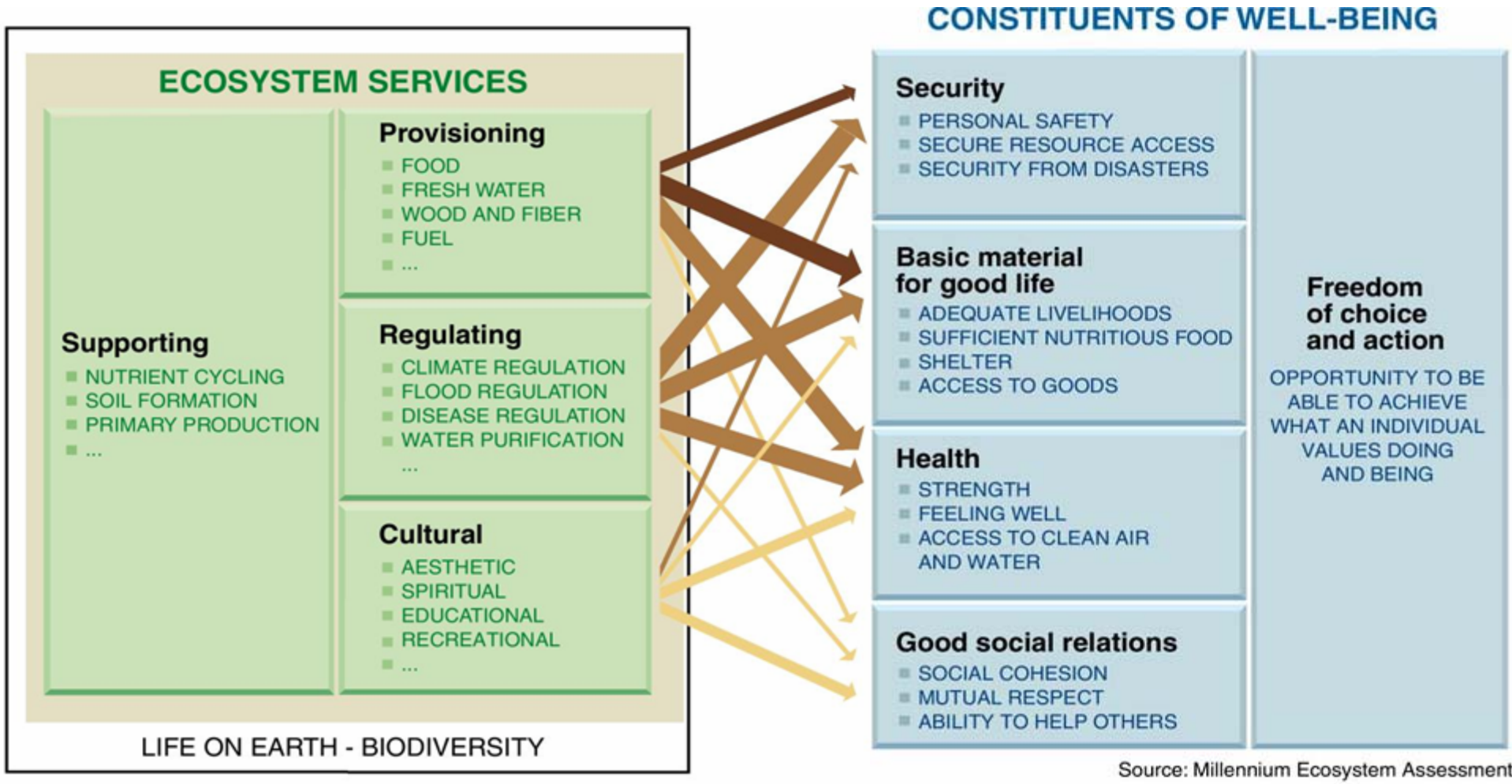
People impact nature

Nature provides people benefits

# MA Conceptual Framework



# The linkages between Human Well-being and ecosystem services




Source: Millennium Ecosystem Assessment

**How do we meet these needs?**

# MA CF and Development

- Development:
  - Increased use of ecosystem goods. For example timber, freshwater, crops for fuel
  - Increased reliance on ecosystem services. For example we put out more carbon dioxide in the air and thus rely more on the regulating service of carbon sequestration. Increasing demands for freshwater, we rely more on the freshwater regulating service provided by ecosystems.

**Bottom line: Development = Increasing dependence on ecosystems**

# MA CF and Development

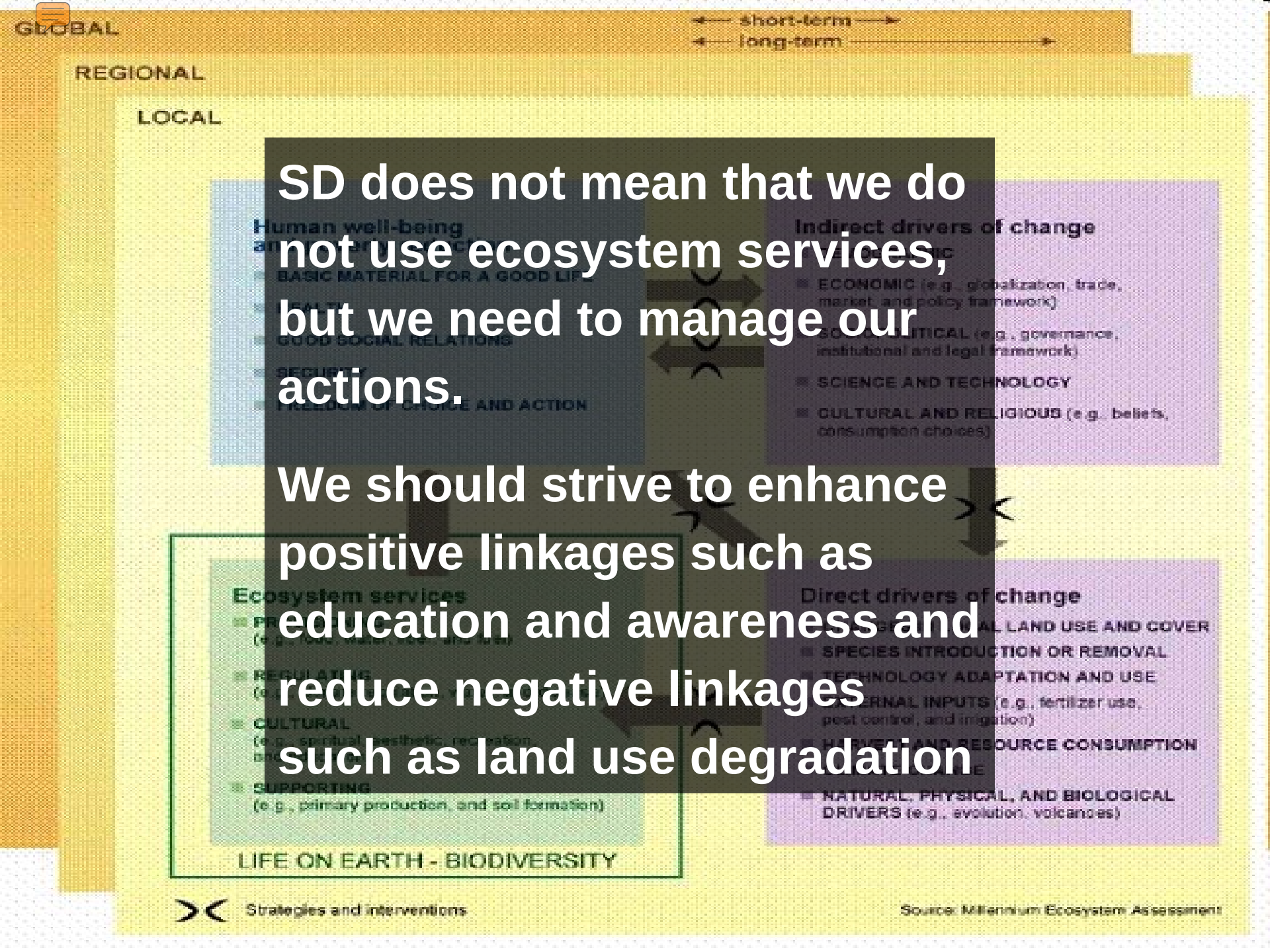
- Increased dependence, misuse and overuse of ecosystem services are the driving forces – the actions that impact on ecosystem services.

**Direct Drivers of Change**

- Changes in land use
- Species introduction or removal
- Technology adaptation and use
- External inputs *(e.g., irrigation)*
- Resource consumption
- Climate change
- Natural physical and biological drivers *(e.g., volcanoes)*

**Indirect Drivers of Change**

- Demographic
- Economic *(globalization, trade, market and policy framework)*
- Sociopolitical *(governance and institutional framework)*
- Science and Technology
- Cultural and Religious




**SD does not mean that we do not use ecosystem services, but we need to manage our actions.**

**We should strive to enhance positive linkages such as education and awareness and reduce negative linkages such as land use degradation**

# Example: The Buccoo Reef Ecosystem

- Buccoo Reef a coral reef ecosystem
- Started by identifying some of the services that the Buccoo Reef ecosystem offers
  - Tourism and recreation provides employment and income from tourism *PROVISIONING and CULTURAL SERVICES*

| $$ The Revenue Sheet $$ | |
|---|---|
| **Activity** | **Income** |
| Accommodation; reef recreation (diving, snorkelling and glass bottom boats) | TT $261 million per year |
| Purchase of materials to support tourism like boats and food sales | TT $348 – 516 million per year |
| **Total** | **TT $509 – 777 million per year** |

# Example: The Buccoo Reef Ecosystem

- Buccoo Reef a coral reef ecosystem
- Started by identifying some of the services that the Buccoo Reef ecosystem offers
  - Tourism and recreation provides employment and income from tourism *PROVISIONING and CULTURAL SERVICES*
  - Fisheries provide food and employment *PROVISIONING SERVICE*
  - The reef provides habitat for fish, food for fish and fish nurseries *REGULATING SERVICE*

| $$ The Revenue Sheet $$ | |
|---|---|
| **Activity** | **Net Revenues** |
| Direct economic impact :fish sales + fish cleaning and processing | Between TT $3.84 and 5.478 million per year |
| Indirect economic impact: economic activity generated by need for fishing equipment, such as boats and pots | Between TT $708,000 and 1,410,000 per year |
| **Total** | **Between TT $ 4.55 and 6.89 million per year** |

# Example: The Buccoo Reef Ecosystem

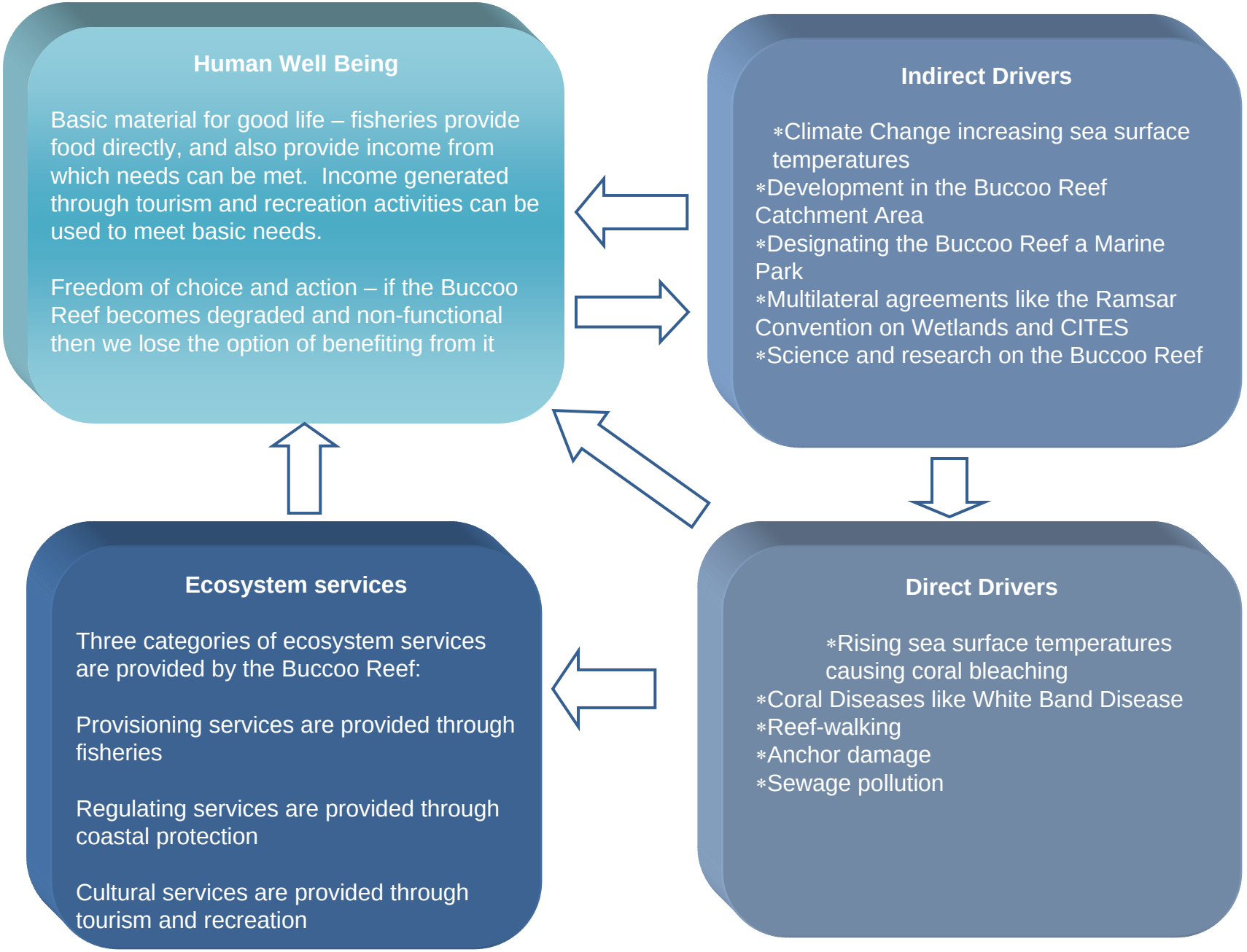
- Buccoo Reef is a coral reef and mangrove ecosystem
- Started by identifying some of the services that the Buccoo Reef ecosystem offers
  - Tourism and recreation provides employment and income from tourism *PROVISIONING and CULTURAL SERVICES*
  - Fisheries provide food and employment *PROVISIONING SERVICE*
  - Coastline protection estimated at TT$ 108 – 198 million per year *REGULATING SERVICE*

# Example: The Buccoo Reef Ecosystem

- Identify the drivers
  - Rising sea surface temperatures causing coral bleaching
  - Coral Diseases like White Band Disease
  - Reef-walking
  - Anchor damage
  - Sewage pollution
  - Climate Change increasing sea surface temperatures
  - Development in the Buccoo Reef Catchment Area
  - Designating the Buccoo Reef a Marine Park
  - Multilateral agreements like the Ramsar Convention on Wetlands

# Example: The Buccoo Reef Ecosystem

- Put the components of HWB, ecosystem services and drivers together


Human Well Being
Basic material for good life – fisheries provide food directly, and also provide income from which needs can be met. Income generated through tourism and recreation activities can be used to meet basic needs.
Freedom of choice and action – if the Buccoo Reef becomes degraded and non-functional then we lose the option of benefiting from it
Indirect Drivers
∗Climate Change increasing sea surface temperatures
∗Development in the Buccoo Reef Catchment Area
∗Designating the Buccoo Reef a Marine Park
∗Multilateral agreements like the Ramsar Convention on Wetlands and CITES
∗Science and research on the Buccoo Reef
Direct Drivers
∗Rising sea surface temperatures causing coral bleaching
∗Coral Diseases like White Band Disease
∗Reef-walking
∗Anchor damage
∗Sewage pollution
Ecosystem services
Three categories of ecosystem services are provided by the Buccoo Reef:
Provisioning services are provided through fisheries
Regulating services are provided through coastal protection
Cultural services are provided through tourism and recreation

Thank you

Questions?