Enhancing Scientific Cooperation between the European Union and Central America

Fortaleciendo la cooperación científica entre la Unión Europea y América Central

"Europe, Central America & Caribbean: Climate Change and Biodiversity Dialogue Workshops"

Setting up the S&T dialogue through a continuous exchange of knowledge and flow of information (proceedings)

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Sixth Bi-regional Dialogue of ENLACE Project was held in Panama City, on the 22 and 23, May, 2013. The event had the objective to set up research priorities on Biodiversity and Climate Change topics, of mutual interest between Europe, Central America and the Caribbean.

In order to achieve the objective more concretely, three research areas were prioritized as follows, taking into accounts the areas identified by the EU-LAC Joint Initiative for Research and Innovation (JIRI):

- Climate change and its relation with ecosystems (regional integrated approach including scenarios, modeling tools and assessment of climate extremes).
- Sustainable management of natural resources and natural hazards related problems.
- Scenarios of climate change (Distribution and extinction risk of species)

The expert's Dialogue gathered speakers coming from the three regions and different sectors, such as European experts and academic researchers from public and private universities of Central America and the Caribbean.

The workshop was structured in three parts, according to the methodology already set for the previous dialogue events.

The first part was a general background introductory session containing the following topics:

- EU-LAC Joint Initiative for Research and Innovation (JIRI) and H2020 visions
- International Cooperation in research and innovation in Environment
- Climate Change, biodiversity & ecosystems: identifying knowledge gaps and research needs

The second part was devoted to the bi-regional dialogue, which was carried out in three parallel sessions. In these sessions, each expert made a presentation of what he/she considered were the priorities of research in its own expertise area (this presentation was made using a template previously sent by the organization of the event). In each group, a rapporteur was appointed to be in charge of moderating the discussion and consolidate the minutes of the dialogue.

The last part of the event was the presentation of the results of each parallel session. The rapporteurs consolidated the discussions and prepared a presentation for the plenary session, which took place on 23 May.

The workshop allowed fruitful knowledge exchange and the identification of common areas of interest of European, Central American and Caribbean bio diversity and climate change research groups which are presented at the end of this document.

INTRODUCTION

The promotion of the **"EU-LAC Knowledge Area"** was first mentioned in the Guadalajara Declaration of 2004 for solving societal problems and creating new opportunities: "*We consider that the future EU-LAC Knowledge Area should be built on the results of the successful science and technology bi-regional dialogue and include reinforcement of cooperation in science and technology, higher education and information and communication technologies.*"

It has been further addressed in the EU-LAC Summit in Madrid in 2010 which put Innovation and technology for sustainable development and social inclusion as central theme. In this context, a new "Joint Initiative for Research and Innovation (JIRI)" for the LAC region has been developed. Five senior officials working groups were established to mobilize stakeholders on priority areas of mutual Connecting Caribbean, Central American and European Researchers, Policy Makers and Stakeholders in Joint research Actions interest. Calling on a wide range of experts from both regions with the support of several INCONETs, the four thematic working groups have narrowed down objectives for the short- and medium term and outlined concrete activities and funding options to be further elaborated for bi-regional cooperation in the following areas:

- Bioeconomy including food security – co-led by Argentina and France
- Information and Communication Technologies (ICT) for meeting societal challenges –Co-led by Chile and Finland
- Biodiversity and Climate Change – co-led by Colombia and France
- Energy – co-led by Mexico and Spain

A fifth cross-cutting group co-led by Mexico and Portugal looks at funding and good practice.

The EU-LAC Senior Official Meeting (SOM), held in Concepción (Chile) in March 2012, was aimed at discussing the state of the art of the Road Map for the implementation of JIRI and the areas of common interest identified by the thematic Working Groups, as well as future actions to undertake. Moreover, in January 2013 the 1st EU-CELAC Summit (7th EU-LAC Summit) brought together European, Latin American and Caribbean Heads of State and Government in Santiago (Chile), to address an Alliance for Sustainable Development to Promote Investments of Social and Environmental Quality. During the Summit, the Leaders adopted a political Declaration and expanded the Action Plan previously adopted in the Madrid Summit in 2010 for bi-regional cooperation.

THE EXPERTS DIALOGUE

The importance of the Seminar in this context

Central America (CA) and the Caribbean are ranked within the world's top twenty-five "biodiversity hotspots". CA alone, with only 0.5 % of global land area hosts approximately 7 % of the world's terrestrial species including 210 endemic mammals and 24,000 plants. Similarly, the insular Caribbean, in spite of its limited land area, boasts 2.3% of the world's endemic flowering plants and the Caribbean Sea supports 9% of the world's coral reefs and six of the seven species of marine turtles. One of the main threats to the biodiversity of both regions is Climate Change (CC). Ecological cycles are being disrupted by CC provoking extreme temperatures, severe meteorological events, droughts, floods, rising sea levels, increasing sea surface temperatures, ocean acidification and glacial melting. It is expected that the impacts will be more critical in developing regions, such as CA and the Caribbean.

There have been some cooperative initiatives among the Central American countries to preserve biodiversity and ameliorate the negative effects of CC. During the Central American Presidents Summit held in San Isidro de Coronado, Costa Rica, December 1989, the presidents of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua signed an agreement to establish the Central American Commission for Environment and Development (CCAD). Within this commission, the Regional Biodiversity Monitoring and Evaluation Program (PROMEBIO), was conceived as a programmatic instrument to generate information to enable the management of biodiversity and natural resources. The program has been adopted by seven ministries of environment of CA countries, as the regional organism in charge of standardizing biodiversity information. Under PROMEBIO´s framework it has been designed methodologies and programs that apply the Pressure State Response (PSR) and the remaining biodiversity index of the natural capital (Mean Species Abundance) i.e. the Global Biodiversity Model (GLOBIO) and Conversion of Land Use and its Effects (CLUE).

The drivers in the models considered are: land use, infrastructure, fragmentation, climate change and nitrogen deposition. The results of the modeling drivers for biodiversity loss, presented as a percentage of the remaining biodiversity for Central America in 2008 show an average loss in biodiversity of 52 %, indicating that only 48% remains. This loss is associated in a 34% to land use, 9 % to road infrastructure, 6% to natural ecosystem fragmentation and 2.6% to climate change. Another joint effort towards biodiversity conservation in the region is the Mesoamerican Biological Corridor (MBC), established in 1997 by the CCAD. The MBC has as a main objective to provide ecological connectivity within national protected areas, supported on conservation and sustainable use of natural resources and with the aim of contributing to the improvement of life quality of the inhabitants of the region.

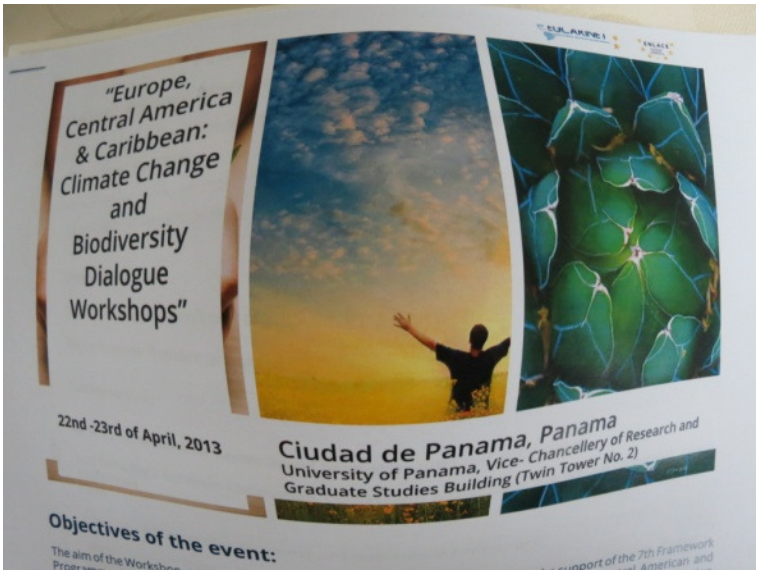
For the Caribbean, a regional approach to biodiversity conservation has been adopted successfully for marine ecosystems. Two good examples are the Integrating Watershed and Coastal Area Management (IWCAM) in the Small Island Development States (SIDS) of the Caribbean project approved by the Global Environment Facility (GEF) in 2004 and the Caribbean Large Marine Ecosystem and Adjacent Areas (CLME) project launched in 2009. In terms of both regions, several Central American countries and Dutch Caribbean

territories are Party to the Inter-American Convention for the Protection and Conservation of Sea Turtles which has several resolutions pertaining to climate change.

All the countries conforming the Central American Integration System (SICA) are part of the United Nations Framework Convention on Climate Change and consequently participate in the negotiations processes and conferences of the parties (COP). As an example of cooperation in the subject, the Ministers of Foreign Affairs of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama signed the Regional Agreement on Climate Change in 1993. And in 1999, the CA countries adopted the Strategic Framework for the Reduction of Vulnerabilities and Disaster Impacts.

With respect to the Caribbean Community (CARICOM), on the instruction of Heads of Government of the region, a comprehensive Strategic Plan for climate change adaptation and mitigation was prepared in 2009 by the Caribbean Community Climate Change Centre (CCCCC) entitled "Climate Change and the Caribbean: A Regional Framework for Achieving development Resilient to Climate Change , 2009- 2015".[1] The overarching importance of managing the region's biodiversity under a changing climate is highlighted throughout the document, but specifically under Strategic Elements 1 and 5. This subject is currently a major focus of research and regional programming for the CCCCC.

Themes assessed by the seminar



The Experts' Dialogue organized by the ENLACE and EUCARINET projects aims at identifying specific research lines and scientific priorities of common interest and benefit between Central America, Caribbean and EU on Climate change and biodiversity, in order to contribute to the JIRI by identifying/adapting/developing/envisioning the main pathways for Central America and the Caribbean.

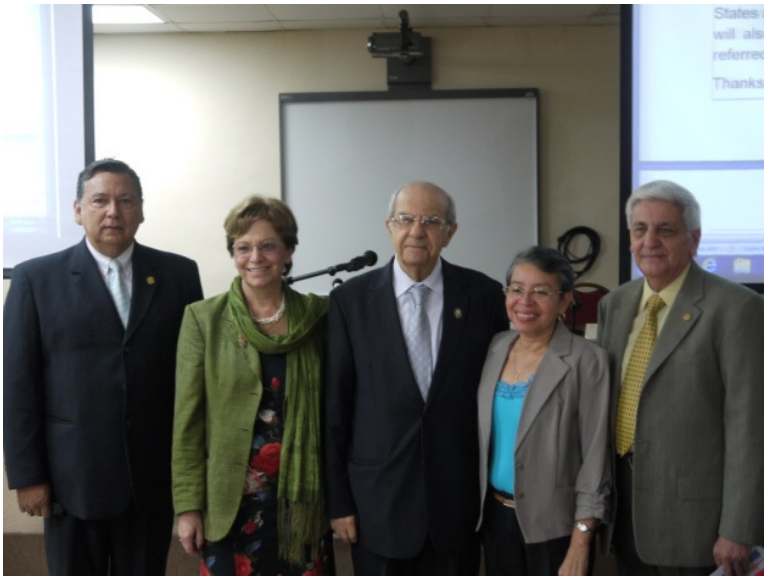
The workshop covered different Thematic Areas identified as elements of mutual interest through priority setting exercises previously developed by ENLACE and EUCARINET and validated by the JIRI Working Group. These are:

[1] For more information please visit http://www.caribbeanclimate.bz/ongoing-projects/2009-2021-regional-planing-for-climate-compatible-development-in-the-region.html

- Climate change and its relation with ecosystems (regional integrated approach including scenarios, modeling tools and assessment of climate extremes).
- Sustainable management of natural resources and natural hazards related problems.
- Scenarios of climate change. (Distribution and extinction risk of species)

Methodology of the Selection of the Central American and Caribbean Experts

A total of 12 experts, 6 from Central America and 6 from the Caribbean countries were chosen to represent both regions in the Dialogue. The process to search and select the experts was conducted by the General Secretariat of the Central American University Superior Council (SG-CSUCA) for Central America, while in the Caribbean was under the responsibility of the partners in EUCARINET consortium. The professional characteristics required to be considered as a candidate to participate in the selection process were:



Higher education authorities in Panama during the Dialogue Workshop

- **Compulsory:** science and technology experts, representative for their respective regions, English speaking, familiar with international cooperation, sound knowledge of the thematic area and good communication skills;
- **Preferable characteristics:** knowledge of the industrial and private sector.

Several CVs were received and a first selection list was made with the names of the candidates that best fulfilled the required characteristics. This list was sent to ENLACE and EUCARINET steering committees in order to have their opinion and final decision.

Once the final list was agreed, the researchers were officially notified with a formal invitation from CSUCA and the EUCARINET Caribbean partners. All researchers accepted the invitation. Later on, background documentation about the Dialogue Event was sent to them to prepare their participation in Climate Change Dialogue. The University of Chiriquí (UNACHI) was in charge to manage the travel logistics.

PLENARY SESSION – CLIMATE CHANGE AND BIO DIVERSITY – IDENTIFYING KNWOLEDGE GAPS AND RESEARCH NEEDS

THE PRIVATE SECTOR'S ENGAGEMENT

CHRISTOPHE YVETOT, UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

Christophe Yvetot – UNIDO, Belgium

This intervention was focused on the theme of Green Industry and its relation with climate change. Some key findings were mentioned in order to contextualize the basis of the problematic. These were:

- Many industries use more materials and energy than their production processes require, due to **continued use of obsolete and inefficient technologies and methodologies.**
- Producers and consumers have adopted patterns of production and consumption that do not take into consideration the **limits of the planet's available resources and its assimilative capacity for emissions,** a situation further complicated by continued population growth.
- Climate change is one main consequence, but **loss of biodiversity, land degradation and desertification, air pollution, surface and groundwater pollution, chemical contamination** are also critical.
- **Current production systems are therefore unsustainable:** they do not allow today's needs to be met without jeopardizing the ability of future generations to meet theirs.
    - **Behavioral changes in society (consumption) and business investments are essential.**
    - **Decoupling economic growth from natural resource consumption and environmental impacts is central**

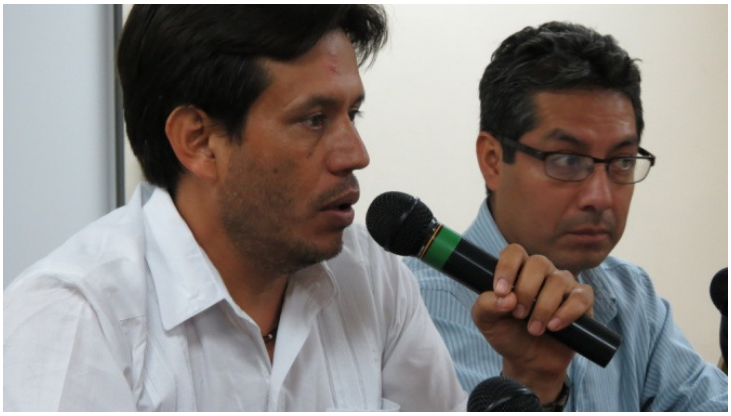
Regarding the critical requirements to a green industry creation and greening of industries, two main points were mentioned in order to pave the grounds for this. The first one was that since change is only possible if it can be measured, policy developments need to be supported by **quantitative targets and indicators**. The second point referred the crucial targets for **encouraging consumers and businesses** to partake in sustainable consumption and production.

UNIDO has been developing the green industry platform ***www.greenindustryplatform.org*** coming as a response by Global, High-Level, Multi-Stakeholder Initiative, the Business, Government, International and Civil Society Organizations Participating and the drivers through the Green Industry Agenda through Concrete Actions. To this end, some targeted activities such as the setting up of sector-specific resource

efficiency benchmarks and indicators, as well as the creation of resource efficiency projects through the UNIDO-UNEP RECP*net* and other activities gearing the greening of the supply chain. A one-week, four events with public and private international and local partners in LAC region has been established under this umbrella. Industrial knowledge to promote growth based on resource efficiency especially to study waste and energy, but also the discussion of Resource Efficiency and Cleaner Production for a Green Industry in Latin American and the Caribbean are the central points of discussion. Moreover, the Green Growth Indicators initiative forms part of UNIDO's work with OECD in seven LAC countries (Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Paraguay and Peru). The discussion and fine-tune of indicators allow better projections and predictions under specific scenarios of change. The findings are shared under the regional Meeting on Energy Efficiency for Industry in the LAC region.

WILDLIFE DEPENDING ON WATER POOLS AND SCENARIOS OF CLIMATE CHANGE IN THE MAYA FOREST

RAFAEL REYNA HURTADO - ECOSUR



Rafael Reyna & Jorge León-Cortés – ECOSUR, Mexico

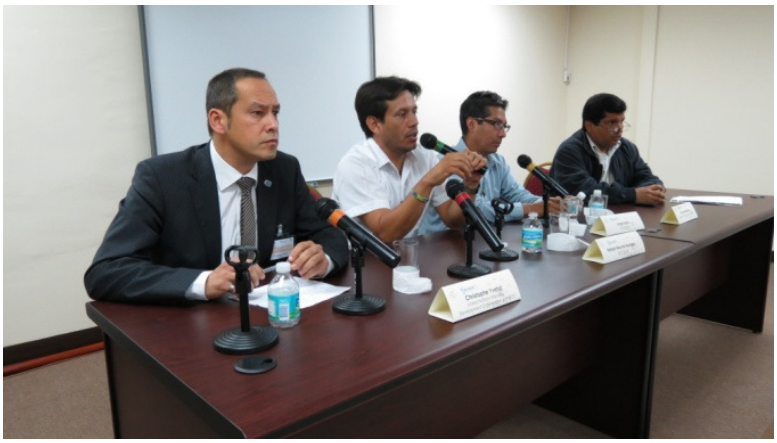
The presentation described the relationship between endangered species, water pools and climate change in the Yucatan peninsula. There are not major rivers in Calakmul area, and the few rivers run underground, therefore in the surface very few places of water ponds can be found, and the only water sources are the "AGUADAS". These are the reserves for the communities and the fauna such as Pecari and Dantas, who depend from the Aguadas. The current research of "Aguadas" is done in Calakmul as it is the largest single protected tropical forest in Mexico (7, 231 km2), adjacent to the Peten reserve. The core of the research is to understand why some Aguadas have water one year but not others. The research has included the prediction of temperatures as a variable that can affect the behavior of wildlife.

Some recommendations from the preliminary research have been the following :

- Develop good practices for water use in the region
- Declare some "Aguadas" as wildlife sanctuaries
- Establish more meteorological stations to monitor climate change in detailed scale
- Include the good practices of water use in environmental education

ELEVATION SHIFTS AND SURVIVAL OF INSECT POPULATION IN RESPONSE TO CLIMATE CHANGE IN SOUTHERN MEXICO

JORGE LEÓN-CORTÉS- ECOSUR



Plenary Session Panel

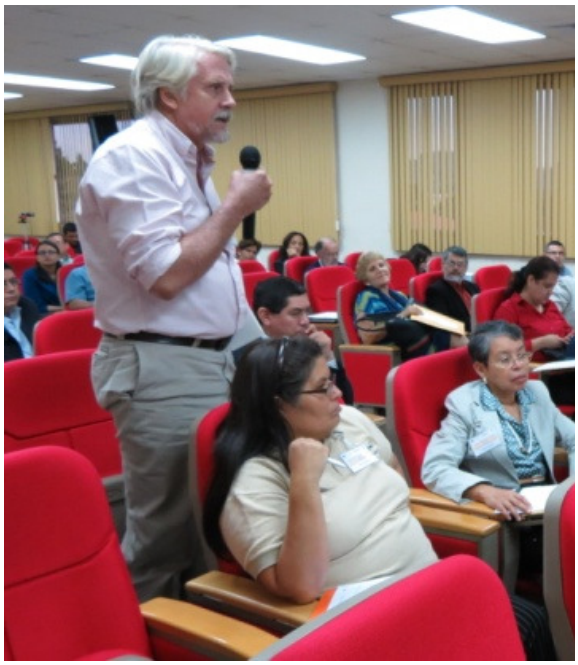
The expert presented the research being done on the anthropogenic impact on climate change to diagnose and predict its effects on the abundance and distribution of species. Some migratory species appear to be able to respond quickly to annual climate variation and by altering the timing and destination of migration. Insects are particularly sensitive to climate change (Menéndez 2007). Specifically, the research of Lepidoptera (Butterflies) as exothermic organisms that respond extremely quickly to environmental degradation are central parameters for the climate change indicator in such research.

DISCUSSION

The discussion around this session ranged from issues such as the need to not oppose green development vs innovation and industry, to the best ways to approach bio diversity regionally.

It first tackled the take up the community as a key parameter to bio diversity management. In this sense, avoiding emblematic governmental projects without consulting the responsible managers and the communities directly involved is a must. Also, there was a common agreement on trying to find the link of global interest of common projects and internationalizing priority areas. Looking for common grounds for green industry and bio diversity exploration was suggested as well. One example given was achieving resource efficiency by dealing with the actual crisis creating jobs while rationalizing costs.

Furthermore, the debate opened to the crucial importance for LAC countries to treat the bio diversity as a transversal theme. It was agreed that policy dialogues as well as research lines should be developed in the interest of the issues on local countries. One core aspect mentioned on this regard was the lack of data information and the data discrepancies for climate change for predictions. This is probably not perceived as necessary sellable but it is crucial for the current environmental issues facing. The discussion then evolved on the way to deal with this lack of information and the creation of open data networks. The question of



Q&A during the Plenary Session Panel

how to improve the system to gather and get better data in networks varied between having Hubble portable systems open to this, challenges for creating this network and the possible clues to deal with climate change with specific observation. Maintaining satellite data and increasing data information to monitor the evolution in the long term is a common understanding as is also the need for future and more complete research.

Environmental hubs were mentioned as an example of a LAC global strategy. Recognizing general phenomena and searching for regional strategies to tackle these issues of general concern remain an important challenge. As a response to these inquiries, an alternative proposed was to look at case studies of Central America and the Caribbean by sector and through the link they have to industries that have advanced considerably on green technology. Having a look at the lessons learnt and using the knowhow acquired to replicate to the ones lagging behind was one of the initial steps to take into consideration.

PRIORITIY DIALOGUE - PARALLEL SESSIONS OUTCOMES

CLIMATE CHANGE AND ITS RELATION WITH ECOSYSTEMS (REGIONAL INTEGRATED APPROACH INCLUDING SCENARIOS, MODELLING TOOLS AND ASSESSMENT OF CLIMATE EXTREMES)

BACKGROUND

Water-related problems and the way they can alter biodiversity

Climate Change would have a prominent impact on the hydrological cycle and as a result on available water resources, some regions of the Earth will become wetter and others drier. All these will have implications on biodiversity; for example in Calakmul, Southern Mexico, large mammals such as Tapir and white leaps peccaries depend on small scattered pools for available water, some of them, the last years, have become dried.

CC would also affect the Ocean chemistry threatening marine biodiversity. With carbon dioxide absorption, the pH of the Ocean decreases. Acidification inhibits the formation of the hard exoskeleton of corals and protective shells of marine mollusks. Loss of reef-building corals will have negative consequences in the whole marine ecosystem. Warming sea water temperatures and sea level rise are anticipated to be particularly problematic for sea turtles with their dependence on beaches for nesting, and temperature-dependent sex determination.

Monitoring and impact of invasive alien species and proliferative species

Invasive alien species (IAS) are considered as the second main threat to biodiversity after land use change and land fragmentation. CC will affect species distribution and therefore the potential for the spread of IAS. However, most introductions of exotic species to new environment have been due to human transportation, deliberately or accidentally. IAS are a threat to biodiversity and economic development, affects human health, fisheries, agriculture, contributing to land degradation, clogging of water reservoirs, irrigation canals and hydroelectric dams. While not attributable to climate change, the current spread of the Pacific lionfish throughout the Caribbean, following its release in Florida, is an excellent and topical example of the profound economic effects that IAS can wreak on ecosystems.

Moderator/ Rapporteur:

Prof. Jose M. Baldasano, Technical University of Catalonia-UPC (Spain)

Participant experts

NAME	ORGANISATION
Marcia Henry	Scientific Research Council, Jamaica
Rahanna Juman	Institute of Marine Affairs IMA), Trinidad and Tobago
Carlota Monroy	San Carlos University, Guatemala
José Fábrega	Centro de Investigaciones Hidráulicas e Hidrotécnicas, UTP/Panamá

Methodology and summary of discussions

The work methodology used was based on an ongoing process with different progressive phases:

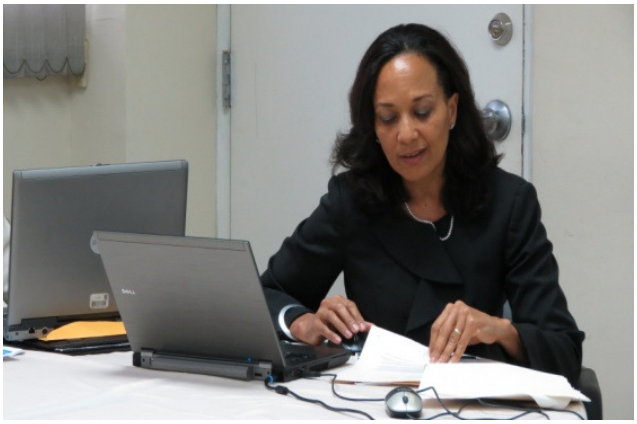
1. Definition of objectives and procedures
2. Independent preparation by expert participants prior to the meeting of their specific analysis documents
3. Presentation by each of the participating experts to the panel
4. General discussion of the participating experts and invited attendees to the panel.
5. General presentation of the synthesis document by the rapporteur
6. Joint review process of discussion of final document
7. Submission of the final document

The discussion took place around the general impacts of Climate Change in Central America and the Caribbean ecosystems. It was discussed that they could be a result of:

- ***Increases in temperature on land*** *- 1.5°-2.0° Celsius increase, across all seasons across all seasons and scenarios, in global temperature by year 2100*
- ***Altered rainfall and runoff patterns***
- ***Sea level rise*** *- global mean of 9 cm-88 cm*
- ***Increase in sea surface temperatures***
- ***Altered intensity of hurricanes***

Altered rainfall & runoff patterns

- Drying of ecosystems leading to loss of species and changes in community composition
- Changes in species distribution and ecosystem composition
- Changes in the geographical extent of habitats and ecosystems
- Flooding of nests of various species and death of young individuals



Marcia Henry - Scientific Research Council, Jamaica

Sea Level Rise

- Changes in structure of coral reefs and shallow water marine communities
- Increased inundation of coastal wetlands and lowlands
- Loss of estuarine, coastal species and communities
- Increased intrusion of salt water vegetation into freshwater ecosystems in coastal areas
- Loss of nesting and feeding habitats particularly for endangered turtle species and crocodiles
- The cost to protect Jamaica from a one meter sea level rise in 1990 - US$462 million (IPCC)

Higher Sea Surface Temperatures

- Mild warming (+2 °C), tropical near-shore communities will change from coral-dominance to algal-dominance.
- Creates conditions that may be suitable for some invasive species to become established in new areas
- High temperatures lead to coral bleaching and even coral death
- The elimination of coral reefs would have dire consequences. Coral reefs provide habitats and nursery areas for numerous commercially important species; economic activities
- Jamaica's coral reefs experienced massive bleaching due to high sea temperatures in years 1987, 1989, 1990 and 1998

Altered Hurricane Intensity

- Loss of vulnerable island species
- Changes in species competitive interactions and species and community composition
- Changes in range of invasive species
- Increased damage to nests & nesting sites
- Increased destruction of sensitive habitats:

- Coral reefs
- Mangrove ecosystems – reduction in economic value
- Terrestrial (esp. forest) ecosystems

RESULTS – CLIMATE CHANGE AND ITS RELATION WITH ECOSYTEMS

Sub-Themes discussion

The following lines were discussed during the session :

Theme 1: SCIENTIFIC KNOWLEDGE OF THE INTEGRATED NATURAL AND HUMAN COMPONENTS OF THE EARTH SYSTEM
➢ ***Earth System Understanding:*** **Fundamental understanding of the physical, chemical, biological, and human components of the Earth system, and the interactions among them, to improve knowledge of the causes and consequences of present climate change.**
➢ ***Science for Adaptation and Mitigation:*** **Advance understanding of the vulnerability and resilience of integrated human-natural systems and enhance the usability of scientific knowledge in supporting responses to climate change.**
➢ ***Integrated Observations:*** **Advance capabilities to observe the components of the Earth system over multiple space and time scales to gain fundamental scientific understanding and monitoring the variations and trends.**
➢ ***Integrated Modeling:*** **Applied models that integrate the components of the Earth system, including feedbacks, to represent more comprehensively and predict more realistically climate change processes.**
➢ ***Information Management and Sharing:*** **Increase the capability to collect, store, access, visualize, and share data and information about the Earth system, the vulnerabilities of integrated human-natural systems climate change, and the responses to these vulnerabilities.**

Theme 2: EDUCATION AND COMMUNICATIONS TO BROADEN PUBLIC UNDERSTANDING OF CLIMATE CHANGE AND DEVELOP THE SCIENTIFIC WORKFORCE
➢ ***Strengthen Communication and Education Research:*** **Strengthen the effectiveness of climate change communication and education research to enhance practices.**
➢ ***Ongoing Capacity:*** **Strengthen and evolve ongoing capacity to conduct assessments with accessible, transparent, and consistent processes and broad participation of stakeholders across regions and sectors.**
➢ ***Reach Diverse Audiences:*** **Enhance existing and employ emerging tools and resources to inform and educate effectively, providing information flow in multiple directions.**
➢ ***Maintain Scientific Workforce*****: Cultivate a capable, diverse scientific workforce that is knowledgeable about global change.**

Theme 3: INFORM DECISIONS: PROVIDE THE SCIENTIFIC BASIS TO INFORM ON ADAPTATION AND MITIGATION MEASURES
➢ ***Inform Adaptation Decisions: Improve the deployment and accessibility of science to inform adaptation decisions.***
➢ ***Inform Mitigation Decisions: Improve the deployment and accessibility of science to inform decisions on mitigation and the mitigation-adaptation interface.***
➢ ***Climate Change Information: Develop the tools and scientific basis to enable an integrated system of climate change information, informed by sustained, relevant, and timely data to support decision making.***

Conclusions

The panel members recommended decisions on the following issues:

1. Build regional capacity in the three themes mentioned above particularly Theme 1;
2. Oriented actions to Social and Environment Challenges;
3. Knowledge Gaps in Climate Change and Biodiversity – possible and actual impacts, opportunities and mitigation strategies etc.;
4. Research Opportunities;
5. Health and environmental issues;
6. Creation of a regional database, comparable to other databases in the world, providing easy and transparent access to research results and other scientific information on climate change and biodiversity, so that stakeholders can take advantage of current and future results at the regional level;
7. Necessity of standardization.

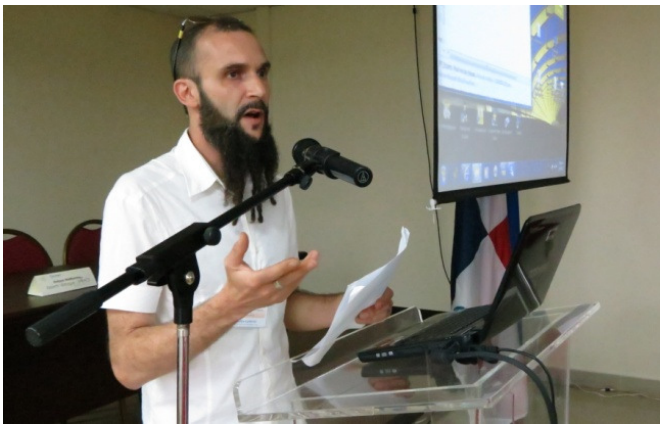
Climate Change and its relation with Ecosystems Panel Discussion

SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES AND NATURAL HAZARDS RELATED PROBLEMS

BACKGROUND

Impact of land use on biodiversity

In CA, energy production and land use change are the main sources of greenhouse gases; both sectors contribute to forest disappearing. According to OLADE, firewood is the main source of energy in housing, and land use change is mainly due to the establishment of pasture lands for cattle production in fields that were covered by forest. Deforestation and forest degradation has a twofold negative impact in biodiversity; with the clearance of forest, plant species are reduced or extinguished and wild animal species lose their habitat, and second, the greenhouse gases emitted by forest clearance (the farmers usually burn the biomass) contribute to climate change which is itself a threaten to biodiversity.



Sergio Calabrese - Department of Earth and Sea Science (DiSTeM), University of Palermo, Italy

For the insular Caribbean, land is limited and probably the major threat to terrestrial biodiversity is loss of habitat, including high biodiversity ecosystems such as mangroves near the coast, especially due to construction of hotels, golf courses and other tourism-related developments. Furthermore, deforestation, changing agricultural practices and infrastructural development can cause soil erosion and have significant negative impacts on coastal water quality and the near shore marine ecosystems**.**

Natural hazards

There are several documented cases of increases in extreme climatic events and climate change in CA and the Caribbean. Hurricanes have become more frequent and intense, and sea level rise is projected. With most of their population, economic activities and infrastructure located at or near sea-level, CA and the Caribbean countries will very likely suffer flooding and erosion with high impacts on people, resources and economic activities. Sea-level rise and increased hurricane activity will therefore be an added burden to the many Caribbean islands already threatened by seismic and volcanic activity.

RESULTS OF THE PANEL DISCUSSION ON "SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES AND MITIGATION MEASUREMENTS TO NATURAL HAZARDS"

Moderator/ Rapporteur: Sergio Calabrese, Department of Earth and Sea Science (DiSTeM), University of Palermo (Italy)

Participant experts

NAME	ORGANISATION
Sergio Calabrese	Department of Earth and Sea Science (DiSTeM), University of Palermo, Italy (geochemist and volcanologist)
Philippe Hunel	Université des Antilles et de la Guyane (UAG), LAMIA and LARGE laboratories
Jorge Mendoza	El Colegio de la Frontera Sur (ECOSUR)/ Mexico
Raul Mora	Escuela Centroamericana de Geología. Red Sismológica Nacional UCR/ Costa Rica (volcanologist)
Benjamin Mueller	University of the Netherlands Antilles /, Royal Netherlands Institute for Sea Research
Angie Murillo	Climate Resilience and Food Security in Central America, CURLA - UNAH/ Honduras (agricultural economist)
Henri Vallès	UWI- University of the West Indies (ecologist)

1. Methodology and summary of discussions

The panel was composed by seven experts from various countries and with different scientific expertise (agricultural economist, ecologist, biologist, geochemist, volcanologist). In addition to experts, about twenty participants and stakeholders actively joined the discussion by making a significant contribution to the debate. In the first phase of the session, the experts shared their experience via an oral presentation of about fifteen minutes; the second part took place with a questions/answers time related to the topics presented by the experts, followed by an informal open discussion.

The final part of the meeting has allowed us to summarize and define the main research lines to suggest for the future, priorities and common needs relating to specific local contexts and their problems, and also identify some overlaps between different scientific contexts, according to a shared perspective and multidisciplinary future pathways

2. Road maps developed per pathway

The working group identified six main sub-pathways to achieve the aims required by the ENLACE/EUCARINET organizers in the area of “Sustainable Management of Natural Resources and mitigation measurements to Natural Hazards”.

Sub-Themes discussion

The following six sub-themes of major importance were recognized as potential future research lines to be suggested for the JIRI agenda and for guide the future work of the ENLACE and EUCARINET projects:

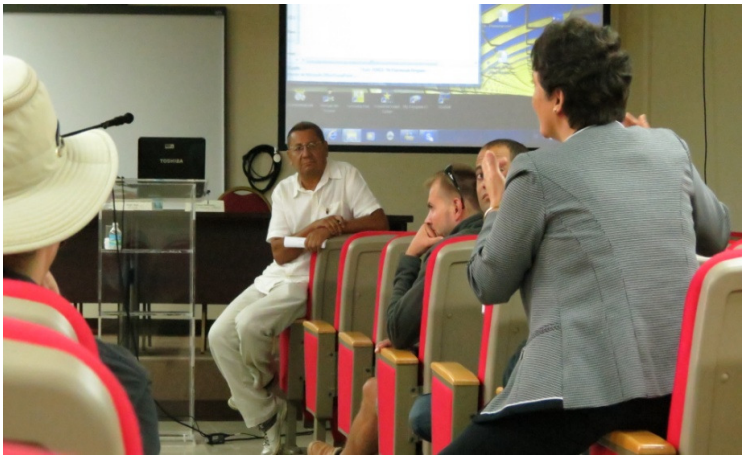
1. **Economic valuation of ecosystem services:** Coral reefs and adjacent costal ecosystems such as sea grass beds and mangroves are hot spots of biodiversity. Furthermore, they provide a plethora of goods (fish, moluscs, algae) and services (coastal protection, areas for recreational activities, aesthetics) to humans. Yet increasingly conflicts arise regarding the use and development of these areas for the construction of hotels, harbor facilities, aquaculture or coastal development in general. In order to be able to make realistic evaluations of the potential benefits of coastal development projects the true value of the natural systems needs to be assessed. Only when environmental losses are included in budgets, in combination with traditionally used measures the true benefit of a proposed coastal development project can be adequately characterized. The realization of such integrated, i.e., standard economic and ecological economic value of coastal systems would be a new way of promoting and stimulating governmental practices to help protecting them.

2. **Promote research to aid the development of new ICZM (Integrated Coastal Zone Management) and system approaches.** Coastal planning activities should acknowledge that the marine environment in large part reflects the activities on nearby shores. While this notion is quickly gaining momentum, much of the ecological and physical mechanisms that connect the two systems remain poorly studied, for example the extent to which groundwater flow carries polluting substances from land to the sea and the effect of chemical pollution (toxins, pesticides, pathogenic microbes). The latter would add to more traditional approaches focusing primarily on nutrients (nitrogen and phosphate) and sediments as the main substances being transported from land to neighboring marine communities. Secondly, integrated ecosystem studies linking all components of marine and terrestrial ecosystems are required to assess the relative importance of processes or groups that are traditionally studied in isolation. Only when the relative importance of the large number of processes taking place in the sea and (or) on land or even in combination are known can adequate management strategies be designed and tested.

3. **Promote the studies on Active Volcanic Areas as potential Natural Hazard and Natural Resources:** Today, about 500 million of the global population live on or close to volcanoes. Is common understanding that the active volcanic areas emit huge amounts of greenhouse gases (CO_2, SO_2, etc.) and potentially toxic chemical elements (fluoride, heavy metals, etc.). Considering that a lot of active volcanic areas are present in the Central America and Caribbean (CAC) regions, the studies on the *impact of volcanic emissions* on the environment, and consequently on the population, are

of remarkable importance both for the countries of CAC regions and for Europe. By contrast, volcanic areas are also precious natural resources considering the sustainable exploitation of *geothermal energy*. The investment in technological innovation would bring down the environmental impact of geothermal power plants, allowing the concerned regions to implement the use of renewable energy.

4. **Promote the integrated Land & Watershed management:** In CA, land use change is one of the main sources of greenhouse gases. Deforestation and soil degradation has a twofold negative impact in biodiversity; with the clearance of forest, plant species are reduced or extinguished and wild animal species lose their habitat, and second, the greenhouse gases emitted by forest clearance (the farmers usually burn the biomass) contribute to climate change which is itself a threaten to biodiversity. Land use change (at the upper, middle and lower part of the watershed) can cause soil erosion and have significant negative impacts on river and coastal water quality; it also has a direct impact on the hydrological cycle and as a result on available water resources which can worsen with CC scenarios.



Sustainable Management of Natural resources - Panel Discussion

5. **Promote the development of an open ICT platform of climate and environmental data on island regions**: Today there are many climate models; scale model is not adapted to the size of the island territories. Many environmental and climatic data are available so scattered in different organizations in the countries of the Caribbean. Thanks to ICT, it may be possible to develop a cluster of these data by an intelligent urbanization of all information systems. This will allow researchers to test, according to climate change scenarios, downscaling methods applied to the island territories. Understanding how the data is currently stored, how they could be shared and exploited. Thus, researchers can check their scenarios on large volumes of data and material to assist in sustainable development policies and development of tourist areas

6. **Promote studies in the impact of climate change on fisheries.** In the CARICOM region, the fishery sector, with a total annual production of about 200,000 metric tons, earns up to USD 6,000 million, employs about 180,000 persons and accounts for about 10 per cent of the protein intake in the region (http://www.caricom.org/jsp/pressreleases/press_releases_2011/pres143_11.jsp). This highlights the importance of fisheries for livelihoods and food security in the Caribbean region. There are several lines of relevant research on how climate change might impact fisheries including (1) Impacts on oceanic productivity sustaining fisheries (e.g. seasonality of productivity and associated physical processes such as upwelling); (2) Changes in exploited species phenology (e.g. spawning seasons), (3) Effects on early life history traits and larval transport and recruitment of exploited species, (4) Changes in species' ranges and migration patterns; (5) Impacts of increasing coastal erosion on fishery infrastructure (e.g. landing sites); (6) Changes in accessibility of fishers to fishing grounds due to changing weather. The lessons learned here are likely to apply to both the pelagic and reef fisheries of European member states.

Theme: Sustainable management of natural resources and mitigation measurements to natural hazards					
Sub-theme	***Beneficiary***	***R&I needs***	**Policy**	**Institutional support/ Investment**	**Human resources**
Economic valuation	Both	Elaboration of existing TEEB (the Economy of Ecosystem services and Biodiversity) toolbox; inclusion in standard economic evaluations required	non existing	universities/ some financial institutions NGO's	Generally lacking **But:** few experts exist (mainly at universities)
ICZM	Both	- connectivity between ecosystems (e.g. land - sea interactions) - design protocols to detect chemicals (e.g. nutrients, microplastics)	intra-regional legislation within Caribbean countries to regulate ICZM (e.g. trade, fisheries, environmental management, tourism)	CARICOMP, Association of Marine Laboratories of the Caribbean (AMLC) **But:** Marine stations are present, though underequipped/ understaffed; lack of water quality labs in the region Need for international collaborations, for investments in scientific infrastructures to increase scientific knowledge (e.g. a centralized Water Quality Laboratory for the Caribbean)	Marine stations and some adequate personnel are present **But**: Few scientists/ technicians of adequate level
Volcanic activity	Both	Permanent monitoring stationfor long-term database: - hydrological and meteorological stations, - network of pluviometers to evaluate the quality of	Industry-academia partnerships; international cooperation scheme;	- Research Infrastructures; - National and international support for financing field work, data acquisition processing and analysis;	PhD and post-doc trainings; scientific exchanges; Undergraduate and master degree programs;

		atmospheric depositions - Gas monitoring instruments to evaluate the impact of volcanic emissions - Geologic and geothermal background	incentives for private sector (industry); Environment law	- Research Infrastructures - Industry investment - Government and university alliance. - Collaborations between EU and CAC institutions. - National and international support for financing field work, data acquisition processing and analysis	Mobility of researchers (from CAC to EU and *vice versa*); State/government personnel;
Integrated Land & Water use management	Both	- GIS modeling; - basic hydrological information calculation; - Hydrological and meteorological stations; Remote sensing	**Reducing emissions from deforestation and forest degradation - known as REDD+** Environmental policy and law for land use and deforestation, water supply, coral reef health.	United Nations Framework Convention on Climate Change (UNFCCC), United Nations Climate Change Conferences (COP) Intergovernmental Panel on Climate Change (IPCC) National, regional and Local governments Articulate Initiatives	PhD and post-doc trainings; scientific exchanges; Undergraduate and master degree programs; Mobility of researchers (from CAC to EU and *vice versa*); State/government personnel;
ICT platform of climate on island regions	Both	Connectivity between researchers and national institutional organizations Data collect, data storage, data access, data process	Cooperation agreements between Caribbean countries Necessity of cooperation between the experts to determine the best models of insular-wide impact	ICT European platform, Caribbean universities, National and international organizations like French Met. Office	scientific exchanges; Mobility of researchers from CAC PhD trainings;
Impact of climate change on fisheries	Both	Long term monitoring		- National and international support for financing field work, data acquisition processing and analysis	

3. Link with JIRI agenda and EU interest

SOM PRIORITIES (JIRI Agenda)	PROPOSED CAC Bio-Diversity and Climate change themes	EU INTEREST OF THE PROPOSED Themes
Taking into account the contribution of ancestral and traditional knowledge	Importance of taking into account communities on the research processes.	
Long term instrumental monitoring	Sharing information : data collection and data strategy access including open access, research networks.	
Capacity Building	Capacity building for all stakeholders of climate change, capacity building, mobility, training, advising.	Improved conditions for CAC Research clusters

4. Conclusions

Central America and Caribbean (CAC) regions represent one of the most important source of biodiversity for the world and the preservation and sustainable management of these areas is a priority for the scientific community. These environments are extremely sensitive to global climate change and are therefore fundamental natural laboratories for studying the impact of these global changes, and for the prediction of possible future scenarios.

The protection of delicate ecosystems that are present in CAC regions is only possible through the joint efforts of local institutions, supported by international organizations involved in sustainable development and community policies for environmental protection and responsible management of natural resources and natural hazards. The role of the scientific community is to provide a key to understanding the evolution of these areas in response to climate change (and the related increase of natural hazard), the exploitation of natural resources, and the consequent human pressure.

Some of the general necessity of common interest that emerged during the discussion concerning: the planning of international projects aimed to connect all the countries of the Caribbean and Central America; the need for long term studies as opposed to the short term monitoring projects in order to collect

substantial data for analysis; enhancement for common environmental policies and laws; open access to journals and cooperation among regional research networks for sharing scientific results and database; last but not least, the development of ecotourism projects to preserve and valorise the areas of greatest natural interest (national parks and protected areas).

The panel members recognized six main sub-themes of major importance as potential future research lines to be suggested for the JIRI agenda and for guide the future work of the ENLACE and EUCARINET projects: 1) Economic valuation of ecosystem services; 2) Promote research to aid the development of new Integrated Coastal Zone Management and system approaches; 3) Promote the studies on Active Volcanic Areas as potential Natural Hazard and Natural Resources; 4) Promote the integrated Land & Watershed management; 5) Promote the development of an open ICT platform of climate and environmental data on island regions; 6) Promote studies in the impact of climate change on fisheries.

Furthermore, it is recommended that any activity carried out should explicitly include a strong dissemination/communication/information component aiming at raising public awareness of the importance of biodiversity and the need to protect it. This stems from the recognition that a great part of the reason as to why little research on biodiversity and climate change gets carried out in the insular Caribbean by Caribbean researchers. There is a general detachment of the Caribbean societies from biodiversity and a the lack of appreciation of the value of biodiversity and associated ecosystem services. Thus, little resources are allocated to this research topic.

SCENARIOS OF CLIMATE CHANGE (DISTRIBUTION AND EXTINCTION RISK OF SPECIES)

BACKGROUND

- ***Indicators of climate change: Use of vulnerable species and phenology changes as indicators***

  Changes in phenology and distribution of plants and animals are occurring in marine, freshwater and terrestrial ecosystems and have been linked to local or regional climate change. Range-restricted species, for example, mountaintop species, show severe range contractions and have been severely affected due to recent climate change. As well tropical coral reefs and amphibians have been negatively affected. Predator-prey and plant-insect interactions have also been disrupted due to differential responses of each to warming.

- ***Extinction of endemic species from Hotspots***

  Hotspots are of particular value due to their high species richness and endemism. Impact due to global warming within these high-value ecosystems would constitute a key threat to the planet´s biodiversity. Of great concern, is the fact that some of these threatened organisms have not even been described or studied.

RESULTS – SCENARIOS OF CLIMATE CHANGE

Moderator/ Rapporteur: Dr. Evangelos Kosmidis, DRAXIS SA, **GREECE**

Name	Organization
Carlos Rodriguez	Mescyt – Unibe, **Dominican Republic**
Gisbert R. Boekhoudt	**Aruba**'s Directorate Of Nature And Environment
Charles Aker	Unan-León/ **Nicaragua**
Jorge Cortés	Ucr/ **Costa Rica**

5. Methodology and summary of discussions

The discussion was mainly focused on the limitation of resources for research and the devaluation of some of the projects performed in Central America and the Caribbean, due to the fact that many researchers (especially PhD Students) working in these projects, do not stay permanently in these areas. In that way the know-how acquired thanks to these projects does not remain in the host countries and scientific knowledge is not advancing. Some indicative factors affecting the general situation are pointed out in the list below:

Scenarios of Climate Change – Panel Discussion

- **Literature** (Limited access to Journals and recent publications)
- **Human resources** (More specialists, Mobility)
- Know-how (Transfer of knowledge between stakeholders)
- Policies (Strengthening of national institutions and projects)
- Sharing of resources (Literature, Data, equipment, scientists)
- Training (To existing local and new scientists)
- Infrastructure (When it is fundamental for certain results)
- Long term research (Monitoring, exploiting existing data sets, access to climate data)

In general, the discussion of access to information was a common issue tackled by Central American and Caribbean (CAC) researchers. There are limitations in developing countries for data and journals access. Depending on the country's resources the availability of the data can be at reach. In other cases, developing countries do not have the possibilities of acquiring this data even at low costs. As a result, professors and students have limited access to the information.

Some knowledge gaps identified were :

- Training and advising of Master and Doctoral students of CAC region in European universities (as well as universities in Latin America, the Caribbean, and elsewhere).
- Direct participation of European professors and thesis students in projects carried out in CAC.
- Training in the use of techniques and equipment required for the proposed projects.
- Studies to evaluate the biodiversity of the region.
- Specific research to discover the unknown endemic species.

- Research to understand the endemic species adaptability to Climate Change.
- Studies to determine the ability of endemic species to move across unfavorable habitats or barriers.

Publication fees in big journals make publishing financially unfeasible for researchers in developing countries. One suggestion is to adopt models for cooperation among research institutions in the region able to pull resources, share and publish information in journals. Agreements between CAC countries for the facilitation of information sharing shall be a research policy. Another important line is the improvement of the impact factors of research journals in Spanish.

Road maps developed per pathway

During the discussion it was obvious that many actions are still needed and should be around the following:

- Identify Indicators of the effect of climate change that will prove useful in a global scale
- Dissemination of Results (In order to achieve better knowledge)
- Promote Collaboration (by promoting projects between countries or areas, bi-national co-operations)
- Pilot projects (more and in different areas)
- Mobility of scientists (Training, collaborations, exchange of experiences)
- Tropical forest conservation (important factor for understanding science)
- Marine research and conservation should be a priority
- Biodiversity Evaluations (enhancing inventory, bioprospecting, health, invasive species, endemic species) - Comparative analysis in one island for example Hispaniola (Haiti and Dominican Republic) to asses climate change in a representative real condition.
- Cloudiness, precipitation and light - An important aspect of climate change that has been largely ignored by biologists until now is the change in cloudiness resulting from increasing sea surface temperatures[2].

[2] Clouds reduce the solar irradiance necessary for photosynthesis and hence the productivity of tropical forests and coral reefs. Perhaps more importantly, recent work suggests that irradiance (PPFD) is an important factor determining both the timing of flowering (reproductive phenology) and reproductive fitness (lifetime seed production) by many tropical trees. Variation in both tree phenology and seed/fruit production can also have important consequences for the animal species that depend on them. As gradients of cloudiness and precipitation evolve in response to rising global temperatures, we can expect tropical trees to experience corresponding shifts in their geographic ranges. For example, as Mesoamerica gradually dries out, as predicted by current global circulation models, tropical wet forests can be expected to disappear from the region and tree species associated with tropical dry forest (already seriously degraded by overexploitation and changes in land use) should begin to migrate to areas formerly occupied by wet forest. The expected responses to climate change of different functional groups of trees may be determined by studying their responses to interannual climate variation due to El Niño-Southern Oscillation (ENSO). A better understanding of how climate change will determine range shifts of tropical tree species should allow for more effective land-use planning and conservation of tropical forests, which are currently among the most biologically diverse ecosystems in the world.

- Integrated Coastal and Marine environment research

An indicative table of sub themes is presented herein:

Theme:					
Sub-theme	***Beneficiary (Caribbean, Central America, both?)***	***R&I needs***	**Policy**	**Institutional support/ Investment**	**Human resources**
Effects of climate change on species	Both	-Access to remote sensing imagery -Mobility of researchers for collaborative planning, monitoring, research, and evaluation of the project.	-National and international funding programmes for financing of field work, data processing and analysis, and generation of reports and joint publications	-Collaboration of universities, research centers, and government institutions in participating Central American and Caribbean countries	-MSc, PhD & Post-doc trainings -Scientific exchanges for researchers from both continents
Biodiversity research	Both	Local research capacity building	Funding research and scholarships	Research support and joint programmes.	MSc, PhD & Post- doc trainings; scientific exchanges.
Creation of a regional infrastructure to better monitor the direct impacts on tropical forest, and coastal and marine ecosystems	Both	-National and international funding programmes for financing of field work, data processing and analysis, and generation of reports and joint publications -Access to remote sensing imagery and digital ecosystem/vegetation maps for participating countries Acess to research vessels for oceanographic studies	Collaboration of universities, research centers, and government institutions in participating Central American and Caribbean countries well as in Europe Support for GIS and remote sensing work Support for equipment and access to oceanic regions	Access to digital ecosystem/vegetation maps for participating countries Access to remote sensing imagery Mobility of researchers for collaborative planning, monitoring and evaluation of the project Acess to equipment and ocean going vessel for pelagic and deep sea research.	-PhD & Post-doc trainings; scientific excMSc, PhD & Post-doc trainings -Scientific exchanges for researchers from both continents -Mobility of researchers for collaborative planning, monitoring and evaluation of the project
Gis Data and Tools and new Funding Mechanisms	Both	-Natioal and International programmes and European Funding	National Collaborations between institutions		-Mobility of Phd Students

6. Link with JIRI agenda and EU interest

As for the JIRI discussion, the main obstacle identified was that very little collaboration among LAC researchers is done because of funding issues. However, solutions to this challenge range from new models of cooperation, to finding creative ways of co-founding among Europe aiming for a more balanced budget share, creating incentives in call for proposals for regional participation, more funding for scientists from the LAC region, and setting up a regional research office able to coordinate EU funding within LAC innovation solutions.

SOM PRIORITIES (JIRI Agenda)	PROPOSED CAC Bio-Diversity and Climate change themes	EU INTEREST OF THE PROPOSED Themes
1. Basic scientific research	Research at all countries	Generation of new information
2. Monitoring	Evaluation of short, medium and long-term changes	Information on changes of the natural communities
3. Capacity Building	Capacity building of scientists in each country	Improved local research capacity

7. Conclusions

The participants noted some technical remarks regarding the need of a more recent and contemporary definition of Biodiversity (e.g. animals, plants, fungus, microorganisms). Also it was noted that GIS data and Tools (expansion of commonly found resources) should be utilized and include more “Marine aspects” in both the resources and policies. Finally it was proposed that a New Funding Mechanism focused on specific areas should be put in place.

Moreover, a very tentative list of conclusions can be seen in the following bullet points:

- International cooperation is essential for this Research Cluster, as the projects proposed are regional in scope and there is a great deal of heterogeneity among the countries involved in terms of capacity, infrastructure, equipment and the availability of funds for research.

Scenarios of Climate Change – Panel

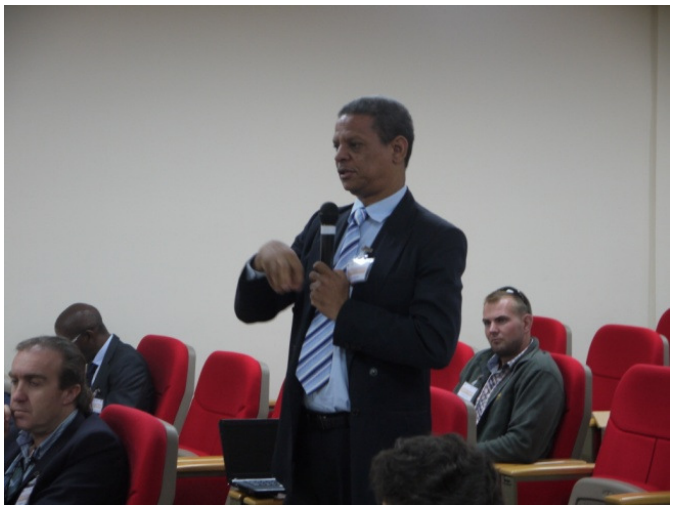
- International funding of approved projects, although essential, has occasionally been sporadic or unpredictable (perhaps because of local institutional inadequacies, lack of timely project evaluations, or political decisions of donor/host country governments).
- The planning of international projects has not always taken into account the needs or interests of the communities where they are implemented, generating unnecessary conflict and delays in execution.
- The transfer of funds from Europe to the local institutions should be much more expedite

GENERAL CONCLUSIONS

The plenary and parallel sessions allowed a more in depth knowledge exchange and the identification of common lines of research of European, Central American and Caribbean Climate Change and Bio diversity research groups. Common understandings of similar problems emerged such as data accessibility and management but also, a comprehensive and centered research on what could be next developed in cooperation with the EU with common socio economic benefits leading to tangible socio economic results. (I.e. avoiding isolated research that could bring out the high value of smaller, yet key areas of research). In addition, the discussion of a multidisciplinary bio diversity research can be encouraged as environmental issues have an Economical, Political, Ecological and Socio- economical effect that coordinated enough, could drive to societal agendas was commonly addressed. However, to this regard, a holistic view entails a difficulty with authorities since scientific and political agendas are difficult to coordinate. Cooperation at the CAC level again confirmed as fragmented due to lack of communication of actions and initiatives. One important center to take into account for the regional reach in Bio diversity and climate change is the Climate Change Center in Belize (Information on Climate Change of the Caribbean, http://www.caribbeanclimate.bz/).

Knowledge gaps

A certain number of knowledge gaps were identified during the discussion. The most prominent was the **general data & information needs**. Sharing information, data collection, data strategy access is lacking in CAC region. Gaps such as, access to resources for CAC researchers, GIS data sharing network, data discrepancies for climate change to make predictions were some of the examples identified by researchers. Open access journals and cooperation among regional research networks was highly recommended as part of an alternative for the data sharing issue. A positive outcome with innovations and research for development will be improved if capacity building and data collection are taken seriously in policy measures. Financial capacity and infrastructure available to invest in research en innovation across borders is necessary (eg, marine bio diversity).



Carlos Rodríguez – Dominican Republic

The **enhancement of climate change information with a long term vision** in order to make better modeling and predict future scenarios came also as a major gap in this thematic area. The need of having informative

decisions in adaptation mitigation was considered as a must. Moreover, the need for **long term studies as opposed to the short term monitoring projects** in order to collect substantial data for analysis was highlighted. In this sense, a wider audience needs to be targeted for research activities, thus proposing research in a holistic and multidisciplinary view. Another aspect hindering research in the region, is the absence of **capacity building and mobility of scientists;** the need for training and support to PhDs and Masters who return or have ongoing research is quite poor for the moment. The follow up of researchers in the area comes also as a common need to the region.

Further, the current **environmental policy and laws** are not yet well defined. Policy makers do not seem engaged profoundly with in depth measures towards research in the area**.** This, added to the **lack of engagement of local communities** in the research and decision making processes makes policies and laws artificial and inadequate to the actual environmental problematic of local communities. Things can be done locally in order to deal with changes which are more realistic than talking about climate change at a large.

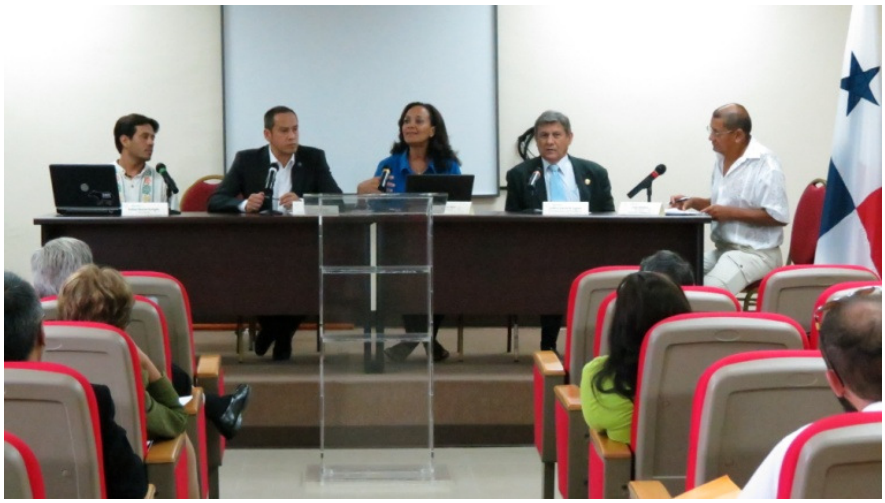
Current and future impact – possible responses

In terms of current and future impacts several ideas were shared. The critical and most evident one was the **economic stress and health associated issues** to which the environment is suffering its consequences. Ageing population can jeopardize the economic growth in the long term. Parameters are difficult to analyze, data is misleading and the way this data is interpreted also affects the decisions made. A careful analysis at the scenarios and the possible environmental responses is needed. Looking at responses from the environmental point of view combined with adaptation and new attitudes, culture shifts and a self environmentally-friendlier education is necessary. On this line of thought, it was also agreed to examine the pressure in population. Urbanization will be an unquestionable trend in the development and environmental impact and growth population will have to deal with energy efficiency and moving towards renewable energy. Private sector among others should be involved in the research agenda.

Another aspect identified was the need to obtain **relevant research in indicators.** Year to year, climate change variations affect biodiversity, hence the importance to take advantage of indicators to help complete the cascade effect the environmental threats of today might imply tomorrow. The example discussed was the **general impacts related in temperature and rainfall patterns.** Researchers concluded that in this particular case robust and solid (understood as long term) monitoring progress in ecosystems, species and human communities are important today. Improving modeling tools (with relevant data), can make feasible the possibilities of modeling the examined species and finding solutions for their conservation.

The need for sustainability plans and disaster management was identified as a major impact that has to be tackled today. It is possible to reduce impact on ecosystems but there will always have an effect whether or not desirable. Fighting climate change directly is probably not the answer. Alternatively, the proposal to

act on the local threats in order to have ecosystems fit to these changes was deeply discussed. Bio diversity starts on the level of molecules to genetic diversity up to ecosystems diversity so take into account the whole system. E.g. Biofuel feedstocks in Nicaragua.



Panel Conclusions and Future Scenarios

Furthermore, **habitat loss monitoring mechanisms** were discussed as part of a long term strategy on the Biodiversity and Climate Change theme. This is a transversal line that has to be coordinated both in Central America and the Caribbean having the Caribbean sea as natural connector and host of most of the research activities related. Research lines tackling the adaptation and mitigation of species in the CAC region is key. Modeling and studying the capacity of certain species to adapt within national protected areas is a way forward proposed to evolve research on the line of Climate Change. To this is added the **importance of taking into account communities on the research processes** as socio economic impact of climate change has to be integrated in the research processes as such. This latter is fundamental for natural laboratories to study the impact of these global changes, and for the prediction of possible future scenarios.

RECOMMENDATIONS

In terms of green industry creation, a number of initiatives and ideas were put on the table to be developed. These were:

- **Resource efficiency**, including energy efficiency should be prioritized in all policies: **it is a pre-requisite** for **decoupling** economic growth from natural resource consumption and environmental impacts.
- **Changes in policy and regulatory instruments**, including research and innovation, need to be supported by **indicators and quantitative targets** with objective of **Absolute decoupling** for industrialized countries (factor 2 by 2030, factor 5 by 2050) and **Relative decoupling** for developing countries.
- **The JIRI should include Resource Efficiency and Green Industry** as areas of Joint Research and Innovation that will benefit the Climate, Biodiversity and Ecosystems. The knowledge created and practical innovations will benefit Governments, the Private Sector and the society and create the ground for increased EU-LAC cooperation.

<u>Elements to draw a long term strategy</u>

re discussed. Here below some ideas discussed during the dialogue:

Claudia Guerrero , representative of the JIRI working group. SENACYT, Panama

- Provision of **training programmes in countries of the CAC region** as well as the need to have local students and scientists trained at the same level.
- A **dedicated effort to understand the link between CAC and EU** but also the need to decouple the relation between urban constructions and preservation. E.g. sustainable energy related to the green economy and industry as an established link within the three regions.
- **Facilitating access to information** for monitoring and prediction of natural hazards as well as disaster prevention along the coasts and lands. Creating research networks in the region able to share

ty and climate change can push forward specific research lines, thus building a significant pole of top research in the field available to the wider LAC region (e.g.

information share on adaptation and mitigation phenomena in tropical species)

- **Exploring the added value of the CAC research.** In order to be sustainable, economic growth combined with the exploration of the research potential CAC countries can provide is necessary. Discovering different types of innovative products in the CAC region, evaluating infrastructure issues, creating focal points in the region that can take in the information, analyze it and process it to finally make it available to policy and agencies, business and researchers for relevant use is necessary.
- **Redefining objectives** by reviewing the economic structure and understanding the real complexity of the theme beyond the three traditional factors that affect bio diversity and influence climate change I.e. population growth, settlement and deforestation.

Finally, in terms of potential lines of research identified, the exercise of crossing the workshop's findings against the five areas of common interest stemming from the survey addressed to EU-LAC STI-related institutions and ministries (July 2012) served to create the following matrix. The result is sought to give a clearer set of opportunities and research lines where the CAC region can be competitive and thus provide the JIRI working group key lines of research tackling Bio diversity and Climate Change.

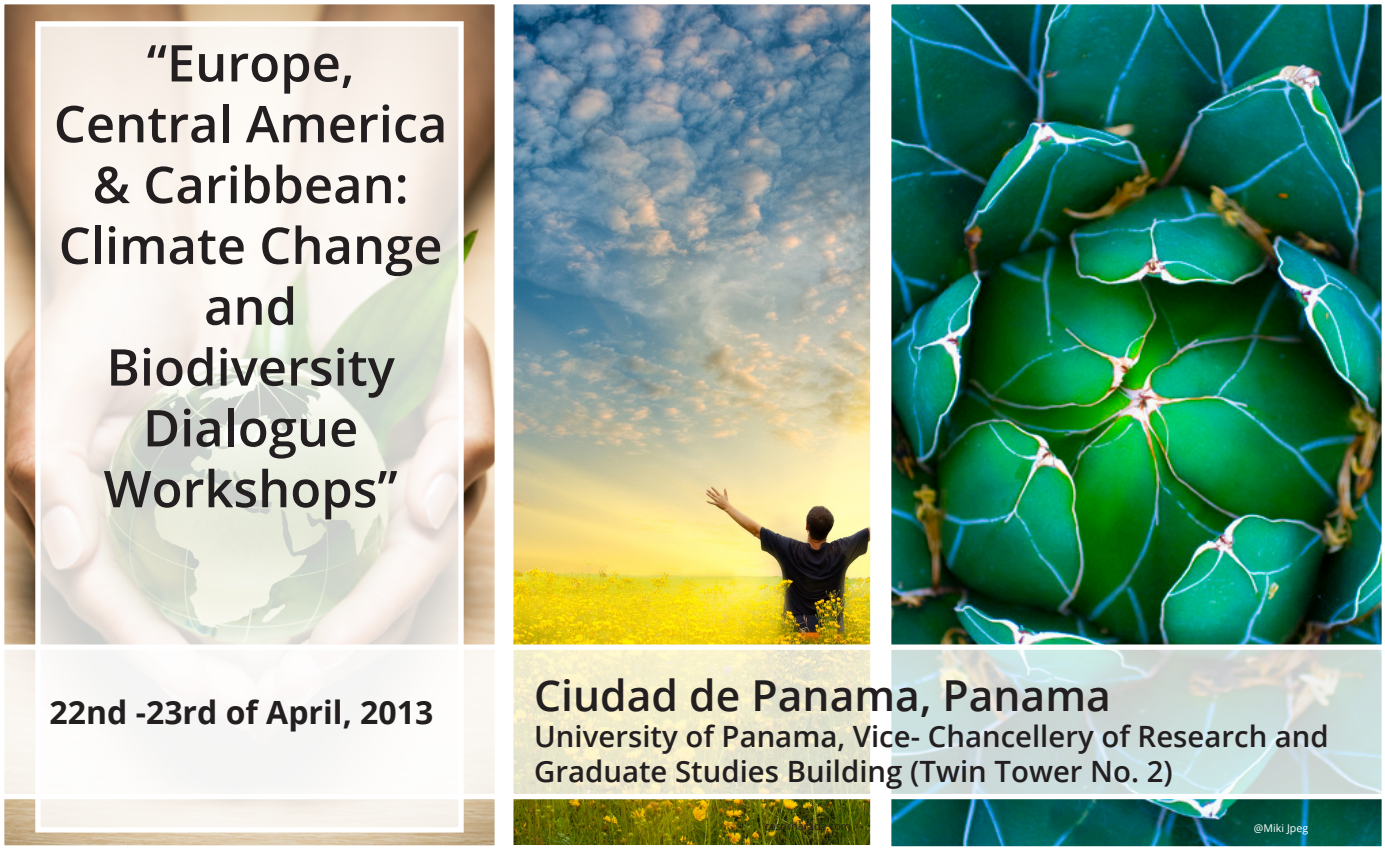
Research lines Vs. JIRI's WG identified areas

CAC Bio-Diversity and Climate change Priority Lines of Research	Beneficiary (Caribbean, Central America)	Leading Country (ies)	Water-related problems (the way they could alter biodiversity and ecosystem processes).	Climate change and its relation with ecosystem functioning in a regional integrated approach	Bioprospecting, considering technology and knowledge transfer and benefit sharing	Focus on monitoring and impact of climate change on key species	Interdisciplinary research looking for multiple and interactive factors that lead to biodiversity loss and impacts on ecosystem functioning.
Climate change and its relation with ecosystems (regional integrated approach including scenarios, modeling tools and assessment of climate extremes)							
Changes in behavioral responses in key species. - In depth exploration of invasive species theme	**Both**		X	X		X	X
Research on tropical forests in CAC region - mountain ecosystems Research in indicators (butterflies)	**Both**	**Mesoamerica region (Guatemala, Mexico)**	X	X	X	X	X
Water use practices in the communities - GIS data and Tools	**Both**	**Dominican Republic**	X	X	X	X	X
Sustainable management of natural resources and natural hazards related problems							
In depth research on fresh water and "Marine aspects" in both resources and policies - E.g., coral reefs, Impact on fisheries-	**Both**	**Curaçao**	X	X	X	X	X
Renewable energy -	**Both**	**Costa Rica**		X			X

Volcanology and their impacts: relation with crops, water and plants (i.e. greenhouse emissions and toxicity).	**Both**	**Dominica or Costa Rica**		X		X	X
Research and scale issues and models: i.e. habitat characterization and species inventories for a base line	**Central America**	**Panama**		X	X	X	X
Scenarios of climate change (Distribution and extinction risk of species)							
Land use change – forest ecosystems protection & sustainable land and resource exploitation.	**Both**	**Honduras**	X	X			X
Changes in cloudiness resulting from increasing sea surface temperatures likely to affect eco systems - Genetic improvement of bio-prospection reproductive and frequencies of flowering of trees.	**Both**	**Nicaragua**	X	X	X	X	X
Indicators and data collection-transversal themes for research cooperation	**Both**	**Costa Rica**	X	X	X	X	X
Research – Bioprospecting in dry forest in CAC region: wild life and human communities living in water limited areas - microorganisms potential for finding innovative solutions and products E.g, pharmaceutical field.	**Central America**	**Mesoamerica region (Guatemala, Honduras, Nicaragua, Mexico)**	X	X	X	X	X
Creation of a regional infrastructure to better monitor the direct impacts on tropical forest, and coastal and marine ecosystems	**Both**	**Aruba**	X	X	X	X	X

ANNEX

AGENDA OF THE EVENT



Objectives of the event:

The aim of the Workshop, organised by the ENLACE and EUCARINET projects with the support of the 7th Framework Programme (FP7) of the European Union, is to strengthen the international visibility of Central American and Caribbean research potential in the field of Biodiversity and Climate Change and to increase the collaboration possibilities with Europe.

The specific objectives of the workshop are:

a) To identify specific research lines and scientific priorities of common interest and benefit to the three regions;

b) To discuss challenges and scenarios for EU-Central America and EU-Caribbean cooperation that can guide the future work of the ENLACE and EUCARINET projects in this last phase.

The workshop will cover different Thematic Areas identified as elements of mutual interest through priority setting exercises previously developed by ENLACE and EUCARINET and validated by the JIRI Working Group:

- Climate change and its relation with ecosystems (regional integrated approach including scenarios, modeling tools and assessment of climate extremes)
- Sustainable management of natural resources and natural hazards related problems
- Scenarios of climate change (Distribution and extinction risk of species)

Priorities Dialogue Workshop

22nd April: Plenary Morning Session

Auditorium of the Vice- Chancillery of Research and Graduate Studies (Second Floor of the Vice-Chancillery Building)

09.00	Registration of the participants
09.30	**Welcome addresses** Diassina Di Maggio, Coordinator of EUCARINET & ENLACE Héctor Requena, President of UNACHI
	Plenary session
10.00	**EU-LAC Joint Initiative for Research and Innovation (JIRI) and H2020 visions** Luis Samaniego, European Commission, DG-Research & Innovation, International Cooperation (Video-conference) Q&As
10.30	**International Cooperation in research and innovation in Environment** Maria Luisa Tamborra, European Commission, DG Research & Innovation, Horizontal aspects - Environment Directorate (Video-conference)
11.00	Coffe Break
11.30	**Climate change, biodiversity & ecosystems: identifying knowledge gaps and research needs** Christophe Yvetot, United Nations Industrial Development Organization (UNIDO) *The private sector's engagement* Rafael Reyna-Hurtado – ECOSUR *Wildlife depending on water pools and scenarios of Climate Change in the Yucatan Peninsula* Jorge León - ECOSUR *Elevation shifts and survival of insect populations in response to climate change in Southern Mexico*
13.00	Open Debate
13.30	Lunch

PARALLEL SESSION

Priorities Experts Dialogue Workshop – Identifying research lines of mutual interest

14.30

- Climate change and its relation with ecosystems - Rapporteur: Prof. José M. Baldasano
- Sustainable management of natural resources and natural hazards related problems – Rappoteur: Dr. Sergio Calabrese
- Scenarios of climate change – Rappoteur: Dr. Evangelos K. Kosmidis

Each session will include the presence of 4 experts – 2 from Central America, 2 from the Caribbean and 1 EU experts and other stakeholders

18.30 End of the afternoon session

23rd April: Plenary Morning Session

09.30 **Welcome addresses**
Dr. Gustavo García de Paredes, President of the University of Panama

09.45 **Conclusions and recommendations from the Expert thematic dialogue workshops:**
Reporting discussions on research lines of mutual interest for future cooperation actions

- Climate change and its relation with ecosystems - Rapporteur: Prof. José M. Baldasano
- Sustainable management of natural resources and natural hazards related problems – Rappoteur: Dr. Sergio Calabrese
- Scenarios of climate change – Rappoteur: Dr. Evangelos K. Kosmidis

Q&As

10.45 **Future expectations and implications of Climate Change and Biodiversity challenges– models and scenarios**

Rafael Reyna-Hurtado, Christophe Yvetot, Marcia Henry

Moderator: Jorge Mendoza, ECOSUR

- Identified common issues;
- Elements to draw a long-term strategy;
- Current & future impacts - possible responses

12.30 **Conclusions:**

Diassina Di Maggio, Coordinator of EUCARINET & ENLACE