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FINAL REPORT

International Conference of Island and Coastal Biosphere Reserves: Climate Change and Island and Coastal Ecosystems

Jeju Island Biosphere Reserve, Republic of Korea
3 – 6 December 2008

United Nations
Educational, Scientific and
Cultural Organization

MAB

Jeju

MAB Republic of Korea

FINAL REPORT

International Conference of Island and Coastal Biosphere Reserves:
Climate Change & Island and Coastal Ecosystems

Jeju Special Self-Governing Province, Republic of Korea
UNESCO Office, Jakarta

in collaboration with
MAB National Committee of the Republic of Korea
Korean National Commission for UNESCO

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Abbreviations and Acronyms

ARC	Australian Research Council
a.s.l.	Above Sea Level
BR	Biosphere Reserve
BRD	Brown Ring Disease
C	Celcius
CBD	Convention on Biological Diversity
CC	Climate Change
CFSD	Centre for Sustainable Development
CO_2	Carbon Dioxyde
COP	Conference of Parties
cm.	Centimetre
CSIRO	Australia's Commonwealth Scientific and Industrial Research Organization
CWCBR	Cape West Coast Biosphere Reserve
CACC	Conservation Area Coordinating Committee
CBET	Community Based Eco–Tourism
DESD	Decade of Education for Sustainable Development
DFPs	Destructive Fishing Practises
DFO	Department of Fisheries and Ocean
DRC	Democratic Republic of the Congo
EABRN	East Asian Biosphere Reserve Network
EMS	Environmental Management Systems
ENSO	El Niño-Southern Oscillation
ERAIFT	Ecole Régionale post-universitaire d'Aménagement et de gestion Intégrés des Forêts et Territoires tropicaux / Regional Post-graduate Training School on Integrated Management of Tropical Forest and Lands
etc.	Et Cetera
ICC	International Coordinating Council International Convention Center Jeju
ILTER	International Long-Term Ecological Research Network
IHP	International Hydrological Programme
IPCC	Inter-governmental Panel on Climate Change
IUCN	International Union for Conservation of Nature/The World Conservation Union
JICA	Japan International Cooperation Agency
Kw	Kilo watt
Km	Kilo metre
KNP	Komodo National Park
Ltd.	Limited
m.	Metre
MAB	Man and the Biosphere
MAP	Madrid Action Plan
MCD	Marinelife Conservation and Community Development
Mt.	Mount
MDGs	Millenium Development Goals
NEPSAP	National Energy Policy and Strategy Action Plan
NBR	Ngaremeduu Biosphere Reserve
NGO	Non Governmental Organization
NFRDI	National Fisheries Research and Development Institute

OBSAM	Observatori Socio Ambiental de Menoria
OIC	Officer in Change
OPVI	Oil Price Vulnerability Index
PacMAB	Pacific Biosphere Reserve Network
PICs	The Pacific Island Countries
PIE	Plum Island Ecosystems
PNG	Papua New Guinea
PIGGAREP	Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project
PV	Photo Voltaic
RMI	Republic of the Marshall Island
ROK	Republic of Korea
SACAM	South and Central Asia MAB Network
SC-ED	Science Education
SIDS	Small Island Developing States
SDBR	Sinan Dadohae Biosphere Reserve
SUV	Sports Utility Vehicle
SST	Sea Surface Temperature
UN	United Nation
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNWTO	United Nations World Trade Organization
UNEP	United Nations Environment Programme
USA	United States of America
USD	United States Dollar
WHC	World Heritage Centre
WNBR	World Network of Biosphere Reserves
WWF	World Wide Fund

Executive Summary

Under the auspices of the Jeju Initiative Cooperation "Asia-Pacific Inter-linkage of Island and Coastal Biosphere Reserves for Environmental Governance and Socio-economic Development", an International Conference of Island and Coastal Biosphere Reserves: Climate Change & Island and Coastal Ecosystems was organized by the Jeju Special Self-Governing Province of the Republic of Korea and UNESCO Office, Jakarta in collaboration with the Korean National Commission for UNESCO and MAB National Committee of the Republic of Korea. The conference took place at the International Convention Center (ICC) Jeju, Jeju Special Self-Governing Province from 3 to 6 December 2008. The Jeju Initiative Cooperation is funded through the Fund-in-Trust scheme of the Jeju Special Self-Governing Province and technically supported by the Korean National Commission for UNESCO and the MAB National Committee of the Republic of Korea.

At the Opening Session, there were representatives from UNESCO Headquarters, Mr. Miguel Clüsener-Godt, Senior Programme Specialist, Division of Ecological and Earth Sciences who delivered an Opening Remark, Mr. Koh Yeo-ho, Director-General, Clean Environment Bureau, on behalf of the Governor of the Jeju Special Self-Governing Province who gave a Welcome Remark and officially opened the conference, and Prof. Choi Chung-Il, Chairperson of the MAB National Committee of Republic of Korea and Mr. Huh Kwon, Assistant Secretary-General of the Korean National Commission for UNESCO who also joined the first two speakers in the opening session and delivered a Welcome Remark.

Approximately 75 participants from biosphere reserves and other MAB regional and international networks and partners attended the conference, including those from Australia, Colombia, Indonesia, Palau, Philippines, South Africa, United States of America, Vietnam, and the hosting country, Republic of Korea. Representatives of the MAB regional networks included those from EABRN (East Asian Biosphere Reserve Network), Pac MAB (Pacific Biosphere Reserve Network), SACAM (South and Central Asia MAB Network), and SeaBRnet (Southeast Asian Biosphere Reserve Network). The Korean participants, as observers, were mainly from NEOs, government officials, research institutions, universities in Jeju Special Self-Governing Province and other partners included IUCN (The World Conservation Union) Bangladesh; Hai Phong City's People's Committee; Marinelife Conservation and Community Development (MCD) Vietnam; Master of Applied Science Research School of Marine and Tropical Biology; ARC Centre of Excellence for Coral Reef Studies James Cook University; Providence Foundation; UNDP Pacific Centre; and Universitat de Illes Balears–Departamento de Biología.

The objective of the conference was to discuss and exchange information and experiences on the following issues:

- awareness of the impacts of climate change in island and coastal ecosystems;
- climate change research, adaptation and mitigation, and the use of biosphere reserves as a model and learning sites for sustainable development; and
- strengthening international cooperation for climate change mitigation and adaptation for island and coastal biosphere reserves.

The conference programme was divided into opening remarks, a keynote speech, and four presentation sessions with specific sub-thematic sessions on: i) Impacts of climate change on island and coastal ecosystems; ii) Climate change impact on and adaptation in island and coastal biosphere reserves; iii) Climate change mitigation for island and coastal biosphere reserves; and iv) Strengthening cooperation and raising societal awareness on climate change. The delegates presented case studies and scientific analyses related to climate change adaptation and mitigation, and integrated management of coastal and island ecosystems in response to climate change. A one-day field visit was devoted to the Hangwon Wind Power Plant, Geomunoreum Lava Tubes, and Jeju Folklore and Natural Museum.

At the end of the conference, participants addressed a number of essential recommendations for follow-up actions and produced an important document called "Jeju Declaration". The Declaration serves as a guideline for developing and strengthening international cooperation among those island coastal and biosphere reserves, and defining a strategic mechanism to come up with an integrated solution combining education, conservation and sustainable development to deal with global climate change issues. The Declaration was written in line with the Madrid Action Plan (MAP) for Biosphere Reserves 2008-2013, Jeju Initiative Scheme, Menorca Declaration on the Network of Island Biosphere Reserves, Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), United Nations Convention to Combat Desertification, and United Nations Millenium Development Goals (MDGs), as well as the Mauritius Strategy. The Jeju Declaration is also included in this report.

The conference was successfully concluded and all the participants expressed their high appreciations and thankfulness to the Organizers, especially to the Jeju Special Self-Governing Provincial Government of the Republic of Korea for hosting the conference and its continued support and financial assistance through the Jeju Initiative Cooperation.

총 론

'섬과 연안 생물권보전지역 환경 거버넌스와 사회경제 발전을 위한 아시아태평양지역 상호연계 사업'를 위한 제주이니셔티브의 후원아래, 2008 년 12 월 3 일부터 6 일까지 제주특별자치도 국제컨벤션센터에서 섬과 연안 생물권보전지역 국제회의가 '기후변화와 섬과 연안 생태계'라는 주제를 가지고 UNESO 한국위원회와 MAB 한국위원회와의 협력으로 대한민국 제주특별자치도와 UNESCO 자카르타 사무소의 주최하에 개최되었다. 제주이니셔티브 협력프로젝트는 제주특별자치도의 신탁기금으로 운용되며 UNESCO 한국위원회와 MAB 한국위원회의 전문적인 협력하에 UNESCO 자카르타 사무소가 수행하고 있다.

개회식에서는 UNESCO 세계본부를 대표해서 참가한 환경과 지구과학팀 프로그램 스페셜리스트 Mr. Miguel Clusener-Godt 이 개회선언을 하고 제주특별자치도 도지사를 대신하여 청정환경국 고여호국장의 환영사로 공식회의 개회를 하였다. 그리고 MAB 한국위원회 최청일 위원장과 UNESCO 한국위원회 허권본부장이 개회식에서 환영사를 하였다.

호주, 콜롬비아, 인도네시아, 팔라우, 필리핀, 남아프리카, 미국, 베트남 등 지역적•세계적 MAB 프로그램 네트워크와 생물권보전지역과 주최국인 한국에서 약 75 명이 참여하여 이번 회의가 개최되었다. MAB 지역네트워크 PacMAB (태평양생물권보전네트워크), SACAM (중앙남아시아생물권보전 네트워크), SeaBRnet (동남아시아 MAB 지역네트워크)의 대표자들이 자리를 함께 하였으며 또한 국내참가자들은 발표자로 참관인으로 NGO 단체, 공무원, 연구소, 대학에서 참여를 했으며 해외기관별로는 IUCN (세계자연보전연맹)를 대표해서 방글라데시, 베트남 하이퐁시민위원회·해양보전과지역발전위원회, 해양과 열대생물연구센터, 제임스쿡도립대학 산호초 ARC 연구센터, UNDP 태평양센터, 발레아르스대학 생물연구센터에서 참여를 하였다.

이 회의는 아래 주제에 대해서 다양한 정보와 경험을 교류하고 논의되었다.

- 섬과 연안 생태계내 기후변화 영향에 대한 인식;
- 지속가능한 발전을 위한 교육센터 및 모델로써 기후변화 연구, 적응, 완화 하기 위한 생물권보전지역의 이용; 그리고
- 섬과 연안 생물권보전지역의 기후변화완화와 적응을 위한 국제협력강화.

회의프로그램은 개회선언, 기조연설과 4개의 세션으로 나누어 진행되었는데 각 세션별 주제는 i) 섬 및 연안생태계에 미치는 기후변화 영향, ii)섬 및 연안 생물권보전지역에서 기후변화 영향과 적응, iii) 섬 및 연안 생물권보전지역에서 기후변화 완화, 마지막으로 iv) 기후변화 인식향상과 협력강화로 4개의 하위주제로 진행되었다. 대표자들은 기후변화에 대응하는 섬과 연안 생태계의 통합관리와 기후변화의 완화와 적응과 관련해서 수범사례 및 과학적 통계자료에 대해서 발표하였다. 현장견학으로는 행원풍력단지, 검은오름 용암동굴계 및 제주자연사박물관을 방문하였다.

회의를 마무리하면서, 모든 참여자들은 이번 회의를 통해 향후 필요한 제안과 실천방안에 대한 '제주선언'를 동의하고 발표하였다. 제주선언은 섬과 연안 생물권보전지역간 상호 국제협력을 강화하고 발전시키기 위한 가이드 라인을 포함함은 물론, 글로벌 과제인 기후변화에 대응하기 위한 교육, 환경보전, 지속가능한 발전을 결합시키는 전략적 메카니즘을 포함한다. 이 선언은 2008-2013 생물권보전를 위한 마드리드 실천강령(MAP), 제주이니셔티브취지, 섬 생물권보전지역 네트워크 메노르카 선언, 생물다양성 보전(CBD), 기후변화유엔사업(UNFCCC), 사막화방지협정, 유엔밀레니엄발전목표 (MDGs)와 Mauritius 전략에 근거한다. 제주선언문은 이 리포트에 수록한다.

이번 회의는 아주 성공리에 마쳤으며 모든 참여자들은 많은 찬사를 주최측에 표시하였으며 특히 이 행사를 주최하고 제주이니셔티브협력 프로그램을 추진할 수 있도록 재정적으로 지원을 아끼지 않는 대한민국 제주특별자치도에 특별한 감사의 말씀을 드린다.

Opening Remarks

Dr. Miguel Clüsener-Godt
Programme Specialist, Ecological Sciences and Biodiversity Section
Division of Ecological and Earth Sciences
UNESCO Headquarters, Paris

Dear Representative of the Jeju Self-Governing Province Government, Mr. Koh Yeo-ho, Director-General of Clean Environmental Bureau, Jeju Special Self-Governing Province, Mr. Kwon Huh, Assistant Secretary-General, Korean National Commission for UNESCO; Prof. Choi Chung-Il, Chairperson, MAB National Committee of the Republic of Korea,
Ladies and gentlemen.

It is again a pleasure for me to welcome you to this important event on Climate Change and Island and Costal Ecosystems, which is being held within the framework of the Jeju Initiative. My special thanks go to the Jeju Government, the UNESCO National Commission in Korea, the MAB National Committee of Korea and the UNESCO Office in Jakarta.

As you may remember, immediately after the 3rd World Congress of Biosphere Reserves in Madrid, Spain in February 2008, took place the first Island Biosphere Reserve meeting in Menorca, Spain. This meeting here is the first follow-up initiative within the Asia-Pacific region. This Conference is a good opportunity to discuss issues related to climate change and biosphere reserves as a learning point for sustainable development. As a follow-up to the Madrid Congress, the Jeju Conference will focus on island and coastal ecosystems. The title of this Conference is significantly useful, as it emphasizes that coastal areas cover among the most important ecosystems in the world, in which the overwhelming majority of human beings are living. The Jeju Conference is right in the middle to bring up this issue. It is such a landmark event as it covers also other relevant issues on conservation and sustainable use of natural resources.

Furthermore, it is worthwhile to mention that this Conference will be a good forum to strengthen the cooperation and explore the possibility for developing proposals for future projects, particularly in the Asia-Pacific realm. This includes as well the west coasts of the Americas, which include some important island or archipelago biosphere reserves. It is particularly with this inter-regional cooperation that UNESCO Programmes are promoted and take significance.

I would like to take this opportunity and thank again the Korean and the Jeju Authorities for inviting to this important Conference. It is my first time that I come to Korea and Jeju, and I strongly believe that we shall jointly lay the ground for a series of future activities including further island and coastal biosphere reserve activities and on major MAB events.

I thank you very much for your attention.

Welcome Remarks

Mr. Yeo-ho Koh
Director-General
The Environmental Bureau, Republic of Korea

It is my honor and pleasure to present a welcoming speech in this opening session of the "International Conference of Island and Coastal Biosphere Reserves" held today. First of all, on behalf of the Citizens of the Jeju Special Self-Governing Province, I would like to take this opportunity to welcome all participants here in Jeju, as a World Natural Heritage site and Biosphere Reserve, to share and discuss issues on 'Climate Change & Island and Coastal Ecosystems'.

We are facing enormous natural disaster such as floods, heavy snows as well as global warming around the world today, especially the island and coastal areas which are directly influenced by the rise of sea level and tsunami. Furthermore, the sustainable development in the whole society and biodiversity are seriously under threatened.

We can see many symptoms as a result of the climate change, for example the average of temperature has risen at 1.5^{0}C during the last century. Meanwhile, the ecosystem and its biodiversity are facing enormous degradation. Last year, we had terrible experience with the typhoon *'Nari'* which caused an enormous catastrophe in Jeju Island.

In this significant time, this conference is a challenge for sharing global experiences, discussing impacts, adaptation and mitigation of the climate change and building a network world-widely among the experts, delegations from the various governmental institutions in the region, managers, NGOs and international institutions on climate change and biosphere reserves. Furthermore, I have confidence that this kind of small movement breathes a new life into the earth even though we start from a small island 'Jeju' on Pacific Ocean.

As you can feel, there is a beautiful landscape with snow flowers in Mt. Halla, pampas and grass and yellow tangerines with 368 Oreums (the second volcanic cons) in Jeju now. I hope you will enjoy and bring it back to your country as meaningful memories from the Jeju Island.

Finally, I strongly believe that this meeting will contribute to further strengthen the international cooperation in solving the disaster caused by the climate change in island and coastal ecosystems. On behalf of the Jeju Citizens and Governor of the Jeju Special Self-Governing Province, Mr. Kim Tae-Hwan, thank you for joining the International Conference of Island and Coastal Biosphere Reserves in Jeju.

Welcome Remarks

Chung-Il Choi, Ph.D.
Chairperson, Man and the Biosphere (MAB) National Committee of Republic of Korea
c/o. Department of Environmental Marine Sciences, Hanyang University, Republic of Korea

Dear
colleagues,
distinguished guests,
scholars, and,
ladies and gentlemen,

On behalf of and as the Chair of the MAB Korea, I have the great pleasure in welcoming all the participants here today, particularly those who have travelled from the long distance including the UNESCO Offices in Jakarta and in Paris Headquarters. I feel very much privileged indeed to say a few words of welcome remarks in our Jeju Initiative Conference on Climate Change and Island and Costal Ecosystems here in Jeju today.

The theme on climate change and the result in substantial changes in ecosystems is, off course, not new. We have come now a long way to face this global inconvenient truth, so the scientifically proven facts together with the public's understanding of the problem quite well. Not only by the IPCC report, but also our UNESCO's World Heritage Committee case studies on climate change in world heritage sites, etc are all too obvious and clear examples of the adaptation and mitigation of this global problem.

I will not repeat here again to mention the importance of this global phenomenon affecting the ecosystems in island and coastal biosphere reserves, which is indicated and briefly summed up on the background and rationale of the Conference brochure. However, one thing is clear that island and coastal ecosystems are biologically very much diversified - does extremely vulnerable by the environmental changes among others, such fundamental as currently ongoing anthropogenically in this climate change.

Human's welfare, culture and wellbeing are all too much and solemnly depend on the health of the ecosystem. This overwhelming tools our thematic epitome of this Conference.

This inception of the idea on the conservation of the island and coastal ecosystems in the Jeju Initiative originated from the 9th meeting of the East Asian Biosphere Reserve Network (EABRN) here in Jeju under the theme of "Conservation and Sustainable Use of the Insular Biosphere Reserves".

The Jeju Initiative, as you know, is an Asia-Pacific Inter-linkage of Island and Coastal Biosphere Reserves for Environmental Governance and Socio-economic Development until 2012. The Jeju Special Self-Governing Province and the MAB Korea have persuaded the development of the theme in various ways up to now and, I am sure, will pursue further with your cooperation and collaboration in the Jeju Initiative. This issue cannot be solved once for all but requires our continuous efforts and attention. It is expected that the Conference will become a forum for stimulating among academics and practitioners for the management of the biosphere reserves in our region to adapt and mitigate the threat of the climate change. In this way we can share common concern in finding ways and means out of the current global dilemma of the climate change. I could see that it might be wise to have new upgraded forms of cooperation among us in such new elaborated ways and means of exchange, lessons of experiences if we are to tackle this global condition of climate change to our island and coastal biosphere reserves.

I hope that our Conference will inspire all the participants to produce elevated and more acceptable ideas that can be implemented in the field and to bear fruits in the years ahead for the conservation with sustainability of our island and coastal biosphere reserves.

As the Chairperson of the MAB Korea, may I say that it has been the pleasure to co-sponsor the International

Jeju Initiative Conference with the Jeju Special Self-Governing Province in collaboration with the UNESCO Jakarta Office.

Once again, I sincerely thank all the participants of the Conference and Organizing Committee for their dedication. I pay utmost appreciation to all the invited speakers who have come along way to share updated research works and for your cooperation.

I do sincerely hope your stay is enjoyable and memorable one with great success from the Conference here in Jeju today.

Thank you very much.

Welcome Remarks

Mr. Huh Kwon
Assistant Secretary-General
Korean National Commission for UNESCO

Mr. Miguel Clusener-Godt, Senior Programme Specialist, UNESCO Headquarters, Paris; Mr. Yoo Durksang, Vice-Governor, Jeju Special Self-Governing Province of the Republic of Korea; Dr. Kim Ji-Tae, Director-General, Nature Conservation Bureau, Ministry of Environment; Dr. Choi Chung-Il, Chairperson, MAB National Committee of the Republic of Korea; Distinguished participants; Ladies and gentlemen.

On behalf of the Korean National Commission for UNESCO, I would like to welcome all the participants from home and abroad to this meaningful event. I also wish to thank the Jeju Special Self-Governing Province for providing this opportunity through the Jeju Initiative project. I must also thank UNESCO for their cooperation in organizing this conference.

At the 9th EABRN (East Asian Biosphere Reserve Network) meeting, which was held here in Jeju Island in 2005 with the theme of "Conservation and Sustainable Use of Insular Biosphere Reserves", the Jeju Provincial Government proposed the establishment of a new regional initiative for cooperation, with an emphasis on improving management of insular and costal biosphere reserves in the Asia-Pacific region. This regional initiative, now called the Jeju Initiative, started in 2006 through the Funds-In-Trust programme. Early this year, at the second Steering Committee meeting of the Jeju Initiative, it was suggested that a conference should be organized among island and coastal biosphere reserves. All the members of the meeting agreed that climate change is a serious problem, especially in island and coastal regions; therefore, the title of this conference was decided.

As you know, the Asia-Pacific region contains diverse ecosystems, especially island and coastal areas that comprise a major part of the rich biodiversity in this region. Island and coastal ecosystems also provide many economic benefits to society, and local people depend upon them for their livelihoods. However, island and coastal areas are vulnerable to environmental damage and are more severely affected by the results of climate change than other areas, such as an increased level of flooding, sea water intrusion into freshwater sources, the increase in extent and severity of storms, and so on.

The international scientific community now widely agrees that climate change will constitute one of the major challenges of the twenty-first century. We are here today to talk about climate change as a common challenge in island and coastal areas. We will share the impacts of climate change on island and coastal ecosystems focusing on the Asia-Pacific region and discuss climate change adaptation and mitigation methods. I expect that many good cases will be presented during the conference. On the last day, the establishment of an island biosphere network will also be considered as a tool for handling climate change adaption and mitigation. Since climate change adaptation and mitigation is not a simple matter, the network will be a good instrument for strengthening international cooperation on climate change issues.

Finally, I hope that all of the participants from abroad will take this opportunity to experience the natural environment and local culture of Jeju Island during the field trip on Friday, while learning about the efforts and measures of the Jeju Provincial Government to address climate change. Jeju Island boasts diverse ecosystems and beautiful landscapes, as well as a unique regional culture within Korea. Its mainland and marine ecosystems, including Mt. Halla, were designated as a UNESCO Biosphere Reserve in 2002 in an effort to promote nature conservation and sustainable development on the island. In addition, Mt. Halla and some lava tubes were inscribed on the list of World Heritage as being of important aesthetic and geological value. Jeju Island has many natural and cultural resources for you to experience, and I hope that you will enjoy your time on the island.

Thank you very much.

Keynote Speech

Dr. Miguel Clüsener-Godt
Senior Programme Specialist
Division of Ecological and Earth Sciences, UNESCO, Paris, France

United Nations
Educational, Scientific and
Cultural Organization

Implementing the Madrid Action Plan:

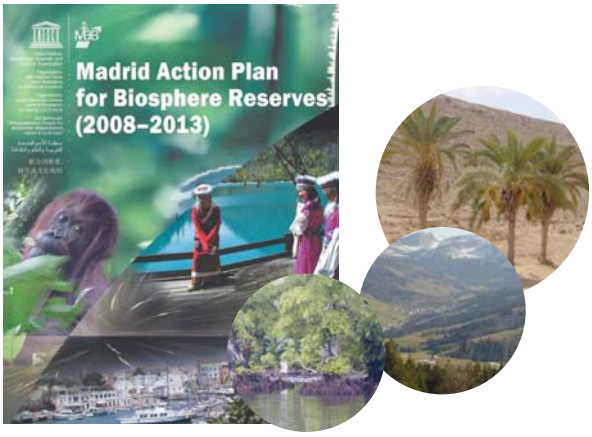
Island Biosphere Reserves, Present and Future
Jeju, Republic of Korea, 3-6 December 2008

Madrid, Spain, 4-9 February 2008
The 3rd World Congress of Biosphere Reserves:
Biosphere Future, UNESCO Biosphere Reserves for Sustainable Development

20th session of the MAB/ICC

III. World Biosphere Reserve Congress:
Alternatives for the Biosphere, UNESCO Biosphere Reserves for Sustainable Development

Madrid Action Plan
Outcome of consultations and discussions during the preparations for and during wokshops and meetings in Madrid and adopted by MAB/ICC
E, F and S versions in the MABNet



31 targets and 65 actions from 2008 to 2013: same time frame as C4 and cognizant of the fact that current C4 "rolling" character
Primary responsibility for implementation: MAB Secretariat, UNESCO National Commissions and MAB National Coommittees.
Main partners: Regional and thematic networks
Evalution: 2010 and 2013

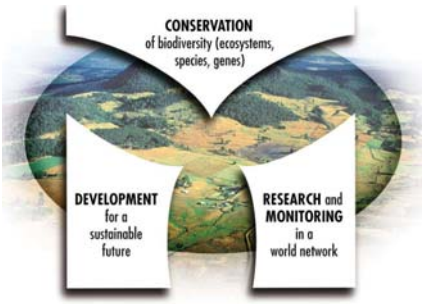
MAB–Biodiversity; ecosystem approach
– Agricultural/rural lands
– Dry and Sub-humid zones
– Forests
– Rivers, lakes, wetlands
– **Small Islands**
– **Coastal Zones and Oceans**
– Mountains
– Urban areas

Biosphere Reserves – A UNESCO designation conferred under the MAB Program; 531 sites in 105 countries (2008), 2 sites in the Republic of Korea

MAB Programme Intergovernmental programme aiming at laying scientific basic for the improvement of people-environment relationship.

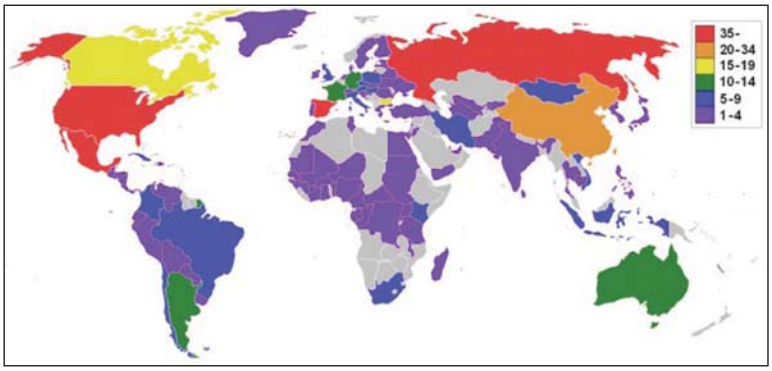
Biosphere reserves concepy designed as field tool for interdisciplinary MAB work, focus on three functions:

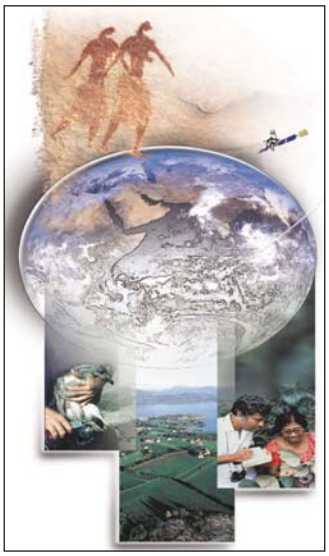
Biosphere Reserves as Learning Laboratories for Sustainable Development



The World Network of Biosphere Reserves, 531 sites in 105 countries (2008)

Biosphere Reserves per Country of the World





Source: Wikipedia 2008

MAB Biosphere Reserves – Learning Sustainable Development Practice

- Place specific censervation-development relationship using knowledge (scientific and traditional), information, data and experlise as bridges
- Reseach to monitor changes in conservation-development relationships using knowledge and insights into adaptive management options for the future
- Link to DESD (target 21 and action 21.1.)
- Link to other ISPs (targets 2, 18)
- Other actions linked to WHC, other intersectoral platforms (Africa; SC ED)

CONSERVATION – from protection to sustainable use

DEVELOPMENT – sustainable and diversifying options for the economic, social and cultural change for the well being of humans

LEARNING – participatory and deliberative ways of building land/seascape level, win-win interactions between conservation and development

Biosphere Reserves – Learning Sites for Sustainable Development

- The "learning approach" - "....is increasingly to accept uncertainty and complexity and put into place mechanisms for monitoring, analyzing and adapting policies in a timely and efficient wanner." (Edmunds & Wollenberg 2001)

Biosphere Reserves as learning places for SUSTAINABLE DEVELOPMENT

- Investigating context specific relationship between conservation/development activities to minimize biodiversity loss, mitigate and adapt to climate change and enhance human well being
- Linking the investigations to learning and capacity building at all levels and generating materials and resources, e.g. case studies, MS and/or Ph.D. theses, technical notes, policy briefs, web-chats, blogs etc, as contributions to the UN DESD (2005-2014)

Madrid Action Plan (2008-2013)
Examples of UNESCO National Commissions/ MAB National Committees worth noting:

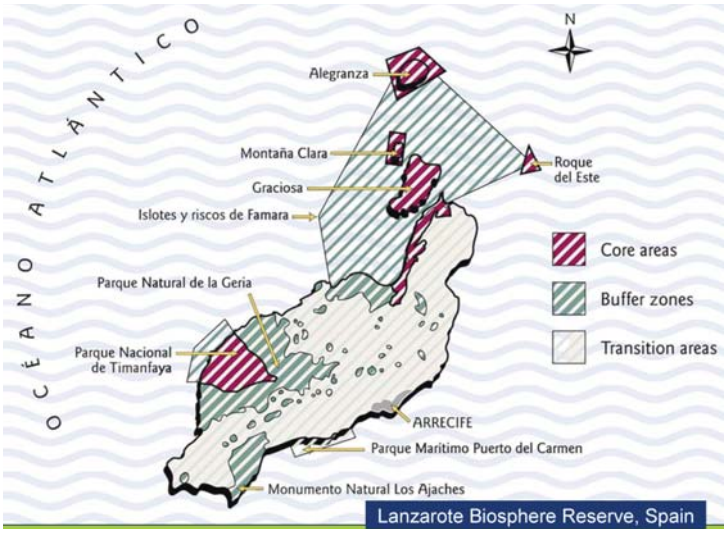
- Canadian National Government Support Canadian Network of Biosphere Reserves with 1 million Can $;
- Rhoen (Germany)/K2C (South Africa) joint event at the CBD/COP9;
- German National Commission work with National Commissions of Lesotho, Madagascar, Mali, Namibia and Rwanda – focusing on MAB (and IHP);
- German BR Partnership with Volvic on nature and water
- Vietnam and Australia MAB National Committees develop the "learning laboratory" model;
- Brazil MAB and Sao Paulo Green Belt BR to review plans in the light of MAP;
- Spanish Government provide support to Spanish BRs for 5 Million EUROS;
- Spanish Government provides UNESCO's Division of Ecological and Earth Sciences with 2,4 Million EUROS for cooperation with BRs in Latin American and in Africa.
- Implementing the Madrid Action Plan: Biosphere Reserves in Japan, present and future. Meeting at Kodomo-no-shiro in Tokyo, Japan, 21 October 2008.

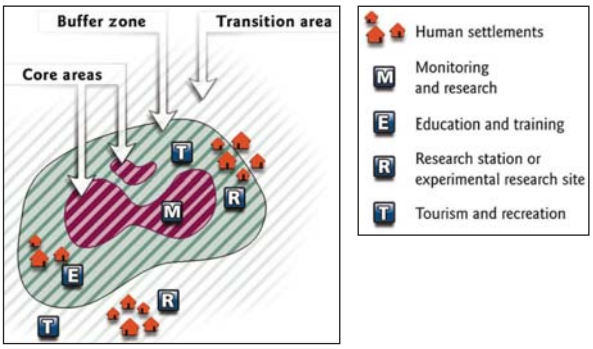
Secretariat work with Member States; relationships to targets emplasized in planning and prioritizing

- US Government invitation to MAB Secretariat for 3 week visit in March 2003 (for reviewing US MAB and US BR activities) (Target 7).
- International workshop on "Sustainable Management of Marginal Drylands" in Jordan (June 2008; addressing several MAP targets like 2, 5, 8 and 16) also used to have a meeting with Jordan National Committee for MAB for restructuring (target 7).
- Spain sponsored meeting in Menorca soon after Madrid events for strengthening and expanding island BR network (target 5).
- Under the guidance of chair MAB/ICC and in cooperation with ERAIFT/DRC, BRs of Congo Basin Forests will be reviewed (several Targets).
- On going consultations with many other countries including China, India etc for special initiatives linked to MAP implementation.

UNESCO Biosphere Reserves

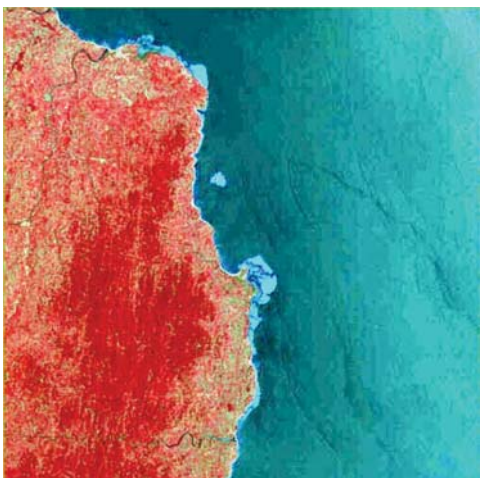
Evolution of the level and nature of integration
Lanzarote Biosphere Reserve, Spain





Managing a Biosphere Reserve

- Mananara-Nord Biosphere Reserve in Madagascar
- Project on Integrated Conservation and Development
- Monitoring of Conservation of Forests and Coastal Zones through Remote Sensing

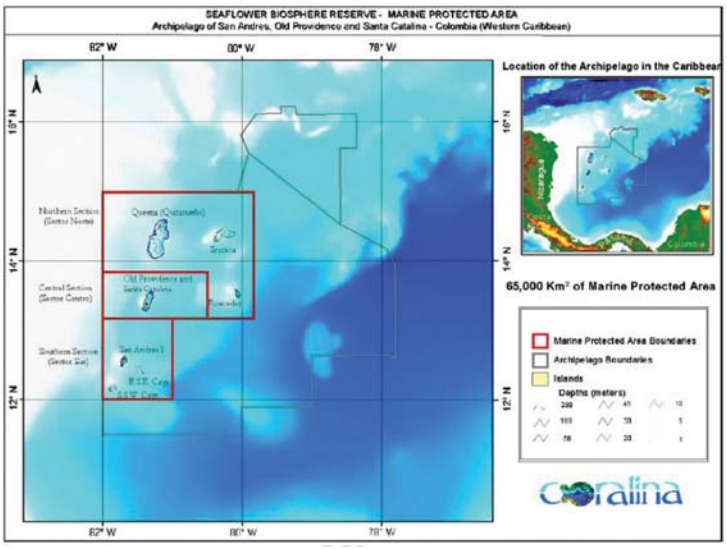


Biosphere Reserves in the Republic of Korea

Republic of Korean: Mount Sorak 1982, Jeju Island 2002

- Creation of the MAB Programme: 1970
- First Biosphere Reserves: 1976
- Creation of Korean Biosphere Reserves:
- Republic of Korea Mount Sorak 1982
- First Biosphere Reserve Congress: 1983, Minsk, Belarus
- UNCED Congress: 1992, in Rio de Janerio, Brazil
- Second Biosphere Reserves Congress: 1995, Seville, Spain
- Seville Strategy for Biosphere Reserves and the Statutory Framework of the World Network: 1995 (324 sites in 84 countries)
- Republic of Korea Jeju Island 2002
- 3. World Biosphere Reserve Congress: 2008, Madrid, Spain (531 sites in 105 countries)
- Madrid Action Plan for Biosphere Reserves (2008-2013): 2008
- Implementation of the Madrid Action Plan in the Republic of Korea?

J.M Mow et al/Ocean & Coastal Management 50 (2007) 209-222



Map 1, San Andres Archipelago and Seaflower MPA boundaries with location (2006), Souce:A.Mitchell

Juan Fernandez Biosphere Reserve, Chile

Robinson Crosoe Island

Galapagos Biosphere Reserve, Ecuador

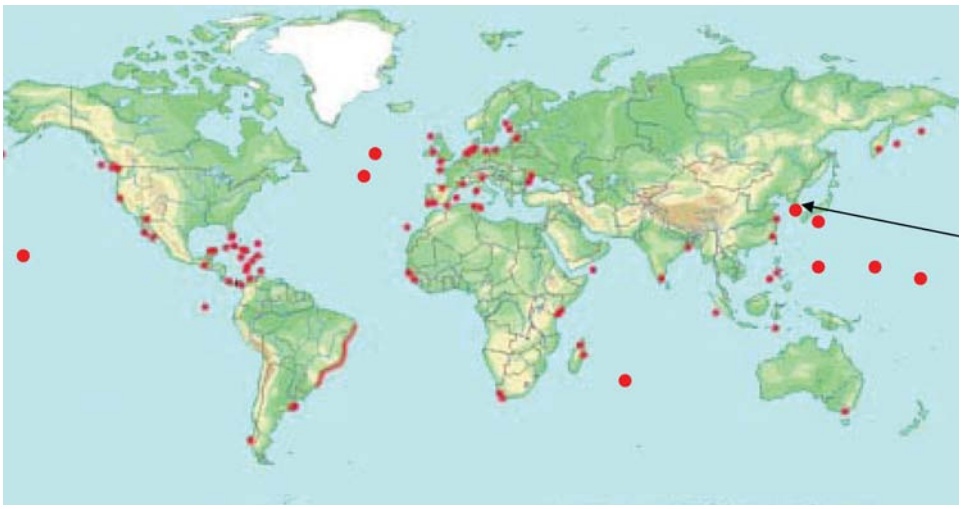
Network of Island Territory Biosphere Reserves
Island approaches to integrated conservation and sustainable human development.
Convened by: Island Council of Menorca, Ministry for Environment of Spain, UNESCO/MAB, and Fundacion Biodiversidad
Venue: 11-12 February 2008, Mahon, Menorca, Spain

- STATEMENT OF THE PARTICIPANTS AT THE MEETING
- Taking into account:
- That the 3rd World Congress of Biosphere Reserves, held in Madrid, Spain, 4-9 February 2008, adopted the Madrid Action Plan, in which special emphasis was given to the integrated biodiversity

conservation of natural resources and sustainable development, as well as to the creation thematic networks, susch as those that target island and coastal zones.

- The work undertaken by the Conservation on Biological Diversity, the United Nations Convention to Combat Desertification, and the United NAtions Framework Convention on Climate Change, as well as the United Nations Millennium Development Goals, in particular MDG-7 on ensuring environmental sustainability.
- That the primary functions of these networks:
- Assisting UNESCO Member States in implementing recommendations of the 3rd world Congress of Biosphere Reserves;
- Identify national strategies for biodiversity protection in biosphere reserves and similarly managed areas, which could become biosphere reserves in a near future, with special emphasis on coastal areas and small islands, and
- Technology transfer and intensive training for the management of renewable natural resources in selected island biosphere reserves and exchange of research data.
- That the network is built on the basis on long-term programme activities carried out by UNESCO's Man and the Biosphere Programme (MAB) and is a major follow-up to the Madrid Action Plan.
- The experiences made by coastal and small island Biosphere Reserves in the world as possible models for learning sites for sustainable development.
- The importance of infolving local communities in biodiversity conservation programmes.
- The uniqueness of the cultural, social and environmental context os islands as well as the need for integration of scientific models with local cultural values and traditional knowledge and pratices in biodersity conservation programmes.
- We decide:
- To initiate in our countries and with UNESCO discussions on the potential of the Network of Island Territory Biosphere Reserves as one vehicle for biodiversity conservation and sustainable management of natural resources.
- To discuss the state of angoing biodiversity conservation and natural resource management activities and programmes in island biosphere reserves.
- To encourage among the international community an increased recognition and appreciation of the unique cultural, social and environmental values and customs os island biosphere reserves.
- To encourage among the international community an increased recognition and appreciation of the unique cultural, social and environmental values and customs of island biosphere reserves.
- To ectively contribute to existing interagency fora for exchange on biodiversity conservation and natural resource management issues among concerned international and regional agencies.
- To explore with UNESCO and its partners funding opportunities for biodiversity conservation and natural resource management in island biosphere reserves.
- To keep UNESCO regulary informed about the island biosphere reserve composition, addresses and work.
- To collaborate actively towards the establishment of an Island Territory Biosphere Reserves Network in the near future.
- Mahon, 12 February 2008

Coastal and Island Biosphere Reserves in the World



4. Participatory regional networks that are managed in a manner assuring adequate representation of biosphere reserve managers/ coordinators	**4.1** Develop a structure, strategy and action plan for each regional network to meet their responsibilities within the MAB Programme and regularly report to MAB National Committees and individual BRs	**2009**	Number of regions completing and implementing structure, strategy and action plan Number of individual BRs participating in regional network activities	Regional Networks	UNESCO Field Offices, National Commissions for UNESCO, MAB National Committees and individual BRs.
	4.2 Ensure that each network has partnerships and long-term financing mechanisms from within its membership to ensure sustainability of its operations and activities	**2010**	Number of networks funded	Regional and Thematic Networks, MAB Secretariat, MAB National Committees, National Commissions for UNESCO	Governmental institutions, national and international NGOs, private sector
5. Enhanced cooperation between experts and practitioners in relevant key issues	**5.1** Create and strengthen existing regional and interregional Thematic Networks formed around key ecosystems, such as mountains, freshwater, oceans, drylands, forests, urban areas, small islands	**2010**	Number of networks and extent of regional and thematic coverage	MAB Secretariat, Regional and Thematic Networks, individual BRs, other institutions	Diverse stakeholders at multiple scales

Keynote Speech
Climate Change on Coastal and Island Ecosystems

Mr. Mahfuz Ullah[1]
Regional Councilor
The World Conservation Union/International Union for Conservation of Nature (IUCN) &
Secretary–General, Centre for Sustainable Development, Dhaka, Bangladesh

Mr. President,
Distinguished participants,
Ladies and gentlemen,

Though it is cold outside, but a warm afternoon to you all.

I feel honoured as I stand here to speak before this distinguished galaxy of people about Impacts of Climate Change on Coastal and Island Ecosystem. I am a student of science but that does not allow me any privilege to talk on this subject. My credentials are different: I am both an islander and a mainlander. My mother comes from an island in the Bay of Bengal, called Sandwip. At one point of time this was called Sand Heap and colonised by the Portuguese pirates.

My father is from one of the affected coastal districts of Bangladesh often visited by tidal surges and cyclonic storms. Frequency of cyclonic storms has gone up so much that over the last one year (2007-08) about 14 depressions were created in the Bay of Bengal sending alert signals to people of coastal areas.

When I was young and visited my mother's house I used to hear only the sounds of the sea at night. I remember my grandmother asking me to take some Purnol to the market, sell them and buy buffalo milk yogurt. Those days and species are gone. Today, I see the sea is going to eat up my maternal grandfather's house caused by erosion.

Today, not only in Bangladesh, coastal zones across the world are increasingly becoming vulnerable to climate variability and changes. Sea level is rising along most of the coast around the world. In the last century, sea level rose 5 to 6 inches more than the global average along the Mid-Atlantic and Gulf Coasts, because coastal lands there are subsiding. Important concerns include sea level rise, land loss, changes in maritime storms and flooding, responses to sea level rise and implications for water resources.

Whatever destiny awaits us, the issue of climate change and its impacts are no more debatable. However, there are three aspects to this issue. These are: the science of climate change and its impacts, the ethical and religious aspect, and the options involved to mitigate the suffering and creating conditions for adaptability.

Climate change and its impacts

I do not like to get into the complexities of the science, but certain references need to be made. Climate does not change automatically nor there is any magic wand influencing climate change. Despite definitional difference, recorded improvements and extensions of numerous datasets and data analyses, broader geographical coverage, better understanding of uncertainties, and a wider variety of measurements have helped in under-

[1] The writer is a Regional Councilor of International Union for Conservation of Nature (IUCN) and professionally heads a think-tank called Centre for Sustainable Development (CFSD) in Bangladesh. Contact email: home@bol-online.com or cfsd.005@gmail.com

standing how climate is changing in space and in time[2]. As of now, many long-term changes in the climate have been observed, like extreme weather such as droughts, heavy precipitation, heat waves and the intensity of tropical cyclones.

Climate change is a global environmental, social and economic challenge. IPCC report speaks of more powerful storms and hotter, longer dry periods. Warmer temperatures mean greater evaporation, and a warmer atmosphere is able to hold more moisture -- hence there is more water aloft that can fall as precipitation. Similarly, dry regions are apt to lose still more moisture if the weather is hotter; this intensifies droughts and desertification. Droughts are becoming more severe as global temperatures increases[3].

Incidentally, increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia. There is also observational evidence for an increase of intense tropical cyclone activity in the North Atlantic since about 1970. Average Arctic temperatures increased at almost twice the global rate in the past 100 years. Temperatures at the top of the permafrost layer have generally increased since the 1980s by up to 3°C. In the Russian Arctic, buildings are collapsing because permafrost under their foundations has melted.

Almost all mountain glaciers in non-polar regions retreated during the 20th century. Widespread decreases in glaciers and ice caps have contributed to sea level rise. The average global sea level rose at an average rate of 1.8 mm per year between 1961 and 2003, but between 1993 and 2003 it rose by 3.1 mm per year.

Scientists have observed climate-induced changes in at least 420 physical processes and bio-logical species or communities like plant migration, change in mating behaviour of birds, advancing of egg-laying time of more than 50 species and so on.

The list of adverse impacts can be very long. But three impacts outshine others, which are: loss in biodiversity, loss in the resources for livelihood and an influx in the number of climate refugees.

Mitigation of and adaptation to climate change

People and scientists are today talking about mitigating the effect of climate change and adaptation to different impacts. But in any situation, these are globally not uniform. Coasts, its biodiversity and people living in the coastal ecosystem across the globe are going to be the primary victims.

Coasts are dynamic systems, undergoing alteration of form and process at different times. These areas in most cases are centres of attraction and have an ecosystem which is yet to be totally explained and understood[4].

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[2] The Inter-governmental Panel on Climate Change (IPCC) defines climate change as any change in climate over time, whether due to natural variability or as a result of human activity. This is different from that formulated by the United Nations Framework Convention on Climate Change (UNFCCC), where climate change means a change in climate because of direct or indirect human activity altering the composition of the global atmosphere, which is in addition to natural climate variability observed over comparable period of time. The Inter-governmental Panel on Climate Change (IPCC) defines climate change as any change in climate over time, whether due to natural variability or as a result of human activity. This is different from that formulated by the United Nations Framework Convention on Climate Change (UNFCCC), where climate change means a change in climate because of direct or indirect human activity altering the composition of the global atmosphere, which is in addition to natural climate variability observed over comparable period of time.

[3] Drying has also been observed over large regions, the Sahel, the Mediterranean, southern Africa and parts of southern Asia. The Rhine floods of 1996 and 1997, the Chinese floods of 1998, the East European floods of 1998 and 2002, the Mozambique and European floods of 2000, and the monsoon-based flooding of 2004 in Bangladesh (which left 60 per cent of the country under water), are examples of more powerful storms.

[4] Coastal systems are considered as the interacting low-lying areas and shallow coastal waters, including their human components. This includes adjoining coastal lowlands, which have often developed through sedimentation during the past 10,000 years, but excludes the continental shelf and ocean margins. Inland seas are not covered, except as analogues.

There has been an exponential growth in the use of coast during the 20th century, which is sure to continue through the 21st century despite forecasts of impending danger. It has been estimated that 23 percent of the world's population lives both within 100 km distance of the coast and <100 m above sea level.

In both developed and developing countries people do migrate to coastal regions. Sixty percent of the world's 39 metropolises with a population of over 5 million are located within 100 km of the coast, including 12 of the world's 16 cities with populations more than 10 million. Rapid urbanisation has resulted enlargement of natural coastal inlets and dredging of waterways for navigation, port facilities, and pipelines exacerbate saltwater intrusion into surface and ground waters.

Coastal population growth in most cases has led to widespread conversion of natural coastal landscapes to agriculture, aquaculture, silviculture, as well as industrial and residential uses. If population growth follows present trends, evacuation of vulnerable populations in these high-risk areas during natural disasters like storms will pose serious problems because many evacuation routes are close to flood-prone areas. Although permanently lost land would occupy a relatively narrow coastal strip, flooding due to storms could periodically engulf a much greater area[5]. Increasing shoreline retreat and risk of flooding of coastal cities in Thailand, India, Vietnam and the United States have been attributed to degradation of coastal ecosystems by human activities.

Human activities often disrupt ecosystem services on the coast. For example, tropical and sub-tropical mangrove forests and temperate salt-marshes provide goods and services (they accu-mulate and transform nutrients, attenuate waves and storms, bind sediments and support rich ecological communities), which are reduced by large-scale ecosystem conversion for agriculture, industrial and urban development, and aquaculture.

The major direct impacts of human activities on the coastal zone include drainage of coastal wetlands, deforestation and reclamation, and discharge of sewage, fertilisers and contaminants into coastal waters. Wetlands provide habitat for many species, play a key role in nutrient uptake, serve as the basis for many communities' economic livelihoods, provide recreational opportunities, and protect local areas from flooding.

The outer boundary of these wetlands, as the sea rises, will erode, and new wetlands will form inland as previously dry areas are flooded by the higher water levels. The amount of newly created wetlands, however, could be much smaller than the lost area of wetlands - especially in developed areas protected with bulkheads, dikes, and other structures that keep new wetlands from forming inland. The IPCC suggests that by 2080, sea level rise could convert as much as 33 percent of the world's coastal wetlands to open water.

Rising sea levels inundate wetlands and other low-lying lands, erode beaches, intensify flooding, and increase the salinity of rivers, bays, and groundwater tables. A given storm surge from a hurricane or northeaster builds on top of a higher base of water. Some of these effects may be further compounded by other effects of a changing climate. Other impacts of climate change may further enhance or mitigate coastal flooding. Flooding from rainstorms may become worse if higher temperatures lead to increasing rainfall intensity during severe storms. An increase in the intensity of tropical storms would increase flood and wind damages. Besides, measures that people take to protect private property from rising sea level may have adverse effects on the environment and on public uses of beaches and waterways.

Shore erosion also increases vulnerability to storms, by removing the beaches and dunes that would otherwise protect coastal property from storm waves. Beaches are continually changing as sand is shifted by waves, tides, and currents. Sea-level rise and land subsidence contribute to beach erosion and the narrowing or movement of barrier islands. Sea level rise also increases coastal flooding from rainstorms, because low areas drain more slowly as sea level rises. Many ocean shores are currently eroding 1 to 4 feet per year.

[5] Coasts are subject to external events that pose a hazard to human activities and may compromise the natural functioning of coastal systems. Terrestrial-sourced hazards include river floods and inputs of sediment or pollutants; marine-sourced hazards include storm surges, energetic swell and tsunamis. Storm events, or changes triggered by internal thresholds that cannot be predicted on the basis of external stimuli can alter the conditions across the coasts. This natural variability of coasts can make it difficult to identify the impacts of climate change.

With climate change, rates of beach erosion would double or triple by the 2020s, increasing three to six times by the 2050s, and four to ten times by the 2080s, relative to the first decade of the twenty-first century. Climate models project an increase in storms, which would further contribute to beach erosion.

Scientists argue climate-related ocean-atmosphere oscillations could lead to coastal changes. One of the most prominent is the El Niño-Southern Oscillation (ENSO) phenomenon. Recent research has shown that dominant wind patterns and storminess associated with ENSO may perturb coastal dynamics. Coral bleaching and mortality appear related to the frequency and intensity of ENSO events in the Indo-Pacific region, which may alter as a component of climate change, becoming more widespread because of global warming.

External terrestrial influences have led to substantial environmental stresses on coastal and near shore marine habitats. As a consequence of activities outside the coastal zone, natural ecosystems (particularly within the catchments draining to the coast) have been fragmented and the downstream flow of water, sediment and nutrients has been disrupted. Land-use change, particularly deforestation, and hydrological modifications have had downstream impacts, in addition to localised development on the coast.

Coasts can be affected by external marine influences. Waves generated by storms over the oceans reach the coast as well; there are also more extreme, but infrequent, high energy swells generated remotely. Tsunamis are still rarer, but can be particularly devastating[6]. Recent trend analyses indicate that tropical cyclones have increased in intensity. Many coasts are experiencing erosion and ecosystem losses.

Long-term ecological studies of rocky shore communities indicate adjustments apparently coin-ciding with climatic trends. There is evidence for a series of adverse impacts on polar coasts, although warmer conditions in high latitudes can have positive effects, such as longer tourist seasons and improved navigability.

Global warming poses a threat to coral reefs, particularly any increase in sea surface tempera-ture. The synergistic effects of various other pressures, particularly human impacts such as over-fishing, appear to be exacerbating the thermal stresses on reef systems and, at least on a local scale, exceeding the thresholds beyond which coral is replaced by other organisms[7].

Two references: Bangladesh and Maldives

Bangladesh and Maldives are the two countries to be worst affected because of climate change. Let us have a brief look at the situations of these countries. Both of them belong to the same economic co-operation grouping called SAARC, but while Bangladesh lags behind, income from tourism has made the Maldivians the wealthiest people in South Asia.

The biophysical and socio-economic condition in the coastal zone of Bangladesh is highly vulnerable to salinity, sea level rise, erosion, cyclone and storm surges. Significant part of the coastal area is already facing problems related to salinity intrusion, cyclone and tidal surges, erosion, water logging, which will be aggravated further under warmer climate particularly due to sea level rise. The average height of the country is not more than 10 m from mean sea level. The height is less in the coastal area. Due to sea level rise, salinity in the coastal area is increasing over time[8].

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6 Ocean currents modify coastal environments through their influence on heat transfer, with both ecological and geo-morphological consequences. Sea ice has physical impacts, and its presence or absence influences whether or not waves reach the coast. Other external influences include atmospheric inputs, such as dust and invasive species.

7 The example of the Great Barrier Reef, where decreases in coral cover could have major negative impacts on tourism.

8 According to IPCC report, the sea level will rise about 30 cm by 2030 and 50 cm by 2050 in Bangladesh coast. If the sea level raises about 30 cm, it would inundate about 4 percent that means 6,300 sq. km of area of Bangladesh. By the year, 2100, if the sea level raises about 100 cm, about 17.5percent or 25,000 ssquare kilometres would be inundated. About 75percent of Sundarbans would be inundated with an increase of about 45 cm sea level rise and the whole Sundarbans would be inundated if sea level raises about 67 cm.

Coastal agriculture, fisheries, livelihood activities of the poor and marginal groups and domestic water sources and uses of all are the key vulnerable sectors in the coastal area. Different consultative meetings with community reveal that increasing salinity in the locality has affected water, soils, agriculture, vegetation, mangrove, fisheries and livelihoods activities of the communities and households. The increased salinity of the land has threatened the agricultural output to affect livelihood of thousands of people. The locality also faces serious health risk due to increased salinity resulting in scarcity of fresh drinking water. It has been observed that cyclones with tidal surge, increase width of river and tidal level are also damaging human settlements, homestead, infrastructures, productive land and natural resources, which decrease the livelihood assets and potentials of the poor and marginal community.

About 60-70 percent of the local people are poor. Of them, about 40 percent are extremely poor, who live on daily wage labour, collection of forestry products from the Sundarbans (the biggest mangrove forest) and subsistence fishing while others are engaged in agriculture, shrimp fry collection and fish cultivation, small trading, etc. The people in the selected villages lack proper understanding and awareness about the emerging changes in nature, environment and climate. Further, they do not have adequate disaster preparedness at family and community levels.

While the situation in Bangladesh is such, just think of the finest beaches in the world is slowly sinking into the sea. And to cope with the situation the first democratically elected president of the island republic Maldives has revealed that he was seriously thinking about moving the whole nation somewhere else. He said in a recent interview that "We can do nothing to stop climate change on our own, so we have to buy land elsewhere. It is an insurance policy for the worst possible outcome. We do not want to leave the Maldives, but we also do not want to be climate refugees living in tents for decades."[9]

People in Bangladesh are thinking a way out, which include building peoples' adaptive capacity to reduce vulnerability due to salinity intrusion, tidal inundation and cyclone as well as to facilitate poverty reduction at local and national level to scale for the long run. But Maldives is planning to move elsewhere, and what an unbelievingly Herculean task.[10]

The ethical and religious aspect

One might wonder why this issue is brought here. The reason is simple as most of our activities are either controlled by greed for more or ethical issues and religious beliefs. With dangers of climate change looming large, we could have a look at the issues for regeneration of ideas in ensuring a survival for future generation.

Before getting into references to religious scriptures, let us read some lines of Khalil Jibran:
And when you work with love you bind yourself to yourself, to your fellow-beings and to God, And what it is to work with Love? It is to build a house with affection as though your beloved were to dwell in that house, It is to sow seeds with tenderness and reap the harvest with joy even as if your beloved were to eat the fruit, It is to change all things with a breath of your spirit.[11]

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[9] Sea level around the country has risen by about 20 cm in the past century, and the UN esti-mates that they will rise a further 58 cm by 2100. The capital Male was inundated by high tides in 1987 causing millions in damages. The Asian Tsunami was even more devastating. The wave that struck the Maldives was barely a metre high but it killed 82 people, displaced 12,000and inflicted $375m of damage including $100m to the exclusive beachside resorts.

[10] Some property owners and governments are already starting to take measures to prepare for the consequences of rising sea level. Some of the most economically important vulnerable areas are recreational resorts on the coastal barriers of the Atlantic and Gulf coasts. In many cases, the ocean-front block of these islands is 5 to 10 feet above high tide; but the bay sides are often less than two feet above high water and regularly flooded. Erosion threatens the high ocean sides of these densely developed islands and is generally viewed as a more immediate problem than inundation of their low bay sides.

[11] Jibran, K. The Prophet, Alfred A Knopf Inc., New York, 1969

From the Christian faith perspective, human beings may relate to nature through three models: Stewardship, Kinship and Partnership. The stewardship model believed that the earth is God's house and stewardship is the management of this house. It is based on the belief that nature is created by God and given to human beings. The biblical basis for the management of nature is usually taken to be Genesis 1:26-28 where humans are given the status of god's representative with the task of ruling over all life on earth. The kinship model emphasises the intimate relationship of all created things including human beings and the nature. Rather than emphasising human beings as managers of the earth, we treat the earth as we would another human being. The Partnership believes that a place God chose as a personal abode and a spatial habitat for humans. Not only are humans placed on this earth to commune with God but to share with God the task of caring and creating. The biblical basis for this model is usually taken to the Genesis 2:15, "The Lord placed the man in the Garden of Eden to cultivate and guard it." Care of the earth is a partnership between God and God's people.

In the Buddhist tradition all living things exist depending on others, this is the Karma theory. This theory can also be adjusted to the subject of environment. The core of the Buddhist theory says "A cause and result and karma expresses the view of human beings and the world and our present world is the fruit of our past endeavour and our future will bear fruit of our past endeavour. In Buddhism life includes the life of animals, plants and even inorganic objects and living is dependent on each other's life.

The ultimate quest for survival in Islamic frame of reference is spiritual emancipation of the peo-ple and as such it should not remain restricted to mere economic development. The Holy Koran pronounces:

And how many people have we destroyed which were taking pride in their economic affluence. (Al-Qasas: 58)

There are repeated warnings in Koran not to corrupt the earth. The intent of the Holy Koran is that man should also develop a sense of inter-communal relationship towards fauna and flora as these are also communities like mankind:

Although there is no beast that walks on earth and no bird that flies on its two wings which is not (God's) creature like yourselves: no single thing have We neglected to our Decree. And once again unto their sustainer shall they (all) be gathered. (Al-Anam:38)

This sense of ecological inter-communal relationship with the surrounding fauna and flora instils a deep concern for environmental quality and conservation of natural resources. The development of natural resources and the conquest of natural environment have been regarded by the Holy Koran as an attribute of good human conduct but at the same time man has been warned that he must never forget that all the handiwork of man bear the seal of impermanence:

Behold, We have willed that all beauty on earth be a means by which We put men to a test, (showing) which of them are best in conduct, and, verily, (in time) We shall reduce all that is on it to barren dust. (Al Kahf: 7-8)

The UN Framework Convention on Climate Change was adopted during the Rio Conference in 1992. The treaty called for the nations to prevent dangerous anthropogenic interference with the climate by stabilising the concentration of greenhouse gases in the atmosphere. Since then no remarkable progress has been made in the climate change policy and politics.

Changing our lifestyle and way of thinking has also been mentioned as major solution to the problem of climate change. There is no one who is satisfied with one's desire; even they pursue their aims for hundreds and thousands of years. But human beings fall into ruin because of this, and climate change is one of those signs of destruction. Some of the mitigational and adaptation strategies worked out so far, have spoken of ethics and a change in value system redirecting life style.

I am an incurable optimist and have great hope in humanity. I believe, despite differences amongst interna-

tional community about the mitigational and adaptation aspects of climate change, we would definitely win the battle. With that hope, before concluding, let me recite the following words of hope:

Be with us, faithful to that ancient promise that we need in our time to hear the sounds of the earth crying.

(The writer would like to record with gratitude the intellectual output received from many pub-lished materi-als including during different IPCC Reports in preparing this article).

Session 1

Impacts of Climate Change on Coastal and Island Ecosystems

Dr. Hee-Young Chae
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Monitoring Bird Migration and Climate Change at East-Asian Stopover Islands

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Abstract

Flexibility of habitat selection in birds has long been noticed as an effective indicator of climate response, long-term records of breeding and migratory behavior have been analyzed in relation to climate change, especially to global warming in Europe and North America. Over 50 years of migration records of these countries revealed that arrival date to breeding ground and breeding initiation timing went faster and migration timing to wintering ground delayed during last several decades. On the contrary to the common guess that global warming will be a threat to population maintenance or species perpetuity of migratory birds; however, impact of climate change on ecology of respective species has been found to be quite different. Warming may be beneficial to short-distance migrants for advantages of advanced breeding whereas non-simultaneous change of habitat condition and competition to increased short-distance migrants may worsen the survival of long-distance migrants. Moreover, different aspects of adaptation in bird species may cause complex interactions with producers or other levels of consumers in ecosystem. Therefore, long-term trends of migration pattern in various species and their ecological roles in habitats should be studied to understand collective impacts by climate change.

Located on the route of East Asian-Australian flyway, the first and only migratory birds center in Korea was found at two small islands in 2005. The stations are important stopover sites for migratory birds in East Asian-Australian flyway with high species diversity and the major gates for birds to enter the mainland Korea. We aim to detect the ecological change of migratory birds by climate change and predict their possible impact on the whole ecosystem. We are currently carrying out researches on:

1. Monitoring of newly recorded species and their habitat change;
2. Long-term monitoring of migration timing patterns;
3. Study of habitat quality and improvement to mitigate possible disturbances of stopover site ecosystem.

As the mean temperature increases, observations of birds which breed in lower latitude from Korea have been increased. We have collected information of 69 newly recorded species since 2000 and classified their status into 3 categories:

- Accidental vagrancy (recorded once only);
- Habitat expansion (recorded several times in locations with direction from known original habitat); and,
- Unknown cause (recorded several times in locations with non-directional locations from known original habitat).

We found fourteen species which recorded at locations of latitudinal direction from known habitat among 28 species that are classified as an expansion group, and the proportion of species of this group has been increased with the number of observations or the new breeding records.

A number of buntings of several species with various migration distances in genus *Emberiza* are annually banded and we analyze the pattern of arrival dates and stopover length and monitor the possible relationship between

migration timing and climate change. We are focusing on sex-differential timing because migration strategies are different between sexes, so differential measures response more sensitively to the environmental changes and sex ratio itself can be an indicator of environmental change because birds usually migration separately by sex or age.

Also we tested the effect of birds on the ecosystem in stopover site. We made an experiment on germination proportion of seeds that were digested from bird's intestine and tracked the bird's home range and the distribution of the plant. We found that migratory birds as the primary consumer are important seed disperser and germinator during their stopover periods; thus change of migratory species can affect the biodiversity of vegetation and consequently the entire ecosystem.

Various studies to reveal the ecological changes of birds by climate changes are actively going on. We detected that many species in lower latitude go to northern area that implies the avifauna of East Asia are under the effect of climate change. Constant monitoring manuals to figure out the ecological changes by global warming was made with the foundation of the Migratory birds center in Korea, and patterns of migration has been analyzed from various angles. Finally, we studied interactions between migratory birds and the habitat environment, and the result implies that the change of migration pattern may cause the change of whole ecosystem as a result of the interactions between ecological constituents.

Flexibility of habitat selection in birds has long been noticed as an effective indicator of climate response

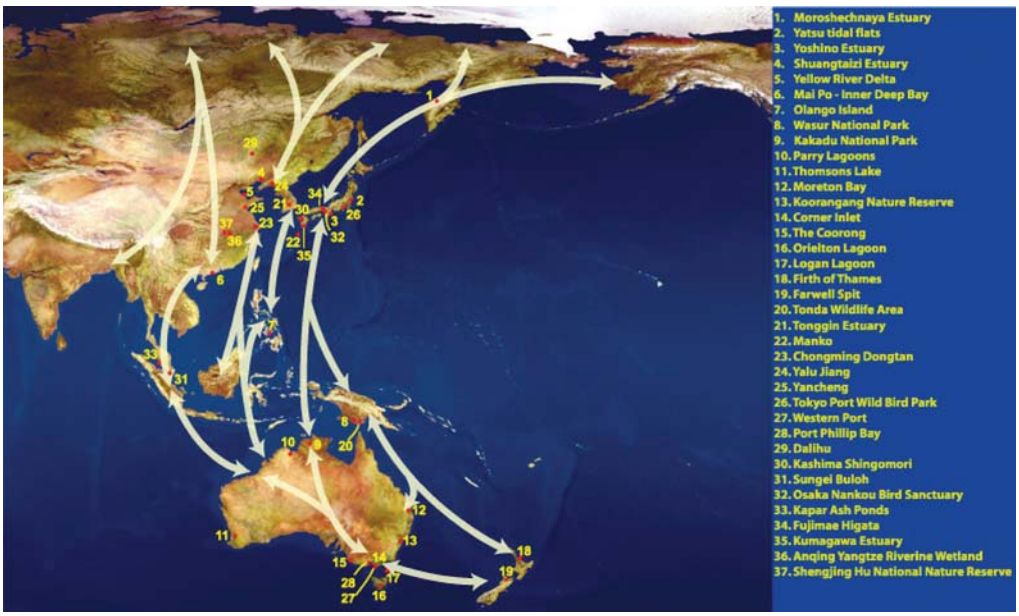
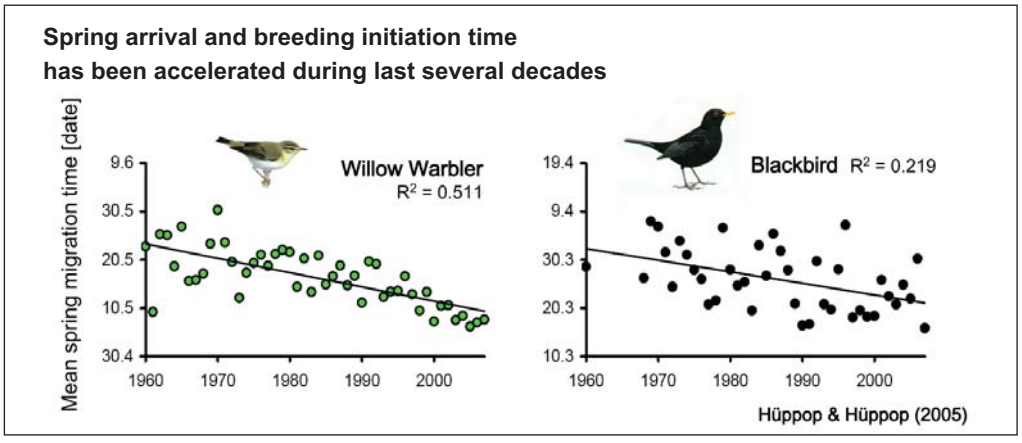


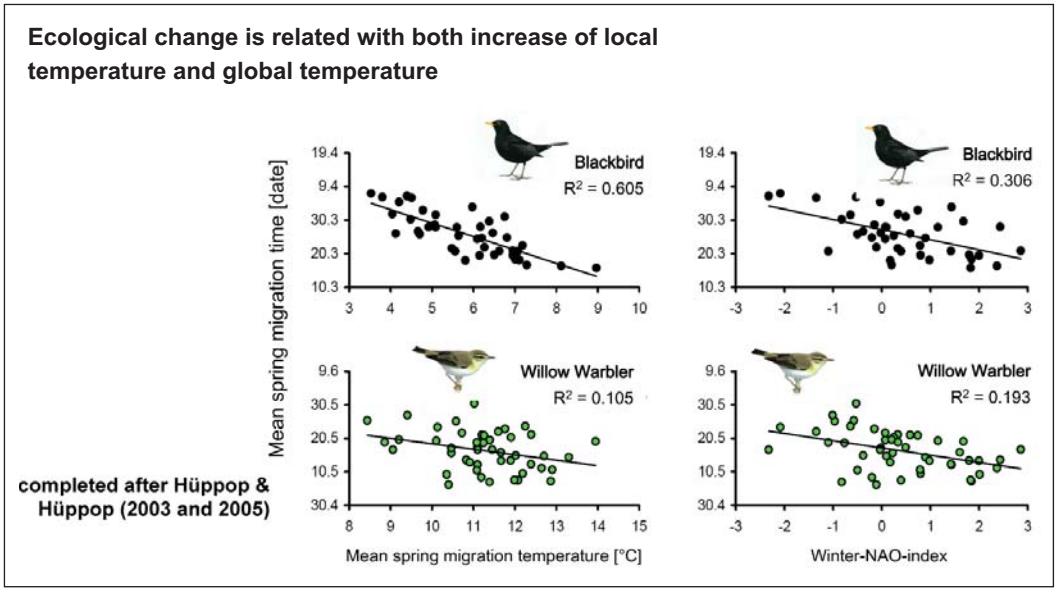
Photo from Australian Wader Studies Group

Long-term ecological monitoring of migratory birds

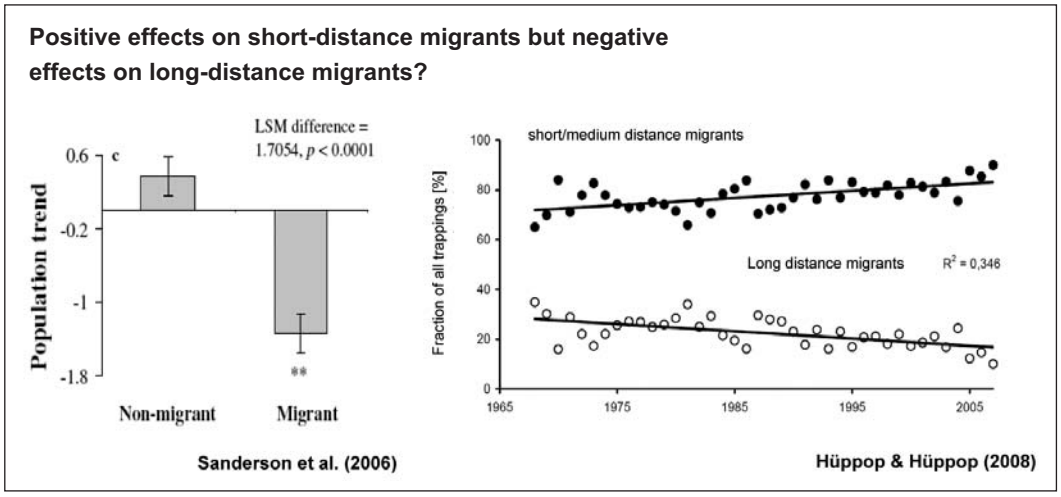
Over 50 years of monitoring in North America and Europe have been conducted



Long-term ecological monitoring of migratory birds
Changes of migration ecology according to climate warming monitored



Long-term ecological monitoring of migratory birds
Response of ecological impacts by climate warming is complex (1)



Long-term ecological monitoring of migratory birds
Response of ecological impacts by climate warming is complex (2)

Possibility of extinction of population lessen species diversity
by Local habitat loss (especially arctic/montane species);
Mismatch (de-synchronization) of resource emersion and arrival;
Failure in competition to well-adapted species in warming.


← Siberian Crane
© David Behrens

↓ Bicknell's Thrush

© Kai Rasporich

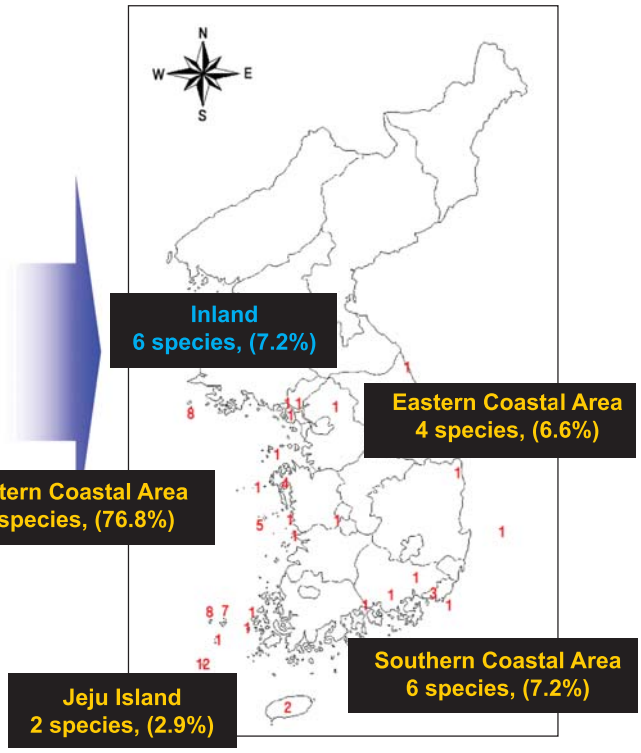
Research Scope
- Monitoring of newly recorded species and their habitat change.
- Long-term monitoring of migration timing patterns.
- Study of habitat quality and improvement to mitigate possible disturbances of stopover site ecosystem.

Monitoring of newly recorded species and their habitat change

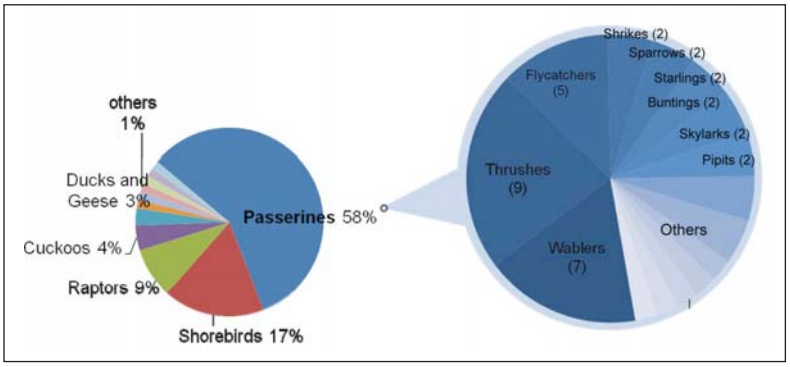
Plumbeous Water Redstart

Locations of newly recorded species

관찰지역	관찰횟수	권역별
강화도 미루지	1	서해안 53종(76.8%)
전남 대흑산도	7	
전남 가거도	12	
충남 서산	4	
어청도	5	
전남 비금면 해상	1	
한강 하구	1	
소청도	8	
전남 홍도	8	
전남 하태도	1	
격렬비열도	1	
인천 옹진군 승봉도	1	
전북 군산	1	
신안군 도초면 우이도	1	
충남 보령 웅천 소황사구	1	
부산 다대포	3	남해안 5종(7.2%)
하동군 갈사만	1	
부산 알바다	1	
경북 울진 진복리	1	동해 4종(5.8
강원도 거진	1	
경북 포항	2	
경기도 양수리	1	내륙 5종(7.2%)
경남 주남저수지	1	
한강 중랑천	1	
충남 대전	1	
경남 진주 수곡	1	
제주도	2	제주도 2종(2.9%)
합 계	69	

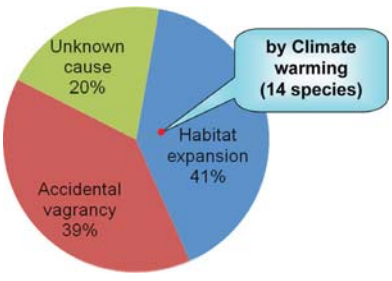


Distribution of newly recorded species

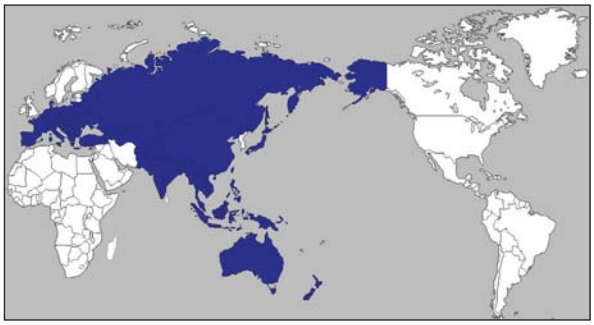


Possible Causes of habitat expansion

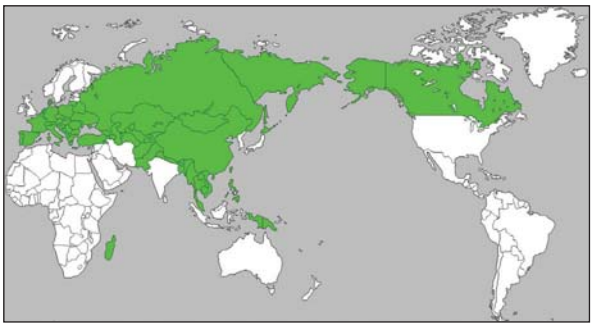
cause	criteria
Accidental vagrancy	recorded only once (by unexpected weather fluctuation)
Habitat expansion	recorded several times in locations with latitudinal direction from known original habitat
Unknown cause	recorded several times in locations with non-directional locations from known original habitat



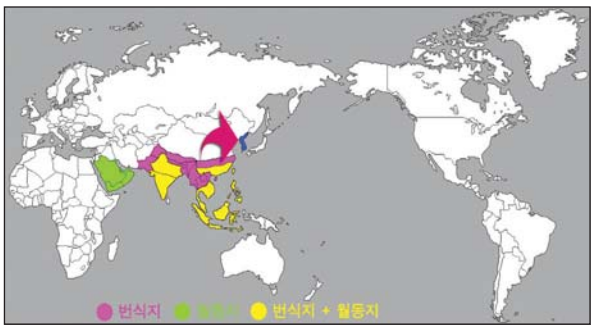
Original distribution of newly recorded species by accidental vagrancy



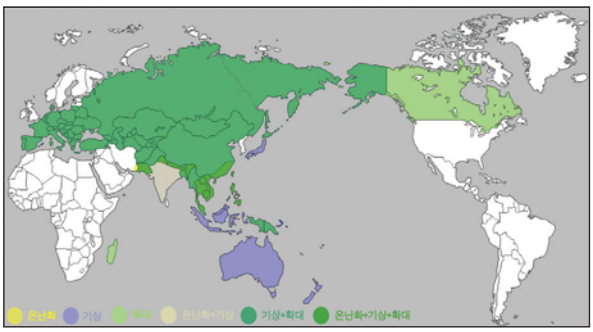
Original distribution of newly recorded species by habitat expansion



Original distribution of newly recorded species by climate warming (habitat expansion)



Combination of causes



Original distribution and expected expansion route of newly recorded species

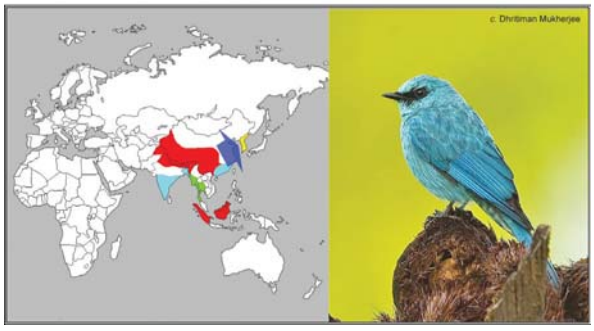
붉은부리찌르레기 Silky Starling

Original distribution and expected expansion route of newly recorded species

검은뻐꾸기 Asian Koel

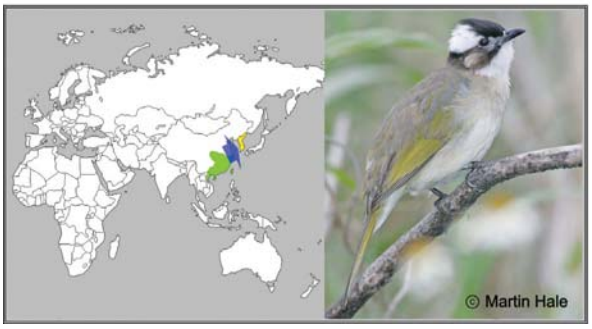
Original distribution and expected expansion route of newly recorded species

파랑딱새 Verditer Flycatcher



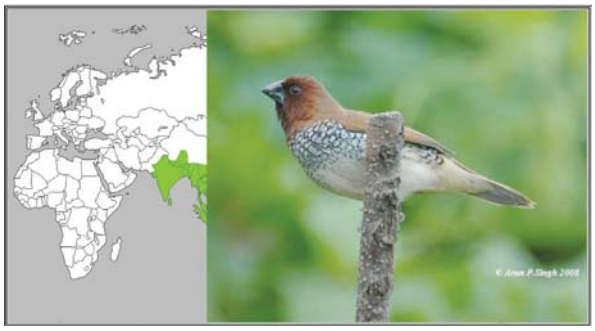
Original distribution and expected expansion route of newly recorded species

검은이마직박구리 Chinese Bulbul



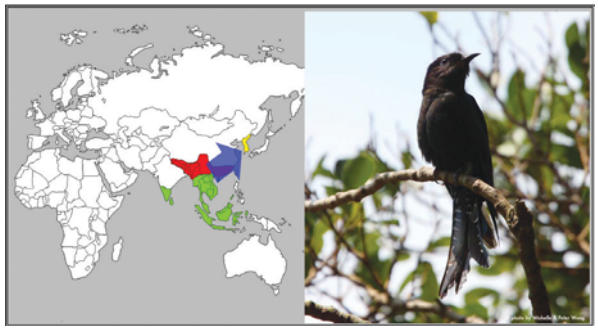
Original distribution and expected expansion route of newly recorded species

얼룩무늬납부리새 Scaly-breasted Munia

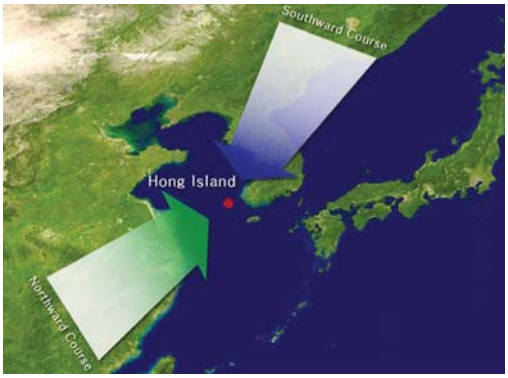


Original distribution and expected expansion route of newly recorded species

검은두견이 Asian Drongo cuckoo



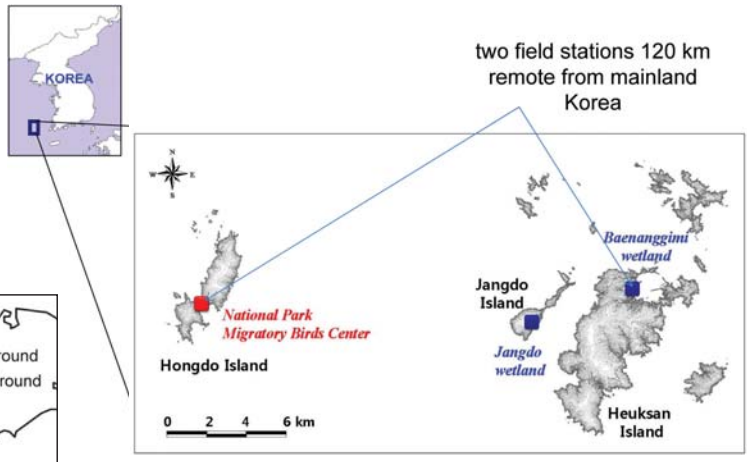
Islands of South-Western part of Korea is very important Stopover sites for Migratory birds



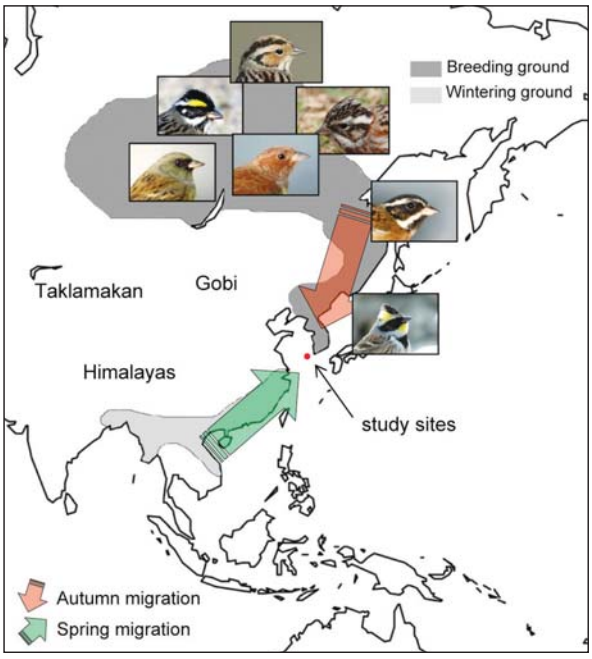
Long-term monitoring of migration timing patterns

Black-faced bunting

Korea National Park Migratory Birds Center



Monitoring Migration Pattern of Buntings



- A number of individuals and species pass through during spring and autumn migration season
- Various migration distance from study sites

Easy to monitor migration pattern

Breeding and wintering habitat is modified and redrawn from Svensson (1992)

Study species

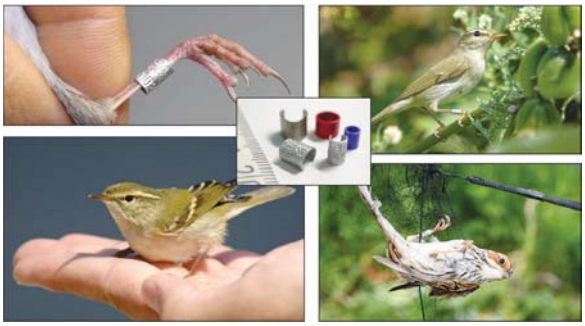
촉새
Black-Faced Bunting
(*Emberiza spodocephala*)

꼬까참새
Chestnut Bunting
(*Emberiza rutila*)

흰배멧새
Tristram's Bunting
(*Emberiza tristrami*)

노랑눈썹멧새
Yellow-Browed Bunting
(*Emberiza chrysophrys*)

노랑턱멧새
Yellow-Throated Bunting
(*Emberiza elegans*)



Mist netting and Bird banding

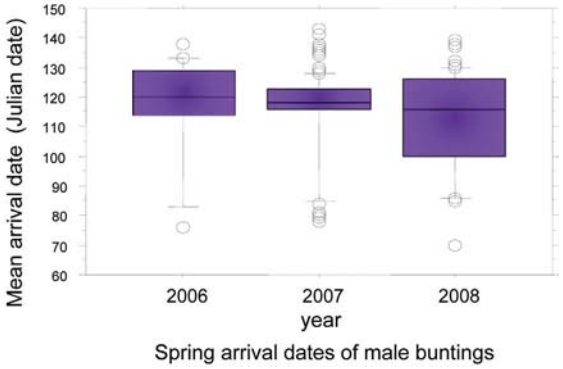
- Mean arrival and departure date
- Stopover length
- Morphology and body mass

Daily Monitoring

- Initial arrival and departure date
- Stopover length

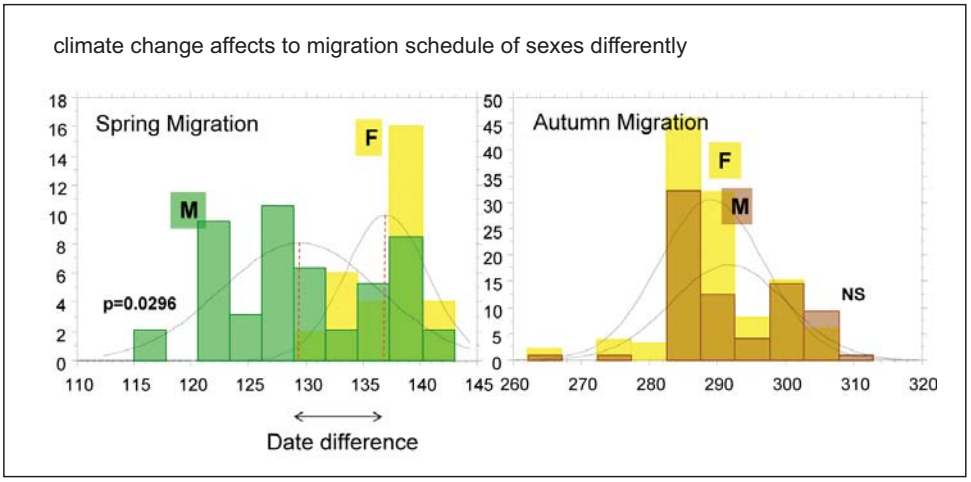
Long-term monitoring of migration pattern

1. Annual change of arrival dates



Long-term monitoring of migration pattern

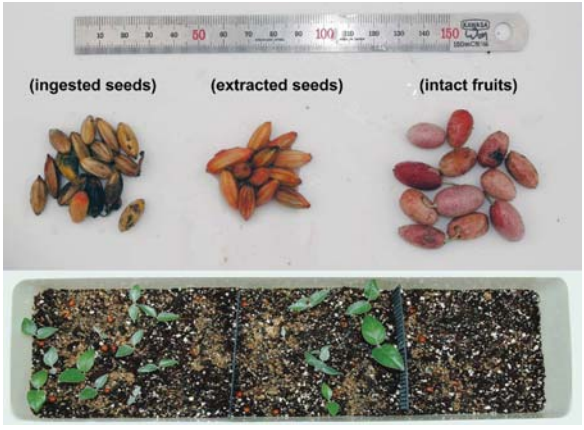
2. Ground research of sex-differential migration pattern and arrival date difference between sexes:



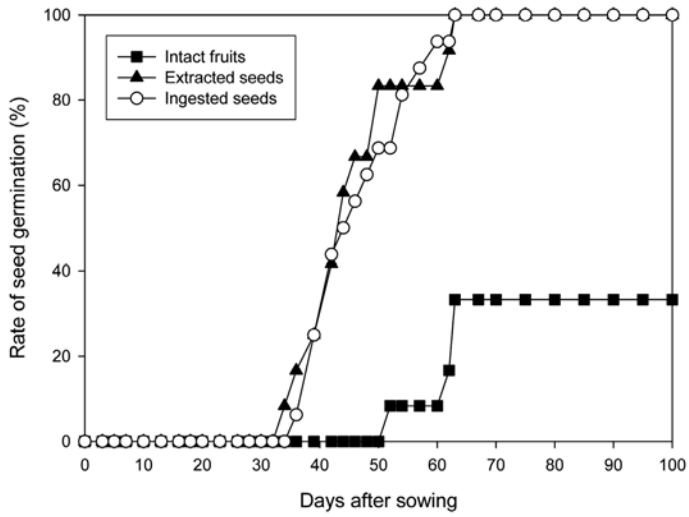
Study of habitat quality and improvement :

Interaction of plant - migratory birds at the stopover islands

Many species of birds use plant seeds as food at the stopover sites



Migratory Birds are Important for plant seed germination in the stopover islands



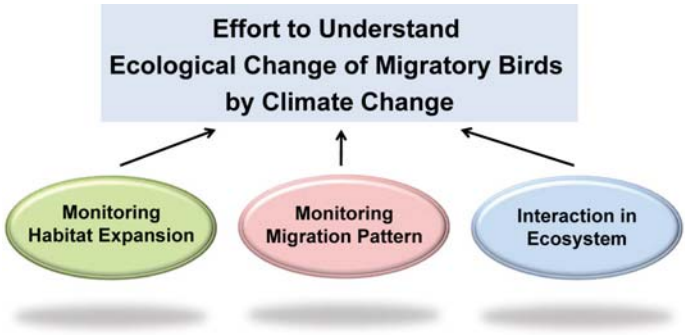
Plant-Disperser Coevolution

Plants → Seed dispersal, Increased seed survival, Higher germination rate
Birds → Increased food resources

Fruiting season = Migratory season

Ecology of specific plant can be seriously damaged if migration pattern is altered

Conclusion



Impact of Climate Change on Komodo National Park, Indonesia

Mr. Tamen Sitorus
Head of Komodo National Park
Directorate-General of Forest Protection and Nature Conservation,
Ministry of Forestry of the Republic of Indonesia

Abstract

Komodo National Park (KNP) is located between the islands of Sumbawa and Flores, at the border of the Nusa Tenggara Timur and Nusa Tenggara Barat Provinces. This area is part of the Wallacea Region of Indonesia and the South-East Asia Coral Triangle-identified as a global conservation priority area. KNP includes three major islands: Komodo, Rinca and Padar, and numerous smaller islands together with total of 1,817 km^2. KNP was established in 1980 and subsequently designated a Biosphere Reserve by UNESCO in 1977, and a World Heritage Site in 1991. KNP was initially established to conserve the unique Komodo dragon *(Varanus komodoensis)*, and its habitat.

KNP also includes one of the world's richest marine environments. It encompasses 510 square miles of exceptionally diverse marine habitats, including coral reefs, mangroves, seagrass beds, seamounts, and semi-enclosed bays. These habitats harbor more than 1,000 species of fish, some 385 species of reef-building coral, and 70 species of sponges, and endangered marine species such as Dugong *(Dugong dugon)*, dolphins (10 species), whales (6 species) – including the blue whale *(Balaenoptera musculus)* and sperm whale *(Physeter macrocephalus)*, marine turtles such as the hawksbill and *(Eretmochelys imbricata)* and green turtles *(Chelonia mydas)*.

Unfortunately, like other national parks in the developing countries, KNP is under pressures of several destructive fishing practices (DFPs), such as dynamite, cyanide, and compressor fishing (mostly done by non-Park inhabitants), reef gleaning and plain over-fishing, severely threaten the Park's marine resources. Terrestrial threats include the increasing pressure on forest cover for fuelwood and water resources as the local human population has increased 800% over the past 60 years. In addition, the Timor deer population, the preferred prey source for the endangered Komodo dragon, is still being poached. The pressure is leading to degradation of the terrestrial resource base. The collection of firewood from the mangroves and surrounding forests degrades them, and leads to the loss of breeding grounds and shelter for marine life and terrestrial species, the loss of windbreaks, increased erosion/siltation, and the loss of food sources for some species.

Furthermore, as an insular biosphere reserve, climate change will be one of the most crucial problems faced by KNP in the near future. Climate change may affect ecosystems, loss of flora and fauna, sea level rise, temperature rise, increased costal erosion, damaged breeding areas, coral bleaching, rainfall and weather pattern, large change in currents and wind and other types of impacts. The impact of recent climate change (in July 2007) has shown the evidences of damaging tourism infrastructures (costal wall, jetty, visitor information, etc), as well as coral ecosystems.

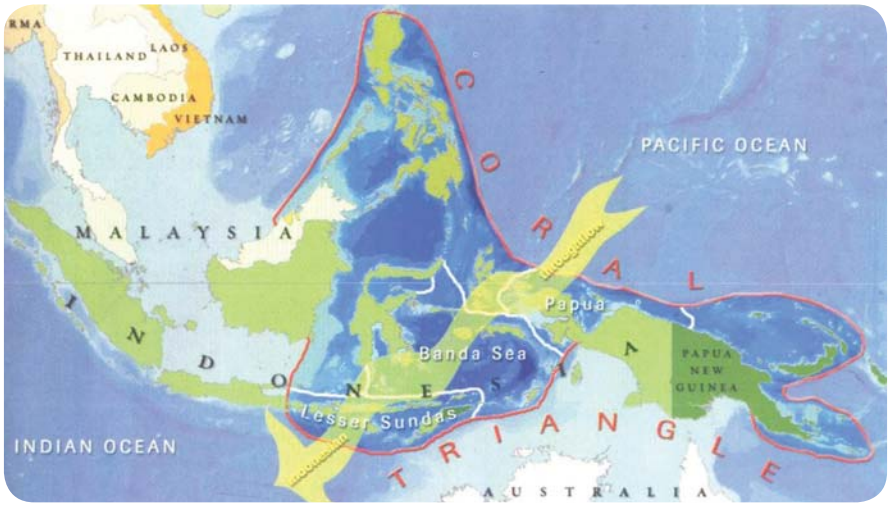
This paper outlines the impact of climate change on the tourism destination and development measures for mitigation and adaptation to climate change on Komodo National Park, Indonesia.

Status & History

- The first Established as National Park in Indonesia, 6 March 1980. (Total Area 173.300 Ha, Marine :132.572 Ha, Terrestrial :40.728 Ha.)
- Listed as Man and Biosphere Reserve by UNESCO in 1977.
- Listed as World Heritage Site by UNESCO in 1991 N(iii) (iv)
- Komodo dragon was listed as a national symbol by the President of the Republic of Indonesia in 1992.
- Listed as Marine Protected Area in 2000.
- Listed as one of National Park models in Indonesia in 2006.
- Proposed to be 1 of 5 National Park self financing in the year 2010

Between Indian & Pacific

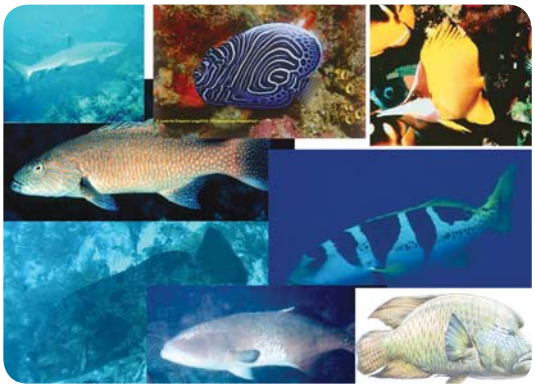
Oceanic crossroads and hotspots



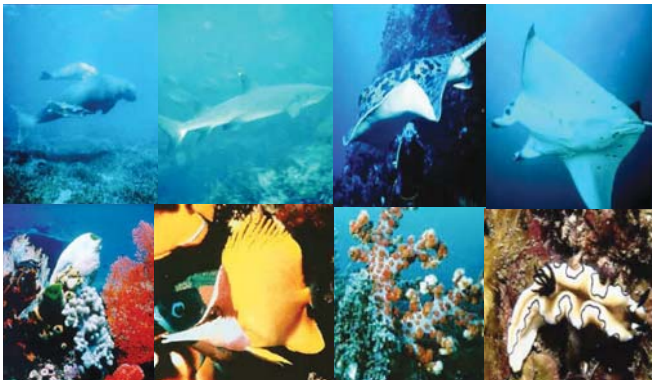
Extremely high marine biodiversity

Marine Habitats
Mangroves
Sea grass
385 coral species.

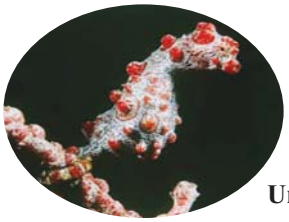
Over 1,000 Fish species



Marine biodiversity







Unique Species…

What are the Impacts of Climate Change in KOMODO?

1. High threat because of global warming, sea level rising, higher sea water temperature, possible occurrence bleaching, and coastal erosion
2. Rainfall and weather patterns will change > longer dry season > forest and savanna fires
3. There may be large changes in currents and winds > more and heavier storms
4. Damaging tourism facilities
5. Impact on migratory species
6. Continue loss of natural areas and degradation of all habitat types

Coastal erosion

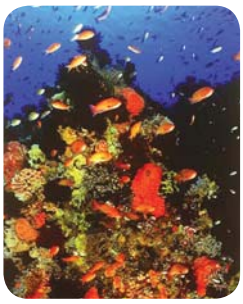
Damaging tourism facilities

MARINE ENVIRONMENT

STRONG CURRENTS > RELATIVELY RESISTANT TO CLIMATE CHANGE DURING ENSO EVENT 1998 (IN WHICH BLEACHING AFFECTED MORE THAN 50% OF ALL CORALS IN INDONESIA), KOMODO MARINE ENVIRONMENT WAS NEARLY UNDISTURBED

↓

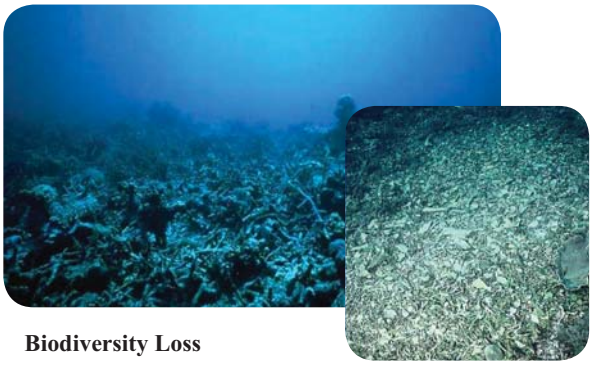
IMPORTANT TO CONTAIN ANTHROPOGENIC THREATS



THREATS

Major Threats - Marine
Unsustainable Fishing
- Blast fishing
- Cyanide fishing
- Compressor fishing
- Reef gleaning
- Fish traps *(bubu)*
- Over-fishing

Major Threats – Terrestrial
- Poaching of deer
- Fire (because of poaching)
- Human encroachment
- Invasive species (cactus)



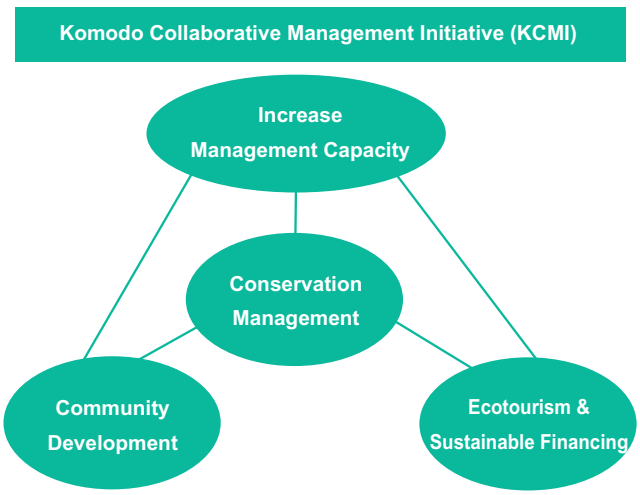
Biodiversity Loss

Adaptation policies and measures:

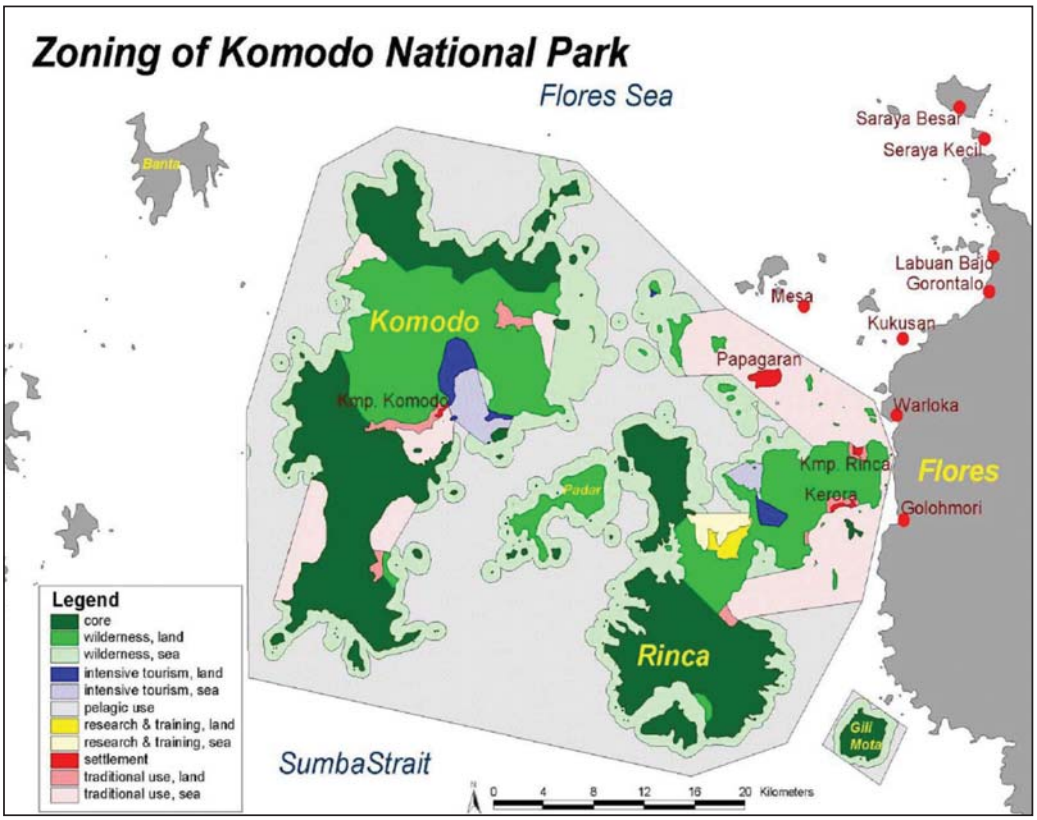
How should we plan for uncertain change?

1. Develop Scientific baseline
   - Need to develop improved scenarios
   - Monitoring Impact of CC
2. Adaptation measures
   - Ecological restoration:
     a. Transplanting Coral
     b. Terrestrial Restoration
     c. Mangrove Restoration
   - Develop Coastal Wall to protect tourist facilities
3. Awareness
   - Educating People and Government Officials
4. Control anthropogenic threats
   - Improve Surveillance and enforcement

LINKING CONSERVATION AND LIVELIHOOD



MONITORING ACTIVITIES



Coral restoration




Terrestrial restoration

Replanting mangroves

Working with local communities

Need to Consider!!!
Small Island

Conclusion :

Climate change has only just begun. The experiences and scientific evidence is clear

Climate change must therefore be considered the greatest challenge to the future of Komodo National Park

"The time for action is now"

Predicting the Impacts of Climate Change on Plants on Jeju Island

Dr. Seok Chan Koh
Department of Biology Cheju National University,
Republic of Korea

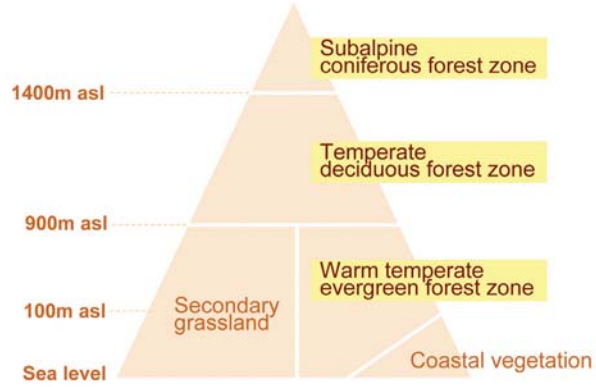
Abstract

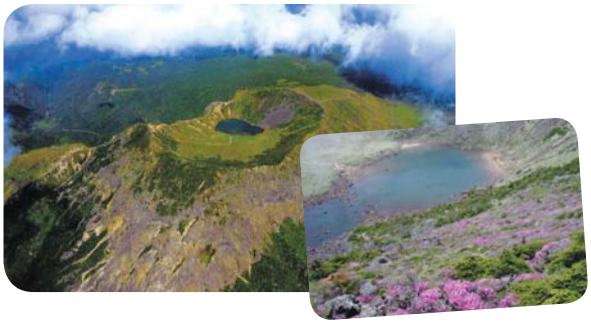
There are more than 1,800 plant species and it is far more on Jeju Island than found on Mt. Sorak, which is the other biosphere reserve in mainland Korea. The high plant biodiversity is partly due to its horizontal location in the southernmost part of Korea, its high mountain elevation, and its various habitats for plant growth: the southernmost location makes many subtropical/maritime elements grow on the low altitude of the island, and on the contrary high elevation of Mt. Halla to 1,950 m a.s.l. makes cold temperate/arctic plants remain on the high altitude of the island. Furthermore, topographical features of the Island supply various habitats for diverse plants such as wetland, dry land, windy field, etc. on the slope of Mt. Halla, and coastal wetland, sand dune and rocky field along the seashore. Jeju Island as a whole actually constitutes a hot spot owing to the rich flora and high number of endemic plants including many rare plants. However, the local and/or global ecosystems are exposed to many kinds of environmental threats. Particularly, the climate change is frequently considered a major threat on the ecosystems. The climate change has significant impacts on the physiology and phenology of plants, the range and distribution of species, and naturalization and invasion of alien plants, resulting in changes of the composition of and interactions within communities, and changes of the structure and dynamics of ecosystems, highlighting common and contrasting features amongst the taxa and systems considered. There is no doubt that the ecosystem of the Jeju Island is also exposed to these threats. I will briefly introduce the altitudinal zonation and plant biodiversity of the Jeju Island, and predict the impacts of climate change on plants on Jeju Island with focusing on the physiology and phenology of plants, the range and distribution of plant species, and invasion and naturalization of alien plants.

- The plant biodiversity of Jeju Island is very high.
- It is due to its horizontal location in the southernmost part of Korea, its high mountain elevation, and its various habitats for plant growth.
- Jeju Island as a whole actually constitutes a hot spot owing to the high biodiversity of vascular plants, and their high endemism and rarity.
- I will introduce the altitudinal vegetation zonation, and the endemism and rarity of plants on Jeju Island, and briefly predict the impacts of climate change on plants on Jeju island.

Altitudinal Zonation of Jeju Island

- Biogeographically, Jeju Island can be regarded as subtropical and temperate rain forests.
- However, altitudinal vegetation zones of Jeju Island are vertically categorized into warm-temperate evergreen forests, temperate deciduous forest, and subalpine coniferous forest, based on geographical location, altitude and slope, and topographical features.



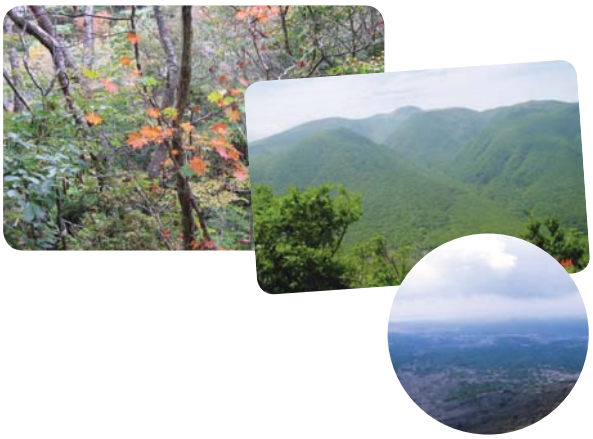


Subalpine coniferous forest zone

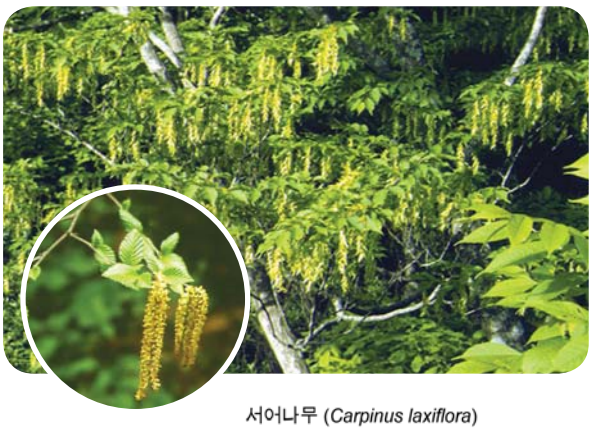
구상나무 Korean fir (*Abies koreana*)

털진달래 Azalea
(*Rhododendron mucronulatum* var. *ciliatum*)

Temperate deciduous forest zone



신갈나무 Mongolian oak (*Quercus mongolica*)



서어나무 (*Carpinus laxiflora*)

소나무 Red pine (*Pinus densiflora*)

Warm-temperate evergreen forest zone

구실잣밤나무 (*Castanopsis cuspidata* var. *sieboldii*)

Secondary grassland

종가시나무 Japanese oak (*Quercus glauca*)

Coastal vegetation

억새 Eulalia (*Miscanthus sinensis*)

잔디 Japanese lawn grass *(Zoysia japonica)*

문주란 Asiatic poisonbulb
(*Crinum asiaticum* var. *japonicum*)

황근 Hamabo mallow (*Hibiscus hamabo*)

선인장 Indian fig (*Opuntia ficus-indica*)

Endemism and Rarity of Plants on Jeju Island

Table 1. The Number of the endemic and rare plants on Jeju Island

		Korean Peninsula	Jeju Island
Total Taxa		4,000 or more	1,800 or more
Endemic Taxa		595	135 (90)
Rare Taxa	IUCN Red Listed	5	2
	Korean Endangered	6	4
	Korean Reserved	52	22

Endemic plants

- Out of 593 plant species endemic to Korea, 135 and 90 plant species are native and endemic to Jeju Island, respectively.
- The most endemic species are found in the subalpine zone above 1,400m a.s.l. including the summit of Mt. Halla and are characterized by their dwarfness.
- However, there are some endemic species distributed in warm-temperate evergreen forests or temperate deciduous forests, particularly Orchidaceae species *Calanthe coreana, Diplolabellum coreanum* and *Goodyera maximowicziana*, and Rosaceae species *Prunus hallaisanensis, Rubus hirsurus*, etc.

구상나무 Korean fir (*Abies koreana*)

섬매자나무 Barberry (*Berberis amurensis* var. *quelpaertensis*)

섬바위장대 Rock cress
(*Arabis serrata* var. *hallaisanensis*)

두메대극(*Euphorbia fauriei*) - Spurge

한라솜다리 Edelweiss
(*Leontopodium hallaisanense*)

눈개쑥부쟁이 Aster (*Aster hayatae*)

깔끔좁쌀풀 Eyebright (*Euphrasia coreana*)

제주달구지풀 (*Trifolium lupinaster* var. *alpinum*) – Lupine clover

Rare plants

IUCN red-listed plant species

- Of five IUCN red listed vascular plant species of Korea, 2 species of Korean fir *(Abies koreana)* and cinnamon tree *(Cinnamomum japonicum)* are distributed on the island.
- Korean fir is endemic to Korea but prevalent in subalpine zones of Mt. Halla.
- Cinnamon tree is a subtropical species and observed in warm-temperate evergreen forest zone.

구상나무 Korean fir (*Abies koreana*)

생달나무 Cinnamon tree (*Cinnamomum japonicum*)

Korean red-listed plant species

- Of 58 Korean red listed species, 4 endangered and 26 reserved plant species are distributed on Jeju Island.
- The most Korean red listed plants are observed in the warm-temperate evergreen forest zone; *Euchresta japonica, Cymbidium kanran, Psilotum nudum, Asplenium antiquum, Chloranthus glabe, Paliurus ramosissimus, Hibiscus hamabo, Osmanthus insularis* and *Lasianthus japonicus.*
- On the contrary, Diapensia lapponica var. abovata is observed on the summit of Mt. Halla in subalpine zone.
- And many Orchid plants in warm-temperate evergreen forests or temperate deciduous forests are also red listed in Korea.

Korean endangered plant species

솔잎란 Whisk fern *(Psilotum nudum)*

만년콩 *(Euchresta japonica)*

돌매화 Diapensia *(Diapensia lapponica* var. *obovata)*

나도풍란 *(Aerides japonicum)*

한란 *(Cymbidium kanran)*

Korean reserved plant species

파초일엽 *(Asplenum anticuum)*

고란초 *(Crypsinus hastatus)*

황근 Hamabo mallow *(Hibiscus hamabo)*

박달목서 *(Osmanthus insularis)*

으름난초 *(Galeora septentrionalis)*

통란 *(Neofinetia falcata)*

지네발란 *(Sarcanthus scolopendrifolius)*

Predicting Impacts of Climate Change on Plants

• The climate change has significant impacts on (1) the physiology and phenology of plants, (2) the range and distribution of species, and (3) invasion and naturalization of alien plants.

• Consequently, it results in (1) changes of the composition of and interactions within communities, and (2) changes of the structure and dynamics of ecosystems, highlighting common and contrasting features amongst the taxa and systems considered.

Impacts on the physiology and phenology of plants

- The temperature, water, and CO^2 concentration directly affect physiological processes such as photosynthesis, respiration, metabolic rates, growth, water use efficiency, tissue composition and decomposition.
- The plant phenological events might be altered by temperature and precipitation. Warmer conditions are generally expected to advance shooting, flowering and fruiting in spring, and to delay leaf falling and color changes in autumn, resulting in increase of the length of the growing season.
- The daily life related to plant physiological and phenological events could be changed.

왕벚나무 Japanese cherry *(Prunus yedoensis)*

유채 Japanese cherry
(Brassica camprestris subsp. napus var. *nippo-oleifera)*

개나리 Korean forsythia *(Forsythia koreana)*

구실잣밤나무 *(Castanopsis cuspidata* var. *sieboldii)*

Impacts on the range and distribution of plant species

- Some tropical or subtropical plant species, including crop plants, could be expected to shift their distribution upward in elevation or northward in latitude.
- Most alpine plants on subalpine zone of Mt. Halla are seriously in the crisis in near future. Particularly, diapensia *(Diapensia lapponica* var. *obovata)* on the top of Mt. Halla could be extinct because there is no place for the plants to immigrate.

Diapensia *(Diapensia lapponica var. obovata)*

한라솜다리 *Leontopodium hallaisanense*

섬바위장대 *(Arabis serrata* var. *halaisanensis)*

설앵초 *(Purimula modesta* var. *fauriae)*

들쭉나무 *(Vaccinium uliginosum)*

시로미 Crowberry
(Empetrum nigrum var. *japonicum)*

Sagentii juniper *(Juniperus chinensis var. sargentii)*

Impacts on the invasion and naturalization of alien plants

- There were observed 199 or more naturalized plant species on Jeju Island.
- Further more thermophilous plant species are expected to spread from garden into surrounding countryside and become naturalized in the island, with immigration of unwanted neighbours such as epidemic diseases.
- Consequently, the landscape of Jeju Island could be seriously changed in near future.

서양 금혼초 *(Hypochoeris radicate)*

왜종려 Windmill palm *(Trachicarpus excelsus)*

삼나무 Japanese ceder *(Cryptomeria japonica)*

The Impacts of Climate Change on Coastal Settlements of Western Port

Ms. Cecelia Witton
Executive Officer
Mornington Peninsula and Western Port Biosphere Reserve, Australia

Abstract

The Mornington Peninsula and Western Port Biosphere Reserve incorporates the coastal region surrounding Western Port Ramsar site and part of Port Phillip Bay on the western side of the Mornington Peninsula, Victoria, Australia

Area:
214,200 hectares — 68% terrestrial, 32% marine
- Comprising Mornington Peninsula, the waters of Western Port, French Island, and the southern part of the Western Port water catchment;
- Five local government areas — Mornington Peninsula Shire and parts of City of Frankston, City of Casey, Cardinia Shire and Bass Coast Shire.

Zones:
- Core 4%, buffer 30%, transition 66%;
- Core and buffer areas are publicly owned, managed by state or local government.

Location:
Approximately 40 km from Melbourne, Victoria, Australia

Population:
- More than 180,000 permanent residents (2002);
- Approximately 250,000 seasonally.

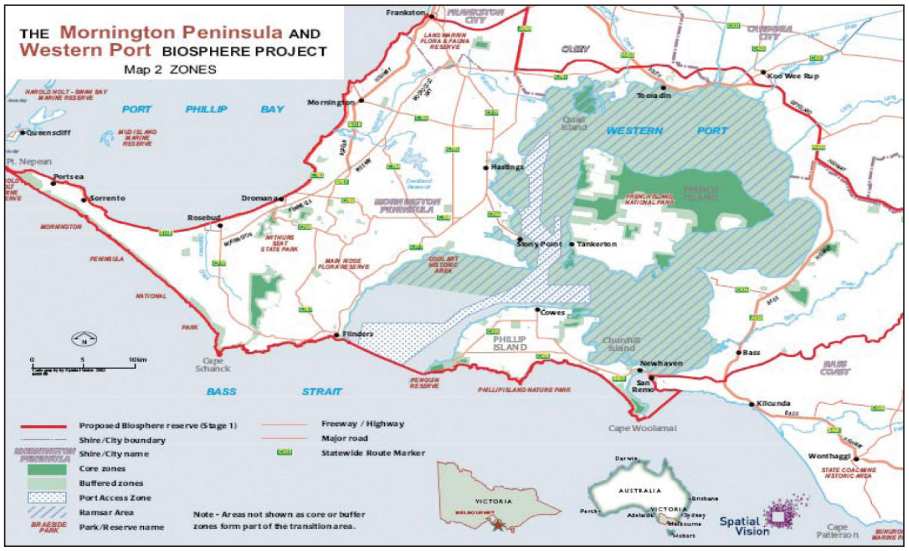
The region is a complex diversity of industrial, urban, agricultural, natural terrestrial and marine environments.

Climate change is emerging as a vital issue for Australian communities. Even with international action to reduce greenhouse gas emissions, the global climate is projected to undergo significant change in the 21st century.

It is important that the impacts of climate change are addressed at regional and local levels since local attributes, including socio-economic characteristics and the physical environment, will significantly determine the extent of the risks and opportunities as well as the nature of community responses.

The WPGA is an alliance of five Western Port Councils that comprise the Biosphere Reserve, and in conjunction with CSIRO, recently undertook study modelling changes such sea level rise, average and extreme rainfall, storm surge, temperature and fire weather, examining the potential impacts to the region's built environment and the social and economic implications of these impacts.

THE RESERVE IS LOCATED IN THE STATE OF VICTORIA AUSTRALIA



- The region is a complex diversity of industrial, urban, agricultural, natural terrestrial and marine environments.
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THE RESERVE

Declaration: November 2002

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Location: Approximately 40 km from Melbourne, Victoria, Australia

Population:
- More than 180,000 permanent residents (2002)
- Approximately 250,000 seasonally

French Island — relatively undisturbed, fox-free habitat, including a national park and has breeding colonies of the Little Penguin, Koala, Australian Fur Seal, Short-tailed Shearwater.

Biologically diverse, Ramsar wetland of international importance.

Nationally significant vegetation communities including rare, threatened and vulnerable species Numerous sites of geomorphologic significance.

Important region for industry, port operations, fishing, agriculture, tourism and urban growth.

Run off from waterways enters Yaringa Marine Park.

IMPACTS FROM

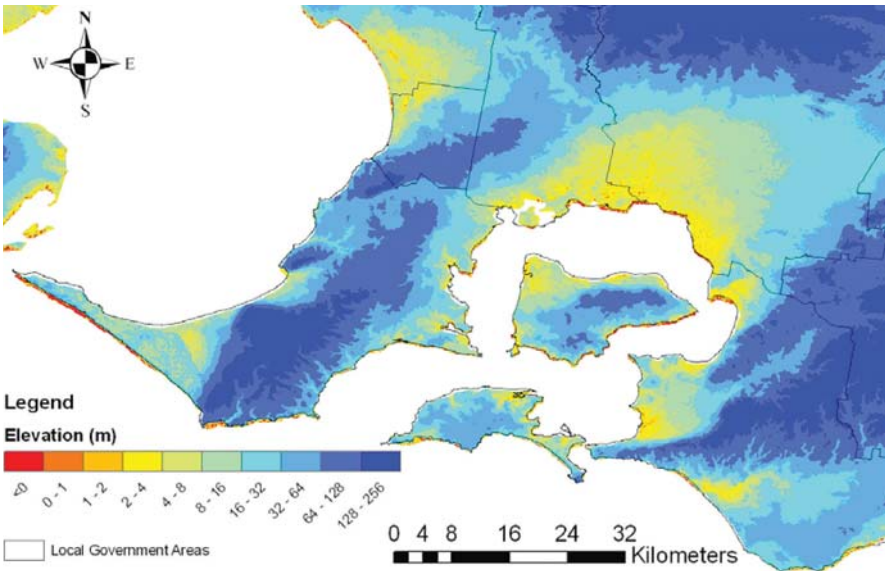
- CHANGES IN WEATHER PATTERN
  - TEMPERATURE
  - SEA LEVEL RISE/STORM SURGE
  - RAINFALL PATTERN
  - DROUGHT
  - FIRE WEATHER

Temperature	2030	2070
Average annual temperature	↑0.5-1.3°C	↑ 1-3.5°C
Days per yr > 30 °C (16 current)	↑1-5	↑ 4-16
Days per year > 40 °C (0 current)	↑ 1	↑ 2
Runs of 3 – 5 > 30 °C (3 current)	↑ 1-2	↑ 2-4

SEA LEVEL RISE /STORM SURGE

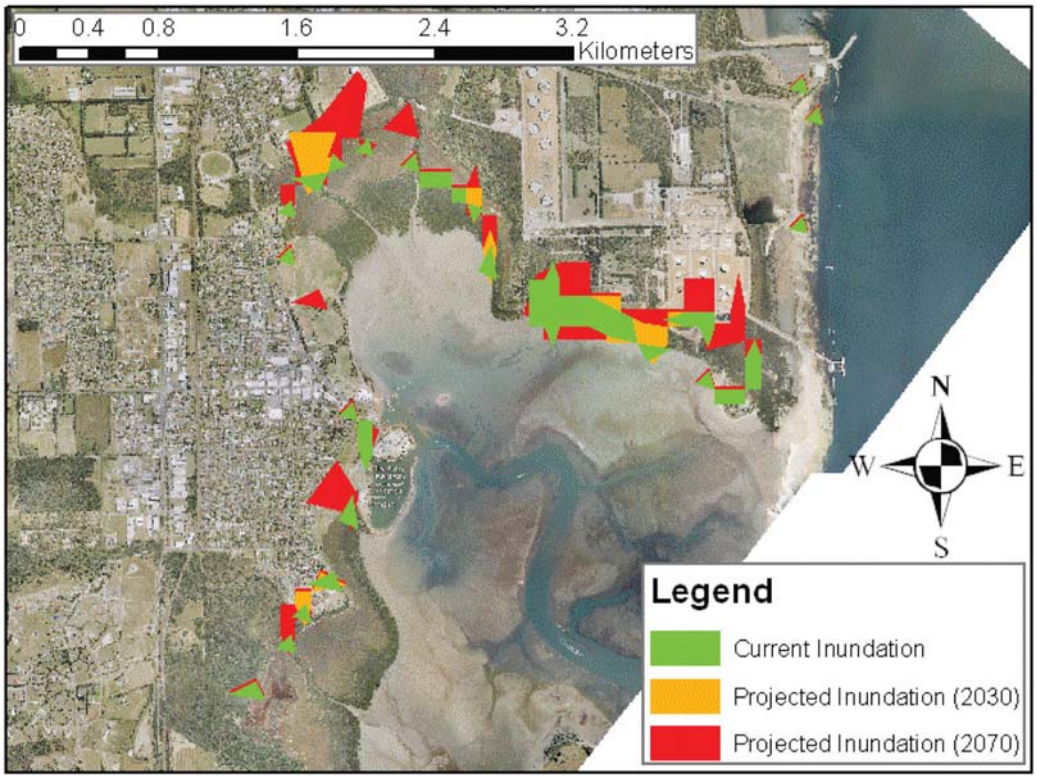
	2030	2070
Sea level rise	↑ 0.17m	↑ 0.49m
Storm tide – max. height,1:100 Year at Cowes in WP now 2.10m	2.29m	2.73m
Storm tide – max height, 1:100 year at Frankston in PP now 1.16m	1.37m	1.80m
Storm surge change to 1:100 year	↓ to 1:40 – 1:10	↓ to 1:20 - 1:2
Inundation area Western Port 1:100 year storm surge	2.6 sq km	3.3 sq km
Inundation area Port Phillip 1:100 year storm surge	0.8 sq km	1.5 sq km

Spatial distribution of elevation in the Western Port region

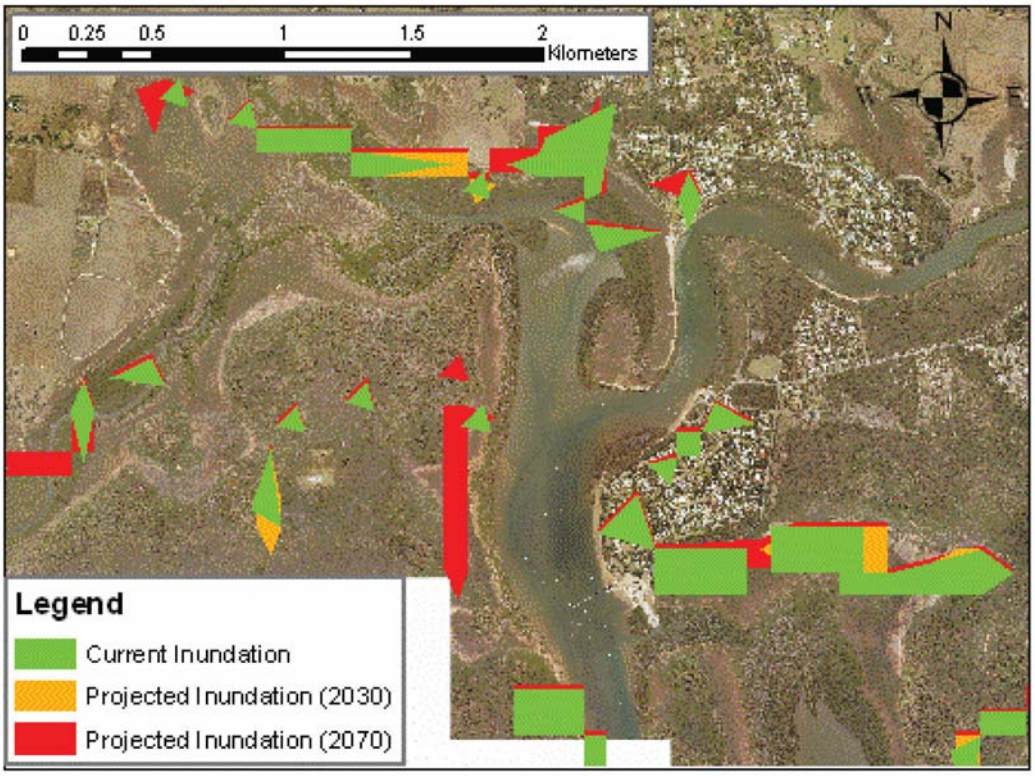


Source: SRTM 90 metre digital elevation model (Jarvis et al., 2004).

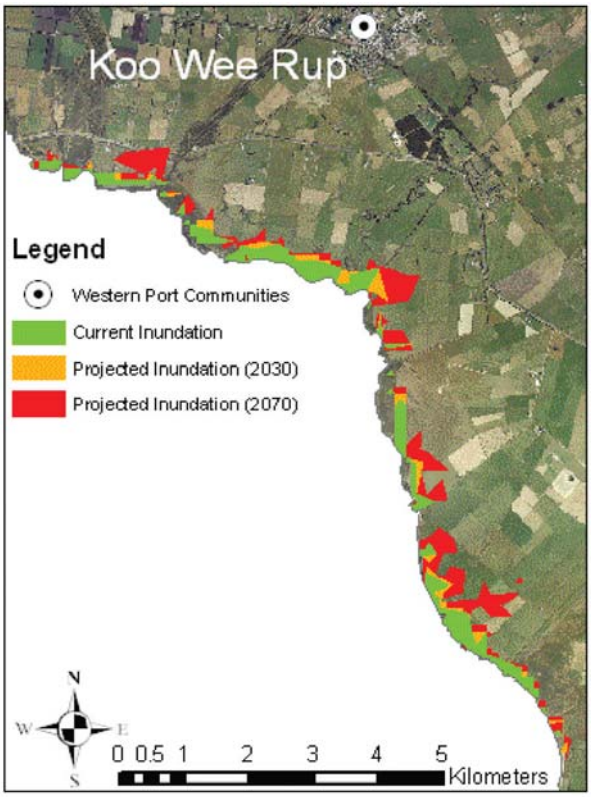
Hastings



Warneet

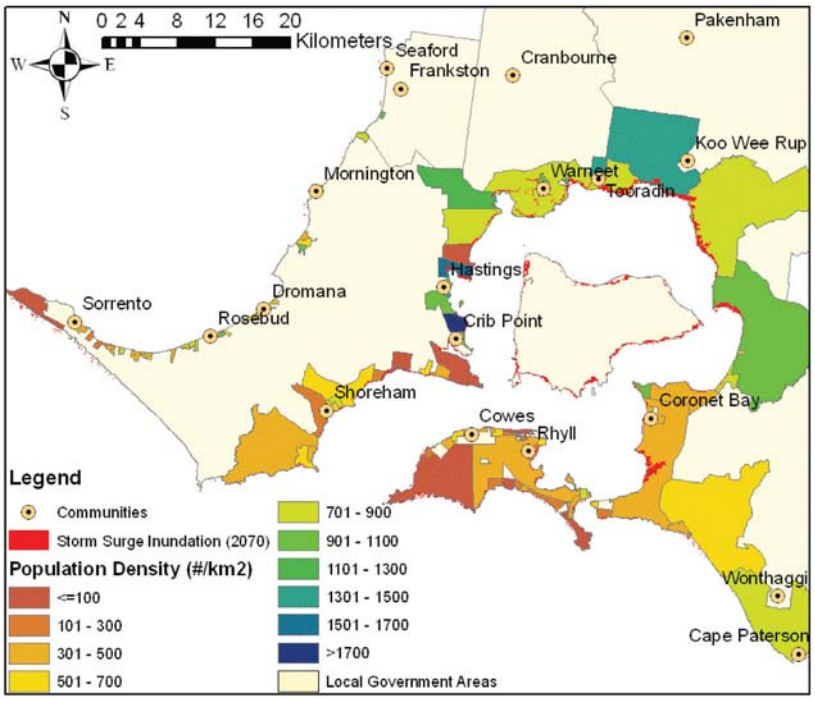


Cardinia Shire Council Coast



Frankston City Council Coast

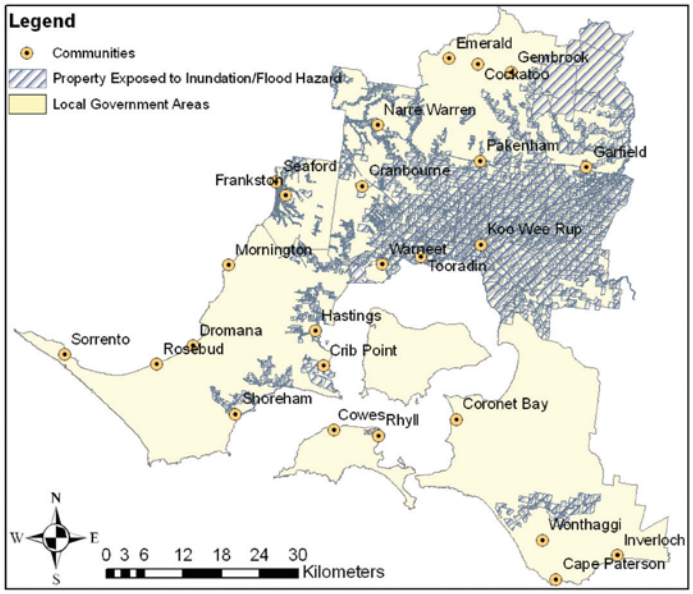
Figure 3.18: Current (2006) population density of census districts exposed to a 1 in 100 year storm surge (2070 scenario)



Average rainfall	2030	2070
Average Annual	↓0-8 %	↓0-23%
Catchment stream flows (worst case)	↓ 25%	↓ >50%
Droughts	↑ frequency	& severity

- Extreme Rainfall
- Increased flood damage to infrastructure, residences with limited freeboard
- Estimated 39,840 people, 13,390 properties, 2050 commercial/industrial properties
- 1,423 km roads, 26 bridges, 580 km^2 land

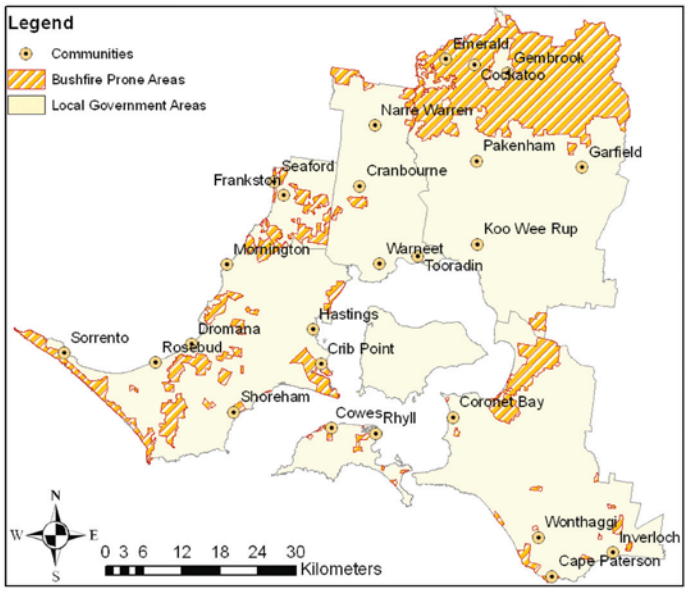
Figure 4.27: Spatial distribution of existing properties associated with inundation/flood prone areas within the Western Port region



FIRE WEATHER

	2030	2050
No of very hire and extreme forest fire risk days (~9-12 days current)	↑ 1-2	↑ 2-7
No of very high and extreme grass fire risk days (~95 days current)	↑ 7-15	↑ 9-30

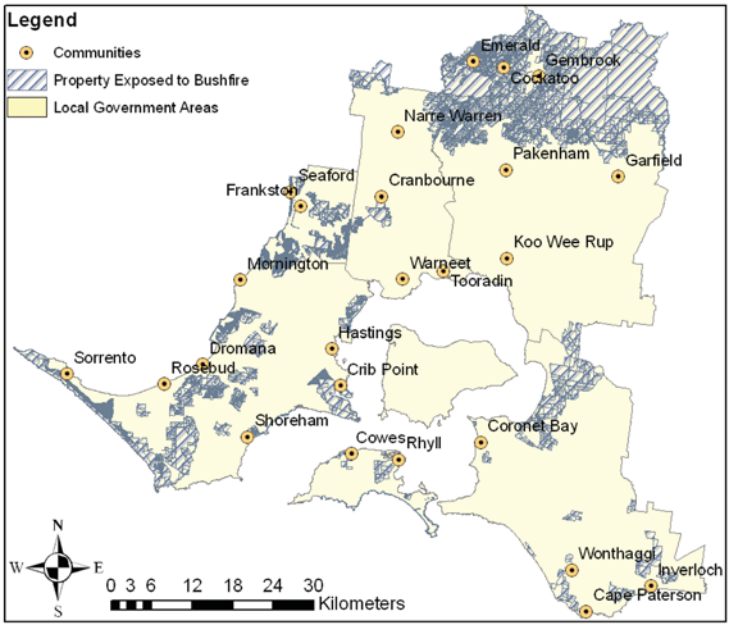
Spatial distribution of current bushfire prone areas within the Western Port region



FIRE WEATHER

- Up to 73,620 people
- 28,443 residences
- 459 commercial/industrial properties
- 5,301 public buildings, reserves, etc
- 1,621km road, 49 km rail,
- up to 468km^2 land
- devastation natural environment
- Stress/social disruption/cost

Spatial distribution of existing propertiesassociated with bushfire prone areas within the Western Port region.



• The foregoing is an overview of impacts and was prepared by C Witton Executive Officer of Mornington Peninsula and Western Port Biosphere Reserve Foundation Ltd. Data was sourced from WPGA report *Impacts of Climate Change on Settlements in the Western Port* Region final report June 2008.

Regional-Scale Ecological Monitoring Across Bering Sea Island Biosphere Reserve: Essential Tool to Interpret Potential Climate Change Impacts

Ms. Olga Romanenko[1]; Mr. Thomas Van Pelt[2]; and Mr. Nikolai Pavlov[3]
[1]Transboundary Ecologic, LLC; [2]North Pacific Research Board; [3]Commander Islands Nature and Biosphere Reserve, United States of America

Abstract

Climate change impacts tend to be expressed at a regional scale, making region-wide monitoring a crucial tool for scientists and managers to understand climate change impacts and distinguish normal local variation from exceptional changes driven by changing climate. And from the community perspective, it is important for villagers living in remote island Biosphere Reserves to understand how local changes fit into regional- and global-scale changes. As highlighted in the Madrid Action Plan for Biosphere Reserves, (1) climate change effects can be expressed particularly strongly in island and coastal zones; and (2) the World Network of Biosphere Reserves provides a key opportunity to develop resilience strategies and practices in the face of climate change. We describe an ongoing effort to improve ecological monitoring of potential climate change impacts across two Biosphere Reserves. The Russian Federation's Commander Islands and the USA's Aleutian Islands are neighboring archipelagos and Biosphere Reserves that together form an ecologically continuous "Aleutian-Commander Arc". These islands are linked in a chain of extraordinary biodiversity, but have historically been managed in isolation due to the international boundary separating the Reserves. Recent work has bridged this boundary, creating a "sister reserve" spanning well over 1,000 km across the southern rim of the ice-affected Bering Sea. One expression of Bering Sea ecosystem changes is changing seabird populations; seabirds in the region are highly valued by scientists as ecological indicators, and also by local people for ecotourism and subsistence harvest. The Commander Islands and Aleutian Islands are together building a network for harmonized monitoring of seabird populations, engaged with local stakeholding communities. This can be a demonstration of the value of Biosphere Reserve networks in the context of climate change.

Acknowledgements:

Yuri Artyukhin
Sergei Zagrebel'ny
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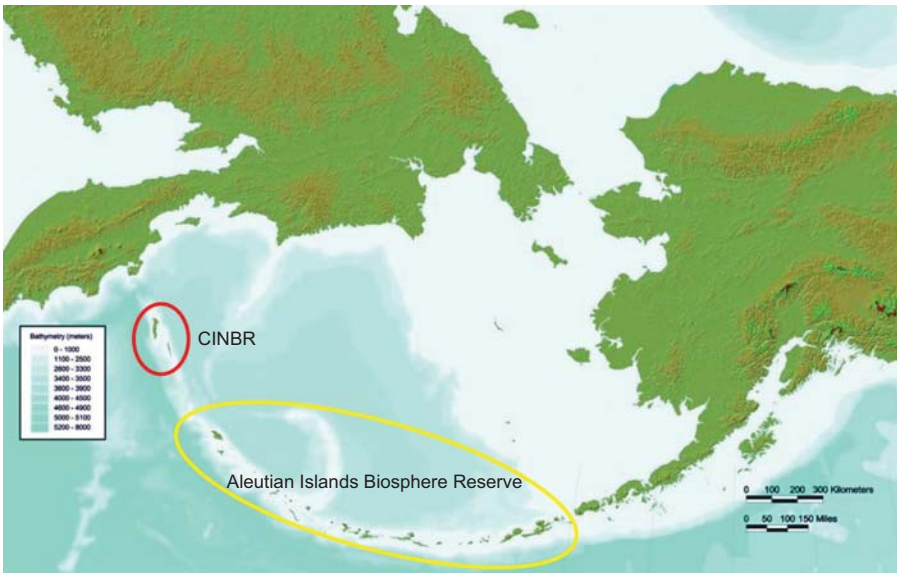
Margaret Williams
Stan Senner
Photos by Yuri Artyukhin and Tom Van Pelt

Russian Federation:
Commander Islands Nature and Biosphere Reserve
USA:
Aleutian Islands Biosphere Reserve

- Introduction
  - History
  - Community
  - Biodiversity
  - Conservation
- Joint transboundary Seabird Monitoring – observation system able to detect climate change impacts

Introduction

Bering Sea Map



Medny Island

Steller Sea Lion
Eumetopias jugatus

Bering Island Wetlands

Nikolskoe Village

1741 Expedition Map

History

Bering, Discovered Aleutians and Commanders

Bering Grave

Enhydra lutris

Callorhinus ursinus

Community

Long-time salmon fishing for subsistence and commercial industry

Unalaska (Eastern Aleutian Islands)

Local Government

Biodiversity

Fritillaria camaschatatcensis

Sea Plants

Oncorhynchus nerca

Rangifer tarandus

Callorhinus ursinus

Orcinus orca

Lunda cirrhata

Lagopus mutus ridgwayi

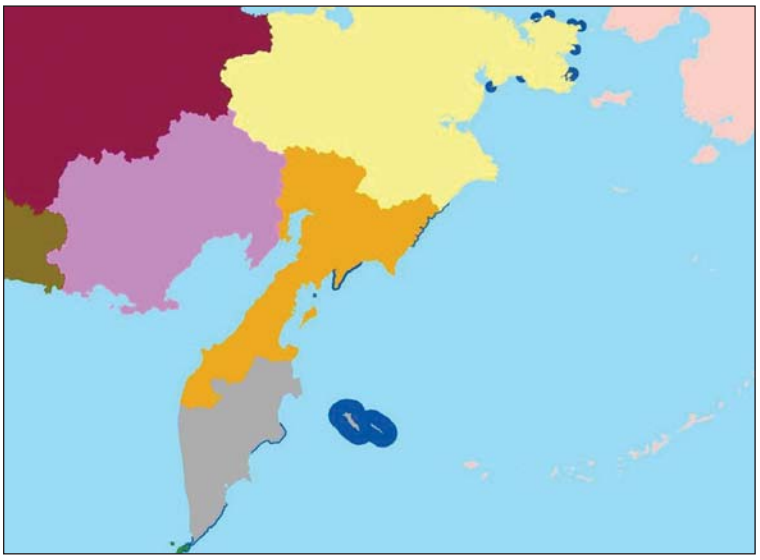
Waterfowl Steller's Eider

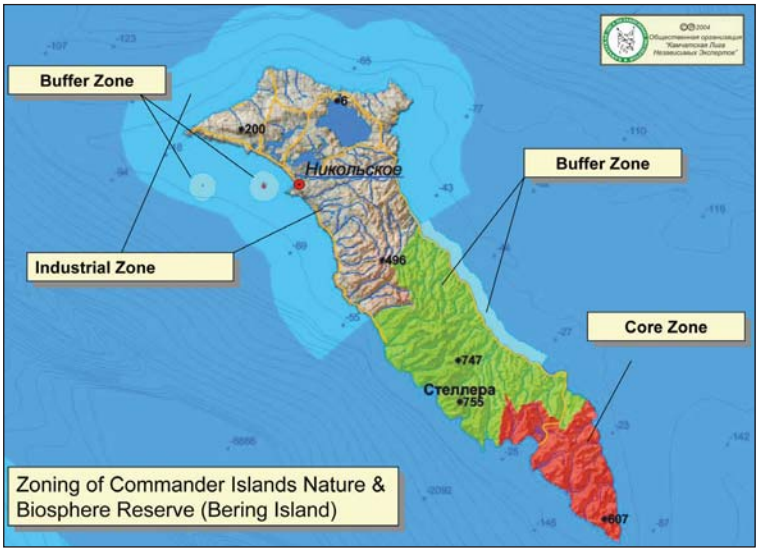
Glaucous Winged Gull (Larus glaucescens)

Conservation

Commander Islands Nature & Biosphere Reserve

- Marine protected area (1958).
- Nature reserve (1993) – mission:
  - conserve marine and terrestrial biodiversity.
  - enable sustainability of traditional lifestyle for residents.
- Biosphere reserve (2002)
  - Protect biodiversity while perpetuating the lives and culture of local population.





Commander Islands Nature & Biosphere Reserve

- Key challenges:
  - **Money.** Severe shortage of funding support.
  - **Community** - involvement in reserve.
  - **Community** - sustainable economy.
  - **Biodiversity monitoring**… inadequate to fulfill mission.
  - **Poaching** in marine and land habitats.
  - **Invasive species.**
  - **Climate change impacts??**

Joint transboundary seabird monitoring

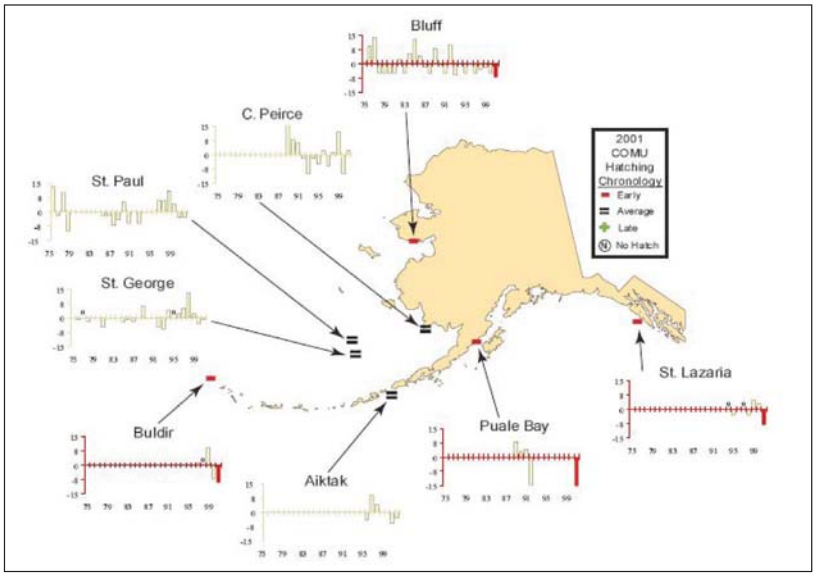
ДОГОВОР О СОТРУДНИЧЕСТВЕ
между
Государственным природным биосферным заповедником «Командорским»
ул. Беринга 18, п. Никольское
Алеутский район, Камчатская обл., Россия, 684500
и
Аляскинским морским национальным заказником
Службы управления ресурсами рыб, диких животных и растений США
ул. Стерлинг 95, офис 1
г. Хомер, штат Аляска, 99603 США

I. ВВЕДЕНИЕ

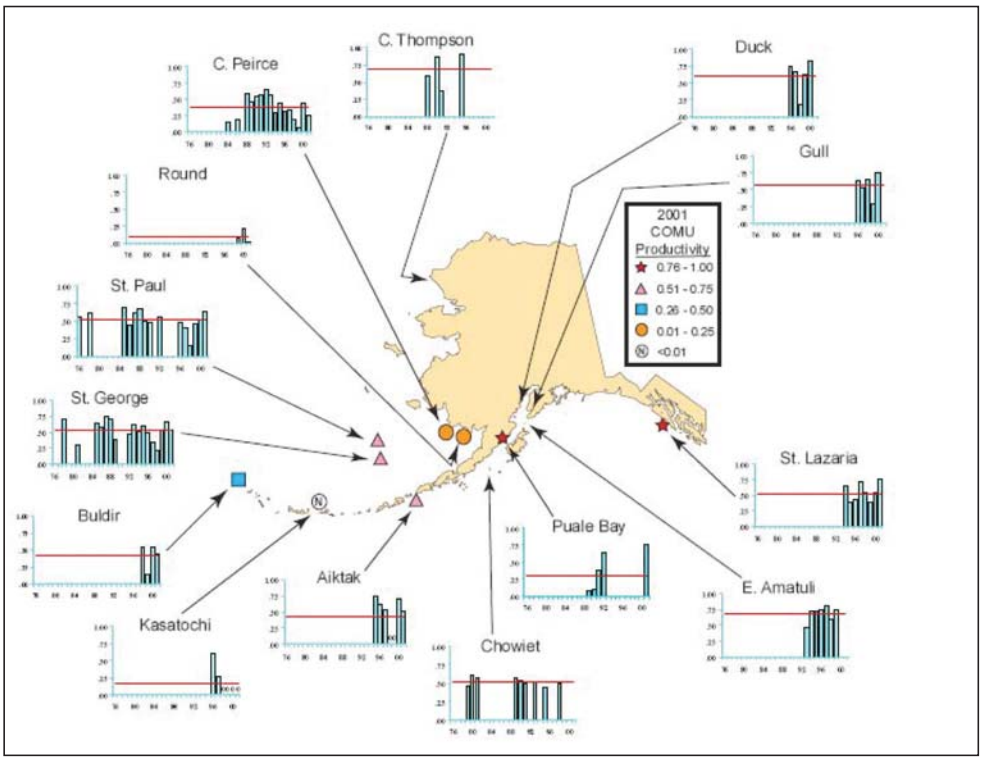
Государственный природный биосферный заповедник «Командорский» и Аляскинский морской национальный заказник объединяет общая цель: охрана морских и наземных биоресурсов на обеих охраняемых территориях.

System of seabird monitoring using standardized methods

Seabird chronology across region



Seabird productivity across region

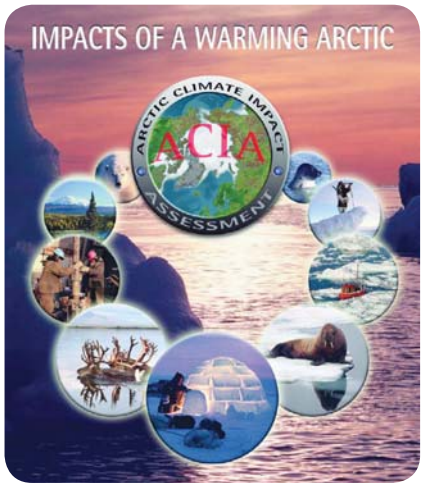


Madrid, 8 February 2008
Original: English

Madrid Declaration on the UNESCO Man and the Biosphere (MAB) Programme and the World Network of Biosphere Reserves (WNBR)

We the representatives of UNESCO Member States, biosphere reserves, and co-operating public and private sector institutions and civil society organizations gathered at the 3rd World Congress of Biosphere Reserves and the 20th session of the International Co-ordinating Council (ICC) of the MAB Programme during 4-8 February 2008 in Madrid, Spain,

- Capitalize upon the potential for action of biosphere reserves to address new challenges such as the loss of traditional knowledge and cultural diversity, demography, loss of arable land, climate change, biodiversity and sustainable development; and, in particular, as places for investments and innovation to mitigate and adapt to climate change, to promote the greater use of renewable energy in sustainable futures of rural and urban areas and to enhance and capitalize upon ecosystem services and products in sustainable development for human well-being;
- Build effective partnerships in biosphere reserves through cooperation among all governmental levels, private sector, mass media, civil society organizations, indigenous and local communities, research, monitoring and education centers and other such institutions for the implementation of the Madrid Action Plan during 2008-2013.



"Improving Future Assessments":
• Long-term monitoring
• International linkages

oromanenko@alaska.net

Session 2

Climate Change Impacts & Adaptation in Coastal and Island Biosphere Reserves

Dr. Kwang-Sik Choi
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Ram Boojh, Ph.D.
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UNESCO New Delhi, India

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Dr. Hong Sun-Kee and Ms. Kim Jae-Eun
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•

Ms. Ho Thi Yen Thu
Deputy Director, Centre for Marine-life Conservation and
Community Development (MCD), Vietnam

•

Mr. Romeo B. Dorado
OIC-Executive Director, Palawan Council for Sustainable Development Staff,
Palawan Center for Sustainable Development, Philippines

•

Mr. Koen Meyers
Technical Adviser for Environmental Sciences,
UNESCO Office, Jakarta, Indonesia

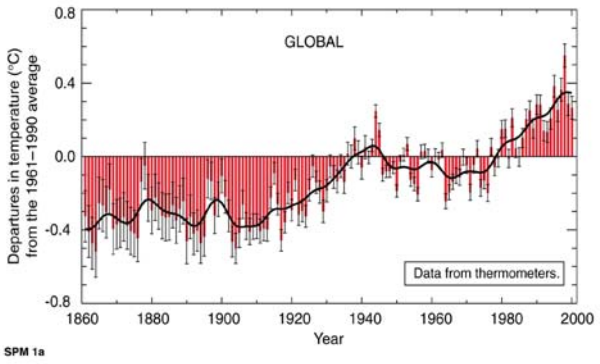
Climate Warming and Outbreak of Perkinsus olseni Disease in Manila Clams

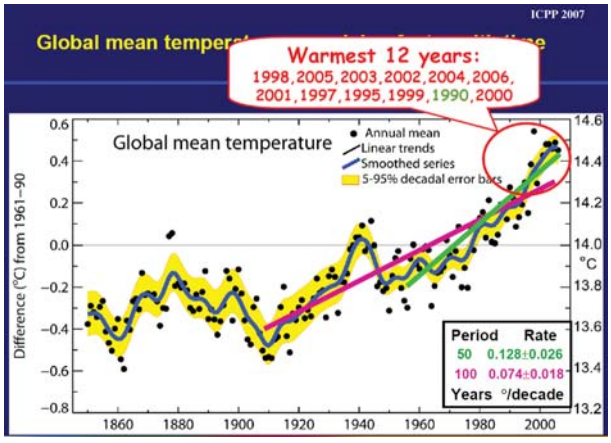
Dr. Kwang-Sik Choi
School of Applied Marine Science
Cheju National University, Republik of Korea

Abstract

Reports on the disease outbreaks in marine organisms have been increased in the past few decades and the outbreaks are often linked with the sea surface temperature increase (SST). In particular, northward range extension of warm water parasite has been observed along the coastal waters and in part, SST increase is responsible for the northern extension. *Perkinsus olseni* is a warm water protozoan parasite infecting some commercially important shellfish species including Manila clam, *Ruditapes philippinarum* in Portugal and Spain and the Australian black lip abalone, *Haliotis rubra*. In Korea, *P. olseni* was first discovered from a clam population located on the west coast near Kunsan in 1995. In 2007 a nation-wide survey was carried out to understand levels of *P. olseni* infection among clam populations in coastal Korean waters and the results were compared with the survey results of 1997. The 2007 survey results indicated that *P. olseni* infection among clam populations in major clam beds in Gyeonggi and Chungcheong Provinces was significantly higher than the level recorded in 1997. Mass mortalities of clams were also observed along the coastal Gyeonggi and Chungcheong Provinces for the past few years. Several studies have suggested that the clam mortalities were linked with the high level of parasitic infection and relatively warmer winters could enhance proliferation of the parasite during the warm winter period. The present study also introduces other cases of shellfish diseases observed from clams in Korean waters for the past decade and the possible impacts of the warm climate on the outbreaks.

Variations of the Earth's surface temperature for the past 140 years





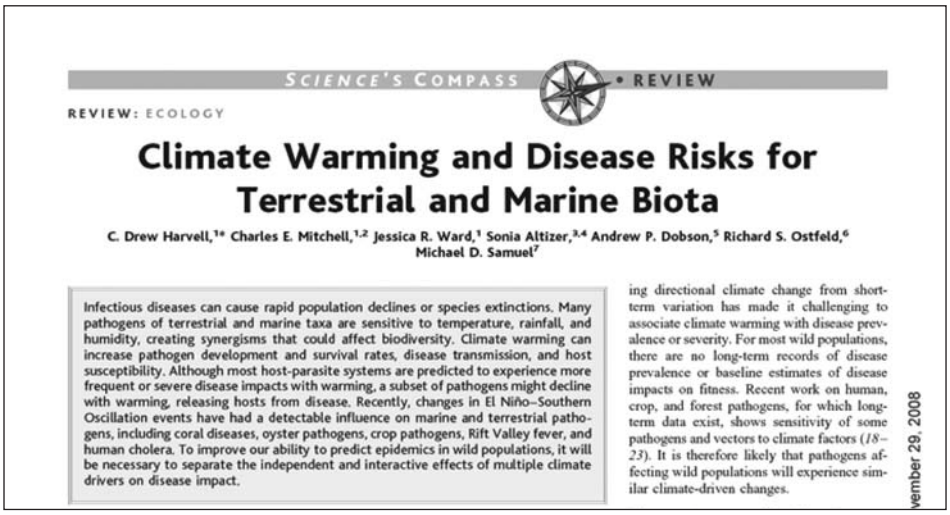
Sea Surface Water Temperature Changes in Korean Water

- According to National Fisheries Agency of Korea, sea surface temperature (SST) in Korean waters has increased by 0.9 ^{0}C for the past 4 decades; Annually, the SST has been increased by 0.024 ^{0}C in Korean waters.

- SST increase in East Sea; 0.002 ^{0}C/year, West Sea; 0.024 ^{0}C/year, South Sea; 0.026 ^{0}C/year for the past 38 years. Accordingly, SST increased 0.82 ^{0}C in the East Sea, 0.91 ^{0}C in the West Sea and 0.98 ^{0}C in the South Sea.
- Impacts of SST increase in Korean waters for the past decades; northward extension of some warmer water fishes to the northern areas, emergence of large jellyfishes off the South Sea, and increase in mass mortalities of shellfishes in coastal areas.

SST Associated Epidemic Disease Outbreak in Shallow Coastal Region

- Northward extension of warmer water fish and shellfish pathogens have been reported world-wide;
- Outbreak of epidemic fish and shellfish disease in shallow coastal areas increased for the past few decades;
- SST increase due to climate warming is believed to be assoiciated with the current disease outbreaks.



SCIENCE'S COMPASS • REVIEW

REVIEW: ECOLOGY

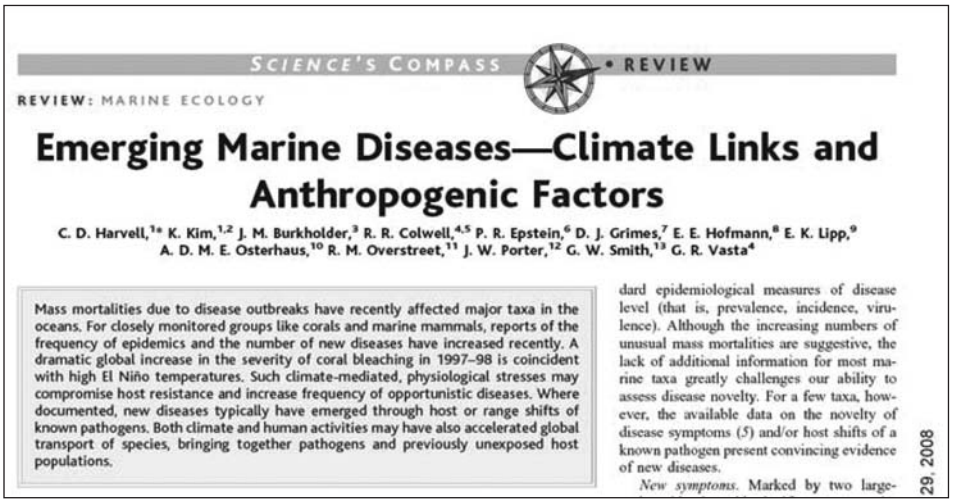
Climate Warming and Disease Risks for Terrestrial and Marine Biota

C. Drew Harvell,[1]* Charles E. Mitchell,[1,2] Jessica R. Ward,[1] Sonia Altizer,[3,4] Andrew P. Dobson,[5] Richard S. Ostfeld,[6] Michael D. Samuel[7]

Infectious diseases can cause rapid population declines or species extinctions. Many pathogens of terrestrial and marine taxa are sensitive to temperature, rainfall, and humidity, creating synergisms that could affect biodiversity. Climate warming can increase pathogen development and survival rates, disease transmission, and host susceptibility. Although most host-parasite systems are predicted to experience more frequent or severe disease impacts with warming, a subset of pathogens might decline with warming, releasing hosts from disease. Recently, changes in El Niño–Southern Oscillation events have had a detectable influence on marine and terrestrial pathogens, including coral diseases, oyster pathogens, crop pathogens, Rift Valley fever, and human cholera. To improve our ability to predict epidemics in wild populations, it will be necessary to separate the independent and interactive effects of multiple climate drivers on disease impact.

ing directional climate change from short-term variation has made it challenging to associate climate warming with disease prevalence or severity. For most wild populations, there are no long-term records of disease prevalence or baseline estimates of disease impacts on fitness. Recent work on human, crop, and forest pathogens, for which long-term data exist, shows sensitivity of some pathogens and vectors to climate factors (*18–23*). It is therefore likely that pathogens affecting wild populations will experience similar climate-driven changes.

vember 29, 2008



SCIENCE'S COMPASS • REVIEW

REVIEW: MARINE ECOLOGY

Emerging Marine Diseases—Climate Links and Anthropogenic Factors

C. D. Harvell,[1]* K. Kim,[1,2] J. M. Burkholder,[3] R. R. Colwell,[4,5] P. R. Epstein,[6] D. J. Grimes,[7] E. E. Hofmann,[8] E. K. Lipp,[9] A. D. M. E. Osterhaus,[10] R. M. Overstreet,[11] J. W. Porter,[12] G. W. Smith,[13] G. R. Vasta[4]

Mass mortalities due to disease outbreaks have recently affected major taxa in the oceans. For closely monitored groups like corals and marine mammals, reports of the frequency of epidemics and the number of new diseases have increased recently. A dramatic global increase in the severity of coral bleaching in 1997–98 is coincident with high El Niño temperatures. Such climate-mediated, physiological stresses may compromise host resistance and increase frequency of opportunistic diseases. Where documented, new diseases typically have emerged through host or range shifts of known pathogens. Both climate and human activities may have also accelerated global transport of species, bringing together pathogens and previously unexposed host populations.

dard epidemiological measures of disease level (that is, prevalence, incidence, virulence). Although the increasing numbers of unusual mass mortalities are suggestive, the lack of additional information for most marine taxa greatly challenges our ability to assess disease novelty. For a few taxa, however, the available data on the novelty of disease symptoms (*5*) and/or host shifts of a known pathogen present convincing evidence of new diseases.

New symptoms. Marked by two large-

29, 2008

Estuarine, Coastal and Shelf Science (1998) **46**, 587–597

The Relationship Between Increasing Sea-surface Temperature and the Northward Spread of *Perkinsus marinus* (Dermo) Disease Epizootics in Oysters

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[a]*Rutgers University, Institute for Marine and Coastal Sciences, P.O. Box 231, New Brunswick, New Jersey 08903, U.S.A.*
[b]*Center for Coastal Physical Oceanography, Crittenton Hall, Old Dominion University, Norfolk, Virginia 23529, U.S.A.*
[c]*Rutgers University, Haskin Shellfish Research Laboratory, 6959 Miller Ave., Port Norris, New Jersey 08345, U.S.A.*

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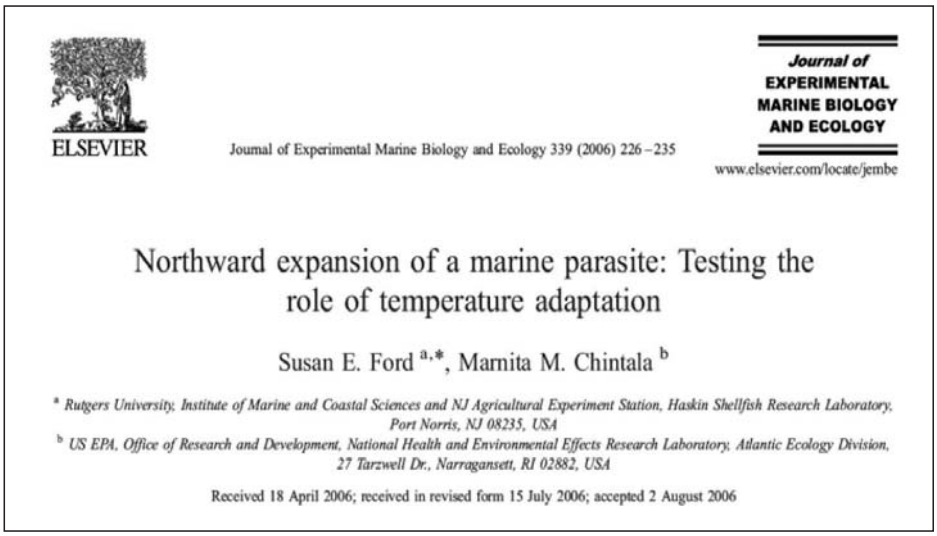

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Journal of Experimental Marine Biology and Ecology 339 (2006) 226–235

Journal of EXPERIMENTAL MARINE BIOLOGY AND ECOLOGY

www.elsevier.com/locate/jembe

Northward expansion of a marine parasite: Testing the role of temperature adaptation

Susan E. Ford [a,*], Marnita M. Chintala [b]

[a] *Rutgers University, Institute of Marine and Coastal Sciences and NJ Agricultural Experiment Station, Haskin Shellfish Research Laboratory, Port Norris, NJ 08235, USA*
[b] *US EPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, 27 Tarzwell Dr., Narragansett, RI 02882, USA*

Received 18 April 2006; received in revised form 15 July 2006; accepted 2 August 2006

What is *Perkinsus ?*

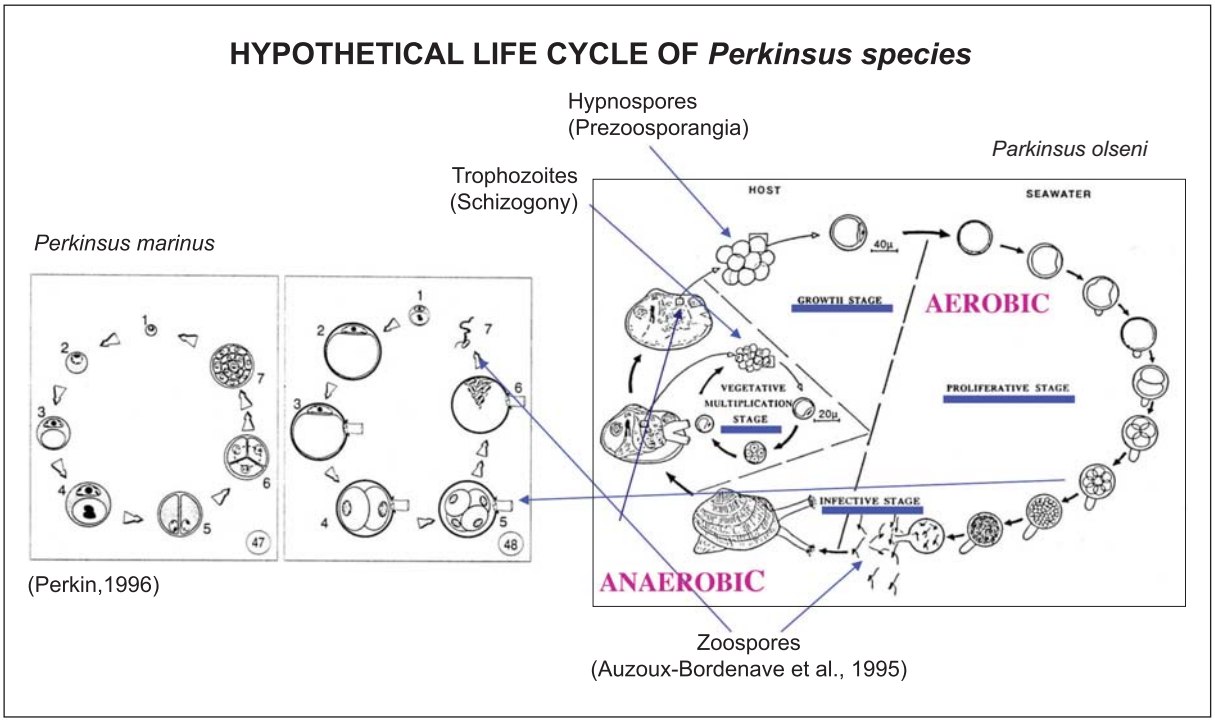
Perkinsus is a parasitic protozoan found in marine molluscs;
Phylum : Apicomplexa (?)
Class : Perkinsia (Levin 1978)
Order : Perkinsidea
Family : Perkinsidae

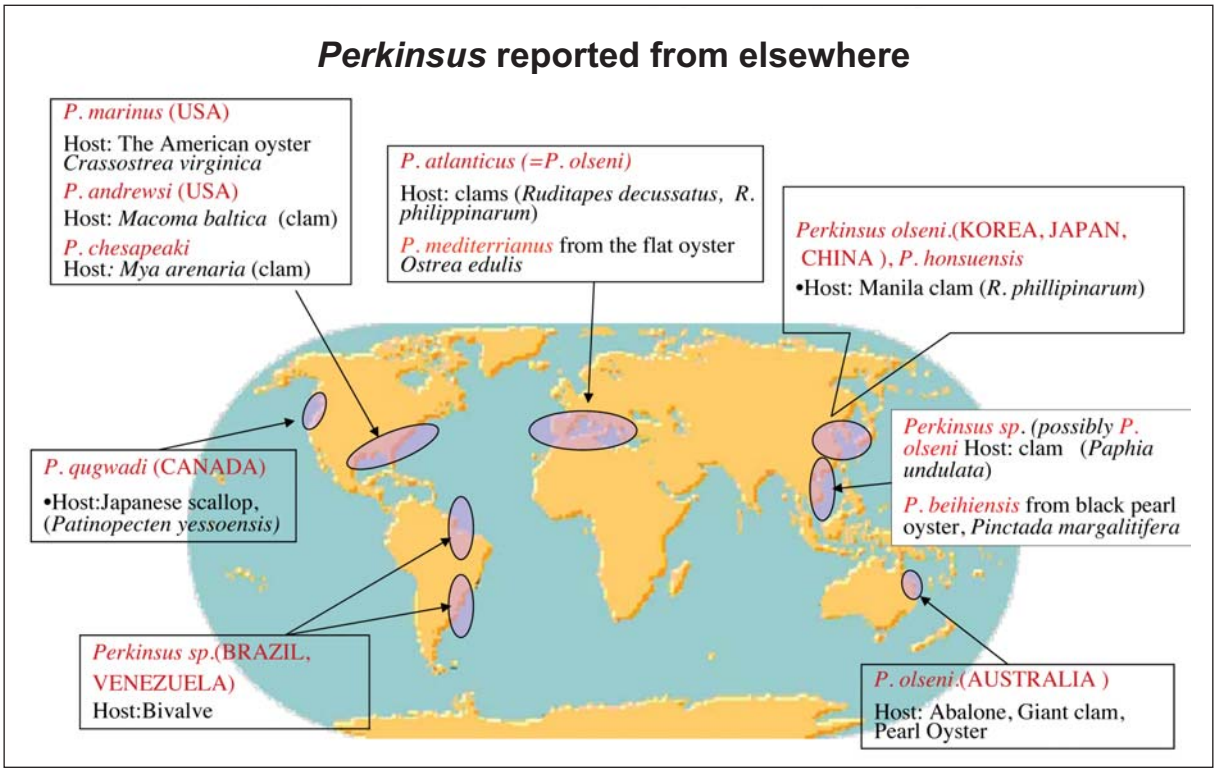
- *Perkinsus* disease was first reported from the American oysters in the Gulf of Mexico in 1950 by Mackin et al;
- Several *Perkinsus* species have been discovered from various marine shellfishes including oysters, clams and abalone since 1980's
- *Perkinsus* favors warmer water temperature and high salinity;
- Spatial distribution of *Perkinsus* is limited by water temperature.

Perkinsus species have been reported to the science,

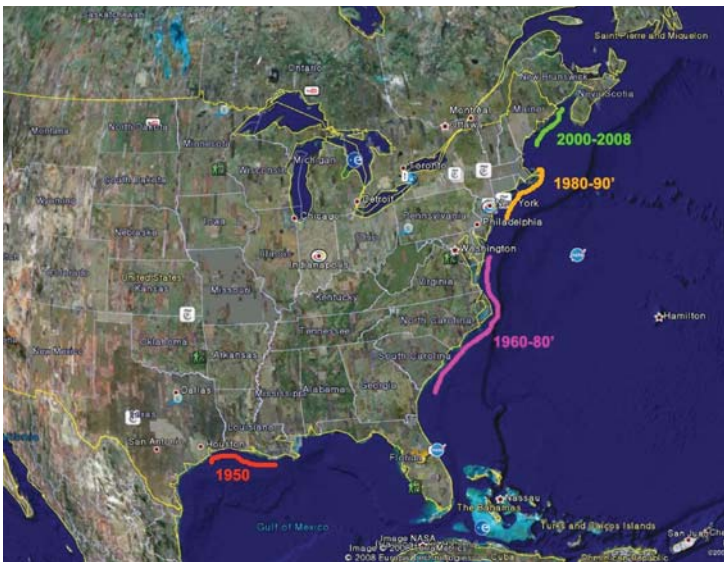
- *Perkinsus marinus* (Mackins, Owens, Collier, 1950): found in *Crassostrea virginica,*
- *Perkinsus olsoni* (Lester and David, 1981): found in Australian black rib abalone, *Haliotis rubra*
- *Perkinsus atlanticus* (Azevedo, 1989): found in the Portuguese little neck clam, *Rutitapes decussatus* in Portugal, later synonymized with *P. olseni*
- *Perkinsus chesapeaki* (McLaughlin et. al, 2000): found in *Mya arenaria* in USA
- *Perkinsus andrewsi* (Coss et. al, in 2001): found in the Baltic clam, *Macoma baltica* in USA

- *Perkinsus mediterrianus* (Villalba et. al, 2005, found in *Ostrea edulis* in Spain)
- *Perkinsus honsuensis* (Reese et. al, 2006) Japanese Manila clam from Honsue Japan
- *Perkinsus bohaiensis* (Reese et. al., 2007) Black pearl oyster in Hainan China





Northward Extension of *Perkinsus marinus* infection in the eastern oyster



Mass mortality of clams in Korean waters

- Recurring mass mortalities of the clams in the clam beds in early spring or late summer.
- Poor condition of the clams; poor growth and reproduction.
- Pathogenic organisms such as *Perkinsus olseni* and *Vibrio tapetis*-like bacteria have been identified from gaping clams as well as physiologically poor clams.

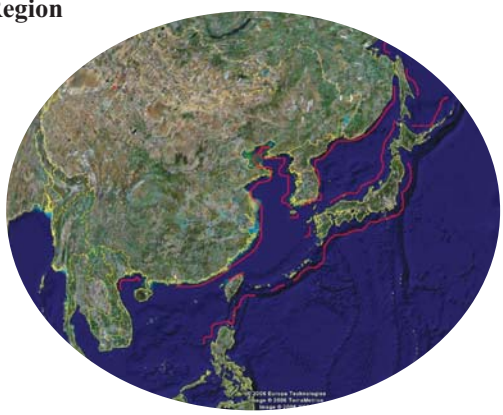
Manila Clam *Ruditapes philippinarum*

- Scientific name; *Tapes, Ruditapes, Venerupis philippinarum,* Common name: Manila clam, short neck, little neck clam , Japanese little neck, Japanese carpet shell
- Commonly occurring on the west and south coast of Korea, as well as in China and Japan.
- Introduced to the west coast of USA and to the European countries including Portugal, Spain, France and Italy
- Considered to be one of the most important species in world shellfish aquaculture industry

Manial Clam *(Ruditapes philippinarum)*

• Indigenous to the coastal Eastern Pacific and the Yellow Sea

***Ruditapes philippinarum* in Pacific Asian Region**



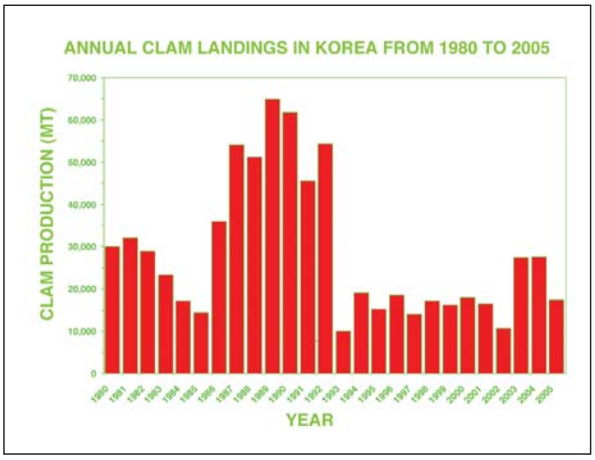
Clam *(Ruditapes philippinarum)* culture grounds in Asia

• Sandy-mud intertidal flats are used as culture ground

Kikuchigawa, Kumamoto Japan Qingdao, China

Clam Culture

- Clam seeds are collected from spat-fall ground
- Seeds are also produced from hatchery
- 5-15mm seeds are sowed on commercial culture grounds
- After 2-3 years of grow-out period, they are harvested manually by local clam growers cooperative
- Whole sale price of 1.5-2.5 Euros and retail price of 3-4 Euros



Mass mortality incidence of clams on the west coast of Korea


서해 가로림만 양식 바지락 집단 폐사

[오마이뉴스 안서순 기자]서해안 가로림만에 위치한 서산 태안지역의 바지락 양식장 수백ha에서 바지락이 집단 폐사돼 관계기관이 원인 조사에 나섰다.

▲ 원인 모르게 폐사한 채 죽어있는 바지락 ©2005 안서순

14일 서산시와 태안군 관계자에 따르면 이 지역의 바지락 양식장에서 지난달 10일께 '양식 중인 바지락이 폐사되고 있다'는 양식어민들의 신고가 있은 이후 지금까지 서산지역의 팔봉·지곡어촌계의 양식장 1500ha(허가 40ha, 비허가 110ha)에서 양식 중이던 바지락 30~90%가 폐


일반 포토

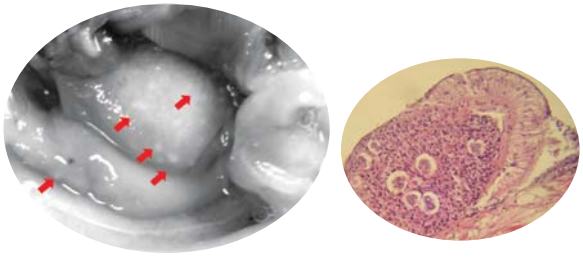
2005.4.14 (목) 17:39 · 연합뉴스

시름에 잠긴 바지락 어민

서해 천수만과 가로림만 갯벌에서 바지락들이 집단 폐사하고 있는 가운데 충남 서산시 팔봉면 호리 송석화(46) 이장이 시름에 잠긴 채 죽은 바지락들을 바라보고 있다./정윤덕/지발/사회/수산/2005.4.14. (서산=연합뉴스)
cobra@yna.co.kr

YONHAP NEWS

Pathogenicity of Parkinsus infection



Mantle epithelium

2007 National Clam Surveillance Program

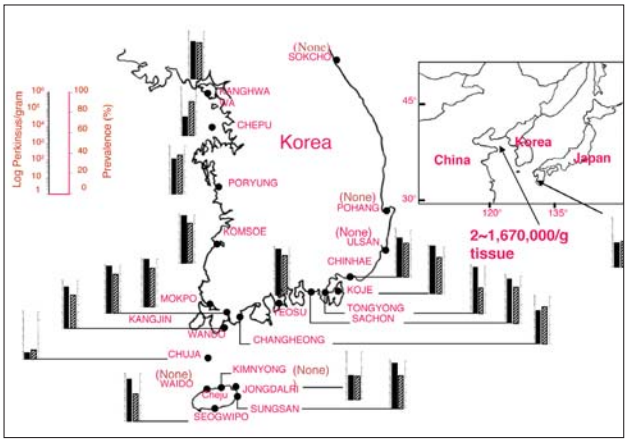
- Funded by Korean Fisheries Agency (NFRDI), Inchon Metropolitan City and the Gyeonggi Province
- Shellfish Research Lab of Cheju National University
- National Fisheries Research and Development Institute, West Sea Institute (NFRDI, West Institute)
- Monthly Sampling of clams from 9 major clam beds along the coastal Yellow Sea
- Pathological, ecological survey for 24 months since January 2007
- Spring/Fall survey on the clam pathology and fatness

The surveillance program includes,

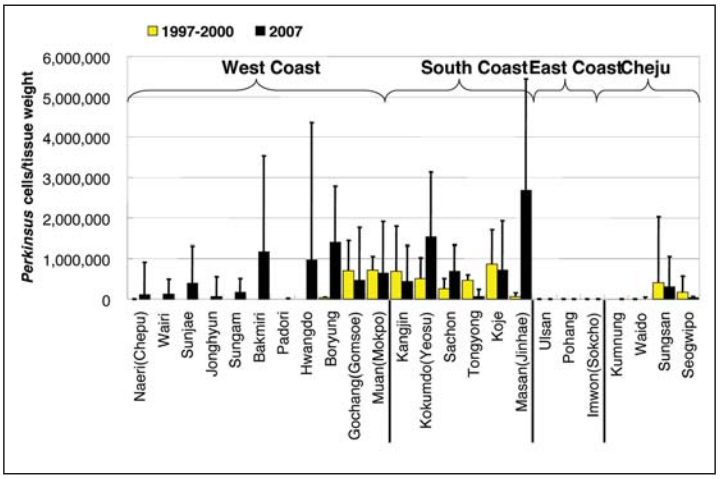
- Perkinsus total body burden/prevalence
- Histopathologic condition of clam
- Clam fatness (condition index=tissue wt/shell dwt)
- Reproductive effort and gonad development
- Proximate Composition of clam tissues
- Brown Ring Disease (BRD)
- Trematod infection
- Other parasitic organisms (cestoda, copepod, etc)
- Clam density
- Chlorophyll level in the sediment
- Sediment types of the clam bed
- Predators and benthic ecology of the clam beds

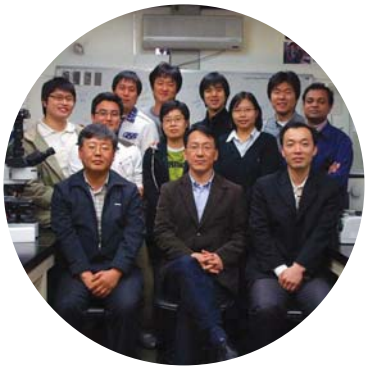
Sampling sites

***Perkinsus olseni* infection survey during 1997-2002**



***Perkinsus* infection intensity-Nation-wide survey**





?

- *P. olseni* infection prevalence and intensity in Korean water increased for the past 10 years.
- In particular, high level of *P. olseni* in Gyeonggi Bay area become prevalent in 2007.
- Increase in the infection intensity and prevalence observed in Korean water for the past decade is believed to be associated with sea surface water temperature increase and relatively warm winter period due to the warming.

Staffs of the Shellfish Research and Aquaculture Laboratory

Acknowledgements

- National Fisheries Research and Development Institute (NFRDI); West Sea Research Institute for the funding and the sampling efforts.
- Funding from Incheon Metropolitan City.
- Funding from Gyeong-gi Provincial government.

Impacts of Climate Change on the Ngaremeduu Biosphere Reserve, Palau

Ms. Alma Ridep-Morris
School of Marine & Tropical Biology
ARC Centre of Excellence for Coral Reef Studies James Cook University, Australia

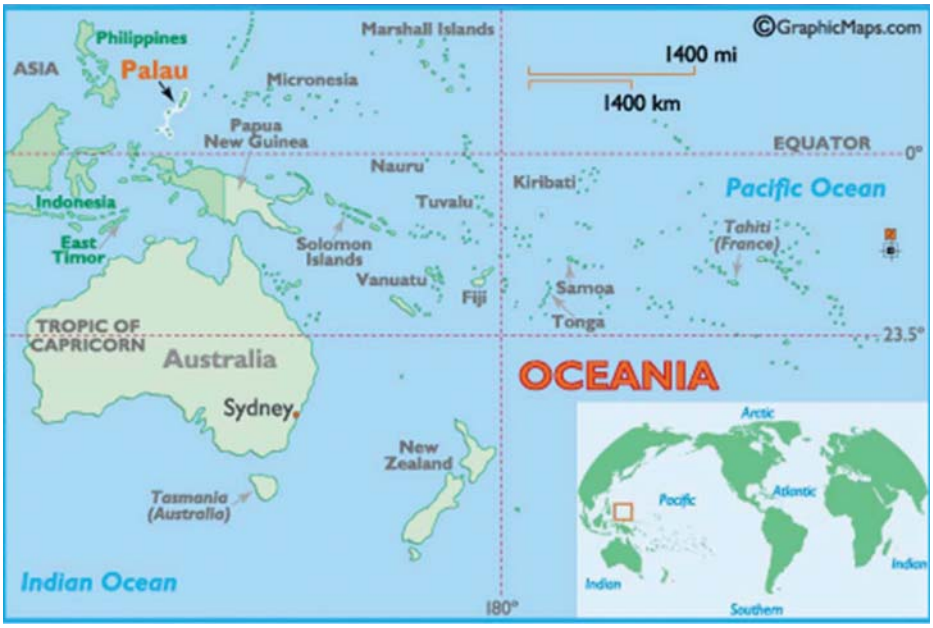
Abstract

Ngaremeduu Biosphere Reserve (NBR), which was officially established in 1999 as Ngaremeduu Conservation Area, was the first Biosphere Reserve designated in the Pacific Region in 2005. It is the biggest protected area in Palau well known for its high biodiversity and multitude of ecosystems. The Ngaremeduu Biosphere Reserve is considered one of the highest biodiversity areas in the Micronesian Region. The diversity of mangroves, corals, fish, seagrass, as well as the presence of endangered species like the dugongs, crocodiles and turtles makes this place one of the most unique areas in Palau. The goal of the Ngaremeduu Biosphere Reserve is to conserve the biological diversity of the area while encouraging sustainable development through a community participatory approach.

However, Palau, as well as many of the Pacific Islands, is extremely vulnerable to climate change. The effects of climate change on Pacific Islands include losses of coastal infrastructure and land, the increase in intensity and frequency of cyclones and droughts, losses of coral reefs and mangroves, decline in coastal fisheries and subsistence crops, and the increase in the spread of certain diseases'. Climate change is very likely to affect the Pacific way of life and the sustainable development of the Pacific Islands.

Therefore, climate change can affect the coastal communities in the Ngaremeduu Biosphere Reserve by affecting the unique biodiversity, for example, extreme weather events such as cyclones, droughts, increased sea surface temperatures and sea level rise can lead to changes in the habitats of plants and animals which may result in the increase of invasive species in the ecosystem. Climate change can also affect the sustainable development of Palau by affecting industries such as tourism, since Palau's economy is very reliant on tourism. Thus the effect of climate change on tourism in Palau will likely include the loss of beaches, degradation of coastal systems, saline intrusion, and damages to critical infrastructure.

Where in the world is Palau?



Palau – one of the diversity hotspots in the Pacific Region

Palau as part of the World BR Network

Ngaremeduu CA/Biosphere Reserve

NGAREMEDUU BIOSPHERE RESERVE, PALAU

1st Biosphere Reserve in the Pacific

Declared 29 June 2005 as a BR

Ngaremeduu Biosphere Reserve Commemorating Ceremony (December 2005)

Ngatpang Governor
Mr. Shallum Etpison

Aimeliik Governor
Mr. Demei Obak

Ngeremlengui Governor
Mr. John Skebong

Final ASPACO meeting Palau,
December 2004

Ngaremeduu BR

Located within (3) states
- Aimeliik
- Ngaremlengui
- Ngatpang

Area – 13,674 ha
Over 25 various ecosystems (mangroves, seagrass, coral reefs, etc.)

Ngaremeduu Conservation Area

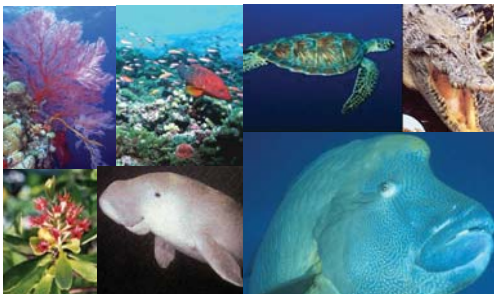
- Initially created in 1997
- Endorsement of traditional leaders, state governors, state legislatures, Palau National Government

FULLFILMENT OF THE THREE FUNCTIONS OF BIOSPHERE RESERVES

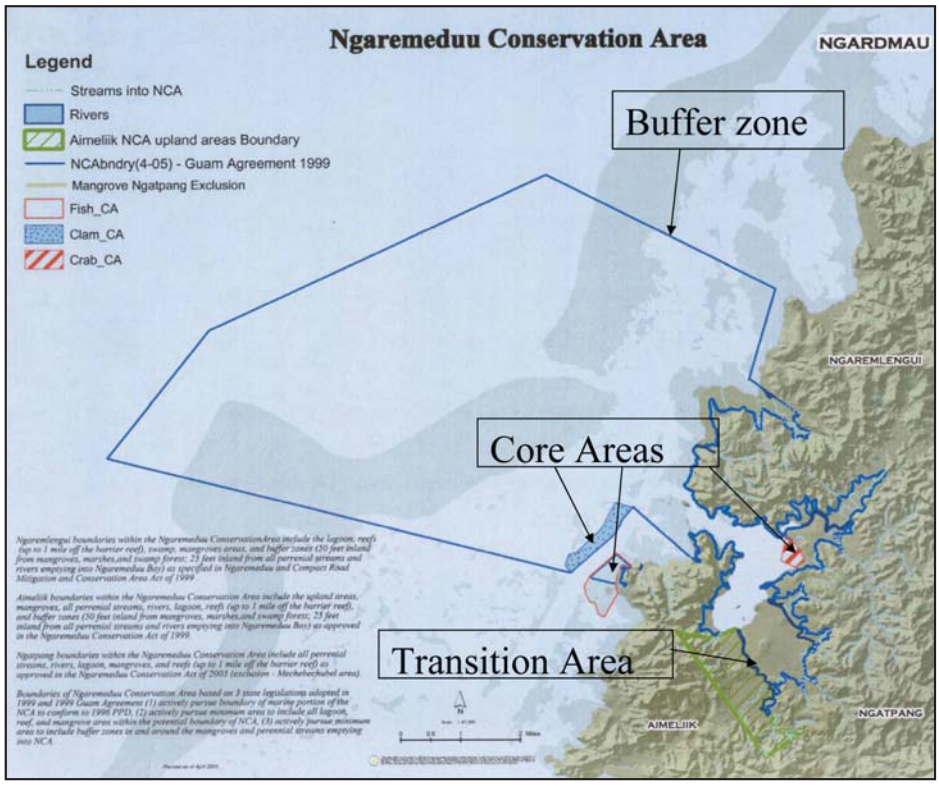
- Conservation - To promote the conservation, protection, and wise management of the diverse and abundant resources within the BR.
- Sustainable Development – Promotion of ecotourism projects within BR, with community involvement.
- Environmental Education – Proactive awareness.

Community Leadership (CACC)

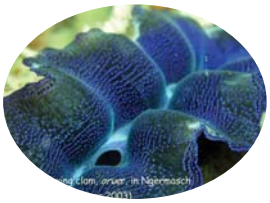
Rich Biodiversity



Ngaremeduu Biosphere Reserve Ngaremeduu zonationszonations

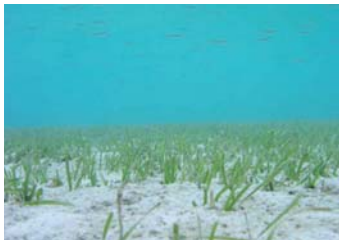


NBR Core Zone consist of Fish CA, Crab CA, and Clam CA (3 MPAs)


Monitoring Programs of NBR


Coral reefs


Sea grasses


Sedimentation rate


Water quality

Coral Reef Surveys

Invertebrates Survey

Monitoring of Local Resources

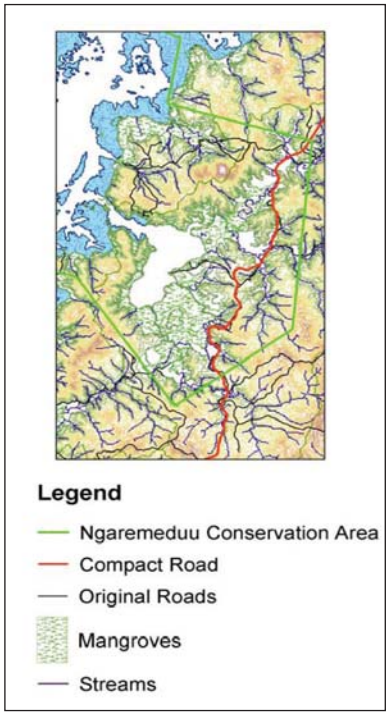
Especially those resources that local people depend upon




Water Quality Monitoring

Linked with sedimentation monitoring

Different freshwater sites both above and below construction for the Compact Road were tested and compared to baseline data.



Sea Grass Monitoring

Community participation in monitoring programs promotes environmental awareness.

Quarterly monitoring of sea grass beds at established sites ensures early detection of potential environmental stressors.

Educational Programs

School visits to raise environmental awareness

- Field trips to the Biosphere Reserve
- Mangrove Video Project with high school students.

Sedimentation Rate Monitoring

When the Compact Road was being constructed, an increase in sedimentation rates in the bay and surrounding reef areas was noticed through studies done by the MCPA program.

NBR Management

• National Government
– MCPA Program is lead agency.
• Local Management
– Conservation Area Coordinating Committee (CACC).
  • Local people appointed by 3 state governors (4 from each state, including traditional leaders, women, youth).
  • Traditional conservation methods observed.

Partnerships

- National Government (MRD, MOF)
- NGOs (TNC, PCS)
- States (communities)
- Donors (UNESCO, SPREP, Nippon Foundation, Pro Natura, and others)
- Others (PICRC, CRRF)

Sustainable Development

- Kayak tours
- Waterfall tours
- Hikes to cultural sites

NBR Ecotours – sustainable tourism

SPREP Brief on Climate Change in the Pacific

Many Pacific islands are extremely vulnerable to climate change, climate variability, and sea level rise and will be among the first to suffer the impacts of climate change and among the first to be forced to adapt or abandon or relocate from their environment. The islands are low lying or have coastal features and characteristics that make them particularly vulnerable to climate change, variability and sea level change. In addition to significant coastal impacts climate change will affect biodiversity, soils and the water supplies of small islands. Most small island states will find it extremely difficult to adaptation to these changing conditions. The impacts will be felt for many generations because of the small island states' low adaptive capacity, high sensitivity to external shocks and high vulnerability to natural disasters.

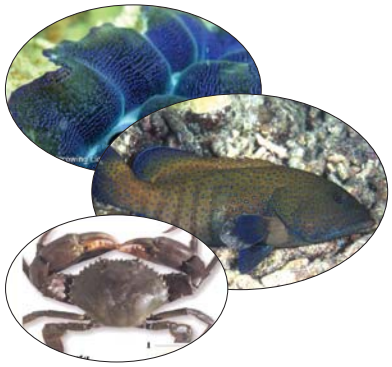
Even with Success, comes Challenges

- Particularly challenges to Small Island nations
  – Climate Change
  – Natural Disasters
  – Environmental degradation

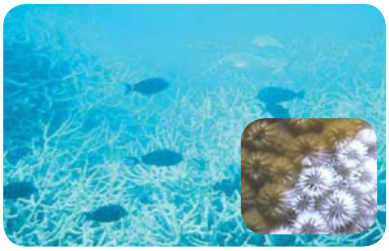
Impacts on NBR Coral Reefs from Climate Change

- Impact to coral reef ecosystems – affect biodiversity
- Impact to fisheries stock
- Local communities livelihoods depends on the health of coral reefs, thus any impacts of climate change can impact the health and economic well-being of residents

Climate Change will affect NBR MPAs biodiversity



Vulnerabilities of the NBR

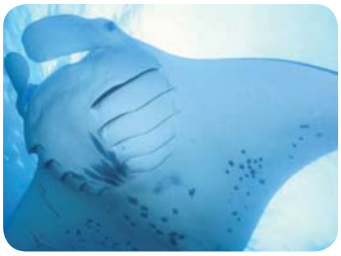


1998 Coral Bleaching Event in Palau

Increased Temperature – Coral Diseases

Increase in Cyclones can lead to sediment runoff from upland areas

Coastal Erosion



Palau and NBR relies on our natural resources for our livelihoods

- Fishery
  - Local fishery
  - Tuna exports
- Agriculture
- Tourism industry

"The economic stability of Palau is based primarily on the management and sustainable development of its tourism, fisheries, and agricultural sectors. Therefore, the stability of Palau's economy is highly dependent on the health of the nation's natural resources, all of which are sensitive to climate change."

Climate Change can affect our fishing industry

Subsistence Fishery

Tuna Offshore Fishery

CC can affect our agriculture

Lessons Learned

Key Components of NBR
- Community Support
- Supportive policies
- Strong science
- Effective management
- Sustainable finance

NBR - Palau – Pacific Region - the World

- Learning platforms for sustainable development – Ecotourism project in Ngaremeduu BR
- Cooperation amongst various stakeholders (managers, communities, scientists, decision makers, etc.) to support the long-term sustainability of the BR
- Meeting global, regional and national targets
  - Mitigating and Adapting to Climate Change
  - Micronesia Challenge: conserve 30% marine resources and 20% terrestrial resources by 2020

Micronesia Challenge

Meeting of the Leaders in Micronesia

We do not inherit the earth
from our ancestors,
We are borrowing it
from our children.

Kom Kmal Mesulang!
Thank You!!

Climate Change and Sunderban Biosphere Reserve in India

Ram Boojh, Ph.D.
Programme Specialist
Ecological & Earth Sciences, UNESCO New Delhi, India

Abstract

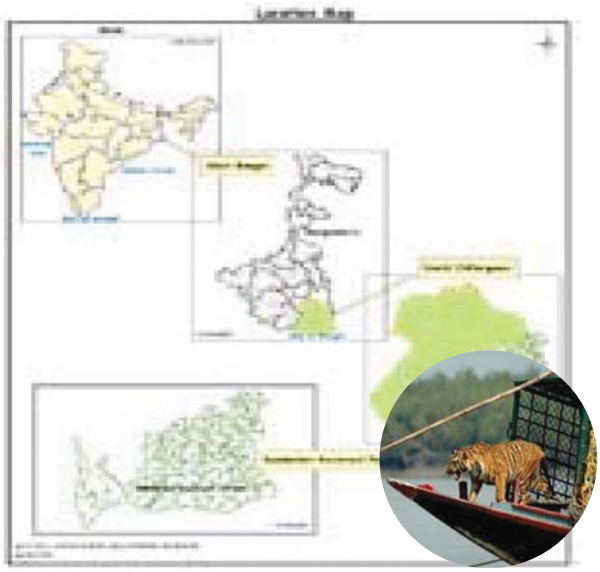
The Sundarban, the largest delta and also the largest halophytic mangrove forest in the world, consists of 10,200 sq km of mangrove forest, spread over India (4200 sq km of reserved forest) and Bangladesh (6,000 sq km of reserved forest). Another 5,400 sq km of non-forest, inhabited region in India, along the north and north-western fringe of mangrove forest, is also known as Sundarban region in India. Hence, the total area of Sundarban region in India is 9,600 sq km which constitutes the Sundarban Biosphere Reserve. The Sundarban literally means "beautiful forest" but many believe that Sundarbans also derived from the Sundari trees (Heritiera fomes) found in Sundarbans in large numbers. The Sundarban was declared as a Biosphere Reserve by the Government of India in 1989 and was included under the UNESCO World Network of Biosphere Reserves in November, 2001. Sundarban National Park, forming the core area of Sundarban Tiger Reserve, received recognition as World Heritage Site by UNESCO in 1987.

The Sundarbans is a unique ecosystem intersected by a complex network of tidal waterways, mudflats and small islands of salt-tolerant mangrove forests. It has extremely rich diversity of aquatic and terrestrial flora and fauna. It is also home to Royal Bengal Tiger. Sundarban's highly productive ecosystem acts as a natural fish nursery. Sundarban Mangrove reduces the fury of cyclonic storm and prevents erosion due to tidal action. Millions of people depend on Sundarban ecosystem for their livelihood and sustenance through fishing, collection of honey and fuelwood/timber. There are currently 100 islands on the Indian side, of which 46 are forested and the rest variably inhabited. The Sundarbans ecosystem is highly fragile and economically valuable. It offers a huge challenge to conservation and sustainable development. The man animal conflict is one of the most intriguing challenges of the area. Straying of tigers from the forested areas into the habitations occasionally result into death of cattle/human beings as well as tiger. There have been instances of killing of humans who enter into the forests for fishing or honey collection. The people have also evolved unique cultural responses to these challenges. The two most famous among them are Dakshin Ray and Banabibi who are worshipped both by Hindus and Muslims before entering the forests.

One of the greatest challenges people living on the Sunderbans may face in coming years is the threat of rising sea levels caused mostly by subsidence and partly by climate change. The 2007 report by UNESCO, "Case Studies on Climate Change and World Heritage" has stated that an anthropogenic 45-cm rise in sea level (likely by the end of the twenty-first century, according to the Intergovernmental Panel on Climate Change), combined with other forms of anthropogenic stress on the Sundarbans, could lead to the destruction of 75% of the Sundarbans mangroves. One of the major islands within the Biosphere reserve the "Sagar Island" is highly endangered due to global warming. It has been reported that the rate of relative sea level rise as measured from the tidal records of the Sagar Islands is found to be 3.4mm per year, which is substantially more than the global average of 1-2mm per year. The rate of sea surface temperature increase is .019 degrees centigrade per year, which might lead to a 1 degree temperature by 2050. As the rate of coastal erosion is found to be strongly correlated with the rate of sea level rise, this implies increased erosion and submergence of the island system. Some of Sunderban islands such as Lohachara and Suparibhanga or Bedford islands and many more are shrinking as the rising water breaches the dykes and another dyke is built inside the previous, thus losing a part of the island. These have made the sinking Sunderban islands one of the first climate

hotspots in India. The poor communities living in these islands are the most vulnerable. The rising sea level will displace the poor populations in low lying islands and coastal areas due to loss of habitation and land.

It is reported that the vulnerability of the Sunderbans to climate impacts is very high in comparison to other coastal areas of India. Over 70,000 people from the Sunderbans are under the risk of losing their habitat permanently due to sea level rise, increased cyclone intensity and flooding by the year 2030. The intensity and frequency of floods during past few years due to swelling rivers fed by monsoon rain, strong winds and rising sea level have led to water overflowing the dykes of 54 human-inhabited islands of Sunderbans causing damage to the standing paddy crops, releasing fish from the ponds, flattening mud houses, killing livestock and making the farmland saline by sea water. A research team has found 82 square km land has gone under water in the estuarine island system over the past three decades. The team found erosion and submergence have been taking place in the twelve sea-facing southern Islands of the Sunderbans in West Bengal, including the largest island of Sagar where a large number of pilgrims gather at Kapilmuni Temple during Ganga Sagar fair in January. Increased salt water intrusion is considered as one of the causes of top dying of Sundari Trees. This impact of sea level rise will further intrude the saline water to landward. The rate of salt water intrusion will also affect the ability of the ecosystem to adapt. The protection of mangroves and planting mangroves in vulnerable areas has been considered as the immediate adaptation measure to arrest coastal erosion and save the Sunderbans.



Sunderban Biosphere Reserve

- Located in the eastern Indian state of West Bengal in vast delta of the Ganges, south of Calcutta & bordering Bangladesh in the east
- Location 210 30' to 210 15'N; 880 10' to 890 10' E
- Total area 9,630 Sq. Km / 963,000 hectares
- Core area 1,690 Sq. Km / 169,000 hectares
- Buffer zone 2,233 Sq. Km / 223,300 hectares
- Largest contiguous mangrove ecosystem (along Bangladesh) in the world

Sunderbans- Unique Ecosystem

- Largest delta & halophytic mangrove in the world, consists of 10,200 sq km of mangrove forest, spread over India (4,200 sq km of reserved forest) and Bangladesh (6,000 sq km of reserved forest).
- Sundarban means "beautiful forest" also linked to Sundari trees *(Heritiera fomes)* found in large numbers.
- A national Biosphere Reserve in1989; UNESCO WNBR in 2001 & World Heritage Site in 1987.

The People

- 102 islands, 48 are inhabited
- Population mainly migrant settlers from Bangladesh and southern West Bengal for last 60 - 120 years
- Major livelihood activities are:
  - Agriculture
  - Fishery
  - Wood Collection
  - Honey Collection

The Land and People

- Most backward area - most part without Power & basic infrastructure.
- Livelihood-fishing and other natural resources.
- Agriculture mainly rain fed. No natural source of sweet water. One third land mass is water body but saline.
- Population density is high, compounded due to illegal migration from long porous International border.
- Frequent fury of cyclonic storms.

The Rich Flora

The Fauna

The Fauna

Sunderban under stress

- It has the largest mangrove diversity in the world including several threatened floral and faunal species.
- Approximately 4 million people live in Sunderban.
- The community is fully dependent on the forest resources.
- Agriculture is not properly developed due to many reasons.
- Sunderban is under severe stress and the community is quite vulnerable.

Man-Tiger Conflict

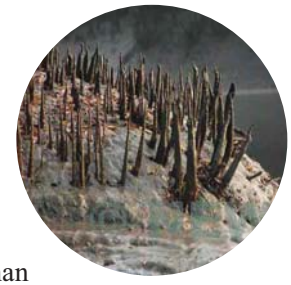
- Conflicts Inside Forest Area: Tiger attacks the fishermen, honey collectors etc. inside the forest area.
- Conflicts Outside Forest Area: Tiger strays into fringe villages and mainly kills live stock. *Rarely human beings attacked or killed.*

Fragile ecology

- The Sundarbans ecosystem is highly fragile and economically valuable.
- It offers a huge challenge to conservation and sustainable development.
- The people have also evolved unique cultural responses to these challenges.
- The two most famous among them are Dakshin Ray and Banabibi who are worshipped both by Hindus and Muslims before entering the forests.

Cimate change issues

- The 2007 report by UNESCO, "Case Studies on Climate Change and World Heritage" has stated that an anthropogenic 45-cm rise in sea level (likely by the end of the twenty-first century, according to the Intergovernmental Panel on Climate Change), combined with other forms of anthropogenic stress on the Sundarbans, could lead to the destruction of 75% of the Sundarbans mangroves.



Observed climate change impacts

Temperature:

- The span of summer season has increased.
- Span of winter has decreased.

Rainfall & Humidity :

- Rainfall has considerably increased (known to be one and half times more than what it was 15 years ago).
- The span of monsoon season has shifted (approximately it is now delayed by 15 - 20 days).
- The number of cloudy & humid summer days has increased.

Sea Level Rise

- Villagers see definite changes in terms of sea level rise
- They have seen sufficient increase in the level of water during high tide (Bhara Kotal).
- Community also talked about settlement of the local habitat and river siltation as major causes for flooding of rivers.

Sea water intrusion

- Intrusion of saline water into the agricultural land - loss of yields & greater risk to the farmer.
- Permanent intrusion causes loss of agricultural land and making people migrate (environmental refugees).
- Change in monsoon pattern causes severe stress on agriculture which is fully dependent on weather.
- Increase in span of summer increases insect attack on crops.
- The delayed winter hampers the cultivation of "Ravi Crop" (winter crops).
- The intrusion of saline water causes severe stress on availability of drinking water.
- Increasing humidity leads to incremental phenomenon of vector borne diseases.

Sagar Island

- Sagar Island is highly endangered due to global warming.
- Rate of relative sea level rise at Sagar Islands is 3.4mm/ year, substantially higher than global average of 1-2mm per year.
- Rate of sea surface temperature increase is .019 degrees centigrade per year, which might lead to a 1 degree temperature by 2050.
- Sea level rise implies increased erosion and submergence of the island system.

Climate Hotspot

- Sinking Sunderban islands one of the first climate hotspots in India.
- Some of islands eg. Lohachara & Suparibhanga or Bedford islands are shrinking as the rising water breaches the dykes and another dyke is built inside the previous, thus losing a part of the island.
- Poor communities most vulnerable- rising sea level will displace the poor populations in low lying islands and coastal areas due to loss of habitation and land.

Vulnerability of Sunderbans to Climate change

- The vulnerability of Sunderbans to climate impacts is very high in comparison to other coastal areas of India.
- Over 70,000 people from Sunderbans are under the risk of losing their habitat permanently due to sea level rise, increased cyclone intensity and flooding by the year 2030.

More Devastating Floods

- Intensity and frequency of floods during past few years due to swelling rivers fed by monsoon rain, strong winds and rising sea level have led to water overflowing the dykes of 54 human-inhabited islands of Sunderbans causing damage to the standing paddy crops, releasing fish from the ponds, flattening mud houses, killing livestock and making the farmland saline by sea water.

Sea level rise

- A research team has found 82 km^2 land has gone under water in the estuarine island system over past three decades.
- Erosion and submergence in 12 sea-facing southern Islands including the largest Sagar where a large number of pilgrims gather at Kapilmuni Temple during Ganga Sagar fair in January each year.
- Increased salt water intrusion is considered as one of the causes of top dying of Sundari Trees.
- This impact of sea level rise will further intrude the saline water to landward. The rate of salt water intrusion will also affect the ability of the ecosystem to adapt.

Strategies

- Reforestation (mangroves) on the mud barrage to make it durable
- Alternative livelihood options for proper substitution of certain livelihood activities like baby prawn/ shrimp catches, timber smuggling etc.
- Capacity building through scientific and organizational intervention in support of indigenous adaptation efforts.

The three things they need the most:

- Alternative Livelihoods Option & Proper Market Linkages.
- Education.
- Primary Health Services.

Adaptation to Climate change

- The protection of mangroves and planting mangroves in vulnerable areas has been considered as the immediate adaptation measure to arrest coastal erosion and save the Sunderbans.

Strategies

- Shifting of farming time in anticipation of shifting of monsoon season - currently an issue as this will lead to lower market demand & price.
- Diversification into different weather resistant crops - not a secure mechanism since realization of money against the crops due lack of market linkages still needs to be addressed.
- Construction and renovation of ponds and canals for rain water harvesting and use in winter cultivation.
- Constructing of mud-barrages around the island to protect it from incursion of saline water - lack of finance and absence of a proper institutional mechanism are major deterrents.

Climate proofing through mangrove plantation

Global Environmental Change and Response Strategy of Island Ecosystem

Dr. Hong Sun-Kee and Ms. Kim Jae-Eun
Institute of Islands Culture
Mokpo National University, Republic of Korea

Abstract

Korea is an island and a coastal country that has more than 3,000 islands and a long coastal line. Especially, the tidal flat ecosystem in West Sea is a unique landscape in Korea Peninsula. Those geomorphologic characteristics have been as a role of important habitats of biological diversity in marine and coastal ecosystems in Korea. Currently, our institute is carrying out a project regarding UNESCO-MAB to designate island and tidal-flat landscapes in Dadohae Maritime National Park area as UNESCO Biosphere Reserve. Island ecosystem (especially small islands) is one of sensible ecosystems to climate change and pollution in the world, therefore, many international societies including IUCN and ILTER pay attention to its dynamics of biodiversity and socio-cultural system changes. It is necessary to establish a strategic solution on island ecosystem change in the world network system. Monitoring system should be developed in the island ecosystem. Monitoring on island ecosystem depends on short-term and irregular project and its research is oriented in fauna and flora, therefore there are very few data on long-term change. Biological diversity and vegetation in island ecosystem in Dadohae Maritime National Park as UNESCO Biosphere Reserve area is important for their vulnerability in East Asia. However, environment changes owing to climate change, pollution and human impact are influencing to biological diversity and fishery as well as island livelihood. Moreover, sea-level rise is critical issue in the most islands in this area, because salt field and some agricultural area are covered in the coastal area of island. International long-term ecological research network (ILTER) is world-wide organization to monitor the changes of biological and physical environments. Real time data on structure and function of ecosystem (from site and station) can be applied to global change simulation model and then researchers can be set up the response strategy on ecosystem change. The Plum Island Ecosystems LTER (PIE LTER, USA) is one of LTER station and good example. They had been an integrated research, education and outreach program with the goal of developing a predictive long-term response of typical ecosystems in Plum Island to changes in climate, landscape and even in sea level rising. Dadohae Maritime National Park area of UNESCO Biosphere Reserve in Korea needs such effective long-term monitoring. Moreover, socio-cultural monitoring is also necessary to get valuable indigenous knowledge on wise-use of natural resources in the coastal and island systems.

A Location of Southwestern Dadohae (多島海)

Ecosystem:
Many Islands
Huge Tidal-flat
Rias-type coastal landscape

Human Resource:
Fishery
Salt field
Fish cultivation
Agriculture

Traditional Land Use in Coastal Area

Forest and sacred places

Maritime cultural diversity

Food Resource Diversity

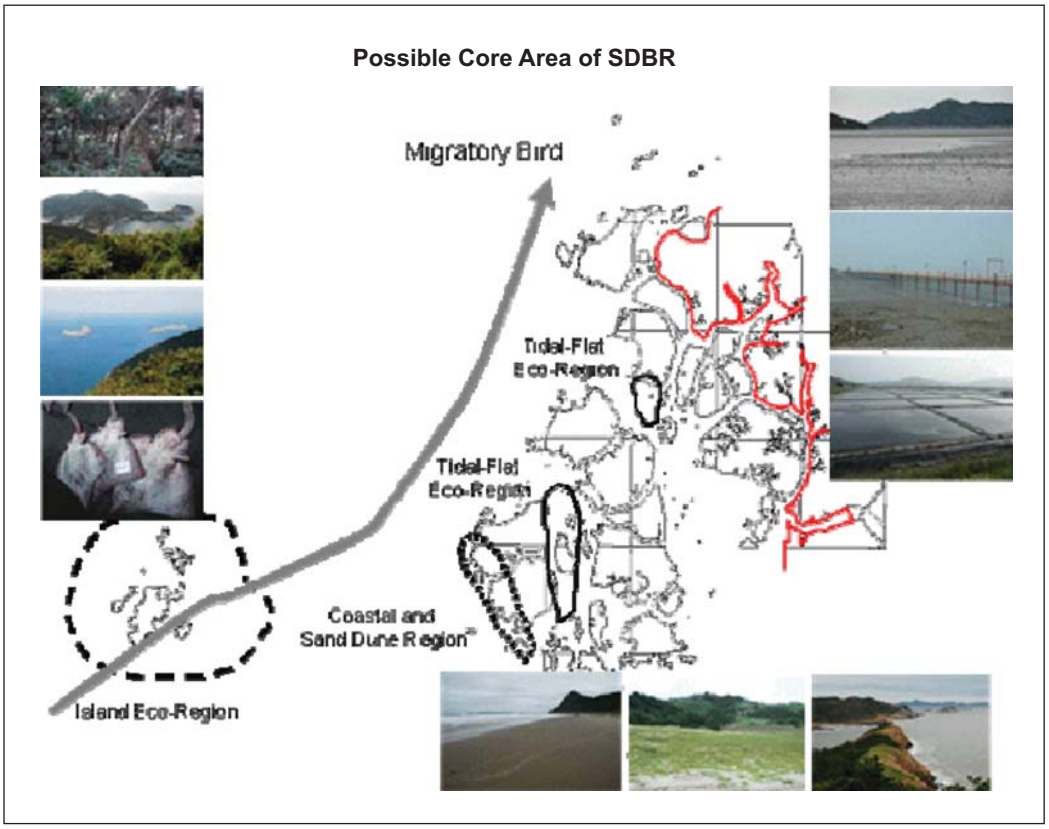
Land Use of Coast and Islands in Southwestern Korea

Type	Number and Size						House and Population	
	Total		*Inhabitat Island		*Inhabitat Island		House	Population
	Number	Size	Number	Size	Number	Size		
Total (A)	3,167	3,912.26	492	3,827.16	2,675	86.30	308,843	833,494
Southwestern Korea (B)	1,989	1,800.09	279	1,755.49	1,688	44.61	83,520	214,692
A/B	62.6%	46.0%	56.7%	45.9%	63.0%	51.7%	27.0%	25.8%

Resource : Government Statistics 2005

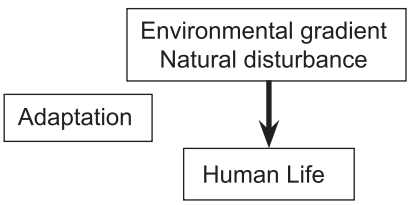
UNESCO Biosphere Reserve Area

Dadohae Marine National Park
"Blue-Green-Human Network"



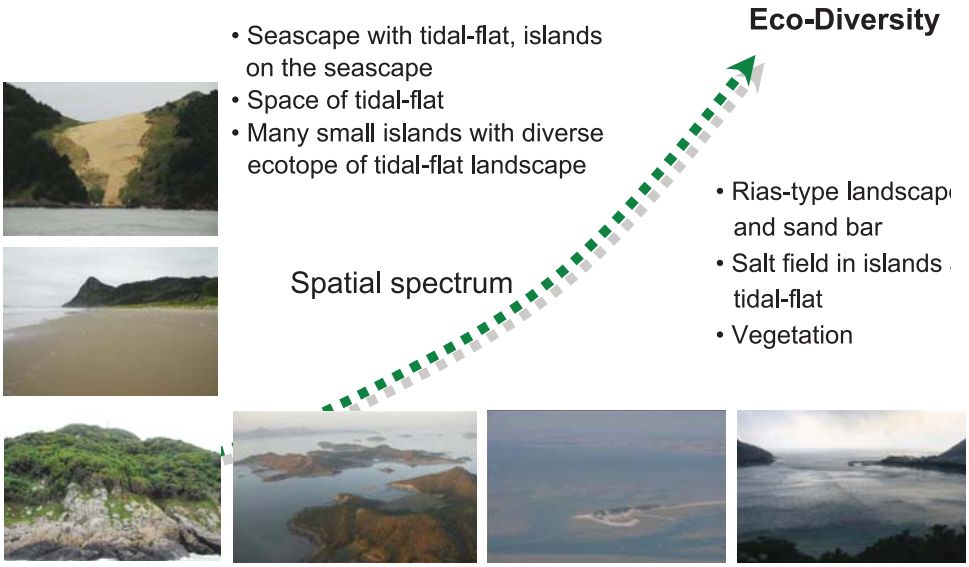
Characteristics of SinanDadohae

1. Geophysical landscape and human adaptation to nature environment





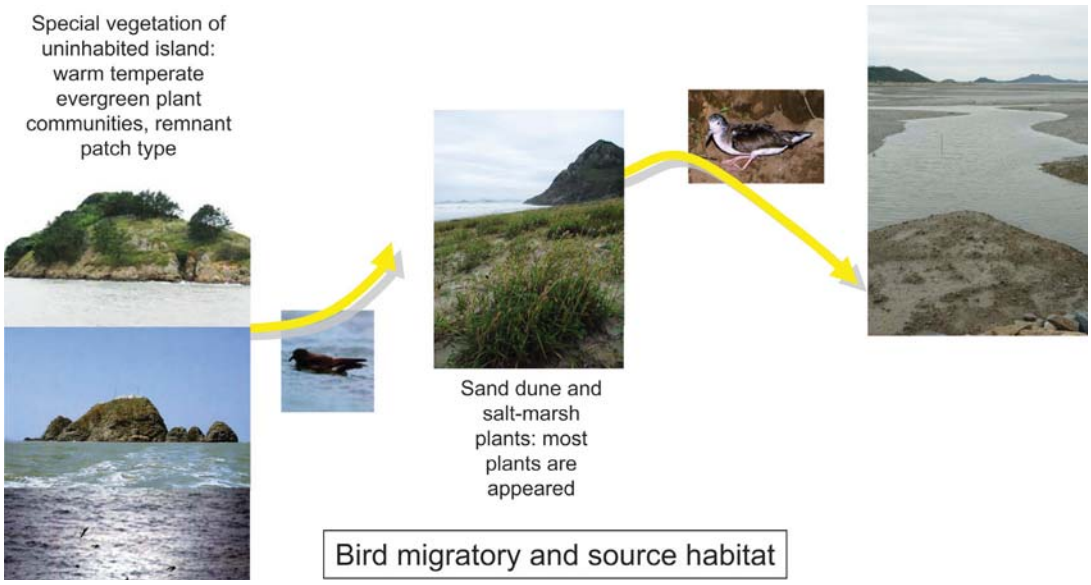

2. Ecological diversity of marine space



3. Salt field: Salt and life space

Salt is paddy field in the tidal flat of coastal landscape
Salt field is socio-ecologically reliable space between tidal flat and island
Conservation of salt marsh plants
Sustainable economy in tidal flat

4. Bio-Space, Biodiversity, and Ecological Network



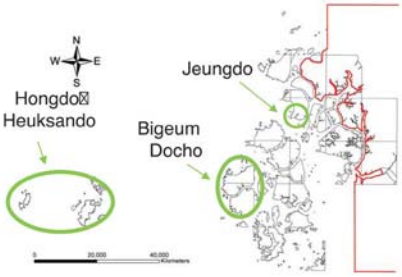
5. People in Tidal-flat

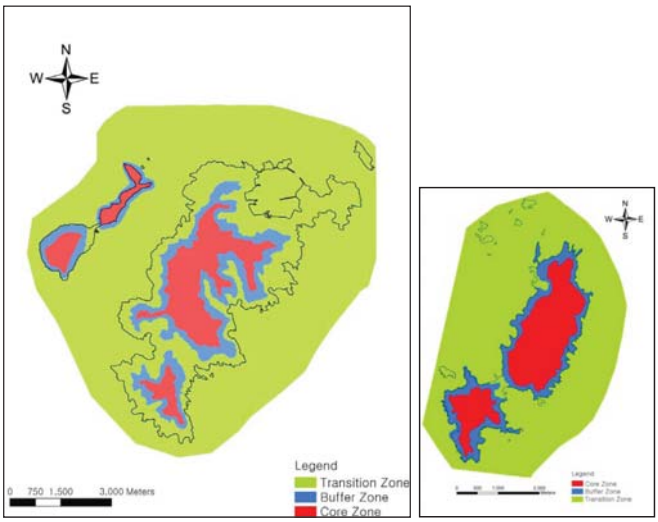
   Beyond the natural resource and daily food
   Ecotourism resource

Sinan Dadohae (多島海) UNESCO Biosphere Reserve
Characteristics of Core Area

Area of Sinan Dadohae Biosphere Reserve

Zone	Region
Total area: 75750ha	
Core Area	Area: 3440ha (4.5%) Hongdo·Heuksando (rare plant habitat and Vegetation)· Chibaldo·Wooiido · Bigeumdo· Jeungdo (Tidal-flat Prefecture Park)
Buffer Area	Area: 26038ha (34.4%) Dadohae Maritime National Park (Hongdo·Heuksando·Wooiido ·Bigeumdo·Dochodo) and a part of Jeungdo
Transition Area	Area: 46272ha (61.1%) Human settlement area and Dadohae Maritime National Park, Hongdo·Heuksando·Wooiido ·Bigeumdo·Dochodo, and Jeungdo



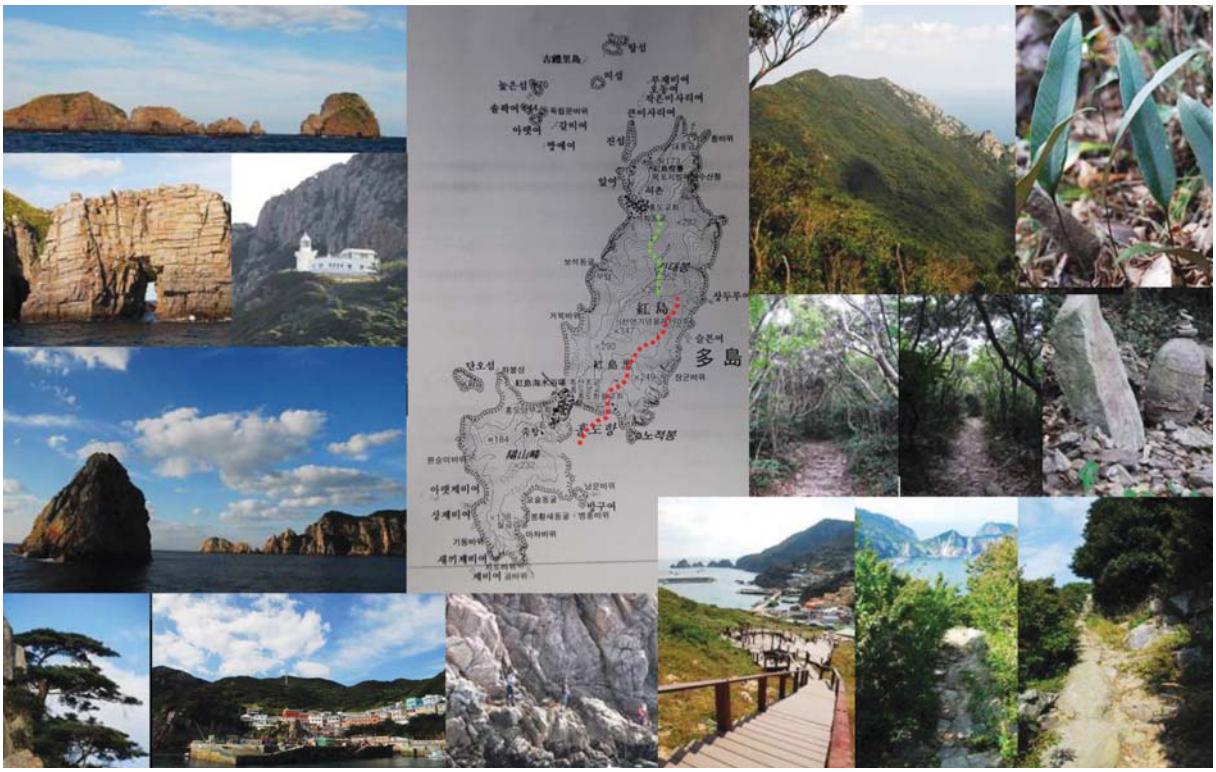


Zone of Biosphere Reserve (1)

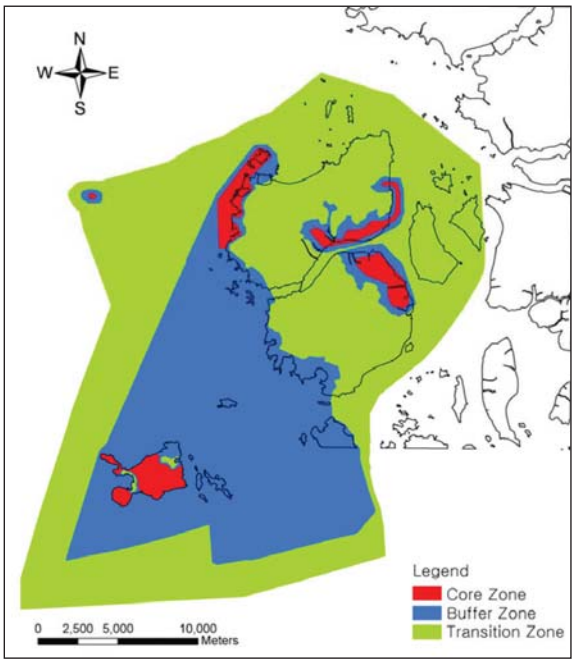
Hongdo • Heuksando

- Core area: Genetic conservation, source habitats for rare plant and valuable plants
- Buffer area: Terrestrial area except for human settlement and coastal area
  - Seascape tourism resource
  - Important area for creating ecotourism service
- Transitional area: human settlement area and marine area
  - Merits: Sustainable development with nature landscape and ecosystem service
  - Weakness : Nothing

Eco-cultural Resource in Hong-Do



Eco-cultural Resource in Heuksan-Do



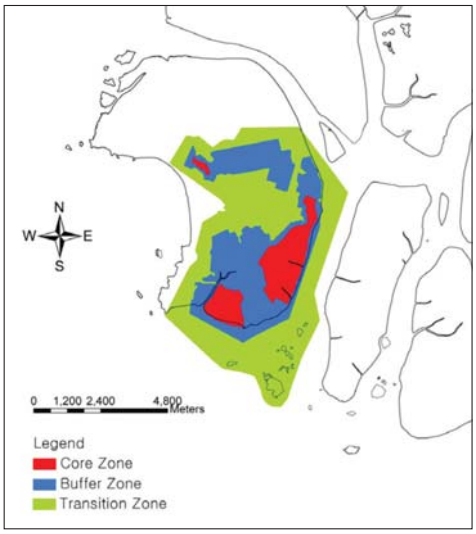
Zone of Biosphere Reserve (2)

Bigeum • Docho-do

- Core area
  - Bigeum: Chilbaldo, Usedo, Tidal-flat area
  - Docho: Wooiido, Terrestrial area
- Buffer area : Area of Dadohae Marine National Park, land-use of tidal flat
  - Sustainable economy in tidal-flat
  - Ecotourism program
- Transitional area:
  - Marine area and tidal flat
  - Sustainable agricultural area

- Merit : Land use of tidal flat for salt field
- Weakness : Nothing

Eco-cultural Resource in Bigeum and Docho-do
(Dadohae Maritime National Park)



Zone of Biosphere Reserve (3)

Jeungdo

- Core area: Excellent area for biodiversity in “Tidal-flat Prefecture Park”
- Buffer area : “Tidal-flat Prefecture Park”
  - Sustainable fishery in tidal-flat area
  - Ecotourism
- Transitional area: human settlement area
  - Salt field area
  - ‘ Slow City’

- Merit : Brand salt production / ecotourism

Eco-cultural Resource in Jeung-do

Expected Effect

Securing ecologically valuable area

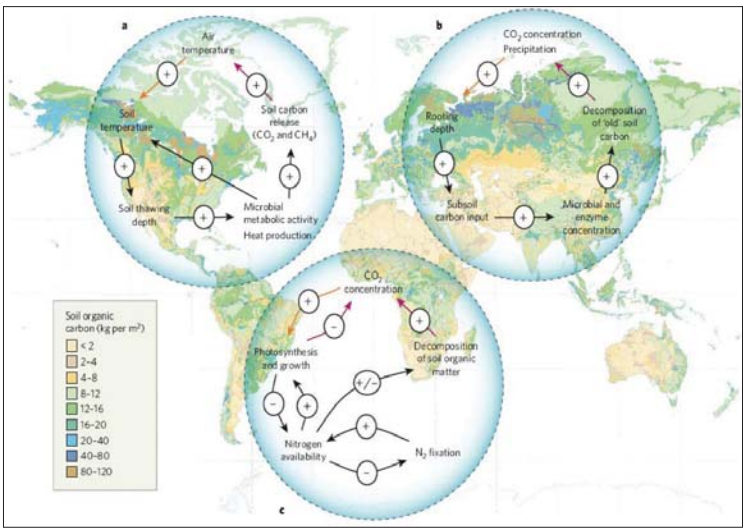
- Conservation of tidal flat of World Class
- Securing biological diversity area

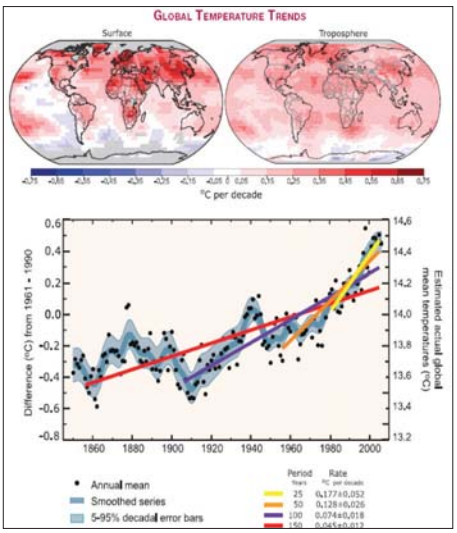
Sustaining indigenous knowledge

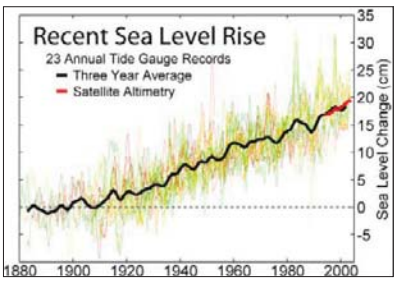
Activation of local economy

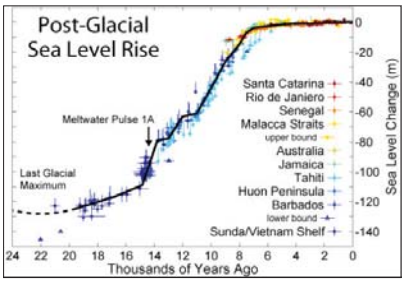
- Sustainable fishery
- Ecotourism development
- Developing UNESCO brand

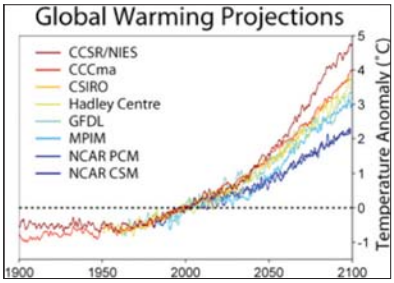
Climate Change









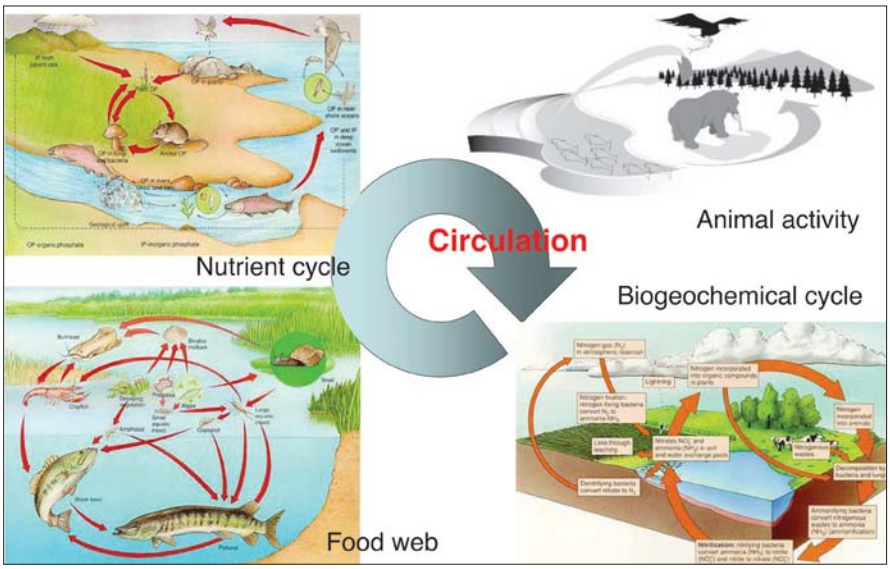


Intergovernmental Panel on Climate Change results
The results from the *IPCC Third Assessment Report* (TAR) sea level chapter (convening authors *John A. Church* and *Jonathan M. Gregory*) are given below.

IPCC change factors 1990-2100	IS92a prediction	SRES prediction
Thermal expansion	110 to 430 mm	
Glaciers	10 to 230 mm[1] (or 50 to 110 mm)[2]	
Greenland ice	–20 to 90 mm	
Antarctic ice	–170 to 20 mm	
Terrestrial storage	–83 to 30 mm	
Ongoing contributions from ice sheets in response to past climate change	0 to 55 mm	
Thawing of permafrost	0 to 5 mm	
Deposition of sediment	not specified	
Total global-average sea level rise *(IPCC result, not sum of above)*	**110 to 770 mm**	**90 to 880 mm (central value of 480 mm)**

[1]"Climate Change 2001: The Scientific Basis". Retrieved on 2005-12-19.
[2] "Climate Change 2001: The Scientific Basis". Retrieved on 2005-12-19.

Importance of Ecosystem Research



Core Area Research in LTER

What are 'Core Areas'?
The Core Areas are five research themes that are central to Long Term Ecological Research Network science. These core areas require the involvement of many scientific disciplines, over long time and broad spatial scales.

Data on the Core Areas is collected at regular intervals over space and time to establish and understand the existing conditions in an *ecosystem* before any kind of experimental manipulation can begin. An understanding of existing conditions is the basis for experimental CORE AREAS:

1) *Primary Production* Plant growth in most ecosystems forms the base or "primary" component of the food web. The amount and type of plant growth in an ecosystem helps to determine the amount and kind of animals (or "secondary" productivity) that can survive there.

2) *Population Studies* A population is a group of organisms of the same species. Like canaries in the coalmine, changes in populations of organisms can be important indicators of environmental changes.

3) *Movement of Organic Matter* The entire ecosystem relies on the recycling of organic matter (and the *nutrients* it contains), including dead plants, animals, and other organisms. Decomposition of organic matter and its movement through the ecosystem is an important component of the food web.

4) *Movement of Inorganic Matter* Nitrogen, phosphorus and other mineral *nutrients* are cycled through the ecosystem by way of decay and disturbances such as fire and flood. In excessive quantities nitrogen and other nutrients can have far-reaching and harmful effects on the environment.

5) *Disturbance Patterns* Disturbances often shape ecosystems by periodically reorganizing or destroying them, allowing for significant changes in plant and animal populations and communities.

Goals of KoFlux

- Establish Korean regional flux network to monitor, analyze, and evaluate carbon and water cycles in key ecosystems in Monsoon Asia ;
- Provide an infrastructure for strategic research cluster in AsiaFlux which will assist proactive decision makings on changing global climate and environment.

KOFLUX KOREA FLUX NETWORK (www.koflux.org)

HOME CONTACT

- home
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  - Overview
  - Research Strategy
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  - Contact
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  - map
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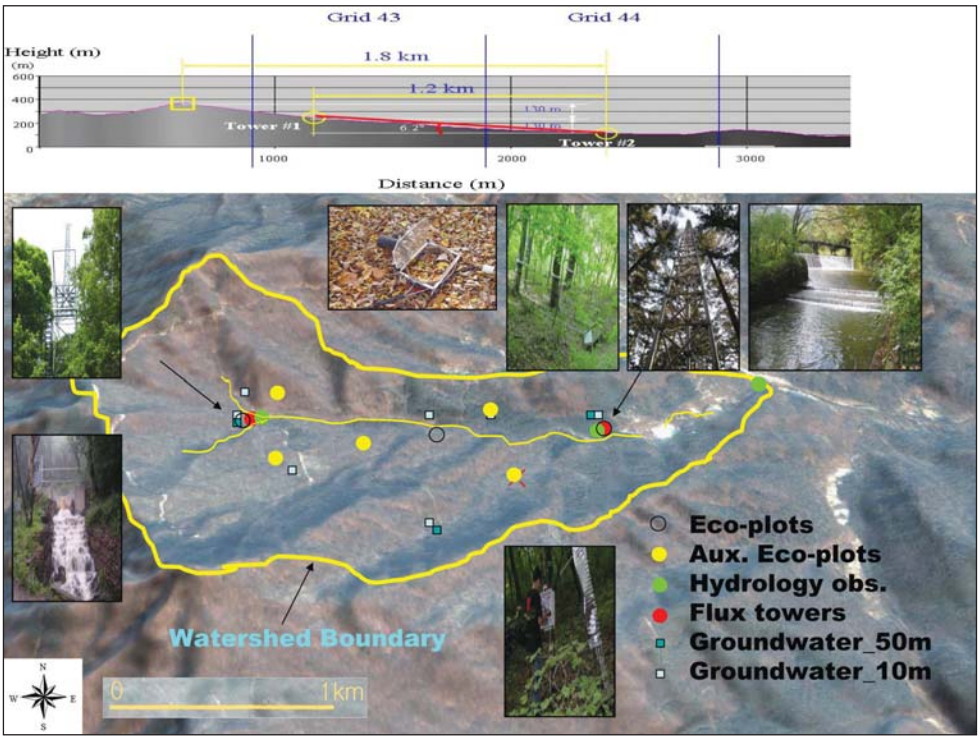
  - Chamber Measurement
  - Hydrological Measurement
  - Ecological Measurement
  - Isotope Measurement
  - Remote Sensing
  - EcoHydrology Modeling
  - SVAT Modeling
- Photo Gallery
- News

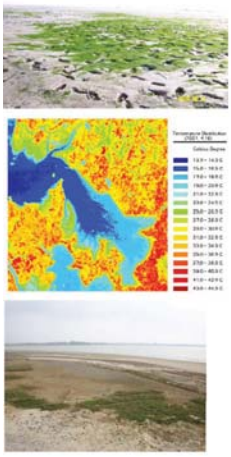
FROM TURBULENCE TO MONSOON

The KoFlux Program is dedicated to understanding the fluxes of energy and matter, net ecosystems production, and water resource management in key ecosystems of Monsoon Asia.

Such work helps the global community make informed decisions in the context of the Kyoto protocol.

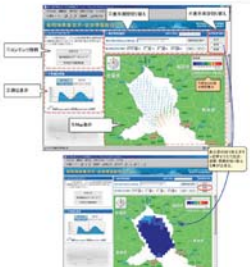


Ministry of Environment
National Long-term Ecological Research
(Tidal Flat Ecosystem, 2003-2013)

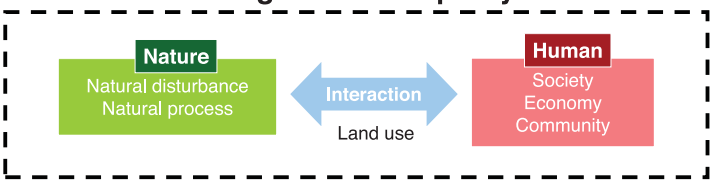


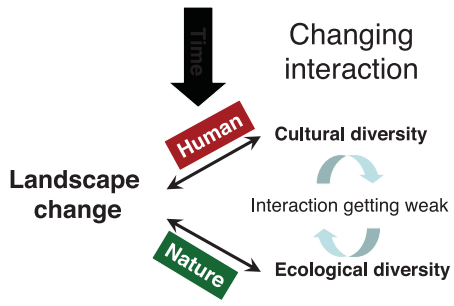
- I.Meteorological data and Environmental factor
- II. GIS and Remote Sensing
- III. Benthic invertebrates
- IV. Diatomes
- V. Marine algae
- VI. Halophyte

Monitoring of Sea Level Rising of Coastal area in western Japan



Monitoring of Landscape Dynamics





Suggested Protocol of Island Ecosystem Monitoring and Research System

- Meteorological Data
- CO^2 Fluctuation
- Sea Level Rising
- Land Use Change
- Biological Diversity
- Socio-Cultural Monitoring
- Research & Education Center

Responding to Climate Change Through Mangrove Conservation and Livelihood Improvement in the Red River Delta Biosphere Reserve

Ms. Ho Thi Yen Thu
Deputy Director Centre for Marinelife Conservation and
Community Development (MCD), Vietnam

These initiatives are co-financed by European Union, Oxfam Novib and McKnight Foundation

Abstract

Mangrove forests, found along the coasts and in most of the biosphere reserves of Vietnam, may become tools for the country in the fight against climate change. Studies reveal that mangroves may sequester more carbon than any other ecosystem on earth, soaking up some of the carbon dioxide that humans generate, and mangroves may increase the resilience of human and habitats to climate change through the various services that they provide.

However, such mangrove forests are being destroyed due to demand of immediate livelihoods of the coastal habitants. In the last 20 years Vietnam has lost more than 2,000 km^2 of its mangrove in wetlands and tidal floodplains mainly through clearing for agriculture and aquaculture, and to a smaller extent for housing material and fuel. This practice is still strongly seen in the Red River Delta area where a UNESCO Biosphere Reserve is located. The challenge lies on how to reduce and eliminate this practice to conserve and develop the mangrove forests while ensuring that the local people still have livelihoods that sustain.

The Centre of Marinelife Conservation and Community Development (MCD) has made its efforts in building up a model of environmental conservation through alternative ecologically friendly livelihoods in the UNESCO Red River Delta Biosphere Reserve. In the last 3 years, the first piloted component of this model has been introducing and implementing community based ecotourism in the area. A continuous improvement process has been designed and followed, at the technical support of MCD and its partners, and at the initiative and ownership of the local communities. Initial results have shown that ecotourism can become a new livelihood, from which the local communities can get income through indirectly and sustainably utilising the services that the mangrove forests and the biosphere reserve can provide, without destroying the ecosystems. Furthermore, part of the profits from ecotourism can come back to protect and develop the mangroves. As such, the model contributes to both mitigation of climate change causes and adaptation to climate change effects in Vietnam.

Contents

About MCD – who we are

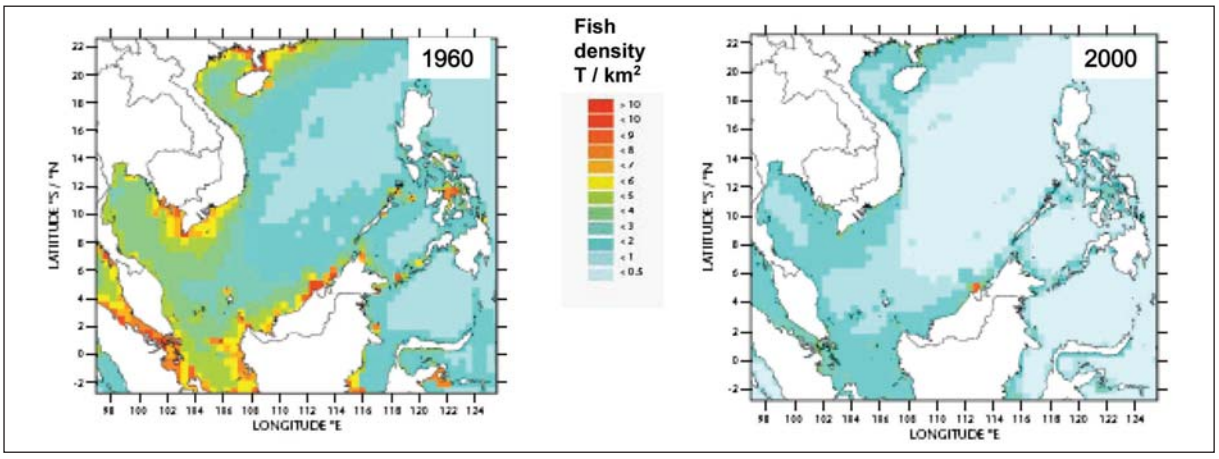
- Vietnamese NGO devoted to marine conservation and coastal community development in Vietnam
- Recognizes interdependency of coastal communities and coastal & marine ecosystems
- Understands the concerns and challenges of the coastal zone
- Connects local needs with available support
- Informs policy makers different levels

About MCD – what drives us

- Coastal ecosystems and biodiversity badly damaged
- Coastal zone highly vulnerable to natural disasters and climate change
- Poverty concentrated in the coastal zone
- Fisheries communities less represented in poverty-reduction programs
- Community conflicts and tensions increasing

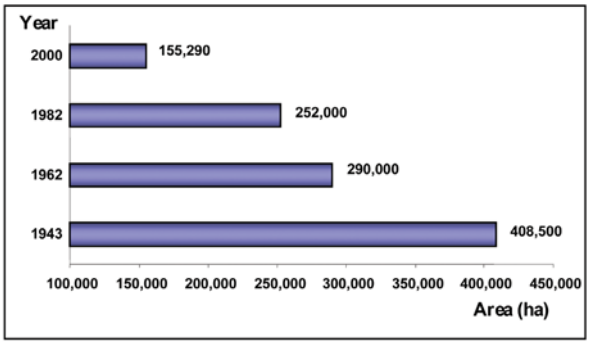
About MCD – what drives us

Where have all the fish gone?

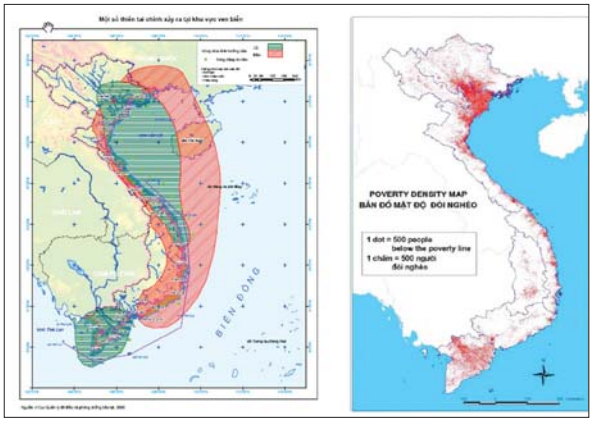


About MCD – what drives us

How about Mangroves?



About MCD – what drives us



About MCD – approaches

- We seek to improve and sustain the quality of life in coastal communities and marine ecosystems through:
  - Enhancing coastal resource management
  - Supporting community development
  - Promoting applied sciences
  - Coordinating education and advocacy

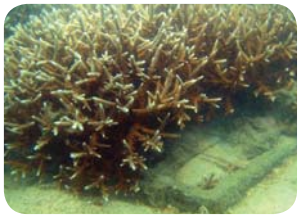
    Applying community based co-management and integrated coastal zone management

About MCD – where we work

- Site selection: people & ecosystems strongly impacted by intense development pressure
- 3 coastal communities: in buffer zones of important coastal nature reserves, focus on the poor fishers and women, most vulnerable, low livelihood resilience:
  - Giao Xuan Commune, Xuan Thuy National Park, Nam Dinh Province (Red River Delta)
  - Nam Phu Commune, Tien Hai Natural Reserve, Thai Binh Province (Red River Delta)
  - Van Hung Commune, Trao Reef Protected Area, Khanh Hoa Province (South Central Coast)

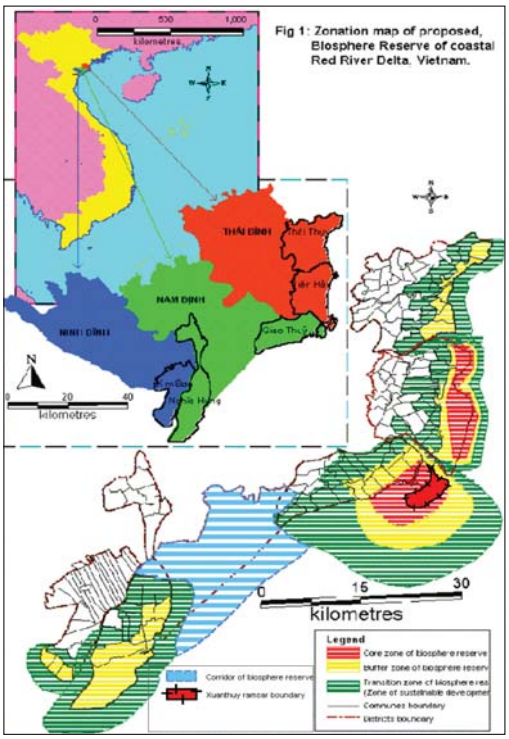
About MCD – where we work

Trao Reef Protected Area, Khanh Hoa



Xuan Thuy National Park, Nam Dinh

Tien Hai Nature Reserve, Thai Binh



Red River Delta Biosphere Reserve

- Full name: Red River Delta Inter-provincial Coastal Wetland Biosphere Reserve
- UNESCO officially designated: 2/12/2004
- Total area: 105,557 ha, 5 districts, 3 provinces
- Population: ~128.000 people

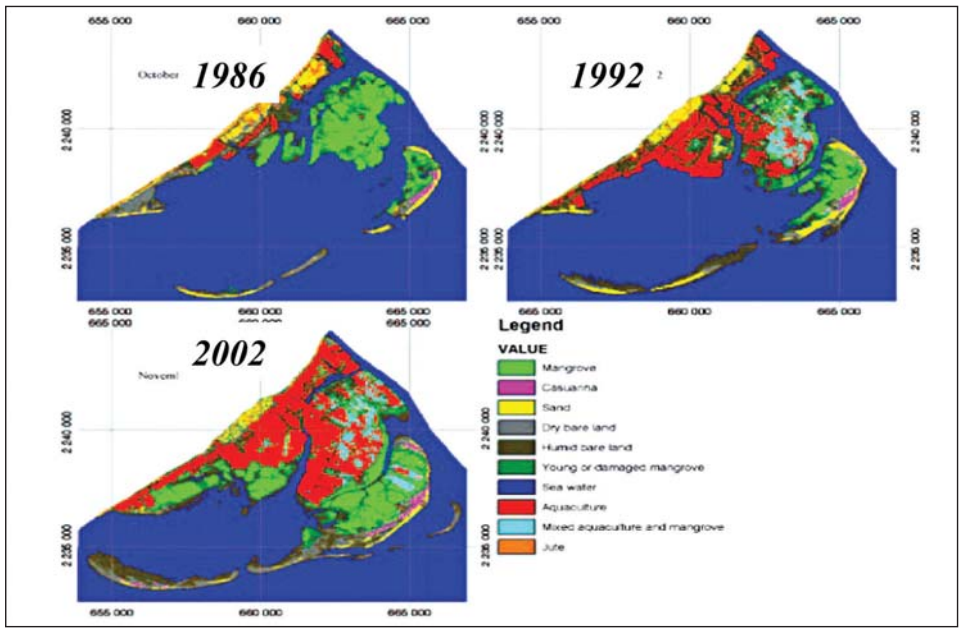
Red River Delta Biosphere Reserve

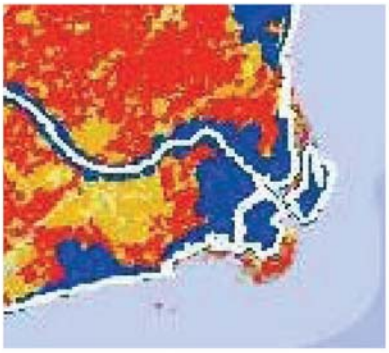
- High biodiversity: 200 bird species (50 migratory, 60 waterfowl, Red Book list species), 9500 ha mangroves, 500 aquatic species
- Rich culture: long history with mysteries, traditional folk arts, local festivals, traditional crafts, architectures, religions

Red River Delta Biosphere Reserve

- Population heavily depends on coastal ecosystem services: food, fuel, housing, safety, recreation
- Poverty: in 5 districts 37-40% (national 29%)
- Mangrove cutting, destructive fishing, water pollution, dams & reservoirs, climate (frost)

Red River Delta Biosphere Reserve
Mangroves and aquaculture?





Red River Delta area

1m SLR inundation
2m 3m 4m 5m

Carew-Reid, 2008

Projected impacts of Sea Level Rise

- 60% (1700 km^2) of coastal wetlands threatened by SLR and heavy impacts on coastal fisheries and communities
- South Central Coast: 194 km^2 inundated (0.6% land area), 75,000 people affected (1.1% population)
- Red River Delta: 340 km^2 inundated, 4.05% land area, 160,000 people affected (1.7% population)

Why does MCD care about CC?

- Coastal ecosystems and the services they provide at the project sites are threatened by CC
- All three communities of MCD projects are at risk from CC
- Unhealthy coastal ecosystems and poor local people are less resilient to CC
- CC impacts may weaken or eliminate the impacts of conservation and livelihood improvement interventions
- CC impacts can be reduced by relevant and timely conservation and livelihood interventions

Climate Change – mitigation

- Conservation efforts: Healthy mangrove forests, coral reefs, sea grass fields act as important carbon sinks
- Community development efforts: Sustainable fisheries practices and livelihood alternatives with less use of fuel and energy, reuse and recycle promotion

Climate Change – adaptation

- Conservation efforts: to increase the resistance and resilience of coastal ecosystems
  - Maintain fisheries resources & good environment for alternative livelihoods
  - Act as buffers that protect coastline from sea level rise and storm surges
  - Moderate the climate conditions from extremes
- Community development efforts: to empower communities to reduce their vulnerability to environmental, social and economic changes
  - Sustainable aquaculture demonstration
  - Non-destructive fishing promotion
  - Alternative livelihood development (ecotourism)
  - Sustainable financial resources (microfinance and microbusiness)
  - Capacity building, gender mainstreaming, advocacy

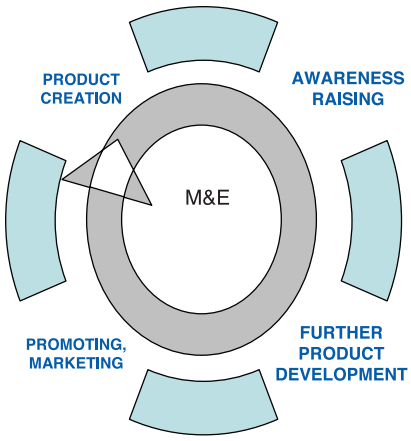
Climate Change response – a local model

Community Based Eco-Tourism (CBET):

- Major parts of the Red River Delta Biosphere Reserve
- Xuan Thuy National Park, Giao Thuy district, Nam Dinh province
- The first Ramsar site in Vietnam (1989), National Park (2003), Biosphere Reserve (2004)
- Significant values in biodiversity, wetlands and mangroves, especially ground for migratory birds
- Heavy pressure from aquaculture (clam farming) and fishing
- Giao Xuan community of 9,000 people, 60 % depend on fisheries

Community Based EcoTourism development

1. Product creation
- Consult with experts and stakeholders
- Participatory assessment on ecotourism potential and impact
- Product identification
- Building community groups and implementing plan of project
- Kick-off workshop



2. Awareness raising/Capacity building
- Study tour
- Workshop on CBET development planning
- Building local group on managers and service providers
- Training on skills providing tourism service
- Dialogue on CBET development, environment and local culture preservation
- Community Coastal Clean up
- Campaign on environment protection and tourism development

3. Product development
- Building visit places, routes in participation of community and tourism companies
- Approach to investment and micro credit
- Improving facilities for tourism service
- Pilot tour and finalise service products

4. Promoting and marketing
- Compiling publications and materials to promote CBET
- Building network distributing responsible CBET products (companies, travel agencies, sale on web..)
- Organising events introducing products and pilot tour
- Promoting products via website, trade fair and tourism events, network, associations
- Presenting products via public media, newspaper, TV...

Centre for Marinelife Conservation and Community Development (MCD)

What have been developed

- Awareness raising: continuously, for wider communities and local governments
- Core groups selected and trained: reception, guiding, cooking, housing and home-stay, art performance, management
- Multi-actor management mechanism established
- Tours designed, consulted and piloted
- Basic infrastructure improved
- Business sector connected and committed
- Promotion through media and events
- Practices and income generation

Ecotourism at buffer zone of Xuan Thuy National Park

Levering Actions

- Collaborating with NGO-CCWG for information sharing, capacity building, effort streamlining
- Co-Initiating and Participating in a Network for Vietnamese Civil Society Orgnisations and Climate Change – for capacity building, Vietnamese civil forces joining and coordination, and counter-parting with government efforts
- Connecting the local needs with global and national supports

Thank you for your attention

"Think globally act locally"

An Initial Vulnerability Assessment to Climate Change of the Palawan Biosphere Reserve

Mr. Romeo B. Dorado
OIC, Executive Director
Palawan Council for Sustainable Development Staff
Palawan, Philippines

Abstract

Declared a Man and Biosphere Reserve (BR) in 1991, the Palawan Biosphere Reserve in the Republic of the Philippines is a biologically diverse island province of 1.5 million hectares (ha) and is composed of 1,700 islands and islets. It is an island and coastal BR characterized by the presence of tropical rainforests, mangrove forests, seagrass beds, coral reefs, and beach ecosystems. The tropical forest of the province is estimated to have an area of 666,337.65 ha (2005) one of the highest in the Philippines. Its mangrove forests cover an approximate area of 44,500 ha which accounts for 40% of the total mangroves of the country. Its coral reef with an approximate area of 9,800 square kilometers accounts for 36.29% of the Philippines. The diversity of Palawan's coastal resources is comparable to that of the whole Philippines; it harbors 31 species of mangroves, 13 species of seagrass, and 379 species of corals representing 90%, 81%, and 82% of the known respective species found in the country.

The rich environment and diverse natural resources of the Palawan BR serves as the backbone of its economy with agriculture and fishery together with the thriving tourism and mining industries as its key economic sectors. The changing global climate and concomitant impacts on the world's ecosystem are foreseen to have significant impacts on the natural system of the Palawan BR and its economy. It is imperative that urgent measures need to be put in place to cushion the impact of climate change on both the natural and economic systems of the Palawan BR. To this end, well coordinated and integrated efforts are required to identify highly vulnerable environmental components (i.e. species, habitat, natural processes) and economic factors and determinants (i.e. human communities, settlements/development centers, economic sectors).

Outline of Presentation

1.0 Profile of Palawan BR
2.0 Potential Effects and Impacts of Climate Change and Global Warning to the Palawan BR
3.0 The Challenges to the Palawan BR

Home of two World Heritage Sites

Tubbataha National Marine Park

Puerto Princesa Subterranean River Marine Park

Our forest area is estimated at 666,337.65 ha

and mangrove cover of 44, 500 ha.

Our coral reef has an approximate area of 9,800 square kilometers

Biodiversity rich island province with:

- 105 or 22% of the 475 threatened species recorded in the Philippines
- 67 or 64% of the 105 threatened species found in Palawan are endemic to the Philippines
- 42 or 63% of the 67 endemic species are Palawan endemics
- 31 species of mangroves
- 13 of sea grass
- 379 species of corals
- 89% of the total reef species recorded in the Philippines
- 4 of the 5 marine turtles species in the country are found in Palawan

Coastal Dwellers

Palawan BR has 1700 islands and islets

Sign of bad weather occurence

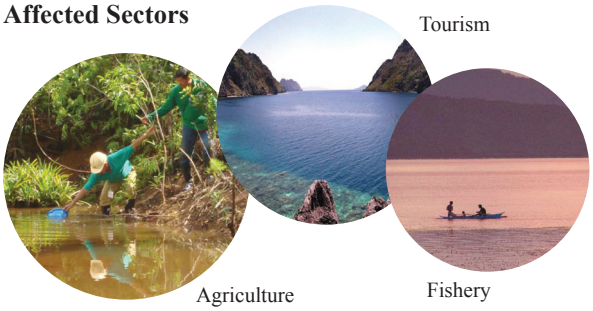
Rural folks braving typhoon

Possible loss of important habitats

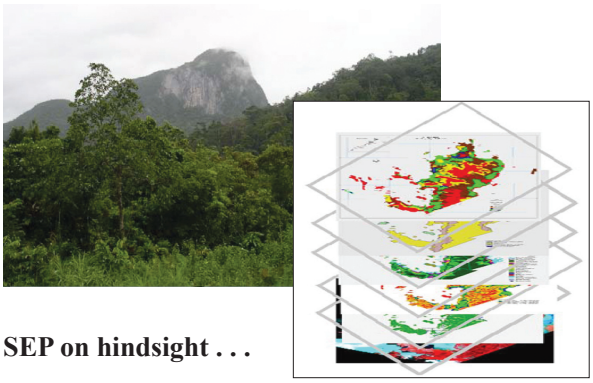
Disrupt processes and high negative impacts on associated species

Coastal Settlements

Affected Sectors



The Challenge to Palawan BR



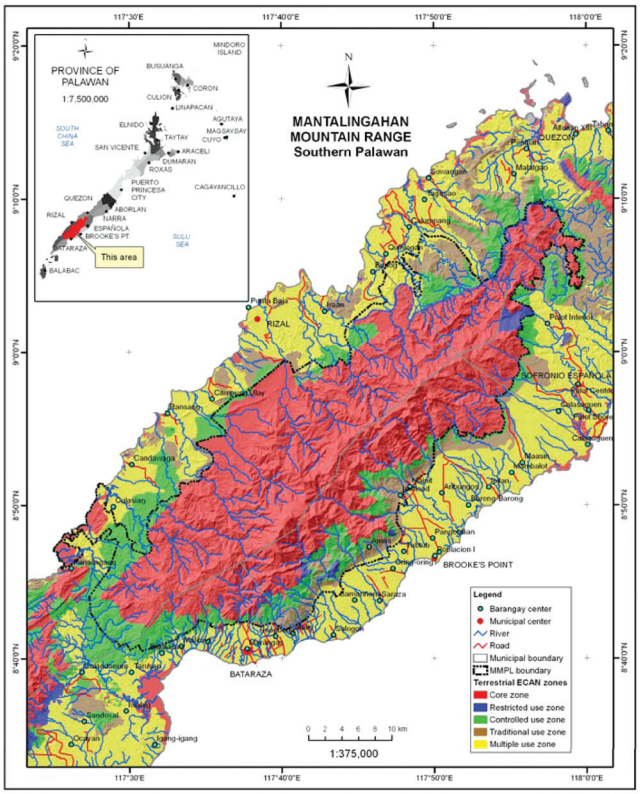
SEP on hindsight . . .

- Republic Act 7611, approved on June 19, 1992.
- A comprehensive framework for the sustainable development of Palawan.
- A framework that aims to protect & enhance the natural resources & endangered environment.
- A framework to guide the LGUs & other agencies in Palawan on formulation/implementation of plans, programs & projects.

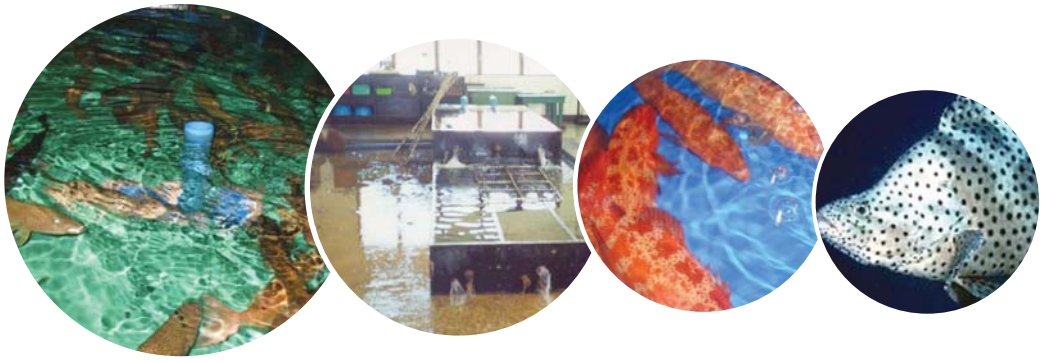
IDENTIFY:

1) **Highly Vulnerable Environmental Components**
   - Species
   - Habitats
   - Natural Processes
2) **Economic Factors and Determinants**
   - Human Communities
   - Settlements/Development Sectors
   - Economic Sectors

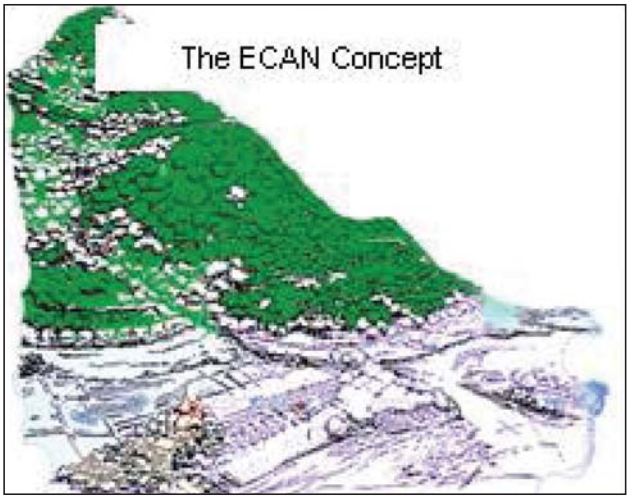
The Mount Mantalingahan Protected Landscape



The Live Fish for Food Industry in Palawan



Environmentally Critical Areas Network is a graded system of development control over the province of Palawan



Climate Change: a defining issue of our time

Island and Coastal Biosphere Reserves as Learning Sites for Climate Change Adaptation

Mr. Koen Meyers
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UNESCO Office Jakarta, Regional Science Bureau for Asia and the Pacific

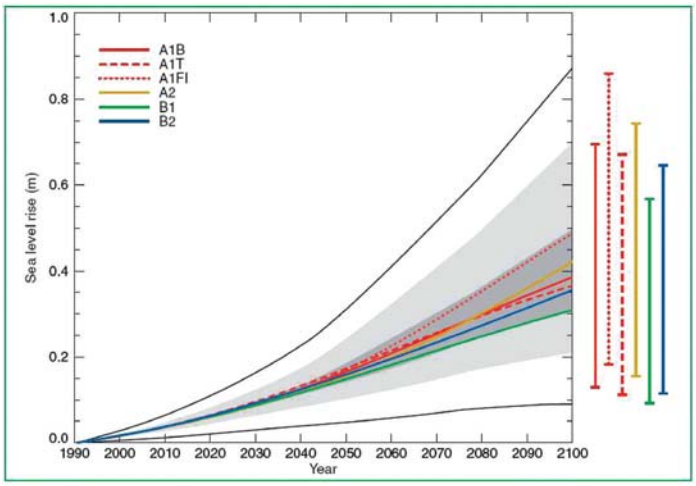
Abstract

Despite their ecological, geographical and cultural diversity, island and coastal biosphere reserves share many similarities in their vulnerabilities and challenges. Islands and coastal areas are often typified by their ecological uniqueness, geographical remoteness, limited availability of resources, rapidly growing population and high susceptibility to natural disasters. Island and coastal ecosystems and biodiversity have faced increasing pressure during the last decades from unsustainable use of natural resources. These threats have become even more profound and irreversible with increasing climate change pressures. These direct threats are furthermore reducing the natural resilience of the island and coastal ecosystems to climate change. Under current climate change scenarios, island and coastal ecosystems will be heavily impacted. Coral reefs will be significantly reduced by bleaching caused by increased sea surface temperatures and acidification of the oceans; freshwater reliant ecosystems will change due to variations in precipitation patterns and saltwater intrusion, mangroves will disappear because of sea-level rise. Furthermore climate change in island and coastal zones is expected to impact the economic, social and cultural spheres of society. Aside from rising conflicts over marine and terrestrial resources, additional resource depletion will push resource users to seek for more extractive – and often destructive methods, with as result increased loss of biodiversity, adding further to the vicious circle of climate change. During the 3rd World Congress of Biosphere Reserves, in Madrid, Spain, 2008, climate change was identified as one of the most serious and globally significant challenges to society and ecosystems around the world today. The Madrid Action Plan (MAP) for Biosphere Reserves calls for societal responses to climate change centered on adaptation and mitigation. It further calls on UNESCO member states and the MAB community to use biosphere reserves as learning sites for research, adaptation, mitigation in relation to climate change. Without proper climate change adaptation interventions in place, current conservation strategies for biosphere reserves are ill-prepared. Many barriers to overcome these challenges still exist, including low capacity, weak monitoring systems, and lack of policy integration and upscaling. As a result many biosphere reserves have yet to identify the potential impacts of climate change and define strategies for adaptation. It is therefore important to develop rapid and swift action to conserve biosphere reserves in their changing environment, based on increasing the resilience of ecosystems. A two-folded strategy towards combating climate change is fundamental, reducing current non-climate stresses (pollution, habitat loss, introduction of invasive species) and resisting the effects of climate change (incorporate adaptation into management plans, establishing corridors linking different ecosystems, modify BR zonation, developing stronger networks and links between existing biosphere reserves). Such interventions will help increase the natural resistance and resilience of biosphere reserves to the added stress of climate change. The role of biosphere reserves is essential to seek and test solutions to the challenges of climate change as well as monitor the changes as part of a global network. Biosphere Reserves can be areas for demonstrating adaptation measures and spearheading new strategies and interventions. Considering the range of biosphere reserves and the systems they represent, successful adaptation measures will provide valuable lessons for other ecosystems in the world.

CLIMATE CHANGE IS HAPPENING!

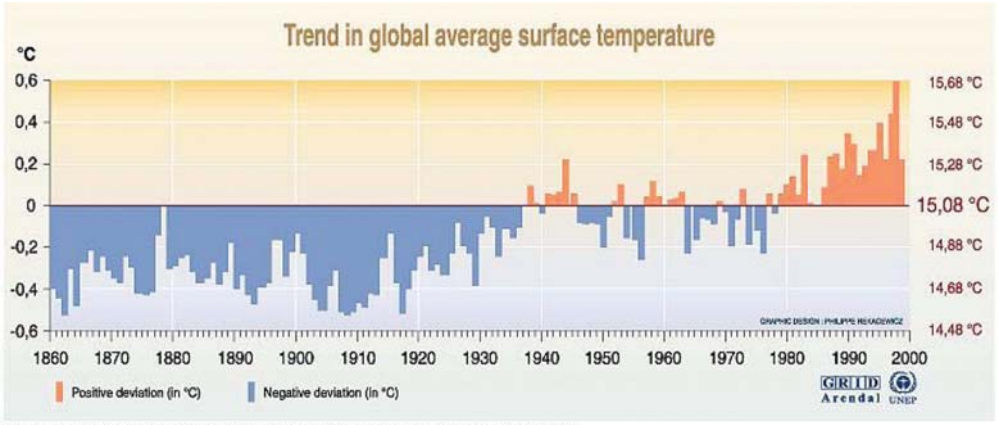
- **Average temperature is changing**
  - 0.7°C increase since 1800s
  - 10 warmest years of the last century all oc curred with the last 15 years.
  - 2001, 2002 and 2003 were three of the hottest years ever recorded.
- **Rising sea level**
  - 17.78 cm since 1850 (California)
- **Shrinking snow pack and glacial retreat**

Predicted sea level rise according to different scenarios of greenhouse gas and other human-related emissions for the period 1990 through 2100.



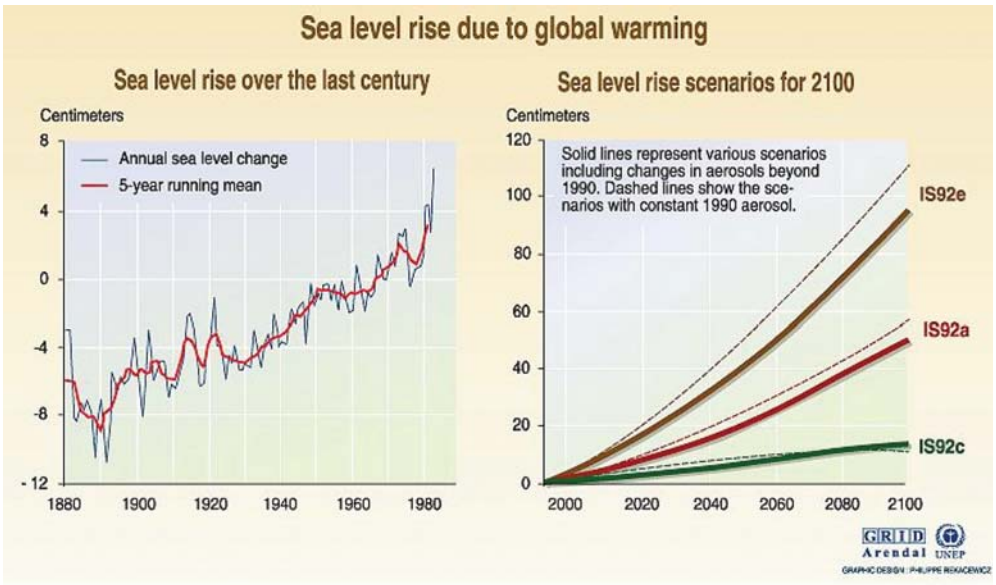
Intergovermental Panel on Climate Change climate models (Church at al., 2001).

Global surface temperature increasing



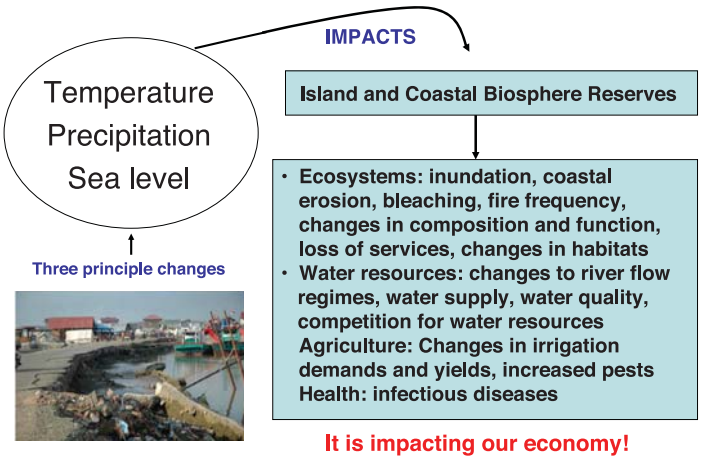
Source: School of environmental sciences, climatic research unit, university of East Anglia, Norwich, United Kingdom, 1999.

IPCC predicts a rise in global average temperatures between 1.4°C and 5.8°C by 2100



Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996; Sea level rise over the last century, adapted from Gornitz and Lebedeff, 1987.

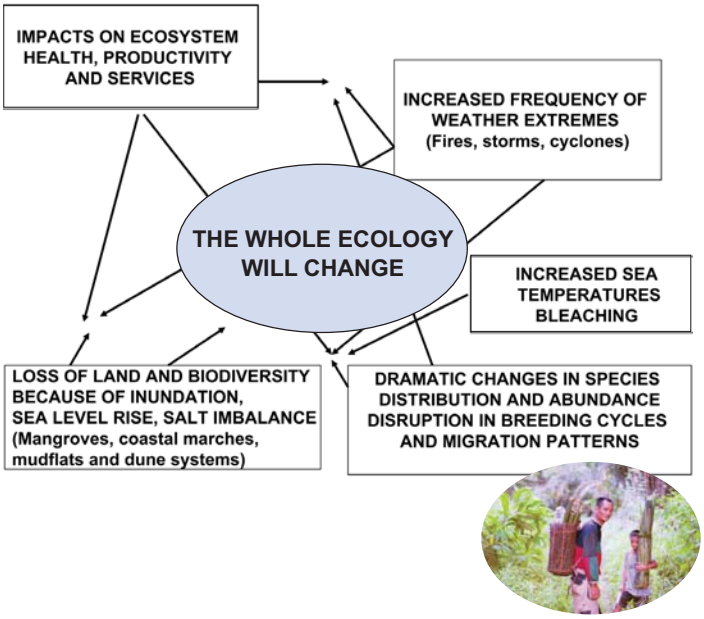
Climate Change Impacts



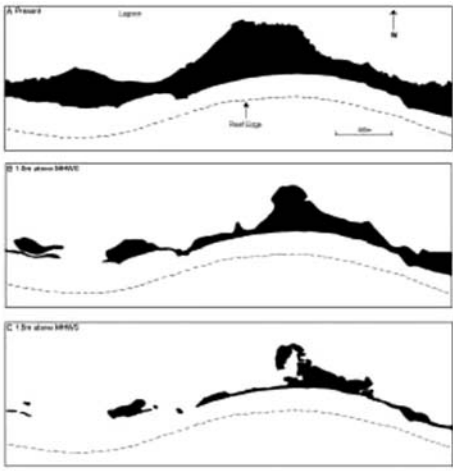
It is impacting our economy!

HUMANS ARE RESPONSIBLE BUT ALSO THE SOLUTION

Climate change induced shocks in combination with non- climate induced shocks such as logging, encroachment, poaching can have a fatal impact on the ecosystem resilience and capacity to adapt



Projected inundation of Bikenibeu Island Tarawa, Kiribati



Present status

Residual island under worst case scenario 2100

Residual island under worst case scenarios and storm surge, 2100

Need for Swift Action to Combat Climate Change

Goal

INCREASED RESILIENCE OF ECOSYSTEMS

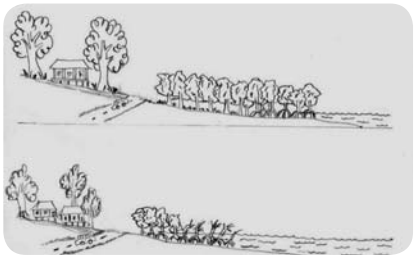
TWO-FOLDED STRATEGY

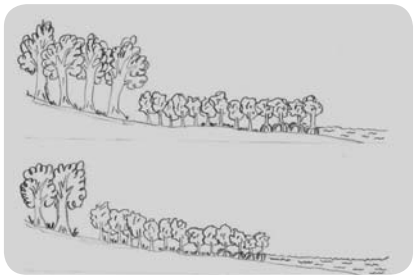
REDUCING NON-CLIMATE STRESS

- Halt destructive practices (blast fishing, illegal logging, poaching)
- Reduce destructive development impacts (infrastructure, pollution, overexploitation)

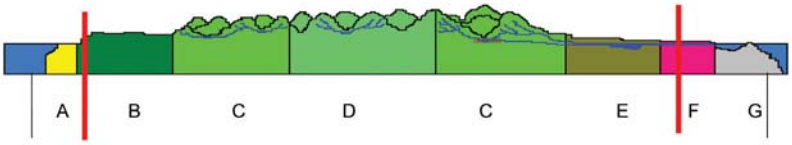
ADAPTATION

- Develop adaptation measures and Incorporate them into a policy framework
- Establishing connectivity/corridors
- Improve zonation system





TRANSECT OF SIBERUT BR



A: West coast
B: Barringtonia forest
C: Mixed forest
D: Dipterocarp forest
E: Swamp forest
F: Mangrove forest
G: East coast (coral reefs)

Adaptation is to rethink development!

MAB Community (Biosphere Reserve managers, policy makers, scientists, private sector and
local communities) should respond to CC threats by envisioning the future and not by relying on reactive decision-making

AGRICULTURE-INFRASTRUCTURE-WATER USE-ENERGY USE

ADAPTATION IN BRs IS NOT ONLY ABOUT NATURE CONSERVATION
BUT ABOUT MANAGING ALL SECTORS

WHAT CAN BE DONE AT BR LEVEL?

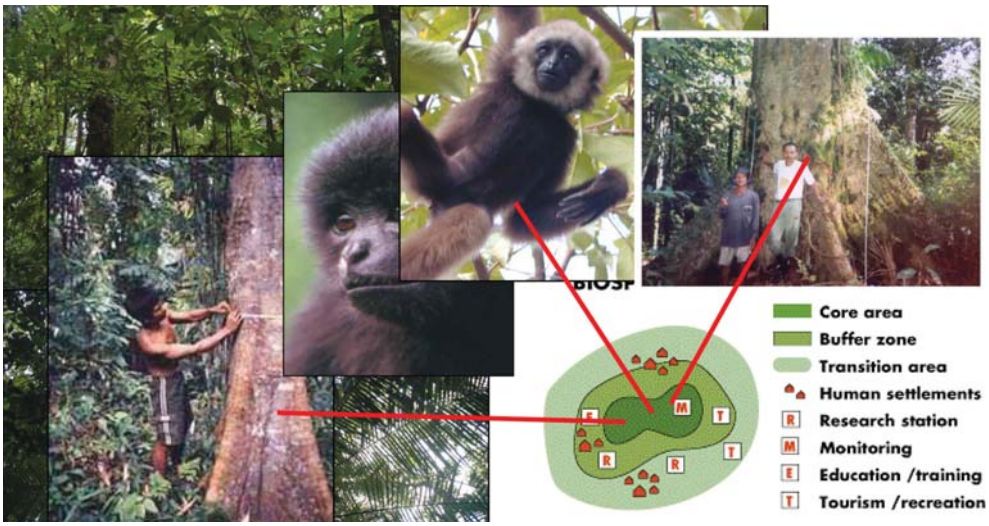
EXAMPLES OF STRATEGIC RESPONSES ACCORDING TO DIFFERENT SECTORS:

- **AGRICULTURE**
  1. Improve soil management, fertilization methods and pest control
  2. Introduce climate change (drought) resistant crop varieties that consume less water
  3. Disseminate climate change predictions to farmers

- **WATER MANAGEMENT**
  1. Improve irrigation and water management systems (recycle)
  2. Develop appropriate water storage and distribution infrastructure for drought periods
  3. Impose water conservation methods for large-scale consumers (industry, hotel sector)

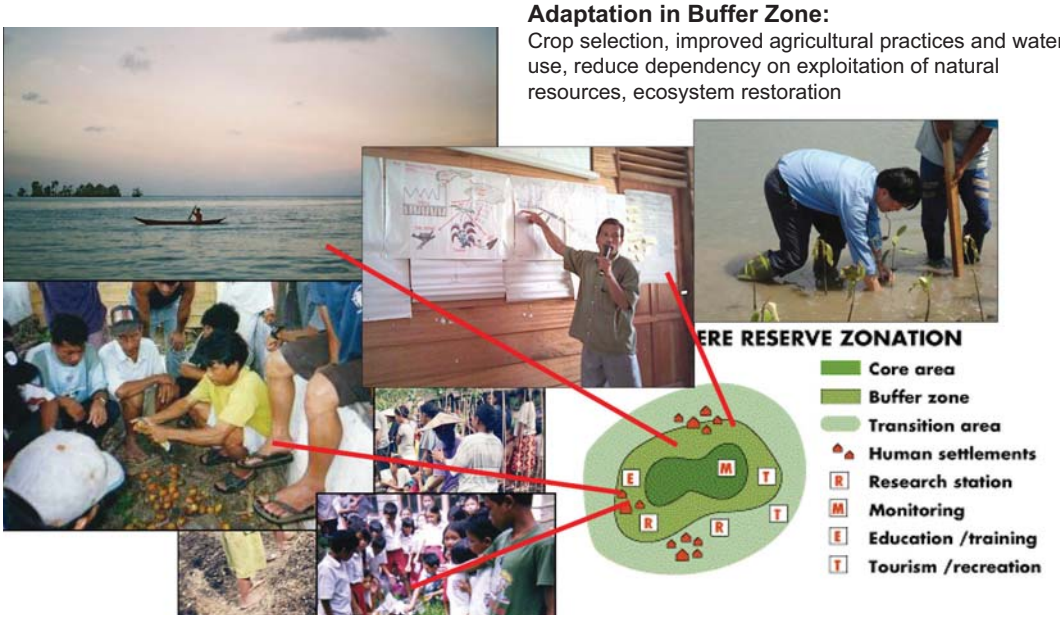
- **TOURISM**
  1. Protect tourism assets from sea-level rise, storm surges and other extreme weather events
  2. Impose strict EIA for tourism development
  3. Develop financial mechanism for reducing carbon footprint and reinvesting funds in adaptation activities

MAKE SOCIETY MORE DEPENDENT ON RENEWABLE RESOURCES!



Adaptation in Core Area:
Connectivity, Monitoring, species re-introduction, eradication of invasive species, ecosystem restoration

Adaptation in Buffer Zone:
Crop selection, improved agricultural practices and water use, reduce dependency on exploitation of natural resources, ecosystem restoration



Adaptation in Transition Area:
Stronger regulations of industrial use of water and natural resources, appropriate infrastructure development

WHAT CAN BE DONE AT BR POLICY AND NETWORK LEVEL?

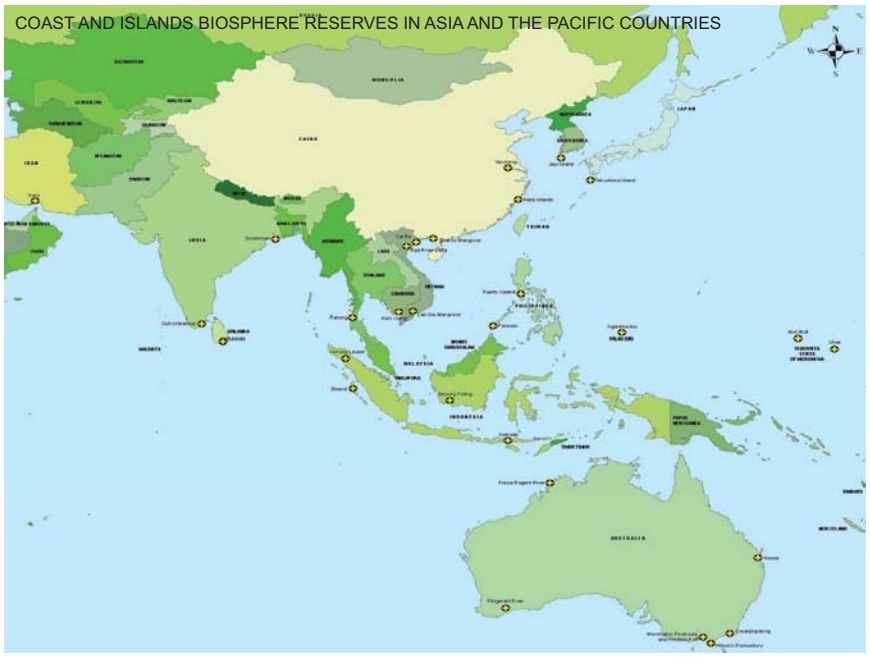
- Establish baseline information per BR, develop local and regional climate change predictions and modeling and incorporate in regional database
- Establish indicators for climate change monitoring, agreed research protocol, including local community monitoring schemes
- Incorporate changes into planning and policy making. Incorporate scientific research/data into policy making
- Identify ecosystems and biomes under threat
- Identify potential new BRs, as well as re-assess BR zonation and boundaries based on adaptation needs
- Link to observation networks and existing regional initiatives such as South Pacific Sea Level and Climate Monitoring, and Caribbean Planning for Adaptation to Climate Change

Improved and more Strategic BR design

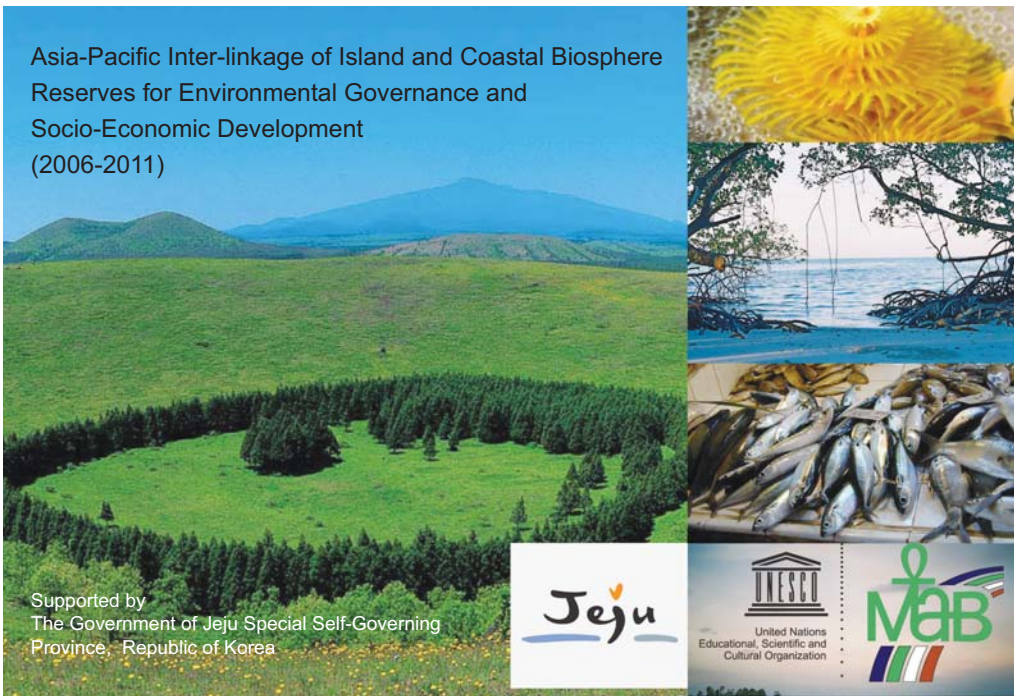
A good network of large protected areas at the core of Biosphere Reserves may be wild nature's best climate change shock absorber (Welch, 2005)

AVOID FURTHER FRAGMENTATION!

IMPROVE NETWORKING AND COOPERATION



BR Network and Jeju Initiative constitutes a strategic platform to bridge science, policies, best practices and institutional frameworks between BRs to overcome the challenge of Climate Change



'We must indeed all hang together, or most assuredly we will all hang separately'.

- Ben Franklin

Session 3

Climate Change Mitigation in Coastal and Island Biosphere Reserves

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•

Mr. Do Quang Hung
Senior Officer, The People's Committee of Haiphong City, Vietnam

Impacts and Responses on Climate Change in the Tourism Sector

Prof. Yong Kun Suh, Ph.D.
Department of Tourism Management
Cheju National University, Republic of Korea

Abstract

The study aims to figure out the impact of climate change in tourism and its countermeasures. Prior to dealing with the issue, a basic proposition is needed, and it is that an environmental issue cannot affect a political issue distorting facts. Accordingly, a balanced view is more important than anything else.

Some reasonably argument that excessive skepticism presented by Bjorn Lomborg, a Danish professor who wrote "The Skeptical Environmentalist," is also problematic. Sustainable tourism that has been recognized as an important philosophical idea since the 1980s is also important. With regard to environmental issues, more scientific and objective data and analyses are required, and political logic should not be involved, and a more balanced view needs to be introduced.

UNWTO, WMO and UNEP held the 1st International Conference on Climate Change and Tourism in Djerba, Tunisia in April 2003 in an effort to raise awareness of governments, tourism industry and other stakeholders about relationship between climate change and tourism and adopted Djerba Declaration that contains the role of tourism for the purpose of reducing the climate change.

UNWTO, UNEP and WMO assume that tourism industry recorded 1,302 million tons in the emission of CO_2 in 2005 (transport and accommodation included/ tourism facilities and development not included) and that it accounts for 4.95% of the entire emission on the globe.

It is specifically reported that tourism transport accounts for 75% (airplanes 40%, vehicle 32% and others 3%) while accommodations facilities and tourism activities, respectively, 21% and 4%.

Since the impact of the climate change depends on ecological environment in each and every region and systems in local communities, response strategies befitting regional characteristics are needed.

As for adaptation related to the climate change, it is important to develop and evaluate countermeasures based on the impact of the climate change, assessment on weaknesses and the level of risks that can be accepted by regions. In addition, observation areas where one can systematically observe various impacts of the climate change needs to be selected in order to effectively establish strategies.

Specifically, reasonable marketing activities can be conducted through an accurate meteorological forecast based on the development of tourism weather indices as a climate change impact evaluation index and understanding about how it affects demand for specific tourism industry and services.

Sustainable tourism activities can be facilitated through the introduction of carbon label, increased use of bicycles, expansion of natural forests, improved awareness of tourists about environmental preservation and green management system on the part of tour companies.

Contents

I. Climate change impacts on tourism

1. Climate change impacts on tourism
   (1) Direct environmental change impacts
   (2) Indirect environmental change impacts
   (3) Policy impacts
   (4) Indirect socio-economic change impacts
2. Contribution of tourism to climate change
3. Climate change adaptation in tourism
4. Mitigation of the carbon emissions created by tourism
5. Adaptation and mitigation

II. Current status - Cases

1. International Cases
   (1) Turkey
   (2) Fiji
   (3) Tuvalu
   (4) Aspen, USA & Whistler, Canada
   (5) Germany
   (6) Australia
   (7) France
   (8) Betchart Expeditions in California, USA
2. Cases – Korea
   (1) Kangwon Province
   (2) Taean County, South Chungcheng Province
   (3) Daegu Metropolitan City
   (4) Gimpo, Kyunggi Province
   (5) Jeju Island

III. Responses

1. Transportation industry
   (1) Airlines
   (2) Cars
2. Accommodations
3. Tour operators
4. Tourists
5. Destinations

Airlines

- Recommendations:
  a. Seek to maintain a young fleet with regard to the technology used.
  b. Achieve an average load factor (passengers) of at least 80%.
  c. Reduce operating empty weight by removing excess amounts of water & catering.
  d. Choose more efficient flight paths.
  e. Aircraft should be densely seated to carry the maximum certified number of passengers.
  f. Airlines should support the inclusion of aviation in the EU ETS and other emission trading schemes.

g. Airlines should seek to adjust bonus programmes.
h. Airlines should extend their economic scope.
i. Airlines should seek to engage strategically with climate change.

Cars

- Recommendations:
  a. Promote the use of low-emission cars
  b. Avoid any kind of Sports Utility Vehicle (SUV)
  c. Replace old cars

Accommodations

- Mitigation in accommodation
- Room temperature
- Lighting
- Restaurants
- Other options to save energy

Other options to save energy

- Recommendations:
  a. Establish environmental management systems (EMS)
  b. Reduce energy use
  c. Use renewable energy only
  d. Reduce the use of materials
  e. Recycle wastes
  f. Rethink food in restaurants
  g. Constructions
  h. Communicate green action

Tour operators

- Recommendations:
  a. Re-think their choice of destinations
  b. Avoid promoting long-haul destinations
  c. Support low-carbon holiday options and carbon labelling
  d. Develop new low-carbon products
  e. Offer high standard carbon offsets

Tourists

- Recommendations:
  a. Travelling less often and staying longer
  b. Minimise air travel
  c. Reward airlines with sound environmental management
  d. Offset flights that cannot be avoided
  e. Reward pro-environmental and pro-development tour operators
  f. Certified destinations or accommodation

Destinations

- Recommendations:
  a. Officially highlight and work towards the goal of tourism sustainability
  b. Restructure source markets
  c. Provide low-carbon public transport
  d. Achieve carbon neutrality
  e. Communicate pro-environmental action

Climatic Change in Menorca – Actions for Mitigation and Fight

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Abstract

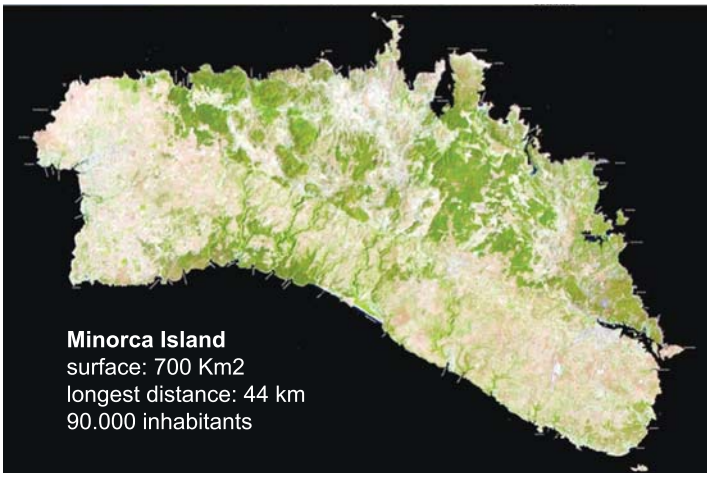
Menorca is an island with a surface area of 700 km^2 and is located in the Western Mediterranean basin, where it forms part of the archipelago of the Balearic Islands. This island was declared a Biosphere Reserve by UNESCO in 1993. There are indications of climatic change for the island that are compatible with the models of global warming. The prognosis based on meteorological observations for the last fifty years show that in Menorca, the temperatures are rising at rate of 5.3ºC/100 years, with the minimums at 6.1ºC/100 years; and moreover, these increments are proportionally greater during the summer months. On the other hand, precipitation for the Balearics on the whole have fallen off at a rate of 30%/100 years, coupled with an increase in torrential precipitations (Ramis et. al., 2006). In the waters of the Mediterranean Sea, an average temperature increase of 1.1ºC has been observed, and at times temperature extremes of more than 29ºC have been registered (Duarte, 2006). These changes have provoked or exacerbated some of the environmental problems on the island, with serious consequences for the islands ecosystems, and have threatened the local economy. Amongst these effects, the following stand out:

- Beach erosion;
- Expansion of invasive algae tropical in origin;
- Alterations of the underwater prairies of Posidonia oceanica;
- Risk of an increase in forest pests (i.e. Lymantria dispar i Thaumetopoea pityocampa);
- Modification of the flowering phenology of flowering plants;
- Reduction in germination of threatened species (Apium bermejoi);
- Reduction of aquatic habititats, especially temporal pools.

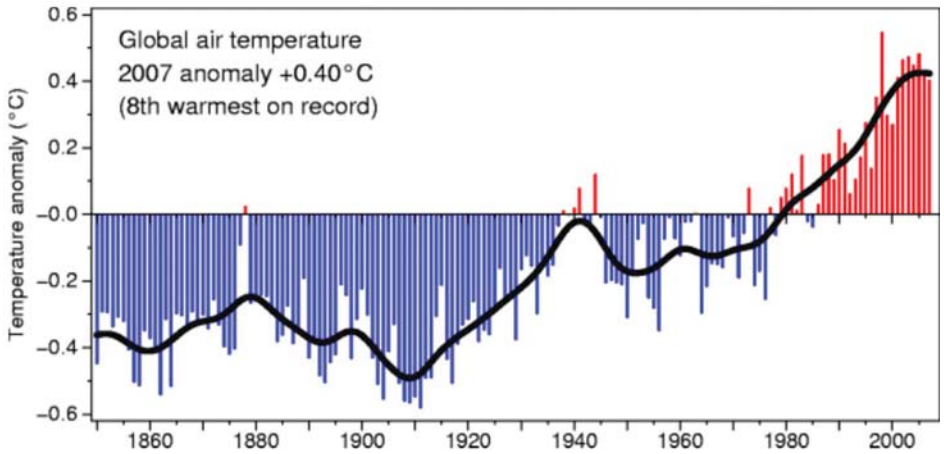
The public administration and especially the Insular Government are developing some initiatives to mitigate these, with many of these problems can be financed with funds from the European Union, for example:

- Management and restoration of dunar systems;
- Protection of native plant species;
- Protection and recovery of wetlands;
- Pilot projects for forestry management.

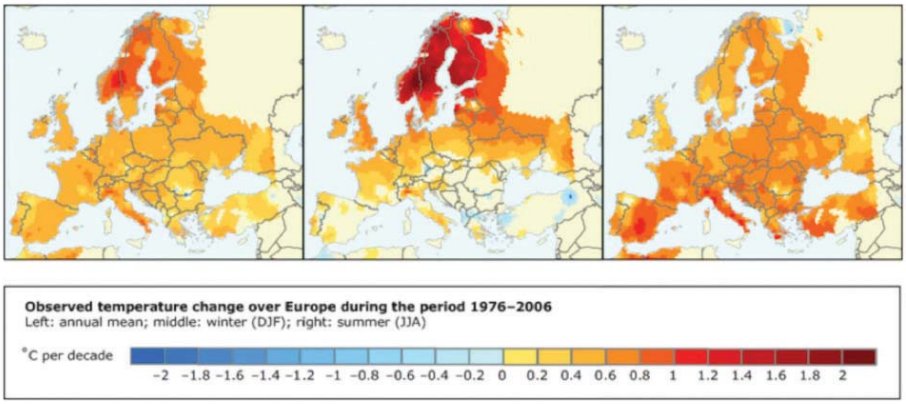
However, these policies to combat climatic change, and concretely for emission reduction have began with much delay. Carbon dioxide emissions have doubled since 1990 and only with the last three years has there been certain stabilization (Source data from: Observatori Socio Ambiental de Menoría, OBSAM, 2008). Sources of solar and wind energy have begun to be significant since 2004, although in 2007 these sources only made up 1% of the source for electricity production in Menorca. It is hoped that in the following years that island emissions will descend even further when liquid petroleum fuels are substituted for natural gas in electricity generation and there is an increase in solar energy plants.



Climate change is a global problem

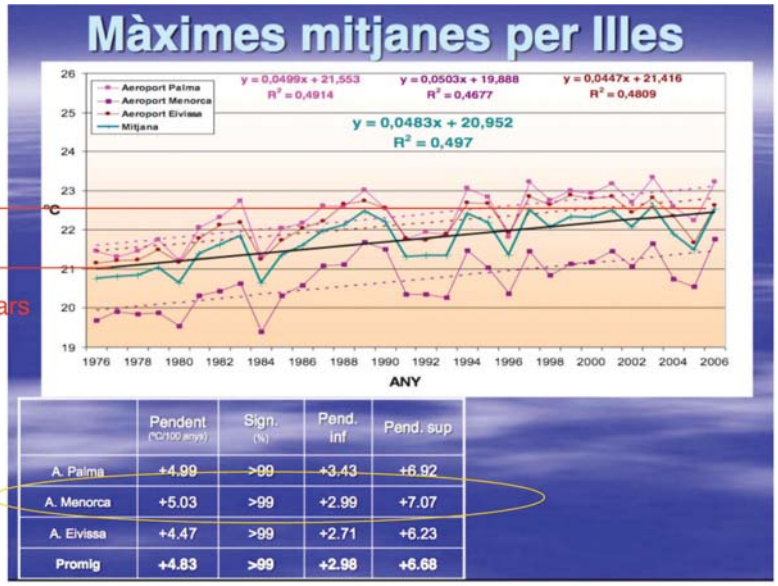


In the Mediterranean Sea the rise of temperature is more evident in summer

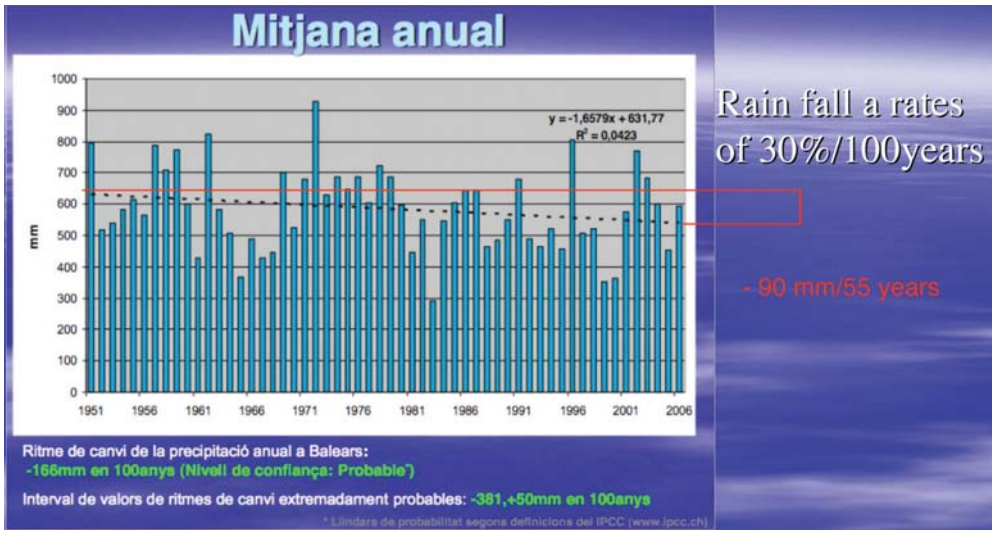


Environmental European Agency (2008)

Balearic Is.: Maximum Temperature Average

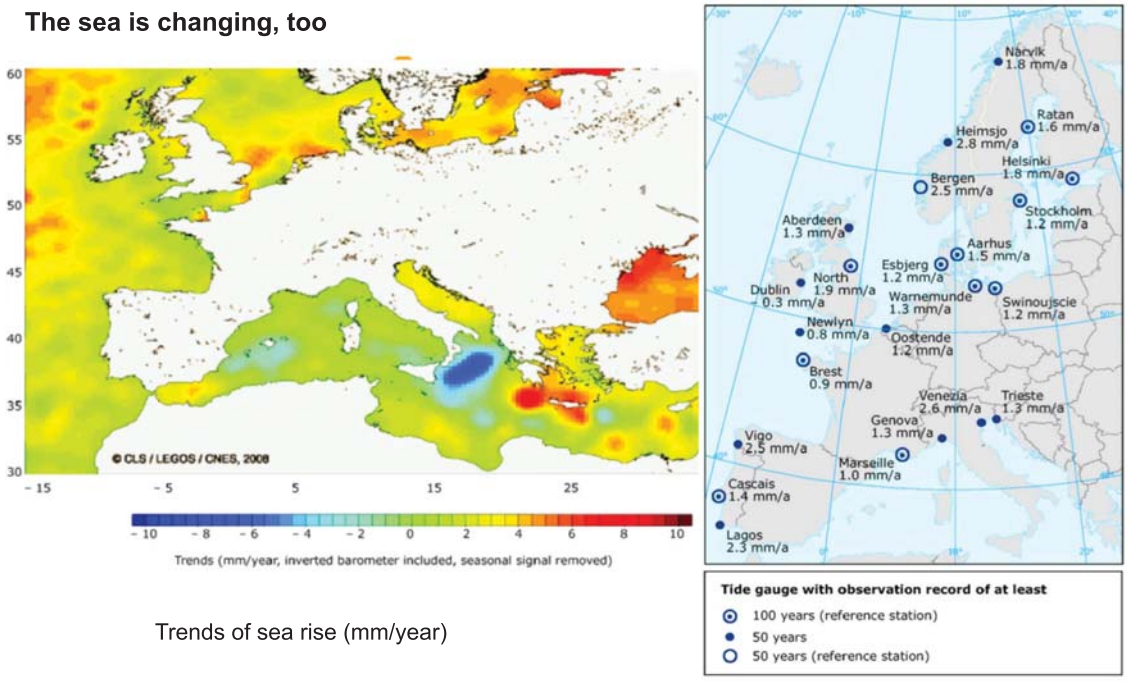


Tendències climàtiques a les Illes Balears (*Ramis et al, 2002; review 2007*)



Main changes observaded of clime of Minorca

- Increase of temperature average at rates of 5,3ºC/100 years for maximum and 6,1 for minimum
- Decrease of rain at rates of 30%/100 years
- The decrease of rain is higher for the automn and winter
- Increase of the days with torrential rain



Trends of sea rise (mm/year)

Also the sea is changing

- Global increase of sea temperature 0,31ºC during the last 50 years
- But the Mediterranean sea increase the temperature in 1,1ºC
- Maximum temperature of Balearic sea in 2006: 30ºC
- The sea level of Balear sea rise at an average rate of 1 mm/year, slower than other regions

Effects of climate changes

- Many environmental problems are the result of the sum of several factors
- It is difficult to prove the direct effects of climate change
- Climate change exacerbates the effects of other disturbance factors

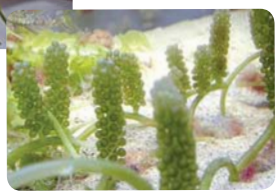
Environmental effects of climate change

- Effects on plant communities
  - Changes in the distribution of plant communities
  - Erosion of vegetation on the dunes
  - Salinization of coastal lagoons
  - Increased risk of forest fires
  - Increased risk of forest pests
- Effects on plant species

- Extinction of endangered species
- Changing phenological patterns of plants
- Invasion of tropical algae
- Altering the ecology of the seagrass Posidonia oceanica

• Other observed effects
- Expansion of vectors of pathogens
- Changes in migration patterns of animals
- Increase of jellyfish populations

Caulerta taxifolia



Caulerpa racemos

Asparagopsis armata

Tropical seaweeds invasion

- Six of the top 10 worst invasive seaweeds are found in the Balearic Islands
- Most of them came from tropical seas

Erosion of beaches and dunes

CAMBIO CLIMÁTICO / *Los efectos en las Islas*

Las playas de Baleares habrán retrocedido 16 metros en 2050 por la subida del nivel del mar

Un informe del Ministerio de Medio Ambiente y la Universidad de Cantabria dice que el efecto invernadero «afectará mucho» a la costa de las Islas

Las medusas seguirán en la costa balear todo el verano y cada año habrá más

Erosion of beaches and dunes

1956

1979

Erosion of beaches and dunes

1979

1979

The turistic use increase the erosion of the beaches

1979

2007

The problem is dramatic is some tourist beaches

1956

1995

2007

The old methods of cleaning beaches, a problem for beach conservation, too

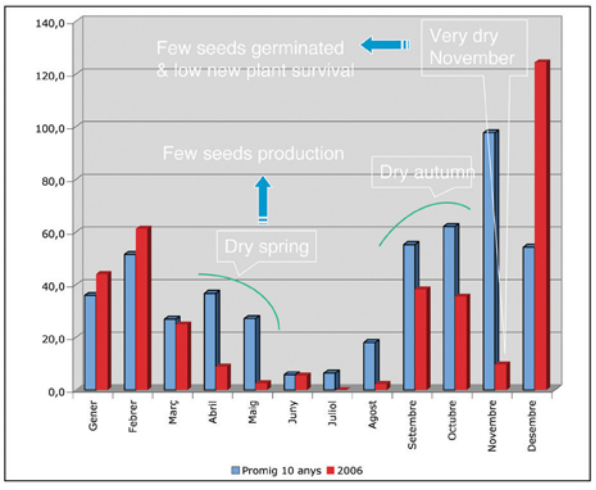
Adaptation: new methods more respectful with the environment

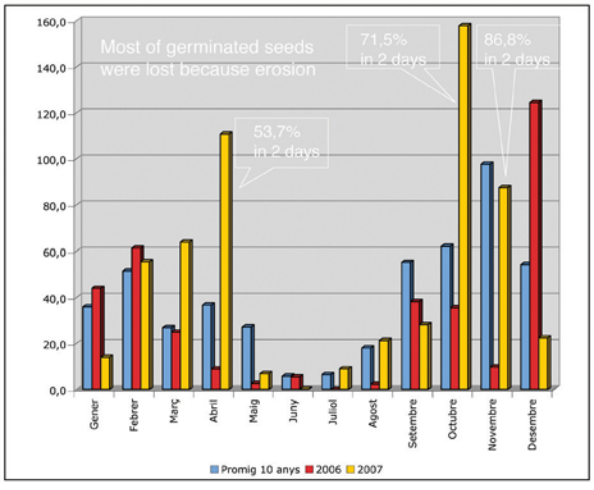
There are problems for some endangered plant species

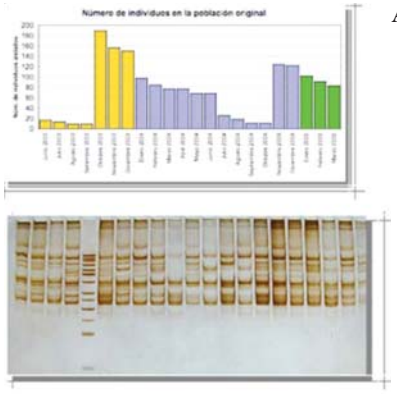
It lives in a small torrent, blooms at the end of spring and fruit in summer

Adaptation: restoration of the dunes

Apium bermejoi, critically endangered specie

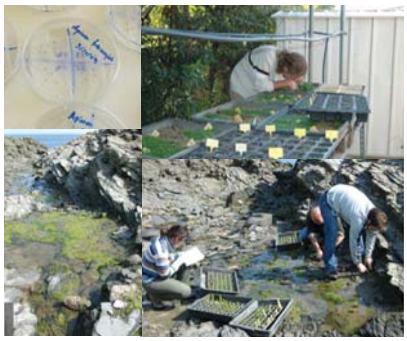






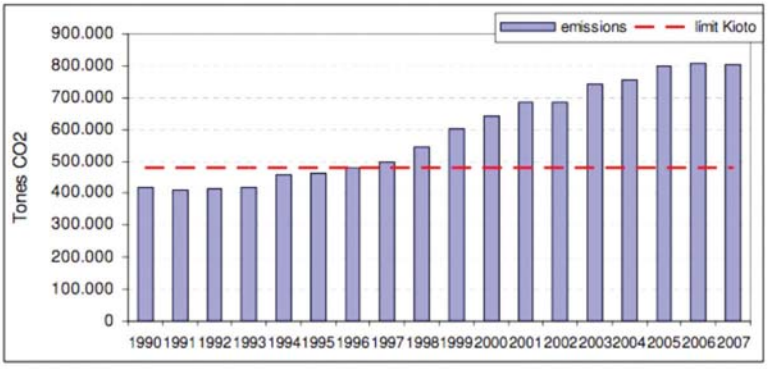
Adaptation: Plant conservation performances

Biological and
ecological studies
enetic variability study (col. Univ. Valencia)
Collection of seed bank (col. JardíBotànic Sóller)



Ex situ population
Introduction in three new localities

Emissions of CO_2 in Minorca



Mitigation Climate Change

- Special administrative body to fight against climate change (Regional Government)
- Action Plan to Mitigate the Climate Change (2008)
- Construction of a gas pipeline from the Continent (reduction of emissions)
- Subventions to the installation of renewable energy
- An wind power plant was open in 2004 (3,200 Kw)
- A solar power plant was open recently (2008): 5% of electricity of the island

Mitigation Climate Change

- Specific administrative body for the fight against climate change (Regional Government)
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But… emissions is not the unique problem for an insular Biosphere Reserve

The renewable energy plants could be an important environmental threat

But… emissions is not the unique problem for an insular Biosphere Reserve

Es Diari
Diario digital de Menorca

Portada · Noticias · Hemeroteca · Clasificados · Servicios · Publicidad

Buscar

Del 16-Noviembre al 23-Noviembre de 2008 — Año XI · Semana 46 · Número 741 · Edición Semanal

PORTADA ¦ ACTUALIDAD ¦ SOCIEDAD ¦ DEPORTES ¦ BREVES ¦ NOTAS DE PRENSA ¦ OPINIÓN

SOCIEDAD (Fecha 16 de Marzo de 2007 - Número 654 - Año X)

El Consell Insular de Menorca y los Ayuntamientos de la Isla se manifiestan en contra de la política en materia de energía eólica del Govern.

El Consell Insular de Menorca y los Ayuntamientos de la Isla, podrían denunciar ante los Tribunales los proyectos que desde el Govern Balear se han puesto sobre la mesa, en relación a las posibles autorizaciones de parques de energía eólica en Ses Comunas y Son Bruc. Pero antes buscarán el consenso en una reunión con el Conseller de Industria y Energía del Govern.

El Conseller de Ordenación del Territorio, Marc Pons, lo exponía de forma contundente. Para el Consell Insular y los Ayuntamientos, estos proyectos significan un impacto sobre Menorca que hay que parar. De todos modos Marc Pons confía en acercar criterios con el Govern.

El Alcalde de Es Mercadal, Ramón Orfila, tildaba los proyectos de disparatados.

En la misma línea se expresaba el Alcalde de Ferreries, Josep Carreras.

El día 14 se enviaba la solicitud para mantener una reunión urgente con el Conseller José Juan Cardona.

The Insular Government and the Municipalities of the islands against the wind energy policy (2007)

Solar energy could be a good business but… Do we want to lost farmlands ?

Ultima Hora Menorca / Martes, 22 de mayo de 2007

Los ocho parques de energía solar que se tramitan en Menorca abastecerían a 24.000 personas

Si se pusieran en marcha ahorrarían al año el consumo de 1.684 toneladas de petróleo

El parque solar de Son Saforné es el que está más avanzado, ya en obras.

Los proyectos de Menorca se ubicarían en Ferreries, Ciutadella, Es Mercadal, Sant Lluís y Alaior

Los promotores son empresas de reciente creación

La producción media de las instalaciones

Eight solar power plant project on agricultural land

Complex debate and difficult decision

- Should an insular Biosphere Reserve produce renewable energy but losing landscapes and important habitats? or
- Should an insular Biosphere Reserve increase its emissions without control
- To save energy and a land planning for wind and solar plants could be the best way to reduce emissions
- Climate change raises other environmental problems
- The islands are especially vulnerable
- Adaptation and mitigation actions are essential
- The best way to reduce emissions is energy saving and land planning for wind and solar energy plants

In conclusion

- Climate change is a serious threat for insular Biosphere Reserves

Climate Change Mitigation in Small Island Developing States (SIDS) – Establishing Win-Win Situations

Mr. Thomas Lynge Jensen
Environment and Energy Policy Specialist
United Nations Development Programme Pacific Centre (UNDP-PC)
Fiji Country Office

Abstract

Climate change is the defining human development issue of our generation. In the long run climate change is a massive threat to human development and in some places it is already undermining the international community's efforts to reduce poverty. A variety of studies indicate that islands such as the Small Island Developing States (SIDS) will be hardest hit by climate change - SIDS are on the front line of climate change and they are already highly vulnerable to climate disasters. However the potential gains for greenhouse gas emission reductions in SIDS are minimal: potential carbon gains from investing in islands and SIDS are almost non-existent. Therefore in SIDS climate change mitigation per se is not a national priority. Instead priority should be given to the provision of access to reliable and affordable modern energy services in an effort to reduce poverty. Nevertheless there are opportunities to ensure that future development of energy sources in SIDS will be carbon-friendly. Thus an entry point is to open the door to win–win scenarios for human development and climate change mitigation. In addition it can be argued that islands are important for the promotion of renewable energy worldwide with the Danish island of Samoa as an excellent example. There is however a long way to go - there are still many islands where the potential for renewable energy is not yet tapped. Islands structural characteristics both enable and inhibit the utilization of renewable energy and in addition many man-made barriers need to be removed before large scale utilization will become a reality. The Pacific Island Countries (PICs) will be used as a case to illustrate these main points.

Structure of Presentation

1. Climate Change
2. Small Island Developing States and Climate Change
3. Entry Point: Win–Win Scenarios for Human Development & Climate Change Mitigation
4. Islands and Renewable Energy
5. References

Climate Change

- Climate Change
  – Is the defining human development issue of our generation
  – No issue merits more urgent attention - or more immediate action
    - The world has less than a decade to change course
    - The starting point for action and political leadership is recognition on the part of governments that they are confronted by what may be the gravest threat ever to have faced humanity
- Climate Change Mitigation

- Climate change mitigation is about transforming the way that we produce and use energy
- Without urgent mitigation action the world cannot avoid dangerous climate change
- Over the next few decades, the world needs an energy revolution that enables all countries to become low-carbon economies
  - That revolution has to start in the developed world - developed countries have to take the lead
  - However the credibility of any multilateral agreement will hinge on the participation of major emitters in the developing world

SIDS & Climate Change

- SIDS are on the front line of Climate Change
  - They are already highly vulnerable to climate disasters
  - A variety of studies indicate that the Least Developed Countries (LDCs) and SIDS will be hardest hit by climate change
- However SIDS are Not Causing Climate Change
  - Island communities around the globe produce only a tiny fraction of the global greenhouse gas emissions
    - In a global context the PICs are responsible for just 0.03% of the world's carbon dioxide emissions
- Interventions in Climate Change mitigation are often of marginal relevance to countries' mainstream Development Agendas, especially in LDCs and SIDS
  - Fit between the objective of national poverty reduction and global climate change mitigation has been questioned
    - In LDCs and SIDS, the focus on global environmental problems has left large gaps in national priority areas related to environment and energy
  - Potential carbon gains in the SIDS are almost non-existent
  - Especially in the LDCs and SIDS climate change mitigation is not a national priority

Entry Point: Establishing

Win-Win Situations

- In LDCs & SIDS Need to Ensure Relevance to Countries' Mainstream Development Agendas
- In particular the objective of poverty/hardship Reduction
- Broad Definition of Poverty/Hardship in PICs
  a) Lack of access to basic services
  b) Lack of opportunities to participate fully in the socio-economic life of the community
  c) Lack of adequate resources (including cash) to meet the basic needs of the household, customary obligations to extended family, village community, and/or the church
- Poverty/Hardship real Issue in PICs
  a) In the Pacific region hardship and poverty are real issues in the lives of many people in both urban and rural areas and on outer islands
  b) The % of households living in poverty, according to a basic need poverty line are estimated to be: Kiribati = 50% (1996), Vanuatu = 40% (1998), PNG = 37% (1998), Solomon Islands = 22% (2005/2006), Tonga = 22% (2001), Samoa = 20% (2002)

Win-Win Situations (#2)

- Affordable energy is an essential prerequisite for Poverty Reduction
  - If reduction of poverty and hardship is an objective, which it should be, then provisioning of affordable energy is an essential prerequisite
  - While there is no Millennium Development Goal (MDG) dealing specifically with energy it is clear that without access to adequate quantity and quality of modern energy services, achievement of the MDGs will not be possible
- National Priorities with regard to Energy

- Accessible, reliable and affordable modern energy services
- Energy access
  - In the PICs significant energy access gaps exist in electricity and/or fossil fuel access in PNG, Solomon Islands, Vanuatu, Fiji, Republic of the Marshall Islands (RMI), Federate States of Micronesia (FSM), and Kiribati
  - And there are low income households in most PICs, who use little petroleum fuel or electricity because of their high costs, even though these could be easily accessed

Win-Win Situations (#3)

- Focus should be on Establishing win–win scenarios for Human Development and Climate Change Mitigation
  - There are opportunities to ensure that future development of energy sources in SIDS towards facilitating access to reliable and affordable modern energy services will be carbon-friendly
  - Cooperation could expand access to energy and improve energy efficiency, thereby lowering carbon emissions and supporting poverty reduction efforts in the process
  - However is neither realistic nor equitable to expect the world's poorest and most vulnerable countries including SIDS to finance both the energy investments vital for poverty reduction at home and the incremental costs of a low-carbon transition to support international climate change mitigation
- Thus increased financial and technological support for low-carbon power generation in developing countries is one priority area

Islands and Renewable Energy

- Renewable energy is one option to provide energy access for poverty/hardship reduction
  - The other key areas as part of sustainable energy being energy conservation and energy efficiency
- However the Potential for Renewable Energy is not yet tapped
  - Globally most island states are blessed with abundant potential for developing renewable energy resources, but they are largely underexploited and conventional solutions continue to dominate
- Structural Characteristics of Islands
  - Both enable and inhibit the utilization of renewable energy on a large scale in PICs
  - Enabling Factors
  - Extreme dependence on imported petroleum fuels for their energy needs, high import prices for petroleum products and high energy costs in general, fragile ecosystems, vulnerability to externally generated economic shocks, good potential for renewable energy, etc

- **Asia-Pacific Oil Price Vulnerability Index (OPVI)**

COUNTRY	INDEX	RANK
Maldives	0.00	1
Vanuatu	0.17	2
Cambodia	0.17	3
Solomon Islands	0.18	4
Sri Lanka	0.18	5
Samoa	0.24	6
Fiji	0.28	7
Lao PDR	0.31	8
Pakistan	0.34	9
Bangladesh	0.34	10
Nepal	0.38	11
Afghanistan	0.38	12

COUNTRY	INDEX	RANK
Philippines	0.39	13
Myanmar	0.40	14
Vietnam	0.42	15
Mongolia	0.43	16
Thailand	0.44	17
Indonesia	0.45	18
Papua New Guinea	0.46	19
India	0.49	20
Bhutan	0.56	21
Malaysia	0.72	22
China	0.78	23
Iran	1	24

- Of the seven (7) most oil price vulnerable Asia-Pacific countries four (4) are PICs
- Most vulnerable country is a SIDS, i.e. Maldives
- PNG, an oil exporter, is an PIC exception

– Inhibiting Factors
  - Extraordinary logistical challenges of working with small populations widely dispersed over enormous areas
    – Delivery of services difficult, maintenance of installed facilities costly and requires the installation of high cost, high quality energy systems if a reliable energy supply is to be provided.
  - The small market size of most PICs is a barrier to companies in establishing a local presence
  - Extreme environmental conditions.
    – Electronics are faced with a marine, tropical environment that includes ambient temperatures from 25°C-40°C, humidity approaching 100% and significant risk of salt laden air contact.
  - Very small cadres of skilled people coupled with high population mobility with exceptionally high rates of overseas emigration pose serious problems in the context of operation and maintenance and overall sustainability.

- In addition there are Man-Made Barriers towards Large-scale Utilization on PICs
  – Changes in energy demand and supply is a long term challenge that includes overcoming several man-made barriers
  – A few examples of some of the barriers identified in development and commercialization of renewable energy technologies in the Pacific are
    - Fiscal and Financial
      – The real economic cost of electricity and other energy is not known
      – Subsidies for electricity supply and in some cases for petroleum products often exist in the PICs but are rarely transparent and therefore difficult to evaluate
      – Import duties on energy producing and using equipment in some PICs are not applied uniformly. Some utilities get fuel tax-free but there may be tax on renewable energy technologies

- Institutional
  – Poor understanding of the needs, resources and abilities of rural communities to sustain renewable energy installations. The resulting institutional systems established for renewable energy use in rural areas are either excessively costly or simply do not work
  – There is inadequate capacity to design and implement renewable energy projects both in government and the private sector
  – Intellectual inertia in utilities and energy delivery institutions makes it difficult for them to accept new technologies and operational structures
  – Most PICs have not provided for project support for the long term including adequate spare parts arrangements, training for new operating and maintenance personnel that replace those originally trained at the time of installation, etc

- Barrier Removal
  – Currently UNDP is supporting interventions that focus on climate change mitigation by removing some of the major barriers in the PICs to the widespread and cost-effective use of commercially viable renewable energy technologies
    - Regional level: Pacific Islands Greenhouse Gas Abatement through Renewable Energy Project (PIGGAREP)
  – In the recent past UNESCO and UNDP in collaboration with PICs has supported interventions to promote the utilization of renewable. Examples include:
    - Preparatory phase for solar photovoltaic (PV) mini-grids in Apolima island (Samoa) and Fakaofo atoll (Tokelau)
    - Preparation of the Tokelau National Energy Policy and Strategic Action Plan (NEPSAP)
    - Feasibility study & project proposal development for grid connected wind power on Rarotonga (Cook Islands)
    - Technical Assistance to increase the utilisation of renewable energy technologies in five outer islands in the Cook Islands

- Why islands are Important for the Promotion of Renewable Energy World-wide
  1. Well-defined entities not only speaking of geography, but also in terms of energy production, population, economy, etc. Thus, islands can become highly visible entities for renewable energy technology, organisation, and financing
     – Islands are useful to make future energy systems visible and concrete
  2. If decision-makers world-wide should be inspired to aim at a broader use of renewable energy as part of a sustainable development, it is necessary to demonstrate renewable energy in a large-scale, integrated and organised form and placed in a well-defined area such as islands

  3. A dramatic shift to renewable energy on a large scale on continents/mainland is unrealistic in the short and medium term. However it would be of interest to demonstrate the possibilities of smaller communities to base their entire energy supply on renewable energy sources
     - Islands can cheaper, faster, and easier reach a higher share of renewable energy in its energy balance than a much bigger mainland
     - The very smallness of the islands – that often is seen as a disadvantage – is in this context an advantage
  4. Experiences gathered on islands can be used, not only on islands, but in principle everywhere
     - Islands can serve as demonstration projects for mainland local communities, not only in developed countries, but also in developing countries

- The Danish island of Samoa an excellent example of Islands possible Global Significance concerning Renewable Energy
  - Won a Danish competition in October 1997
    - For the most realistic plan to achieve 100% self-sufficiency with renewable energy in a local area
  - Results 10-years Later
    - In power and heating sectors 100% self-sufficiency with renewable energy using local resources, at the same time removing the emission of CO_2 and other air pollutants
  - Key success factors
    - Bottom-up method by creating citizen involvement right from beginning
    - Mobilization of the local population has been a key success factor

References

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Some Issues on Integrated Coastal Management to Haiphong City (Vietnam) in Sustainable Development

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The People's Committee of Haiphong City, Vietnam

Abstract

Haiphong is a coastal city with a natural area of 1,520 km^2, 1.85 million inhabitants. There are 6 districts with 22 coastal communes in among 15 administration units. Sea and islands are the most special physical geography factors of Haiphong. With 125 km of coast, around 3,500 km^2 of natural surface area, among it, island area is over 300 km^2, Cat Hai is one of 2 island districts of Haiphong with 366 small and large islands. Cat Ba is the main island of the Cat Hai district. It has national primeval forest with plenty and precious fauna and flora, beautiful natural scenes, archaeological monuments that reflect Ha Long ancient culture. On 2nd December 2004, Cat Ba Archipelago was recognized as a World Biosphere Reserve and it is now listed as one of 12 natural sea conserves of Vietnam.

Territorial water of Haiphong is located in the center of Tonkin Gulf, next to 3 large fisheries of Bach Long Vy, Long Chau Ba Lat, Cat Ba. Area for aquaculture of Haiphong is rather large, over 40,000 ha for breeding high economical value fresh water, brackish water and sea water fishes and others as shrimp, crab, fish, mollusk, sea-weed; especially floating caged-fish breeding and precious seafood as abalone, etc.

Sectoral specific risks can be identified for typical sectors in development corporation programmes. To determine the risks to which sectors are exposed, it is necessary to examine their vulnerability to specific hazards. The potential hazards from climate change and climate variability include:
Increased surface temperatures.
Sea level rise.

- Decreased or increased precipitation.
- Soil erosion.
- Fluctuating and changing courses of rivers.
- Changes in frequencies and intensity of storms.
- Changing weather patterns, including drought and flood patterns.
- Glacier lake outbursts from increased melting of ice mountains.

Sectors that are most vulnerable to the risks of climate change and increased climate variability are:

- Agriculture: influence on crop production from higher temperatures and changes in rainfall and water supply, changes of pest and disease patterns.
- Water resources: greater evaporation, changes in rainfall, changes in ground water levels, increasing water demands in warmer climate, salt-water intrusion with sea level rise.
- Human health: greater risks of vector borne and water borne diseases, greater heat stress, and exposure to ultra-violet radiation.
- Biodiversity and natural ecosystems: greater risks of loss of vulnerable coastal and marine ecosystems including wetlands, mangroves, and coral reefs, increased risk of desertification and loss of biodiversity, impact on migratory species.
- Coastal area infrastructure: sea level rise, more severe storms.

- Housing and other infrastructure: heavier rains and storms, water availability.
- Tourism: temperature changes, sea level rise, disease patterns, and water availability.

The impacts of climate change and extreme weather events, like tropical storms and floods, can have a devastating impact on developing countries' economies. For example, climate change can cause damage to infrastructure, e.g. roads, harbours and other development projects, often funded by poor countries with a mixture of loans, soft loans and grants.

The scientific challenge includes three main issues:

1. What is climate change?
2. What are the causes of climate change?
3. What are the impacts of climate change?
    - To the city, challenges that directly affected to sustainable development of sea-economy is epidemic of cutting mangrove forest to fish breeding, un-planned encroachment of sea, pollution affected to coastal ecosystem. Protection of marine environment, coastal and island environment and development of marine resources meet difficulties due to often be affected by storms, erosion; annually Haiphong is affected by the average of 3 to 5 storms or tropical low pressures, among them there is 1 to 2 strong ones directly affected to Haiphong.
    - Pressure in population increase, industrialization formed coastal industrial zones, rapid urbanization speed in coastal areas and free emigration took to increase of natural resource using and habit of waste-use natural resources caused degradation of marine and coastal resources. Coastal industrial zones and urban areas had flushed un-treated wastewater and solid waste directly to the sea, taking to serious pollution. Vicious circle is profound appeared: live-hood demand - excessive excavation - exhausted natural resources - poverty.
    - Sustainable development is urgent need and indispensable trend. To "develop social-economic in close with environment protection and improvement; ensure harmony between human-being made and natural environment; maintain diversified biology" the city has prepared action plan to implement Decision 153 of Prime Minister on strategic orientation in sustainable development in Vietnam (Implementation of Agenda 21).

THE "TWO-LEG" APPROACH IN CLIMATE AND DEVELOPMENT

Efforts to address climate change must "walk on two legs". The one leg is to support adaptation to climate change. The other is to enhance mitigation of climate change.

Adaptation options include:

- Protection against sea-level rise, where possible, including salt-water intrusion in water supply.
- Strengthening primary health care as a response to changes in distribution of vector borne diseases.
- Changes in design specifications and building codes to address climate change and more frequent extreme weather conditions.
- Rehabilitation of natural ecosystems, e.g. mangroves as a barrier against violent storms and floods.
- Construction of infrastructure to stand higher level of water run-off, e.g. wider bridges and larger culverts in roads, or reduced construction demands if less precipitation is anticipated.
- Risk adjustments to address variations in crop production in agriculture, e.g. use of more robust crop varieties and access to crop insurance.
- Management of water resources in order to maintain access to water and alleviate risks of drought or protect against floods.

Mitigation of Climate Change

- Reduction at the source of emissions from use of fossil fuels by means such as energy efficiency, fuel switching (e.g. from coal to gas), renewable energy, and clean coal technology.
- Capturing of waste greenhouse gases, such as methane emitted from landfills with organic waste.
- Creating sinks for storing carbon through natural resource management options, including land use and forest management that lead to the sequestration of carbon in organic matter in soils and biomass, in particular in trees.

Contents

1. General features of Hai Phong city
2. Coastal area of Haiphong
3. Cat Ba Island Archipelago Biosphere Reserve
4. Threats to coastal area of Haiphong (climate change effects and human activities)
5. Application of the "Two leg" approach in climate change and sustainable development

Vietnam map

General feature of Hai Phong city

- Area: 1,519 km^2
- Population: 1,85 millions
- Labor force: ~ 1 million
- GDP growth rate: year 2007: 12,82%; 2008: 13,02%
- GDP structure:
  - Services: 51,88%;
  - Industry and Construction: 37,64%;
  - Agriculture, Forestry and aquaculture: 10,48%
- Export: year 2008: US$ 1,5 billion
- Seaport cargo throughput: 30 millions tones in 2008
- Number of tourists: year 2008: 3,9 millions

General feature of Hai Phong city

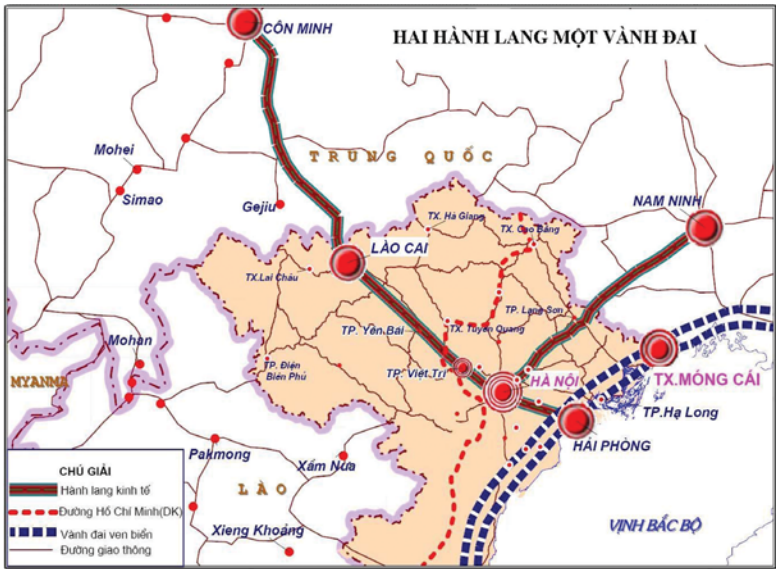
- Coastal City in the Gulf of Tonkin (South China sea), 102 km from Hanoi Capital, marine water surface area of 4,000 km^2
- 15 administration units: 7 urban districts, 8 rural districts; 40% urban residents.
- Convenient transportation systems: road, railway, marine line, inland waterway and airline.
- Tropical and temperate climate with 2 seasons: summer and winter. Average temperature: 20^{0}C - 23^{0}C; average humidity: 80% - 85%.

PORT OF HAIPHONG
THE INTERNATIONAL COMMERCIAL PORT

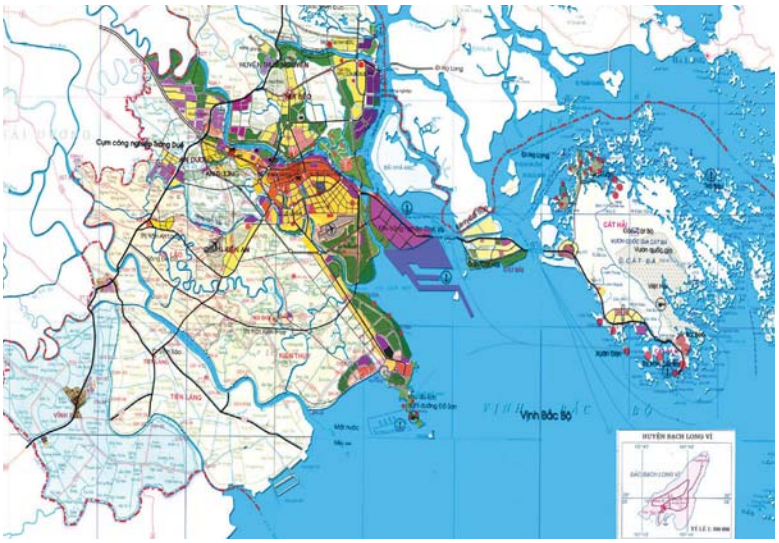
Port	Distant (Knots)
Danang	320
Hochiminh City	799
ZhangZiang	200
Hong Kong	500
Manila	885
Kaoshiung	940
Bangkok	1390
Singapore	1442
Klang	1528
Penang	1730
Bussan	1749
Vladivostok	2114
Kobe	2141
Tokyo	2349
Sydney	5560
Rotterdam	9770

General feature of Hai Phong city

- Economic dynamic pole of the Northern economic area (Hanoi - Haiphong - Quang Ninh)
- An important junction of the chain in "two corridors, one economic belt Vietnam - China"
  - Kun Ming (China) - Lao Cai - Hanoi - Haiphong (Vietnam)
  - Nan Ning (China) - Lang Son - Hanoi Haiphong
  - Haiphong - Quang Ninh (Vietnam) - Hai Nan (China) Economic Belt
- >300 FDI Projects, ~ USD 4 bil. of 26 countries/ territories



Haiphong City – 120 km coast line



2. Coastal area of Haiphong

- 125 km of coast line.
- 6 coastal districts with 22 coastal communes.
- Island area of over 300 km^2.
- 3 main islands (Cat Hai, Cat Ba, Bach Long Vy) and 366 smaller islands.
- Territorial waters of Haiphong is in the center of Tonkin Gulf
- Marine water surface area and for aquaculture: 4,000 km^2.

3. Coastal area of Haiphong City

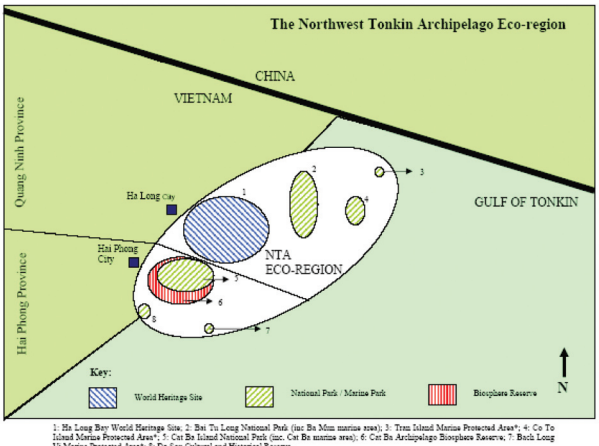
- Breeding of high economical value seafoods: fresh water, brackish water and sea water fishes; and precious seafood as abalone…
- Aquaculture: shrimp, crab, fish, mollusk, sea-weed farms; floating caged-fish breeding
- Salt farms
- Two major sea tourist attraction: Catba island, Doson peninsula

3. Cat Ba Island (Haiphong)

The World Biosphere Reserve

- On 2nd December 2004, Cat Ba Archipelago was recognized as the World Biosphere Reserve;
- Listed as one of 12 natural sea conserves of Vietnam;
- The national primeval forest with plenty and precious fauna and flora;
- Beautiful natural scenes, archaeological monuments that reflect Ha Long ancient culture.

3. Cat Ba Island Archipelago Biosphere Reserve



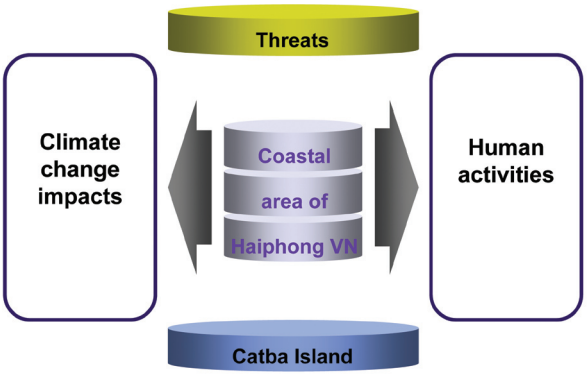
1: Ha Long Bay World Heritage Site; 2: Bai Tu Long National Park (inc Ba Mun marine area); 3: Tran Island Marine Protected Area*; 4: Co To Island Marine Protected Area*; 5: Cat Ba Island National Park (inc. Cat Ba marine area); 6: Cat Ba Archipelago Biosphere Reserve; 7: Bach Long Vi Marine Protected Area*; 8: Do Son Cultural and Historical Reserve.
* Site has been proposed to the GOV

3. Cat Ba Island Archipelago Biosphere Reserve

in connection with Halong Bay – the world natural heritage

3. Catba Island (Haiphong) The World Biosphere Reserve

3. Threats to Coastal area of Haiphong



The effects of climate change

- Increase or decrease precipitation
- Typhoon
- Flashflood ➾ soil erosion
- Fluctuating and changing courses of rivers
- Drought
- Flood-tide
- Increased melting of ice from the poles
- Sea level rise

- A typhoon combined with high tide in Doson (Haiphong) - famous a tourist resort

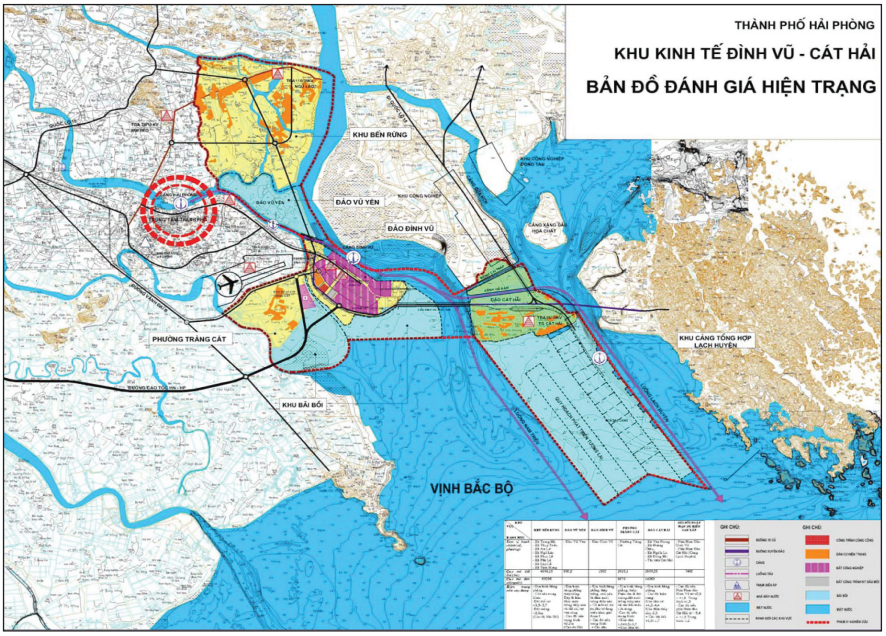
After a storm

The effects of climate change

- Biodiversity and natural ecosystems: greater risks of loss of vulnerable coastal and marine ecosystems including wetlands, mangroves, and coral reefs, increased risk of desertification and loss of biodiversity, impact on migratory species.
- Coastal area infrastructure: sea level rise, more severe storms.
- Housing and other infrastructure: heavier rains and storms, water availability.
- Tourism: temperature changes, sea level rise, disease patterns, and water availability.

Human activities' impacts

Reclaimation for new development projects



The effects of climate change

- Agriculture: influence on crop production from higher temperatures and changes in rainfall and water supply, changes of pest and disease patterns.
- Water resources: greater evaporation, changes in rainfall, changes in ground water levels, increasing water demands in warmer climate, salt-water intrusion with sea level rise.
- Human health: greater risks of vector borne and water borne diseases, greater heat stress, and exposure to ultra-violet radiation

Human activities' impacts

- Over populated: Haiphong population 1,85 mil. with grow rate of ~ 1%
- Urbanization: very fast, from 5 urban districts to 7 urban districts since 2007
- Industrilization: industrial production increased > 18% annually for more than 20 years; 55 industrial parks and zones.
- Reclaimation and leveling of shallow coastal areas for new tourism resorts: Hondau resort, Daso resort in Doson; Caigia resort in Catba…
- Development of new deep-sea ports: Lach Huyen ~ 1.800 ha; South Doson port…
- Expansion of shipbuilding industry: all potential front water reserved for shipbuilding
- Water pollution from port activities and sewege discharge
- Over use of pesticide and chemicals
- Expansion of aquaculture (cutting mangrove forest for fish and shrim breeding, fish breeding floated cages…)

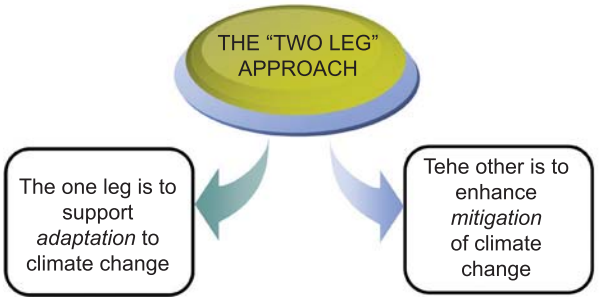
Human activities' impacts

- Expansion of aquaculture (cutting mangrove forest for fish and shrim breeding farms, fish breeding floated cages…)

After pond embankment making, mangroves not being able to survive due to failure to undertake respiration by roots.

5. Application of the "Two Leg" Approach in climate change and sustainable development

- Efforts to address climate change must "walk on two legs".



5. Application of the "Two Leg" Approach in climate change and sustainable development

- **Adaptation options:**
  - Protection against sea-level rise, where possible, including salt-water intrusion in water supply.
  - Strengthening primary health care as a response to changes in distribution of vector borne diseases.
  - Changes in design specifications and building codes to address climate change and more frequent extreme weather conditions.
  - Rehabilitation of natural ecosystems, e.g. mangroves as a barrier against violent storms and floods.

- **Adaptation options:**
  - Construction of infrastructure to stand higher level of water run-off, e.g. wider bridges and larger culverts in roads, or reduced construction demands if less precipitation is anticipated.
  - Risk adjustments to address variations in crop production in agriculture, e.g. use of more robust crop varieties and access to crop insurance.
  - Management of water resources in order to maintain access to water and alleviate risks of drought or protect against floods.

- **Mitigation of Climate Change:**
  - Balance economic development and conservation: new developmet projects must take into account ecosystem conservation
  - Reduction at the source of emissions from use of fossil fuels by means such as energy efficiency, fuel switching (e.g. from coal to gas), renewable energy, and clean coal technology.
    Haiphong and JICA are figuring out potential co-benefit CDM projects (sewage water treatment, power distribution…)

- **Mitigation of Climate Change:**
  - Capturing of waste greenhouse gases, such as methane emitted from landfills with organic waste.
    Landfill sites for solid waste at Trangcat, Dinhvu, Giaminh…
  - Creating sinks for storing carbon through natural resource management options, including land use and forest management that lead to the sequestration of carbon in organic matter in soils and biomass, in particular in trees

Session 4

Strengthening Cooperation and Raising Societal Awareness on Climate Change

Dr. Kyoung-Mann Cho
Mokpo National University
Korean MAB National Committee, Republic of Korea

•

Ms. Janette du Toit
Cape West Coast Biosphere Reserve, South Africa

•

Mr. Kim Yang-Bo
Environmental Policy Director
Jeju Special Self-Governing Provincial Government, Republic of Korea

•

Ms. June Marie Mow and Mr. Juvencio Gallardo
Executive Director, Providence Foundation, Colombia

Making Creative Communities for the Collaboration Among Island Biosphere Reserves

Dr. Kyoung-Mann Cho
Mokpo National University
Korean MAB National Committee, Republic of Korea

Abstract

Islands have contributed to conspicuous advances in the studies on human society, like the studies on reciprocity in Trobriand Islands and like the social network theory. In social praxis islands can be platforms of pioneering the prospect of global future. For MAB socio-cultural strategy of making creative communities is to realize collaboration in these environmental crisises. For this paper suggests that understanding the culture of island locality and networking is needed.

Islands are both self regulating and interdependent entities. The rootedness and route are cultural themes of islanders live. The cultural specificity and networking along the currents or marine routes have enabled 'open locality'.

Under the dominance of mainland-centered policy, Korean islands have been culturally constructed with the mainland cultural values. Also their developmental ways have been only local specification of those of mainland ones. But even in these historical and contemporary circumstances we can find several evidences of the self regulating politico-social relations, cultural identities, the open ventures among themselves and toward mainland. In the first we have to revitalize island values which can exist as prototypical features or as everyday experiences confronting the island environments and societies.

Thinking about these features we can envision island-scape locality and networking to pioneer a solution of contemporary global environmental crisis. Not to pioneer technical solution but to that of human society. As for the ecological affairs we can meet people's discursive reactions from their life experiences of local environmental change with their own terms and with their own ways of seeing. Awareness is a quite cultural thing. Also we can meet people's networks with their organizational behaviors, open to the broader scope of islands and coasts. In May and October 2008 coastal people of Haenam county, south western part of Korea made ritual visits to the counterparts of Bogil Island and Chungsan Island. These trips were based on the cultural history of the coast-island route and traditional organizational behaviors of connectedness. The leaders of the ritual visits are trying to revitalize and create the appreciation of nature which would proceed to the environmental awareness.

These cases are small scale prototypes. But they tell the needs for the 'island literacy' which is based on 'learning organism'. That is, transcending usual enlightenment to the people, creating the cultural situations to activate people's intellectual responses from their own resources and by their own ways of epistemology appreciating the environment of cognition, appreciating the social networks, especially socio-geographical world in the islands. These works can be done by both transmission of people's learning behavior and strong creativity of contents. The works are live, interactive, creative process toward learning community.

Considering these small scale prototypes, we can envision MAB methodology of awareness and collaboration among islands, which is basically toward the live learning island and communicative literacy. It should be the cultural program transcending mere awareness method.

I. Root & Route

- Islands are both self regulating and interdependent entities.
- The rootedness and route are cultural themes of islanders lives.
- Rootedness in the local environment and socio-economic exchange among the coastal and island societies are traditional adaptive strategies and cultural values.
- In the southwestern coasts and islands of Korea, there have been autonomous economic activity and resource regulating system called joobi . As a result it contributed to conserve marine resources, forests and self-regulating social relations.
- The Sinan Dadohae Biosphere Reserve (SDBR) which is in application is a representative region of small islands located in Sinan County, Jeollanam-do province, Korea.
- Sinan county includes over 1,000 small islands. SDBR is planned to protect essential environmentally important areas and to enhance traditional adaptive values.
- Especially it includes huge tidal flats surrounding the islands ("islands up and down with tidal flats in tide and ebb") and temperate ever-green broad leaf forests.
- Besides, village forests, temple forests and traditional village relics have contributed to conserve natural environments in transition to human, cultural area.
- The landscape of this area exists as an ecological ecotone that gradually connects sea, tidal flat, coastal beach, sand dune and vegetation in an environmental gradient.
- The various organisms of the area illustrate the results of ecological adaptation to a multi-ecosystem spectrum and its continuity, which lends higher conservation value to the marine and landscape diversity.
- Also people's adaptive economic behaviors and social customs related with seaweed, ground fish and shellfish harvesting tell the sustainable strategy.
- Getting nutrients with very primitive, simple tools-the cultural theme of this technology
- Between islands and mainland local societies there had been resource exchange, called dobu practice. Along the marine routes there had been intimate cultural contacts including visits, rituals, marriages discourses and informations.
- Through reflexive consideration of these traditions, in SDBR, there is an envision to establish creative communities.

II. Creative Communities

- This presentation only deals with conceptual strategies regarding creative communities and collaborations.
- The traditions previously told are now embedded in the habitual practices or remain as cultural survivals.
- But inheritance or invention of tradition adapting to the changed social, economic and environmental setting is needed.

1. Communication

- In SDBR and other protected area planning, the most difficult one is to communicate with stakeholders, especially with local peoples and their representatives.
- Not only because of the present economic interests (usually 'tragedy of the commons') and visions (we are the last generation to live here, victims of the environmental policy)
- but because of the fact that they feel excluded.
  - Regarding climate change they feel the ocean and resource change quite well in their fields of subsistence.
  - But they also feel 'how to do with that in our own range?'
  - For BR we have to clarify the themes for the local peoples regarding the BR conservation, the sustainable development and the reaction to the climate change.
  - The development of thematic questions of 'what do they mean for you, the conservation, sustainable development , climate change and reactions?' are needed.
  - The more urgent task is to develop the ways of communication.
  - People are accustomed to normal meetings, explanations and discussions. They listen and talk. But in most cases they do not participate in the common themes. They listen, talk, interpret with their own 'ways of seeing' the situation, with their own interests and as quite important phenomenon, they would like to enjoy the fact itself that they are not disregarded. In many cases they say 'it is a first time to listen' or 'why don't you talk about it last time?'.
  - To solve this situation considerate development of communication is needed.
    - Making thematic questions together depending on the people's experiences
    - Finding out culturally appropriate field of communication or understanding depending upon their cultural ways of discourse.

– Feeling is the primary concern, people would like to be respected. People are always confronted with identity choices which usually depend upon the feeling of being respected. Respect of their ways of lives and traditions even though they are not related with immanent situations or are the facts ideally recalled.

(ex. The rise and solution of conflict between DFO (the Department of Fisheries and Ocean) and First Nations in Canada in 1999, BC were from the feeling of insult and the feeling of 'respect to the culture and people can begin').

- So posing the meaning of traditions on the common ground is a way to make feeling of respect regardless or to make past experiences ideally recalled or to reinvent 'ancient future'. The traditional island values which can exist as prototypical features or as everyday experiences confronting the island environments and societies.
- Values: Islands are both self regulating and interdependent entities. The rootedness and route are cultural themes of islanders lives. The cultural specificity and networking along the currents or marine routes have enabled 'open locality'.
- Thinking about these features we can envision island-scape locality and networking to pioneer a solution of contemporary global environmental crisis. Not to pioneer technical solution but to that of human society.
- In May and October 2008 coastal people of Haenam county, south western part of Korea made ritual visits to the counterparts of Bogil island and Chungsan island.
- These trips were based on the cultural history of the coast-island route and traditional organizational behaviors of connectedness.
- The leaders of the ritual visits are trying to revitalize and create the appreciation of local nature which would proceed to the environmental awareness.

2. Making together

- Awareness, understanding, making thematic questions and making solutions, for the local people, occur through the concreteness. Especially concreteness experienced through praxis.
  - Knowledge with their bodily behaviors
  - Feeling is always local. The local as the medium of understanding the global
  - Understanding and cooperation through 'making something' with their own. (ex. Muan Wetland Reserve villagers who are getting interested in the common environment through their telling or dramatizing themselves.
- Creativity : understanding the reality through making something. envisioning the construction of livable world. making common ground of communication and cooperation by creation or reinventing something.
- BR :
  - Coordination: To establish the function of common ground of creativity. With present environmental and life issues, with traditional values recalled and reinterpreted. Awareness by making thematic questions together based on the local experiences.
  - Beyond social monitoring: To establish lab of interactive access. To establish lab for the design of culturally appropriate ecological, social values.

III. Collaboration among Island BRs

1. Construction of common and mutual learning

As common ground of local people's awareness, understanding, creating together, as lab of interactive access and island community design, BR is not merely physically protected area. Also it is not merely geographically sustainable development object.

- Collaboration is an activity among people's 'learning organism' .
- That is, transcending usual enlightenment to the people, making the BR as organism of learning by concrete problematics and creative praxis.
- Collaboration is to be based on mutual 'mirroring' of conditions, resources, processes and 'culture' of making creative communities, learning organism.
- It is also to confront the global crisis empowering biodiversity with cultural diversity. Creating the network of 'island literacy' (BRs and people, learning through creative work), beyond mere information change and technical cooperation can be planned.
- In Dadohae Korea we are at the first step with people for systematization of biodiversity, cultural diversity and collaboration based on rootedness and route.

Strengthening Cooperation and Raising Societal Awareness on Climate Change Within The Cape West Coast Biosphere Reserve

Ms. Janette du Toit
Cape West Coast Biosphere Reserve, South Africa

Biosphere reserves provide a concrete means of addressing international obligations such as Agenda 21, the Convention on Biological Diversity, the Millennium Development Goals, the Plan of Implementation of the 2002 World Summit on Sustainable Development and the UN Decade of Education for Sustainable Development as well as recommendations flowing from the Intergovernmental Panel on Climate Change.

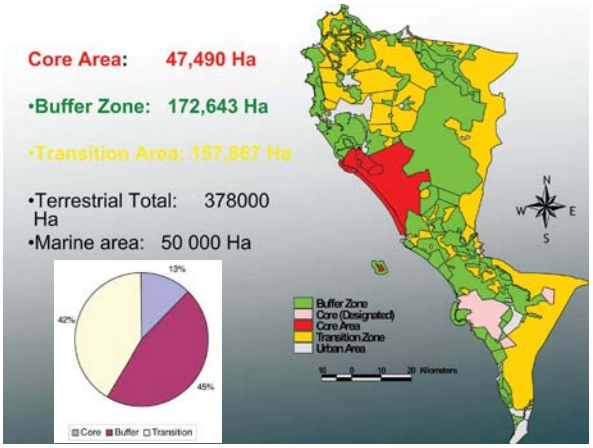
South Africa's Cape West Coast is a semi arid, global biodiversity hotspot, filled with a unique and rich natural, cultural and paleontological heritage. Climate change predictions however state that a process of desertification is underway, putting enormous pressures on our limited natural resources such as water and soil. Unfortunately, to add to this, the heritage is poorly protected in lowland coastal areas and under extreme pressure from a rapidly expanding population and ongoing industrial, urban and property development. In this context, what is the role of Biosphere Reserves and how do we as Managers address these important issues?

Key to integrating development with conservation and heritage preservation is the promotion of sustainable practices that will "green the biosphere". The Cape West Coast Biosphere Reserve ("CWCBR") Company is engaging with local stakeholder groups (schools, hostels, business, farmers, government) from key sector (education, property development including construction and architecture, fishing, agriculture, tourism and mining) in developing and implementing a strategy and action plan to "green" the CWCBR.

These are centered around a series of themes reflecting global imperatives and strategic priorities whilst focused on empowering stakeholders, promoting involvement and guidance towards sustainable action and development and piloting a project that will inform the greening and sustainable development strategies of other Biosphere Reserves around the globe.

Is this being achieved?

Small achievements are good beginnings - Developments are being designed holistically, municipalities are upgrading their technologies to reduce their carbon footprint and green building guidelines are approved.



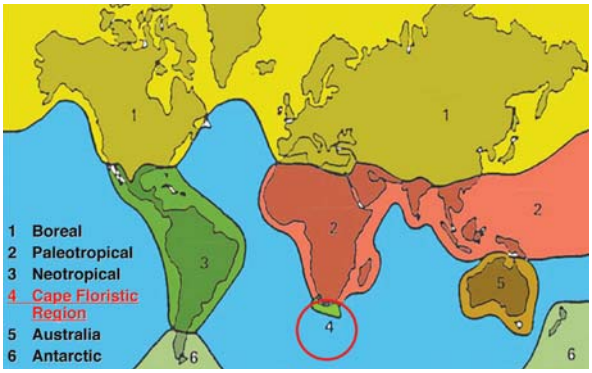
Biospheres Criteria
- a special status site (RAMSAR site)
- a lagoon system (resource exploitation).

Biosphere Criteria
- a moist to dry Mediterranean type climate - influences natural resource conservation strategy directly.

Biosphere Criteria
- a coastal location

Biospheres Criteria
- significant urban populations (major drivers of land use change)

The Six Plant Kingdoms of the World



MAP and Climate Change

A.1 CLIMATE CHANGE

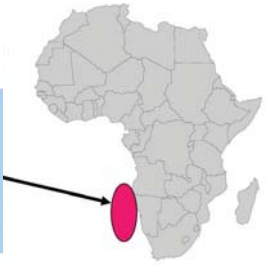
For the Natural Sciences as well as other Programme Sectors of UNESCO, biosphere reserves can be areas for demonstrating adaptation measures for natural and human systems, assisting the development of resilience strategies and practices. Buffer zones and transition areas of biosphere reserves may also be used to test many mitigation tactics and strategies.

African Projected Climate: Trends, Extremes

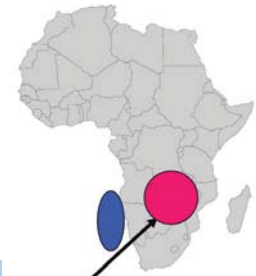
- Average temperatures increased between 0,2^{0}C & 1^{0}C sinc 1970s
- 2020-2029 projection is warming of 1,5^{0}C to 2^{0}C
- A 1^{0}C increase = 5% increase in evaporation
- 10-30% decrease in average river run-off
- More severe and prolonged droughts
- Sea level rise of 4,5cm every 10 years

Extreme Events

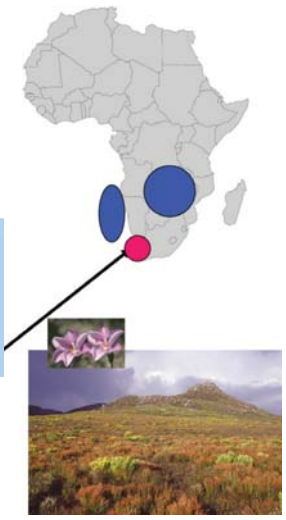
South-West Africa
Coastal marine fisheries adversely affected by changes in Benguela current



Southern Africa Droughts
Long-lasting impacts of drought on the SADC economies



Cape Flora
Loss or displacement of species in biodiversity-rich Cape and Karoo areas

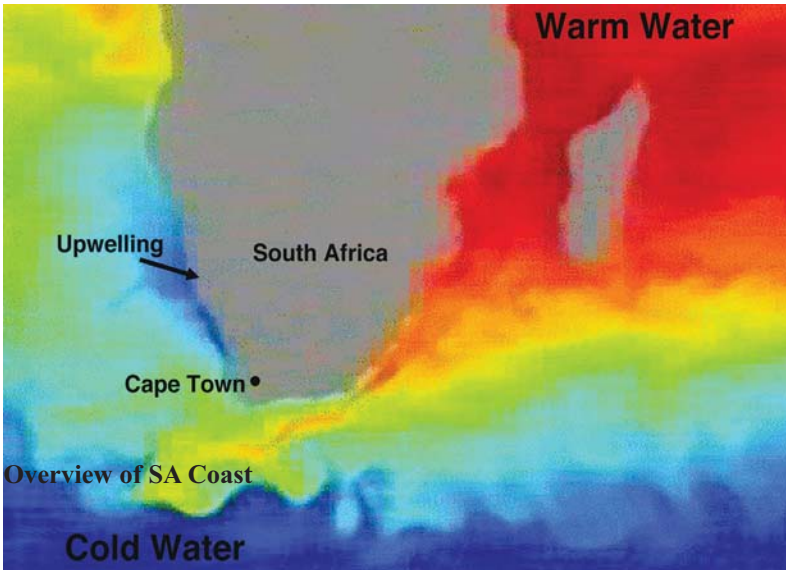


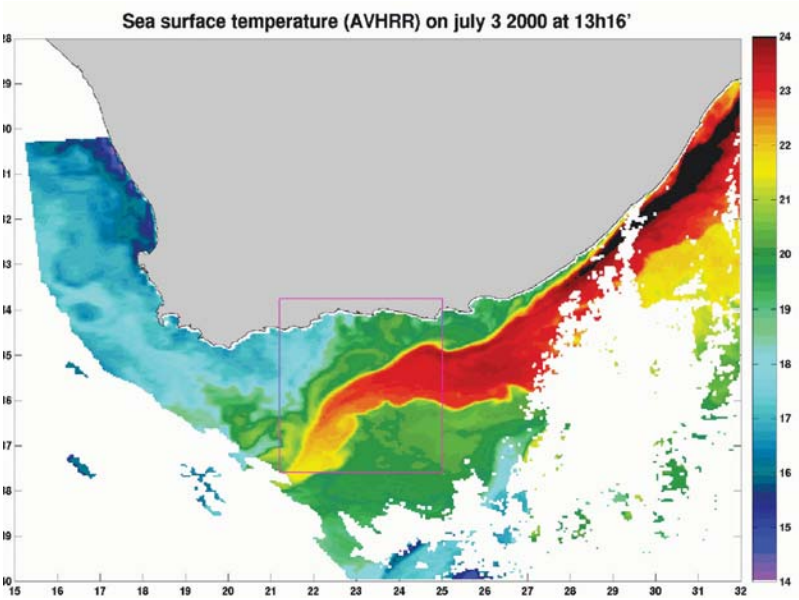
Overall Vulnerability High

Vulnerability of human systems high as a **result of heavy reliance on rain-fed agriculture**; **frequent droughts and floods**; and **poverty**.

Issues within the CWCBR

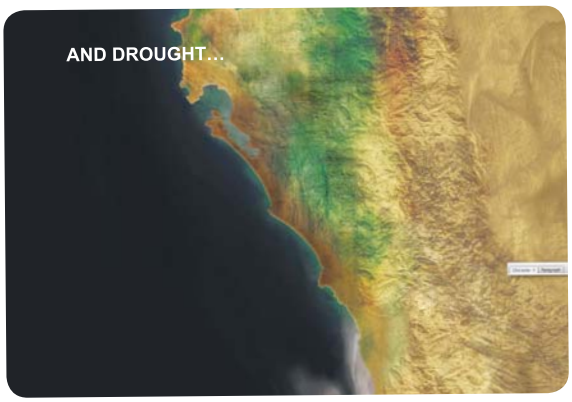
Local Fishers…and climate change consequence

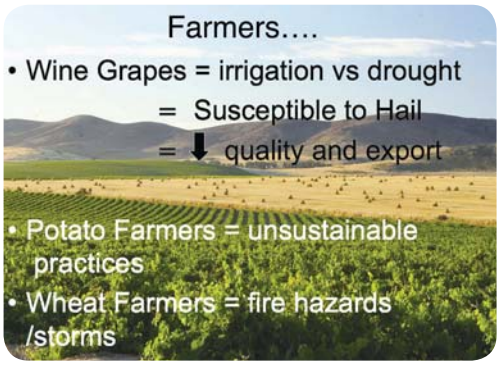




Conservationists & Researchers..

Politicians/ Developers /Planners = Storm surge…

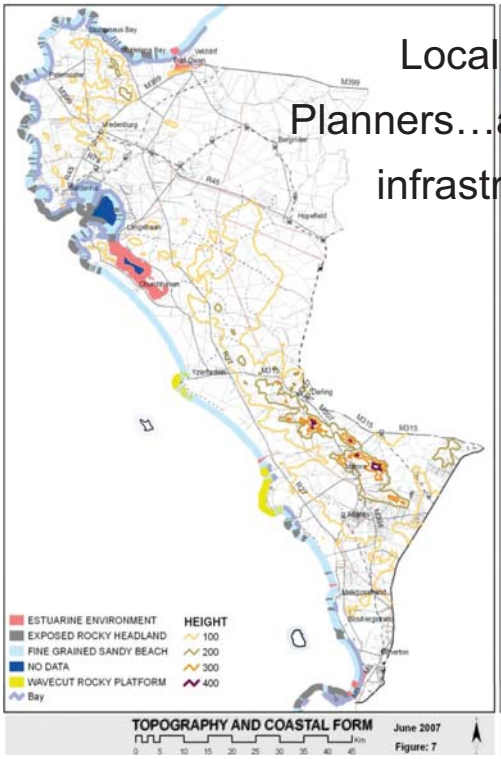




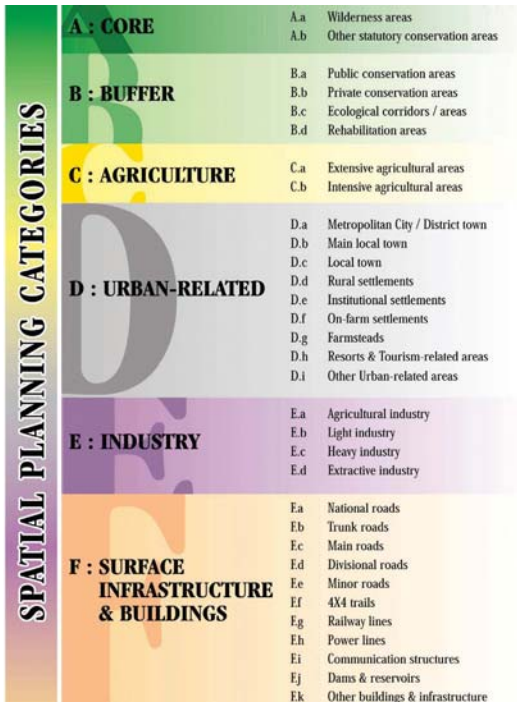
Biosphere Reserves… bridging the

GAP?

Local level Planners…appropriate infrastructure



SPATIAL PLANNING CATEGORIES



Implementation of bioregional planning and biosphere reserve principles utilising a practical land use planning tool

Mitigation in Going Green…for Climate Change

Procurement Policy…

Municipal Computers in CWCBR (average observations)

- 160-210 Watts per hour (excluding screen)
- Energy consumption (per week)
  – 26,8 kilowatt hours
  – 79 kg of coal

1 ton of coal every 13 weeks!

Preferred computer: Intel VPRO

- 86 Watts per hour (excluding screen)
- Energy Consumption (per week)
  – 14,4 kilowatt hours
  – 42 kg of coal
- Only costs R48 extra per PC

1 ton of coal from every 13 to every 23 weeks!

~7500 PC's in Municipalities in CWCBR

- Energy consumption (per week)
  – 295, 680 kilowatt hours
  – 593 tons of coal
  – ~USD 17,200 per month

3.5 tons of coal per hour!

- Every Watt consumed generates heat that will be extracted
- Airconditioner ~ 50% of Municipal electricity consumption
- Costs approximately 2.5 watts of Aircon to extract 1 watt's worth of heat
- Monthly electricity saving (VPro PC's) = USD 8,000
- Monthly Electricity saving (Aircon) = USD 8,000 x 2,5w = USD 20,000
- Total Savings = USD 28,000 per month

Collaboration with Development Bank of Southern Africa

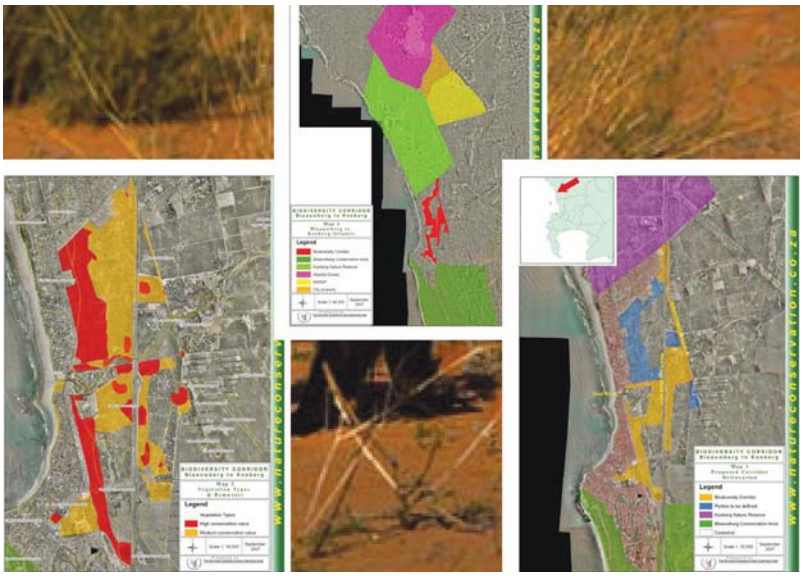
Developments

• Used Provincial Policy on Climate Change to lever developers to build resorts/developments =
Off the water
=Off the Electricity Grid
• Two resorts to date….

Collaboration with National Government, Policy and Poverty Alleviation Project

Collaboration with Community Champions

Adaptation in the Core Area = Species Migration…?



The children….

In Conclusion

- Multi-Pronged Approach
- Using Biosphere Reserve for Learning and adapting
- Collaboration at different levels required

IMAGINE…
A SOCIETY WHERE EVERY INDIVIDUAL KNOWS THEIR RESPONSIBILITY IN TERMS OF CLIMATE CHANGE AND IMPACTS….

Construction of Strategy for Enhancing the Degree of Recognition about Climate Change in Jeju Island

Mr. Kim Yang-Bo
Environmental Policy Director
Jeju Special Self-Governing Provincial Government,
Republic of Korea

Abstract

Jeju Island was designated as UNESCO's ecological preservation area in December 2002. Also, Jeju Vocanic Island and lava tubes were inscribed on UNESCO's world heritage list in June 2007, which was the first and unique in South Korea. In addition, Muljangori and Mulyoungari marshy areas, known as Ramsar wetlands, are also registered. Jeju Island is uncommonly beautiful in the world and also one of the most precious treasures. Climate experts acknowledge that Jeju is one of the most preferable places for investigating the effects caused by global climate change and constructing the scheme of adaptation to climate change due to cultural, geological and ecological characteristics. Due to Jeju's geological location, the life of Jeju Island shows diverse origins, which include China, Japan, even tropical and subtropical regions. Some life forms in Jeju Island are distributed over China, Japan and Jeju and others over Taiwan, Japan and Jeju. Furthermore, the horizontal distribution made by geology and topography contributes to the diverse life forms in Jeju Island.

The recent climate change has caused a dramatic change of the Jeju Island's ecosystem such as endangered Korean fir group in Hala Mountain and the decrease of fishes and shellfishes, which have brought difficulties to prospecting Jeju Island's future. This situation requires the necessities to devise the cooperation system and construct networks among islands. And then it is also important to recognize about the proper actions in ecological preservation areas in islands for the recent climate change.

Jeju Special Self-Governing Province and National Government of Korea made the first contract about the active preparation for global climate change. From 2008 to 2012, Jeju will reduce ten percent of green house gas emission compared to 2005. Jeju Special Self-Governing Province plans to analyze the effect of climate change on Jeju society and ecosystem in long-term base. This plan should be based on the cooperation among other Islands to build systematic models related to its policy, maintenance, adaptation and research specifically. We should make an effort together to solve global environmental problem by finding the best solution for climate change.

Contents

I. Vision & Goal of Jeju Special Self-Governing Province

Vision

- Establishing Win-win situation for Environmental and Economic society through Low Carban and Recycling
- Security & Sustainable Development for Citizens

** Crisis of Climate Change will be an opportunity toward Future Oriented Green Growth*

Goal

- Reducing Greenhouse Gas emissions at 10% in compared to 2005 by 2012
- Supporting New-Energy Industry
- Strengthening & Raising Societal Awareness on Climate Change
- Minimizing damaged districts through constructing Disaster System on Climate Change

II. Outlook on Climate Change in the world

Now

- Increase in Greenhouse Gas Production
  ➡Raising the Average Temperature on Earth
- Global Warming, Drought & Flood
  ➡Changing Pattern of Wind, Rainfall & Eco-system

Result

- Average Temperature on Earth has risen at 6,4°C, Sea Level has increased 59 cm
- Increase in Natural Disasters and Tropical Disease
- Main Crops Changed & Eco-system Destruction
- Expecting the rise of huge markets with changing Low-Carbon Society

III. Case in Jeju

Geographic Characteristic

- Unique Eco-system and Social-Economic Structure
  - Abundant of Marine Resources, Endangered or endemic species of plants and animals
  - World Natural Heritage & Lava Plateau
  - Rely on Primary & Tertiary Industries

- Jeju is the most serious part of the Korean Peninsula from the effect of Climate Change

Phenomenon

- Increase of Sea Level of Younmeori Cliff (5 mm per year)
- *Chromis notata* (Temminck et Schlegel) moving to North
- Chlorosis & Jellyfish appeared
- Appearance of Subtropical Marine Species such as *Thunus thynnus* (Linnaeus), *Tripletai, Dasyatis akajei.*
- Decrease of Korean fir *(Abies koreana)*, Naturalized Plants

Youngmeori Cliff

Tripletai

Giant Stingray

Thunus thynnus (Linnaeus)

Acceleration of Subtropical Climate

Nari Typhoon 2007

IV. Activities

- Establishment of creating the Model Province for Climate Change (2007)
- Agreement for the Model Province with Environmental Ministry (2007)
- Foundation of a Committee (43 members)
- Outsourcing on establishing Roadmap for responding Climate Change (2007-2008)
- Establishing New Team (2008)
- Addressing Strategy for Climate Change through Research & Analysis (2008)
- Agreement on cooperation for Climate Change (2008)
- Incentive of Low-Carbon point(2008)
- Outsourcing on developing the Adaptation Model for Climate (July 2008)
- Enactment of the composition of Special Team for Climate Change (30 July 2008)

V. Action Plan for Climate Change

Goal

- Reducing Greenhouse Gas Emission (382,000t CO_2⬇)
  - First step (2008-2010) : A decrease of 5% compared with 2005
  - Second step (2011-2012) : A decrease of 10% compared with 2005

Targets

- Total 5 Task force Teams with 45 tasks

  Planning Team
  - Establishing Strategy & Action Plan, Enactment of responding Climate Change, Foundation of Education Center, Introduction of Emissions Trading , Promotion & Raising Societal Awareness

  Team for Greenhouse Gas Emission
  - Supplying New-Energy, Recycling, Afforesting Mountains, Building ITS, Green Industry and so on

  Team for Environmental Friendly Industry
  - Agricultural & Livestock Industry, Marine Forest, Reseach Marine and Terrestrial Ecosystem and so on

  Team for Environmental Friendly City
  - Establishing Green City with Low-Carbon, Improving Energy Effect of House, Relating to Tourism and so on.

  Researching Team
  - Building Inventory System for Greenhouse Gas emission, Researching Marine Resources, Monitoring & Researching long-term ecosystem of Mt. Halla, Developing methods for afforesting coastal zones in Jeju.

Ecological Education Model Complex

Food Waste Resouce Center

Windpower Complex

Main Plan for Raising Awareness

- Establishing Short-term & long-term Strategies & Action Plan.
- Introduction of Low-Carbon Point & Emissions trading.
- Enactment of Responding Climate Change.
- Research on Climate Change in Jeju & developing Responding Model (2008 - 2012).
- Foundation of National Education Center.
- Strengthening Cooperation nationally and internationally & Developing Promotion Programme.

Small Islands and Global Climate Change
Successful Examples of Community Resiliance

Ms. June Marie Mow[1] and Mr. Juvencio Gallardo[2]
Executive Director
Providence Foundation, Columbia

Abstract

San Andres, Old Providence and Santa Catalina are tiny islands in the Western Caribbean. Their total terrestrial area is just 57 km^2. The islands' subsistence economies are based on farming and fishing, which, of course depend on climate conditions and seasonal availability of fish and marine resources.

National policies imposed since 1960, following continental planning models without considerations of insularity, smallness, coastal ecological processes, absence of "hinterland" and the perceptions and knowledge of native islanders, descendents from early settlers, have damaged local socio-cultural capacities, as well as the structure of the island ecosystems and their ability to adapt to environmental and global climate changes and reduce vulnerabilities.

Negative impacts that have affected the islanders' economic activities and health, and also damaged the ecosystems are:
(a) high and uncontrolled population growth; we register a density of 2,855 inhabitants/km2;
(b) altered groundwater quantity and quality; marine intrusion and high concentrations of nitrates;
(c) coastal erosion;
(d) overexploitation of natural resources.

The San Andres global climate change scenario is that if the sea level increases by 1 meter in 50 years, 17% of the 27 km^2 island will disappear, along with human settlements, infrastructure and groundwater availability.

Socio-economic resilience will need to be recovered and strengthened. Islanders own the knowledge and skills based on socio-cultural traditions to rediscover and recover local capacities to reduce existing vulnerabilities and adapt to environmental and global climate change.

The Providence Foundation and COASTMAN, with funding from InWEnt, facilitated a community planning process to develop a guide for disaster prevention in Old Providence and demonstrated that tiny islands are natural labs for research on methods to improve identification and evaluation of options to address global climate change.

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[2] Executive Director Ketna. Avenida XX de Julio, San Andres, Isla, Colombia. Tel.: +57 51 256 69.

OVERVIEW

- Introduction to the San Andres Archipelago
- The Development Model
- San Andres Archipelago: human
- induced transformation
- Role of individual and informal leadership
- Fostering community self organization
- Conclusions

LOCATION

INTRODUCTION

- Area: Approximately 300,000 km^2; 57 km^2 of land.
- Land-Sea Ratio: 1/5,263.
- 0.019 % is Land or interface Land-Sea, the rest is Sea and Tropical Ecosystems.
- Extensive coral reefs, atolls, small islands and cays, seagrass beds, mangroves, and beaches.
- Population Groups.

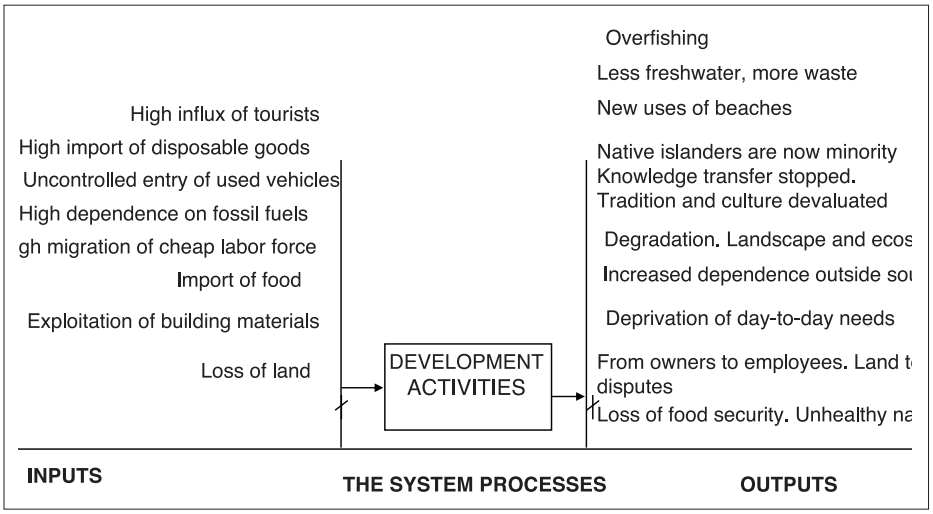




THE DEVELOPMENT MODEL

- Traditional people – native islanders - CHANGES.
- Centralized decision making and management processes – Did not provide the answers for locals.
- Destruction of ecosystems.
- Lack of recognition for socio-cultural aspects.
- Emphasis on economic growth.

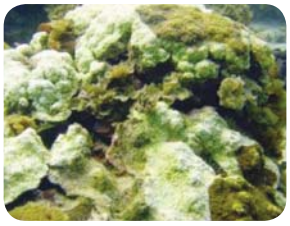
HUMAN INDUCED TRANSFORMATION



HUMAN INDUCED TRANSFORMATION

- Wetlands were filled up.
- Main road built on the sand dunes.
- The San Andres global climate change scenario is that if the sea level increases by 1 meter in 50 years, 17% of the 27 km^2 island will disappear, along with human settlements, infrastructure and groundwater availability.






INDIVIDUAL AND INFORMAL LEADERSHIP

- The actions of individuals affect the resilience of the socio-ecological system on small islands.
- Precarious life on small oceanic islands.
- Type of activities people did for survival: what was available – limited supplies from outside ▶ self-sufficiency?
- Remnants of traditional lifestyle.
- Lessons learned from traditional patterns of life ▶ develop new methods for socio-ecological systems for Island Biosphere Reserves.

INDIVIDUAL AND INFORMAL LEADERSHIP

- Sweet Man (Mr Carlos Williams).
- Mr. Maximo Livingston.
- Ms. Melodia Pomare.
  - Food, housing, clothing , medicines, and means of transportation provided locally. Deforestation.
  - Source of water = rainwater harvest.
  - Their diet. Cultivated crops, fish, pigs and chickens provided daily sustenance. Dates for harvesting each crop and fish different species (site specific).
  - Housing. Yards were big, kitchens built separate from the house.

SELF-ORGANIZATION

- Capacity to learn.
- Store knowledge and experience.
- Self-empowerment.
- Pivotal role of community organizations (grassroots level).
- Capacity to manage resilience ▸ COLLECTIVE.
  - Prevent the islands moving into an undesirable state or intentionally into a desirable island system state.

CONCLUSIONS

1. Many individual and informal leaderships.
2. Drawing experiences from traditional island lifestyle.
3. Collective actions, cooperation and collaboration. Proactive and positive responses to change.

▸ TO BUILD SUSTAINABLE, RESILIENT COMMUNITY
(social networks, family members, neighbors, friends)

Closing

Conference Photos

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Annexes

1. Jeju Declaration
2. Questionnaire & Analysis of a Questionnaire
3. Programme
4. List of Participants

Conference photos

Annex 1
Jeju Declaration

JEJU ISLAND
REPUBLIC OF KOREA
06 - December - 2008

With reference to:

- The Madrid Action Plan for Biosphere Reserves 2008-2013
- The Jeju Initiative, Asia-Pacific Inter-linkage of Island and Coastal Biosphere Reserves for Environmental Governance and Socio-economic Development, 2005-2011
- The Menorca Declaration on the Network of Island Biosphere Reserves, 2006-2012
- The work undertaken by the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification, the United Nations Millennium Development Goals, in particular MDG 1 and MDG-7, as well as the Mauritius Strategy.

Recognizing:

- That island and coastal biosphere reserves are highly specific as they share many similarities in vulnerabilities and challenges despite their ecological, geographical and cultural diversity. Islands and coastal biosphere reserves are often typified by their ecological uniqueness, geographical remoteness, limited availability of resources, rapidly growing population, vulnerability to natural disasters and global changes.
- That island and coastal ecosystems and their biodiversity have faced increasing pressure during the last decades from anthropogenic and climate change threats. This has accelerated the loss of biological and cultural diversity with regime shifts and unexpected consequences that impact the ability of ecosystems to provide services critical for human well-being.
- That under current climate change scenarios, island and coastal ecosystems will be heavily impacted. Coral reefs will be significantly reduced by bleaching caused by increased sea surface temperatures and acidification of the oceans; freshwater reliant ecosystems will change due to variations in precipitation patterns and saltwater intrusion, coastal ecotones will disappear because of sea-level rise. The pace of which these changes are taking place does not allow for natural adaptation.
- That the current trend of degradation in island and coastal ecosystems is expected to impact heavily on the economic, social and cultural spheres of society, and increase the risk for conflicts.
- That aside from rising conflicts over marine and terrestrial resources, additional resource depletion will push resource users to apply more destructive practices, with as result the increased loss of biodiversity, adding further to the vicious circle of climate change.
- The strong testimony of linkages between biological and cultural diversity in island and coastal ecosystems, and the unmistakable fragile interrelation between environmental and human components in island and coastal biosphere reserves.
- The unique role island and coastal biosphere reserves play as key-indicators or learning sites for global problems, such as energy consumption, waste management, water availability/accessibility, population pressure and climate change impacts, as well as in spearheading innovative solutions supporting sustainable development.
- That the MAB Programme, with at its core the World Network of Biosphere Reserves, provides a positive framework for the sustainable management of island and coastal ecosystems.

- The strong commitment made by the Jeju Special Self-Governing Province and Menorca Government in promoting sustainable development in island and coastal biosphere reserves and enhance international cooperation between the MAB island and coastal community.

Notifying:

- That key issues related to island and coastal biosphere reserves are often not given appropriate attention in the regional MAB networks, and resultantly there is a strong need for thematic MAB technical focus and exchange on island and coastal biosphere reserves.
- That many barriers to overcome challenges in island and coastal biosphere reserves still exist, including limited capacity and monitoring systems
- That there is a strong need for upscaling of and policy integration within island and coastal biosphere reserves, and for the development of stronger linkages between knowledge-base and decision-making.
- The need to enhance resilience of island and coastal ecosystems through appropriate rapid and swift actions.

Agreeing:

- That experiences, expertise and the knowledge base accumulated in coastal and island biosphere reserves should be shared.
- That further capacity for the MAB community in island and coastal biosphere reserves should be built.
- That exchanges provide the foundation for sound networking and improved implementation of the sustainable development agenda in island and coastal biosphere reserves
- That networking consists of a variety of approaches, including but not limited to establishing discussion forums (e.g. website, blog), topical training (e.g. restoration, rehabilitation, ex-situ conservation), knowledge and technology sharing (e.g. clean energy), topical meetings (e.g. climate change, quality economy etc.), support of small-scale innovative projects (e.g. development and availability of a funding mechanism), joint research and monitoring (e.g. development of publications and best management practices), and site exchanges (e.g. between scientists, policy makers, decision-makers, practitioners and local communities).
- That the network can play a pivotal role in translating information from research and local communities into policy and decision-making.
- To the importance of the contribution of the Jeju Self-Governing Province for the island and coastal biosphere reserve agenda and express hope for continued support to this significant initiative and recommendations made herein.

Annex 2
Climate Change Questionnaire for Islands and Coastal Biosphere Reserves

Jeju Islands, 6 December 2008

Please answer the next questions to have a review of the Climate Change effects and reactions in our biosphere reserves.

Name of Biosphere Reserve :
Name of person :
e-mail :

Impact of Climate Change
Have you observed in your islands any of the next impact directly related with the climate change (CC). (Probable means that the phenomena has been observed but it is not sure that it's directly related with CC// NC means no answer).

On the ecosystems

1.	Coastal erosion	Yes	Probable	No	NC
2.	Extreme climate events	Yes	Probable	No	NC
3.	More frequency or intensity of hot waves	Yes	Probable	No	NC
4.	More frequency or intensity of huge storms or typhoons	Yes	Probable	No	NC
5.	More frequency or intensity of droughts	Yes	Probable	No	NC
6.	New pathogens in the ecosystems	Yes	Probable	No	NC
7.	Changes in floral phenology of plants	Yes	Probable	No	NC
8.	Changes in the patterns of distribution of the species	Yes	Probable	No	NC
9.	Coral blenching	Yes	Probable	No	NC
10.	More frequency of jellyfish	Yes	Probable	No	NC
11.	Others effects don't included? ……				
12.	……..……				

On the communities or the economy

1.	Climate refugees	Yes	Probable	No	NC
2.	Reduction of water availability	Yes	Probable	No	NC
3.	Lose of tourist beaches	Yes	Probable	No	NC
4.	Some infrastructures destroyed	Yes	Probable	No	NC
5.	Lose of production lands (for agriculture of sea productions)	Yes	Probable	No	NC
6.	Number of tourist reduction because environmental disturbances (e.g. coral)	Yes	Probable	No	NC
7.	Rise of health problems because hot waves	Yes	Probable	No	NC
8.	Others effects don't included ……				
9.	……..……				

Adaptation to CC

Any of the next performances have been done in your Biosphere reserve

1.	Design of infrastructures far of sea cost	Yes	No	NC
2.	Restoration of coastal areas	Yes	No	NC
3.	Dykes to prevent flood events	Yes	No	NC
4.	Movement of communities to other places	Yes	No	NC
5.	Monitoring of the environmental effects of Climate change	Yes	No	NC
6.	Water reservoirs	Yes	No	NC
7.	Ex situ protection of endangered species	Yes	No	NC
8.	Other actions don't included …….			
9.	…….			

Mitigation of CC

Any of the next performances have been done in your Biosphere reserve

1.	Wind or Solar farms	Yes	No	NC
2.	Regulation of new buildings	Yes	No	NC
3.	Subvention to wind or solar domestic plants	Yes	No	NC
4.	Changes in the transportation systems	Yes	No	NC
5.	Sown of new forestall areas	Yes	No	NC
6.	Changes in the industrial production to save emissions	Yes	No	NC
7.	Changes in the electricity fares	Yes	No	NC
8.	Other actions don't included …….			
9.	…….			

Are you afraid that the climate change will affect your biosphere reserve hardly during the next 20 years?. Please, comment the answer, if you want.

Analysis of a Questionnaire on the Effects of Climate Change on the Insular and Coastal Biosphere Reserves.

Dr. Juan Rita Larrucea
Departmento De Biologia
Universitat de les Illes Balears, Spain

Introduction

This questionnaire was answered for managers of island and coastal biosphere reserves and experts who belong to entities related with UNESCO-MAB or with protected areas in broad sense; all of them participating in the International Conference of Island and Coastal Biosphere Reserves, held in Jeju Biosphere Reserve in December 2008.

There are 17 answers which, are few to obtain conclusive results since they work in very different area all around the world (Eastern Asia, Australia, India, Caribbean Sea, South Africa, Bering Sea, and Mediterranean Sea) and have different experience of climate change as well. However, the results should be understood as important indicators of the perception of people with a high level of comprehension and a direct contact with the environment about the effects of Climate Change (CC) on Islands and Coastal Biosphere Reserves.

The questionnaire was divided in four sections:
- Effects of Climate Change on the ecosystems.
- Effects of Climate Change on the communities and economy.
- Adaptation to Climate Change.
- Mitigation of Climate Change.

The answer "NC" could have different meanings:
- The answer is not known.
- Without answer to the question.
- The question is not pertinent (for ex. coral bleaching for a place without coral).

The answer "Probable" could have two meanings:
- Probably this effect happen.
- Probably this effect happen because of the global warming.

Main results

Effects of Climate Change on the Ecosystems

The items more clearly related with CC, with more than 50 % of positive answers were:
- Extreme climate events (76,5 %).
- More frequency or intensity of huge storms and typhoons (58,4%).

Q. 2 and Q. 4 could be related with common phenomenon of effects of Climate Change around us , however, Q. 2 Extreme climate events is more general than Q. 4.

Coastal erosion is a problem for 94,2 % of answers and with more of 80 % of answers are recognized:
- Changes in the patterns of distribution of the species.

- More frequency or intensity of droughts.
- New pathogens in the ecosystems.

It's very likely that "Coral bleaching" is under answered, because more than 35 % of the answers are NC, probably under the meaning of "not pertinent". If this question would be considered only for the tropical Biosphere Reserves, then the result would show different one.

Effects of Climate Change on the communities and economy.

The items with more than 50% of positive answer were:
- Reduction of water availability (58,8%).
- Some infrastructures destroyed (52,9%).

Nevertheless if "Yes" and "Probable" answers are added, then most of the items receive more than 50 % of positive answer. Even "Lose of productive lands" and "Lose of tourist beaches" had more than 70% of positive answers. It could be interesting that "Climate refugees" could be a problem for 41% of the answers; probably this is a rising problem.

Adaptation to Climate Change.

According with the people who answered the questionnaire, "Monitoring of the environmental effects of Climate Change" and "Restoration of Coastal Areas" are performances that were done in more than 75% of the biosphere reserves. On the other hand, about 50% of the cases "Water reservoirs" and "Ex situ protection of endangered species" were done, too.

Mitigation of Climate Change.

The items of this paragraph received less positive answers than those referred to Adaptation to CC, and the "NC" answers were higher than 15% in most of the cases. Nevertheless the next items received more than 50% of positive answers:

- Wind or Solar farms.
- Regulation of new buildings.
- Changes in the industrial production to save emissions.
- Changes in the electricity fares.

Discussion

The answers to the questionnaire showed that Climate Change is clearly perceived as a real problem for people who work or is related with coastal and insular biosphere reserves. Probably its effects are mixed with other global problems like urbanization, human occupation of coastal areas, over exploitation of natural resources, etc. where the CC play a role exacerbating their effects. But it seems that some performances have been implemented or initiated to fight against this important problem, in this sense the adaptation as a reaction in front of the consequences of CC is more general than the mitigation actions.

According to the results of the questionnaire, the people who work with insular biosphere reserves have detected the main problems of climate change over the environment and the economy of the islands. "Extreme meteorological events" seems to be recognized as a direct problem related with Climate Change. These sort of meteorological events are related with other items as "More frequency of huge storms and typhoons", and with "Coastal erosion". These three items were recognized as the three main environmental problems directly related with CC. Nevertheless, coastal erosion was the main environmental problem (or its consequence) if the positive and likely answers are joined.

However, for the people who answered the questionnaire were difficult to know if a particular phenomena observed is related directly or no with the CC. That is especially true for some items, which need thematic specialists and very precise data, that quite often are not easily gotten or known. Then, some effects were detected but the people who answered the questionnaire had doubts about the real role of Climate Change in it. That is especially true for "New pathogens in the ecosystems", or "More frequency or intensity of droughts In the same way, It's quite interesting that the rise of jellyfish were detected as a problem for of 60% of the answers, it seems that it is a global phenomena, but it's very difficult to have evidences to relate it with CC. "Coral bleaching" was detected as an important factor, but this type of ecosystem is limited to tropical islands, then the results underestimate the problem (people from non tropical islands answered the questionnaire, too).

The second main economic problem of Climatic Change on the islands is the destruction of infrastructures, that it is clearly related with the extreme climate events. But, the first economic items recognized for the people who answered the questionnaire were the "Reduction of water availability". This result is a little bit surprising, because the problem was detected for more than 90% of participant, although is not sure for them that this reduction of water is due to climate change or not. More likely it has a multifactor origin and the CC is exacerbating it. Climate Change is a threat for important economic resources, mainly for those activities developed in the costal areas, that is the case of tourism for example, mainly because the erosion of beaches.

Some performances for adaptation and mitigation of Climate Change are been done in most of the cases, but probably with no enough intensity. In more than 80% of the cases the "Monitoring the environmental effects of CC" and "Restoration of coastal areas" received positive answers. But only a 52% are doing "Ex situ protection of endangered species". The wind and solar energy is produced in more than 50 % of the cases; as well as, changes in the regulations of new buildings, methods in industrial production and changes in electricity fares. However, these particular conclusions are conditioned, or they have a low reliability, owing to the high number of people who cannot give a concrete answer to these questions (more than 20 % in most of the cases).

Annex 3
Programme

United Nations Educational, Scientific and Cultural Organization

International Conference of Island and Coastal Biosphere Reserves

Climate Change & Island and Coastal Ecosystems

3-6 December 2008
Jeju Biosphere Reserves, Jeju Special Self-Governing Province, Republic of Korea

Background and Rationale

Recognized for its mega-diversity, the Asia and Pacific region is endowed with some of the richest and most diverse marine and terrestrial ecosystems on this planet. Islands and coastal zones comprise a vital part of the rich biodiversity in the Asia-Pacific and provide a wide range of environmental, economic, social and cultural services, benefiting local communities as well as the global community.

Island are often biological anomalous with evolution as a consequence of insularity. Species on islands have often evolved in relative isolation for very long periods, developing thereby endemic characteristics. The greater and longer the geographical isolation of a given island, the higher the taxonomic level of endemism encountered. Island ecosystems are often characterized as "improvished" and island species have often lost their defensive adaptations, making them especially vulnerable to extinction.

Coastal ecosystems form an integrated network of species-rich habitats, ranging from entirely marine habitats to marshes, coral reefs, mangroves, tidal wetlands, seagrass beds, estuaries, peat swamps and dunes, thet serve critical ecological and biological functions. They often include ecotones that harbor rich assemblages of fauna and flora, and serve as controls on the movement of matter, energy and genetic flow between adjacent ecosystems.

Island and coastal ecosystems have an important economical value as the majority of the population in Asia and the Pacific is living within 100 kilometer radius of the coast. Island and coastal ecosystems offer many direct economic and subsistent benefits to society such as food (i.e. fish, shellfish, and seaweed), building materials (i.e. sand, rock, wood), areas for tourism and recreation, and are also an important source for household products, cosmetics, etc. Additionally island and coastal zones provide shelter and protection against natural elements (winds and waves) and disasters (i.e. stroms, tsunamic, etc.). Since a large portion of the world's marine fisheries and marine culture production occurs in the Asia and Pacific region, the coastal and marine resources constitute a major pillar in the economic development of the region.

However, despite their importance in terms of biodiversity, economical development and their vital contribution as life support systems, island and coastal ecosystems are increasingly facing environmental degradation. The population size in the Asia-Pacific region is expected to grow substantially within the next 25 to 35 years. Such growth will lead to overexploitation of natural resources, pollution and further urbanization of

natural habitat. Due to uncontrolled and unplanned development, a significant portion of island and coastal habitats are at high risk of being lost in the next decade, as mangroves are cut, sea grass beds degraded and coral reefs destroyed.

Similar described anthropogenic pressures on coastal and island ecosystems in the Asia-Pacific region are including VISA, American Express, Diner's Club, Master card, and JCB card are accepted at most hotels, department stones, and restaurants. However, foreign issued ATM cards may have limited use.

Electricity System

Outlets for 220 volts 60 cycles are dominant. Always check the power supply before using your equipment.

Island of World Peace

It began when Jeju Island hosted the Korea-U.S.S.R Summit on April 18, 1991, providing geopolitical collaboration for peace too be established on the Korea Peninsula. This summit led to the reorganization of order in Northeast Asia. Shortly afterwards, at the international meeting for the "Maintenance of Peace for the Pacific Ocean" held in New York on May 17, 1991, discussions about Jeju as an Island of Peace initiated a movement that culminated in with Jeju being designated as the Island of World Peace by the national government in 2005. In order to lay a solid groundwork for peace-building efforts, the Jeju International Peace Foundation and the Jeju Peace Institute were also establisshed. Today, the Jeju Peace Forums, held since 2001, have helped Jeju promote the peace of Northeast Asia.

Free International City – Vise Free Entry

Under the direct auspices of the Prime Minister's Office, Jeju has been officially designated as Korea's "Free International City" where the exchange of human and material resources and cultures is given freedom. It has provided veritable wings to this island, situated in its unparalleled geopolitical location at the center of Northeast Asia. The Free International City's ideal is to strive for bbecoming a future hub of Northeast Asia through free trade and harmonious cultural exchanges. The Free International City alsoo includes Visa Free Entry to visitors from all but 11 countries around the world, which makes Jeju an ideal location for holding internationally diverse events.

UNESCO World Naturall Heritage

The UNESCO listing oof Jeju as World Natural Heritage refers to "Jeju Volcanic Island and Lava Tubes," covering Mt. Halla's Natural Reserve, Geomunoreum lava tube system, and Seongsan Ilchulbong Tuff cone. Mt. Hallasan (note: Mt. Hallasan and Mt. Halla are two different mountains) is characterized by its volcanic topography including Baekrokdam (Mt. Hallasan's crater), a trachyte dome, and pillar-shaped joints of Yeoungsil rock formation; the mountain at different altitude levels is rich in diverse plants and trees, some are uniquely native to the island.
Seongsan Ilchulbong was formed by hydrovolcanic eruptions at shallower levels. It is a typical tuff cone and has significant scientific values. Lava flowed from Geomunoreum to the coastline formed Geumunoreum lava cave cluste. Moreover, secondary formations inside the lava caves are rare and are regarded as valuable objects of natural heritage. The total area of the heritage sites is 9,475ha.

Samba: Abundance of Rock, Wind and Women

The Island's abundance in rock originated from the Mt. Halla's ancient volcanic activity. People head to cultivate the land through a long process of clearing away the numerous rocks covering the lands and then form inlets for irrigation, construction walls for protection against the wind. Located in the path of typhoons, Jeju is famous for its windy weather. As an island society, many men were lost at sea, making the population of women always larger in number. This made Jeju women independent supporters of their families from ancient times.

Sammu ("Three nothings"): Scarcity of Thieves, Gates and Beggars

As an island of political exiles during the era of Joseon Dyansty, the people of Jeju valued honor above all. The highest virtue of the islanders was diligence, thrift, and interdependence. The resulting community of pioneers in this harsh environment

produced a society known for its three scarcities: the lack of thieves, gates, and beggars.

Average Temperature: Yearly Average 15 ^{0}C (4-6 ^{0}C in December)

Industry: Primary industry 23.6%; Secondary industry 4.2 0C; Tertiary industry 72.2%

Visa: No-visa entry for 30 days (With the exeption of 11 countries not eligible for visa waiver: Cuba, Syria, Macedonia, Iran, Iraq, Afganistan, Palestine, Ghana, Sudan, Nigeria, and Libya)

Features: The largest island in South Korea, Jeju came into existence 700,000 to 1.2 million years ago when lava spewed from a sub-sea volcano and surfaced above the waters. Then 100,000 to 300,000 thousand years ago, another volcanic eruption formed Mt. Halla. The final volcanic eruption that took place approximately 25 thousand years ago created the creater lake, Baengnokdam, at the summit of the mountain. Mt. Halla rises in the center of Jeju to 1950m above sea level. The rest of the island slopes down from its summit and is covered with dark gray volcanic rocks and volcanic ash soil. Relatively isolated from the rest of the world, the island's unique ecological system has been well preserved in its prehistoric state. That is why traveling to Jeju is like traveling back in time.

The are a variety of sandy beaches developed by the seasonal winds. The small sand dunes have been formed by a southeast seasonal wind on some shorelines. In the northeast shoreline, sand dune layers are found on a large scale. The western shoreline of Jeju including Sanbangsan-Gunsan, Daepo, Oedolgae, Seogwipo and Namwon has many different steep rock formations. A few beaches in the Moseulpo areas have terraces features.

Lenguage

Hangeul (Korean) was invented in 1443, during the reign of King Sejong. It is composed of 10 vowels and 14 consonants. Hangeul has 11 compound vowels, 5 glottal sounds.
'The Hunminjeongeum,' a historical document that provides instructions to educate people on the use of Hangeul, is registered with UNESCO's Cultrual Heritage.

National Symbols

Tha Korean flag is called "Taegeukgi" in Korean. The circle in the center of the flag is divided into two equal parts. The upper red section and the lower blue section symbolize the principles of the yin and yang in Oriental philosophy. The two forces together embody the concepts of continual movement, balance, and harmony that characterize the sphere of infinity. The circle is surrounded by four trigrams, one in each corner. Each trigram symbolizes one of the four universal elements: heaven, earth, fire, and water.

Food

Korea was once primarily an agricultural nation, and Koreans have cultivated rice as their staple food since ancient times. These days Korean cuisine is characterized by a wide veriety of meat and fish dished along with wild greens and vegetables. Various fermented and preserved food, such as kimchi (fermented spicy cabbage), jeotgal (matured seafood with salt) and doenjang (fermented soy bean paste) are notable for their specific flavors and high nutritional values.

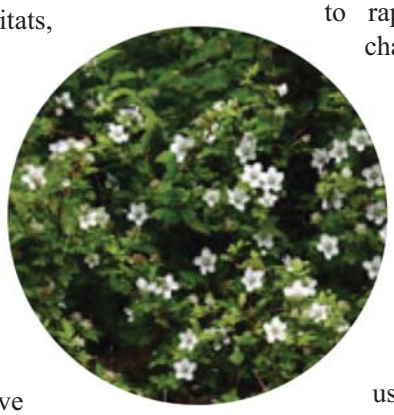
Business Hours

Government office hours are from 09:00 to 18:00 Most private businesses open anywhere from 08.30 to 22:00 and close sometime in the evening. Banking business hours, however, are from 09:30 to 16:30 on weekdays. They are closed Saturdays and Sundays. Major department stores are usually open from 10:30 to 20:00, including Sundays but smaller shops tend to be open earlier and close later every day of the week.

Currency Exchange

The unit of Korean currency is the Won. Major foreign currencies that can be exhanged at banks, hotels, and the airports include US Dollar, Japanese Yen, Euro, and UK Sterling. Internationally recognized credit cards

found back at a global level. The threats will become even more profound and irreversible with increasing climate change pressures. Significant disruptions of ecosystems from events such as droughts, fires, pest infestations, invasion of alien species, stroms, and coral bleaching will increase and thereby impact the health of ecosystems. The ecological productivity and biodiversity of coastal and islands will be altered by climate change and related sea-level rise, with an increased risk of species extinction. Changes in climate will also affect photosynthesis, plant respiration, organic matter decompositions and other micro biochemical processes. An ensuing collapse of ecosystems, loss of habitats, and local extinctions will occur.



Climate change in island and coastal zones is expected to also impact heavily the economic, social and cultural spheres of society. Aside from rising conflicts over marine and terrestrial resources, additional resource depletion will push resource users to seek for more extractive – and often destructive methods, with as result increased loss of biodiversity, adding further to the vicious circle of climate change. Climate change is also increasing the frequency and severity of natural disarters, including sea level rise, hurricanes and flooding, to which coastal and island communities are already vulnerable. These threats are magnified for island populations as there is little space or opportunity to relocate people affected or provide alternative livelihoods. Sea level rise related to global warming of even a few centimetres could threaten the sustainable development, livelihood and the very existence of islands, coasts and their populations.

The loss of biodiversity will be commensurately great, unless it is attenuated through timely conservation and wise management efforts. International experience and lessons learned on addressing climate change impacts stress the need for using a number of adaptation management responses at ecosystem level. The Man and the Biosphere Programme, with at its core the World Network of Biosphere Reserves, provides an opportunity to develop such strategies, to implement relevant actions, desseminate lessons throughout the region, and in doing so to pilot replicable approaches.

During the 3rd World Congress on Biosphere Reserves, in Madrid, Spain, 2008, climate change was identified as one of the most serious and globally significant challenges to society and ecosystems around the world today. The Madrid Action Plan for Biosphere Reserves calls for societal responses to climate chhange centered on adaptation and mitigation. It further calls on UNESCO member states and the MAB community to use biosphere reserves as learning sites for research, adaptation, mitigation in relation to climate change.

The role of biosphere reserves is indeed essential to rapidly seek and test solutions to the challenges of climate change as well as monitor the changes as part of a global network. Biosphere reserves can be areas for demonstrating adaptation measures for natural and human systems, assisting the development of resilience strategies and practices. Buffer zones and transition areas of biosphere reserves may also be use to test many mitigation tactics and strategies. In numerous biosphere reserves, carbon can be sequestered as in forest and wetland systems. In all of them capacity can be built for low-carbon economies using a mix of technology-and labour-based social enterprises. From a social sciences point of view, the political dimensions of changing lifestyles can be explored. The range of biosphere reserves and the systems they represent will provide valuable lessons for the rest of the world.

UNESCO and the Government of Special Self-Governing Province of Jeju Island, Republic of Korea, which was designated as Biosphere

Reserves in 2002, have established a new initiative of cooperation, with emphasis on the improvement of management of island and coastal Biosphere Reserves, including issues related to climate change. This new regional initialive, now called the "Jeju Initiative", underlines the strong commitment of Jeju Special Self-Governing Provincial Government towards preserving biological and cultural diversity.

The initiative is supported through Funds-In-Trust by the Jeju Special Self-Governing Provincial Government, and technically supported by the Korean National Commission for UNESCO and the National MAB Committee of the Republic of Korea.

Objective

- To raise awareness and exchange information on the impacts of climate change in island and coastal ecosystems.
- To discuss and exchange experiences and knowledge on climate change research, adaptation and mitigation, using Biosphere Reserves as models for sustainable development.
- To strengthen international cooperation on island and coastal biosphere reserves and climate change.

Participants

- Manager of island and coastal biosphere reserves
- Experts on the climate change and biosphere reserves
- Researchers and NGOs
- UNESCO, IUCN and other international institutions

Venue and Travel Arrangements

The meeting will be held in:

International Convention Center Jeju
2700 Jungmun-Dong, Seongwipo City,
Jeju Province 697-120, Korea
Phone: +82-64-735-1000
Fax: +82-64-739-5900
www.iccjeju.co.kr

Jeju has instituted a very broad visa waiver program. Kindly note that for international participants traveling to Jeju through Seoul, you have to transfer from incheon International Airport to Gimpo International Airport to catch your connecting flight. However, please check with the R. O. Korea Embassy in your country for visa issue.

Languages

English and Korea

Jeju Biosphere Reserve

General Description

Jeju Island is situated in the southem part of the Korean Peninsula and covers a lava plateau with a shield volcano at an elevation of 1,950 meters above sea level. The biosphere reserve is located at the center of the island, comprising in its core area Mt. Halla National Park, two stream corridors and three islets. A diversity of ecosystems is respresented in the biosphere reserve, e.g. montane coniferous forest, temperate deciduous hardwood forest, warm-temperate evergreen hardwood forest and temperate grasslands. The three uninhabited islets are of great importance from a biodiversity point of view and also comprise coral communities. In the surrounding buffer zone of the islets, fishing and submarine tours take place. The buffer zone and transition area also include afforestation areas, agricultural fields, pasture land and residential areas. Human land use is increasing from the center of the island to the coast. About 7,500 people within the Jeju Island Biosphere Reserve live mostly in the transition area (2002) and make their living from tourism, cattle-ranches and agriculture. The high biological diversity, unique volcanic topography and the culture of Jeju

Island attract many tourists. Sustainable tourism development will be one of the main challenges for the biosphere reserve.

Major ecosystem type
Sub-tropical and temperate rainforests.

Major habitats and land cover types

Alpine coniferous forest dominated by Abies koreana and with Betula ermanii var. saitoana, Texus cuspidata etc.; temperate deciduous hardwood forest dominated by Mongolia oak (Quercus mongolica) and with Acer pseudosieboldianum, Carpinus laxiflora etc.;
temperate deciduous hardwood forest dominated by Carpinus laxiflora and with Acer pseudosieboldianum, Daphniphyllum macropodum etc,; temperate deciduous hardwood forest dominated by Quercus serrata and with Carpinus laxiflora, C. tschonoskii, Styrax japonica etc.; warm temperate evergreen hardwood forest (streamside vegetation) including Castanopsis cuspidata var. sieboldii; warm temperate evergreen hardwood forest (island vegetation) with Castanopsis cuspidata var. sieboldii, Camellia japonica, Daphniphyllum glaucescens etc; agricultural land; residential areas

Location
33^0 21'29"N; 126^0 31'53"E

Area (hectares)

Total	83,094 ha
Core areas(s)	15,158 ha (of which marine: 32 ha)
Buffer zone(s)	14,601 ha (of which maarine: 871 ha)
Transition area(s)	53,335 ha (of which marine: 1,420 ha)

Altitude
-74 to + 1,950 m above sea level

Year designated
2002

Jeju Special Self-Governing Provincial Government

General Information

Jeju Island
Area: 1,847 km2 (1.8% of mainland Korea)

Population: 563,388 persons

Hangwon Wind Power Plant
Jeju Special Self-Governing Province Wind Power Project is to meet ever-increasing demand or energy in the region and to contribute effective development of wind power through utilizing environmental friendly energy source. In addition, this project provides the sustainable development of local communities with the creation of direct and indirect employments to the region, and the local community obtains advanced technology support from the dispatched engineers.

Ecological Education Model Complex

Jeju is blessed with a mild climate, clean ocean and mountains, and a rich wind resource. These advantages in developing an energy-saving and eco-friendly urban plan and the need that it should be properly informed and leveraged in a manner that it leads to citizen's voluntary participation in

developing such a model complex. Therefore, it is proposed to develop an ecological model complex around the Bongaedong area as a pilot project.

This complex may be used not only for education and publicity but may also be proposed as a distinctive environment-friendly ecological experience tour program and training space such as Sanitary landfill site, Recycling Center, Food Waste Resource Center, Electricity Generation Facility using the gas coming from the landfill, Citisens' Environmental Experience Education Center, and the Fowl Park.

Mt. Halla – Biosphere Reserve & World Natural Heritage

Mt. Hallasan is the central peak of Jeju Island, a shelfal shield volcano constructed on the contiinental shelf of the Yellow Sea. Rising 1950 m above sea level, Mt. Hallasan is the highest peak in South Korea and is the symbol of Jeju Island. Mt. Hallasan boasts peculiar volvanic landscape, produced by the crater lake Baeknokdam at the summit, the precipitous rocky cliffs of the Yeongsilgiam, and about forty volcanic cones. Mt. Hallasan was designated as a natural monument and a national park in 1966 and in 1970, respectively. It was also designated as a UNESCO Biosphere Reserve in 2002 and is carefully protected from human actifity.

Accommodation

The participants will be staying at:

Hotel Travellers
30 Hoisudong, Seogwipo City,
Jeju Proovince 697-120, Korea
Phone: +82-64-738-9000
Fax: +82-64-738-9009
www.travellersjeju.com

Upon receiving your confirmation, the hotel reservation will be made by the organizer.

Programme

Wednesday, 3 December, 2008
13:30 – 15:30: Opening Ceremony

- Opening Remarks
  Mr. Miguel Clusener-Godt, Senior Programme Specialist, UNESCO Headquarters
- Welcome Remarks
  Mr. Kim, Tae-Hwan, Governor Jeju Special Self–Governing Province
  Dr. CHOI Chung-Il, Chairperson, MAB National Committee of the Republik of Korea Mr. HUH Kwon, Assistant Secretary-General, Korea National Commission for UNESCO
- Keynote Speakers
  Mr. Miguel Clusener-Godt, Sennior Programme Specialist, UNESCO Headquarters
  Mr. Maffuz Ullah, Regional Councilor, International Union for Conservation of Nature (IUCN)

16.00 - 18.00 Session 1: Impacts of Climate Change on Island and Coastal Ecosystem

Chair: Mr. SHIN Won-Woo, Executive Director of Park Conservation, Korea National Park Service

- Dr. Hee-Young Chae, Director, Migratory Birds Center, National Park Research Institute
  (Title: Monitoring Bird Migration and Climante Change at Easr-Asian Stopever Island)
- Mr. Tamen Sitorus, Head, Komodo National Park, Indonesia
  (Title: Impact of Climante Change on Komodo National Park, Indonesia)
- Dr. Seok Chan Koh, Professor, Department of Biology, Cheju National University
  (Title: Predicting the Impacts of Climante Change on Plants on Jeju Island)
- Ms. Cacelia Witton, Executive Officer, Mornington Peninsula and Western Port Biosphere Foundation Ltd
  (Title: The Impact of Climate Change on Coastal Settlements of Western Port)
- Ms. Olga Romanenko, Conservation Consultant and Coordinator, Tranboundary Ecology LLC
  (Title: Regional-Scale Ecological Monitoring across Bering Sea Island Biosphere Reserve; Essential Tool to Interpret to Potential Climate Change Impacts)

Thursday, 4 December 2008
09.00 - 12.00 Session 2: Climate Change Impacts & Adaptation in Island and Coastal Biosphere Reserves

Chair: Dr. Choi Chung-Il, Chairperson, MAB National Committee of the Republic of Korea

- Dr. Kwang-Sik Choi, School of Applied Marine Science, Cheju National University
  (Title: Climate Warming and Outbreak of Perkinsus olseni Disease in Manila Clams)
- Ms. Alma Ridep-Morris, Masster of Applied Science (Research) School of Marine & Tropical Biology, ARC Centre of Excellence for Coral Reef Studies James Cook University (Title: Impacts of Climate Change on the Ngaremeduu Biosphere Reserve, Palau)
- Dr. Ram Boojh, Ph.D, Programme Specialist, Ecological & Earth Sciences, UNESCO Office, India (Title: Climante Change and Sunderban Biosphere Reserve in India)
- Dr. Sun-Kee Hong, Research Professor, Institute of Island Culture, Mokpo National University (Titlle: Global Environmental Change and Respons Strategy of Sinan Dadohae Island Ecosystem)
- Ms. Ho Thi Yen Thu, Deputy Director, Center for Marinelife Conservation and Community Development (MCD), Vietnam
  (Title: Responding to Climate Change Through Mangrove Cconservation and Livelihood Improvement in the Red River Delta Biosphere Reserve)
- Mr. Romero B. Dorado, OIC-Executiive Director, Palawan Council for Sustainable Development Staff, Palawan Center for Sustainable Development.
  (Title: An Initial Vulnerability Assessment to Climate Change of the Palawan Biosphere Reserve)
- Mr. Koen Meyers, Technical Adviser for Environmental Sciences, UNESCO Office Jakarta
  (Title: Island and Coastal Biosphere Reserves as Learning Sites for Clima te Change Adaptation)

13.00 - 15.00 Session 3: Climate Chhangge Mitigation in Island and Coastal Biosphere Reserves

Chair: Dr. Jong-Gilje, Director, City and Nature Institute

- Prof. Yong Kun Ssuh, Ph.D. Associate Professor, Dept. of Tourism Management College of Business and Economics, Cheju National University
  (Title: Impacts and Responses on Climate Change in the Tourism Sector)
- Dr. Juan Rita Larrucea, Dept. of Biology, Universitat de les Illes Balears
  (Title: Climatic Change in Menorca Island (Spain)-Actions for Mitigation and Fight)
- Mr. Thomas Jensen, Environment and Energy Policy Specialist, UNDP Pacific Centre
  (Title: Climate Change Mitigation in Small Island Developing States (SIDS)-Establishing Win-Win Solutions)
- Dr. Do Quang Hung, Expert, Office of Hai Phong City's People's Committee
  (Title: Integrated Coastal Management to Haiphong City (Vietnam) in Sustainnable Development)

15.00 - 17.30
Session 4: Strengthening Cooperation and Raising Societal Awareness on Climate Change

Chair: Prof. Dai-Yeun Jeong, Professor, Cheju National University)

- Prof. Kyoung-Mann Cho, Member of MAB-ROK, Mokpo National University
  (Title: Making Creative Communitiies for the Collaboration among Island Biosphere Reserves)
- Ms. Janette du Toit, Programme Manager, Cape West Coast Biosphere Reserve
  (Title: Strengthening Cooperation and Raising Societal Awareness on Climate Change within the Cape West Coastt Biosphere Reserve)
- Mr. Yangbo Kim, Director of Environmental Policy Department, Jeju Special Self-Governing Provincial Office.
  (Title: Construction of Strattegy for enhanncing the degree of recognition about climate change in Jeju Island)
- Ms. Juan Marie Mow, Execuutive Director, Providence Foundation
  (Title: Small Island and Global Climate Change)

Friday, 5 December 2008
09.30 - 17.30 Field Trip: Climate Change Adaptation and Mitigation Measures on Biosphere Reserve & World Natural Heritage Site in Jeju island.

Saturday, 6 December 2008
09.00 - 11.30 Discussion on the Establishment of Insular Biosphere Reserve Network and agreement on future Action Plan

- Chair: Dr. Choi Chung-Il, Chairperson, MAB National Committee of the Republic of Korea

Field Visit

Mulyoungari Wetland

Mulyeongari-oreum is the only wetland in Korea which is located on top of oreum. The oreum is one of the secondary volcanoes around Halla mountain which had volcanic eruptions about 1.2 million years ago. It is believed that the wetland was formed by the volcanic activities assumingly in between 100 and 2.5 thousands years ago.

The oreum has kept the original status since it was formed and displays unique example of wetland type. On top of the oreum, there is a shallow crater lake in which the level of water changes by the seasons and this water is just from rainfalls due to the topographical features of Mulyeongari-oreum.

Geomunoreum Lava Tubes - World Natural Heritages

The Geomunoreum Lava Tube System refers to a series of lava tube caves formed in the large amounts of basaltic lava spewed out by the live Geomunoreum volcano, the summit of which has an elevation of 456 m. The lava from the Geomunoreum volcano flowed down the slope of Mt. Hallasan in a north-northeast direction down to the coasline for about 13km. This system is estimated to have been formed between about 100 and 300 thousand years ago.

The Geomuneroum lava tube system is the most impressive and significant series of protected lava tube caves in the world and includes a spectacular array of secondary carbonate speleothems (stalacites and other formations).

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Annex 4
List of Participants

International Conference of Island and Coastal Biosphere Reserves:
Climate Change and Island and Coastal Ecosystems
From 3 to 6 December 2008
Jeju Biosphere Reserve, Republic of Korea

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