COASTAL & MARINE

Preparing to Adapt

Sharing coastal experience with the Young Professionals Coastal Community - YPCC

EUC Coastal & Marine

Volume 22 • No. 2 2013

Statements

It is my great pleasure to write a few words introducing this valuable booklet. The present young generation of professionals will make decisive decisions in the next decades regarding the future of the our globe and its inhabitants. Sustainable, long term decision making for the vulnerable coastal zone must be based on increased knowledge of the coastal system and particularly on the integration of its socio-economic and natural components.

As former President of the Coastal and Marine Union – EUCC, an NGO with European network of more than 2500 coastal members, I recognise the importance of disseminating coastal knowledge. Therefore I support this 'Young Professionals Coastal Community – YPCC' initiative to promote transfer of information and to establish an exchange platform between students, lecturers and mentor/guest-teachers. It is essential to strengthen exchange of knowledge and experience between the older and the young generation in order to deal effectively with the wide-ranging coastal challenges.

During the biannual international Littoral 2012 conference in Oostende, students of three Universities for Applied Sciences presented their analyses of the impacts of future coastal changes and adaptive, sustainable solutions for 'their' coastal stretch. This booklet illustrates their enthusiastic efforts.

In order to increase the flow of applied coastal knowledge to the students in the future, this YPCC initiative needs to grow and involve more Universities of Applied Sciences along the practical way demonstrated. I fully endorse this YPCC initiative taken by the Universities and EUCC.

Prof. Dr. Johan Vande Lanotte,
Vice Prime Minister and Minister of Economics, Consumers and the North Sea, Belgium

This publication describes a challenging opportunity for BSc-students of Universities of Applied Sciences and the coastal professional community as a whole. As president of the Dutch Council of Universities for Applied Sciences (HBO-Raad), it is my pleasure to introduce and support this kind of relevant contribution to the education and professionalization of our students . On the one hand it links theory and practice in a very concrete way and on the other it focusses on the local level with an outlook to the international context as well.

The Dutch Universities for Applied Sciences are stimulated to participate in this kind of initiatives that foster the application of theory in practice, bringing experts close to young professionals thus, training their students for their profession in a challenging way.

Therefore, I support this 'Young Professionals Coastal Community – YPCC' initiative!

Thom de Graaf
President of the Council of Universities for Applied Sciences
HBO-Raad
The Netherlands

Our climate is changing; the sea is rising and all around the world low lying coastal areas are subsiding. Changing weather patterns will influence the amounts of rain and river discharge in winter and summer. In the future these conditions will most likely exacerbate.

The Netherlands is a very low-lying, prosperous and densely populated delta, which is vulnerable to flooding. If something goes wrong, the impact will be enormous: many casualties, billions of Euros in damage and a disrupted society. Our delta and its inhabitants are too valuable not to take the necessary precautions.

As a response to these challenges the Delta Programme was created. Its objective is to secure the water safety of the Netherlands during the 21st century. Its continuity during such a long period is guaranteed by the Delta Act and the Delta Fund, giving it legal status and financial backing. As Delta Programme Commissioner I am responsible for the progress and cohesion of the programme.

The Delta Programme combines safeguarding against flooding and providing sufficient water supply with an innovative and adaptive approach, that applies to the whole of the Netherlands. It involves cooperation; integrating different governmental levels and organizations, trade and industry and NGOs. It also involves finding multifunctional solutions, by building with nature and with smart spatial planning, to optimize results.

To realize fundamental adaptive solutions, the involvement of the Dutch public and particularly our young generation is essential. The problems we face will not be solved by this generation alone, but will also challenge the generations to come. Raising awareness among and passing on knowledge to coming generations, are key ingredients for the future success of the Delta Programme. Moreover, if it comes to innovation and adaptation there is a lot the old can learn from the young.

I therefore support this Young Professionals Coastal Community – YPCC initiative, directed at increasing the exchange of knowledge of coastal systems between students and teachers of academia, and guest-lectures/mentors. This YPCC initiative is one of the outcomes of the 'Climate of Coastal Cooperation' production and assists in empowering our young generation to cope with their future challenges

Wim Kuijken
Government Commissioner for the Delta Programme,
The Hague, the Netherlands
http://www.deltacommissaris.nl/english/

Building Capacity in a *Climate of Coastal Cooperation*

Because of their importance and beauty, Europe´s coastal zones are great assets which are intensively used. In many locations this has caused problems for the environment and for natural, socio-economic and cultural resources. The fundamental goal of Integrated Coastal Zone Management (ICZM) has been to maintain, restore or improve the quality of coastal zone ecosystems and to ensure the sustainable future of the societies they support. Cooperation and increased capacity to address these challenges is therefore essential to achieve ecologically and economically sustainable development of coastal areas.

The role of international NGOs such as the Coastal & Marine Union - EUCC has been instrumental in fostering cooperation among stakeholders and various sectors, with emphasis on ensuring participation and awareness raising as a basis for successful and integrated coastal management. EUCC has initiated many ICZM programmes and made stakeholder participation, dissemination of practices and experiences and proper communication the heart of these programmes. Besides, education and capacity building are fundamental for coastal communities, authorities and coastal managers in order to undertake effective action or to make informed decisions. Although there are many institutes providing courses and trainings throughout Europe, we are aware of many of the obstacles that professionals and young generations face regarding accessibility and availability of information in a tailor-made manner, providing the knowledge base that is adapted to their needs.

One relevant example of a bottom-up approach involving user groups led to the development of a free, on-line, multilingual distance training tool for ICZM, which is known as CoastLearn (www.coastlearn.org). One of its unique points is that it is available, in a complete manner, in 13 different languages and illustrated with many practice examples. This tool is both regarded as appropriated to coastal managers and professionals - main target groups – as to university staff and academy students.

Another example dealing with academic education is the 'Climate of Coastal Cooperation - CCC' production (the Book and the extended internet publication www.coastalcooperation.net), which has led to the initiative involving young professionals. This initiative is based on the principle that innovative, resilient, no-regret adaptive options should involve young professionals at an early stage through familiarising them with the ICZM concepts and tools demonstrated in the CCC production.

This publication is therefore intended to introduce this initiative and the steps towards the establishment of a Young Professionals Coastal Community (YPCC). It illustrates the triggers behind it, shares the coastal experiences and innovative research, and shows the results by students supporting an integrated approach.

Maria Ferreira
Coastal & Marine Union - EUCC

´Youngsters as agents of ICZM change...´

Field trip Littoral 2012, photo Tjark van Heuvel

Towards the establishment of a *Young Professionals Coastal Community (YPCC)*

"Sharing experiences in integrated coastal zone management will contribute to sound development of coastal resources and to find resilient, adaptive responses to climate change."

This is one of the main messages extracted from the wealth of experiences compiled in the ***'Climate of Coastal Cooperation – CCC'*** Production (Book & Internet Publication). Transferring experiences in coastal research, management and development in the light of future coastal changes is a major aim.

In order to ensure that the CCC develops into a new way to prepare for a sustainable coastal future with innovative solutions, it is good to involve young professionals at an early stage, to make them become familiar with integrated management approaches. This has been the climate in which the practical CCC knowledge has been shared with students from three academia, for a try-out in 2012. The three cooperating Colleges/Universities for Applied Sciences are the Belgium College KHBO, Bruges – Ostend, the Dutch Delta Academy, HZ University of Applied Sciences, Vlissingen and the Van Hall Larenstein University of Applied Sciences, Leeuwarden.

Coastal knowledge was exchanged between students, lecturers and guest lecturers during ICZM fieldwork periods. The students were introduced in their 'own' coastal stretch with its inhabitants, economics, hydraulics, geomorphology, flora and fauna. The students were assigned to analyse the effects of climate change and socio-economic scenarios for the 21st century and to identify adaptive, no-regret coastal measures. Then a selection was made and in total three student groups were invited to report and present their findings and cases during the CCC Workshop organised within EUCC's LITTORAL Conference, Oostende, 27-29th November 2012.

Approximately 50 participants have attended this dedicated Workshop involving young professionals, the students and the lecturers. These professionals presented three practical cases from the Belgium coast: Vlaamse Baaien, and two Dutch cases: the Waterdunen, West-Flanders and in the north: Wadden Sea/ Groningen coast. The preparation time available for the three student groups was different and ranged from one week to three months. This resulted in different approaches: from a conceptual identification of solutions to a more profound analysis of alternative, no-regret options. The cases presented by the students and lecturers were enthusiastically received by the international audience (see also www.littoral2012.eu). You will learn about their view in this brochure.

The workshop concluded with support and willingness to create a ***Young Professionals Coastal Community (YPCC)*** that will be based on the principles of:

> **Working together and sharing knowledge on impacts and solutions between experts and students by developing challenging training programmes with appealing field work guided by experts, for academia with the academia!**

The YPCC initiative will entail the establishment of an e-communication platform, the set-up of an international core group of experts performing as guest-lecturers (YPCC Mentor group) and the continuation of the ICZM fieldwork, all in close cooperation with the academia and according to a plan: YPCC 2013 – 2015.

Extension of future YPCC activities to other colleges and other countries, based on growing expertise, is foreseen.

Robbert Misdorp, CCC Initiator, Editor and co-author
Tjark van Heuvel, CCC Author

Student presentation at Littoral 2012, photo Maria Ferreira

Littoral 2012, photo Tjark van [illegible]uvel

Facts & Figures – CCC Production

More than 20 years of experience in integrated coastal programmes and projects in Europe and Asia, is collected in the CCC Production (Book & Internet Publication). Sharing this experience is sharing our trust in long term sustainable development of coastal resources and in finding resilient, adaptive responses to climate change for the valuable and vulnerable areas.

The motto is: **Think and plan in an integrated way, implement coastal measures in a sustainable manner.**

You will find online: the CCC Book (208 page) and the extended CCC Internet Publication (>800 pages) with: the Full Chapters of the cases, demos of the GIS based spatial planning tools, training manuals and examples of adaptive, no-regret coastal measures. The interactive list of the 101 CCC authors with their e-mail addresses facilitates communication between the reader and authors/developers …all downloadable at

www.coastalcooperation.net

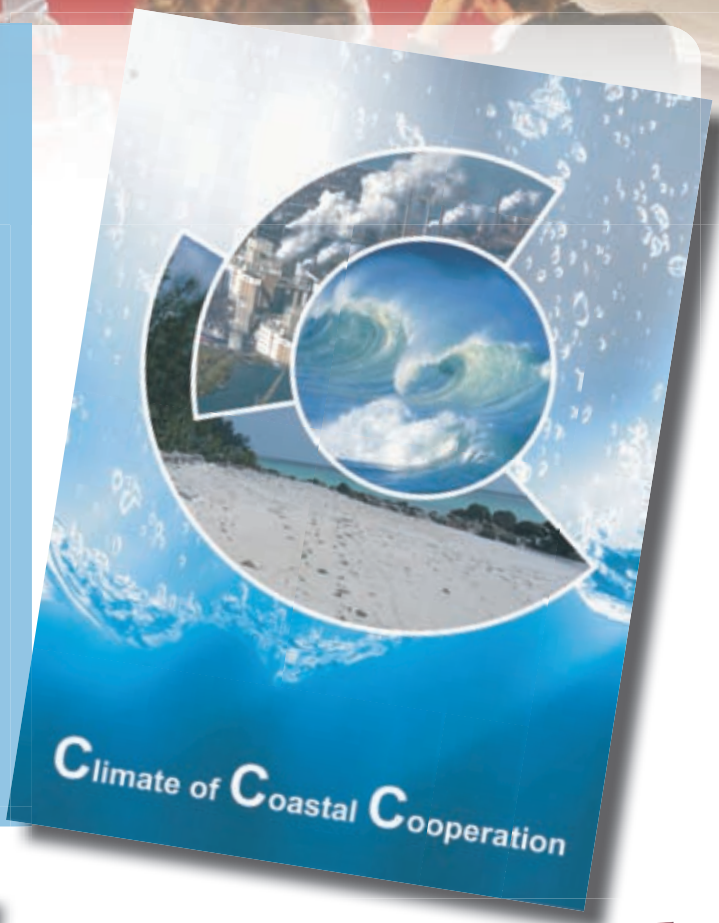


Photo: Harry van Reeken

The CCC Book was officially presented during the International Water Week – Amsterdam, 3rd November 2011 in the presence of the Ambassadors of the CCC coastal countries, high level representatives of the Dutch Ministries, universities, knowledge institutes, consultancies, NGOs.

Prof. Dr. Cees Veerman, former Dutch Minister of Agriculture, Nature and Food Quality, Chairman of the Second Delta State Committee and special water advisor to the Vietnamese President, delivered a speech emphasising the need for a holistic approach to solve complex coastal challenges. Prof. Veerman appreciated the efforts by the editor and the CCC authors. He positioned the CCC production as an evidence of the leading Dutch position in the world of integrated water management and coastal development.

Photo: Robert Aarts

The first copy of the CCC Book was handed by Robbert Misdorp to Mr. Al Gore, Vice President of the USA, shortly after his inspiring speech to ABN-AMRO bankers on the economic benefits of sustainable projects, Breda, 29th September 2011.

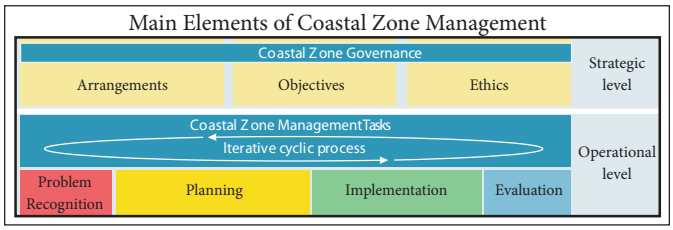
Holistic elements and triggers, lessons and benefits of ICZM

Elements of a holistic, integrated approach

The natural and socio-economic processes in the coastal zone are complex and interactive. Coastal cooperation and formalised Integrated Coastal Zone Management (ICZM programmes) help to manage such challenging areas of work. ICZM is adopted as an important mechanism by international conventions, organisations and governments.

A number of common concepts lay the foundation for effective coastal cooperation starting with appointing an initial leader with a long term and integrated vision on sustainable development of coastal areas, increasing coastal resilience, decreasing the damage due to unsustainable coastal resource uses and identifying options to respond to the anticipated impacts of climate change.

The ICZM programme deals with activities at a Strategic and an Operational level, structured in a cyclic fashion.

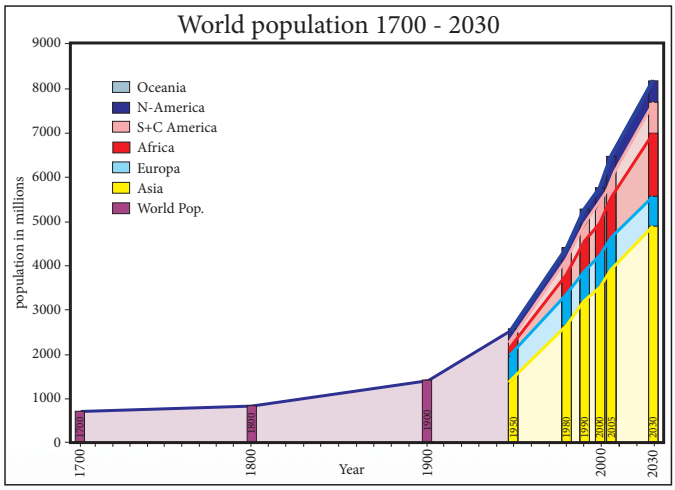


Institutional and funding arrangements for ICZM could be based on international conventions (e.g. UNFCCC) and EU directives, national legislation and regional/provincial regulations.

Three triggers for a holistic approach

The main reasons for applying integrated coastal zone management are the importance, the complexity and vulnerability of the coastal zone and the increasing pressure. Since the mid 20th century and specially during the last decades, we have noticed that the trends in the pressures on the coastal system and their adverse effects have become visible. The pressures being the strong economic development combined with strong growth of coastal population density often leading to overexploitation and environmental degradation. Impacts of climate change may seriously aggravate these threats in the coastal zone.

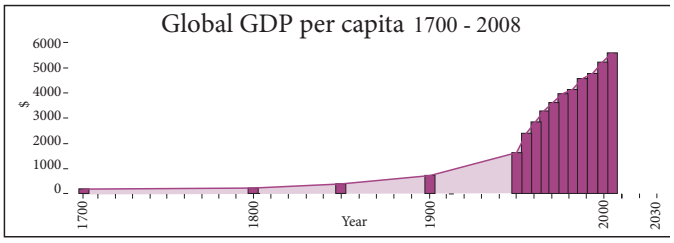
1. Population: About half of the world's population is living, working, recreating in the coastal zone, where almost all the mega cities (> 10 million inhabitants) of the world are located. The coastal zone is a crowded area: accommodating 50% of the world population on only 15% of the land.
High birth rates and migration to the coast make the coastal population growth even larger than the total already strongly increasing world population with an expected 8 billion inhabitants in 2030



World population 1700 – 2030: an exponentially growing trigger. (source: Robbert Misdorp based on www.j-bradford-delong. net + WRI database)

Warnemünde beach, photo Gerald Schernewski

2. Economic development: The coastal zone attracts strong economic development and provides increasingly employment, food and base for education. The world wealth (GNP/capita) is strongly growing with an unprecedented doubling time of only 30 years during the last century.



(Source: R.Misdorp based on www.j-bradford-delong.net: 1700 – 1950; WRI database in 2000 constant US$:1960 – 2005)

This very strong growth, however, is unfortunately also accompanied by very negative side effects such as overfishing, rapid deforestation of the world's last green lungs, large scale waste 'deposits' like marine plastic litter, dying of coral ecosystems and pollution of water, air, and sediments.

3. Climate change: the main coastal impacts of human induced climate change are sea level rise, increase of storminess, changes in rainfall and river regimes. These impacts will increase the flooding frequency, coastal erosion and salt water intrusion, effecting the safety of coastal inhabitants, the agricultural production, navigation and drinking water supply in low lying coastal zones.

These three strongly changing coastal pressures are the triggers for a world wide, holistic, integrated approach to solve the interactive and complex challenges in a sustainable and comprehensive fashion.
There is no space and time left over for continuing the business-as-usual, short term, fragmented sector management practices…
The losses due to great catastrophes – for a large part due to storm surges and flooding are worldwide exponentially increasing since the mid 20th century and will exceed an averaged level of 100 billion $ per year in our decade.

CCC Lessons learned

The book and website 'Climate of Coastal Cooperation - CCC' contains the lessons learned during the execution of many coastal projects and programmes within an integrated cooperative framework. Sharing these lessons with young professionals is the main thrust: empowering the next generation to make balanced decisions responding to the strongly changing coastal zone.

Some general CCC lessons summarised are:

- Build with Nature, if feasible, 'soft' coastal measures are preferred;
- Prepare long term solutions, and create short term measures within a long term sustainable frame;
- Build capacity and train people at different levels, to enlarge the awareness of beneficial integrated approaches and the participation of stakeholders;
- Let NGOs play an important role in promoting stakeholder participation, dissemination of knowledge of the coastal system and daily management of coastal areas.

Coastal cooperation and ICZM

Not all examples of successful integrated coastal cooperation follow the ICZM approach. An example of successful coastal cooperation is the Rotterdam harbour development (1993-2010) which includes many elements of an ICZM programme, but without the label.
The main driver of the CCC-Publication is to demonstrate that coastal cooperation pays off, with or without a formal ICZM framework.

Sand-nourishment along the Netherlands coast, photo Van Oord

Economic and environmental benefits

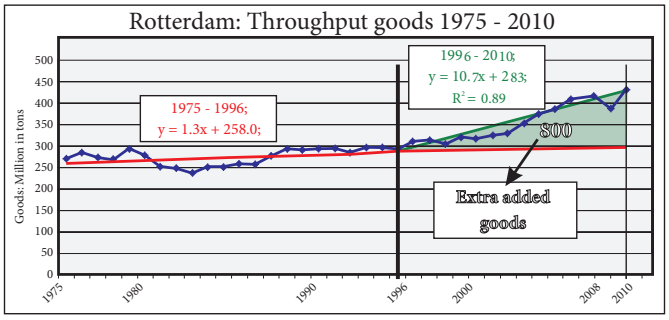
The 'Climate of Coastal Cooperation' production exhibit many years of experience of executed coastal programmes and projects in Europe and Asia. Many examples of CCC programmes show that an integrated approach directed to sustainable development of coastal resources requires some initial funding but delivers both large economic and environmental benefits.

Four examples of created beneficial, win-win, resilient, innovative and adaptive solutions are given:

Rotterdam - sustainable harbour development through long term integrated ROM Rijnmond programme 1993 – 2010 and the Rotterdam Harbour Development programme 2010 – 2020.
The ROM Rijnmond programme involved high level representatives of two Dutch ministries, the Zuid-Holland province, 18 city councils of the greater Rotterdam area, the Port of Rotterdam and 600 harbour companies and a number of NGOs.

A covenant was signed in 1993 worth 7 billion € to execute 28 projects in 17 years within an integrated frame improving the environment and to increase at the same time the economic output, based on national legislation and provincial regulations.
The outcomes of this 1993-2010 win-win programme:

- Strong economic growth 1996-2010 with an extra added 800 million ton throughput goods representing an added value of 25 billion €;
- Strong improved air & water & sediment quality;
- 750 ha greenery & 25,000 ha sea bed protection area compensating the 2000 ha land reclamation for the 2011-2013 harbour extension (Maasvlakte 2) into the North Sea;
- Improved housing & recreational conditions and human health;
- Re-using industrial waste heat.



Strong increase of Throughput goods started in 1996, three years after the ROM Rijnmond programme began and resulted in 800 tons 'extra added goods'. (source: R.Misdorp based on Port of Rotterdam statistics)

The 25 billion € extra added value is economically seen positive regarding the 7 billion € investment for the total harbour area.

Vietnam - mangrove replanting: Since 1994 Viet Nam Red Cross (VNRC) members, volunteers and local people planted more than 22,000 ha of mangrove forest in the coastal zone of Vietnam, which helps provide a defensive ribbon of forest. VNRC has worked with related ministries, governmental bodies and obtained the approval from the Prime Minister to continue caring, managing and protecting the planted mangrove forests.

The benefits for the people, the economy and the environment are:

- Increasing safety against cyclones and flooding through effective reduction of attacking waves;
- Reducing coastal defence costs with about 7 million US$/ year for a 100 km coastal stretch with sea dikes, while the investment of the replanting of this part of the coastal coast cost about 1 million US$;
- Increasing fish breeding habitat & fisheries and protecting shrimp aquaculture ponds;
- Enlarging the coastal bio-diversity;
- Providing employment and income for many thousands of coastal residents;
- Reducing the impacts of climate change on the coast.

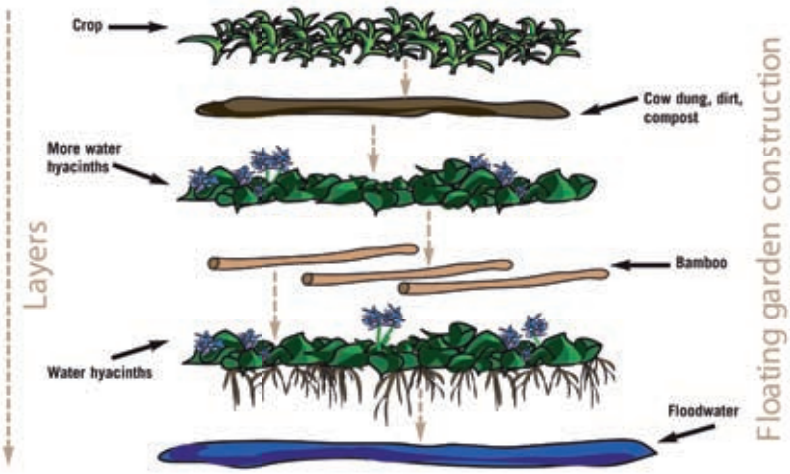
Mangrove forests will become increasingly important in the future, together with the increasing involvement of the coastal population. Disaster preparedness through mangrove plantation and the protection of mangrove forests from logging involved training of many tens of thousand coastal inhabitants, teachers and about 600,000 schoolchildren.

Mangrove planting to reduce effects of typhoons and flooding risks: the Vietnam Red Cross has planted over 22,000 hectares of which nearly 9,000 ha cover muddy sediments along the seaward side of over 100 kilometers of sea dykes in eight provinces (2010). Here, a group of Vietnam Red Cross volunteers from the Hai Phong branch makes a routine check on the condition and growth of the mangrove trees. (photo: Yoshi Shimitzu, International Federation, 2003)

Floating Vegetable Bed Cultivation. (photo: Atiq Rahman / Muslem Uddin Miah, BCAS)

Bangladesh - floating vegetable bed cultivations: A vast area of Bangladesh is situated more than two meters below mean sea level and vulnerable to high tides. Flooding and water logging is a common problem in the low lying coastal zone of Bangladesh. Climate change will aggravate this problem. There is evidence already of these adverse impacts, which affect the livelihood of people by reducing crop production and increasing food insecurity. Many communities have developed *baira* (floating bed) cultivation as an adaptive strategy to reduce their vulnerability.

The *baira* provides:
Employment and income **and** food for the farming families **and** local communities, **and** furthermore, it helps the coastal flood prone population adapt to the changing environment. The floating garden construction (water hyacinths and bamboo) provides a base to raise seedling, vegetables and crops. More than 20 varieties of vegetables are grown. The *baira* cultivation has many benefits: meeting the household food requirements and earning a living also during periods of flooding and water logging. In the dry season , composted material from the *baira* is used as organic manure for field crops.



Layered floating garden construction. (source: Practical Action: www.practicalaction.org)

First - built floating greenhouse in the world - Demonstration version, municipality of Westland (photos: Dura Vermeer).

The Netherlands – flood proof architecture: the concepts and constructive solutions to adapt to rising water levels are dealing with making floating greenhouses and houses. A number of adaptive, no-regret projects have been realised: a five hectares floating greenhouse (the Floating Roses), 32 amphibious and 14 floating houses in a left-over meander of the river Maas were all finished during the last few years. These types of measures safeguard living and agricultural production even during periods of increased flooding.

In conclusion: Stimulate Coastal Cooperation, ICZM is do-able, the challenges are large, but sustainable, innovative, adaptive solutions are within reach….and the resulting economic and environmental profits are also large.

Robbert Misdorp , CCC Initiator, Editor, Author
and Tjark van Heuvel, CCC Author
www.coastalcooperation.net

Van Hall Larenstein University of Applied Sciences, Leeuwarden, the Netherlands

As member of the Executive Board of Van Hall Larenstein University of Applied Sciences, I want to congratulate our students Integrated Coastal Zone Management on their inspiring contribution to Littoral 2012. By presenting different scenarios on the consequences of sea level rising and flooding, and the related effects on ecology and economy, they provoked a meaningful discussion with the international audience.

As one of the leading Educational Institutes in the Netherlands - within the domain of Integral Area Development, Animal Management and Food & Health - Van Hall Larenstein tutors young people in an inspirational learning and working environment, towards becoming capable, inspired and socially responsible professionals. The contribution of our students to the preparative fieldwork and the presentations during Littoral 2012 proves that we are well on our way.

I'd like to thank EUCC for giving our students the opportunity to meet interesting actors in their future working field, to listen to inspiring speakers and to broaden their knowledge regarding on the experiences gained for instance in the 'Climate of Coastal Cooperation - CCC' Publication and therefore helping Van Hall Larenstein realise her goals in educating the Coastal Zone Managers of the future.

Dr. ir. Rien Komen, Member of the Executive Board
Van Hall Larenstein University of Applied Sciences

Integrated Coastal Zone Management is an international endeavour in which The Netherlands play a leading role. Most relevant in our country is our inventiveness, our international trading spirit and, last but not least, our excellent education programmes. The internationally orientated BSc study of Integrated Coastal Zone Management at van Hall Larenstein University of Applied Sciences is a prime example of excellent education (see www.iczm.nl). The study exists since 2001 and delivers well-trained professionals in applied research, communication, planning and policy-making in coastal and marine areas. Students of our ICZM programme took part in Littoral 2012. They prepared an inspiring presentation on the consequences of sea level rise and flooding of Groningen, The Netherlands. In relatively short time they prepared this assessment in a target-driven, co-operative joint effort together with renowned experts and teachers. The result was appraised by the international audience. These young professionals form our future workers in sustainable and adaptive coastal management.

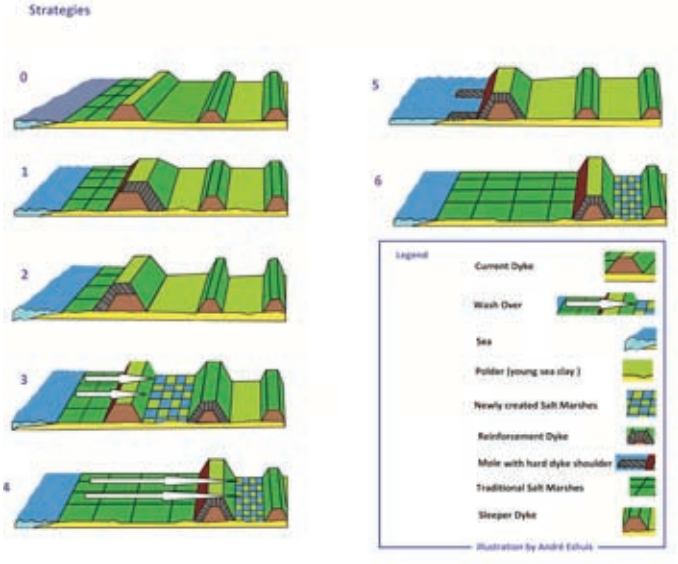
Dr. ir. M.J. Baptist, Lector Marine Ecosystems Management,
Van Hall Larenstein University of Applied Sciences

Introduction: the College Student's Views and Experiences

The Students Association "Medusa" represented by students of the BSc study of Integrated Coastal Zone Management (3rd year) took up the challenge of co-organising a training to address adaptation measures to sea level rise on the Wadden island of Ameland, in the North of the Netherlands. For this purpose, a learning field work weekend was organised on the island with the participation of various experts and in cooperation with NAM (Shell operated). It set-up the challenge of preparing a case study on sea level rise to be presented and discussed during the CCC workshop at the international LITTORAL 2012 Conference in Ostend. It was an inspirational experience with external experts delivering lectures on the challenges posed by climate change, the elements of integrated coastal zone management (ICZM), the morphological and vegetation dynamics of the Wadden Sea area and the gas mining implications. The various ways of protecting against the sea by means of dunes, beach nourishment and dykes was also covered. The impacts of subsidence due to gas extraction have been monitored and annually reported for more than 25 years on the island of Ameland. This is unique and contributes to our understanding of the effects of relative sea level rise. We learned that there are limits to which nature (e.g. morphology, vegetation and fauna) can adapt.

Case Study:

For the participation at the LITTORAL 2012 Conference, the group of students chose to present the impact of sea level rise on a possible dyke breach in the province of Groningen, situated in the south east of the Wadden Sea region. Groningen is protected by the Dijkring 6 dyke. The Delta safety standard for this dyke is a breaching chance of one in four thousand years. Economic factors, safety and impact on nature were analysed against the risk of flooding. With an absolute sea level rise of 130 cm the chance of a breach would increase greatly, from 1/4000 years to 1/100 years in the most south eastern part of Groningen (Nieuw Statendam) by the year 2100.



VHL students, lecturers and external experts, visiting the NAM gas production site during the fieldwork weekend in Ameland, first weekend of November 2012, photo Tjark van Heuvel

What are the risks of flooding? The Dutch have a vivid traumatic memory of the flooding of 1953, when more than 1800 people drowned. Most of the Groningen province lies below sea level and it would be prone to flooding in the case of a dyke breach. The sleeper dykes (secondary dykes) around the old polders are not maintained but would slow down the water as would motorways and railways built on higher grounds. Flooding would leave deeper polders under 2 meters of water. Evacuation would be extremely difficult as viaducts would become inaccessible. Furthermore, Groningen has the largest gas fields in Europe representing a very important sector of the Dutch economy. Almost the entire area of the Groningen gas field would be under water, bringing 70% of Dutch gas production to a halt. Around 35 % of the power stations would be unable to provide electricity while pump stations, sluices and bridges would cease to work. Many households could be left without electricity. Other areas in Europe would also be impacted as 56% of European gas production comes from the Netherlands. The financial consequences would be great, the gas compressors comprise investments of 2 billion Euros, and flood damage would take up to 2 years to be fully repaired. About 91% of the agricultural ground in the province, with an approximate value of 8.6 billion Euros, would also be flooded. Harvests would be partly or even totally lost for some years due to salt intrusion. This could amount to costs of about 4.5 billion Euros. Furthermore, 68% of the built-up area in Groningen would be covered by water.

Assuming that about 173,000 buildings are located in this area, this represents a value of about 30 billion Euros. Additionally, both Eemshaven and Delfzijl would be flooded. These areas produce 35% of the Dutch energy production and 15% of chemical production. Moreover Google has its largest European data storage base located in Eemshaven.

All in all it's time to examine an adaptive coastal management approach which would integrate safety, economics and nature. We need to prepare for the worst and work towards the best. Storm surges at spring tide combined with sea level rise dramatically increases the chances of flooding, coastal erosion and salt water intrusion. Lessons learnt from the subsidence of the salt marshes on Ameland due to the extraction of gas, show that roughly nature can adapt up to a certain extent: a Sea Level Rise of a half meter per century can be withstood, one meter becomes critical and one and half meters would drastically change the wetland system.

Being proactive and using an adaptive integrated approach are key objectives in this case study. The study was enthusiastically shared at the CCC workshop during the international Littoral 2012 conference. Detailed information about the study and strategies proposed by the group, in particular about the opportunities of using Climate Buffers in an integrated management approach, will be available online.
See YPCC website: www.ypcc.eu

"LITTORAL 2012 was a great experience… listening, presenting and meeting coastal international experts and learning about their research to work towards a sustainable future, has been an eye-opener. We hope that the University of Applied Science Van Hall Larenstein will continue to participate in these knowledge sharing and networking opportunities."

André Dijkstra, Miriam von Thenen, André Eshuis and Sandra Kunze, students of BSc study of Integrated Coastal Zone Management (3rd year)

Photo Tjark van Heuvel

HZ University of Applied Sciences, Vlissingen, the Netherlands

Pilot master class: Coastal Cooperation

The HZ University of Applied Sciences (HZ) is situated in the centre of the Rhine-Meuse-Schelde Delta in the Southwest of the Netherlands. Within the University, the Scaldis and Delta Academies are specialised in education and applied research concerning respectively coast related tourism-business and safety-space-nature-production related delta issues. In 2012, the Board of Directors of HZ decided to promote cooperation between both Academies to explore the possible synergies of each others expert knowledge. This cooperation has been materialised in a master class: "Waterdunen", a specific real life case in the Delta which combine themes of interest of both Academies. This case produced four main results: i) training of a mixed group of students of both academies, ii) updating knowledge of and teaching materials for use in courses, iii) exploring synergies strengthening further cooperation between both academies and iv) extending the network of coastal professionals.

The Waterdunen case, enthusiastically presented by our students during the "Climate of Coastal Cooperation-CCC" Workshop within the international LITTORAL 2012 conference was highly appreciated by the audience.

Frank Rothuis, Director of HZ Scaldis Academy
Rien Boeijen, Director of the HZ Delta Academy

Waterdunen Spatial Plan, bureau VHP (commissioned by Province Zeeland), Rotterdam, 9 oktober 2009.

Delta issues and project Waterdunen

The Delta area, surrounding HZ, is a patchwork of land and sea, estuaries, salt and fresh water lakes, connected by channels, roads and railways, dissected by dikes and dams. Within this area, protective infrastructure - dikes against flooding have been constructed throughout history, they nowadays dominate the landscape and changed coastal ecosystems. This development increased the safety for the inhabitants of the delta where nature, aquaculture, agriculture, industrial production, transport over land and water and tourism are intensively mixed. At present, however hundreds of kilometers of dikes need to be upgraded to maintain the minimum safety levels. One of the weakest spots of the sea defence is located on the Western Scheldt mouth, west of Breskens near the former island Waterdunen.

In search for an integrated and sustainable solution for this West Zeeuws Flanders area, an innovative Waterdunen project started a decade ago, providing a win-win opportunity encompassing safety, economy and nature.

An old dike section, defending the 360 ha Waterdunen area, will be strengthened by constructing a large protective dune area with wide beaches. Landwards, a sheltered, micro-tidal lagoon with islands will be created providing new sustainable habitats with high natural quality and diversity. In the same area, tourism will be stimulated through the development of a new Waterdunen recreational park.

The Delta and Scaldis Academies of HZ University of Applied Science, Vlissingen organized an autumn 2012 course: a pilot master class Coastal Cooperation with fieldwork for students, with a background of civil engineering and tourism. The fieldwork was organized in the Waterdunen area. All kinds of activities have been executed, such as presentations by stakeholders, reconnaissance bicycle tours guided by local experts and interviews with farmers about the pros & cons of the innovative Waterdunen project. The assignment to the students contained elements of physical planning, nature conservation, agriculture, cultural history, coastal flora and fauna, and tourism.

Besides discussions and field visits, student groups had to present their ideas to control the impact of an increased sea level rise (maximum of 1.3 meter/21st century) on the Waterdunen area. The dunes, the culvert, the controlled tide inside lagoon, the opportunities for ecotourism got most attention.

The winning team had chosen to present their case in the form of a theater play as employees of the Waterdunen recreation park in the future, 30 years from now. The ecologist presented the lagoon situation, the civil engineer the connection to the sea and safety

Photo Tjark van Heuvel

against flooding, and the tourist hosts spoke about the success formula of wellness and haut cuisine using 'home' cultured salt water vegetables such as glasswort (*Salicornia sp*).
The HZ contribution to the CCC Workshop at Littoral 2012 was substantial: the role play was well received, and ten HZ students joined the vivid discussion and provided suggestions to improve future courses.

Margot Tempelman, Manager Scaldis Applied Research Centre
Mindert de Vries, Leading Lector Delta Academy Applied Research Centre

Future developments

After the successful execution of the masterclass Waterdunen, HZ is aiming to extend the masterclass set-up into a summer course setup, organized by the Scaldis and Delta Academies. The summer course focusing on an integrated approach, will be repeated yearly and will be attractive to an international student audience. HZ envisages this as an opportunity to join forces with other universities and organizations to broaden the basis of the summer course. We thank the Coastal and Marine Union (EUCC) for providing the opportunity to participate in the CCC Workshop and we are looking forward to strengthening our cooperation.

Peter van Dongen (Vice Chairman of the Executive Board)

Student statements

'It was really interesting to see how safety, people and nature come together in one area. By working together with students from Scaldis Academy and Civil Engineering of Delta Academy, the project was an eye-opener'.
Maureen Pesman

'Teamwork is the future. The broad structure of the project motivated all concerned to produce a good product, of which the best would be chosen for presentation at Littoral in Ostend. Eventually we realised that there is no place in today's world for "working alone".
Rutger Blok

'Because we were students from different Academies we complemented each other. I learned a lot about the potentials of nature in the Netherlands, about tourism in the area, and about weaknesses in defence along the coast. We stayed for 3 days in the surroundings of the 'Waterdunen', in this way we have gained the best experience of the daily routine of this region'.
Wendy Slager


Photo Tjark van Heuvel

University College KHBO, Oostende and KU Leuven - University, Belgium

Introduction of the KHBO - Ostend

The University College KHBO is a part of Association KU Leuven. The Association KULeuven is with its almost 100 000 students and 23 campuses the largest association in Flanders, Belgium. Within this association academic bachelor and master study programmes of a high quality are offered. The Association KU Leuven enhances the co-operation between students of different study programmes. From September 2013 on the University College KHBO will be fully integrated in KU Leuven.
During the last 5 years, a coastal cooperation between students of the K.U.Leuven 'Master of Engineering Technology' programme and the KHBO 'Master of Engineering Science' programme has already been set up. In this way the students are stimulated to work in project-based, multi-disciplinary teams.

One selected team of students of last year's edition of the project work was offered to present their 'Vlaamse Baaien 2100' case during the CCC Workshop within the LITTORAL2012 conference in Ostend, co-organised by the Coastal and Marine Union – EUCC. Their presentation was appreciated by the audience and showed that a new generation of engineers is ready to tackle the challenges of the future regarding coastal zone management
We welcome future cooperation with the EUCC stimulating an exchange of coastal knowledge to address the envisaged coastal changes through integrated planning and implementation of adaptive coastal measures.

Prof. dr. ir. Wim Haegeman - Dean of Department Engineering Technology KHBO,
Prof. dr. Jan Beirlant - Campusrector of the University College Campus KU Leuven KHBO

Introduction student project work : Vlaamse Baaien Plan 2100

Various coastal engineering projects have been worked out during the last 5 years, e.g. designing the harbour breakwater in Oostende and the extension of the outer harbour of Zeebrugge and elaborating six projects of the 'Vlaamse Baaienplan 2100': designing artificial islands in front of the Flemish coastline. The main aim of such project work is to actively develop and train students in competences in the fields of coastal and applied engineering within an integrated frame. They have to carry out a genuine engineering task.

External experts from the field (the 'client') present and introduce the engineering task during the introductory days. In this way, the project becomes more authentic and more relevant. In between, students present their preliminary results and feedback is given. At the end, the same experts evaluate, by mutual agreement with the project coaches and the didactical experts, the output of the student teams during a consulting interview with each team. These consulting interviews also resemble a real life engineering setting.

The recent coastal design projects have been undertaken by six teams of students and are all based on the 'Vlaamse Baaienplan 2100' of the Flemish Government (www.vlaamsebaaien.com). The main issues of this offshore development plan are: enlarging the coastal safety in relation to future changes and integrating the sea as a sustainable energy source, attractive for tourism and inhabitants, providing space for nature and development.
During the CCC Workshop at LITTORAL2012, an overview of all six Vlaamse Baaien student project works was given and one student team presented their case in detail as shown hereunder.
The full report of this project team, in Dutch language, entitled: "PROJECTWERK BOUWKUNDE Groep 5, - samenwerking KHBO & KULeuven", will be made available on the YPCC website www.ypcc.eu

Dr. Ir. Björn Van de Walle, Head of Education, Department Engineering Technology KHBO

Oostende, photo Tjark van Heuvel

Summary of project work: Vlaamse Baaien Plan 2100 – student group 5.

Climate change and sea level rise are threatening the Flemish coast and the hinterland. To guarantee the safety level, measures have to be taken. The 'Vlaamse Baaienplan 2100' is characterized by five key words: safety, sustainability, attraction, naturalness and economic development.

Suggested projects in the Vlaamse Baaienplan are using the existing shallow sandbanks in front of the coastline. The island designed by our group, is projected on the 'Stroombank', a sand bank about 1.5 km out of the coastline of Oostende (Figure 1). The island is conceived as a natural area with possibilities for development of marine fauna and flora.

The dimensions of the designed island are given as an artist view (Figure 2). Due to the 'form' of the island, the longitudinal current in front the coastline is diverted by the west side of the island. The diverted current should launch a sediment transport towards the coastline. By this, a natural nourishment of the foreshore with sand, which waves can transport towards the beach, would be generated. However, due to numerical instabilities of our software this issue could not be investigated thoroughly, so further research is needed.

The design parameters for the island are based on a return period of 100 years. To protect the island against waves, a rubble mound breakwater is built around the island, except for the southern part of the island as wave attack does only occur by diffracted waves. The armour layer of the breakwaters protecting the island consists of stones of about 7 ton. The core of the breakwater is created with geobags, i.e. bags made of geotextile and filled up with sand. Between the armour layer and the core, a protection layer is placed.

Whereas the island is designed to withstand a 100-year storm, the 'Vlaamse Baaienplan 2100' aims at a protection of the Flemish coastline against a 1000-year storm. Furthermore, an in depth analysis has been carried out for the hydrodynamic boundary conditions values of water level, wave height and wind speed of the Flemish coast. In Figure 3 a comparison between the situation as it is nowadays, without the island, and the situation with the island in front of the coastline is shown. Significant wave heights are plotted for NNW wind (and wave) direction. The influence of the island is noticed clearly: over a distance from the coast of 4 km, the incident significant wave height is reduced by at least 0.5 m.

Graduated KHBO and KU Leuven students:
Arne Ureel, Gunther Pauwels, Jelle Weustenraad, Jonas Coene, Jonas Degeyter, Jorgen Van Bael, Merel Kroeders, Michael Weymeis, Sebastiaan Passchyn

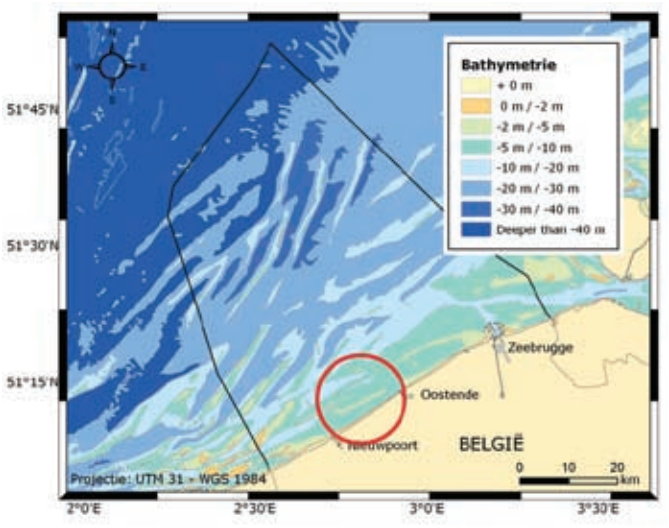


Figure 1: Location 'Stroombank', Bathymetric map of the Belgian part of the North Sea and surrounding areas. Prepared by the Belgian Marine Data Centre, Royal Belgian Institute of Natural Sciences. Parts of the map are extracted from Maes et al., 2000, "Limited Atlas of the Belgian Part of the North Sea, Belgian Science Policy Office."

Figure 2: Artist view of the designed island

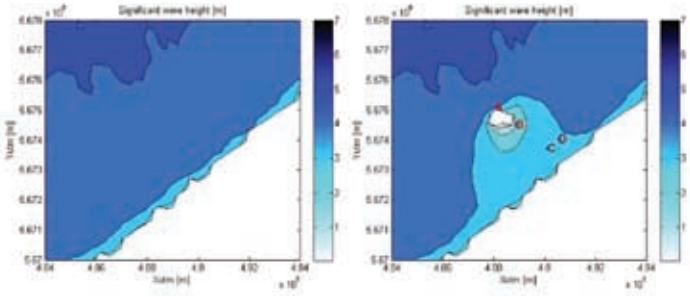


Figure 3: Significant wave height 1000-year storm, NNW direction, (left) without the island, (right) with the island.

Preparing to Adapt

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Marlous Heemstra, Tutor Littoral 2012
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The Coastal & Marine Union is dedicated to conserving and maintaining healthy seas and attractive coasts for both people and nature.
EUCC's mission is to promote coastal and marine management that integrates biodiversity conservation with those forms of development that sustain the integrity of landscapes, the cultural heritage and the social fabric of our coast. EUCC advocates best practice by developing coastal and marine policies, mobilising experts and stakeholders, and providing advice, promoting capacity building actions and information. EUCC´s activities range from innovative policy advice (e.g. ICZM progress indicators and sustainable development indicators) to involvement in initiatives aiming at the improvement of access to coastal information and knowledge (e.g. distance learning training packages), and field projects combining coastal and marine biodiversity conservation and sustainable development.
EUCC offers memberships for professionals and private individuals, and other non-profit organisations. Please visit www.eucc.net for more details.

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Colophon

EUCC's magazine Coastal & Marine Special on '*Preparing to Adapt*' (volume 2013-2) , ISSN 1877-7953

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Design & Layout: Erik Devilee

Opinions expressed in Coastal & Marine do not necessarily reflect the official views of EUCC.

Cover photo: © Tjark van Heuvel

Photo cover insets: Ameland © Tjark van Heuvel, logo CCC © Harry van Reeken, Littoral 2012 © CP-Foto Jan

Thanks for support are expressed to: *Mike Mannaart and Robert Steenbergen (EUCC)*

Funding acknowledgements are given to: *EU Action Programme promoting European NGOs, Van Hall Larenstein and Hogeschool Zeeland*

Sole responsibility of this publication lies with the authors; the Commission is not responsible for any use that may be made of the information herein.