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de Arhitectură și Urbanism
"Ion Mincu"



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LE:NOTRE Institute
Linking landscape education, research and innovative practice



ISOCARP
Knowledge for Better Cities

CHANGING LAND/SEASCAPES: Dynamics of Coastal Landscape and Drivers for Change

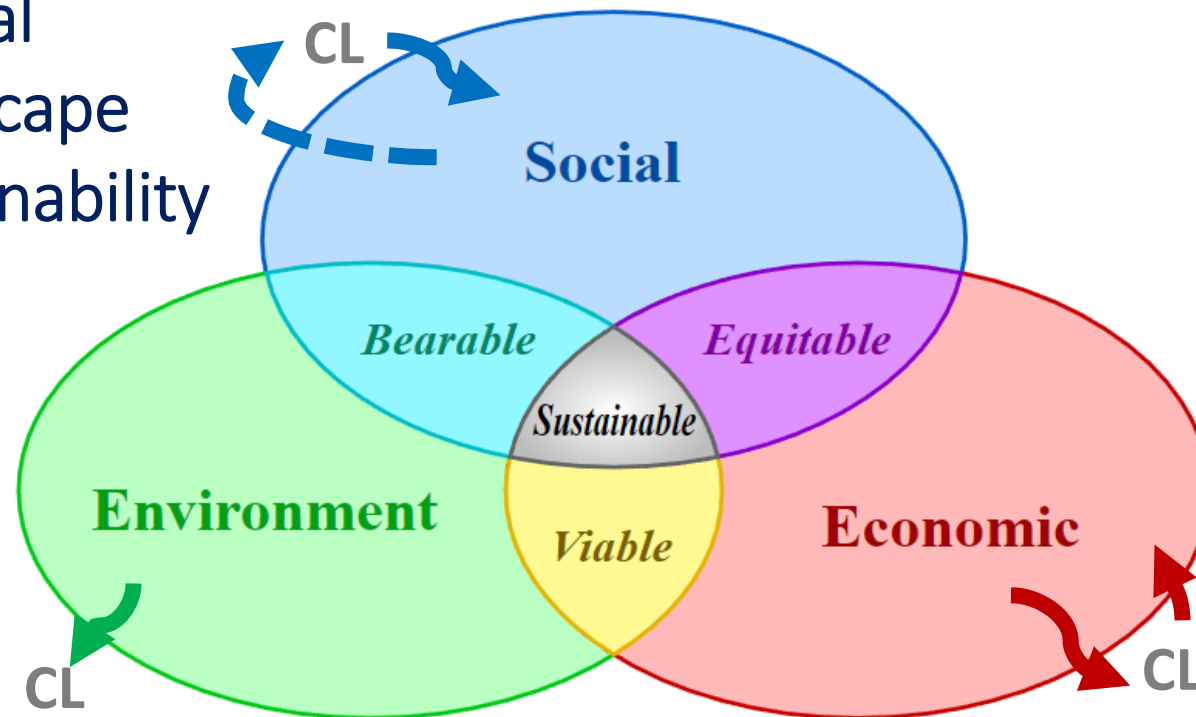


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Topics for Today:

1. Natural environment
2. Economic activity
3. Social factors
4. Planning approach
5. Be a coastal manager - Simulation game
6. North Sea overview

Coastal
Landscape
Sustainability



Nature:



To understand how coastal processes shape coastlines

- Learning objectives:**
- ✓ Coast/Shore/Coastal zone
 - ✓ Drivers of coastal processes: waves, tides
 - ✓ Coastal processes: deposition & erosion
 - ✓ Coastal landforms and environments



Nature:



Coast, shore & coastal zone defined

Coast: - Area of contact between land and sea

- Extend inland until meets a different geographical setting

Shoreline: Precise boundary where water meets adjacent dry land

Coastal zone: the region that is directly influenced by marine or lacustrine hydrodynamic processes



Nature:



Drivers of coastal processes: Waves/Tides/Currents

Waves: transport energy by motion

— ultimate source of wave energy is the sun

Tides: Daily fluctuations in the height of the ocean

— caused by gravitational attraction of water to Sun and Moon

Currents: mainly driven by the wind



Tidal range: varies depending on latitude and the shape of the coasts

Bay of Fundy tidal range up to 17 m.

Nature:



Coastal deposition & Landforms created

Occurs when amount of sediment exceeds wave/current ability to transport it

Beaches: relatively narrow strips of sand or pebbles along a shoreline

- 90% of beach sediment comes from streams that drain to coast — transported by longshore currents



Nature:



Coastal deposition & Landforms created

Spit and/or **hook**: Narrow strip of sand that grows across the mouth of bay due to longshore current

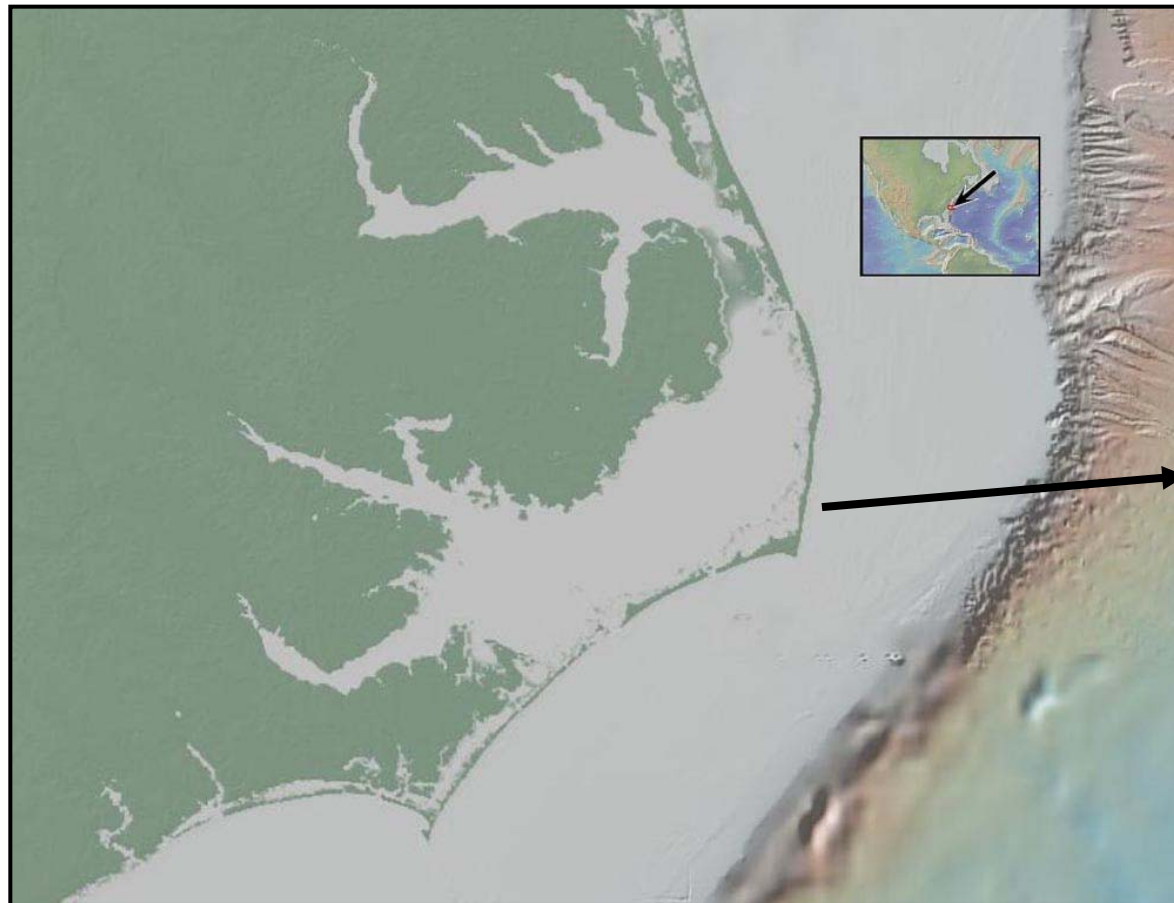


Nature:



Coastal deposition & Landforms created

Barrier islands: Long narrow islands made of sand that flank main shoreline and separate bays from open sea.



Nature:



Coastal deposition & Landforms created

Tombolo: Narrow strip of sediment deposited behind a sea stack by refracted waves

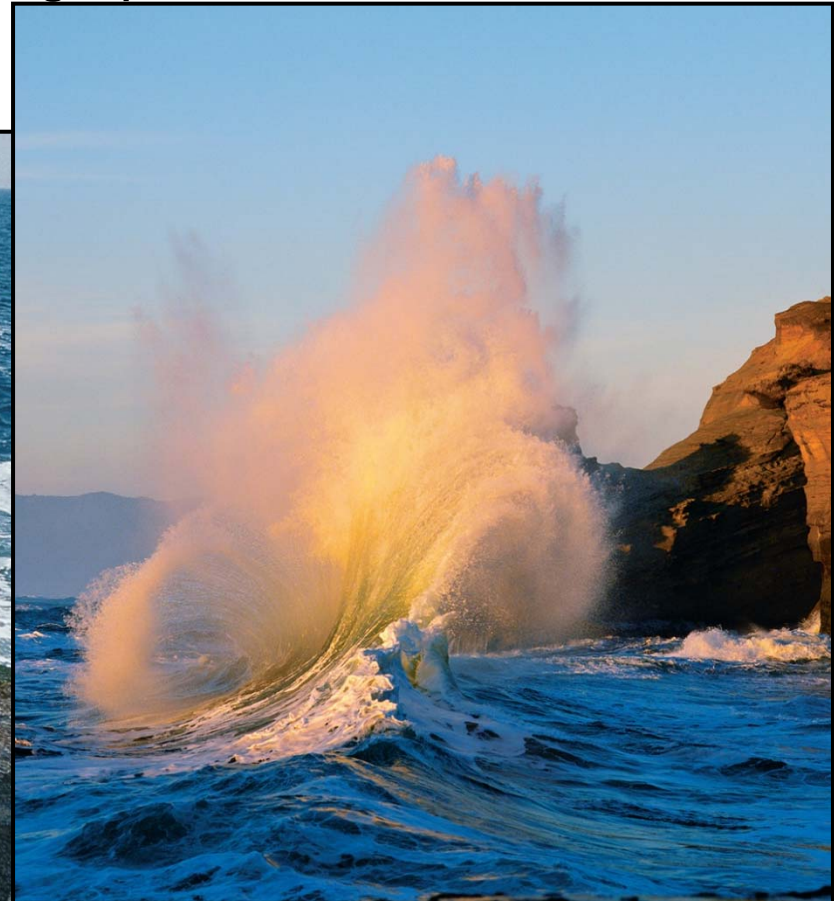


Nature:



Coastal erosion

Waves are dominant mechanism in coastal erosion —
Water forced into cracks in rock at high pressures



Source: https://www.colby.edu/academics_cs/courses/.../Shores-and-coastal-processes.ppt

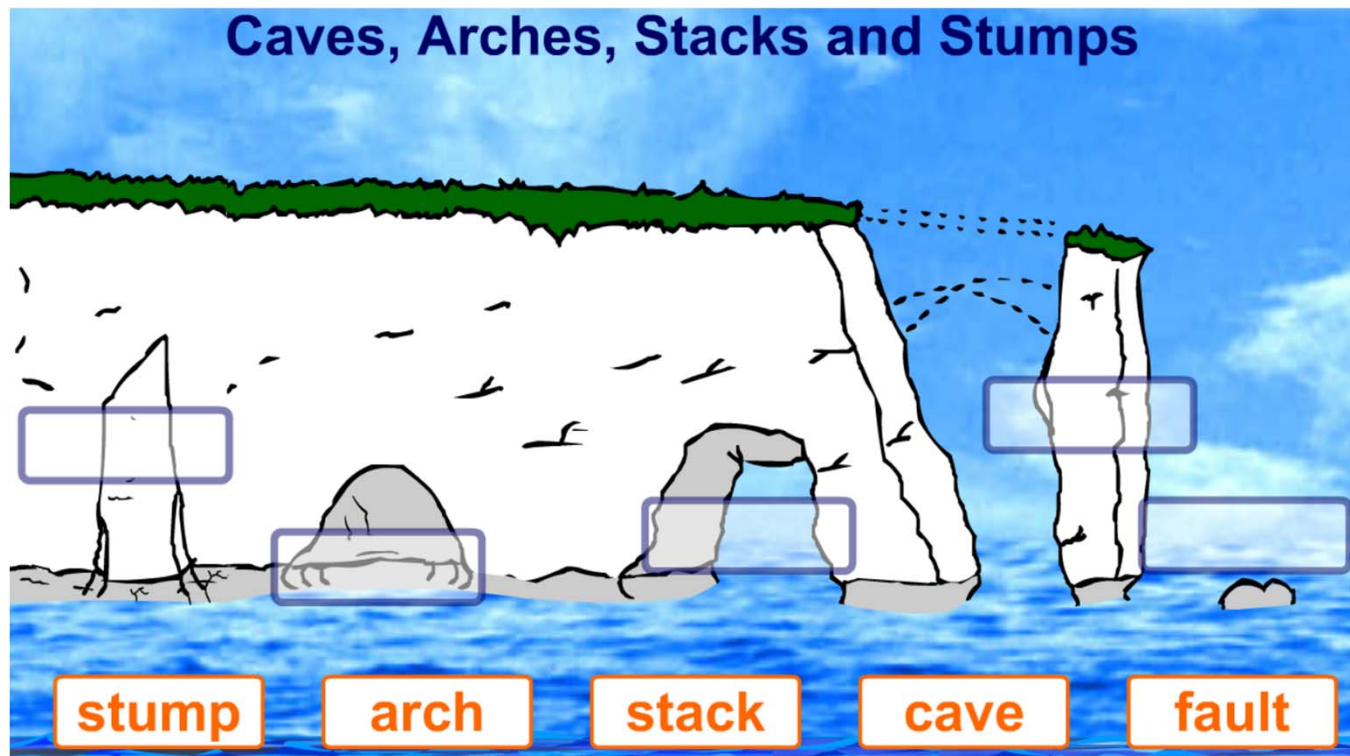
Nature:



Landforms created by coastal erosion

Wave energy is focused on **headlands**: prominent cliffs that jut out into deep water

- ❖ attack the sides of headlands and form **caves**, **arches**, and **stacks** by undercutting them



Nature:



Coastal environments

- Coastal **sand dunes** form as a result of both wave action and aeolian processes.



<https://www.steveparish-natureconnect.com.au/nature-centre/beach-and-coastal-dune-communities/>



<https://www.nature.com/scitable/knowledge/library/coastal-dunes-geomorphology-25822000>

Nature:



Coastal environments

- **Estuaries/deltas** - coastal river valleys flooded by sea water
 - characterized by mixing of fresh and salt water



Nature:



Coastal environments

- **Coral reefs** build up through time. Coral polyps can grow only in clear, mud-free water where the temperature does not fall below 22°C.



<https://earthobservatory.nasa.gov/IOTD/view.php?id=88109>

Nature:



Coastal environments

- **Mangroves** - range of tree and bush species
 - adapted to life in coastal swamps and estuaries in tropical waters & located between mid tide and high tide marks



<https://www.newscientist.com/article/dn27498-sri-lanka-first-nation-to-promise-full-protection-of-mangroves/>



<https://www.iucn.org/theme/forests/our-work/forest-landscape-restoration/mangrove-restoration>

Economy:



To understand how economic activities shape coastal landscapes and how these activities are shaped by a coastal location

Learning objectives:

- ✓ Economy as a subject of CL processes
- ✓ Economy as an agent of CL processes



https://cf.furunavi.jp/img_introduction.ashx?municipalid=434&imgno=1075

Economy:



Economy as a subject of CL processes

- Infrastructure <= coastal erosion and floods/tsunami (Indonesia earthquake)

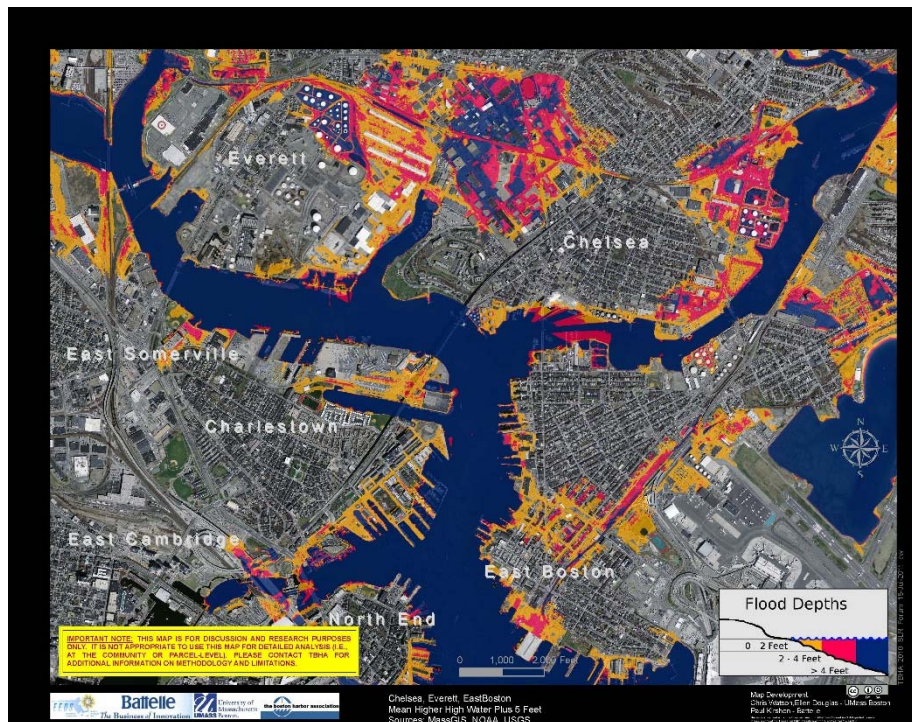


Economy:



Economy as a subject of CL processes

- Fertile soils, beaches, infrastructure \leq global sea level rise + local subsidence



<http://www.bostonharbornow.org/what-we-do/work/climate-change-preparedness/maps/>



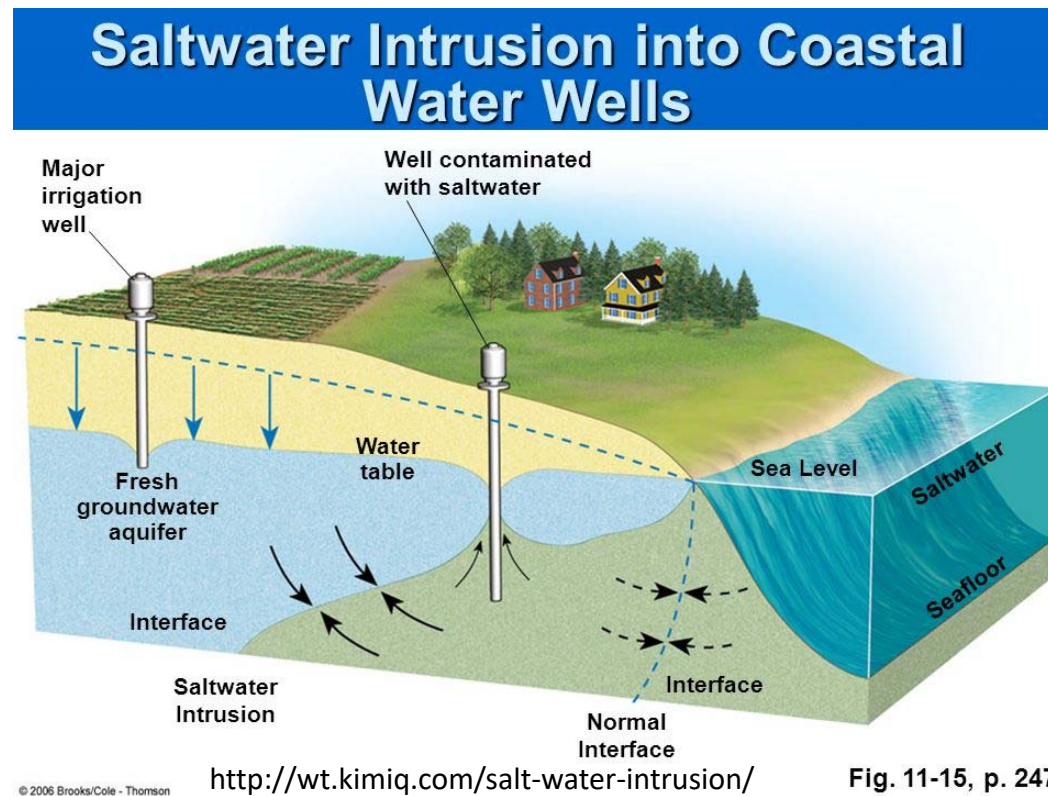
<https://earthzine.org/2008/04/06/sea-level-rise-modeling-with-gis-a-small-universitys-contribution-to-understanding-a-global-dilemma/>

Economy:



Economy as a subject of CL processes

- Food production and drinking water \leq seawater intrusion in freshwater aquifer



Economy:



Economy as a subject of CL processes

- Water transport <= siltation in harbors and estuaries



<https://www.independent.ie/regionals/braypeople/news/fears-bray-harbour-could-be-abandoned-35238383.html>

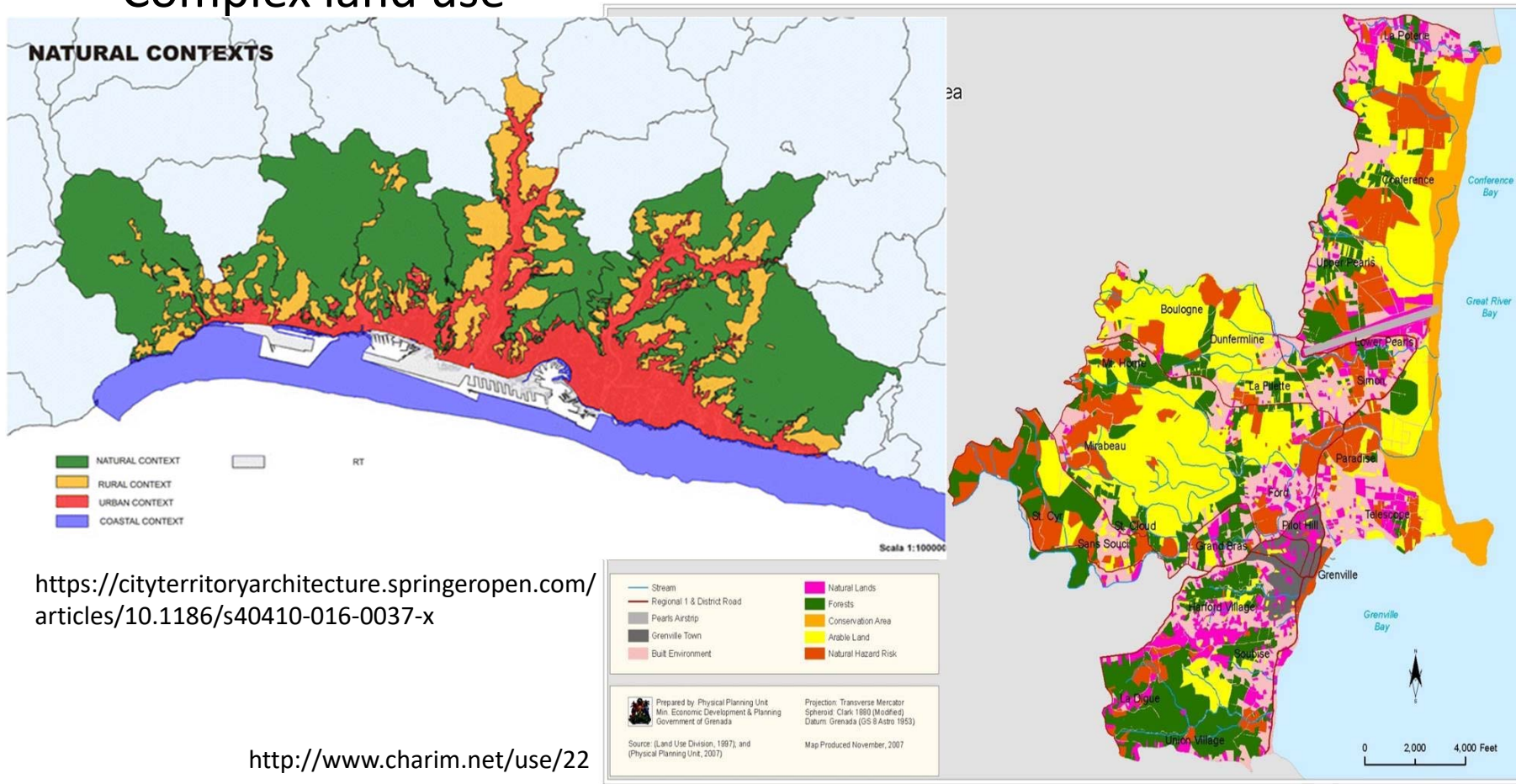


<https://www.localmatters.co.nz/news/13786-tide-turns-on-mahurangi-river-siltation.html>



Economy as an agent of CL processes

- Complex land use

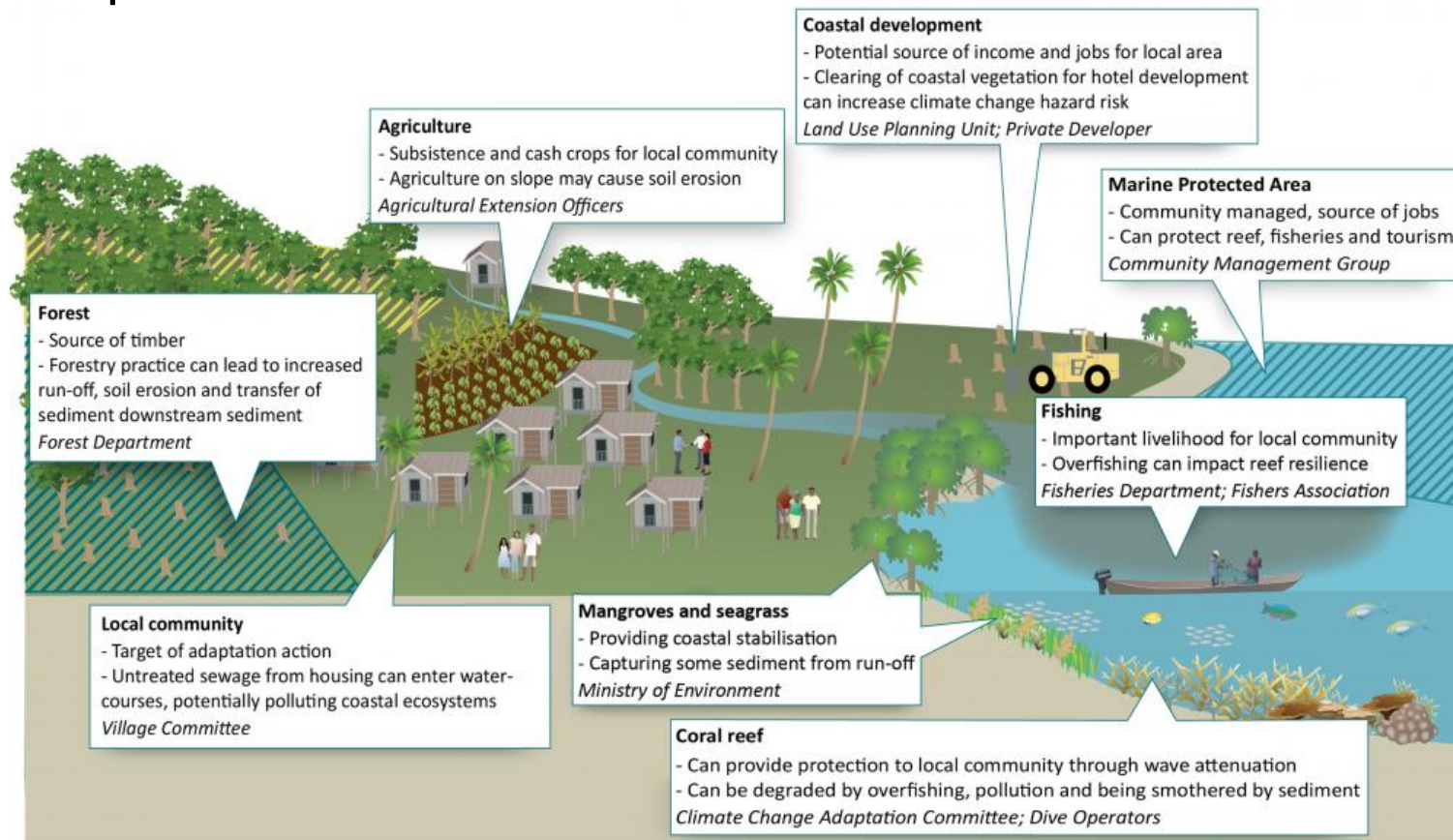


Economy:



Economy as an agent of CL processes

■ Complex activities



<http://web.unep.org/coastal-eba/planning-context>

Economy:



Economy as an agent of CL processes

- Agriculture



<http://www.greekboston.com/culture/ancient-history/agriculture/>

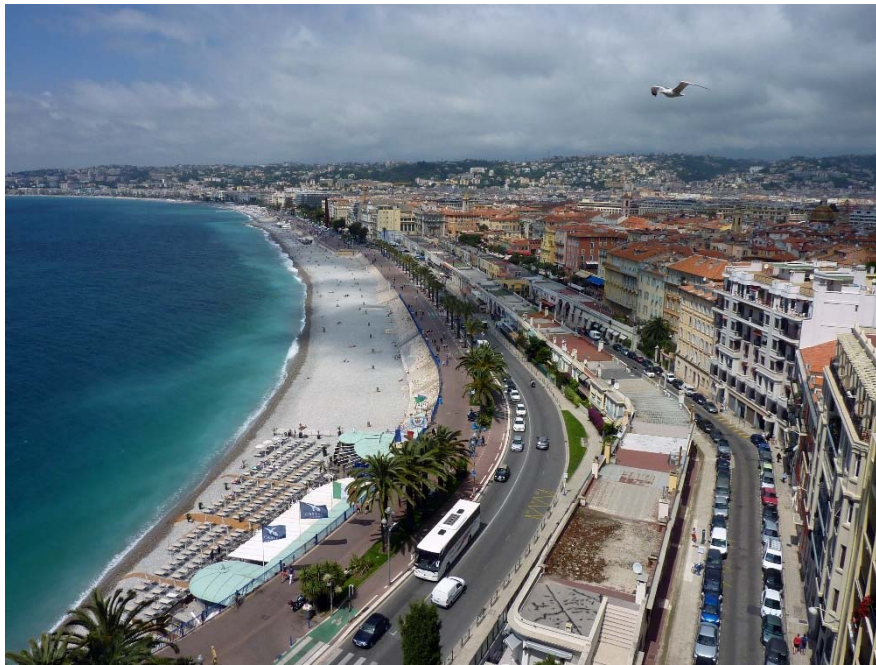
http://www.v3wall.com/es/html/pic_down/1920_1080/pic_down_89009_1920_1080.html

Economy:



Economy as an agent of CL processes

- Infrastructure: urban



https://batinfo.com/actualite/lurbanisation-de-la-cote-dazur-en-question_3619



<http://www.jpnnews.in/2017/07/Coastal-Road-Project.html>

Economy:



Economy as an agent of CL processes

- Infrastructure: industrial



<https://www.singaporebusiness.com/2016/looking-ahead-for-singapores-chemicals-sector.html>

<http://footage.framepool.com/en/shot/353583460-oil-refinery-oil-industry-dock-north-island>

Economy:



Economy as an agent of CL processes

- Infrastructure: transportation



<https://www.pinterest.com/pin/760475087049223161/>



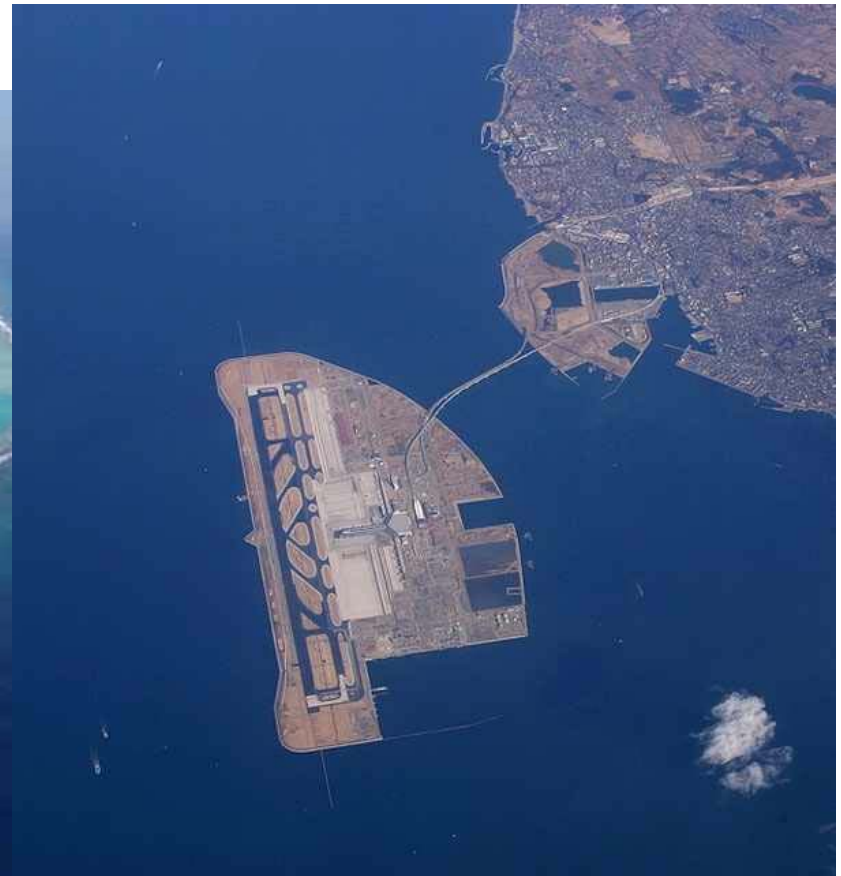
<http://www.afr.com/news/policy/climate/ipcc-warns-climate-change-will-hit-agriculture-infrastructure-20140331-ix9no>

Economy:



Economy as an agent of CL processes

- Infrastructure: transportation



<http://www.ba-bamail.com/content.aspx?emailid=15630>

Economy:



Economy as an agent of CL processes

- Marine resource exploitations: fisheries, aquaculture, extraction of minerals

<https://www.globaldashboard.org/2014/06/06/environmentally-friendly-oil-rigs-well-yes-norway/>



<https://www.youtube.com/watch?v=YVTJL5RIXng>



<https://www.workinaquaculture.com/about/>

Economy:



Economy as an agent of CL processes

- Navigation and shipping; ports



<https://investigator.org.ua/news-2/202584/>

<http://luxuryachts.eu/luxury-yachts/luxury-yacht-destination-guides-the-mediterranean-sea>



Economy:



Economy as an agent of CL processes

- Recreation/tourism

<https://www.tripsavvy.com/family-vacation-deals-at-atlantis-resort-3266134>



<https://www.centarahotelsresorts.com/centara/crf/>



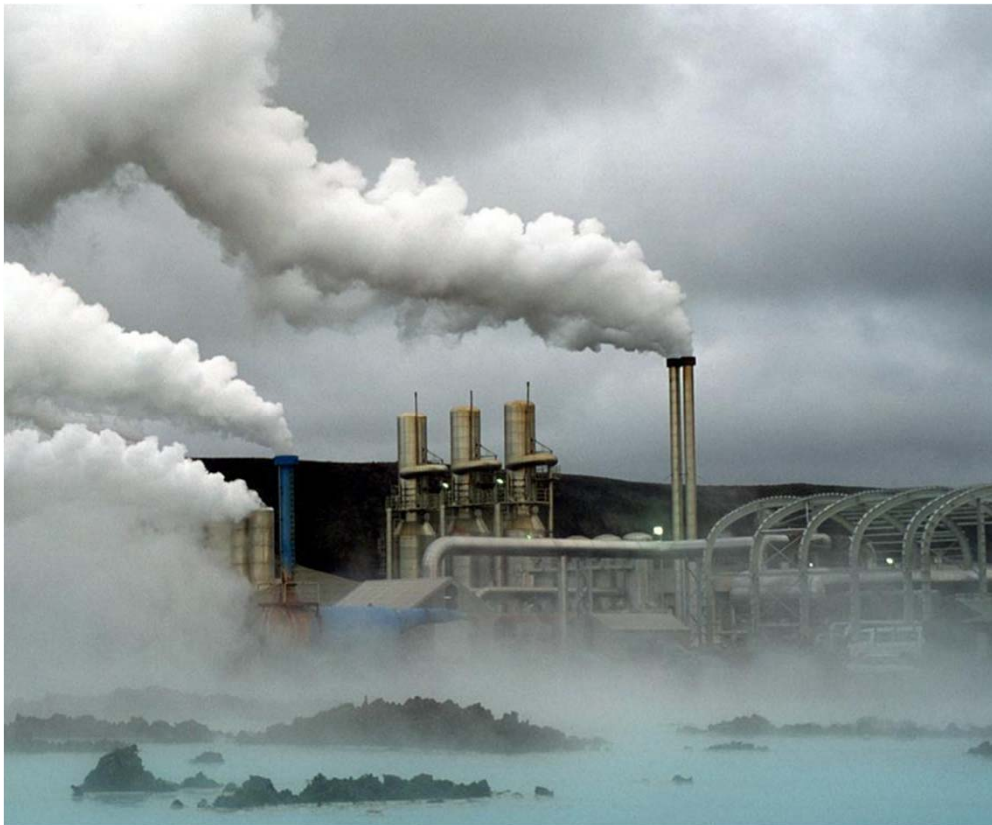
<http://www.pliska-goldensands.com/index.php?page=goldensands&lang=en>

Economy:



Economy as an agent of CL processes

- Pollution from industry and agriculture



<http://www.environment-health.ac.uk/>



<http://www.natureponics.net/florida-coastal-cities-plagued-by-massive-pollution-brought-to-you-by-big-agriculture/>

Economy:



Economy as an agent of CL processes

- Pollution from industry and agriculture (from cattle farming and agricultural fertilizers)



<http://slideplayer.com/slide/6922096/>

Society:



To understand how to make coastal landscapes socially sustainable

Learning objectives:

- ✓ CL sustainability
- ✓ CL development: DPSIR
- ✓ DPSIR terminology
- ✓ Socially sustainable CL

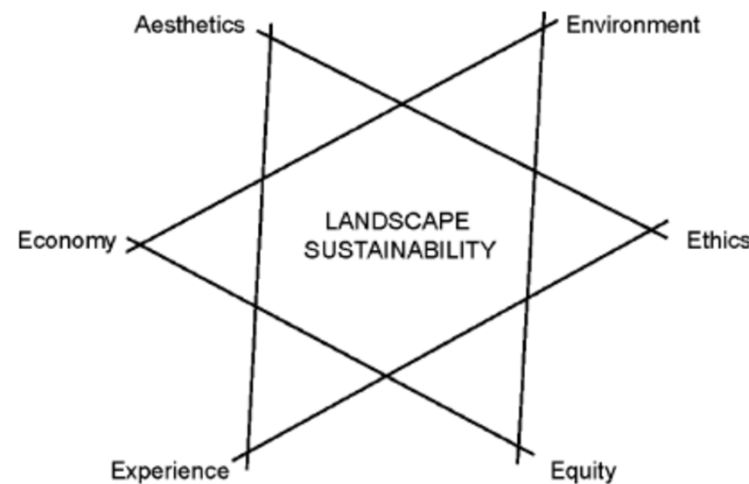


<https://www.thesun.co.uk/wp-content/uploads/2017/07/nintchdbpict000338380247.jpg>

Society:



Coastal Landscape Sustainability — the six **E**s:
= local communities' resilience, economic resilience and ecological resilience



(Musacchio 2009)

- E**nvironment – minimum environmental impact, preservation of biodiversity
- E**conomic – local development
- E**quity – fair use of resources and profit distribution
- A**esthetics – natural features and attractiveness
- E**xperience – local knowledge
- E**thics – respect for both natural and cultural heritage

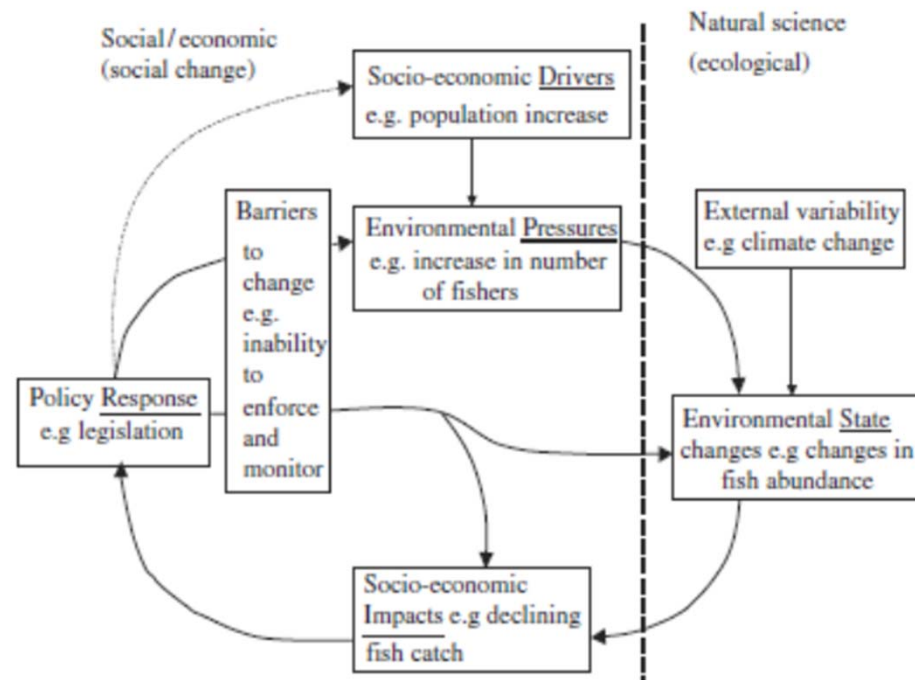
Society:



Coastal Landscapes Development

I. Human impact on coastal landscapes

- the **DPSIR** (*driver–pressure–state–impacts–response*) approach:
human activity (administrative boundaries) / environment degradation (ecosystem boundaries)



The DPSIR framework (Mangi et al. 2007)

*socio-economic drivers – environmental pressures – changes in the state of the environment
– impacts on human welfare (declining resources) – policy responses to mitigate
the damage or problem, or re-orientate drivers or pressures*

Society:



Coastal modelling forces. How do we call them?

Factor - a fact or situation that influences the result of something (Cambridge Dictionary)

- **GloBio** speaks about *environmental drivers* (<https://www.globio.info/>)
- **Millenium Ecosystem Assessment Report** (2005) uses the term *direct drivers* for the same phenomena as above
- **DPSIR Framework** uses the term *pressure* (for natural forces) and *drivers* (for man-made activity)

For more info on terminological differences see *Oesterwind et al., 2016* (doi: 10.1016/j.jenvman.2016.05.058)

For more info on DPSIR see *FAO definition*: <http://www.fao.org/land-water/land/land-governance/land-resources-planning-toolbox/category/details/en/c/1026561/> or *EEA approach* (<https://www.eea.europa.eu/help/glossary/eea-glossary/dpsir>)

For overview of DPSIR Framework evolution see *Patricio et al., 2016* (doi: 10.3389/fmars.2016.00177)

Society:



DPSIR definitions

(Oosterwind et al., 2016)

Driver is a superior complex phenomena governing the direction of the ecosystem change, which could be both of human and nature origin (e.g. clean water demand or earthquake)

State is the actual condition of the ecosystem and its components established in a certain area at a specific time frame, that can be quantitatively-qualitatively described based on physical (e.g. temperature, light), biological (e.g. genetic-, species-, community-, habitat-levels), and chemical (e.g. nitrogen level, atmospheric gas concentration) characteristics

Pressure is a result of a driver-initiated mechanism (human activity/natural process) causing an effect on any part of an ecosystem that may alter the environmental state (e.g. climate change)

Impacts can be defined as consequences of environmental state change in terms of substantial environmental and/or socio-economic effects which can be both, positive or negative.

Response represent all management actions seeking to reduce or prevent an unwanted change or to develop a positive (desirable) change in the ecosystem.

Society:



DPSIR example - constructions

(based on Oesterwind et al., 2016)

Drivers

Demand for energy
maritime transport
urbanization
food production

Pressures

Abrasion
Siltation
Noise

State

of habitat
of hydrological processes

Impacts

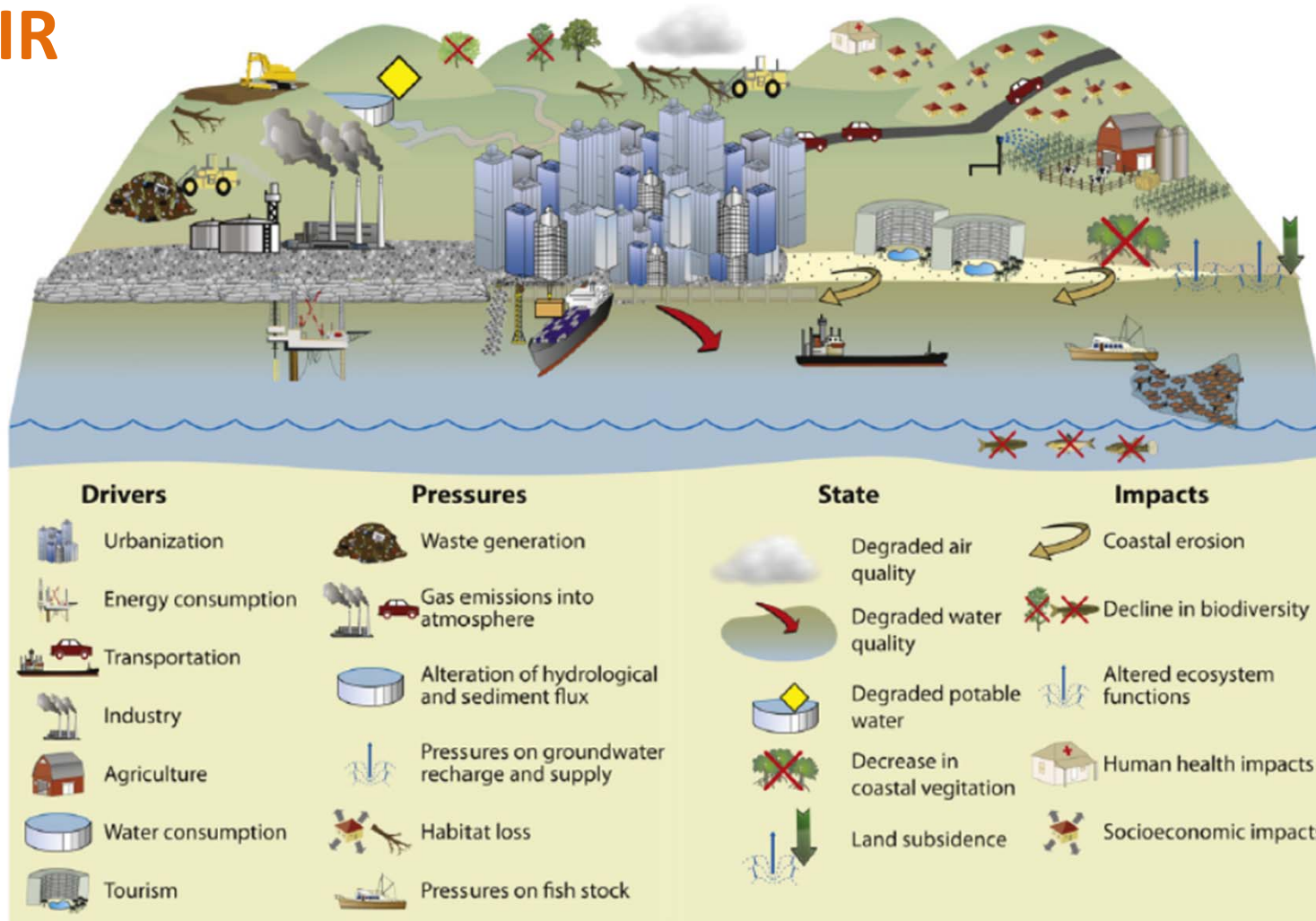
Lost of habitats
Alteration of hydrological processes

Response

Prior Environmental Impact Assessment
Restoration of lost habitats

Society:

DPSIR



Drivers, Pressures, State and Impacts regarding **megacities** in the coastal zone
(Sekovski et al. 2012)

Society:



Coastal Landscapes Development

II. Impact on the local communities

- **Social conflicts among user groups** (*fishers' livelihoods vs. tourism/industry*)
 - loss of local culture and traditions
 - commercialization of local culture
 - living standardization
 - adaptation to tourist demands
- **Environmental degradation** (*quality of life and human health decrease*)
 - inadequate water supply, the contamination of drinking water, solid waste generation, air pollution, the urban heat island effect
 - loss of agricultural land, the loss of jobs in the agricultural sector, rise in food imports, inability to satisfy food demands
 - decline in tourism
 - climate change effects and extreme weather events
 - mass migrations of people
- **Resource overexploitation** (*impoverishment*)
 - resource scarcity
 - loss of public access
 - social disruptions
 - changes in the community structure

Society:

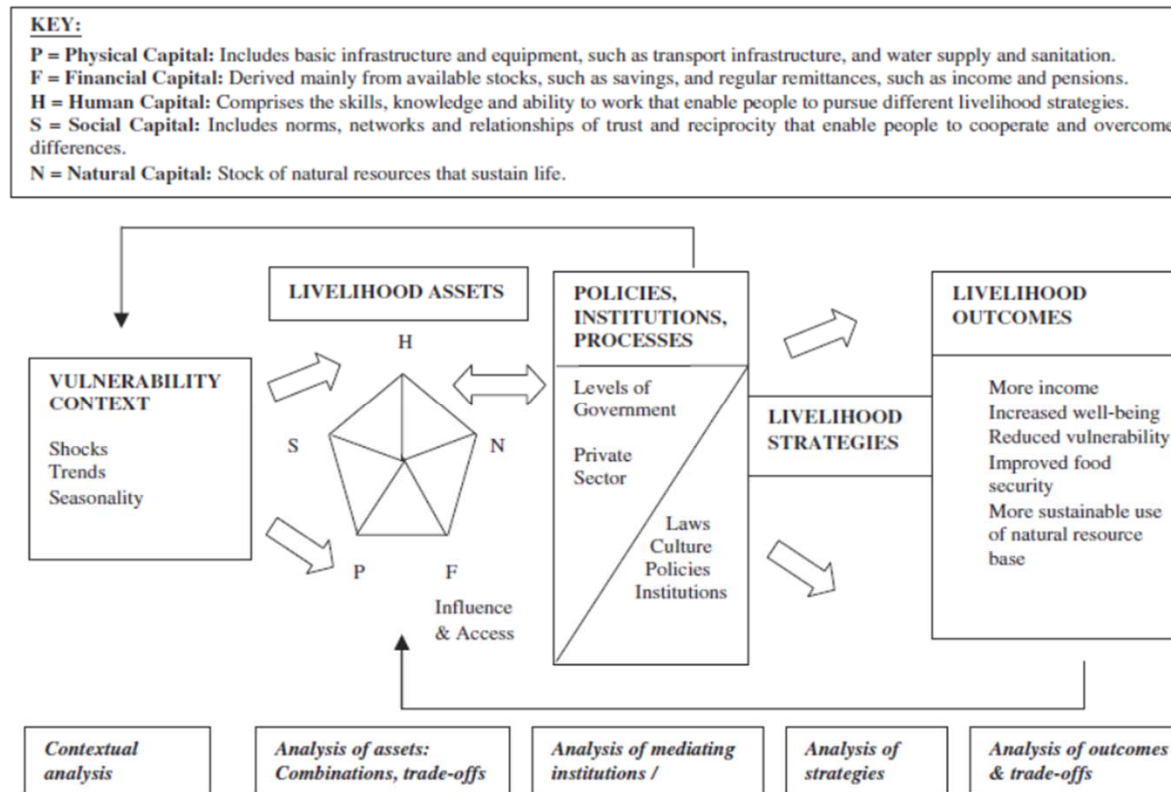


Socially sustainable coastal landscapes

Sustainable livelihoods:

= capabilities + equity + sustainability:

- giving 'voice' to the concerns, needs and well-being of poor people
- actively involving poor people to identify livelihood priorities and develop improving strategies



The sustainable livelihood framework (Glavovica and Boonzaier 2007)

Society:



Socially sustainable coastal landscapes

Sustainable livelihoods:

Livelihood strategies employed by poor coastal communities

- Employment (*waged employee in both formal and informal employment - fishing/agriculture; remittances from other employment*)
- Pensions and government grants (*disability grants*)
- Agricultural production (*subsistence farmers, garden/community agriculture, forestry, commercial agriculture*)
- Resource harvesting (*fishers, medicinal plants, sand and mussel*)
- Production of goods (*craft production for the tourist market*)
- Services (*guiding for the tourism industry—ski boat assistant, guide, accommodation*)
- Trading (*informal trading of goods and products and resources*)
- Migration (*to areas of perceived greater opportunities*)
- Investing in social relationships and networks (*maintaining rural/urban and coastal/inland linkages*)

Planning:



To understand how to manage coastal landscape challenges

Learning objectives:

- ✓ Coastal hazards
- ✓ Dealing with planning & management challenges
- ✓ Co-management of coastal development
- ✓ Simulation game



De Panne (Belgium)
Photo by I.Sirodoev
Nov 15, 2019

Planning:



Coastal hazards

Combined onshore wind and high tide
Results in deep Storm Surge



Sea Level Rise
Storms
Tsunamis

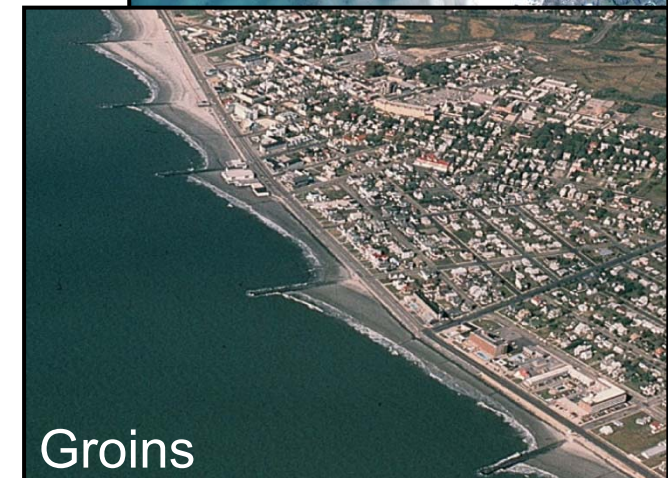
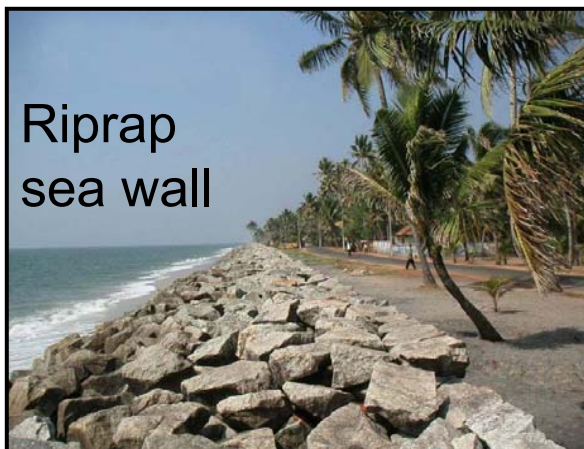
Planning:



Mitigating Against Coastal Hazards

Hard Stabilization

- to interrupt the force of waves:
 - seawalls, built parallel to the coastline
 - breakwaters, similar purpose, built slightly offshore
- to interrupt the flow of sediment along the beach:
 - groins and jetties, built at right angles to the beach to trap sand and widen the beach.



https://www.colby.edu/academics_cs/course/s/.../Shores-and-coastal-processes.ppt

Planning:



Mitigating Against Coastal Hazards

Alternatives to Hard Stabilization: Soft Stabilization

- by adding sediment to the coastline – **Building with nature**
- Limit building near shorelines
- Relocation: move structures rather than protect them in areas of erosion



Planning:

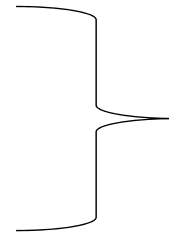


Dealing with planning challenges

Coastal processes



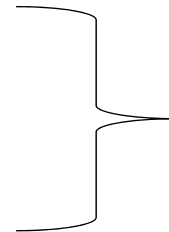
positive impact on human activity



Coastal processes



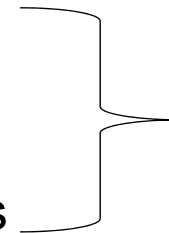
can also affect human activity



Human activity



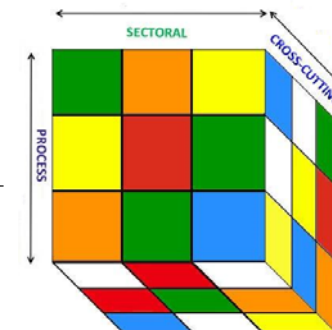
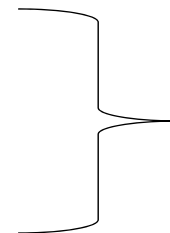
can also affect coastal processes/landforms



Human activity



positive impact on coastal processes/landforms



<http://www.eaarth2ocean.com/pdfs/Unit%20Powerpoint%20presentations/Unit%203%20powerpoint.pptx>

Planning:



Who manages the coast and how?

❖ Land-sea perspective: Integrated Coastal Zone Management - ICZM

Managing coastal resources = managing across user groups
- integrating their needs and those of the natural environment

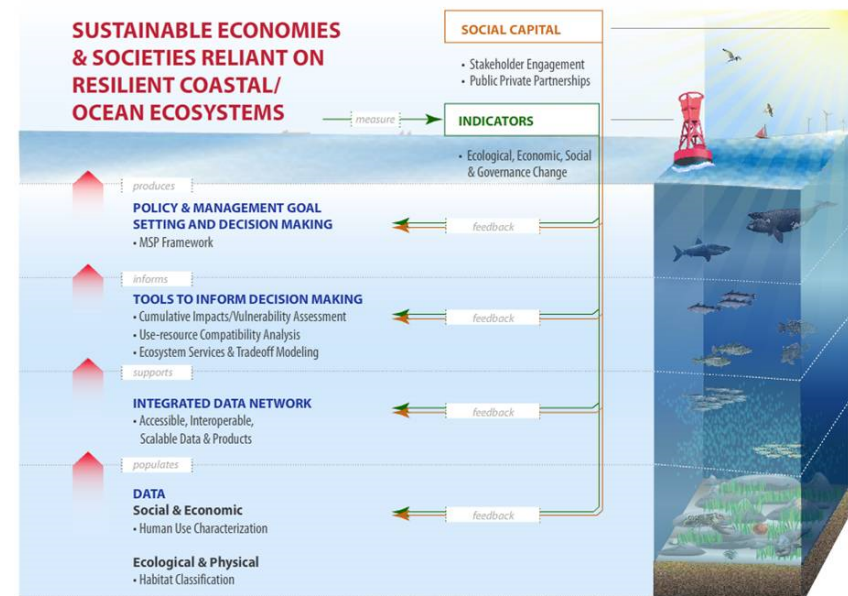
Integrated approach reflects the close links between human activities, the natural environment and the impacts of human activities in the coastal zone



❖ Sea-land perspective: Marine Spatial Planning (MSP)



COASTAL AND MARINE SPATIAL PLANNING



<http://www.earth2ocean.com/pdfs/Unit%20Powerpoint%20presentations/Unit%203%20Powerpoint.pptx>

Planning:



Co-management of coastal development

= **government, communities and other stakeholders** share both the responsibility and the authority for decision-making and implementing the agreed management plans

= **building coastal community resilience** – participation, empowerment and local resource management:

- strong institutions (leadership and rule enforcement)
- good cross-scale communication (co-management of scientific and local knowledge)
- equity in resource access and fair sharing of benefits from their utilization
- promotion of public awareness and education
- support of local populations to develop and implement remedial action in degraded areas
- preservation of both natural and cultural heritage
- use of local people's knowledge as source of innovation and novelty

Planning:



Co-management of coastal development

- **Stakeholder participation** issues:
 - *equal shares in coastal development*
 - who may legitimately access, use and manage natural resources
 - social-economic control over local stakeholders
 - competition over coastal resources

Current challenges for socially sustainable coastal landscapes:

- breakdown of locally-devised institutions and authority system (*the Romanian case*)
- rapid technological changes leading to more efficient resource exploitation
- rapid changes in the local socio-economic system
- institutional instability at higher political levels negatively affecting local management (*the Romanian case*)
- social justice – public expenses for managing coastal erosion in cases of private property
- urbanization – place-based problems

Planning:



Activity: Simulation Game

Click (will not run unless you activate flash player in your browser – see below the instructions):

<http://www.open.edu/openlearn/nature-environment/the-environment/environmental-decision-making/be-coastal-manager-interactive>

Some guides to make flash player run by default on that site
(Google Chrome only):

<https://www.freecodecamp.org/news/how-to-enable-adobe-flash-player-in-google-chrome/>

Enjoy!
**Feel yourself as a
coastal manager!**

Have a go at managing your own piece of the coastline.



North Sea



De Panne

<https://www.britannica.com/place/North-Sea#/media/1/419398/95736>

Physical features

- Present coastlines established 3000 years ago
- Dogger Bank is shallow area known for fishing
- Norwegian Trench is the deepest area
- Rugged upland coasts in the north (cliffs)
- Regular lowland coasts of the south (sand beaches, sand dunes and marshes)
- Tidal ranges average between less than 3 m (north and east) and 6 m (south and west)

Economic importance

- Europe's most productive fisheries
- Prominent shipping zone
- Exploitation of petroleum and natural gas
- Off-shore wind farms

For more info on North Sea see *Encyclopædia Britannica* (<https://www.britannica.com/place/North-Sea>)

Threats

- Water pollution from marine traffic
- Dumping of sewage and industrial wastes
- Sea-level rise

North Sea

Co-funded by the
Erasmus+ Programme
of the European Union



Typical Norwegian North Sea coast

<https://northseablog.eu/wp-content/uploads/2018/06/Norway4-720.jpg>



Typical British North Sea coast

<https://media.timeout.com/images/105440183/750/562/image.jpg>



Typical Dutch North Sea coast

https://media.npr.org/assets/img/2017/11/15/zand-motor-sand-motor-duinen_slide-64e2988924e6979227f2c0a14babfcd29c49a43c-s800-c85.jpg

North Sea

Co-funded by the
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of the European Union



(Not so)
typical German North Sea coast:
Wadden Sea

https://en.wikipedia.org/wiki/Wadden_Sea#/media/File:13-09-29-nordfriesisches-wattenmeer-RalfR-19.jpg

(Not so)
typical British North Sea coast:
Dover Cliffs



https://i.telegraph.co.uk/multimedia/archive/03374/white-cliffs-of-do_3374213b.jpg

North Sea



Afsluitdijk dam

<https://www.britannica.com/place/IJsselmeer-Polders#/media/1/282547/115213>

A Dutch polder

<https://www.britannica.com/science/land-reclamation>





Thank you for your attention!

