



Università di Trieste
Corso di Laurea in Geologia

Anno accademico 2020 - 2021

Geologia Marina

Parte VI

Modulo 6.3 Sviluppo sostenibile dell'ambiente marino
(*Sustainable Blue Growth*)

Docente

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Sustainable development in marine environment

- 1) the origin and evolution of the concept of Sustainable Development
- 2) Pillars of Sustainable Development and the Planetary Boundaries
- 3) the Blue Growth
- 4) Case study: Gulf of Trieste



SUSTAINABLE DEVELOPMENT

The most common definition:

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

From:

Brundtland Report “Our Common Future” , Published in 1987
by the World Commission on Environment and Development (WCED)

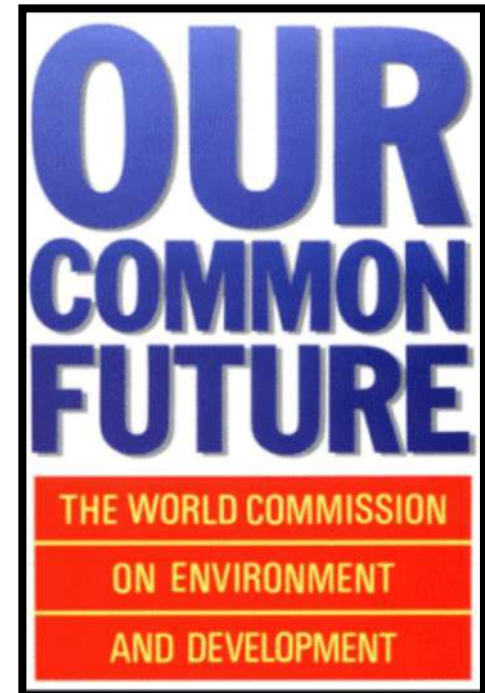


Gro Harlem Brundtland
Norwegian Prime Minister

4/2/1981 - 14/10/1981

9/5/1986 – 16/10/1989

3/11/1990 – 25/10/1996



There are a lot of other definitions.
Another one is:

Sustainable development

Sustainable development is a process for meeting human development goals while sustaining the ability of natural systems to continue to provide the natural resources and ecosystem services upon which the economy and society depend.

The concept of sustainability comes from the sustainable forest management

It is considered that the sustainable development has its roots in ideas about sustainable forest management which were developed in Europe **during the XVII and XVIII centuries.**

In response to a growing aware of the depletion of timber resources in England, John Evelyn in 1662 wrote that:

"sowing and planting of trees had to be regarded as a national duty of every landowner, in order to stop the destructive over-exploitation of natural resources".

In 1713 Hans Carl von Carlowitz, a senior mining administrator in the service of Elector Frederick Augustus I of Saxony, published *Sylvicultura oeconomica*. Building upon the ideas of Evelyn and French minister Jean-Baptiste Colbert, von Carlowitz developed the concept of managing forests for **sustained yield**.

yield = rendita

sustained = duratura

(> **sustainable** = able to be maintained at a certain rate or level)

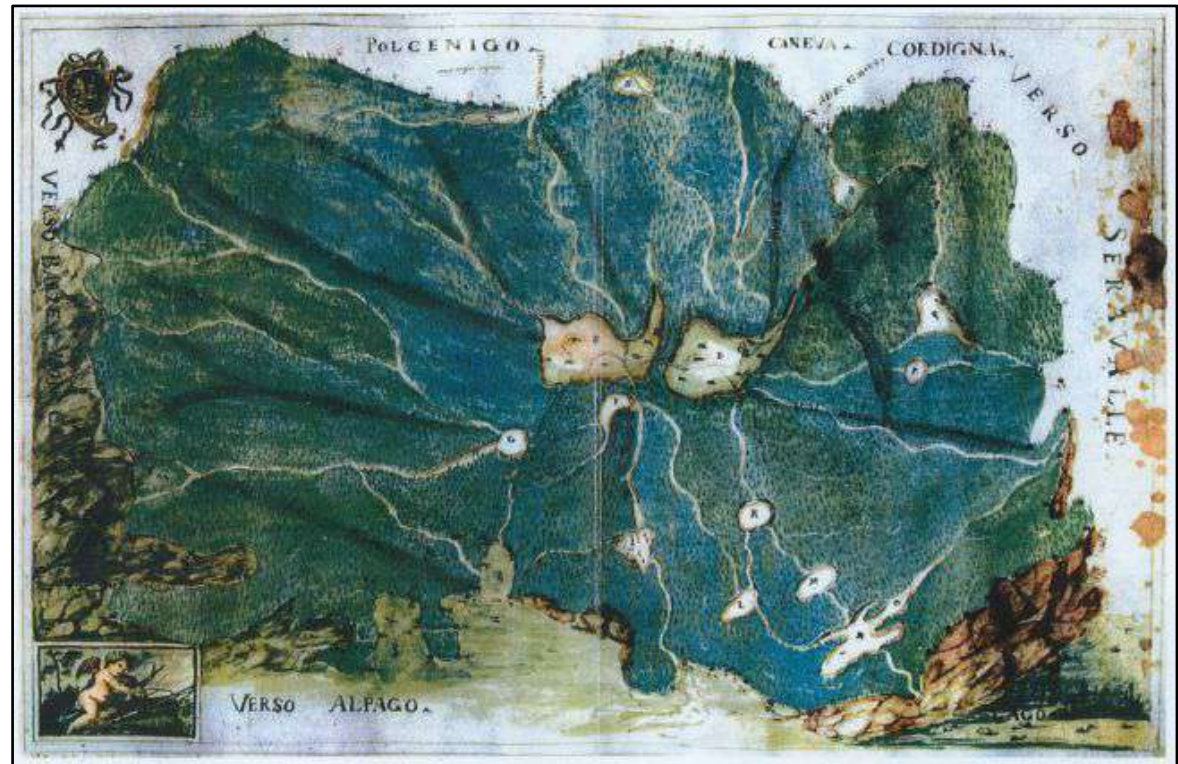
ensure the replacement of the part harvest by regrowth or reproduction before another harvest occurs





..... however, also the Republic of Venice, had severe laws for the management of the forest from which come the timber for the “Arsenale” to built the ships.

Fra i più significativi provvedimenti ed innovazioni si devono indicare: i catasti, le leggi, le riserve, le “cariche forestali”, la razionale applicazione del taglio saltuario nei boschi misti di conifere, nonché gravi sanzioni per tagli abusivi.



Diritti collettivi della laguna di Marano

(bene comune o proprietà collettiva)

forma scritta già nel XI secolo, ma ascrivibili a pratiche consuetudinarie molto più antiche

Il regolamento sulla pesca del 1887 aveva come obiettivo:

1) conservazione delle diverse specie ittiche indicando puntualmente i luoghi, i tempi e i modi della pesca e le sanzioni per i trasgressori;

2) *“l’equabilità del diritto di tutti i maranesi pel godimento delle proprietà lagunari del Comune in modo che il benessere non possa sopraffare e calpestare il povero”*

e quindi considerava forme di mutuo soccorso verso i compagni che si ammalavano e le famiglie più bisognose della comunità.





Club of Rome

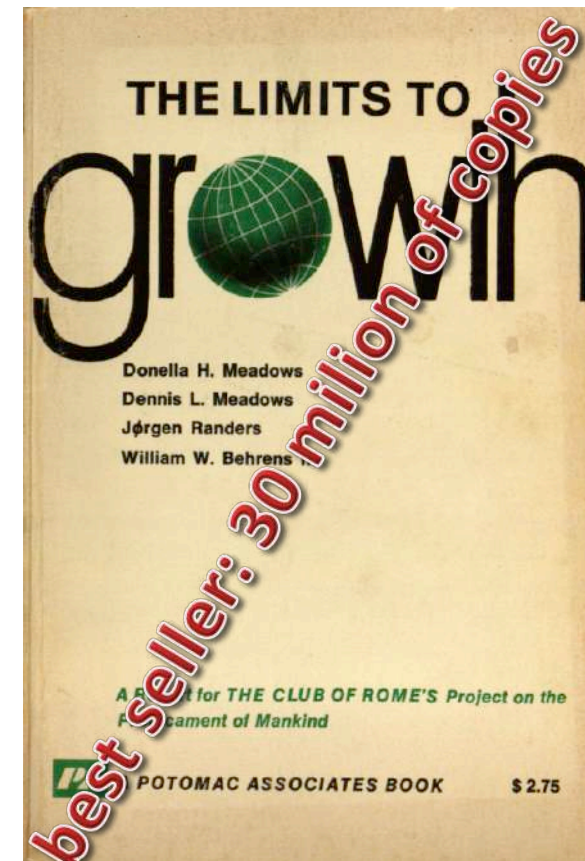
founded in 1968 by Aurelio Peccei (FIAT and Olivetti consultant/manager) and by Alexander King (scientist, pioneer of the Sust. Dev.) together with and Nobel Prizes, politics, etc

The report "**Limits to Growth**" published in 1972 by group of scientists led by Donella and Dennis Meadows (Massachusetts Institute of Technology).

It predicted that **economic growth could not continue indefinitely because of the limited availability of natural resources**, particularly oil.

Describing the desirable "state of global equilibrium", the authors wrote: "*We are searching for a model output that represents a **world system that is sustainable** without sudden and uncontrolled collapse and capable of satisfying the basic material requirements of all of its people.*"

One of the **first uses of the term sustainable in the contemporary sense.**



United Nations Conference on the Human Environment Stockholm, Sweden in 5-16 June 1972

Sweden first suggested to the UN Economic and Social Council in 1968 the idea of having a UN conference to focus on human interactions with the environment. In 1972 the UN General Assembly convened, at the initiative of the Government of Sweden, in Stockholm.

Results:

- An agreement for leaders from around the world to **meet every 10 years to discuss the state of the world's environment.**
- It is the beginning of the creation of an international environmental law, as well as the **beginning of political and public awareness of environmental issues.**
- **Stockholm Declaration**, an action plan, **stated that environmental protection is one of the major humanitarian and economic issues facing the world.** It deals with various environmental issues including human rights, pollution prevention, and natural resource management.
- Development of the **United Nations Environment Programme (UNEP)**, which helps developing countries to implement environmentally sustainable policies, as well as encourages sustainable development.
- UNEP headquarters is in Nairobi.



The Brundtland Report “Our Common Future”

Published in 1987 by the United Nation

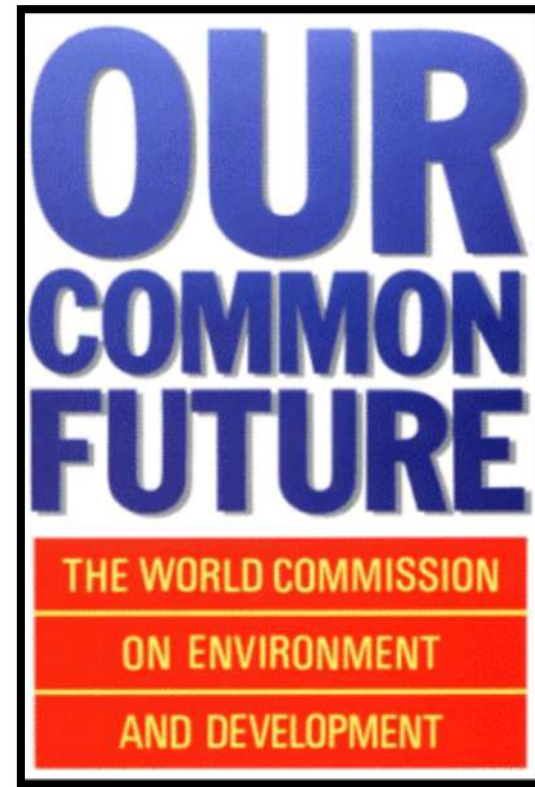
World Commission on Environment and Development (WCED)

Coined and defined the meaning of the term

SUSTAINABLE DEVELOPMENT *is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

The report states that critical global environmental issues are the primary source of poverty in the South, as well as non-sustainable consumption in the North.

The Report’s goal is to unite efforts for global sustainable development and environmental practices.





Nobel Peace Prize in 2007

Intergovernmental Panel on Climate Change (IPCC)

Created in 1988 by the World Meteorological Organization and UNEP

Scientists from around the world meet to research climate change since the threats are becoming so serious, and they feel increasing pressure to combat the depletion of the ozone layer.

Reports:

- ❖ IPCC First Assessment Report 1990
- ❖ Supplementary Report 1992
- ❖ IPCC Second Assessment Report: Climate Change 1995
- ❖ IPCC Third Assessment Report: Climate Change 2001
- ❖ IPCC Fourth Assessment Report: Climate Change 2007
- ❖ IPCC Fifth Assessment Report: Climate Change 2013-2014
- ❖ IPCC Sixth Assessment Reports: Global warming, Climate Change, ecc... 2018-2022

United Nations Conference on Environment and Development

Rio de Janeiro, 3-14 June 1992



- 72 governments participated, with 116 sending their heads of state or government.
- 2,400 representatives of non-governmental organizations (NGOs)
- 17,000 people at the parallel NGO "Global Forum" who had Consultative Status.

The issues addressed included:

- 1) **systematic scrutiny of patterns of production** - particularly the production of toxic components, such as lead in gasoline, or poisonous waste including radioactive chemicals
- 2) **alternative sources of energy to replace the use of fossil fuels which are linked to global climate change**
- 3) **new reliance on public transportation systems** in order to **reduce vehicle emissions**, congestion in cities and the health problems caused by polluted air and smoke
- 4) **the growing scarcity of water**

RIO CONFERENCE 1992

Resulted documents:

- Rio Declaration on Environment and Development
- **Agenda 21 (regards the Sustainable Development)**
- Forest Principles

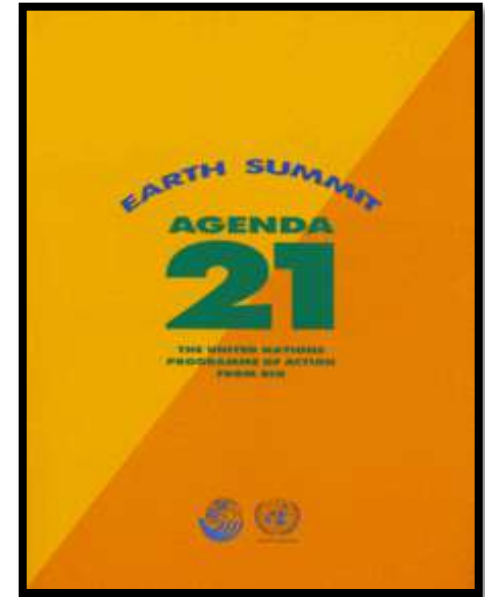
Agreements opened for signature:

- **United Nation Convention on Climate Change (UNFCCC) (which in turn led to the Kyoto Protocol in 1997)**
- **United Nation Convention on Biological Diversity**, start towards redefinition of measures that did not inherently encourage destruction of natural ecoregions and so-called uneconomic growth.
- **United Nations Convention to Combat Desertification**



Agenda 21

Action plan of the United Nations
with regard to sustainable development



It is a non-binding, voluntarily implemented.

It is an action agenda for the UN, other multilateral organizations, and individual governments around the world that can be executed at local, national, and global levels.

The "21" in Agenda 21 refers to the 21st Century.

It has been affirmed and modified at subsequent UN conferences.

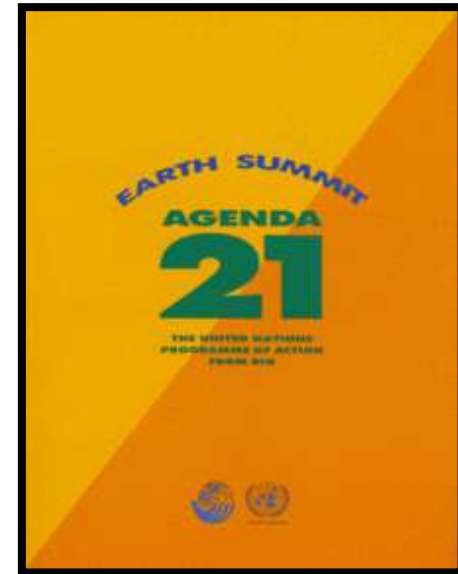
Agenda 21 is a 350-page document divided in 4 sections

Section I: Social and Economic Dimensions is directed toward combating poverty, especially in developing countries, changing consumption patterns, promoting health, achieving a more sustainable population, and sustainable settlement in decision making.

Section II: Conservation and Management of Resources for Development Includes atmospheric protection, combating deforestation, protecting fragile environments, conservation of biological diversity (biodiversity), control of pollution and the management of biotechnology, and radioactive wastes.

Section III: Strengthening the Role of Major Groups includes the roles of children and youth, women, NGOs, local authorities, business and industry, and workers; and strengthening the role of indigenous peoples, their communities, and farmers.

Section IV: Means of Implementation: implementation includes science, technology transfer, education, international institutions and financial mechanisms.



KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

- ❖ an **international treaty**, which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC)
- ❖ **commits State Parties to reduce greenhouse gases emissions by at least 5% below 1990 levels in the period 2008-2012, based on the premise that global warming exists and man-made CO2 emissions have caused it.**
- ❖ adopted in Kyoto, Japan, on 11 December **1997 and entered into force on 16 February 2005**. There are currently **192 Parties** (Canada withdrew effective December 2012) to the Protocol.
- ❖ implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to 'a level that would prevent dangerous anthropogenic interference with the climate system' (Art. 2). The Protocol is based on the principle of common but differentiated responsibilities: it puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

- l'atmosfera terrestre contiene 3 milioni di megatonnellate (Mt) di CO₂;
- le attività umane immettono 6.000 Mt di CO₂ all'anno, di cui 3.000 dai Paesi industrializzati e 3.000 da quelli in via di sviluppo;
- il protocollo di Kyoto prevede che i Paesi industrializzati riducano del 5% per cui se ne dovrebbero immettere 5.850 ogni anno anziché 6.000, su un totale di 3 milioni



United Nation Conference on Environment and Development World Summit on Sustainable Development Johannesburg (South Africa) 26 August – 4 September 2002

With the participation of governments and a number of leaders from business and non-governmental organizations

Results:

Johannesburg Declaration

focus on "the worldwide conditions that pose severe threats to the sustainable development of our people, which include: chronic hunger; malnutrition; foreign occupation; armed conflict; illicit drug problems; organized crime; corruption; natural disasters; illicit arms trafficking; trafficking in persons; terrorism; intolerance and incitement to racial, ethnic, religious and other hatreds; xenophobia; and endemic, communicable and chronic diseases, in particular HIV/AIDS, malaria and tuberculosis

Agreements > Millennium Development Goals



RIO+20
United Nations
Conference on
Sustainable
Development

United Nation Conference on Environment and Development World Summit on Sustainable Development Rio de Janeiro (Brasil) 13-22 June 2012

Main themes:

- ❖ How to build a **GREEN ECONOMY** to achieve sustainable development and lift people out of poverty, including support for developing countries that will allow them to find a green path for development.
- ❖ How to improve **international coordination for sustainable development by building an institutional framework.**

Outcome:

The report “**The Future we want**” (largely reaffirms previous action plans like Agenda 21)

The text includes language supporting the development of Sustainable Development Goals (SDGs), a set of measurable targets aimed at promoting sustainable development globally. It is thought that the SDGs will pick up where the Millennium Development Goals leave off and address criticism that the original Goals fail to address the role of the environment in development.

Green economy

The **green economy** is defined as an economy that aims at reducing environmental risks and ecological scarcities, and that aims for sustainable development without degrading the environment. It is closely related with ecological economics, but has a more politically applied focus.

The 2011 UNEP Green Economy Report argues "that to be green, an economy must not only be efficient, but also fair. Fairness implies recognising global and country level equity dimensions, particularly in assuring a just transition to an economy that is low-carbon, resource efficient, and socially inclusive.



United nations conference
on climate change

COP21/CMP11

COP21



Agreement between **177** countries (196 participants)

Valid since 2020, and after 55 countries responsible for the 55% of green house gas emission will subscribe it.

Aim:

Increase of Temperature contained below 2°C (ideal +1.5°C)

Within the 2050:

Cutting the anthropic gas emission of 40-70% of those of 2010 > warming 2°C

Cutting the anthropic gas emission of 70-95% of those of 2010 > warming 1,5°C

The Paris agreement entered in force on 4 November 2016 after the ratification of 55 countries (including USA and China) accounting for 55% of total greenhouses gas emissions.

GREEN DEAL EUROPEO

Accordo UE – 10 dicembre 2020

Da **40 a 55% (rispetto le emissioni del 1990) entro il 2030**

Il quadro prevede politiche e traguardi per rendere l'economia e il sistema energetico dell'UE più competitivi, sicuri e sostenibili. L'UE ha inoltre riformato l'EU ETS, adottato norme sul monitoraggio e la comunicazione e affermato la necessità di piani nazionali per l'energia e il clima e di strategie a lungo termine.

Strategia a lungo termine

Neutralità climatica entro il 2050

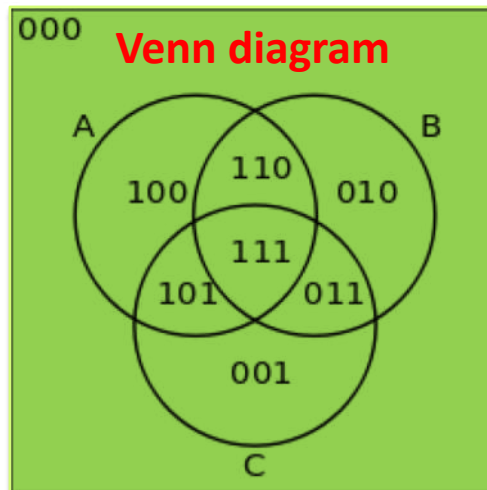
Necessità di predisporre un quadro favorevole per assicurare una **transizione efficiente in termini di costi, socialmente equilibrata ed equa** verso la neutralità climatica, tenendo conto delle diverse situazioni nazionali.

The three pillars of Sustainability

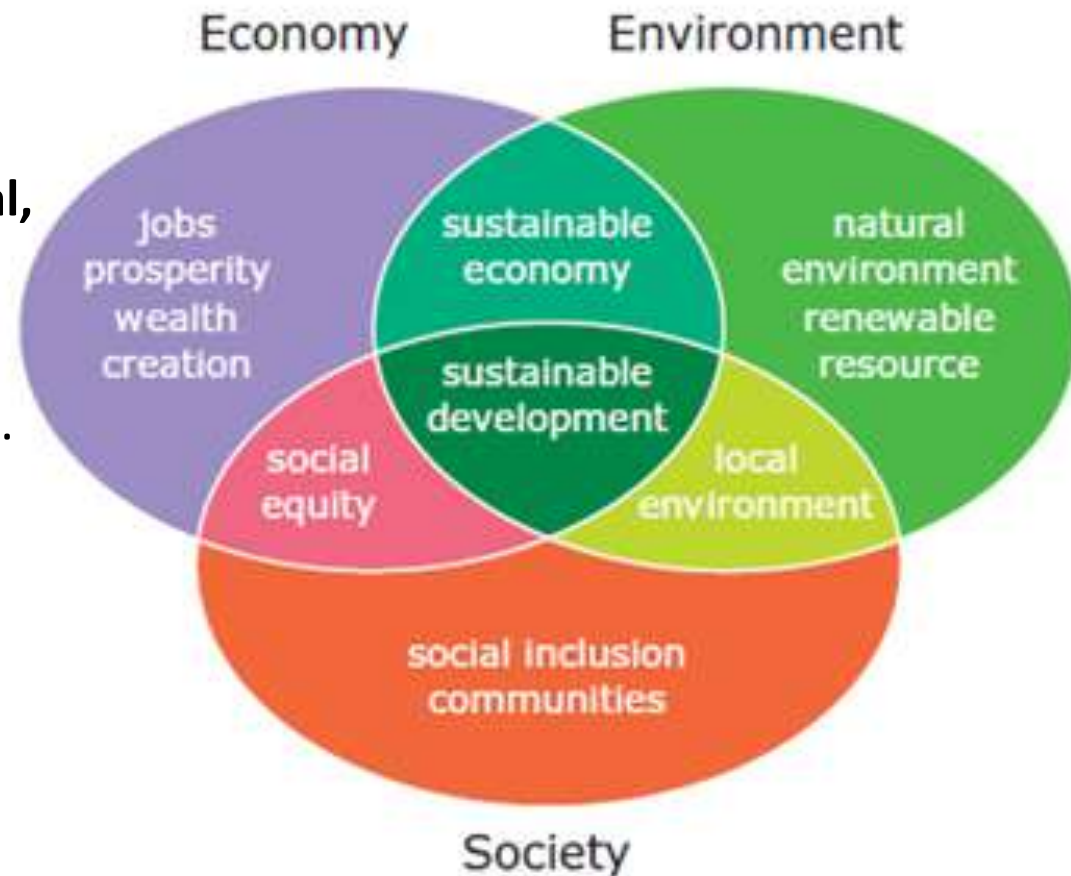
Tool for defining the complete sustainability problem.

This consists of the **economic, social, and environmental pillars**.

If any one pillar is weak then the system as a whole is unsustainable.



$$100+010+001=111$$

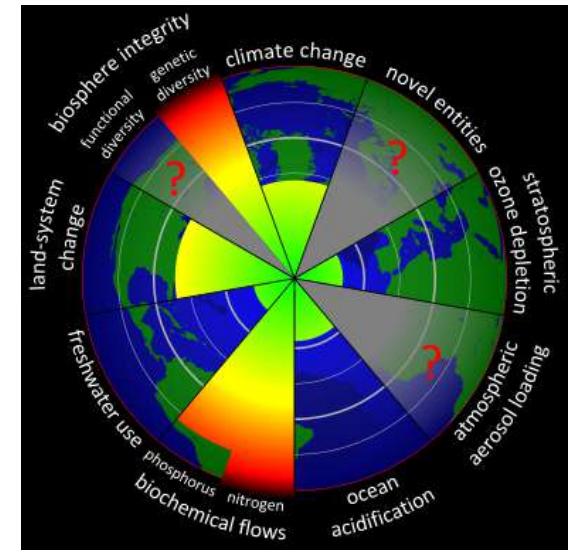


The nine planetary boundaries

Presented in 2009 to the General Assembly of the Club of Rome in Amsterdam by a group of Earth system and environmental scientists led by Johan Rockström from the Stockholm Resilience Centre and Will Steffen from the Australian National University.

The framework of “planetary boundaries” was designed to define a “safe operating space for humanity” for the international community, including governments at all levels, international organizations, civil society, the scientific community and the private sector, as a **precondition for sustainable development**.

It asserts that once human activity has **passed certain thresholds** or tipping points, defined as “**planetary boundaries**”, there is a risk of “**irreversible and abrupt environmental change**” which could make Earth less habitable.



Planetary Boundaries

green areas: represent human activities that are within safe margins

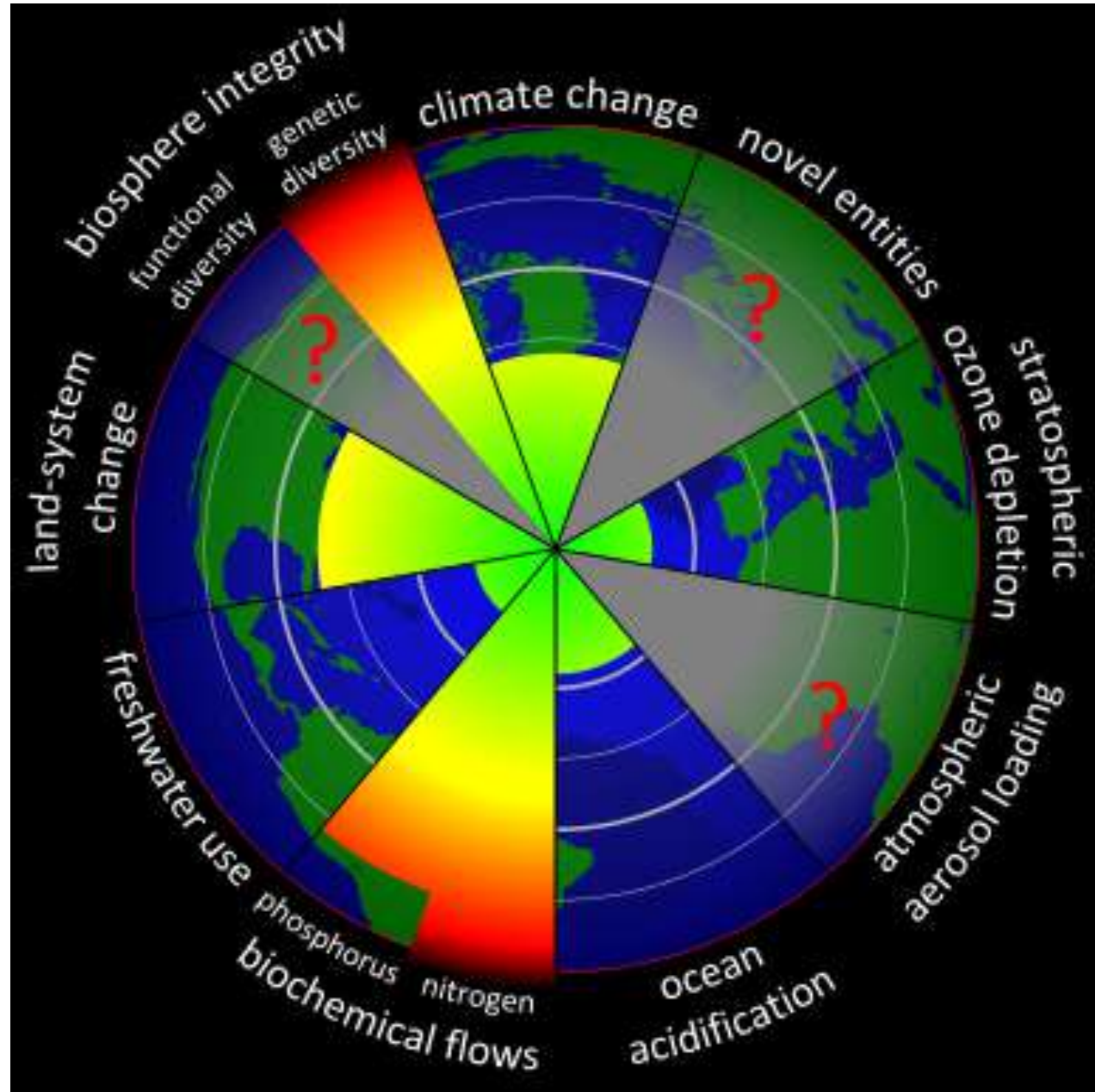
yellow areas: represent human activities that may or may not have exceeded safe margins

red areas: represent human activities that have exceeded safe margins

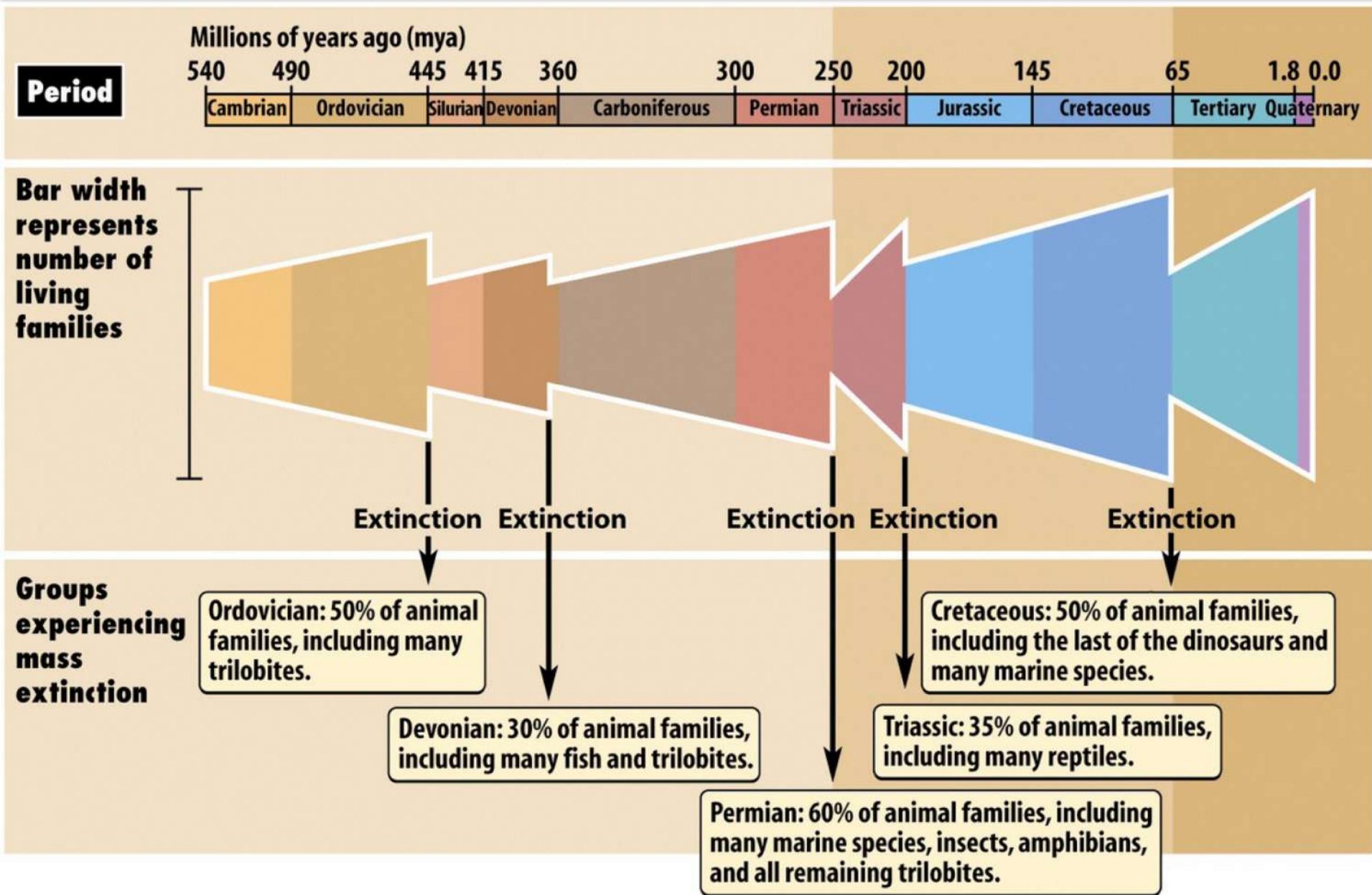
gray areas with ?: represent human activities for which safe margins have not yet been determined

Rockström *et al.*, 2009

Steffen *et al.*, 2015



Planetary Boundaries ^[24]					
Earth-system process	Control variable ^[25]	Boundary value	Current value	Boundary crossed	Preindustrial value
1. Climate change	Atmospheric carbon dioxide concentration (ppm by volume) ^[26] <i>See also: Tipping point (climatology)</i>	350	387	yes	280
	Alternatively: Increase in radiative forcing (W/m^2) since the start of the industrial revolution (~1750)	1.0	1.5	yes	0
2. Biodiversity loss	Extinction rate (number of species per million per year)	10	> 100	yes	0.1–1
3. Biogeochemical	(a) anthropogenic nitrogen removed from the atmosphere (millions of tonnes per year)	35	121	yes	0
	(b) anthropogenic phosphorus going into the oceans (millions of tonnes per year)	11	8.5–9.5	no	-1
4. Ocean acidification	Global mean saturation state of aragonite in surface seawater (omega units)	2.75	2.90	no	3.44
5. Land use	Land surface converted to cropland (percent)	15	11.7	no	low
6. Freshwater	Global human consumption of water (km^3/yr)	4000	2600	no	415
7. Ozone depletion	Stratospheric ozone concentration (Dobson units)	276	283	no	290
8. Atmospheric aerosols	Overall particulate concentration in the atmosphere, on a regional basis	not yet quantified			
9. Chemical pollution	Concentration of toxic substances, plastics, endocrine disruptors, heavy metals, and radioactive contamination into the environment	not yet quantified			



CARSO

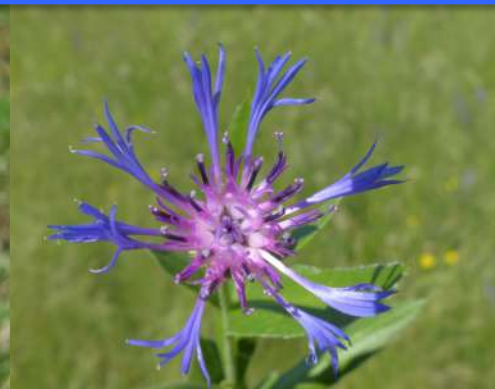
Presenti attualmente 1900 specie vegetali in 500 kmq,
una delle zone con maggiore biodiversità in Europa

.... ma ...

119 specie vegetali estinte dal 1800 da zone umide,
coltivazioni cerealicole, zone costiere, prati e pascoli



7,4% delle specie scomparse (Poldini, 2009)





EUROPEAN UNION: STRATEGIES FOR SUSTAINABLE DEVELOPMENT

The European Union has formulated a long-term strategy to dovetail the **policies for economically, socially and environmentally sustainable development**, its goal being **sustainable improvement of the well-being and standard of living of current and future generations**.

ACT:

- ❖ Commission Communication of **15 May 2001** 'A Sustainable Europe for a Better World: **A European Union Strategy for Sustainable Development**' (Commission proposal to the Gothenburg European Council).
- ❖ Commission Communication of **13 December 2005** on the review of the **Sustainable Development Strategy – A platform for action**.



Blue Growth:

sustainable growth from the oceans, seas and coasts

Blue Growth is the long term strategy to support sustainable growth in the marine and maritime sectors as a whole. Seas and oceans are drivers for the European economy and have great potential for innovation and growth. It is the maritime contribution to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth.



The 5 Blue Growth sectors

- Biotechnology**
medicines,
industrial enzymes
- Renewable energy**
wind, waves,
tides, biofuel
- Coastal & Maritime Tourism**
coastal tourism,
cruise tourism,
yachting
- Aquaculture**
farming of fish,
shellfish, marine plants
- Mineral resources**
gravel, sand,
zinc, cobalt,
copper

other sectors of the blue economy crucial for value & jobs

- Shipbuilding & Ship repair**
- Transport (cargo & ferry)**
- Fisheries**
- Offshore oil & gas**



Maritime spatial planning

It's about planning **when and where human activities take place at sea** – to ensure these are as efficient and sustainable as possible. Maritime spatial planning involves stakeholders in a transparent way in the planning of maritime activities.

In July 2014, the European Parliament and the Council adopted legislation to create a common framework for *maritime spatial planning* in Europe.

While each EU country will be free to plan its own maritime activities, local, regional and national planning in shared seas would be made more compatible through a set of **minimum common requirements**.



Maritime spatial planning

The benefits of *maritime spatial planning* are:

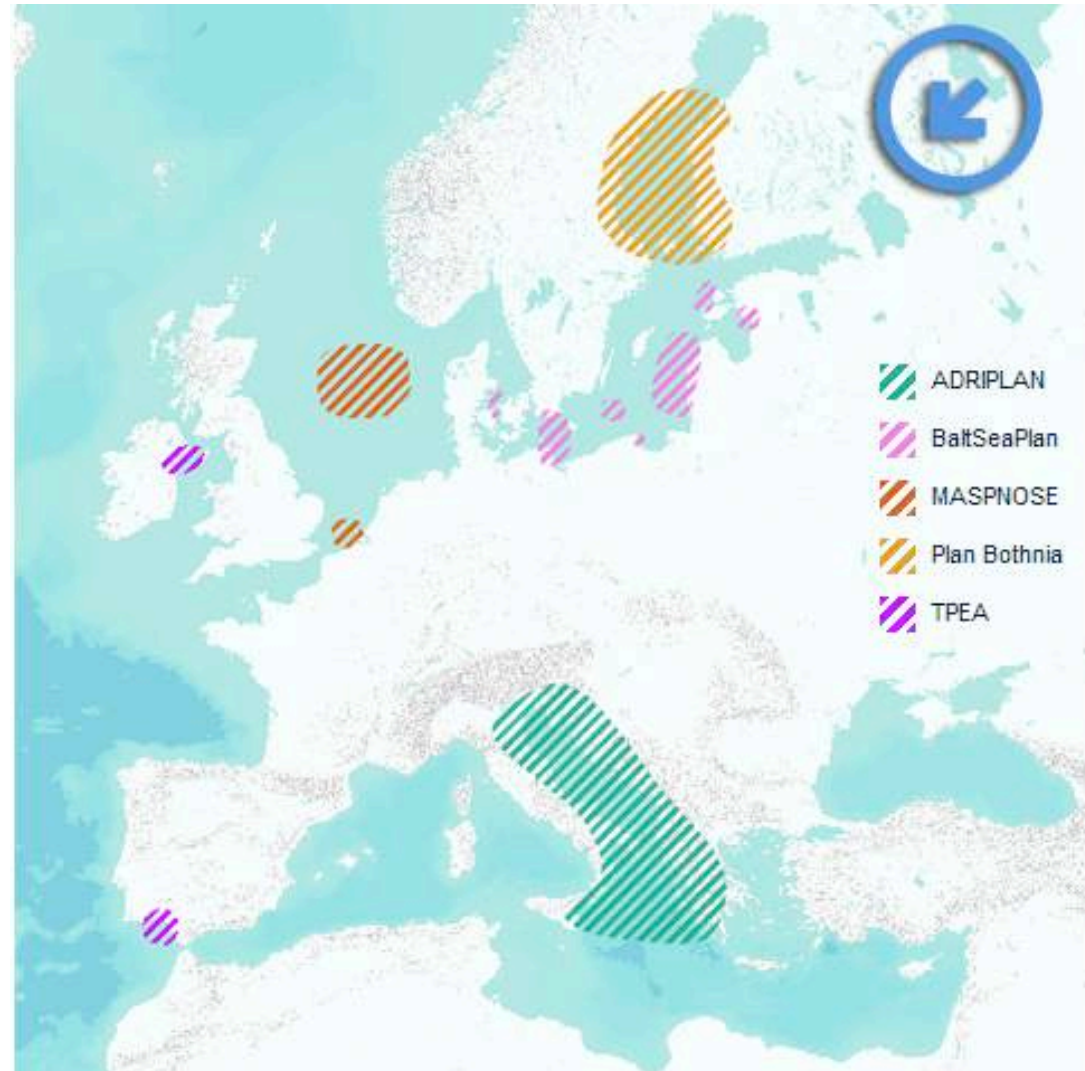
- ❖ **Reduce conflicts** between sectors and create synergies between different activities.
- ❖ **Encourage investment** – by instilling predictability, transparency and clearer rules. This will help boost the development of renewable energy sources and grids, establish Marine Protected Areas, and facilitate investment in oil and gas.
- ❖ **Increase coordination** – between administrations in each country, through the use of a single instrument to balance the development of a range of maritime activities. This will be simpler and cheaper.
- ❖ **Increase cross-border cooperation** – between EU countries, on cables, pipelines, shipping lanes, wind installations, etc.
- ❖ **Protect the environment** – through early identification of impact and opportunities for multiple use of space.



Maritime spatial planning

Projects

- ❖ MASPNOSE - Preparatory Action on Maritime Spatial Planning in the North Sea (2010-12)
- ❖ Plan Bothnia - Preparatory Action on Maritime Spatial Planning in the Baltic Sea (2010-12)
- ❖ BaltSeaPlan - Baltic Sea Region Programme project "Introducing Maritime Spatial Planning in the Baltic Sea" (2009–12)
- ❖ TPEA, Transboundary Planning in the European Atlantic – Project on Maritime Spatial Planning in the Atlantic, including the Celtic Sea and Bay of Biscay (2012-14)
- ❖ **ADRIPLAN - ADRIatic Ionian maritime spatial PLANning (2013-15).**





ADRIPLAN

ADRIatic Ionian maritime spatial PLANing

The ADRIPLAN project will promote sound technically/scientifically based political decisions in order to promote a **coherent transnational approach to the spatial planning of the sea.**

How

- ❖ by using the best knowledge available
- ❖ by evaluating present and future potential conflicts and synergies among marine and maritime uses
- ❖ by applying an ecosystem-based approach to the management of human activities
- ❖ through the engagement of the Institutional partners and the Observers
- ❖ through the effective interaction with the key stakeholders
- ❖ ADRIPLAN promotes the harmonized implementation of the EU Strategy for the Adriatic and Ionian Region (EUSAIR).

The ADRIPLAN project is implemented by 17 Partners from 4 countries of the Adriatic –Ionian Macroregion: 8 Scientific Partners and 9 Institutional Partners (inner circle). 17 Observers (outer circle) are also contributing to the project.

ADRIPLAN Data Portal

ADRIPLAN is a project for Marine Spatial Planning.

For more information about this project, visit the project's web page: <http://adriplan.eu/>.

Hai bisogno di aiuto? [Iniziare](#)



14 Layers

Clicca per la ricerca di dati geospaziali pubblicati da altri utenti, organizzazioni e fonti pubbliche. Scaricare i dati in formati standard.

[Explore layers »](#)



70 Mappe

I dati sono disponibili per la navigazione, l'aggregazione e lo stile per generare mappe che possono essere condivisi pubblicamente o riservato solo agli utenti specifici.

[Explore maps »](#)



62 Utenti

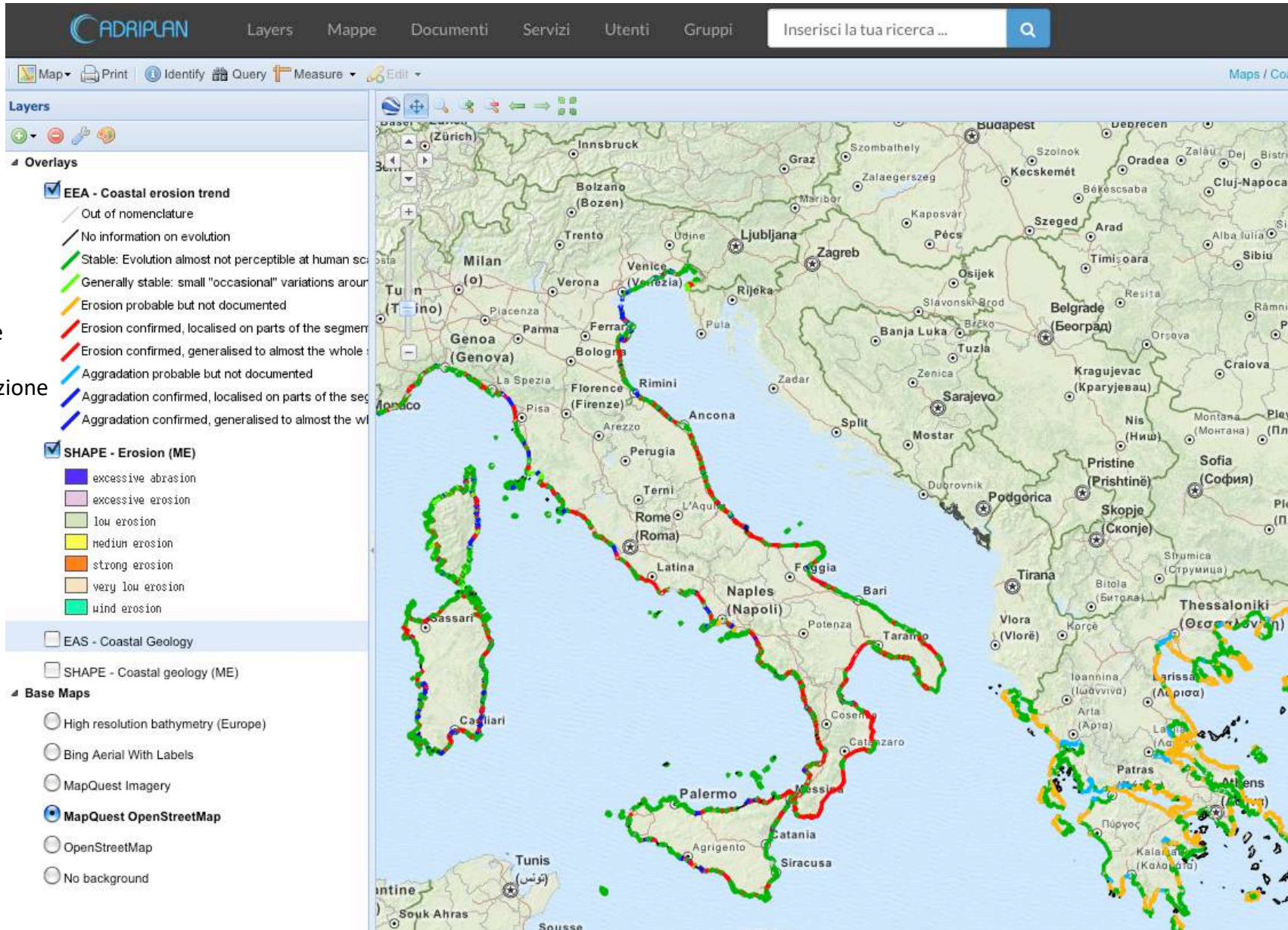
GeoNode consente agli utenti registrati di caricare facilmente i dati geospaziali in diversi formati, tra cui shapefile e GeoTiff.

[See users »](#)



Hydrocarbon research areas

Erosione costiera

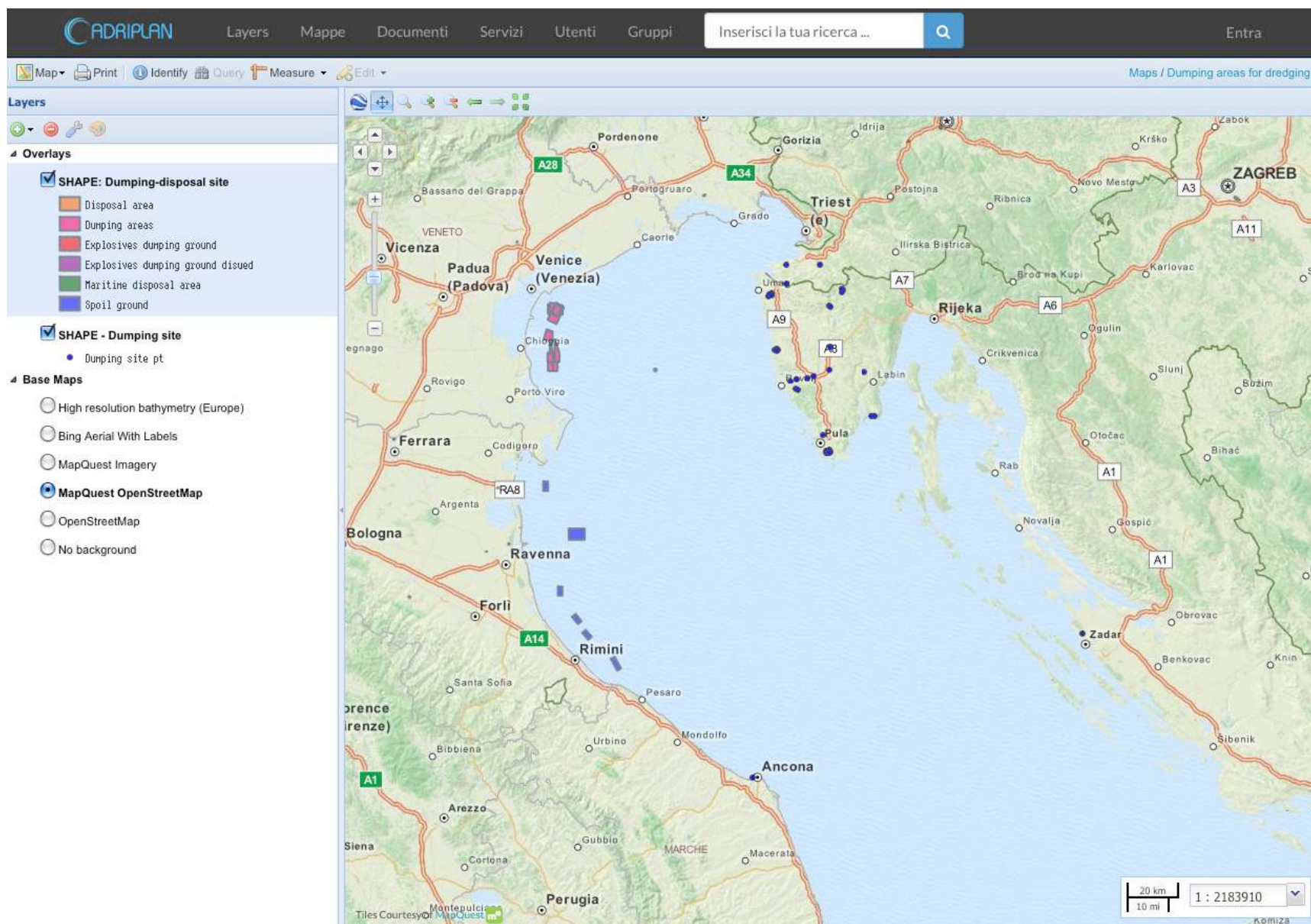


stabile

erosione

aggradazione

Discariche





Integrated Coastal Management

1978

Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean.

It can be regarded as a corner stone for the promotion of environmental protection and integration in the Mediterranean.

The European Community and all the EU Mediterranean Member States are contracting parties to the Convention.

2010

Ratification of **the Protocol on Integrated Coastal Zone Management (ICZM)** to the Barcelona Convention (Council Decision 2010/631/EU).

This EU conclusion decision follows the signature of the Protocol adopted by the Council on 4 December 2008.



Integrated Coastal Management

The role of integrated coastal management in addressing the challenge of Climate Change

The challenge of climate change needs to be addressed inter alia through integrated and ecosystem-based approaches and instruments, such as integrated coastal management. These are crucial **to build the foundations for sustainable coastal management and development, supporting socio-economic development, biodiversity and ecosystem services.**

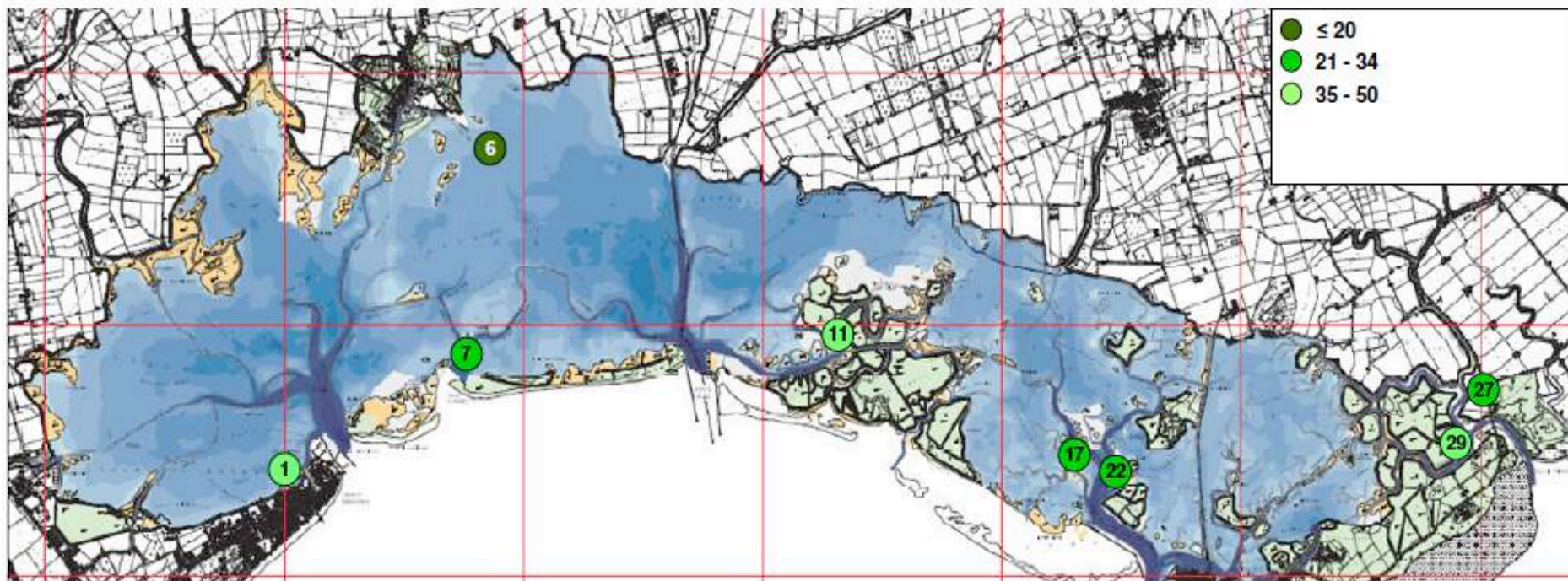
Integrated coastal management is an acknowledged tool to deal with current and long-term coastal challenges, including **climate change and its impacts (for instance sea-level rise, changes in storm frequency, strength and patterns and increased coastal erosion and flooding)**. In 2002, the EU's Recommendation on Integrated Coastal zone Management referred to the threat to coastal zones posed by climate change as the basis for a strategic approach on coastal management.

The challenges posed by climate change to coastal areas have been also addressed by national integrated coastal management strategies, which have implemented different principles **and tools to respond to these challenges: long-term perspective and precautionary principle, adaptive management, accounting for diversity of local conditions, working with natural processes and coherence between planning and management.** Relevant cases on implementation of integrated coastal management can be found on the [OURCOAST database](#). Specific cases that deal with adaptation to climate change can also be found on the [European Climate Adaptation Platform](#).

Articolo 23 - Erosione costiera

1. In conformità degli obiettivi e dei principi enunciati agli articoli 5 e 6 del presente protocollo, le parti, al fine di prevenire e mitigare più efficacemente l'impatto negativo dell'erosione costiera, si impegnano ad adottare le misure necessarie per **preservare o ripristinare la capacità naturale della costa di adattarsi ai cambiamenti, includendo quelli provocati dall'innalzamento del livello del mare.**
2. Nell'esaminare nuove opere o attività nelle zone costiere, comprese le opere marittime e gli interventi di difesa costiera, **le parti tengono in particolare considerazione gli effetti negativi dell'erosione costiera e i costi diretti e indiretti che potrebbero derivarne.** In relazione alle attività e alle strutture esistenti, le parti adottano misure intese a **ridurre al minimo gli effetti sull'erosione costiera.**
3. Le parti si impegnano a **prevenire gli impatti dell'erosione costiera attraverso la gestione integrata** delle attività e segnatamente l'adozione di misure specifiche per i sedimenti costieri e le opere costiere.
4. Le parti si impegnano a **condividere i dati scientifici** atti a migliorare le conoscenze sullo stato, l'evoluzione e gli impatti dell'erosione costiera.

Barene con prospettiva di scomparsa inferiore a 50 anni



Codice id barena	Superficie 2006 (ha)	Prospettiva di scomparsa (anni)
6	0,45	20
17	0,62	27
7	0,57	28
22	0,73	28
27	0,26	34
29	1,15	35
11	1,40	38
1	1,19	43

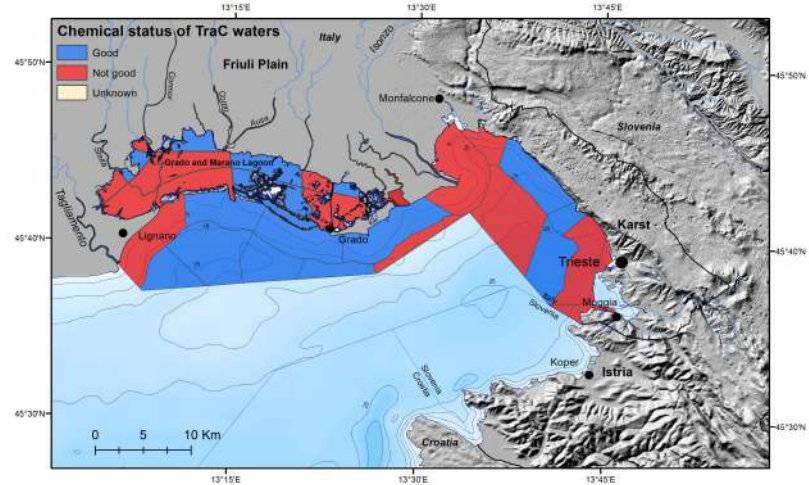
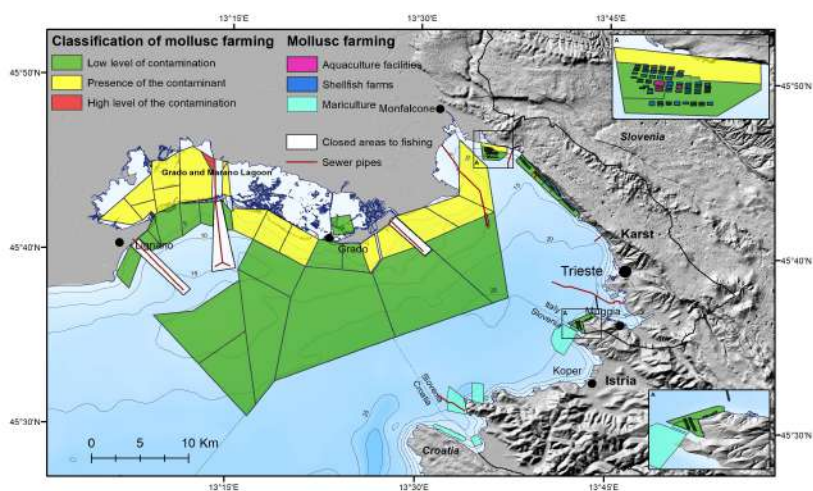
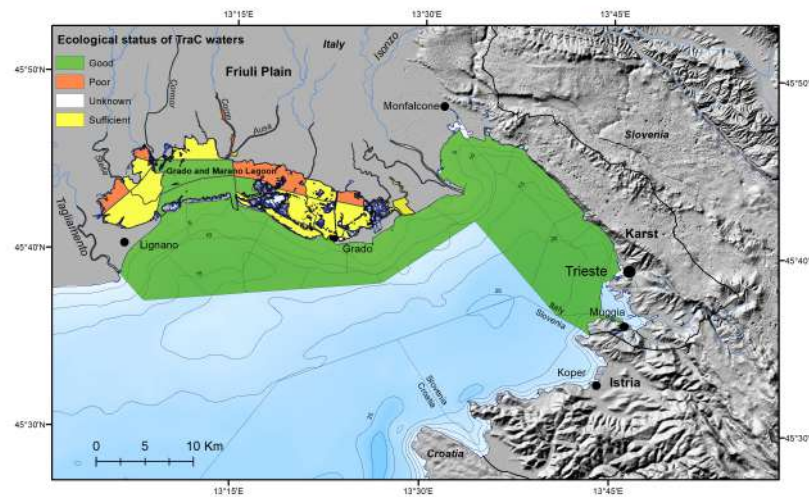
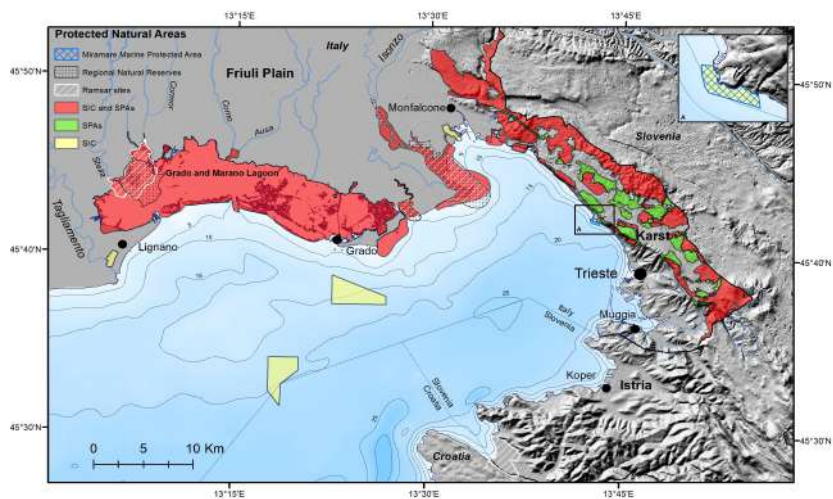
	Costo unitario (€/m)	Unità/m	Totale (€/m)
Paleria (castagno)	15	6	90
Fascine (ontano)	2	10	20
Salicornia	-	-	4
Battipalo (noleggio a caldo)	-	-	57
Oneri di sicurezza e progettazione	-	-	15
Totale			186

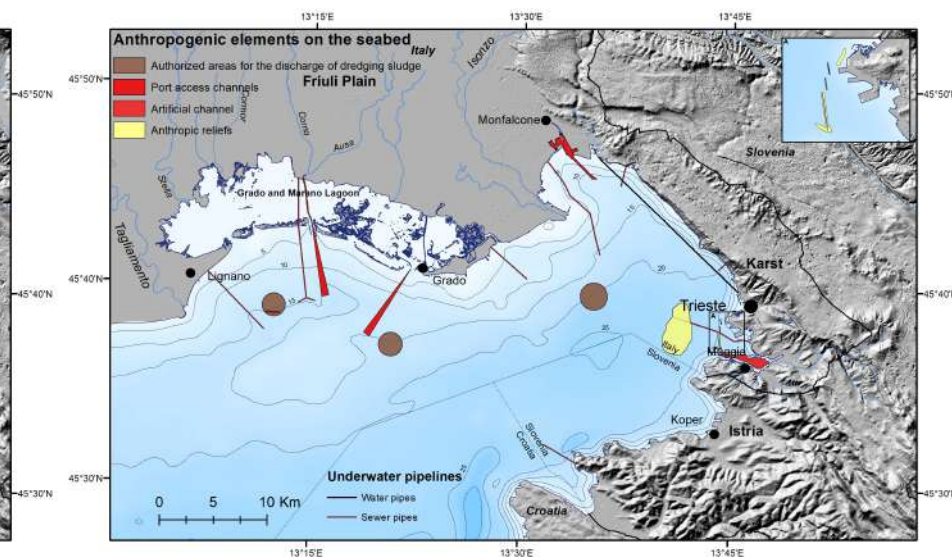
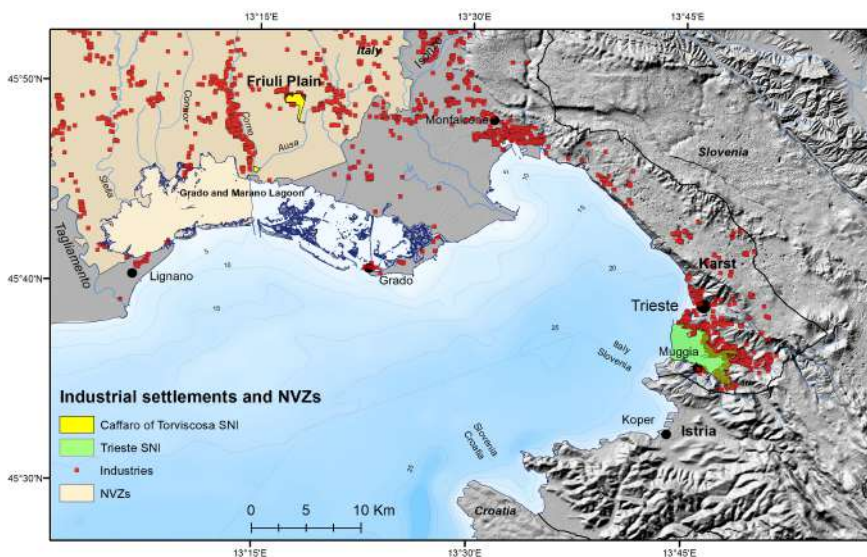
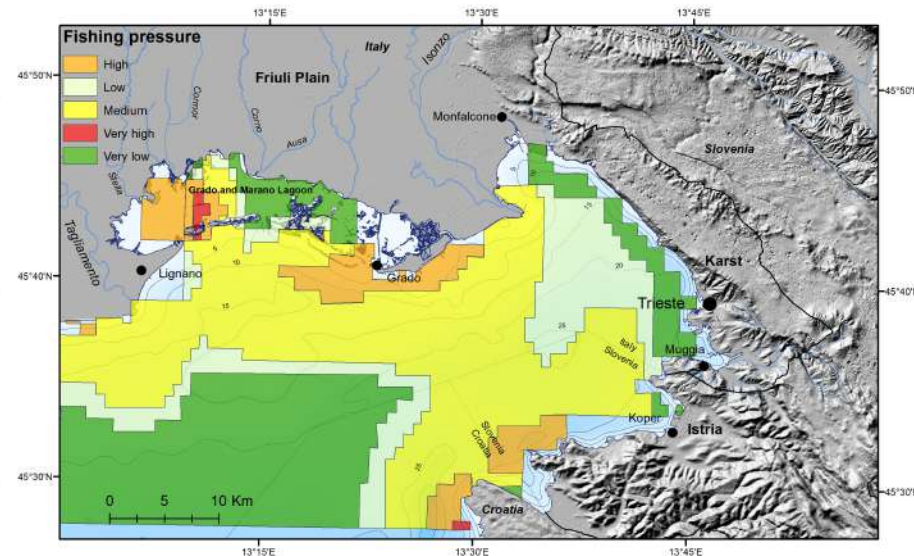
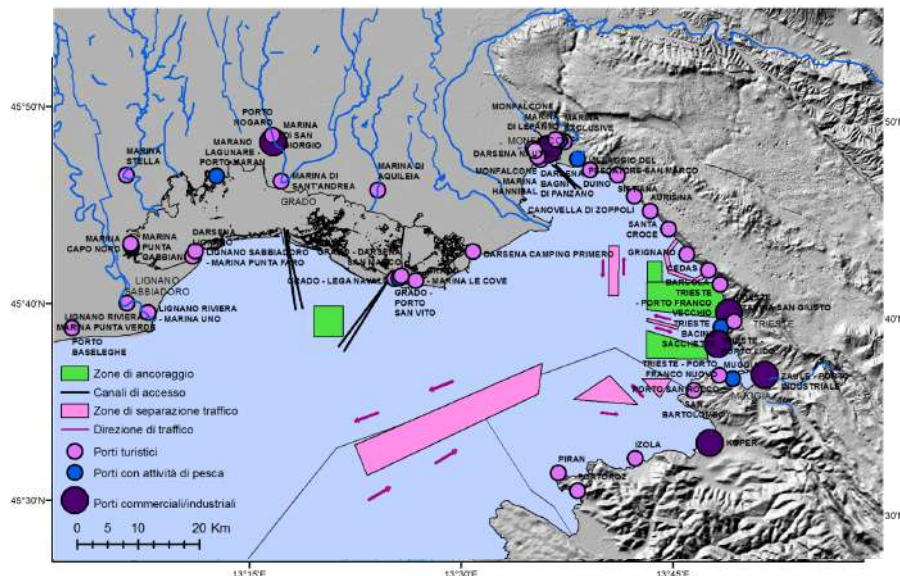
Tab. 3.2: Costi per metro lineare di spondatura di una barena lagunare

Analisi delle evidenze di attività antropiche nel fondo di mare del Golfo di Trieste in ambiente GIS, finalizzata ad una gestione sostenibile delle zone marine e costiere per favorire una crescita blu responsabile

Mariangela Pagano

Tesi di laurea AA 2016-2017





La governance marittima dell'UE

- ***Direttiva quadro (2008/56/CE) sulla Strategia per l'ambiente marino (MFSD – Marine Strategy Framework Directive), recepita in Italia attraverso il D.Lgs. 190/2010***

Obiettivo: protezione, salvaguardia e ripristino dell'ambiente marino, per preservare la diversità e la vitalità del mare raggiungendo entro il 2020 il buono stato ambientale per le proprie acque marine

Buono stato ambientale delle acque marine: capacità di preservare la diversità ecologica, la vitalità dei mari e degli oceani, affinché siano puliti, sani e produttivi, salvaguardando il potenziale per gli usi e le attività delle generazioni presenti e future. Non è uno stato incontaminato originario degli ecosistemi naturali, ma un ecosistema che funzioni in modo ottimale e mantenga la propria resilienza in presenza di cambiamenti ambientali indotti da attività umane.

- ***Direttiva sulla Pianificazione dello Spazio marittimo (2014/89/EU)***

Obiettivo: Gestione efficiente, evitare potenziali conflitti e creare sinergie tra le diverse attività, al fine di conseguire obiettivi ecologici, economici e sociali. Vengono analizzate e organizzate le attività umane nelle zone marine → pianificare quando e dove svolgere le attività umane nelle zone marine, per garantire che siano efficienti e sostenibili, elaborando **una mappatura di tali attività. Obbligo giuridico di collaborazione tra i diversi Paesi.**

- ***Comunicazioni della Commissione europea***

Comunicazione sulla Crescita blu (Com (2012) 494): individua cinque settori dell'economia come possibili fonti di crescita sostenibile e occupazione nell'ambito della Crescita blu: Acquacoltura, Turismo, Biotecnologia marina, energia oceanica, estrazione dai fondali marini.

Comunicazione sulla Innovazione blu (Com (2014) 254): l'innovazione non si pone solo obiettivi di natura commerciale proteggere e migliorare l'ambiente

Descrittore 6 della Strategia marina: Integrità del fondale marino

“L’integrità del fondale marino è ad un livello tale da garantire che le strutture e le funzioni degli ecosistemi siano salvaguardate e gli ecosistemi bentonici, in particolare, non abbiano subito danni”

Attività antropiche che inducono pressioni che possono influire sul fondo del mare:

infrastrutture costiere, ormeggi, alcune pratiche di pesca, acquacoltura, inquinamento, rimobilizzazione di sedimento, rilascio di fango dragato.

Dragaggio: operazione di escavo eseguita mediante draghe per asportare sabbia, ghiaia e detriti da un fondo subacqueo. Produce materiale di scarto che viene portato via dall’area dragata e ricollocato altrove.

Rilevanti effetti, soprattutto sul piano ambientale. L’escavazione dei fondali e l’eventuale scarico in mare dei materiali di risulta costituiscono un’attività di notevole rischio, per la possibile presenza di **contaminanti nei sedimenti, variazioni della morfologia e batimetria dei fondali**, aumento della torbidità delle acque con ripercussioni sulle biocenosi.

D.M. 24 gennaio 1996 riguardante *“lo scarico nelle acque del mare o in ambienti ad esso contigui, di materiali provenienti da escavo di fondali di ambienti marini o salmastri o di terreni litoranei emersi, nonché da ogni altra movimentazione in ambiente marino”*

Morfologie di origine antropica presenti sul fondo mare

Rilievo A

- 2,1 km a nord-ovest di Punta sottile,
- 2,3 km ad ovest della diga
- Asse maggiore = 4800 m,
- asse minore = 2500 m
- Area = 9.25 km².
- Volume totale del rilievo è di $11,8 \times 10^6$ m³

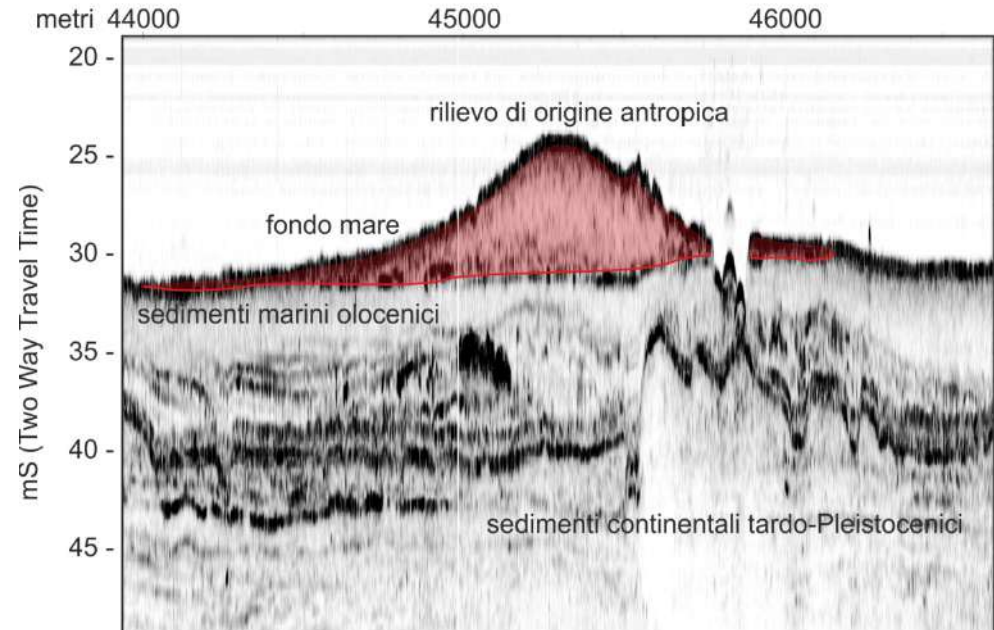
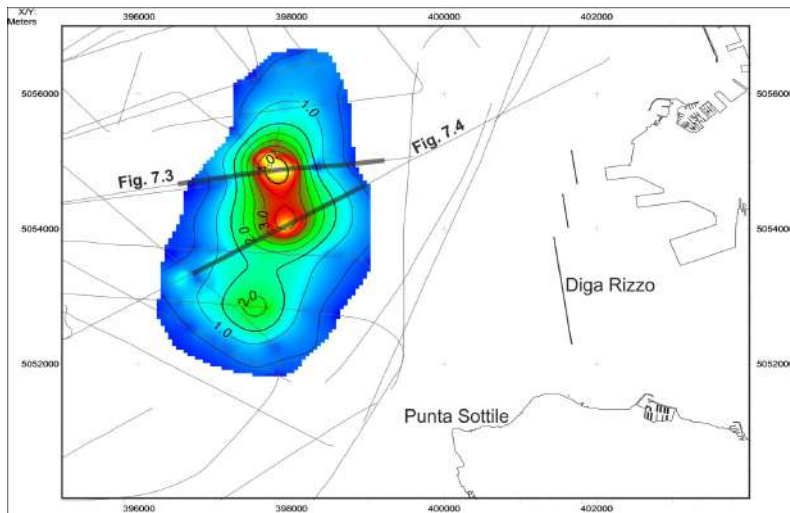
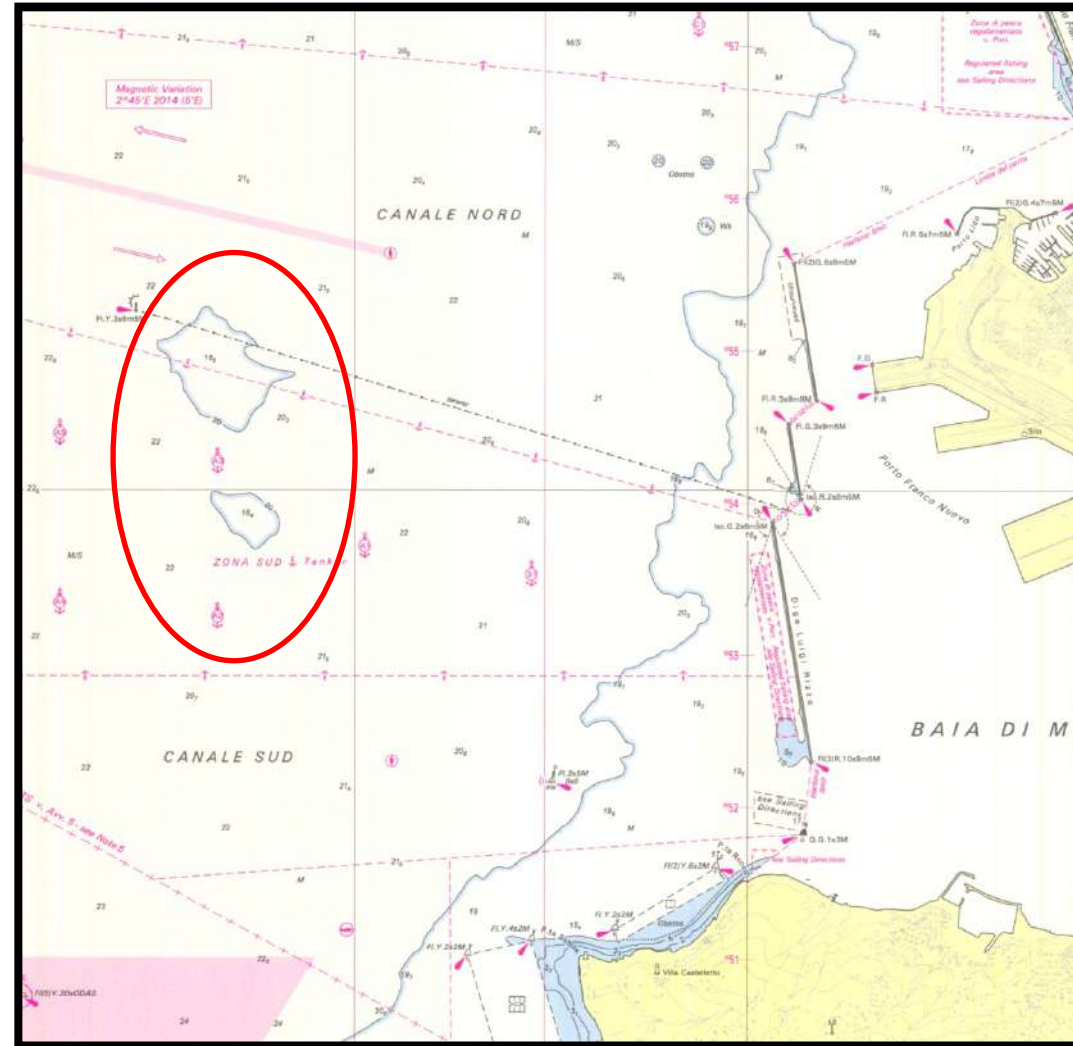
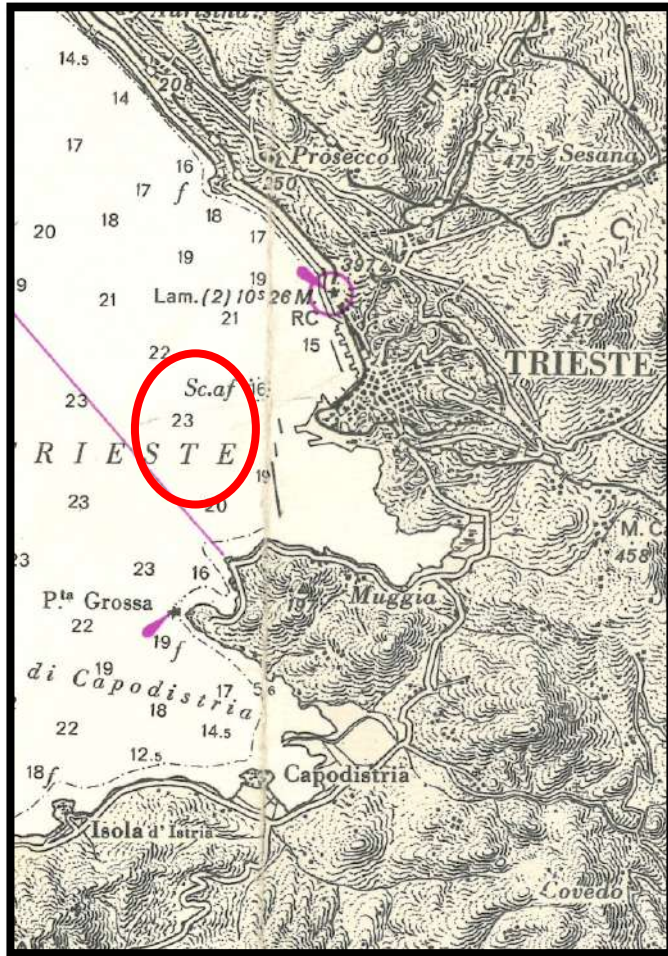


Fig. 7.3 - Profilo Chirp che attraversa il Rilievo A. La trasparenza in rosso evidenzia il corpo del rilievo.



Carta Nautica “Da Porto Corsini all’Isola di Pago”, scala 1:250.000, n.924, pubblicata nel 1964 dall’Istituto Idrografico della Marina.

Carta Nautica “Litorale di Trieste”, scala 1:25.000, n.239, pubblicata nel 2014 dall’Istituto Idrografico della Marina.

Morfologie di origine antropica presenti sul fondo mare

Canale artificiale

- Lunghezza = 4700 m
- Larghezza 110 - 1100
- Volume stimato del materiale asportato = $5,2178 \times 10^6 \text{ m}^3$.
- Spessori massimi visualizzati nell'isopaca: 7 m e di 8 m.
- Spessore max = 11 m
- Larghezza = 1100 m

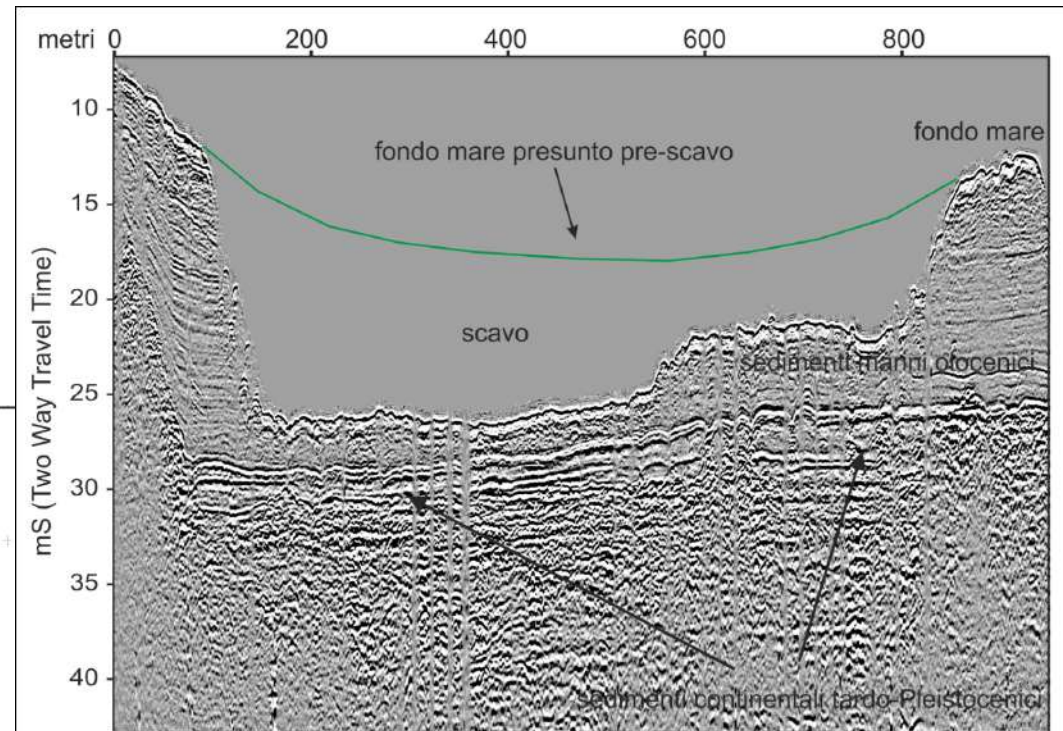
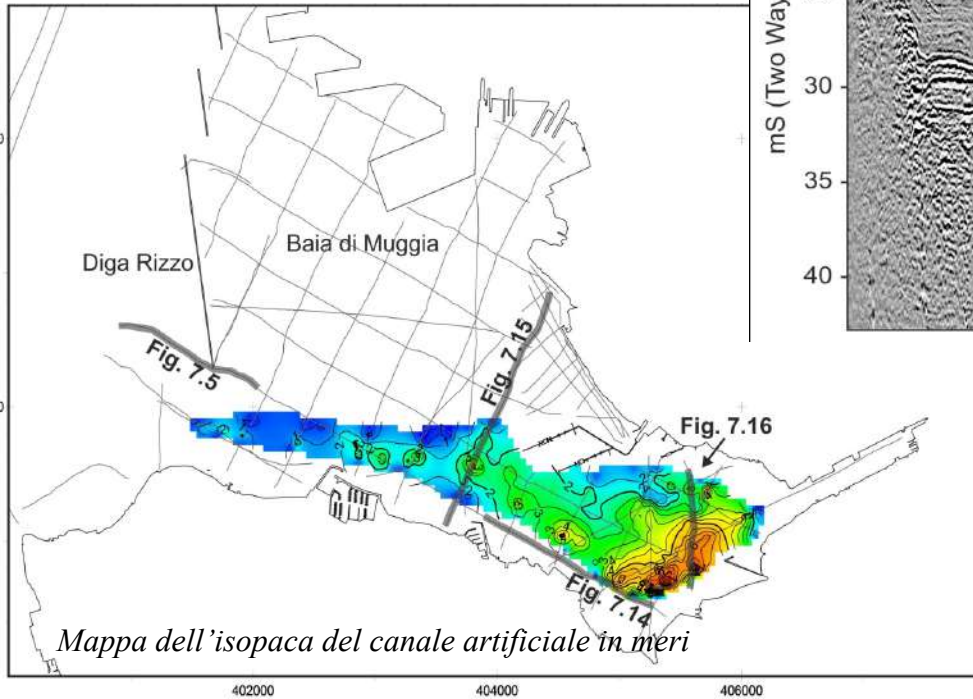


Fig. 7.16 - Profilo sismico Boomer GT13-B26 situato nella Baia di Muggia in cui è visibile una sezione trasversale del Canale artificiale. La linea verde rappresenta il presunto fondo mare naturale pre scavo.

Morfologie presenti sul fondo mare

Rilievo E

Ferriera di Servola, a partire dalla linea di costa artificiale

Volume del materiale = $133.743,282 \text{ m}^3$.

I picchi massimi nell'isopaca contour di 6 m e di 4 m

Lunghezza = 700 m, altezza = 9,5 m

Mapa dell'Isopaca del Rilievo E., in metri

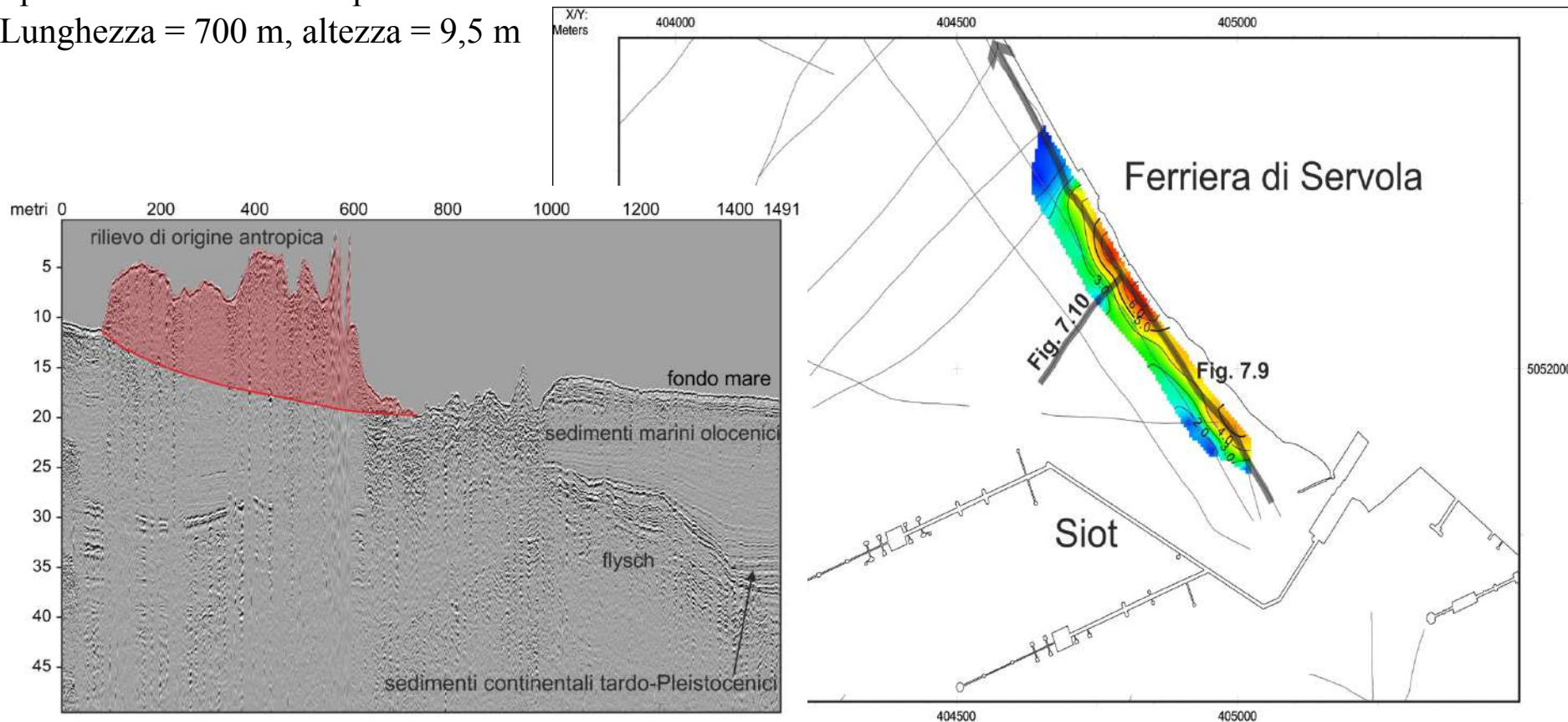


Fig. 7.9 - Profilo sismico Boomer GT13-B31 parallelo alla costa in prossimità della Ferriera di Servola con direzione nord-ovest/sud-est attraverso il Rilievo E. La trasparenza in rosso evidenzia il corpo del rilievo.

Analisi Multicriterio per la creazione delle mappe di antropizzazione

Analisi Multicriterio (Multi Criteria Analysis/Decision Analysis, MCA/MCDA) applicata al GIS per la valutazione complessiva, criteri di valutazione generalmente numerosi e spesso in conflitto tra di loro (layer cartografici che vengono elaborati e rappresentati in ambiente GIS).

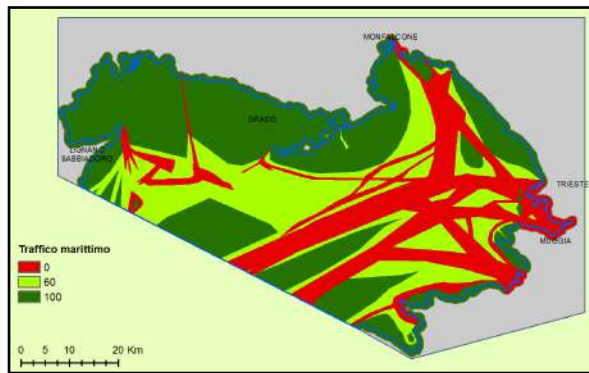
- 1) Creazione 18 indicatori sulla base dei dati raccolti, punteggio (score) convenzionalmente tra 0 e 100:
 - il valore 0 indica impatto massimo (massima antropizzazione)
 - il valore 100 indica impatto nullo (massima naturalità)
- 2) Assegnazione di un peso ad ogni indicatore ed aggregazione finale
- 3) Combinazione pesata: mappe di suitability/plausibilità per l'obiettivo considerato (antropizzazione), che tiene conto di tutte le variabili considerate:
 - **Mappa di antropizzazione del fondo mare**
 - **Mappa di antropizzazione dell'ambiente marino**

Indicatori realizzati

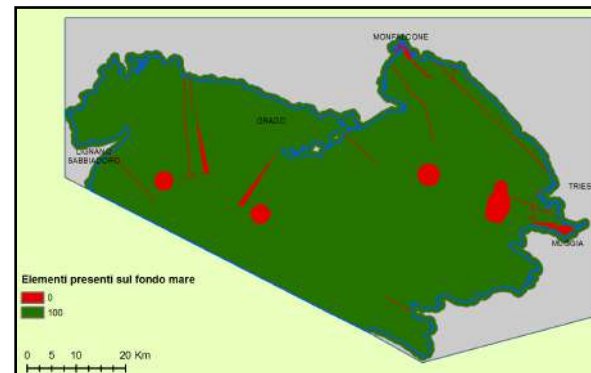
Intensità di ogni emissione proporzionale alla distanza dalla costa del punto di emissione in mare, valutato in progettazione sulla base della intensità degli scarichi depurati che vengono emessi.

A partire dal punto di emissione, l'intensità decade fino ad arrivare a 0 alla distanza minima che il punto ha dalla costa più vicina. Se le intensità dei punti di emissione si sovrappongono, i valori vengono sommati.

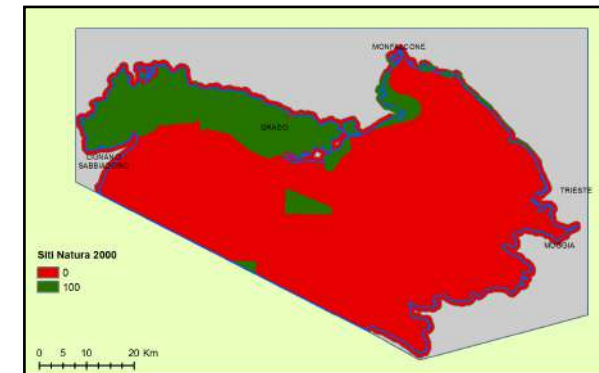
Analisi multicriterio



Mappa dell'indicatore "Traffico marittimo"
Digitalizzato da MarineTraffic:
punteggio 0 al traffico più intenso,
60 a quello moderato,
100 traffico basso.

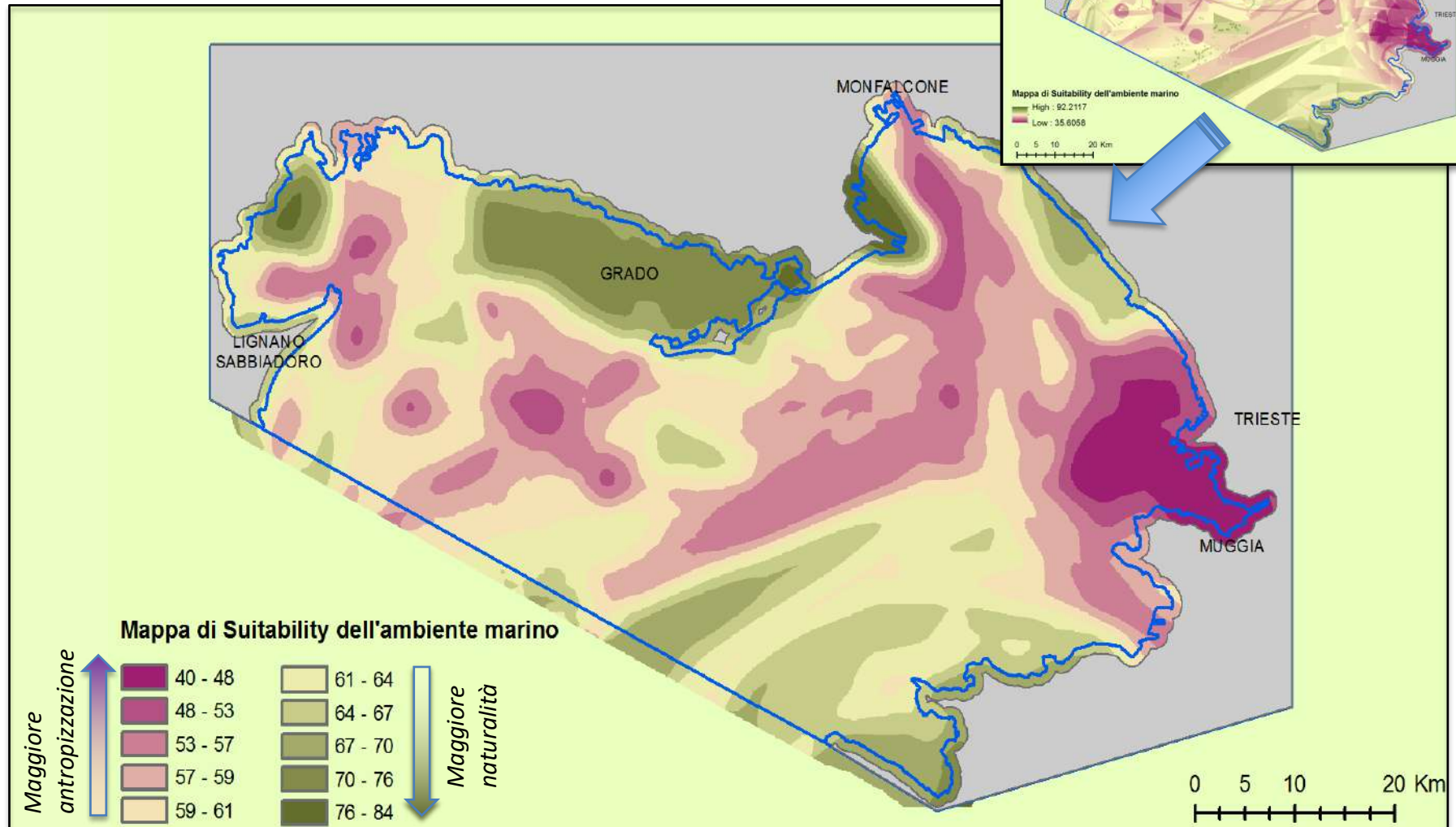


Mappa dell'indicatore "Elementi di origine antropica presenti sul fondo del mare"



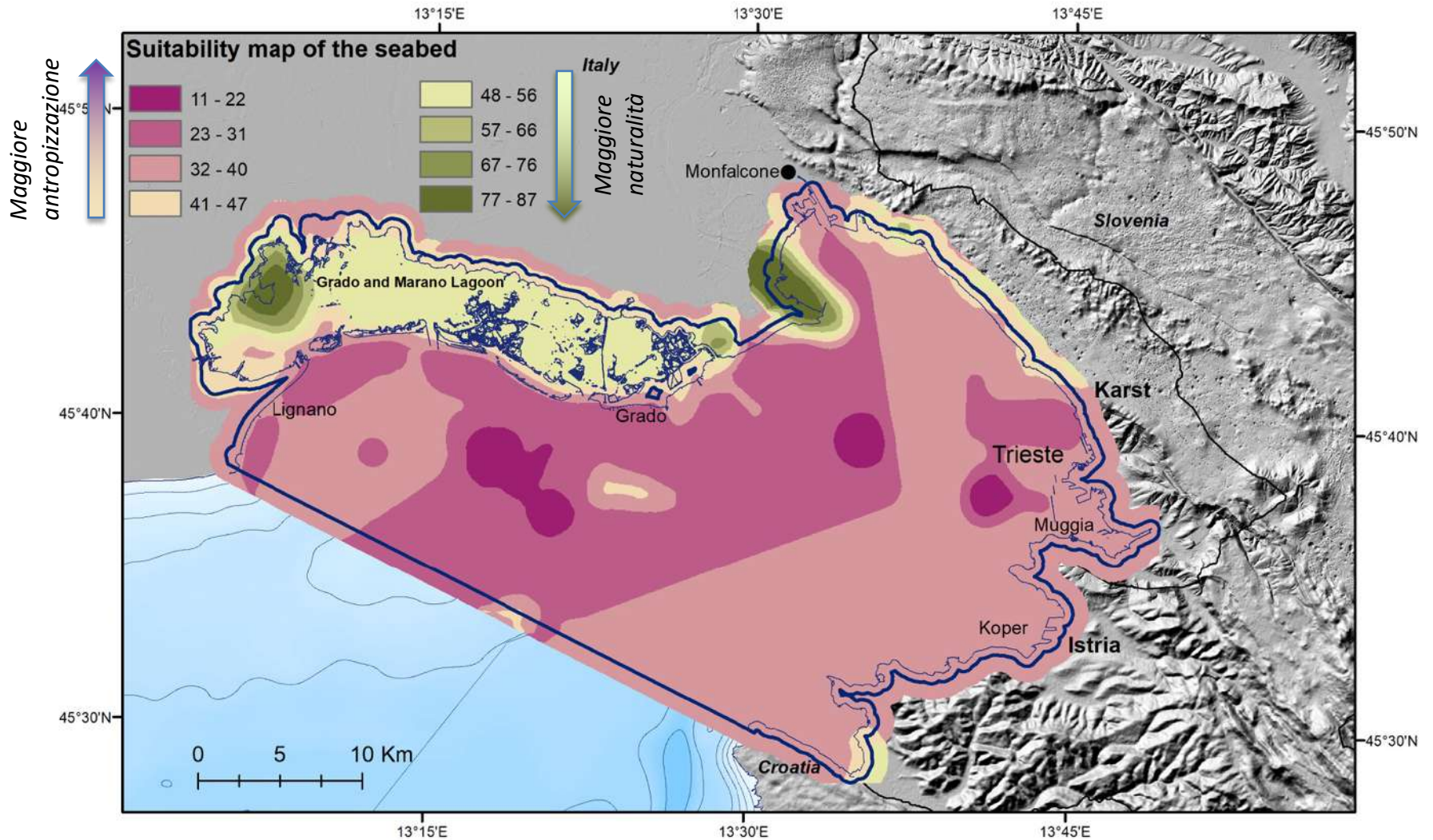
Mappa dell'indicatore "Siti Natura 2000"

Mappa di Suitability dell'ambiente marino



Realizzata tramite rielaborazione statistica di tutti indicatori, riassegnando ad ogni cella la media dei valori di tutte le celle presenti nel raggio di 1 km.

Mappa di Suitability del fondo mare



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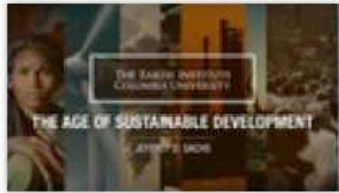
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L'impronta ecologica, parametro introdotto nel 1996 da Mathis Wackernagel e William Rees, “misura quanto l'umanità richiede alla biosfera in termini di terra e acqua biologicamente produttive, necessarie per fornire le risorse che usiamo e per assorbire i rifiuti che produciamo. (...) Quest'area viene espressa in ettari globali, ettari cioè con una produttività biologica media globale”.

M. Wackernagel, W. Rees, L'impronta ecologica

Università di Ferrara

<http://sostenibile.unife.it/index.php/it/impronta-ecologica>

Fondazione Enrico Mattei

http://www.feem-project.net/pandora/impronta_eco.php?ids=125

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