Biodiversity in Danger!

When Mediterranean species are threatened by climate change

Type of pedagogical project, activity, action, accompanying	**Activity – Team work - Game**
Key words of relevant disciplines/ Pedagogical content	Biodiversity, habitat, endangered species, Mediterranean, Mediterranean region, causes, ecosystem
Problematic	**Why is Climate change a threat for Mediterranean species?**
Thematic	Biodiversity, Mediterranean ecosystem
Disciplines (sciences, geography)	*Geography* *Biology* *Natural science*
Pedagogical Objectives/New targeted skills	**Students will be able to:** ● understand the importance of Biodiversity and the impact of climate change on Biodiversity in the Mediterranean region ● understand general relation between causes and effects (through examples of specific species)
Public target(s) (age, requested skills…)	12-16 No prerequisite
Description (step by step)	*The activity consists in three steps:* **Step 1) Classroom: the Mediterranean ecosystem & Human interactions** **1.1** The teacher explains the **specificity of the Mediterranean region (20')**: ● Sea and coastline: richness and diversity of natural habitats, from subtropical deserts to temperate mid-latitude regions.

	• a hotspot of biodiversity, but also, a fragile environment: - a semi-closed sea exchanging water with the Atlantic Ocean through only the narrow Strait of Gibraltar - a lot of endemic species, - a strong human pressure due to densely populated coastal areas. Additional resource on Biodiversity What is 'biodiversity', and why do we need it? (in English) https://youtu.be/ngz5oNuKL5M (European Environment Agency) **1.2** In **groups of 4 or 5**, students are asked to identify **how human interact** with the Mediterranean ecosystem **(10')** • They discuss on how human benefits from the Mediterranean ecosystem and how we affect it in negative ways. • They identify two groups of key words: positive interaction / negative interaction. • On the board, one student collects and lists in 2 columns (+ and -) the key words resulting from the groups discussions. The teacher helps the students to bring together the main notions and, eventually, complete the interactions that were not identified by the students. The teacher ends up the discussion with one question: **And what about the impact of Climate change on the biodiversity?** The map of the European Environmental Agency can be used https://www.eea.europa.eu/soer-2015/europe/climate-change-impacts-and-adaptation/climate-change-impacts-in-europe/ **Step 2) Game: The Ecological chains and the impacts of Climate change (30')** Students will then visualize what they have identified in class through a game. **The class is divided into two groups that will work in parallel:** **2.1 Group A: Let's build Mediterranean chains, a fragile equilibrium** • The following game will help students understand the **Mediterranean ecosystem and the interdependencies** between its elements.

	• The students form a circle. The teacher assigns each of them a role, as natural elements of our Mediterranean environment (being vegetal, animal, non-biotic factor, etc.) and distribute badges specifying these roles. Students communicate it to the others ("I am a rock, I am a river, a sea turtle, a seagrass, the oxygen in the sea..."). The teacher can add anthropogenic elements with various roles such as Fisherman, Tourism businessman, etc.
	
	• Then, one of them starts throwing a rope in succession to another, referring to their own role and to the relationship with the other ("I am an seagull and I throw the rope to the small fish because I feed on fish" - "I'm a small fish and I throw the rope to the Posidonia because I nest here ", "I am a river and I throw the rope into the sea because I end up there"- "I am a hotel manager and I throw the rope to the sand because I use the beach for my tourists"...). Several chains (food chains, other ecological chains, socio-economic chains, etc.) are developed and identified by different color of ropes.[1]
	Students are asked to keep tight and straight the rope. Slowly, they represent the networks of ecological relationships and interdependencies of the natural elements. The teacher helps for the definition and explanation of some ecological links when needed.
	
	2.2 Group B: Scientists report on the Climate change effect on the Mediterranean ecosystem
	
	• Teacher will have selected and shorten several articles referring to different impacts of Climate change on the Mediterranean region:
	  ◦ augmented risks of drought and forest fires
	  ◦ augmented risks of floods
	  ◦ augmented temperature of the sea
	  ◦ acidification of the sea,
	  ◦ etc.
	
	These articles will be chosen in strong relation with the natural elements chosen for Group A

[1] See example of food chain in the Mediterranean Sea below.

***Eg.1*: Marine Turtle – (English)**
Marine Turtles are highly sensitive to climate warming. While adults have been known to move to avoid too warm waters, a changing climate will impact greatly on their offspring. Tortoises and turtles are among the species with temperature-dependent sex determination. ***Warmer temperatures*** *will produce more females resulting in a dangerous sex bias. Also increased flooding will increase egg mortality and warmer sand will also produce smaller and weaker hatchlings.*
Other factors: Sea turtle populations are already impacted by a range of anthropogenic activities, such as fisheries bycatch, coastal development, pollution and habitat degradation. (source: WWF EU)
http://wwf.panda.org/_core/general.cfc?method=getOriginalImage&uImgID=%26%2AR0%26%21%2ES7%0A

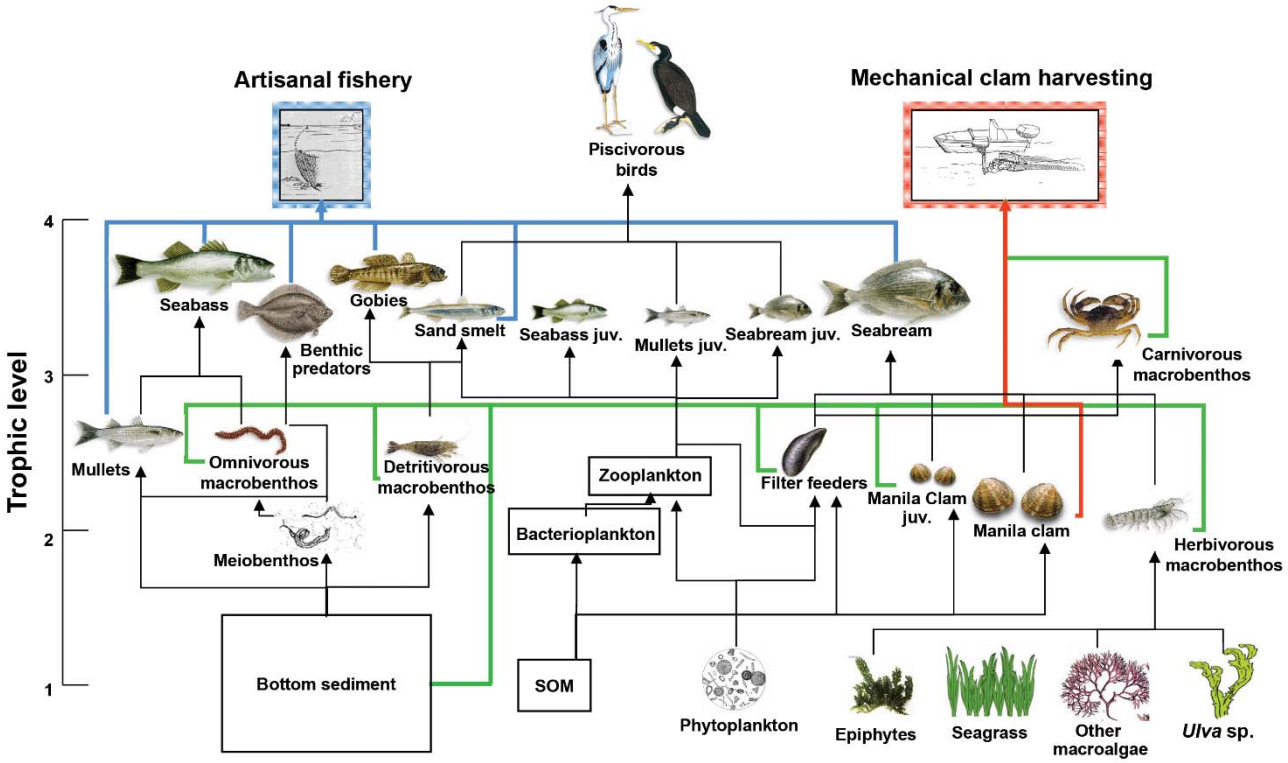
Eg.2 : **Posidonie (Français)**
Son rôle en Méditerranée
See video: La POSIDONIE : CHRONIQUES de la MER MÉDITERRANÉE
https://www.youtube.com/watch?v=QPBKzyErtrg

Other examples can be found:
E.g. in English *: https://www.fs.usda.gov/ccrc/topics/wildlife (from the US Forest Service)*
E.g. in French: *https://www.ecologique-solidaire.gouv.fr/impacts-du-rechauffement-climatique-sur-biodiversite (Ministère de l'Ecologie Solidaire) or https://www.climat.be/fr-be/changements-climatiques/les-effets/biodiversite (Site Fédéral Belge sur le Climat)*
E.g. in Greece*: http://kpe-kastor.kas.sch.gr/biodiversity_site/b/climatic_change.htm http://kpe-kastor.kas.sch.gr/worksheets_biodiversity/index.htm*

- Students from Group B are asked to study the articles and identify the impacts of the phenomenon on the natural elements (changes of the habitat, extinction of some species, etc.)

	Step 3) Biodiversity in Danger! The scientists give their conclusion… ● Joining Group A and the various chains they will have built, students of Group B – the "scientists" -- explain the problems studied and, subsequently, ask the elements that will be impacted or will disappeared to leave successively the group. ● The network loses its solidity and the various elements of nature are missing each other, disrupted the ecological balance. NEXT STEP: This activity will help to prepare the **Project: Save Biodiversity in Danger!**
Place (meeting room, outside space, …)	Classroom
Individual and / or collective actions	The National Geographic propose the same kind of approach, available on line, eg. on invasive species https://www.nationalgeographic.org/activity/introduction-invasive-species/?utm_source=BibblioRCM_Col
Material needed	● Laptop and projector ● Badges ● Ropes of several colors
Duration of pedagogical project or activity	2-4 hours
Evaluation of the new acquired skills	At the end of the activity the teacher could give the students a questionnaire or a test to check new knowledge.
Eco-citizen adaptation, knowledge	**Link to:** ● **Climate Change: Shall we play? 99 questions on climate change and related issues (external resources)** ● **Let's save the Mediterranean biodiversity!**

enhancement and links to other topics	• **Marine environment and Climate change** **French:** - https://bebiodiversity.be/biodiversity-is-a-balance/ - https://www.pourlascience.fr/theme/biodiversite/ - https://srednja.hr/ekobiz/ekologija/prosvjed-ucenika-siri-se-po-hrvatskoj-petak-klimu-ulicu-izlaze-splicani/ - http://klima.hr/razno/publikacije/klimatske_promjene.pdf http://www.wwfadria.org/naa_zemlja/klimatske_promjene/utjecaj_klimatskih_promjena/ - https://skepticalscience.com/translation.php?lang=29 **Greek:** http://kpe-kastor.kas.sch.gr/biodiversity_site/b/climatic_change.htm (educational site on biodiversity) **Italian:** - Introduction to biodiversity (Slow food video, ITA): https://www.youtube.com/watch?v=pjqJ37SmZeo - Publications by Italian Environment Ministry and LIPU about CC and LIPU (ITA): https://www.minambiente.it/sites/default/files/archivio/allegati/biodiversita/cambiamenti_climatici_biodiversita.pdf
Observations	



Source: Global Patterns in Ecological Indicators of Marine Food Webs: A Modelling Approach
Johanna Jacomina Heymans, Marta Coll, Simone Libralato, Lyne Morissette, Villy Christensen
Published: April 24, 2014 - https://doi.org/10.1371/journal.pone.0095845

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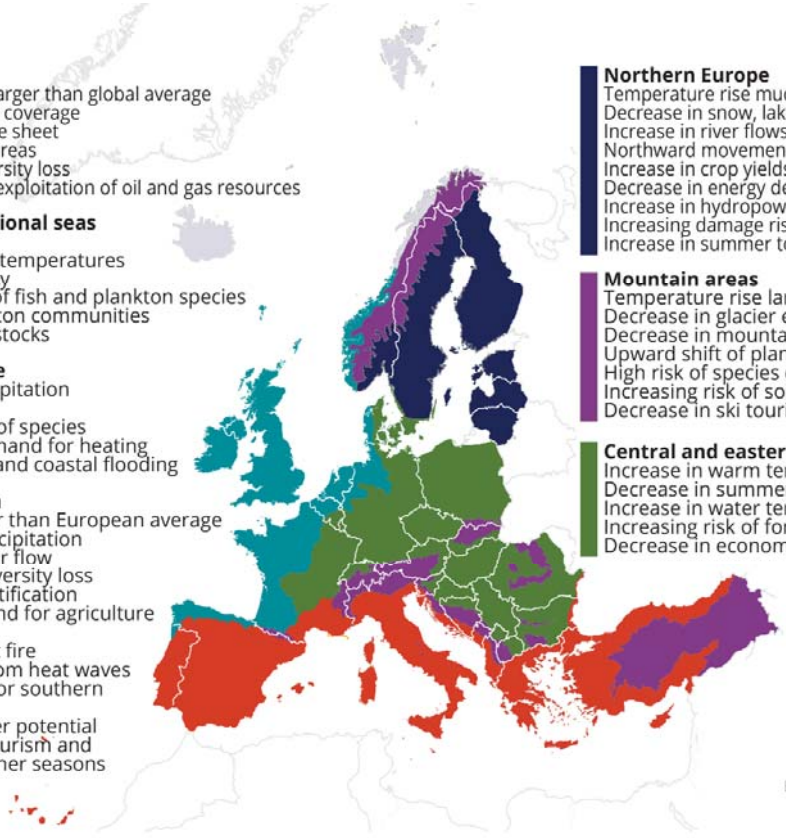
Arctic
Temperature rise much larger than global average
Decrease in Arctic sea ice coverage
Decrease in Greenland ice sheet
Decrease in permafrost areas
Increasing risk of biodiversity loss
Intensified shipping and exploitation of oil and gas resources

Coastal zones and regional seas
Sea-level rise
Increase in sea surface temperatures
Increase in ocean acidity
Northward expansion of fish and plankton species
Changes in phytoplankton communities
Increasing risk for fish stocks

North-western Europe
Increase in winter precipitation
Increase in river flow
Northward movement of species
Decrease in energy demand for heating
Increasing risk of river and coastal flooding

Mediterranean region
Temperature rise larger than European average
Decrease in annual precipitation
Decrease in annual river flow
Increasing risk of biodiversity loss
Increasing risk of desertification
Increasing water demand for agriculture
Decrease in crop yields
Increasing risk of forest fire
Increase in mortality from heat waves
Expansion of habitats for southern disease vectors
Decrease in hydropower potential
Decrease in summer tourism and potential increase in other seasons



Northern Europe
Temperature rise much larger than global average
Decrease in snow, lake and river ice cover
Increase in river flows
Northward movement of species
Increase in crop yields
Decrease in energy demand for heating
Increase in hydropower potential
Increasing damage risk from winter storms
Increase in summer tourism

Mountain areas
Temperature rise larger than European average
Decrease in glacier extent and volume
Decrease in mountain permafrost areas
Upward shift of plant and animal species
High risk of species extinction in Alpine regions
Increasing risk of soil erosion
Decrease in ski tourism

Central and eastern Europe
Increase in warm temperature extremes
Decrease in summer precipitation
Increase in water temperature
Increasing risk of forest fire
Decrease in economic value of forests

European Environment Agency