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#EU GREEN WEEK

Exploring the Role of Coastal Marine Environment within the WEFE Nexus

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THE WATER-ENERGY-FOOD NEXUS: BUILDING RESILIENCE TO GLOBAL CHALLENGES

NexusNet

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

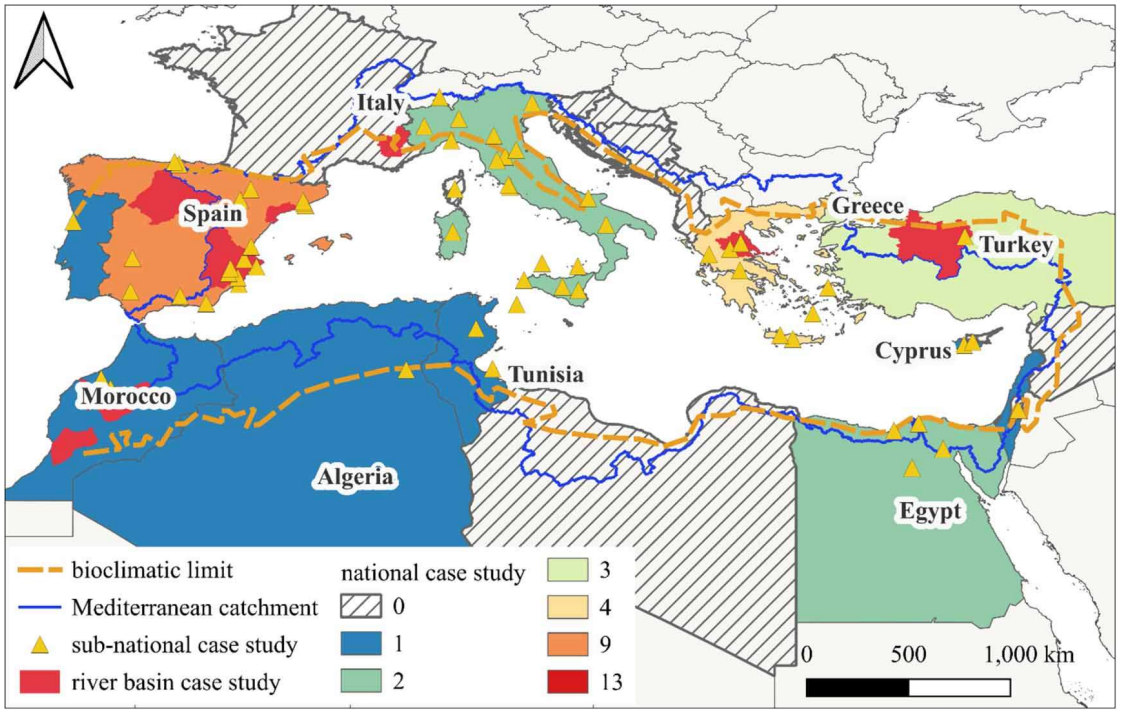
Motivation and Scope : Sea water is missing

Marine systems are core to the Water-Energy-Food-Ecosystem (WEFE) Nexus in the mediterranean.

Traditional nexus studies treat the sea as a **stressor;** we treat it as a **domain**.

Focus: Mediterranean Sea as a **WEFE hotspot** of interdependence.

Goal: Build a **policy-relevant**, **EO-based nexus analysis** using **Marine Ecosystem Services (MES)**.



Lucca et. Al, 2023

Marine Ecosystems: The Missing Component

Provisioning Services

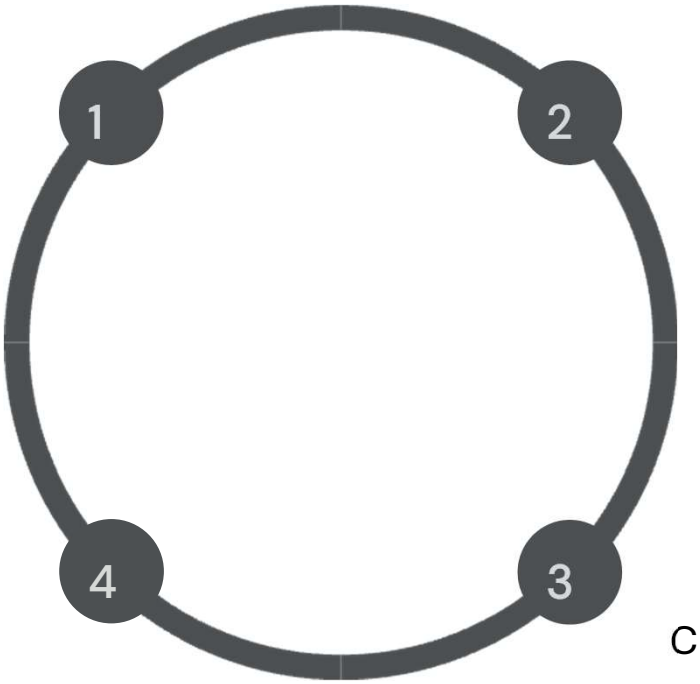
Food production through fisheries and aquaculture

Raw materials for pharmaceuticals and biotechnology

Supporting Services

Primary production and nutrient cycling

Habitat provision for marine biodiversity



Regulating Services

Carbon sequestration and climate regulation

Water purification and waste treatment

Cultural Services

Tourism and recreation opportunities

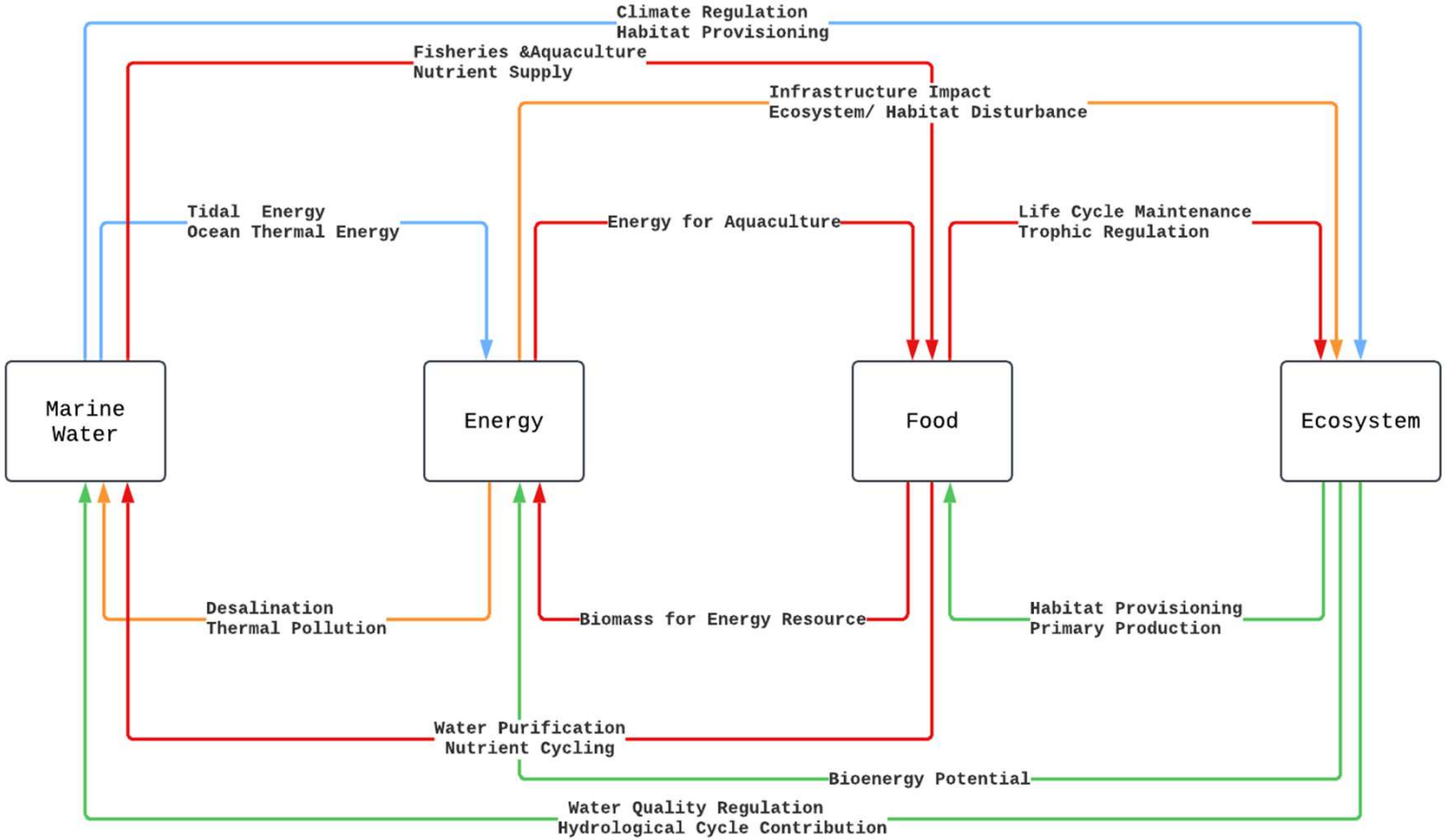
Cultural heritage and scientific knowledge

MES are connected to the NEXUS components

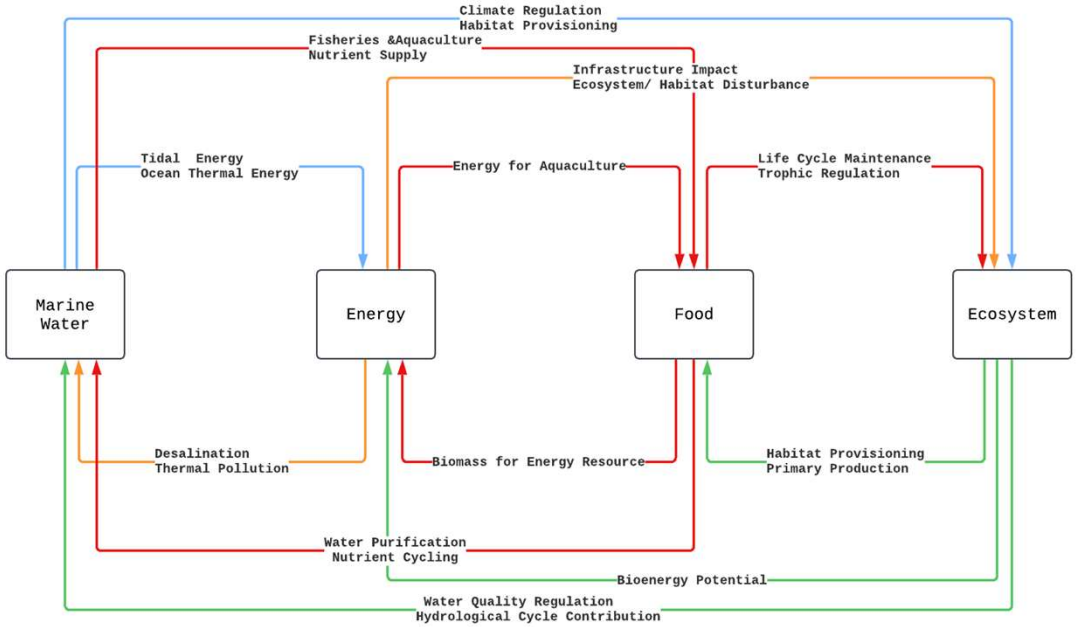
Each nexus element (Water, Energy, Food, Ecosystem) interacts through MES.

Diagram shows bidirectional interlinkages:
E.g., thermal regulation ↔ desalination, wave energy ↔ aquaculture, seagrass ↔ habitat provisioning.

Key MES: desalination, fisheries, offshore energy, seagrass meadows.



MES are connected to the NEXUS components



I. SYSTEM UNDERSTANDING THROUGH INDICATORS

II. SYSTEM DYNAMICS THROUGH SCENARIOS

I. SYSTEM UNDERSTANDING THROUGH INDICATORS

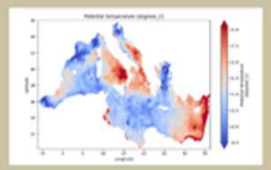
Each nexus interlinkage is linked to **quantifiable Earth Observation (EO) proxies**

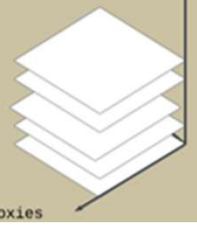
Data sources: MODIS, Sentinel-3, Copernicus Marine **Indicators by domain**:

- *Marine Water*: SST, salinity, turbidity, chlorophyll-a
- *Energy*: wave height, current velocity
- *Food*: NPP, NDVI, chlorophyll-a
- *Ecosystem*: DO, seagrass extent,coastal erosion

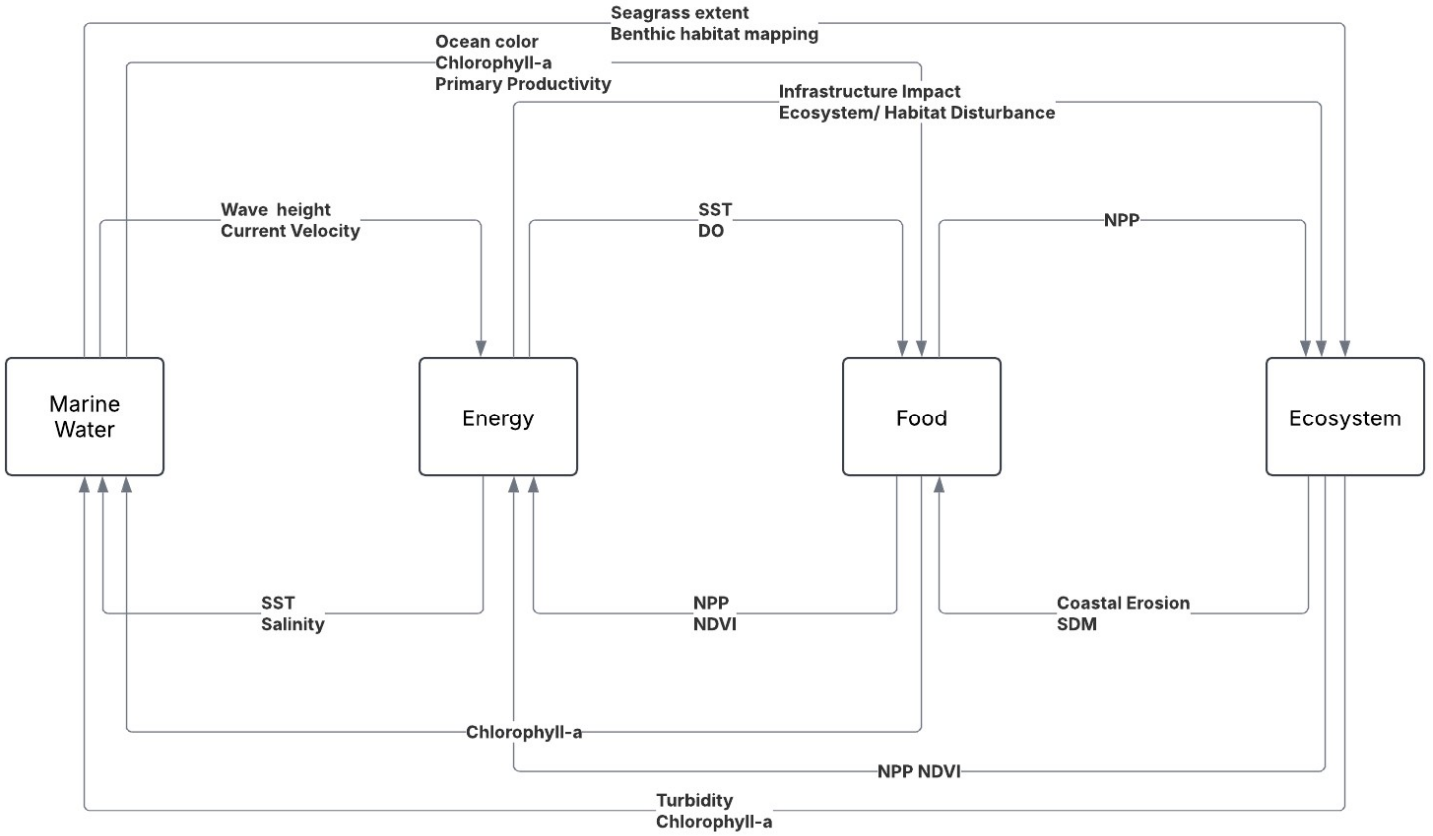
Cross-domain metrics:

- Chlorophyll-a, NPP, NDVI → link all four domains
- Infrastructure & habitat impact → assess ecosystem disturbance





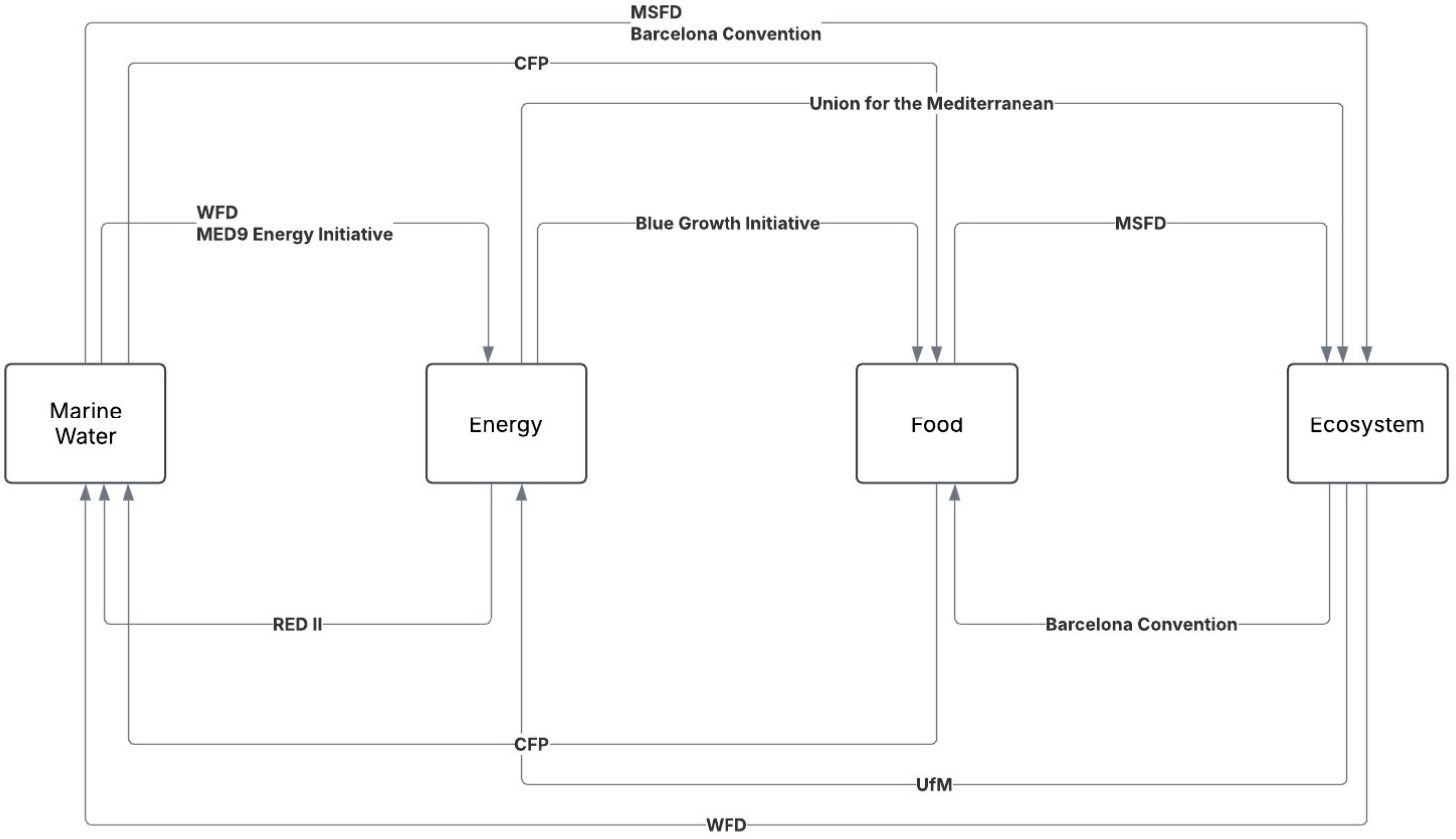
Spatial Cubes of Selected EO proxies



II. SYSTEM DYNAMICS THROUGH SCENARIOS

How the change in policy would affect other components?

System dynamics modelling



EXPECTED OUTCOMES

Enable quantifiable WEFE analysis using MES and EO integration.

Classify Action Zones (high MES + high policy) and Opportunity Zones (high MES + low policy).

Foundation for evidence-based interventions in nexus-sensitive Mediterranean regions.

Supports EU Green Deal, MSP, and SDG 14/15 frameworks.