



The challenge of building a sustainable society under a global crisis: fusion of green deal and blue development

Félix Diego López Figueroa

Full Professor of Ecology of Malaga University and Director of the Andalusian Institute of Blue biotechnology and Development (IBYDA)

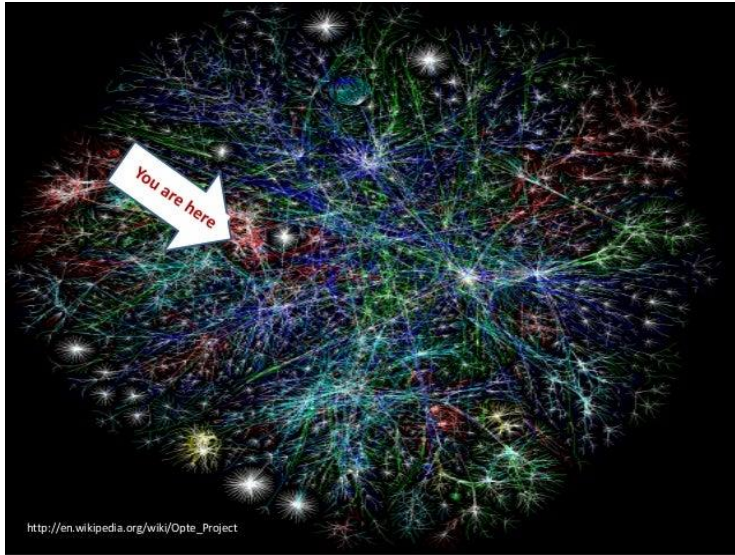
<http://www.ibyda.es>



UNIVERSIDAD
DE MÁLAGA

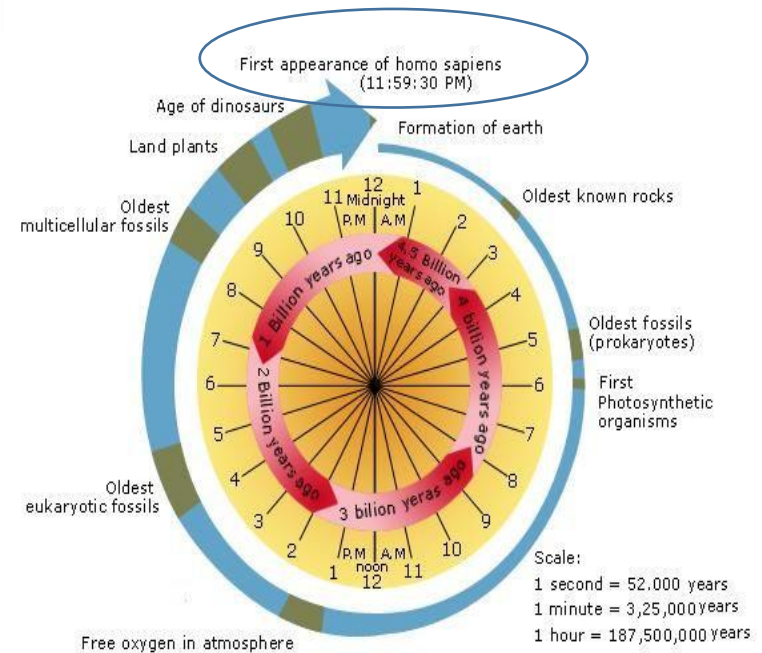
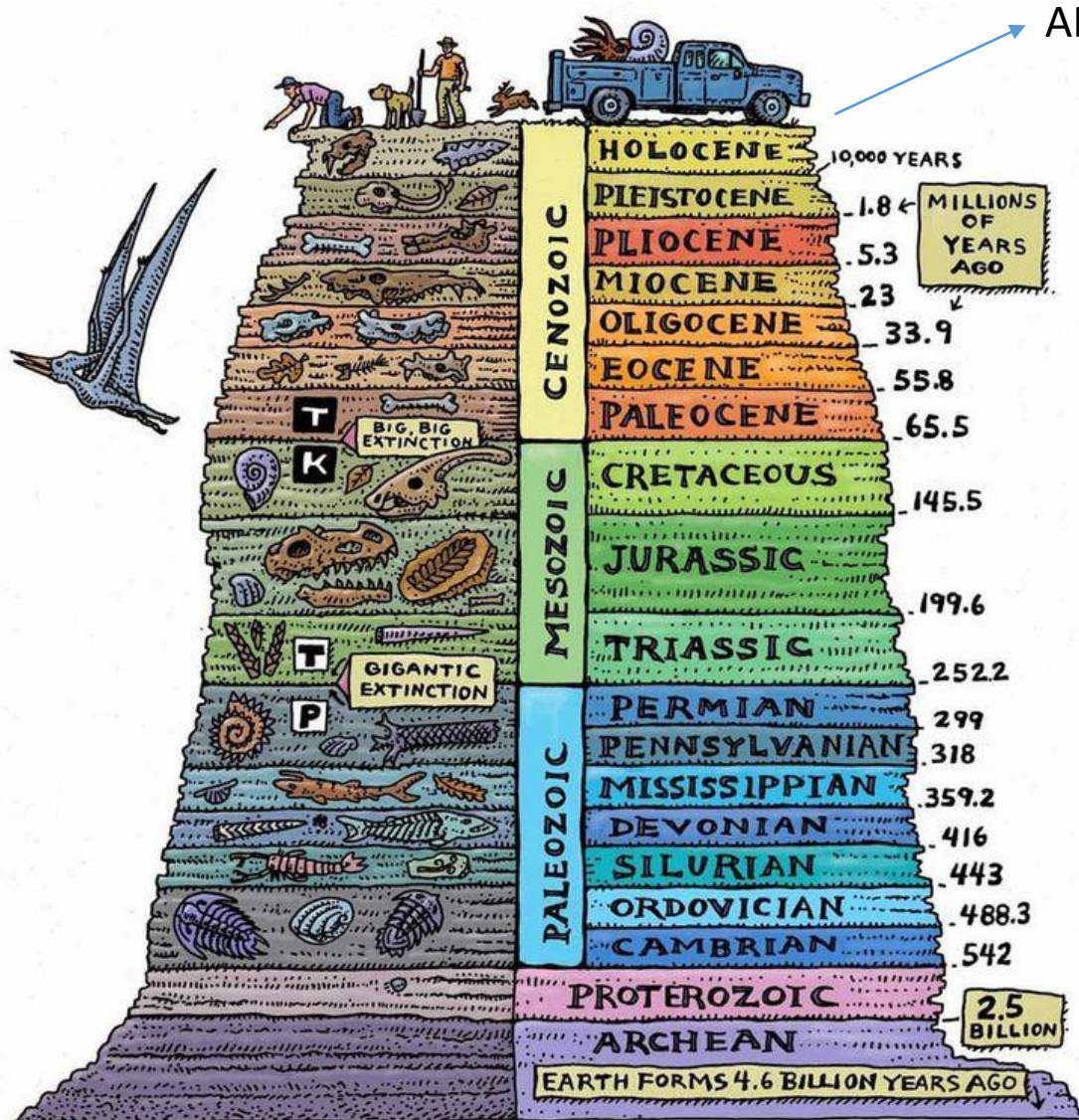


The Earth represents a minuscule space in the Universe



The Earth a Blue Planet and
the Moon, White Satellite

and the humans are very small and very recent in the Earth . Taking into account the time from the formation of the Earth within 24h, the Homo sapiens appears at 11:59:30 pm

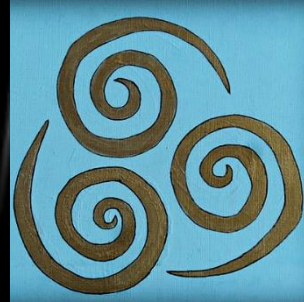


The Earth is diverse and beautiful

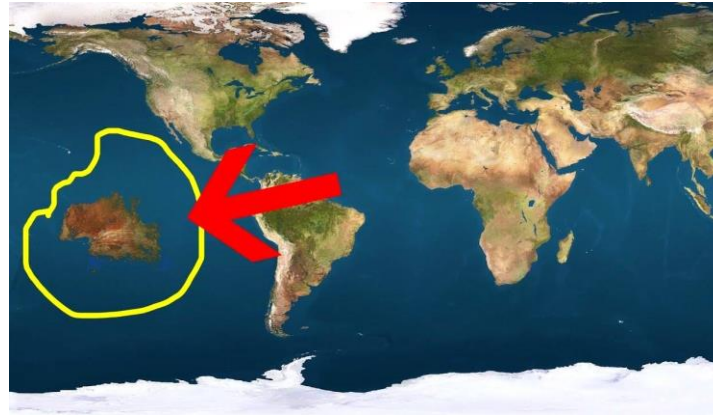




But how do we use the four elements?



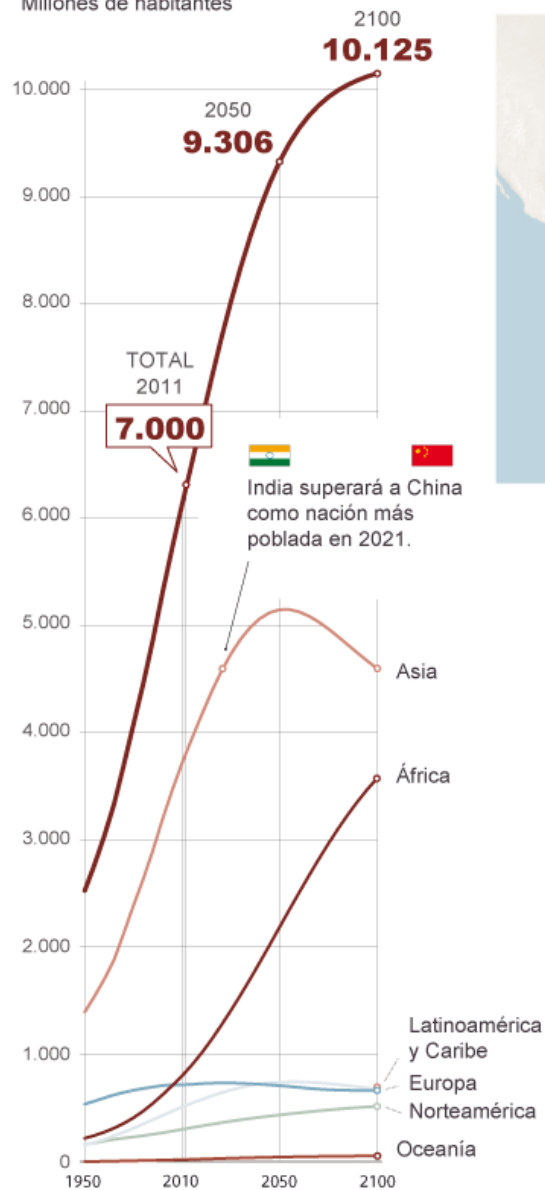
we have an over consumption of earth resources and we produce high impacts



HUMAN POPULATION AND AVAILABLE RESOURCES

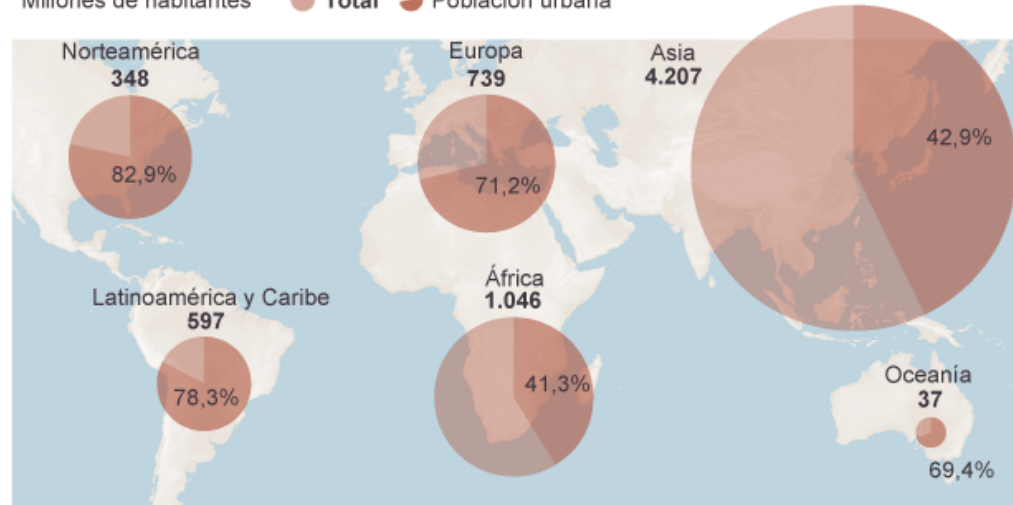
- EVOLUCIÓN DEL TOTAL Y PREVISIÓN

Millones de habitantes



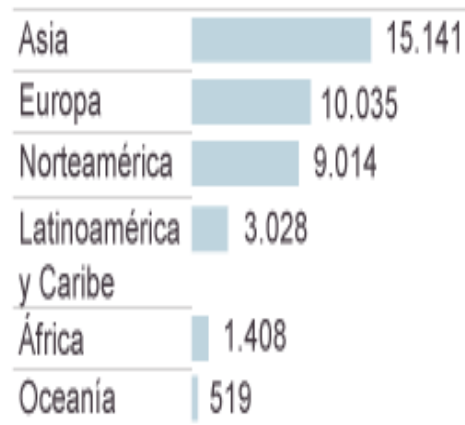
- DISTRIBUCIÓN POR REGIONES

Millones de habitantes ● Total ● Población urbana

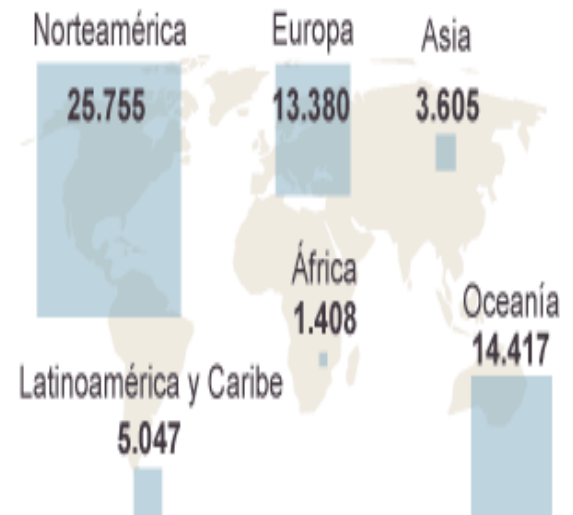


- PIB Y REPARTO DE LA RIQUEZA

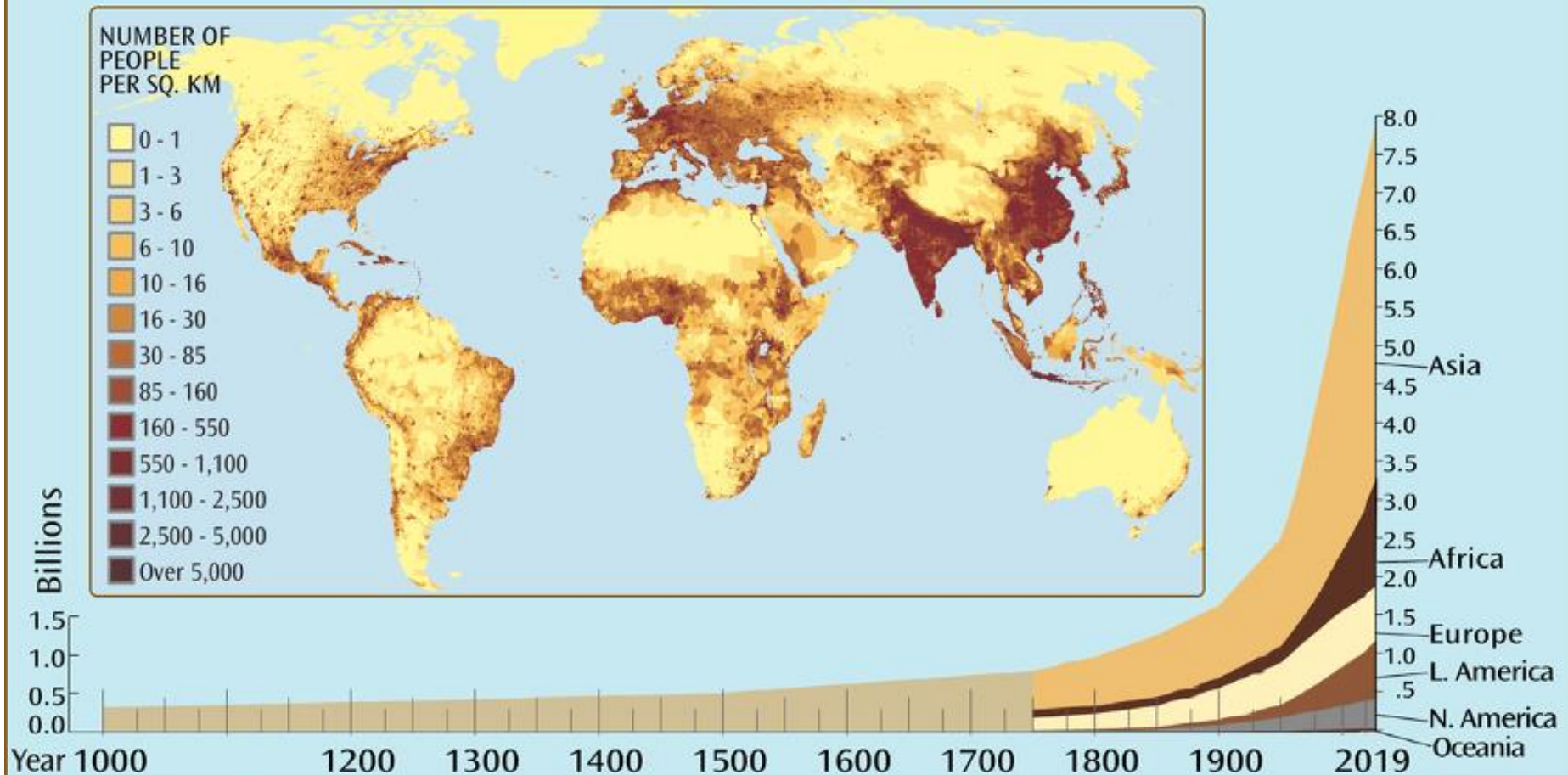
Total, en miles de millones de euros



Per cápita, en euros



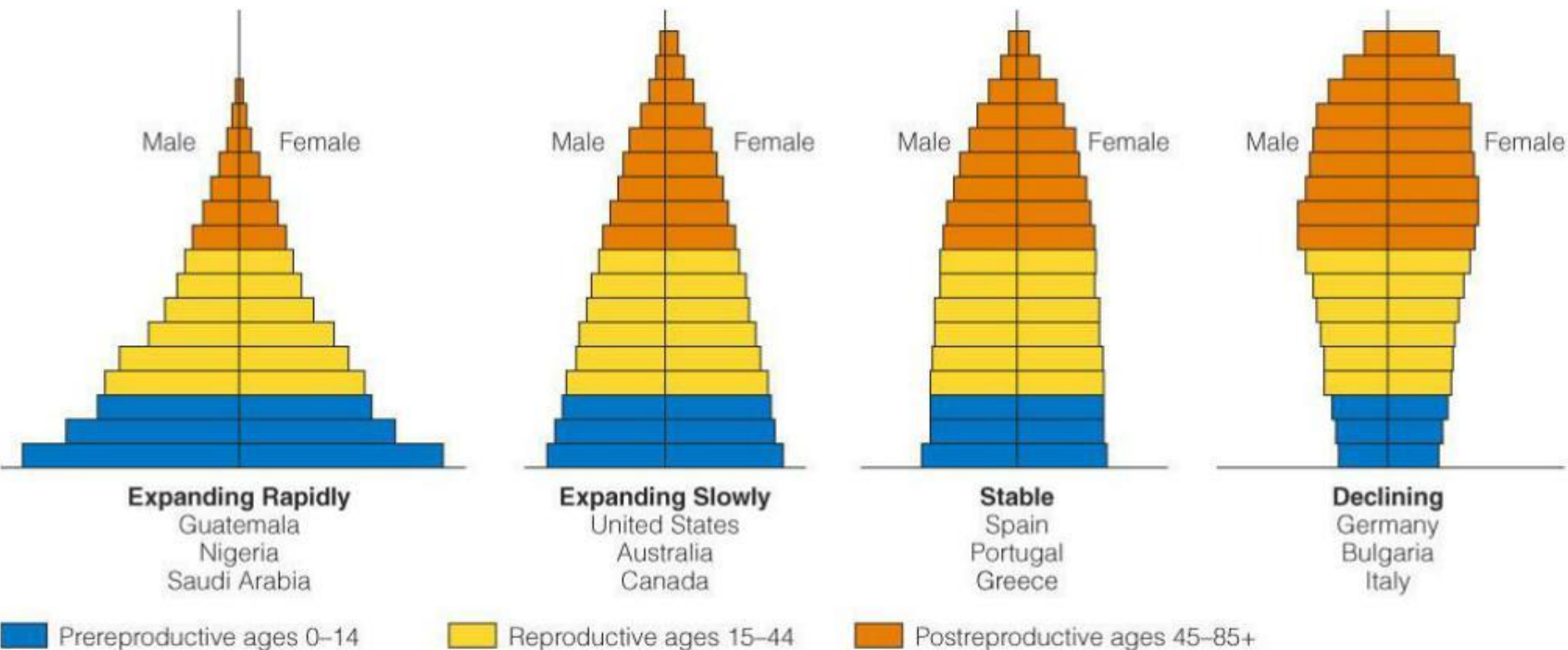
HUMAN POPULATION GROWTH & DENSITY



The World at Six Billion; Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2004 Revision and World Urbanization Prospects: The 2003 Revision; <http://esa.un.org/unpp>; "The Determinants and Consequences of Population Trends, Vol.1" (United Nations, New York). United Nations, "World Population Prospects": www.geohive.com/global/; 2019 data; ourworldindata.org/grapher/world-population-by-world-regions-post-1820



POPULATION AGE STRUCTURE



© 2007 Thomson Higher Education

⊕ Populations with a large proportion of its people in the prereproductive ages 1-14 have a large potential for rapid population growth.

Figure 9-9

The half of world population lives in cities



Shanghai



Social differences in Brazil



Qatar



Los Asperones



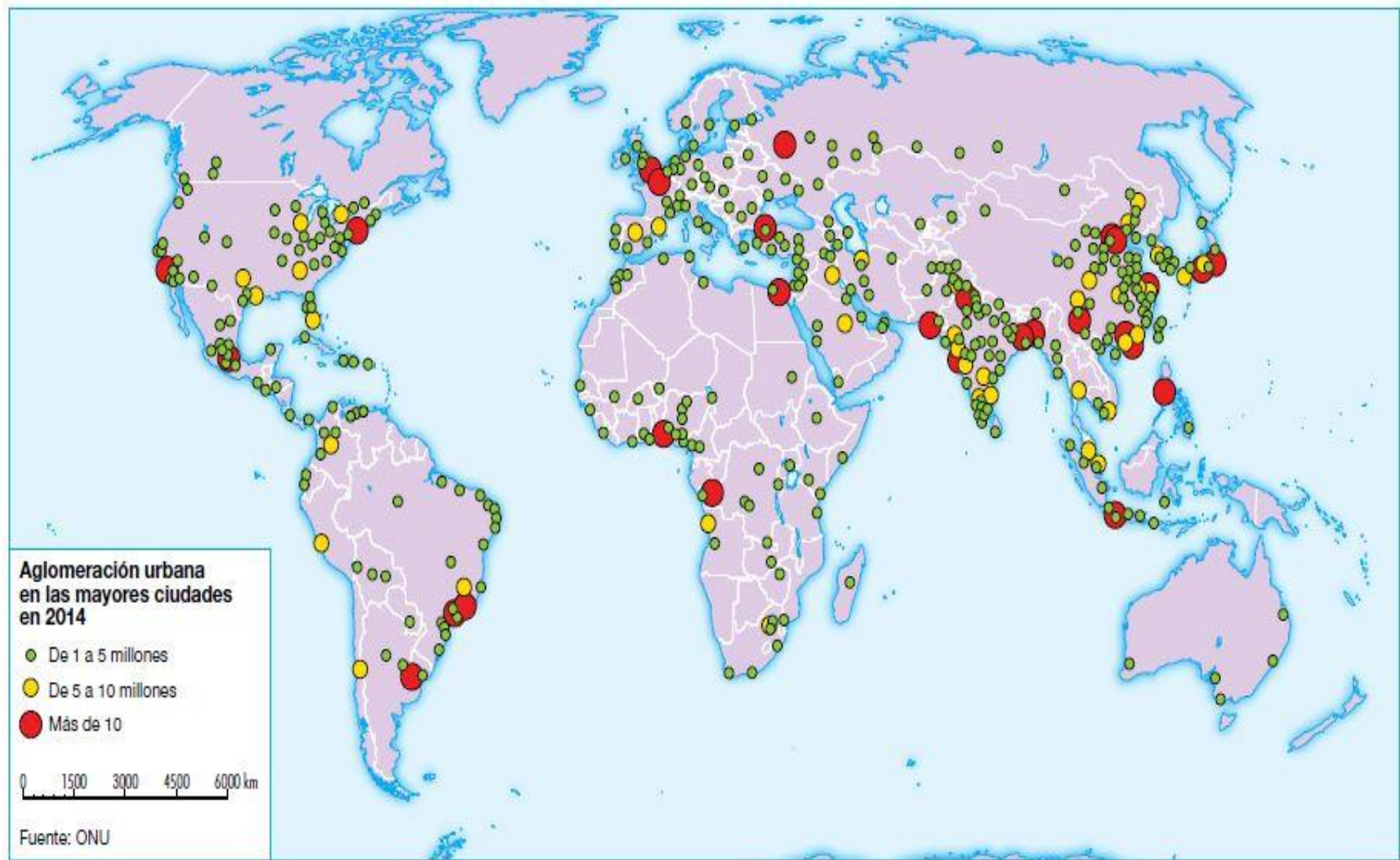
Dubai



Mumbai



Johannesburgo

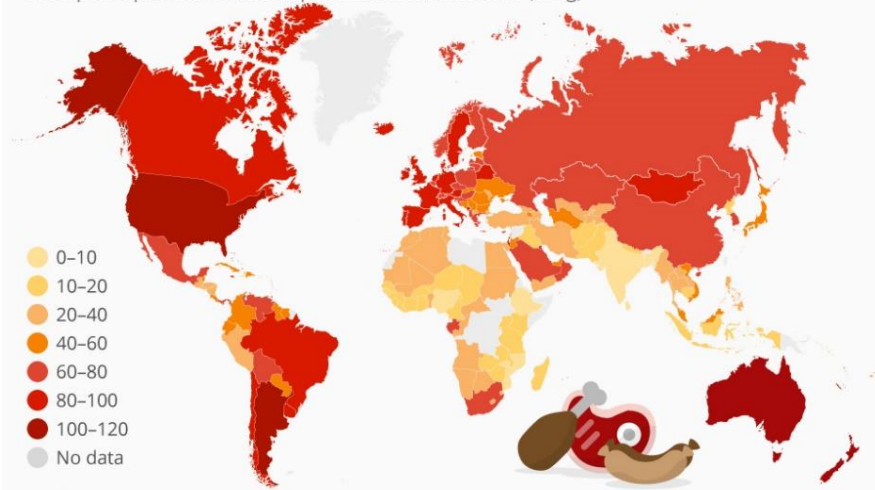


–Megacities (Millions of Habitant)

Tokio (39,8), Shanghai (31,1), Yakarta (28,9), Delhi (27,2 Mh), Karachi (25,1), Seúl (24,8), Manila (24,6)...Ciudad de México (22,3),.Sao Paulo (21,8),.Buenos Aires (15,8), ..Rio de Janeiro (12,1),..Bogotá (9,5),Lima (8,8) Santiago de Chile (7,0h),..Madrid (6,2)

Where Meat Consumption Is Highest & Lowest

Total per capita meat consumption worldwide in 2014 (in kg)*

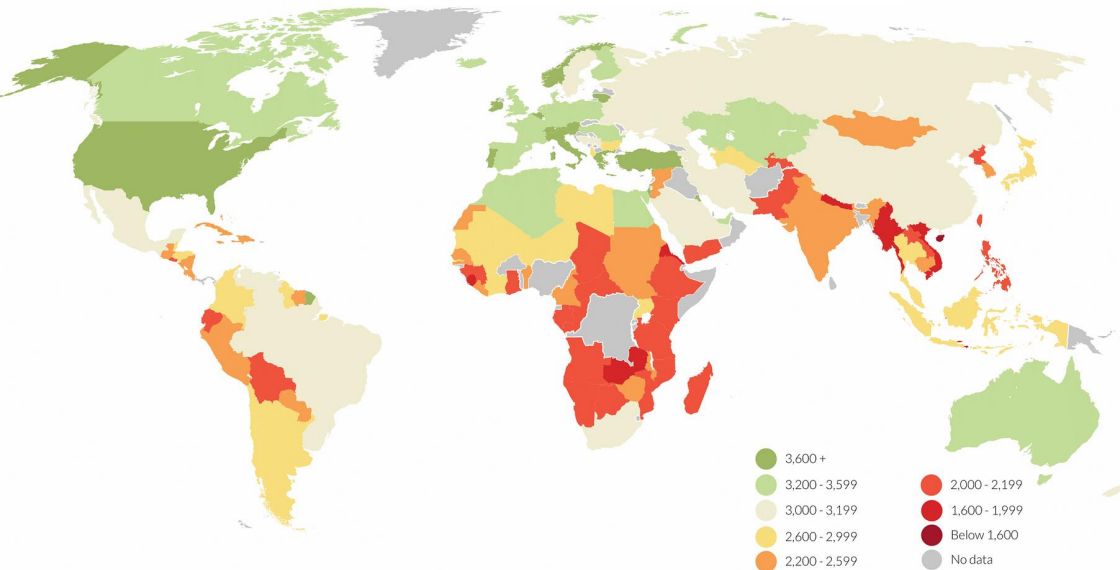


CC BY-SA
@StatistaCharts

* 2014 is the latest year data is available. Excludes seafood.
Source: UN Food and Agriculture Organization

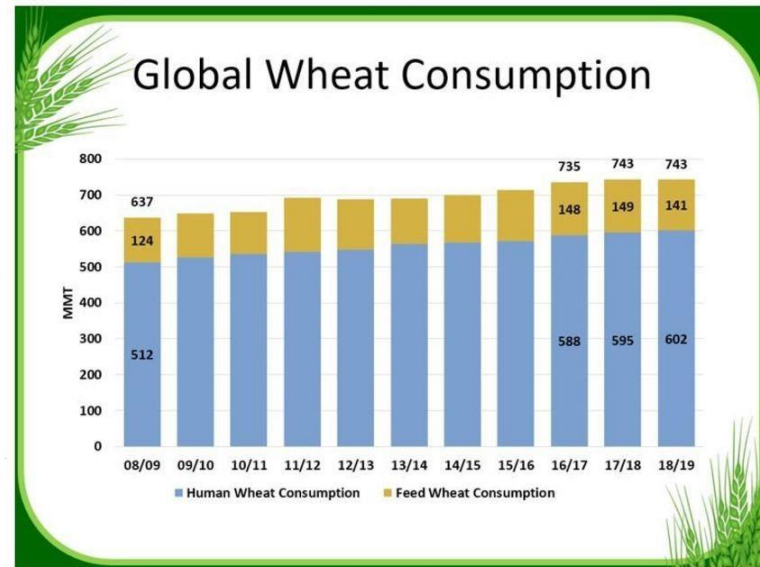
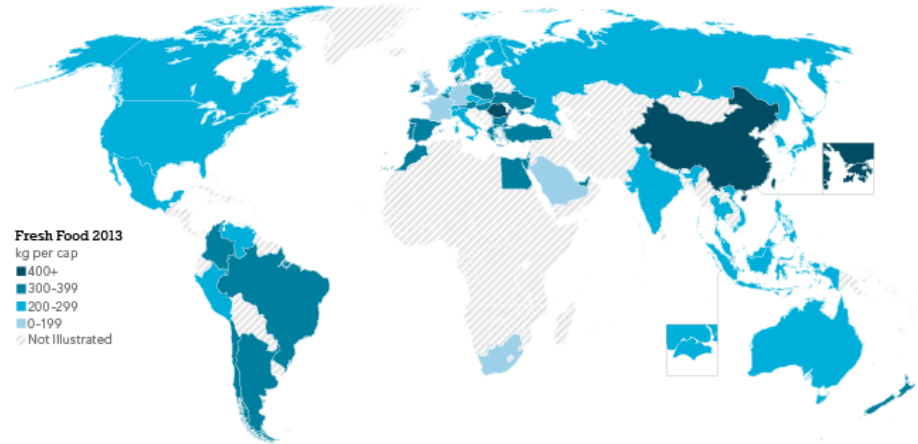


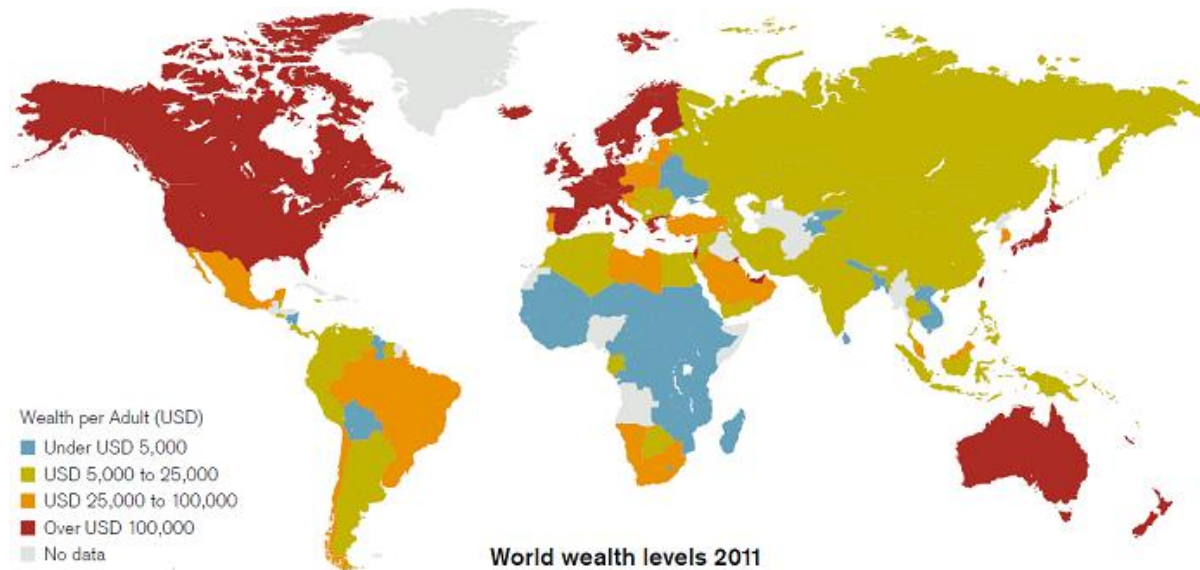
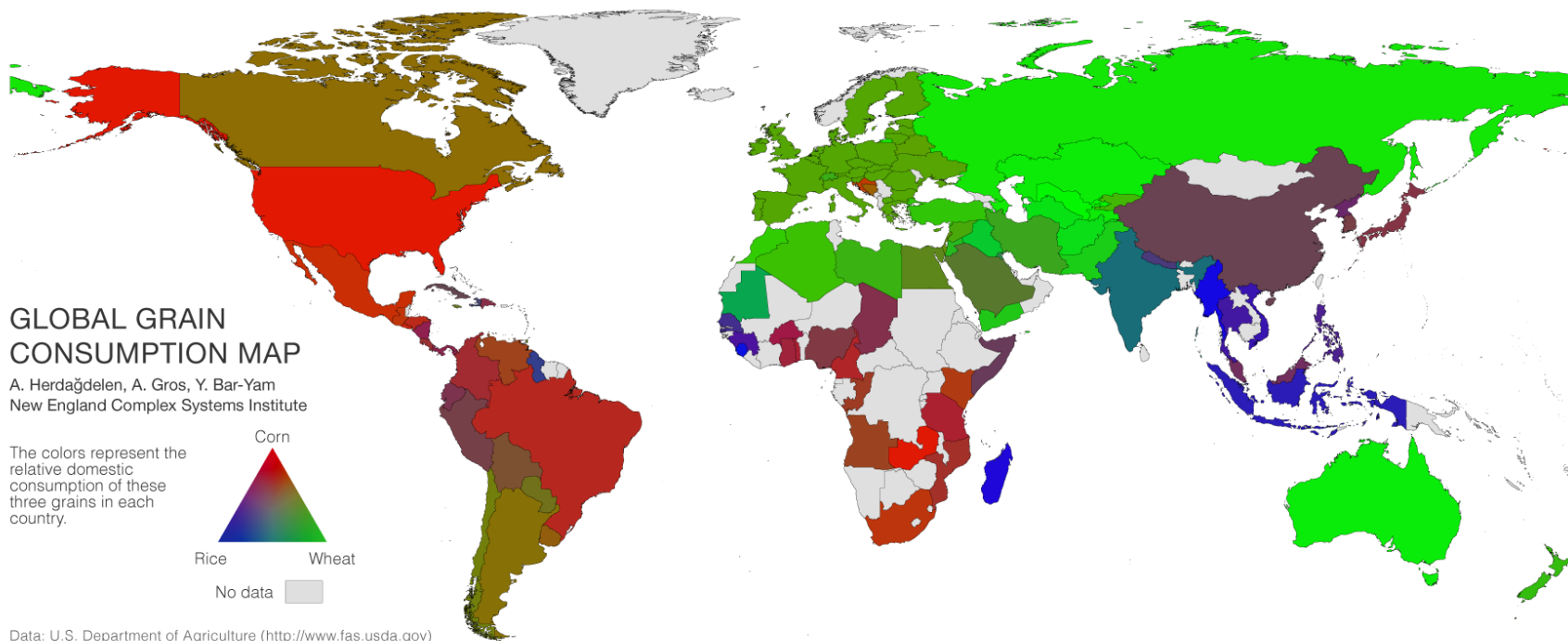
GLOBAL CALORIES PER CAPITA

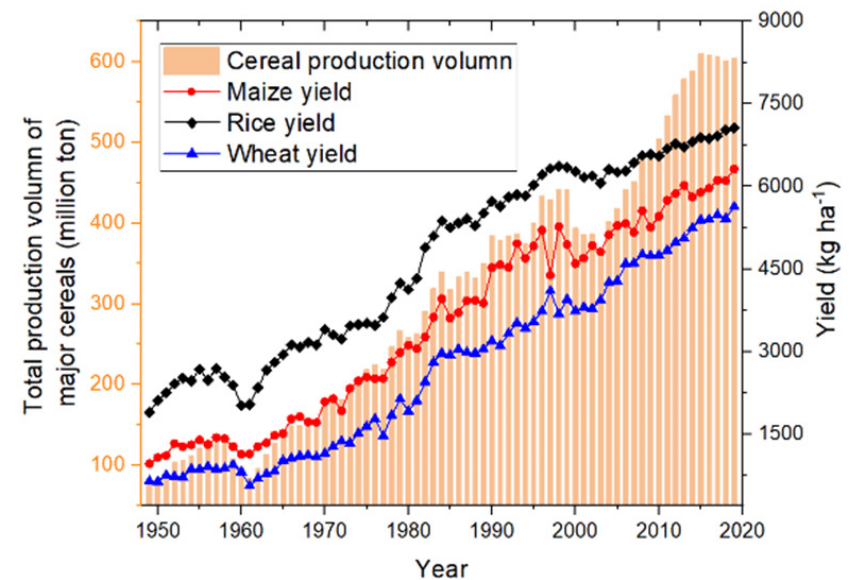
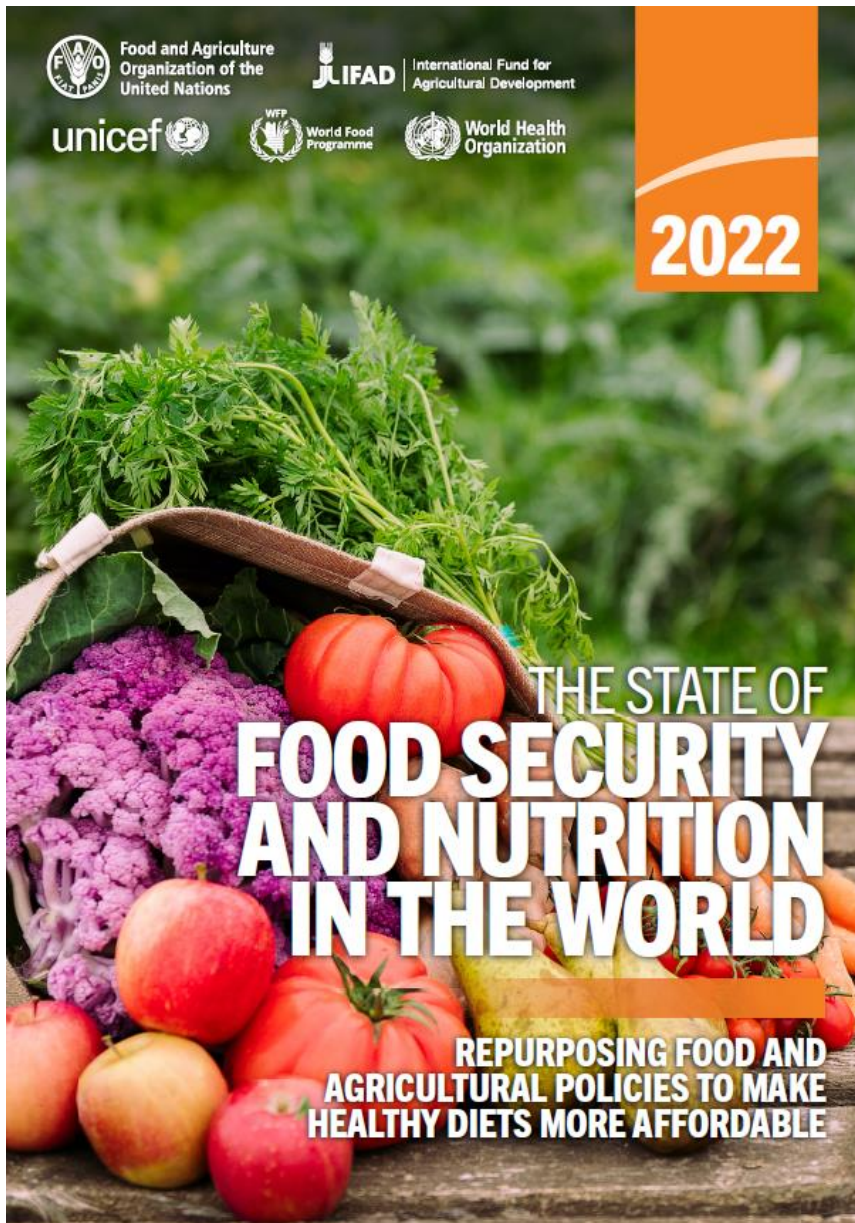


DATA GRAPHIC FRESH FOOD

Fresh Food Volume Consumption: 2013





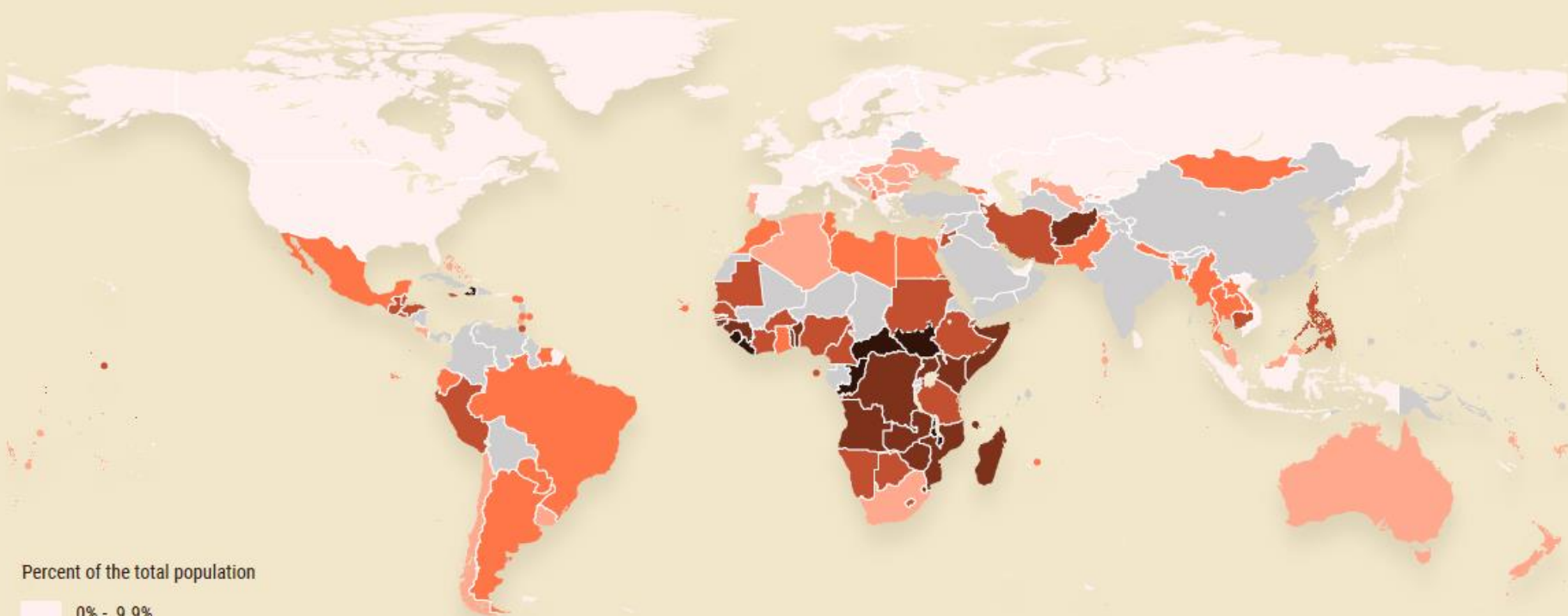




Food and Agriculture
Organization of the
United Nations

FAO FOOD INSECURITY MAP

Prevalence of Moderate or Severe Food Insecurity
SDG Indicator 2.1.2



Percent of the total population



Source: FAO, IFAD, UNICEF, WFP and WHO. 2022. *The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable*. Data are available on FAOSTAT (<https://www.fao.org/faostat/en/#data/FS>)

The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.



1927

2 Billion



1960

3 Billion



1987

5 Billion



1999

6 Billion



2011

7 Billion



GLOBAL FOOD PRODUCTION MUST INCREASE
70% BY 2050 TO MEET OUR NEEDS.



Annual Cereal production must rise by **42%**.

LAUNCH
FULL

infographic >

A LARGE QUANTITY OF IS WASTED



\$31 billion
worth of food is
wasted in Canada
each year.



Food waste in Canada is equal to



1,200 sandwiches
per person a year.

Food waste in the University's
main dining hall is equal to



1,735 food servings
per day.

over **30%**
of North America's fruits
and vegetables are rejected
by supermarkets because
they aren't attractive
enough for consumers.



LOVE FOOD.
NOT WASTE.



Services Alimentaires
Food Services

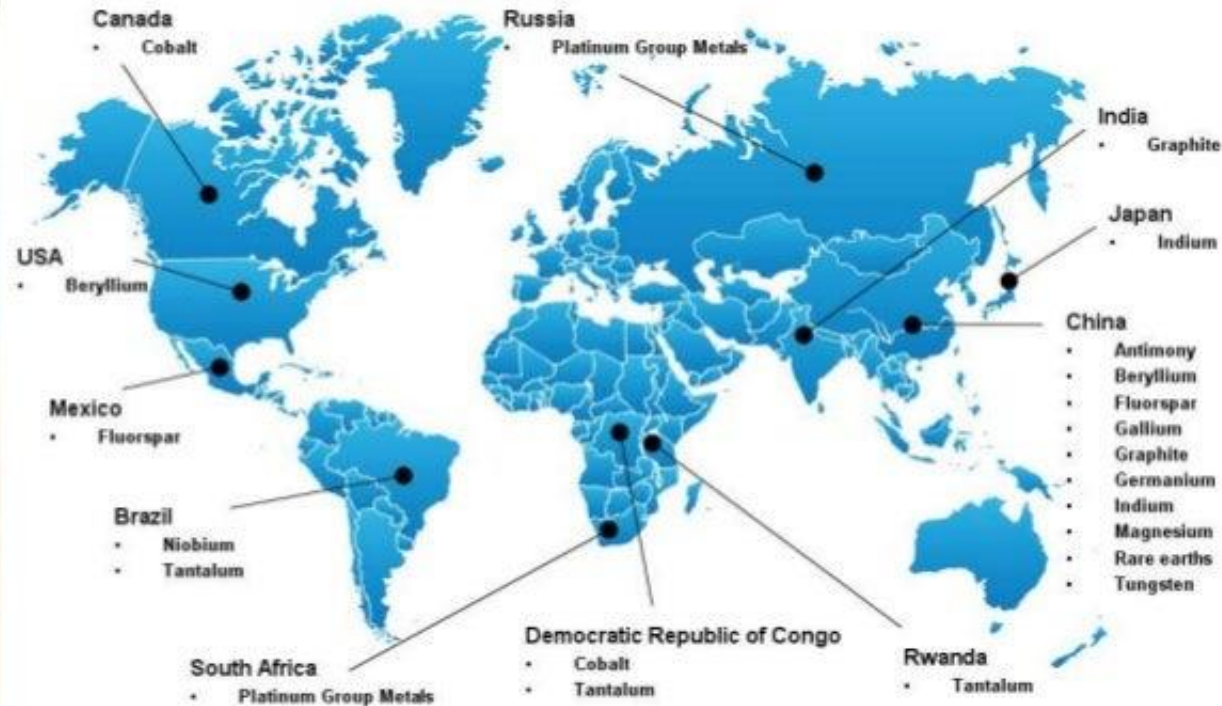
BUREAU DU
DÉVELOPPEMENT
DURABLE



OFFICE OF
CAMPUS
SUSTAINABILITY

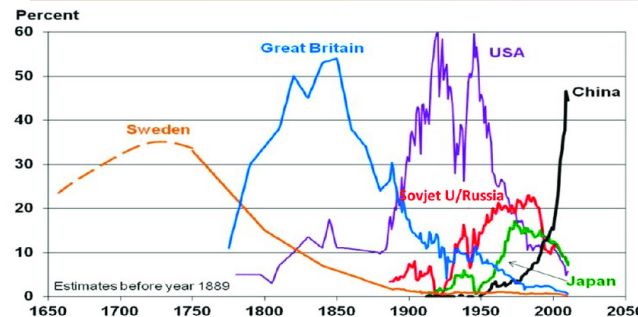
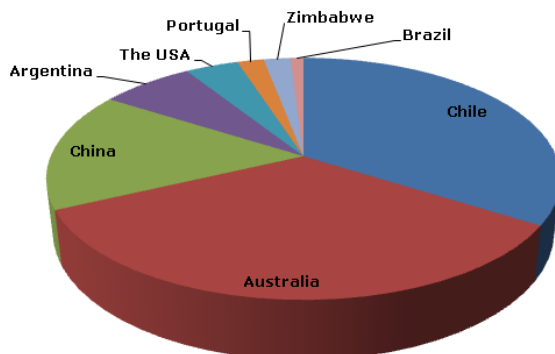
EU Critical Raw Materials Initiative

Production concentration of critical raw mineral materials



LITHIUM

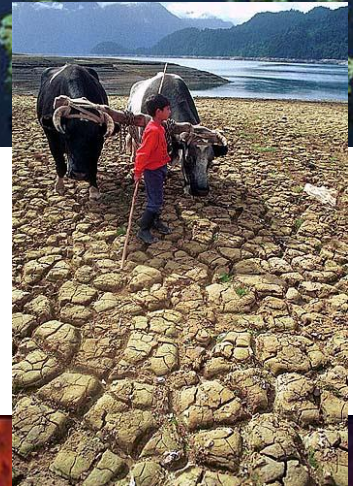
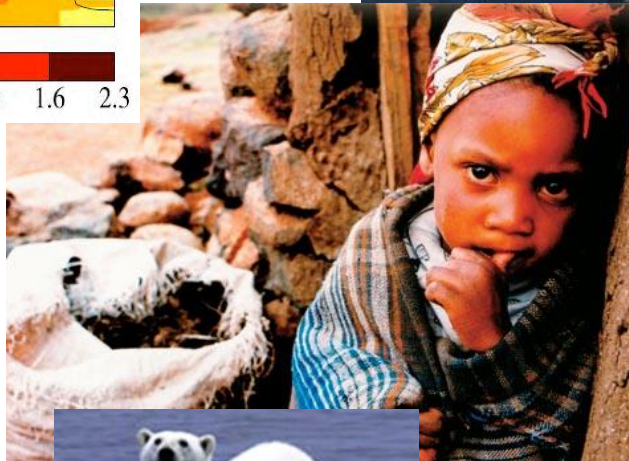
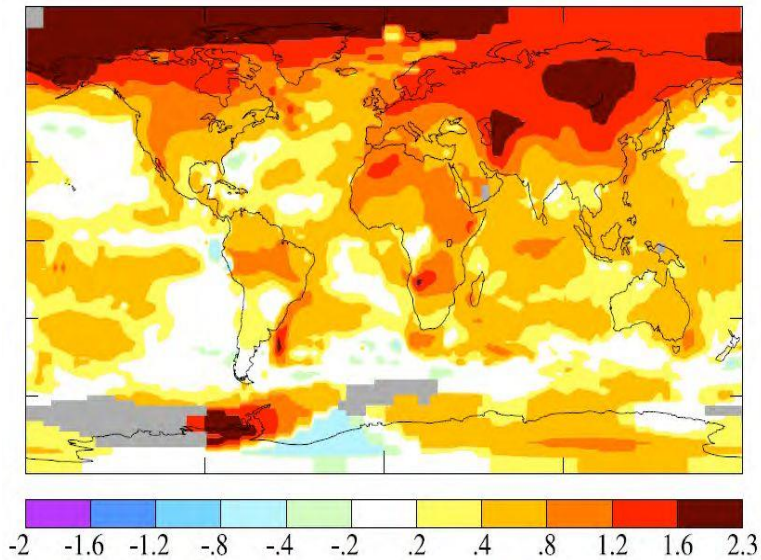
Source: EU Raw Materials Initiative



OAKDENE HOLLINS
RESEARCH & CONSULTING

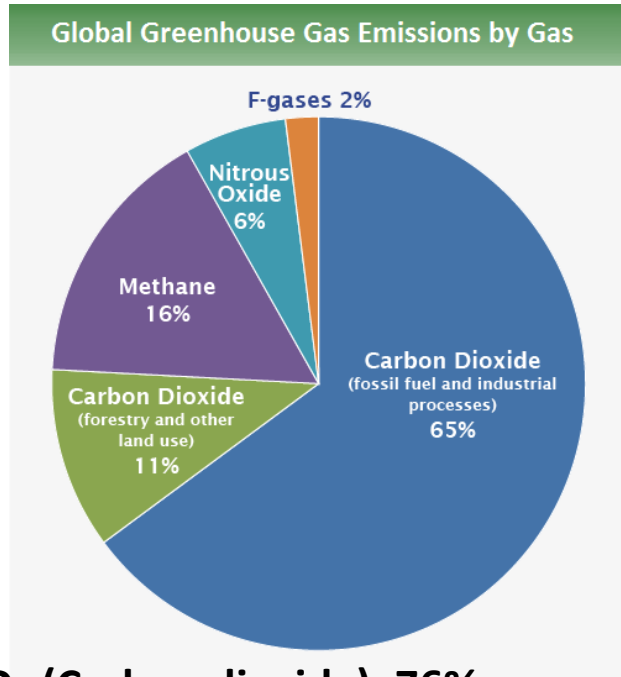
Steel production

CLIMATE CHANGE AND CLIMATIC EMERGENCY



CLIMATE CHANGE: SOURCES AND SINKS

SOURCES



CO₂ (Carbon dioxide): 76%

Fossil carbon (transport, industry, electricity)

CH₄ (Methane): 16%

Animal husbandry (excrements)

Agriculture (rice fields),

Biomass combustion

N₂O (Nitrous oxide): 6%

Chemical Industry, Transport

HFCs, PFCs, SF₆ = 2%

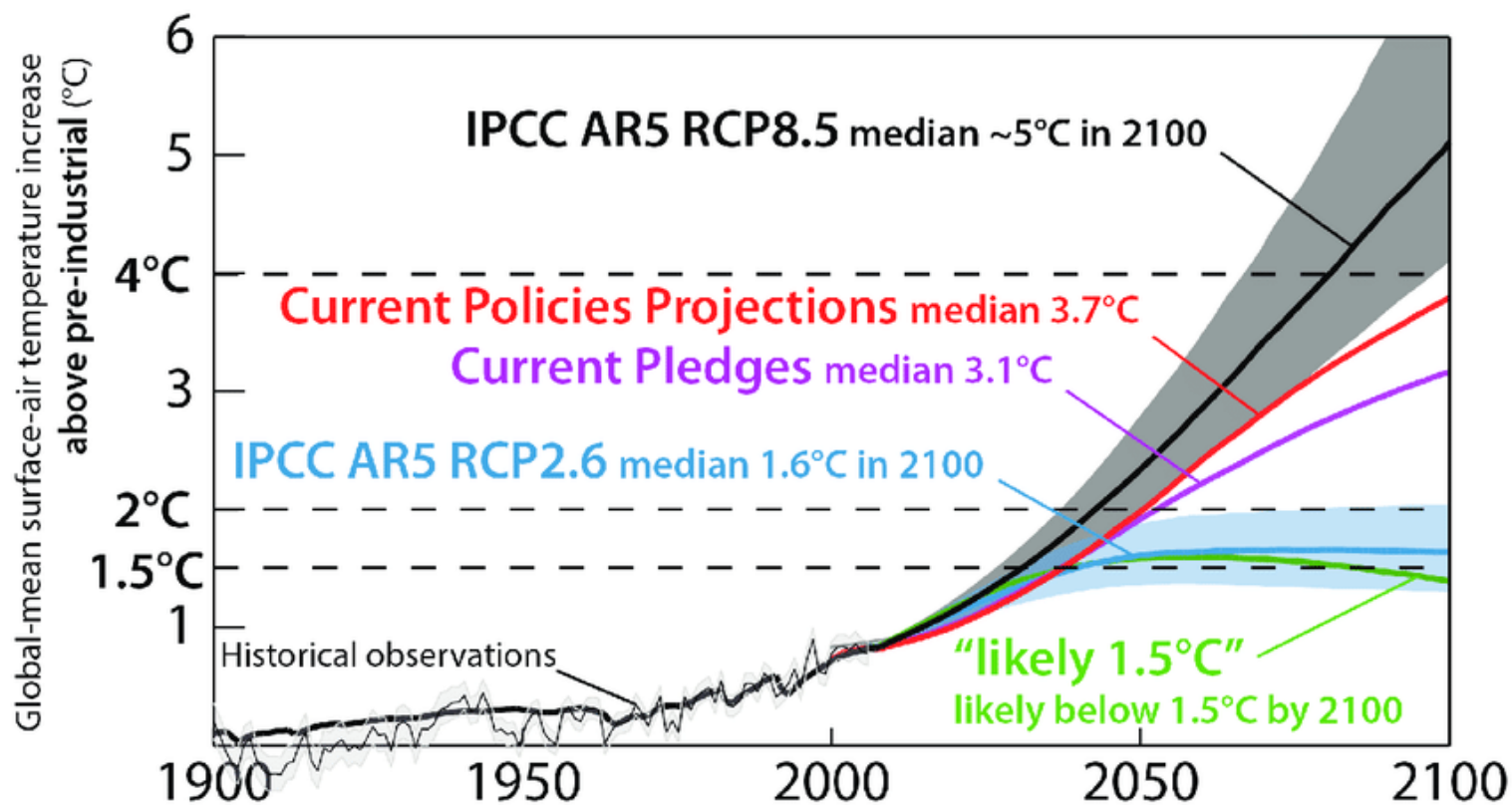
refrigerants, aerosols, synthetic foam, insecticides

CONTINENTS: PLANTS AND SOIL

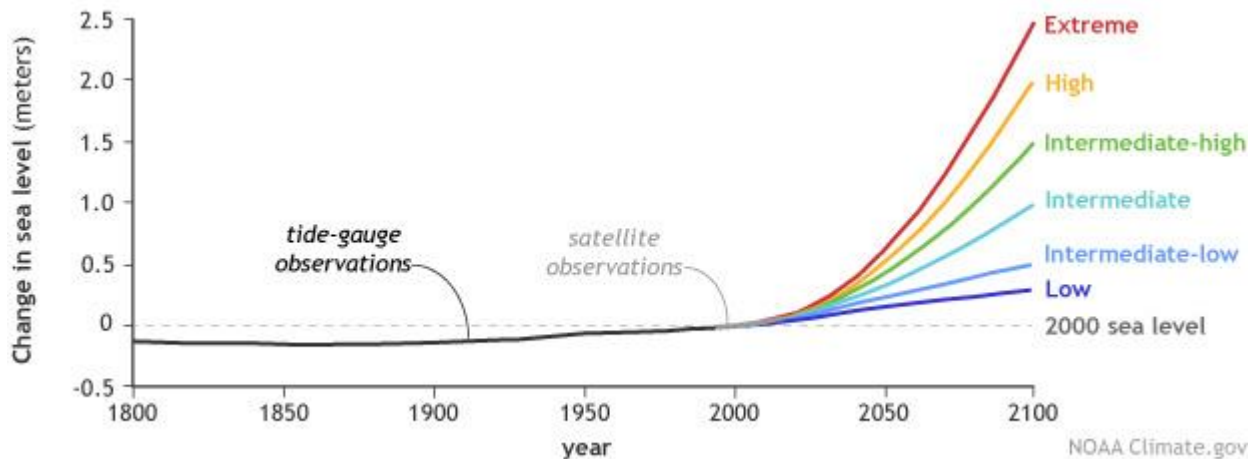


OCEANS: ALGES, MARINE PLANTS AND SEDIMENTS





Possible future sea levels for different greenhouse gas pathways

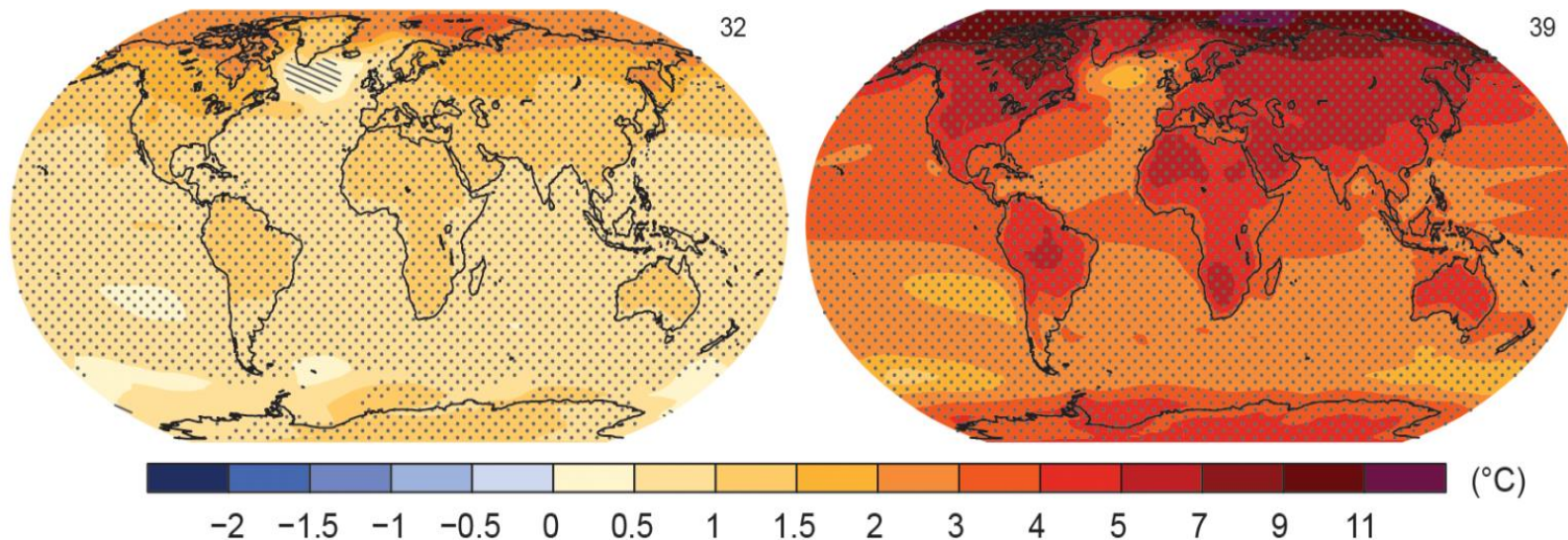


RCP 2.6

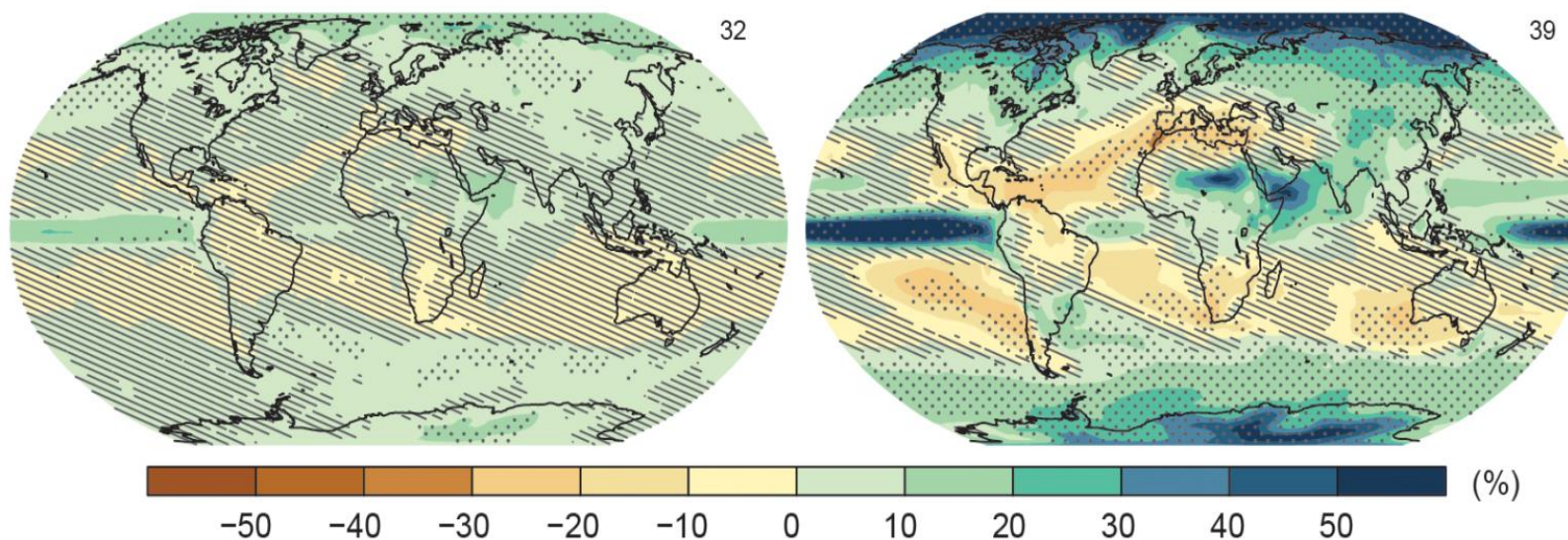
RCP 8.5

All Figures © IPCC 2013

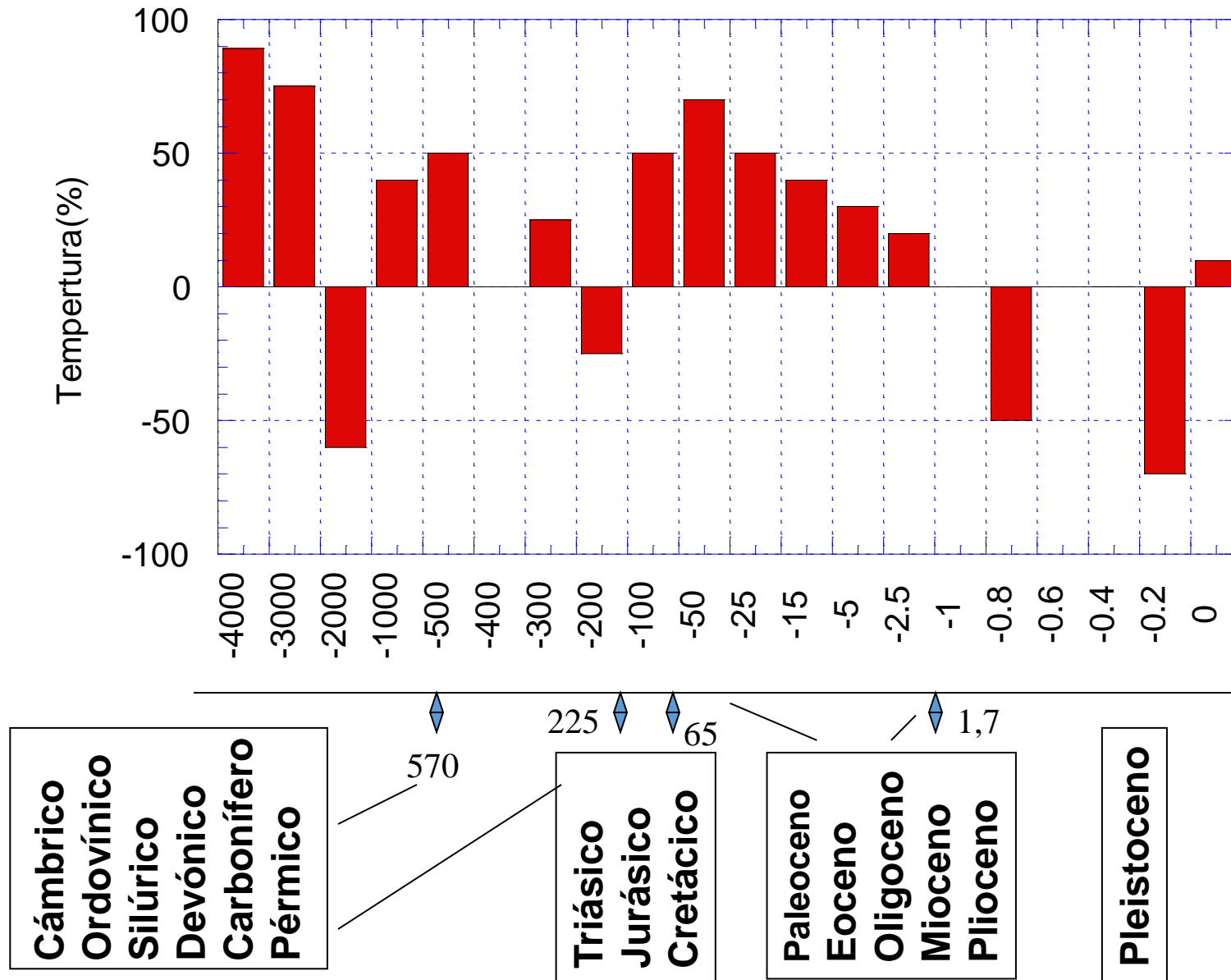
(a) Change in average surface temperature (1986–2005 to 2081–2100)



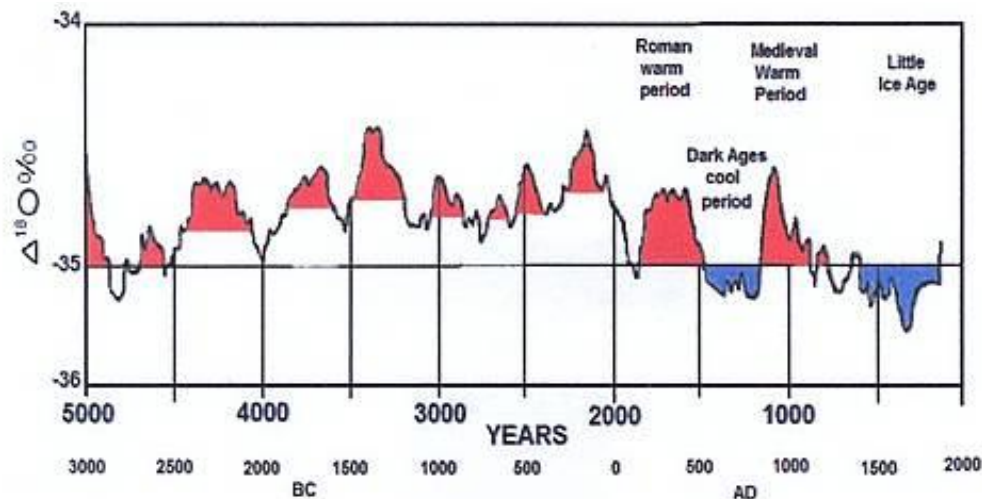
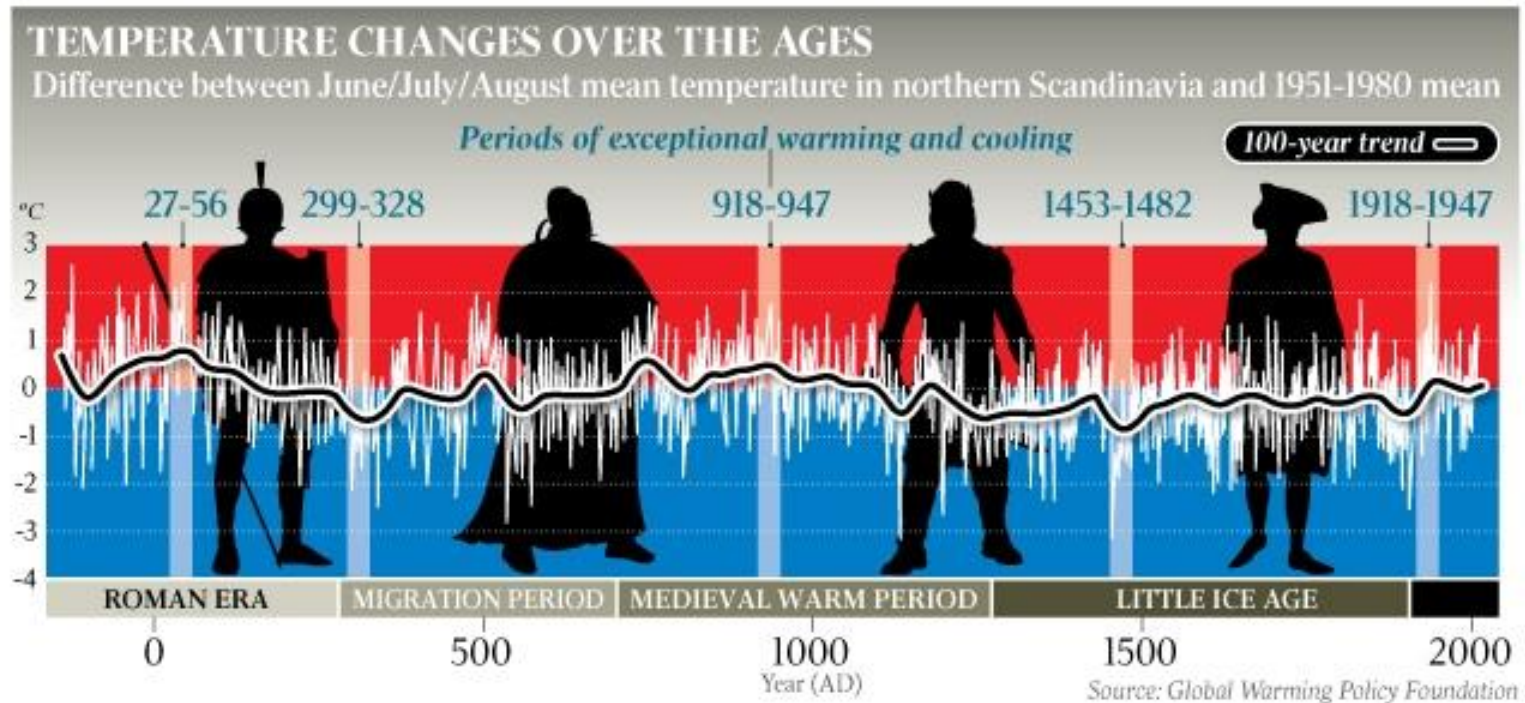
(b) Change in average precipitation (1986–2005 to 2081–2100)



CLIMATE VARIATIONS AT GEOLOGICAL SCALE



CLIMATE CHANGE AND CIVILIZATIONS



El niño/la niña

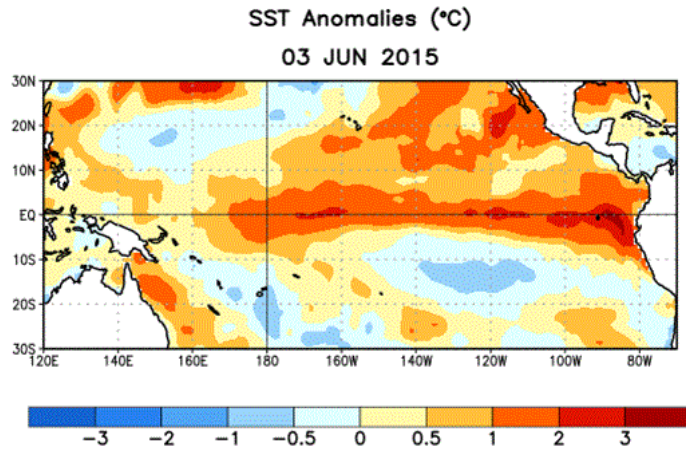
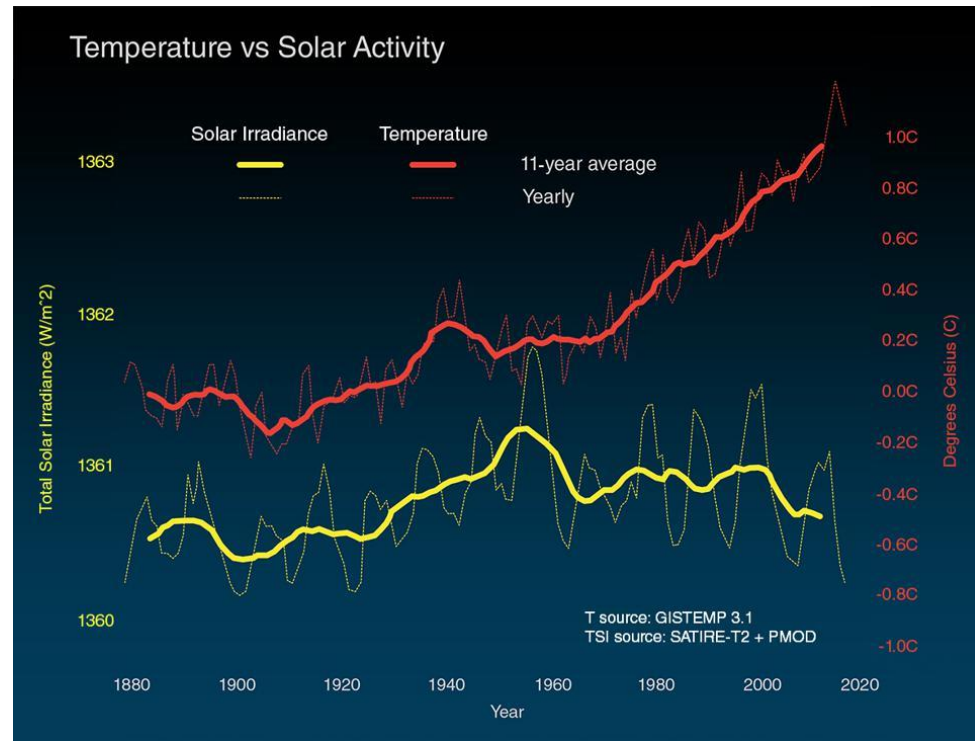
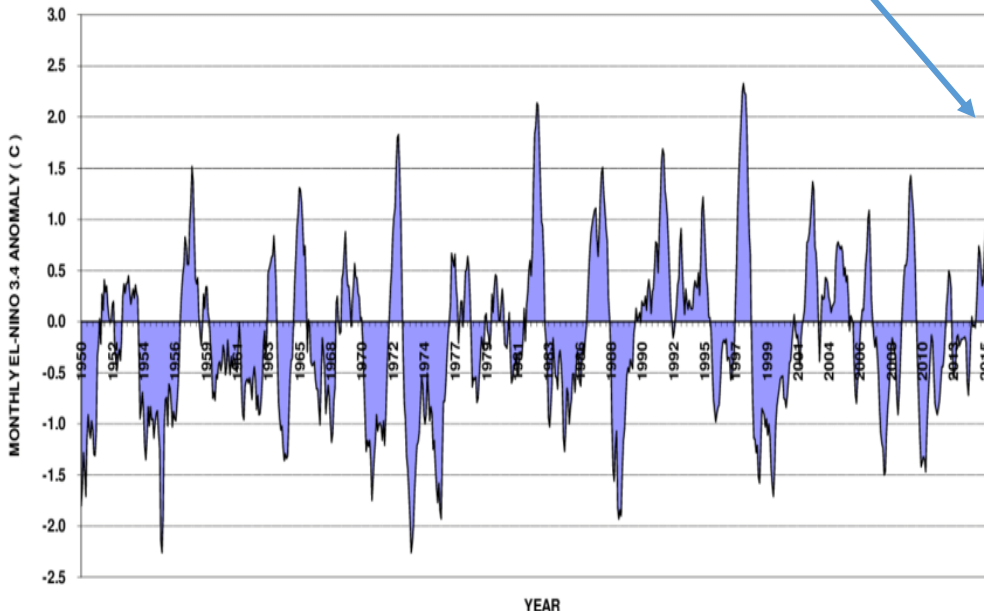


Figure 1. Average sea surface temperature (SST) anomalies (°C) for the week centered on 3 June 2015. Anomalies are computed with respect to the 1981-2010 base period weekly means.

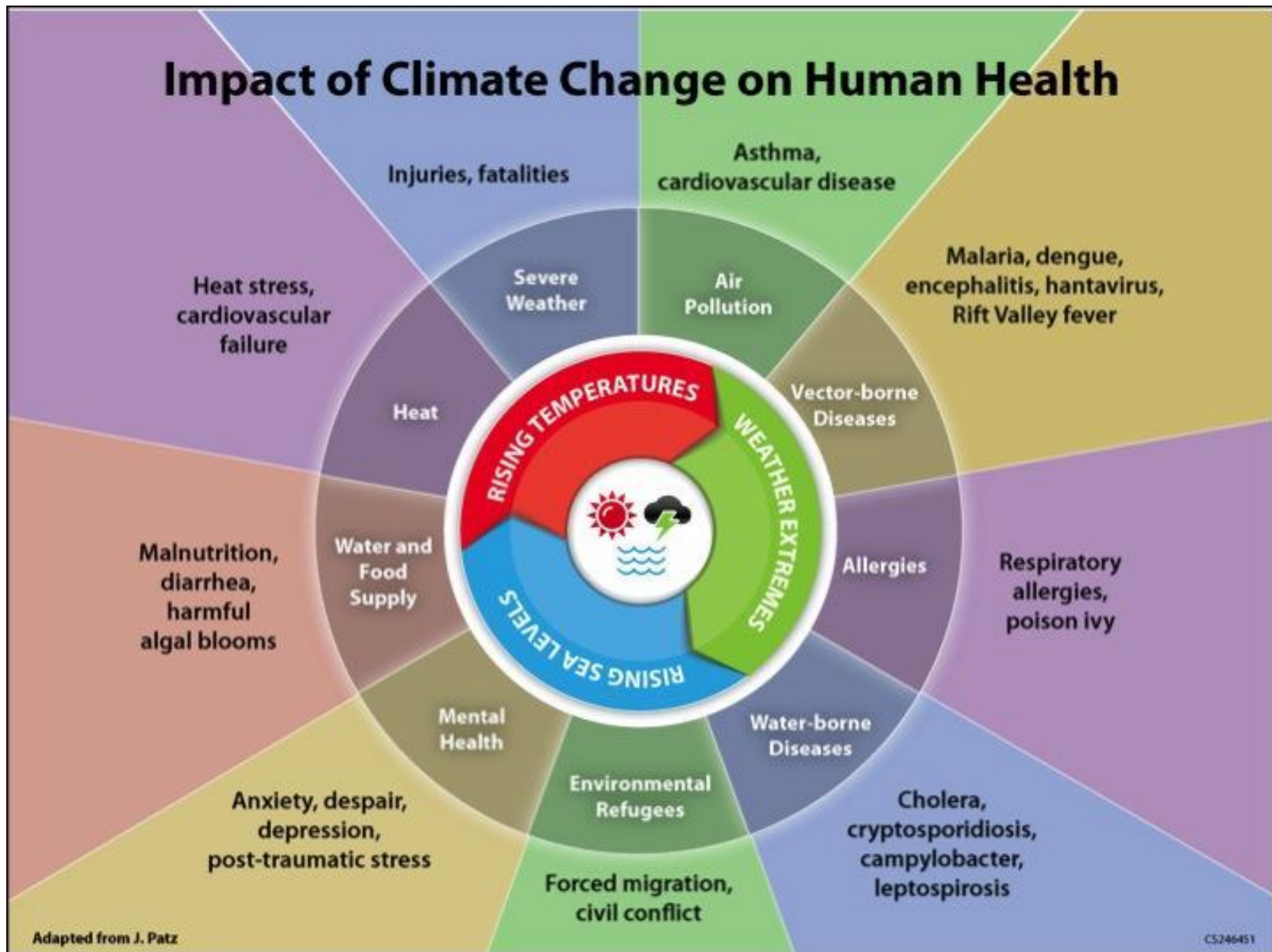


El niño/La niña (1950-2015)



The increase of temperature is not related to natural temperature variations due to solar activity

Impact of Climate Change on Human Health



WHAT CAN WE DO?

FROM GLOBAL TO LOCAL ACTIONS

THE GLOBAL GOALS For Sustainable Development



The Paris climate agreement: key points

The historic pact, approved by 195 countries, will take effect from 2020



Temperatures 2100



- Keep warming "well below 2 degrees Celsius". Continue all efforts to limit the rise in temperatures to 1.5 degrees Celsius

Finance 2020-2025



- Rich countries must provide 100 billion dollars from 2020, as a "floor"
- Amount to be updated by 2025

Differentiation



- Developed countries must continue to "take the lead" in the reduction of greenhouse gases
- Developing nations are encouraged to "enhance their efforts" and move over time to cuts

Emissions objectives 2050



- Aim for greenhouse gases emissions to peak "as soon as possible"
- From 2050: rapid reductions to achieve a balance between emissions from human activity and the amount that can be captured by "sinks"

Burden-sharing



- Developed countries must provide financial resources to help developing countries
- Other countries are invited to provide support on a voluntary basis

Review mechanism 2023



- A review every five years
First world review: 2023
- Each review will inform countries in "updating and enhancing" their pledges

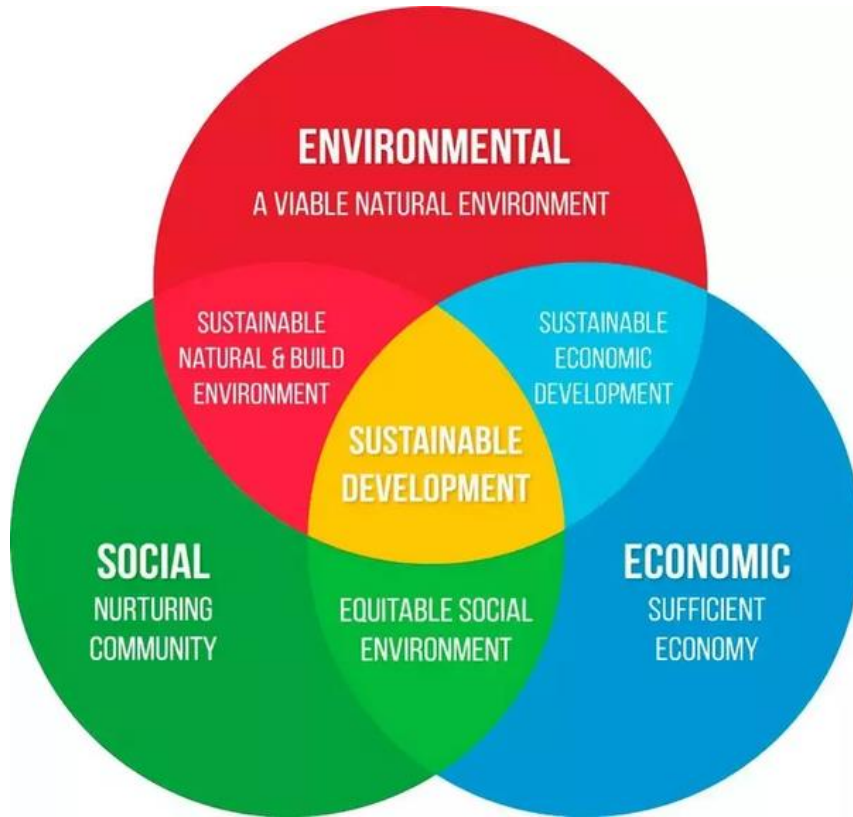
Climate damage



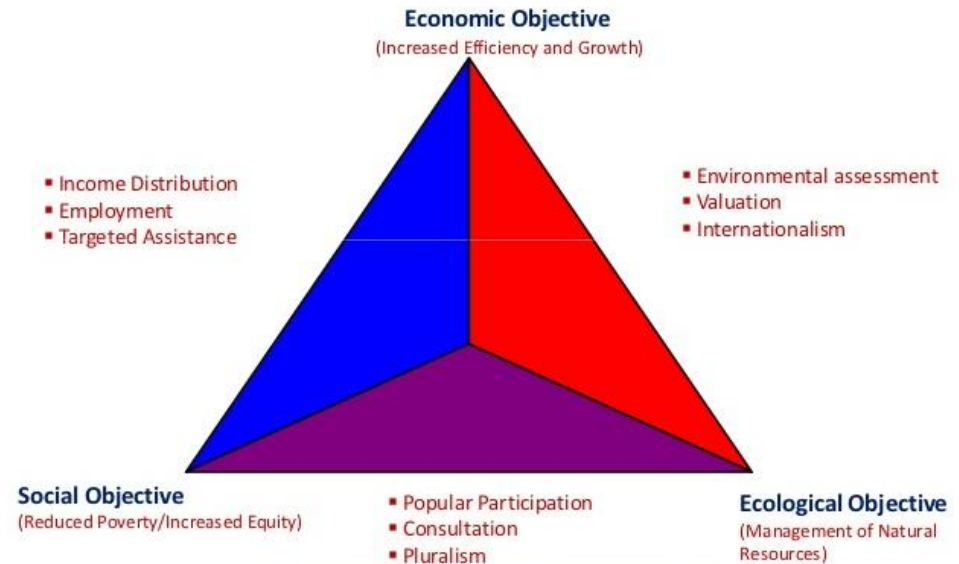
- Vulnerable countries have won recognition of the need for "averting, minimising and addressing" losses suffered due to climate change



SUSTAINABLE DEVELOPMENT

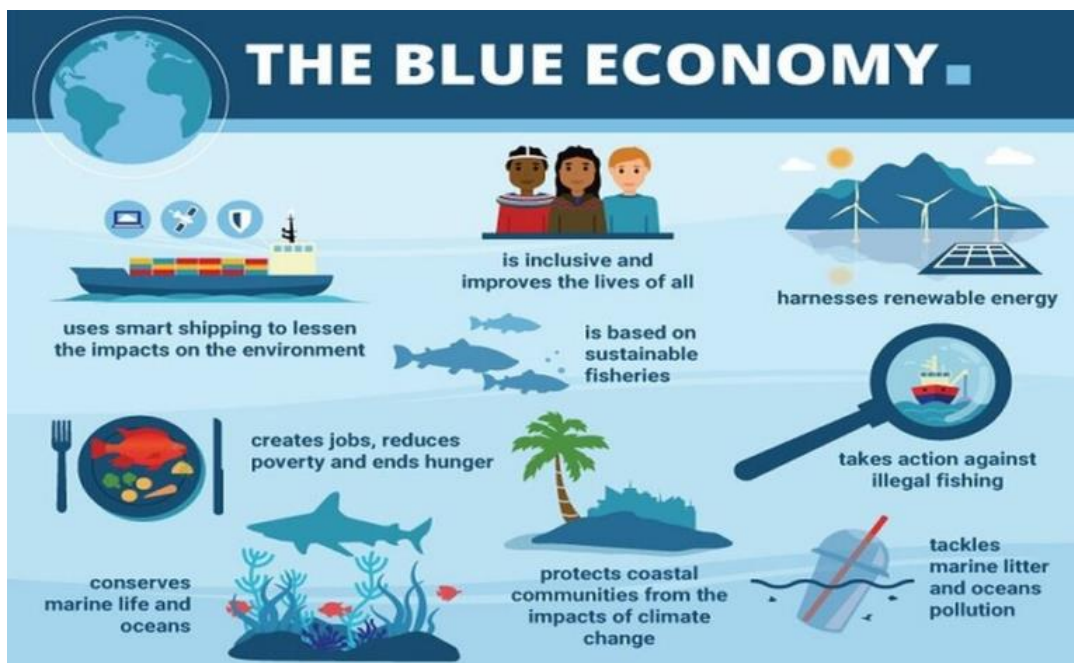
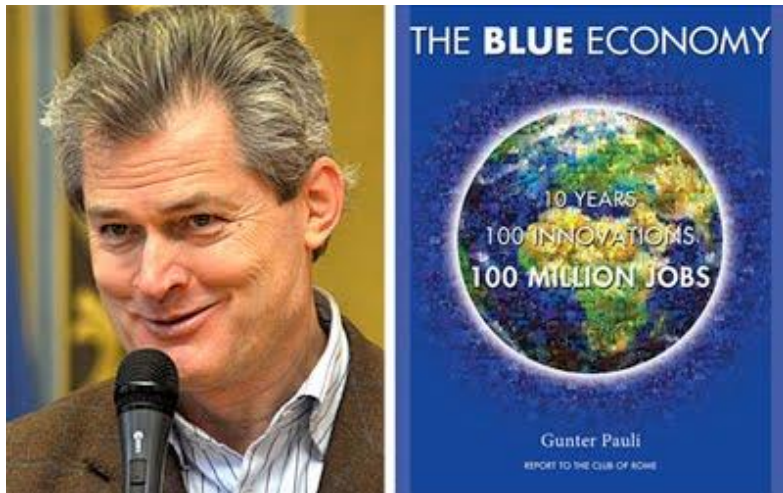


Objectives of Sustainable Development



Source : Mohan Munasinghe , World Bank Environmental Paper No.3 ,1993

FROM GREEN TO BLUE





Circular Economy Action Plan

The European
Green Deal



EU's #CircularEconomy Action plan



CIRCULAR ECONOMY



Image: Sustainable Global Resources Ltd.
Recycling Council of Ontario



3 BILLION TREES BY 2030

Under the European Green Deal, the EU Biodiversity Strategy commits to **plant at least 3 billion additional trees in the EU by 2030**. A roadmap in the EU Forest Strategy outlines how the Commission will facilitate the achievement of this pledge.

July 2021
#EUForests
#EUGreenDeal

TREE PLANTING SHOULD NOT BE SEEN AS AN ALTERNATIVE TO PRESERVING EXISTING TREES, WHICH REMAINS THE FIRST PRIORITY, BUT AS AN ADDITIONAL EFFORT TO INCREASE TREE COVER IN THE EU



THE NEW CIRCULAR ECONOMY ACTION PLAN

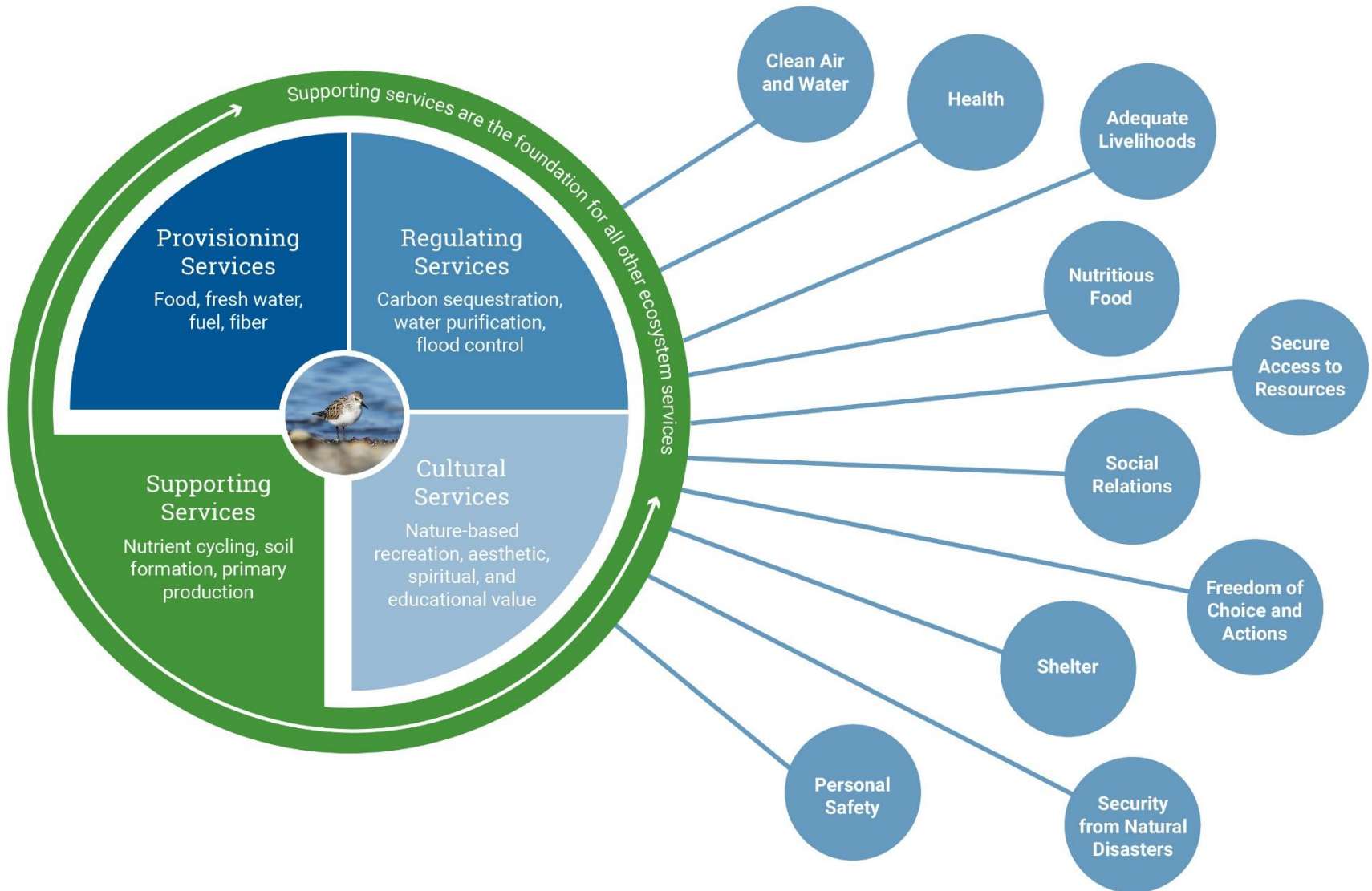


TO TAKE CARE ON THE ECOSYSTEMS SERVICES

ECOSYSTEM SERVICES



CONSTITUENTS OF HUMAN WELL-BEING



Refine



Refine

Expand reduction, reusable & recycling through changes in materials and design

Reduce

Develop design and manufacturing technology that generates less waste.

Reuse

Ruse the waste generated by the manufacturing process.

Recycle

Turn reprocessed waste into new products.

Recovery

Recover energy for other uses.

ENERGY: SAVE AND MORE EFFICIENT

Eolic

Hydroelectric

Solar -Thermic

Solar -Thermoelectric

Solar -Photovoltaic

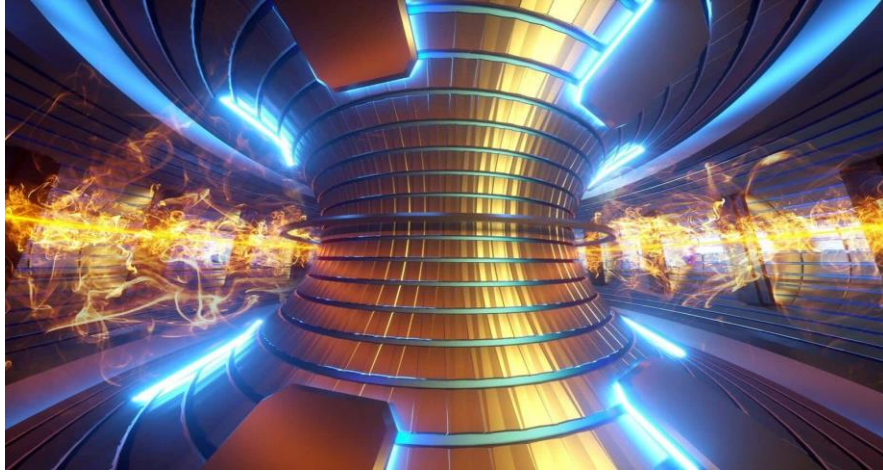
Biomass

Biogas

Biofuel



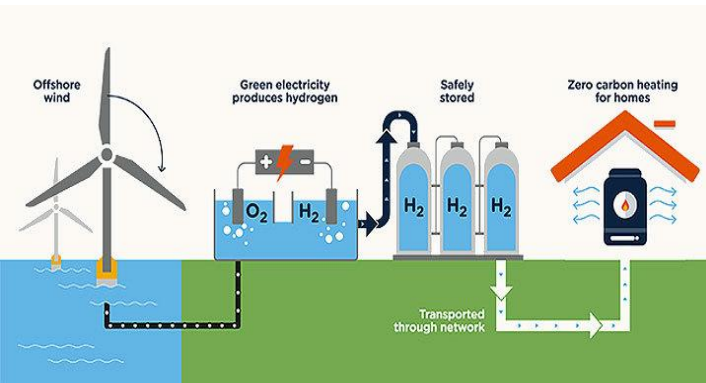
NUCLEAR FUSION



Nuclear fusion is a reaction in which **two or more atomic nuclei are combined to form one or more different atomic nuclei and subatomic particles (neutrons or protons)**. The difference in mass between the reactants and products is manifested as either the release or absorption of energy



GREEN HYDROGEN



Green hydrogen (GH₂ or GH₂) is **hydrogen generated by renewable energy or from low-carbon power**. Green hydrogen has significantly lower carbon emissions than grey hydrogen, which is produced by steam reforming of natural gas, which makes up the bulk of the hydrogen market.



Save energy and money

SOURCE: ENERGY SAVING TRUST

£ Typical Annual Saving

Spend a minute less in the shower every day

£7

Switch to a water efficient shower head

£70



Switch appliances off rather than leave them on standby

£30



Use LED lighting

£35



Turn off lights when not in use

£15



Use a bowl to do the washing up, don't leave the tap running

£25



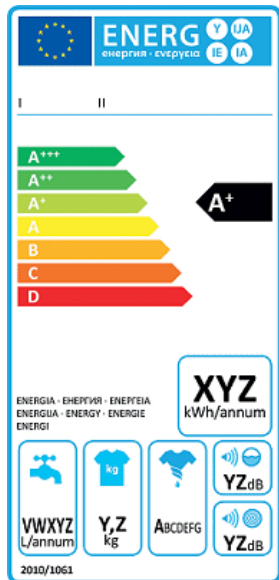
Only fill kettle up to what you need

£7

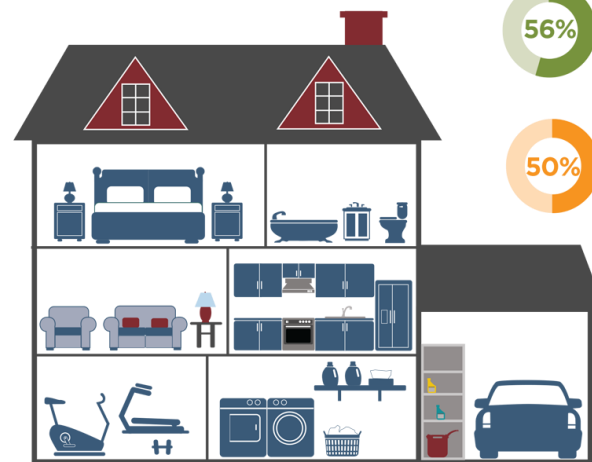


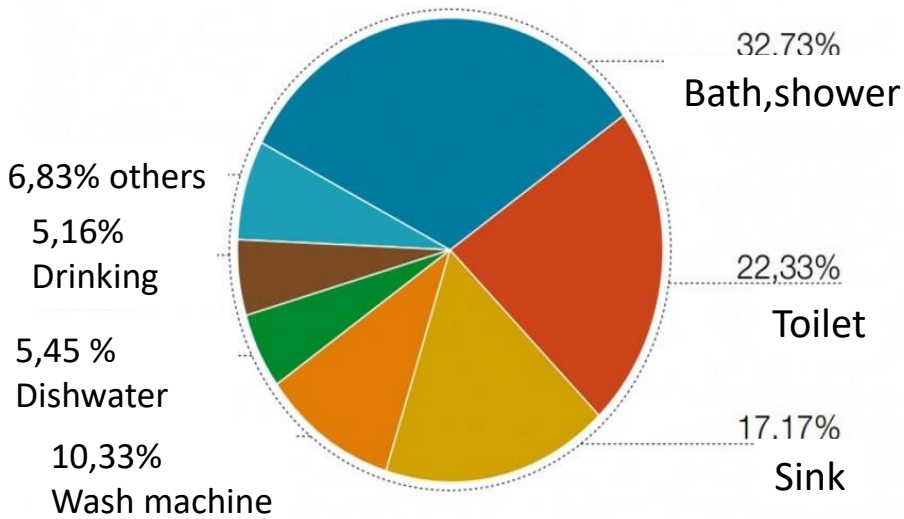
DOMESTIC

SAVE ENERGY EFFICIENCY



Of those planning to remodel, here are the room(s) they plan to tackle (respondents could select more than one):

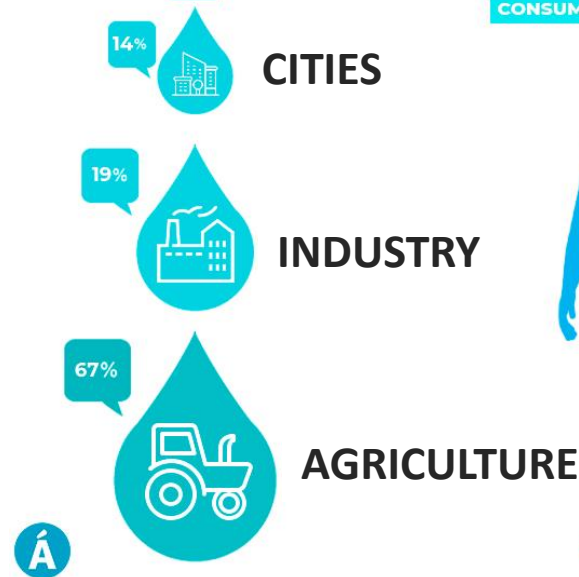




OMS considers that the proper water consumption per capita including drinking , cooking , cleaning etc has to be 50 l/capita. To this amount we need to add the water used in the agriculture, industry and conservation of freshwater : minimal daily amount of 100 L/capita (In Spain was 133 L/capita in 2020)



WATER CONSUMPTION IN SPAIN



CONSUMO MEDIO



PROCEDENCIA



CONSUMO POR COMUNIDAD

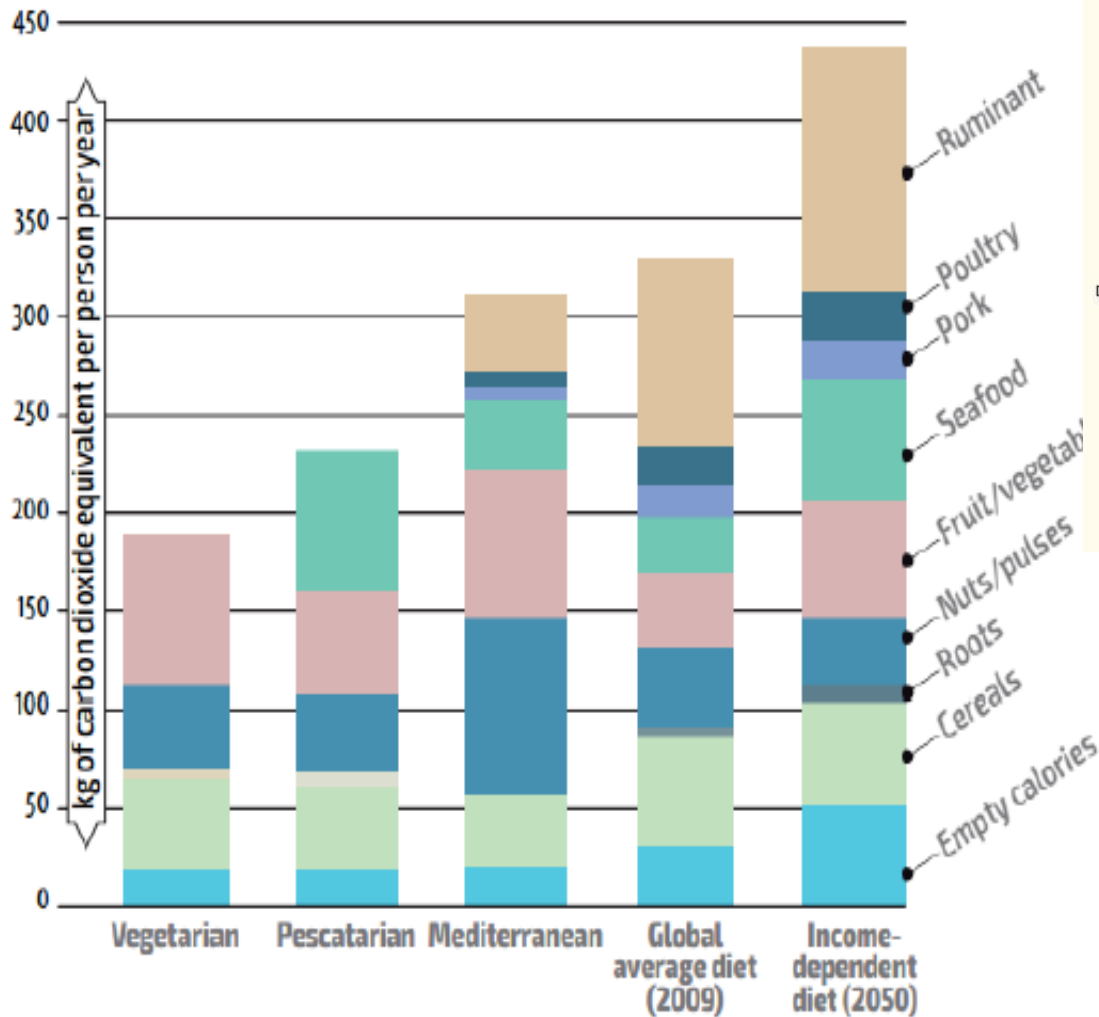


BIOCLIMATIC ARQUITECTURE

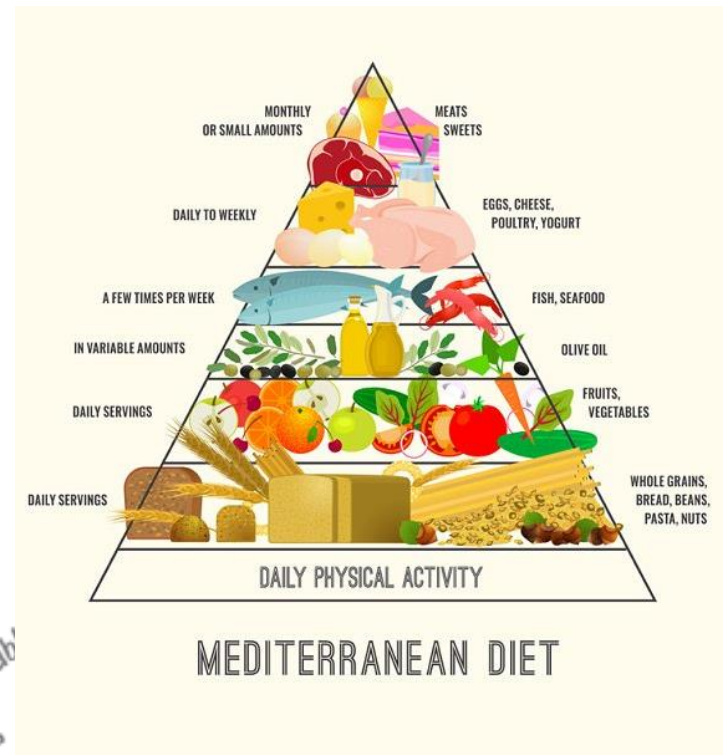


FOOD

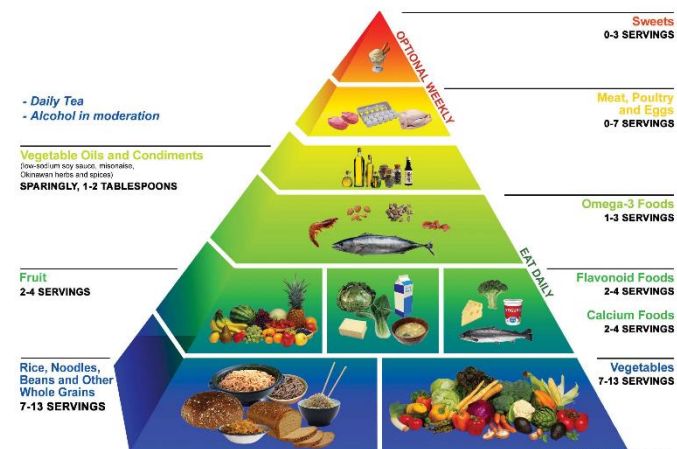
Figure 9.3 Greenhouse gas emissions by diet type



Source: IFPRI, 2015.

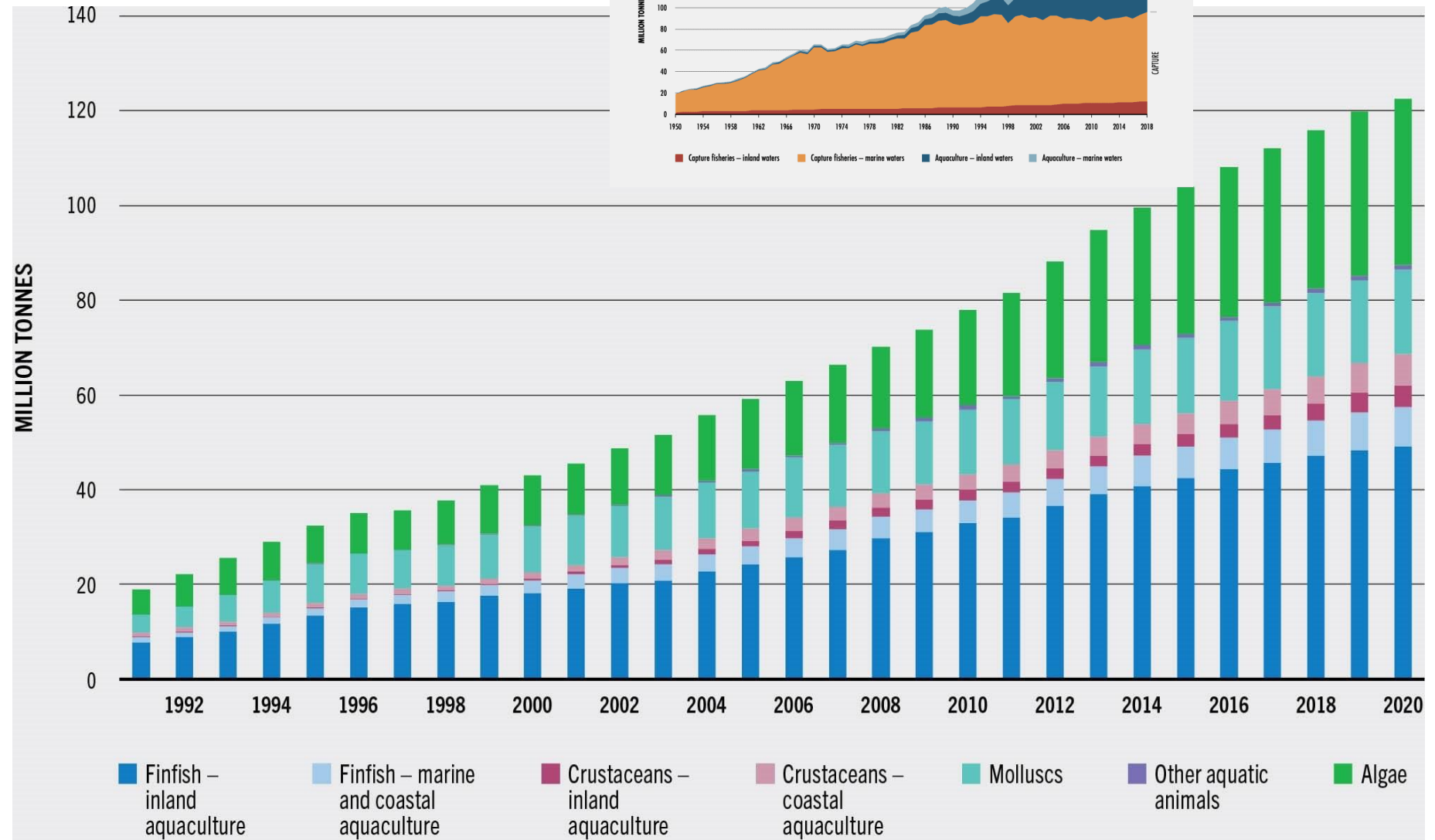
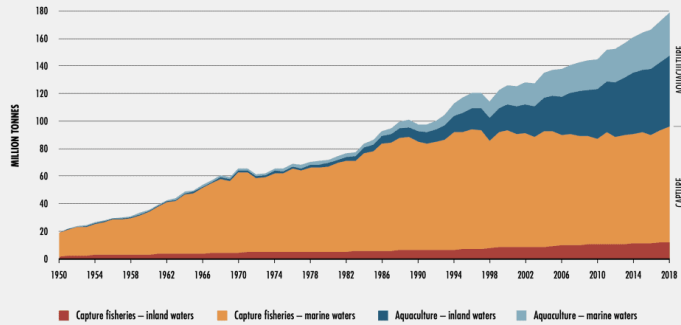


The Okinawa Diet™ Food Pyramid
A Guide to Daily Food Choices



AQUACULTURE

FIGURE 1
WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION





Food and Agriculture
Organization of the
United Nations

Those Curious AND DELICIOUS *Seaweeds*

A FASCINATING VOYAGE FROM
BIOLOGY TO GASTRONOMY

José Lucas Pérez Lloréns
Ignacio Hernández Carrero
Juan José Vergara Oñate
Fernando G. Brun Murillo
Ángel León

With the collaboration of
some of the best-known and
avant-garde chefs in Spain

Editorial UCA

PROMOTION OF ALGAE CONSUMPTION AROUND THE WORLD



INSECTS FOR FOOD AND FEED





UNIVERSIDAD
DE MÁLAGA



Agente Andaluz del
Conocimiento
(AAC)-21.12.2021

CENTRO EXPERIMENTAL GRICE HUTCHINSON



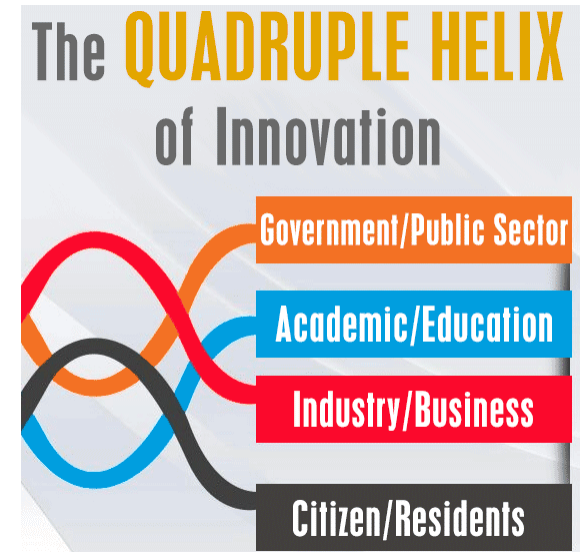
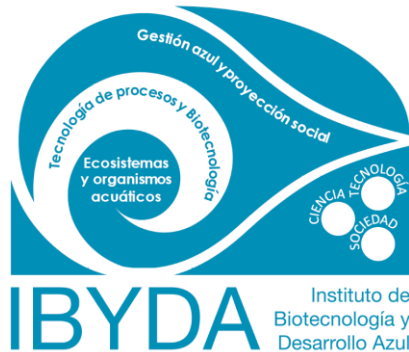
1. Teaching, Research, Transference and Dissemination to the society on Blue Biotechnology and Development.
2. Promote the entrepreneurship of blue development projects.
3. Offer aquaculture infrastructures and services, including the socio-economic analysis of projects, and the modeling of different scenarios and their application to the management and planning of the territory.

TRANSDISCIPLINARY APPROACH

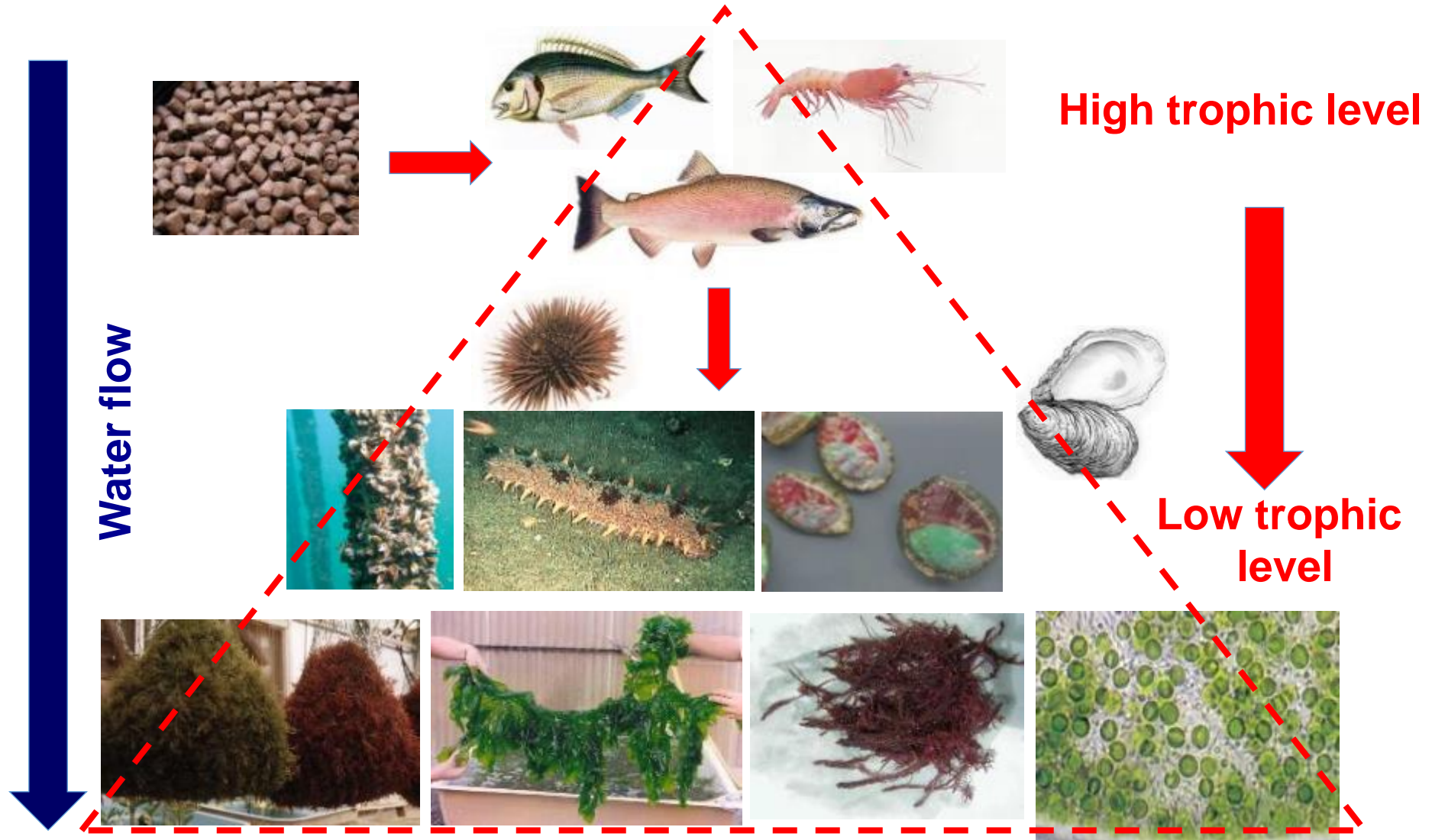
**Unit 1: Ecosystems and aquatic organisms
(ECO A)**

**Unit 2: Technology of Processes and
Biotechnology (BIOTEC)**

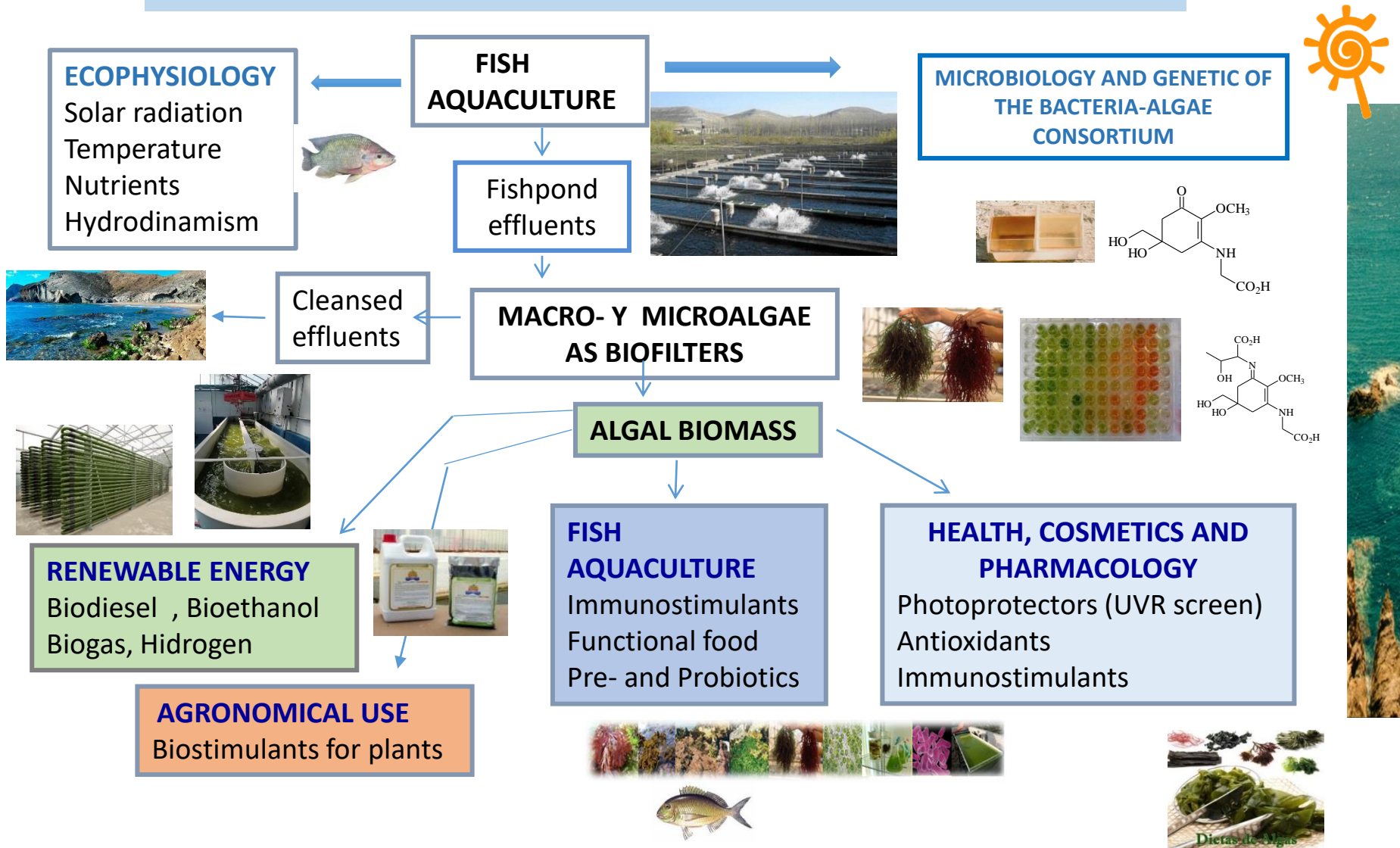
**Unit 3: Blue Management and social projection
(GESPRO)**



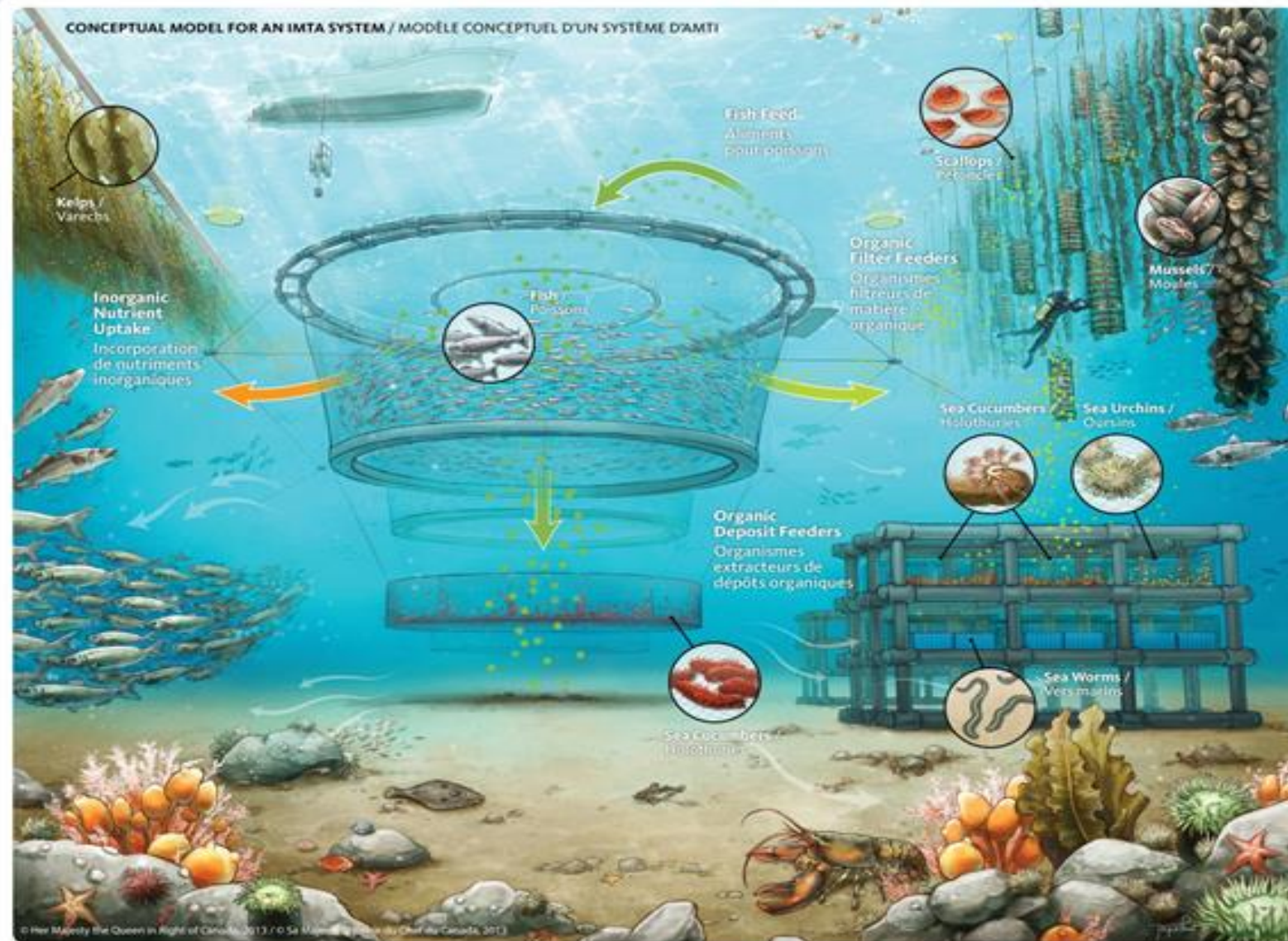
Integrated multitrophic aquaculture (IMTA)



IMTA SYSTEMS TO PRODUCE BIOMASS -BIOACTIVE COMPOUNDS



Integrated Multi-Trophic Aquaculture (IMTA) - Aquaculture multi-trophique intégrée (AMTI)

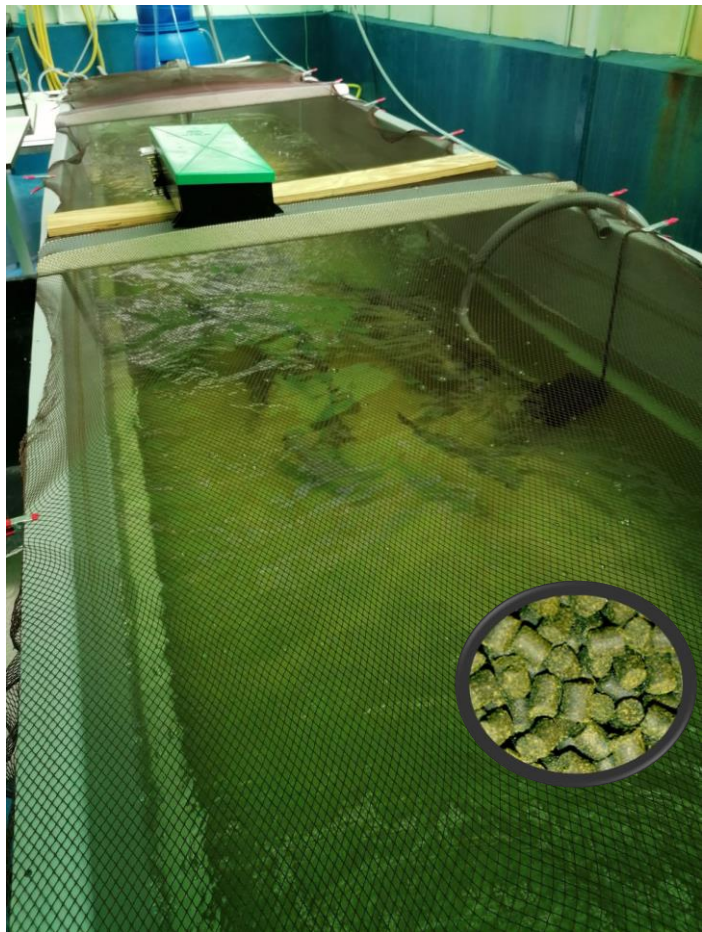


ACUAPONCIS AND ALGAL CULTURE

- Invernadero modelo P-8x5-SC de 336,7 m²
- Umbráculo de retícula plana modelo T-4x4 de 170 m².

Superficie total cubierta 505 m².



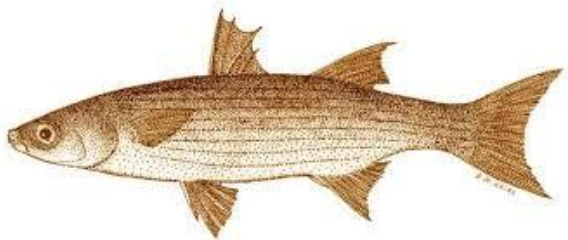


AQUAPONIC EXPERIMENTS

Dietary replacement of fish meal by microalgae *Chlorella fusca* at 15% inclusion rate in juvenile thick-lipped grey mullet (*Chelon labrosus*) during 90 days trial



Ulva production in Raceways



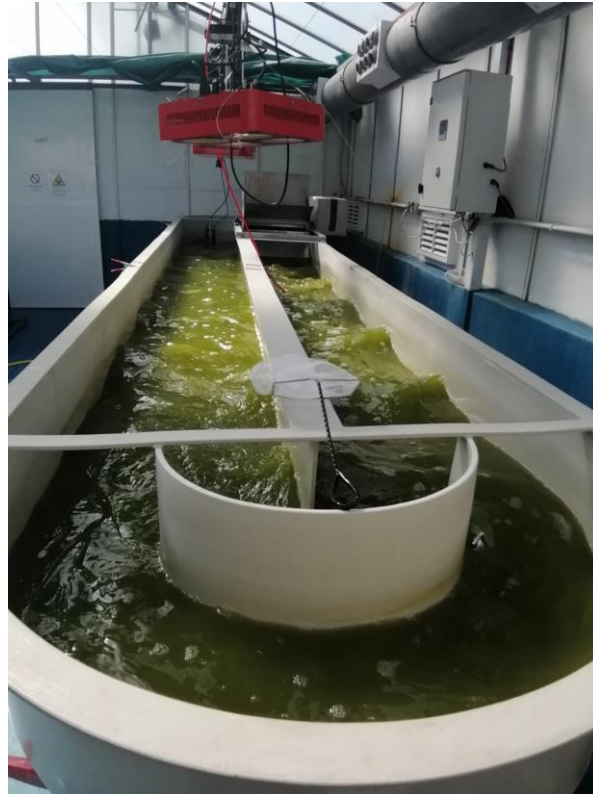
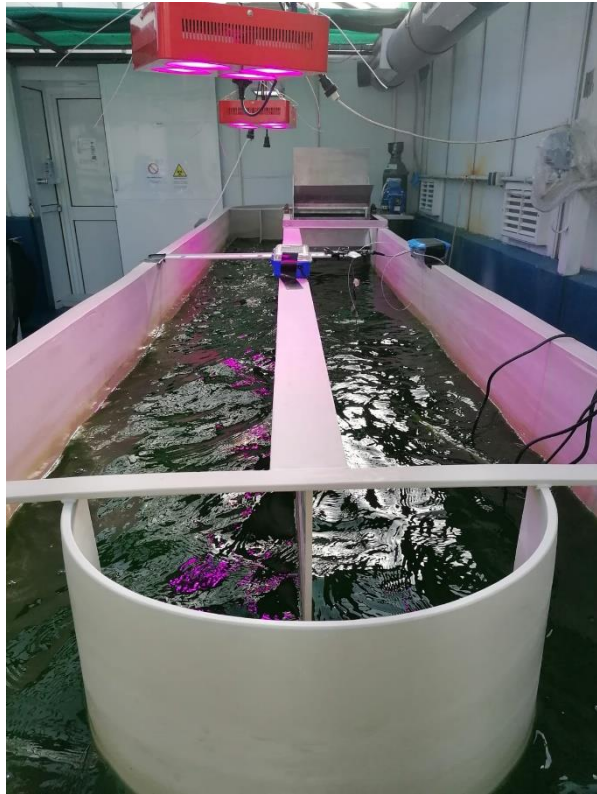
Grey Mullet (*Chelon labrosus*)



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Culture of *Euglena sp.* Production of carotenoids

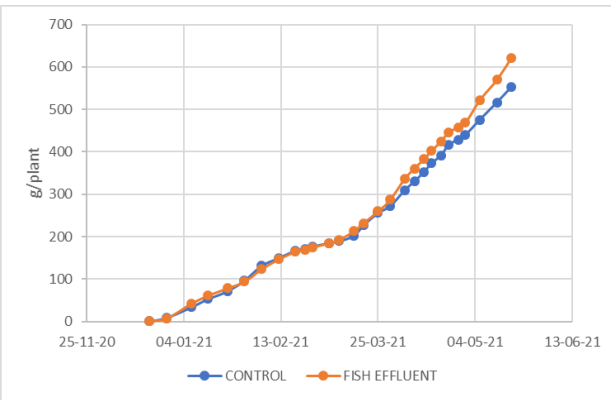


STRAWBERRY PRODUCTION IN AQUAPONICS SYSTEMS

SYSTEM #1 (CONTROL.FERTILZERS))



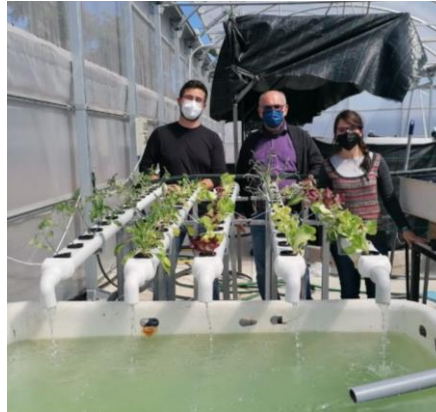
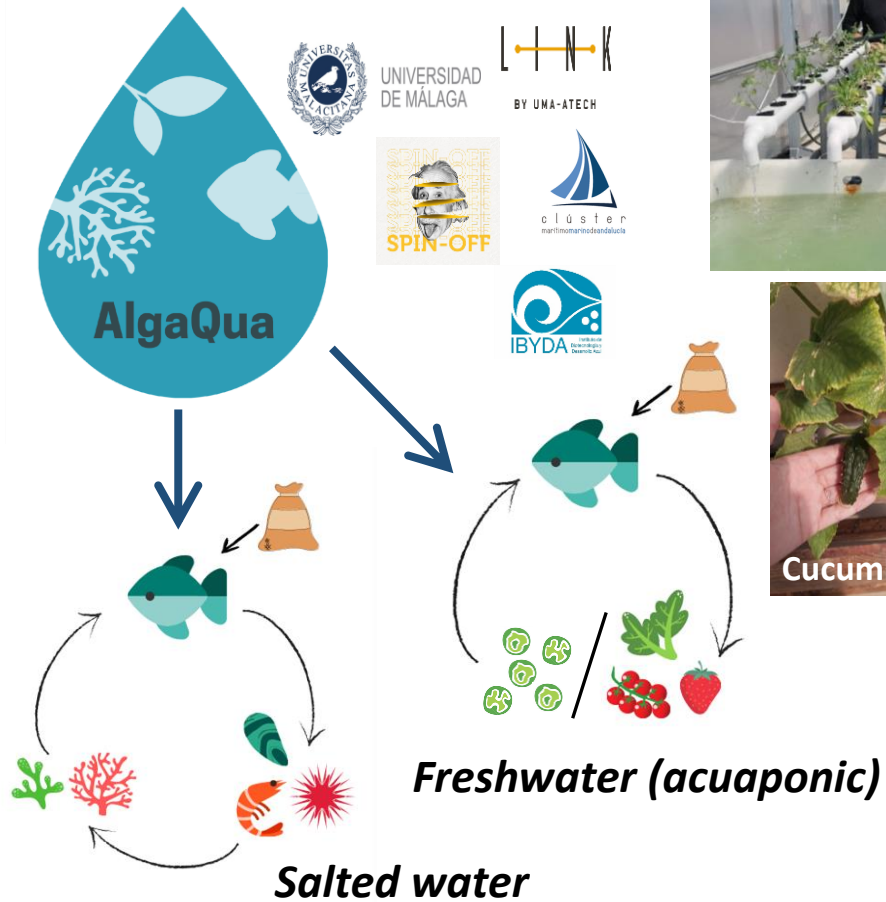
SYSTEM #2 (FISHPOND EFFLUENTS)



	Brix	Acid	Vitamin C	Firmness
CONTROL	9,78±1,08	1,00±0,09	76,75±5,97	6,08±0,42
FISHPOND EFFLUENT	9,8±0,45	0,91±0,01	76,25±4,11	5,98±0,38

	ORGANIC CARBON	TOTAL NITROGEN	ORGANIC MATTER	Na	Ca
CONTROL	53,10±1,36	2,06±0,13	91,33±2,35	0,04±0,03	1,03±0,11
FISHPOND EFFLUENT	53,39±0,52	2,35±0,24	91,83±0,90	0,08±0,04	1,33±0,08

Spin-off Project



NFT "Nutrient film technique"



Lettuces



Raft system
Aubergine



Cucumber



Aromatic plants



Tomatoes



Pepper



Water-melon



Salicornia



ALGAQUA

"Farming in Blue"

Victor Robles & Julia Vega



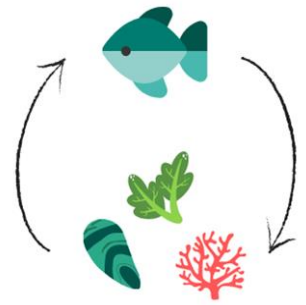
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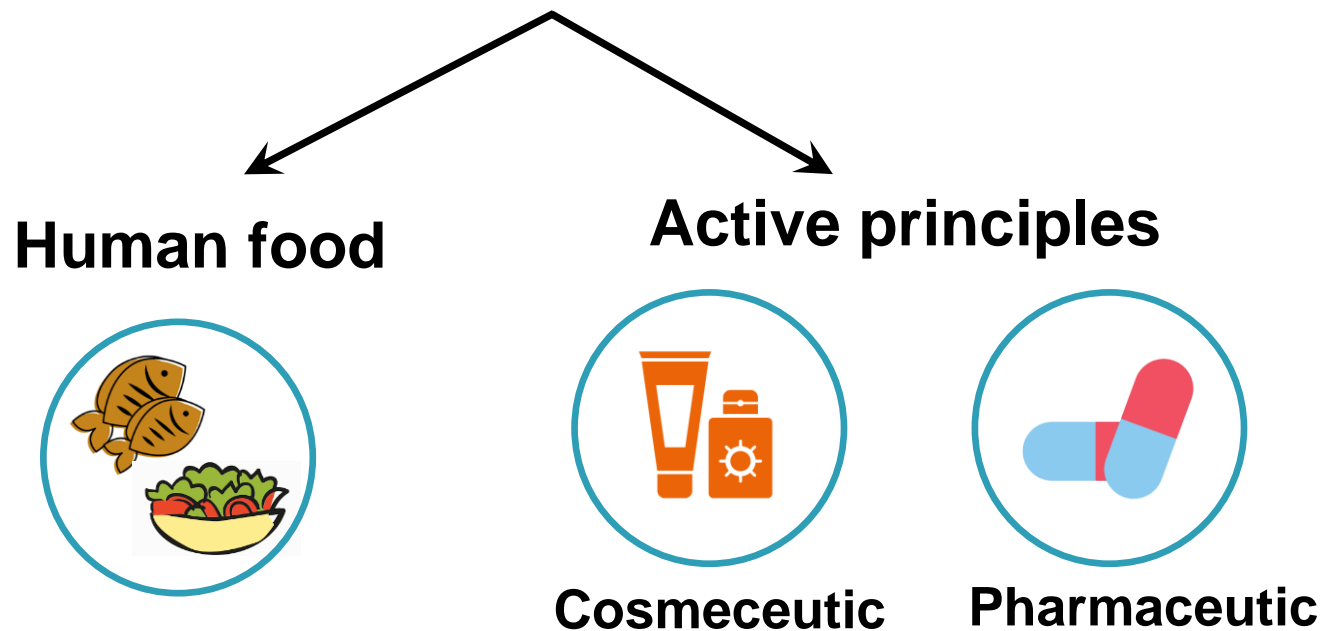
BY UMA-ATECH



Objective



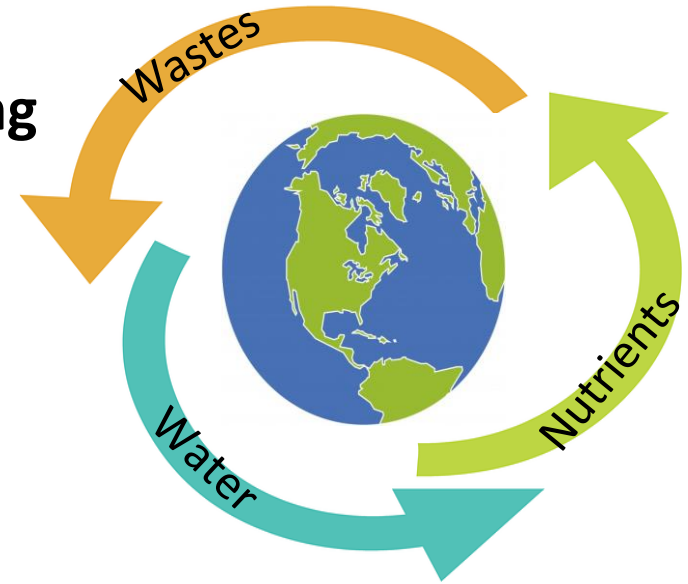
Sustainable and symbiotic production of aquatic organisms and plants



Problem

Global population is continuously growing

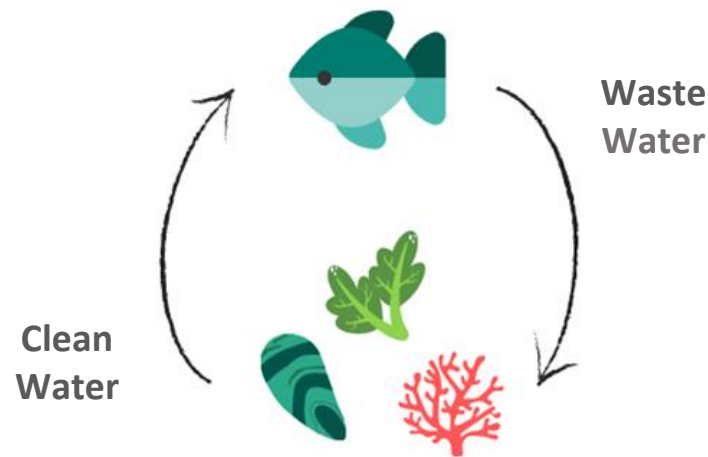
2021 → 2040
7800 millions people → 9000 millions people



- The production model should change to a more sustainable way
 - People are more concern about environment and demand sustainable and natural products
- The **transport chain** must be reduced to improve freshness of the products
 - The market demands greater **modernization** of farmers

Solution

ALGAQUA can produce a great **diversity** of organisms in a **sustainable way**

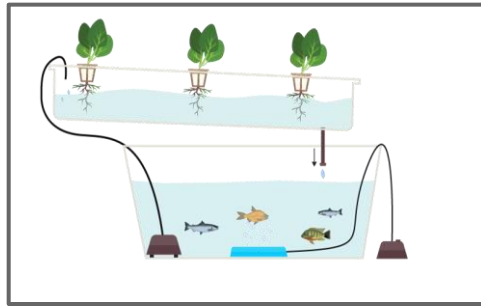
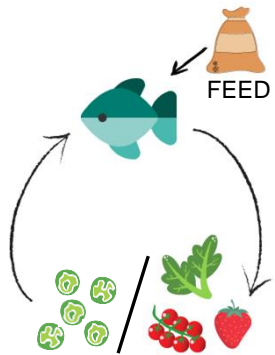


- **Recirculating systems:** Reduce nutrients, water and energy loss
- **High productivity**
- **Minimize environmental impact**
- **Possible to produce near consumption areas**

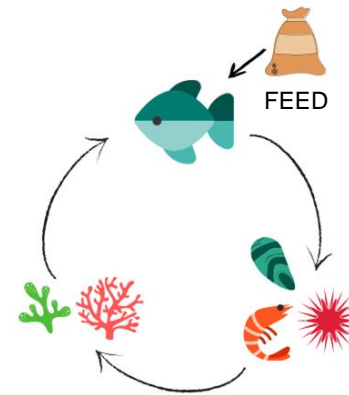
What do we do?

Integrated Multitrophic Aquaculture (IMTA)

A. Fresh water (aquaponic)

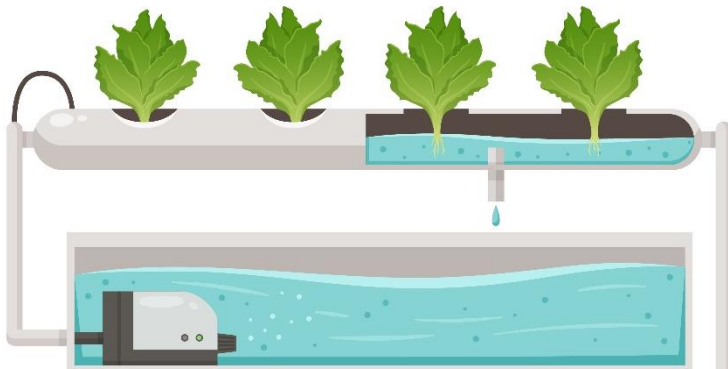


B. Salted water



Hydroponics vs Aquaponics

- **Hydroponics** consists on the cultivation of vegetables in water (without soil), using inorganic or organic fertilizers for their growth
- **Aquaponics** is the cultivation of fish and plants together in a recirculating ecosystem, utilizing natural bacterial cycles to convert fish waste to plant nutrition. This is an environmentally friendly, natural food-growing method that harnesses the best attributes of aquaculture and hydroponics without the need to discard any water or filtrate or add chemical fertilizers

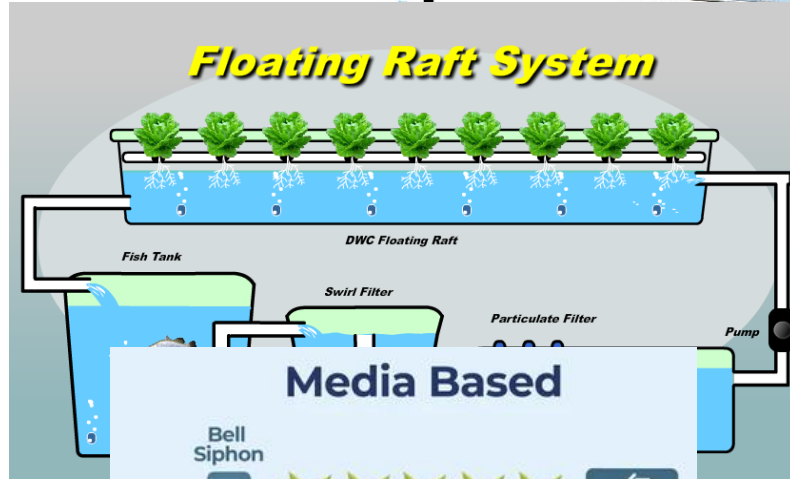


Different aquaponic systems

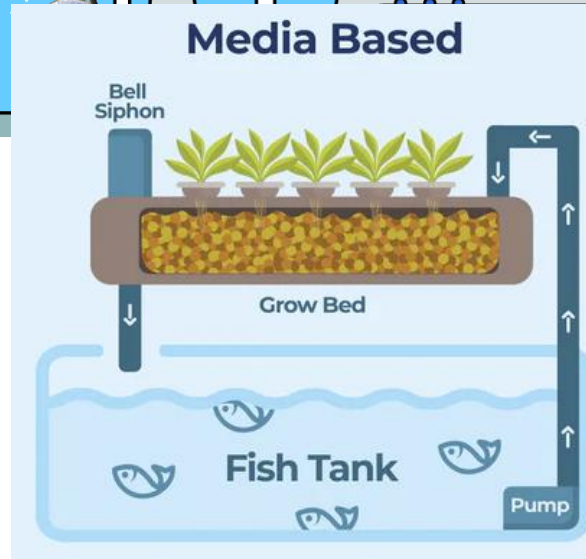
- NFT or Nutrient Film Technique



- Raft System

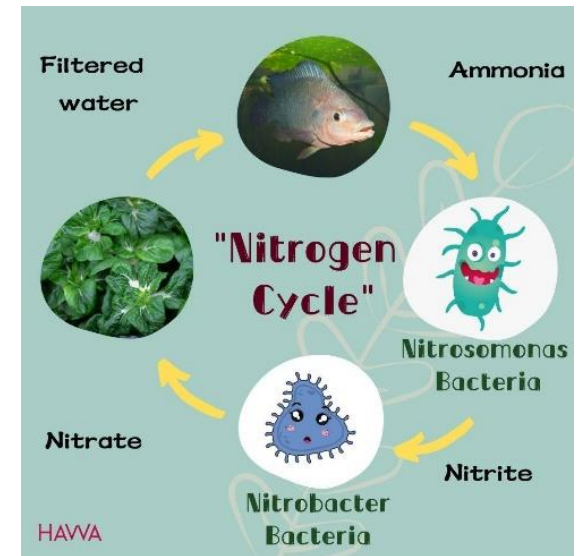
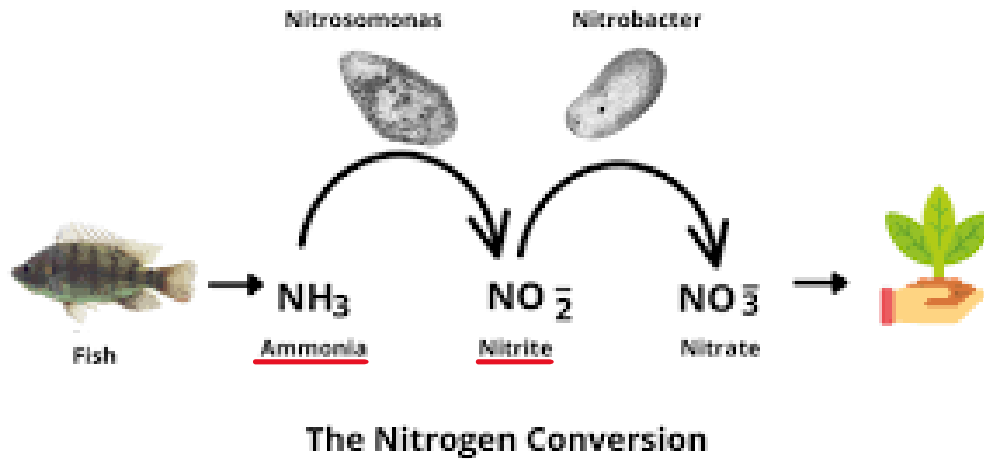


- Grow beds



Importance of bacterias in the systems

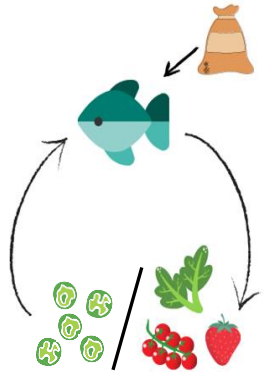
- Nitrifying bacterias



- Probiotic bacterias



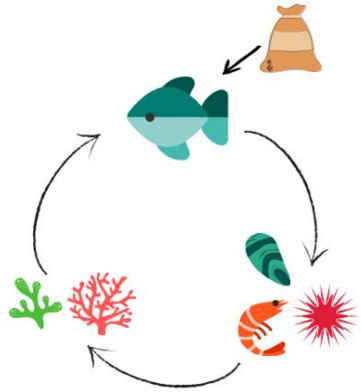
Fresh Water Production (Aquaponics)



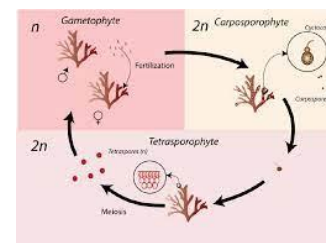
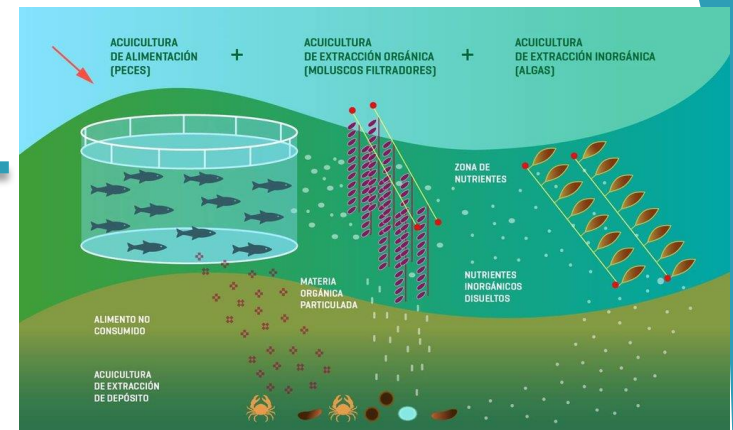
- ↑ Productivity $\begin{cases} \uparrow \text{Plants / m}^2 \\ \text{Vertical crops} \end{cases}$
- ↓ Water used (Recirculation)
- ↓ Nutrients and fertilizers used (fishpond effluents)
- Great diversity of vegetables and fruits
- Microalgae production
- Fresh water fishes (not very commercially exploited)



Salted Water Production



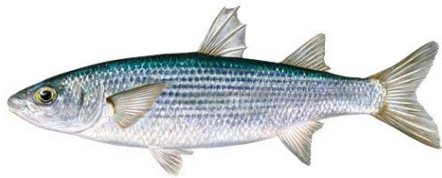
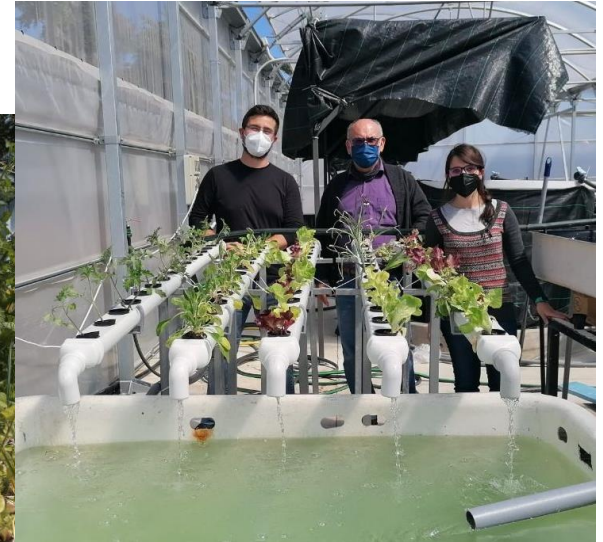
- Artificial sea water
 - Pathogens free
 - Microplastics free
 - Inland areas
- ↓ Water used (Recirculation)
- ↓ Nutrients and fertilizers used (fishpond effluents)
- Re-used of salt
- Some vegetables can acquire greater economic value
- Novel species (Macro / microalgae or salicornia)



Our systems in IBYDA

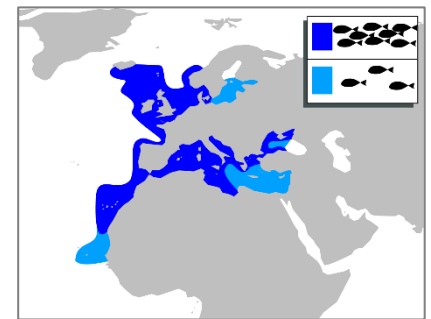


NFT "Nutrient film technique"

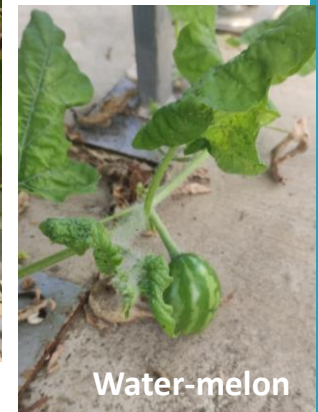


Chelon labrosus

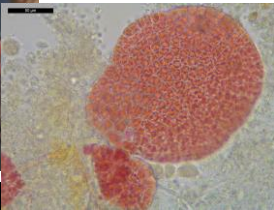
- Mugilidae family
 - Euryhaline and eurythermal species
 - Rapid adaptation to salinity changes
 - Wide geographical distribution, specially in coastal areas
- Gastronomically appreciated in the Mediterranean coast



Our systems in IBYDA



Our systems in IBYDA



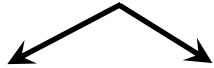
GASTRONOMY: high level of proteins / new flavours / antioxidant properties

FARMACEUTICS: antioxidant / antiinflammatory / anticancer properties

COSMECEUTICS: photoprotective / antioxidant / antiaging properties

Products

Fishes



Fresh Water



Tench

Salted Water



Sea bream



Mullet



Sea bass

Plants



Lettuce



Salicornia



Sprouts

Algae



Ulva



Gracilaria



Porphyra

Aquaponics at home



<http://www.friendlyaquaponics.com/>



Policulture

Tomado de José Lobillo, Universidad de Sevilla



... Commercial

Canada (trouts in cold waters).



**Sistema UVI
(tilapia in
tropical waters).**



Plantas en monoculture



**Cabagge Hill
farm (tilapia,
perca, trouts).**



Tomado de José Lobillo, Universidad de Sevilla (2016)

Science fiction ?



**Mirai-Tokio (Hidroponic: 10.000
lettuces/day en 2.300 m²).**

Tomado de José Lobillo, Universidad de Sevilla (2016)



ALGAQUA

"Farming in Blue"

Victor Robles & Julia Vega

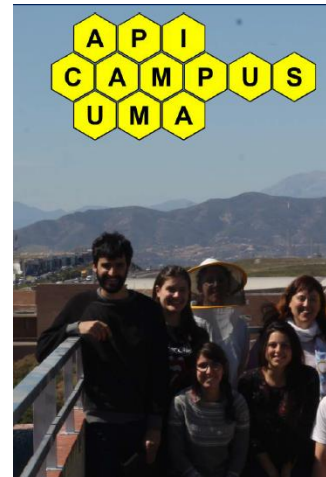
Thanks for your attention i

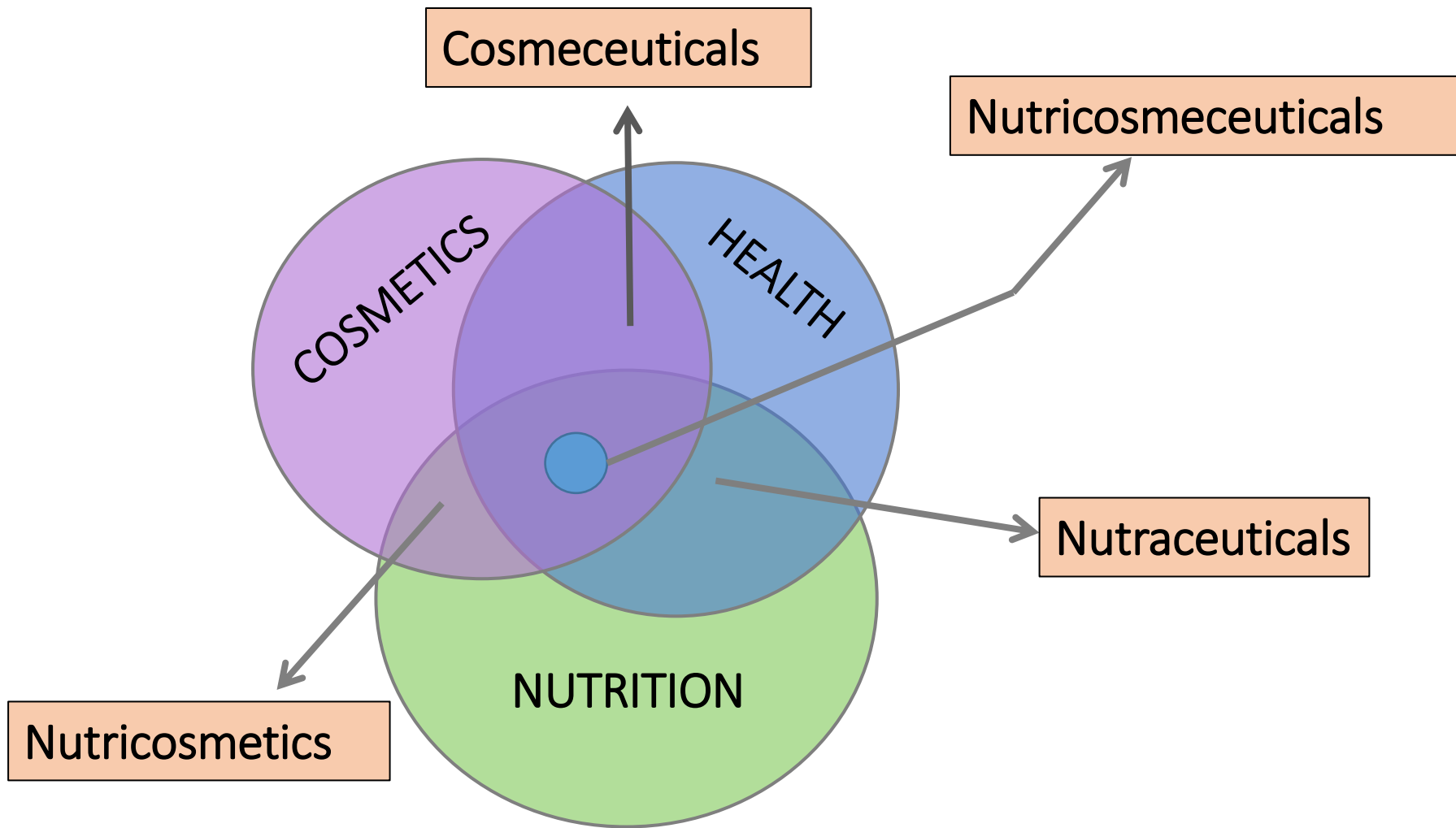


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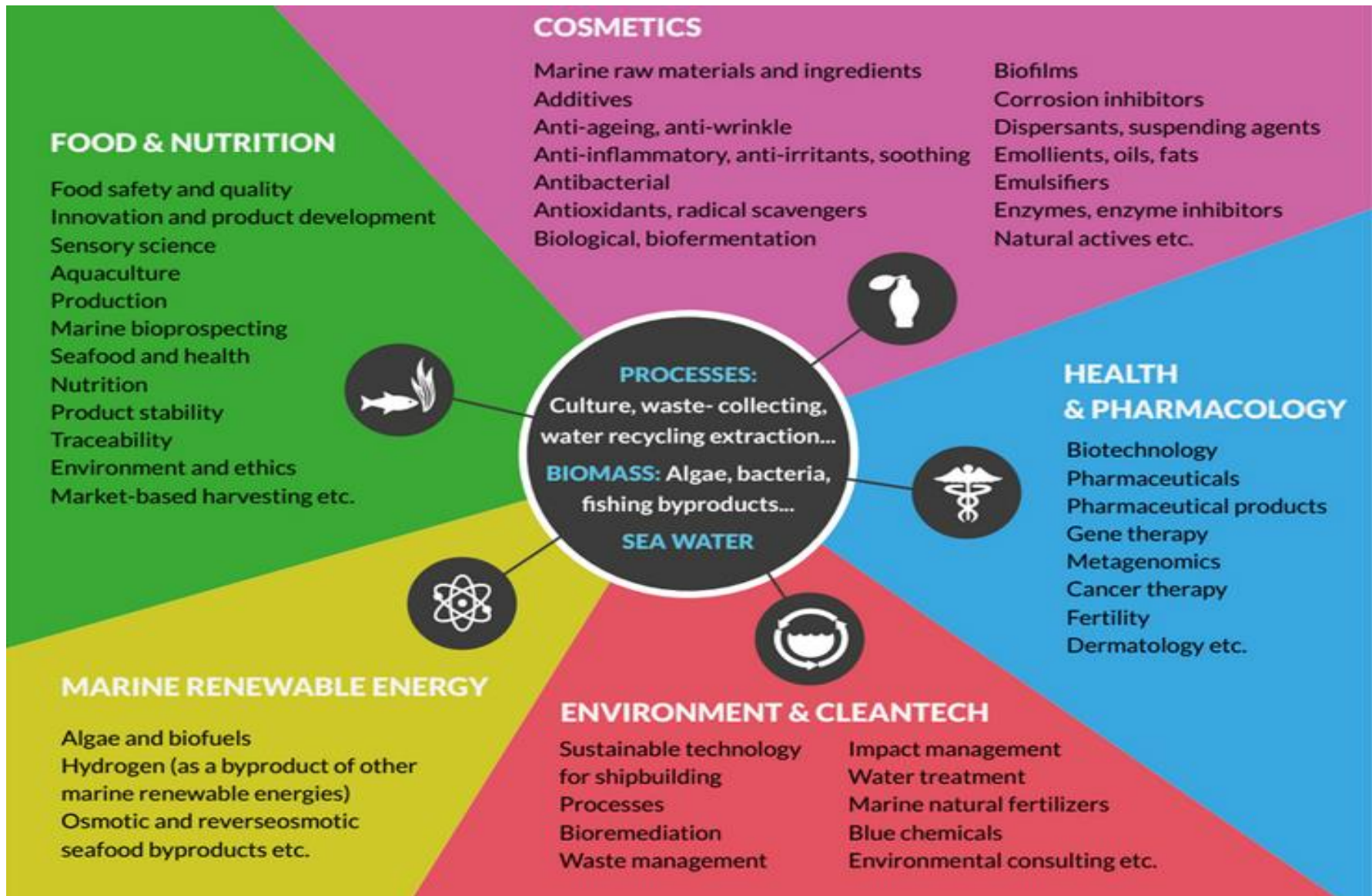


Production of honey in the cities





USES OF ALGAE



COSMECEUTIC PRODUCTS FROM ALGAE



K5.
FIVE RABBITS
ORGANIC
BEAUTY

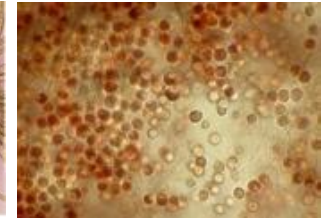
Fiverabbits Organic Beauty Collection

.....





Harvesting by filtration
or centrifugation



(1) Cell lysis
(freezing/sonication)
(2) Buffer extraction
(3) Centrifugation



“Waste” biomass
(Sub-Action C.1.3.)



Quantification and
Purity criteria
 $PC A620/A280 > 4.0$
 $PE A565/A280 > 4.0$



VALORIZATION OF ALGAL BLOOMS

NATIVE BEACH CAST ALGAE



Sargassum (México)



Ulva (China)

EXOTIC INVASIVE SPECIES (Spain, Portugal, France and Marocco)



Rugulopteryx okamurae



ALGAL USES

AGRICULTURE

FOOD

COSMETICS

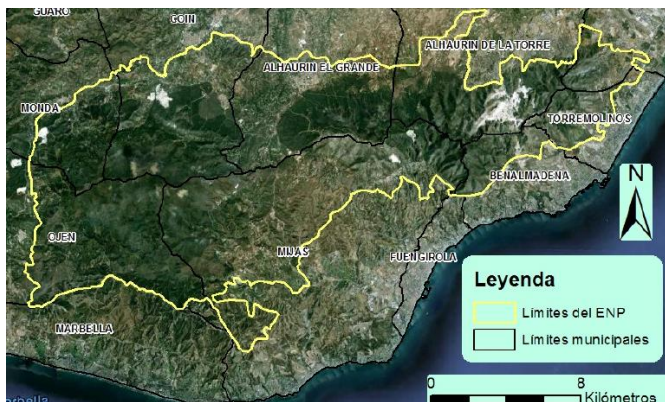
BIOMATERIALS

AQUACULTURE

FEED

PHARMACEUTICS

BIOENERGY



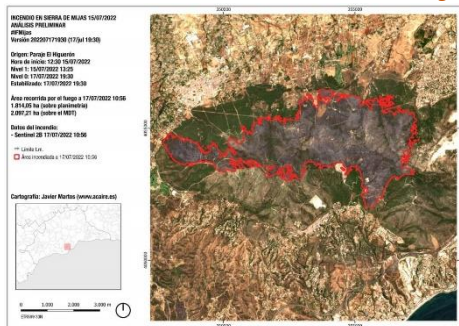
Propuesta de Parque Natural

ARBORETUM DE JARAPALOS SIERRA DE MIJAS

PROYECTO DE SENSIBILIZACIÓN
MEDIOAMBIENTAL



JULIO-22. Incendio Forestal en la Sierra de Mijas



El Arboretum
se salvó del
Incendio!!

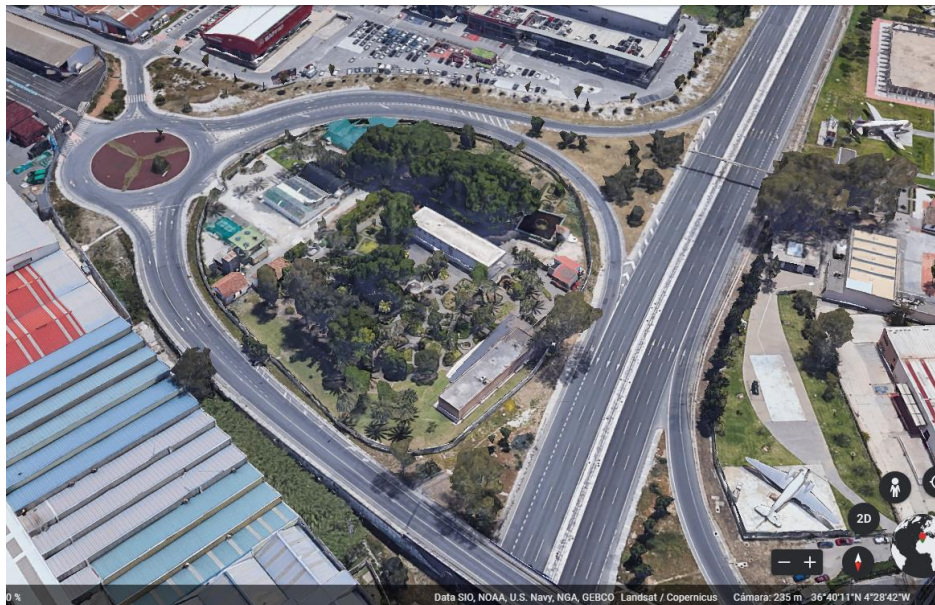


Área
quemada





THANK YOU FOR YOUR ATTENTION
GRACIAS POR SU ATENCIÓN



UNIVERSIDAD
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Félix López Figueroa
Felixlfigueroa@uma.es

Julia Vega Sánchez
Juliavega@uma.es

Víctor Robes Carnero
Victorrobles@uma.es



<http://www.ibyda.es>