Education Summit

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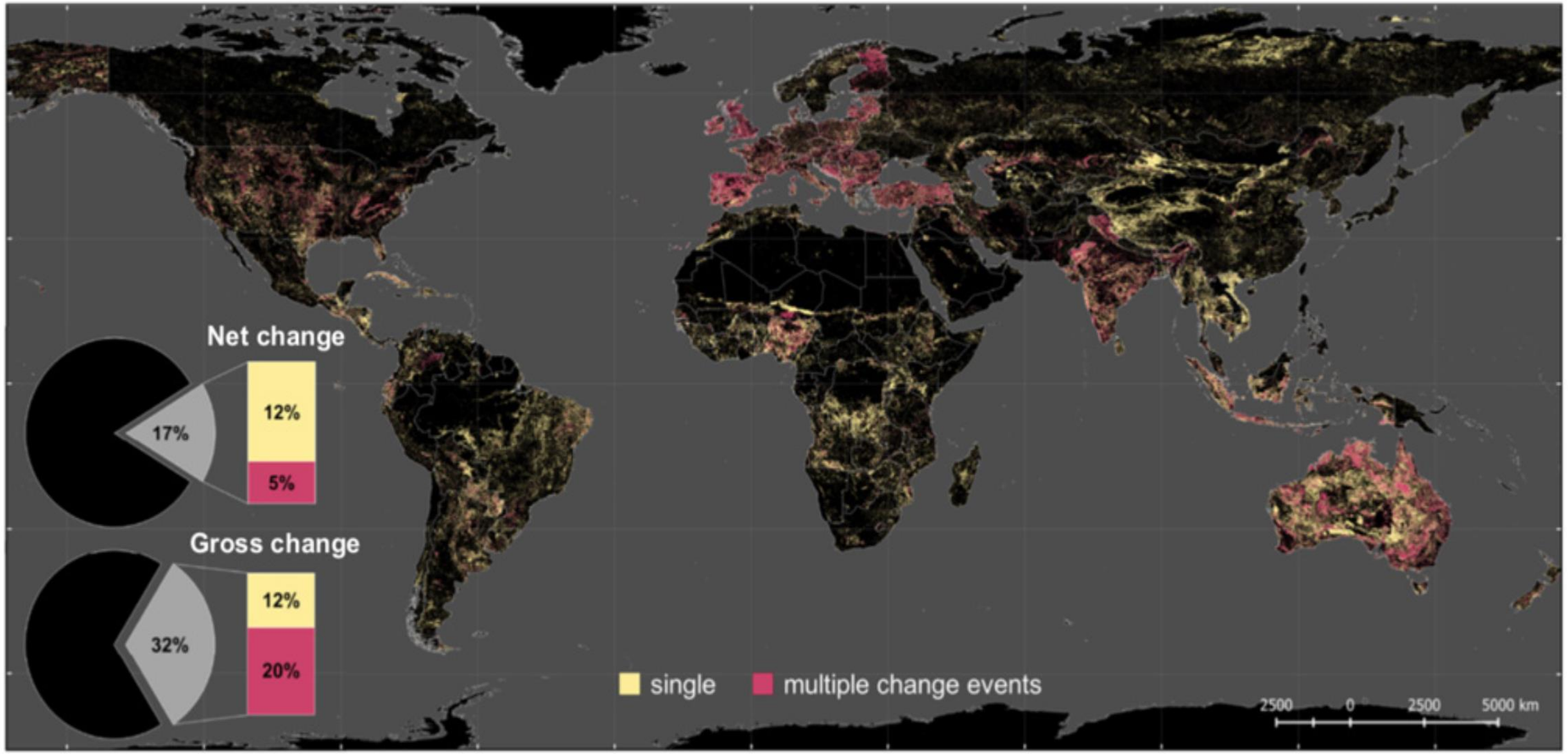
O *Geodesign* como ferramenta na preparação de Planos de Ação Climática

Um estudo de caso em Portugal

Pedro Arsenio (ISA / Univ. de Lisboa, PT) &
Carl Steinitz (Universidade de Harvard, USA)

com contributos de
Michele Campagna (Universidade de Cagliari, ITA),
Tijana Dabovic (Universidade de Belgrado, SRB),
Peter Droege (Liechtenstein Inst. for Strategic Development, LIE)

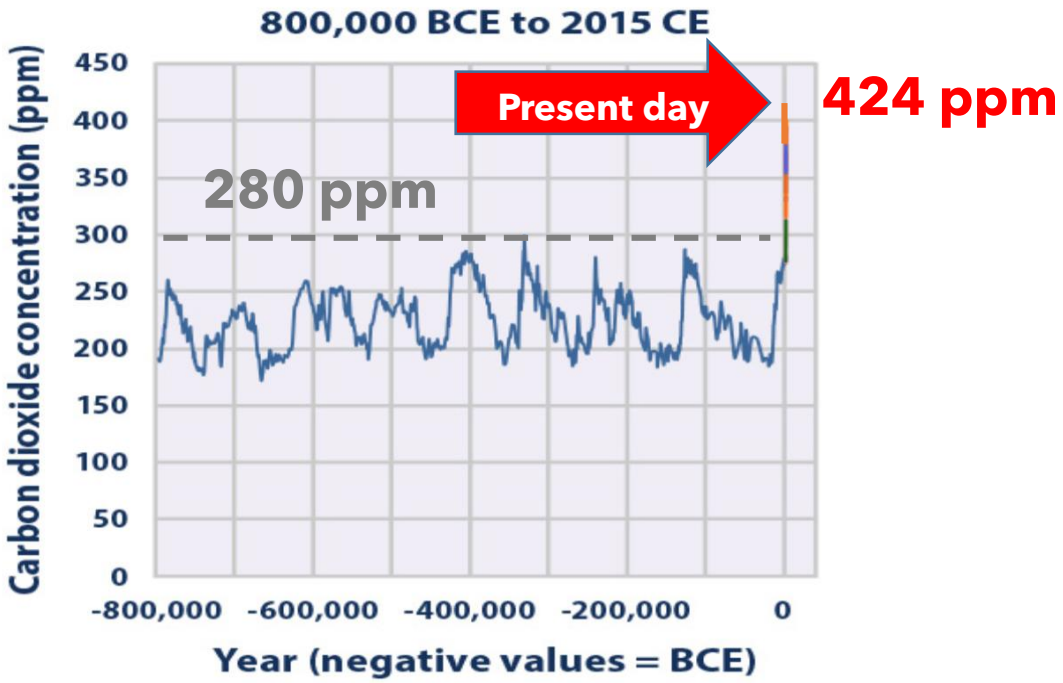
GLOBAL LAND USE CHANGE, 1960 - 2020



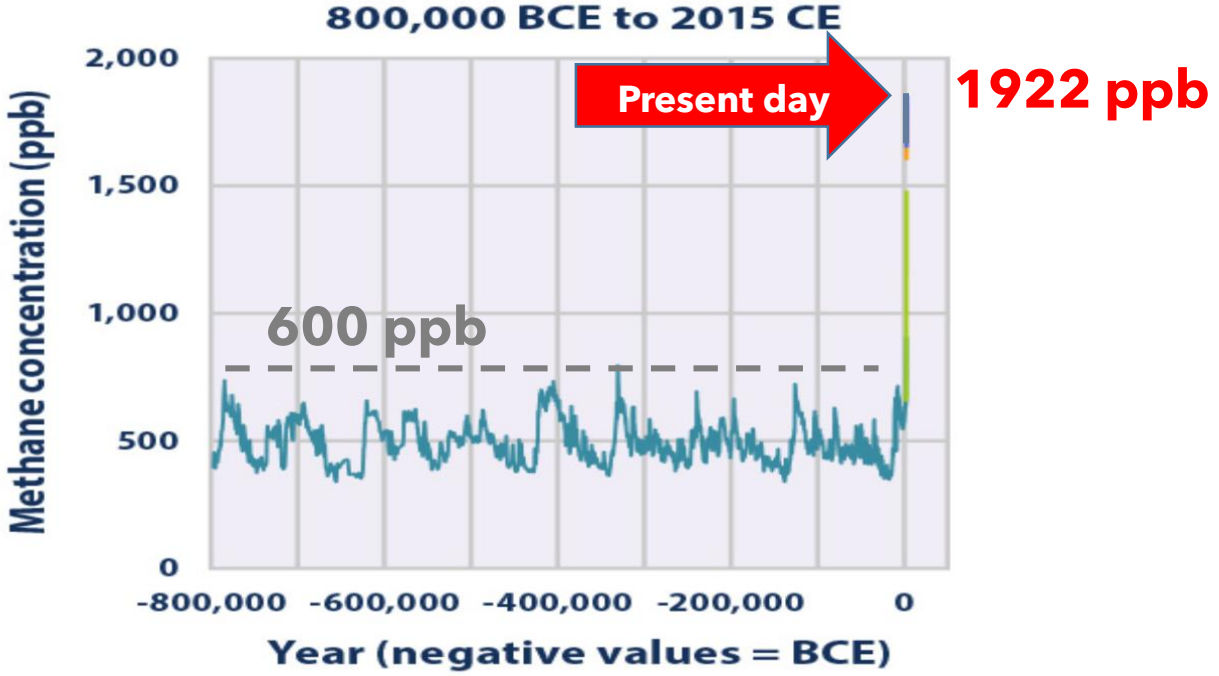
Karina Winkler, Richard Fuchs, Mark Rounsevell, Martin Herold (2021). Global land use changes are four times greater than previously estimated. *Nat Commun* **12**: 2501. https://doi.org/10.1038/s41467-021-22702-2

CARBON DIOXIDE AND METHANE ATMOSPHERIC CONCENTRATIONS

CARBON DIOXIDE



METHANE

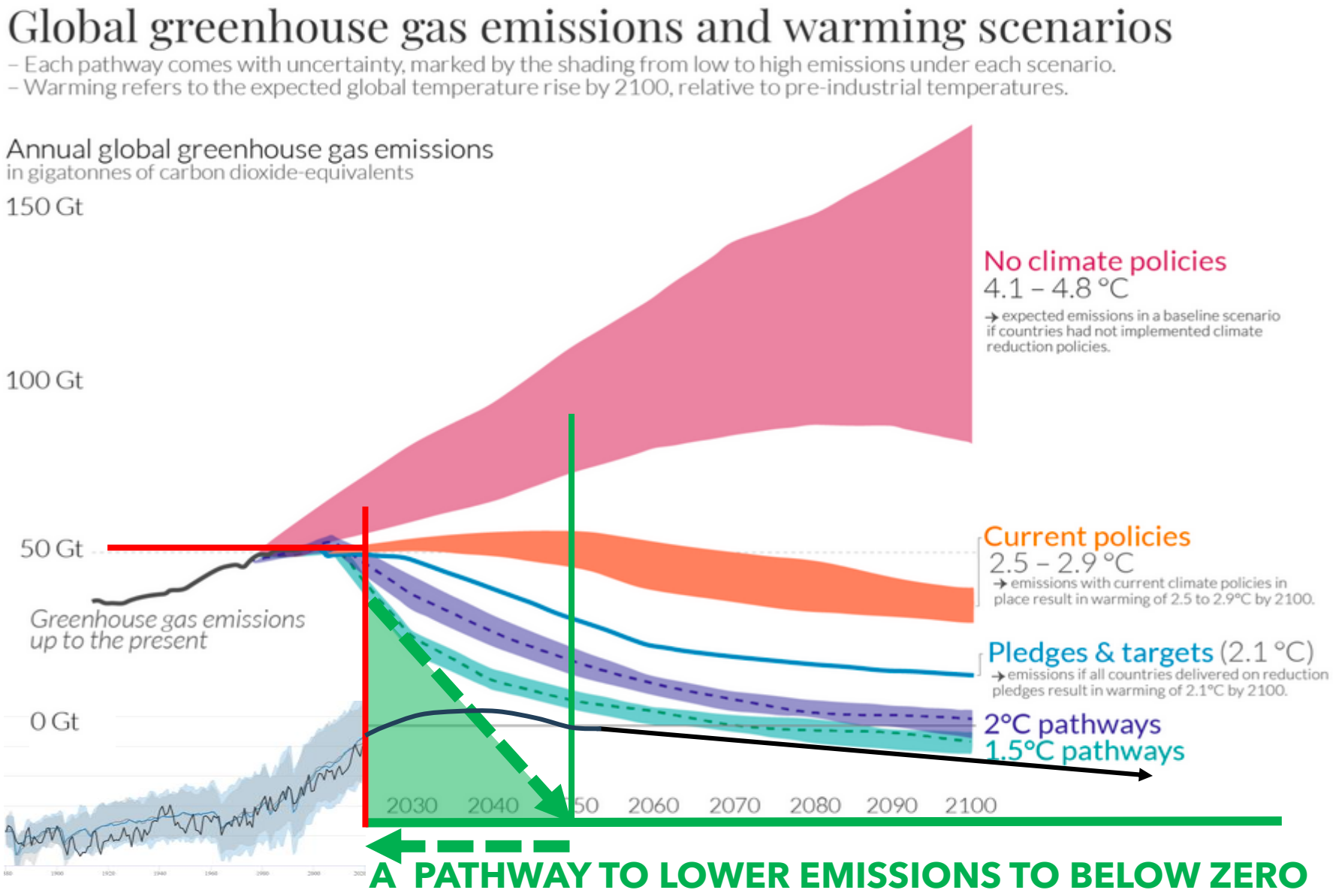


Over the past 800,000 years, atmospheric concentrations of carbon dioxide and methane peaked at 280 ppm and at 600 ppb respectively.

In the present day, they are 150%, and 300% resp. above that level, and rising exponentially.

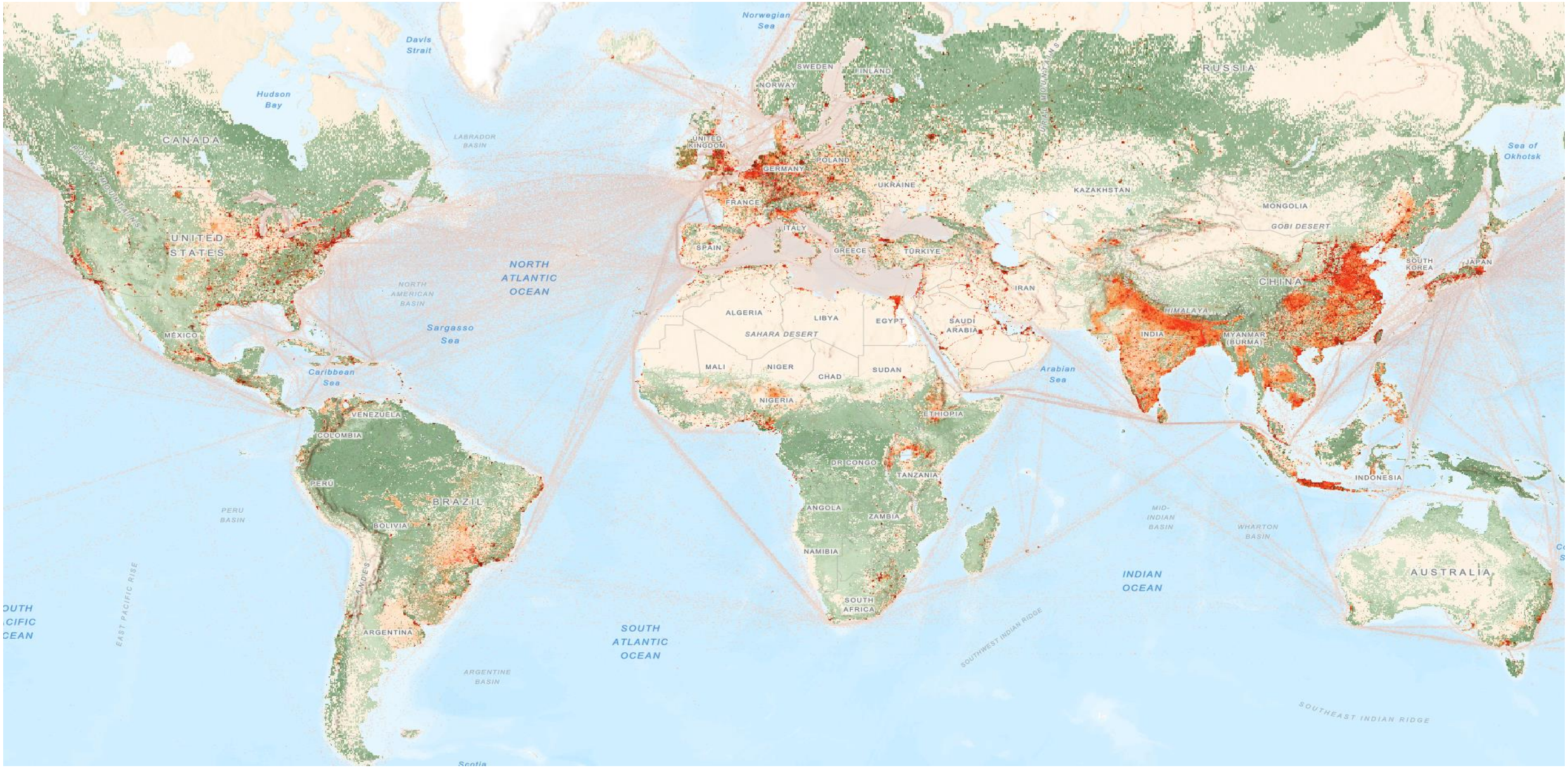
P Droege (LISD) visualization on gas concentrations updated to May 2023, based on EPA, NASA, NOAA data

We must act now to implement Climate Policies and Climate Actions to mitigate climate change



Temperature 1880 – 2024 and projected

Global Emissions and Sinks are Unequally Distributed



Courtesy of Charlie Frye, Esri, unpublished

For the UN Climate Change Conference – COP29 in 2025

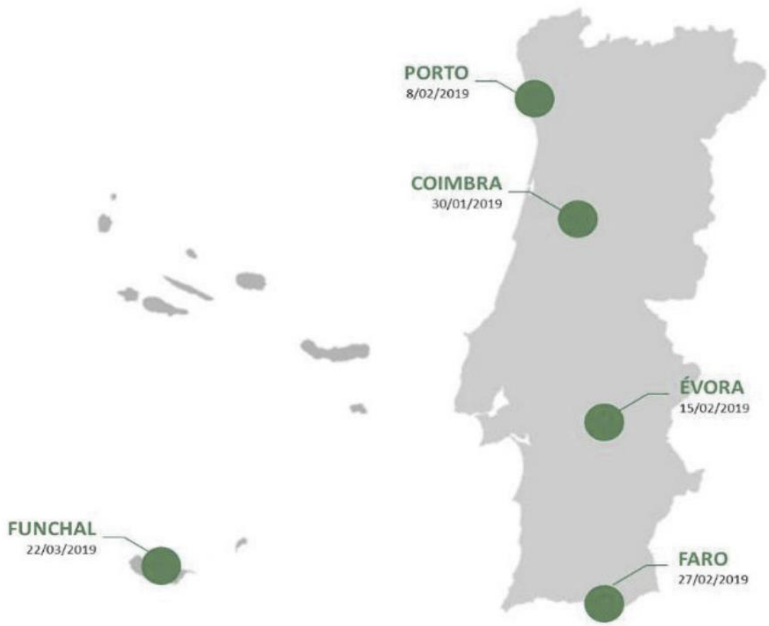
"In 2025 all countries need to submit new and ambitious Nationally Determined Contributions to avert climate calamity.

These new national climate plans must align with the 1.5-degree limit and cover all greenhouse gases, all sectors, and the whole economy."

UN Secretary-General, Antonio Guterres

UN Development Programme launches next phase of flagship climate action initiative
United Nations Development Programme (undp.org)

PNEC 2030
PLANO NACIONAL ENERGIA E CLIMA



PRESIDÊNCIA DO CONSELHO DE MINISTROS

Resolução do Conselho de Ministros n.º 53/2020

Sumário: Aprova o Plano Nacional Energia e Clima 2030 (PNEC 2030).

Portugal assumiu, em 2016, na Conferência das Partes da Convenção Quadro das Nações Unidas para as Alterações Climáticas, o compromisso de alcançar a neutralidade carbónica até 2050.

Nesse sentido, em 1 de julho de 2019 foi publicada a Resolução do Conselho de Ministros n.º 107/2019, de 1 de julho, que aprovou o Roteiro para a Neutralidade Carbónica 2050 (RNC 2050).

Para alcançar a neutralidade carbónica, conforme previsto no RNC 2050, foi estabelecida a redução de emissões de gases com efeito estufa (GEE) para Portugal entre 85 % e 90 % até 2050, face a 2005, e a compensação das restantes emissões, através do sequestro de carbono pelo uso do solo e florestas. A trajetória de redução de emissões foi fixada entre 45 % e 55 % até 2030, e entre 65 % e 75 % até 2040, em relação aos valores registados em 2005.

Em linha com as conclusões do Relatório Especial do Painel Intergovernamental sobre Alterações Climáticas sobre 1,5°C, concluiu-se que é na década 2021-2030 que se devem concentrar os maiores esforços de redução de emissões de GEE, sendo este o período essencial para o alinhamento da economia nacional com uma trajetória de neutralidade carbónica.

No horizonte 2030, foi estabelecida para a União Europeia uma meta de redução de emissões de, pelo menos, 40 % em relação a 1990, com reduções nos setores abrangidos pelo Comércio Europeu de Licenças de Emissão de 43 % face a 2005 e de 30 % nos restantes setores, uma meta de 32 % de energias renováveis, uma meta de 32,5 % para a eficiência energética e de 15 % para as interligações elétricas.

O Regulamento (UE) 2018/1999, do Parlamento Europeu e do Conselho, de 11 de dezembro de 2018, relativo à Governação da União da Energia e da Ação Climática, prevê que todos os Estados-Membros elaborem e apresentem à Comissão Europeia um Plano Nacional integrado de Energia e Clima para o horizonte 2021-2030.

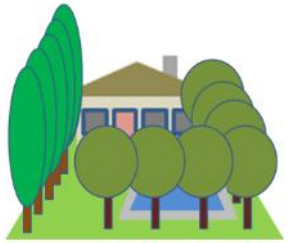
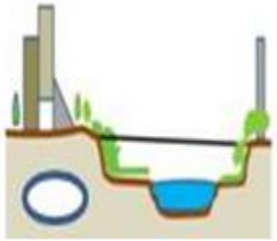
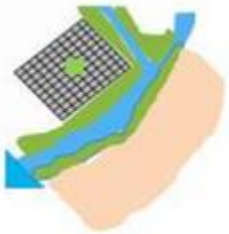
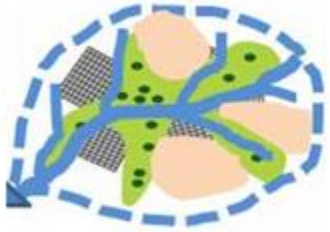
Este Plano visa o estabelecimento, pelos Estados-Membros, de metas, objetivos e respetivas políticas e medidas em matéria de redução de emissões de gases com efeito de estufa, incorporação de energias de fontes renováveis, eficiência energética, segurança energética, mercado interno e investigação, inovação e competitividade, bem como uma abordagem clara para o alcance dos referidos objetivos e metas.

Neste âmbito, e em articulação com os objetivos do RNC2050, foi desenvolvido o Plano Nacional Energia e Clima 2021-2030 (PNEC 2030) que constitui o principal instrumento de política energética e climática nacional para a próxima década rumo a um futuro neutro em carbono, que agora se aprova. O PNEC 2030 estabelece metas ambiciosas, mas exequíveis, para o horizonte 2030 e concretiza as políticas e medidas para uma efetiva aplicação das orientações constantes do RNC2050 e para o cumprimento das metas definidas.

A resposta a este desafio é verdadeiramente transformacional da forma como se encaram alguns dos aspetos mais determinantes da vida em sociedade, em particular no que diz respeito aos padrões de produção e consumo, à relação com a produção e utilização de energia, à forma como se pensam as cidades e os espaços de habitação, trabalho e lazer, à forma como nos deslocamos e como se encaram as necessidades de mobilidade.

O PNEC 2030 constitui o primeiro de um novo ciclo de políticas integradas de energia e clima. Constitui, por isso, um instrumento pioneiro e inovador que traduz uma abordagem convergente e articulada para concretizar a visão que aqui se estabelece para Portugal: promover a descarbonização da economia e a transição energética, visando a neutralidade carbónica em 2050, enquanto oportunidade para o País, assente num modelo democrático e justo de coesão territorial que potencie a geração de riqueza e o uso eficiente de recursos.

Embora todos os setores devam contribuir para os objetivos estabelecidos no presente Plano o Governo assume, de forma clara, o compromisso da transição energética, enquanto alavanca de competitividade para o País, com o objetivo de reduzir as suas emissões de gases com efeito de estufa.

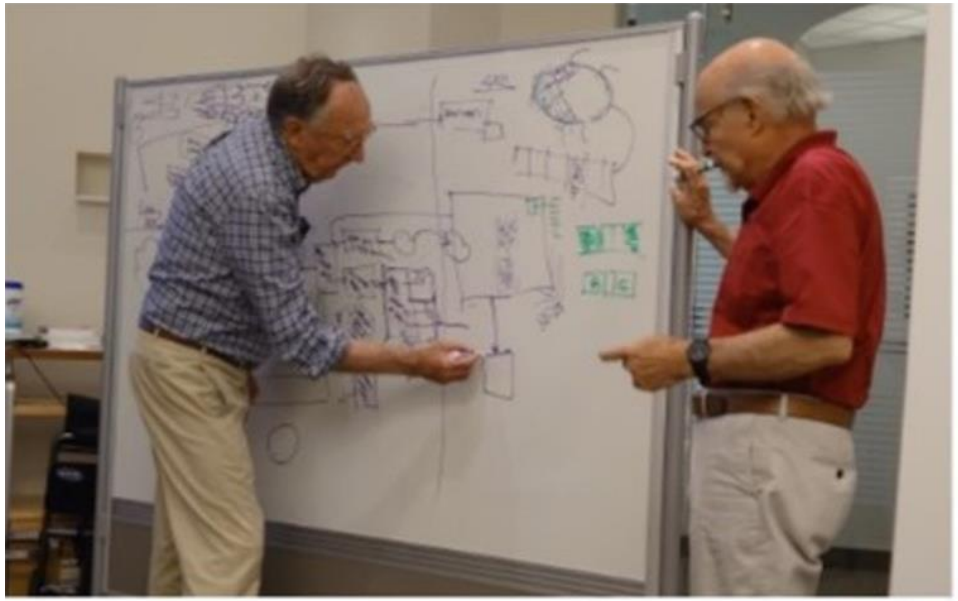

"Climate change is a global phenomenon.
No Nation controls its own climate.
All nations must act in collaboration if climate mitigation is to succeed.

This requires looking and <u>thinking ahead in time</u>, globally to locally to globally…and <u>planning to act now</u> for the future of everyone.

This must also influence how we will need to re-define the problems within which we work and teach, and how we work and teach."

Carl Steinitz, Pedro Arsenio, Michele Campagna, Tijana Dabovic

September 12, 2022
Esri, Redlands
CA USA



Photographs
Tess Canfield

IGC INTERNATIONAL GEODESIGN COLLABORATION

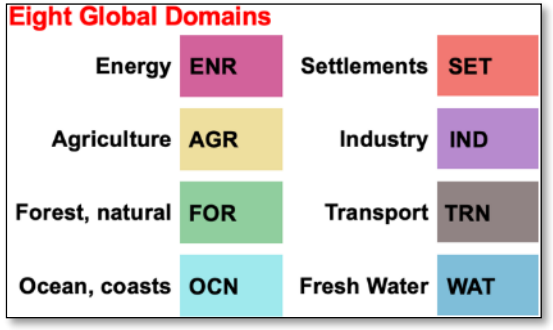
Changing Geography by Design

https://www-igcollab.hub.arcgis.com

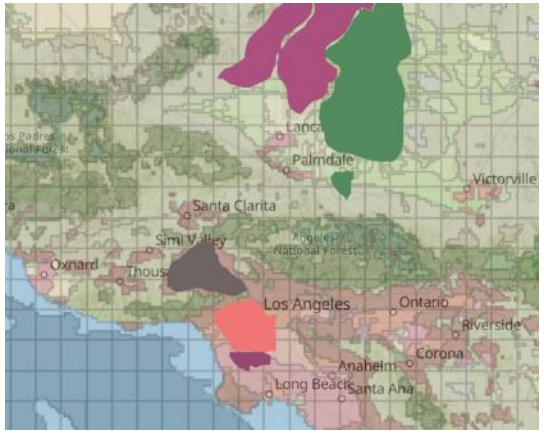
2018-2024: There are 240+ IGC UNIVERSITY-BASED TEAMS IN 61+ COUNTRIES with 130 COMPLETED GEODESIGN STUDIES

Local Teams Adopt the Following Common Requirements:

1. Study areas are a minimum 50 x 50km

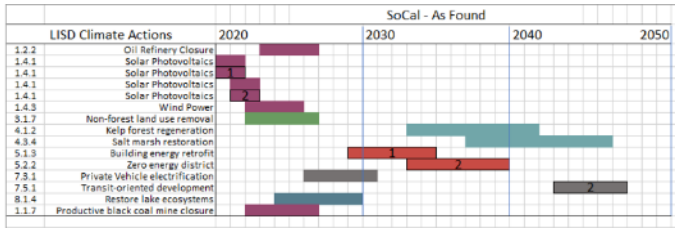


2. Climate Actions are selected from eight Climate Domains / geodesign themes of development and conservation

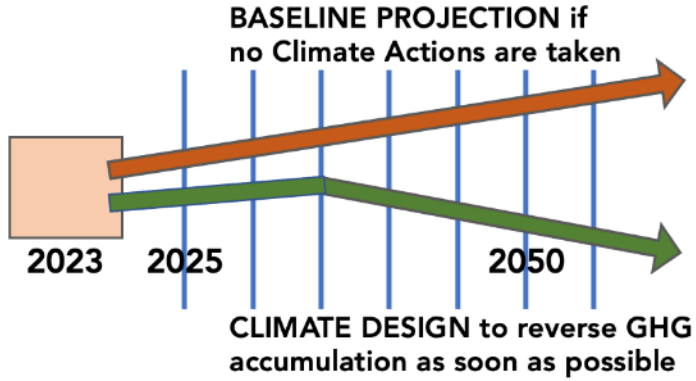


3. Actions within domains are shown using a common color palette

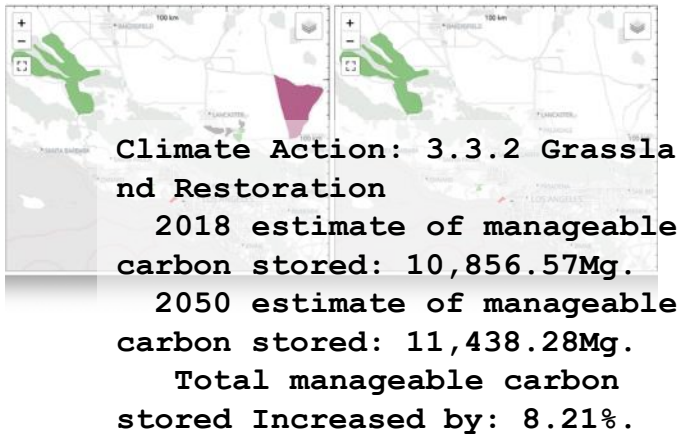
4. Climate Actions are applied either singly or grouped as programs



5. Program application is timed to reverse Greenhouse Gas accumulation as soon as possible



6. After negotiation, designs are assessed for performance in reducing emissions and augmenting carbon sinks.



Mitigation requires Climate Regeneration, lowering CO_2 concentrations to 280 ppm

- ending carbon energy emissions globally and locally;
- halting deforestation and loss of grasslands and wetlands;
- implementing regenerative agriculture on a large, systemic scale;
- ending pollution and exploitation practices to protect ocean biodiversity.




Eight Global Domains

Energy	ENR	Settlements	SET
Agriculture	AGR	Industry	IND
Forest, natural	FOR	Transport	TRN
Ocean, coasts	OCN	Fresh Water	WAT

	Domain	No. of actions
	01 Energy: fossil to renewable	32
	02 Agriculture: soils and systems	19
	03 Forests, inland wetlands and grasslands	17
	04 Oceans and coastal ecosystems	16
	05 Settlements: energy, micro-climate and circularity	17
	06 Industry: key sectors, facilities and circularity	12
	07 Transport: surface, air and water	18
	08 Water: blue, green, potable, waste	12
	TOTAL	143

Climate Performance Policies and Climate Actions

Domain	Climate Policy No.	Climate Policy	Climate Policy GHG Emissions Reductions	Climate Action GHG Emissions Reductions	Climate Action No.	Climate Action	Biodiversity impact	Action Vector: GHG emissions avoided	Atmospheric GHG sequestered or CO2 avoided	Renewable electricity produced	Renewable thermal energy produced
01 Energy: fossil to renewable											
	CP1.1	Close primary fossil energy sources			CA1.1.1	Active natural gas well closure					
					CA1.1.2	Inactive natural gas well capping					
					CA1.1.3	Active oil well closure					
					CA1.1.4	Inactive oil well capping					
					CA1.1.5	Active brown coal mine closure					
					CA1.1.6	Inactive brown coal mine remediation					
					CA1.1.7	Active black coal mine closure					
					CA1.1.8	Inactive black coal mine remediation					
					CA1.1.9	Active shale gas field closure					
					CA1.1.10	Inactive shale gas field remediation					
					CA1.1.11	Active shale oil field closure					
					CA1.1.12	Inactive shale oil field remediation					
					CA1.1.13	Active oil sands closure					
					CA1.1.14	Inactive oil sands remediation					
	CP1.2	Close fossil energy refineries			CA1.2.1	Natural gas processing facility closure					
					CA1.2.2	Oil refinery closure					
	CP1.3	Close fossil energy generators			CA1.3.1	Brown coal power plant closure					
					CA1.3.2	Black coal power plant closure					
					CA1.3.3	Diesel power plant closure					
					CA1.3.4	Natural gas power plant closure					
					CA1.3.5	Waste energy plant closure					
					CA1.3.6	Wood energy plant closure					
					CA1.3.7	Peat energy plant closure					
	CP1.4	Substitute with renewable energy systems[1]			CA1.4.1	Solar photovoltaics					
					CA1.4.2	Solar thermal					
					CA1.4.3	Wind energy					
					CA1.4.4	Hydro energy					
					CA1.4.5	Geothermal energy					
					CA1.4.6	Wave energy					
					CA1.4.7	Tidal energy					
	CP1.5	Repower older renewable energy systems			CA1.5.1	Solar photovoltaic upgrade					
					CA1.5.2	Wind repowering					
02 Agriculture: soils and systems											
	CP2.1	Transform to regenerative agriculture			CA2.1.1	No tillage					
					CA2.1.2	Humus enrichment					
					CA2.1.3	Biochar application					
					CA2.1.4	Crop rotation					
					CA2.1.5	Primary crop diversification					
					CA2.1.6	Cover crops					
					CA2.1.7	System of rice intensification					
					CA2.1.8	Crop residue management					
					CA2.1.9	Agriculture fertiliser use reduction					
					CA2.1.10	Organic crop farming					
	CP2.2	Improve water management			CA2.2.1	Water harvesting and storage					
					CA2.2.2	Drip irrigation					
	CP2.3	Decrease enteric fermentation			CA2.3.1	Feed and manure management					
					CA2.3.2	Rotational grazing					
					CA2.3.3	Grazing land management					
	CP2.4	Operate farms with renewable energy			CA2.4.1	Renewable electricity supply					
					CA2.4.2	Biogas production					
	CP2.5	Decrease foodmiles			CA2.5.1	Urban agriculture					
					CA2.5.2	Peri-urban agriculture					
03 Forests, inland wetlands and grasslands											
	CP3.1	Manage forests sustainably			CA3.1.1	Proforestation					
					CA3.1.2	Silviculture					
					CA3.1.3	Intercropping					
					CA3.1.4	Agroforestry					
					CA3.1.5	Carbon plantations					
					CA3.1.6	Avoided deforestation					
					CA3.1.7	Biomass use avoidance					
					CA3.1.8	Reforestation					
					CA3.1.9	Afforestation					
					CA3.1.10	Forest restoration					
					CA3.1.11	Urban forest establishment					
	CP3.2	Protect wetlands			CA3.2.1	Wetland protection					
					CA3.2.2	Wetland restoration					
					CA3.2.3	Peatland protection					
					CA3.2.4	Peatland restoration					
	CP3.3	Protect grasslands			CA3.3.1	Grassland protection					
					CA3.3.2	Grassland restoration					

[1] Every fossil energy removed requires renewable energy replacement or consumption reductions.

Domain	Climate Policy No.	Climate Policy	Climate Policy GHG Emissions	Climate Action GHG Emissions	Climate Action No.	Climate Action	Biodiversity	GHG emissions avoided	Atmospheric GHG sequestered or CO2 avoided	Renewable electricity produced	Renewable thermal energy produced
04 Oceans and coastal ecosystems											
	CP4.1	Safeguard oceanic ecosystems			CA4.1.1	Marine Protected Areas					
					CA4.1.2	Sea floor protection					
					CA4.1.3	Kelp forest protection					
					CA4.1.4	Kelp forest restoration					
					CA4.1.5	Sea grass protection					
					CA4.1.6	Sea grass restoration					
					CA4.1.7	Coral reef protection[2]					
					CA4.1.8	Coral reef restoration[2]					
	CP4.2	Foster sustainable mariculture			CA4.2.1	Sustainable fishing					
					CA4.2.2	Seaweed farming					
					CA4.2.3	Kelp farming					
	CP4.3	Safeguard coastal ecosystems			CA4.3.1	Mangrove protection					
					CA4.3.2	Mangrove restoration					
					CA4.3.3	Salt marsh protection					
					CA4.3.4	Salt marsh restoration					
					CA4.3.5	Vessel pollution avoidance					
05 Settlements: energy, micro-climate and circularity											
	CP5.1	Create energy independent buildings			CA5.1.1	Domestic fuels replacement					
					CA5.1.2	Basic renovation					
					CA5.1.3	Advanced renovation					
					CA5.1.4	Zero carbon renovation					
					CA5.1.5	Plus-energy renovation					
					CA5.1.6	Plus-energy new development					
	CP5.2	Create energy independent districts			CA5.2.1	Renewable cogeneration					
					CA5.2.2	Solar street lighting					
	CP5.3	Reduce the heat island effect			CA5.3.1	Green roofs					
					CA5.3.2	Street trees					
					CA5.3.3	Private lot trees					
					CA5.3.4	Parks and gardens					
					CA5.3.5	Wet pavements					
					CA5.3.6	High albedo surfaces					
	CP5.4	Sustainably manage urban waste			CA5.4.1	Landfill gas recovery					
					CA5.4.2	Construction waste mining and recycling					
					CA5.4.3	Urban household waste recycling					
06 Industry: key sectors, facilities and circularity											
	CP6.1	Decarbonize industrial sectors			CA6.1.1	Metal ore mining efficiency improvements					
					CA6.1.2	Metal ore mining renewable energy integration					
					CA6.1.3	Metal industry efficiency improvements					
					CA6.1.4	Metal industry renewable energy integration					
					CA6.1.5	Mineral industry efficiency improvements					
					CA6.1.6	Mineral industry renewable energy integration					
					CA6.1.7	Chemical industry efficiency improvements					
					CA6.1.8	Chemical industry renewable energy integration					
					CA6.1.9	R&A[3] industry efficiency improvements					
					CA6.1.10	R&A[3] industry renewable energy integration					
	CP6.2	Sustainably manage industrial waste			CA6.2.1	Industrial waste heat recovery					
					CA6.2.2	Industrial waste mining and recycling					
07 Transport: surface, air and water											
	CP7.1	Increase intra-city public transport share			CA7.1.1	Bus lines					
					CA7.1.2	Light rail					
					CA7.1.3	Heavy commuter rail					
					CA7.1.4	Shared EV mobility					
					CA7.1.5	Car free zones					
					CA7.1.6	Bikepaths					
	CP7.2	Decarbonize inter-city transport			CA7.2.1	High-speed rail					
					CA7.2.2	Air traffic improvements					
					CA7.2.3	Airport-to-airport rail					
	CP7.3	Electrify land transport			CA7.3.1	Private vehicle electrification					
					CA7.3.2	Bus electrification					
					CA7.3.3	Freight truck electrification					
					CA7.3.4	Vehicle charging					
	CP7.4	Create emission controlled zones			CA7.4.1	Low emission zone					
					CA7.4.2	Zero emission zone					
	CP7.5	Create people-oriented urban fabric			CA7.5.1	Transit-oriented development					
					CA7.5.2	Walking-oriented development					
	CP7.6	Clean ocean transport			CA7.6.1	Maritime fuel substitution					
08 Water: blue, green, potable, waste											
	CP8.1	Rehabilitate rivers and lakes			CA8.1.1	Agricultural run-off prevention					
					CA8.1.2	Urban and industrial run-off prevention					
					CA8.1.3	Restore river ecosystems					
					CA8.1.4	Restore lake ecosystems					
	CP8.2	Localize water supply			CA8.2.1	Rainwater retention, filtration and reuse					
					CA8.2.2	Water recycling systems in buildings					
	CP8.3	Decarbonize potable water supply			CA8.3.1	Potable water system efficiency improvements					
					CA8.3.2	Potable water system green energy use					
	CP8.4	Decarbonize wastewater treatment			CA8.4.1	Wastewater system efficiency improvements					
					CA8.4.2	Wastewater system green energy use					
					CA8.4.3	Wastewater gas recovery					
					CA8.4.4	Wastewater recycling					

[3] R&A: Refrigeration and airconditioning.

A case study in Portugal

Results from the **November 3rd-4th, 2023** workshop at

Instituto Superior de Agronomia (ULisboa)

Team
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Tess Canfield (IGC Project Consultant)

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Cristina Castel-Branco (Associate Professor)
Patrícia Rodrígues González (Assistant Professor)
Rui Figueira (Assistant Professor)
Ana Luísa Soares (Assistant Professor)
Sónia Talhé Azambuja (Invited Assistant Professor)

ISA/Lisbon University Landscape Architecture Master's Students
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Fernando Reis Torres
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João Pedro Coelho Silva
Johannes Felix Reisch
Julia Chavolla González
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Other collaborators
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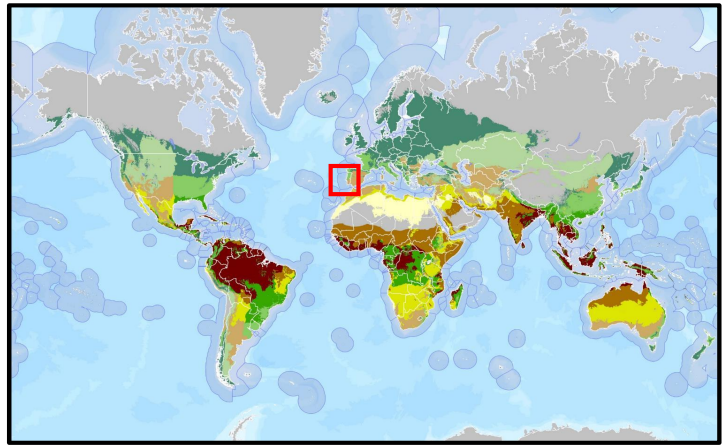
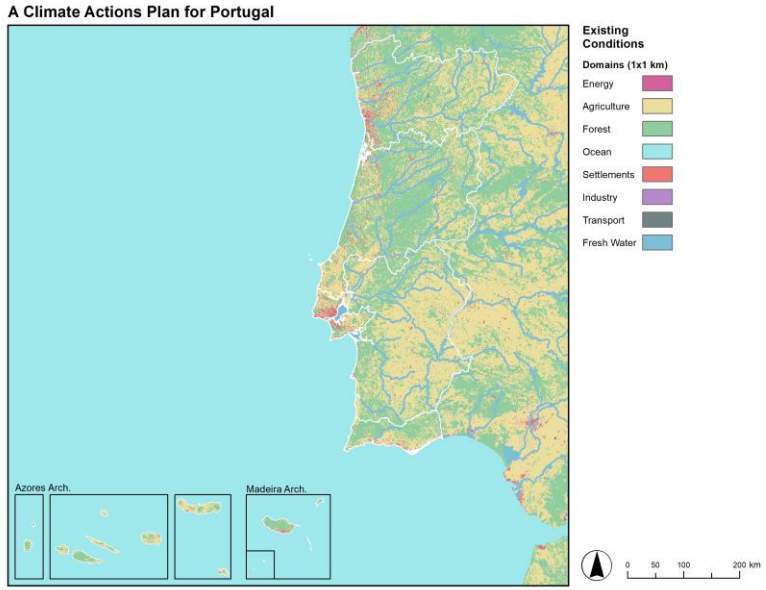
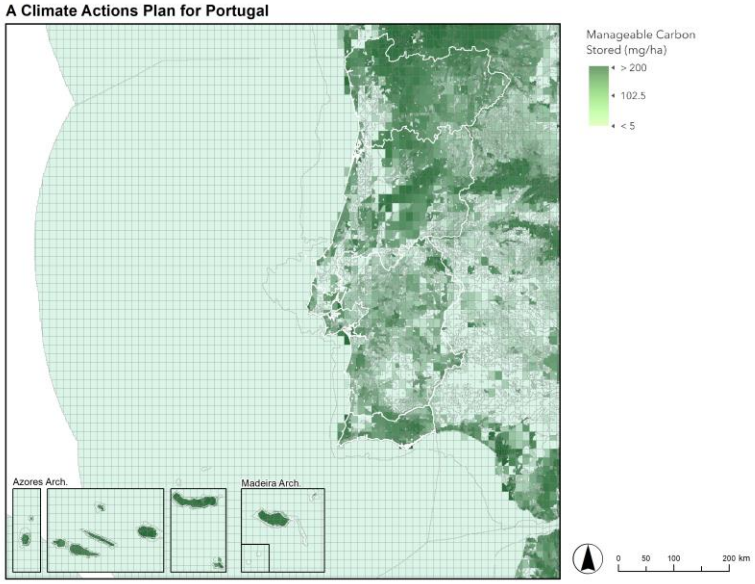
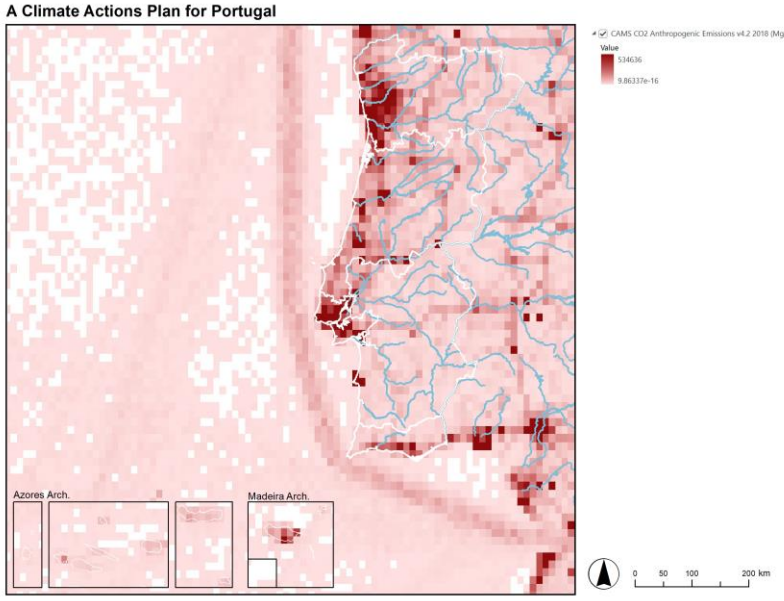
António Sacchetti (Photographer)
Rui Figueiredo (Environmental Ministery Consultant)

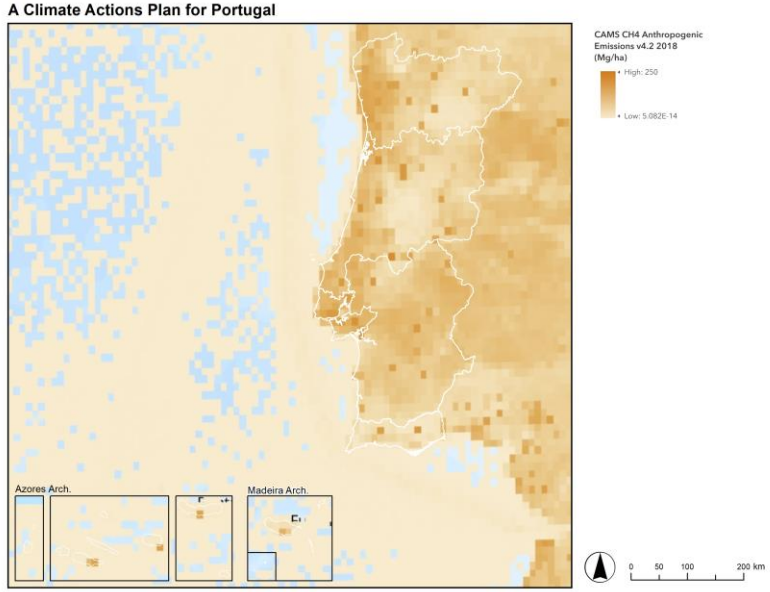
Pre-Workshop preparation











Imagery, the study area and its domains, BSU ecosystems (as carbon sinks), carbon and methane emissions.

Portugal workshop draft schedule V2 CS

Day 1 – Friday 09h00 - 17h30

0900--Get settled into space, Introductions: people, location (PA)

0930--Overview of GC, Portugal case (CS)

1000--Organize by domains, 5 minute (X 8) presentations of key climate and other issues fi
past research

1100-- Break for coffee

1130--LISD list of climate actions and Gantt charts (in PA format).
Teams to make timed Gantt charts by domain, with CAs from other domains as needed.

1230--Presentation of Gantt charts, discussion of inter-domain issues

13h00-- Lunch (in situ)

1400--Make diagrams of CAs (can be begun before, and some from prior test…..all to Pedr

1530--Present CAs diagrams BY DOMAIN IN ONE POWERPOINT SLIDE on Portugal base

1530--Break for coffee

1600--discussion of inter-domain dependency issues

1700--Revise /add to Gantt charts and diagrams

(PA to transfer diagrams to GDH)

Day 2 - Saturday 09h30 - 17h30

0900--Who goes first? Is it Environment vs Economy?

0930--Make two mixed teams, ENV and ECO, each makes an 8-domains design in GDH, with Gantt chart legend

1200--Present ENV and ECO designs, discussion on differences and similarities

13h00 - 14h00 - Lunch (in situ)

1400--In GDH, negotiate one design (CS/PA to manage, Ze Miguel as Prime Minister to decide arguments)

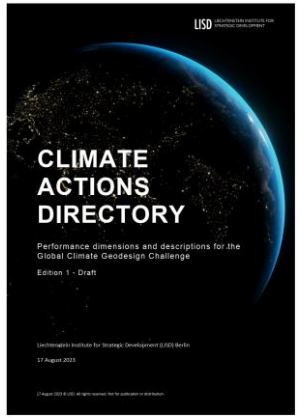
Around 1600--Break for coffee

Around1630-- Make Gantt chart and final presentation figures

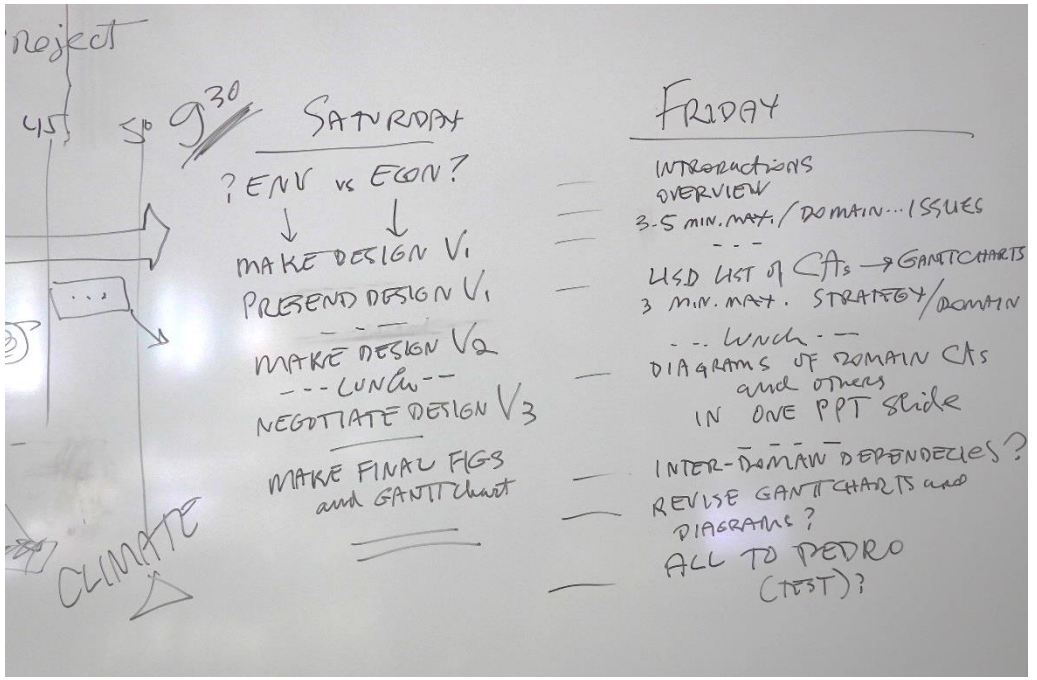
Around 1700--Discussion and Closing session

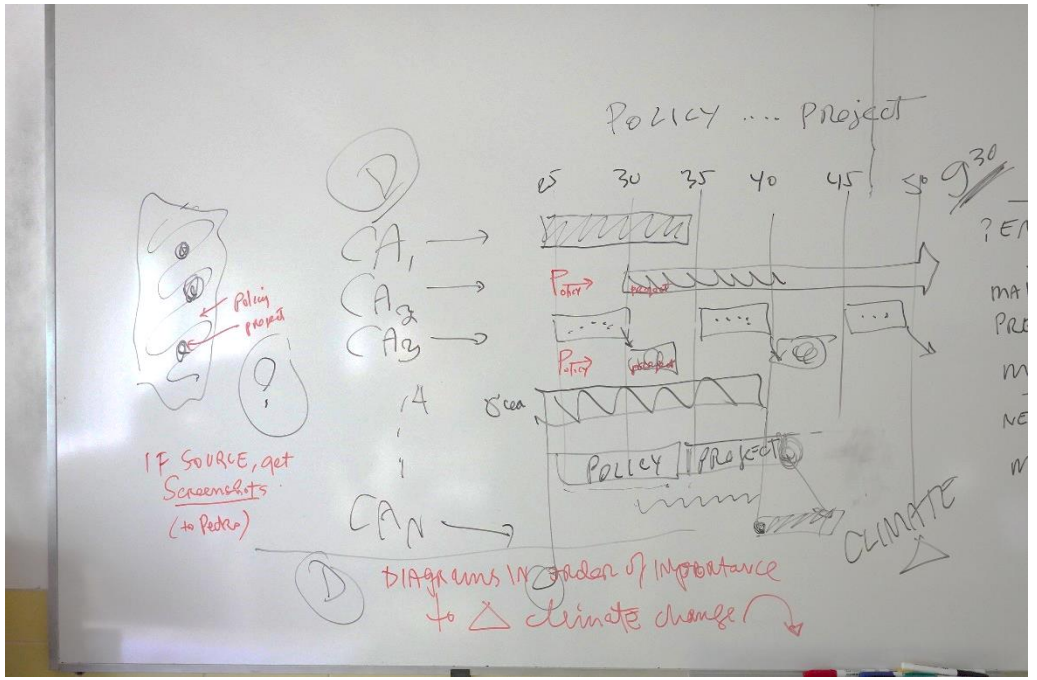
Day 1 Morning

Overview



LISD Climate Actions and timed Gantt Charts

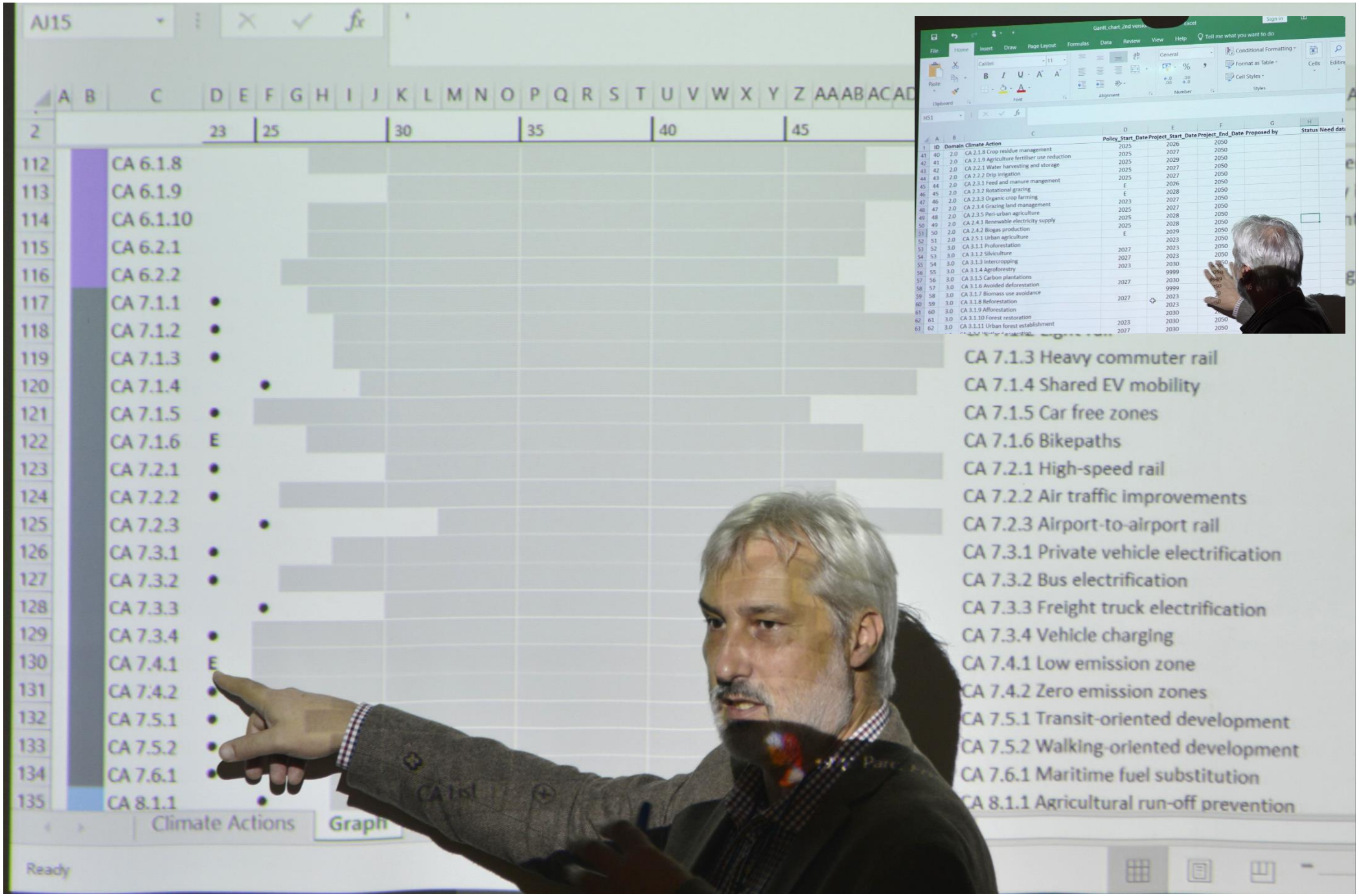




Photographs
Tess Canfield

Day 1 Morning

Selecting LISD Climate Actions and making timed Gantt Charts



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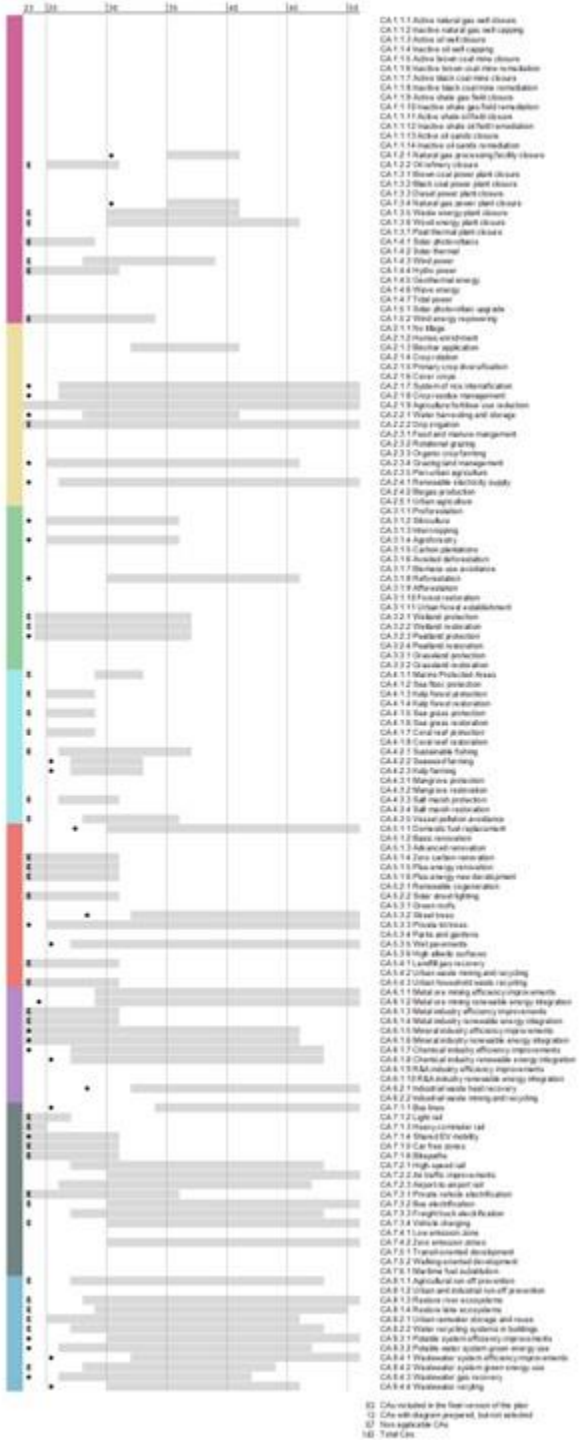
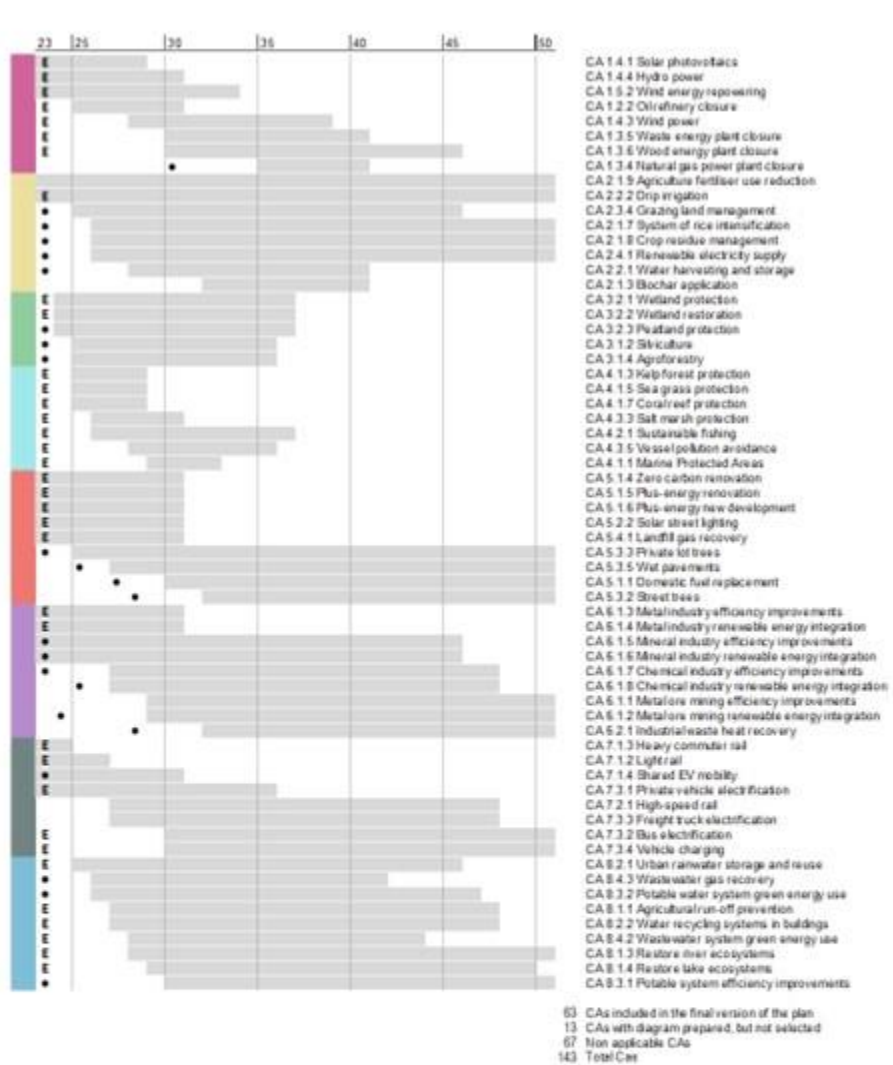
Tess Canfield





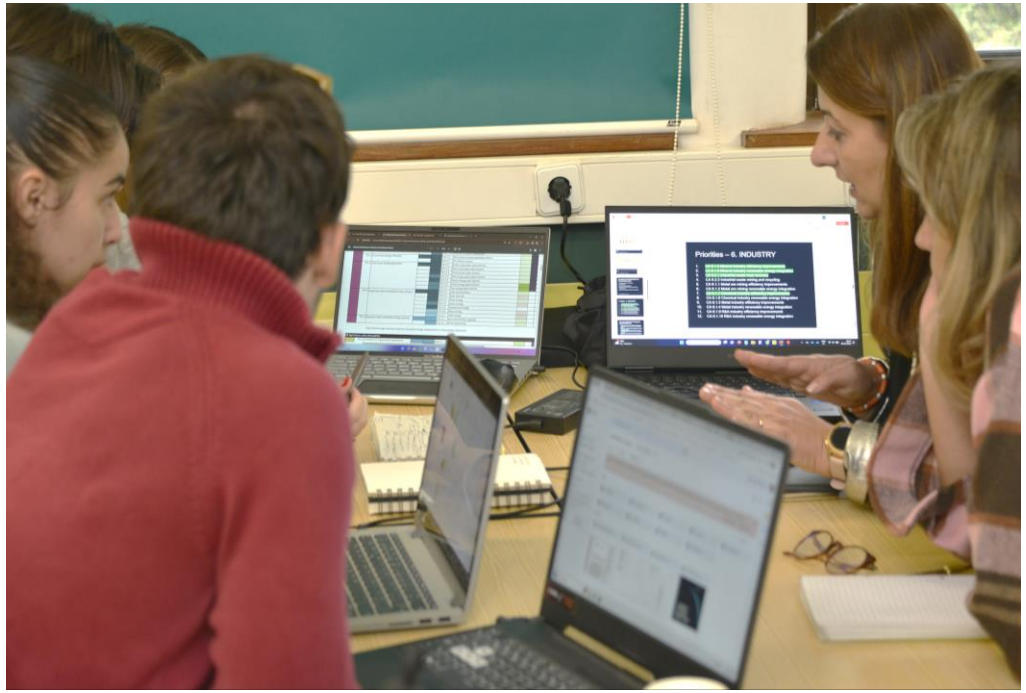
Selected Climate Actions by Domain

Selected Climate Actions by Timing

All LISD List Climate Actions,
with timing for those selected
as being appropriate for Portugal

Day 1
Morning

Making diagrams for LISD Climate Actions and Gantt Charts



Photographs
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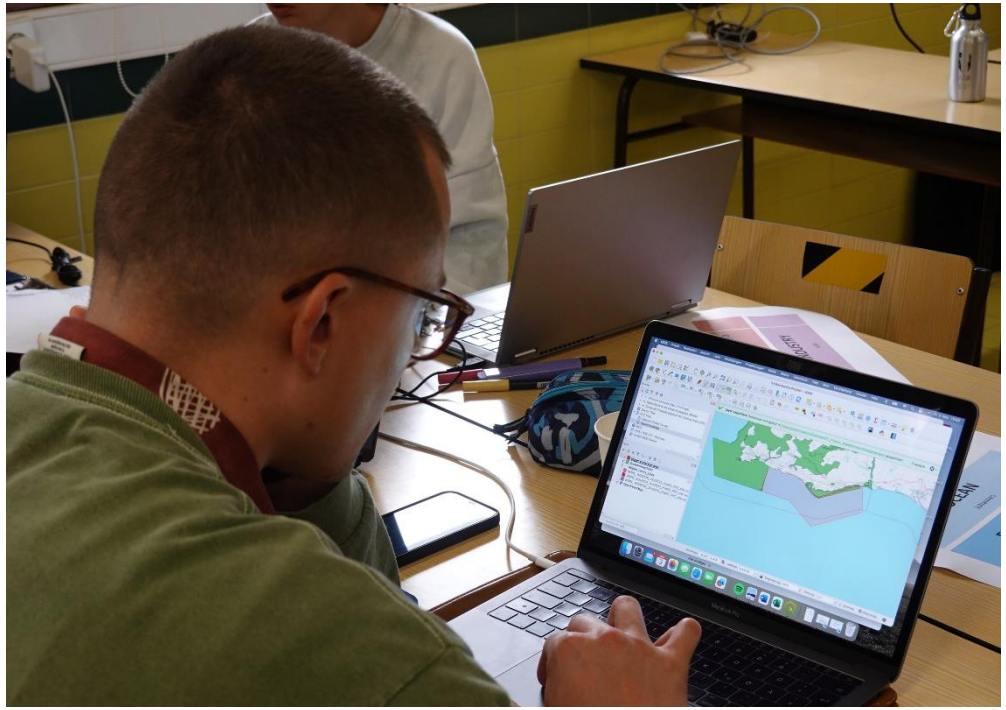
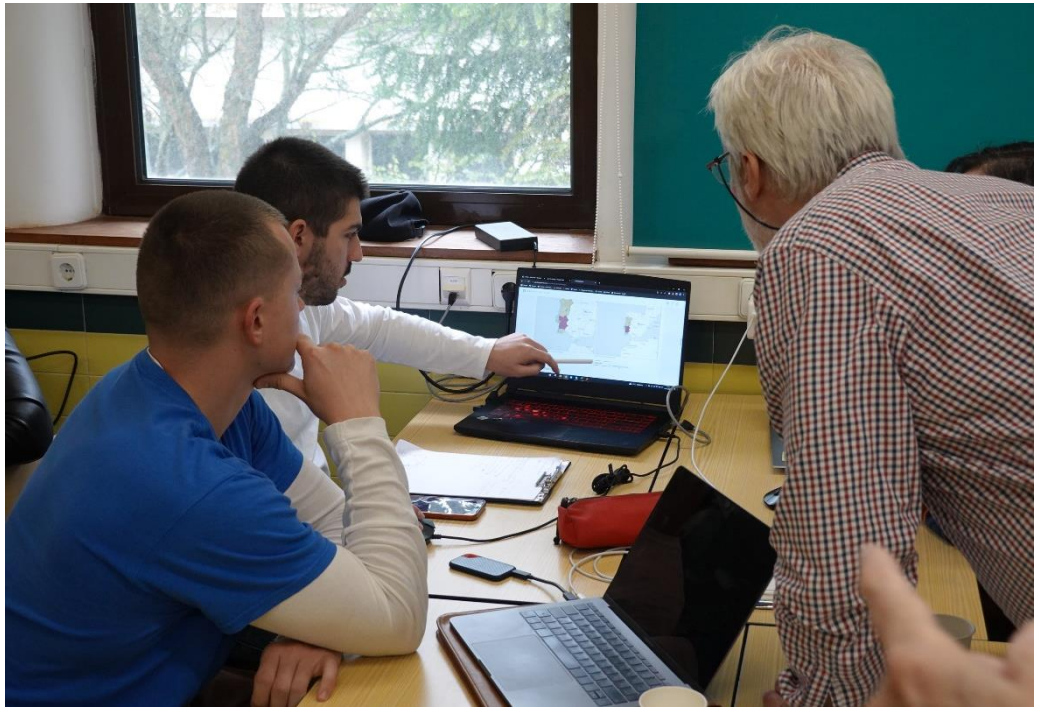
Day 1
Afternoon

Making diagrams for selected climate actions

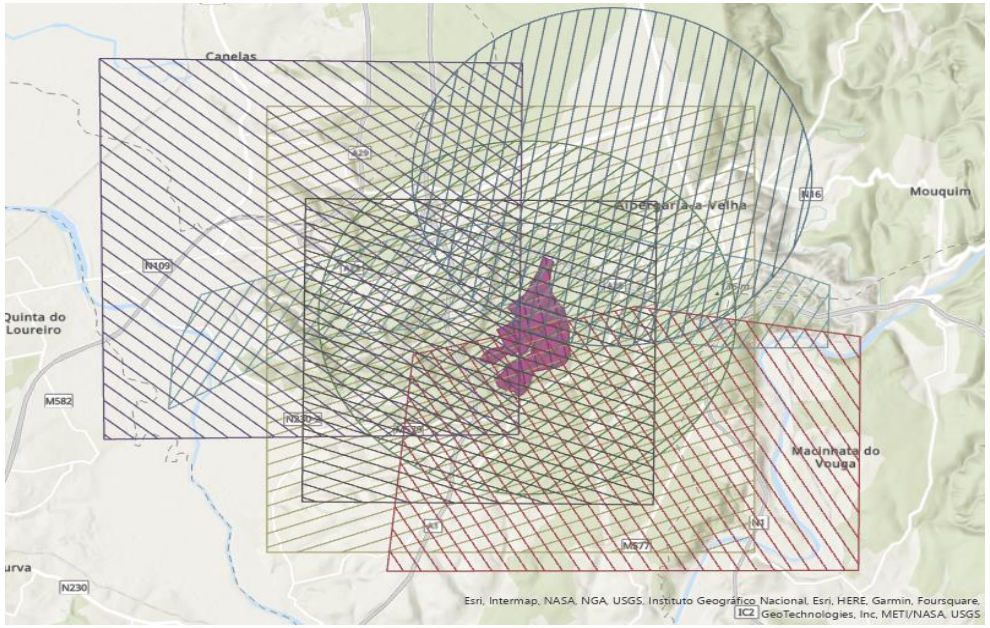


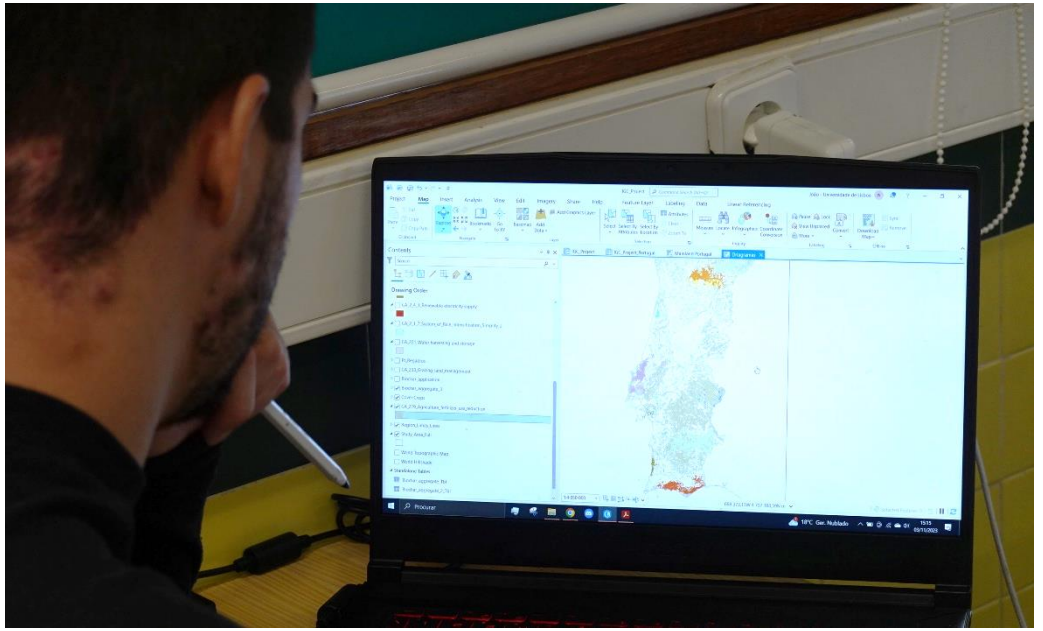


Testing diagrams

Testing designs

Diagrams sent to Geodesignhub





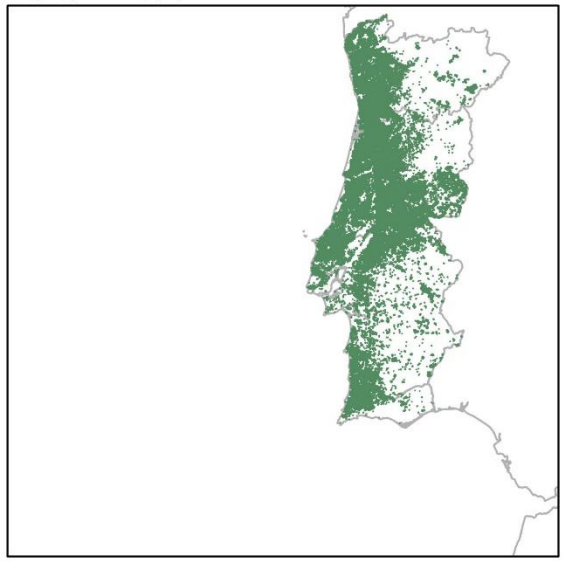
Photographs
Tess Canfield

Examples of prepared diagrams (one for each domain)

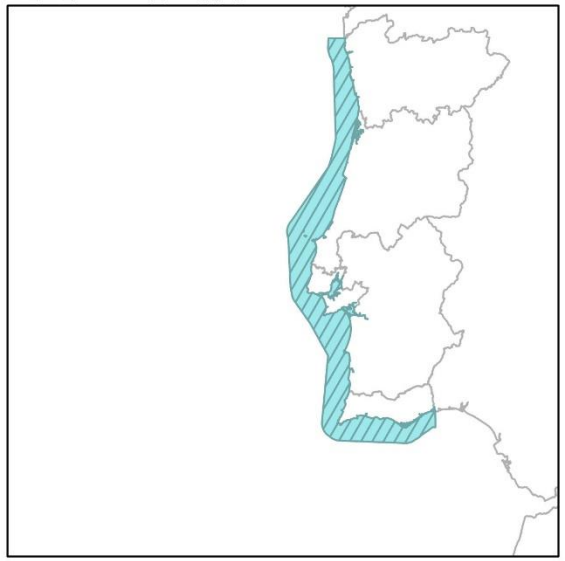
CA_143_Wind_energy_sea_project

CA_218_219_2110_241_Regenerative_agriculture_policy

CA_312_Silviculture_project



CA_421_Sustainable_fishing_project

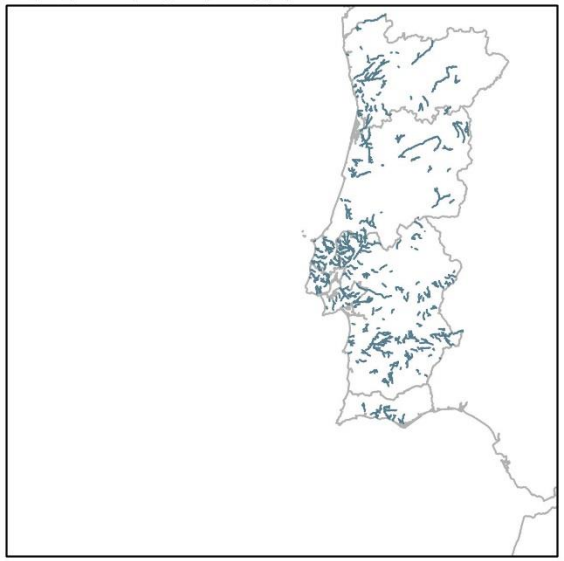


CA_516_533_534_535_Urban_expansion_policy

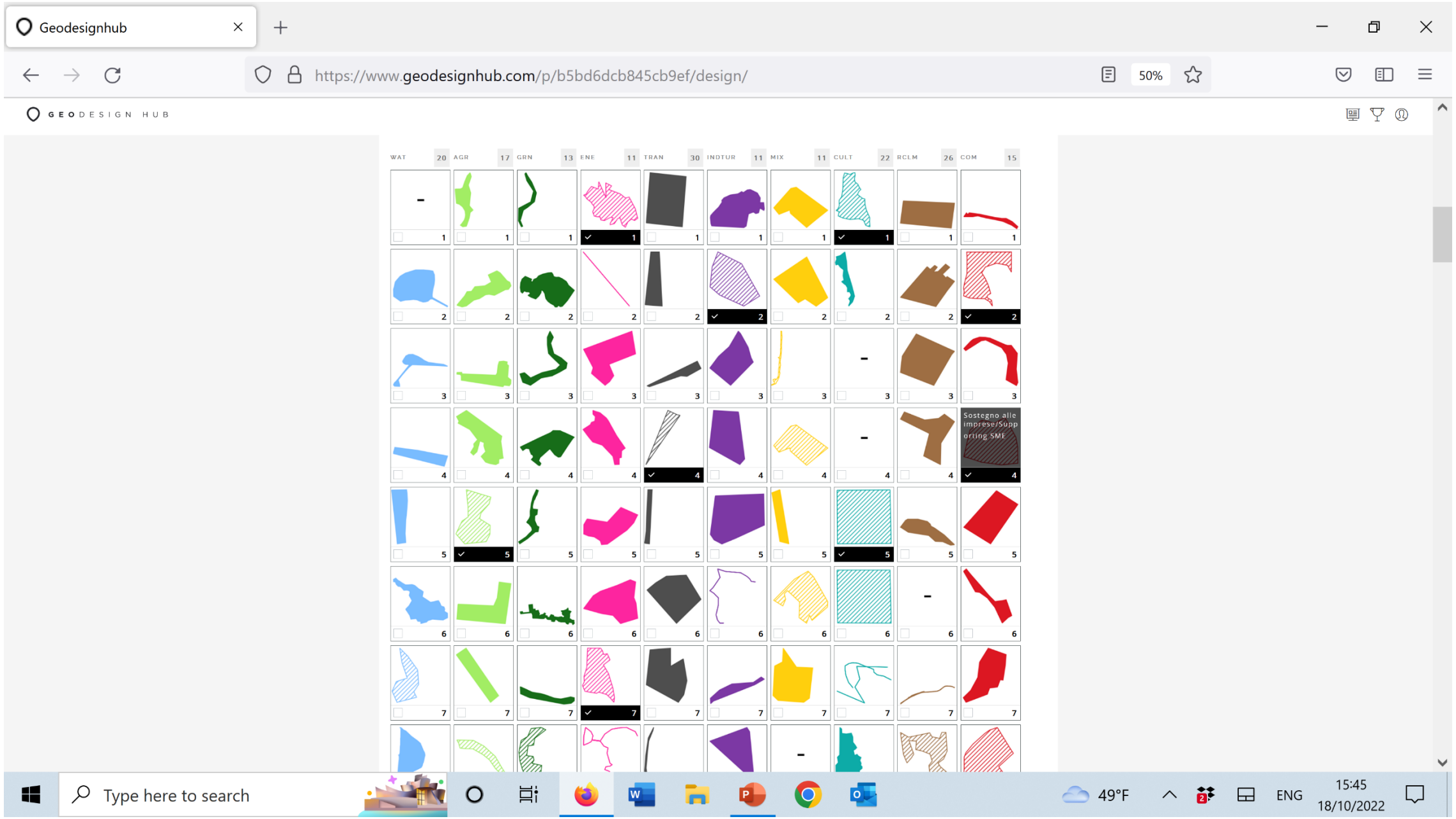
CA_611_612_Metal_mining_efficiency_improvements_&_Green_energy_project

CA_711_Bus_lines_project

CA_813_Restore_river_ecosystems_project



Diagrams are imported into **GeodesignHub**



Day 2
Morning

Organizing two design-synthesis teams and their *foci*

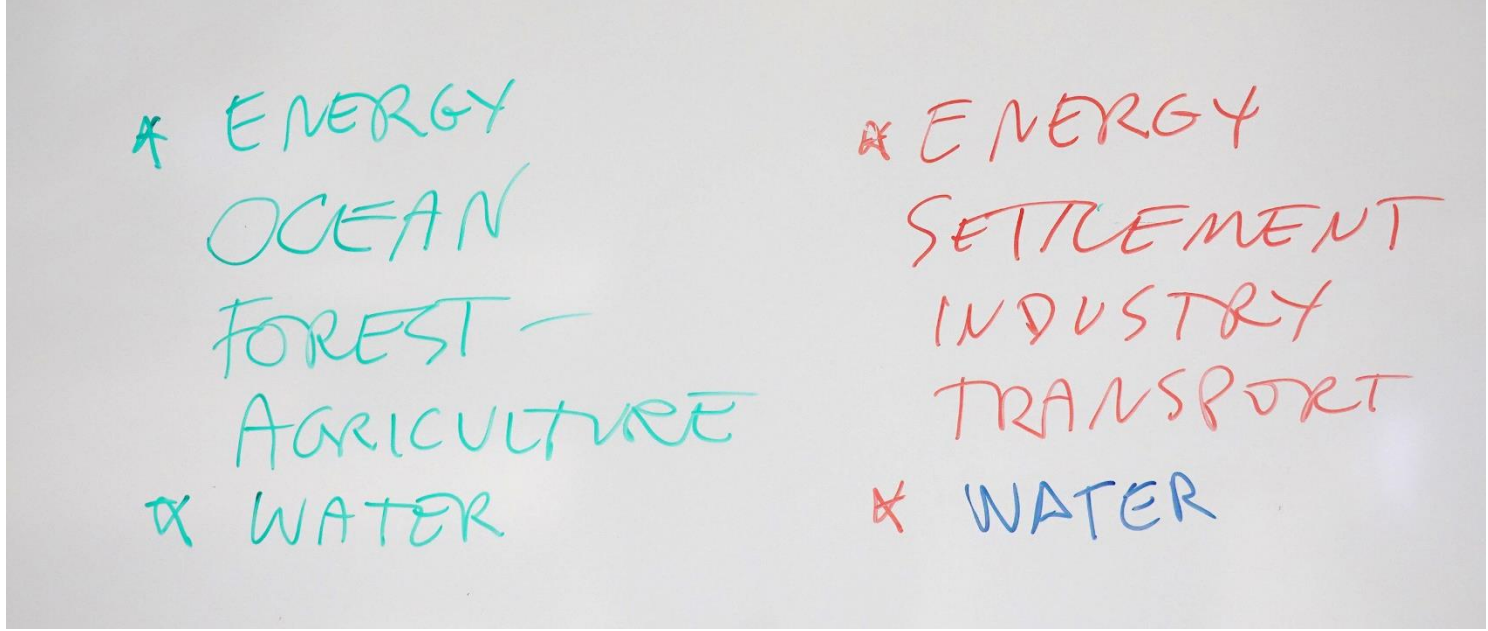
Making
NATUR V1
ECON V1

Presentations

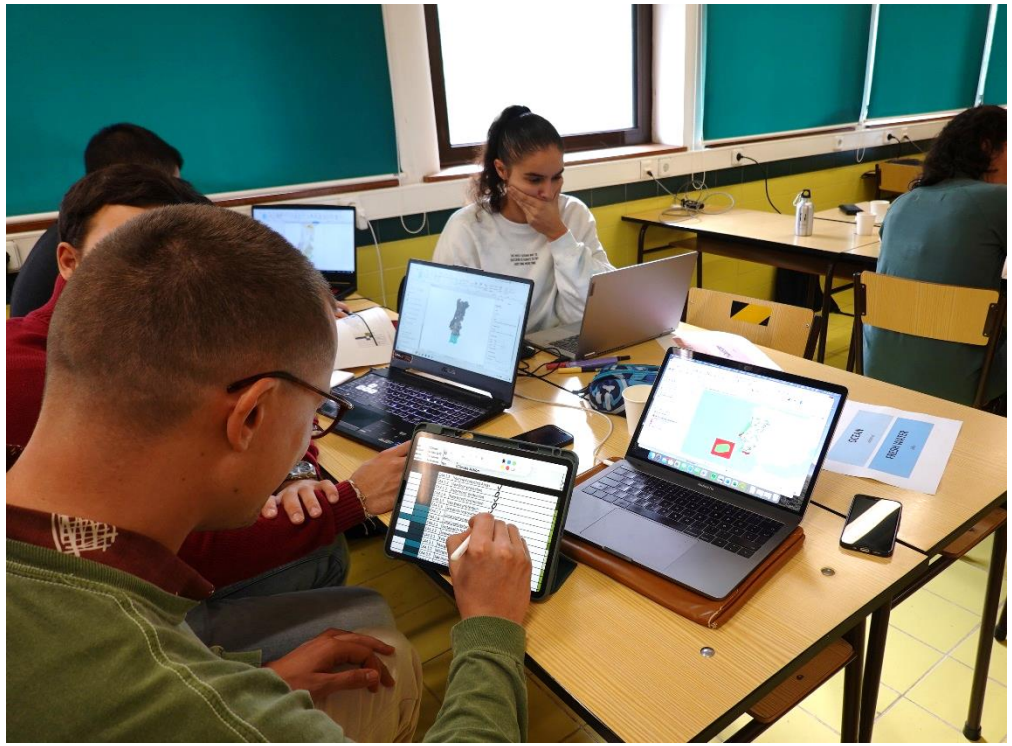
Informal negotiation

Making
NATUR V2
ECON V2

NATURE



ECONOMY



Photographs
Tess Canfield

Day 2
Afternoon

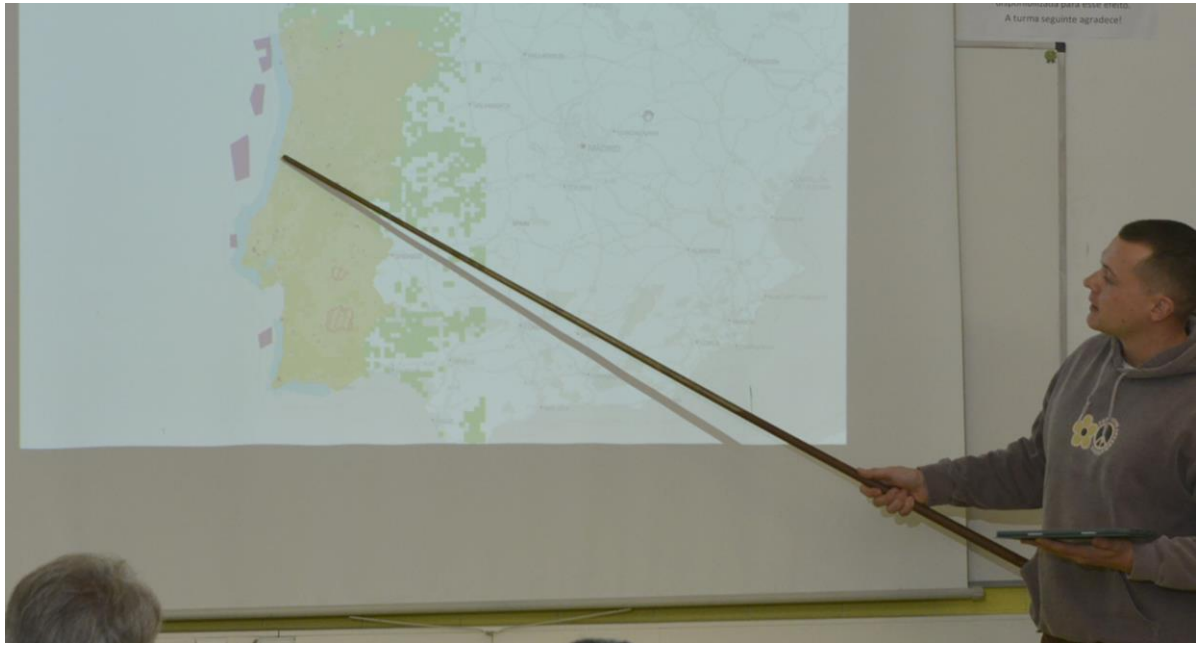
Overview and negotiation proceedure

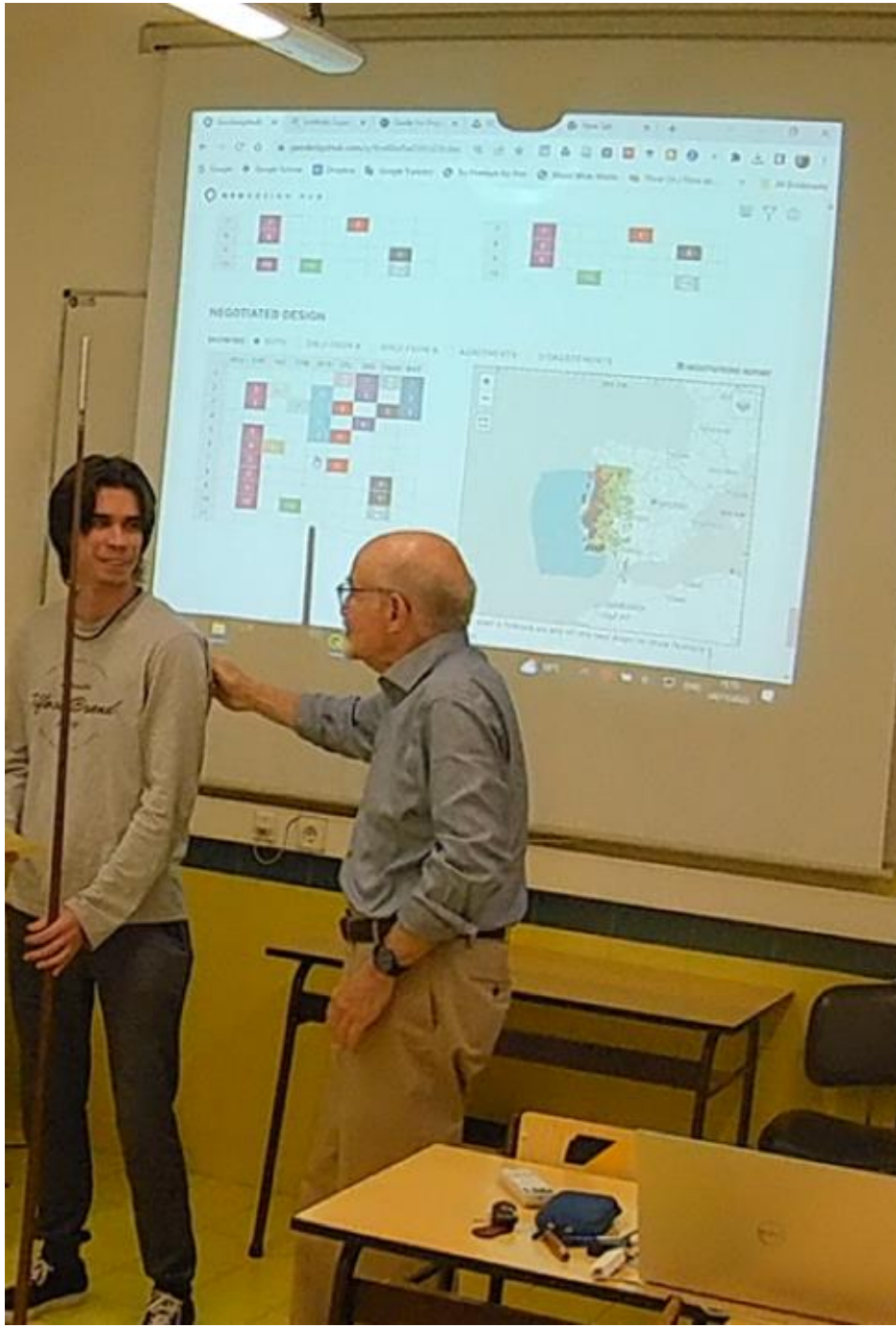
Presentation NAT V2 and ECON V2

Photographs
Tess Canfield

Day 2
Afternoon

Making the final design by negotiation in a sequence of domain-based selected climate actions





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Day 2
Afternoon

Orientation to negotiation tools in Geodesignhub

José Miguel Júdice acting as Prime Minister

Photographs
Tess Canfield

Day 2 Afternoon

The FINAL negotiated design for

A National Climate Actions Plan for Portugal

Photographs
Tess Canfield

A Climate Action Plan for Portugal

2023

Existing Conditions

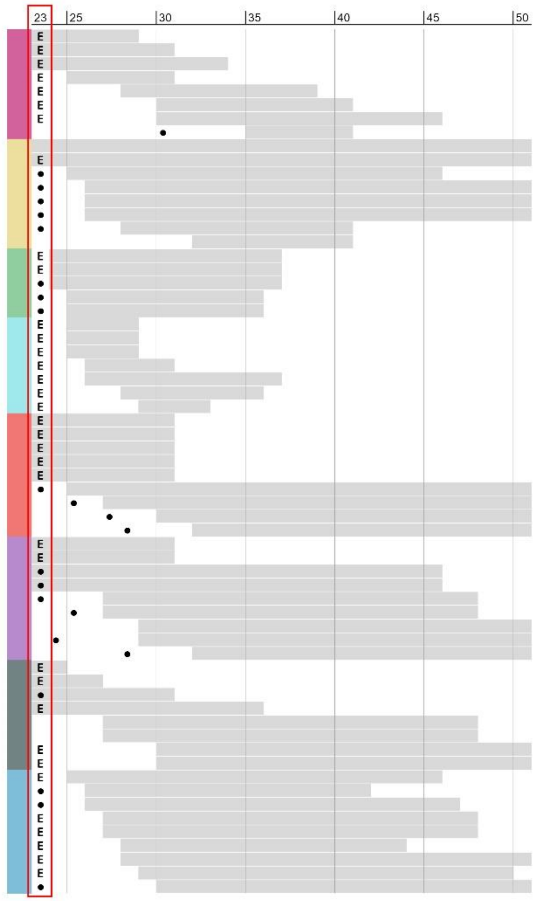
Domains (1 km)

- Energy
- Agriculture
- Forest
- Ocean
- Settlements
- Industry
- Transport
- Fresh Water

Climate Actions

Policies | Projects

Timed Domain Programs



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CA 1.4.3 Wind power
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CA 1.3.6 Wood energy plant closure
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CA 2.2.2 Drip irrigation
CA 2.3.4 Grazing land management
CA 2.1.7 System of rice intensification
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CA 2.2.1 Water harvesting and storage
CA 2.1.3 Biochar application
CA 3.2.1 Wetland protection
CA 3.2.2 Wetland restoration
CA 3.2.3 Peatland protection
CA 3.1.2 Silviculture
CA 3.1.4 Agroforestry
CA 4.1.3 Kelp forest protection
CA 4.1.5 Sea grass protection
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CA 4.3.3 Salt marsh protection
CA 4.2.1 Sustainable fishing
CA 4.3.5 Vessel pollution avoidance
CA 4.1.1 Marine Protected Areas
CA 5.1.4 Zero carbon renovation
CA 5.1.5 Plus-energy renovation
CA 5.1.6 Plus-energy new development
CA 5.2.2 Solar street lighting
CA 5.4.1 Landfill gas recovery
CA 5.3.3 Private lot trees
CA 5.3.5 Wet pavements
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CA 5.3.2 Street trees
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CA 6.1.4 Metal industry renewable energy integration
CA 6.1.5 Mineral industry efficiency improvements
CA 6.1.6 Mineral industry renewable energy integration
CA 6.1.7 Chemical industry efficiency improvements
CA 6.1.8 Chemical industry renewable energy integration
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CA 7.1.2 Light rail
CA 7.1.4 Shared EV mobility
CA 7.3.1 Private vehicle electrification
CA 7.2.1 High-speed rail
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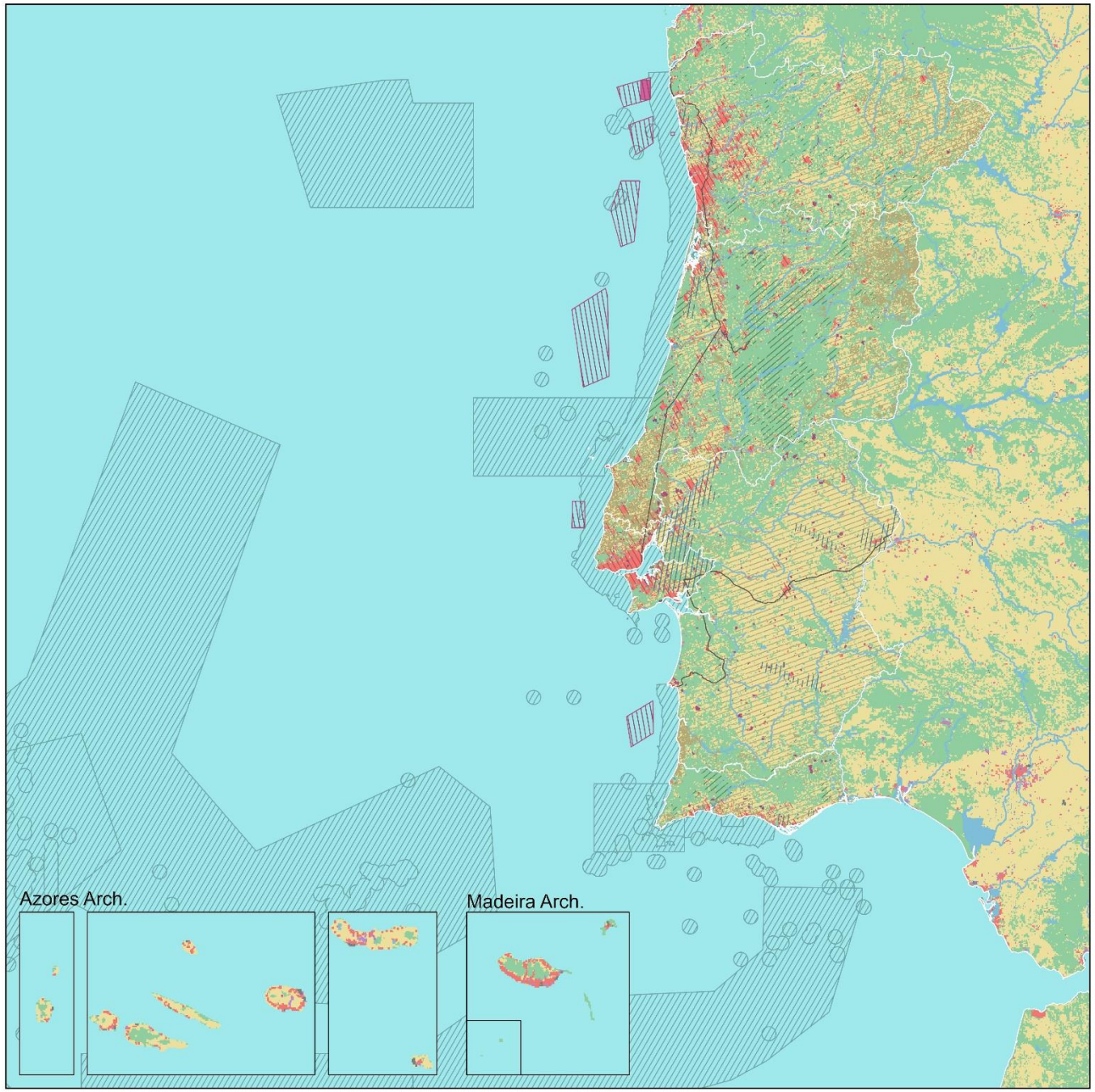
CA 8.3.1 Potable system efficiency improvements

63 CAs included in the final version of the plan
13 CAs with diagram prepared, but not selected
67 Non applicable CAs
143 Total Cas

0 50 100 200 km

A Climate Action Plan for Portugal

2025



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Domains (1 km)

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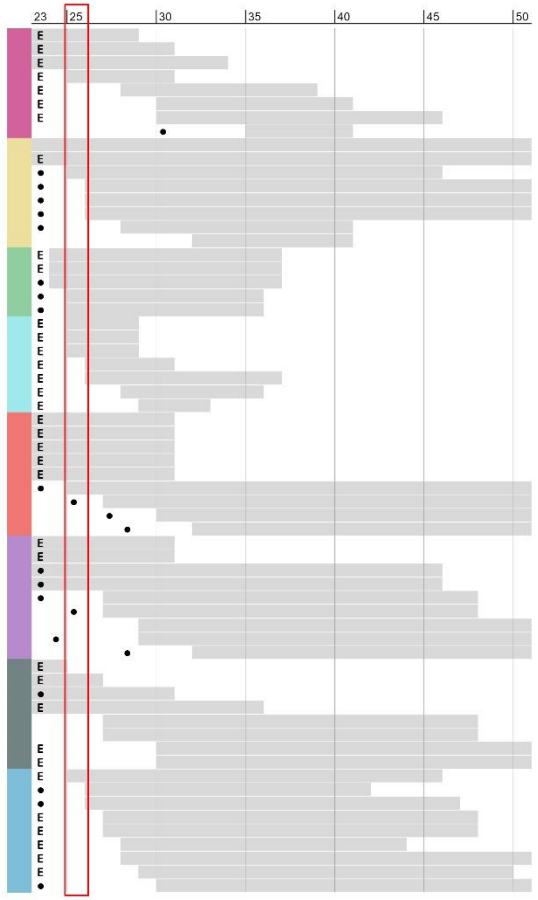
Climate Actions

Policies **Projects**

Timed Domain Programs



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A Climate Action Plan for Portugal

2030

Existing Conditions

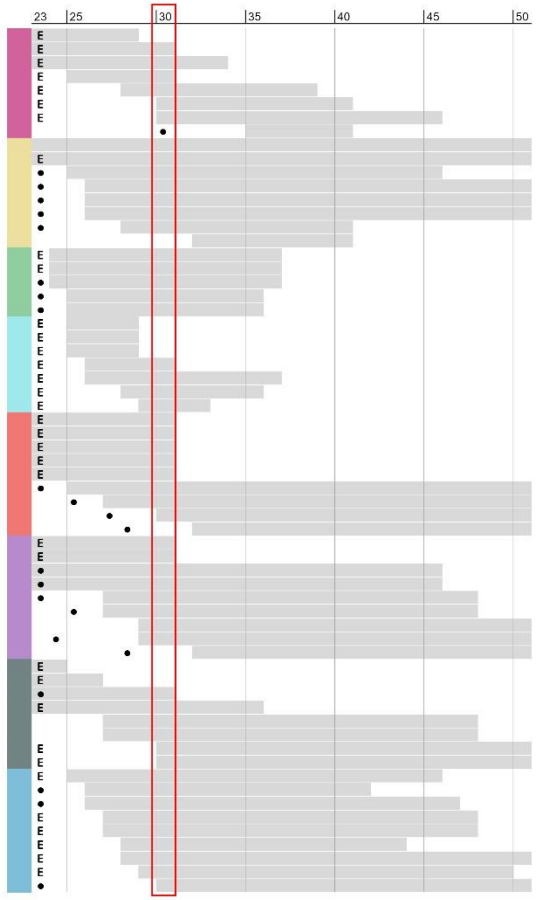
Domains (1 km)

- Energy
- Agriculture
- Forest
- Ocean
- Settlements
- Industry
- Transport
- Fresh Water

Climate Actions

Policies | Projects

Timed Domain Programs



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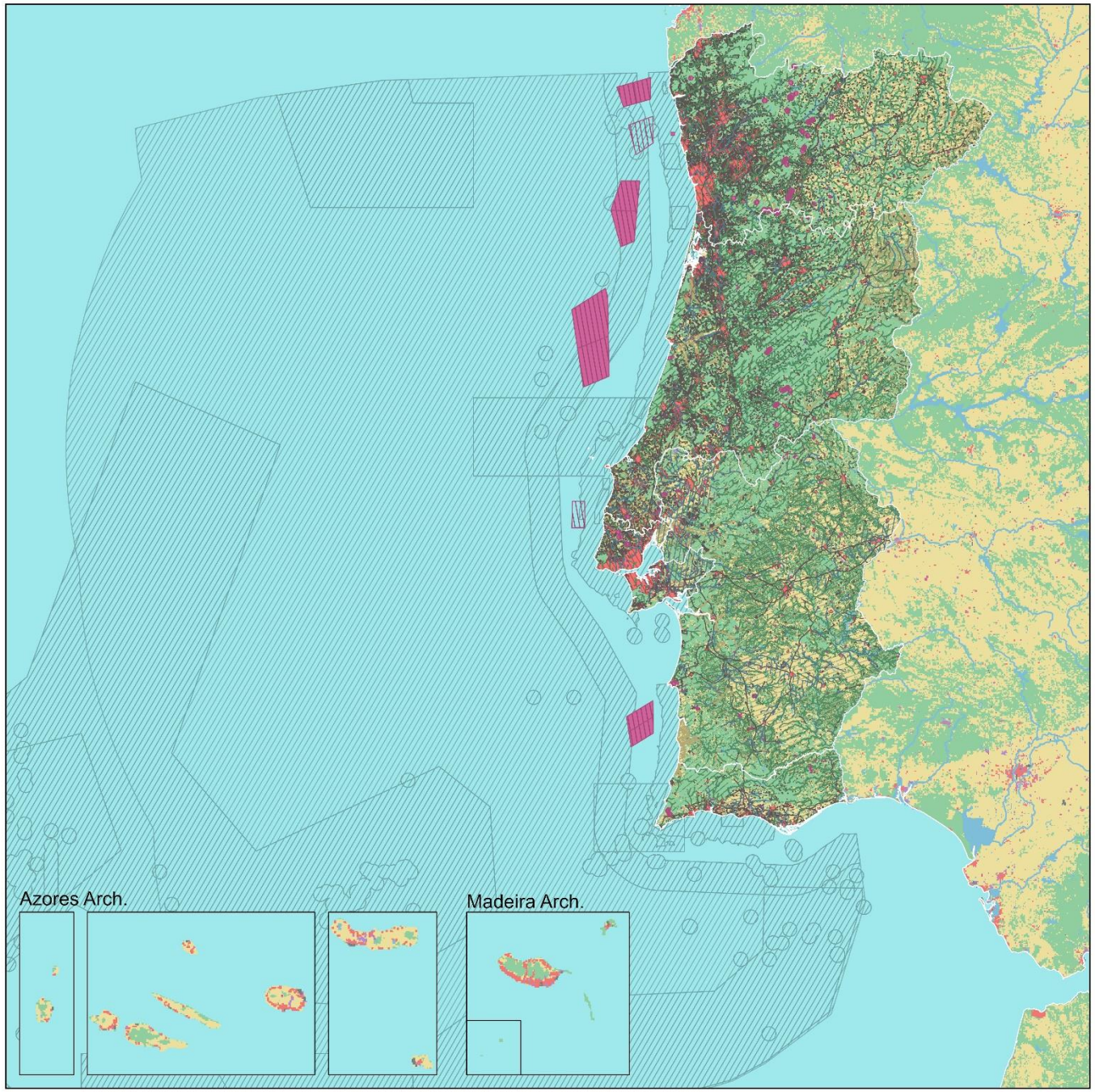
A Climate Action Plan for Portugal

2035



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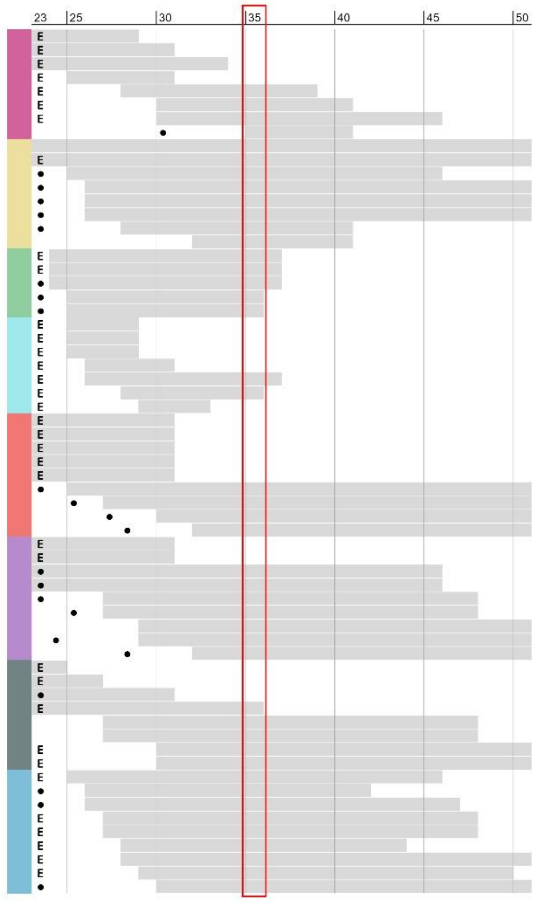
Climate Actions

Policies | Projects

Timed Domain Programs



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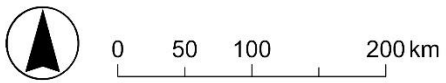
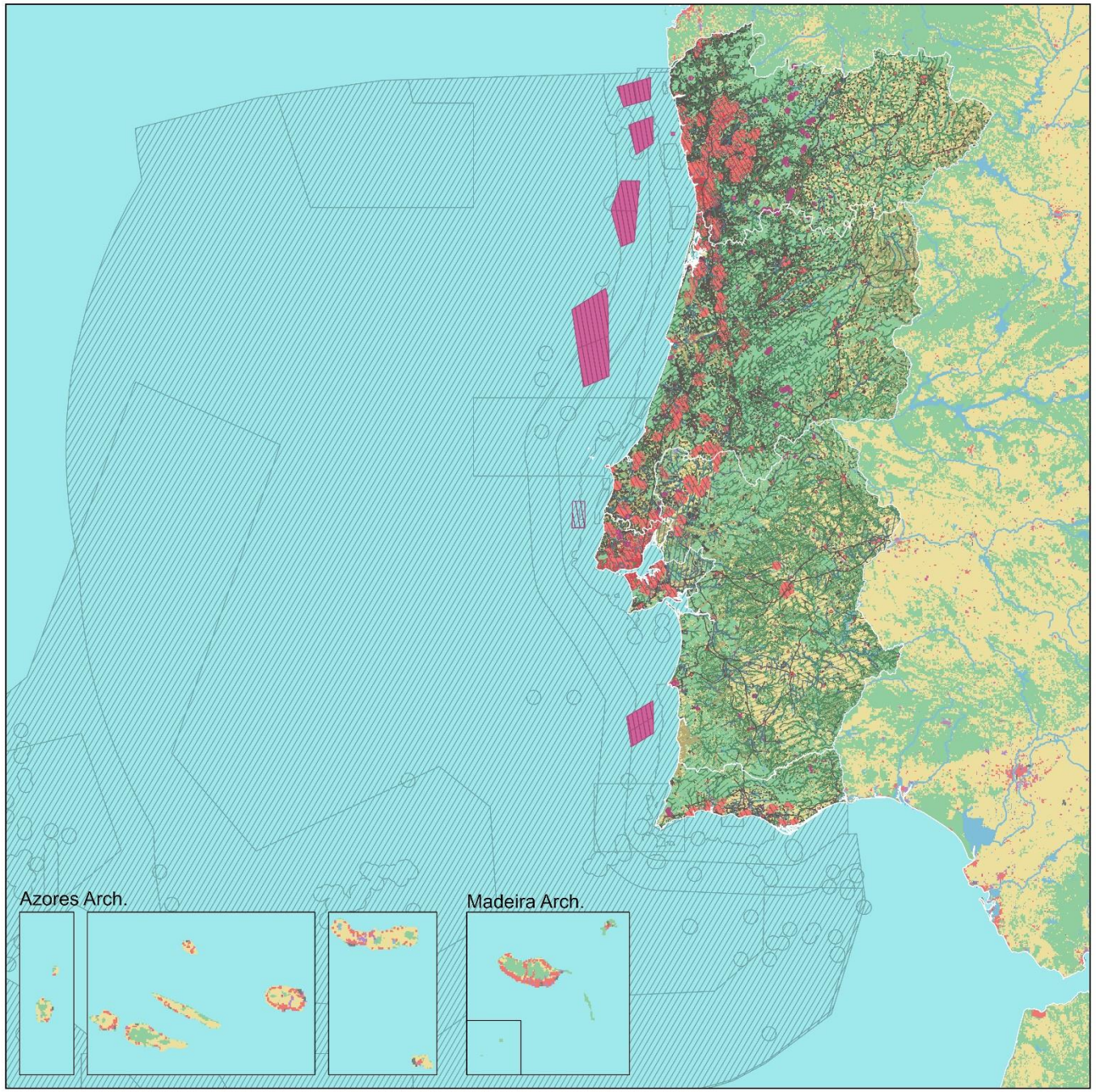


A Climate Action Plan for Portugal

2040



Existing Conditions

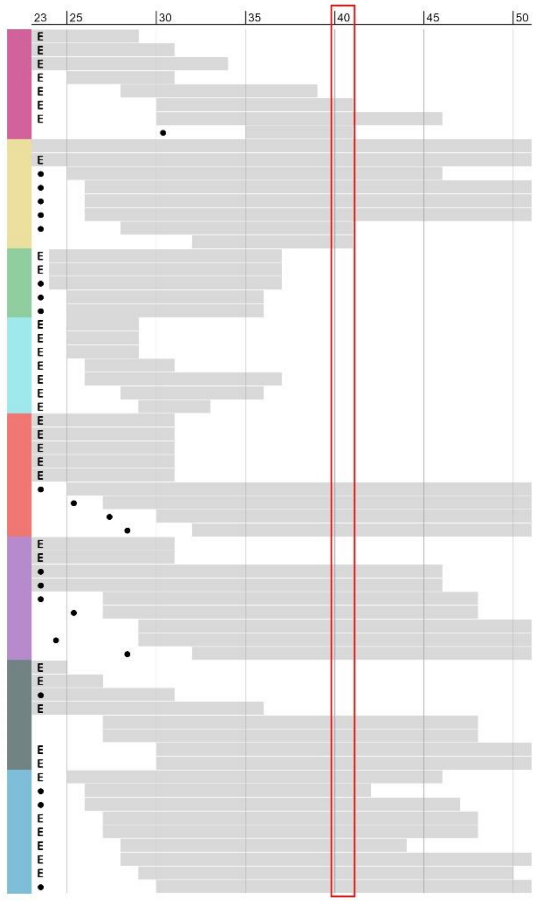
Domains (1 km)

- Energy
- Agriculture
- Forest
- Ocean
- Settlements
- Industry
- Transport
- Fresh Water

Climate Actions

Policies | Projects

Timed Domain Programs



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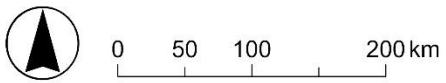
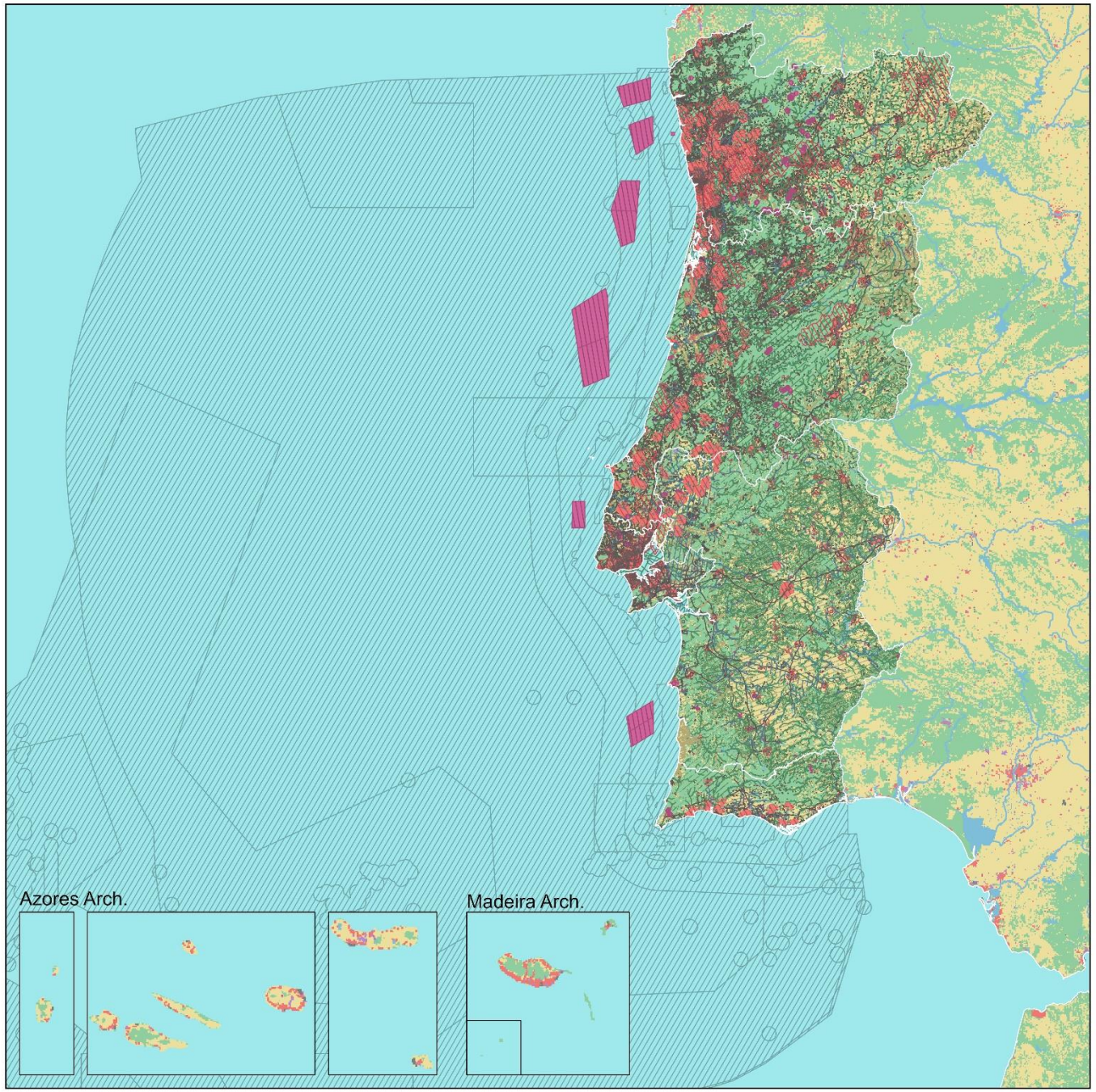


A Climate Action Plan for Portugal

2045



Existing Conditions

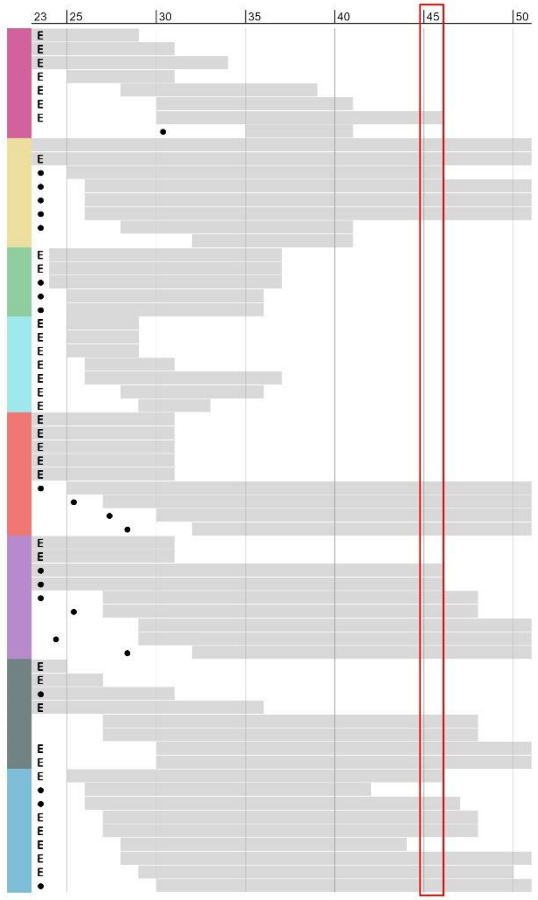
Domains (1 km)

- Energy
- Agriculture
- Forest
- Ocean
- Settlements
- Industry
- Transport
- Fresh Water

Climate Actions

Policies **Projects**

Timed Domain Programs



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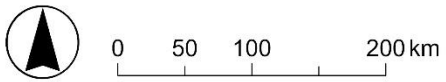
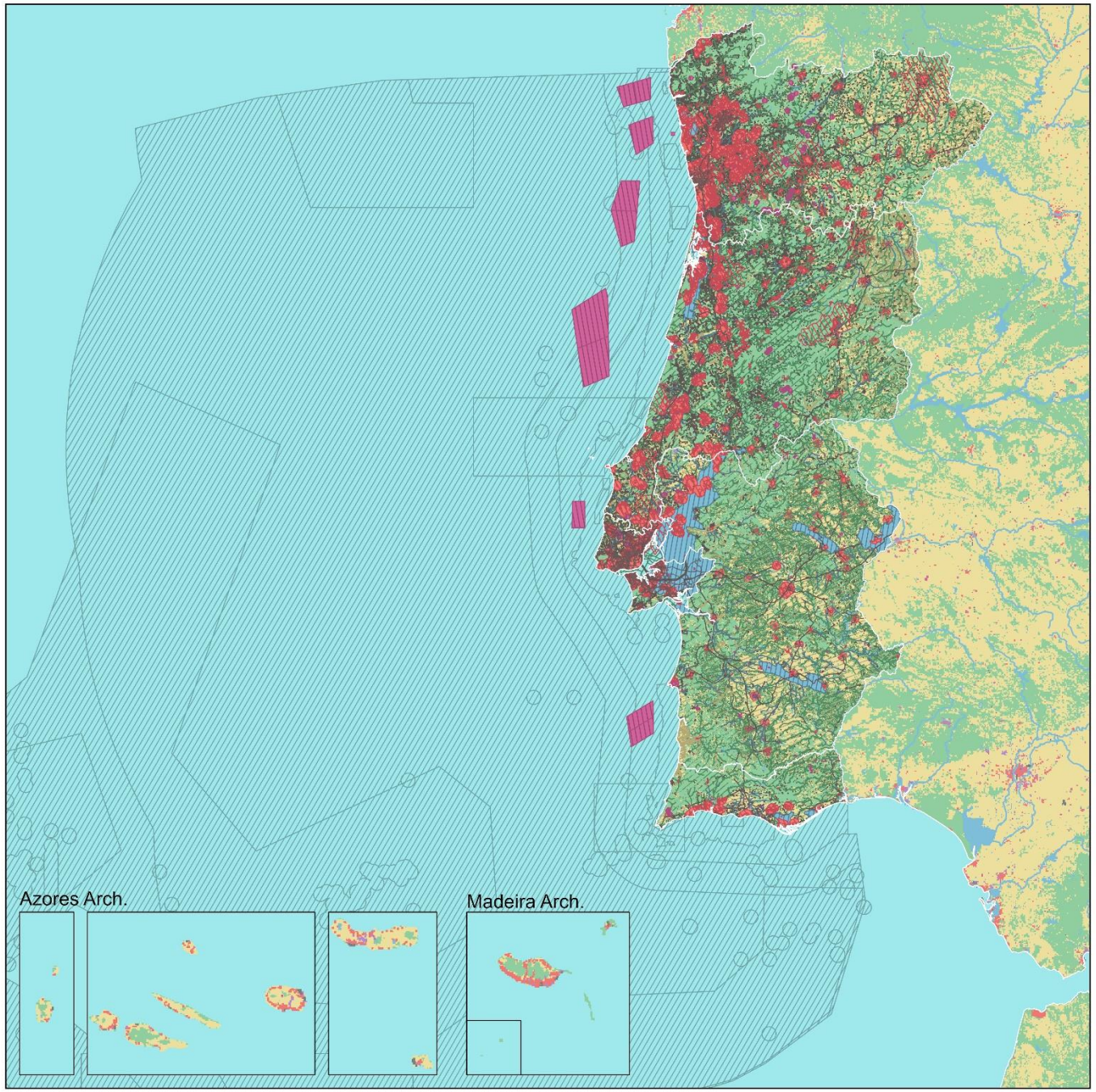


A Climate Action Plan for Portugal

2050



Existing Conditions

Domains (1 km)

- Energy
- Agriculture
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- Ocean
- Settlements
- Industry
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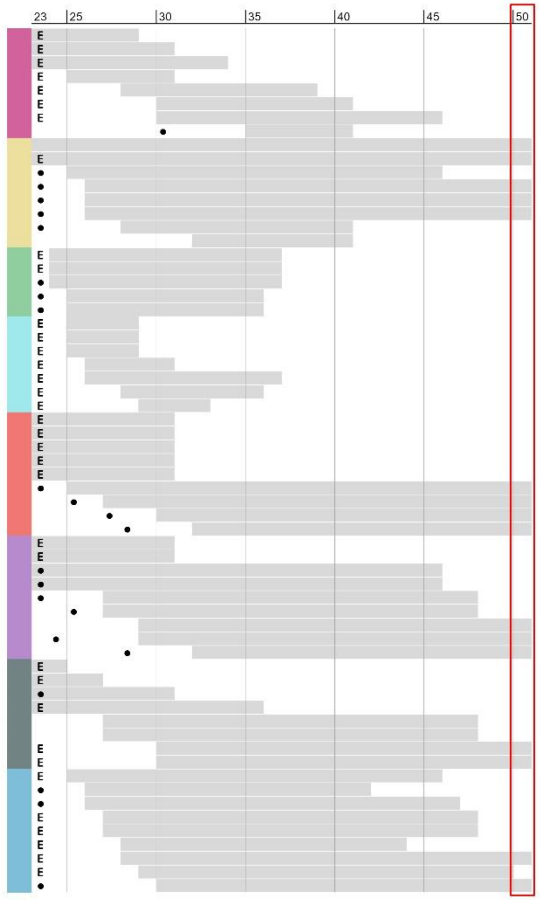
- Fresh Water

Climate Actions

Policies | Projects

Timed Domain Programs



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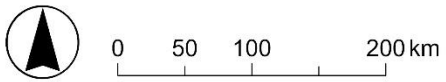

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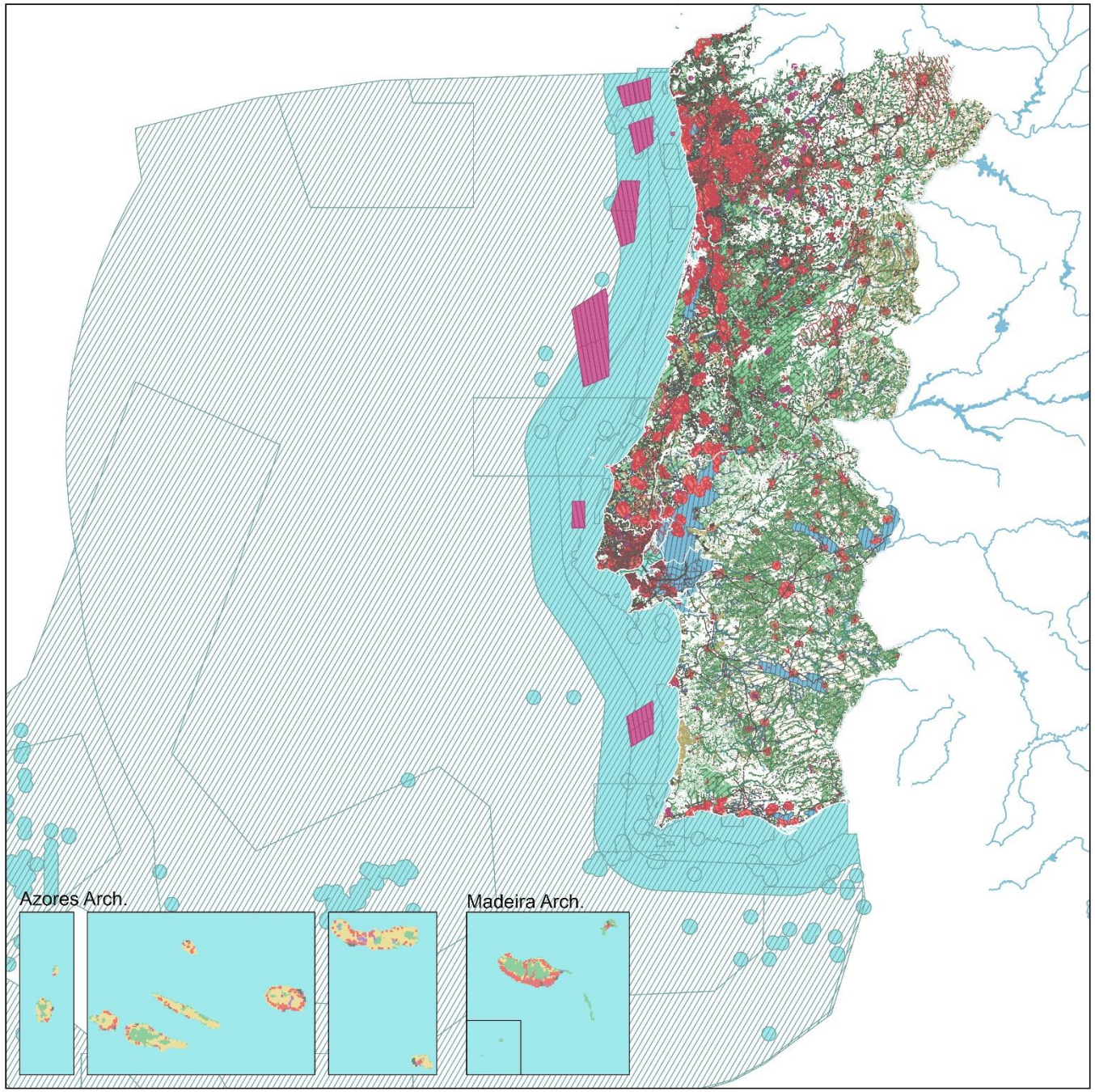

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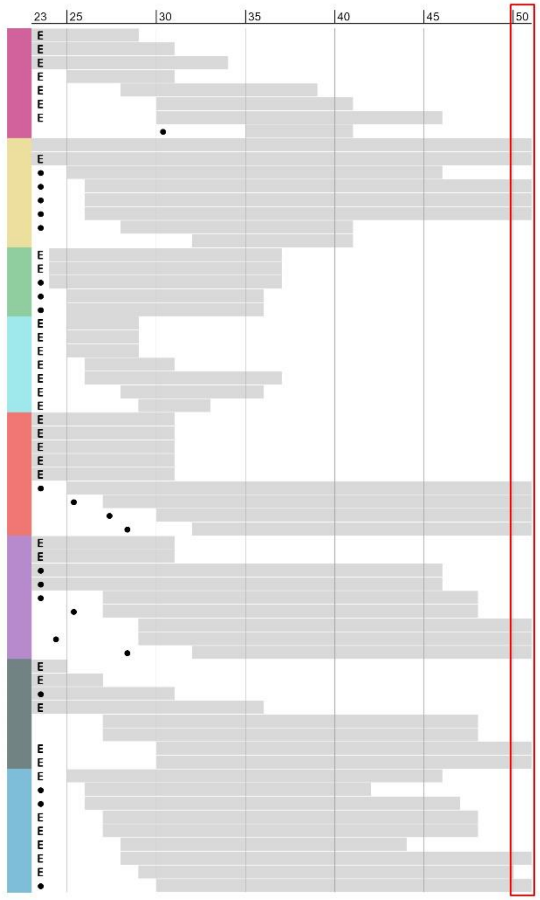

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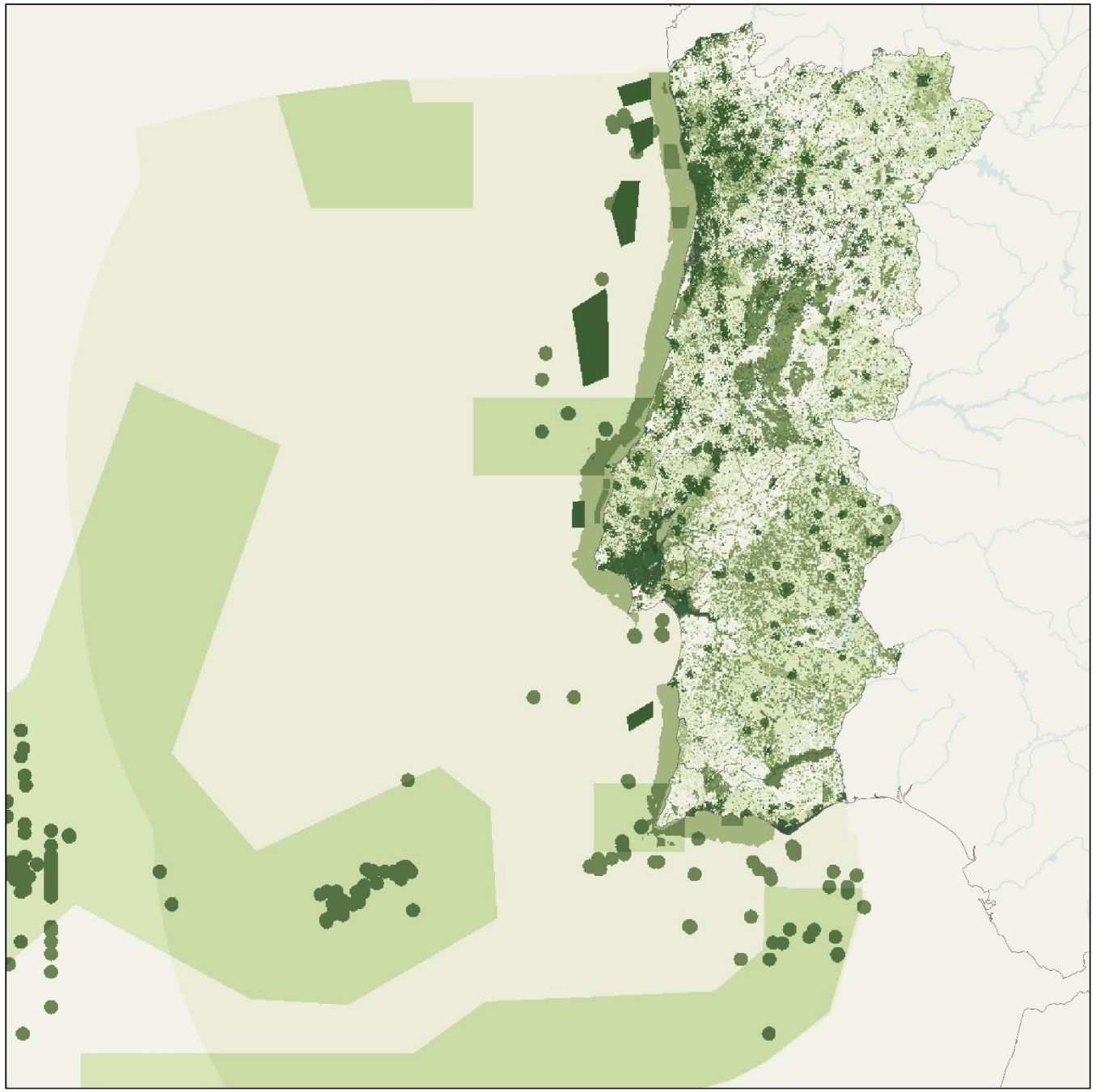
0 50 100 200 km

A Climate Action Plan for Portugal



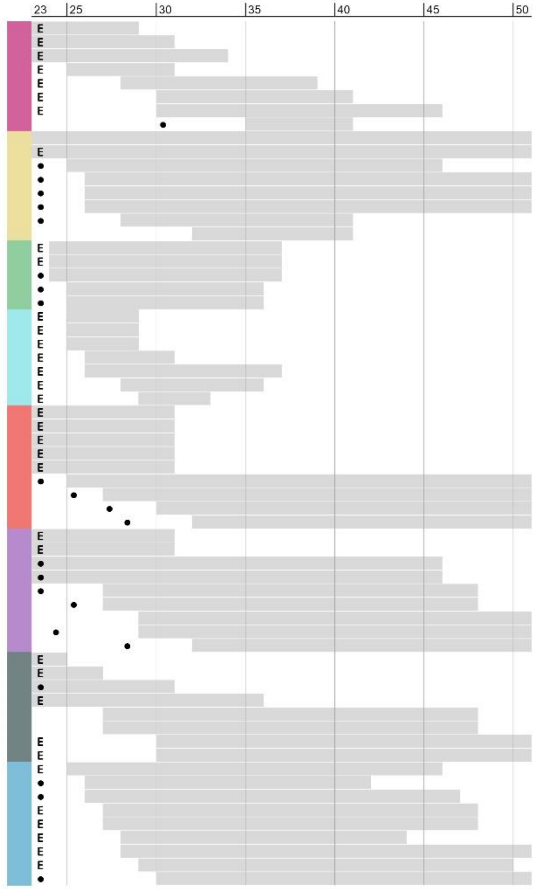
Avoided CO2 emissions (t/km2/year)

- 5 301 - 3 342 100
- 2 406 - 5 300
- 1 801 - 2 405
- 1 506 - 1 800
- 306 - 1 505
- 301 - 305
- 56 - 300
- 6 - 55
- 1 - 5
- 1 - 0

Climate Actions

Policies Projects

Timed Domain Programs



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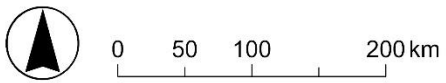
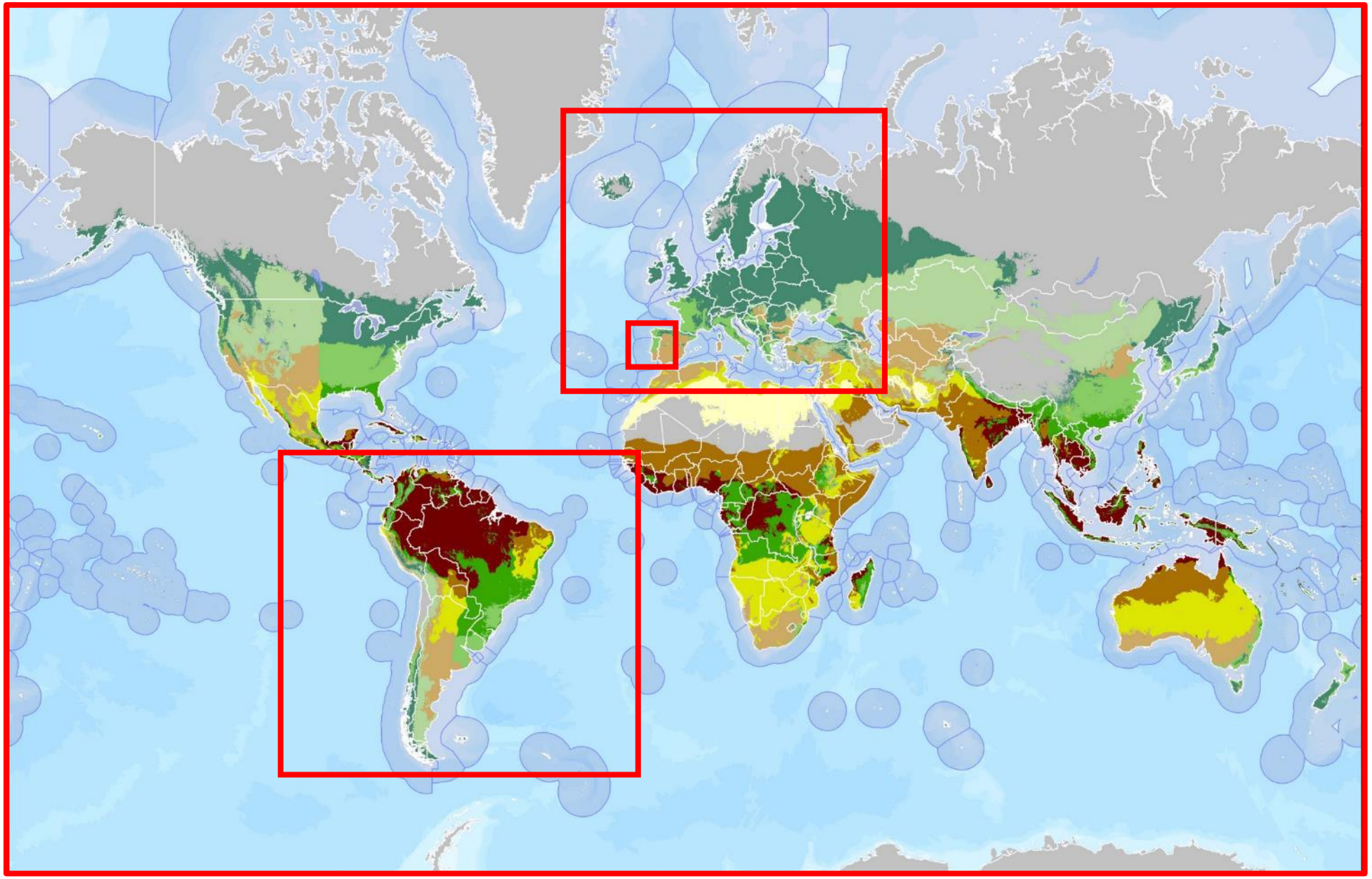


Subsequent Workshops

- Europe (Feb 12, 2024)
- South America (March 8, 2024)
- World (March 19, 2024)

The Global Study Region, Nation Boundaries and World Bioclimate Regions: A Proof-of-Concept Demonstration



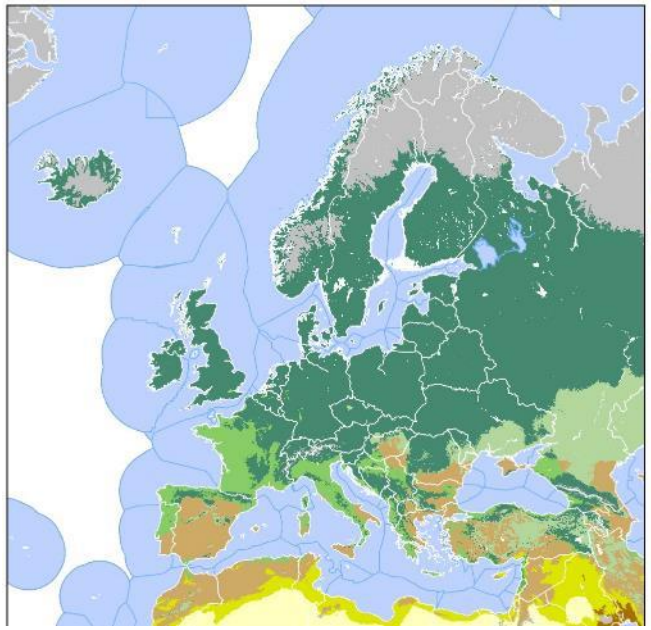
Charlie Frye, Esri

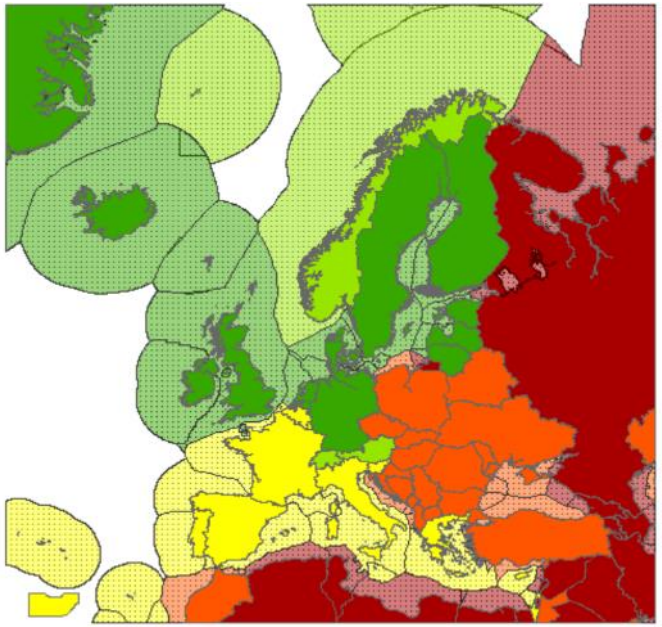
12 February 2024 “Europe” Workshop

“You should act throughout in the interests of your territory as best you understand these, but **with a global mandate to mitigate climate change as rapidly as nationally feasible**.”

Each team selects Climate Policies and Actions and their timing for each domain (e. g. energy, forests, ocean, etc.) which are appropriate to the conditions of the geographic territory and its national capacity, to 2050.

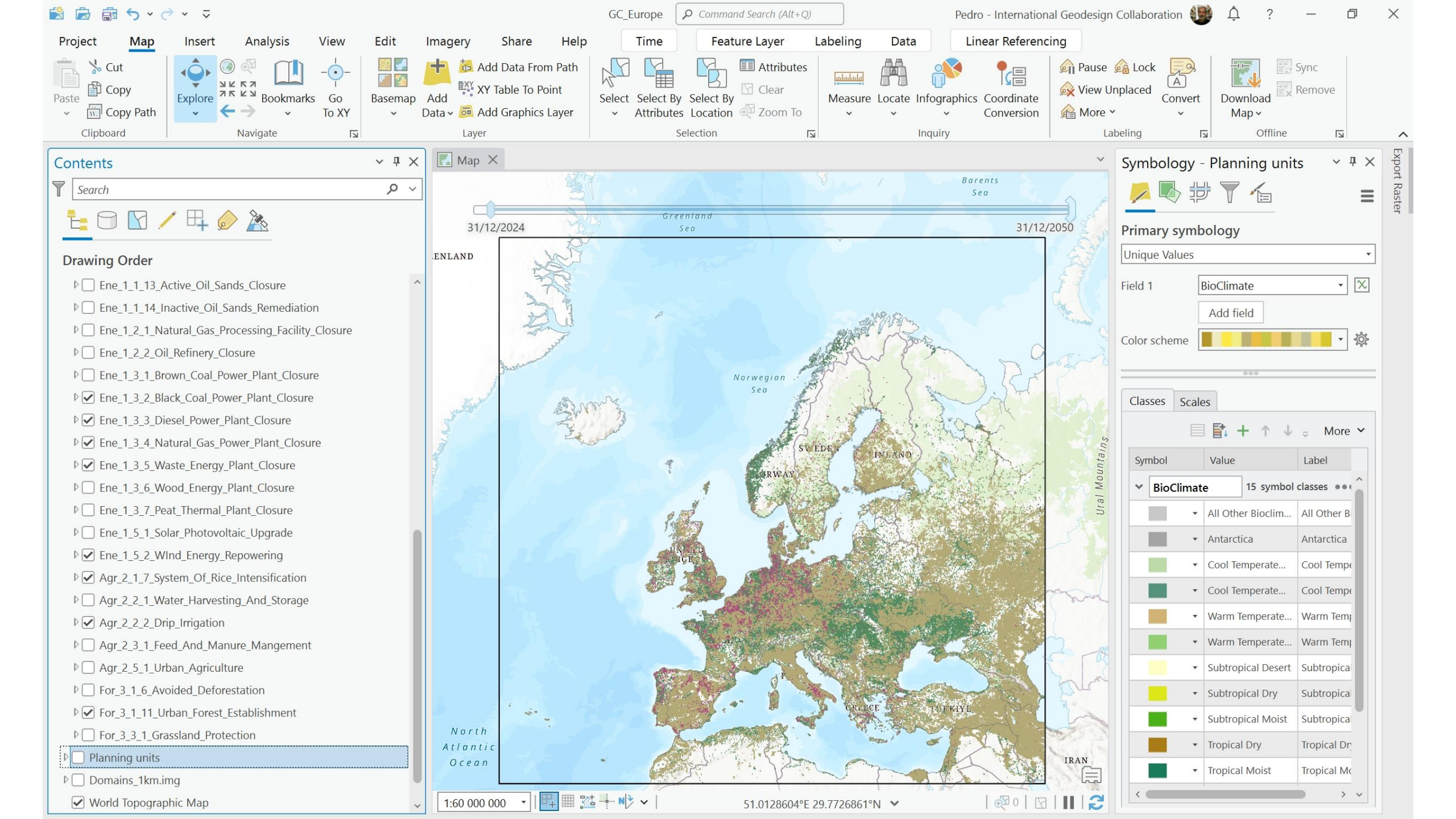
Gantt Charts for 11+ Bioclimate Region Classes X 5 National “Capacity” Classes = 32 of 58 Spatial Unit Types





This is the active geodesign synthesis tool

Carl Steinitz, and Pedro Arsenio, University of Lisbon


GC_Europe
Command Search (Alt+Q)
Pedro - International Geodesign Collaboration
Project
Map
Insert
Analysis
View
Edit
Imagery
Share
Help
Time
Feature Layer
Labeling
Data
Linear Referencing
Paste
Cut
Copy
Copy Path
Clipboard
Explore
Bookmarks
Go To XY
Navigate
Basemap
Add Data
Add Data From Path
XY Table To Point
Add Graphics Layer
Layer
Select
Select By Attributes
Select By Location
Attributes
Clear
Zoom To
Selection
Measure
Locate
Infographics
Coordinate Conversion
Inquiry
Pause
Lock
View Unplaced
More
Convert
Labeling
Download Map
Sync
Remove
Offline
Contents
Search
Drawing Order
Ene_1_1_13_Active_Oil_Sands_Closure
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Ene_1_2_2_Oil_Refinery_Closure
Ene_1_3_1_Brown_Coal_Power_Plant_Closure
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Ene_1_5_2_WInd_Energy_Repowering
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Agr_2_2_1_Water_Harvesting_And_Storage
Agr_2_2_2_Drip_Irrigation
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For_3_3_1_Grassland_Protection
Planning units
Domains_1km.img
World Topographic Map
Map
31/12/2024
31/12/2050
Barents Sea
Greenland Sea
Norwegian Sea
North Atlantic Ocean
Ural Mountains
SWEDEN
FINLAND
GREECE
TÜRKIYE
IRAN
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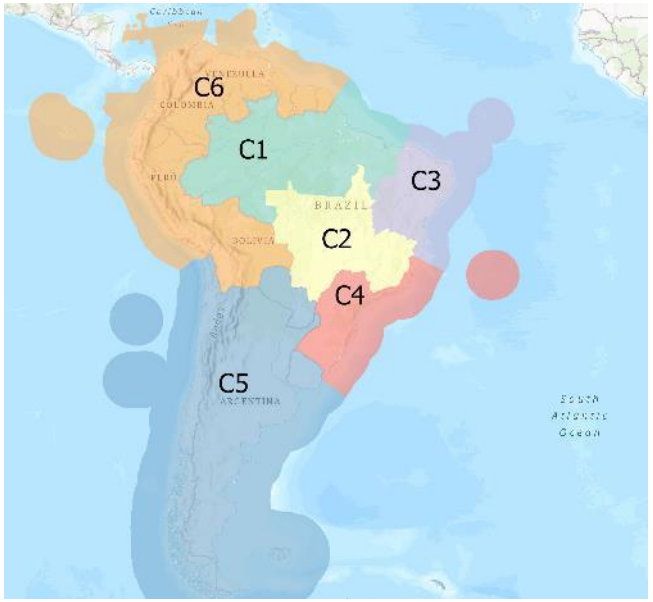
Symbology - Planning units
Primary symbology
Unique Values
Field 1
BioClimate
Add field
Color scheme
Classes
Scales
More
Symbol
Value
Label
BioClimate
15 symbol classes
All Other Bioclim...
All Other B
Antarctica
Antarctica
Cool Temperate...
Cool Tempe
Cool Temperate...
Cool Tempe
Warm Temperate...
Warm Temp
Warm Temperate...
Warm Temp
Subtropical Desert
Subtropica
Subtropical Dry
Subtropica
Subtropical Moist
Subtropica
Tropical Dry
Tropical Dr
Tropical Moist
Tropical Mo
Export Raster

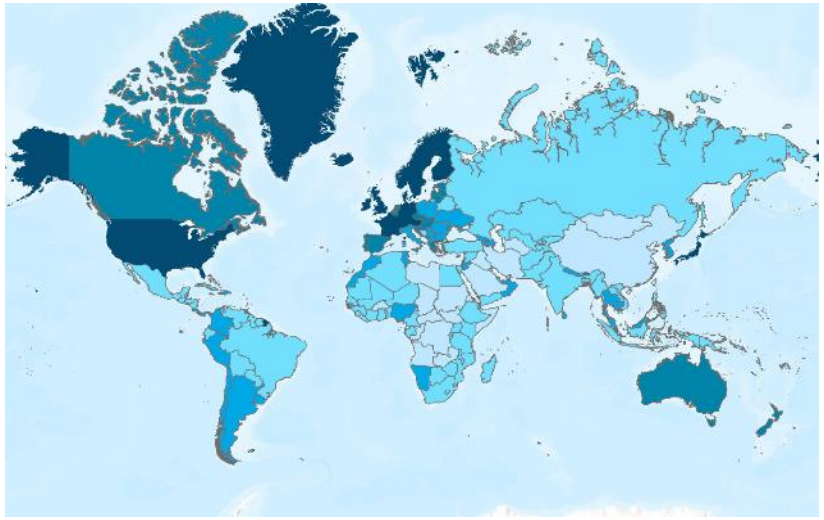
A South America Climate Actions Geodesign Study, in Geodesignhub From “Expert” Climate Action Maps (March 8, 2024)

Geodesign Teams

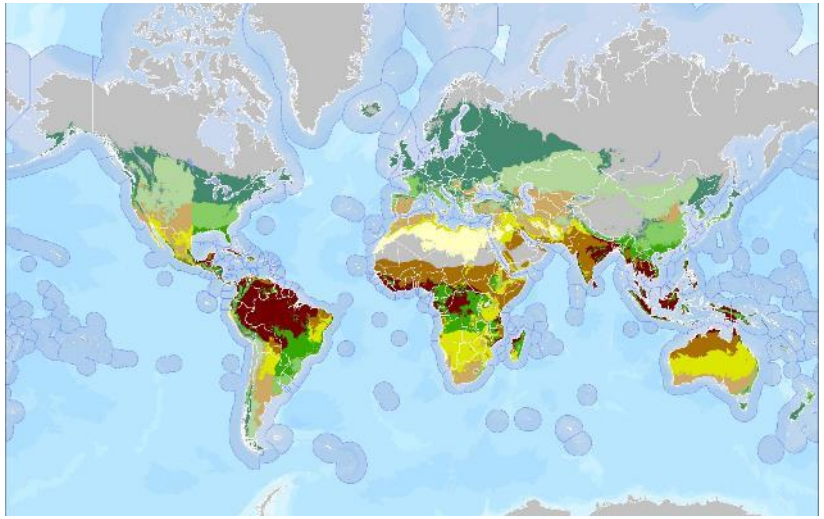


Paulo Pellegrino, University of São Paulo, Chiara Cocco, University College Dublin

Planning Unit “Similarity” and Assignment of Gantt Charts: E. g. France and Japan

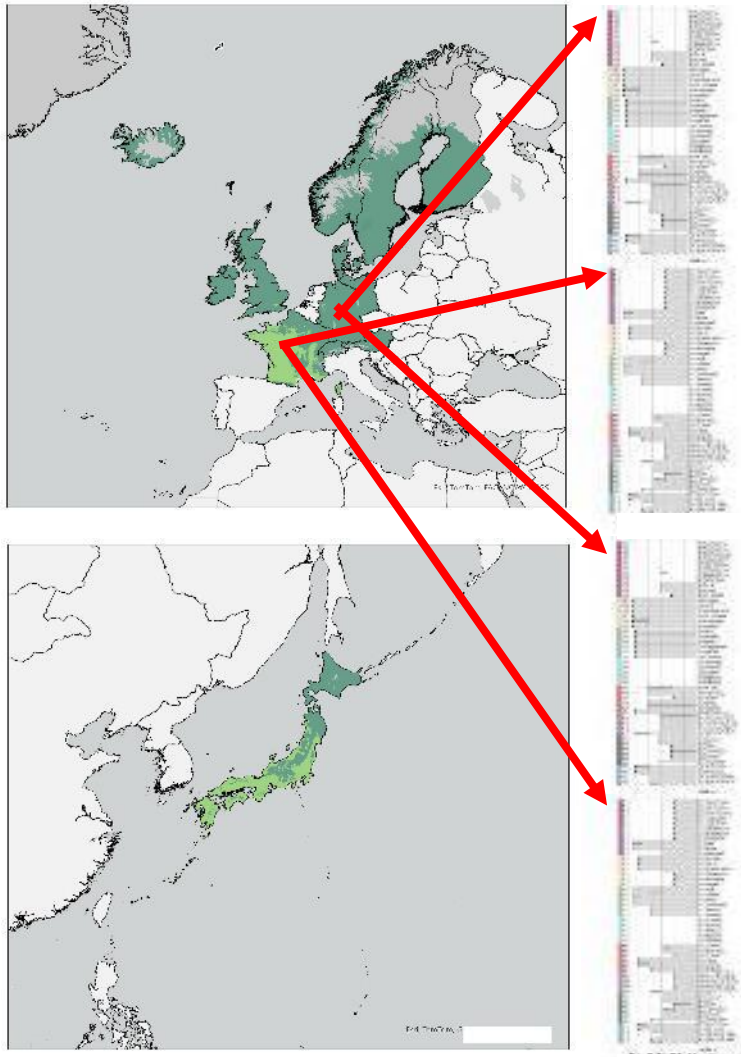


National Readiness
- Very High 71.2-82.5%
- High 59.9-71.2%
- Moderate 48.7-59.9%
- Low 37.4-48.7%
- Very Low 26.2-37.4%



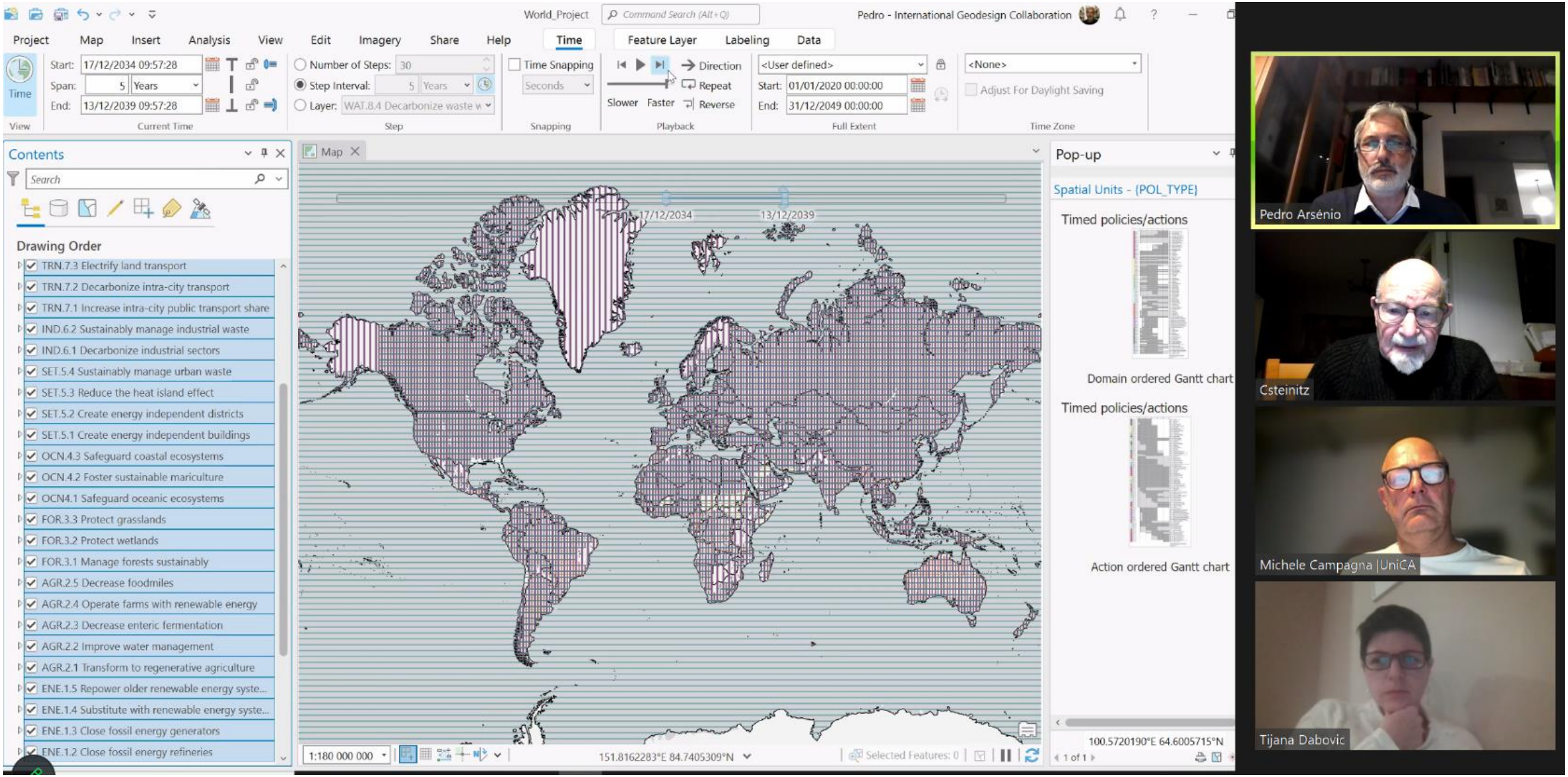
BioClimates
- Cool Temperate Dry
- Cool Temperate Moist
- Subtropical Desert
- Subtropical Dry
- Subtropical Moist
- Tropical Dry
- Tropical Moist
- Warm Temperate Dry
- Warm Temperate Moist
- All Others
- Economic exclusive zones

Resolution at 1 sq km



The geodesign task in this Global to Local demonstration is to generate and assign Gantt charts of timed Climate Policies and Climate Actions to similar National and Bioclimate Planning Unit types in the global set of 1,000 Planning Units.

FIRST GLOBAL PROOF OF CONCEPT GEODESIGN TESTS: 19 MARCH 2024



Workflow Decision → Automated → Feedback at any stage

Global Exploration

LISD list "live" → Globe CO2 status → Global current status → Global Policies → Study areas → Select → **Global data**, Esri Living Atlas, other



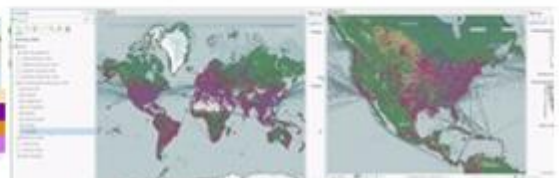
Map underlays, e.g. LULC
Map overlays e.g. sattelite
LISD Climate Policies
LISD Climate Actions
Past GC designs on Global
Past GC Carbon ass. on Global
e.g. population, finance, bioclimate.

Multiple Planning Units

LISD to Gantt Charts by subtraction or addition → Editing matrix → "Similarirty" → Geodesign V.1 to Final → CO2 emissions assessment → Representation → To Globe

If Planning Units or jurisdictions are missing, assign by "similarity"

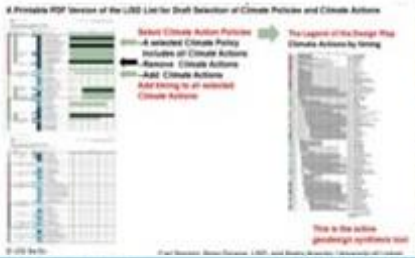




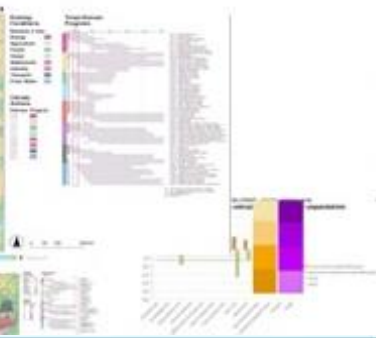
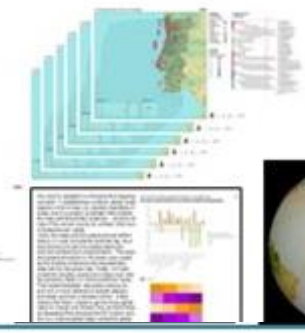

Single Planning Unit

To GDH
If needing drawn diagrams or negotiation, and
If Local and single jurisdiction, Add local data if in GC conventions

LISD to Gantt Chart by subtraction or addition → Geodesign → Design V. Final → CO2 emissions assessment → Representation → To Globe





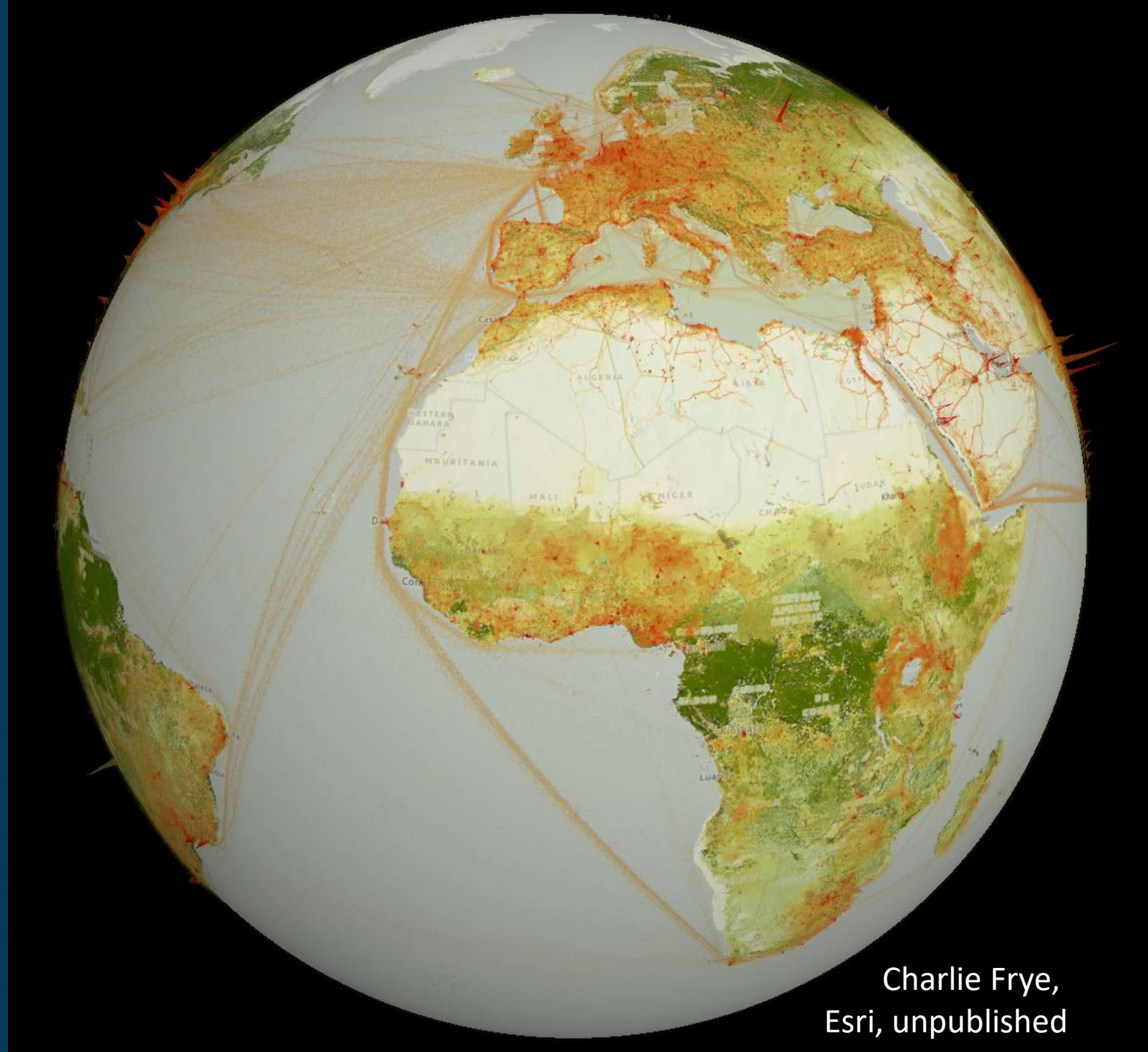




Geodesign as a tool to prepare Climate Action Plans

A case study in Portugal

Thank you for the attention!

Pedro Arsenio (arseniop@isa.ulisboa.pt),
Carl Steinitz



Charlie Frye,
Esri, unpublished