National Roadmap for Adaptation 2100

Portuguese Territorial Climate Change Vulnerability Assessment for XXI Century

REPORT

WP1 – STAKEHOLDER ENGAGEMENT

National Roadmap for Adaptation 2100

Portuguese Territorial Climate Change Vulnerability Assessment for XXI Century

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Title: RNA2100 – Stakeholder engagement

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1. Introduction

This report presents the preliminary results of Working Package 1 (WP1) of the National Roadmap for Adaptation XXI (RNA2100) project, regarding the Stakeholder Engagement and Workshops domains (Table 1).

Sector / Domain	Responsible partner	Participant partners	Considerations
Stakeholder Engagement	FCUL (Luís Dias)	APA, DGT, DSB	- Identification of the type and format of the variables and indices needed for the sector. - Discussion on the main sectoral drivers of relevance. - Refinement of the details of the socioeconomic scenarios. - Validation of assumptions (e.g., value of parameters) to be considered after in WP4. - Identification of improvements in the methodology. - Validation of assumptions to be used in the modelling. - Identification of additional potential adaptation measures. - Discussion and establishment of criteria to identify priority adaptation measures. - Validation of assumptions (e.g., value of parameters) associated to adaptation measures. - Reflection on the impacts of the climate indices on the different sectors. - Discussion on type, format, and detail of the storylines to be considered for the sector.

Table 1 - Proposed tasks for the assessment of climate change impacts on Portugal's mainland's hydrological balance & agroforestry.

The first workshop of the RNA2100 took place on May 4th, 2023, and aimed to disseminate, to the interested parties, the work carried out within the scope of the National Roadmap for Adaptation project, and to gather information about climate change adaptation measures that the stakeholders deemed most suitable to address climate projections until the end of the 21st century in Portugal. The goal was also for these contributions to be relevant to the process of constructing sector-based and NUTS II-based storylines for mainland Portugal. In this way, the gathered information will be used in both WPs 5 (adaptation needs) and 7 (development of the adaptation storylines).

In addition to the direct contributions for the creation of the storylines, the holding of this workshop was valuable for the validation of the assumptions used in WP4 (sectorial impacts modelling), as well as for discussing the main sectoral drivers of relevance.

DELIVERABLES

WP1A	Reports for each of the workshops held, expressing the stakeholder's views on the WP subjects listed above

Since this is a preliminary report, the information presented may be subject to change in future reports, allowing for updates and the introduction of relevant information by other consortium members.

2. Materials and Methods

The workshop was held on May 4th, 2023, at the Ministry of Environment facilities, situated on Rua de O Século, in Lisbon. This event was thoughtfully structured into two parts with the aim of providing participants with a holistic understanding of the project and its methodologies.

In the first part of the workshop, highlight was given to the presentation of the overall project, its methodologies, and a preliminary introduction to the results achieved up to that point. During this phase, the speakers focused on key aspects of the project, its mission, and the methods employed to achieve the objectives.

The second part of the event was designed to promote a more practical and engaging interaction. Participants were invited to split into three thematic rooms, each dedicated to one of the critical sectors of the project, including impact modeling and adaptation measures. The thematic rooms were as follows:

- Room 1: Water Resources & Agroforestry;
- Room 2: Sea-Level Rise & Coastal Erosion;
- Room 3: Forest Fires.

This approach allowed participants to embark on an in-depth exploration of their specific areas of interest and collaborate with others who shared their common interests. It was a valuable opportunity to exchange ideas, share perspectives, and explore innovative solutions. The carefully planned alignment ensured that all attendees had the opportunity to establish a solid initial contact with the project and understood the applied methodologies in detail. Table 2, found below, provides a summary of the session's alignment, including the titles of the presentations given and the speakers responsible for each one, offering a comprehensive overview of the event.

Hours	Events
9:00	Welcome and general project overview. (APA – Nuno Lacasta and Ana Daam)
9:20	Challenges of climate change (FCUL - Filipe Duarte Santos)
9:40	The future of the Portuguese climate (FCUL - Pedro Matos Soares)
10:00	Water resources & Agroforestry (FCUL – Luís Filipe Dias)
10:10	Sea level rise & Coastal erosion (FCUL – Gil Lemos)

Hours	Events
10:20	Forest fires (FCUL – Virgílio Bento)
10:30	Coffee break
11:00	Thematic rooms
12:40	Closing plenary session (APA – Ana Daam)

Table 2 - Program for the session held on May 4th, 2023.

ORGANIZATION OF THE THEMATIC ROOMS

Each thematic room was divided into a different number of tables to allow moderators to manage the dynamics and ensure more effective control of the available time for each exercise. This division aimed also to identify potential adaptation measures to climate change in different regions of the country, thus initiating the process of defining adaptation storylines for Portugal.

In total, two thematic tables were created for the sectors of "Sea Level Rise & Coastal Erosion" and "Forest Fires". In the case of the "Water Resources & Agroforestry" sectors, it was necessary to divide the stakeholders into three groups due to the higher number of participants. These groups were categorized according to three geographical areas of mainland Portugal, namely, the northern area (River basin districts 1- Minho e Lima, 2 - Cávado, Ave e Leça, and 3 - Douro), central area (River basin districts 4 - Vouga, Mondego e Lis, and 5 - Tejo e Ribeiras do Oeste), and southern area (River basin districts 6 - Sado e Mira, 7 - Guadiana, and 8 - Ribeiras do Algarve).

The moderation of the thematic rooms was ensured by the team from the Faculty of Sciences, namely: Sílvia Carvalho, Franciane Santos, Joana Parente, Miguel Rodrigues, Gil Lemos, Pedro Costa, Rita Cardoso, Carlos Antunes, Virgílio Bento, Ana Russo, Sílvia Nunes and Carlos da Camara.

The organization of each room sought to address the specific needs of each sector, with a similar overall alignment, implementing three exercises.

The first exercise involved reading six adaptation measures previously identified within the scope of the project consortium. After the reading, participants were encouraged to suggest two additional comprehensive and cross-cutting adaptation measures for the entire country or large regions.

The second exercise aimed to prioritize adaptation measures for the country, considering the six measures proposed by the consortium and the two measures subsequently suggested, based on the understanding of the stakeholders.

The third and final exercise sought to identify major areas or territories where the implementation of the adaptation measures was considered most relevant. For this purpose, one or more maps were provided to support this identification.

At the beginning of the session, a brief presentation was given outlining the exercises' objectives, the alignment, and the time frame for each exercise. This time frame is summarized in Table 3.

Hours	Events
11:00	Exercise presentation and definition of objectives (FCUL: Luís Filipe Dias, Gil Lemos, Virgílio Bento)
11:10	Exercise #1: Familiarization with adaptation measures and suggestion of new ones.
11:40	Exercise #2: Prioritization of adaptation measures by order of relevance considering the impacts of climate change.
12:00	Exercício#3: Geographical identification of territories where the measures are feasible for implementation
12:30	Conclusion of the exercise

Table 3 - Thematic room program.

As mentioned, each thematic session began with the reading of six proposed adaptation measures by the project consortium, which resulted from various discussion meetings. Each measure was presented in the form of a card identifying its name, the rationale behind it, how it can be implemented, and what constraints can be overcome with its implementation. Table 4 summarizes the adaptation measures presented in each thematic session, and all the cards provided at this stage can be found in the Appendix A. Proposed adaptation measures.

#	Water resources & Agroforestry	Sea level rise & Coastal erosion	Forest fires
1	Water retention landscapes	Construction of barriers and dykes	Controlled biomass burning

#	Water resources & Agroforestry	Sea level rise & Coastal erosion	Forest fires
2	Increasing irrigation efficiency	Definition of safeguard zones and relocation	Reduction of fuel continuity
3	Reducing water losses in the distribution network	Cliffs stabilization	Enhancing vegetation resilience to fire
4	Reuse of treated wastewater	Maintenance and construction of groins and breakwaters	Reducing the population's vulnerability to fire
5	Application of techniques to improve soil water retention	Rehabilitation of dunes and use of nature-based solutions	Reducing ignitions through awareness campaigns
6	Selection of crops better suited to climate change projections	Artificial beach nourishment	Increasing response capacity in wildfire situations

Table 4 - Adaptation measures proposed by the consortium for discussion.

The adaptation measures presented to stakeholders aimed to encompass both incremental measures and transformative adaptations. Incremental measures involve marginal changes over time within existing system parameters, such as reducing water losses in the distribution network, stabilizing cliffs in coastal areas, or enhancing response capacity in wildfire situations. On the other hand, transformative adaptations fundamentally alter the functioning of a system and may include initiatives like water retention landscapes, relocation in coastal areas, or enhancing vegetation resilience to wildfires (Dilling et al., 2023; Pelling et al., 2015). This option aimed to understand the preferences of stakeholders in this domain (transformative or incremental adaptation) and indirectly assess the effort they were willing to make to potentially alter the system. It's noteworthy that the stakeholders invited to this workshop hold positions in institutions with decision-making power regarding the potential implementation of climate change adaptation measures.

3. Results

The main results of the exercises conducted during the first workshop of the RNA2100 project are presented in the following subsections, with the information organized chronologically and by sector.

3.1 NEW MEASURES PROPOSED BY STAKEHOLDERS

The adaptation measures suggested by stakeholders emerged after reviewing the measures proposed by the consortium to avoid overlaps. The new measures resulted from the consensus or agreements reached in each session, a process facilitated by the moderators.

Tables 5 to 7 present the new measures proposed by stakeholders. These are categorized by thematic rooms and discussion tables.

Water resources & Agroforestry	**Table North**	**Table Centre**	**Table South**
Improving the registration of agricultural-associated water consumption	X		
Promotion and optimization of rainwater storage	X		
Improving water retention and infiltration capacity in urban environments		X	
Enhancing water efficiency in industry and urban consumption		X	
Diversifying water sources / reducing demand / increasing efficiency			X
Changing crops to fall/winter crops			X

Table 5 - New measures proposed by stakeholders for the sectors of water resources and agroforestry.

Sea level rise & Coastal erosion	**Table 1**	**Table 2**
Accommodation of urban coastal areas and harbor infrastructure	X	
Relocation/removal of structures exposed to risk (long-term measure)	X	
Establishment and/or revision of legislation related to IGTs, along with its enforcement to safeguard the infrastructure, communities, and ecosystems in coastal areas		X
Incremental and adjustable implementation of a variety of adaptation measures (i.e., from accommodation to relocation)		X

Table 6 - New measures proposed by stakeholders for the sectors of sea level rise and coastal erosion.

Forest fires	Table 1	Table 2
Ensuring income through the compensation for ecosystem services	X	
Settling the population in rural areas	X	
Enhancing the landscape and the services provided by the forest		X
Creation of flow chains and valorization for pruning biomass and fuel management		X

Table 7 – New measures proposed by stakeholders for the sector of forest fires.

3.2 PRIORITIZING ADAPTATION MEASURES

Tables 8 to 10 present the results of the prioritization conducted for the adaptation measures. The information is broken down by thematic session and table. The assigned values range from 1 (the most important/urgent measure) to 6 (the least important/urgent measure), with the sum of the values assigned to each evaluated measure presented in the last column on the right side of each table. In this case, the lower the score, the more relevant the adaptation measure is for the stakeholders involved in this process.

Rank	Water resources & Agroforestry	Table North	Table Centre	Table South	Final score
1	Selection of crops better suited to climate change projections	1	1	1	3
2	Increasing irrigation efficiency	4	1	1	6
2	Reducing water losses in the distribution network	2	2	2	6
4	Reuse of treated wastewater	3	4	1	8
5	Application of techniques to improve soil water retention	5	5	3	13
5	Water retention landscapes	6	3	4	13

Table 8 - Prioritization of measures within the sectors of water resources and agroforestry.

Rank	Sea level rise & Coastal erosion	Table 1	Table 2	Final score
1	Artificial beach nourishment	1	2	3

Rank	Sea level rise & Coastal erosion	Table 1	Table 2	Final score
2	Definition of safeguard zones and relocation	3	1	4
3	Rehabilitation of dunes and use of nature-based solutions	2	3	5
4	Cliffs stabilization	4	5	9
4	Maintenance and construction of groins and breakwaters	5	4	9
6	Construction of barriers and dykes	6	6	12

Table 9 - Prioritization of measures within the sectors of sea level rise and coastal erosion.

Rank	Forest fires	Table 1	Table 2	Final score
1	Enhancing vegetation resilience to fire	1	1	2
2	Reducing the population's vulnerability to fire	2	2	4
3	Reduction of fuel continuity	3	3	6
4	Increase the capacity to respond in forest fire situations	4	4	8
5	Controlled biomass fire	5	6	11
5	Increasing response capacity in wildfire situations	6	5	11

Table 10 - Prioritization of measures within the sector of forest fires.

3.3 IDENTIFICATION OF AREAS WITH POTENTIAL FOR IMPLEMENTATION

Figures 1 to 3 summarize the work carried out in identifying areas where adaptation measures would have greater territorial benefits through their implementation.

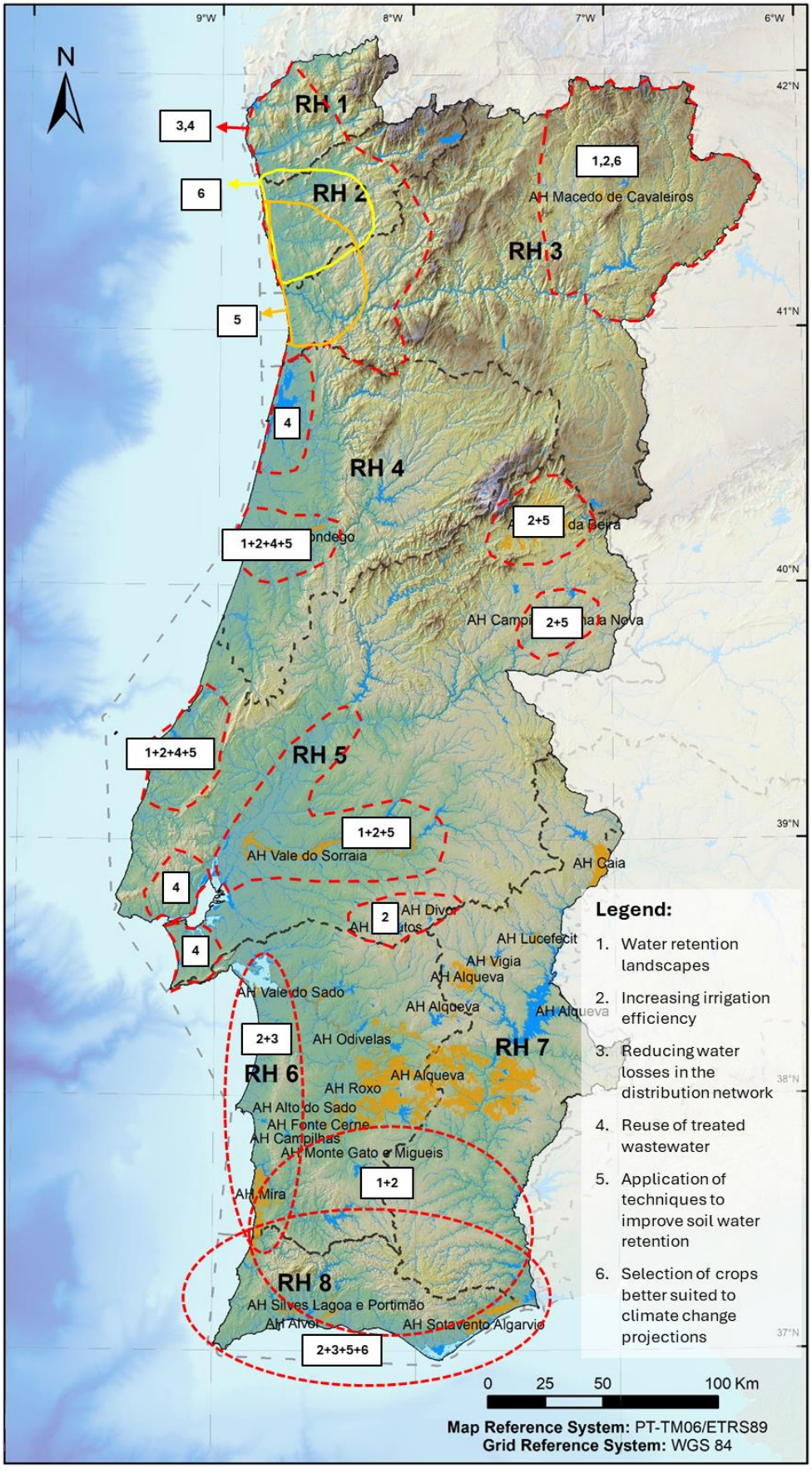

Figure 1 - Spatialization of adaptation measures discussed in the sectors of Water resources & Agroforestry.

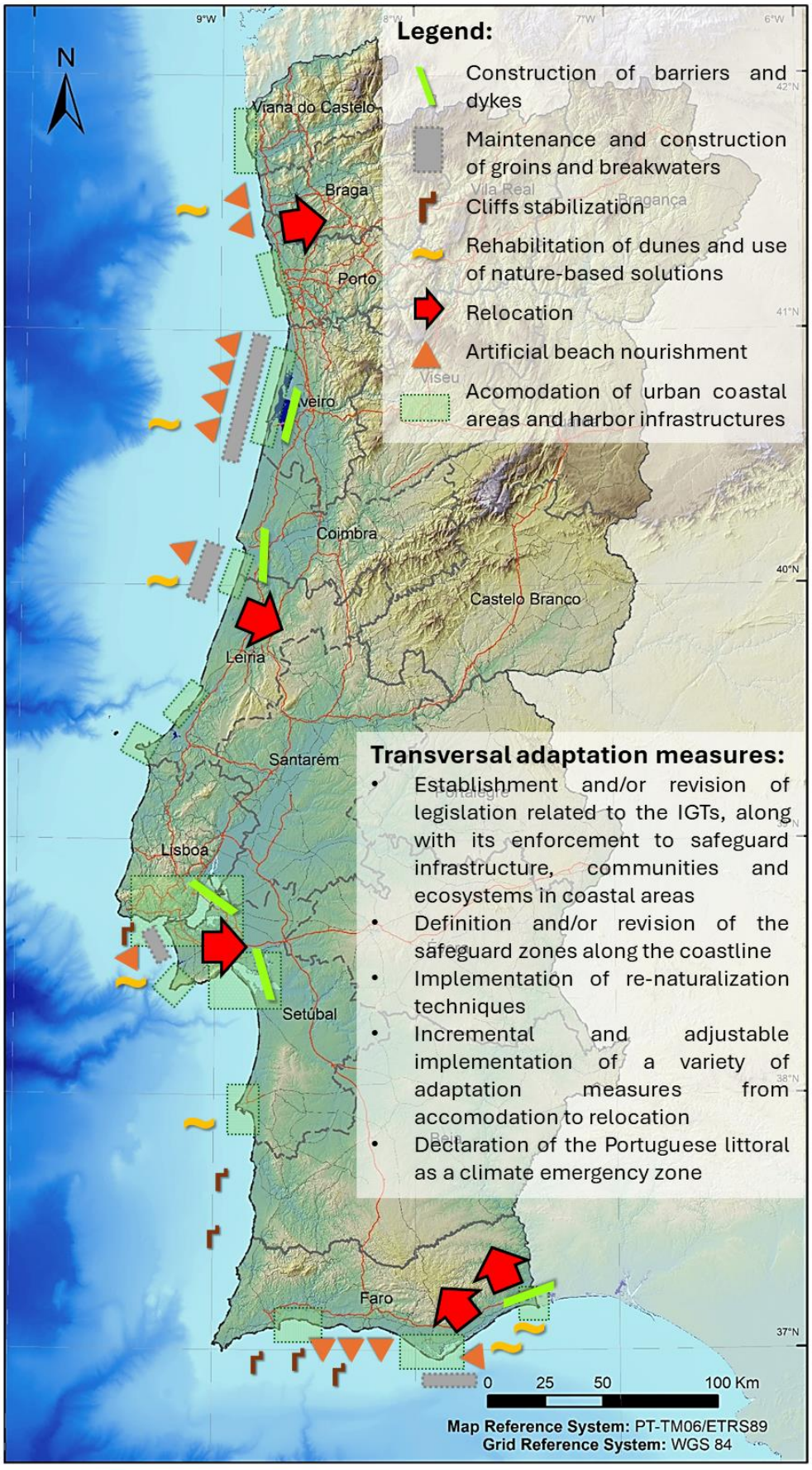

Figure 2 - Spatialization of adaptation measures discussed in the sectors of Sea level rise & Coastal erosion.

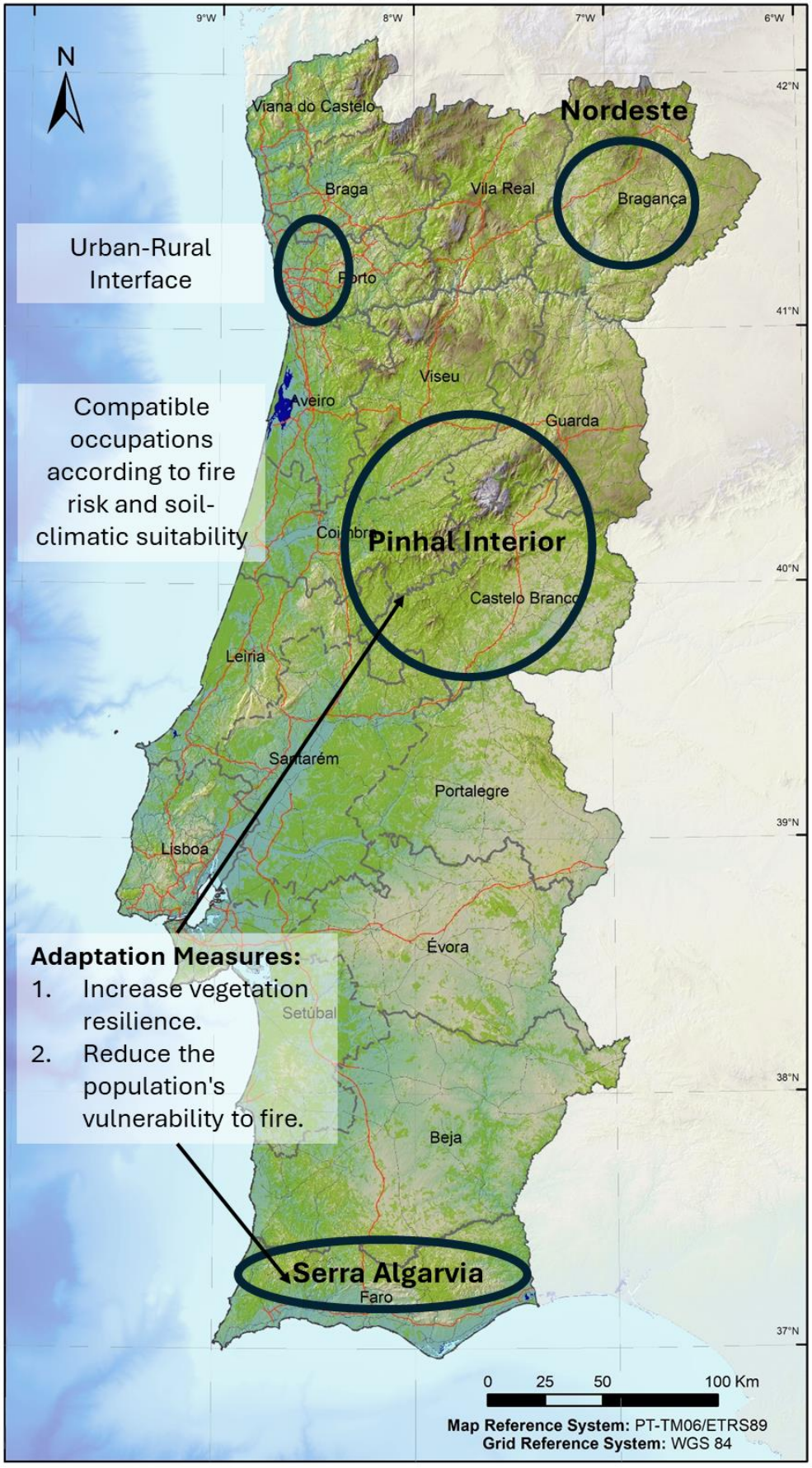

Figure 3 - Spatialization of adaptation measures discussed in the sector of Forest fires

4. Discussion and conclusions

The workshop was highly productive, making a significant contribution to the evaluation of adaptation measures within the impact modeling framework and the development of storylines.

In general, there is a growing acceptance of measures with transformative characteristics, with new proposals being made by stakeholders with these features. An example is the "Relocation/removal of structures exposed to risk" measure proposed in the context of the Sea level rise & Coastal erosion sectors, which may involve proactively choosing to relocate communities or infrastructures away from vulnerable coastal areas, thereby allowing natural processes to reclaim these areas. Another example is observed within the Forest fires sector, by the measure "Enhancing the landscape and the services provided by the forest". This strategy often needs systemic changes in land-use planning, forestry practices, and resource management, demanding a reevaluation of how landscapes are managed to address climate change.

Among the proposed measures, it's worth noting that there were suggestions at the strategic level, which are more related to adaptation options than specific measures. Examples include the option of "Diversifying water sources / reducing demand / increasing efficiency" in the context of the Water resources & Agroforestry sectors, as well as the "Incremental and adjustable implementation of a variety of adaptation measures (i.e., from accommodation to relocation)", within the Sea level rise & Coastal erosion sectors.

Regarding the prioritization of measures, different perspectives are observed depending on the analyzed sector.

In the case of the Water resources & Agroforestry sectors, the two measures with the highest priority, according to stakeholders, are incremental ones. The top priority measure is "Selection of crops better suited to climate change projections", followed by "Increasing irrigation efficiency" and "Reducing water losses in the distribution network". The measure "Water retention landscapes", the only transformative one among the six proposed, was ranked last. It's important to note that, in these sectors, all remaining measures proposed by stakeholders are incremental, reaffirming the preference previously identified in other studies for incremental approaches within this sector (Dias et al., 2020).

In the Sea level rise & Coastal erosion sectors, the measure of "Artificial beach nourishment" emerges as the most important according to stakeholders, being a measure that is already regularly practiced in several areas of the Portuguese coast. However, the second measure exhibits transformative characteristics, as it involves the "Definition of safeguard zones and relocation".

Finally, in the Forest fires sector, the most voted measure was an incremental one, namely “Enhancing vegetation resilience to fire”, followed by a transformative measure aiming for “Reducing the population's vulnerability to fire”.

Regarding the spatial distribution of measures, it is observed that, in the understanding of the stakeholders, many measures should be applied across the entire territory, while others are solely necessary in specific areas.

Within the Water resources & Agroforestry sectors, measures with broader applicability across Mainland Portugal include “Increasing irrigation efficiency” and “Application of techniques to improve soil water retention”. The measure “Reducing water losses in the distribution network” is likely to be more suitable in the southern regions, while the measure “Reuse of treated wastewater” was identified as feasible for implementation in urban areas with higher population density. The measure “Selection of crops better suited to climate change projections” appears to be recommended for the Algarve region, most likely due to the local production of oranges and avocado, but it also shows applicability in the north of the Douro River. In these same areas, “water retention landscapes” were identified as a suitable measure for implementation.

Regarding the Sea level rise & Coastal erosion sectors, the spatialization of measures was significantly more concrete. The measure “Construction of barriers and dykes”, was directed towards flood-prone areas at the river mouths of the main national rivers. The measure “Maintenance and construction of groins and breakwaters” is closely associated with areas where these types of structures already exist, namely in the Aveiro, Figueira da Foz, Costa da Caparica, and in the sandy coastline of the Algarve. The measure “Cliffs stabilization” was directed towards the Vicentine coast and the Algarve's west coast, while “Artificial beach nourishment” and “Rehabilitation of dunes and use of nature-based solutions” were identified as complementary measures aimed more specifically at areas most vulnerable to shoreline retreat.

Finally, in the Forest fires sector, stakeholders assigned greater importance to two specific measures: “Enhancing vegetation resilience to fire” and “Reducing the population's vulnerability to fire”. Only certain areas were considered with potential for implementation, such as the northeastern region of Mainland Portugal, the Pinhal Interior area, or the interior of the Algarve region. Additionally, areas with urban-rural interface, often associated with sprawling urban development, should also be considered key-locations for implementing these measures.

5. Bibliography

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Appendix A. Proposed adaptation measures

WATER RESOURCES & AGROFORESTRY

1	
2	

3	 Diminuir perdas de água na rede de distribuição Diminuir perdas de água na rede de distribuição Porquê? O controlo e deteção de perdas de água na rede de distribuição (urbana e agrícola) são medidas importantes para melhorar a eficiência na distribuição e evitar desperdícios desnecessárias. Como? Implementação de sistemas de deteção de perdas, controlo de pressão, manutenção de medidores e controlo contra usos não autorizados são medidas que podem ajudar a mitigar perdas reais e aparentes de água. O quê? Reduz a captação de água das fontes disponíveis, diminuindo a procura global do recurso. Dicas As intervenções podem aumentar a consciencialização pública sobre a conservação da água, promovendo a eficiência hídrica e comportamento mais sustentáveis
4	 Tratamento e reutilização de águas residuais Tratamento e reutilização de águas residuais Porquê? O tratamento e reutilização de águas residuais (água para reutilização) é uma importante resposta de adaptação às alterações climáticas, aumentando a disponibilidade do recurso e promovendo a economia cicrular. Como? Tecnologias de recolha, tratamento e aproveitamento de águas residuais, nomeadamente das autarquias, da indústria e da agricultura. A água reciclada pode ser utilizada para irrigação ou fins industriais, bem como uso doméstico, desde que devidamente tratada O quê? A utilização de águas para reutilização pode diminuir os custos económicos e ambientais decorrentes da criação de novas captações nomeadamente se estiverem associadas a novas barragens. Dicas Tecnologia de custo relativamente baixo em comparação com alternativas como extração e transporte.

5	
6	

Figure 4 – Adaptation measures proposed by the consortium for the water resources and agroforestry sectors.

SEA LEVEL RISE & COASTAL EROSION

1

2

3	 Estabilização de arribas Estabilização de arribas Porquê? Para diminuir as taxas de erosão nas arribas, protegendo igualmente infraestruturas e vidas humanas em casos de rápida movimentação de terras e/ou blocos Como? Através de técnicas como a aplicação de betão projetado nas camadas mais friáveis, a pregagem de blocos instáveis passíveis de estabilizar, ou a desmontagem de blocos não-estabilizáveis, bem como a cobertura da arriba com uma rede de suporte O quê? Redução da instabilidade das arribas através de processos de estabilização artificial, diminuindo as taxas de erosão Dicas Medida que deve ser acompanhada por monitorização e limitação de actividades de recreio e de implementação de infraestruturas próximo das arribas
4	 Manutenção e construção de esporões e quebra-mares Manutenção e construção de esporões e quebra-mares Porquê? Para proteger as zonas costeiras dos efeitos erosivos da agitação marítima, melhorar as características das praias e promover a acreção sedimentar Como? Mantendo as estruturas actuais estáveis e capazes de cumprir as suas funcionalidades, ou reforçando e alterando-as com vista a melhorar os sistemas de protecção costeira O quê? Manutenção das actuais estruturas e/ou construção de novas, com vista a proteger as zonas costeiras dos padrões normais e extremos de agitação marítima, promovendo o equilíbrio sedimentar Dicas Medida facilitada pela monitorização das estruturas existentes e dos fenómenos de erosão locais

5	
6	

Figure 5 -Adaptation measures proposed by the consortium for the sea level rise and coastal erosion sectors.

FOREST FIRES

1

2

3	**Aumentar a resiliência da vegetação ao fogo**  **Aumentar a resiliência da vegetação ao fogo** **Porquê?** Com as alterações climáticas, regiões compostas por espécies não resilientes ao fogo (por não ser habitual acontecer historicamente naquele local) poderão passar a ser vulneráveis a estes eventos. **Como?** Planeamento regional de um melhor padrão de paisagem (floresta, agricultura), adaptando a alterações nas condições bioclimáticas futuras e novos regimes de fogo (planear o futuro da paisagem) **O quê?** Ajudar a prevenir para as consequências das alterações climáticas. **Dicas** Planear consoante as alterações no clima de cada região, tendo em conta espécies florestais e agrícolas.
4	**Reduzir a vulnerabilidade da população ao fogo**  **Reduzir a vulnerabilidade da população ao fogo** **Porquê?** Muitos incêndios acabam por destruir habitações, fábricas, e outras infraestruturas humanas, porque não existe uma distância de segurança entre a floresta/mato e essas infraestruturas. **Como?** Através da limpeza de florestas e matos na interface entre a floresta/mato e locais de habitação e infraestruturas humanas. **O quê?** Salvar habitações e negócios, criando uma interface segura entre estas e zonas vulneráveis a arder. **Dicas** Mapear a interface urbana-florestal em cada região e implementar medidas a nível regional/local.

5	**Reduzir as ignições através de campanhas de sensibilização**   **Reduzir as ignições através de campanhas de sensibilização** **Porquê?** Muitas ocorrências de ignição que levam a grandes fogos e grandes áreas ardidas devem-se a negligência. **Como?** Através de campanhas de consciencialização, campanhas educativas, ou através de treino e campanhas rurais sobre fogo controlado. **O quê?** Visar aumentar a consciência do perigo às pessoas, de forma a haver um maior cuidado em dias de perigo elevado. **Dicas** Utilizar espaços na televisão, rádio, jornais, para sensibilizar a população às consequências das suas ações.
6	**Aumentar a capacidade de resposta em situações de incendio florestal**  **Aumentar a capacidade de resposta em situações de incendio florestal** **Porquê?** Para aumentar o número de operacionais e consequentemente a capacidade de resposta de forma a atacar a frente de incêndio de forma mais eficaz. **Como?** Contratar mais autoridades competentes, investir em mais treino e em mais conhecimento, e assim aumentar o número de operacionais capazes de dar resposta em situações de incêndio florestal. **O quê?** Sermos capazes de ter uma melhor resposta às ignições. **Dicas** Promover o aumento dos operacionais e do seu treino a nível regional.