Climate resilience | tools for assessment and water management enhancement

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LISBOA E NOVA
Agência de Energia e Ambiente de Lisboa

Speaker presentation

Speaker

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Focus: Resilience assessment in the urban water cycle

Speaker

Name

(Work: …… …..)

Focus: ……

Speaker

Name

(Work: …… …..)

Focus: ……

Speaker

Name

(Work: …… …..)

Focus: ……

Moderator

Name

(Work: …… …..)

Focus: ……

Resilience Assessment Framework

- Supports objective-driven resilience diagnosis
- Assesses resilience progress
- Facilitates communication among stakeholders

Water management | circularity enhancement

- Supports decision for alternative water sources
- Assesses risk for urban non-potable water reuse

Water management | measurements enhancement

- Provides confidence and traceability of measurement results used for decision making
- Allows comparability with other results,

Lisbon city pilot | Alvalade

Tools implemented @UP2030

Tools applied @ Lisbon

A. **RAF | Resilience Assessment Framework** RESCCUE/ICARIA

B. **Decision Support for Alternative Water Sources** B-WaterSmart

C. **Risk assessment for urban non-potable water reuse** B-WaterSmart

D. **Tools for measurements in the urban water cycle** EMUE

E. **Neutrality Story Maps** VUB

F. **Circular urban planning tool** ETH

G. **Air quality tool** LINKS

Tools from LNEC @UP2030

A. **Resilience Assessment Framework RAF** RESCCUE/ICARIA

B. **Decision Support for Alternative Water Sources** B-WaterSmart

C. **Risk assessment for urban non-potable water reuse** B-WaterSmart

D. **Tools for measurements in the urban water cycle** EMUE

Water-smartness Assessment Framework B-WaterSmart

Reclaimed water quality model in distribution systems B-WaterSmart

Lisbon city scale | Alvalade Parish scale | Facility scale

For more information:
https://up2030-he.eu/tools/

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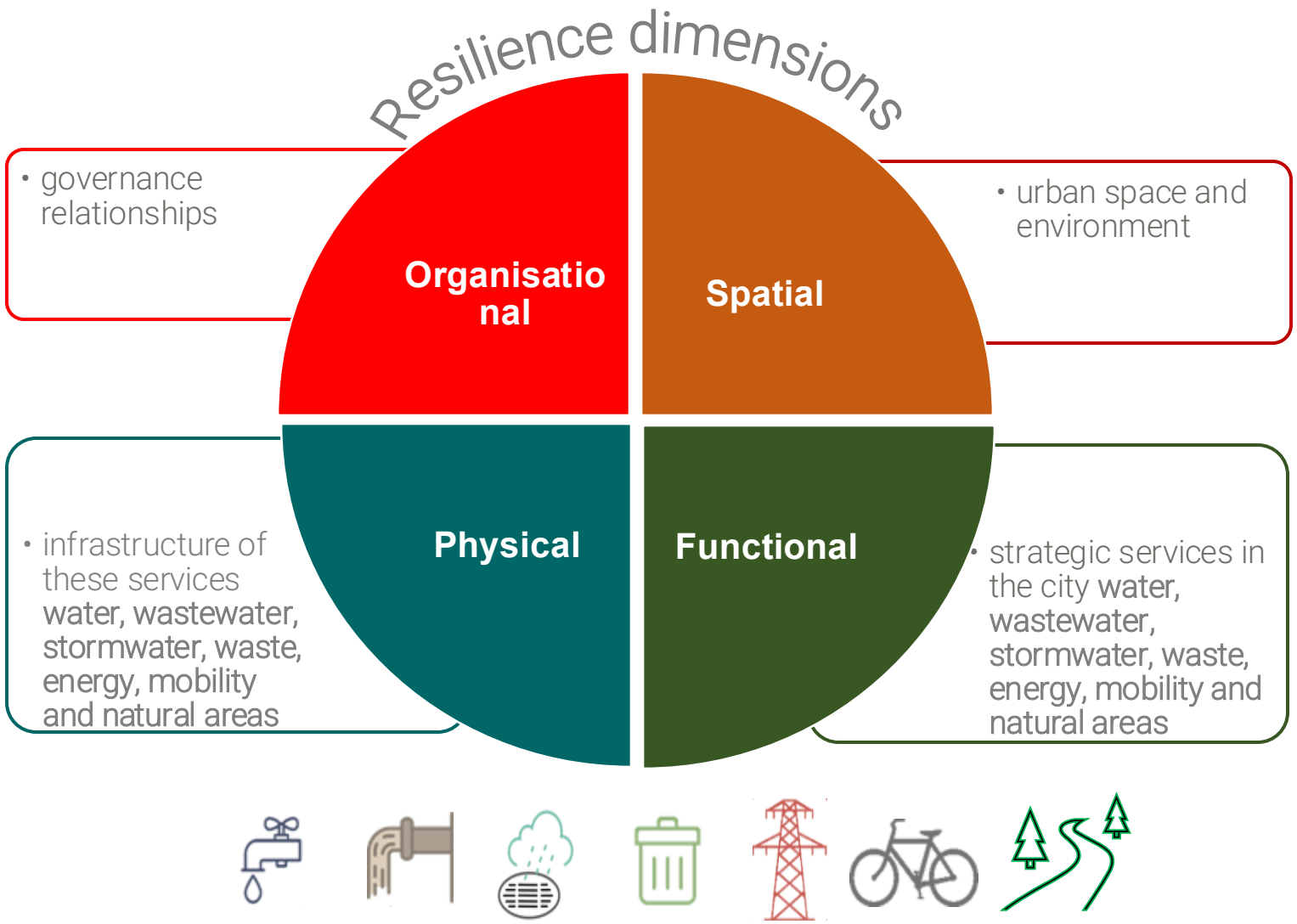
RAF – Resilience Assessment Framework

Developed within the framework of H2020 RESCCUE project (Resilience to Cope with Climate Change in urban areas) and further developed in the HE ICARIA project (Improving ClimAte Resilience of crItical Assets)

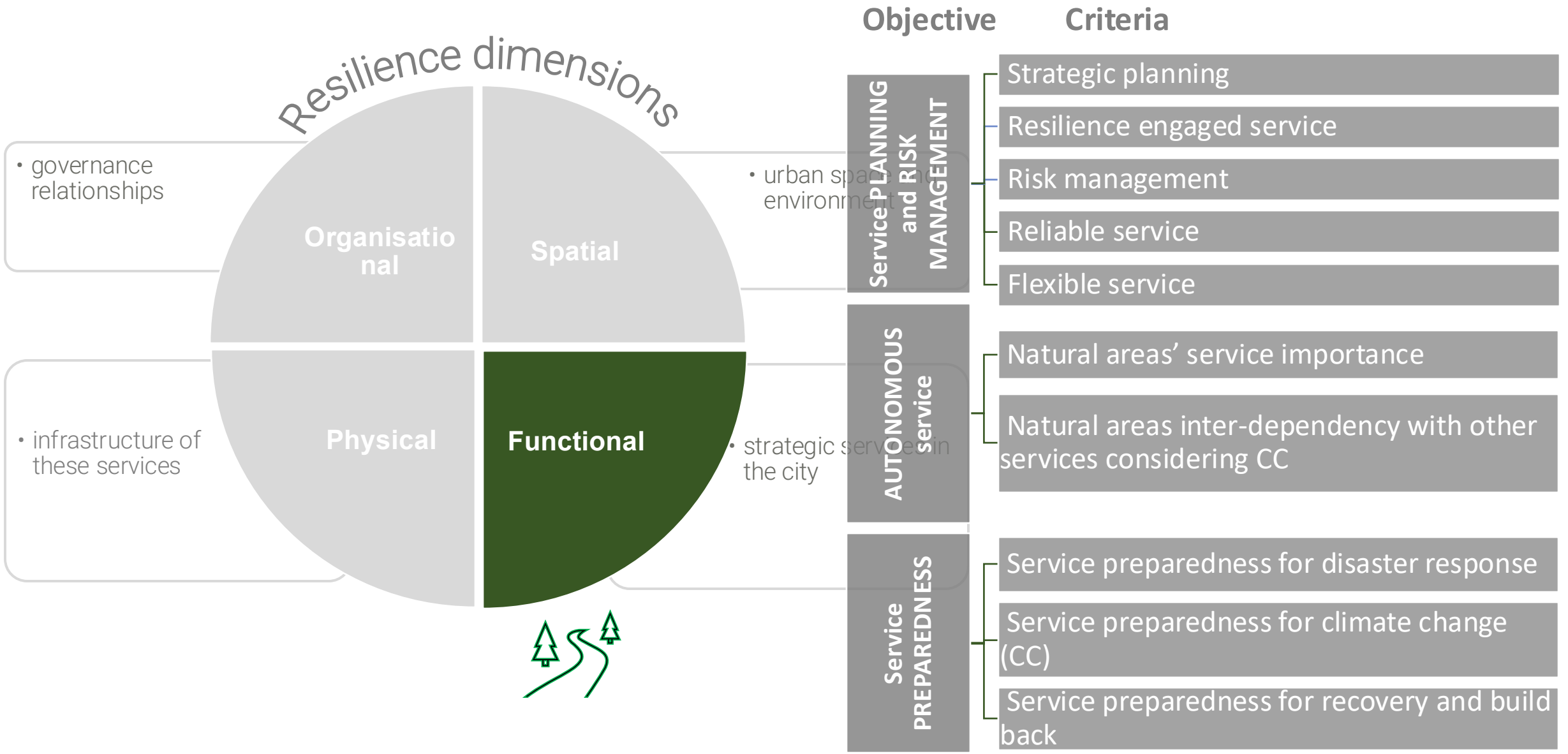
an open-source tool to support resilience diagnostics, monitoring and planning

assesses regional, urban, or service resilience to climate change, water-related focuses on regional, city, services and infrastructure resilience

objective-driven diagnosis supported on the compliance of resilience objectives, delivering resilience development levels



RAF – Resilience Assessment Framework


Resilience dimensions
Organisational
Spatial
Physical
Functional
• governance relationships
• urban space and environment
• infrastructure of these services
• strategic services in the city
Objective
Criteria
Service PLANNING and RISK MANAGEMENT
Strategic planning
Resilience engaged service
Risk management
Reliable service
Flexible service
AUTONOMOUS service
Natural areas' service importance
Natural areas inter-dependency with other services considering CC
Service PREPAREDNESS
Service preparedness for disaster response
Service preparedness for climate change (CC)
Service preparedness for recovery and build back

Metrics

905g - Air quality improvement (kg/ha/year)

What is the estimated air quality improvement due to the implementation of natural areas (in terms of annual removal rate of air pollutants per canopy cover)?

Dimension	Functional	Objective	Service planning and risk management
Subdimension	**Natural areas**	Criteria	Resilience engaged service
Source	Beceiro (2021) and ICARIA	Importance	Comprehensive
Metric type	Single choice	Level	Tactical

Additional information

If in situ measurements for air quality are not available, then quantification of the areas covered with herbaceous vegetation, shrubs, and trees, of the locations under assessment, is required for estimation of this metric. The estimated air quality improvement corresponds to the area-weighted average of the air quality improvement estimated for each location under assessment, based on the annual removal rate of air pollutants per canopy cover (SO_2, NO_2, PM10, O_3). These can be estimated as follows:
- tree: 140 kg/ha/year;
- shrub: 111 kg/ha/year;
- herbaceous vegetation: 85 kg/ha/year.

The previous annual removal rates and air quality improvement classifications are based on Yang et al. (2008), Baumgardner et al. (2012), Bottalico et al. (2016), Currie & Bass (2008), Manes et al. (2016), Marando et al. (2016), Nowak (1994a), Yang et al. (2018) and Beceiro (2021).

Development assessment rule	Development level
a) High improvement (removal above 40 kg/ha/year)	3
b) Medium improvement (removal between 10 and 40 kg/ha/year)	2
c) Low improvement (removal below 10 kg/ha/year)	1
d) No improvement	0

103 - Considerations in damage and loss estimation (-)

Damage and loss aspects taken into account by risk assessments for key identified scenarios

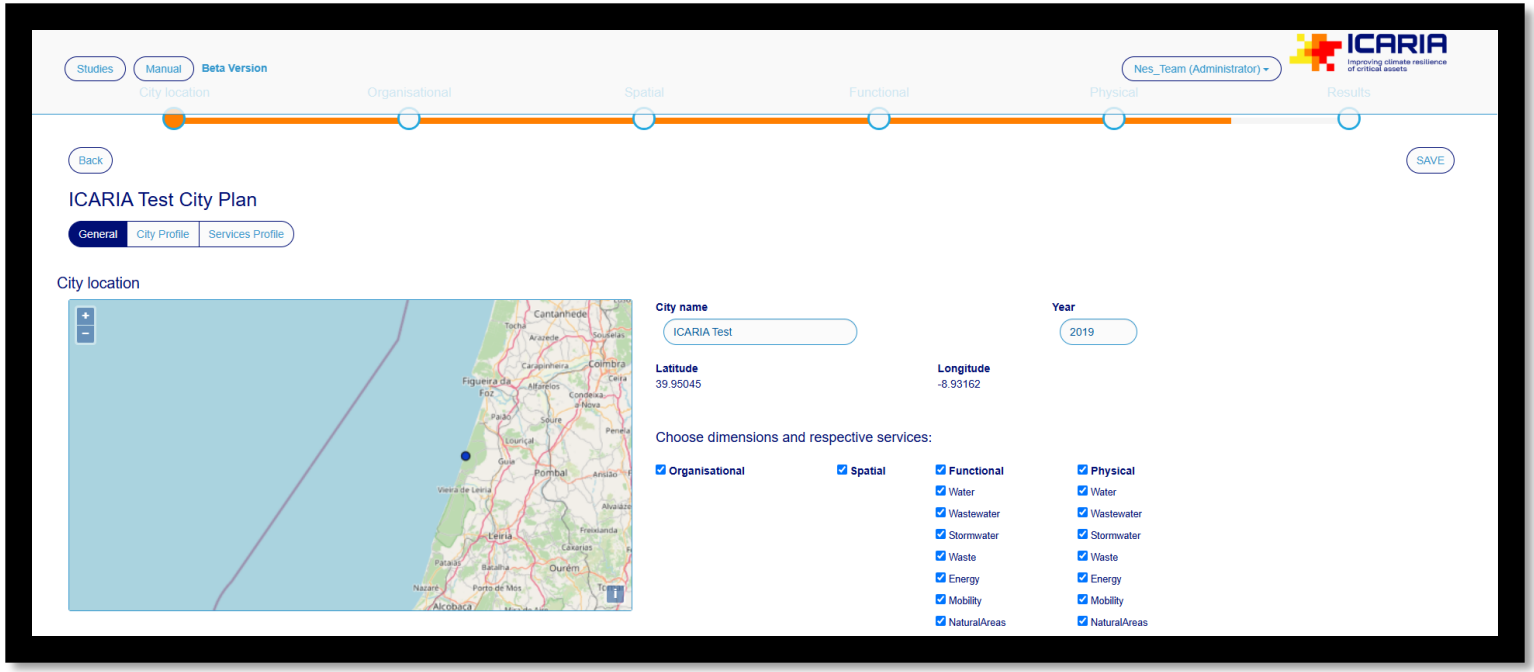
Dimension	Spatial	Objective	Spatial risk management
Subdimension	**-**	Criteria	General hazard and exposure mapping
Source	UNISDR Scorecard D2.2.2, adapted in ICARIA	Importance	Essential
Metric type	Multiple choice	Level	Tactical

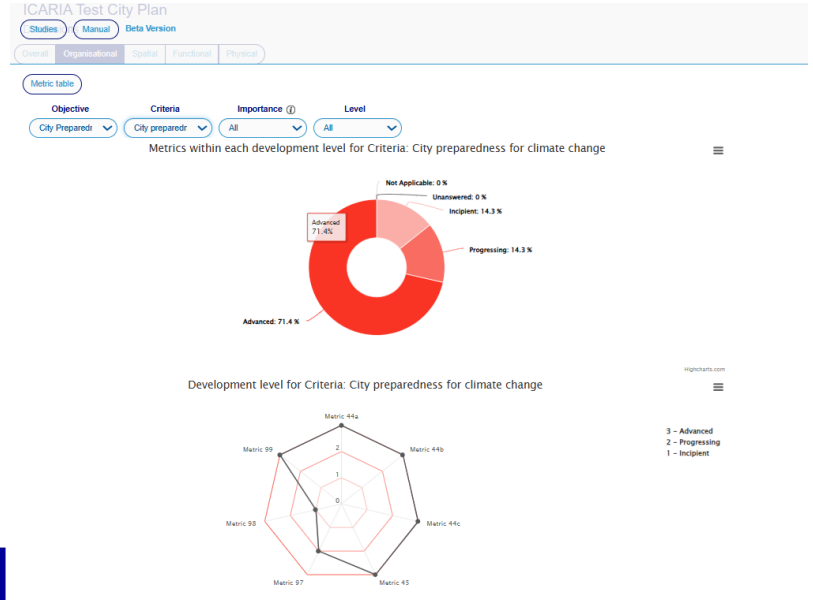
Additional information

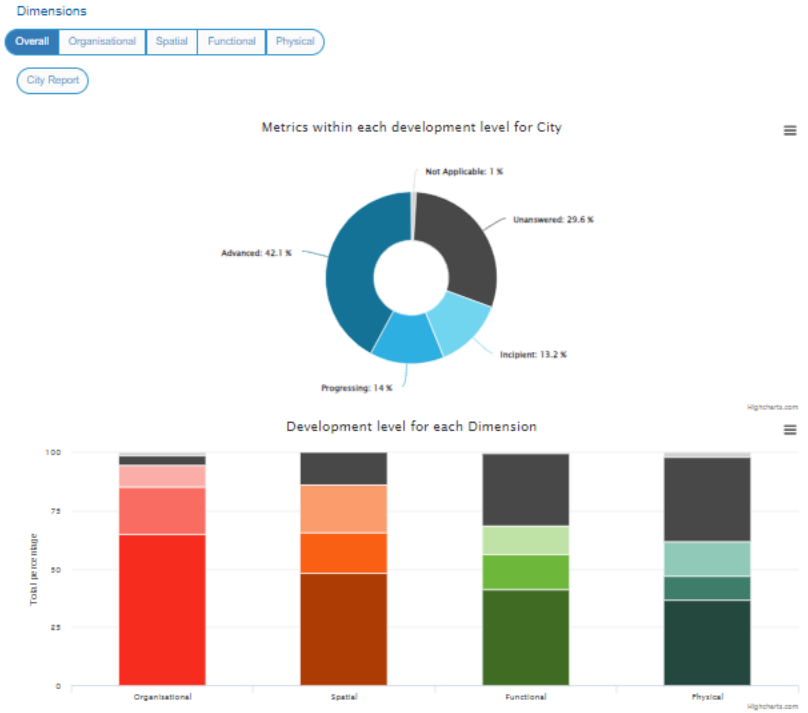
Please select one or more of the options provided as answers. Sum of the selected answers and a scale to 3 is made.

Development assessment rule	Development level
a) Changes in economic activities	1
b) Population at risk	1
c) Urban footprint at risk	1
d) Economic activities at risk	1
e) Natural areas at risk (green, blue or other, either natural or nature-based areas)	1
f) none of the above	0

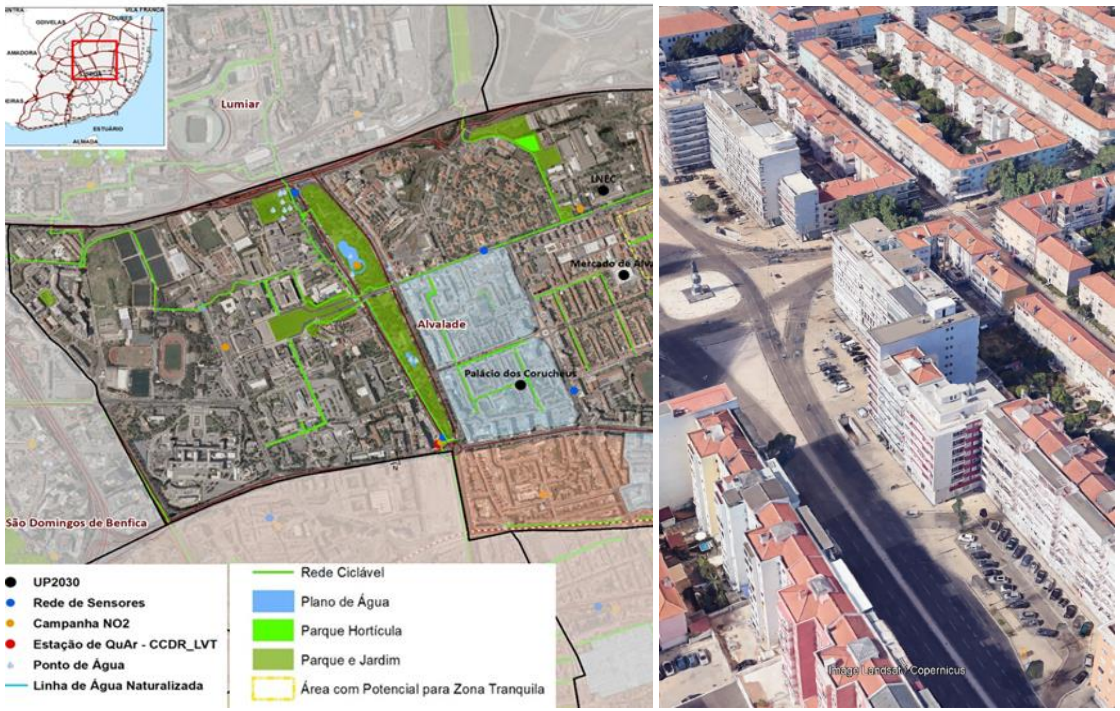
RAF – Resilience Assessment Framework web-app

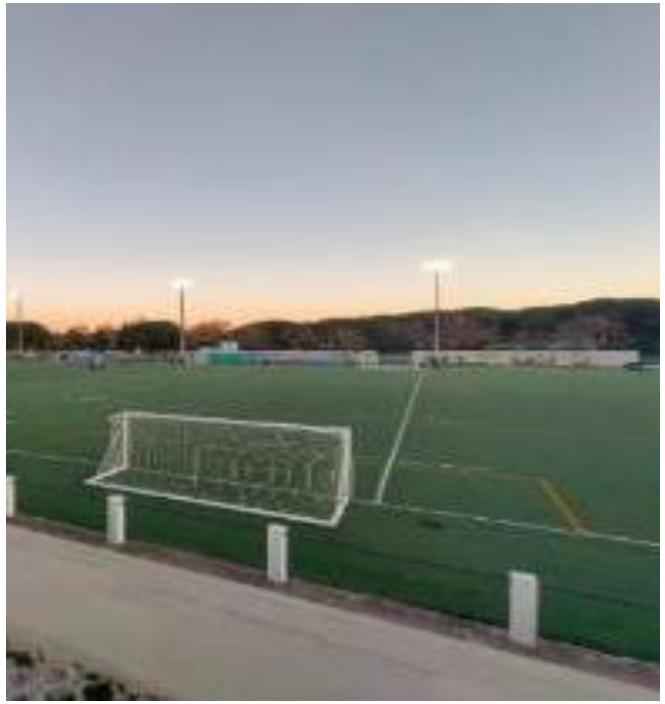






RAF | UP2030 innovative applications at new scales





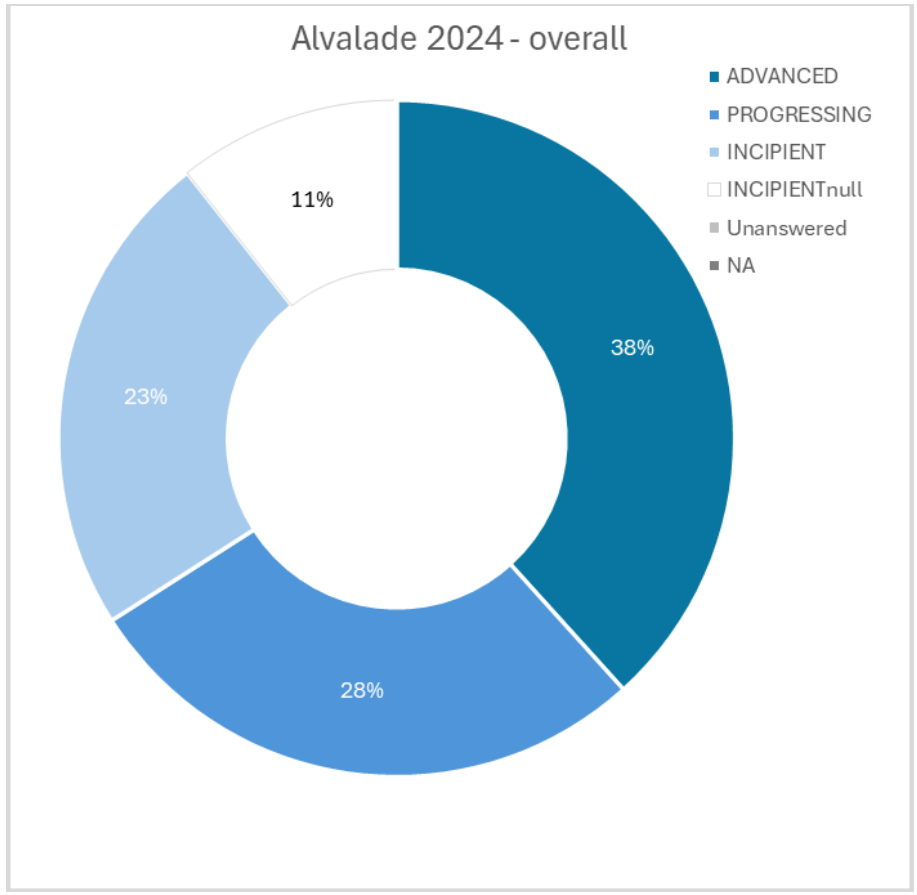
Parish scale | Alvalade

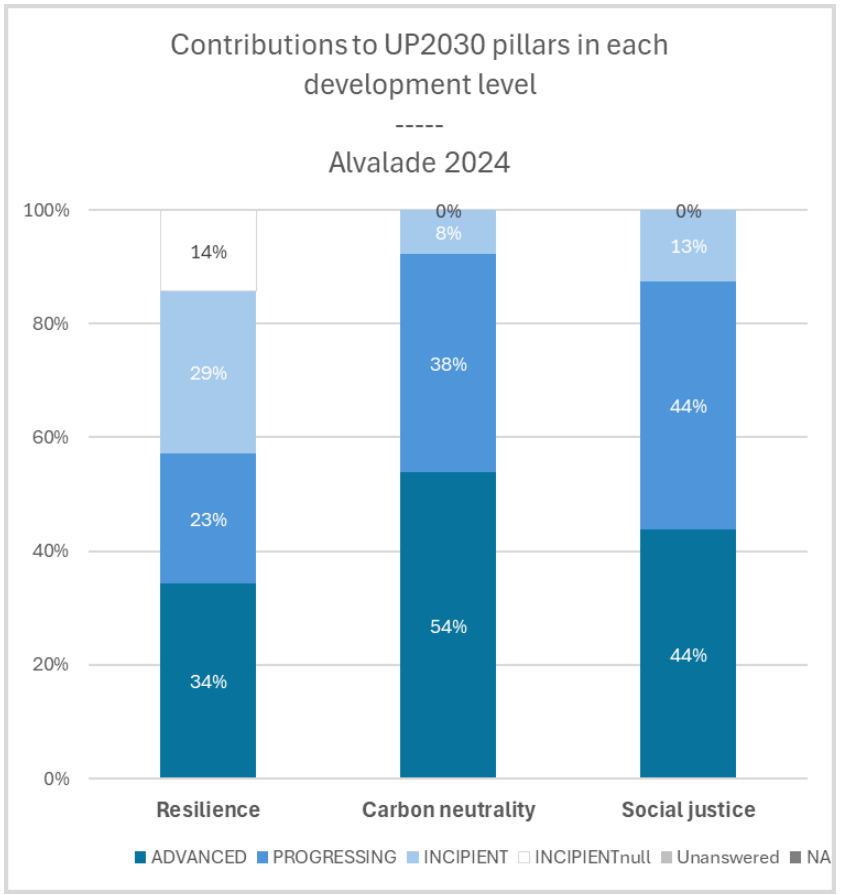
Facility scale | São Miguel Rugby Club (CRSM)

RAF | UP2030 innovative applications at new scales

Alvalade Parish

RAF assessment



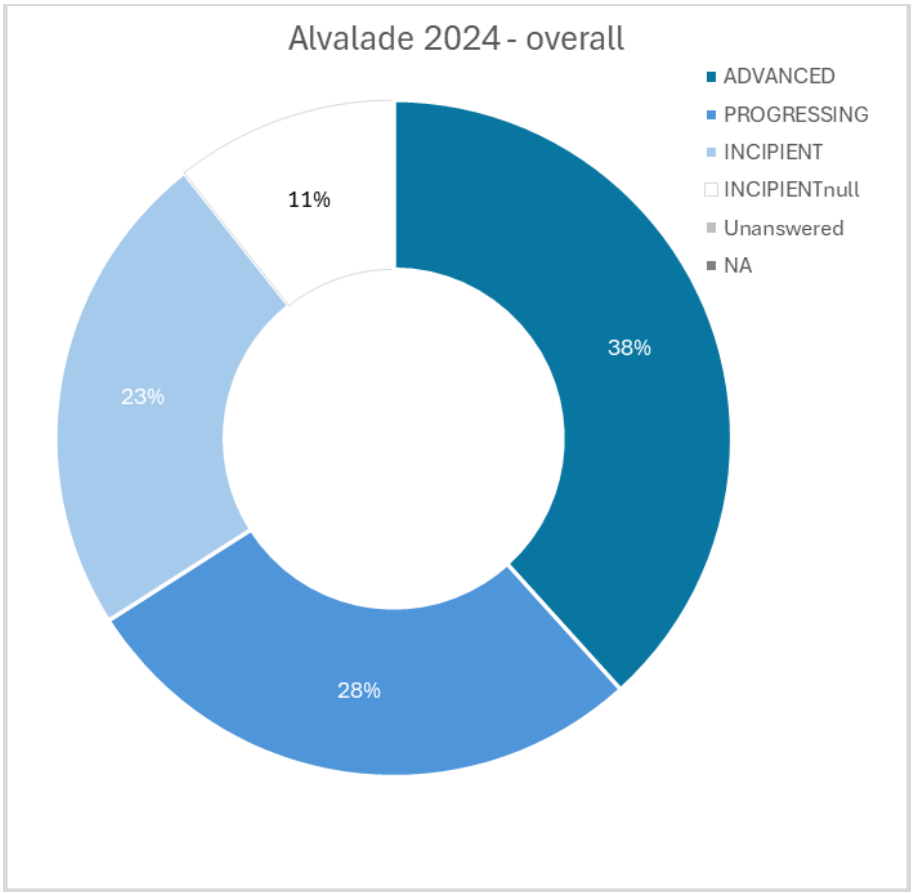


Initial situation

RAF | UP2030 innovative applications at new scales

Alvalade Parish

RAF assessment



Initial situation

Improvement actions

i) creating a vision for the parish, rethinking Alvalade 2030
ii) organizing four workshops with the participation of stakeholders for engagement,
iii) design and implementation of the walking route “
iv) development of a seal and “Guide to sustainable and climate-neutral events”
v) development of an information sheet to improve, monitor progress, and facilitate communication
vi) air quality monitoring,
vii) application of a tool for forecasting air quality
viii) integration of intelligent decision support systems into a GIS platform
ix) teaching and sharing ongoing reflections on “Integrating water into urban planning: nature-based solutions” using the parish of Alvalade as a case stud
x) assessment of climate change resilience and the effect of implementing measures, using the RAF tool
xi) Calculation of estimates of quantities of construction materials throughout their life cycles, embedded environmental and potential for reuse of construction components, using the Circular Urban Planning Tool
xii) application of a user-friendly tool to raise awareness and engage citizens in climate neutrality initiatives: Neutrality Story Maps

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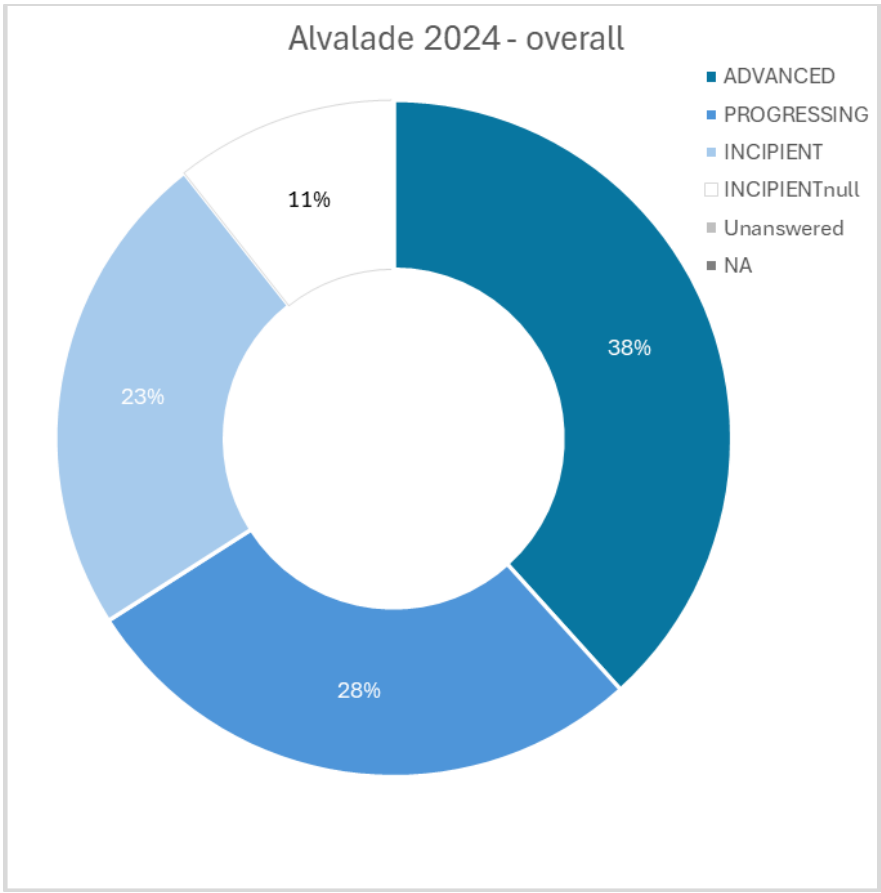
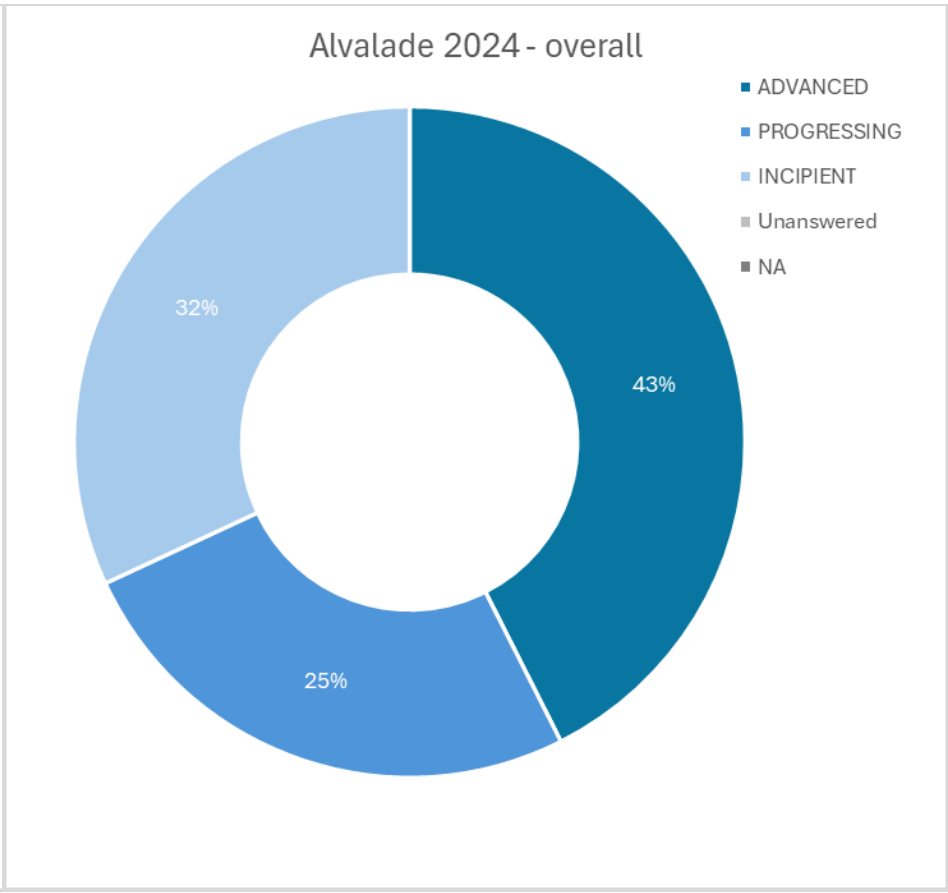
Alvalade Parish

RAF assessment



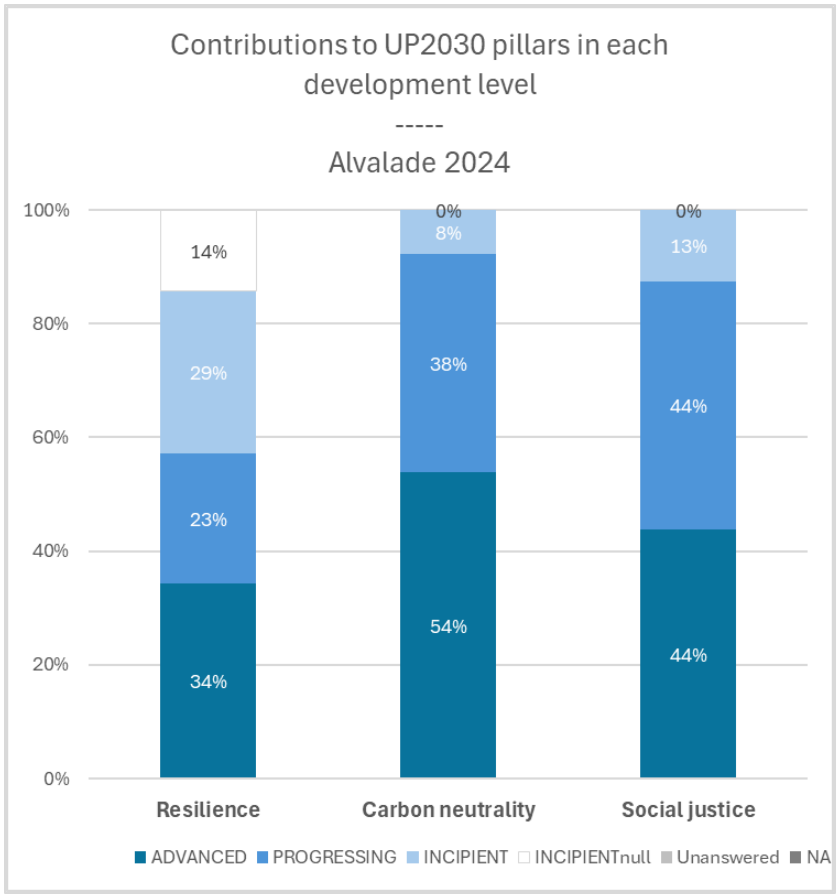


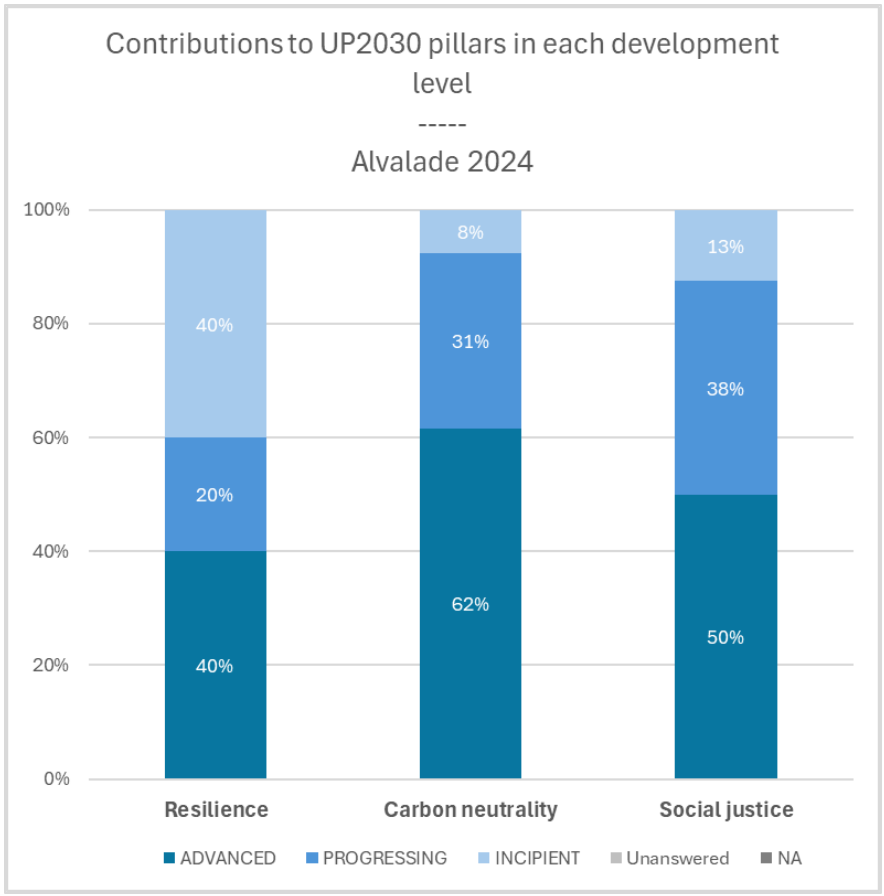
Initial situation **Improved situation**

RAF | UP2030 innovative applications at new scales

Alvalade Parish

RAF assessment





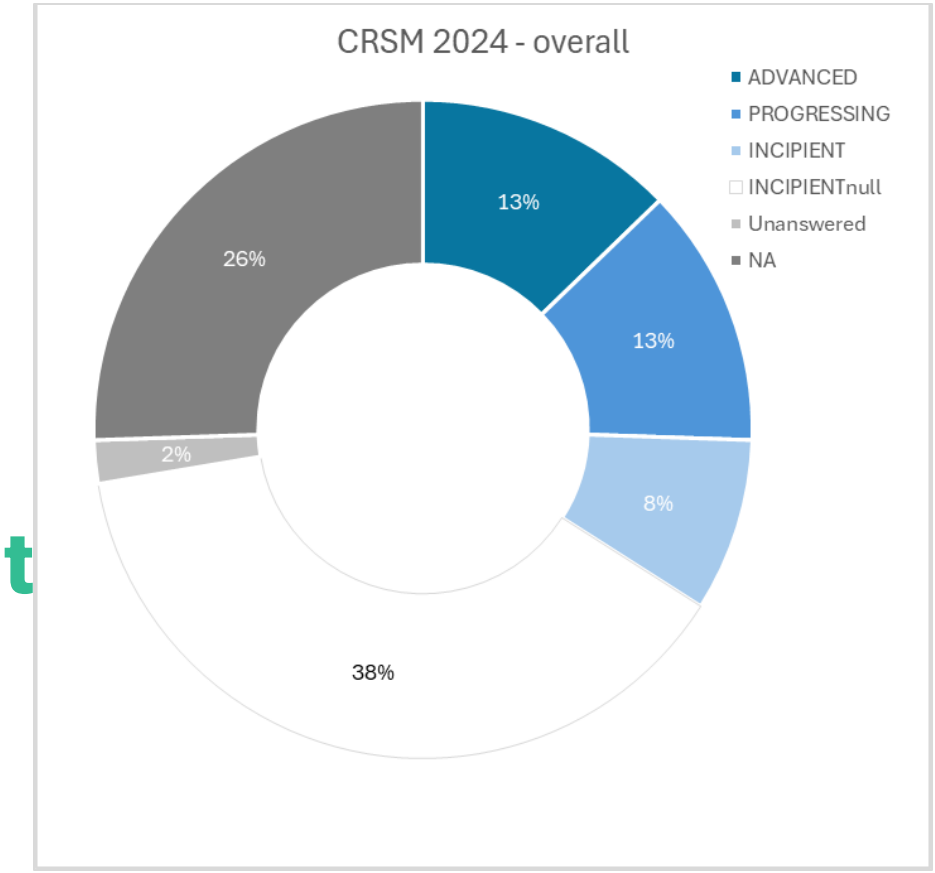
Initial situation

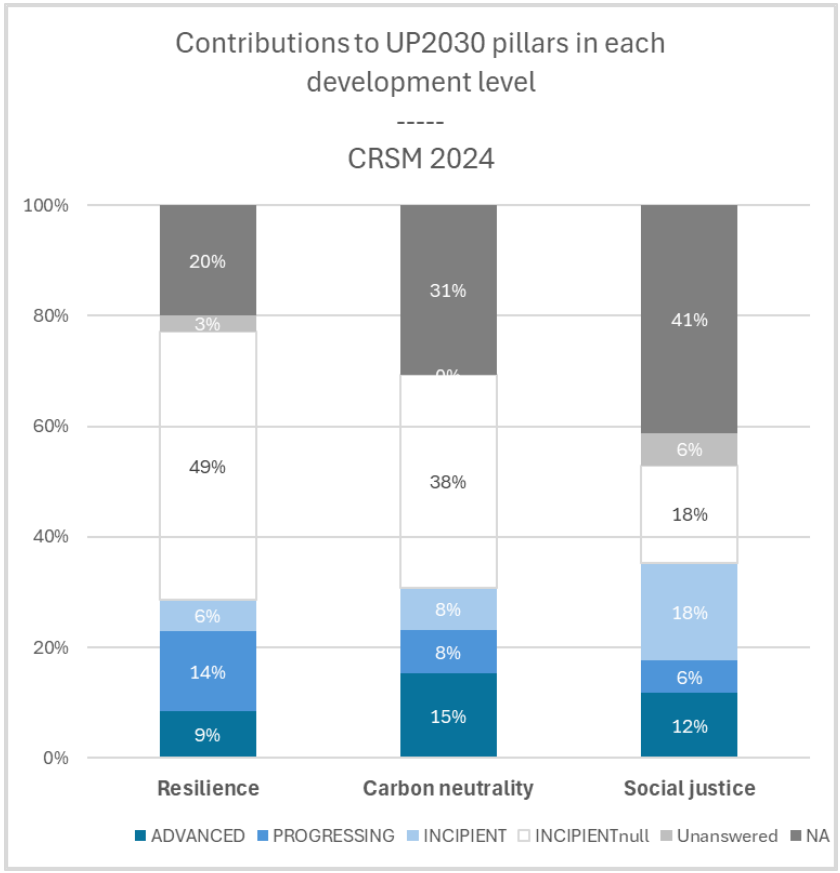
Improved situation

RAF | UP2030 innovative applications at new scales

CRSM Facility

RAF assessment



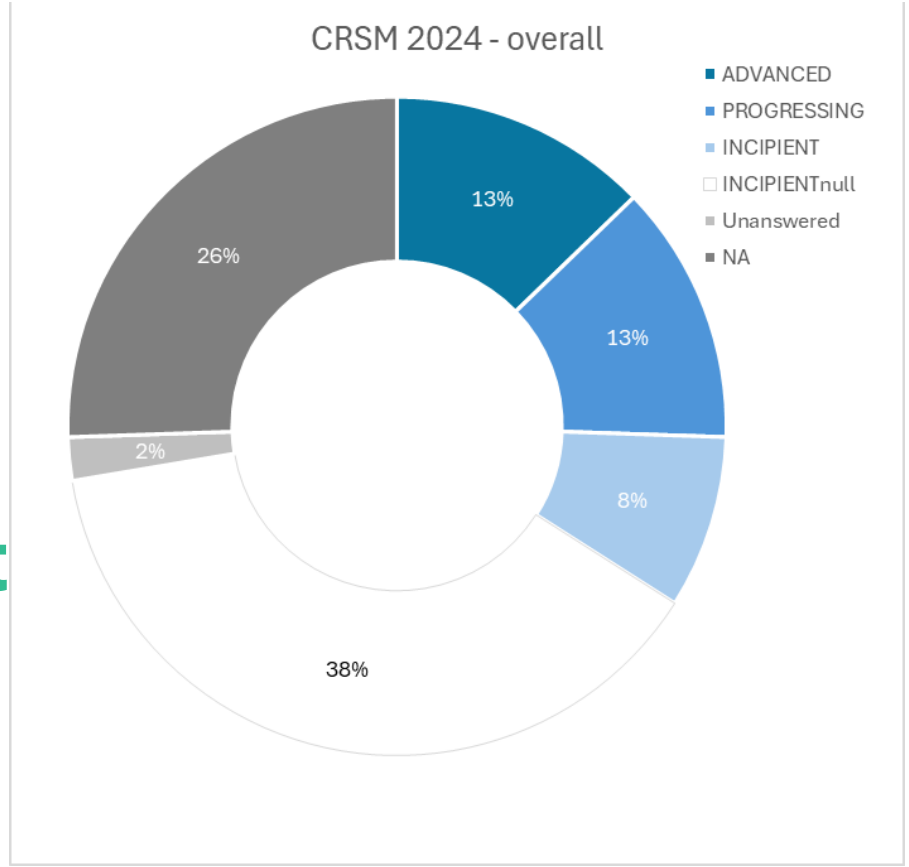


Initial situation

RAF | UP2030 innovative applications at new scales

CRSM Facility

RAF assessment



Initial situation

Improvement actions

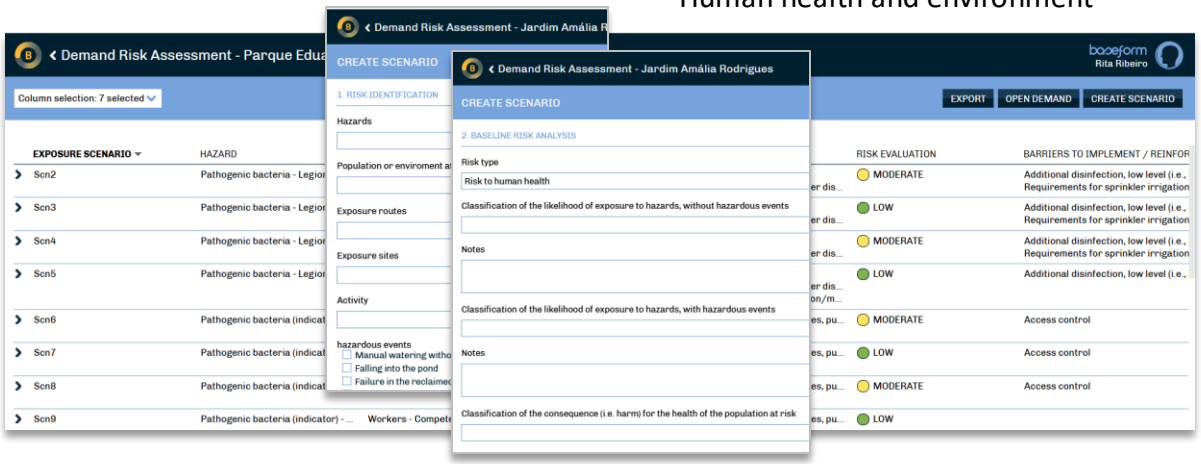
i) Application of the "Guide to sustainable and climate-neutral events"
ii) development of an information sheet to improve, monitor progress, and facilitate communication
iii) promotion of circularity and reuse of sports equipment, waste separation
iv) installation of GIRA stations and electric charging
v) creation of a mural alluding to environmental and sports ethics
vi) installation of photovoltaic panels
vii) improvements to the lighting system (LED);
viii) monitoring of water and energy consumption, based on the Lisbon Observatories
ix) assessment of water efficiency and the water-energy nexus, through Climate Ready Certificates
x) application of a user-friendly tool to raise awareness and engage citizens: Neutrality Story Map
xi) assessment of the potential for water reuse, using B-WaterSmart decision support tools for alternative water sources and risk assessment
xii) assessment of the potential for rainwater reuse and storage
xiii) replacement of pavement to increase permeability
xiv) strengthening green infrastructure NBS
xv) assessment of climate change resilience RAF tool

Potential for water reuse | decision support tools for alternative water sources and risk assessment

B-WaterSmart tools

CRSM Facility

SAFETY in water reuse

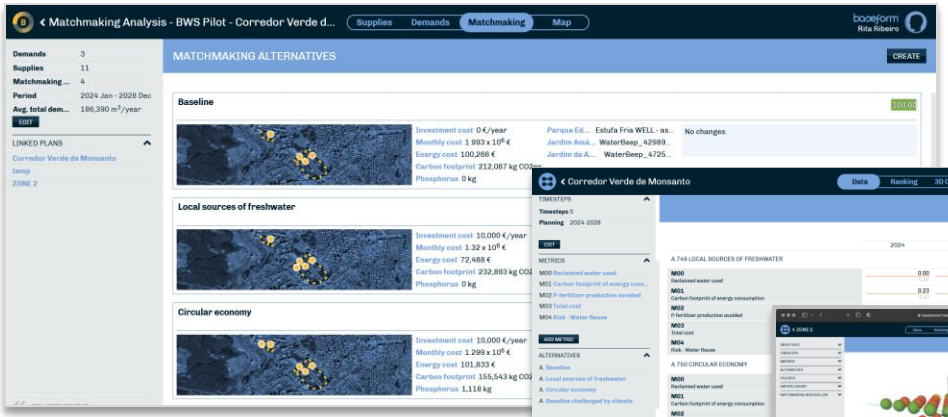


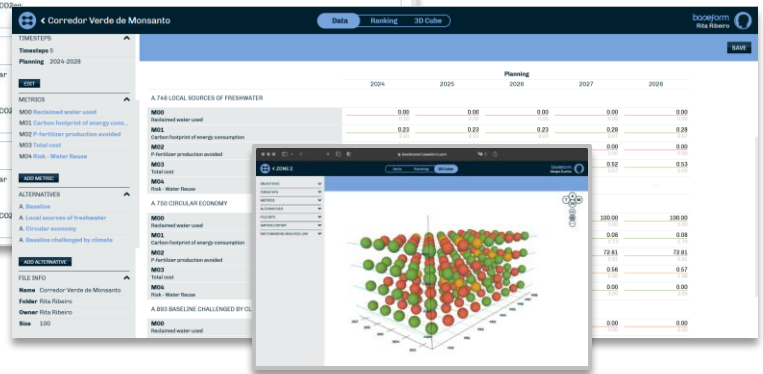
Risk assessment (BWS tool #27) Risk assessment related to water reuse – Human health and environment

Sustainability
- Water sources
- Associated costs

Safety
Human health and environmental risk

SUSTAINABILITY (water *fit-for-purpose*)





Matchmaking (BWS tool #25) Definition of water alternative sources – Reclaimed water and potable (cost, Carbon footprint, etc.)

Plan (BWS tool #17)
Comparison of alternatives – Reclaimed water and potable (metrics)

Non potable water use

Artificial turf

- Washing
- Temperature control (hot days)

UP2030

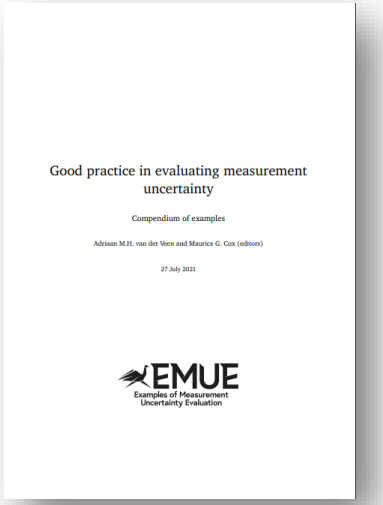
Ajuntament de Barcelona

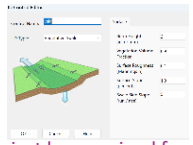
Tools for measurements in the urban water cycle

EMUE

CRSM Facility

- Analysis of **alternatives for the naturalization of the water cycle** to **enhance hydrological functions** (e.g. infiltration, retention), **storage of rainwater** for local uses, and **reduce peak outflows** to public drainage system
- Hydraulic model for stormwater drainage in the facility, support of **analysis and comparison of measures to increase climate-resilience**, providing information to the RAF assessment and to the analysis of alternatives





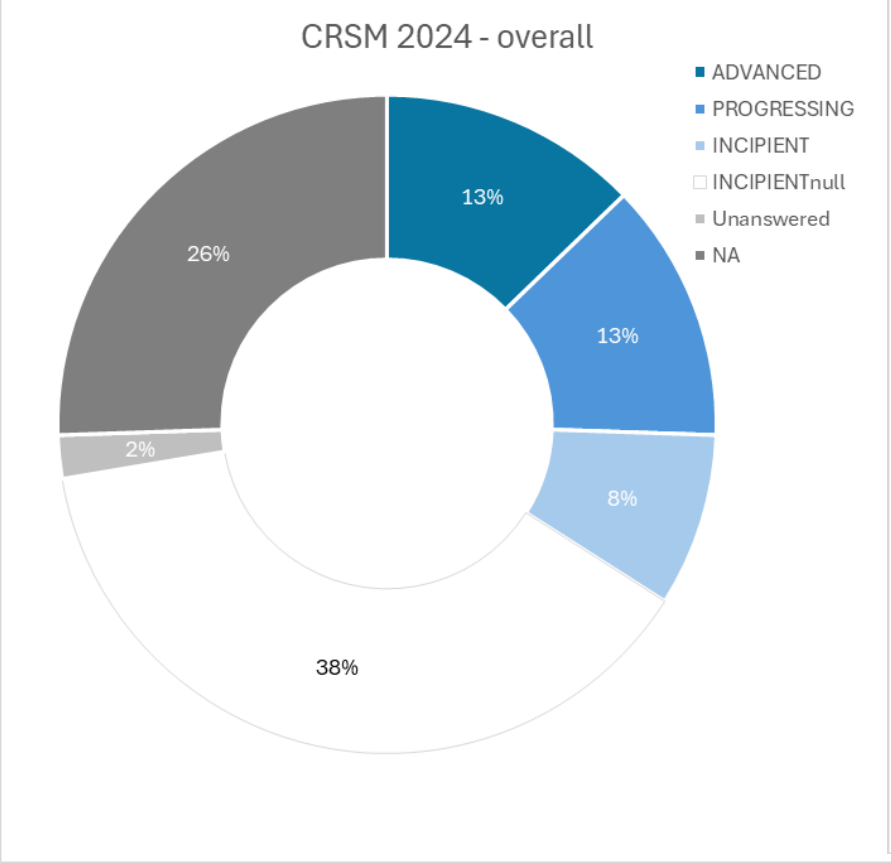
Rainfall measurements

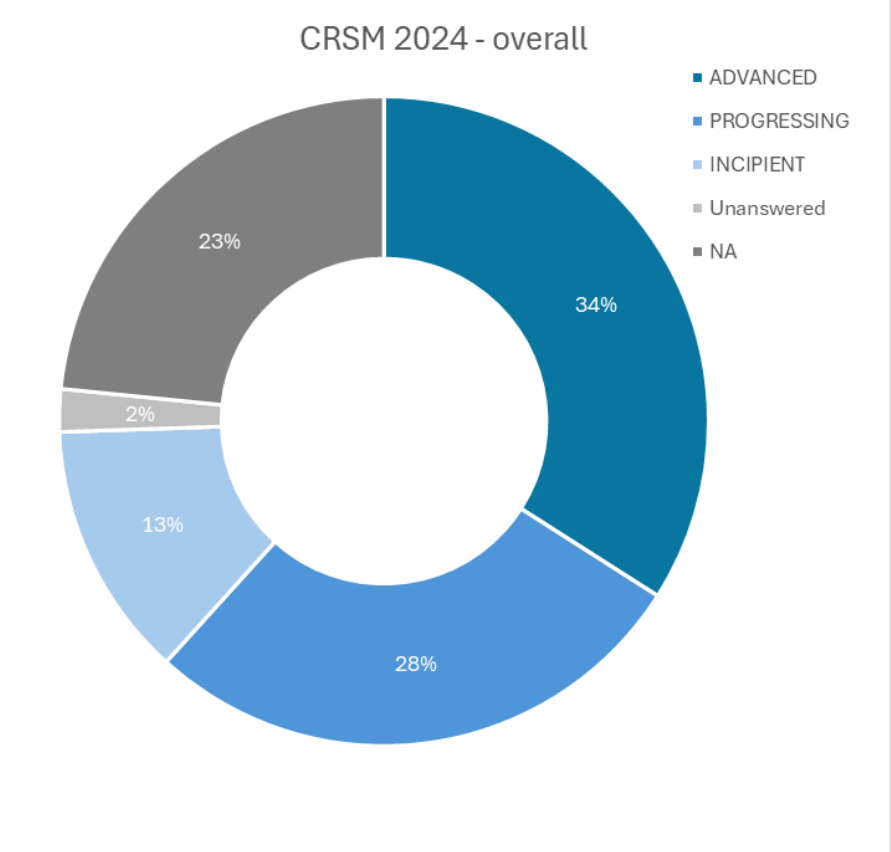
This project has received funding from the Horizon Innovation Actions under the grant agreement n° 101096405.

RAF | UP2030 innovative applications at different scales

CRSM Facility

RAF assessment



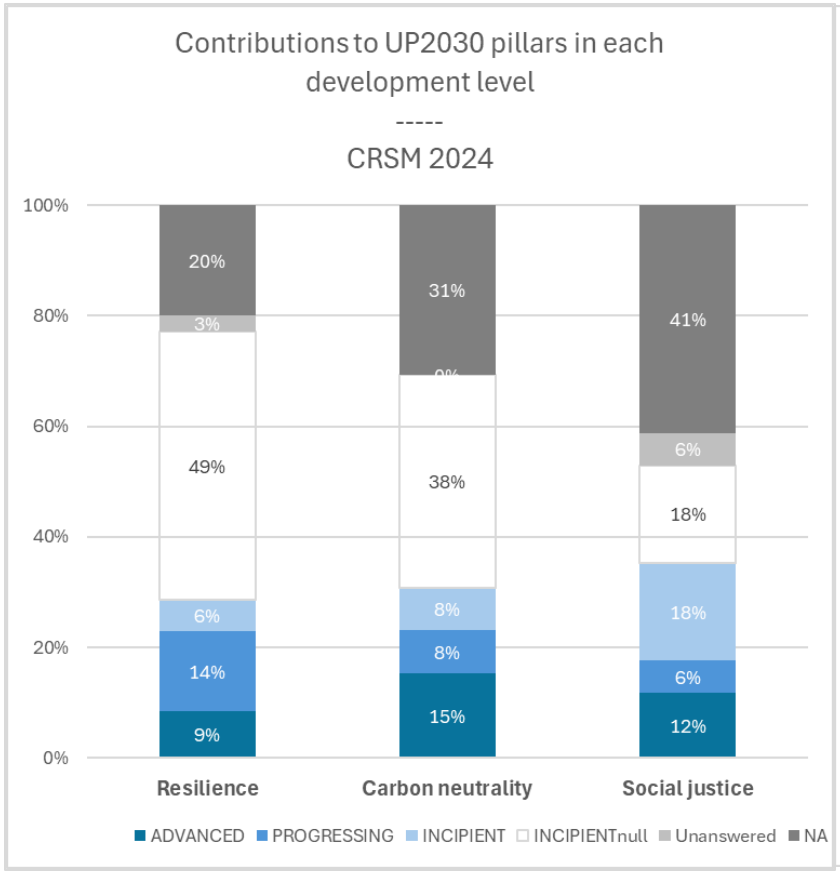


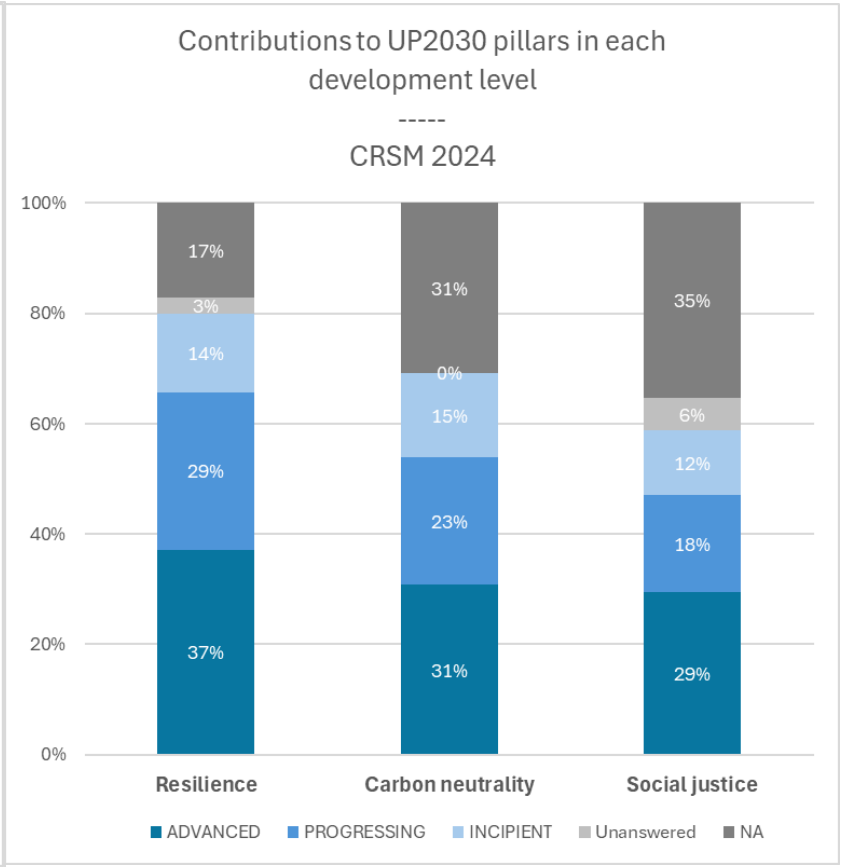
Initial situation

Improved situation

RAF | UP2030 innovative applications at new scales

RAF assessment





Initial situation

Improved situation

Key takeways

RAF – Resilience Assessment Framework

Application at **parish scale**

- resilience advanced level improved by 2%
- all relevant aspects having now action

Application at **facility scale**

- resilience advanced level improved from 13% to 34%
- resilience progressing level improved from 13% to 28%
- all relevant aspects with action

- **facilities** can significantly **contribute** to the **resilience of the parish**
- **replicating** appropriately the measures in other **facilities** could lead to a significant increase in the overall climate resilience of the **parish**
- **expanding** the application of similar measures to other **parishes** would be an important contribution to the **city's** climate resilience
- the **RAF** allows to identify needs, **assess progress** and the benefits of **upscalling** improvement actions

Aknowledgements

Responsible of the Alvalade Parish, São Miguel Rugby Club, Coruchéus Library, Alvalade Market, and LNEC for the involvement, information, availability, work, and all contributions.

THANK YOU!

Social media:

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