AGÊNCIA PORTUGUESA DO AMBIENTE

Management of temporary rivers on the South of Portugal

Maria Helena Alves (Administração da Região Hidrográfica do Tejo e Oeste)

Alice Fialho (Administração da Região Hidrográfica do Alentejo)

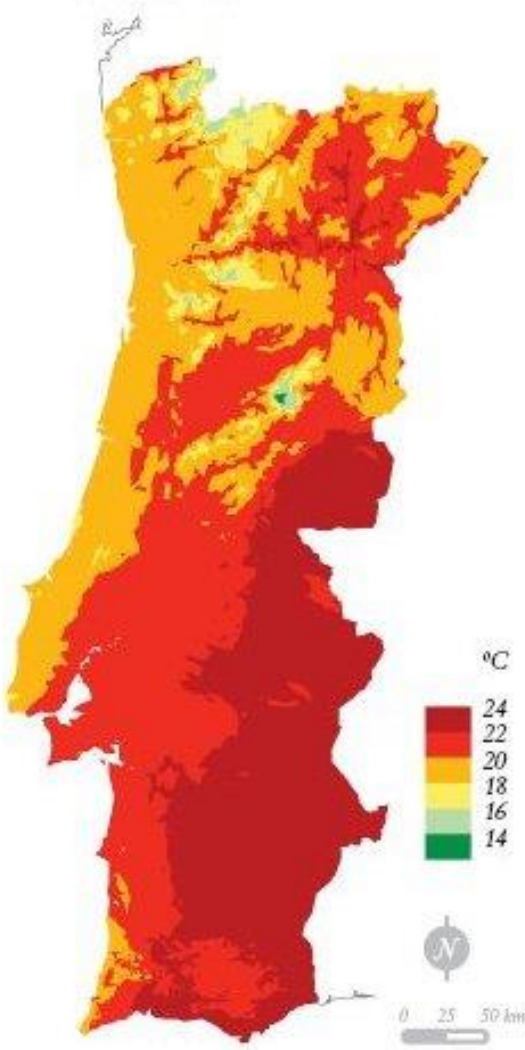
Manuela Morais (Universidade de Évora)

Barcelona, 3th of May of 2018

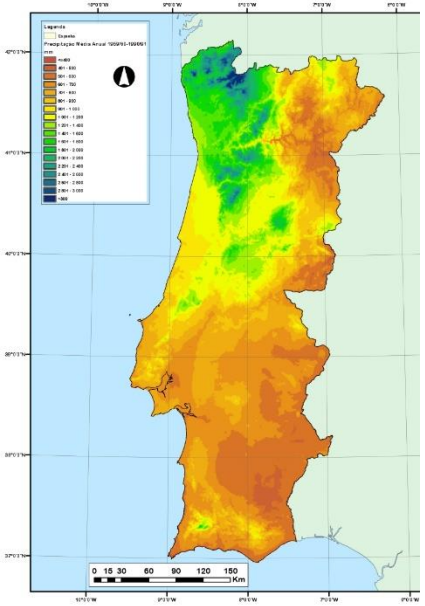
REPÚBLICA PORTUGUESA
AMBIENTE

1. Distribution of the temporary rivers in the South of Portugal

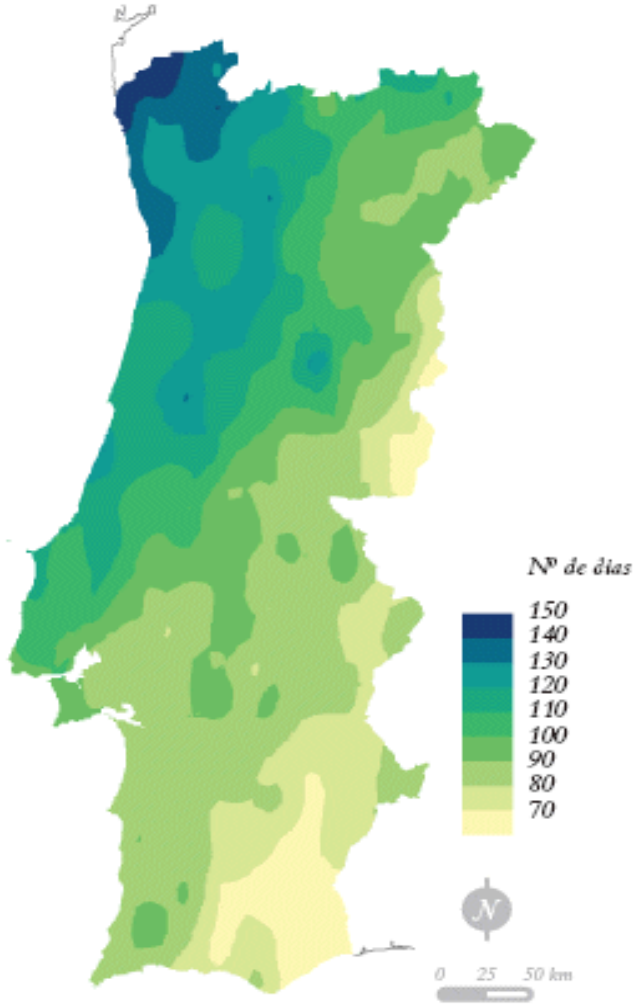
Average air temperature in summer months



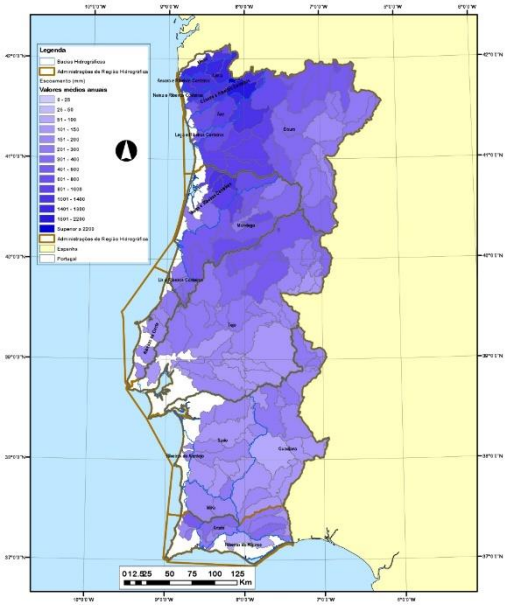
Average annual precipitation



Days with Precipitation > 1 mm



Runoff



- The climate is predominantly influenced by latitude, orography and proximity to the Atlantic Ocean;
- Precipitation and temperature present strong north-south and west-east gradients, and very marked seasonal and interannual variability.

1. Distribution of the temporary rivers in the South of Portugal

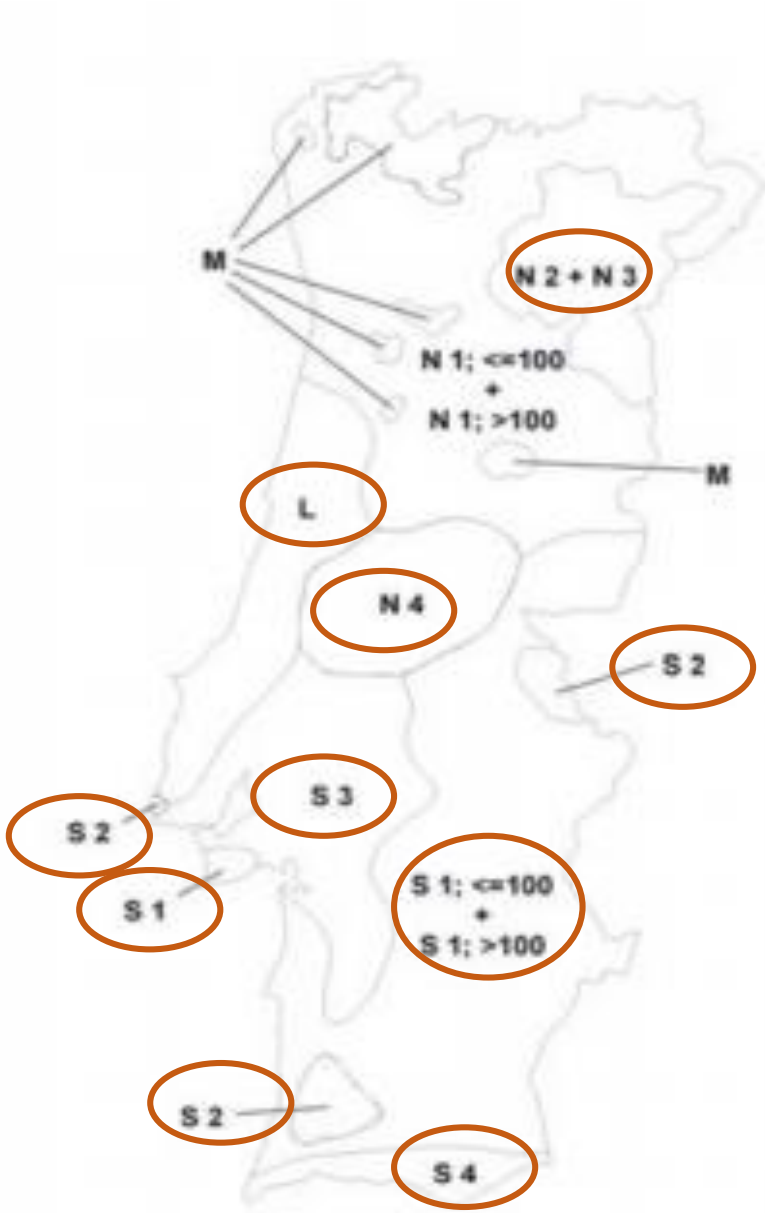
River Typology

Methodology

1. Application of System B
   - Obligatory : Altitude, drainage area, latitude, longitude, geology.
   - All rivers with a drainage basin ≥ 10 km² and a length ≥2km.
   - Facultative*: runoff, average slope, mean annual precipitation, coefficient of variation of precipitation, annual average temperature, annual average thermal amplitude.

2. Multivariate analysis validated with biological data

* Insufficient flow data



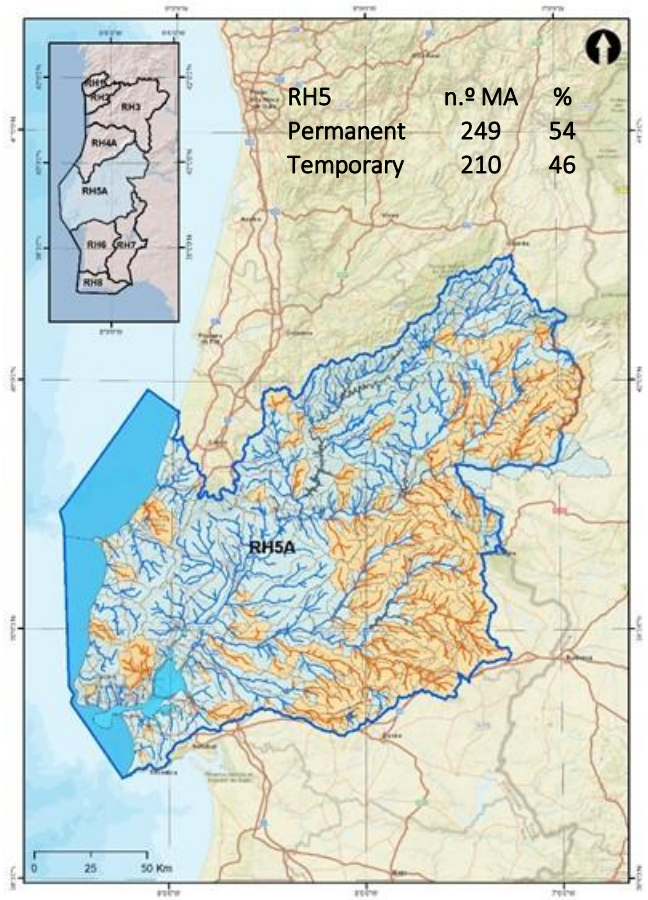
River Type	Code	
Mountainous North	M	
Northern Small	N1 ≤ 100 km²	
Northern Medium – Large	N1 ≥ 100 km²	
Nothern Upper Douro Medium – Large	N2	TEMPORARY
Nothern Upper Douro Small	N3	
North-South Transitional	N4	
Central Coast	L	
Southern Small	S1 ≤ 100 km²	
Southern Medium – Large	S1 ≥ 100 km²	
Mountainous South	S3	
Tajo and Sado Sedimentary Deposits	S3	TEMPORARY
Calcareous from Algarve	S4	
Large Northern (Minho and Douro)	GR Norte	
Central (Tejo)	GR Centro	
Southern (Guadiana)	GR sul	

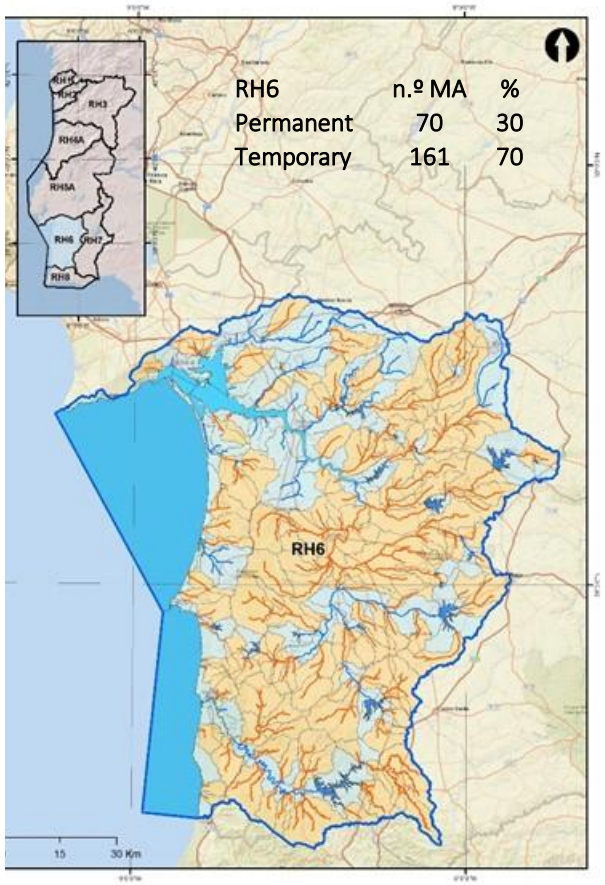
AGÊNCIA PORTUGUESA DO AMBIENTE

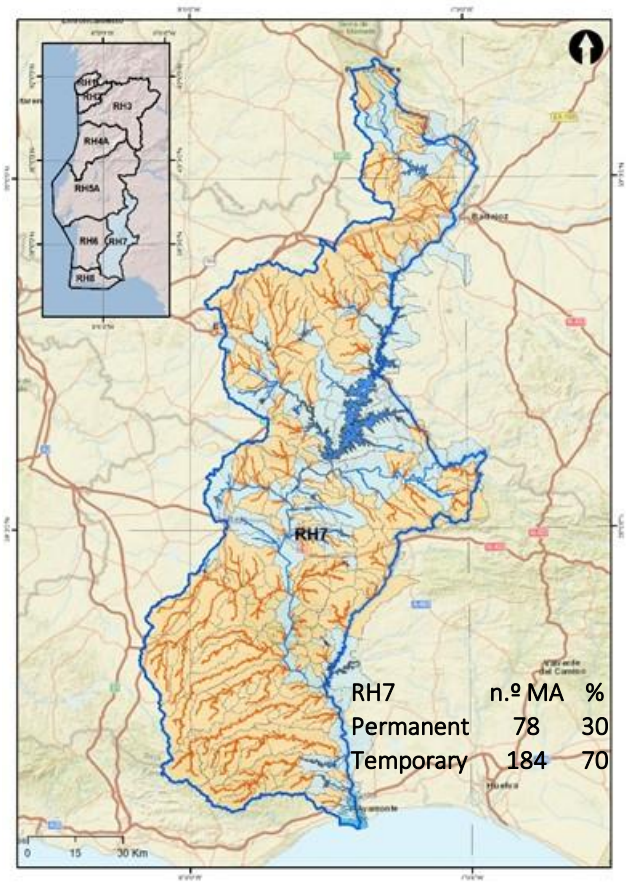
1. Distribution of the temporary rivers in Southern Portugal

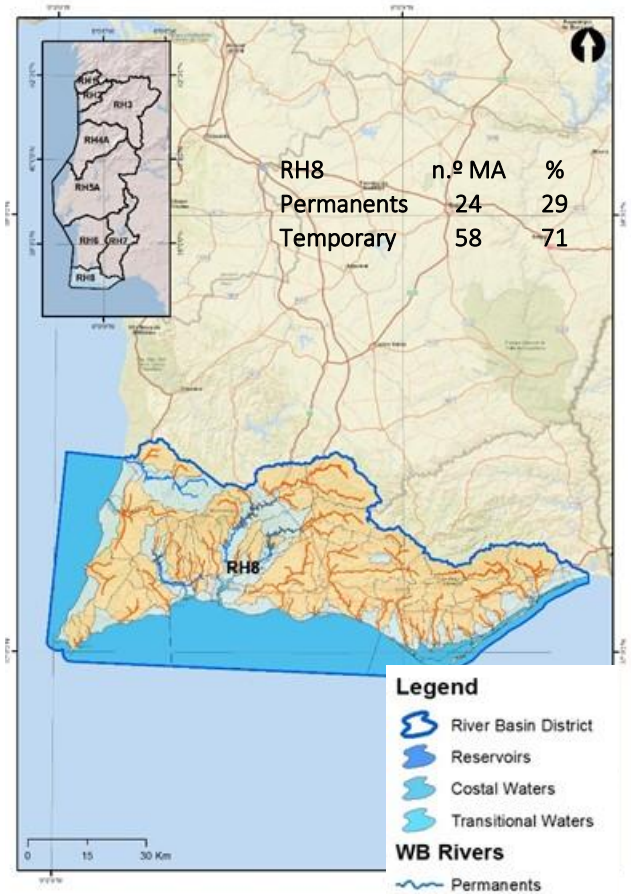
Zero-flow condition when (Q<=1 L/s) and at least one episode of zero flow for five consecutive days in the period of record)

SMIRES Science and Management of Intermittent Rivers and Ephemeral Streams









Legend
River Basin District
Reservoirs
Costal Waters
Transitional Waters
WB Rivers
Permanents
Temporary
WB Drainage Basins
Permanents
Temporary
World Street Map

1. Distribution of the temporary rivers in Southern Portugal

The temporary character of the hydrological regime is aggravated by anthropogenic pressures:

- Water abstractions for irrigation at local level
- Dams
- Small reservoirs on topographic depressions that decrease runoff on the river basin
- Animal watering

But during summer some rivers may have more water due to the drainage of irrigated areas creating conditions for invasive fish species and for the decline of native fish species which are adapted to the temporality of the hydrological regime.









1. Distribution of the temporary rivers in Southern Portugal









AGÊNCIA PORTUGUESA DO AMBIENTE

2. Distribution of the temporary rivers in the South of Portugal

Climate scenarios

EC- Earth Consortium

Mainland Portugal will be hotter and drier:

- Warming should be higher in the south and in the interior than in the north and the coast,
- The decrease in precipitation will be more pronounced in the southern regions

2040

- Average annual temperature is expected to rise 0.5 - 1.0 º C
- Annual rainfall will decrease by 15%

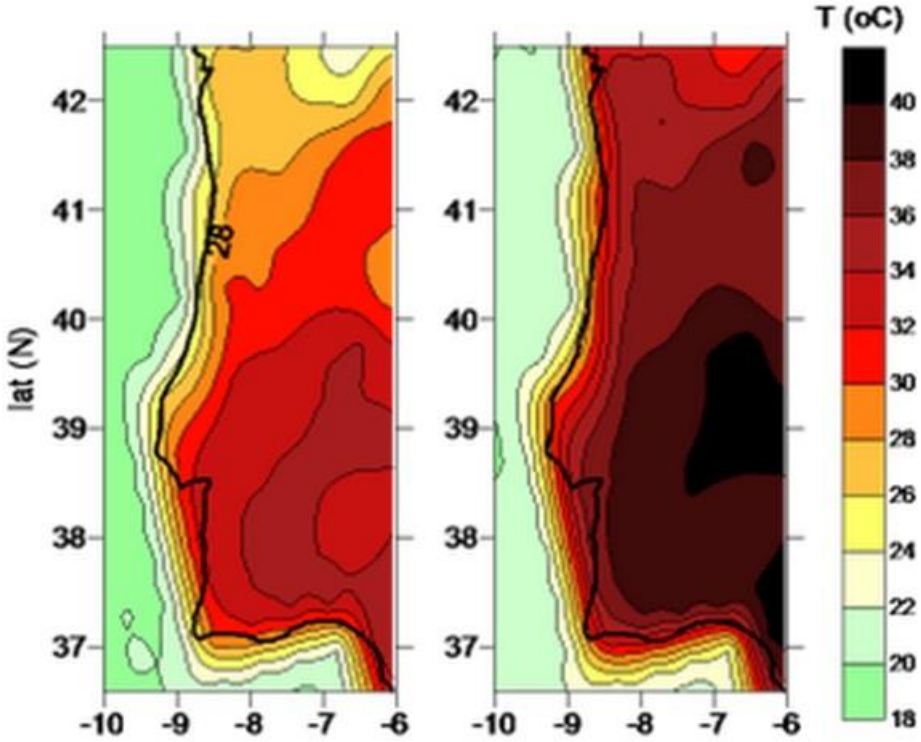
2100

- Average annual temperature may rise between 2 - 5 º C, depending on the region and the emission scenario.
- Annual rainfall will decrease by 30%

http://ecearth.knmi.nl/

Projeto SIAM

Maximum summer temperature



1961-1990

2071-2100 (according to the A2 scenario)

http://cciam.fc.ul.pt/prj/siam/

2. Ecological Status Classification System

- Monitoring network includes all the water bodies.
- Same BQE (fishes, diatomous, macroinvertebrates, macrophyte) for all the river types
- Sampling methods are the same for all river types
- The frequency for the biological, physico-chemical and hydromorpholocical quality elements was definid according the established in the Annex V of the WFD
- Common metrics and indices (harmonized boundaries by IC Exercise)

Quality element	Frequency	Season
Macro invertebrates	Once a year	Spring
Fish	Once a year	Spring
Phytobentos	Once a year	Spring
Macrophytes	Once a year	Spring
Physico-chemical (1)	Four times/year	Spring, Summer, Automn, Winter
Hydromorphological	Once a year	Spring

(1) As a guideline, monitoring should take place at intervals not exceeding those shown in the table of the Annex V (3 month) below unless greater intervals would be justified on the basis of technical knowledge and expert judgment.

3. Constraints to the management of temporary rivers

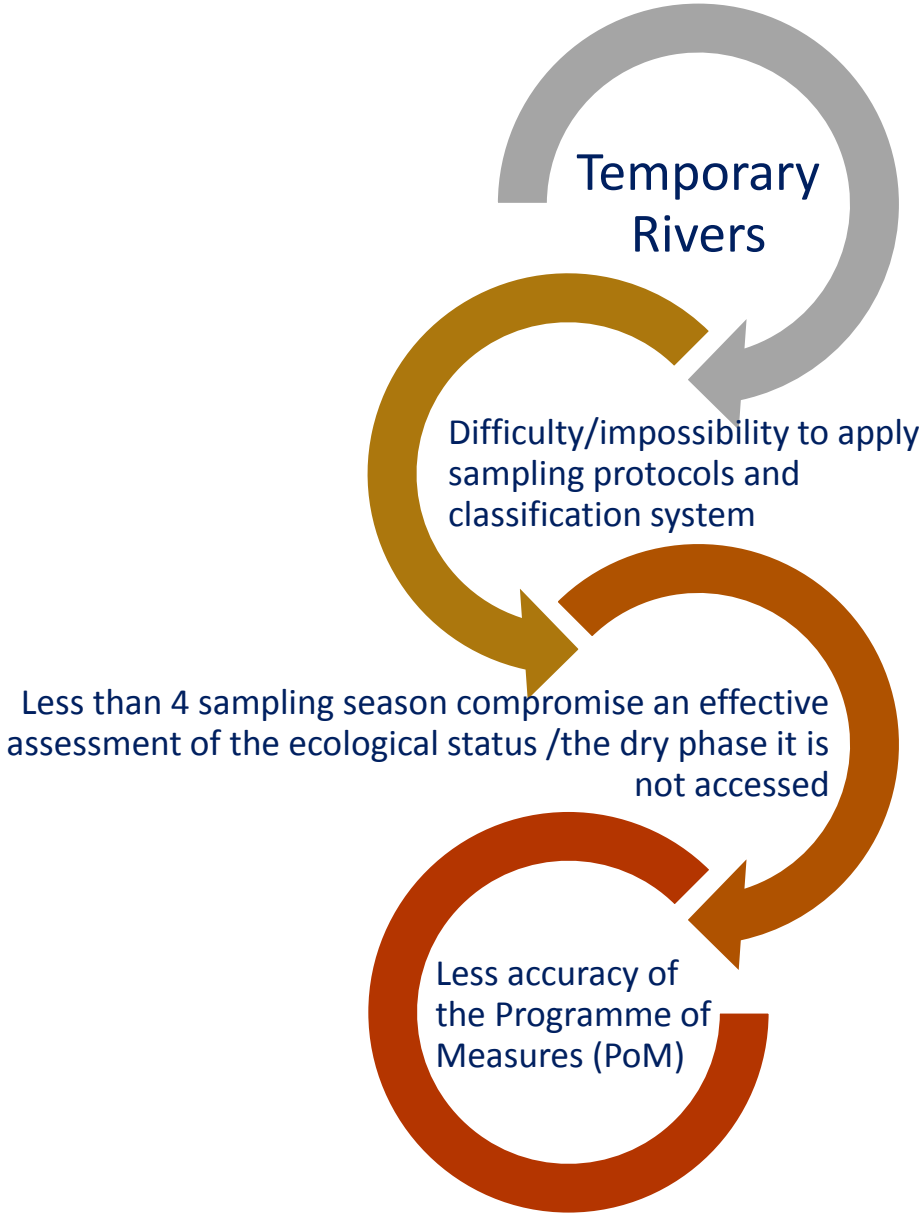
- The absence of flow during some periods of the year (later Winter/Spring/Summer early Autumn), compromise the application of the sampling protocol:
  - For some WB, instead of having 4 sampling seasons for the physico-chemical quality elements it is only possible to have 3, 2 or even 1, sampling seasons despite of some adjustments:
    - Anticipation of Spring sampling which is very often done at the last week of February/beginning of March.
    - Anticipation of Summer sampling which is done as soon as possible, starting at the beginning of June.
    - The Autumn sampling is postponed as long as possible in order to take place after the first rains.
  - There are severe limitations to the application of the classification system, since for some WB it is impossible to have 4 sampling seasons, which compromise an effective assessment of the ecological status.

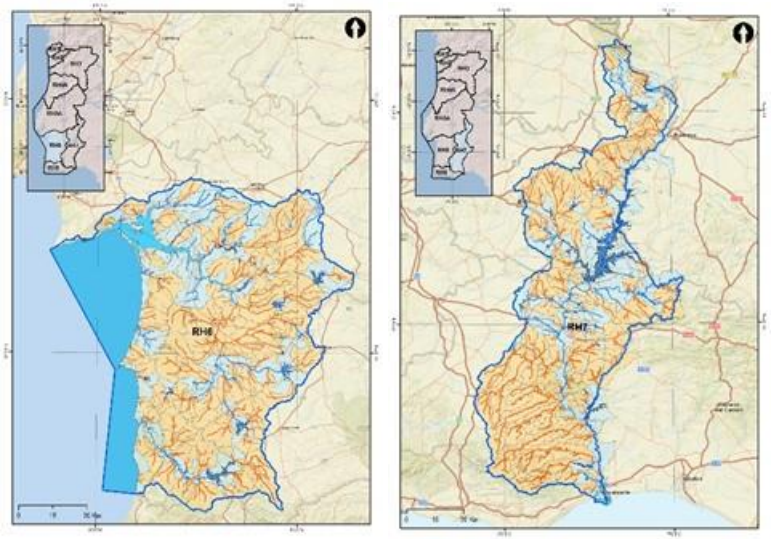
- Lack of hydrological data, specially in small river basins, difficult to define:
  - An effective planning of the sampling campaign in order to cacth the period with flow.
  - The effect of hydrological pressures (e.g. consumption of water for local irrigation) on the extension of the “no flow period”.





3. Constraints to the management of temporary rivers



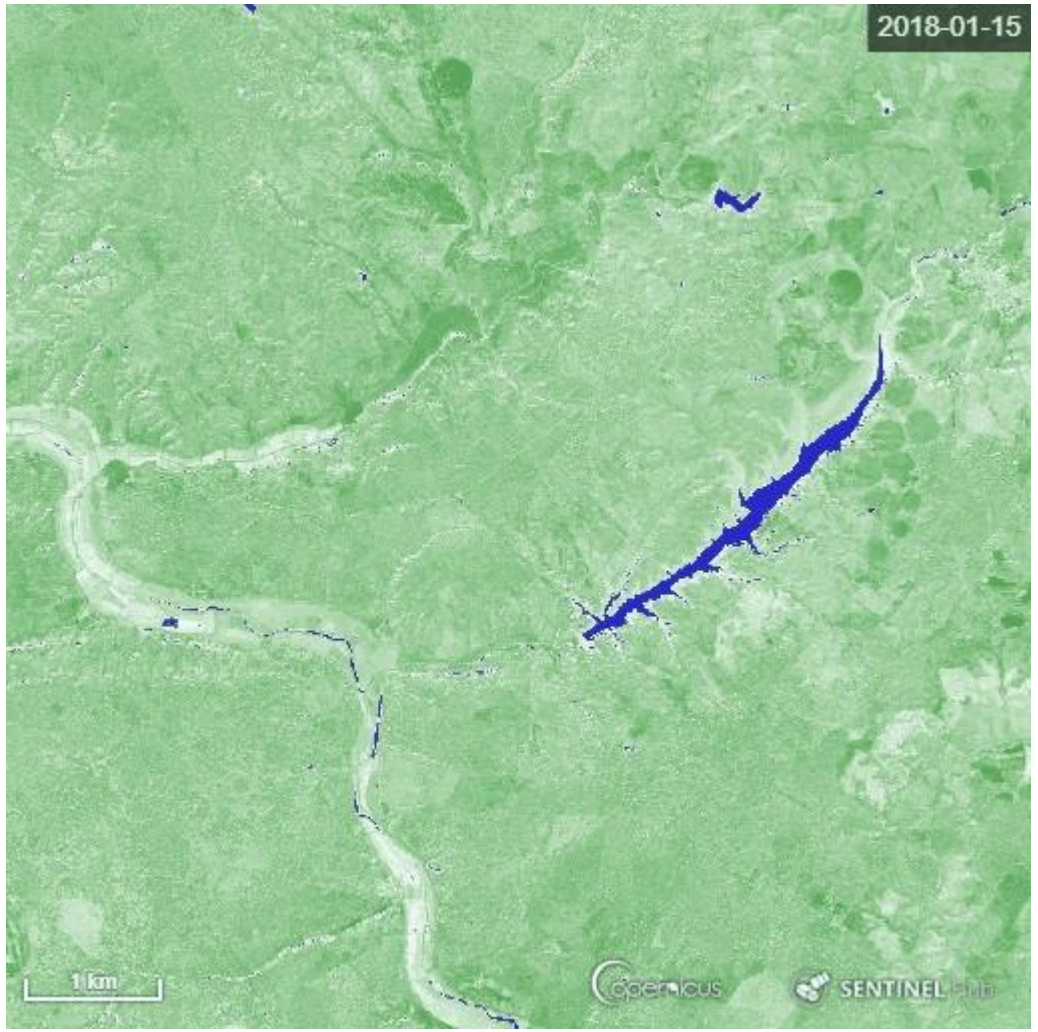


2017 was a dry year!
As a consequence, the number of WB with no flow increased

Monitoring sites	% of sites with no-flow		
	Summer	Automn	Winter
176	51	64	45

4. Future developments

- Establishment of a typology based on a gradient of temporality and predictability (eg. adapted from Gallart, F. *et al,* 2012)).
- Updating of the hydrological pressures (weirs and dams) using SENTINEL data, complemented with field work.
- Mapping temporary rivers (including the rivers that are temporary due to anthropogenic pressures).



4. Future developments

- Development of new tools for the monitoring and assessment of ecological status of temporary rivers, adapted to the functional particularities of each temporary river type, namely the occurrence of a dry phase.
  - New biological sampling methods such as dry biofilm for the identification of encrusted diatoms,
  - Complementary biological elements should be considered for the dry phase, such as riparian vegetation and carabids.

- Development of a national project, based on the first results of a research project in progress leaded by University of Évora.


Rib.ª da Palheta (Spring)


Rib.ª da Palheta (Summer)

4. Future developments

National Project on temporary rivers in the Guadiana River Basin (since Spring 2017)

- **Spring – flow**
  - Sampling of benthic macroinvertebrates and diatoms according to the national protocols.


Ribeira de Valverde (Spring)

- **Summer (4 months later) - no-flow**
  - **Pools** - Sampling of benthic macroinvertebrates and diatoms.
  - **Dry substrate** - Biofilm was sampled for the identification of encrusted diatoms.
  - **Installation of pitfalls** for collecting carabids in the canal and on river banks.


Ribeira de Valverde(Summer)

4. Future developments

First Conclusions

❑ Macroinvertebrates

- The 11 best classified sites in flow conditions (Good and Excellent) were the most affected by the flow interruption with significant reduction on richness and diversity;
- For the 7 sites classified as Moderate or Poor the differences were not so significant.
- A decrease in the relative abundance of Trichoptera, Plecoptera and Ephemeroptera were observed, while Diptera, Heteroptera and Oligochaeta (more adapted to lentic conditions) showed an increase

↓

CHANGES IN COMMMUNITIES

❑ Diatomaceous

- In sites with low flow during Spring there was no significant differences between Spring and Summer communities.
- In sites with higher flow during Spring there was significant differences between Spring and Summer communities (regardless of whether they were sampled in the pools or in a dry biofilm)

↓

CHANGES IN COMMMUNITIES

4. Future developments

Carabids

- During the dry season, 14 species of carabids were identified, both in the channel and on the river banks. Among them, some species are typical of the riverside systems;
- However, most are opportunistic and also occur in typically terrestrial systems such as agricultural and forested areas.







4. Future developments

- Temporary rivers are very dynamic aquatic/terrestrial ecosystems, characterized by high biodiversity but extremely vulnerable due to their own dynamism;
- The limited knowledge about the structure and functioning of the temporary rivers, commits the implementation of an effective management;
- The current assessment system to evaluate the ecological status is not suitable for temporary rivers.





AGÊNCIA
PORTUGUESA
DO AMBIENTE



REPÚBLICA
PORTUGUESA

AMBIENTE