Riparian vegetation assessment in Spain

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Introduction

Water districts are the territories where management and assessment of water bodies is unified.

According to **Water Framework Directive,** ecological status of water bodies should be assessed and improved.

Water districts in Spain

Quality indicators of WFD

- Biological
- Phisico-chemical
- Hydromorphological
  - Flow regime
  - River Continuity
  - Hydromorphological conditions
    - River width and depth variability
    - Grain size and distribution
    - Riparian zone structure

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Introduction

Instructions for the hydrological management plans

- Tools for the assessment of hydromorphological quality in rivers

HMF

- Flow regime: Environmental flows, Hydrological alterations Indicators…
- River Continuity: Reach length without barriers, barriers typology
- Morphological conditions: Riparian Vegetation Index and Fluvial Habitat Index

Index of riparian vegetation (QBR)

Munné A, Prat N, Sola C, Bonada N, Rieradevall M. 2003. **A simple field method for assessing the ecological quality of riparian habitat in rivers and streams: QBR index**. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *13*(2), 147-163.

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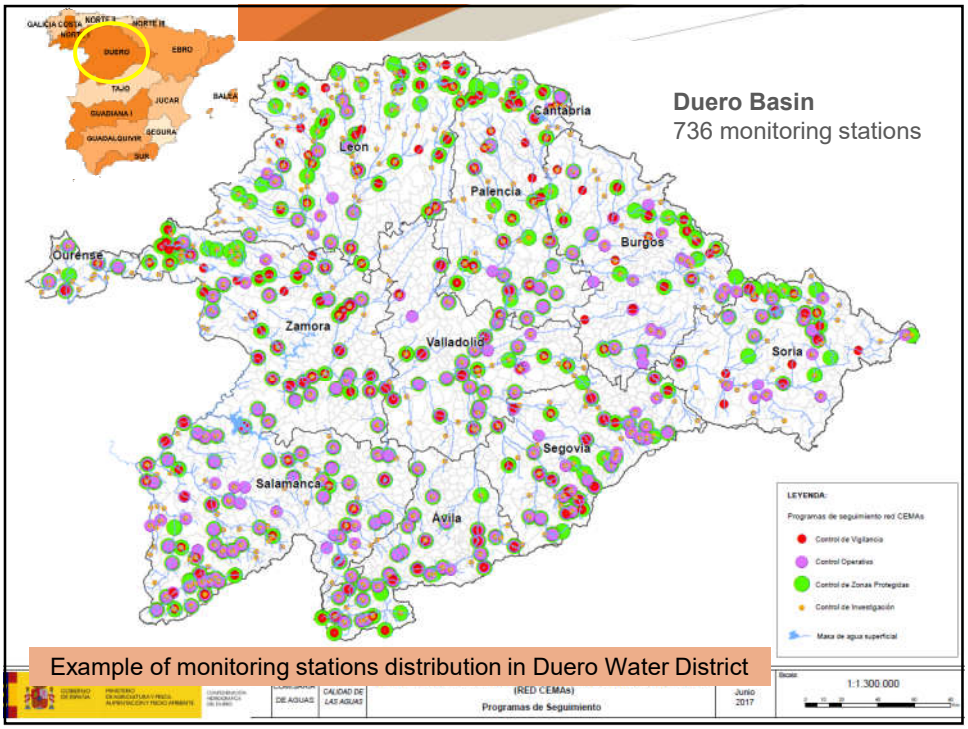
Introduction

Instructions for the hydrological management plans

- To assess the ecological status a reference situation is needed.
- In Spain 32 river typologies have been stablished
- Reference values have been assigned to each of them

River type	Elemento	Indicador	Reference value	mite muy bueno/bueno	Límite bueno/moderado	mod
1. Ríos de llanuras silíceas del Tajo y Guadiana	Organismos fitobentónicos	IPS	13	0,94	0,70	
1. Ríos de llanuras silíceas del Tajo y Guadiana	Fauna bentónica de invertebrados	IBMWP	75	0,78	0,59	
1. Ríos de llanuras silíceas del Tajo y Guadiana	Condiciones morfológicas	IHF	61,5	0,91		
1. Ríos de llanuras silíceas del Tajo y Guadiana	Condiciones morfológicas	QBR	80	0,81		
1. Ríos de llanuras silíceas del Tajo y Guadiana	Condiciones de oxigenación	Oxígeno (mg/L)	8,8	7,5	6,6	
1. Ríos de llanuras silíceas del Tajo y Guadiana	Salinidad	Conductividad (µS/cm)	160	<320	<600	
1. Ríos de llanuras silíceas del Tajo y Guadiana	Estado de acidificación	pH	7,7	6,9 - 8,5	6,2 -9	
3. Ríos de las penillanuras silíceas de la Meseta Norte	Fauna bentónica de invertebrados	IBMWP	103	0,83	0,62	
3. Ríos de las penillanuras silíceas de la Meseta Norte	Condiciones morfológicas	IHF	71	0,89		
3. Ríos de las penillanuras silíceas de la Meseta Norte	Condiciones morfológicas	QBR	64	0,73		
3. Ríos de las penillanuras silíceas de la Meseta Norte	Condiciones de oxigenación	Oxígeno (mg/L)	8,2	7	6,2	
3. Ríos de las penillanuras silíceas de la Meseta Norte	Salinidad	Conductividad (µS/cm)	150	<300	<500	
3. Ríos de las penillanuras silíceas de la Meseta Norte	Estado de acidificación	pH	6,8	6,1 - 7,5	6 - 8,2	

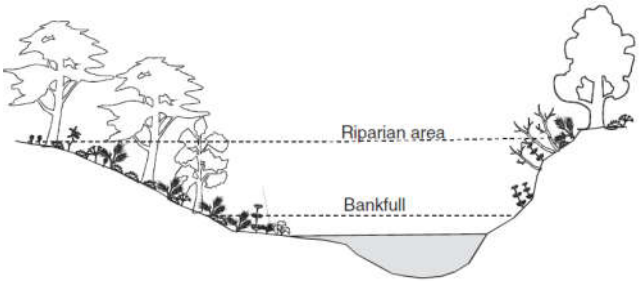


Example of monitoring stations distribution in Duero Water District

QBR

PREVIOUS TO ITS APPLICATION AND CACULATION…

- Main channel and floodplain zone should be differentiated identifying the bankfull zone.



From Munné et al., 2003

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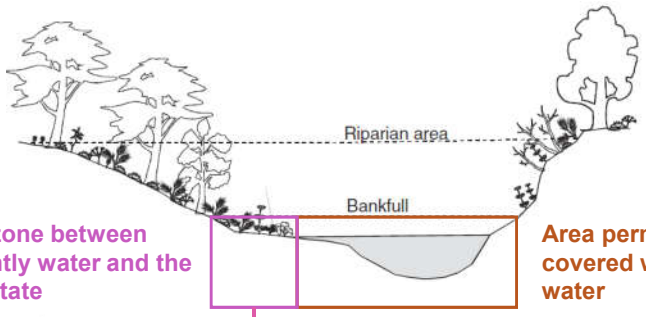
PREVIOUS TO ITS APPLICATION AND CALCULATION…

- Main channel and floodplain zone should be differentiated identifying the bankfull zone.



Channel zone between permanently water and the bankfull state

Area permanently covered with flowing water

From Munné et al., 2003

Helophytes

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QBR

RANGES FROM 0 TO 100

REACHES 50 – 100 METERS LONG

FOUR COMPONENTS OF RIPARIAN QUALITY (0-25)

- **Total vegetation cover**
- **Vegetation cover structure**
- **Cover quality**
- **River channel alterations**

- Initially the score for each aspect: 0; 5; 10; 25.
- Additional criteria could increase or decrease the score, but within the limits 0 – 25.
- Field sheet

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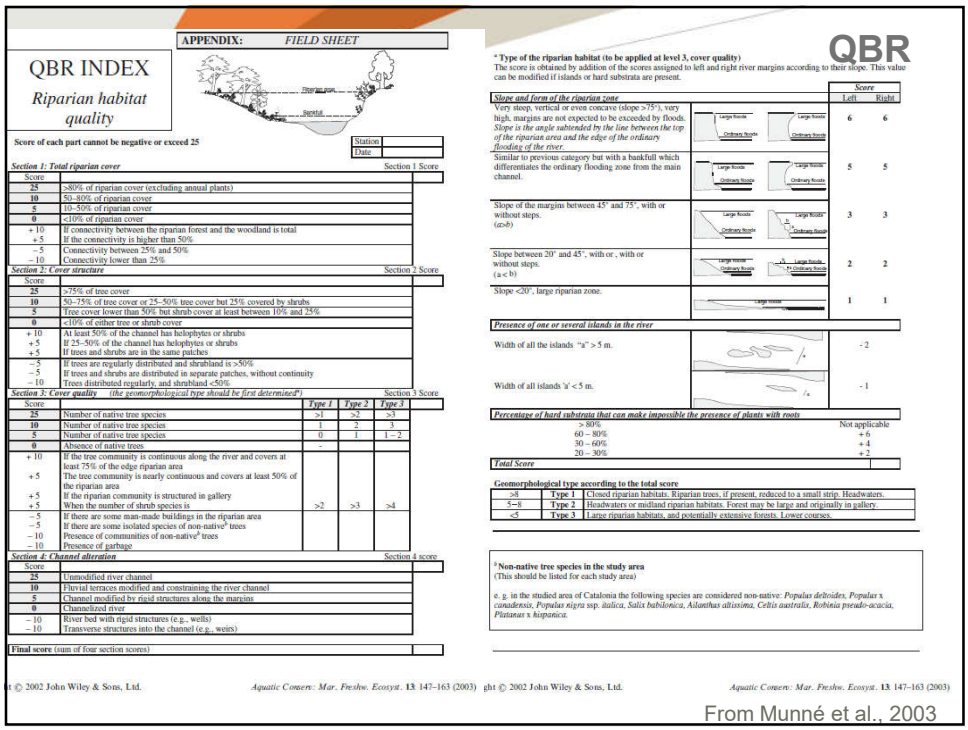

APPENDIX: *FIELD SHEET*

QBR INDEX

Riparian habitat quality

Score of each part cannot be negative or exceed 25

Station

Date

Section 1: Total riparian cover Section 1 Score

Score	
25	>80% of riparian cover (excluding annual plants)
10	50–80% of riparian cover
5	10–50% of riparian cover
0	<10% of riparian cover
+ 10	If connectivity between the riparian forest and the woodland is total
+ 5	If the connectivity is higher than 50%
− 5	Connectivity between 25% and 50%
− 10	Connectivity lower than 25%

Section 2: Cover structure Section 2 Score

Score	
25	>75% of tree cover
10	50–75% of tree cover or 25–50% tree cover but 25% covered by shrubs
5	Tree cover lower than 50% but shrub cover at least between 10% and 25%
0	<10% of either tree or shrub cover
+ 10	At least 50% of the channel has helophytes or shrubs
+ 5	If 25–50% of the channel has helophytes or shrubs
+ 5	If trees and shrubs are in the same patches
− 5	If trees are regularly distributed and shrubland is >50%
− 5	If trees and shrubs are distributed in separate patches, without continuity
− 10	Trees distributed regularly, and shrubland <50%

Section 3: Cover quality *(the geomorphological type should be first determined*)* Section 3 Score

Score		*Type 1*	*Type 2*	*Type 3*
25	Number of native tree species	>1	>2	>3
10	Number of native tree species	1	2	3
5	Number of native tree species	0	1	1 – 2
0	Absence of native trees	-		
+ 10	If the tree community is continuous along the river and covers at least 75% of the edge riparian area			
+ 5	The tree community is nearly continuous and covers at least 50% of the riparian area			
+ 5	If the riparian community is structured in gallery			
+ 5	When the number of shrub species is	>2	>3	>4
− 5	If there are some man-made buildings in the riparian area			
− 5	If there are some isolated species of non-native[§] trees			
− 10	Presence of communities of non-native[§] trees			
− 10	Presence of garbage			

Section 4: Channel alteration Section 4 score

Score	
25	Unmodified river channel
10	Fluvial terraces modified and constraining the river channel
5	Channel modified by rigid structures along the margins
0	Channelized river
− 10	River bed with rigid structures (e.g., wells)
− 10	Transverse structures into the channel (e.g., weirs)

Final score (sum of four section scores)

Aquatic Conserv: Mar. Freshw. Ecosyst. **13**: 147–163 (2003)

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QBR

* **Type of the riparian habitat (to be applied at level 3, cover quality)**
The score is obtained by addition of the scores assigned to left and right river margins according to their slope. This value can be modified if islands or hard substrata are present.

Slope and form of the riparian zone	Score Left	Score Right
Very steep, vertical or even concave (slope >75°), very high, margins are not expected to be exceeded by floods. *Slope is the angle subtended by the line between the top of the riparian area and the edge of the ordinary flooding of the river.*	6	6
Similar to previous category but with a bankfull which differentiates the ordinary flooding zone from the main channel.	5	5
Slope of the margins between 45° and 75°, with or without steps. ($a>b$)	3	3
Slope between 20° and 45°, with or , with or without steps. ($a<b$)	2	2
Slope <20°, large riparian zone.	1	1
Presence of one or several islands in the river		
Width of all the islands "a" > 5 m.	- 2	
Width of all islands 'a' < 5 m.	- 1	
Percentage of hard substrata that can make impossible the presence of plants with roots		
> 80%	Not applicable	
60 – 80%	+ 6	
30 – 60%	+ 4	
20 – 30%	+ 2	
Total Score		

Geomorphological type according to the total score

>8	**Type 1**	Closed riparian habitats. Riparian trees, if present, reduced to a small strip. Headwaters.
5–8	**Type 2**	Headwaters or midland riparian habitats. Forest may be large and originally in gallery.
<5	**Type 3**	Large riparian habitats, and potentially extensive forests. Lower courses.

§ **Non-native tree species in the study area**
(This should be listed for each study area)

e. g. in the studied area of Catalonia the following species are considered non-native: *Populus deltoides, Populus x canadensis, Populus nigra* ssp. *italica, Salix babilonica, Ailanthus altissima, Celtis australis, Robinia pseudo-acacia, Platanus x hispanica.*

From Munné et al., 2003

QBR

CLASSES OF RIPARIAN QUALITY

- 5 quality classes which broadly correspond to those suggested in WFD

Table 1. Quality classes according to the QBR index

Riparian habitat quality class	QBR
Riparian habitat in natural condition	⩾95
Some disturbance, good quality	75–90
Disturbance important, fair quality	55–70
Strong alteration, poor quality	30–50
Extreme degradation, bad quality	⩽25

From Munné et al., 2003

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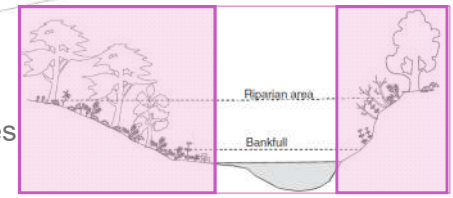
QBR

1.TOTAL VEGETATION COVER

- Includes trees, shrubs or helophytes
- No grasses
- Additional criteria:
  - Connectivity between the riparian environment and adjacent terrestrial ecosystems: Metalled road is a barrier (-5 points for each margin), sand roads or paths (<4m) are not considered a threaten.



Section 1: Total riparian cover

Score	
25	>80% of riparian cover (excluding annual plants)
10	50–80% of riparian cover
5	10–50% of riparian cover
0	<10% of riparian cover
+ 10 + 5	If connectivity between the riparian forest and the woodland is total If the connectivity is higher than 50%
– 5 – 10	Connectivity between 25% and 50% Connectivity lower than 25%

From Munné et al., 2003

QBR

2. VEGETATION COVER STRUCTURE

- Structural complexity that would increase biodiversity
- Initial score according to tree cover.
- Additional criteria:
  - Shrubs or helophytes presence (+)
  - Regularly distributed (-)

Section 2: Cover structure

Score	
25	>75% of tree cover
10	50–75% of tree cover or 25–50% tree cover but 25% covered by shrubs
5	Tree cover lower than 50% but shrub cover at least between 10% and 25%
0	<10% of either tree or shrub cover
+ 10 + 5 + 5	At least 50% of the channel has helophytes or shrubs If 25–50% of the channel has helophytes or shrubs If trees and shrubs are in the same patches
– 5 – 5 – 10	If trees are regularly distributed and shrubland is >50% If trees and shrubs are distributed in separate patches, without continuity Trees distributed regularly, and shrubland <50%

From Munné et al., 2003

QBR
3. COVER QUALITY

- Number of native **tree species**
- Additional criteria
  - Contiguity of tree community along the river (+)
  - Presence of non-native vegetation (-)

Section 3: Cover quality (*the geomorphological type should be first determined*[a])				Section
Score		*Type 1*	*Type 2*	*Type 3*
25	Number of native tree species	>1	>2	>3
10	Number of native tree species	1	2	3
5	Number of native tree species	0	1	1 – 2
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– 5	If there are some man-made buildings in the riparian area			
– 5	If there are some isolated species of non-native[b] trees			
– 10	Presence of communities of non-native[b] trees			
– 10	Presence of garbage			

From Munné et al., 2003

QBR
4. RIVER CHANNEL ALTERATION

- Man-made river channel alterations
  - Continuous structures (channelization)
  - Not continuous structures (<25%) (e.g., embankments…)
- Additional criteria
  - Rigid structures in the river bed (-)
  - Transverse structures into the channel (-)

Section 4: Channel alteration

Score	
25	Unmodified river channel
10	Fluvial terraces modified and constraining the river channel
5	Channel modified by rigid structures along the margins
0	Channelized river
– 10	River bed with rigid structures (e.g., wells)
– 10	Transverse structures into the channel (e.g., weirs)

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From Munné et al., 2003

QBR

Red de Control de Calidad Biológica

Tajo Water Dictrict

COD. EST. SPF	Fecha	IBMWP	IBMR	IPS	QBR	pH	O_2 (mg/l)	O_2 (%sat)	Amonio (mg/l)	Fosfato (mg/l)	Nitrato (mg/l)	Est. FQ asociada	Nat. Masa	Tipo
TA51201006	22-5-08	98		16,5	80	8,0	7,5		0,05		<1	307	N	12
TA51201006	3-6-09	62		19,4	80	7,8	8,1		0,05		<1	307	N	12
TA51201006	14-6-10	34		16,7	80	7,7	10,2		<0,02		9,00	307	N	12
TA51201006	11-6-13	55		17,2	95	7,7	9,7	103,6	<0,1		<2,5	307	N	12
TA51201006	25-6-14	68		13,5	45	7,7	4,9	55,0	0,00		0,00	307	N	12
TA51201006	25-6-15	60		11,5	45	7,17	8,7	90,5	0,05	0,05	1,25	307	N	12
TA58501003	12-6-08	61		13,3	20	7,9	7,2		0,15		8,25	325	N	12
TA58501003	28-5-09	60		14,1	20	7,8	8,4		5,03		10,16	325	N	12
TA58501003	8-6-10	48		15,5	20	7,9	10,6		0,15		24,25	325	N	12
TA58501003	7-6-13	58		13,2	10	8,0	12,1	128,4	<0,1		22,00	325	N	12
TA58501003	4-6-14	64		14,4	15	7,9	11,7	128,4	0,00		17,75	325	N	12
TA58501003	25-6-15	63		14,1	15	7,77	9,1	97,8	0,12	0,21	16,51	325	N	12
TA56201006	19-5-08	149		18,3	20	7,8	8,7		0,03		4,68	296	N	12
TA56201006	27-5-09	122		18,1	25	7,8	9,0		0,04		9,30	296	N	12
TA56201006	9-6-10	115		15,1	25	8,0	10,4		0,03		16,25	296	N	12
TA56201006	29-6-15	90	0,0	13,5	20	7,91	8,5		0,08	0,36	10,65	296	N	12
TA56201006	25-4-16	108	6,0	15,3	20	7,7	10,6	95,9	< 0,10	< 0,15	12,46	296	N	12
TA53901003	21-5-08	88		10,0	80	8,1	10,7		0,04		<1	8	N	12
TA53901003	5-6-09	160		17,2	80	8,2	10,1		0,03		<1	8	N	12
TA53901003	9-6-10	127		16,1	80	8,2	9,8		<0,02		<1	8	N	12
TA53901003	13-6-13	75		17,1	100	8,1	8,5	100,7	<0,1		<2,5	8	N	12
TA53901003	23-6-14	129		17,6	85	8,5	9,9	118,3	0,03		0,00	8	N	12
TA53901003	30-6-15	181		15,9	85	8,23	10,8	120,0	0,05	0,44	1,25	8	N	12

al 2016

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QBR

Tajo Water Dictrict MONITORING NETWORK

TABLA A1: AÑO 2013

Cód. Int. Punto	Cód. Masa de agua	Nombre Punto de Control	Fecha Muestreo	Tipo-logía IPH	Natura-leza	Calidad Biológica	Calidad FQ	Calidad HMF	Estado/ Potencial Ecológico
TA12088	ES030MSPF0318010	Huerce - Sorbe	05/06/2013	11	Natural	Buena	Muy buena	Muy buena	Bueno
TA12101	ES030MSPF0426010	Cardoso de la Sierra - Jarama	05/06/2013	11	Natural	Muy buena	Buena	Muy buena	Bueno
TA12087A	ES030MSPF0322010	Villares de Jadraque - Bornova	05/06/2013	11	Natural	Muy buena	Muy buena	Mode-rada	Bueno
TA12081A	ES030MSPF0329010	Sigüenza - Salado	05/06/2013	13	Natural	Buena	Muy buena	Mala	Bueno
TA12102A	ES030MSPF0450010	Alameda del Valle - Lozoya	28/05/2013	11	Natural	Moderada	Buena	Mode-rada	Moderado
TA12102B	ES030MSPF0450010	Rascafría - Lozoya	29/05/2013	11	Natural	Muy buena	Buena	Muy buena	Bueno

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QBR: FINAL REMARKS

ADVANTAGES

- Easy and fast implementation in the field (10 – 20 minutes)
- Little taxonomic expertise (only native vs non native)

LIMITATIONS

- Imprecise
- Vegetation cover is considered in 3 of 4 index components
- High vegetation cover → high quality
- Naturalness of riparian corridor is not considered.
- Connectivity with adjacent terrestrial ecosystem is very positively valuated, independently of riparian corridor dimensions.
- Temporal dimension of riparian vegetation is not considered: age structure is not considered.
- River channel alterations outside the reach are not considered

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Thank you
Gracias

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