
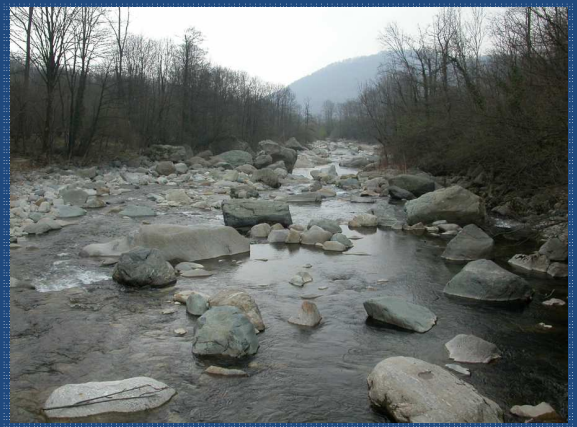


CARAVAGGIO: habitat information and indices

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Corso di formazione "introduzione al metodo *CARAVAGGIO*"
Core Assessment of River hAbitat VAlue and hydro-morpholoGIcal cOndition
3-5 Ottobre 2012

Indices/descriptors actually derived from CARAVAGGIO

- **Morphological alteration** → HMS - Habitat Modification Score
- **Habitat Diversification** → HQA - Habitat Quality Assessment
- **Local hydromorphological condition** → LRD - Lentic-lotic River Descriptor
- **Land Use** → LUI – Land Use Index

- **All indices/descriptors available at Pd3** – "Guideline and field protocols for deriving hydro-morphological and habitat information"; http://www.life-inhabit.it/en/inhabit-themes-results/dissemination

Habitat Modification Score (HMS)

From Raven et al., 1998

The principle of HMS: different scores are assigned to different morphological alteration (and than summed)

High HMS values → high morphological alteration

Features		Scores			
		Each SC	# of SC <3	# of SC 3-5	# of SC 6≥
Spotcheck	Reinforcement to banks (RI)	2			
	Reinforcement to bed (AR)	2			
	Resectioned bank or bed (RS)	1			
	Two-stage bank modification (BM)	1			
	Embankment (EM)	1			
	Culvert	8			
	Dam, weir, ford (DA, FO)	2			
	Bank poached by livestock (PC)		0	1	2
Sweep-up			Bank one		Bank both
	Artificial bed material	1			
	Reinforced whole bank	2			3
	Reinforced top or bottom only	1			2
	Resectioned bank	1			2
	Embankment	1			1
	Set-back embankment	1			1
	Two-stage channel	1			3
	Weed-cutting	1			
	Bank mowing	1			1
	Culvert	8 each			
	Dam, weir, ford	2 each			
		# of features 1			# of features 2≥
	Roadbridge	1			2
	Enhancements, such as groynes	1			2
		Partly			Extensively
	Site affected by flow control	1			2
	Realigned channel	5			10

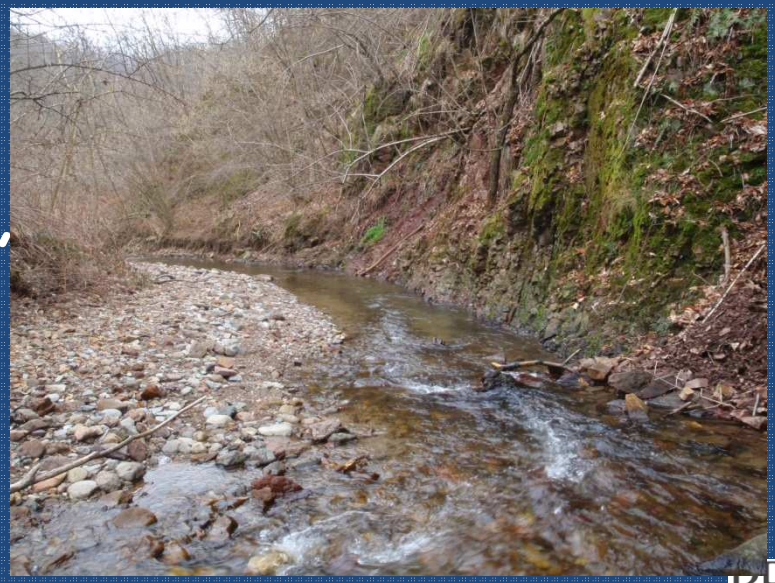
Habitat quality assessment (HQA)

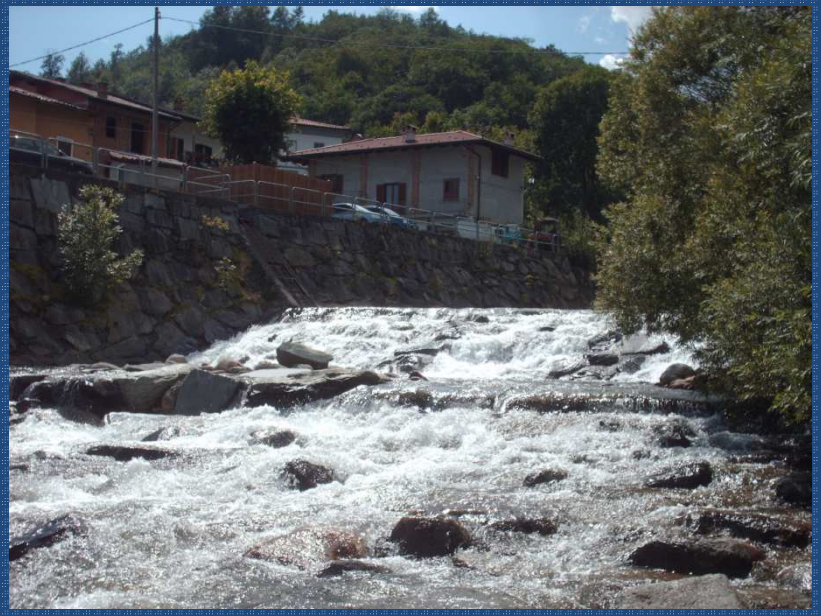
High HQA values → high habitat diversification

Category (note)	Features	Spotcheck #1	Spotcheck #2-3	Spotcheck #4≥	Sweep-up (note)
Flow types	Every features	1	2	3	1 each (if not in the SC)
Channel substrates	Every features (NV score 1 only if 6≥)	1	2	3	
Natural channel features	Every features	1	2	3	1 each (if not in the SC)
Bank features	EC, SC, PB, VP, SB, VS	1	2	3	
Bars	VP, PB, SB, VS				1 each (if not in the SC)
					# of features 3-8 / 9≥
	PB+VP (count together)				1 / 2
Bank vegetation structure (each bank is scored separately)	Bankface (S or C)	1	2	3	
	Banktop (S or C)	1	2	3	
In-stream channel vegetation (either present or extensive)	Liverworts/mosses	1	1	2	
	emergent broad-leaved herbs	1	1	2	
	emergent reeds/rushes/sedges	1	1	2	
	floating-leaved, free floating and amphibious	1	1	2	
	submerged broadleaved	1	1	2	
	submerged linear and fine-leaved	1	1	2	
Land-use within 50 m (each bank is scored separately)					P / E
	Broadleaf woodland, moorland/heath and wetland				1 / 2
	Exclusively recorded: Broadleaf woodland, moorland/heath and wetland				7
Trees (each bank is scored separately)	Isolated/scattered				1
	Regularly-spaced or occasional clumps				2
	Semi-continuos or continuos				3
Associated features					P / E
	Overhanging boughs				1
	Exposed bankside roots, underwater tree roots				1 / 2
	Coarse woody debris				1 / 3
	Fallen trees				1 / 5
Special features	Waterfall more than 5m high, braided or side-channels, debris dams, natural open, fen, carr, flush, bog				5

Savenca Reference (Alpi, Piemonte):
HMS 1
HQA 49

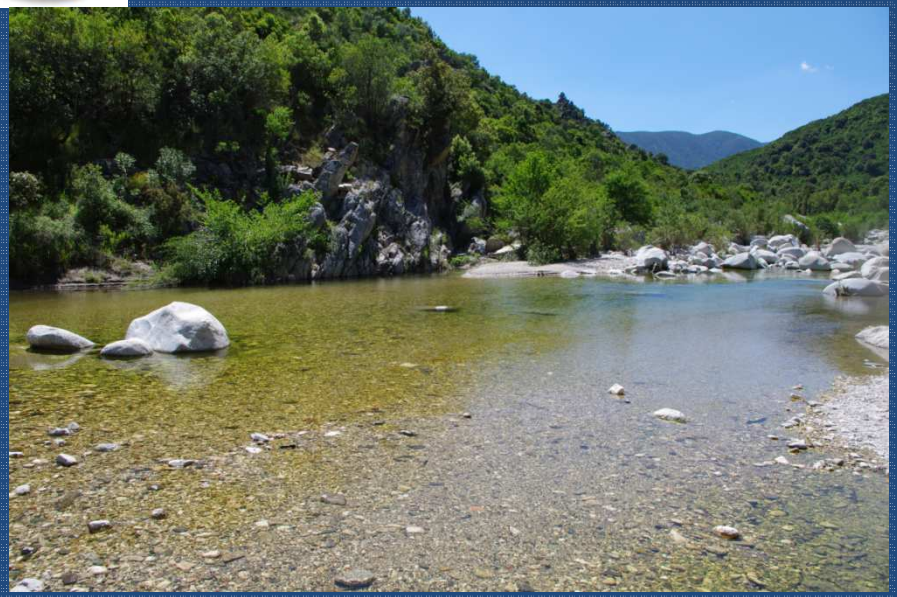
Sizzone (Pianura Padana, Piemonte):
HMS 4
HQA 51





Savenca ponte (Alpi, Piemonte):
HMS 37
HQA 35

Guarabione ponte (Pianura Padana, Piemonte):
HMS 46
HQA 22

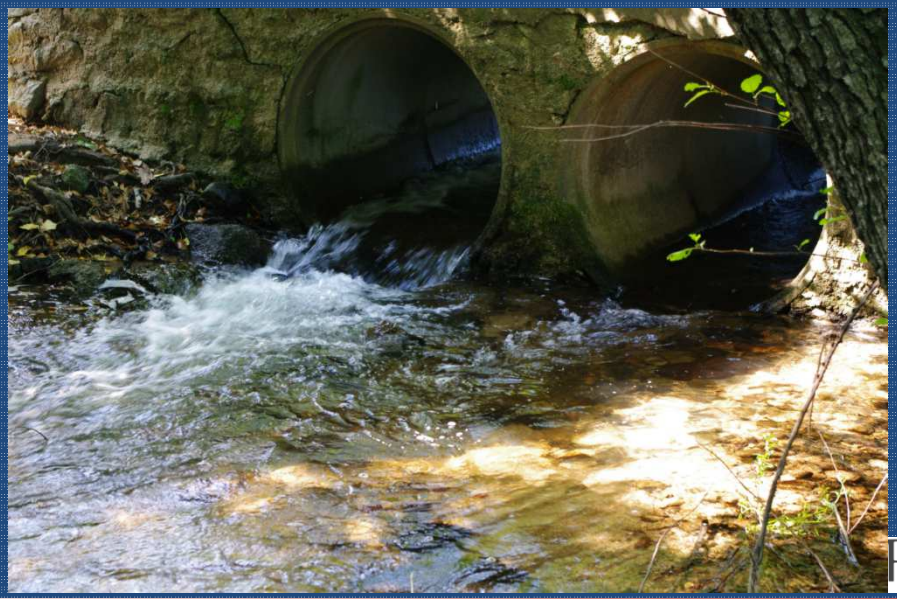


Flumineddu (Sardegna):
HMS 0
HQA 61

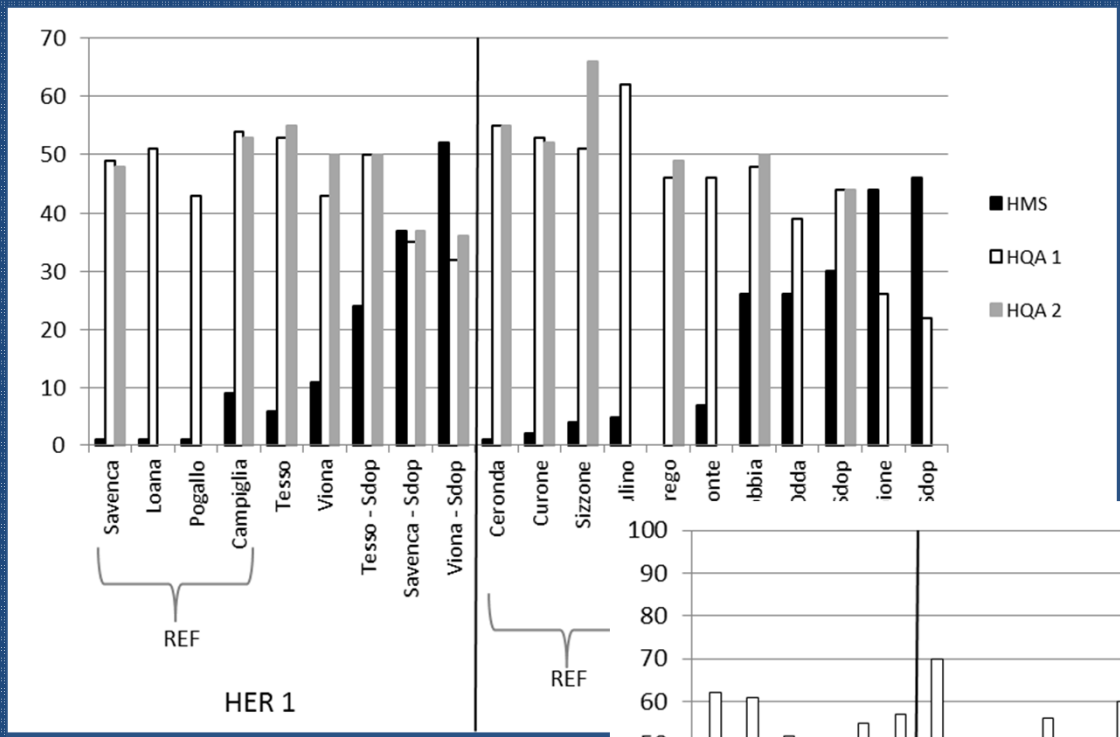
Affluente Posada (Sardegna):
HMS 0
HQA 50

Corre pruna ponte (Sardegna):
HMS 79
HQA 26

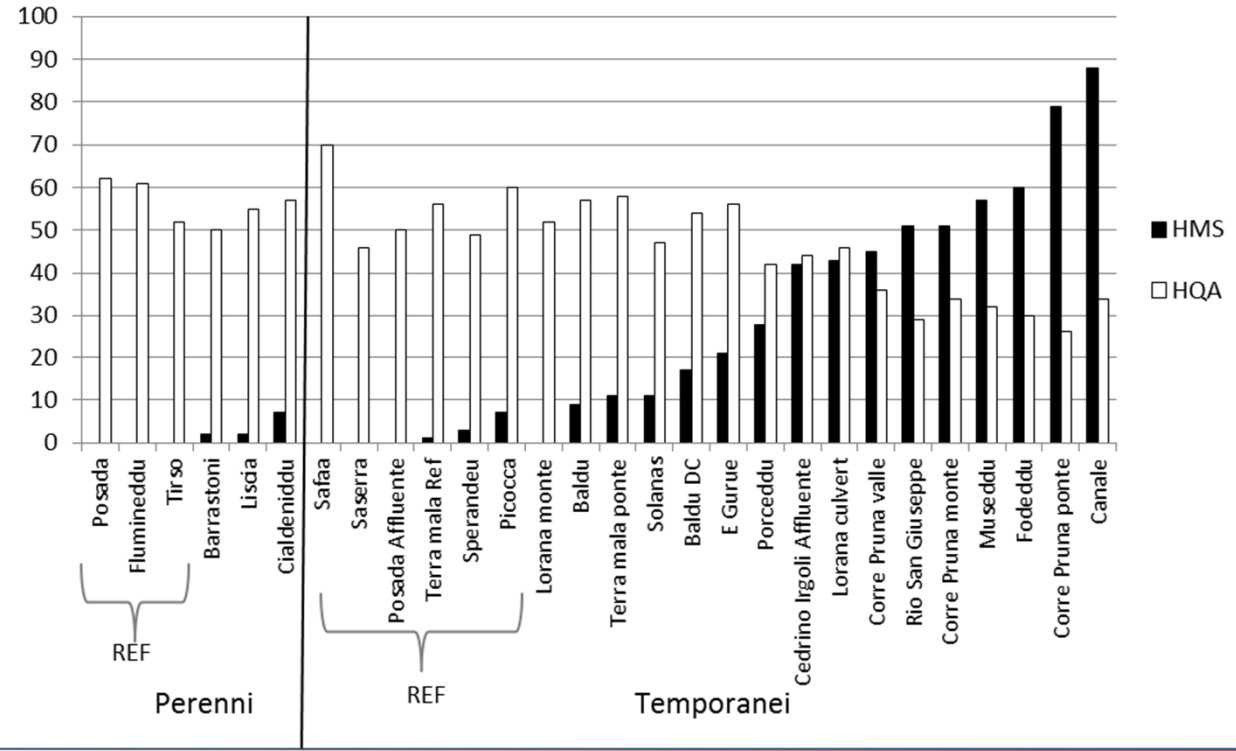
Baldu Downstream (Sardegna):
HMS = 26
HQA 54



Risultati INHABIT - HMS HQA



Piemonte



Sardegna

Land Use Index (LUI)

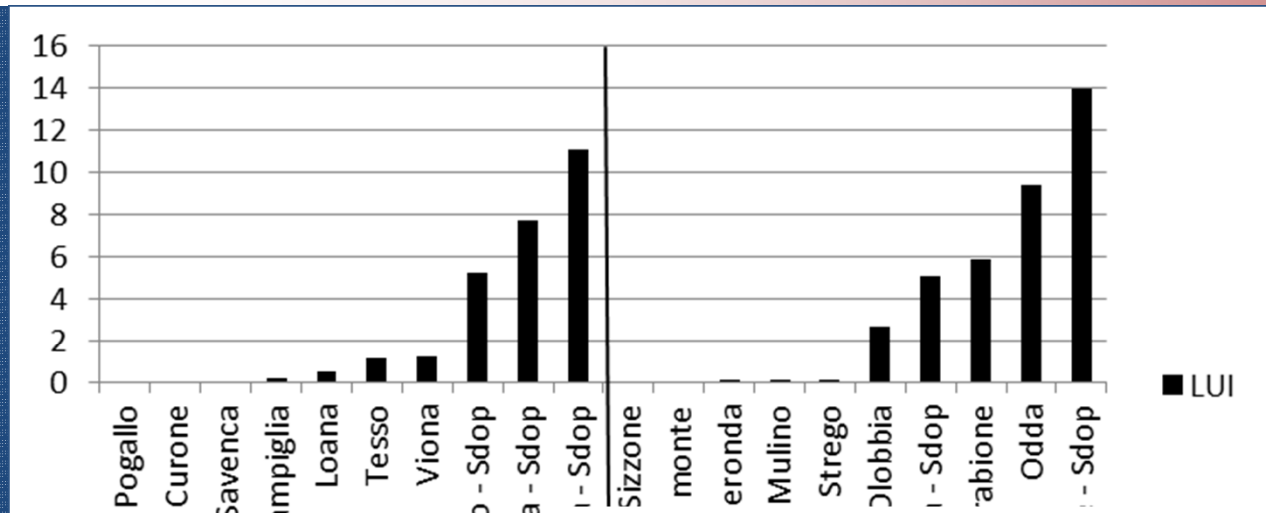
Features recorded with the CARAVAGGIO method included in the calculation of LUIr and related sections of the field form. WF: the feature is used as a Weight Factor.

Sec.	Spot-checks / Sweep-up	Feature	River section	Score / WF
A	Spot-checks	Land use within 50 m of bankt		
		Banktop height (m)		
		Bankface extension (m)		
E		Total channel width		
I	Sweep-up	Land use within 50 m of banktop		
		Land use on bankface		
J		Bank profiles - Embanked		
		Bank profiles - Set back embankment		
Q	Sweep-up	Tillage of fileds perpendicular t river course		

Natural land uses: all receiving 0

Land Use (agriculture)	Score: Spot-checks and Sweep-up	Score: Adjusted scores for spot-checks if tillage of fields is perpendicular to river course		
		P	E	W
BP, CP, EU, PO, FM	3			
OR, VI, TL, RF	3	3.3	3.9	4.5
RP, WM	1			
OL	1	1.1	1.3	1.5

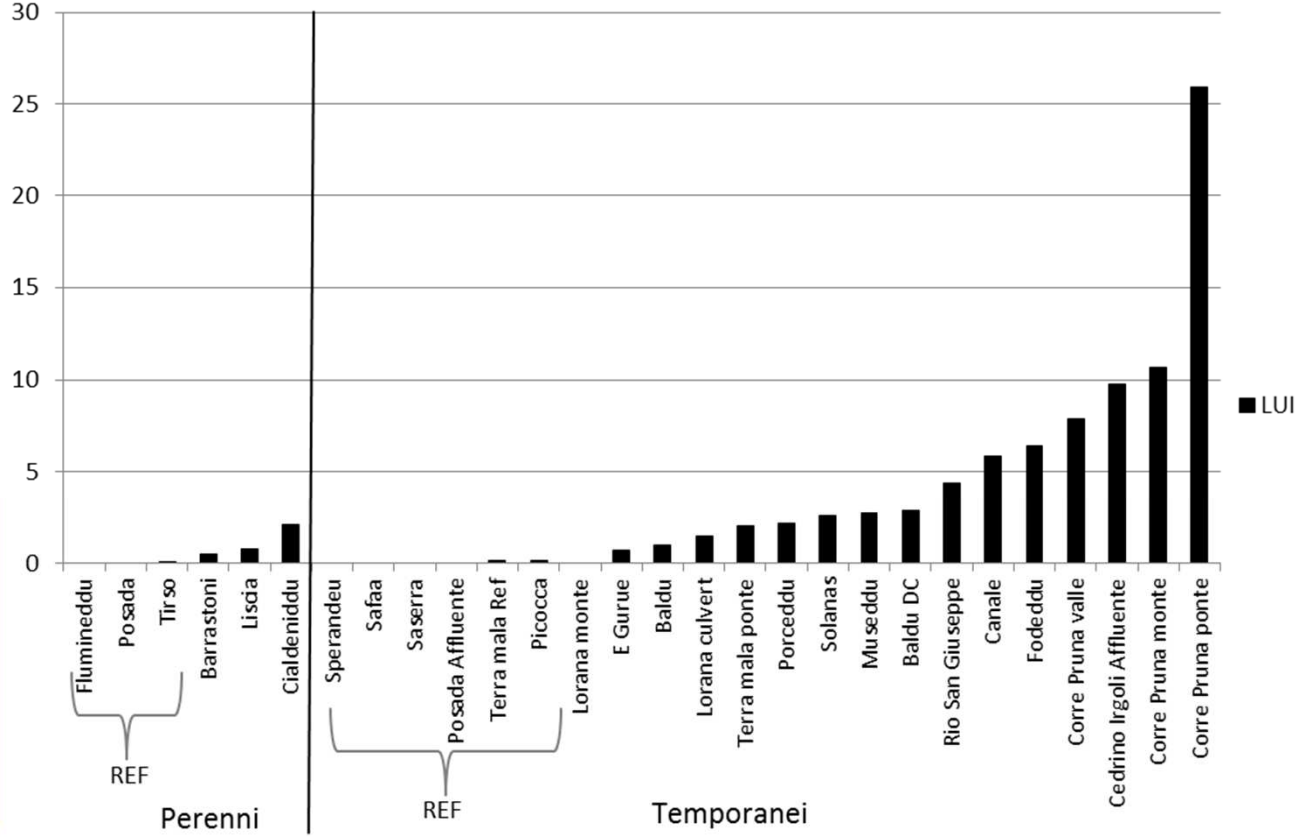
Land Use (Artificial)	Score: Spot-checks and Sweep-up	Score: Only for Sweep-Up, when different from spot-checks (sec. I)		
		P	E	W
IN, UR, WT, QU	5			
SU	3			
MS, RA	3	0.3	0.45	0.6
PG, AW	1			
RO	1	0.1	0.15	0.2
WR	0			



Piemonte

HER 1

Sardegna



Ecological Quality Ratio: HMS & LUI

90th percentile (MHS=6) → High/Good boundary

EQR_{HMS} = 100-HMS observed /100-0 [where 0 is HMS median value at reference sites]

EQR HMS	HMS Score range	Range 100-HMS	Quality status
≥ 0.94	0 - 6	94-100	High status
≥ 0.82	7-18	82-93	Good status
≥ 0.58	19-42	58-81	Moderate status
≥ 0.28	43-72	28-57	Poor status
< 0.28	≥ 73	≤ 27	Bad status

90th percentile (LUI) → High/Good boundary

EQR_{LUI} = 39.2-LUIobserved /39.2-0 [where 0 is HMS median value at reference sites]

$EQR_{LUIcara}$	Range di punteggio LUIcara	Range in Max-LUIcara	Stato di qualità
≥ 0.95	0 - 2	37.2- 39.2	stato elevato
≥ 0.72	2.01-11	28.2-37.19	stato buono
≥ 0.49	11.01-20	19.2-28.19	stato moderato
≥ 0.26	20.01-29	10.2-19.19	stato scarso
< 0.26	> 29	<10.2	stato cattivo

EQR → DM 260/2010 for High/Good boundary

Ecological Quality Ratio: HQA

10th percentile (HQA) → High/Good boundary

EQR_{HQA} = HQAobserved -11 /reference median value-11 [where 11 is HQA minimum value, if HQA is < 11 (very rare) → = 0]

EQR_{HQA}	Punteggio HQA – fiumi mediterranei temporanei	Stato di qualità
≥ 0.66	≥ 42	elevato
≥ 0.49	34-41	buono
≥ 0.32	26-33	moderato
≥ 0.15	18-25	scarso
< 0.15	≤ 17	cattivo

EQR_{HQA}	Punteggio HQA – fiumi piccoli di pianura	Stato di qualità
≥ 0.69	≥ 42	elevato
≥ 0.51	34-41	buono
≥ 0.33	26-33	moderato
≥ 0.16	18-25	scarso
< 0.16	≤ 17	cattivo

EQR_{HQA} (median REF 54)	Punteggio HQA – Alpi	Stato di qualità
≥ 0.84	≥ 47	elevato
≥ 0.63	38-46	buono
≥ 0.42	29-37	moderato
≥ 0.21	20-28	scarso
< 0.21	≤ 19	cattivo

EQR_{HQA}	Punteggio HQA – Appennino	Stato di qualità
≥ 0.91	≥ 59	elevato
≥ 0.68	47-58	buono
≥ 0.45	35-46	moderato
≥ 0.23	23-34	scarso
< 0.23	≤ 22	cattivo

EQR_{HQA}	Punteggio HQA – Appennino poco diversificato	Stato di qualità
≥ 0.88	≥ 47	elevato
≥ 0.66	38-46	buono
≥ 0.44	29-37	moderato
≥ 0.22	20-28	scarso
< 0.22	≤ 19	cattivo

EQR_{HQA}	Punteggio HQA – altri fiumi	Stato di qualità
≥0.78	≥ 47	elevato
≥ 0.59	38-46	buono
≥0.39	29-37	moderato
≥0.20	20-28	scarso
<0.20	≤ 19	cattivo

EQR → DM 260/2010 for High/Good boundary

Lentic-lotic River Descriptor

Negative scores associated to lotic features

Positive values associated to lentic features

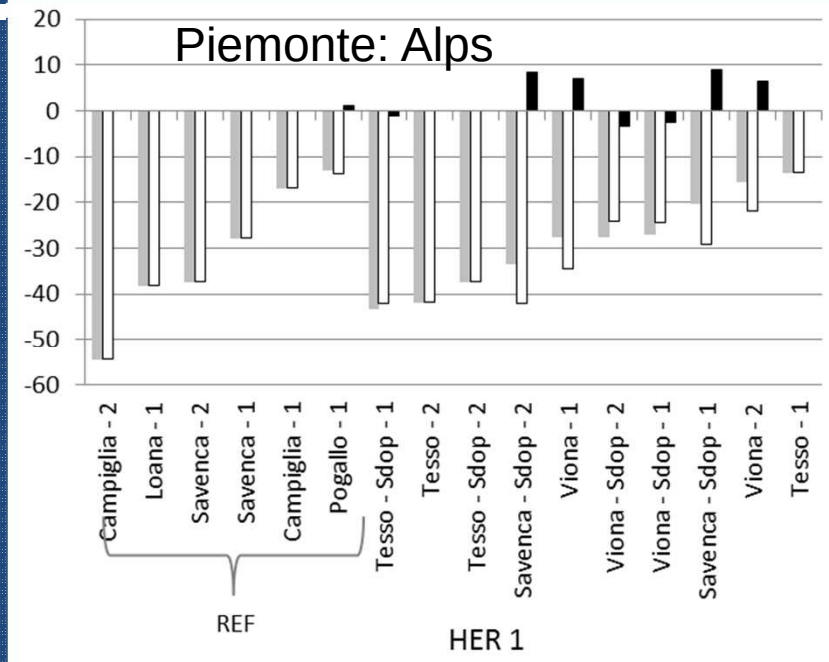
	Description (page - section)	Category	Feature	Score	
Spot-checks	Flow type (2-F)	Lentic	DR	8	
			NP	2	
		Intermediate	CH, SM, UP	0	
		Lotic	RP	-0.5	
			UW	-1	
			BW, CF, FF	-2	
	Maximum water depth (2-E)	Deep	>75	1	
		Intermediate	25?x?75	0.5	
		Not deep	<25	0	
	Channel substrate (2-F)	Lentic	CL, SI, SA	1	
		Intermediate	GP, BE	0	
		Lotic	CO, BO	-1	
		Artificial	AR	0	
	Channel vegetation types/ Organic debris (2-H)		Extension	P <33%	E ?33%
		Lentic	Emergent reeds/sedges/ rushes/grasses	1	3
			Floating-leaved (rooted) Free-floating		
			Organic matter (CPOM/FPOM)	1	3
		Lotic	Liverworts/mosses/ lichens	-1	-3
Sweep-up			Class	Present	Frequent	Very frequent
			Occurrence (# features)	1-2	3-4-5-6	>7
	Flow type (1-D)	Lentic	DR	16	24	24
			NP	4	6	10
		Intermediate	CH, SM, UP	0	0	0
		Lotic	RP	-1	-1.5	-2.5
			UW	-2	-3	-5
			BW, CF, FF	-4	-6	-10
	Bars (1-C & 1-D)	Every recorded bar scores		-0.5 (maximum total score -5)		
				Major	Intermediate	Minor
	Artificial features (2-G)	Weirs/sluices, Bridges, Culvert		2	1	0
		Deflectors, Fords		1	1	1
	General degradation (4-Q)				Yes <33%	Yes ?33%
		Is water impounded by weirs/sluices?			3	6
	Features of special interest (4-R)		Extension		P <33%	E ?33%
		Natural water falls (>5 m high)			-3	-5
		Natural water falls (>5 m high)			-1	-3
		Debris dam(s)			1	3

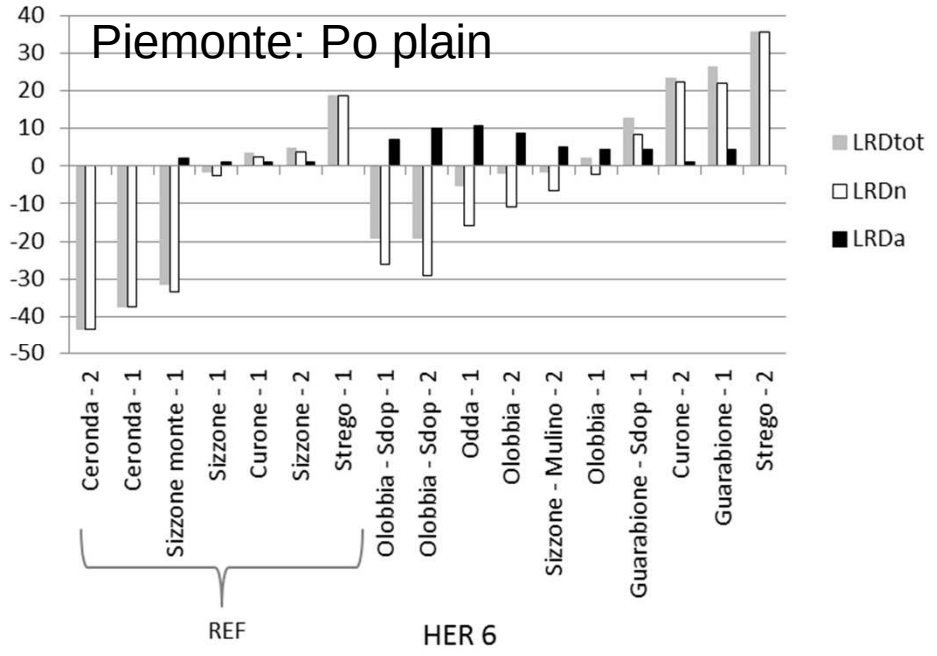
LRD varies between -70 (extremely lotic) and 90 (Extremely lentic)

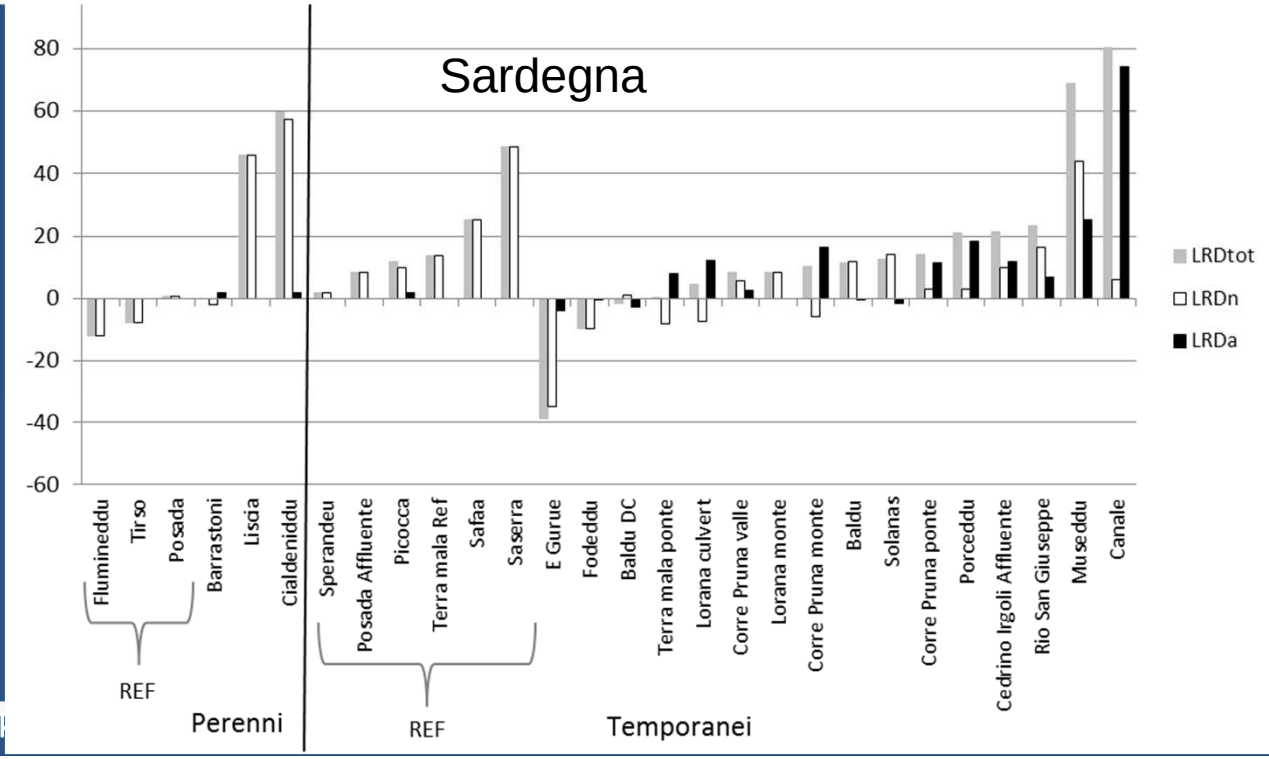
Class	Name	Value		
1+	Extremely lotic		LRD	≤-50
1	Very lotic	-50<	LRD	<-30
2	Lotic	-30≤	LRD	<-10
3	Intermediate	-10≤	LRD	<10
4	Lentic	10≥	LRD	<30
5	Very lentic	30≥	LRD	<50
5+	Extremely lentic		LRD	≥50

Curone 23

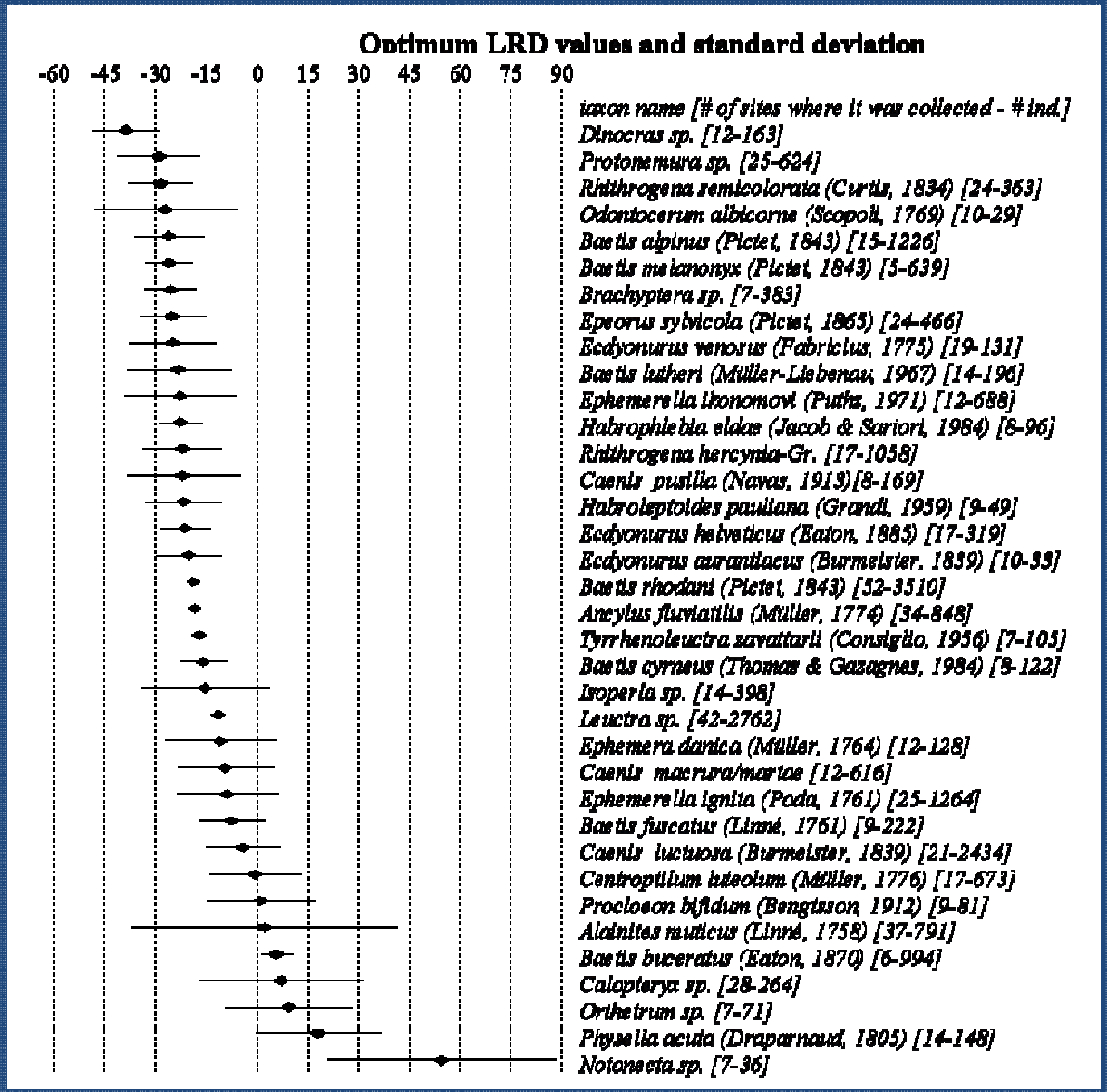
FOTO


Piemonte: Alps
20
10
0
-10
-20
-30
-40
-50
-60
Campiglia - 2
Loana - 1
Savenca - 2
Savenca - 1
Campiglia - 1
Pogallo - 1
Tesso - Sdop - 1
Tesso - 2
Tesso - Sdop - 2
Savenca - Sdop - 2
Viona - 1
Viona - Sdop - 2
Viona - Sdop - 1
Savenca - Sdop - 1
Viona - 2
Tesso - 1
REF
HER 1


Piemonte: Po plain
40
30
20
10
0
-10
-20
-30
-40
-50
Ceronda - 2
Ceronda - 1
Sizzone monte - 1
Sizzone - 1
Curone - 1
Sizzone - 2
Strego - 1
Olobbia - Sdop - 1
Olobbia - Sdop - 2
Odda - 1
Olobbia - 2
Sizzone - Mulino - 2
Olobbia - 1
Guarabione - Sdop - 1
Curone - 2
Guarabione - 1
Strego - 2
REF
HER 6
LRDtot
LRDn
LRDa


Sardegna
80
60
40
20
0
-20
-40
-60
Flumineddu
Tirso
Posada
Barrastoni
Lisaia
Cialdeniddu
Sperandeu
Posada Affluente
Picocca
Terra mala Ref
Safaa
Saserra
E Gurue
Fodeddu
Baldu DC
Terra mala ponte
Lorana culvert
Corre Pruna valle
Lorana monte
Corre Pruna monte
Baldu
Solanas
Corre Pruna ponte
Porceddu
Cedrino Irgoli Affluente
Rio San Giuseppe
Museddu
Canale
REF
Perenni
REF
Temporanei
LRDtot
LRDn
LRDa

Lentic-lotic River Descriptor (LRD): Centroidi



Lentic-lotic River Descriptor (LRD)

All: Emilia – Toscana – Cilento - Sardegna

All area Samples: 103

Correspondence Analysis

Axes	I	II	III	IV	Total inertia
Eigenvalues	0.34	0.23	0.22	0.20	4.24
	Lentic-lotic character: LRD (R=0.77)	**Environmental quality gradient:** Combined Pressure HMS-HQA-LIM-IFF (R=0.49)	**River type:** Slope (R=0.32)	**Season:** annual rainfall (R=0.46)	

Sardinia Samples: 37

Principal Component Analysis

Axes	I	II	III	IV
Eigenval	0.248	0.121	0.082	0.069
	Lentic-lotic character: LRD (R=0.77)	**Upstream/ downstream** site altitude (R=0.74)	**Typology**	**Environmental quality gradient:**

Temporary rivers


Grazie per l'attenzione!
FOTO ANDREA BUFFAGNI
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