

EVALUATION FORMS FOR SEMI- AND UNCONFINED CHANNELS

Version 1 - January 2011

GENERALITY

Date 01 / 01 / 20 10 Operators M. Rossi
 Catchment Idraim Stream/river Idraim River
 Upstream limit confluence Idraim branch Downstream limit nearby S.Anna
 Segment code 4 Reach Code 4-3 Reach length (m) 2.4 km

GENERAL SETTING AND INITIAL SEGMENTATION

1. Physiographic setting

Physiographic area P HM=Hills-mountains, P=Plain Physiographic unit High plain

2. Confinamento

Confinement degree (%) 10- 90 >90, 10-90, ≤10
 Confinement index >n 1-1.5, 1.5-n, >n (n=5 single-thread channels; n=2 multi-thread or wandering channels)
 Confinement class SC SC=Semiconfined, UNC=Unconfined

3. Channel morphology

Aerial photo or satellite image Aerial Flight Tuscany Region 2007 (name, year)
 Sinuosity index ~ 1.2 1-1.05, 1.05-1.5, >1.5
 Braiding index ~ 1.3 1-1.5, >1.5 Anastomosing index 1 1-1.5, >1.5
 Typology W ST=Straight, S=Sinuous, M=Meandering, SAB= Sinuous with alternate bars,
 W= Wandering, B= Braided, A= Anastomosed
 Bed configuration BR=bedrock, C/SP=Cascade/Step Pool, PB=Plane bed, RP=Riffle Pool, DR=Dune ripple
 (only for ST, S, M, SAB morphologies) A= Artificial, NC= not classified (high depth or strong alteration)
 Mean bed slope 0.0035 Mean channel width (m) 42
 Bed sediment (dominant) G-C C=Clay, Si=Silt, Sa=Sand, G=Gravel, C=Cobbles, B=Boulders

4. Other elements for reach delimitation

Upstream Tributary Downstream _____
 bed sope discontinuity, tributary, dam, artificialization, changes in width of alluvial plain and/or in confinement,
 changes in channel width, changes in grain sizes, other (specify) _____

Additional available data / information

Drainage area (at the downstream limit) (km²) 760
 Sediment size D₅₀ (mm) 35 Unit Ba(SU) Be=Bed, Ba=Bar (SU=surface layer, SUB=sublayer)
 Discharges NA M=measured, E=estimated, NA=not available
 Gauging station (if M) _____ Mean annual discharge (m³/s) _____ Q_{1.5} (m³/s) _____
 Maximum discharges (indicate year and Q when known) Intense flood in 2004

GEOMORPHOLOGICAL FUNCTIONALITY

Continuity

		part.	prog.	conf.
F1	Longitudinal continuity in sediment and wood flux			
A	Absence of alteration in the continuity of sediment and wood	0		
B	Slight alteration (obstacles to the flux but with no interception)	3		
C	Strong alteration (discontinuity of channel forms and interception of sediment and wood)	5	5	

There is a large check dam intercepting most of the bedload and creating a discontinuity of channel forms (disappearance of bars downstream)

F2 Presence of a modern floodplain

A	Presence of a continuous (>66% of the reach) and wide floodplain	0		
B	Presence of a discontinuous (10÷66%) floodplain of any width or >90% but narrow	3		
C	Absence of a floodplain or negligible presence (≤10 of any width)	5	8	M +2

Not evaluated in the case of mountain streams along steep (>3%) alluvial fans

There is some uncertainty for part of the reach whether it is a modern floodplain or a low terrace

part.: partial scores (to circle) prog.: progressive scores confidence level between A and B
 conf.confidence level in the answer, with M=Medium, L=Low (High is omitted) confidence level between B and C

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F4 Processes of bank retreat			
A	Presence of frequent retreating banks particularly along outer banks of bends	0	
B	Infrequent retreating banks because impeded by bank protections and/or scarce channel dynamics	2	
C	Complete absence or widespread presence of unstable banks by mass failures	3	8

Not evaluated in the case of straight – sinuous channels of low energy (lowland rivers, low gradients and/or bedload)

F5 Presence of a potentially erodible corridor			
A	Presence of a wide potentially erodible corridor (EC) for a length >66% of the reach	0	
B	Presence of a narrow potentially EC for >66%, or wide but for 33-66% of the reach	2	
C	Presence of a potentially EC of any width but for ≤33% of the reach	3	10

Morphology

Morphological pattern

F7 Forms and processes typical of the channel pattern			
A	Absence (<5%) of alteration of the natural heterogeneity of forms expected for that river type	0	
B	Alterations for a limited portion of the reach (≤33%)	3	
C	Consistent alterations for a significant portion of the reach (>33%)	5	13

F8 Presence of typical fluvial forms in the alluvial plain			
A	Presence of alluvial plain forms (oxbow lakes, secondary channels, etc.)	0	
B	Presence of traces of alluvial plain forms (abandoned after the 1950s) but with possible reactivation	2	
C	Complete absence of alluvial plain forms	3	

Evaluated only in the case of meandering rivers (now or in the past) within a lowland plain physiographic unit

Cross-section configuration

F9 Variability of the cross-section			
A	Absence (≤5%) of alteration of the cross-section natural heterogeneity (width and depth)	0	
B	Presence of alteration (cross-section homogeneity) for a limited portion of the reach (≤33%)	3	
C	Presence of alteration (cross-section homogeneity) for a significant portion of the reach (>33%)	5	16

Not evaluated in the case of straight, sinuous or meandering channels with natural absence of bars (lowland rivers, low gradients and/or low bedload) (natural cross-section homogeneity)

Bed structure and substrate

F10 Structure of the channel bed			
A	Natural heterogeneity of bed sediments and no significant clogging	0	
B	Evident armouring or clogging in various portions of the site	2	
C1	Evident and widespread (>90%) armouring or clogging, or occasional substrate outcrops	5	
C2	Widespread substrate outcrops or alteration by bed revetments (>33% of the reach)	6	21

Not evaluated for sand-bed rivers, and for deep rivers when it is not possible to observe the channel bed

F11 Presence of in-channel large wood			
A	Presence of large wood	0	
C	Negligible presence or absence of large wood	3	21

Not evaluated above the tree-line and in streams with natural absence of riparian vegetation

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Vegetation in the fluvial corridor

F12 Width of functional vegetation in the fluvial corridor			
A	High width of functional vegetation	0	
B	Medium width of functional vegetation	②	
C	Low width of functional vegetation	3	23

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F13 Linear extension of functional vegetation along the banks			
A	Linear extension of functional vegetation >90% of maximum available length	0	
B	Linear extension of functional vegetation 33-90% of maximum available length	③	
C	Linear extension of functional vegetation ≤33% of maximum available length	5	26

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ARTIFICIALITY

Upstream alteration of longitudinal continuity

part. prog. conf.

A1 Upstream alteration of discharges			
A	No significant alteration (≤10%) of channel-forming discharges and with return interval >10 years	0	
B	Significant alteration (>10%) of discharges with return interval >10 years	③	
C	Significant alteration (>10%) of channel-forming discharges	6	29

A2 Upstream alteration of sediment transport			
A	Absence or negligible presence of structures for the interception of sediment fluxes (dams for drainage area <5% and/or check dams/abstraction weirs for drainage area <33%)	0	
B1	Dams (area 5-33%) and/or check dams/weirs with total bedload interception (area 33-66%) and/or check dams/weirs with partial interception (area >33% <i>plain/hills</i> or >66% <i>mountains</i>)	3	
B2	Dams (drainage area 33-66%) and/or check dams/weirs with total bedload interception (drainage area >66% or at the upstream boundary)	⑥	
C1	Dams for drainage area >66%	9	
C2	Dam at the upstream boundary of the reach	12	35

Alteration of longitudinal continuity in the reach

A3 Alteration of discharges in the reach			
A	No significant alteration (≤10%) of channel-forming discharges and with return interval >10 years	①	
B	Significant alteration (>10%) of discharges with return interval >10 years	3	
C	Significant alteration (>10%) of channel-forming discharges	6	35

A4 Alteration of sediment transport in the reach			
A	Absence of structures for the interception of sediment fluxes (dams, check dams, abstraction weirs)	0	
B	<i>Plain/hills units:</i> consolidation check dams and/or abstraction weirs ≤1 every 1000 m <i>Mountain units:</i> consolidation check dams ≤1 every 200 m and/or open check dams	④	
C	<i>Plain/hill units:</i> consolidation check dams and/or abstraction weirs >1 every 1000 m <i>Mountain units:</i> consolidation check dams >1 every 200 m and/or retention check dams or presence of a dam or artificial reservoir at the downstream boundary (<i>any physiographic units</i>)	6	39

In case of density of interception structures, including bed sills and ramps (see A9), is >1 every n, add 12 where n=100 m in mountain units, or n=500 m in plain/hills units

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A5 Crossing structures			
A	Absence of crossing structures (bridges, fords culverts)	0	
B	Presence of some crossing structure (≤ 1 every 1000 m in average in the reach)	2	
C	Presence of many crossing structure (> 1 every 1000 m in average in the reach)	3	41

Alteration of lateral continuity

A6 Bank protections			
A	Absence or localized presence of bank protections ($\leq 5\%$ total length of the banks)	0	
B	Presence of protections for $\leq 33\%$ total length of the banks (sum of both banks)	3	
C	Presence of protections for $> 33\%$ total length of the banks (sum of both banks)	6	41

In case of extremely high density of bank protection ($> 80\%$) add 12

A7 Artificial levees			
A	Absent or distant levees, or presence of levees close or at contact $\leq 10\%$ total length of the banks	0	
B	Medium presence of levees close and/or at contact (at contact $\leq 50\%$ bank length)	3	
C	High presence of levees close and/or at contact (at contact $> 50\%$ bank length)	6	41

In case of extremely high density of levees at contact ($> 80\%$) add 12

Alteration of channel morphology and/or substrate

A8 Artificial changes of river course			
A	Absence of artificial changes of river course in the past (meanders cut-off, channel diversions, etc.)	0	
B	Presence of changes of river course for $\leq 10\%$ of the reach length	2	
C	Presence of changes of river course for $> 10\%$ of the reach length	3	41

A9 Other grade control structures			
A	Absence of structures (bed sills/ramps) and revetments absent or localised ($\leq 5\%$)	0	
B	Sills or ramps (≤ 1 every m) and/or revetments $\leq 25\%$ permeable and/or $\leq 15\%$ impermeable	3	
C1	Sills or ramps (> 1 every m) and/or revetments $\leq 50\%$ permeable and/or $\leq 33\%$ impermeable	6	
C2	Revetments $> 50\%$ permeable and/or $> 33\%$ impermeable	8	44

m=200 m in mountain units; m= 1000 m in plain/hills units

In case of widespread bed revetment ($> 80\%$) add 12

Intervention of maintenance and removal

A10 Sediment removal			
A	Absence of recent (last 20 years) and past (from 1950s) significant sediment removal activities	0	
B	Moderate activities in the past (from 1950s) but absent during last 20 years, or absent in the past but present recently (last 20 years)	3	
C	Intense activities in the past, or moderate in the past but present during last 20 years	6	50

There is some uncertainty whether the activity in the past was intense or moderate.

There was not sediment removal activity during the last 20 years.

A11 Wood removal			
A	Absence of removal of woody material at least during the last 20 years	0	
B	Selective cuts and/or clear cuts over $\leq 50\%$ of the reach during the last 20 years	2	
C	Total removal of woody material during the last 20 years	5	52

Not evaluated above the tree-line and in streams with natural absence of riparian vegetation

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A12 Vegetation management			
A	No cutting interventions on riparian vegetation during the last 20 years	0	
B	Selective cuts and/or clear cuts over ≤50% of the reach during the last 20 years	2	
C	Clear cuts over >50% of the reach during the last 20 years	5	52

Not evaluated above the tree-line and in streams with natural absence of riparian vegetation

CHANNEL CHANGES

			part.	prog.	conf.
V1	Changes in channel pattern	<i>(applied only to channels wider than 30 m)</i>			
A	Absence of changes of channel pattern since 1950s	0			
B	Change to a similar channel pattern since 1950s	3			
C	Change to a different channel pattern since 1950s	6			55

V2	Changes in channel width	<i>(applied only to channels wider than 30 m)</i>			
A	Absent or limited changes (≤15%) since 1950s	0			
B	Moderate changes (15÷35%) since 1950s	3			
C	Intense changes (>35%) since 1950s	6			61

V3	Bed-level changes	<i>(applied only to channels wider than 30 m)</i>			
A	Negligible bed-level changes (≤0.5 m)	0			
B	Limited to moderate bed-level changes (0.5÷3 m)	4			
C1	Intense bed-level changes (>3 m)	8			
C2	Very intense bed-level changes (>6 m)	12			65

Not evaluated in the case of absolute lack of data, information and field evidences

Total deviation: $Stot = 65$ $62 \div 67$

Maximum deviation: $Smax = 142 - Sna = 139$

where Sna = sum of maximum scores for those indicators that have not been applied

Morphological Alteration Index: $IAM = Stot / Smax = 0.47$ $0.45 \div 0.48$

if Stot > Smax it is assumed IAM=1

Morphological Quality Index: $IQM = 1 - IAM = 0.53$ $0.52 \div 0.55$

Quality class of the reach Moderate

0 ≤ IQM < 0.3: Very Poor or Bad; 0.3 ≤ IQM < 0.5: Poor; 0.5 ≤ IQM < 0.7: Moderate;
0.7 ≤ IQM < 0.85: Good; 0.85 ≤ IQM < 1.0: Very Good or High