

EVALUATION FORMS FOR SEMI- AND UNCONFINED CHANNELS

Version 1 - January 2011

GENERALITY

Date _____ Operators _____
 Catchment _____ Stream/river _____
 Upstream limit _____ Downstream limit _____
 Segment code _____ Reach Code _____ Reach length (m) _____

GENERAL SETTING AND INITIAL SEGMENTATION

1. Physiographic setting

Physiographic area _____ HM=Hills-mountains, P=Plain Physiographic unit _____

2. Confinamento

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

3. Channel morphology

Aerial photo or satellite image _____ (name, year)
 Sinuosity index _____ 1-1.05, 1.05-1.5, >1.5
 Braiding index _____ 1-1.5, >1.5 Anastomosing index _____ 1-1.5, >1.5
 Typology _____ 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 _____ Mean channel width (m) _____
 Bed sediment (dominant) _____ C=Clay, Si=Silt, Sa=Sand, G=Gravel, Co=Cobbles, B=Boulders

4. Other elements for reach delimitation

Upstream _____ 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) _____
 Sediment size D₅₀ (mm) _____ Unit _____ Be=Bed, Ba=Bar (SU=surface layer, SUB=sublayer)
 Discharges _____ 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) _____

GEOMORPHOLOGICAL FUNCTIONALITY

Continuity

part.	prog.	conf.
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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		

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		

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

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	

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

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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	

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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	

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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

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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	

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)

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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	

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

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

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	

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

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	

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

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	

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	

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	0	
B	Significant alteration (>10%) of discharges with return interval>10 years	3	
C	Significant alteration (>10%) of channel-forming discharges	6	

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	

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	<input type="text"/>
B	Presence of some crossing structure (≤ 1 every 1000 m in average in the reach)	2	<input type="text"/>
C	Presence of many crossing structure (> 1 every 1000 m in average in the reach)	3	<input type="text"/>

Alteration of lateral continuity

A6 Bank protections			
A	Absence or localized presence of bank protections ($\leq 5\%$ total length of the banks)	0	<input type="text"/>
B	Presence of protections for $\leq 33\%$ total length of the banks (sum of both banks)	3	<input type="text"/>
C	Presence of protections for $> 33\%$ total length of the banks (sum of both banks)	6	<input type="text"/>
		<i>In case of extremely high density of bank protection ($> 80\%$) add</i>	12 <input type="text"/>

A7 Artificial levees			
A	Absent or distant levees, or presence of levees close or at contact $\leq 10\%$ total length of the banks	0	<input type="text"/>
B	Medium presence of levees close and/or at contact (at contact $\leq 50\%$ bank length)	3	<input type="text"/>
C	High presence of levees close and/or at contact (at contact $> 50\%$ bank length)	6	<input type="text"/>
		<i>In case of extremely high density of levees at contact ($> 80\%$) add</i>	12 <input type="text"/>

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	<input type="text"/>
B	Presence of changes of river course for $\leq 10\%$ of the reach length	2	<input type="text"/>
C	Presence of changes of river course for $> 10\%$ of the reach length	3	<input type="text"/>

A9 Other grade control structures			
A	Absence of structures (bed sills/ramps) and revetments absent or localised ($\leq 5\%$)	0	<input type="text"/>
B	Sills or ramps (≤ 1 every m) and/or revetments $\leq 25\%$ permeable and/or $\leq 15\%$ impermeable	3	<input type="text"/>
C1	Sills or ramps (> 1 every m) and/or revetments $\leq 50\%$ permeable and/or $\leq 33\%$ impermeable	6	<input type="text"/>
C2	Revetments $> 50\%$ permeable and/or $> 33\%$ impermeable	8	<input type="text"/>
		<i>m=200 m in mountain units; m= 1000 m in plain/hills units</i>	
		<i>In case of widespread bed revetment ($> 80\%$) add</i>	12 <input type="text"/>

Intervention of maintenance and removal

A10 Sediment removal			
A	Absence of recent (last 20 years) and past (from 1950s) significant sediment removal activities	0	<input type="text"/>
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	<input type="text"/>
C	Intense activities in the past, or moderate in the past but present during last 20 years	6	<input type="text"/>

A11 Wood removal			
A	Absence of removal of woody material at least during the last 20 years	0	<input type="text"/>
B	Selective cuts and/or clear cuts over $\leq 50\%$ of the reach during the last 20 years	2	<input type="text"/>
C	Total removal of woody material during the last 20 years	5	<input type="text"/>
		<i>Not evaluated above the tree-line and in streams with natural absence of riparian vegetation</i>	

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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	

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		

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		

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		

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

Total deviation:

Stot =

Maximum deviation:

Smax = 142 - Sna=

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

Morphological Alteration Index:

IAM = Stot / Smax =

if Stot>Smax it is assumed IAM=1

Morphological Quality Index:

IQM=1-IAM =

Quality class of the reach

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