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Durance River (Southern Alps, France)

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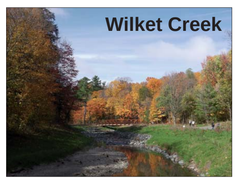
Wilket Creek (Toronto, Ontario, Canada)



SEDIMENT TRANSPORT AND MORPHODYNAMICS OF TWO DYNAMIC AND HIGHLY MODIFIED RIVERS: VALLEY MANAGEMENT ISSUES AND KEYS FOR RIVER STAKEHOLDERS

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1. Problem statement and objective

River hydrology and morphodynamics are significantly modified by human activities. In many watersheds, this has led to a **flashier hydrological regime** and an increase of flooding risk.

In addition, a river system can be **highly instable** at different spatial and temporal scales. When this instability conflicts with human use, **sediment fluxes** and **morphodynamics** issues become a key factor for river management. However, sediment mobility is frequently not considered by river managers.

We have studied two river systems, the Durance River (France) and Wilket Creek (Canada). Even if the spatial scales of these systems are significantly different, it is interesting to notice that **management issues** converge. More importantly, it appears that long-term management issues can only be solved by an **integrative approach** that considers sediment transport for the whole system.

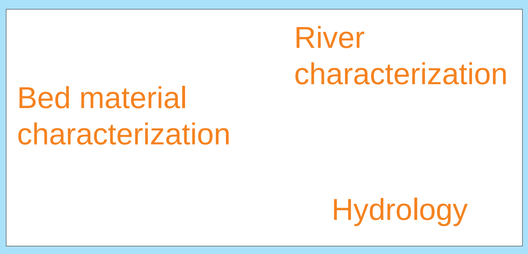
The objective of this poster is to present a methodology to **characterize gravel-bed river mobility in highly modified systems** in order to support **decision making** for river stakeholders.

2. Study sites

System	Durance River	Wilket Creek
Location	Southern Alps, France	Toronto, Canada
Description	Wandering gravel bed	Sinuous gravel bed, local bedrock control
Drainage area	14,000 km^2	15 km^2
Width	300 m	15 m
Slope	0.3%	0.9%
D_{50} (>8 mm)	44 mm	39 mm
Main human features	Dams, competition for valley occupation	Impervious watershed, dams, competition for valley occupation
Hydrology	Flash floods or long events	Flash floods

3. Proposed approach and result examples

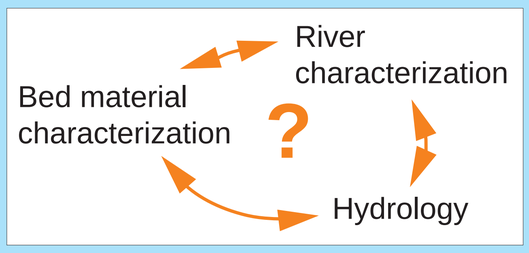
River physical characterization



(1) and (2).
Definition of homogeneous reaches according to sediment transport discontinuities or slope breaks.

River processes characterization

Sediment stocks and fluxes:
availability, timing of transit and renewal

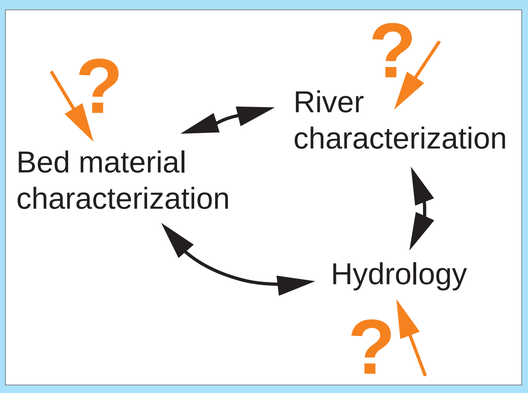


(3) and (4).
Stock renewal and sediment reworking in the channel.

Management guidelines

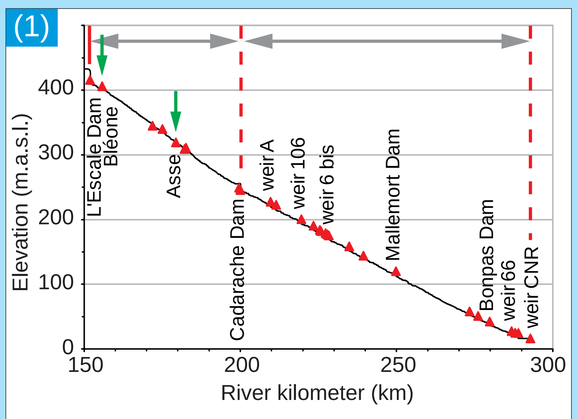
Definition of guidelines of **'acceptable' vs. 'non-acceptable' adjustments**

Definition of **relevant 'management scales'**



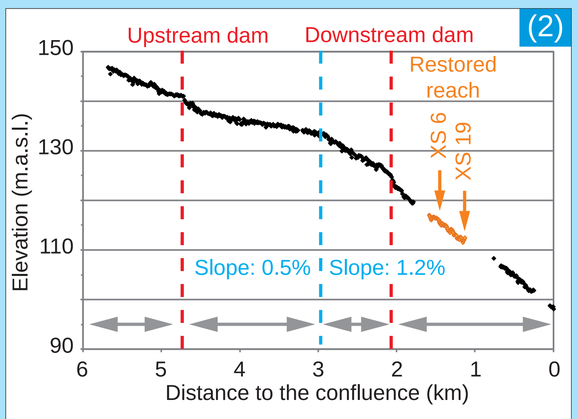
(5) and (6).
River processes proposals and keys for river management decisions.

Durance River

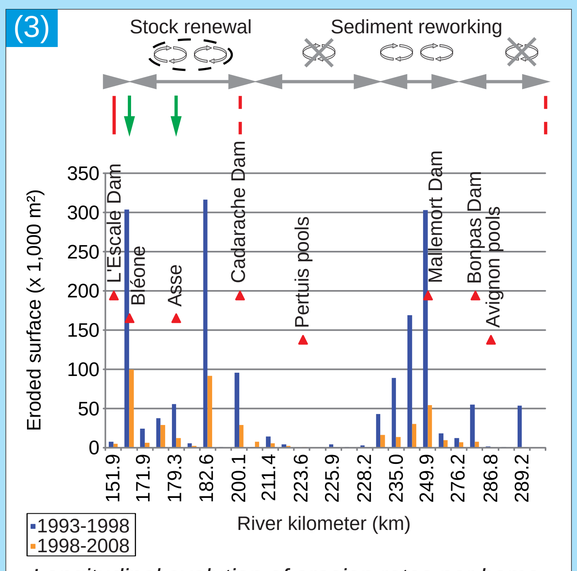


Longitudinal profile of the Durance River (2008) and definition of homogeneous reaches.

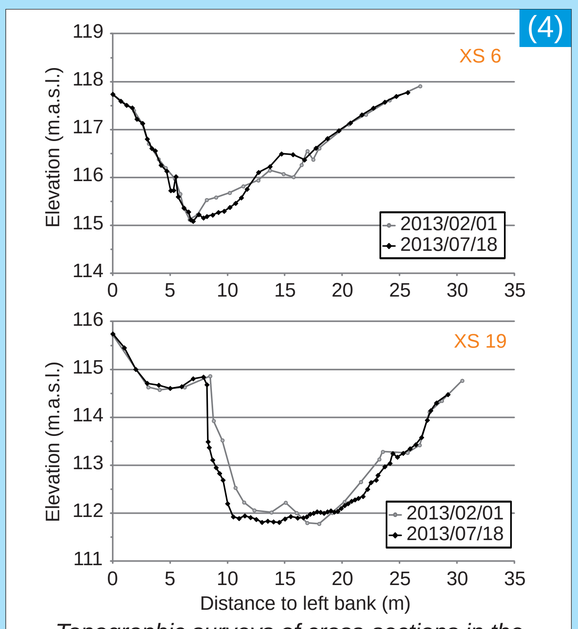
Wilket Creek



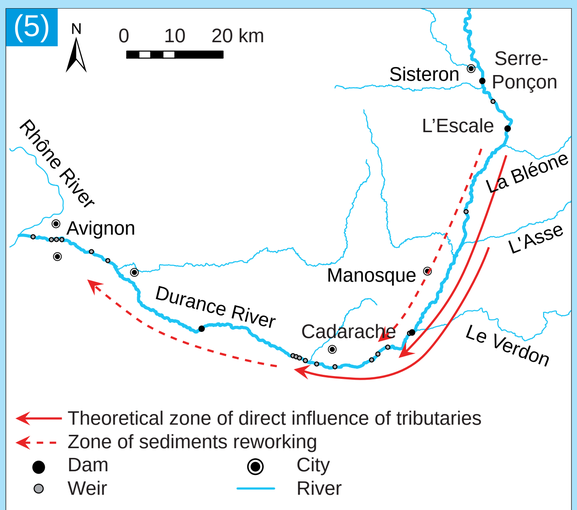
Longitudinal profile of Wilket Creek (2013) and definition of homogeneous reaches.



Longitudinal evolution of erosion rates per homogeneous reach during the 1993-1998 and the 1998-2008 periods (Durance River) and redefinition of homogeneous reaches according to sediment dynamics.



Topographic surveys of cross-sections in the restored reach. Two significant floods occurred between the two profiles.



Current longitudinal transfer processes of sediments in the Durance River, if the management procedures of dams remain the same as today.

In Wilket Creek the information collected will be used to ensure the overall stability of the stream while maximizing ecosystem services, particularly in restored channel sections.

4. Perspectives

The improved knowledge of river morphodynamics then enables us to give relevant management keys for river stakeholders.

The proposed methodology aims at giving insights of **sediment transport processes** and **channel dynamics** at different **time and spatial scales**. Management indexes or charts are to be developed according to specific river management **long-term objectives** and decision making is to be **locally adapted**.

5. References

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- **Chapuis M. & Collomb D. (2012).** *La cicatrisation des rivières méditerranéennes françaises après les grandes perturbations de la deuxième moitié du XXe siècle: réponses des systèmes fluviaux et stratégies de gestion. Exemples de la Durance, du Var, de la Cèze*. Revue Méditerranée, vol. 118, pp. 65-74.

- **MacVicar B. J., V. Bevan & M. Chapuis (in prep.).** *Morphological response to urbanization and restoration of Wilket Creek: Canada´s first suburban creek*. Canadian Water Resources Journal.