Regaining sediments: the Orba River lower reach bank erosions (NW Italy)

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Introduction: Bank retreatments and advancements represent in-channel lateral erosion and deposition processes and their analysis can offer important information concerning the sediment balance [1,2]. These processes constitute the natural evolution of a river but in modified systems, a diffuse presence of lateral erosions with high and steep banks can be a sign of lack of sediments [3]. This research describe bank retreatments that occurred in the last 17 years in the low Orba River (Alessandria, NW Italy), a reach 14 km long, located downstream two important dams and for decades heavily affected by gravel mining and banks stabilization.

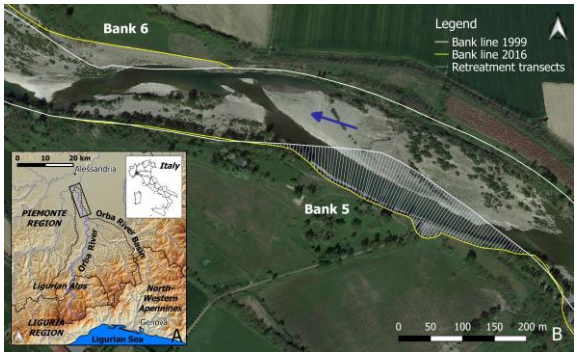

Fig. 1: *A) Location map and Orba River study reach; B) A representative portion of the study reach.*

Methods: This work is based on a GIS multi-temporal analysis [4] and on a consistent field survey activity. Starting from seven sets of georeferenced orthophotos, aerial photos and satellite images, of different scale and different year (from 1954 to 2016), we manually digitized the river channel for each time series. We prepared a GeoDB mapping structures like bank protection, levees, bridges and weirs. Moreover, we mapped retreating and instable banks. To perform a more detailed analysis we recognized three sub-reaches with homogeneous features and we identified the main lateral erosion sites. Focusing on them, through an innovative geoprocessing procedure utilizing Grass GIS Console, we analyzed the retreatment processes in a quantitative way, in space and time.

Results: Nowadays the lower reach of the Orba River presents about 30% of instable and retreating banks and 58% of protected banks. Figures 2 and 3 show the temporal retreatment trend and the loss of surface since 1999 (except for "Bank_3" that is older) for the eight investigated sites.

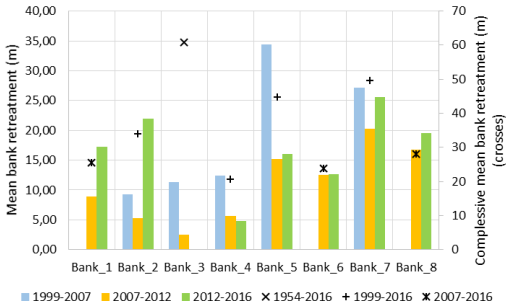

Fig. 2: *Mean bank retreatment (partial for bars and total for crosses) for each investigated site.*

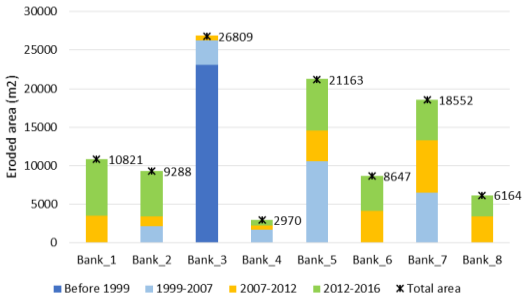

Fig. 3: *Partial and total eroded surface for each investigated site.*

Discussion: The identified incision process that involved this reach reactivated lateral dynamics after years of interruption. The river is widening where possible and bank protection structures result often dug out at their base or already collapsed. Even if plans and researches go in opposite direction, new but "old school" works are planned to contrast current dynamics. It's evident that society, and rivers, need a change of perspective in river management to restore the fluvial environment and to reduce risks.

References: [1] Sear et al. (2003) *R&D Technical Report FD1914*; [2] Maraga et al. (2005) *Proceedings of EGU*; [3] Rinaldi et al. (2014) *ISPRA Manuali e linee guida* 113/2014; [4] Gurnell et al. (1998) *HYP* **12(6)**:981-993.