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Alpine SPACE
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SEDALP

SedAlp project (Alpine Space Programme): events, updatings and news

Welcome to the fourth newsletter of SedAlp Project! You'll find news and updatings about some of our studies and activities in specific pilot areas and we'll talk about recent and upcoming events.
SedAlp partners met in Padova (Padua, Italy) on 2-4th of September 2014 for the fourth "Advisory Board Meeting". All delegates representing 14 project partners and subcontractors intensively discussed actions, activities and outputs of the project and planned the final steps. SedAlp project was then promoted with a special stand at IAEG XII International Congress on 15-19th September 2014 in Torino (Turin, Italy).
We're now looking forward to next partners meeting, which will be very soon in Lion (France) on 20-22nd January 2015.
Please save the date of the final conference of SedAlp project, open to the public: 8-10th June 2015 in Bolzano/Bozen (NE Italy)!

Project partners representatives during 4th Advisory Board meeting at "Palazzo del Bò", historical and beautiful palace of University of Padova (Padua, Italy), September 2014.

We invite you to follow the progress of SedAlp project on this newsletter and find interesting aspects of sediment-related topics in the Alps on our website

www.sedalp.eu

and SedAlp

Reading the historical data of alpine streams: the example of Bouinenc Torrent (South France)

In the framework of the SedAlp Workpackage 4 (WP4), a specific activity is dedicated to the historical analysis of alpine basins. This topic is of critical importance for understanding complex geomorphic responses to global changes, and for enhancing the prediction of morphological trajectories of alpine rivers. This challenging task relies strongly upon on ability to read the historical record available in the Alpine Space, and to combine this information with data from leading-edge technology.

The SedAlp project gave the opportunity to implement this kind of research work in the Southern French Prealps, a good place to look at the effect of hillslope reforestation on channel morphology and sediment transport. In fact, this region was particularly affected by vegetation encroachment related to both reforestation works during the 1880-1915 period, and decline of farming pressure on the landscape since the 1950s. A subsequent decrease of sediment supply and rapid incision of stream channels occurred. Although channel changes associated with mountain reforestation have been well investigated in France and Italy, these works rarely provide a well-documented chronology of channel incision, notably for small alpine streams where topographic archives are generally not available. The work conducted by SedAlp partner Irstea-Grenoble on the Bouinenc Torrent, a tributary to the Bléone River near Digne-les-Bains, shows that by combining historical aerial photographs and a recent airborne LiDAR survey, it is possible to reconstruct the long-term time evolution of bed-level with a resolution depending on the frequency of aerial photo surveys and on the good conservation of remnant active channel surfaces along the study reach.

The historical analysis was conducted in the last 3 km of the Bouinenc, where the stream develops alternate bars in a 200-m-wide floodplain, at the exit of a confined gorge. Nine sets of aerial photos between 1948 and 2004 were georectified, and active channels at all dates were digitized for overlaying on a high-resolution digital elevation model (DEM) derived from a 2010 airborne LiDAR survey. This information was used to produce a map of the age of surface formation for the forested floodplain of the Bouinenc (Fig. 1A). This map gives for each unit of the floodplain the last date at which the unit was included in the active channel. A mosaic of dated remnant surfaces was in this way provided and used to characterize the active channel elevation at each date. The systematic analysis of remnant surfaces elevations allowed the reconstruction of the long-profile evolution of the 3-km reach (Fig. 1B).

The combination of historical aerial photographs and high-resolution LiDAR data proved to be an efficient method for the reconstruction of channel changes of the Bouinenc Torrent during the last 60 years. A strong active channel narrowing was detected during the 1950s and 1960s, which was associated with a shift from braided to wandering pattern. It is also interesting to point out that the active channel of the torrent did not increase during the recent period, under the effect of large floods in 1962, 1986 and 1994. This can be explained by the decreasing sediment supply from the catchment, which prevents the reactivation of a braided channel pattern.

The long-profile extraction from LiDAR points on dated remnant surfaces revealed at least two periods of channel incision (Fig. 1C). The one observed during the 1950s and 1960s can be clearly associated with the effect of spontaneous reforestation induced by farming decline. The second phase of incision, which started in the 1990s, is instead more difficult to explain. One possibility is that it

corresponds to the recovery of a possible aggradation following the 1986 and 1994 large floods (attested by the comparison of 1984 and 1990 remnant surfaces). If this scenario is correct, it implies that the present-day entrenchment was already reached in 1975. This is partly suggested by the lack of remnant surfaces of the 1975 active channel.

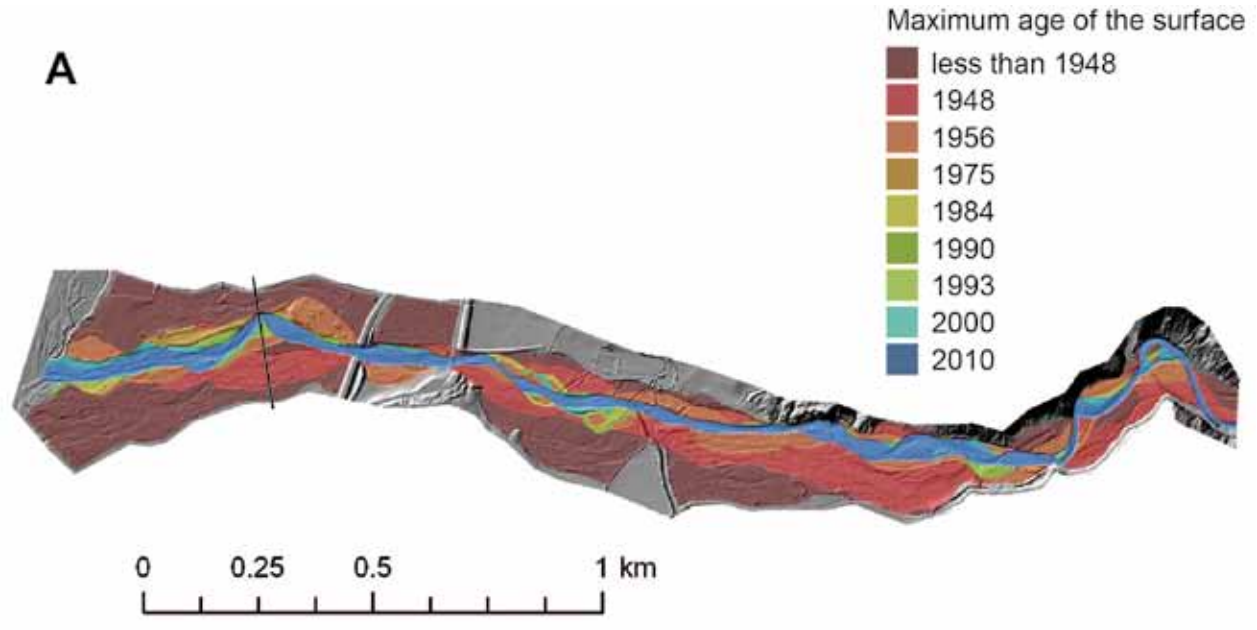
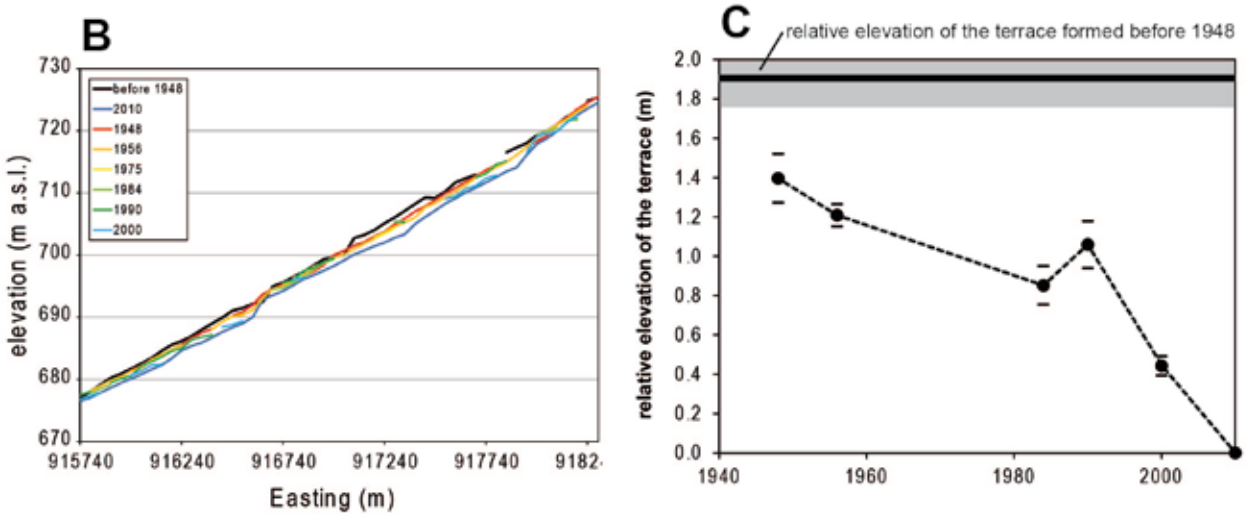


Figure - 1. Historical analysis of channel changes for the Bouinenc Torrent: (A) dating of terrace formation from historical aerial photographs (background: hillshade view of the LiDAR derived 2010 DEM).



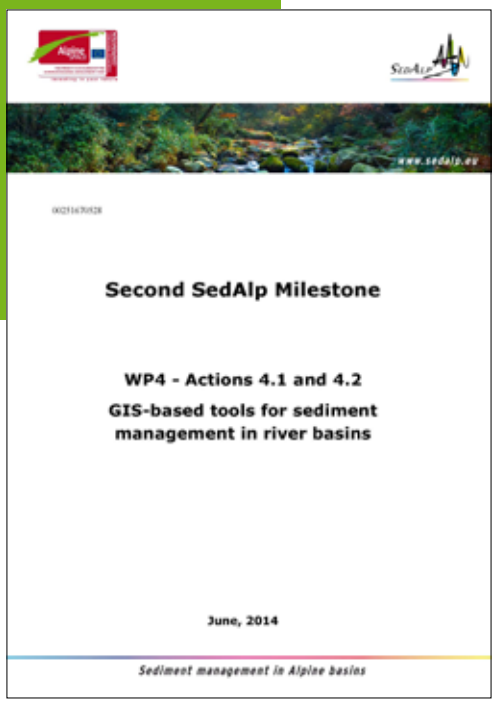
(B) long-profile evolution of the Bouinenc Torrent derived from historical aerial photos and LiDAR data; (C) relative elevation of remnant surfaces as a function of time; the black solid horizontal line shows the relative elevation of the surfaces abandoned before 1948; the grey rectangle shows one standard error buffer around the line; error bars of points correspond to one standard error from the mean.

GIS-based tools for sediment management in river basins (WP4)

The second "Milestone" of SedAlp project is online:

http://www.sedalp.eu/download/reports.shtml

The milestone includes the guideline of the Sediment Connectivity Model by SedAlp partner CNR-IRPI, and guidelines of the Fluvial Corridor Toolbox by SedAlp partner CNRS.



An event in the Maira Valley (Italy): three European projects in the same valley

The high Maira Valley, a beautiful place in North-Western Italy (Piedmont Region), offered sunny and colorful autumn landscapes on 17th and 18th October 2014, the two days dedicated to the presentation of three European projects concerning such a beautiful location. The Maira Valley is in fact a research area for the SedAlp project (partner Piedmont Region/Regione Piemonte) as well as for other two European projects: the ALIRHYS project, collecting knowledge about drinking-water sources in use for a better integrated management of the resource (French-Italian territorial cooperation programme ALCOTRA - http://www.polito.it/ALIRHYS and the E2STORMED project which focuses its attention on the reuse of water for energy saving (MED programme - http://www.e2stormed.eu/ and it involves partners in several European countries (Spain, Italy, Greece, Montenegro, Croatia, Malta, the UK).

The first day of the techno-scientific conference was dedicated to professionals, researchers, technicians of the public administration and companies managing hydroelectric plants to present them the subjects of these three projects. The day started with a technical excursion along the Mollasco creek, a tributary of Maira River which is probably the most representative one from the point of view of hydrogeological instability. The Piedmont Region geologist Marina Zerbato led the visit explaining the different sources of sediment that feed the large solid transport of the basin (activities carried out under the SedAlp project - Workpackage 4, WP4).

Figure - 2. Excursion on Mollasco basin, during the "Maira Valley event" (17-18 October 2014).

These three European projects, their subjects of study and their first results were presented in the afternoon in the small town of San Damiano Macra. Regarding the SedAlp project, the discussion involved the census sources of sediment, their connection to the drainage network, the possible quantification of the volumes involved, the interference with the two dams in the valley (Saretto and San Damiano) and the possible management policies of the sediments. Dr. Marco Cavalli of the CNR-IRPI of Padua (SedAlp partner) presented the IC-Tool, the Index of the sediment Connectivity (link: http://www.sedalp.eu/download/tools.shtml) and its application to the Maira Valley. Such Tool was completed during the SedAlp project. As far as the ALIRHYS project was concerned, the "Politecnico di Torino" (Engineering School of Turin) presented the analysis of the quality of the hydrological regime of the sources of the Maira Stream, which is an extremely important drinking- water supply source. The University of Valencia (SP) presented the E^{2}stormed project and its ability to implement simple steps for a more careful use of rainwater and its resulting energy savings.

On Saturday, the second day of the event, the local communities, the associations of the agriculture and fisheries sectors, the two companies managing the basins and hydroelectric plants of the valley (Enel and Enel Greenpower - observers of the SedAlp project), the Piedmont Region and the inhabitants of the Valley discussed the issues of water use and the problems related to the sediments. Particular attention was focused on the different ways water is used: to water fields, to produce energy, to drink, as well as water to be defended from and water to be respected. The day ended with a technical visit to the dam of San Damiano.

The event attracted considerable attention and participation. These two days were intense and full of ideas and discussions, which managed to involve all the numerous stakeholders of the Maira Valley interested in these various topics, as well as in the matters dealt. More detailed insights of the event, such as presentations, photos and flyers are available on the SedAlp website: http://www.sedalp.eu/events/other.shtml.

Suspended sediment dynamics in the Gradaščica River experimental catchment (Slovenia)

The monitoring and analyses of suspended sediment concentrations are important for understanding of processes directly connected with soil erosion due to extreme hydrological events and consequent ecological conditions in streams and catchments. Therefore, the information about the concentrations of suspended sediments in the river network is important from the integrated water resources management point of view. Suspended sediments are composed of organic and inorganic materials and can include, among other particles, nutrients, pesticides and other chemical pollutants. High concentrations of these particles can aggravate the ecological conditions of streams, which can endanger fishes and other aquatic organisms. However, most of the suspended sediment and bedload is generally transported during few extreme events. But, in some cases moderate magnitude and high frequency flows can also have significant influence on the suspended sediment loads.

In the scope of the WP5, the University of Ljubljana is performing the hydrometeorological monitoring and the monitoring of the suspended sediment transport in the Gradaščica River (catchment area = 78.8 km^2 and its small tributaries, the Kuzlovec torrent (catchment area = 0.7 km^2) and the Mačkov graben torrent (catchment area = 2.33 km^2). The monitoring system at the Gradaščica River experimental catchment (central Slovenia) is shown in Figure 3. Several extreme flash floods occurred in this area,

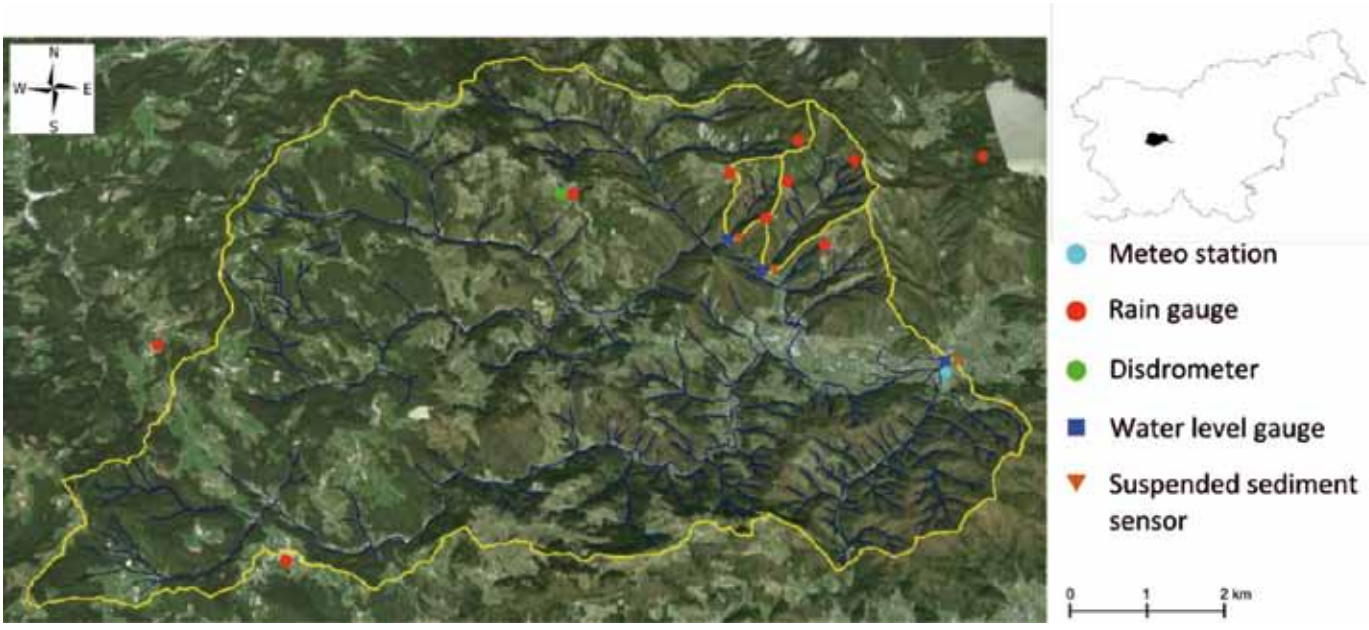


Figure - 3. The monitoring system at the Gradaščica River experimental catchment (Slovenia).

the most severe in 1924, which took the life of 19 people. During the August 2014 flood event in this area, 50 landslides were triggered, 10 housed and 2 industrial buildings were damaged, 30 to 50 km of local roads was damaged and 4 bridges collapsed. Initial estimation of the damage in the area of Polhov Gradec for the August 2014 flood event was 400.000 €. The knowledge of the hydrological, hydraulic conditions and sediment transport processes in the Gradaščica river catchment is also important in view of the flood hazard situation in the western part of the urbanized area of the city of Ljubljana, which is positioned further downstream, where several mayor flood events occurred in 2010 and also in August and October 2014.

Figure - 4. The measuring equipment at the Gradaščica River experimental catchment (left: the suspended sediment probe; right: the disdrometer and a tipping bucket rain gauge).

Figure 4 shows the turbidity sensor used for the measurements of the suspended sediment concentration and the disdrometer, which is used for measurements of raindrop characteristics (amounts, size, velocity, etc.). Turbidity measurements in the Kuzlovec torrent were performing continuously during specific events in different seasons. Several events were recorded in period from March 2013 to November 2014. From June 2013 to May 2014 approximately 5 t of suspended sediment material were transported through measuring cross section in the Kuzlovec torrent. Most of the suspended sediment was transported during winter 2013/2014, which was relatively warm and with small amounts of snow. Autumn 2013 contributed about 30% of the total suspended sediment load, while in summer 2013 and spring 2014 together about 10%.

There were two major flood events in the Gradaščica River catchment in 2014, one in August and another in October. The results of the suspended sediment measurements performed at the Dvor water station (see location of the Meteo station in Figure 3) during the October and November 2014 flood events are shown in Figure 5. During this sequence of these flood waves, the total amount of the transported suspended sediment material was about 21,000 t, which yields a specific sediment yield of about 2.6 t/ha. The estimated total volume of the suspended material transported along the Gradaščica River channel was approximately 8000 m^3.

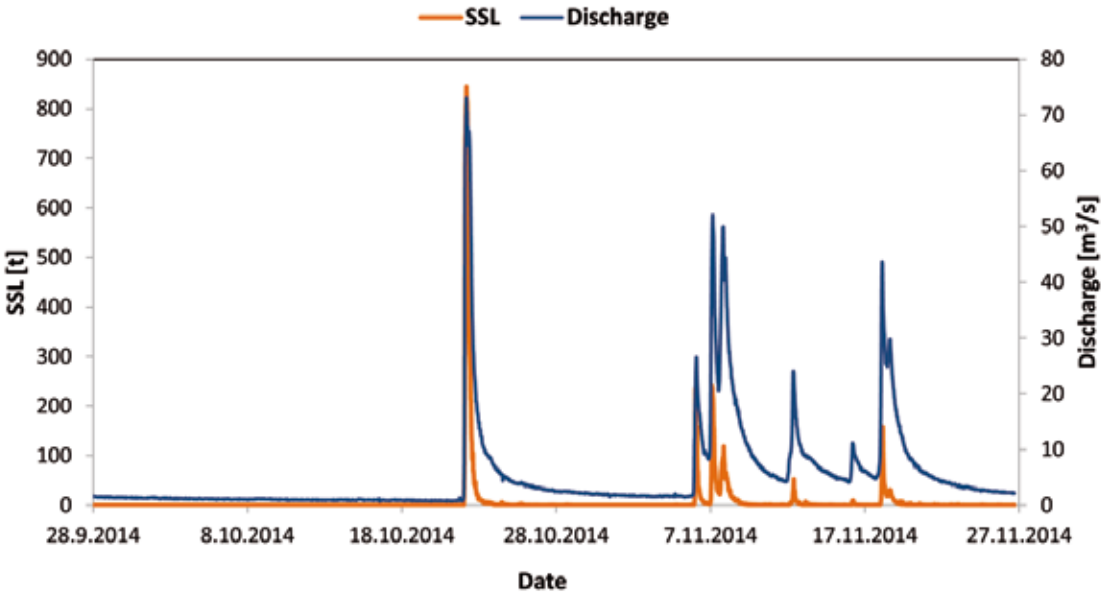


Figure - 5. Gradaščica River discharge and suspended sediment load (SSL) measurements for October and November 2014 flood events.

The suspended sediment mobilisation and transport during the 2014 flood waves was high and resulted in high deposition of suspended sediment material along the downstream Gradaščica River reaches and also further downstream along the river network. Figure 6 shows high fine material deposits in along the upper sections of the Gradaščica River channel, which occurred when the flood water was returning back to the main channel.

Suspended sediment transport data will be further used for assessing the influence of sediment transport processes on hydraulic conditions in the Gradaščica River in the scope of the flood protection scheme for the Ljubljana urban area.

Figure - 6. Sediment deposits along the Gradaščica River channel after the October 2014 flood event (left: suspended sediment deposition on the floodplain; right: excavation of deposited material).

Enhancing sediment flux control and natural hazard risk mitigation through a structured conceptual planning approach (WP6 activity)

(Article by SedAlp partner Autonomous Province of Bolzano and Mountaineering S.r.l., Bolzano - Italy)

Preventing the release of sediments from their sources in mountain catchments, stabilizing the streambeds through the realization of grade control structures and retaining solid material volumes transported during extreme events is a widespread strategy to reduce risks in mountain areas. On the contrary, it is ascertained that, without a release of sediments and without maintaining sediment connectivity throughout the stream network the reactivation of hydro-morphological and associated ecological functionalities of mountain streams is unfeasible. In parallel, on several debris cones and alluvial fans a clear increasing tendency of wealth moving into flood prone areas could be retraced over the last decades, leading to a possible exacerbation of risk. Hence, concerning sediment continuity a fundamental and intentionally strongly polarized management question might be posed: to release and bear the arising risk costs or not to release and bear the costs to maintain the functionality of the system throughout its life cycle?

We argue that striving for design excellence can greatly contribute to resolve the above outlined apparent contradiction, namely effectively reactivating the hydro-morphological and ecological system dynamics, while keeping risk well below acceptable levels and reducing cost flows over the system's life-cycle to sustainable levels. In WP6 – Interaction with structures - we conceived a structured conceptual planning approach, by deriving it from the well established general design framework of axiomatic design. Contextually, we introduced specific efficiency indicators for use in the conception stage of the design process to solve wicked types of problems related to sediment flux control and to extend the space for possible solutions. To show the applicability of the proposed methods and concepts, moreover we detailed the single analytic steps of the procedure through a case study on the Gadria stream, a tributary of the Adige River in South Tyrol, Italy.

In particular we analysed through the above mentioned computational approach the efficiency of open check dam design solutions and compared their performance with the current and poorly performing setting of a retention check dam, built in the mid seventies.

The adopted investigation strategy clearly indicates that modifying the existing check dam by widening its opening could significantly contribute to increase the functionality of the system thereby reducing the life cycle costs to a significant extent. Possible flood risk exacerbations for the endangered settlement areas could be avoided by established techniques (e.g. local object protection, local deflection walls and a modification of a wood bridge). Provided that integrative local protection measures will be realized, this solution would contribute significantly to a complete solution of the acute counter-productive debris flow material deposition problem.

Figure - 7. View of the retention check dam (Gadria stream, NE Italy). Sediment continuity is clearly interrupted; significant costs arise on event occurrence to clean the available retention volume.

The 3rd International Conference "Wood in World Rivers" is coming in Padova (Italy)

The SedAlp project (Alpine Space Programme) gives attention also to the aspects related to the interaction between the riverine processes and the riparian vegetation. Particularly attention is due to the recruitment, characterization and displacement of the woody material during low flow condition and during flood events.

Wood in river systems exert both geomorphologic and ecologic functions. It interacts with a wide range of fluvial processes thus affecting the structural complexity of the river as well as increasing the potential risk for human structures during floods. As a result, the scientific community devoted to large wood (LW) deeper attention in order to better analyse the characteristics of LW, its displacement and storage, as to be able to quantify the wood dynamics in the context of a mass balance analyzing the balance of wood input and output at various time scales.

The WWR3-2015, 3rd International Conference Wood in World Rivers, aims to analyze the importance of wood of all sizes, both living and dead, and the riparian forests which produce wood, a crucial element for geomorphology, ecology and management of rivers. Main purposes of the Conference are to:

- synthesize the knowledge on the physical dynamics and ecological interactions of wood in streams and rivers in different geographical regions;
- create a framework for interpreting and applying research results and management systems;
- assess physical and biological responses of large wood in stream restoration;
- explore links between physical and ecological dynamics of large wood, resource management systems and the communities and cultures in which they are applied.

WWR3-2015 aims to promote also a connection between geosciences and ecology, which represents a challenging aspect for restoration purposes. Following the line of the first two conferences on Wood in World Rivers, the intention is to attract a wide assembly of wood lovers and to consolidate the idea to

have regular International Conferences and Meetings.

An important goal of the 3rd International WWR Conference is to promote and increase the relationships between scientists and professional operators. The integration of these two worlds will have positive effects on many fields such as surveys, monitoring techniques, design procedures, implementation of projects. The 3rd International Conference will also offer an extraordinary opportunity for scientists, agencies and companies to meet and improve together the state-of-the-art of wood in world rivers and, in detail, will discuss on the following topics and sessions:

1- Wood and fluvial ecosystems;

2- Wood dynamics in rivers;

3- Techniques for wood monitoring and modeling;

4- Wood perception and management.

The 3rd International Conference on Wood in World Rivers will be held at the University of Padova, Italy. The conference venue will be located in the historical center of Padova: "Aula Magna- Palazzo del Bò", University of Padova and S. Gaetano cultural centre-Auditorium. For more informations, you can visit the WW3-2015 website: http://intra.tesaf.unipd.it/cms/wwr3/

For more informations about SedAlp project and partnership please visit the SedAlp website www.sedalp.eu and the page.

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Austria

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- Amt der Tiroler Landesregierung
- Amt der Kärntner Landesregierung
- Universität für Bodenkultur Wien (BOKU)

France

- Centre National de la Recherche Scientifique (CNRS)
- Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture (Irstea)

Germany

- Bayerisches Landesamt für Umwelt (LfU)

Italy

- Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto
- Consiglio Nazionale delle Ricerche (CNR – IRPI)
- Provincia Autonoma di Bolzano/Autonome Provinz Bozen
- Regione Piemonte
- Università di Padova

Slovenia

- Inštituit za vode Republike Slovenije
- Univerza v Ljubljani

Project observers

- Agence de l'Eau Rhône-Méditerranée-Corse
- Agenzia Regionale per la Protezione dell'Ambiente della Valle d'Aosta
- Austrian Hydro Power
- Autorità di bacino del fiume Po
- Autorità di bacino del fiume Adige
- Bundesamt für Umwelt (BAFU)
- Enel Produzione SpA
- Enel Produzione SpA – UBI Hydro Piemonte
- Enel Green Power SpA
- Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft (WSL)
- Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA)
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SedAlp – **Sed**iment management in **Alp**ine basins:
integrating sediment continuum, risk mitigation and hydropower

The project is co-funded by the European Regional Development Fund

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