European River Restoration Conference
Featuring the IRF Riverprize

Connecting River Restoration Thinking to Innovative River Management
6th Edition | 27–29 October 2014 | Vienna
Integrated with the final event of the SEE River project

SESSION 8
RESTORING HYDRO-MORPHOLOGICAL PROCESSES

Soil Bioengineering application in river restoration projects: case studies from Southern Portugal

Ana Mendes (University of Évora, Portugal, aimendes@uevora.pt), André Fabião (Institute of Agricultural Sciences, University of Lisbon, Portugal), Helena Almeida (Institute of Agricultural Sciences, University of Lisbon, Portugal), Marques Afonso (Administrative Hydrographic Region of Algarve, Portugal), Rui Cortes (University of Trás-os-Montes-e-Alto-Douro, Portugal), Sofia Delgado (Administrative Hydrographic Region of Algarve, Portugal), Leopoldino Diaz (Administrative Hydrographic Region of Algarve, Portugal), Marta Duarte (Águas do Algarve, Portugal), António Fabião, Carla Faria, Maria da Luz (Águas do Algarve, Portugal), Maria Teresa Ferreira (Institute of Agricultural Sciences, University of Lisbon, Portugal), Marisa Viriato (Águas do Algarve, Portugal).

Paúl da Goucha restoration project


Figure 1. Location of the restoration initiatives under the scope of the RIPIDURABLE Project.

1

Paúl da Goucha is located in the Tagus River Basin. It has been heavily influenced by human activity, particularly quarrying of aggregates. This activity has significantly affected vegetation cover and in some areas has created small artificial lakes, which have been subsequently used for dumping litter and trash. Such impacts made restoration to a pristine state impossible. The Paúl da Goucha environmental mitigation project started in January 2005. It was one of the several restoration initiatives developed through the Ripidurable Project.


Figure 2. General overview of the Paúl da Goucha restoration area in July 2005, before the start of the project .


Figure 3. During works, April 2008.


Figure 4. Present situation, August 2014.

2

Main objective: Recover the habitat to the best possible situation.
•Trigger riparian vegetation colonization of the site.
•Develop the feeding, breeding and refuge habitats for aquatic birds.
•Create environmental interpretation trails to promote the importance of river habitat restoration.

3

Approximately 575 saplings of 12 tree species were planted in 2008. Average survival rate in 2010 was 68%. Average survival rate in 2014 is 59%. If we compare number of detected plants in 2014 with the number in 2008, the skewed success rate is 92%. These survival rates indicate that the project was successful in triggering the natural vegetation colonization process (Figure 5), since not intervened nearby locations do not show the same level of natural tree regeneration.

4

The following bioengineering techniques had different success rates after 6 years (Table 1):
- Cribwall (A, B e C): low success;
- Brush mattress (D): failure (human disturbance);
- Coconut fibber rolls (E): successful;
- Wattle fences (F): successful;
- Fascines (G): successful.

Technique	Number of poles (Salix sp.)	Average DBH (cm)
Watle fences	43	5,43
Live fascines	33	3,86
Brush Mattresses	10	0,1

Table 1. Success rate of different bio-engineering techniques assessed by mean number of poles and average DBH.

Wattle fences showed higher numbers of sprout survival after 6 years, and bigger growth rates, followed by live fascines and brush mattresses.

5

Due to the harsh environmental conditions in the Mediterranean region, it would be interesting to test the use of rooted plants (rather than live stakes) on some bioengineering techniques. Adopting bioengineering techniques from Northern and Central European countries does not always gives the same level of results since the dryer Mediterranean climate (where most of the annual rainfall is concentrated in the winter months) compromises the survival of the tree cuttings.

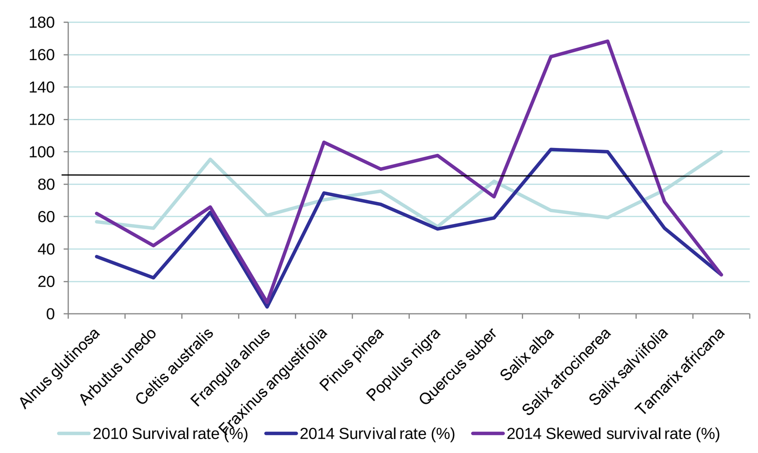
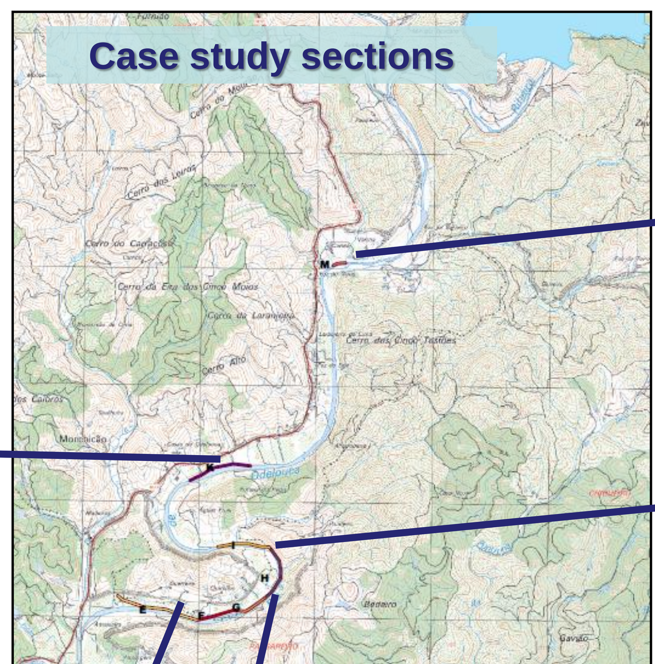


Figure 5. Percentage of survival of planted tree species in 2010 and 2014. Success rates in 2014 are also measured using 2010 live plants as benchmark (Skewed survival rate).

Riparian requalification in the Odelouca Dam

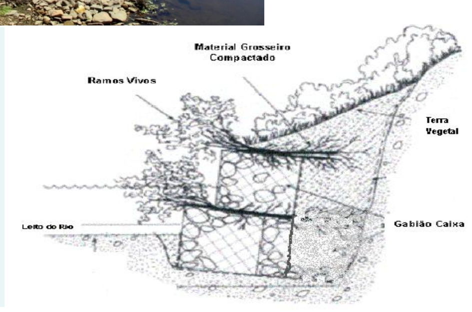
1

The Odelouca river basin is located in the Algarve region, south of Portugal. The field work of the Odelouca riparian requalification project started in 2012, following the environmental compensation measures due to Odelouca Dam construction. This project made extensive use of soil bioengineering techniques, although with some adaptations to the dryer Mediterranean climate (use of rooted plants instead of cuttings as often as possible).



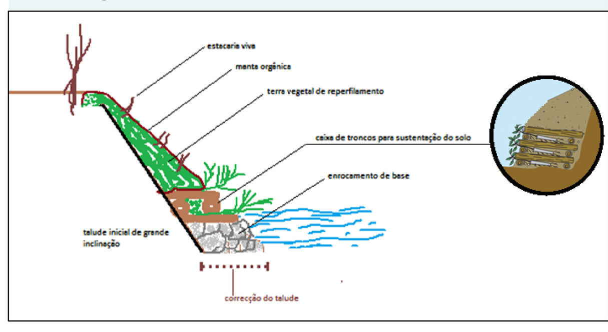
2

Vegetated hard gabions: two rows, vegetated with *Salix* spp. rooted plants; upper row covered with topsoil and planted with *Salix* spp., *Nerium oleander*, *Tamarix africana* and *Fraxinus angustifolia.*
Major findings: the use of rooted plants improved success rates.

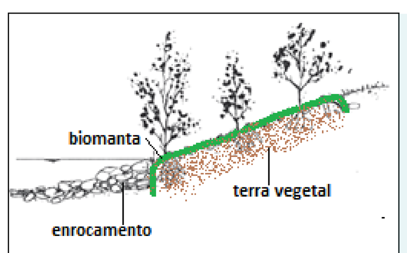


3

Vegetated log Cribwall: Riprap foundation over a geotextile mat; live cuttings of *Salix* spp.; plantation of *Salix* spp., *N. oleander*, *F. angustifolia*, *F. alnus*, *T. africana.*
Major findings: in dryer locations *N. oleander* and *T. africana* cuttings seem to show better results than *Salix* spp. cuttings.



6



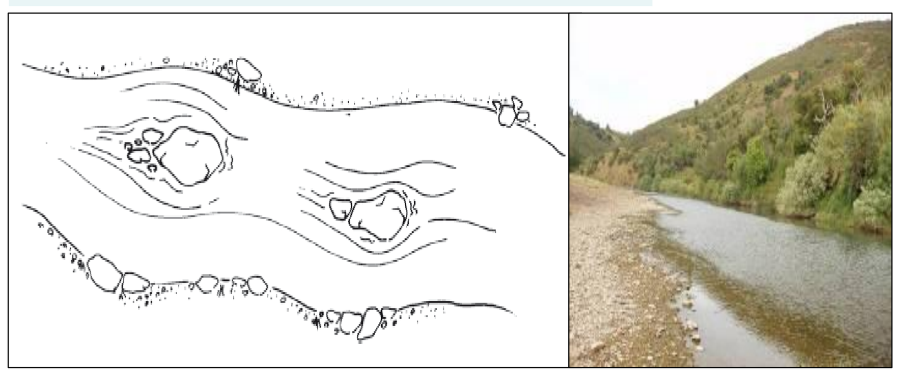
Plantation: embankment stone removal; planted riprap foundation; geotextile mat; plantation of *Salix* spp., *N. oleander*, *F. angustifolia*, *Frangula alnus*, *T. africana.*
Major findings: the use of rooted plants improved success rates.

5

***Arundo donax* removal:** two overlapped geotextile mats with 20 cm of topsoil between them; planted riprap foundation; live cuttings (*Salix* spp.); plantation of *Salix* spp. and *N. oleander*
Major findings: *Arundo donax* removal not 100% successful.

4

Islands (baffles, structuring boulders): geotextile mat with one layer of large boulders on top; large gaps to provide cover for fish; one layer of smaller boulders, with gravel and topsoil between the gaps; plantation of *T. Africana*, *Salix* spp, and *N. oleander.*
Major findings: impact on fish population increment not yet demonstrated.



Final Remarks

Both projects objectives will take some years to be totally achieved, but the conditions are set for a successful outcome. Groundwater levels and local population involvement are essential for technique success. It is imperative to adapt existing bioengineering techniques to the Mediterranean reality.

Acknowledgements:
The Paúl da Goucha restoration project was partially funded by EU, through the Interreg IIIC Initiative - RIPIDURABLE Project.
The Odelouca riparian requalification project was partially funded by the EU, through the Interreg IVB Initiative - RICOVER Project.