



River restoration

Site A



The problems

- ✘ **Artificial setting of the river environment** due to the presence of gabionades on the banks and of a concrete sole in the watercourse
- ✘ **Discontinuity of the river bed** due to the presence of a drop about 1 m high
- ✘ **Instability of the banks** due to the presence of active erosion in several points

The solutions

- ✘ **To build a slope** with stone blocks, fixed to the sole, and to cover the blocks with gravel and cobbles in order to hide the concrete sole and promote habitats for benthonic fauna
- ✘ **To build a ramp of stone blocks**, medium slope 10%, in order to fill up the drop
- ✘ **To shape the banks** in order to control erosion and then to protect the slopes with a thin layer of tnt made of mineral fibre and to seed grass (in the higher part of the banks) or with living horizontal/vertical fences (in the lower part of the banks)



Site B



The problems

- ✘ **High deterioration of bank's flora** caused by interruption of continuity and abundance of *Robinia pseudoacacia*
- ✘ **Instability of the banks** due to the presence of several points of active erosion and excavation close to the road at the bank edge

The solutions

- ✘ **To re-establish riparian flora**, reducing *Robinia* and replacing with shrubs (*Euonymus europeus*, *Cornus sanguinea*, *Rosa sempervirens*, *Ligustrum vulgare*)
- ✘ **To shape the banks** in the upstream portion of the site and to protect the slopes as described for site A
- ✘ **To build living horizontal/vertical fences** (avoiding the access of machinery into the river) in order to consolidate the portion of slopes interested by erosion



Site C



The problems

- ✘ **Evident erosion of the extrados** of the meander after the bridge
- ✘ **Instability of the banks** due to the presence of active erosion in several points

The solutions

- ✘ **To shape the banks** (and particularly the extrados) giving a more fixed shape to the slopes and to build a cover "double pole" on the foot of the slopes
- ✘ **To build living vertical fences** in order to protect the banks foot from erosion
- ✘ **To lay dead brushwood** fixed by living poles in order to protect bare banks
- ✘ **To re-establish riparian flora** planting *Alnus glutinosa* and other species as in site B



Bioengineering works



Reducing water pollution

The problems

- ✘ **Bad working of the sewerage system** inadequate to drain the wastewater flow, particularly during the hydraulic peaks, even when it doesn't rain
- ✘ **Several wastewater overflow channels operate within the catchment**, discharging a significant pollution load into the small ditches and the Sellustra stream
- ✘ **Impossibility of adopting a conventional solution** because the water purifier plant of Imola is not able to treat more than the actual average Q

Section of the designed constructed wetland to treat part of the wastewater of Toscanella



Already existing constructed wetland similar to the one designed for Sellustra Life (photo Iridra srl)

The solutions

- ✘ To build a **constructed wetland adopting the technique "horizontal subsurface flow" (SFS-h)**, in order to drain all the sewage and to restore good quality effluents to the river. The characteristics of the wetland are: surface 390 m² (26 x 15 m), depth about 1 m, deep sealed with an EPDM film covered by a thin layer of tnt made of mineral fibre, filling medium made of 8 mm diameter gravel, banks covered by jute cloth and by grass, *Phragmites australis* planted in the deeper areas. The operating capacity is **102 equivalent inhabitants** (EI), normal hydraulic load is **136,5 l/EI/die**, normal organic load is **60 g BOD₅/EI/die**, minimum temperature of sewage (in winter) is **6 °C**. In order to insure best performance of the constructed wetland, it will be equipped with a drain well for distribution of the sewage, an inspection well and a control well for adjusting sewage level and allow sampling
- ✘ An **Imhoff tank** will be constructed at the inflow of the system to provide a primary treatment of sewage in order to separate solid sediment

Constructed wetland

Wooded buffer strips

The problems

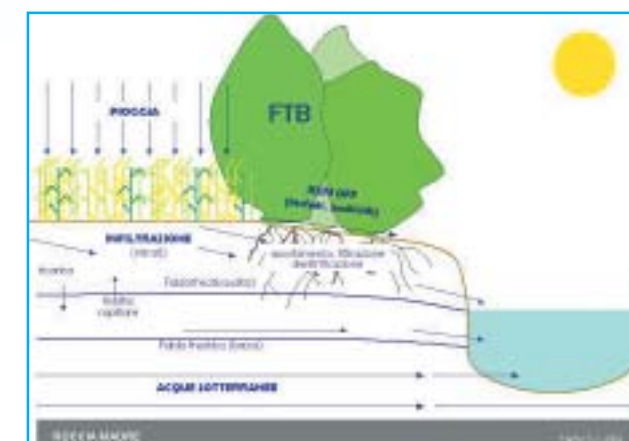
- ✘ **Percolation of nitrates** and other diffused pollutants from the field towards the river, its tributaries and the ditches
- ✘ **Instability of the river banks** of Sellustra and of other small streams and ditches
- ✘ **Loss of riparian habitats and discontinuity of ecological network** due to lack of riparian vegetation along the Sellustra and the stream and ditches network of the whole watershed



Lack of riparian vegetation along the Sellustra stream banks

The solutions

- ✘ Stimulation of the land owners neighboring streams and ditches, aimed to encourage them to join the operative strategy of the project and realize **wooded buffer strips (WBS)** by planting mono or two-row hedges along the main and secondary hydrographical network



Hydrology, diffuse pollution and WBS role



Dissemination of the results

Environmental monitoring

Stimulation activities

The objectives

- ✘ **To demonstrate the effectiveness** of the initiatives undertaken, by mean of the evaluation of the river characteristics (water quality, ecosystem functionality, quality of the vegetation growing along the river banks) before and after the realization of the works
- ✘ **To compare several environmental indices** in order to evaluate their reliability (sensitivity, coherence, suitability and capability to resume several aspects of the quality of the river)



Location of monitoring stations

The indices adopted

- ✘ **Improvement of water quality and control of the erosion**
EBI (Extended Biotic Index)
Bacteriological and chemical macro indicators
SECA (Ecologic state of the rivers)
Leaf packs
BSI (Buffer Strip Index)
- ✘ **Increasing of biodiversity and improvement of landscape**
WSI (Wild State Index)
Macroinvertebrates taxa
IFF (River functional index)
ELI (Environmental Landscape Indices)



EBI, Macro indicators, SECA and Macro invertebrates taxa will be assessed every three months
Leaf packs, BSI, WSI, IFF, ELI will be evaluated before and after the realisation of works

The objectives

- ✘ **To stimulate the adoption of the proposed techniques** in other territories, characterised by similar environmental and human conditions
- ✘ **To disseminate the concept of the need of an integrated approach** to environmental restoration, toward public administrators and other subjects involved in the planning and the management of the territories

The instruments

- ✘ **The info point**
A technician well experienced on buffer strips and the "energy-wood" chain will operate within the Municipality premises in order to: **stimulate farmers, disseminate technical and scientific information** concerning the proposed methods and technologies, **supply technical assistance** in writing the requests of public funding for the realisation of buffer strips
- ✘ **The "observer group"**
It will be constituted by public administrators and technicians in order to **analyse thoroughly the problems concerning planning and restoration of territories, evaluate several existing techniques of intervention, estimate the suitability and reliability of the proposed methods.**
- ✘ **The participation of the Municipality of Dozza to international exhibitions and congresses**
- ✘ **The set up of a WEB site, dedicated to the project**
- ✘ **The publication of a bimonthly newsletter (distributed by e-mail) and of a "process manual"**



Presentation of the Sellustra Life project during the meeting organised at Province of Bologna



The project

Strategy

A new approach to safeguard the quality of the water at catchment scale

- Systemic view of all the aspects concerning water quality, considering relationships between components and system's processes in order to evaluate effects in their own complexity
- Participation of the stakeholders to the decisional processes and promotion of concerted actions
- New guidelines for public administration and new incentives to private initiatives
- Reclamation of parts of the territory to the rivers and the streams for restoration of ecosystems and landscape, creation of ecologic corridors, water purification
- Adoption of low impact techniques and criteria for carrying out works concerning hydraulic defence (bio-engineering) and effluents softening (constructed wetlands)
- Multidisciplinary approach and interactions through techniques and competence
- Sustainable management of restored areas, promoting conversion of farming techniques toward new productive courses (i.e. biomass for energetic purposes)
- Involvement of private financiers in building infrastructures concerning drainage, defence, restoration of water bodies

Objectives

To restore the environment of the Sellustra river catchment

To demonstrate the effectiveness of the integrated application of low impact techniques

To demonstrate the effectiveness of shared planning initiatives and multidisciplinary approach



A view of the Sellustra catchment

Expected results

Improvement of water quality

Initiatives for water purification by constructed wetland for treating wastewater and by mean of wooded buffer strip for controlling nutrients flow



Water eutrophisation in Sellustra river

Increasing of biodiversity and improvement of the landscape

Initiatives for restoration of natural flora by reduction of invasive species (i.e. Robinia) and enlargement of native riparian vegetation (buffer strips)



Discontinuity of the ecological network



Erosion of the bank

Control of erosion

Bioengineering works including shaping of the banks, construction of living fences and plantation of wooded buffer strips

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This brochure is one of the dissemination documents produced by the LIFE00/ENV/IT/000065 project and it has been made with the financial contribution of European Commission. Supplement with "Dozza, Notizie" - N. 1 - 2002 - Project by Startier srl. Special thanks to Bruno Boz, Viniario Dall'Acra, Editrice La Mandragora - Printed by Fonti Imola - 100% chlorine free chemical pulp.

With the collaboration of:



The initiative is realised by:



Municipality of Dozza

Planning and realization of integrated methods for restoration of the catchment in Val Sellustra (Italy)



Life Environment Program



LIFE00/ENV/IT/000065