ASSESSING THE ECOLOGICAL STATUS OF RIPARIAN SYSTEMS

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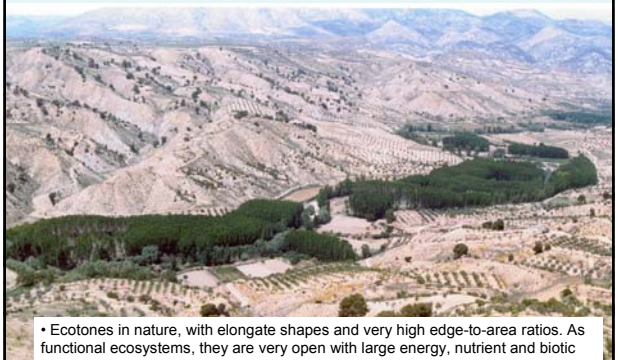
1. **Basic concepts on the structure and functioning of riparian systems**
2. **Attributes for assessing their ecological status**
3. **Bases for restoring riparian systems**

RIVERINE LANDSCAPES

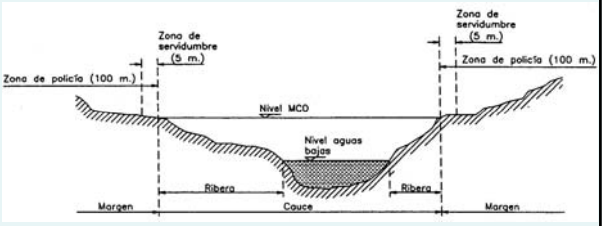


• Ecotones in nature, with elongate shapes and very high edge-to-area ratios. As functional ecosystems, they are very open with large energy, nutrient and biotic interchanges with aquatic systems on the inner margin and upland terrestrial ecosystems on the other margin (Odum, 1978).

RIVERINE LANDSCAPES

• Lateral zones containing an extensive interconnected number of biotopes and environmental gradients, which together with their biological communities, constitute the fluvial systems (Ward, 1998).

RIVERINE LANDSCAPES

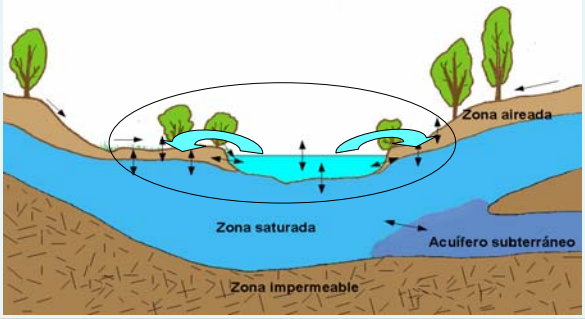


Spanish Water Law:

• Fajas laterales de los cauces públicos situadas por encima del nivel de las aguas bajas hasta el nivel de la máxima crecida ordinaria (Ley de Aguas, 1986)

RIVERINE LANDSCAPES

• Lateral zones of the fluvial systems, characterized by the hydro-geomorphic fluvial processes, containing a large variety of ecological relationships



RIVERINE LANDSCAPES

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In practice:

STRUCTURE AND FUNCTIONS OF THE NATURAL RIPARIAN SYSTEMS

Natural Corridors, characterized by the sinuosity and the height (Forman & Godron, 1986)

STRUCTURE AND FUNCTIONS OF THE NATURAL RIPARIAN SYSTEMS

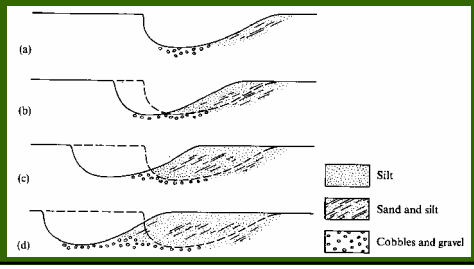
Structure: **VEGETATION**

- Vegetation adapted to the flow regime and the fluvial erosion and sedimentation processes

STRUCTURE AND FUNCTIONS OF THE NATURAL RIPARIAN SYSTEMS

Structure: **SOIL MATERIAL**

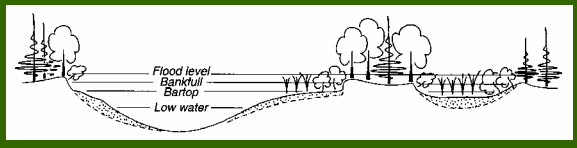
Flat relief modulated by the floods, containing coarse materials very permeable, over which the fine sediments are deposited, allowing the vegetation growth



STRUCTURE AND FUNCTIONS OF THE NATURAL RIPARIAN SYSTEMS

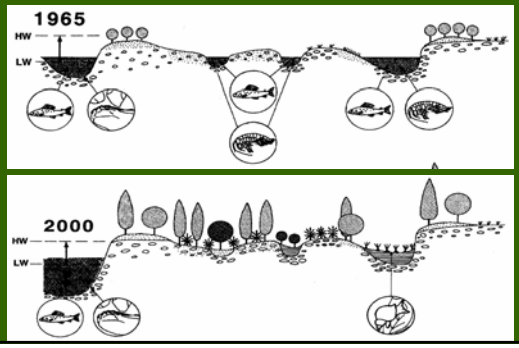
Functioning: **FLOODS**

Periodic floods due to natural variability of the flow regime, which connect the fluvial biotopes and posibilitate the interchange of materials, energy and biologic organisms



STRUCTURE AND FUNCTIONS OF THE NATURAL RIPARIAN SYSTEMS

Functioning: Effects of channel alteration



STRUCTURE AND FUNCTIONS OF THE NATURAL RIPARIAN SYSTEMS

Main elements:

Structure: - Characteristic vegetation

- Flat relief

-Permeable, coarse materials

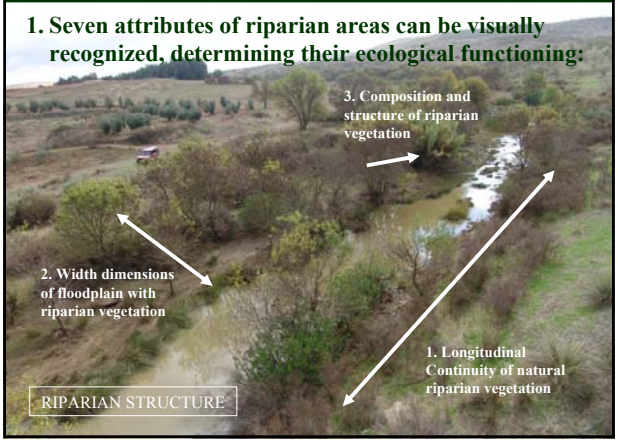
-Functioning: - Periodic floods: Connectivity and Interchange

-Dynamic processes

-Great heterogeneity of biotopes, environmental gradients and ecological relationships

THEORETICAL PRINCIPLES OF THE RIPARIAN QUALITY INDEX (RQI)

1. Seven attributes of riparian areas can be visually recognized, determining their ecological functioning:



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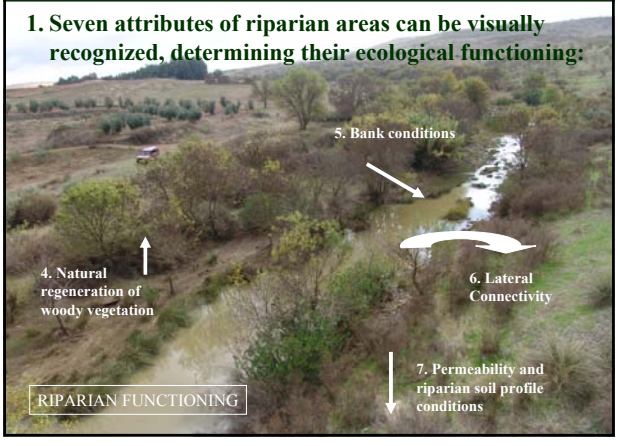


ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

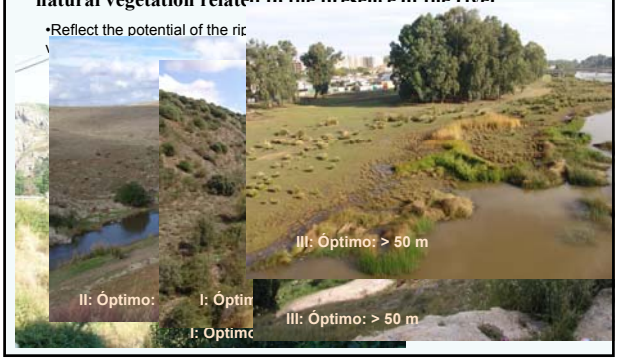
1. Longitudinal continuity of the riparian vegetation

- Necessary for assuring the fluvial corridor functions
- Esential for maintaining the diversity of riparian species
- Can be estimated according to the vegetation coberture or fragmentation level

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

2. Dimensions (width) of the riparian space containing natural vegetation related to the presence of the river

•Reflect the potential of the ri



ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

3. Composition and structure of the riparian vegetation

• Each fluvial reach has its optimum in vegetation development, according to the biogeographic region, ri

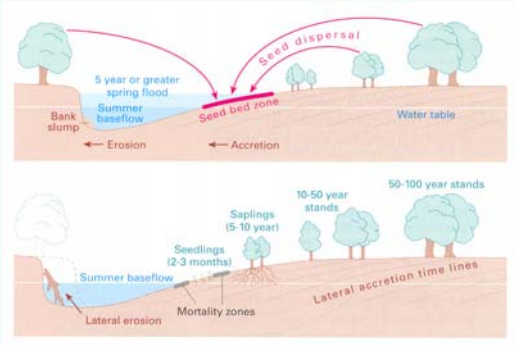
ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

4. Natural regeneration of woody riparian species

- The age diversity is a main characteristic of the riparian vegetation, and takes part of the biological diversity of the riverine systems
- Indicates the adaptability of the riparian vegetation to the present flow regime

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

Natural regeneration of the riparian vegetation



ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

Natural regeneration of the riparian vegetation

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

Natural regeneration of the riparian vegetation

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

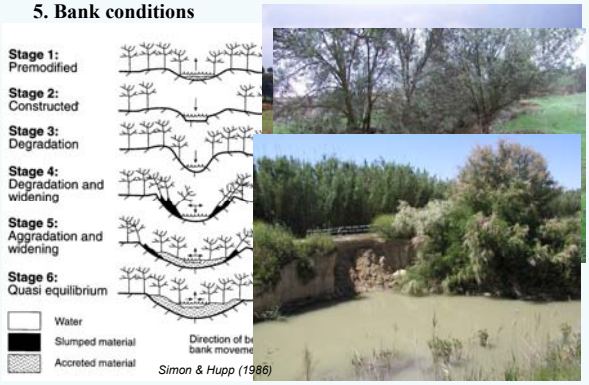
5. Bank conditions

The erosion and sedimentation in banks and channel bed are natural processes related to the fluvial dynamics

Very often the bank erosion comes from antropogenic processes, which have created channel instability and incision

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

5. Bank conditions



Simon & Hupp (1986)

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

5. Bank conditions

- In natural conditions, the perimeter of the banks is very irregular, creating a high diversity of microhabitats and environmental gradients
- Channelization works realign and simplify this perimeter, promoting an increase of the shear stress
- This effec makes more dificult the colonization of the banks by organisms, specially when the banks are reveted with hard structures

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

5. Bank conditions

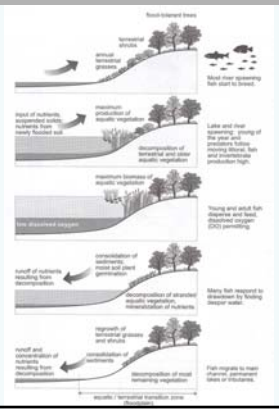
ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

6. Lateral connectivity

- The lateral connectivity refers the hydrological and ecological conexión that in natural conditions exist between the channel and the riparian zones, during the floods
- This conexión permits the interchange of water, sediments, nutrients and organisms, which is necessary for maintaining the natural functioning and integrity of the river ecosystems

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

6. Lateral connectivity of the channel with the riparian zones



ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

6. Conectividad Lateral del Cauce

Many human activities reduce the lateral con
with the floodpl

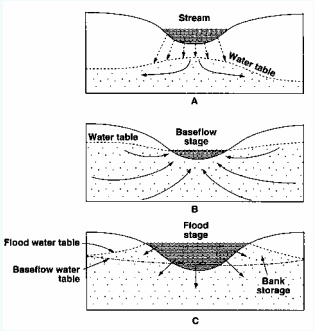
ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

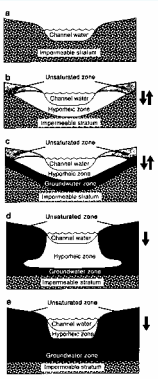
7. Permeability and riparian soil alteration

- In the riparian zones, the coarse and permeable materials are dominant, having a high infiltration capacity and acuifer recharge facility
- Soil sealing and compactation makes dificult the subsurface water flows and exchanges in river corridors
- Gravel extractions, adition of aloctonous material, unwanted soil, building debris, etc., are frequent alterations in the riparian soils, preventing the development of the riparian vegetation

ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

Subsurface hydrological flows in rivers





ATTRIBUTES FOR ASSESSING THE ECOLOGICAL STATUS OF THE RIPARIAN SYSTEMS

7. Permeability and riparian soil alteration

THE ECOLOGICAL RESTORATION OF THE RIPARIAN SYSTEMS

The restoration of the riparian areas should be integrated in a more general strategy of restoring the fluvial hydrosystems

Only is possible to achieve when the hidro-geomorphic processes are recovered, and they create the forms and biological structure of the river

The ecological restoration of the riparian systems should enhance and promote the riparian structure and functioning atributes

Ecological conditions of riparian areas in the Guadiana Basin (Upper and Middle Basin, Spain)

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J.M. Varela
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STUDY AREA:

125 study sites distributed along 75 rivers, belonging to the Upper and Middle reaches of Guadiana Basin

1. METHODOLOGY:

River surveys done in 2004, **applying the Riparian Quality Index,** which takes into account:

- Longitudinal Continuity of natural riparian vegetation
- Dimensions (width) of floodplain area occupied by riparian vegetation
- Composition and structure of riparian vegetation
- Woody species regeneration
- Bank conditions
- Lateral connectivity
- Permeability and riparian soil profile conditions

2. ANALYSIS OF RESULTS

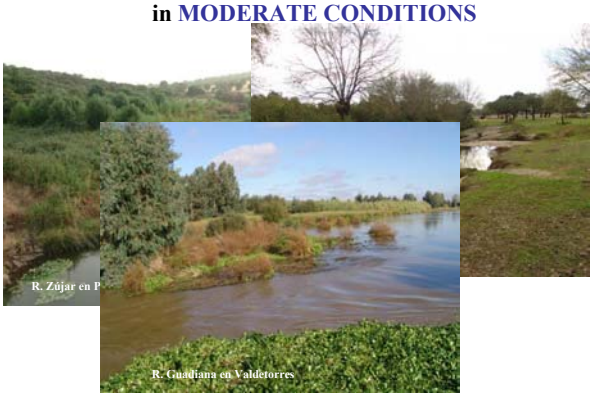
3. REVIEW OF THE MAIN DEGRADATION FACTORS

4. PROPOSAL OF ALTERNATIVES

RESULTS: **Only 3, 4 % of studied sites (4 river reaches) in VERY GOOD CONDITIONS**

RESULTS: **GOOD CONDITIONS**

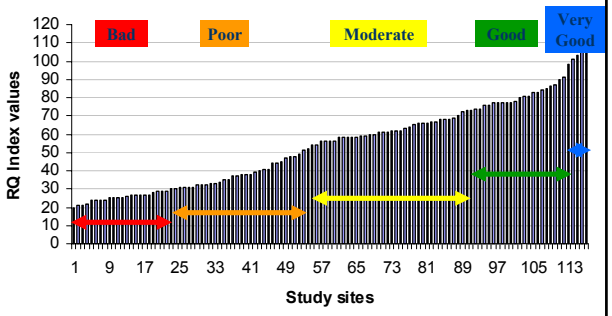
RESULTS: **30,5 % of studied sites (36 river reaches) in MODERATE CONDITIONS**



RESULTS: 24 % of studied sites (28 river reaches) in **POOR CONDITIONS**

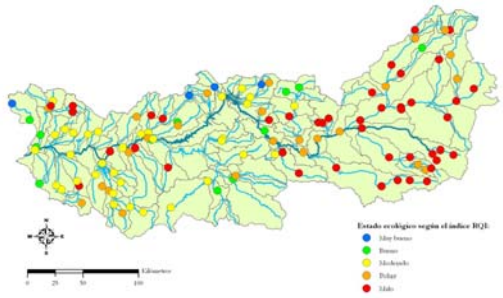
RESULTS: 20 % of studied sites (24 river reaches) in **BAD CONDITIONS**

RESULTS:

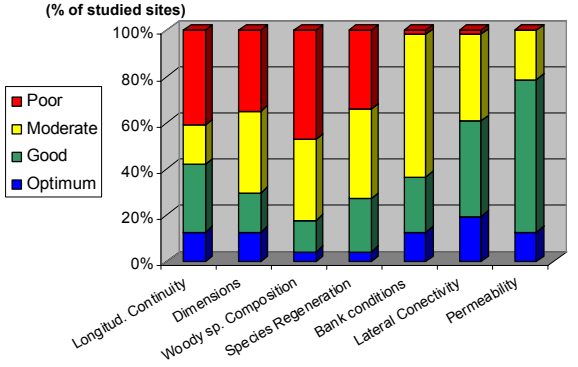


More than 75 % of the riparian sites do not reach the ecological "good status" and have to be restored

Assessing the Ecological Status of the riparian areas in the Guadiana Basin, using the Riparian Quality Index (RQI)



Assessing the ecological status of the main riparian landscape attributes using the RQ Index in the Guadiana Basin



RESTORATION ALTERNATIVES FOR IMPROVING RIPARIAN LANDSCAPE CONDITIONS IN THE GUADIANA BASIN

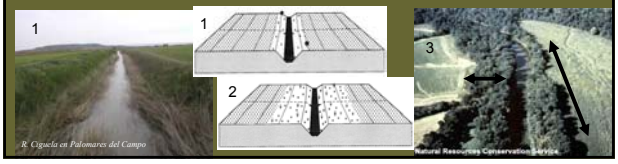
1. Increasing Longitudinal Continuity and Width Dimensions:

Present condition: (1)

Riparian vegetation rather fragmented and reduced, very often in small and isolated patches, due to agricultural and grazing practices

Restoration proposals: (2 to achieve 3)

Delimiting continuous buffer-strips along the rivers by means of agreements with farmers. Main objective is recovering the space where natural vegetation can regenerate and dynamically function.



RESTORATION ALTERNATIVES FOR IMPROVING RIPARIAN LANDSCAPE CONDITIONS IN THE GUADIANA BASIN

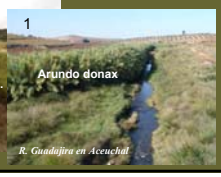
2. Improving Composition and structure of vegetation:

Present condition: (1)

Riparian vegetation degraded by flow regulation and grazing, with non-native species (i.e. *Eucalyptus*), abundance of *Rubus*, and very often dominated only by herbaceous communities

Restoration proposals: (2)

Controling grazing activities in the riparian areas and releasing ecological flow regimes to promote natural woody species regeneration



RESTORATION ALTERNATIVES FOR IMPROVING RIPARIAN LANDSCAPE CONDITIONS IN THE GUADIANA BASIN

3. Promoting Natural woody species regeneration:

Present conditions: (1)

Little natural regeneration in many riparian sites, due to agricultural practices, grazing, local fires and flow regulation

Restoration proposals: (2)

Controling farming activities in the riparian areas and releasing ecological flow regimes to promote natural woody species regeneration

RESTORATION ALTERNATIVES FOR IMPROVING RIPARIAN LANDSCAPE CONDITIONS IN THE GUADIANA BASIN

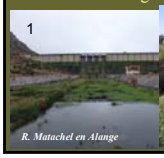
4. Assuring Lateral Connectivity:

Present conditions: (1)

Flow regulation and many channelized reaches, decreasing the flooding occurence for agricultural practices

Restoration proposals: (2)

Ecological flow regimes released by the dams including ordinary floods, and control of incision processes due to chan
removing lateral dykes and widening the



Ecological conditions of riparian areas in the Guadiana Basin (Upper and Middle Basin, Spain)

CONCLUSIONS

1. Present degradation of Guadiana Basin riparian areas is reflected mainly in terms of:
   - Fragmentation of riparian forest
   - Reduction of width of the space with natural riparian vegetation
   - Alteration of natural composition and structure of vegetation
   - Decrease of lateral connectivity

2. Main human disturbances come from AGRICULTURAL PRACTICES, which promote flow regulation and channelization, decreasing floodplain areas, lateral connectivity and natural species regeneration

Ecological conditions of riparian areas in the Guadiana Basin (Upper and Middle Basin, Spain)

CONCLUSIONS

3. Restoration activities should aim the objective of RECOVERING FLUVIAL NATURAL DYNAMICS, to restore morphological conditions and riverine landscape biodiversity.

   Releasing ecological flow regimes and leaving free space for the rivers are crucial for the success of the restoration processes


What is wrong?
What to restore ?