

HEDGES AND HEDGEROW PLANTING

3rd draft

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Description

Create a field margin composed of two sides and a inter-field area planted with trees, on or without bank. As for all the field margins, this landscape feature can be extremely various, in its own structure (e.g. width, elevation range), in vegetation cover (type and management of the trees and the two sides) and in location in the landscape. It aims to break the hydrological connectivity of the landscape, regarding surface and subsurface flow and to remove nutrients both dissolved and particulate ones.

Preexisting hedgerows have to be maintained and managed properly to provide the expected buffer effect on water quality.

Rationale, mechanism of action

Different functions relative to the water quality are associated to the hedge rows: 1) stop surface runoff, erosion, suspended sediment, and therefore all the associated pollutant (e.g. phosphorus, FIO) and solids (organic matter); 2) removal of nitrate by denitrification and plant uptake; 3) stop drift and increase the local deposition of NH₃ emission. A network of hedgerows (such as “bocage”) modifies the flow regime of streams and rivers, decreasing the peak flow by modifying surface, subsurface, and the inter storm flow, by modifying evapotranspiration on the catchment, and therefore can contribute to decrease the erosion of the river bank.

Thus the hedgerow has an effect on water quality, when the tree row is located such that the runoff goes across (surface flow pathways), and when the trees interact with the water table (subsurface flow).

Applicability

- Function 1 (stop surface runoff): direction regarding the slope, upslope conditions (length of the upslope plot), width or presence of a bank;
- Function 2 (modify flow regime): hedge density, root distribution, slope position of the hedges rows on the hillslope, particularly related to a potential interaction with the groundwater, ditches and streams.
- Function 3 (nitrate removal): hedge density, root distribution, soil depth; hedge row management (frequency, intensity)
- Function 4 (stop drift): height and permeability of the canopy, position according to dominant wind.

Practicability

Specific consultants are required (landscape management).

Effectiveness, including uncertainties

There is a total stop of erosion and particular P if bank sufficient and total un-connectivity from field to field. If not, depending of soil, saturated conditions,... Many uncertainties concern P cycling in such a system: the long term effect of P accumulation, and thus risk of P release; location of P storage in biomass of trees, and thus, recycling through dead leaves. No studies are known about this.

Nitrate removal from 50 to 80% can be locally observed in the surface of the groundwater, in fall time and for hedges that interact with a shallow groundwater. The efficiency of nitrate

removal depends on the contribution of this part of the groundwater to the stream flow, compared to deeper levels of the groundwater. This may represent few % at the year level. The level of N removal stays low and uncertain, depending of the interaction between water table and trees.

Time frame

Hedge rows are efficient on short and long term. On long term, the efficiency slightly depends on the management: chemical weeding on the sides of the hedge rows can contribute to degrade them. As any buffer area, the risk of P saturation of the soil exists.

Environmental side-effects / pollution swapping, e.g.

The hedge rows modify water fluxes in temperate regions. The higher the flow is, greater the density of the hedge rows on the catchment have an effect of the flow, increasing the interaction between tree and water table. In cold region this practices may increase moisture along the edge of the field and trap snow.

We can also notice other positive effects.

- Function 1: also remove fecal organisms, sediments, pesticides, ammonium-N
- Function 4: can also catch greenhouse gasses
- Other environmental functions: biodiversity, C storage in soil, atmospheric dispersion of seeds, climatic regulation (animal, crop,...), wind stop.
- Other functions: natural heritage, wildlife, biomass production (wood, milk, fruits, honey...), delineation of the farm boundary.

Relevance, potential for targeting, administrative handling, control

Easy to control visually. We can locate all the hedge rows network at any time by remote sensing.

Costs: investment, labor

Implementation requires a high investment. Management is required for weeds (two sides of the hedge rows) and tree (branches). There is no need for specific equipment. But an expert from extension service or a landscape planner is needed to design the hedge.

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