

A PLOT TREE STRUCTURE TO REPRESENT SURFACE FLOW CONNECTIVITY IN RURAL CATCHMENTS AND FACILITATE LANDSCAPE MANAGEMENT AND WATER PROTECTION

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Agricultural landscapes are structured by a mosaic of farmers' fields whose boundaries and land use change over time, and by linear elements such as hedgerows, ditches and roads, which are more or less connected to each other. Such man-made features are now well known to have an effect on catchment hydrology, erosion and water quality. In such agricultural landscapes, it is crucial to have an adequate functional representation of the flow pathways and define relevant indicators of surface flow connectivity over the catchment towards the stream, as a necessary step for improving landscape design and water protection.

A new approach is proposed to build the drainage network on the identification of the inlets and outlets for surface water flow on each farmers' field, estimating the relative areas contributing to the surface yield. The delineation of these areas and their links in terms of surface flow pathways provides us with a pattern of relationships between individual plots, i.e. going from each plot to the other plots over the entire catchment. If present, linear networks such as roads and hedge rows, or land use such as grasslands and woodlands modify this tree structure. The drainage network is therefore composed of a set of elementary plot outlet trees labelled by attributes while the global plot outlet tree represents the pattern of surface flow relationships over the catchment.

This drainage network has been applied to different catchment areas. It greatly reduces the number of objects in comparison with a drainage network made up of pixels or DEM cells. It provides a simple and appropriate way of representing the surface flow connectivity from plot to plot over the catchment, which leads to a functional display of data for decision support. It allows us to highlight the plots of potential risk regarding the surface runoff which are not very extended on the studied sites and mainly located closed to the stream. The results are discussed in front of suspended sediment budget and rating curves analysed at different temporal scales on these catchments. This analysis confirms the key role of the banks, the riparian zone and the artificial areas in the suspended matter export. This tool has been included and in different modelling approach (herbicide contamination) and in Territ'eau, an operational framework dedicated to implement mitigations measures

References

- Aurousseau P, Gascuel-Oudoux C, Squidant H, Trepos R, Tortrat F, Cordier MO, 2009. A plot drainage network as a conceptual tool for the spatial representation of surface flow pathways for agricultural catchments. *Computer and Geosciences*, 35, 276-288.
- Gascuel-Oudoux C, Aurousseau P, Doray T, Squidant H, Macary F, Uny D, Grimaldi C. Incorporating landscape features in a plot tree structure to represent surface flow connectivity in rural catchments. Submitted. *Hydrological Processes*.
- Gascuel-Oudoux C., Massa F., Durand P., Merot P., Baudry J., Thenail C., 2009. Framework and tools for agricultural landscape assessment relating to water quality protection. *Environmental Management*.
- Lefrançois J, Grimaldi C, Gascuel-Oudoux C, Gilliet N, 2007. Suspended sediment discharge relationship to identify bank degradation as a main source on agricultural catchments. *Hydrological Processes*, 21, 2923-2933.