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Connectivity: quantification, simulation and manipulation

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Connectivity is a useful framework for understanding the physical link between cause and effect. It also provides an attractive framework for communication with stakeholders, policy makers and practitioners. However, if connectivity studies are to be of practical use, the goals of connectivity mapping and dynamics must be carefully tailored to the question being asked. If the purpose is to address flood levels in a downstream village or town, then the water that caused that flood needs to be mapped back to its source. There needs to be an understanding of the flow generation processes and the flow pathway delivery mechanisms for example it maybe overland flow or drain flow that maybe the connectivity vector. Similarly, if the question relates to a downstream ecological habitat that is being degraded then the mapping of the upstream sediment and pollution sources and delivery mechanisms are required. However, it is important to recognise that connectivity changes in time and this can radically alter the mapping of the sources.
Examples of flow visualisation, indicating cause and effect, are presented at the hillslope and catchment scales. Finally to demonstrate the implications of disconnecting flow pathways will be shown for a joined up approach to flood alleviation and pollution management. The impact of soft engineered structures that can disconnect fast overland flow processes with high erosion power will be shown. Equally the potential to disconnect high flows from the main channel to the flood plain and to ponds will be demonstrated. The ability to optimise the connectivity pattern for a range of multiple hydrological and ecological issues will be introduced.