What factors affect runoff from agricultural land?

A review of research into surface water runoff from agricultural land has found that less intensive management leads to more predictable runoff generation over the course of a year. The review also identified several gaps in our understanding, which need to be better represented in hydrological models if the environmental impact of runoff is to be reduced.

Surface runoff from agricultural fields can lead to erosion, loss of productivity, and can affect water bodies by silting up reservoirs and increasing the flood risk. Agricultural runoff can also cause pollution and poor water quality.

The researchers examined the effects of a variety of agricultural land management techniques on surface water runoff at two different scales. First, how practices changed the conditions in a single field over time and how this affected runoff, including changes to soil bulk density, soil 'crusts', and roughness. At the catchment scale, the researchers looked at the effects of the size and layout of different fields or 'patches' and the influence of linear features, such as ditches, on the passage of water from one part of the landscape to another and on overall runoff.

Within a single field, no-till systems, where the soil is not disturbed between growing seasons, produced less annual variation in soil bulk density than conventional ploughing. Soil cover (such as a layer of organic material) changed more under conventional ploughing regimes than others. The seasonality of soil cover is one of the important factors affecting the formation of a soil crust, caused by rainfall, which influences runoff as it prevents rainwater infiltrating the soil.

At the catchment scale, the review found that there were no studies of the effects of field size on runoff, although studies of natural landscapes have shown that fewer patches (i.e. larger field size) reduced the amount of water that was retained and made available for plants by 25%. Finally, the review found that some linear structures, such as ditches, increased runoff by up to 30%. However, linear features that increase the distance runoff has to travel, or reduced flow rate can reduce run-off rates. Despite their strong influence on runoff rates, linear structures are often not incorporated into models of surface runoff rates in small catchments.

This research highlights that a better understanding of the range of land use factors that affect agricultural runoff is critical to underpin mitigation strategies. Until these large knowledge gaps begin to close, particularly in terms of the interactions between patches over time, the spatial organisation of patches and the interactions with linear features, such as ditches, the ability of hydrological modelling tools to predict agricultural runoff and contribute to reducing the environmental impact is limited, say the researchers.


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