

Understanding nutrient runoff



Which nutrients are important?

The two main nutrients used in cropping which have the potential to impact on waterways are **nitrogen** and **phosphorus**.

These nutrients are only a problem if they move from the crop to a location, such as a creek, dam, etc where they will have an impact (e.g. algal bloom).

High levels of these two nutrients in waterways can contribute to algal blooms, fish kills and a decline in water quality.

Nitrogen and phosphorus also occur naturally in the environment and agriculture is not the only source of these nutrients in runoff and waterways.

Nutrient runoff occurs in all land use environments – from forests to urban areas and agriculture. Algal blooms in waterways have been recorded since 1894 – long before the use of fertilisers began in the cropping industry.

Runoff and eutrophication occur naturally in the environment but can be exacerbated in conditions that encourage runoff and excess nutrient export.



Algal bloom in the Hopkins River, Glenelg-Hopkins Catchment and one of our water sampling points.

Nitrogen

Nitrogen is often the limiting nutrient for plant growth. This problem occurs because most plants can only take up nitrogen as the inorganic forms of ammonium or nitrate.

The majority of soil nitrogen is contained in soil organic matter. Organic nitrogen needs to be converted first to ammonium and then to nitrate by microbial decomposer communities before it can be used by plants. This process is called mineralisation.

Most plants obtain the nitrogen they need as nitrate from the soil solution. Nitrate is highly soluble and will move wherever water flows.

Phosphorus

Phosphorus is required in relatively large amounts for plant growth and is an essential component of soil organic matter.

In soil, phosphorus exists as phosphate, a chemical form in which each phosphorus atom is surrounded by four oxygen atoms. Phosphate is taken up by plants from the soil and returned to soils as organic residues decay.

When plant materials are returned to the soil, the organic phosphate will slowly be released as inorganic phosphate. This process is called mineralisation and is caused by soil microorganisms breaking down the organic compounds.

Phosphate can potentially be lost through soil erosion and to a lesser extent in water running over or through a soil (runoff).

Many phosphate compounds are not soluble in water. However, soil water and surface waters (rivers and lakes) usually contain low concentrations of dissolved (or soluble) phosphorus as orthophosphate.

Water bodies can also contain organic phosphorus and phosphate attached to small particles of sediment. These may not be released for many years, but given the right conditions these particles can release the phosphorus and increase the nutrient levels in the water body.

How nutrients move

There are two ways in which nutrients can be transported in runoff.

Nutrients can be dissolved in the surface runoff or attached to soil particles that are mobilised into the runoff by erosion.

Soil sediment or 'particulate' nutrients tend to settle out when water movement slows down. Particulate nutrients are easier to see in runoff. Dissolved nutrients go unnoticed because they are smaller than the size of a virus (<0.45 micron).

Dissolved nutrients are more environmentally damaging than particulate nutrients because they can be transported further into the water body. Dissolved nutrients are also more bioavailable to aquatic plants and organisms.

Grassed waterways and buffer strips slow water movement, help reduce the movement of particulate nutrients, but are not effective in reducing the movement of dissolved nutrients.

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Algal growth in a paddock where runoff is collected in Hamilton (Glenelg-Hopkins Catchment).



Runoff from the Hamilton paddock flowing through the flume where samples are collected. The samples are then analysed for nitrogen and phosphorus concentrations in the laboratory and compared with recommended stream concentrations.

Title photo: Cropping system in the Glenelg-Hopkins Catchment region where fertilisers and therefore phosphorus and nitrogen are most likely going to runoff into a water system due to the closeness of the crop to the water.

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