National Map Of Phosphorus Leaching

Soils are biological systems and require phosphorus to be available for biological growth. Following rainfall, some of that available phosphorus is lost by surface and subsurface flow. Surface flow occurs during intense rain; sub-surface flow (leaching) is the more common pathway. Excessive amounts of leached phosphorus can lead to the accelerated eutrophication of surface waters, which can in turn lead to the degradation of aquatic habitats. A measure of the amount of phosphorus readily available to periphyton in water is the dissolved reactive phosphorus (*DRP*), measured in milligrams of dissolved reactive phosphorus per litre of water.

According to McDowell and Condron (2004) the dissolved reactive phosphorus (*DRP*) of water (mg/litre) that has moved by sub-surface flow through a soil with an Olsen P (mg/kg) may be estimated by

$$DRP = 0.069 \left(\frac{Olsen\ P}{P\ retention} \right) + 0.007 \qquad (1)$$

where P retention is the phosphate retention in %. P retention may be obtained nationally from the Fundamental Soil Layers. Soil Olsen P is approximately twice the stock units per hectare minus 7 (Parfit et al., 2008; Clothier et al., 2007), and can be estimated from a national map of stock units (see pamphlet on **National map of stock units**).

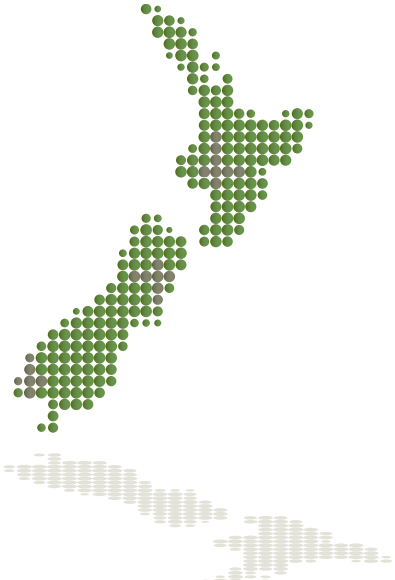
The quantity of dissolved phosphorus going into waterways from a hectare of land in one year may be estimated from the product of DRP (in equation 1) with the volume of water that runs off in one year from that hectare (see pamphlet on **National map of water yield**). This assumes that most of the runoff occurs as subsurface flow, as the DRP of surface flow is one third that of sub-surface flow (McDowell and Condron, 2004). Note that DRP is lost between soil and river by sorption in streams and sediment (Parfitt et al. (2008) reported 50% loss).

REFERENCES

McDowell, R.W., Condron, L.M., 2004. Estimating phosphorus loss from New Zealand grassland soils. New Zealand Journal of Agricultural Research 47: 137-145.

Clothier, B. and 9 others, 2007. Farm strategies for contaminant management. (http://www.horizons.govt.nz/assets/horizons/Images/one_plan/Farm%20Strategies%20for%20Contaminant%20Management%20June%202007.pdf - last accessed 13/1/11)

Parfitt, R. and 9 others, 2008. Best practice phosphorus losses from agricultural land. (http://www.horizons.govt.nz/assets/horizons/Images/one-plan-tech-reports-public/Best%20Practice%20Phosphorus%20Losses%20from%20Agricultural%20Landsmall.pdf – last accessed 13/1/11)



Contact John Dymond for access to data
e: dymondj@landcareresearch.co.nz • **p:** 06 353 4955
www.landcareresearch.co.nz

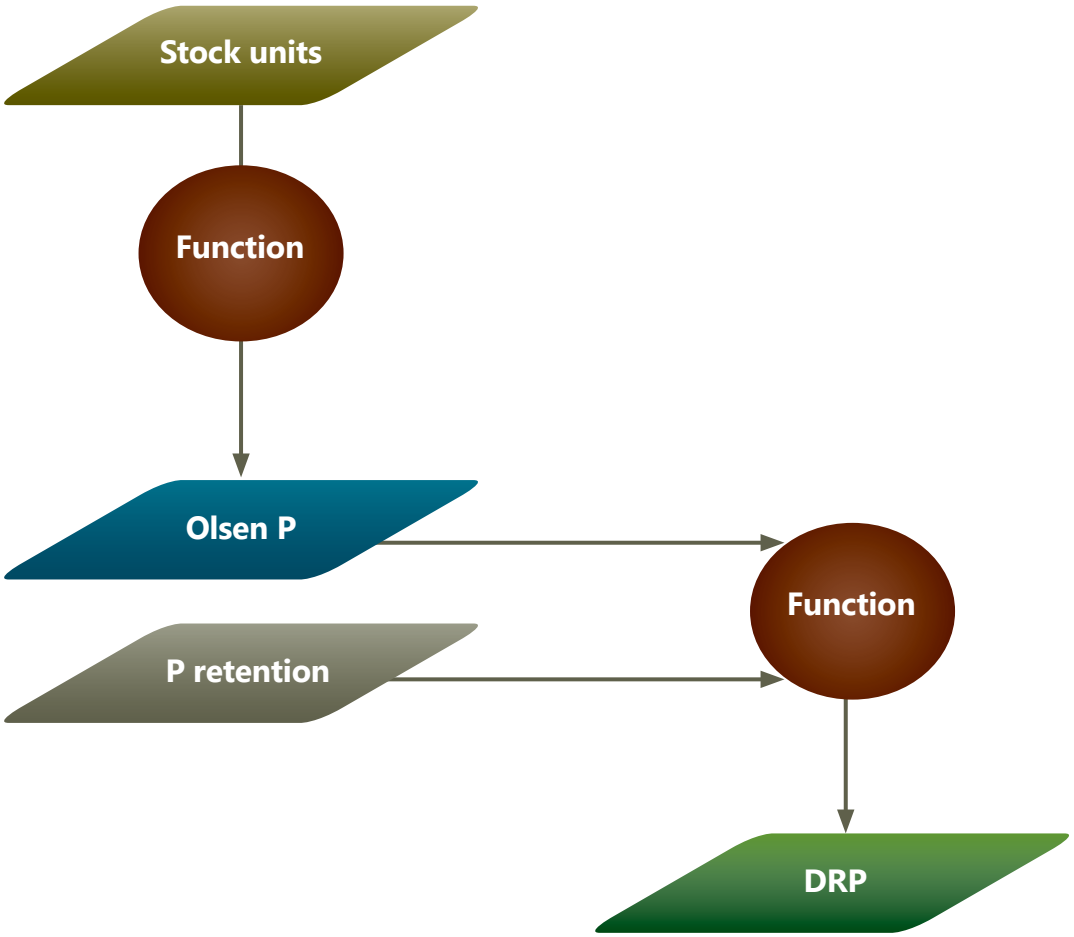


FIGURE 1: A national map of DRP may be made from national maps of animal stock units and soil P retention. Olsen P is an intermediate national map derived from the national map of animal stock units by assuming a linear relationship with animal stock units.

Stock units: 2003 national map of stock units per hectare at 100 m pixels. Derived from MAF 2003 district statistics and spatially extrapolated using NZLRI stock carrying capacity and LUNZ land use.

P retention: national map of P retention in soils at 100m pixels. Derived from Fundamental Soil Layers of New Zealand.

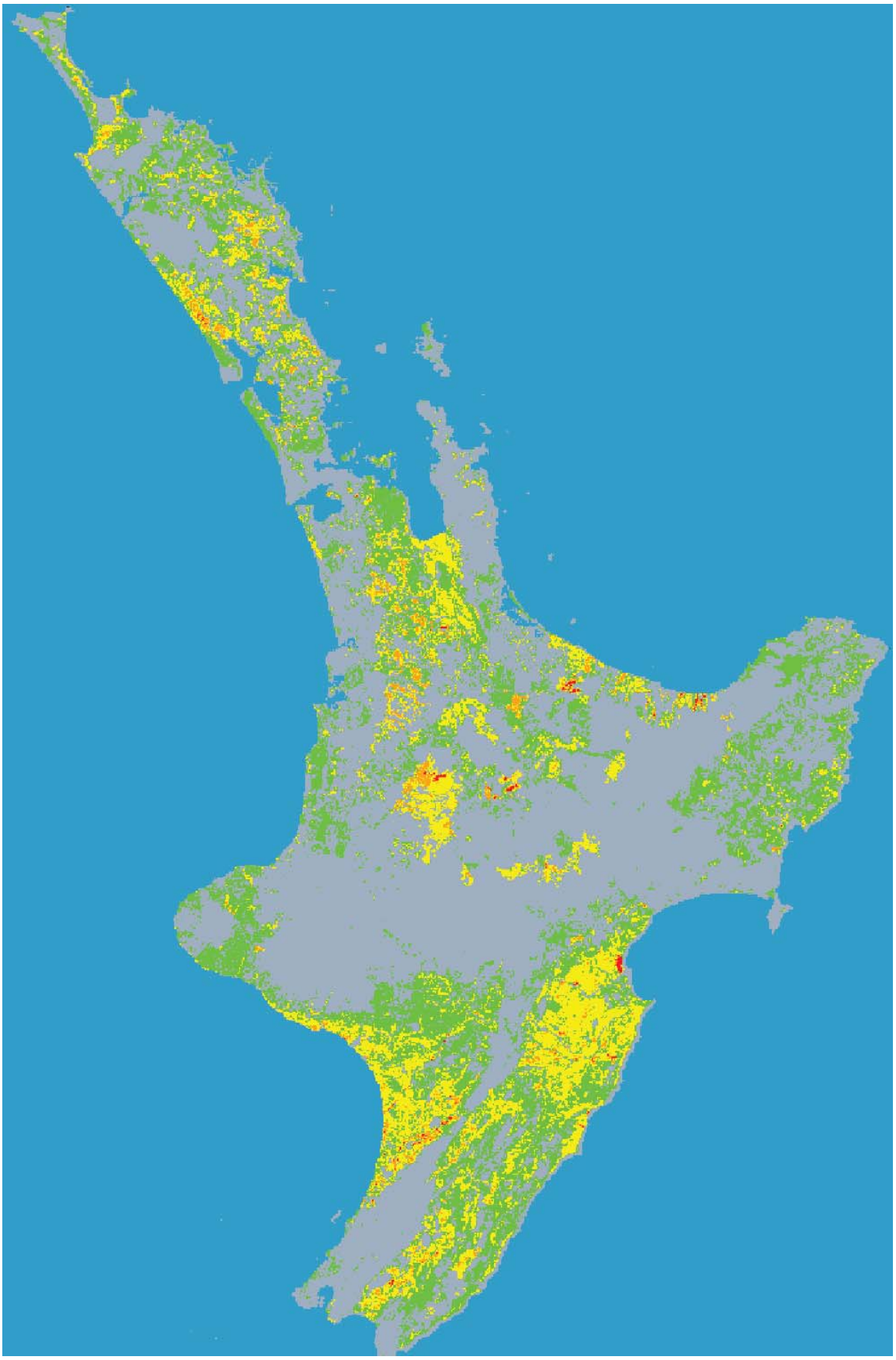


FIGURE 2: Leaching of dissolved reactive phosphorus in mg DRP/litre for North Island (100m pixels): grey (0–0.02); green (0.02-0.05); yellow (0.05–0.1); orange (0.04-0.2); red (>0.2).

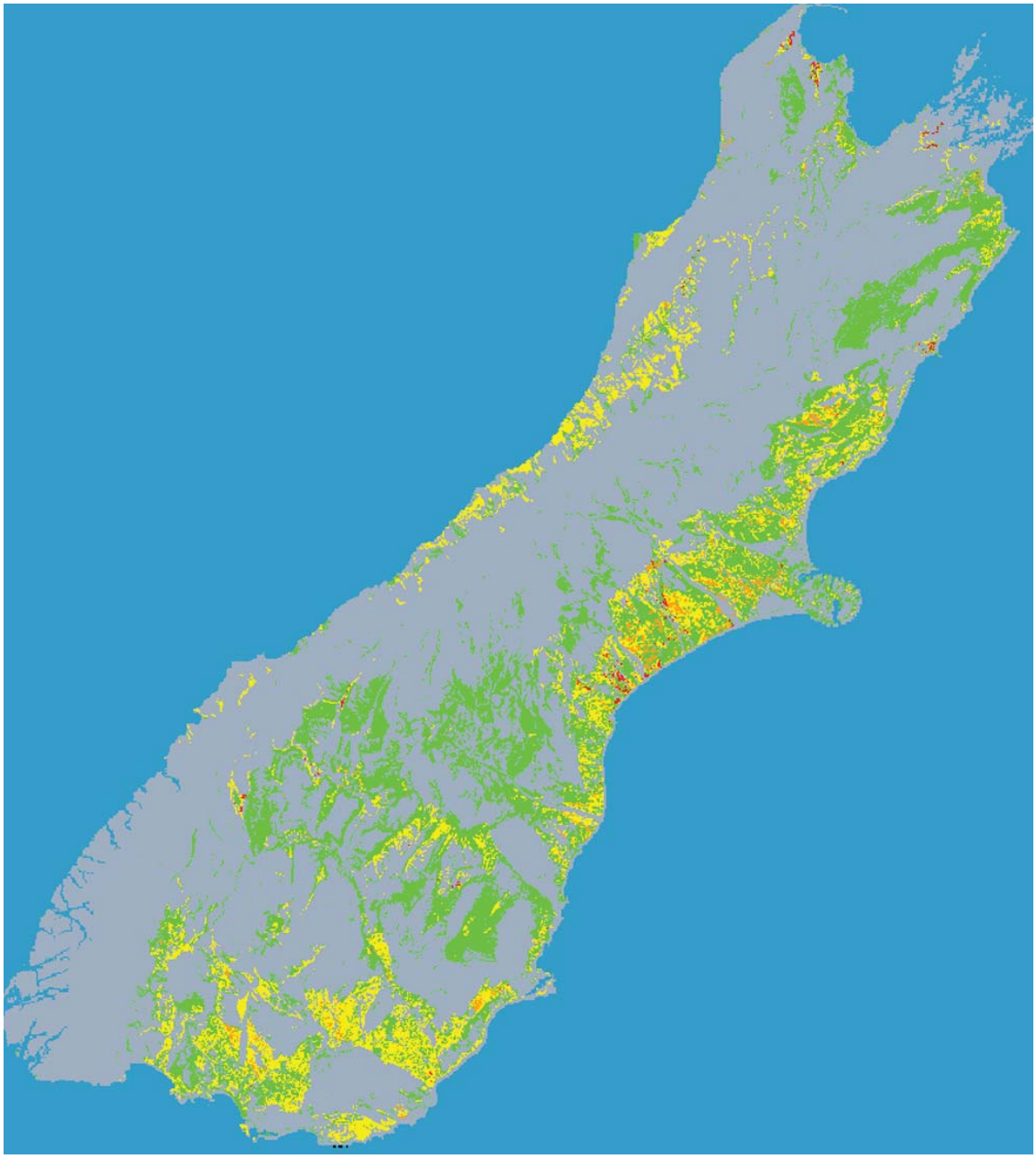


FIGURE 3: Leaching of dissolved reactive phosphorus in mg DRP/litre for South Island (100m pixels): grey (0–0.02); green (0.02–0.05); yellow (0.05–0.1); orange (0.04–0.2); red (>0.2).

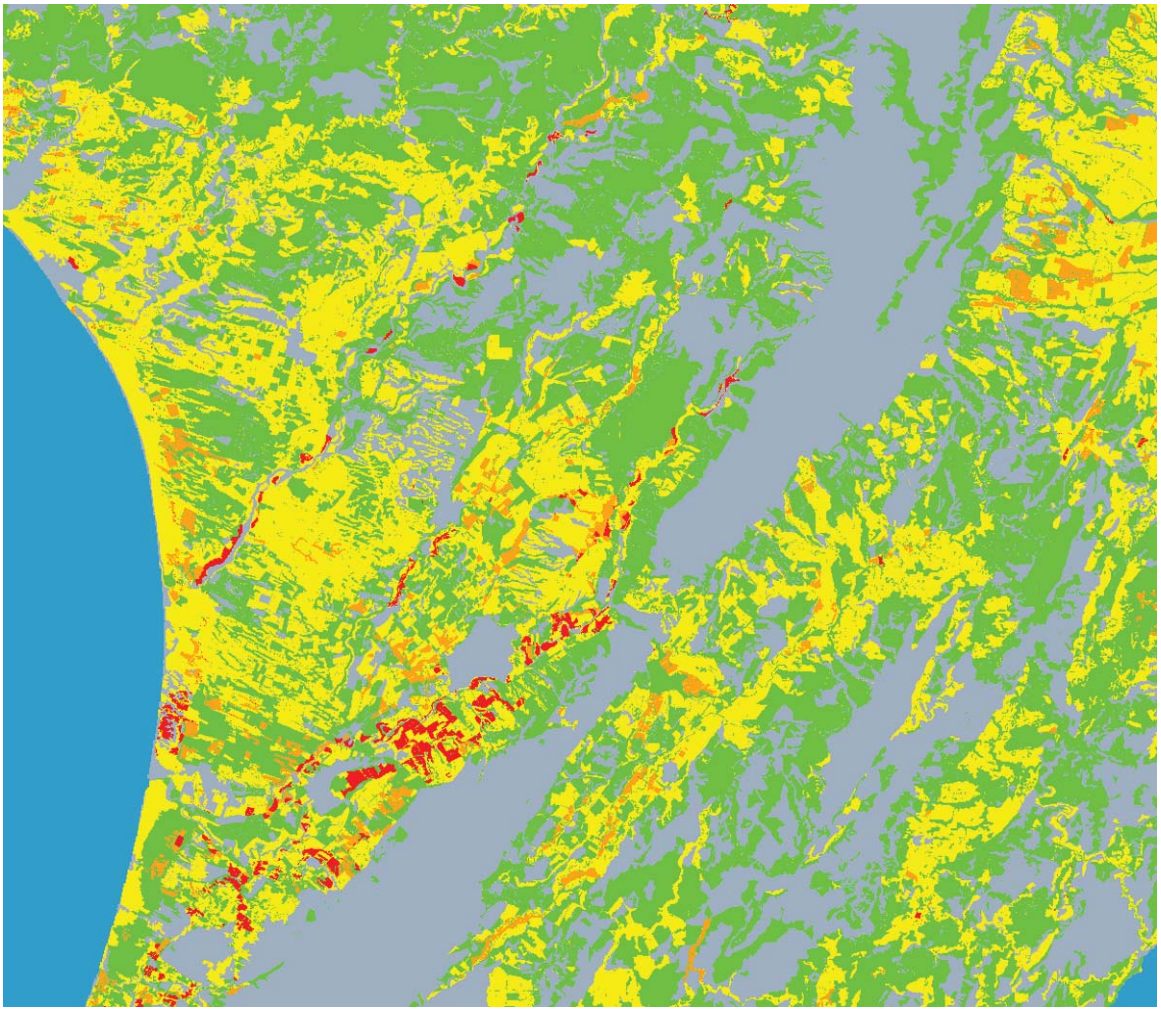


FIGURE 4: Leaching of dissolved reactive phosphorus in mg DRP/litre for central Manawatu (100m pixels): grey (0–0.02); green (0.02–0.05); yellow (0.05–0.1); orange (0.04–0.2); red (>0.2).