

Intensive Livestock Farming on New Zealand Hill Country Farms Creates Critical Source Areas of Potential Pollution

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Nitrogen (N) from animal urine is a major potential water pollutant coming from grazed hill pastures in New Zealand. To ensure access to world markets, food must be produced sustainably. This research programme identifies reasons for and location of potential critical source areas (CSAs) which might lead to cost-effective, practical opportunities to mitigate N pollution. Urine sensors and GPS units for cows and ewes located urination events. Motion sensor data, a GIS and statistical models, made it possible to predict sheep resting and urination sites in response to variation in pasture mass and quality, slope, elevation and aspect. Aggregated urination events, or potential CSAs, were widespread at higher elevations within sheep paddocks. Because resting and urination zones were heterogeneously distributed, yet highly auto-correlated ($r = 0.88$), maps of resting areas alone predicted CSAs ($R^2 = 0.82$). Cattle resting and urination areas were more pronounced, with 50% of urination events found in just 5-16% of paddock areas, generally in small, low-slope ($\leq 12^\circ$) areas of steep paddocks and frequently near waterways. Models located cattle CSAs using GPS resting and contour data only. Greatest urinary N loads per cow urination occurred at night. Because these will mainly be excreted in campsites, >50% of daily urinary N will be excreted and leached from campsites. Farmers can probably access most of these small, low-slope areas, to target mitigation strategies to reduce N leaching. Possibly contour maps alone might be sufficient to identify CSAs, while GPS tracking and mitigation records would prove resource consent compliance.