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Integrated agriculture modelling in a te ao Māori framework

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Abstract: New technologies will allow automatic gathering of high-resolution, cost-efficient environmental data. Three central challenges are interpreting the data, organising the biophysical data into the forms required by assurance schemes, and understanding trade-offs between costs and returns. Within New Zealand, Māori entities are leading the charge to build these technologies into their operations to guide commercial development strategies that meet their Kaitiaki (Stewardship) obligations while generating wealth to benefit their communities (Reid et al., 2022). Members and shareholders are also grappling with intergenerational social and cultural concerns.

Aerial hyper-spectral imaging, ground-penetrating radar and LiDAR can be combined via machine learning and environmental modelling to produce (near) real-time high-resolution data which may be used for assurance schemes. Their measurements can produce information about nutrient losses into the environment, biomass and sequestration, biodiversity, greenhouse gas (GHG) emissions, and hydrological flows (Reid and Castka, 2023). The information can inform markets and demonstrate compliance with regulations. Māori entities are looking to lead environmental intelligence initiatives, not only to monitor and manage their operations to ensure that they are meeting their own targets, but to also establish environmental intelligence systems, grounded in indigenous values, that can be applied more broadly. There are three challenges in building these systems.

The first challenge is interpreting the data. Although data collection is becoming cheaper, the raw observations need to be converted into useful metrics and assessments. This will require calibration research, boosted by machine learning on datasets that include both raw measurements and the target metrics, and assimilation of data into environmental models for factors of interest, such as hydrological flows.

The second challenge is organising the findings into appropriate frameworks. Typically, regulators, importers and consumers want to know whether a producer is compliant. Metrics need to be produced for each of the requirements and assessed against performance criteria, so data processing is necessary.

A third challenge is analysing metrics to account for the economic impacts of different practices, social and culture aspirations of owners, and strategies of land managers. Integration requires owners and managers to understand the relative weights and priorities that members and shareholder place on different impacts and outputs.

This research is focused on designing and building Kaitiaki (Stewardship) Intelligence Platforms in partnership with leading Māori collectives, and is taking the first steps towards creating the required integrated framework and connecting it to automated environmental monitoring with new technologies. It is identifying land managers operating in ways that generate positive environmental, social, cultural and economic impacts. It also aims to quantify the gap between them and other land managers and measure progress over time towards better outcomes.

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