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USING DRONE TECHNOLOGY FOR ENVIRONMENTAL COMPLIANCE

Gathering data with a drone

This article looks at the views of farmers, rural professionals and regulators on drone use for environmental compliance purposes. It also discusses the benefits they see in this type of technology and their concerns.

'Eye in the sky' – drones

Technological advances in recent years have led to the increased use of unmanned aerial vehicles (UAVs), or drones, for multiple roles on-farm such as moving livestock and spraying weeds. Meanwhile, the ongoing evolution of environmental regulations in New Zealand has brought challenges to all parties involved in environmental compliance, including farmers, rural professionals and regulators.

The farm plans that have been used to identify risks to and develop mitigation strategies for freshwater quality can be time-consuming and costly to develop and monitor. Can 'eye in the sky' drones help improve the efficiency of these environmental compliance processes? To find out, we set out to seek the opinions of farmers, auditors and regulators with the following research questions in mind:

1. How are drones currently used during on-farm environmental compliance processes?
2. What do farmers, auditors and regulators perceive as the benefits and concerns when using drones within on-farm environmental compliance processes?

Increasingly complex regulatory environment

Freshwater resources in New Zealand are under increasing pressure from agricultural activities, and as a result regulatory frameworks around on-farm environmental compliance have become more complex. The National Policy Statement for Freshwater Management came into force in 2014 and was amended in 2017 and 2020. Through this the Government mandates the implementation of a catchment-scale approach by regional councils to manage surface and groundwater. Each regional council then implements the national policy by first setting up their own regional policy statements, and then providing the mechanisms by which these regional policies can be implemented.

With each amendment and update of the National Policy Statement for Freshwater Management, the Government has set more and more strict guidelines around freshwater management. In response, regional councils around

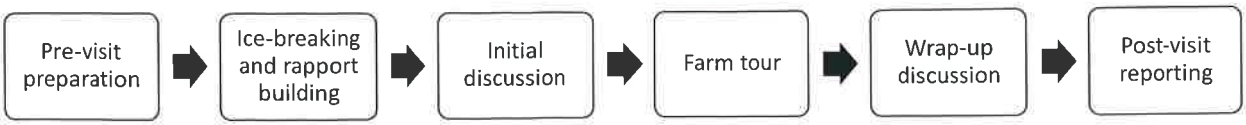

Figure 1: Stages in the Farm Environment Plan audit process incorporating drone use

New Zealand have developed their own policies and mechanisms to implement the national freshwater policy, with the aim of mitigating the negative impacts on the environment from human activities, particularly farming.

For example, Environment Canterbury (ECan) adopted the use of Farm Environment Plans (FEPs), with associated audits as their mechanisms for freshwater management. As the regulatory environment continues to evolve at both the national and regional levels, Freshwater Farm Plans and Integrated Farm Plans have become the new familiar phrases seen in the industry. Compliance processes are also becoming increasingly time-consuming and costly.

Can drones help?

To find out if drones can help improve the efficiency of these environmental compliance processes, we carried out a two-stage investigation:

- Stage I – involved field observations and semi-structured in-depths interviews conducted with eight farmers and three auditors in Canterbury between December 2020 and March 2021, then three more auditors in September 2021
- Stage II – involved eight in-depth interviews (12 participants in total) from central and regional governments (Southland, Otago, Canterbury, West Coast and Manawatu-Whanganui) conducted between March and May 2022. We used three short hypothetical scenarios for our Stage II interviews, to provide conversation platforms that could reduce participants' preconceived ideas about farming practices and related environmental topics.

Our Stage I research focused on drone use during the auditing of FEPs, but during Stage II, enquiries to the regulators about the potential use of drones for environmental compliance purposes were not confined to only auditing. Rather, we were interested in the idea of using drones for both constructing and auditing farm plans and sought the regulators' opinions on that.

Stage I research revealed that drones tend to be used in the farm tour stage (**Figure 1**), with auditors reporting that other stages in the process were undertaken in a similar fashion regardless of whether a drone was used or not. During the farm tour stage, the drone was flown by the auditor over key areas of interest on the farm for the audit, such as rivers and areas where livestock had been fed supplement.

Several factors (listed in **Table 1**) were reported to have an impact on the use of drones during an on-farm environmental audit.

Farmers and auditors interviewed during Stage I research identified three key benefits of using drones in an on-farm audit process:

- Improved confidence in decisions made during the audit process
- A reduction in time and therefore the cost of conducting the on-farm audit
- Improved health and safety while conducting the audit.

The farm context, both in general and on the day of the audit, influenced the degree of the last two benefits. For example, there is a clear advantage in using drones on an extensive sheep/beef operation, where it may take hours to drive around in a vehicle, but less than an hour to fly around

Table 1: Factors that influence the use of a drone during an on-farm environmental audit

Factor type	Factors	Details
Enabling factors	Farmer's permission	Farmer's permission to use the drone
	Suitable weather conditions	Wind – speeds less than 40km/hr
		Dry conditions
Operational factors	Technical factors	Auditor efficient at setting up the drone
		Footage visibility to farmer
	Drone flying procedure	Initial aerial orientation of the farm
		Clarification of farm boundaries

using a drone. These benefits were echoed by our finding in Stage II, where regulators also recognised the improved robustness of data-gathering for environmental compliance processes, as well as time and fuel savings on larger-scale properties and/or farms with a steeper land contour.

Concerns over drone use

It is not all good news when it comes to drone use, however, as all parties involved expressed some concerns over its use for environmental compliance purposes. These are summarised in **Table 2**, along with selected quotes from people we interviewed.

What became obvious to us in the process of uncovering people's concerns was that there was some confusion, and indeed at times conflicting ideas, about issues related to drone use for environmental compliance purposes, especially about the ownership and access of the drone footage. We have therefore selected some of the conflicting quotes to demonstrate this in **Table 2**.

In addition to some of the conflicting opinions displayed above, there were differences reported by regulators from different regions of the country about 'permitted' and 'consented' activities. While some of these differences reflect the geographical diversity of New Zealand, they nevertheless add confusion for farmers.

When we put the results from the two stages of the research together, it became apparent that there is a real lack of clarity within our current environmental regulatory framework, which hinders the use of technologies such as drones. We have demonstrated the causal links for such a lack of clarity in **Figure 2**, which was developed during Stage II of this research.

Table 2: Concerns over drone use for environmental compliance purposes

Concerns	Concerned Parties	Sample quotes
Issue verification	Farmer	There's going to be some sort of pugging and from the photo, it can look really bad, but then when you actually physically walk in the paddock and you think, 'Oh, that is actually not', it's like [the auditor] suggested, the depth – he said when he measured it himself, physically measured it – was, it's actually not as bad as it looks.
Reduced senses	Auditor	With the drones, that's only one of the senses; that's the vision ... have that, the hearing ... to listen to [how] things are working properly ... if you listen to it, we'll look at an irrigator going. Also smell, smell's a big one around effluent discharge, so you're missing a couple of senses.
Use of footage outside auditing purposes (linked to ownership of imagery)	Farmer	It's fine using whatever image you want ... for the audit, as long as those images weren't used by other ... groups... and then someone ... takes a photo ... and boom! ... so that'd be more of a concern.
	Auditor	So, the privacy, at what point do the images become private? That seems to be grey, isn't it? If an auditor is taking an aerial photo of the paddock, or whatever it is ... Whenever I asked Josh or Neil [pseudonyms], they were saying that they think technically the image is owned by the auditor, but the permission has to be sought before using the image for anything else. How did that work? ... It seemed to be vague ... Who owns the image?
Permission to capture drone footage for audits	Regulator	With auditors, if they want to use a drone on a farm, they would need to get permission from the farmer ... [But] under our warrant under section 332 ... we can take a drone on whether the farmer likes it or not.
Ownership and storage of footage	Regulators	The auditors [are] taking their footage on behalf of the Council, so the Council has a responsibility for owning that footage and securing that footage.
		It belongs to the farmer. Well, it belongs to the person who took it.
Access to the footage	Regulators	There's no reason for them to pass that imagery onto anyone else, but the farmer.
		It's not often explained to a farmer up front. Everything that's done through regional council processes is discoverable.

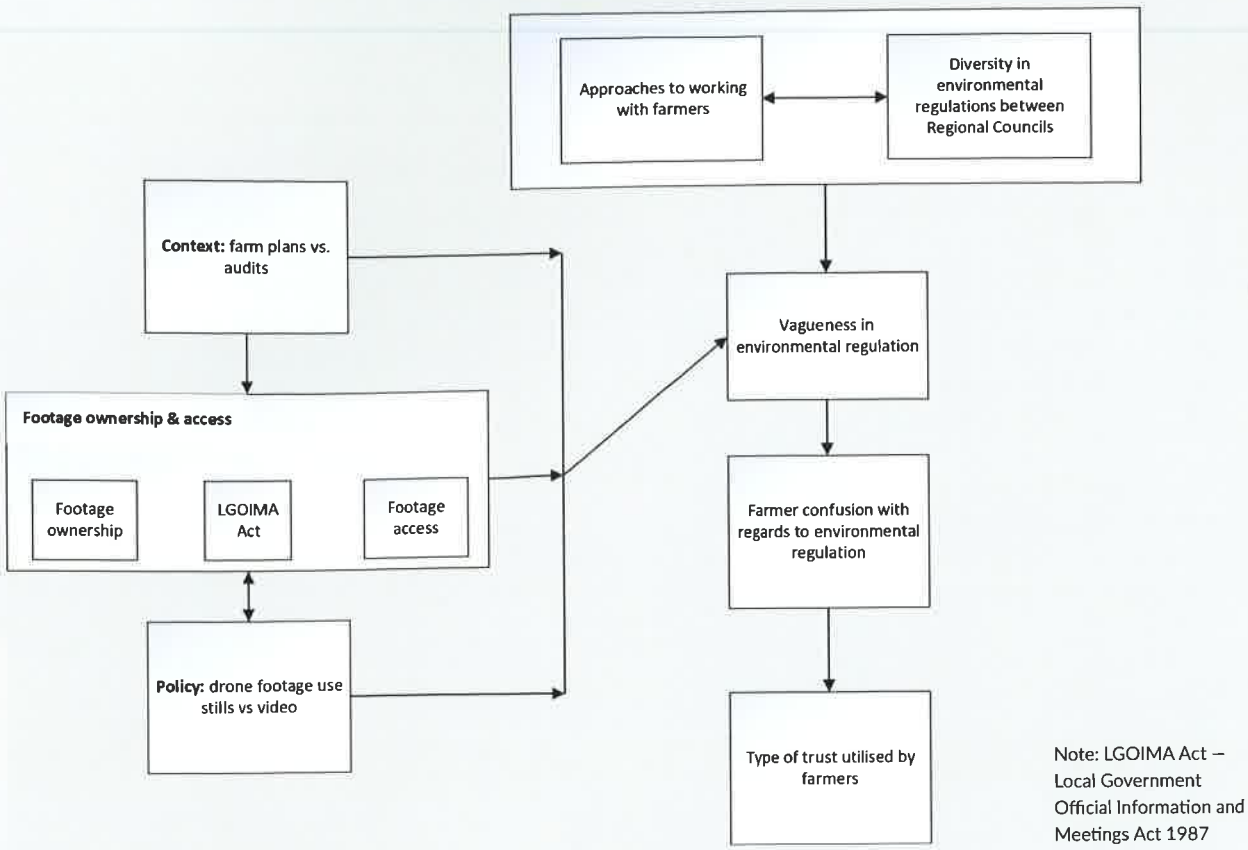

Figure 2: Causal links from lack of clarity surrounding implementation of regulations through to the type of trust that farmers used for drone use in environmental compliance

A misalignment of foci

Upon reflection on the results of the two stages of this research, what became apparent, yet perhaps unsurprising to many, is the misalignment of foci of the three stakeholder groups involved in this research. The three foci are:

- Farmers' focus – how to continue farming while complying with increasing environmental regulations
- Auditors' focus – how to audit farming to encourage good farming practices that are responsible for their environmental impact
- Regulators' focus – the robustness of processes in environmental compliance that can cater for diverse farming systems.

These different foci undoubtedly reflect each of these stakeholder groups' core businesses, and perhaps also the speed at which environmental compliance has evolved over the last decade. So much has happened within this regulatory environment over the last 10 years that everyone involved in it seems to be playing 'catch-up'.

Each stakeholder group therefore remain focused on their core businesses, with the aim to 'do a good job'. This misalignment of foci may, however, reflect a lack of understanding across the three groups. One would then wonder if the specific focus of each group driven by their own interests could perhaps overshadow the common goal – to reduce the impact of farming on the environment.

There were differences reported by regulators from different regions of the country about 'permitted' and 'consented' activities.

Our investigation set out to get a greater understanding about the view of drone use for the environmental compliance purposes of three different stakeholder groups – farmers, rural professionals who acted as auditors, and regulators. The original aims were relatively technical – to find out if these people believe that using drones could be helpful for the increasingly complex and time-consuming environmental compliance processes. What we uncovered is a far more complex dynamic that exists amongst those involved, which reflects the nature of processes that have human involvement.

Farmer-enhanced wetland mitigated sediment and nutrient loss

There is a fine balance to strike across farmers, auditors and regulators to cater to the interests of each.

To find a way forward within such complexity would require people working together with better communication and greater trust between each other. Indeed, both farmers and auditors that we interviewed recognised the utmost importance of a positive professional relationship for the environmental audit process.

The missing link, or a mismatch, appears to be regulators' fear of this trust being taken advantage of, leading to unjust processes. As bystanders, we see this fear may at times overshadow the ultimate goals of these environmental regulations – to encourage and guide farmers to be good stewards of the land and reduce the negative impacts of farming on the environment.

Drones useful under certain conditions

Drones can be useful tools to aid environmental compliance if used under certain conditions. Within New Zealand's environmental compliance framework, there is a fine balance to strike across farmers, auditors and regulators to cater to the interests of each while not losing sight of the common goal. Communication across these three groups will help the collective stay focused on the ultimate prize of reduced environmental impact from farming.

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