

Ride the sky pilot

FINAL EVALUATION FINDINGS

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Mahi Haumarū Aotearoa

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EXECUTIVE SUMMARY

Quadbikes and other farm vehicles are the main sources of serious harm and fatalities in agriculture. Reducing this harm is a priority for WorkSafe. Changing how and when farm vehicles are used is likely to reduce harm in agriculture.

During discussions in 2022, small unmanned aerial vehicles ('drones') were identified as a potential substitute for farm vehicles for some tasks on the farm. A literature review identified no robust evidence that drones did result in farmers using their vehicles less. To address this gap, Ride the Sky was established as a pilot to test if providing drones to farmers would reduce their use of farm vehicles.

The pilot involved providing farmers with a DJI Mavic drone and training. The pilot was structured to allow a pre-post evaluation of intervention efficacy. Data on farmers' use of farm vehicles were collected using a GPS tracker attached to their farm vehicle(s). This data covers 1 year before the drone and training were provided, and 1 year after. The GPS data was supplemented with semi-structured interviews conducted with farmers approximately 3 months after they were given the drones.

A staggered rollout of the intervention was undertaken due to both the practicalities of data collection and the limited availability of the training provider. Data collection occurred from 2022 to 2025. The final data for Ride the Sky was received in December 2025. Of the 15 farms who participated in the pilot, 11 had usable pre- and post-data on farm vehicle usage for analysis.¹

Analysis of the combined pre- and post-GPS data collected for Ride the Sky has found no statistically significant change in either time or distance of vehicle usage post-intervention compared to pre-intervention. Therefore, combined GPS data does not allow a statement on what impact a nationwide campaign to promote drones might have on farm vehicle usage. When viewed on a farm-by-farm basis, the results are mixed:

- 4/11 showed a significant decrease in driving distance
- 1/11 showed a significant increase in driving distance
- 6/11 showed no significant change in driving distance
- 3/11 showed a significant reduction in driving time
- 3/11 showed a significant increase in driving time
- 5/11 showed no significant change in driving time.

Pre-implementation interviews with the farmers have previously suggested that they found drones useful but that there were limitations to their usage, particularly in hill country or during adverse weather. Additionally, while most farmers said that they found the drones particularly useful for a range of tasks, this was not a universal sentiment. For example, cattle farmers felt that drones would be more useful for sheep farmers.

The mixed results, and the results of the semi-structured interviews, suggests that drones may be more suitable as a substitute for farm vehicle usage on some farms but not on others. A larger, more detailed study would be required to ascertain for which farms drones are a suitable intervention to reduce farm vehicle usage and which ones are not.

Despite these results, Ride the Sky has demonstrated the feasibility of piloting engineering interventions, such as drones on New Zealand farms, and provides a model for potential intervention pilots going forward. It also demonstrates that pilots need to be sufficiently large enough to demonstrate intervention efficacy.

¹ The contracted data provider was contacted several times for more complete data on 2 of the farms but did not respond to requests.

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1.0

Introduction

IN THIS SECTION:

- 1.1 Why the research was conducted
- 1.2 About the research and pilot

1.1 Why the research was conducted

As health and safety regulator, WorkSafe's role is to influence businesses to meet their obligations under the Health and Safety at Work Act 2015. Businesses must do all that they can to keep people safe at work.

Farm vehicles are a major mechanism for fatalities and week away from work injuries in the Agricultural sector particularly in livestock farming. Their prevalence as mechanisms of harm makes them a primary focus for WorkSafe's activities to reduce harm in the agriculture sector.

During discussions in 2022, small unmanned aerial vehicles ('drones') were identified as a potential way to reduce farm vehicle usage. The logic underpinning the intervention was that the camera feed allowed drones to function as substitutes for farm vehicles for some tasks, such as farm maintenance and stock management. Every task completed by the drone was one in which the farmer was not using their farm vehicle.

A literature review identified no robust evidence that drones did result in farmers using their vehicles less. It was suggested that piloting an intervention would address this gap in the literature and establish if WorkSafe or ACC should pursue a nationwide intervention to promote drones to farmers.

1.2 About the research and pilot

The pilot, called 'Ride the Sky,' was conducted from 2022 to 2025. It tested the hypothesis that providing New Zealand farmers with simple quadcopter unmanned aerial vehicles ('drones') would reduce these farmers' use of their farm vehicles. There were 3 major assumptions underpinning the piloted intervention:

1. farm vehicles can be replaced by drones for some tasks
2. replacing quad bikes and side by sides with drones will reduce farm vehicle usage
3. reducing the use of quad bikes will reduce vehicular injuries in agriculture.

The pilot and evaluation tested the first 2 assumptions. The third assumption, regarding the reduction of vehicular injuries, was not tested. Instead, the pilot proceeded with an assumption that for every 1 percent reduction in farm vehicle usage (either measured by time of usage or distance travelled) there would be a corresponding once percent reduction in farm vehicle harm.

The piloted use of drones as a replacement for farm vehicle usage aligns WorkSafe's hierarchy of controls as a substitution measure. The hierarchy of control measures outlined in the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 states that "if it is not reasonably practicable to eliminate the source of risk then a PCBU must take 1 or more of the following actions:

- a. substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk
- b. isolating the hazard giving rise to the risk to prevent any person coming into contact with it
- c. implementing engineering controls."

These controls are deemed more effective than either personal protective equipment (PPE), such as rollbars or helmets, or administrative controls. Thus, the intervention piloted in Ride the Sky constituted a test of a high-level risk control that had the potential to substantially reduce serious harm and fatalities in the agriculture sector.

2.0

Methods

IN THIS SECTION:

2.1 Pre-post output evaluation

2.2 Process evaluation

The pilot was designed as a mixed-methods pre-post study on farms across New Zealand.

The main evaluation consisted of a quantitative output evaluation measuring farm vehicle usage for 1 year before and after the drone and training were provided. This quantitative component was supplemented with a small qualitative process evaluation consisting of interviews with participating farmers.

Fifteen farms were recruited for the pilot in early 2022. Farmers were invited to join the pilot through an advertisement in a farming newsletter. Farms involved in the pilot needed to:

- agree to partake in the pilot for 2 years, and
- currently employ at least 1 quadbike or side-by-side in daily work operations.

One farm requested to withdraw from the pilot during the second year, resulting in 14 farms completing the pilot.

Farmers were provided with GPS trackers. The trackers were fitted to 1 to 4 of their farm vehicles, for a period of 2 years, funded by WorkSafe New Zealand. After 1 year of data collection these farmers were given the intervention: a single DJI Mavic drone and a full day training in how to use the drone. GPS tracking continued for another full year after farmers were provided with the training and equipment.

The GPS trackers allowed WorkSafe to measure the daily distance travelled and time of use of each of the fitted farm vehicles. A full year of pre-intervention and post-intervention data was necessary to account for seasonal variation in farm vehicle usage.

To supplement the pre-post GPS data, WorkSafe carried out semi-structured interviews with 10 of the participating farmers. These interviews took place several months after the drone was provided. They aimed to identify what farmers were using the drones for, any issues with operating the drones, and any recommendations for improvements they might have for WorkSafe going forward.

Participating farms received 1 DJI Mavic drone. Training was delivered by a single trainer, funded by WorkSafe New Zealand. For their participation, the farmers were entitled to keep the drones at the conclusion of the pilot. Additionally, WorkSafe funded insurance for the drones for the duration of the pilot and paid for the installation and upkeep of the GPS tracking devices.

Because of the limited resources for training and the time involved in onboarding farms, the pilot involved a staggered roll out of drones during the 2023/24 financial year. Two of the farmers who signed up for the pilot already used Fleetpin, a GPS tracking and fleet management provider, to track their farm vehicle usage. Both farms agreed to provide their previous year's data to WorkSafe. This provided the baseline pre-intervention measure for both farms and allowed the intervention to be rolled out to these farms in 2022.

2.1 Pre-post output evaluation

The aim of the pre-post output evaluation was to measure changes in exposures to hazards before and after the intervention. The assumption was that reduced usage of farm vehicles would also reduce exposure to farming hazards, and a reduction in harm experienced. Measuring reduction in farm vehicle usage provides a high-quality proxy measure of the intended impact of the intervention.

The plan was for all vehicles, on each farm, to be tracked. This was deemed necessary to capture accurate data of farm vehicle usage. Due to an error, only 1 to 4 vehicles were tracked per farm. It was noted that the use of untracked vehicles' may have impacted the observed changes in tracked vehicle use during the pilot period.

Observational data was collected for the pilot using the 'Fleetpin' GPS system, to allow the tracking of distances travelled and times of engine activation of farm vehicles fitted with devices.

The GPS devices allowed reliable usage data to be collected automatically. Automatic data collection ensured that data collection was consistent between participants and, over time, allow a degree of combined analysis of all farms that completed the pilot. Furthermore, it reduced the burden of data collection for participants and likely reduced the dropout rate in the pilot.

A full year of post-intervention data on farm vehicle usage was collected after farms were provided with drones. A complete year of both pre- and post- data was necessary because of the expected variability in farm vehicle usage throughout the year.

Data analysis

The data was analysed for normality using a Shapiro test. Data identified as normally distributed was analysed using the standard paired t-test. A paired t-test is testing whether the mean difference between 2 paired measurements which follow a roughly normal distribution is zero.

$$H_0: \mu_{post-pre} = 0$$

In instances where the data failed tests of normality, analyses were conducted using both the Wilcoxon signed-rank test (non-parametric) and Yuen's paired t-test with 5% trimmed means (robust alternative to the paired t-test).

Wilcoxon Signed-Rank tests compare the median of the paired differences:

$$H_0: \text{Median}_{post-pre} = 0$$

Whereas Yuen's paired t-test compares trimmed means (μ_t) of the paired differences which is resistant to outliers:

$$H_0: \mu_{t(post-pre)} = 0$$

Both tests are alternatives to the standard paired t-test. Generally, the results from the Yuen's t-test should be preferred over those of the Wilcoxon Signed-Rank test because it reduces the influence of outliers, works well when data are skewed or heavy-tailed, keeps good statistical power compared to other non-parametric tests, and makes the test more robust than the standard t-test. However, results for the 2 alternative tests showed the same significances in all cases, except for the change in driving time for farm 5 which was significant using Yuen's t-test but not using the Wilcoxon Signed-Rank test.

2.2 Process evaluation

After the intervention was rolled out, interviews were conducted with participating farmers as part of a process evaluation to get initial feedback on how the training went, and how farmers were finding the drones. It was also hoped that interviews might provide potential explanations for findings of the outcome evaluation.

Initially, it was envisioned that an external research company would conduct the interviews and provide WorkSafe with anonymised transcripts of the interviews to be analysed. This avoided the potential risk of participants revealing breaches of HSWA 2015 and encouraged participants to be more candid if they had critical feedback about the pilot. After the initial 2 interviews were conducted, a decision was made to bring the evaluation in-house.

The remaining 13 farms were contacted to be interviewed by the lead evaluator. Participants were sent an invite to be interviewed with a consent form and information about WorkSafe's privacy policy. They were reminded of the key principles in both, particularly that the interview was voluntary and the contents would be anonymised except in the case of the participant revealing a severe breach of HSWA, which would have to be reported to WorkSafe's Inspectorate.

Seven of the 13 farmers agreed to be interviewed, with interviews being conducted in 2023 and 2024. The interviews were recorded and transcribed by the interviewer. The recordings were subsequently deleted after transcribing and the transcripts were anonymised.

3.0 Results

IN THIS SECTION:

- 3.1 Impact on farm vehicle usage
- 3.2 Combined results
- 3.3 Individual farm usage
- 3.4 Interview themes

3.1 Impact on farm vehicle usage

A total of 14 farms completed the intervention and had GPS data provided to WorkSafe for at least 1 vehicle, with a total of 31 vehicles providing at least some usable data. The evaluation team were interested in whether there had been an overall reduction in farm vehicle usage across all participating farms, as well as how many individual farms had shown a reduction in vehicle usage after the intervention.

The data of 11 vehicles was incomplete. Of the incomplete datasets, 5 included data for at least 6 corresponding months pre and post intervention and were included in the final analysis. The other 6 vehicles' data was not of sufficient quality to analysis and were excluded from any analyses. This meant that farms 13 and 14 had to be excluded from any analysis.

In addition, it was discovered during the interviews that 1 participating farmer (farm 10) had moved farm shortly after receiving their drone, excluding that farm from any analyses as well. In total, 11 farms with data from 23 bikes were included in the pre- and post- analysis.

The GPS partially failed on 2 vehicles and driving distance and engine time was reported as tow distance and tow time, respectively. After discussion with the data provider, it was decided to include these 2 bikes but to sum the driving and tow distances ('distance') and engine and tow times ('time') to account for this error. The same summation was applied to all farms' usage data.

Driving distance was provided in kilometres travelled in each trip, whereas time data was converted from hours/minutes/seconds into seconds for each trip.

3.2 Combined results

As shown in Table 1 below, when all remaining farms data were combined neither the driving distance data or time of operation passed the Shapiro test for normality. The Yuen's paired t-test found a small, non-significant difference in both driving distance (p-value = 0.42) and operation time (p-value = 0.83) which was confirmed by the Wilcoxon signed-rank test (p-value = 0.11 and p-value = 0.89 respectively).

	SHAPIRO TEST (normality)	WILCOXON SIGNED-RANK TEST (2-tailed)	YUEN PAIRED T-TEST (2-tailed)	RESULT
Distance	×	Test statistic = 3839524 p-value = 0.11 $\alpha = 0.05$	Trimmed 5% Test statistic= 0.79 p-value = 0.42 $\alpha = 0.05$	p-value > α No significant difference between before and after intervention
Time	×	Test statistic = 3781246 p-value = 0.89 $\alpha = 0.05$	Trimmed 5% Test statistic = -0.83 p-value = 0.40 $\alpha = 0.05$	p-value > α No significant difference between before and after intervention

TABLE 1: Distance and time results for combined usage from 11 farms

3.3 Individual farm usage

Paired t-tests were performed on the usage data for 11 farms with sufficiently high-quality evidence. A simple summary of results is shown in Table 2 and discussed below. Detailed results of the analysis are available in Appendix 1.

FARM	DISTANCE RESULT	TIME RESULT
1	No significant change	A significant increase
2	No significant change	No significant change
3	A significant increase	A significant increase
4	A significant decrease	A significant decrease
5	A significant decrease	A significant increase
6	No significant change	No significant change
7	No significant change	No significant change
8	No significant change	No significant change
9	A significant decrease	A significant decrease
11	A significant decrease	A significant decrease
12	No significant change	No significant change

TABLE 2:
Simplified distance and time results for each farm

Individual farm distance results

In terms of individual farms, only 3 passed the Shapiro test for normality (farms 1, 2 and 3). Of these 3, 1 (farm 3) showed a significant increase in farm vehicle distance travelled. Of the remaining 8 farms, 4 showed significant reductions in farm vehicle distance travelled using a Yuen paired t-test (farms 4, 5, 9, 11).

This means in total 4 of the 11 farms showed a significant reduction in farm vehicle distance travelled from the intervention, 1 showed an increase and 6 showed no statistically significant change.

Individual farm time results

Seven of the farms time data passed the Shapiro test for normality (farms 2, 3, 4, 8, 9, 11 and 12). Of these, 3 showed a significant reduction in time of farm vehicle distance travelled (farms 4, 9, 11) and 1 showed an increase in time of use (farm 3). Of the 4 farms that did not pass a Shapiro test for normality, 2 showed an increase (farms 1 and 5).

This means that in total 3 of the 11 farms showed a significant reduction in the total farm vehicle usage time after the intervention while 3 showed a significant increase.

3.4 Interview themes

As noted previously 2 phase 1 farmers were interviewed by an external research provider, and 7 farmers were conducted by the internal WorkSafe researcher for a total of 9 interviews.² Interviews were conducted approximately 3 months after the training. There was a trade-off between conducting the interviews shortly after the training while farmers' memories were fresh, and later after they had experience with using the drone. Three months provided a balance between recency and time to get experience with the drones.

² The remaining 5 farmers either did not respond to an interview request or declined to be interviewed.

The interviews aimed to capture how farmers found the training, what their initial experience with using the drones was, and if they had experienced any issues with the drone. The 2 externally conducted interviews were conducted face to face, whereas the internally conducted interviews were over Microsoft Teams as a cost saving measure.

What are drones being used for?

Participants reported using the drones for the following tasks:

- moving stock (both cattle and sheep)
- checking fencelines
- checking water tank levels
- checking for cast or bearing sheep during pregnancy.³

In all cases, the farmers reported feeling that the drone was both safer and quicker than a farm vehicle.

Farmers used their drones to check water tank levels and fencelines. The drone, with its powerful camera, allowed them to check if fences were intact (particularly after storms) and if water tank levels were getting low without having to drive out to check in person. If there were issues identified by the drone, the farmer would have to drive out to address the issue, but drones were seen to make maintenance checks safer and more efficient. Some examples given by farmers were:

“So we can check them, check the fences on the waterways, you know we’re in the [area] and there is fence all the waterways off, it’s good getting all of that, it saves you doing it.”

“You might notice that the electric fence voltage is down so you’re thinking why the hell is that, and you can use a drone to go up fly up the fence and see what the problem is. So that’s quite good, really good actually.”

“I use it for many things, checking boundary fences, trying to find holes in the fences where sheep are escaping into the forestry blocks and stuff.”

“I’ve been using it to check some water supplies and some fence lines.”

“We’ve used it to check fence lines so, if we know something has gone through, rather than going up with the wrong gear we fly along the fence line and check what the hole is and what it looks like, so what we need. And then we’ve just got to go up once.”

Identifying cast or bearing sheep was seen as particularly valuable because this task was extremely quick using the drone’s powerful camera but was extremely time consuming to do on a vehicle:

“We can fly around the farm and look for cast sheep and the idea is that we fly above the farm to a good enough height so that we can just look down. And you can, if you’re a good stockman you can tell by how the animal is behaving as to whether they are in trouble, like obviously if they are cast they are lying on their backs with their legs in the air, but you can check out their demeanour. A ewe having difficulty birthing, so as I can say, we can fly around with the drone and zoom in on them and have a look on them.”

“Mainly I’ve used it during lambing time so if you know, when we didn’t have that I was sort of driving, driving around my ewes and you know checking on them.”

³ A cast sheep is one that has rolled onto its back and is unable to right itself, requiring immediate human assistance within hours to avoid fatality.

Once the farmer found cast sheep, they needed to drive to right the sheep, this still saved time and farm vehicle usage:

“[if] it’s properly cast well you know that you’ve got to go there. And the saving is that you’ll go right to it, you know where it is, so you’ll go directly to it rather than just wandering around the farm looking for cast sheep.”

Identifying cast or bearing sheep more quickly made the farmer able to intervene in time, saving the sheep and lamb. Consequently, sheep farmers thought that the drone could easily pay for itself through lowering stock losses, an unintended positive outcome.

Cattle and dairy farmers reported using drones less for stock welfare probably because cows face fewer risks in calving than sheep. The drone could still be used to check on cattle to make sure they were not stuck, in danger, or had not escaped a paddock.

It is also viable to use drones to move stock. Several farmers commented that they were using the drone for this purpose:

“I’ve been using it to actually muster the sheep out of forestry blocks that are not ours, you know, escaped sheep [...] and we used that instead of having to drive the bikes in.”

“We can put it up and it’ll look over the field for you, and you can fly it at the sheep and they’ll run. You don’t even need to get that close to be honest, you can just be hovering and they’ll start running, they really don’t like it.”

The usefulness of using drones in moving stock was mixed, with some farmers finding the drone less useful than dogs and vehicles, particularly as stock get used to the drone:

“It doesn’t really seem to affect the sheep as much as cattle. Sheep don’t really tend to actually move off it too much. The cattle sort of don’t like it. But the sheep it doesn’t really tend to phase them too much.”

“I think they get used to it too, like you’re out there just about every day. If the weather’s fine. To start you can see them looking at it, but towards the end they just carry on.”

One farmer suggested that the drone would be more useful in moving stock if it had some form of noise maker on it as they found their stock were curious about the drone but not concerned enough about it to move away.

“The noise, barking would be, that would be a big plus for mustering.”

When asked, farmers felt that the usage of the drone would peak around lambing and calving seasons (August to October). However, this expectation was not evidenced in the usage data, with no significantly higher drop in quadbike usage in these months compared to other months.

Farmers also found creative uses for the drones, including helping with pest control, (for example, checking traps or spotting larger pests such as pigs, forestry management – both using the camera) as well as to carry ropes on to branches. These activities were not part of everyday farming, but are tasks that traditionally use farm vehicles. The use of a drone instead is likely to also reduce farm vehicles usage.

Despite this, the interview findings contradict what is observed in the GPS data. Three months into the intervention, most interviewees stated that they felt the drone had reduced their vehicle usage, although the GPS data did not show reductions on most farms.

The results for farms 3 and 5 suggest that farmers were not reliably able to identify if the drone had reduced their quadbike usage. GPS data from farm 3 found a significant increase in both distance and time of vehicle usage, however the farmer felt that: "I think [the drone] will have definitely lowered my [kilometres] on the bike".

In contrast, farm 5 saw mixed results, with a significant decrease in distance travelled but an increase in time of usage. The interviewee from farm 5 stated that "I thought it was going to be more of a game changer than it honestly has been" and noted that they were unlikely to purchase another drone.

Training experience

All participants enjoyed the training and found that it covered the relevant topics and adequately taught them how to use the drone. For example:

"I thought it was quite thorough, he spent a lot of time with us."
 "You walked away from the training with an idea of what to do and then it's pretty much just get out and fly and see what it can do."

Several participants noted that the training was informative and added confidence in using the drone.

"Training was, was good, was around safety of using the drone. And they'd give me quite a few ideas that I wouldn't have thought of, thought about before."
 "We spent a full day being trained on various things about the drone, all the health and safety um what I'm liable for if there's an incident, what I can and can't do. You know it was really quite good because most people who buy a drone just walk into Noel Leeming and just buy it and don't really understand, because, because I was blown away with what he was telling me that we need to know. So, it was a really good day with that, that trainer, I'm really glad I learned to fly you know a drone with him."

The mix of practical and theoretical training was commented on as being suitable and avoiding boredom while covering various legislative and manufacturer requirements. For example:

"It was really good. He came we went straight out and did some flying. He showed us the things and we went out flying. And then it was like starting to rain so we came inside and did all of the paperwork and all of the learning stuff and then we went back out and we flew again after the end of it."

The face-to-face nature of the training was particularly important to farmers, with the trainer gaining a better understanding of their operating environment:

"We were very impressed and very grateful that the guy came all the way to our place to do it. So he could actually see what we were doing, and the sort of things that we were dealing with [...] I don't think people really realise what it's like operating drones on steep hill country versus say a rolling dairy farm. It's a different set of circumstances."

Training all members of the farm was also important to prevent farmers from having to pass on training without confidence to employees.

Although training was considered comprehensive by interviewees, there was also a period of acclimatisation to the drone after the training for farmers, particularly older farmers requiring practice to become comfortable and familiar with the drone. Furthermore, 2 farmers felt that additional follow up training would have been helpful to refresh their memories and to answer follow up questions and issues that they had identified after becoming familiar with the drone.

Overall, the training achieved its goals and familiarised farmers with the drones. Training also made farmers more confident in using their drones, which will need to be accounted for by interventions developed in response to Ride the Sky as the impact of drone provision may be lessened without training.

Limitations and challenges

Although farmers found the drones useful and felt well trained on their use, they did encounter some issues with them. The main issues were bad weather performance and communicating with the drone in hilly country.

The DGI Mavic drones provided to farmers were inoperable in wet weather which limited when the drones could be used in place of farm vehicles. Several farmers noted that this reduced their use of the drones:

“I was mustering out the back, and I want to fly up and get those sheep off the hill but if you can barely stand up on the hill then there’s no way the drone can fly.”

“I’d like to do more flying but that was just the weather, that was it, really.”

“I have used it quite a bit but our limitations are weather at the moment because they told me not to get it too wet and not to get it to [far] in the wind.”

Some farmers were also concerned about using the drones in high wind. Other participants mentioned that the drones were remarkably stable in high winds and so had gained confidence in using them when it was windy. As one farmer noted, the weather limitations ironically meant that drones could not be used at the times when they would be most useful:

“Rain and wind... you can’t take it out with you on those days. Basically, it’s a no-go so you’ve got to drive to your water tanks ... That is probably their biggest handicap; you’re controlled by the weather a bit. Like the other month it was bad weather; the days you want to use it, you know so you’re back to [farm vehicles].”

In addition to weather limitations, some of the farmers found maintaining a direct line of sight between the controller and the drone was an issue. This problem was prevalent in hill country farms. For example, one farmer described having to drive up to nearby hills to use their drone:

“Oh yeah, so where we live is in a gully. So if we send it up and then you like have to be at the top of a hill to send it, or else it will lose signal. There’s so many hills if you’re up on top you can fly around and see everything without losing signal, but as soon as you flick it around might just drop over a ridge a tiny bit and it’s like beep beep beep and then you have to pull it back. So that’s the only thing for this country that’s like if you’re up on top it’s fine but from our house as such, yeah it does miss out on the signal a little bit.”

Although line of sight issues do not completely eliminate drones as substitutes for farm vehicles, it means farmers drive vehicles up potentially steep slopes in order to use their drones exposing them to the risks the drones are designed to reduce.

Farmers were asked if the lifespan of the drone's battery was sufficient. Responses were mixed with some farmers feeling that the 20–30-minute battery life was sufficient but others feeling that they needed 3 or more batteries to ensure that the drone was available when needed. Additionally, farmers felt that charging batteries became another task that farmers needed to adapt to, although at least 1 farmer felt this was a relatively easy adaptation because of the large number of batteries they already had to charge regularly.

A final, minor issue was the bulky nature of the drones, which meant that farmers had to adapt their quadbikes to carry them. This added an additional barrier to the use of the drone but one that farmers were able to overcome.

None of these limitations eliminate the benefits from drones but they are expected issues that will reduce the efficacy of any future intervention to promote drone use as a substitution for farm vehicle usage.

Improvements to the intervention

Farmers were generally supportive of the intervention and felt that it went well. They suggested the intervention could be improved with additional training and additional features on the drone. When asked, 2 older farmers felt that follow up training 1 to 3 months after the initial training would be helpful. Additional training would allow farmers to ask questions and raise issues that had only emerged since using the drone regularly:

“It would have been good to have a follow up session you miss things. You miss quite a bit. And when you're out there a couple of weeks, a month later you think, you know, there are things you are not sure of.”

“You've had your drone for 3 months and then just get a follow up on what, you know they can show you what else you want to use it for. Because then you've got an idea of how you want to use it too.”

Additional training would also allow the trainer to reinforce key messages that farmers may have forgotten since the initial training.

Most farmers did not see value in follow up training, feeling that the initial training was sufficient and that they felt competent and comfortable using the drones:

“I'm not really sure if more training would be needed.”

“Probably not. I don't think so. Maybe if somebody had crashed their drone twice or something [laughs] or had crashed it. But nah, I'm pretty happy like I think if I didn't know how to do something I'd just hop on to the internet yeah, or, or contact somebody or something like that.”

“I don't think so, no, because he you know what he, he did a pretty broad overview of everything you know just even the basics of flying [...] I don't think would be necessary for another training session.”

One farmer suggested that if follow up training were provided, it could be done in a group session:

“Yeah I think one suggestion I’d make if you did do follow up training you could probably amalgamate a few operators that you’ve already trained, in a district. Go to somebody’s place and discuss things and see if there’s any problems. But there’s probably some efficiency in terms of travel and time. You could probably ... you could get 5 or 6 people together all with their drones and just go through stuff.”

In addition to follow up training, farmers also made a few suggestions for additional features to the drone including a noise add-on for mustering sheep and a strobe light to help operators identify where the drone is while flying. One farmer noted that they had since purchased a second drone with an attachment point for a strobe light and noise-making attachment, which they preferred to the WorkSafe-provided drone.

Cost expectations

Farmers were asked how much they would be willing to pay for a drone having experienced using one for several months. Responses ranged from \$3,000–\$5,000. Farmers also emphasised that they would have paid less before they realised the value-add drones could give. For example:

“I suppose if [a farmer] had one [...] then actually 10 grand is actually not a huge investment. But off the back of never owning a drone, I would say that a couple of grand would max most farmers out. If they don’t, if they haven’t use it before and they don’t because it’s different if you’ve had one and you’re like I’m going to use it for this, this and this and you can justify it.

“I think we probably if we’d look at one we’d probably have paid 3, 3 and a half max. But then now you see it, we wouldn’t have known how good that one was.”

Although 8 of the interviewed farmers felt they would buy another drone, 1 farmer felt they would not buy another drone:

“I probably wouldn’t buy one no, I think we thought we were going to use it way more [...] I’m going to say 1000 dollars but, because if I was to buy one I’d probably want to test it out to see if I got the full benefit [...] But again we’ve only just come to this place, and we haven’t probably used it to its full extent, yet.”

As mentioned above, the interviewee from farm 5, who was the most sceptical participant, showed mixed results overall but did record a reduction in driving distance after the intervention. Overall though farmers thought that, with proper information and experience, farmers would be able to see the value of drones and would purchase them.

Suggestions for encouraging farmers to use drones

Participants were asked how WorkSafe could encourage other farmers to adopt drones on their farms. They provided various suggestions including:

- allow the spread of information by word of mouth
- presentations at field days
- use stories of farmers who have successfully used drones
- work with industry organisations such as beef and lamb to do demonstrations.

In all cases the involvement of experienced farmers who had been using drones was seen as necessary to create real, relatable stories of how drones could be successfully used, not only to improve safety but to improve productivity on the farm.

One farmer outlined how they felt that nationwide adoption of drones would simply take time and be a matter of farmers purchasing drones during boom periods. They also emphasised that current farming conditions were not conducive for farmers purchasing drones:

“So lucky you’re only in testing mode at the moment because we’re going to need to come out of this terrible farming time. There’s not many farms with spare money for a drone for a bit and they’re trying to reduce loss [...]”

Coupled with the emphasis on word of mouth and practical experience, this suggests that uptake on farms is likely to be a relatively slow, organic process rather than something that could be rushed or forced by an external organisation such as the regulator.

Interview conclusions

Overall, most farmers expressed a positive sentiment toward their drones, seeing them as useful tools that were more efficient than farm vehicles for many tasks related to farm maintenance and stock management. The greater efficiency, and the possibility to save livestock highlight that drones provide financial benefits in addition to the safety improvements from lowered use of farm vehicles.

Most of the issues that arose were minor and could be overcome with experience and familiarity. The limited ability for drones to operate in poor weather and the difficulties in operating drones in hill country are the 2 exceptions to this. Both weather and topography issues are likely to be common across New Zealand and, unless they can be mitigated, will pose significant barriers to the adoption of drones by farmers.

The training provided to farmers was positively received and, going on farmers’ responses, increased their confidence in using the drones as well clarifying how to use them safely and legally. However, providing nationwide training for farmers to use drones safely is unlikely affordable or practical.

4.0

Discussion and conclusions

IN THIS SECTION:

- 4.1 Drones may not have the expected impact
- 4.2 The pilot might not have been large enough to identify a reduction
- 4.3 Issues with the GPS data may have obscured a reduction
- 4.4 Conclusions

Ride the Sky **did not find** sufficient evidence that providing the cohort of farmers with drones and training to use them resulted in a significant impact on farm vehicle usage.

Similarly, the results from individual farms were mixed, with a minority of farms showing a significant reduction in farm vehicle driving distance, but an equal number of farms seeing an increase and decrease in driving time. This means that the Ride the Sky pilot cannot say that interventions to increase drone usage in the New Zealand agricultural sector will reduce harm from farm vehicles.

There are several possible reasons why Ride the Sky did not identify the hoped for reduction in farm vehicle usage:

1. drones may not have the expected impact
2. the pilot might not have been sufficiently large enough to identify a reduction
3. issues with the GPS data quality may have obscured a reduction.

These possible reasons are discussed below.

The mixed methods approach indicates that farmers may not be good at self-identifying changes in their vehicle usage when asked. The lack of usage reduction in the data conflicts with the reported experience of farmers who, overall, felt that drones were useful on the farm and could replace vehicles for maintenance and stock management tasks.

The interviews identified some potential issues that may have limited the impact of drones. They also provided valuable insights into how farmers found the training and what they were using drones for. The interviewees also provided some insights into potential changes to Ride the Sky and what farmers would be willing to pay for a drone.

4.1 Drones may not have the expected impact

Although Ride the Sky was based on a sound intervention logic model that drones could replace farm vehicles, or reduce their use for many tasks, and the interviews indicated that this logic was also shared by farmers, it is possible that drones do not replace farm vehicle use in any meaningful way.

Interviewed farmers did identify several issues with the drones, particularly with running them in adverse weather and hilly country, which are commonly experienced in New Zealand. Although it is not possible to control for such confounding factors in the pilot due to the small number of farms in Ride the

Sky it does seem plausible that drones will have more of an impact on farms with better weather and flatter terrain. Even if this is the case, it might suggest that drones will reduce farm vehicle usage in situations where the risk of vehicle incidents is already lower.

It is also possible that farm stock type may impact the efficacy of drones, with farmers suggesting that drones are particularly useful for sheep management during lambing season. Most of the participating farms were both sheep and beef/cattle farms, which prevented testing this hypothesis between sheep versus cattle farms.

In the interviews farmers noted a frequent need to drive a farm vehicle to a good spot to use the drone, particularly in hill country. This may have reduced the impact of drones on farm vehicle usage. Furthermore, it is possible that farmers left their vehicles idling when operating the drone, which would be recorded as usage time in the GPS data.

Finally, the interviews suggested it is possible that farmers struggled to adapt to a new way of working with the drones. The need to have some way to transport the drone during daily operations, coupled with some farmers having battery life issues may have reduced drone usage and resulted in farmers maintaining their traditional way of performing tasks.

Contrary to the logic model, it is possible that drones will not have the expected impact on farm vehicle usage and that the lack of impact identified by Ride the Sky is representative of the likely impact of drones on farm vehicle usage across a wider population. If this is the case the pilot can be considered successful in closing this as an avenue for reducing farm vehicle usage.

4.2 The pilot might not have been large enough to identify a reduction

Initial planning within WorkSafe identified 15 farms as likely to be a large enough sample to demonstrate efficacy, while at the same time being cost-efficient and not creating issues of recruiting suitable farms and allowing the pilot to be completed in a reasonable timeframe.

A larger pilot might have allowed better detection of an effect on vehicle use (if present) to become apparent. It would also have allowed the testing of other, more nuanced, hypotheses such as whether drones have a significant impact on farm vehicle usage on different types of farms, or if the effect varied by month. A larger pilot would have also increased costs and time for completion unless additional trainers and GPS procurers were brought on board.

4.3 Issues with the GPS data may have obscured a reduction

As noted in the results section, only 11 of the original 15 farms provided data of sufficient quality for analysis. The exclusion of 4 farms was for various reasons; 1 farm (15) withdrew from the pilot for personal reasons; 1 (10) moved farm shortly after receiving their drone; the GPS service provider did not provide enough data for 2 farms (13 and 14).⁴

Some vehicles did not receive a GPS device. This meant that the apparent impact of drones on these farms may have been diluted as any change in usage of other vehicles is not captured in the data.

Both data issues can be avoidable in future pilots by ensuring closer management of non-researchers during recruitment and pilot design and through tighter contract management of external data suppliers.

⁴ This was contrary to the providers contracted requirements, but this data could not be captured without restarting the pilot for these 2 farms.

4.4 Conclusions

Given the lack of identified impact of drones on farm vehicle usage, it is not advisable at this stage that WorkSafe promotes drone usage on farms unless higher quality evidence to the contrary becomes available.

Despite the lack of identified impact on farm vehicle usage, Ride the Sky has demonstrated the feasibility of piloting engineering interventions such as drones on New Zealand farms. It has also highlighted improvements for future pilots.

Appendices

IN THIS SECTION:

Appendix 1: Driving and tow distance

Appendix 2: Time (seconds)

Appendix 1: Driving and tow distance

FARM	SHAPIRO TEST (normality)	MEAN DISTANCE (pre-intervention)	MEAN DISTANCE (post-intervention)	PERCENTAGE CHANGE IN MEAN	PAIRED T-TEST (2-tailed)	YUEN PAIRED T-TEST (2-tailed)	RESULT
1	✓	38.88	39.59	1.8	p-value = 0.72	-	No significant difference
2	✓	41.20	47.19	14.5	p-value = 0.07	-	No significant difference
3	✓	25.63	29.64	15.6	p-value <0.05	-	Significant increase
4	✗	19.52	17.79	-8.9	-	p-value <0.05	Significant decrease
5	✗	18.83	14.86	-21.1	-	p-value <0.05	Significant decrease
6	✗	47.77	49.50	3.6	-	p-value = 0.87	No significant difference
7	✗	17.60	17.37	-1.3	-	p-value = 0.79	No significant difference
8	✗	29.87	28.91	-3.2	-	p-value = 0.68	No significant difference
9	✗	19.13	14.39	-24.8	-	p-value <0.05	Significant decrease
11	✗	38.89	32.30	-16.9	-	p-value <0.05	Significant decrease
12	✗	25.52	27.00	5.8	-	p-value = 0.48	No significant difference
Overall	✗	29.81	29.39	-2.1		p-value = 0.42	No significant difference

Appendix 2: Time (seconds)

FARM	SHAPIRO TEST (normality)	AVERAGE TIME (pre-intervention)	MEAN TIME (post-intervention)	PERCENTAGE CHANGE IN MEAN	PAIRED T-TEST (two-tailed)	YUEN PAIRED T-TEST (two-tailed)	RESULT
1	✗	13,844.14	18,822.78	36.0	-	p-value <0.05	Significant increase
2	✓	13,285.67	15,171.14	14.2	p-value = 0.09	-	No significant difference
3	✓	8,325.28	10,251.71	23.1	p-value <0.05	-	Significant increase
4	✓	9,888.15	9,006.52	-8.9	p-value <0.05	-	Significant decrease
5	✗	6,777.20	8,494.46	25.3	-	p-value = 0.01	Significant increase
6	✗	12,526.13	11,888.71	-5.1	-	p-value = 0.30	No significant difference
7	✗	6,264.02	7,016.87	12.0	-	p-value = 0.25	No significant difference
8	✓	9,690.08	9,456.65	-2.4	p-value = 0.73	-	No significant difference
9	✓	6,436.11	5,026.50	-21.9	p-value <0.05	-	Significant decrease
11	✓	37,642.34	27,856.64	-26.0	p-value <0.05	-	Significant decrease
12	✓	24,130.29	23,927.96	-0.8	p-value = 0.88	-	No significant difference
Overall	✗	13,394.16	13,223.15	-1.3		p-value = 0.40	No significant difference

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