

VARIABLE RATE FERTILISER APPLICATION ON PASTORAL HILL COUNTRY, A SIMPLE AND EFFECTIVE SYSTEM

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It has long been known there are significant productivity gains or fertiliser savings available from differential application of fertiliser to pastoral hill country. This is to account for the variation in productivity potential due to slope and aspect, combined with the impact of nutrient transfer by grazing animals.

Farmers have been aware of this need for some time, and it has been well documented by researchers (for example, Gillingham *et al.* 1973, Gillingham *et al.* 2003).

However, unlike the broadacre cropping sector, adoption of variable rate application by pastoral farmers has been limited due to a lack of tools and having to use overly complex systems. This has made differential application too challenging for many farmers, advisors, and the spreading industry to implement.

With this in mind, in 2013 TracMap started developing a system that was simple enough to be used by most farmers and fertiliser representatives, would work with the variety of spreading technology used by the industry, and deliver the productivity gains expected.

TracMap's system uses simple mapping tools on the TracMap Online website to split a farm into Management Zones based on aspect, contour, and location of subdivision fences, which is then stored as a Variable Rate Base map. Target rates for each zone can then be specified at the time of creating a job order, and sent with the map to the TracMap unit in the truck. This file is then able to instruct the existing rate controller to automatically apply the target rate as the truck drives around the farm.

Feedback from farmers and spreading operators who have piloted the system has been very positive. A typical example can be explained as follows; instead of applying super at 230 kg/ha over an area of 43 ha, a farmer was able to apply no fertiliser to 9 ha, only 100 kg/ha to 8 ha, and 350 kg/ha to the remaining 26 ha, all with just the push of a few buttons, achieving the nutrient input needed for full and efficient pasture maintenance.

An Example of how it works

The TracMap system, which is used by the majority of fertiliser spreading trucks in the country, is utilised to easily deliver differential application on farm. The system comprises two parts, a TracMap display unit mounted in the cab of the truck (Fig: 1), and TracMap Online, the company's cloud-based system, linked by cellular connection.



Fig: 1 – TracMap Display Unit

Creating a Variable Rate Map

Consider a typical hill country property, such as the illustration below (Fig: 2), or a close up view of part of the property as shown to the right (Fig: 2.1). Like all hill country properties, it comprises ridges, rolling to steep faces, and gullies, broken by subdivision fences.

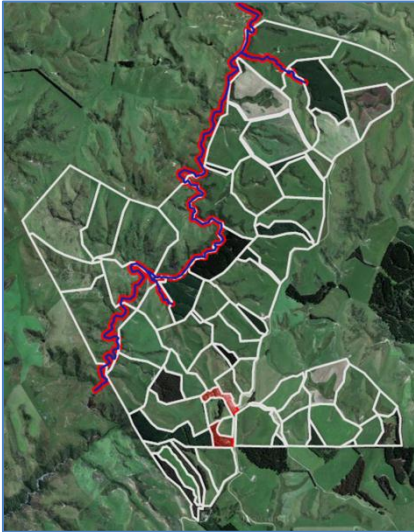


Fig: 2 – Typical hill country property map



Fig: .2.1 – Typical hill country property map (Close up)

The first step is to use the TracMap Online tools to draw a map that breaks the property up into **Management Zones (Fig: 3)** that reflect the desired differential fertiliser treatments. In this example we are splitting into six zones

- Stock Camps: high fertility area unlikely to require fertiliser. (Coloured Blue).
- High Fertility: areas where stock transfer and other factors mean that sub maintenance fertiliser will be needed. (Coloured Green).
- Low Fertility: areas where maintenance or above maintenance fertiliser will normally be required. (Coloured Yellow).
- Gullies: improved native that may need different treatment to the cultivated pasture. (Coloured Orange).
- Waste: areas of gorse and other locations not needing fertiliser. (Coloured Purple).

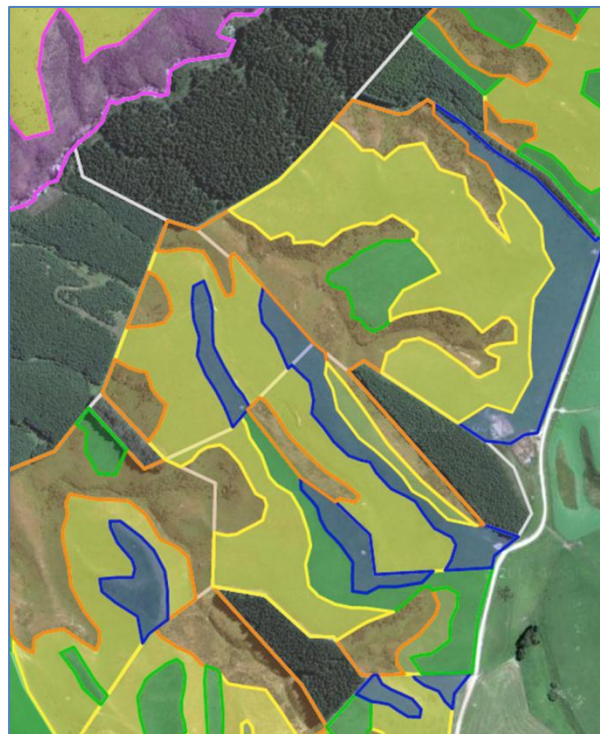


Fig: 3 – Farm broken into management zones

One of the keys to the TracMap system is the ease in which paddocks can be split and allocated to a Management Zone. The image at right is taken from the “step by step” guide (Fig: 4) and shows the process of using a mouse to draw a line down the boundary between two zones.

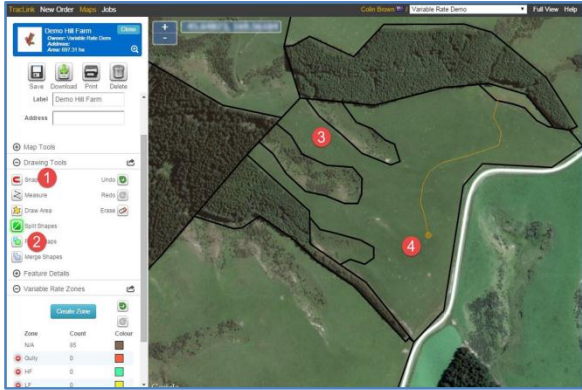


Fig: 4 – Step by step guide

Once the map is drawn, it is saved as a Variable Rate Map in the TracMap Online website.

The keys to success in using the system are:

- Good local knowledge: it is important to be able to make a reasonable guess where boundaries of Management Zones should be placed by looking at the map image.
- Critical thinking: have a clear understanding of the desired outcome to ensure the map is not too detailed and complicated.
- Understand the purpose of the system: the spreading truck will be driving at over 20km an hour with a spread of 18 to 20 metres. Absolute precision of zone boundary placement is not necessary. Rather, the objective is to place the majority of fertiliser where it is needed most, and limit wastage where it is not required.

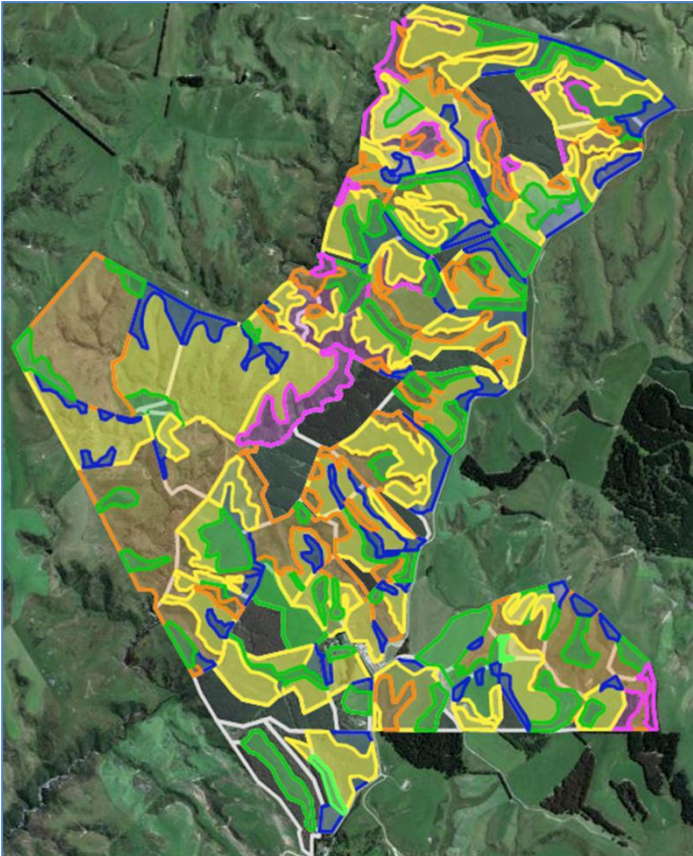


Fig: 5 – Entire property split into management zones.

Creating a Variable Rate Order

The first step is to use representative soil testing to make a decision on what fertiliser application rates are appropriate. For the purpose of this example we will assume superphosphate is to be applied at the following rates:

- Stock Camps: 0 kg/ha
- High Fert Zones 100 kg/ha
- Low Fert Zones 350 kg/ha
- Gullies 0 kg/ha

The images below show the original Variable Rate map (Fig: 6), and how that shows as a rate outline during the order creation process (Fig: 6.1).



Fig: 6 – Variable rate map



Fig: 6.1 – Variable rate map outline during order creation

The next step is to select the blocks to be treated, using the simple tools on the TracMap Online website. The illustration below (Fig: 7) shows the process of selecting blocks (highlighted in blue) while the details box reports the size of the area selected, and an estimate of the product quantity required.

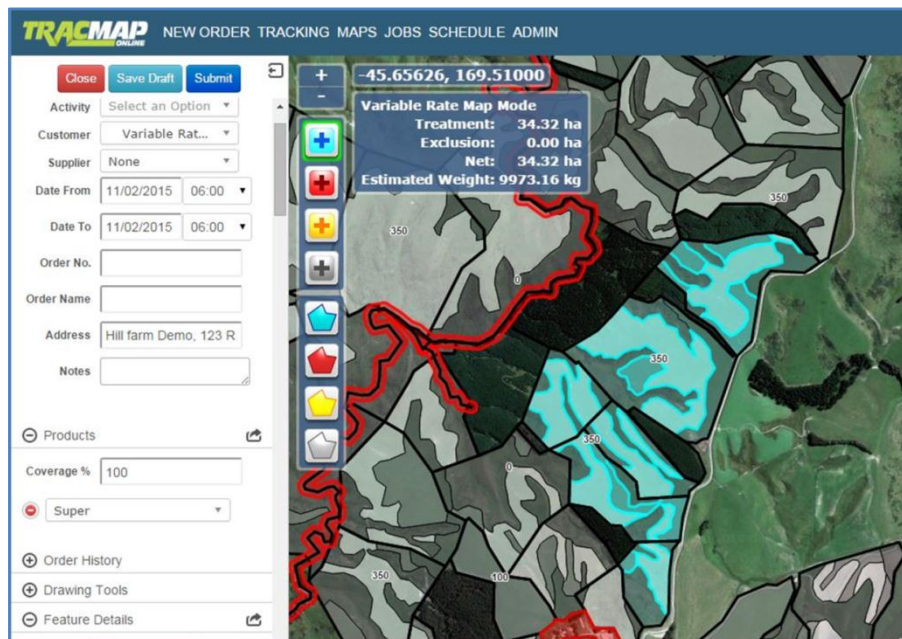


Fig: 7 – TracMap Online – select the blocks to be treated

Once the areas to be treated are finalised, the resulting map is transferred to the fertiliser truck. The images below show the original Variable Rate map on the left (Fig: 8), and the resulting map as it appears on the TracMap display in the truck (Fig: 8.1).

The driver then simply drives around the blue shaded areas, and the computer controller in the truck automatically adjusts the fertiliser rate being applied.



Fig: 8 – Variable rate map

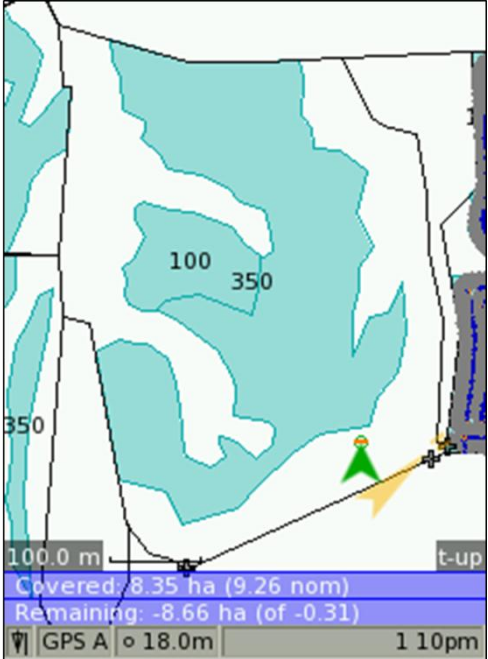


Fig: 8.1 – Variable rate map in TracMap display unit

The images below show what the driver sees as they move from a 100kg/ha zone (Fig: 9) to a 350 kg/ha zone (Fig: 9.1).

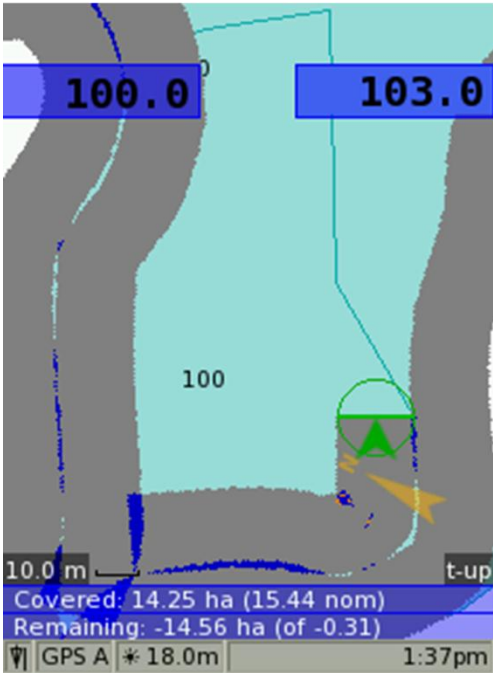


Fig: 9 – Display unit map – 100kg/ha zone

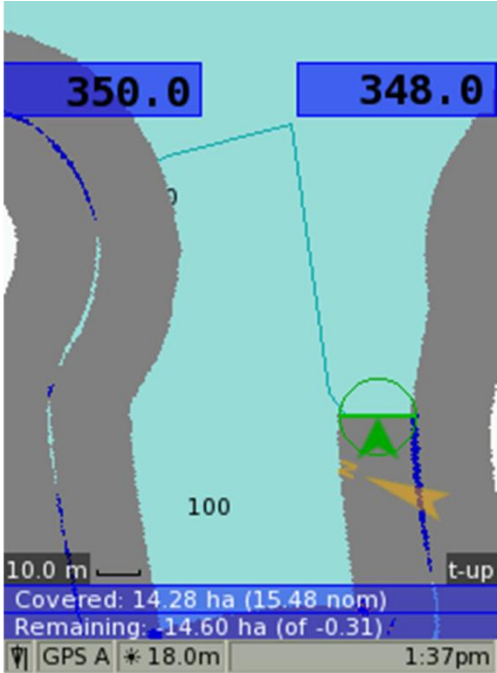


Fig: 9.1 – Display unit map – 350kg/ha zone

At the completion of the job the driver transfers the results back to the TracMap Online system (online connection or USB stick) where it is available for viewing by the farmer and their advisors by logging in using their password (Fig: 10). This way they will know the paddocks have been effectively managed rather than seeing months later where something may be missed.

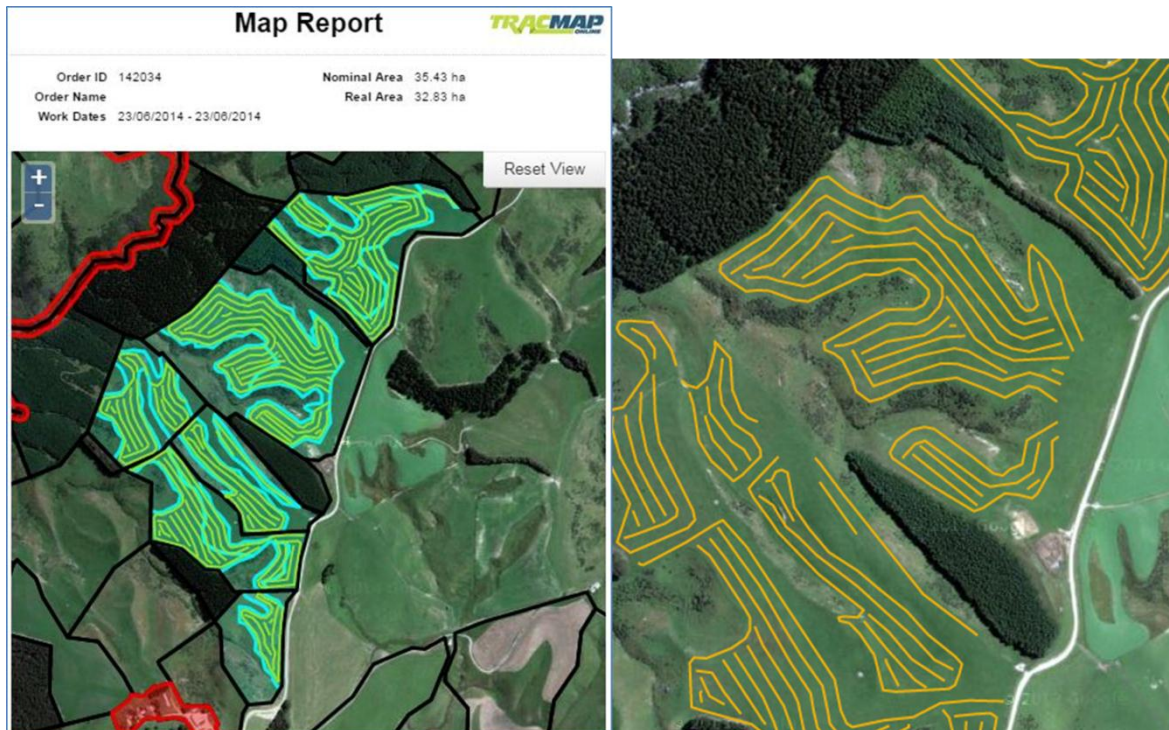


Fig: 10 – Report of variable rate application

Summary

While it has been known there are significant agronomic and economic benefits from non-blanket application of fertiliser to pastoral hill country, the difficulty associated with achieving the variable rate outcome has impeded farmer's ability implement this knowledge

The TracMap system makes such a process and outcome achievable for any farmer and their advisors who has a reasonable understanding of the variable fertiliser requirements for their property

This particular example used a truck to spread 10 tonne of fertiliser, resulting in superphosphate being applied at rates of 100 kg/ha and 350 kg/ha, instead of 230kg/ha blanket rate across the whole area. This would also be applicable to aerial application, or variable nitrogen application by tractor across a dairy farm.

References

- Gillingham, A.G.; During, C.1973. Pasture Production and Transfer of Fertility within a long established hill country pasture. *New Zealand Journal of Experimental Agriculture* 1:3 227-232.
- Gillingham, A.G.; Morton, J.D.; Gray, M.H. 2003. The role of differential fertiliser application in sustainable management of hill pastures. *Proceedings of the NZ Grasslands Association* 65. 253-257.