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# Science is just the start - the development of the NRM Spatial Hub.

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## **Abstract:**

The NRM Spatial Hub (The Hub) is world leading on-line mapping technology that is revolutionising Australian rangeland monitoring and management. The Hub began as a dispersed multitude of government and non-government GIS systems, satellite information, maps and datasets across the country and the people and institutions who managed these. Its development brings together the world's largest archive of satellite data, mapping and analysis capabilities accessible to land managers.

The identification of the need for improving monitoring for NRM interventions by the Rangelands NRM Alliance coincided with increasing demand from land managers to better map and monitor their management decisions. This provided impetus for the development of the partnerships that lead to this tool developing. It required a huge number of partners, some serious coordination and considerable flexibility in how we went about getting the end result land managers wanted. The NRM Spatial Hub project brought together the funding partners, the technical staff for data interaction, extension staff to provide opportunities to work with the end users to ensure that the Hub provided the information in a format they would use.

The development of this tool from the initial idea to develop a collaborative national project which resulted in the technology that is now being applied by a number of industries demonstrates the rangelands can trigger transitions of science via collaboration. The first stage ran for 2 years with an overwhelming level of uptake by Rangeland managers. To further develop the capacity for delivery the initial investors have self funded further delivery and the development of a business plan for expansion.

## **The Background:**

Rangeland monitoring is complicated because there are large areas, natural heterogeneous landscapes, a variable climate and very few people. The potential of spatial information to provide long term monitoring, at multiple scales for various uses has been promoted for a number of decades.

The Rangeland NRM Alliance (The Alliance) identified the inability to monitor rangeland health as a major barrier to improving investment in NRM planning, delivery and assessment. Not being able to demonstrate improvements affects investor confidence.

In 2009 the Northern Gulf NRM in Queensland was working with Queensland Remote Sensing Centre and CRC Spatial Information to show the area and extent of severe flooding for an exceptional circumstance application.

The resulting spatial mapping formed was demonstrated to the Alliance who were impressed. Still a little sceptical – spatial information/satellite imagery had made many promises in the past. However, the Alliance had recently developed the Australian Rangeland Initiative, a blueprint for rangeland NRM investment, which highlighted the inability to monitor land based impacts of NRM activities as a major problem and hugely expensive to remedy. This seemed like an opportunity to address this vital issue.

The Rangeland NRM Alliance began working with the CRC Spatial Information and partners with the aim of developing a tool to allow people, without a super computer or a degree in Geographic Information Systems, to access the mountain of dispersed spatial data available in a simple useful format.

It seemed an ambitious, if not ridiculous, endeavour there are so many data owners, a variety of scientists, pastoralists, 14 NRM regions, 5 government jurisdictions, CRCs Industry representatives and Universities. This technology needed it to work for the rangelands which are huge, where there is very limited internet access and people manage farms the size of the ACT. Scepticism was valid. It would require too much cooperation, too many unforeseen issues to overcome, and a tonne of money.

It seemed possible though and particularly so in the rangelands. Not only did we have the need but the rangelands, while big, and varied and a long way from urban centres, has few people who all know each other with a lot of good will and that is how we managed it, all of us, with our different skills and specialities and quirks. We made it happen. We got the science and put it through the mincer of people and came out the other end with something really useful.

### **The Development:**

In 2011/12 the Alliance and the CRC Spatial Information costed the development of a fully functioning NRM Spatial Hub, it had all the bells and whistles. It would have the potential to work at many levels from mapping pastoral properties and analysing their groundcover, providing NRM and Government agencies with project reporting and monitoring tools and having the ability to collate data at state or national level to report to government.

There were a mix of partners in the science field, land management field and agricultural industry to provide investment and in-kind assistance. Then we approached the Australian Government to fund the development of this wide ranging tool. Probably unsurprisingly, they were hesitant to provide the investment for such an early stage innovation.

The National Landcare Program then called for Sustainable Agriculture Innovation Grants in 2013/14. These were grants focussed on agricultural industry so applications needed to be focused on agricultural production. Was this our chance? What could achieve with this size grant and time period? Was it worth it or would it result in an ineffective tool?

It was decided that we should apply and to prove the concept and develop the platform via building and testing with pastoralists as the end user. This required the gathering of considerable in-kind support from the NRMs, scientific partners, land managers, State Agencies, the CRC SI and financial support from industry via Meat and Livestock Australia. We were successful and this Australian Government investment gave us two years to prove the concept.

Two years later, in 2016, the concept was proven (Figure 1). The NRM Spatial Hub is on-line, there were more than 300 land managers using the tool at the end of the project surpassing its target of 40. It made it on to the front page of NASA's magazine as an innovative use of spatial information. The logistics of making this happen are impressive and the uptake with landholders is a resounding accolade for the inclusive way the tool was developed. It works because the end users made it work.

An on-line survey was conducted in February 2016 with landholders who have participated in the project. 90% of respondents found the Hub easy to use; 95% said from their experience to date that the Hub has the potential to measurably improve the productivity, profitability and sustainability of their property. More than 50% felt the Hub would save them between 10 and 30 labour days a year. 75% said it would measurably increase safe carrying capacity through better paddock utilization. It is also important to note that around half the survey participants considered their property was only around 50% developed, suggesting that a large proportion have opportunities for increasing total stock numbers with investment in infrastructure. Around 72% rated this type of technology as important to making their business both viable and sustainable in the future.

By March 2016 over 300 properties with an area of more than 50 million hectares are using the system. OPPIS provides tools for mapping: infrastructure and landtypes; planning new infrastructure; analysis of grazing circles; time-series remote sensing analysis and reporting; and estimation of safe carrying capacity.

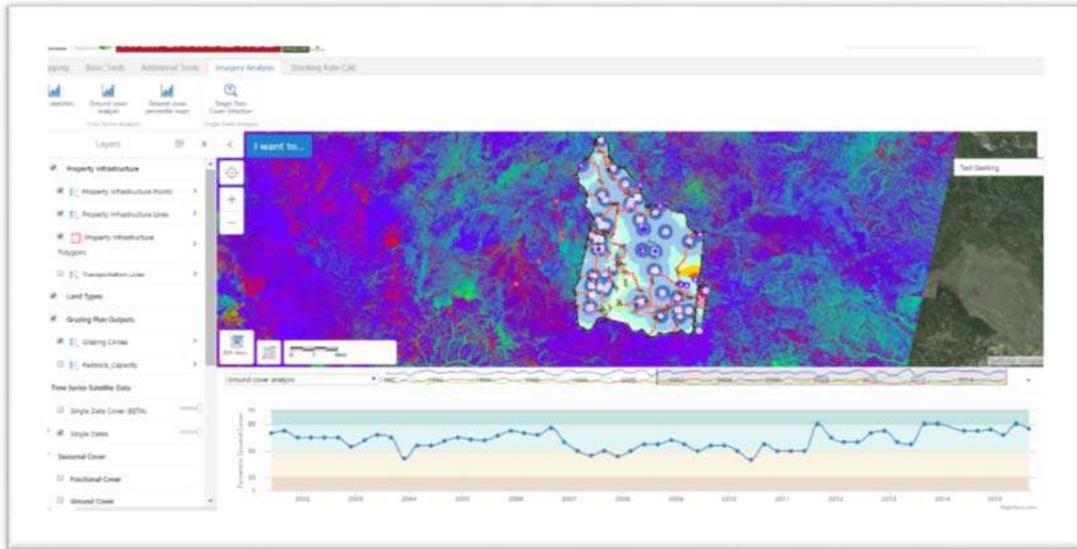


Figure 1. The NRM Spatial Hub interface. This images shows property infrastructure mapping; a high resolution image in the background; grazing circles calculated for each water source; a fractional ground cover image in the foreground (red = bare ground, blue=non-photosynthetic ground cover, green=photosynthetic ground cover). The graph on the bottom is a ~30year analysis of ground cover over the entire property relative to the neighboring properties.

The partners in the project to develop the NRM Spatial Hub decided to continue funding the maintenance of the tool and development of a business model to keep the Hub operational beyond the project scope and to access new markets. It has had a name change for agricultural application to FarmMap4D and new applications are being developed for wider markets.

**Conclusion:**

The NRM Spatial Hub has brought spatial information into a format that ordinary people can understand and use. The NRM Spatial Hub has demonstrated the enormous potential for cloud-computing; user-driven application development and collaboration to increase technology adoption across the rangelands. The transition of the scientific ability via people to end user application has transformed what people think they can demonstrate about rangeland management. This success is entirely due to the commitment of the staff involved. Their hard work and dedication to the end user approach was highly motivating and the results are an unmitigated success. It was ambitious, slightly ridiculous and completely worth the effort to collaborate to get this innovation from a concept to reality. It was also instigated in the rangelands. It works best in rangeland application. It has to be adjusted for other uses in more populated areas. This time the low population and huge expanses worked in our favour