

**PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE**  
**Official publication of The Australian Rangeland Society**

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Author family name, initials (year). Title. *In*: Proceedings of the *n*th Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).

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Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite (*Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15<sup>th</sup> Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

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# **Quantum innovation in measuring, monitoring and managing ecological function on large scales, reliably and affordably**

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**Keywords:** monitoring; function; GIS/remote sensing

## **Abstract**

This presentation discusses a pre-eminent concern of landscape level watershed management and introduces a tool developed to foster cost-effective stewardship. The need to accurately and quickly assess site potential and track ecological changes on watershed scale rangelands exists in all terrestrial ecosystems. The focus of this presentation links traditional riparian and water quality assessments techniques with existing remote sensing technology in order to assist with decision support with management of large watersheds. Moreover, its implementation can promote both environmental enhancement and improved profitability of economically sustainable rangeland businesses. This system offers a powerful new approach for yielding actionable information over large areas at low cost.

## **Introduction**

I am a lifelong natural resource management professional. My personal mission statement is “to be a positive resource management example”. Throughout my career I have learned that alone I can only do so much. Thus, I have spent the last ten years developing a powerful new tool for leveraging the abilities of motivated property

managers. By integrating satellite imagery, multiple wavelength low aerial photography, and ground-truthing techniques to monitor ecological processes with a high degree of reliability, including vegetation change, water cycling, and carbon sequestration we can eliminate much of the mystery and guesswork from large-scale land management. Cheap to analyze and replicate, this system stands to revolutionize rangeland monitoring and management practices.

### *Project purpose*

The need to accurately and quickly assess site potential of rangelands at a watershed scale exists in all terrestrial ecosystems. However, implementation of recipe-like 'Best Management Practices' (BMPs) often happens with little feedback regarding their effectiveness. Funding to install BMPs on both public and private land is limited and it is important to understand where funds could best be invested at a watershed scale to have the most beneficial impacts. Riparian areas are often the focus of study when assessing overall health of a watershed. They serve as a barrier trapping sediments and contaminants, provide essential habitat for rangeland wildlife, produce an abundance of livestock forage and are often a source of livestock drinking water. On the ground visual stream assessments and water quality sampling primarily total suspended solids (TSS) are two effective methods of monitoring watershed health improvements.

Unfortunately both methods are extremely expensive and time consuming when applied on a broad scale.

In many cases, key areas are selected for monitoring sites, which can leave many gaps in understanding what is happening at a systems level. These key areas may fail to depict the effectiveness of BMP implementation especially when the watershed examined is several million acres. Large watersheds are complex and heterogeneous, creating large spatial and temporal variation.

New techniques in remote sensing may offer a missing link to help explain the large spatial and temporal variations that cannot be detected by key area sampling.

The focus of this project is to link traditional riparian and water quality assessments techniques with existing remote sensing technology in order to assist with decision support with management of large watersheds. The merging of these techniques and technologies has produced a rudimentary tool and basic process that can assist land managers in making sound decisions that produces results beneficial to riparian health and water quality improvement.

The project takes a broad approach to examining watersheds. Locations were selected based upon availability of existing data, willing local cooperators and demand for the development of this tool. In addition, implementation can promote both environmental enhancement and improved profitability of economically sustainable rangeland businesses.

## **Industry Analysis**

### *Definition and Characteristics of Industry*

In the United States, the Federal Land Policy and Management Act of 1976 (FLPMA) determined that “the national interest will be best realized if the public lands and their resources are periodically and systematically inventoried and their present and future use is projected through a land use planning process.”<sup>1</sup> To determine whether a lessee has been a good custodian of the public’s land each state has developed its own Standards for Rangeland Health and Guidelines for Livestock Grazing Management (Standards and Guidelines) that comply with a national directive. Thus, managers are both legally and morally obligated to periodically review the range condition and assess whether or not it is meeting the Standards and Guidelines of its state, the terms of

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<sup>1</sup> FLPMA pg1

agreement with the landowner relating to the grazing permit, and commiseration with the values of good stewardship, economic productivity, and long term land health.

For example, the Bureau of Land Management (BLM) manages 21,379 allotments that account for 156,661,328 acres in ten region/states: Arizona, California, Colorado, Idaho, Montana/Dakotas, Nevada, Oregon/Washington, Utah and Wyoming. Each year the grazing permits on approximately 2,137 allotments or one tenth of the total amount allotments, should come up for review. For each allotment an assessment of its condition and trend must be made in accordance with the pertaining states Standards and Guidelines. Last year, the fiscal year 2009, 1,240 allotments were assessed; little over half of the 2,137 allotments theoretically up for renewal in that year, as part of expiring grazing permits.<sup>2</sup> Since 1989, the first year a national, BLM-wide Rangeland Inventory, Monitoring, and Evaluation Report has been compiled, 14,791 of the 21,379 allotments have been assessed, or a hair over 69%. In 20 years 69% of the BLM's allotments have been assessed. Extrapolating the assessment rate of these allotments for the last 20 years over 23 years prior—from 1976, the year FLPMA mandated that federal lands be “periodically and systematically inventoried,” to 2009, the BLM has assessed their allotments one time and are a little more than 40% into the next round. It takes the BLM 30 years to assess their national holdings one time. The rate at which the BLM assesses their allotments does not meet the mandate established in Section 201(a) of FLPMA, which requires that the “inventory shall be kept current so as to reflect changes in conditions and to identify new and emerging resource and other values.”<sup>3</sup> The BLM simply cannot meet the demand for allotment assessment brought by expiring grazing permits that, in the context of the extreme variability and change of the underlying landscapes, expire at an immense 10 year period. From this analysis alone, the BLM is either negligent and in gross violation of the law or they simply cannot afford the cost of their assessments. The demand for assessments greatly exceeds the

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<sup>2</sup>[http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning\\_and\\_Renewable\\_Resources/rangeland.Par.75184.File.dat/Rangeland2009.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/rangeland.Par.75184.File.dat/Rangeland2009.pdf)

<sup>3</sup> FLPMA pg4

number that they can provide at the price they provide them. The problem has two efficient market solutions: either the demand for assessments must be lawfully reduced through amendment or the BLM must lower the cost of their assessment methodology.

## Conclusion

The law will not be amended, nor should it. The striking reality is that the BLM has an assessment methodology that it simply cannot afford, that does not meet the mandates of the law and does not meet the information needs of concerned parties: its own people and processes, land managers, environmentalist, and recreationalist alike. More perniciously the immense period between allotment RE-assessments—whether it is the reality of 30 years between BLM assessments or the logical, but still less than useful, 10 years when grazing permits expire—prevents the BLM, managers and interested citizens from accessing information about the current condition of rangelands, while constructing a meaningful trend impossible and not only circumventing the law, but what concerned parties know to be right: we must monitor our land periodically, systematically, and with a methodology that is affordable enough to be DONE.

Private range monitoring firms such as Cirrus and Land EKG offer relatively expensive services, but market share for such labor-intensive solutions, is limited. A new solution that complements these services and enriches our understanding of land health, ecological function, and trends is essential. This presentation introduces one such system and illustrates the power of this approach for yielding actionable information over large areas at low cost.

Simonds, G. (2010). Quantum innovation in measuring, monitoring and managing ecological function on large scales, reliably and affordably. In: *Proceedings of the 16<sup>th</sup> Biennial Conference of the Australian Rangeland Society*, Bourke (Eds D.J. Eldridge and C. Waters) (Australian Rangeland Society: Perth).