

**WOOL PRODUCERS WITH REMOTE CONTROL: NEW TOOLS FOR WHOLE OF PROPERTY
MANAGEMENT**

MILESTONE 4 & FINAL REPORT

26 MAY 2006



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MILESTONE NO.:	4	DATE OF FINAL REPORT:	28 th April 2006
LWA PROJECT REFERENCE NO.:	CSE 27		
PROJECT TITLE:	Wool producers with remote control: New tools for whole of property management		
PRINCIPAL INVESTIGATOR:	Name: Dr Craig James Contact details: CSIRO, PO Box 2111, Alice Springs NT 0871 Ph: (08) 8950 7157, Fax: (08) 8950 7187, Email: craig.james@csiro.au		
OTHER PROJECT TEAM MEMBERS:	Gary Bastin and Vanessa Chewings, CSIRO, Alice Springs Amanda Brook, SA Department of Water, Land & Biodiversity Conservation		
OTHER COLLABORATORS:	Seven woolgrower families in project area of north eastern South Australia		
PROJECT OBJECTIVES (from the Project Schedule):	<ol style="list-style-type: none"> 1. Consult with wool producers in the study region to determine what sorts of information (from remote sensed sources), delivered in what ways, would be most useful for making decisions concerning forage levels and stocking rates in paddocks. 2. Design maps and images that show vegetation cover values for entire properties at paddock level that are tailored to local thresholds and benchmarks, as specified by producers. 3. Use existing software tools to demonstrate how the creation of the above products might be automated and also to demonstrate how a software tool might be developed to streamline the process, thereby reducing the cost of processing and delivering multi-temporal scenes over large regions. 4. Develop a prototype method of displaying the products listed above that meets the needs of producers for ease and mode of presentation (eg: a web-like interface, though other avenues would be explored as directed by producers). 		
MILESTONE (from the Project Schedule) :	<p>Components</p> <p>Core tasks – Milestone 1 (component 1, following page):</p> <ol style="list-style-type: none"> 1. Hold preliminary consultation with primary and secondary producer groups, to engender commitment of primary group of producers to the project, and to derive project specifications. 2. Hold at least one additional workshop with primary producer group at which preliminary products will be introduced and field validity discussed. 3. Evaluate the potential for automation of processing and display systems. 4. Submit a report to Land & Water Australia outlining progress with core tasks above and other developmental issues arising from technological or producer concerns. <p>Core tasks – Milestone 2 (component 2, following page):</p> <ol style="list-style-type: none"> 1. Conduct final consultation with producer group, delivering to the group an assessment of positive and negative issues associated with the demonstration software. 2. Organise assessment of project products by peers outside project team. 3. Make an assessment of potential for continued development taking into consideration technological or producer concerns that have arisen during the project. 4. Submit a report to Land & Water Australia outlining progress with core tasks above. 		

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<p>ACHIEVEMENT RESULTS FOR COMPONENT 1:</p>	<p>Task 1: Engage with wool growers and develop project specifications: Three introductory workshops involving eight stations were held in the last week of March 2005. During each workshop we discussed how managers establish paddock stocking levels throughout the year, their capacity to adjust numbers if required, and how products derived from remote sensing might assist their decision making. Although most managers were sceptical that satellite-derived estimates of cover would assist them with paddock stocking decisions, all were keen to participate in the project and some nominated focus paddocks where they thought that products may be of greater interest and benefit. Most woolgrowers wanted additional historical context and we invested effort in acquiring, interpreting and delivering archived imagery (MODIS, AVHRR NDVI and Landsat). Providing this additional contextual information helped us build credibility with participating woolgrowers.</p> <p>Task 2: Additional workshop to trial products and validate results: Rather than workshop this task, we spent time with each woolgrower family between September and December 2005 tailoring image products to their interests and requirements. We also did some field checking of cover products, often in the company of the station owner or manager. Product updates were subsequently supplied to each woolgrower family in mid December 2005 (by mail) and early March 2006 (in person at the final evaluation workshops). This process allowed us to build credibility with woolgrowers and explain necessary remote sensing and image processing techniques, and increased our understanding of individual station management and how cover products may assist.</p> <p>Task 3: Evaluate potential for automated processing & display systems: We provided freeware image display software (Open EV) and digital historical Landsat images to each woolgrower family. Some families used this resource to further “explore” their place in a historical sense. However, we considered that due to the limited timeframe of this project it was inappropriate to “push” too much technology onto woolgrowers. Thus we did not proceed with developing an automated processing and display system for MODIS cover images and related products.</p> <p>Task 4: Submit report outlining progress with Component 1 tasks: Progress described in the first milestone report provided at the end of September 2005. Milestone report subsequently accepted by the LWW Project Manager.</p>
<p>ACHIEVEMENT RESULTS FOR COMPONENT 2:</p>	<p>Task 1: Final consultation with producer groups We held workshops with two groups of woolgrowers in early March 2006. The first workshop was with our primary group (woolgrower participants) and the second with neighbouring woolgrowers in the region (some aware of the project but none involved). The purpose of both workshops was to obtain producer evaluation of satellite-based monitoring of vegetation cover, products developed and interest in continuing the work (if suitable funding becomes available). Because of our shift in emphasis away from automated processing and display systems (Task 3 above), it was inappropriate to use the final workshops to assess issues associated with demonstration software. Both groups provided positive responses to our formal evaluation questions and were enthusiastic for the project to continue, if possible, in an expanded form (see attached project report).</p> <p>Task 2: Assessment of project products by peers outside project team Project products and progress were formally reviewed as part of the LWW Pastoral Sub-program Research Review (Adelaide, 8-9 February 2006). The two reviewers considered “that the technology has great potential but hasn’t yet overcome the significant technical and delivery challenges of fitting into a pastoral woolgrowing enterprise” (see Reviewers’ Report by Ian Watson and Jenny Treloar for their more complete assessment).</p> <p>Task 3: Assessment of potential for continued development</p>

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	<p>This project has demonstrated that there is genuine woolgrower interest in the use of MODIS image products for monitoring vegetation cover at paddock and property scale. This interest is presently more in the areas of using image products to complement on-ground monitoring by providing regular updates with comprehensive spatial coverage, adding to the long-term monitoring record and helping to justify appropriate land management stewardship (duty of care) by woolgrowers – rather than providing close to real time information about cover to assist decision-making about paddock stocking rates. To progress the technology, it needs to (1) be tested across larger geographic regions (including northern cattle producers); (2) have a suitable delivery method developed (possibly by an internet subscription service); (3) have suitable software developed so that producers can customise required products (results) to their own requirements; and (4) have necessary training delivered so that producers have the skills and confidence to use the technology.</p> <p>Task 4: Report to LWA outlining progress with core tasks This report.</p>
<p>SUMMARY OF PROJECT METHODS & MODIFICATIONS:</p>	<p>Methods: Archived 16-day cloud-free composites of 250-m resolution MODIS imagery were acquired from CSIRO Land & Water colleagues in Canberra for the period late 2000 to December 2004. Similar images for 2005 and early 2006 were downloaded from the US. We used the ‘visible red’ band to indicate vegetation cover – with cover products scaled to the specific interests of each woolgrower family. Maps of cover were overlaid with fencelines to assist interpretation and delivered to participating woolgrowers at three times during 2005 and early 2006. Charts showing average cover for major land types in selected paddocks, with accompanying brief documentation, were supplied with the maps. We also supplied (1) time-traces (as charts) of vegetation greenness (AVHRR NDVI) for the period 1981-2003 as additional historical context and (2) multi-date digital Landsat imagery and cover indices (1972-2002) with image viewing software (Open EV) for each station.</p> <p>Modifications: We focussed on building relations with woolgrower families and delivering credible and valued products derived from MODIS imagery. This left insufficient time to develop and test automated processing and display software and investigate delivery mechanisms (e.g. via internet).</p>
<p>STATEMENT OF RESULTS, THEIR INTERPRETATION AND PRACTICAL SIGNIFICANCE AGAINST EACH PROJECT OBJECTIVE:</p>	<p>1. Initial consultation with wool producers. Although woolgrowers were initially sceptical of the project’s intent (i.e. adjusting paddock stock numbers partly based on MODIS image products), they helped us refine the objectives and all were keen to participate in the project. This emphasised the importance of building credible relationships with participating families before focussing too heavily on the technology components of the project.</p> <p>2. Maps and images of vegetation cover and derived products. We worked with woolgrower families to develop scaled maps of vegetation cover relevant to each station. We then provided time-series maps of cover for either the whole station or focus paddocks based on this scaling. Time-trace charts of average cover (by land type) in paddocks were also supplied. Feedback from both groups at the final workshops demonstrates that these products are understood by woolgrowers and are considered useful (most participants rated image displays scaled to emphasise cover differences across a particular paddock or their property as more useful than comparing their property against the region; all considered the time traces of cover useful, and particularly for showing present cover against that at various times in the past).</p> <p>3. Existing software to demonstrate products & develop software tools for automated processing.</p>

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	<p>Through interaction around a laptop computer at each homestead, we successfully involved family members in setting image display thresholds that best represented, for them, the cover range for their station. At the final workshops, all participants said they were either “likely” or “very likely” to be able to receive and use the type of information in demonstrated products on their computer.</p> <p>Most family members were also interested in the digital Landsat images (including cover) of their station (delivered during station visits) and said they would test the supplied software (Open EV) to view images. We have no objective data on the degree of uptake but all families expressed appreciation that we had supplied this resource. As explained above, we did not progress development of software tools for automated image processing.</p> <p>4. Prototype method of product display meeting needs of producers.</p> <p>Through interaction with woolgrower families and feedback evaluation at final workshops, we now have a good understanding of useful products (all participants in both workshops said they would use cover products developed and also said they would prefer to receive images by web-site download if such a service was available). However, as described above, we did not proceed with testing the internet (world wide web) as the probable delivery mechanism during the short time period of this project.</p>
<p>OUTLINE HOW THESE OUTPUTS CAN BE ADOPTED:</p>	<p>Uptake should be facilitated when more producers have had exposure to MODIS-derived products via a suitable delivery mechanism and access to suitable software tools that tailor products to individual requirements. This requires:</p> <ol style="list-style-type: none"> 1. Broader testing of products with a greater number of producers (both wool and meat) in other regions (SA and interstate). This expansion should also involve relevant staff of rangeland management agencies in those regions. 2. Development and testing of software tools resident on each producer’s computer that allow image updates to be tailored to client requirements – e.g. cover scaled relative to a paddock of interest, the property or region (for benchmarking purposes) supported by time-traces of cover (presented for interpretation as preferred by the client). These tools will need to be supported by necessary training and follow-up technical support. 3. Demonstration of a technically feasible and commercially viable system for delivering product updates as required by producers. One option is by producer subscription to a password protected web site operated on a commercial basis. The economic viability of such a service in the rangelands needs to be investigated.
<p>SUMMARY OF COMMUNICATION, TECHNOLOGY TRANSFER OR ‘ADOPTION’ ACTIVITIES TO DATE:</p>	<ol style="list-style-type: none"> 1. Favourable and encouraging responses from the second of our final workshops where we sought feedback from neighbouring woolgrowers who may have been aware of the project but not directly involved. 2. Newspaper article in the Peterborough Times reporting woolgrower participation in our final workshops. 3. Article describing the project and its outcomes to appear in the June 2006 issue of <i>Australian Landcare</i>. 4. Poster and accompanying paper for the September 2006 conference of the Australian Rangeland Society (to be held in Renmark).
<p>ASSESSMENT OF ANY COMMERCIAL POTENTIAL:</p>	<p>If we receive additional funding to expand this work, there may be some commercial potential resulting from this project. However, this is contingent on a future project reporting favourably on the economic viability of operating a commercial image processing and delivery system for MODIS-derived products.</p>
<p>LIST OF PUBLICATION TITLES:</p>	<p>Poster to be presented at the 14th Biennial Conference of the Australian Rangeland Society, Renmark, September 2006. A short paper titled “Woolgrowers with Remote Control: New Tools for Whole of Property Management” will be printed in the proceedings of that conference.</p>
<p>WHERE CAN THE READER OF THIS</p>	<p>It is likely that an article describing the project will appear in the June 2006 issue of <i>Australian Landcare</i> (published by the <i>Australian Farm Journal</i>).</p>

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REPORT OBTAIN ADDITIONAL INFORMATION (if required):	Otherwise, for additional information, contact Gary Bastin (gary.bastin@csiro.au)
REFERENCES (if any):	
LIST OF ATTACHMENTS:	<p>Technical Report Newspaper article – Peterborough Times, February 2006 Magazine article – June 2006 issue of <i>Australian Landcare</i></p>
ABSTRACT (for AANRO):	<p>Monitoring the condition of vegetation and soil resources is becoming progressively embedded as best practice by rangeland woolgrowers. In the main, monitoring is conducted by routine visual inspection during water runs, from photos taken at fixed sites (perhaps supplemented by notes and some data) and from the air for those stations with an aircraft. Satellite data can provide a periodic and complete assessment of some vegetation attributes (e.g. cover, greenness) but until now, has mainly been used by the research community, government or consultants because of cost and technical complexity of interpretation. This project tested whether a partnership of wool producers and scientists could develop information products from satellite data that assisted managers to make more precise and spatially-extensive assessments of vegetation cover as part of their grazing management. Steps in the project included:</p> <ol style="list-style-type: none"> 1. Building relationships with woolgrowers to deliver credible products. 2. Providing images, maps and graphs that showed both historical and close-to-real-time levels of cover and that linked to on-ground observations. 3. Providing additional historical context on vegetation change – during initial workshops, woolgrowers requested historical data so as to better judge present cover levels (and possible management responses) against those existing in the past. <p>Seven woolgrower families on nine stations covering 8220 km² were involved. Cover maps were based on the ‘visible red’ band of 250-m MODIS imagery and extended from late 2000 to early 2006. We worked with family members to produce the following information products from satellite images: (i) vegetation cover scaled to minimum and maximum values on their properties; (ii) time-traces of average levels of cover by land type within selected paddocks; (iii) historical context of cover change from AVHRR NDVI (vegetation greenness) images of the region for the period 1981 to 2003 and Landsat images (in digital form) for each station between 1972 and 2002; (iv) user-customised views for tracking change in designated cover classes (eg to monitor change in area of a paddock classified as ‘low’ cover). We also supplied freeware image viewing software (Open EV) to allow family members to “explore” vegetation and landscape change on their place. During final workshops with project woolgrowers and a “new” group (neighbours not familiar with the project), most participants considered MODIS-derived cover products relevant to their management (mainly for longer term monitoring), were interested in possible web-based delivery with access to software tools for further customising on their own computer, and expressed enthusiasm to be involved in further product testing and development.</p>

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SUMMARY STATS FOR ENTIRE PROJECT PERIOD:						
Reporting period: from 1/6/05 to 31/3/06						
NO. FIELD SITES:	9	NUMBER OF PRESENTATIONS OR BRIEFINGS ON YOUR PROJECT:				6
TYPES OF FIELD SITES:	Whole of larger paddocks (>20 km ²) on each of nine stations					
NUMBER OF PUBLICATIONS:	<i>Research</i>		<i>Extension</i>	1	<i>Journals</i>	
	<i>Books</i>		<i>Brochures</i>		<i>Other</i>	1
NUMBER OF FIELD DAYS ETC., ATTENDANCE AND PROFILE OF PARTICIPANTS	<i>Field days:</i>		<i>No. woolgrowers:</i>		<i>No. of service providers:</i>	
	<i>Courses:</i>		<i>No. woolgrowers:</i>		<i>No. of service providers:</i>	
	<i>Workshops:</i>	5	<i>No. woolgrowers:</i>	16	<i>No. of service providers:</i>	4
HAVE YOU ESTABLISHED ALLIANCES WITH OTHER PROJECTS/PROGRAMS?	Briefing to senior staff of Rural Directions, Clare – running pastoral BestPrac groups					
OTHER PROJECT ACTIVITIES (EG: PHOTO SHOOTS, FINANCIAL ANALYSIS, MEDIA ARTICLES):	Newspaper article in Peterborough Times in conjunction with final project workshops (March 2006)					
HAS YOUR PROJECT GOT ANY EXAMPLES OF INNOVATIVE ACTIVITIES?	Some family members of participating woolgrowers using Open EV image viewing software and digital Landsat images to “explore” recent vegetation change on their respective stations.					
HAVE YOU RECEIVED ANECDOTAL FEEDBACK ON YOUR PROJECT (OR THE LWW PROGRAM IN GENERAL)?	Yes: interest in, and agreement with, project philosophy (i.e. delivery of additional tools to help producers with decision making); project needs a longer time-frame for methods to become established; government agencies with a role in land monitoring should be using similar technologies.					
IS THERE DEMAND FOR PRODUCTS FROM YOUR PROJECT?	WHAT?	Continuing maps and time-traces of cover at paddock and/or property scale – delivered perhaps quarterly				
	HOW MANY?	Majority of family members directly involved in project and all woolgrowers participating in the second of final workshops (total = 15)				
	FROM WHOM?	Project participants and neighbouring stations				
DO YOU HAVE EVIDENCE THAT:	Eg: statistics and anecdotes from Field Day evaluation forms					
(A) THE TARGET AUDIENCES FOR YOUR PROJECT’S ACTIVITIES AND PRODUCTS FIND THEM USEFUL?	Yes: all participants at the project’s final workshops formally recorded (via a structured questionnaire) enthusiasm for demonstrated cover images and related time-traces of cover. All said these products would provide additional valuable monitoring information for their management. Some saw value in the products for more immediate decisions about paddock stocking rates. All expressed interest in being involved in a next-version of the project if the opportunity arises.					
(B) AS A RESULT OF YOUR PROJECT, WOOLGROWERS HAVE A GREATER UNDERTSANDING OF THE PARTICULAR NRM ISSUE YOUR PROJECT IS DEALING	Producers are already aware of the NRM issues we are dealing with (vegetation management, long and short term changes, managing grazing pressure – both domestic and feral/native herbivores) but they are becoming more aware of how products derived from remotely sensed data and delivered in an appropriate and timely					

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WITH?	manner could assist their management.
(C) AS A RESULT OF YOUR PROJECT, WOOLGROWERS ARE MOTIVATED TO ADOPT BETTER PRACTICES?	The project has not run for sufficiently long to engender this change.
(D) AS A RESULT OF YOUR PROJECT, WOOLGROWERS BELIEVE THEY HAVE AN INCREASED ABILITY TO ACT ON THE NRM ISSUE YOUR PROJECT IS DEALING WITH?	We have no direct evidence that this has occurred. However we are encouraged by producer feedback that the more complete record of recent vegetation change (extending back to the 1970s) has provided improved understanding of how seasonal conditions and grazing pressure affect vegetation dynamics. For most (based on comments made), this has reinforced their need to actively manage stock numbers in the face of highly variable seasons experienced.