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Submission to the Western Australian Government Sustainability Strategy by Satellite Remote Sensing Services, Department of Land Administration (DOLA)

Title:
Achieving sustainability through the application of spatial information to renewable resource management - To measure is to manage

Executive Summary
Satellite sensors daily measure the earth's atmospheric, ocean and land surface conditions. The atmospheric data are processed by the Bureau of Meteorology for weather forecasts, while the land and ocean data remains largely unprocessed. If this information was extracted and made widely accessible it would significantly improve the ability of Managers to sustainably manage Western Australia's renewable resources. Without access to real-time earth surface information, Managers can only realise a fraction of the true value of increasingly accurate weather forecasts.

In recognition of this imperative DOLA proposes the Cooperative Research Centre for Application of Earth Observations (CAEO), **a** joint venture partnership between the Private Sector, State Natural Resource Agencies, CSIRO, Universities and Rural Industry R&D Corporations to capture this opportunity. CAEO could mobilise resources of $12m per year over its 7 year life to achieving these outcomes. For a cost of $7,000,000 to the WA Government, $21m of CRC funding could be attracted to Western Australia and give WA national leadership in this area of sustainable management of renewable resources.

Introduction
Uncertainty caused by spatial-temporal variability of Australia's renewable resource base makes decisions that achieve sustainability difficult and outcomes uncertain. Weather interacts with highly variable land and marine environments creating the complex spatial-temporal variability of the resource base. This complexity means that without help farmers, fishermen and pastoralists cannot manage Australia's renewable resources sustainably.

The consequence – unsustainable decisions
In their struggle for economic survival and without the tools to adequately manage this spatial-temporal variability farmers, fishermen and pastoralists are forced into unsustainable management that degrades Australia's renewable resource base. This is evidenced by trees being cleared faster than they are being replanted, on-going salinisation, soil acidification, soil structural decline, loss of biodiversity, desertification of rangelands, uncontrolled bush fires, depleted fish stocks, pollution of rivers and coastal waters, low crop yields, poor pasture utilisation, poorly controlled product quality which all demonstrate that we still lack the information to sustainably manage Australia's renewable resource base.

Until the spatial-temporal variability of the resource base is **measured** it cannot be **managed** sustainably. However the vast areas and temporal frequencies over which this spatial variability operates has rendered conventional point measurement techniques too costly to be effectual. With limited application of satellite remote sensing measurement techniques Government Agencies have had limited success in changing these unsustainable practises.

Finding the solution
Because of the necessity for improved weather forecasts and defence systems (eg. Star Wars) remote measurement of the earth's spatial variability from space have become increasingly accurate. In a modern equivalent of beating swords into plough shears, these same techniques are being applied to managing the impacts of global climate change on the environment (eg. http://www.earth-outlook.com). Over the last 10 years the potential of these techniques for renewable resource management have been demonstrated in Western Australia by CSIRO and DOLA through projects such as Vegetation Watch, FireWatch, Land Monitor, Land Cover change, AgImage and FOO/PGR (Feed on Offer/Pasture Growth rate). Because of the potential opportunities the WA Satellite Technology Application Consortium (WASTAC)

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upgraded its reception capabilities in 2001 to receive data from NASA's next generation of environmental satellites with data from MODIS on the TERRA platform being now received.

An unparalleled opportunity

Data from NASA's latest environmental satellite sensors are being received and archived daily in Perth, Alice Springs and Hobart, but without the information being extracted and made widely accessible for renewable resource management. This information when combined with the power and accessibility of the internet offers an unparalleled opportunity to bridge the knowledge gap on spatial-temporal variability and enable new tools for the sustainable management of Australia's renewable resources to be rapidly deployed.

To capture this opportunity DOLA proposes the Cooperative Research Centre for Application of Earth Observations (CAEO), a joint venture partnership between the Private Sector, State Natural Resource Agencies, CSIRO, Universities and Rural Industry R&D Corporations to capture this opportunity. CAEO could mobilise resources of $12m per year over its 7 year life to achieving these outcomes. At least $1,000,000 pa of WA Government support is needed to attract $21m of CRC funding to Western Australia.

Outcomes from the real time application of earth observations in combinations with DOLA's other spatial information:

Based on DOLA's experience over the last 10 years, it is confident that the following information and outcomes can be achieved with the new earth observation satellites now available:

Marine

Daily information on the spatial-temporal variation of phytoplankton, water quality and surface currents of the oceans and coastal regions which will improve:

Fish population management by:

- Fishermen being able to achieve their fish catch quota with less expenditure of fuel and time,
- State agencies being able to sample and model more accurately fish populations for conservation,

Pollution and environmental degradation management by:

- Measuring euthrophication impacts of sewage outfalls on the coastal zone
- Identifying oil pollution from oil and gas extraction industries
- Measuring catchment conditions and loads of sediments and dissolved organic matter in coastal waters

Bio-diversity management by:

- Monitoring the response of coral reefs and sea grass habitats to environmental stress.

Atmosphere

State Government Agencies will have near real-time information for improved:

Spatial atmospheric pollution monitoring by:

- Having background information on particle density for detecting atmospheric pollution levels from smoke.

Weather forecasting from more accurate:

- Information on vertical profiles of T, H_20 and Pressure over the Southern and Indian ocean.

Agriculture and Rangelands

Managers will have near real-time spectral information on green biomass, dead biomass, vegetation species, soils and surface temperature at farm scale which will result in more spatially accurate:

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Grazing and crop production as a result of access to:

- Weekly green biomass for more accurate feed budgeting to sustainably increase stocking rates and tactical crop management decisions to increase yields and product quality.
- Forecast end-of-season crop and pasture yields from in-season biomass measures for forward selling at higher prices.
- Maps of soil fertility for zonal farm management leading to increased fertiliser efficiency through increased crop and pasture productivity.
- Reduced erosion hazards from monitoring of dry vegetation cover over summer.
- Soil water content at break of season for more timely sowing decisions.

Near real-time changes in native vegetation cover which will enable Governments to ensure that the rate of tree planting exceeds the rate of clearing through ability to:

- Detect illegal clearing within one month of occurrence at a resolution of 1 ha.
- Report all changes every 12 months at a resolution of 0.1ha.
- Monitor the change in "health" of native vegetation every 12 months.

Establish sustainability indicators at regional scale based on:

- Crop production forecasts as a function of actual areas of crop planted and forecast crop yield.
- Identification of land productivity units based on historical green biomass production.
- Long term sustainability indicators of % arable land, land use and productivity of the arable land against benchmarks.

Identifications of areas of environmental stress caused by:

- Salinity, waterlogging, soil acidity, wind erosion and loss of perennial vegetation.
- Conditions of wetlands and riparian vegetation.
- Biomass burning of stubble residues.
- Extreme Circumstances caused by Drought and frequency of frost occurrence.

Bush Fire Management, Bio-diversity and Greenhouse Gas emissions

Integrated information at regional and continental scale will be accessible which will enable;

Improved bush fire management for sustainability by providing near real-time information on:

- Active fires and fire fronts in remote areas to be monitored and managed economically.
- Bush fire risks in remote areas to be quantified and appropriate management regimes prescibed.
- Fire histories of all landscapes enabling long term sustainable bush fire regimes to be implemented.
- Impacts of smoke plumes on atmospheric pollution to be determined and managed.
- Carbon balance of continental scale biomass processes for Greenhouse Gas emission management.
- Long term trends in the cover of native vegetation in extensive rangeland systems.

Conclusion:

Government investment in making this information available in near real-time for application by State Agencies and Managers will have a significant impact in achieving sustainability of the State's renewable resources and dependant rural and regional communities. The return to Western Australia will annually exceed the cost by a thousand fold.

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