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Development of catchment Management in Australia

Land degradation is a major problem in the agricultural regions of Australia. Increasing dryland and irrigated land salinity have a significant impact on the productivity of the agricultural sector. Although agricultural production has increased over the last ten years, the increase could have been much larger if land was not being lost to salinity. Salinity is recognised as a groundwater problem and as such the groundwater has to be managed. There is considerable research that shows that this management MUST be done on a catchment basis. Individual farmers particularly those at the lower end of catchments are reluctant to proceed with remedial actions, whether assisted by government funds or unassisted, if the rest of the catchment is doing nothing.
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Value of Catchment Approach

The regolith is the zone between surface and the basement rock. This zone is where most of the groundwater flows, particularly in areas of dryland salinity in the upland areas of the Great Dividing Range in Eastern Australia, Eyre Peninsula, SA and in the southwest agricultural area of WA. The regolith is extremely variable in composition and thus in hydrogeological character. Groundwater flow can move preferentially vertically or laterally via preferred pathways, which make up a very small fraction of the regolith. Salt is also built up and/or remobilised in an extremely variable fashion.

In order to plan remedial actions in catchments it is necessary to collect data that reflects the highly variable nature of the regolith. The recent National Airborne Geophysics Project conducted under the National Dryland Salinity Program has shown that airborne geophysics can give a considerable amount of the information. The challenge to provide better information has been taken up by World Geoscience Corporation and more sensors are being developed in conjunction with CSIRO.

High resolution airborne geophysics is the only way that detailed information can be obtained quickly across the whole landscape. Present methodology using satellite data, airphotos, soil mapping etc are only seeing the surface and cannot measure the changes beneath the ground although these techniques can be used to compliment and enhance the value of airborne geophysics. Geology is still being interpreted from airphotos in catchment management projects. Three contracts have been let in the last six months for such work in WA alone. The mining industry has largely discarded these techniques as being too unreliable especially where detailed information about the basement rock is required. Soil mapping is proceeding at scales of 1;50,000 or coarser when studies show that these scales are useless except at regional decision levels. At catchment management level the soils have to be remapped. Hydrogeological investigations continue with expensive drilling techniques. Costs in WA are such that $250,000 was expended in one project covering 50,000 hectares. This amounted to drilling some 30 holes. The complete are was flown by a geophysical survey with samples every 6 metres of some 20 plus parameters along lines 150 metres apart.

Particular techniques that should be implemented on a broad scale are:

1. Airborne electromagnetic surveys - The SALTMAP system developed by WGC/CSIRO won a National Landcare award. Limitations were noted in that system by government agencies and it has been replaced by the more recent TEMPEST which is now under trial by AFFA, AGSO, BRS and CRC-AMET. These systems can measure the salt in the sub-surface, detect areas of preferential flow or the reverse, detect depth to basement and provide a 3 dimensional view of the regolith.

2. Airborne magnetic surveys have been in wide use by the mining industry for many years to map the underlying geology. It is now recognised that the underlying basement geology plays an important part in the development of the regolith and inferences can be made about groundwater flow from an understanding of the basement geology. Many catchment management projects are persisting with outdated airphoto interpretation techniques which have largely been superceded in the mining industry. These techniques are cheaper but cannot give the necessary information. Expensive decisions in catchment management are being made on substandard information.

3. Airborne radiometric surveys can map the soil characteristics in much greater detail than can be achieved in ground based investigation. Airborne radiometrics will be combined in the same survey with the new SWIPS/TIPS hyper-spectral profiling system being jointly developed by CSIRO and WGC. These combined tools will be the future for detailed soil mapping at scales applicable for farm and catchment management.. It will not be easy however for some scientists to change their present practices.

4. Digital terrain models are essential for catchment management. Large areas of Australia are being mapped at 2 metre contour interval using soft photogrammetric methods. However, DTMs can be obtained at the same time as other data sets in an airborne geophysical survey.

Other datasets such as cadastre, road networks, vegetation and climate are also essential. Mostly these are available through government agencies although increasingly these departments are making these data more expensive to obtain and with unnecessary (and questionable) copyright restrictions. Water table depth across catchments would ideal to obtain to better assist in management but until geophysical techniques such as NMR (which is currently under development) becomes more useable we can never hope to achieve the detail that we would like in water table depth. Drillholes by their very nature are an invasive and costly technique cannot deliver the level of information required. Surrogates for drilling such as can be obtained geophysical data will become more necessary and widespread in catchment management.

Best Practice Methods

Best practice in environmental catchment management particularly in areas of land degradation demands high resolution, high quality data. The level of resolution and quality can only be provided by the widespread collection of airborne geophysical survey data.

Techniques for remedial actions are being developed. These need to be carefully implemented in the landscape in order to have maximum effect with minimum alienation of land. Present indications in Western Australia are that an effective leaf are index close to the original vegetation will be needed to reverse the effects of salinity. Under the present "Billion Trees' mentality will see complete revegetation of the landscape and the end of broadacre farming.

Good quality, high resolution data that defines the sub-surface conditions in the regolith can allow remedial actions to be placed in a best practice manner. The alternative is like walking in the dark.

Roles of government and private sector

Catchment management in Australia is primarily in the hands of government agencies and instrumentalities. Unfortunately funding for catchment management is controlled by the same groups. These groups have great resistance to change. There continues to be constant inter-departmental rivalry between departments despite the best efforts of politicians and the widespread community. Three departments (or more) control funding for catchment management in Western Australia. The money allocated through schemes such as NHT, LWRRDC, NDSP etc is essential for the continued operation of these departments at current levels. There is great resistance therefore to allocate any money to other groups. In the battle for funding the private sector is seen as a greater risk to continued funding than rival departments. Yet there is probably greater expertise in the private sector than in government. The mining sector due to community pressure has had to develop best practice to manage mining operations within catchments.

It has long been recognised that one of the major incentives to arrest land degradation will be the effective demonstration that remedial methods can be cost effective. Government departments have been extolling this dogma for some time. However, it is very hard to see how alternative ventures can be .successful in the broadacre areas where soils are poor and rainfall is low.

Until the private sector becomes more involved the landowners will continue to be directed by government agencies who often have little feeling for the commercial endeavour.

Tree plantations are one example where there has been considerable investment over the last five years. This has been primarily driven by tax incentives. Little planning goes into the location of these plantations other than distance to the near mill. Consequently widespread failure is evident. Tree death and/or poor growth rates due to lack of water, shallow bedrock or saline soils is common. Investors have made their return and the promoter have come and gone. Tax incentives should be more carefully applied so that proper investigations are carried out prior to planting. That way the investors, the government and the environment get the most return. The loser will be the promoter who has to do more work for his money. The indications form forestry are that a 150% tax incentive on well planned remedial work in catchments would achieve more than any of the present funding programs.

Planning in catchments

Catchment planning to date in most areas of Australia has proceeded from the farm up. Workshops are convened by government agencies on farm planning to reverse degradation. Farm plans are amalgamated to make catchment plans. This approach is fundamentally flawed in that the farmers never see or address the large landscape issues in their remedial actions.

There is an urgent need to collect high resolution data over catchments that reflects the whole landscape issues. Airborne geophysics can provide this information. The techniques have been under development for some 10 years now and are ready to be deployed on a wide scale. Famers need the information but it will take a major shift in government funding policy and a statesman like approach to begin the operation. Once started the results will speak for themselves.