PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE

Official publication of The Australian Rangeland Society

Form of Reference

The reference for this article should be in this general form;
Author family name, initials (year). Title. *In*: Proceedings of the nth Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).
For example:
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 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

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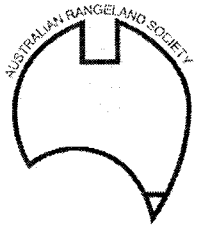

The Australian Rangeland Society

IMPROVING ACCESS TO CLIMATE INFORMATION NEEDED FOR RANGELAND MANAGEMENT

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ABSTRACT

Ready access to climate data facilitates a better understanding of climate and enhances rangeland research. The Bureau of Meteorology collects climate data across Australia and stores the data in both a manuscript archive system and on computer. Retrieving the data to assist in research projects can be time consuming and expensive. Consequently government agencies have developed their own data storage and analysis systems, an example being the Queensland Department of Primary Industries (QDPI) climate data bank for Queensland. To assist rural enterprises minimise the management risks associated with climate variability, a range of "climate" products have been developed throughout Australia. Such products include books, software and advisory services which can benefit all those involved in range management.

INTRODUCTION

Climatic factors, particularly rainfall, greatly influence the productivity and stability of Australia's rangelands (McKeon *et al.* 1990). Thus to ensure appropriate range management practices, a clear understanding of the magnitude of climatic factors, such as rainfall variability, needs to be acquired.

All personnel involved in any aspect of range management utilise some type of climatic information in undertaking their work. The property manager watches the nightly weather for any new developments, the range extension officer has tables of rainfall probabilities close at hand, the research team requires historical data sets to simulate pasture growth models and the head-office administrator ponders the last months rainfall distribution maps. Climatic data are critical to their decisions.

A sound decision needs to accommodate the current and future climatic conditions to pursue the best option for range management. For example, initiating a major woody weed control programme by bladeploughing may need to be delayed if the seasonal outlook, as indicated by El Nino / Southern Oscillation, may be too dry for re-establishing pasture following ploughing. Decisions on stock agistment may be influenced by comparing current feed on hand and long term rainfall probabilities for two prospective locations where stock could be moved. However, how readily can the range manager access such climatic information and how can it be made relevant to property practices?

The custodian of climate information in Australia, the Bureau of Meteorology, has extensive data sets for many sites in Australia. The upsurge in recent years by State and Federal agencies to utilise climate data for various research and extension developments has initiated the need to develop "in-house" ways of storing and managing the data.

In this paper the types of products, such as books, software and advisory services, that are available to range management personnel are reviewed.

CLIMATE DATA COLLECTION AND STORAGE BY THE BUREAU OF METEOROLOGY

Data Collection

There are approximately 6,000 stations currently collecting rainfall data and 600 stations collecting temperature and other climate data in Australia. Each month the data (unverified) are sent to the Bureau of Meteorology in Melbourne and entered into computers for checking and storing. "Quality control" checks the data for errors, by running it through several programs. The verified data are stored on computer and the originals are archived as manuscripts (Bureau of Meteorology 1990).

TABLE 1 Some climate data products and services in Australia

Product	Cost	Presentation format	Data type	Coverage
ACRU seasonal rainfall forecast	$250*	monthly report	rainfall forecast	20 000 points across Australia
Climate Averages Australia Bureau of Meteorology	$78 $10 $60	book microfiche printout	rainfall, temperature and humidity	All Australian climate stations
MetAccess Horizon Agriculture	$490	software	rainfall, temperature, humidity, evaporation, frost and more	16 000 individual stations Australia wide
Queensland's Rainfall History QDPI	$60	book	rainfall	170 Queensland stations
Rainman QPDI	$250	software	rainfall, temperature, humidity, evaporation	450 Queensland stations
Seasonal Climate Outlook Bureau of Meteorology	$120*	monthly report	seasonal rainfall forecast	Australia wide
SOI hotline QDPI	STD phone call	telephone recorded message	Recent SOI, implications for rainfall and grazing management	
Weather call Bureau of Meteorology	0055 phone call	telephone recorded message	daily rural forecasts, seasonal forecasts	

* annual subscription.

Access to stored data

Climate data are available to the public from the Bureau of Meteorology as raw data or with some statistics, on computer disks, microfiche or printed material. Data in computer format (e.g. ASCII text files) can be easily manipulated on the user's computer. Data on microfiche are cheap and compact. Books such as *Climatic Averages Australia* (Bureau of Meteorology 1988), can be purchased by the public. *Climatic Averages Australia* includes 600 stations from all over Australia, which is a useful resource book for nationwide coverage (Table 1).

Locating suitable climate data from the Bureau of Meteorology can be a problem, even though access is straight forward. The problem arises when a desired location does not have a full data set, and then having to complete the data set with a composite set from one or more nearby stations. The Bureau of Meteorology's directory of stations and *Summary of Climate Data* (Bureau of Meteorology 1990, limited circulation) have the required station information but there is a need for maps to visually locate and compare station data sets.

IMPROVING ACCESS TO CLIMATE DATA

Quick and easy access to climate data benefits range management personnel in undertaking their various tasks. Examples of groups in Australia who are making climate data more accessible follows. We believe the listing is not exhaustive, particularly where new climate services have not been widely publicised.

1. QDPI CLIMATE DATA BANK

Background

The QDPI climate data bank was established to improve access to climate data for researchers , to overcome the expenses of re-purchasing the same climate data sets, and to provide climate information relevant to the rural industries in Queensland (Willcocks and Lloyd 1988). The data bank is on a main frame computer with access via satellite or telephone link. The QDPI climate data bank includes information on :

* Daily rainfall data for 400 stations;
* Monthly rainfall for all stations in Queensland and the Northern Territory;
* Probability tables, which include the effect of SOI, for monthly and seasonal rainfall for 1000 stations in Queensland;
* Daily climate data (eg. temperature, evaporation, relative humidity) for 16 stations in Queensland;
* Climate averages for all stations in Queensland;
* Historical SOI values.

Developments

The QDPI Drought Research Unit and the joint CSIRO and QDPI "Agricultural Production Systems Research Unit" (APSRU) are two major users of the QDPI climate data bank and have added data (e.g. daily rainfall for additional stations) and improved access through creating new programs. The Drought Research Unit aims to warn producers and government of impending drought, based on the current condition of pastures, El Nino / Southern Oscillation information and using models to calculate future feed reserves. The models use current climate data ("real-time" data), so the group is preparing a real-time climate data retrieval system using METEX (a Bureau of Meteorology real-time data access service). The group also has the *SOI Hotline*, a telephone recorded message with the latest SOI, and implications for future weather and grazing management strategies (Table 1). Between 2 April and 11 May 1992, there were 775 calls (for three updated messages).

Products from the QDPI climate data bank for range managers

To date, there are two major products available to producers which have come from the QDPI climate data bank. The first is the book *Queensland's Rainfall History* (Willcocks and Young 1991), which presents graphs of rainfall patterns for 270 stations across Queensland (Table 1). For each station there is a table with probability distributions of monthly rainfall, and three graphs, namely, yearly averages and 5 and 10 year moving averages of summer and winter rainfall. Moving averages smooth out the extreme year to year variability so the periods of above and below average rainfall can be better identified.

The second product (a joint venture with Bureau of Meteorology) is *Rainman : Rainfall Information for Better Management* (Clarkson and Owens 1991), a computer decision support package (Table 1). The *Rainman* package has data for 450 stations across Queensland and provides information on:

* daily, monthly and seasonal rainfall characteristics;
* changes in rainfall probability with changes in the SOI;
* drought;
* historical records of monthly rainfall;
* average monthly temperatures, humidity and evaporation (86 stations);

The package also includes a book *Will it Rain?* (Partridge 1991) which explains the El Nino / Southern Oscillation and its effects on crop and pasture growth.

Climate software such as *Rainman* improves access by range managers to climate information by providing complex yet fast analysis of large data sets on the home computer.

Rainman and *Queensland's Rainfall History* can be improved with maps showing the locations of the stations, for instances when climate information is required for locations not included.

2. THE BUREAU OF METEOROLOGY

There is a major project under way to modernise the Bureau of Meteorology data bank which will improve access to climate data. The rural community requires better access to both real-time data (unverified) and stored data (verified). Part of the improvements will come from using electronic field books. It will save data entry time, make more types of data available as real-time data and make verified data available faster than in the current system. Simplified data access is being developed for clients. When in place, communication services such as fax, DIFACS, pollfax, bulletin boards, and computer-computer links will all make forecasts and data easier to access.

3. METACCESS

MetAccess (Donnally *et al.* 1992) is a computer package providing statistical and historical climate information (Table 1). It includes data for rainfall, evaporation, temperature, wind, solar radiation and frost. The information is presented graphically or as tables. The statistical analyses are detailed and there are options to combine different data sets on the one screen. The graphing, flexibility in choosing data sets and ability for users to enter and analyse their own data, are improvements on the *Rainman* software. However, *MetAccess* does not include analyses with the SOI, and it has less interpretive information, such as the drought analysis.

The main restriction with both *MetAccess* and *Rainman* is that they do not integrate climate variables which together influence pasture growth. A software program called *Climate*, being developed by the CSIRO in Alice Springs is furthering the information in *MetAccess* to make it more useful in range management decision making (Mark Stafford-Smith pers. comm.). For example, *Climate* will integrate rainfall and temperature probabilities to determine the probability of pasture growth which provides useful information for destocking decisions at the end of summer.

4. WESTERN AUSTRALIA DEPARTMENT OF AGRICULTURE

The Western Australia Department of Agriculture (WADA) provides detailed rainfall probabilities. The probability information is generated on computer for each season and includes such probabilities as having an early break to the dry season and the probability of a dry spell following that early break. Current use is by extension officers to service producer enquiries. In addition they provide general climate information included in agricultural information books for different regions (e.g. Payne *et al.* 1987).

In future, the WADA hopes to produce a series of pamphlets on rainfall graphs and probabilities similar to those in *Queensland's Rainfall History*. They plan to produce a separate pamphlet for each station rather than a book.

WEATHER FORECASTING SUPPLEMENTS USE OF CLIMATE DATA

Analysis of climate data provides a background understanding of the climate regime and its variability, but weather predictions are based on what is currently occurring in the atmosphere and oceans. Forecasting techniques and services have progressed rapidly in the last few decades, and the following are examples of what is currently available.

Bureau of Meteorology

The Bureau of Meteorology has improved the accuracy of their day to day forecasts and initiated seasonal forecasts. The Bureau of Meteorology has

"weather call" services (0055 numbers) for daily forecasts in rural NSW and Victoria, and for the national seasonal forecasts. A brief version of the seasonal outlook is provided to the media and is published by several rural newspapers and broadcast by various radio stations. More detailed reports about the national seasonal outlook are available through an annual subscription to the *Seasonal Climate Outlook* (Table 1).

The daily forecasts, which are used by the mass media, access the rural industries daily. The Bureau of Meteorology has specialised forecasting services for various rural industries such as dried fruit, grape growing (frost forecasts), sheep grazing and sugar cane (Noar 1991).

The Applied Climate Research Unit

The Applied Climate Research Unit (ACRU) at the University of Queensland provides seasonal and yearly forecasting services and various specific consultancies, all on a commercial basis. The seasonal rainfall forecasts are for individual centres anywhere in Australia (20 000 points). The forecasts are sent each month and give three probability levels of rainfall (30%, 50% and 70% probability of exceedence) and general information about the forecast and the current weather patterns (Table 1). This forecasting service is specific to a location whereas the *Seasonal Climate Outlook* is Australia wide.

BETTER ACCESS IMPROVES RANGE RESEARCH

Better access to climate data benefits research which in turn benefits range management. Range management research depends on collecting weather data or using climate data already collected. Modelling work, in particular, uses long term climate records (McKeon *et al.* 1990, Foran and Stafford-Smith 1991). Quicker access to climate data improves range management by increasing the efficiency of range research. Many decision support packages use climate data in their simulations eg : *Grassman* (Scanlan and McKeon 1990) and *RangePack Herd-Econ* (Stafford Smith and Foran 1988).

The "Agricultural Production Systems Research Unit" (APSRU) in Queensland is assessing in economic terms (e.g. gross margins), the usefulness of forecasting systems in crop production. APSRU is finding SOI information can help minimise risk when making decisions, such as date of planting and whether to apply nitrogen fertiliser (Roger Stone pers. comm.). Such an approach also shows potential for range management.

FUTURE

Rainman and *MetAccess* are the first examples of software products about climate that producers can purchase. It is planned that *Rainman* will soon be an Australian wide product. However, the success in updating the data in such packages is yet to be tested.

Currently, in Australia the expense of obtaining climate data relates to the cost of extracting and supplying the data. World Weather Watch, under the auspices of the World Meteorological Organisation, is an international agreement whereby weather observations, collected by 160 nations worldwide, are made available freely and quickly to other nations. Many nations, including Australia, are developing privatised services for specialist requests, but are keeping a free service for general forecasts and access to data (Trenberth 1992). The New Zealand Meteorological Service however, is now charging for data and forecasts, the aim being to reduce costs and improve services (Grant 1992). Such charging could jeopardise the free exchange of data. Any charging for climate data will restrict access, and reverse the current trend of increasing use of climate data in range management.

Access to climate data needed for range management has improved in the last decade through new services provided by rangeland researchers, advisers and the Bureau of Meteorology. It will continue to improve as the Bureau of Meteorology upgrades its data bank and access methods. In addition, forecasting techniques have vastly improved and the resulting seasonal forecasts and rural weather warnings are now useful tools for range management.

ACKNOWLEDGMENTS

We wish to thank the following people for the helpful discussions and information which enabled us to write this paper; Mary Voice and Gary Moore, Bureau of Meteorology, Melbourne; Ian Foster, WADA, Perth; Mark Stafford-Smith, CSIRO, Alice Springs; John Carter and Col Paull, Drought Research Unit QDPI, Brisbane; Roger Stone, APSRU, Toowoomba; Vic Squires, University of Adelaide, Adelaide; Rob McCook, Horizon Agriculture, Sydney; and Andris Auliciems, ACRU, Brisbane.

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