GAMMON RANGES SCIENTIFIC PROJECT

A GENERAL DESCRIPTION

The Beginning

This project arose out of curiosity how did the Gammon Plateau support such a dense growth of vegetation in a low rainfall area. This curiosity was heightened by an experience in which extremely heavy rain in the ranges was observed to be confined almost entirely to the ranges.

It was soon recognised that the only way to get an answer to the question of exactly how much rain actually falls in the ranges would be to establish a long term rainfall monitoring project. It was also recognised that this could provide a different and valuable opportunity for SEG to assist in the training of young people in field science activities. From this rather humble start and with the help of many people and organisations this project has now grown into a significant, broad environmental monitoring exercise which will provide valuable information to organisations such as National Parks and Wildlife Service, and other relevant agencies in government and private enterprise, as well as providing training and wilderness experience for expeditioners.

On 11 September 1988 the project was officially commenced with the turning on of a pluviometer which had just been installed on the Plateau. The project was dedicated to the memory of Louise Grandfield, a SEG member and leader on the Expedition Freeling Plateau in 1986, who devoted much of her short career to caring for the Flinders Ranges. Tragically Louise was killed in a car accident on a field trip to the Flinders just one month after the Expedition.

The Gammon Ranges in the far northern Flinders Ranges consist of a deeply dissected quartzite plateau with steep gorges and spectacular cliffs. The sites for the SEG project are all located towards the western end of the Gammon Ranges and are reached from a camp site off the Mt Serle to Yankaninna road. This area was selected because it is less popular than the eastern part of the park which means that the scientific equipment is less likely to be disturbed and the data collection trip is in an area of near wilderness which adds to the experience for participants. It is intended that the project will continue for at least 20 years (ie until 2008). Four data recovery trips are made to the area each year.

The program has gradually expanded to include seven activities:

- Pluviometers (recording rain gauges) at eight sites
- Botanical monitoring at six sites
- Aquatic biology monitoring at two sites
- Human impact monitoring at three sites
- Stream-flow monitoring and electrical conductivity recording at one site
- Yellow footed rock wallaby colony monitoring
- Feral animal counts, numbers and locations.

A native vegetation monitoring program has been run by Robert Henzell, of the Feral Animal and Plant Control unit since the early 1970s. He has set up fenced exclosures to investigate the regeneration of native grasses, shrubs and trees when all grazing pressure is removed. During the 1996 Expedition Gammon Ranges SEG helped construct a series of exclosures at key sites on Arcoona Creek. They can be seen during trips to and from the Plateau.

A pitfall trapping program began in 1996, and has come to an end. The pitfall buckets were removed in 2001 and the sites restored.

Rainfall Monitoring

Little is known about the variability of rainfall with height in this semiarid climate, although orographic effects can cause an increase in the rainfall at favourable locations.

The eight pluviometers maintained by SEG are located :

- on the Plateau between North Tusk Hill and Four Winds Hill
- at the foot of North Tusk Hill, near Lower Sambot waterhole
- near the camp site on Arcoona Creek at the western boundary of the Gammon Ranges National Park
- in the middle of Arcoona South sub-catchment
- on a spur of Arcoona Bluff
- near North Mooloolloo homestead
- at Pfitzner's well, south-east of North Mooloolloo homestead
- near Maynard's Well homestead.

The initial rainfall monitoring site, on the Gammon Plateau, is at an elevation of approximately 930m. This makes it the highest automatic recording rain gauge in South Australia. The others are at various elevations, down to 320m. These eight instruments are ideally located to investigate the orographic effect of the ranges on the rainfall. They can also be compared with recordings from Balcanoona, Arkaroola, Leigh Creek and other daily read stations on pastoral properties. Because of the random and infrequent nature of the rainfall, it will take many years before sufficient data have been collected to enable an accurate comparison with adjacent stations, however a general understanding of the differences and similarities is already starting to develop.

Servicing a pluviometer

The five sites within the catchment of Arcoona Creek will also provide a good estimate of the total rainfall in the catchment for comparison with stream-flow measurements.

Since the beginning of the project in September 1988, the quality and capability of the monitoring of rainfall, using tipping bucket rain gauges, has improved considerably. In the early days, there were frequent occasions when the data loggers failed to record, or data was overwritten. The pluviometers are now performing consistently within the 3% error bounds used by the Bureau of Meteorology. Currently the data is recorded using dual data loggers at each site.

The instrument on Arcoona Bluff has a modem and CDMA phone facility so that it can be

interrogated by the Bureau of Meteorology each day to find out whether rain has fallen. This is vital information for Robert Henzell who manages the Feral Animal Research Project (exclosures), as he needs to know when there has been sufficient rainfall to cause germination of mulga (*Acacia aneura*) seedlings. It is also a useful indicator of whether there is likely to be water in the creeks, which will reduce the amount that must be carried in by expeditioners..

Botanical Monitoring

The vegetation found in the western part of the Gammon Ranges National Park varies depending on its location. Arcoona Creek is predominantly lined with *Eucalyptus camaldulensis* (river red gum) and *Melaleuca glomerata*, while on the slopes of North Tusk Hill *Triodia irritans* (spinifex) is interspersed with low shrubs. On the Plateau three distinct plant communities exist: a dense heath consisting mostly of *Calytrix tetragona*, *Callitris columellaris* (native pine), *Allocasuarina muelleriana* and *Acacia aneura* (mulga); an open mallee consisting of *Eucalyptus flindersii* and the low shrub *Goodenia vernicosa* with relatively large clear areas of stony soil; and a very dense impenetrable vegetation composed mainly of *Melaleuca uncinata*. The vegetation on the western slope of North Tusk Hill was burnt at some time between 1985 and 1988 and is slowly regenerating. This has provided an opportunity to monitor the succession of plants that colonise this area.

Vegetation photopoints with associated quadrats were installed in each of the identified plant communities on the Plateau and on the slopes of North Tusk Hill in 1988 and 1989. Their purpose is to assess long term changes in vegetation such as density, species composition, condition or growth. These changes are assessed in two ways – by regular photographs from fixed points and by less frequent scoring of the individual plants at each site. Between 1988 and 1999, the photopoints were photographed on most of the quarterly trips, whereas the quadrats were scored 5 times. Photographic monitoring is now limited to the autumn and spring trips.

Botanical monitoring photograph

This method of monitoring has shown that overall there has been little change in all of the photpoints over ten years, demonstrating the slow growth/change in vegetation in this environment. Some of the changes that have been observed are as follows:

- development of track in photopoint 70B
- *Melaleuca uncinata* becoming less dense
- burnt area regenerating, overstorey height increasing
- some response in relation to rainfall

Land Condition Monitoring

In 1999, Department for Environment and Heritage set up a monitoring program for the Gammon Ranges National Park, to monitor land condition using the same methods that are used to assess land condition on pastoral lease properties. Two of the original GRASP

photpoints (66B and 71B) have been adopted as part of the above program. Their structure has been modified so that they are consistent with the pastoral monitoring methods, and SEG will continue to monitor them as part of the GRASP program.

Aquatic Biology

Little is known of the biology of these ephemeral streams. It is known that the pools and running water left after rainfall are rapidly colonised by macroinvertebrates (small invertebrate animals living in streams and sediments, including insect larvae such as mosquitoes and midges). Presumably these animals either live deep in the sediments during dry periods or recolonise from outside the immediate area.

Macro-invertebrates are a major food source of many animals. They also process large amounts of organic matter and are an important component of nutrient cycling within aquatic ecosystems. Many have adapted to living in running waters (e.g. flattened bodies). Others may live in a stream environment but escape high flows by sheltering in low flow areas (e.g. behind rocks or vegetation).

Identifying aquatic invertebrates

The study of macroinvertebrates is important for a number of reasons. The most important in the context of the Gammon Ranges Scientific Project is because of their potential as biological monitors of changes in their habitat (ie changes in water quality). Some species are very sensitive to changes such as increases in salinity, turbidity or nutrients. The presence or absence of a particular species or the abundance of one species can give an indication of changes that have occurred since the last samples were collected. A study has been initiated to identify the species involved. Water salinity is also monitored by using electrical conductivity meters.Two locations on Arcoona Creek are sampled Wild Ass Waterhole (near the junction of Wild Ass and Arcoona Creeks) and Sambot Waterhole (further upstream). Often the sampling sites will be dry or will contain insufficient water to enable meaningful samples to be collected.

Human Impact Studies

Despite the intention of SEG that all its expeditions operate on minimum impact principles, our presence will always have some impact on the environment. This is the case for any human activity anywhere on the planet. Unfortunately, very little quantitative work has been done on investigating the impact bushwalkers have on the environment. Although it has been assumed that there is little or no impact, regular visitors to popular locations will testify to the changes wrought by increasing visitor loads.

As this project involves regular expeditions in the same locality, an ideal opportunity exists to gather quantitative data on the impact caused by bushwalking groups in an arid environment. Photopoints have been set up on the top of North Tusk Hill, at the Plateau pluviometer site and at Vandenberg Camp site (near the foot of North Tusk Hill) to record photographically the

impact at these three locations. Data collected will be stored until a suitable research project can be initiated to carry out analysis.

Camp fires
As part of the effort to reduce human impact, SEG decided not to light camp fires during the regular field trips. Dead timber, twigs, and leaf litter are vital to the survival of small animals and insects at the low end of the food chain. It was noted in other parts of the Flinders Ranges, such as Arkaroola, which are regularly visited by campers, that all dead timber within several kilometres radius is carried off and burnt. The lack of a camp fire to sit beside and talk after dinner comes as a shock to many people. However, SEG feels that the extra effort to minimise the effect on the environment is worth while.

Stream Flow Monitoring
Since 1991 SEG has operated a stream flow monitoring program on Arcoona Creek. The instrument consists of the data logging equipment, a solar panel to charge the batteries, two tubes that lead down to the creek with the control cables and the sensors, mounted against a rock. The recording instruments are housed well above the height of any flood (we hope). The measuring instruments and cables are tucked in against the rocks, protected from the main surge of the current.

The gauging station measures the level of the water in the creek at 5 minute intervals. Most of the time there is no flow in the creek in this semi-arid climate. However when heavy rains have fallen, the instrument records the rise of the water level as it fills the creek, and then records the falling water level as the flood passes down the creek. Engineering calculations are used to convert the level of the water surface to a rate of flow in cubic metres per second (tonnes per second) from which the total volume of water and the peak rate of flow of the flood is calculated. It is then possible, for instance, to compare the volume of water that fell as rain, with the amount of water that flowed down the creek as runoff. This can give an indication of how much water recharges the groundwater supply, how much goes to support the trees and other vegetation and how much is lost to evaporation

In order to minimise the risk that data is lost during the occasions when the creek flows (we have on several occasions failed to record floods due to equipment malfunction), there are actually two data loggers, each keeping a separate record of the flow. On each three-monthly trip we recover the data from the Hydrological Services logger. The data from the larger ‘Cherryville’ logger is recovered once a year.

In addition to water flow, we also record the salinity of the water. This gives an indication of water quality, and is used by scientists to measure the salt balance within the catchment. This is done using a probe which measures the conductivity of the water.

Yellow-footed Rock Wallaby Monitoring
The yellow-footed rock wallaby (*Petrogale xanthopus*) is restricted to small scattered colonies in arid rocky ranges of northern South Australia and adjacent areas of New South Wales and Queensland. This beautiful species has declined considerably since European settlement and many isolated populations have become extinct. Predation by foxes is known to be a major contributing factor in this decline. Wallaby populations protected by fox baiting programs elsewhere in South Australia are recovering strongly.

A small colony survives in the Arcoona Creek area of the Vulkathunha Gammon Ranges National Park. Sightings of only two or three animals at a time have been made in recent years. All have been made in steep gorges associated with two small tributaries of Arcoona Creek In dry

conditions the wallabies descend from the cliffs to drink at soaks in the creek, where they are exposed to increased risk of fox predation.

In September 1997 Scientific Expedition Group, with help from the Animal and Plant Control Commission and the then Department of Environment, Heritage and Aboriginal Affairs, embarked on a program to control foxes and monitor wallaby populations in the Arcoona Creek area. Fox baiting by SEG ceased in 2002 when aerial baiting was begun by the Department for Environment and Heritage

The aim of monitoring rock wallaby numbers and distribution is to measure population changes which might occur as a result of the fox baiting program. The populations of other large herbivores, with which rock wallabies may compete, is similarly monitored.

Feral Animal Counts
Goats, rabbits, donkeys and foxes are known to inhabit the project area. Sightings of these animals, or recent scats, are recorded in all phases of the project.