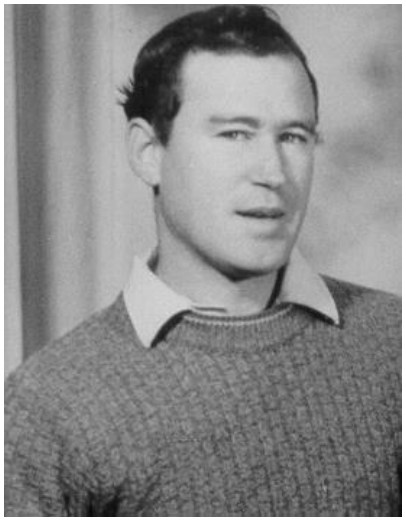


Me and CSIRO -

Des Nelson, April 2001

CSIRO was founded on a permanent basis in Alice Springs by R.E. (Bob) Winkworth in 1953. My first encounter with CSIRO occurred when a party visited Elkedra Station in 1954. I think there were three people in the group. I remember little about their visit except that their vehicle, an Austin Champ got bogged. I was a jackeroo on the station and had just learned to drive, so very proudly drove off in the station Chevrolet Blitz to tow the CSIRO vehicle out of its bog.

During 1956 I commenced work in the Herbarium of the NT, which was part of the Animal Industry Branch of the NT Administration. Botanist in charge was George Chippendale, who arrived in Alice Springs in 1954 to establish the Herbarium. Bob Winkworth (Winky from now on) donated plant specimens, which he had collected on travels in the district, to the Herbarium, so helping to get the facility functional. If George Chippendale had trouble with grass identifications, he would get me to take the specimens to Winky at the CSIRO lab, which was in Gregory Terrace, as Winky was a very good grass taxonomist. This was how I got to be acquainted with Winky. At first Winky worked alone and assistance with clerical matters was given to him by Animal Industry Branch through the efforts of AIB Admin Officer, W.T. (Tom) Hare. So a close bond was established between CSIRO and AIB. Later on Winky employed an assistant, Neville Forde, to help with bush work, and a clerk, Mrs. Sue de Fontenay. She and her husband had established the date farm near Alice Springs.

In late 1957 I began work with CSIRO. The Division was LRRS, Land Research and Regional Survey. Also represented in Alice Springs was Soils Division, headed by E.A. (Ted) Jackson and M.J. (Malcolm) Wright. I was assistant in Microclimatology section to J.C. (John) Turner and Jim Frith, but everyone helped each other with projects as chance permitted. Winky was working on hydrology and soils studies with a study site in the Mulga 16 miles north of town. Neville Forde was doing a study of various phyllode forms of mulga at this site. I helped with this project, but Neville left the NT in 1958. During that year Rod Hodder and J.R. ("Tig") Donnellan began work for Winky.

Microclimatology section was headed by R.O. (Ralph) Slatyer who took up residence in Alice Spring during 1958. During that year Dave McCowan worked for Ralph.

1957-58 was designated an "International Geophysical Year" with data to be collected worldwide. This was a reason for the intensive research in Central Australia. A major site was the 62 Mile site situated on a hard spinifex (*Triodia basedowii*) plain to the north of Connors Well, up the bitumen. I was to spend a great deal of time at this place. A garage frame of angle iron had been erected on a concrete slab. This was clad with compressed wheaten straw slabs ("Solomit") and had a ceiling of the same material. Louvered windows were put in the east and south walls. Usual access was through a wooden door on the eastern side. The floor was of Malthoid. Inside were shelves, a table, kero fridge and a small "Backwoodsman" slow combustion stove and two "cyclone" folding beds. A small water tank on a high platform stood near the door. Out the back was a bucket shower cubicle and there was a pit toilet off to the northwest. There was some stone paving out the front and a small kikuyu lawn.

One of the constant duties at the site was to travel to Connors Well and fill three 44 gallon drums of water from the turkey nest tank there. A "Finsbury" fire fighter's centrifugal pump powered by a Villiers petrol engine was used for this. Connors Well was an operational stock route water at the time (now in disrepair). The water had a flat taste and was used for washing and for watering the lawn. Drinking water was carried up from Alice Springs. A campfire was situated near the north east of the shed close to a wood heated, water jacketted-drying oven used in experiments. In 1957 there was an exclosure to the south of the shed in which the climatological data was collected. The recordings were so diverse that it would take a lot of time to explain them so I made up a little story for the curious.

If you knew where to look while travelling along the highway, you could catch sight of the shed. Some who did this made enquiries as to what was going on there. I would tell them that we were experimenting with the production of alcohol from spinifex, such a product being named "Triodicol". I

believe there were some who thought this to be true. I spent a lot of time alone at the 62 Mile. I usually had a model 51MA Traeger transceiver with me. Its call sign was 8SBV (Sugar Baker Victor in the terminology of the time). George Brown (now of Xlcom) was Base Director at the Flying Doctor Radio Base in Alice Springs.

One of the first operations I learned at the 62 Mile was how to operate a prototype neutron moisture meter. I was informed that there were three in existence. They were developed by Mark Oliphant and we had one to be tested against other forms of ground moisture determining methods.

The probe of the meter was lowered into holes lined with black polythene pipe of two inches diameter. You wore a 6V-motorcycle battery on your back to provide power into the probe to activate a neutron scatter from a slug of radioactive metal, heavy, silver in colour and about half an inch long by half an inch in diameter. I believe it was a slug of Plutonium and was a most dangerous item.

This radioactive source was transported in a thick lead cylindrical container inside a padded wooden box. To place the source into the meter probe, a small trapdoor was opened in the side of the probe. The lead tube was opened and as quickly as possible the source was picked up using long, platinum tipped tongs, and clipped into place inside the probe, the trapdoor was then shut by being pushed with the tongs. The probe was carried to a chosen hole by means of being suspended on the end of a long stick held at arm's length.

To avoid handling as much as possible, when not in use the probe was suspended inside a length of two inch steel pipe which was welded through the centre of a 44 gallon drum which was filled with distilled water. This absorbed the radiation from the source metal. We, those who used the device, were lectured on its dangers, one of which was the possibility of becoming sterile. We were all young, male, and very keen on girls, so we took great note of the warnings and were very careful. We, those that I kept track of, subsequently became the parents of healthy children.

Another early project was the excavation of a pit to see how deeply spinifex roots penetrated the soil. The region was described as a spinifex sand plain, but the sand was a veneer over very hard compacted soil. The sand depth varied from an inch or two down to a foot or a bit more, and then there was a very hard and deep clayey soil. At first we attempted to tow a dam scoop with a Land Rover, but this was not powerful enough. I drove a grey Ferguson tractor from Alice Springs up to the site - a slow journey, only to find that this machine also was not up to the job. Finally we got a diesel powered Massey-Ferguson 35 (I was towed on it) up to the site and this machine completed the job. The pit was excavated to eight feet at which depth the spinifex roots were very sparse. At about two feet there was a layer of dense laterite which had to be loosened with a ripper The remains of the pit can still be seen.

At the time of the Geophysical year there was intense sun spot activity. I believe this was one of the reasons for the worldwide collection of meteorological data.

Among the apparatus used for data collection were dew blocks. These were small oblong blocks of waterproofed wood which were placed on the ground. Any dew would leave water droplets on these blocks. The size and pattern of these droplets was compared with standard photos to give a reading of intensity of dew. The only time dew was recorded at the 62 Mile was on mornings immediately after rare rain. 1957 was a year of average rainfall, but 1958 was a year well below average. It was the start of an eight-year drought.

In the exclosure was a Stevensen screen, in which was a clockwork driven thermohygrograph which recorded temperatures and humidity on a weekly chart. Also in this screen were maximum and minimum and wet bulb thermometers, used for calibrating the thermohygrograph. A gecko had taken up residence inside the screen box, which probably accounts for the fact that it remained free of spider webs. Two devices for recording rainfall were

situated near the screen. One was a standard 8 inch diameter storage rain gauge. The other was a large cylindrical copper item known as a pluviometer. A clockwork mechanism inside had a chart divided into days and hours. As rain entered a funnel it caused a pen to rise up the chart tracing a line, so indicating the amount of rain and the time and duration of its fall. The chart was changed weekly. A small viewing aperture could be opened to allow sighting of the chart without removing the top of the machine. Because of its somewhat similar appearance to the armour of the famous bushranger, we named the pluviometer the "Ned Kelly".

The recording of temperatures was important. As well as the standard screen temperature, temperatures were taken from above ground at various heights, ground level and below ground at various depths. Air humidity and ground moisture levels were also recorded. Recording elements were mounted on short masts, about 1.5m from memory. A prototype recorder which had platinum wire elements, one of which was kept wet by means of distilled water being fed by osmosis from a small reservoir, was sent up from CSIRO Canberra. The main construction was of Perspex. I made duplicates of this device in the Gregory Terrace workshop. This was among various apparatus I made in that workshop. Among them were items made from Perspex, copper, brass, wood and steel. I made thermometer holders, electrical contact boards, part manufactured a dual water bath calibrating table, made frames for collecting phyllodes falling from mulga, repaired instruments as needed and also did carpentry jobs, vehicle maintenance and various other jobs. An offer was made to me to be sent to Canberra to be trained as an instrument maker, but I preferred to stay where I was as I enjoyed working out bush so much.

Back to the 62 Mile - At ground level and just below we had glass thermometers with stems bent at varying distances, enabling the bulb to be situated from surface to shallow depths. Recordings naturally could only be made visually. Other elements were recorded on charts on 2 channel "Cambridge" recorders which were housed in a medium sized aluminium caravan situated just to the north west of the straw

shed, but far enough from the campfire area to be safe. This was a caravan of the type commonly known as a "Silver bullet". Temperature readings were transferred by electric cables from elements to the recorders. Power for these and other instruments which needed power came from a nest of two volt wet cell batteries, which were kept on a trolley, which could be rolled off the tray of a Land Rover onto a platform mounted on two 44 gallon drums. The trolleys and a number of other items were made by Ron Thompson who had his workshop in Priest Street, where he now lives in retirement. We had a system whereby one nest of batteries was in use in the field, while a second nest, also on a trolley, was being charged at Gregory Terrace. Ron Thompson's trolleys made it easy for one person to change over the heavy nests of batteries. The platforms on which the batteries rested were made of wood and were made by Claude Wallace, who had a timber and joinery works in Priest Street, opposite Ron Thompson's place, where the Centre for Appropriate Technology is today.

Occasionally temperature elements were dug up to be calibrated. The twin baths (one hot, one cold) calibrating table already mentioned was used for this duty.

Also used to record temperature was a clockwork driven apparatus, which traced temperatures, transmitted from two elements, one at ground level, one underground. This recorder resembled a large thermohygrograph. Its chart was changed weekly. The brand was Negretti & Zambra. It was the most reliable scientific instrument I have ever known. It was used at the 62 Mile and later transferred to a mulga site where it ran for years without any maintenance, apart from renewing ink on the tracing pens. Its timing was accurate throughout the year - hot or cold. Though it was placed on the ground, it proved to be weatherproof without any shelter.

During one period an instrument called a Psychrometer was used for determining humidity. It contained wet and dry bulb thermometers in a housing, at one end of which was a clockwork driven fan which gave a steady airflow over the thermometers. Readings of this device were taken at one event, each hour during the day and two-hourly at night.

Most tiresome. Similar readings were taken on some other occasions from gypsum blocks buried at varying depths. These readings gave soil moisture information. The gypsum blocks were connected by cables to switches, which in turn were plugged into a wheatstone bridge or resistance box (or simply, R-box). You sat inside a small shelter made of compressed straw panels to operate the R-box.

Soil moisture was also measured by the method of taking samples using a two inch hand auger. So many samples were taken using this method that a large number of containers were needed. An appeal was made for tobacco tins for use as soil sample containers. Many were obtained from the Hotel Alice Springs (also known as "Underdown's" or "Uncle's" after the proprietor, Lycergus [Ly] Underdown). Underdown's was a favourite town waterhole for CSIRO workers, being convenient to Gregory Terrace HQ. The "Diplomat" stands on the site of Underdown's today.

The tobacco tins were boiled in a solution of caustic soda to remove the paint from them and numbers were punched onto them. Ron Thompson made metal cylinders which were used to transport the tins. The earlier-mentioned Neutron moisture meter was also a ground moisture recorder.

The duration of sunshine was recorded by two instruments, one was a solarimeter with an upward-facing sensor, its information being registered onto a chart. The second sunshine recorder was very simple. A glass ball was mounted above a small curved platform on which was placed a strip of treated paper. The rays of the sun were concentrated as a small hot spot onto this strip, which was marked with the hours of the day. As the day progressed, a continuous burn line was made along the strip. No burn registered in cloudy periods, so sunshine events were clearly visible. Of course the strip chart had to be changed daily - before sunrise.

Another parameter to be measured was solar radiation. This was measured by an upward looking radiometer mounted on a mast, to measure direct radiation. A similarly mounted radiometer pointed downwards to measure radiation reflected from ground surface. Sometimes the soil under this radiometer was wetted to get measurements from damp soil. Small electric fans kept a constant stream of

air blowing across the radiometers.

Wind was measured by means of an anemometer on a mast near the Stevensen screen. This had a dial from which total wind distance could be recorded. For wind direction we were sent a prototype wind direction recorder which was operated by the mechanism of a daily wound clock. A chart was placed around a cylinder together with a similar sized piece of carbon paper. The cylinder was moved by a wind vane. A Stylus was held against the chart. This was attached to the clock winder by means of a thread. As the winder turned the thread was wound onto it. This caused the stylus to move vertically along the chart so marking it by means of the carbon paper, which was calibrated for time. The wind revolved the drum. So the trace showed time of day, wind direction and duration. Again, the chart had to be changed early in the morning. There were no sleep-ins for the Microclimatology team at the 62 Mile.

I have pretty well covered the instrumentation of the site and the things with which I was involved within the microclimatology area. I remember Winky's team being involved in "relative turbidity" trials on spinifex. I don't know much about the methodology but I do remember Rod Hodder cutting the tips from spinifex leaves which were weighed, floated on distilled water in petri dishes, then weighed again. Rod, an ex sheep station man said, "I used to shear sheep and now I have to shear spinifex!" Caterpillars were seen on the spinifex. Some were marked with dots of paint and their movements recorded for several days, but I don't think any result came from this.

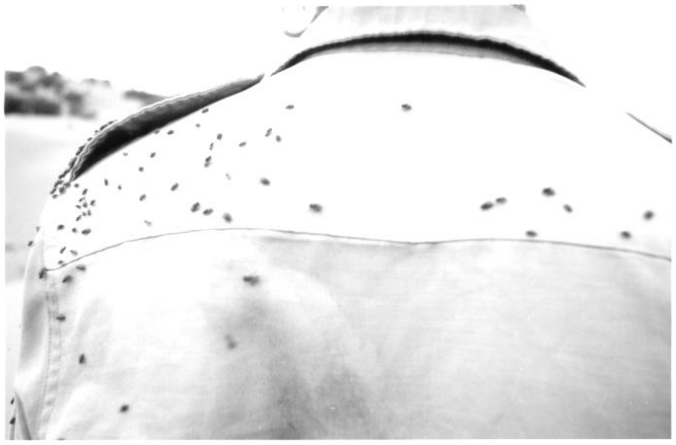
The 62 Mile was quite a show place. Visitors, official and non-official would call in. With the fridge, campfire and a small Shellite stove, we ate well. John Turner liked cooking and was very good at it. Firewood was collected from mulga scrub to the north of the site. Occasionally we'd get native pine (*Callitris glaucophylla*) firewood from the Hann range. You had to watch this wood as it spat live coals about. A few beers went well after work, especially in summer. The "Backwoodsman" stove in the shed made it cosy and warm, as did some pannikins of rum which most enjoyed, although the South Australians in the mob often drank sherry. Aileron was only 20 miles or so up the track, so every now and then, usually on a Friday night, we'd go there for a change for a happy session. I recall at least one occasion when mine host at Aileron had been sampling his stock and was in a jovial mood. We had an extra good session as he wouldn't take our money.

A fencing contractor, George Summers, who was also a butcher by trade, did fencing jobs for CSIRO. One of several jobs he did for CSIRO in 1958 was to fence a long term spinifex trial, a project of Winky's. I am not able to report much about the trial, but I was among those who pitched in to get the work started. In particular, I did the original plowing in the plots, and plowed a firebreak around the paddock or exclosure. There were a number of different treatments to plots. Control plots were untouched. Some of the treatments involved the removal of the spinifex, furrowing with a mould board plow, discing, burning of the spinifex and various combinations of treatments. A Massey/Ferguson 35 diesel tractor was used for the work. The burning treatments were carried out at night. Spinifex tussocks were ignited from burning torches made from cloth wrapped around the ends of long sticks, the cloth being soaked with kerosene. Also used was the fuel tank from the Shellite stove which was pressurised by means of an attached pump. A thin stream of Shellite could be directed at the spinifex and ignited. The fire could then be trailed from plant to plant. Night time burns were done to take advantage of calm conditions, i.e. no wind.

To protect the environment as much as possible we always walked along the same path when approaching work areas. The path to the Stevensen screen had flat stepping stones along it. Tracks to other areas came to resemble sheep or cattle pads (people pads), without becoming incised. They resembled pads made by euros and kangaroos. The final approaches to neutron meter holes were via ladder type platforms elevated about 18 inches off the ground. Readings were conducted from these platforms to avoid disturbance near the holes.

Utility type Land Rovers were the vehicles mainly used. The two which I used were a knockabout one for rough jobs, C77235, and a more often used better kept machine C81810. Ralph Slatyer had a white Dodge utility. Occasionally ,where heavier jobs were involved, I borrowed Soils Division's powerful World War II Dodge weapon carrier, known as "The Camel" due to the humped shape of its cabin. Tractors we used were borrowed from NT Administration departments.

Of wildlife at the 62 Mile, the most abundant were flies and ants. Among the latter were large reddish ants which were able to run about, albeit very swiftly, on bare ground that was very hot in the summer sun. One morning while taking R-box readings, I was watched for some time by a group of emus. They were standing outside the exclosure fence regarding me with curiosity.



A sand goanna dug its hole on a firebreak not far from our camp. He would walk into our camp area and get up on his hind legs and scrounge in a four gallon rubbish bin looking for scraps. He liked egg shells in particular. As he was never molested, he disregarded people around the place. Another less welcome large reptile was a big brown snake which I found in the camp wood heap. I always carried a rifle with me in those days. I shot the snake. On cold nights there often was a loud whistling sound which would come from all directions. This was made by a cricket which lived under the spinifex tussocks. I recall digging up sand gropers at the site.

As I spent a lot of time on my own, and being gun crazy, I used the mound of dirt piled up at our rubbish pit as a rifle range. When the water jacketted drying oven mentioned earlier on in this story was brought up to the site, it was found that it was difficult to calibrate the heat inside. It was suggested that there ought to be a hole in the door to enable the thermometer to be inserted to test the temperature. I shot a hole through the centre of the door. It was just the right size to permit the entry of a thermometer.

Unannounced visitors sometimes called into the 62 Mile camp. One day I saw in the distance a large mob of cattle being driven towards Connors Well. One of the horsemen left the mob and rode up to our camp. It was Wauchope Tilmouth, a well-known stockman and drover. After an exchange of pleasantries he said "Would you like a bit of beef?" It was always a matter of courtesy to accept such an offer, so we did. And what delicious beef it was.

Sometimes friends dropped in, sometimes the curious, but one day a worried couple from Queensland came in on one of the many occasions when I was alone at the camp. With their fuel gauge showing near empty, they had expected to fill their tank at Aileron only to find that the place had run out of petrol. They had poked along slowly the 22 miles from Aileron, and on seeing the shed had called in. I let them have the contents of my four gallon jerrycan to their great relief. A day or two later

when the time came for me to return to town, I checked my fuel tanks. One was dry while the other had only an inch or so of petrol in it. Into the dry tank I tipped the four gallons of kerosene which was the spare supply for the fridge. I had once operated a kerosene fuelled tractor which was started from a small supply of petrol until the engine was warmed, then you switched over to kerosene. I thought I'd try this with the Land Rover. I left camp running on the little petrol left in one tank, then changed over to the kerosene. To my relief the engine kept running, although sluggishly. I retarded the spark which was easily done by means of a small knob on the Lucas distributors with which Land Rovers were then fitted. I then had a good run on to town. I had refused payment for the petrol but had given the couple my address. Some time later they sent me a Golden Casket ticket. It didn't win, but the gesture was nice.

Something similar happened some time later when a uni student called in, heading north. I think his car was using more fuel than he had thought it would, and he was worried about the low state of his tank. Again I donated my spare fuel supply to the one in need. I once more found I had left myself in short supply, though I probably had enough to get me to town. To be sure, I poured into a dry fuel tank the four gallons of Shellite which was used to run a small stove. On this occasion the Land Rover ran very well after I had advanced the ignition spark. Later, I received a post card from the student in which he expressed his gratitude for the CSIRO petrol.

On calm nights you could hear vehicles travelling along the bitumen for many miles. In particular, Kurt Johannsen's truck could be heard for many minutes approaching then receding. Its engine had a particularly unique sound.

The MacDonnell Ranges were 40 miles to the south. During the day they were not visible, but before sunup in the winter there was a mirage effect which elevated the ranges so that they were clearly visible. When the sun rose there was a peculiar effect in which the base of the ranges went out of sight, leaving the upper parts appear to be floating like aerial islands with sky below them. A fire, no doubt caused by lightning, was ignited on Mt. Zeil in the distance to the south west of us. For about a week that fire was apparent as a glow at night and as a column of smoke in the day. I saw a grass fire ignited by lightning not far to the south of the site. It was so close that the flash and bang were instantaneous. A second fire was started to the north, also close. Things were well protected by roads

and firebreaks, but neither fire burned for very long. Even though it was a dry time, it was interesting to see the range of plants which flourished on the burned areas after the spinifex had been burned off.

John Turner was the only person I knew who had sheets in his swag. One warm moonlit night his swag was invaded by a swarm of small green jassids. My swag, which just had blankets in it, was left alone by the insects.

While work at the 62 Mile was at its height, preliminary work was also going on in the groved mulga country just north of the MacDonnell Ranges. A site had to be established for microclimatology and other work in the mulga. I was asked to go to a site on Bond Springs, at first accessed through a gate just north of the Sixteen Mile Creek, and some miles north east into the scrub. Later, seeking to get a shorter route to this site, I worked my way from the site to the west and got to the Bond Springs fence 21 miles north of town. The site therefore was named the "21 Mile Site". A gate was put in the fence and eventually, using a MF35 tractor with a grader/ditcher blade and an axe, I cleared about four miles of track into the site, wide enough to allow vehicles to get in without scraping against trees.

A puzzle to me in early days of working in this area was the discovery of a rock tied into a while sheet. It had been dropped from a plane as a marker but was not able to be seen as it had landed against a tall termite mound, and the sheet had settled bunched up instead of spreading out.

I had to drill a series of holes with a four inch auger to see if the holes could be sunk to six feet without striking rock. This proved not to be the case, as I think I only got one hole to six feet without striking coarsely granular limestone. A second site was looked at, and here I succeeded in getting all holes to six feet through the red earth soil without encountering rock. This site was selected for the microclimatology work. It was on what was then known as the Sixteen Mile Stock Route Reserve. A stock route bore and turkey nest tank was situated on the reserve, but the mulga site was undisturbed as cattle brought onto the reserve were yarded for anti pleuro-pneumonia inoculations, watered and then moved off to the south. The chosen site was named the "Seventeen Mile Site", the turnoff for it being near the 17 miles north of Alice Springs marker.

A track was cleared a half mile or so west of the bitumen. An exclosure was erected and two cement slabs put down by a young man by the name of Hampton. Sand from the Sixteen Mile Creek was used, being carted in

by means of Soils Division's weapon carrier. The larger slab outside the exclosure to the north was a living area, on a corner of which a large tent was erected on a pipe frame. A cement pathway led to a shower bay, and to the north west some distance away the toilet pit was situated. There were some large mulgas in the slab area. Sheet iron circles were placed on the ground around the bases of these trees before the slab was laid. This precaution worked well as the trees remained healthy until killed by a bushfire many years later.

The smaller slab was inside the exclosure. On it was put the aluminium caravan which was brought down from the 62 Mile. Again, the caravan housed Cambridge recorders plus various necessary materials such as charts etc. A Stevensen screen was put up and a rain gauge and pluviometer installed. I had a very busy time transferring equipment from the 62 Mile to the 17 Mile. There were many loads taken down in a Land Rover in quick time to get recorders functioning. I made a waterproof shelter for an inverter which altered the 24 volt DC supply from our battery nests to 240 volt AC for various devices in the exclosure.

The 17 Mile site was more complex than the 62 mile as there were discrete ecological types, viz. the densely vegetated mulga groves and the open intergrove areas with Woollybutt grass (*Eragrostis eriopoda*) and other low vegetation. To cater for these differences it was decided to duplicate the recorders - one lot for the groves, one lot for the intergroves, making the area virtually two sites. Because of the height of the mulga it was decided that instruments ought to be sited on taller masts than was the case at the 62 Mile. To achieve this, light windmill towers were used. In Alice Springs there were a number of such towers left over from the days when people had their own wells and bores, before water reticulation was introduced. CSIRO purchased a tower of about 20 feet height from a person's backyard. I took this to the 17 Mile on the back of the weapon carrier and erected it in a mulga grove. It was given a bit of extra height by the addition of bits of dexion. Ron Thompson made a tower cap for us with a short upright pipe mast.

A second, new tower of similar dimensions, and similarly modified, was purchased from Southern Cross. I bolted this together on site in an intergrove. Attached at varying heights up the towers were mounts for instruments which could telescope out from the towers to get them away from the influence of the temperature and wind resistance of the towers. These mounts were made from dexion. Dexion, holed and slotted angle iron, or angle aluminium, was a very handy and versatile material which we made much use of. It was used for frame work for benches and as cross arms for cable supports which carried electric current to spots in the exclosure.

In 1958 the US Air Force had a site in the hills to the north of Alice Springs. This was referred to as a "Weather Station" but was really a

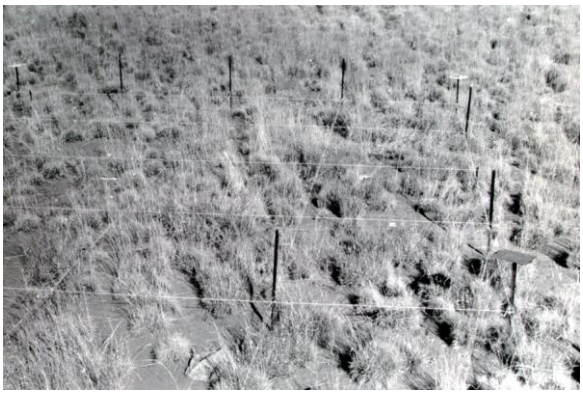
secret operation. The USAF used a very good cable on their enterprise with several insulated wires placed parallel with a central core wire, the lot sheathed by woven stainless steel wire, then an outer black, strong insulation. John Turner arranged for us to get hold of some of this cable. We used it for our instruments. Having so many wires in one set, it saved us a lot of time getting instruments set up.

Recordings were carried on as they had been at the 62 Mile - but in duplicate, but our experiences at the 62 Mile led to our being more efficient. There were some extra observations made in the mulga country. One was an attempt to measure the sap flow in mulga stems. Platinum wires were wound around the stems. An electric current caused the wires to heat. Situated some distance away along the stems were thermistors or heat sensors. The principle was that the wires transferred heat to the mulga sap which carried the heat to be detected by the thermistors, distance and time detected being indicators of the rate of sap flow.

Mulga is a rather shallow rooted plant but is designed to make maximum use of and concentrates falls of rain by means of upwards pointing plyllodes, stems and branches which cause water to course down the furrowed bark to the base of the trunk. To measure the efficiency of this design, rubber troughs were fastened around the trunks of some mulgas. Tubes from these troughs led into four gallon drums. Thus the water collected by the mulgas was intercepted and stored and could be related to rainfall recordings. After rainfall events, which were pretty rare at the time, the ground was prodded with quarter inch diameter steel rods, beginning from some distance from a mulga and proceeding towards and up to the base of the trunk. The distance into the ground to which the rod could be penetrated gave a measure of moisture absorption into the soil.

I wasn't directly involved with the last two operations, but I was involved with a phyllode fall project. In the Gregory Terrace workshop I made, from three-quarter inch meranti timber, dozens of square frames of internal measurements of 75cm x 75cm, this being a convenient size to be placed below the canopy of mulgas. The frames were numbered, dipped in linseed oil then had fly netting stapled across them. They were placed below mulgas at the 17 Mile and at another site called the 15 Mile, an exclosure of Winky's, also established in 1958, to the west of the 16 Mile Bore. Periodically, the phyllodes shed into the frames were collected and weighed to observe the range of phyllode fall over time. (I have seen a manuscript of this work by John Turner in CSIRO archives, but I don't think it was published.) Some mulgas at the 17 Mile were artificially watered with known quantities of water for phenological studies. This was not a project with which I was involved.

Ron Thompson made a mast for us from five inch pipe with angle iron steps welded to it and it was surmounted with a small platform on which a solarimeter was placed, above the canopy level of the mulgas. This mast is still in position.



An amusing task was the determination of the rotation of willy willies (whirlwinds). In a corner of the aluminium caravan was a pile of small scrumpled bits of paper. When a willy willy came along you ran to the caravan to grab a handful of paper, then chased after the willy willy to toss the paper into it. You observed whether the paper revolved clockwise or anti-clockwise, then recorded time and direction on a data sheet. 90% of the willy willies blew in one direction. I think it was anti-clockwise. Some willy willies escaped this operation!

As I did at the 62 Mile, so at the 17 Mile I camped at the site a great deal. The kero fridge was housed inside the tent. I slept on the ground in my swag, or if the night was humid and scorpions or "Barking" spiders (*Selenocosma stirlingi* - they squeaked) were about I'd clear the back of the Land Rover and unroll the swag there. Water was brought up from town in 44 gallon drums. The water from the 16 Mile Bore smelled of Hydrogen sulphide, as I found one day when I collected water from the bore delivery pipe and had a bath with it, and smelled worse at the end than I did at the beginning. I learned later that the 16 Mile Bore goes through a seam of coal, no doubt this being the cause of the H_2S smell.

The 62 Mile was still visited as each Monday was chart changing day. So weekly charts had to be removed from and replaced on thermohygrogaphs and pluviometers at the 17 Mile and the 62 Mile sites. In the event of rain there were rain gauges to be read at various sites, some of which I will now recall.

The 21 Mile site rejected as a microclimatology site had an exclosure erected at it, in which mulga country was subjected to various treatments such as trees being felled and left, trees being felled and removed, control undisturbed areas and so on. There was a camp site set up there with a bough shelter, a bush table and a topless 44 gallon drum was sunk into the ground into which ice could be put for the purpose of keeping tucker and assorted liquids cold. This worked very well - especially for the liquids. There was another part of the 21 Mile known as the Depression. This was a broad shallow channel area across which some low banks were made. I did one of these with the MF35 tractor, then handed over to a young man Reg, from Tennant Creek, to continue the work. Winky did

measurements of heights and widths of mulgas and witchetty bushes here. A rain gauge was installed at the 21 Mile site.

Another depression site was the 15 Mile, mentioned before, to the west of the 16 Mile Bore. An exclosure was put here, with low banks. Buffel grass was planted there but didn't flourish very well. The area is mulga country with assorted other trees and shrubs. A rain gauge was installed there. At this site and at the 21 Mile depression site, crest gauges were also installed. These were tubes of three inch down-pipe with guides through which lengths of rod could pass, inside the pipes. The tops of the rods were fitted with conical caps to shed rain. The rods were coated with water soluble paint. The bottom of the rods rested at ground level. Any overland flow of water dissolved the paint from the rods so giving an indication of the height of water flow.

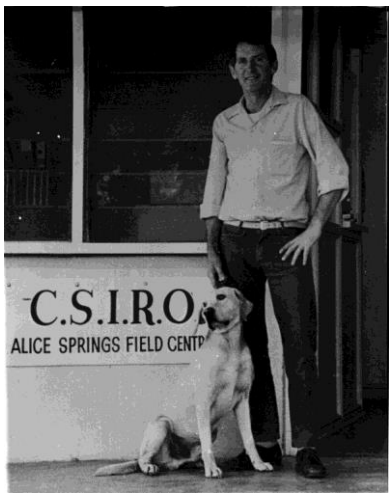
Ralph Slatyer's assistant, Dave McCowan, made a very good delver of wood with a metal tip which was of good use in the construction of the banks and furrows at the depression sites.

Close to the 16 Mile Bore was a site of Winky's on an overgrazed area. I had nothing to do with this site, but can recall the exclosure and large quadrats and pegs inside it.

South of the airport, again in 1958, another site of Winky's was established, known as the "Scald Site". This was situated on claypan country in otherwise open woodland. The area was treated mechanically and buffel grass sown. As usual, a rain gauge was installed. My involvement with this site was to read the rain gauge as required.

By now it can be realised that my time with CSIRO at the period I am recalling was very, very busy, but I found the work most satisfying. However, the position I held was of limited tenure, so early in 1959 when the opportunity arose, I returned to the NT Animal Industry Branch to resume work in the Herbarium of the Northern Territory. However, my involvement with CSIRO was to continue.

Just before my transfer back to the Herbarium, I took part in a cricket match between CSIRO and the Animal Industry Branch. Division of LRRS and Soils could scrape up nine players so we borrowed Tig Donnellan's brother to make up ten. We defeated AIB. I bowled out the botanist, George Chippendale, for whom I would soon be working. All players retired to Gregory Terrace for post game drinks and general hilarity. The AIB team challenged CSIRO to a tug of war, an impromptu decision no



doubt to save face as, it appeared certain that AIB would win. CSIRO staff were a light, lean, young lot whereas AIB could field some older, heavier men. Their anchor man, Bill Steemson, was a very large man. We couldn't refuse the challenge so the contest was held in the Gregory Terrace yard. To their red faced and puffing astonishment, AIB could not pull the CSIRO team over the line. We had made a loop at the end of the rope and put this over the tow hook of the Soils Division's "Camel", or Dodge weapon carrier, and made sure that the truck was in gear and braked. All was revealed shortly and much good natured abuse exchanged.

I think it was in 1960 that Bob Millington joined CSIRO. It would be hard to imagine anyone who worked harder for CSIRO in Central Australia than did Bob Millington. The microclimatology work ceased, but the Stevensen screens, pluviometers, rain gauges and soil temperature recorder were retained at various sites for continued meteorological observations, and Bob maintained these.

Ralph Slatyer and team also departed, but Bob and Winky became involved in new projects. A larger exclosure was built at the 62 Mile. Trials were conducted in it, including an attempt to establish buffel grass and various native trees and shrubs. A paddock on the AIB farm was acquired. In this plant introduction trials were established. It was known as the "Nursery" and was equipped with Stevensen screen and rain gauges. It is now the Horticulture block of Department of Primary Industry and Fisheries. Reclamation work began on what was then Simpson's Gap Cattle Station, and Bob did a great amount of the work there. An observation site was established on severely eroded country near Undoolya Gap - another rain gauge and crest gauges. There were hydrological sites to be attended to, but I know little about these.

In Soils Division, Ted Jackson departed, to be replaced by Wally Litchfield. After a short time, Wally and Malcolm Wright left, further depleting CSIRO numbers. Tig Donnellan went to Katherine, Rod Hodder went to WA and eventually Winky departed and was posted overseas. Bob Millington became virtually a one man band - Mr. CSIRO, with a daunting array of duties. Sue de Fontenay had gone, so Bob had the office to attend to also. Sometimes he had an off-sider, Bert Gee I remember for one. At one stage he had a cleaning lady, a funny little Scottish lady known as Mrs. Mac. She would come to Gregory Terrace late in the day and if she was near the telephone when it rang, she would pick up the hand piece and say "CRIOS - there's nobody here!" and hang up. It didn't matter if there were others around, there'd be "nobody here" and she always

mixed the letters of CSIRO. It might be "CSRIO" and next time "CRIOS", but never "CSIRO".

In the course of my duties with the herbarium I did a great deal of bush work. If I happened to be working up Aileron way I would camp at the 62 Mile site. I knew where a key was hidden so made use of the camp, and I would also check the recorders to make sure they were functioning.

Sometimes, after 1966 from memory, there were times when Bob Millington had to be away, on occasions for fairly lengthy periods. I would then caretake CSIRO. Barry Hart, Assistant Director of AIB, readily agreed to this. There was the weekly chart changing to be done, and rain gauges to be read. Having worked for CSIRO, I knew where everything was, and I was glad to help out for old times' sake. On one of these times there were seedlings to be watered, and the CSIRO tractor engine started and run every now and then. Sometimes I attended to the correspondence. At first I tried to do the chart run on day trips, but often found this put me behind with botany jobs. Later I found it better to travel up to the 62 Mile late on Sunday and camp the night there. I could be up early on Monday, have breakfast, change charts there, go down to attend to mulga sites, and on to my usual work early to mid-morning. This method appealed as I enjoyed camping so much. I was not paid for these extra curricular CSIRO duties, but I did not care about this as I liked doing the work and Bob Millington was a good friend.

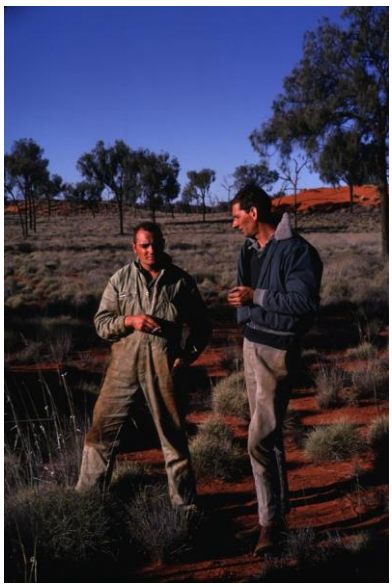
At the nursery paddock on the AIB farm a cement block lab was built and there was also a big machinery and equipment shed. In the Millington era this shed was the scene of great all male Christmas parties. The shed was more than a mile away from the other buildings such as the Arid Zone Research Institute and the three houses on the farm, so you could be as loud as you felt the need to be. During one of these shed parties, Bob Millington became the subject of good humoured banter. His Labrador, Brutus, was looking on. When Bob began to proclaim his defence, loudly, Brutus started barking, Bob gave the classical reply to his dog "Oo too Brutu!"

I was visiting Gregory Terrace one day in 1969 and found Ray Perry was there with a young man to whom I was introduced. He was Bill Low, who was to lead the Cattle Ecology section of a new period of CSIRO activity. Bill had arrived from Canada to have a look at the local scene, then returned to complete his studies.

Meanwhile Rod Hodder began cattle ecology observations. Rod had returned to the Centre to manage Bond Springs Station for some time before rejoining CSIRO. He had done some work for Division of Wildlife, who had begun dingo study work in the 1960s. His skill as a welder was used to make a splendid set of pens and yard for captive dingoes on the AIB farm, not far from the plant nursery paddock. The leader of the dingo research was A.E. (Alan) Newsome, who had been Field Biologist for AIB in the late 1950s and 1960s, during which period he did a major study on the Red Kangaroo.

The first person involved in the early days of the dingo work at Alice Springs was a young man called Shipway. He wasn't around for very long. When the project got really rolling there was a team led by Lawrie Corbett and Lindsay Best. They occupied offices at the Arid Zone Research Centre. I'm not sure what year the project started, but I do recall reporting dingo sightings to CSIRO about 1966, a time when I did a lot of work-related travel in Central Australia.

My family took up residence in a house on the AIB farm in 1967. By then the dingo researchers had a captive colony of dingoes on the farm. At first it was proposed that there would always be a member of the group remain to care for the captive animals while the rest went on field work. However, the demands of the work grew to an extent which meant that all the team needed to be out bush. In 1968 Alan Newsome came on a visit to the Centre. He asked me if I would feed and water the dingoes when his men had to go bush. Barry Hart agreed that this was OK. So once again I had an involvement with CSIRO.



The work was done at weekends and outside normal working hours on weekdays. This time I was paid by Division of Wildlife. A contractor

supplied horse meat which was stored in a large freezer. Rations were thawed overnight. The dingoes also got large coarse dog biscuits. An electric pump on a bore was activated to fill water containers.

The dingo pens adjoined a lucerne paddock. One day I put lucerne into the pens and found that the dingoes ate it, so from then on I would give them some lucerne when I had the feeding and watering to do. There were over twenty individually penned animals, so the task took some time.

One of the air liners in use at that time was the F27 Fokker Friendship. This aircraft had twin turbo prop engines which produced a very highly pitched sound. When these planes flew over the farm the dingoes would set up a great howling session.

I did the part-time caretaking of the dingoes on several occasions and found it to be an interesting and enjoyable experience.

I believe it was in 1970 that Max Ross arrived to be OIC of the successor of LRRS (Land Resources and Regional Survey), LRM (Land Resources Management). Bill Low led the Cattle Ecology Group and Colin Lendon came to lead the Plant Ecology Section. Bob Millington, ably assisted by Ian Tapley, looked after climatology, photography and was dogsbody and essential to everybody, having held the reins until the influx of new blood into the system.

During the relatively short time during which CSIRO occupied offices at the Arid Zone Research Institute, around 1971, Max Ross conducted an experiment in a paddock immediately to the south of the Institute building. Its aim was to determine the composition of the seed bank in the soil. A 44 gallon drum of distilled water was laid on a low stand. From the drum microtubes carried the water to a small plot. As seedlings emerged they were marked at first by means of Elastrator rings being placed around them. Max got me to identify the seedlings for him. Some I knew from ecological work I had been involved with through the Herbarium. Some were carefully excavated to reveal the seed from which they had germinated. There was a profusion of Bogan flea (*Calotis hispidula*).

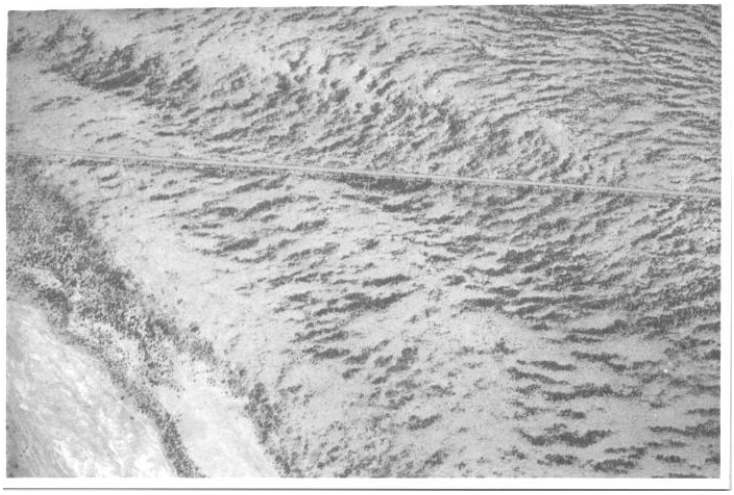
A second part of this work was to skim off a shallow depth of surface soil and then germinate seeds contained in such soil at varying temperatures.

The soil was sampled by the use of a tool which resembled a small dust pan fitted with little wheels at the back and also fitted with a long light pipe handle. This tool could be pushed carefully to allow the surface soil to be gathered. These soil samples were spread across an apparatus known as a germination table. This was a flat metal table which had a copper water tank at either end. The water in one tank was heated while water in the second tank was cooled. Waters were piped and mixed and led under the table to provide a range of temperatures across it. The soil was dampened and a glass lid closed over the top. The idea was to note which plants germinated at certain temperatures. I think there were difficulties experienced in getting the device to work properly. It resembled a much larger version of the device we had made in the 1950s to calibrate temperature recording elements.

Kunoth Paddock on Hamilton Downs Station became the research site for LRM. I went out to Kunoth with CSIRO people to discuss botanical and ecological matters. In 1966 I had been involved with the testing of a pasture assessment method developed by the botanist George Chippendale. A major test site had been Kunoth Paddock, so I was not new to the area in 1970/71.

In 1969 I began work on a project initiated by NT botanist John Maconochie. Rates of growth exhibited by various trees and shrubs grazed by livestock were studied. One of the sites for this study was in the Harry Creek, 32 miles north of town where the subject species was *Acacia victoriae.* The study was quite intensive, so I spent a lot of time at the Harry Creek. From time to time Colin Lendon's assistant, Alan Johns, would arrive at the *Acacia victoriae* site for a yarn and we would go for a drive around the local area to discuss the vegetation. I knew the vegetation of the region very well, so was able to pass on my knowledge to Alan. Alan Johns resigned I think at the end of 1972.

Another species of Topfeed on which observations began in 1969 was *Acacia kempeana*, or Witchetty bush. The Witchetty bush site was located at the south of Alice Springs airport. To get to it you drove past another site of Winky's, the "Scald Site". This site was also established in 1958, on a claypan area which was treated mechanically, and had buffel grass sown on it. The onset of an eight year drought proved a serious drawback to this project. However, as usual, a rain gauge was installed there. It was easy for me to keep a check on this gauge for CSIRO during the four year period of the Maconochie Topfeed project. The exclosure was dismantled in later years, but the corner posts were left to mark the site.



Shortly after Alan Johns left, his position was advertised. Colin Lendon encouraged me to apply for it. The position looked attractive, but my family was happily settled into life on the AIB farm. It was a great place for our four children. I explained to Colin that if I transferred to CSIRO we would have to leave the farm, and we would prefer to stay put. Colin then told us that a caretaker's house, a four-bedroomed one (the AIB farm house had three bedrooms), was to be built on the CSIRO block, and we could move into that. This put a new perspective on things. On asking how long it would take for the house to be built, I was told six months. I approached Barry Hart to ask him if we could remain in the AIB house until the CSIRO house was built, should I succeed in attaining the CSIRO position. Barry said "you can stay there as long as you like". This statement was greatly appreciated as Gino Marinucci, the builder, took two years to build the house. I applied for and succeeded in getting the Plant Ecology section position early in 1973.

CSIRO vehicles at this time were a Morris Mini van used as a town runabout, a Chamberlain industrial type tractor, Holden utes and Toyota Landcruisers. I was allocated a Landcruiser.

For a while, LRM had offices in the Arid Zone Research Institute, but by the time of my return to CSIRO, headquarters were in Ermond Arcade where Yeperenye carpark is today. The Gregory Terrace property was a field centre with workshop, laboratory, computer room and vehicle parking space. The nursery on the AIB farm was now NT Primary Industries Branch Horticulture Block, but CSIRO's presence was still there in the form of a block of six metal clad subterranean pens in which captive termite colonies were being studied. The current CSIRO property was vacant and subject to much planning. It had been part of what had been known as "Golden Horse Stud" which had been operated by one Bill Dunn, a local policeman.

OIC of CSIRO was Max Ross, a very nice person and a true gentleman. Colin Lendon was good to me. I had a series of promotions in a relatively short time due to Colin's recommendations.

My first task back with CSIRO was to roam around Kunoth Paddock to locate study sites, marked plants and rain gauges. This was easy to do making use of a map and aerial photos, and by the fact that the entire 60-odd square miles of the main paddock area had numbered sheet iron

aerial markers laid every half mile in lines half a mile apart, giving a useful grid pattern. Some of these lines had tracks cleared along them. I think the laying of these markers was mainly done by Rod Hodder.

As well as making it simple to find sites on the ground, these markers were used to guide a small plane on aerial survey work. On one week a flight was done during which concentrations of cattle were observed and the phenology, or state of the vegetation noted. Certain areas were photographed when the observations were completed. During the next week, a low level flight was done during which numbers and positions of kangaroos were noted.

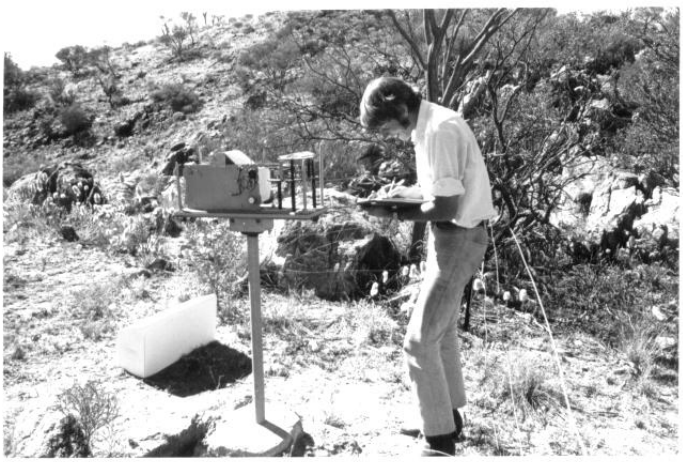
Also to be learned was the operation of the termite project. In each of the six smallish metal-lined and floored pens was a colony of *Amitermes vitiosis* termites, complete with mound, or elevated nest, established in red earth soil brought in from mulga country. Friday was termite day. The termites were provided with various foods contained in lidded tins, with access holes drilled into the lids, which were placed onto the soil. The foods were provided in triplicates and were placed in a circle around each mound. Among the tucker provided were grass species, cow dung (dry), and mulga leaf litter. Each tin contained 50 grams of food. Observations were made on the amount of termite activity in each tin. When activity ceased in a given tin, the residue was saved to be washed and weighed and a new 50 gram aliquot of the chosen food placed in the tin.

Keeping true ants out of the termite pens was a constant worry. Eventually I riveted narrow strips of metal around the top of the perimeter of the pens, these strips being arranged to incline outwards from the pen walls so forming channels, or moats, which were filled with water to deter ant invasion. A man called Watson came up from Canberra to help with the eventual winding up of the termite project. A short time later the pens were repopulated, three with *A. vitiosis* and three with *Drepanotermes* sp. After settling the termites into their pens I had no further involvement with the captive termites. During 1974, Division of Building Research (I'm not sure if this is the right name) asked us to conduct a trial for them to determine the effect of ultra violet light on plastic film. As I was living on the AIB farm and went at least once weekly up to the termites in the former CSIRO nursery paddock, I was

given the task of establishing the trial close to the termite pens. Other sites were set up around Australia. In spite of 1974 being a very wet year with much overcast weather, the Alice Springs site showed up as the region at which plastic was subject to the greatest break-down.

In 1973/74, a large table grape trial was established on the horticulture (formerly CSIRO nursery) block. This was set up by Ian Dahlenberg who later pioneered grape and vegetable growing at Ti Tree, following much ground work by Frank McEllister. Hundreds of vine cuttings were planted, but when they produced green shoots the project was invaded by a myriad of galahs which bit off the shoots and dropped them. To save the project, war was declared on the galahs and a 12-gauge shotgun became part of the horticulture equipment. As I visited the site regularly, I helped shoot many galahs. The project survived, but when the first grapes ripened, various birds arrived for a feast. Crows were the worst offenders, so the galah war became the crow war. The crows showed considerably more intelligence than the galahs, and abandoned the vineyard fairly rapidly.

The usual rain gauge was at the termite project. It was visited frequently in 1974, apart from the usual Friday termite day. Rain gauges were scattered about the countryside, but Kunoth Paddock had virtually a plague of them. There were 48 rain gauges on Kunoth Paddock. 24 of them were standard eight inch gauges and were placed at spots all over Kunoth. The other 24 were four inch gauges congregated at two sites, known as Winky's Mulga and Winky's Floodplain. Hydrological and other data was collected at these sites. Winky had established these sites and I remember Alan Chick, his assistant, attending to these sites. There were moisture meter holes at these and other places. The holes were lined by aluminium tubes. The meters were much more compact and safer than the device that was tested in 1957/58. They were also easier to read.



At the end of 1974 Darwin was devastated by Cyclone Tracy. Within days, cyclone refugees began arriving in Alice Springs. CSIRO staff were prominent in assisting these people. We manned registration checkpoints and helped to arrange emergency accommodation, food etc., often working long hours. Max Ross was prominent in the organisation of this humanitarian work.

Shortly after my return to CSIRO I was approached by Brydan Ganley, the manager of the AIB farm. He told me that there was a partially dismantled garden tractor, property of CSIRO, which was lying under a tree in one of the farm paddocks. Brydan said if the machine was not wanted he would dispose of it. I spent a number of weekends cleaning and reassembling this little tractor, "Simplicity" brand, which had been used in the CSIRO nursery days for yield harvests. When the tractor was in working order I used it to mow the lawns of the Arid Zone Research Institute. This, plus some other weekend jobs, was one way of showing appreciation for being allowed to remain in the house on the farm.

Finally, in 1975, the CSIRO house was completed and we moved in. We were faced with a large yard area full of massive growth of tall buffel grass. It took a week using the garden tractor, which had a three-bladed mid-mounted slasher, to cut the grass down. The house was the first building on the CSIRO site. I was told that no tin sheds were to be constructed. All out-buildings were to be environmentally friendly. This provision meant that I was very busy for some time. A chook yard was an urgent requirement. I made a temporary yard and shelter for the chooks we'd brought with us from the AIB farm while I built a chook house from stones. A pigeon house was also urgent. In this case I did make the pigeon shed of corrugated iron, but I made it blend in by painting it, then throwing dirt onto the paint while it was still wet. I made besser block sized mud and straw bricks to make a play house for our two girls. The roof was thatched. A 24 foot by 12 foot mud shed was built. I filled large tins, e.g. powdered milk tins, with dirt for use in the construction of this. I dug a pit while getting dirt for this shed. Later I made an earth and gravel roof over the pit, fitted it with a hatch and access ladder, and used it as a cellar for the making of home brew.

After all this effort, I was bemused when eventually the workshop from Gregory Terrace was relocated to the CSIRO new site - a large tin shed!

One of the principal projects I had to operate on Kunoth Paddock was a plant phenology study conducted at a number of sites scattered around the area. Recordings were made fortnightly. I decided to increase the numbers of species studied at the sites to provide more information and to typify ecounits better. To cater for this increase in data a simple coding system was devised to make recording of plant species easier. This consisted of using the first two letters of the genus and first two letters of the species. Thus *Aristida contorta* was coded as ARCO,

Portulaca oleracea was POOL, *Enneapogon polyphyllus* became ENPO and so on. Many species became known by the use of their codes phonetically. This coding system remains in use today.

In the course of my travels about Kunoth Paddock I made a plant collection as a reference, and also lodged specimens with the Herbarium of the Northern Territory. During the times of this collection two type species were collected, i.e. newly described plant species. One is *Atriplex humifusa,* the other *Scaevola ambylanthera* var. *centralis.*

Another major project was a co-operative task between Plant Ecology and Cattle Ecology, a project which studied cattle diet. When a cattle observation flight was performed over Kunoth, the area containing the largest congregation of cattle was noted. I would then go to this area and peg out transects along which the major plant species were recorded, and their biomass estimated. Then Kevin Jones would bring several cattle with oesophageal fistulas to the area. These were allowed to graze in the area for some days, then the fistula plugs were removed and collection bags placed on the necks of the animals. What they ate passed through the fistula aperture into the bags. I would identify the plants eaten and determine the percentage of each constituent. The fistulated cattle were kept until needed in a small paddock near Kunoth Well, and transported to where needed on a Bedford truck with a cattle crate on its back. Kevin Jones looked after the cattle side of the project in an admirable and efficient manner.

The time came for Plant Ecology section to move beyond Kunoth Paddock. In May 1975 explorations were done over other parts of Hamilton Downs, Amburla, Milton Park and Narwietooma Stations. Colin Lendon had developed a method of pasture assessment known as "Standards for Testing and Assessing Range Condition" or STARC as it was to be known. This method rated the health of an area by its plant composition and erosion status. Mark Sallaway, a soils condition expert from NT Land Conservation Unit, gave much advice. Graham Griffin was one of those who helped a lot with the initial testing of the method. Pastoral areas were categorized as to their health with the descriptions of Excellent, Good, Fair and Poor. This work went on for some months. Other stations visited during this project were Todd River, Mount Riddock, Alcoota and Woodgreen.

In 1976, Roy Mercer was awarded a contract to construct exclosures on sites that had been selected during the STARC testing project. There were 10 exclosures erected. Three were large ones representing the

Excellent condition ecounits of Woodland, on Narwietooma, Mitchell Grass on a reserve on Amburla, and Mulga, on Hamilton Downs. Smaller exclosures represented categories of Fair and Poor condition on the ecounits and there was also a Good Woodland site selected. These were scattered around the stations mentioned (but Narwietooma had just one site - the Excellent Woodland). At each of these exclosures a Sumner recorder was installed. These machines recorded rainfall and temperature onto charts. They were powered by dry cell batteries. Each year a different person was given the responsibility of maintaining these devices. It was a rare event to find all 10 operating when you did a check run. On some sites we also had Event Recorders which could be attached to various sensors - rain gauges, temperature sensors, anemometer etc. These also were powered by batteries. Some had solar cells to provide power. Their information was recorded by means of punched paper tapes.

Plant ecology section established transects inside and outside each of the new exclosures. At the Woodland and Mitchell Grass sites five transects were placed inside and five outside the exclosures, while at the Mulga sites six transects were placed inside and six outside. Half the mulga transects were placed in groves while half were placed on intergrove areas. The transect ends were located with droppers driven into the ground. When recordings were to be made a rope was stretched between the droppers. The rope was marked at every metre. Chosen marks would be selected at which to place square metre quadrats inside which plants were recorded.

At the start of the project several people were involved. However, I knew that I would be the sole operator soon enough so ways of making the work adapted to a single worker were devised. The method of recording plant data was knows as the Size Class Classification System. With this method plants were categorised into a range of size classes (1 to 6). Size class 1 was for seedlings and other classes were graded up to mature plants (grasses and forbs were the plants measured). Average mature plants were placed in class 5. Size class 6 was for very large adult plants which may occur, for instance, with Mitchell grass plants. Each individual species had to be classified. It was a massive task.

Graham Griffin, who was involved with the foundation of the project, came up with the idea of using an electric counting device using digital counters from remote sensing recorders. Used with a simple data sheet, this device was invaluable to the project. We named the instrument the "Vegometer". Sometimes there were hundreds of individual plants within

a quadrat, particularly seedlings. To simplify recording, quadrats were divided into sections using steel rods welded across to make quarters, and wires then used to further divide the quarters. This made it possible to better keep track of small plants, but presented a problem of interference with larger plants when laying the quadrat down. This was overcome by means of welding legs to the corners of the quadrats, enabling them to stand a short distance above the ground.

When a series of recordings had been made, it was then necessary to calibrate the various size classes of individual plant species. From these calibrations biomass figures were calculated. Ten examples of each plant size class were collected in individual paper bags immediately after the recordings were made. The plants were collected well away from the quadrats and transect lines, so leaving the observation sites undisturbed as much as possible. Collected samples were transported to town to be dried in a large oven, then weighed. Except for nasty plants such as some *Sclerolaena* spp., the dried and weighed plants were disposed of into our chook yard.

In April 1978 I made two more Vegometers. Parts used were scrounged from spares for automatic weather machines. These were named Vegometer Mark 2 and Vegometer Topless, the latter being without a lid. We needed three counting devices as part of a project that aimed to compare the efficiency of three separate methods of plant ground cover density estimations. Sites chosen were in mulga country on Kunoth Paddock and Mitchell Grass country further to the west. The operators of the methods were Vic Squires, Graham Griffin and myself, with peripheral assistance from Colin Lendon and Kevin Jones. Temporary plots were marked out using quarter inch diameter steel spikes. In the mulga we inverted empty drink cans over the spikes to make them visible. By the time we proceeded to the Mitchell grass, cans were in short supply, so we gathered round yellow colocynth paddy melons and pushed them onto the spikes. These made splendid marker guides.

Robin Lamacraft from Division of Mathematics and Statistics had come up from Adelaide to act in a supervisory manner. At the close of the proceedings Robin took the data sheets to Adelaide for processing.

Some time later a large pile of computer printouts arrived, supposedly bearing the results of our endeavours in the Mulga and Mitchell grass. The figures were so ridiculous they were utterly laughable. We three who had performed the exercise out bush had experience going back over quite a number of years, so there was no chance that we could have produced such impossible results. Adelaide was asked to try again. Another pile of printouts came, again crazy results. I don't know how many attempts were made, but always the results were unbelievable. Preparations for this project had taken a week or more, the field work two weeks, and at least another week was spent drying and weighing

samples. However, getting results was taking an unprecedented length of time. Eventually Colin Lendon handed me a mountain of printouts and asked me to find out what was wrong. For me this was awesome, as my mathematical ability could be exceeded by the average sheepdog. I spent days sorting through the sheets of paper, then one day I decided to begin from scratch, starting with the data sheets and a calculator. I immediately began producing believable results. By comparing the results I was getting with the printouts, suddenly all was revealed. Columns of data had been entered by an operator, and from these columns answers were calculated. The adjacent columns in many instances were misplaced vertically, so that calculations performed horizontally produced garble. It was a classic case of a person entering data from a project about which such person knew nothing. Now that the problem had been solved, I felt sympathy for the far-off operator and great relief that the project had been finalised.

CSIRO field workers employed a very practical means of carrying plant harvesting paraphernalia. Plastic garbage bins were used as containers. These were weatherproof and inside them could be carried paper and plastic bags, marker pens, gloves, clippers, staplers, clip board, data sheets and various other items that needed to be carried for particular projects. Small spring balances were carried for use in field estimates of biomass.

Cattle ecology section had a short length of fencing erected near some of the exclosures. These were the basis for temporary fences to be used when their fistulated cattle were employed for sampling vegetation for palatability.

With so many exclosures now in use (there were more, yet to be mentioned), checking and repairing fences became another job on the agenda. Horses broke the fences of exclosures on Narwietooma and Milton Park. Kangaroos broke the fence of the Excellent Mulga site on Hamilton Downs several times. A cow got through the fence of the Fair Woodland site on Milton Park and proved very difficult to remove, as it was spooked by the gate. On occasions the fence of the Excellent Woodland site on Narwietooma was so badly damaged it required major repairs. The Poor Mitchell Grass exclosure was burned out by a wildfire. The exclosure was dismantled and relocated to a non-burned area.

Marg Friedel had an area allocated in each of the rangeland exclosures for her researches, but I had little involvement with her work.

Kunoth Paddock remained as an important base and some projects based there continued after the expansion of other work to further fields. The small paddock near Kunoth Well still housed the fistulated cattle.

For the comfort of field workers there were three demountable "ATCO" sheds which were very handy during rainy or very cold periods. One was prettily located near an isolated hill called Mt. Solitaire on the eastern part of the paddock. One was sited in mulga country at about the centre of the paddock. The third was on the edge of woodland country and floodplain country, and was known as Greentree camp due to its proximity to Greentree Dam. It was situated by a group of shady whitewood trees. Also at Greentree camp was a corrugated iron shed built by Kevin Jones. I was told that the demountables had been used by workers during the construction of the Pine Gap facility. Another Kevin Jones iron shed was built at Winky's mulga to the north of Kunoth Well.

Eventually all these structures were removed. The iron shed from Greentree camp is now on our block in the Alice Springs rural area.

South of Mt. Solitaire a magnificent exclosure was erected. 800 metres in length, it was subdivided into a series of compartments with various kinds of fencing, designed to keep a varying range of herbivores out. The fences ranged from rather open wires down to small netting. The whole was further enclosed by an outer fence. A few times I was involved with some plant biomass recordings inside and outside this exclosure, but apart from that my only involvement with it was to read the rain gauge. That exclosure was one of the best examples of a fencer's art I have ever seen.

In woodland country halfway across the lower part of the paddock was a netted exclosure with a tall fence known as the "Kangaroo exclosure". Neither cattle, roos nor rabbits could access this exclosure. Over the years trees and shrubs increased in there dramatically. At North Dam, towards the north west part of the paddock, was another exclosure on calcareous shrubby woodland. It was one of the phenology sites to which I made a regular visit for some time.

A small exclosure existed a little to the east of Kunoth Well in the mulga scrub. It exclosed a small area of *Eragrostis eriopoda.* It was a study site monitored by Max Ross. Max also had a series of plant productivity sites on all the major ecounits of Kunoth Paddock. These were located by droppers. At these sites blocks of square metre sections were pegged by

use of quarter inch metal spikes painted with various colours. At times of growth, e.g. after significant rain, quadrats were laid over markers of randomly chosen colours and the vegetation was harvested to determine biomass by species.

Some of the sites were protected by means of electric fencing. When the time came to dismantle these sites, I collected hundreds of droppers and quarter inch spikes.

Cattle ecology had observation towers built at watering points and one in the scrub along a cattle pad. Many hours were put in by cattle ecology workers sitting in these towers observing cattle movements.

Overlooking Kunoth Paddock was a hill on the western side of a gap in the ranges, on the south end of the paddock. This hill was known variously as Petrusevic's Hill or Telemetry Hill. Peter Petrusevic had promoted a scheme whereby this hill was to be the base for a monitoring station, to track cattle fitted with radio locating elements. A steep track had been made to get to the top of the hill. The project didn't eventuate, but the hill was a handy place up which to take visitors to view Kunoth, and to terrorise the nervous on the bumpy, steep ascent and the slippery descent.

A calcareous part of the paddock was situated in the north west corner. Here was a population of rabbits with associated warrens. Bill Low's team did some study of rabbits there.

Kunoth Paddock was well watered. There was Kunoth Well, or bore, which gave its name to the paddock, situated halfway across the Tanami Road. In the north west corner was North Dam. To the west was Green Tree Dam. To the south was New Well Dam, and a little further south through a gap in the ranges was New Well Bore.

Even though it is relatively close to town, I spent many nights camped on Kunoth Paddock. Apart from the fact that I like camping out bush, I found that living on site made for much greater efficiency in getting work done, as travelling time was wasted time as far as getting the job done was concerned.

Another branch of studies performed at the various exclosures in the 1970s was the effect of fires. Graham Griffin was a leader in these studies. NT Government fire control people were involved in the early days of this research. It was quite an exciting project, the controlled burns being done at night. Fires were lit using "Firebugs" fuelled by a mixture of dieseline and petrol. Water pumps were used to prevent the

fires from spreading beyond designated areas. It was a revelation to see how efficiently experienced people could control a fire. Knapsack sprays used by people on foot played a great part.

A major site for the fire studies was immediately south of the serial exclosure near Mt. Solitaire. A large grid patterned area was established, with cleared tracks to delineate various blocks on which different burning treatments were employed. Subsequently, this site has been mistakenly shown on Auslig maps as a radar installation, no doubt due to the fact that from aerial photography or satellite imagery it presents a similar picture to the radar facility on Bond Springs, immediately to the east of Kunoth Paddock.

Outside the three Mitchell grass exclosures sets of 20 x 2 metre square quadrat study areas were established for Roger Oxley, who was making a study of this important grass. The data collected from these quadrats was recorded by the use of a pantograph device. The project looked at the changes in the development of plants in Mitchell grass communities. At each site the banks of quadrats were examined, and the outlines of the tussocks of perennial grasses were traced at a reduced scale onto graph paper sheets.

A long stylus at the far end of the pantograph arms was guided around the bases of the grass tussocks, while a pencil reproduced the shapes in miniature onto the paper sheets attached to the surface of a low table. This table was fitted with adjustable legs for levelling. The device was designed to be used by two people. One guided the stylus while the other applied light hand pressure to the pencil to enable a trace to be made. I modified the equipment to enable it to be operated by one person. I fitted a smooth steel plate to the table to enable the paper sheets to be held in position by means of small magnets. I experimented with differing lengths for the spindle of the arms where it was attached to the table, and devised a clamp and compression spring to hold the pencil. I was encouraged to draw plans of these modifications for possible publication. I drew the plans, but a visitor whose name I can't recall saw the modifications and reproduced them interstate. I gave the one person method a successful trial in 1979.

Opportunities arose to keep in touch with some of the old sites. Ralph Slatyer and Winky still retained interest in certain areas. Ralph had become a Professor at ANU. I received a request from him to go to the 62 Mile in early 1975 to test the pH of various desert plants. I had a

nostalgic camp at the old site as readings had to be made at sunset, then repeated at sunrise.

In November 1974 I visited the 17 Mile site with Ray Perry and Ralph Slatyer. Ralph wanted to do a study of mulga growth. He and I marked 166 mulgas ranging in size from seedlings to adults. Ralph delegated the research to Peter Cochrane of ANU. In October 1977 I was asked to relocate and repaint old photo markers inside the exclosure. 20 markers were found and painted. Less than two weeks later a campfire escaped from near the Sixteen Mile Creek. To save the fire from invading Bond Springs Station, a back burn was performed. This extremely hot fire completely destroyed all vegetation in the 17 Mile exclosure. One year later I did a plant survey, including some detailed mapping, showing regrowth since the fire. My involvement with this work continued until 1980.

In April 1979 I was asked to relocate the 21 Mile site. The track I had made 21 years earlier was now overgrown and obscure for much of its length. Winky wanted some data on the sizes of mulgas and witchetty bushes in the Depression area of the 21 Mile site. Peter Reece was also involved with mulga work. Later that year, one Mark Williams and I camped at the Depression area taking tree and shrub measurements for Winky. A tape measure was used to measure canopy width, the tape being laid on the ground. Height was measured by reading off a length of white plastic pipe marked at 10 cm intervals.

I was among a party who travelled to Suplejack Station in October 1978. Suplejack is north of Tanami Bore, along the route of Lajamanu (or Hookers Creek). This trip was of particular interest to me as I had been in the area in 1959 on a botanical survey. At that time Suplejack did not exist and the track north from Tanami was very poor and barely discernable in places. The purpose of the 1978 trip was to locate sites marked on a Landsat image, an early exercise in the use of such a medium. The going was pretty rugged at times, especially when very steep sided creeks had to be traversed. We had two Landcruisers on the job. Photo sites were established and general ecological notes taken. Geology and soils descriptions were made by Bruce Strong and Max Churchward. Colin Lendon and I made ecological and botanical notes. By good fortune we met up with Peter Latz who was also on a field trip in the area for the NT Government. He helped greatly with plant identifications. The trip was a success.

In 1964, while working for the Herbarium of the NT, I travelled to Todd River Station, southeast of Alice Springs, to take photos and collect plants at various locations. The chief interest was Atherrita Bore, which had never been stocked. It was a time of severe drought and all other parts of Todd River had been grazed to bare ground. After my photo run, 500 head of cattle had been put at Atherrita Bore and the area around this

bore was denuded in six months. I repeated the Todd River photo run each year until 1973, when I returned to CSIRO. In 1979 a request came from the NT Government asking if I would do another photo run on Todd River Station. I was happy to do this. I had not used any markers at the photo sites and it was years before the GPS came along, but I knew all the sites. Later on Ian Tapley and Bob Millington did a repeat of the Todd River photo run using my photos and notes. They did a good job and located almost all the sites.

In 1980, Ockie Bosch set up several study sites on the CSIRO block and on the AIB farm. Initially he was assisted by Kevin Jones and myself. A large paddock on the farm was subdivided into four smaller paddocks of varying sizes for use as a grazing intensity study, using the same number of cattle in each paddock except a small control paddock. A "Grant" temperature recorder was set up with 13 temperature sensors placed in various positions, from below ground surface, surface, among grasses and aerial. This recorder had a chart that was changed weekly. Soil samples were taken weekly to determine soil moisture at shallow depths.

Long transects were established in the paddocks. These were delineated by the use of orange painted small sheets of flat iron fastened to the fences. The phenology of grasses along these transects was recorded. Some individual grass tussocks were marked with small stripes of paint so that their progress could be ascertained. Buffel grass and *Enneapogon* were the principal species studied. Biomass was determined by means of clipping quadrats and weighing plant species.

A new pipe line was established on the CSIRO block to take water to a small area, which was fenced off into sections. In this area a spray irrigation system was established. The purpose was to study plant responses to varying water intensity. The amount of water in various plots was monitored by rain gauges.

In another part of the CSIRO block small plots ringed by sections cut from 44 gallon drums were established. Plants were watered, clipped and observations made. *Enneapogon avenaceus* and *Digitaria coenicola* were prominent species studied.

Two plots were established over which large sheets of canvas were placed. The idea was that only a known amount of water would be given to these plots, i.e. they were independent of rainfall. The canvas sheets were stolen during one night. The canvas sheets were replaced and padlocked through brass eyes onto holes in droppers. Again, one night, these sheets were stolen. The thief, or thieves, simply cut around the eyes and left them and the padlocks in situ. The project was abandoned.

A plant demography apparatus was made from light angle iron in the form of a long narrow frame on legs. I think it was two metres long by 30 cm

wide. A sheet of Perspex lay on top of this table like structure. The frame was positioned on marked areas and a sheet of clear acetate sheeting was rolled onto the Perspex. I then had to look vertically through the top of the apparatus and trace the outline of the grasses and forbs on the ground and label their names, onto the acetate sheet. This process was done at the AIB farm and on the CSIRO irrigation site. Subsequent observations showed how individual plants changed.

A tribute should be made here to the great amount of expertise shown by Kevin Jones throughout Ockie Bosch's projects. He did the fencing on the AIB farm and CSIRO block, laid the water pipes and set up the troughs for the cattle, and handled the cattle when necessary. He organised the irrigation facility, made the demography frame and in general was an essential part of the program.

Some observations on plant growth were done in the CSIRO glass house in the course of Ockie's work.

For some time, my son Alex assisted with Ockie's work, mainly on the plant observations in the paddocks. He also entered data onto cards.

In early 1981 I took long service leave. During that year a "clean up" campaign took place. Some exclosures were demolished and lots of meteorological recording apparatus was removed from bush sites. I had my eye on the tin shed at Greentree Camp on Kunoth Paddock. I was told I could have it for a donation of $50.00 to the CSIRO Social Club. I paid up. I had purchased a Mini Moke from Ockie Bosch, so went out in it with swag and essentials to Greentree Camp one afternoon and got to work dismantling the shed. I finished this task the following day. Fortuitously, Kevin Jones happened to arrive on the scene with the large CSIRO truck. Kevin transported the disassembled shed to the rural block on which my wife and I retired some years later. (We live in a house, not the shed!) Kevin's fee was half a carton of beer. All in all, a cheap solid shed. Kevin had built it in the first place.

I remained at our residence on the CSIRO block during my long service apart from a few overnight trips out bush in the Moke. This was handy as my wife was in training for her certificate at the Alice Springs Hospital. I was also able to work on our rural block and did much gardening. The soil on the CSIRO block is very good and family efforts produced good agricultural results.

As a result of the wet year 1974 there was a massive germination of river red gum seedlings on the flood plain of a creek in Kunoth Paddock. A floodplain biomass harvest site was obliterated by the profusion of tree seedlings. I think it was in 1977 that I transplanted some of these small trees from Kunoth to along the northern boundary of the CSIRO house yard. These trees exist today and are large and healthy.

I returned to work early in November 1981 and resumed work on Ockie's projects briefly, before becoming involved with the laying out of large blocks of transects on Kunoth Paddock with Geoff Pickup and Kevin Jones. The transects crossed a range of ecounits: gilgai plain, woodland, mulga, creeks, claypans and mixtures.

Two blocks of transects were established. One set ran from claypans near the ranges northwest to Greentree Dam. There were five lines of transects over 9km in length, covering a width of 1km. The other block of transects was based on a floodplain which ran from the hills towards Kunoth Well. There were 14 transects in this set; 11 were 2km in length, and three were 5km long. The width varied from 3.5km to 1km.

A dropper was placed at each 500m along the transects and each had an identifying code painted on it. White painted sheet metal aerial markers were pegged at the ends of the transects and along centre transects; 68 sites on Greentree transects and 88 on Kunoth transects were chosen as photo monitoring sites. A star peg was driven into the ground at each site to indicate where to stand to take photos. A painted drink can was pushed onto these pegs to make them visible. The soil erosion status of each site was determined. It was my task to photograph the sites and record the vegetation and its phenology at them. This was done annually. I found this job most satisfying. It took eight or nine days to accomplish. I took advantage of the task to have some nice camps in the mulga, a type of bushland that I prefer above others.

Periodically aerial photos were taken along the transects. Before these events it was necessary to lay down extra, temporary aerial markers. These were appropriately sized sheets of aluminium foil clad Sisalation roof insulating material, which were held down at the ends by short lengths of dexion. This was an idea of Geoff Pickup's. It worked well.

When the time came for an aerial photography run, I would park my Landcruiser at the starting point of the first run as a marker for the pilot, Graham Pearce. Geoff Pickup, also on board the plane, would contact me by radio when a run was completed. I would then move the Landcruiser to the start of the next transect. When the developed films arrived much laboratory time was spent classifying soils, erosion types and vegetation on them. The ground photography was carried on for ten years. Certain parts of the transects were designated as "Radiometer runs" but I had little to do with the interpretation of these.

Aerial photo runs were also performed over areas outside Kunoth Paddock. It was my job to locate these runs, then traverse them on the ground and describe soils, erosion status and vegetation. My experience with the use of air photography went back to my days with the NT Herbarium in the 1950's and 60's. In the course of botanical exploration the botanist, George Chippendale and I navigated our way through

western desert and trackless Top End country, using photos taken by RAAF Lincoln bombers in about 1950.

At first I would use large-scale air photos and satellite images to locate the aerial run strips. Landmarks would be ascertained and compass directions determined. I would then proceed out bush to find the runs and do the ground surveys. The first of these runs I tackled was on Owen Springs. The first part was easy, but the rest was a challenge as it crossed very steep hills. Other runs were further south.

One run on Orange Creek was notable for a limestone outcrop formation in the shape of concentric rings. These "onion rings" were prominent on aerial photos, but were not registered on satellite images which depended on reflectance for fixing, rather than light waves. These ground-truthing and air photo runs were all part of experiments to compare with the interpretation of data extrapolated from satellite imagery.

A further part of this work began in September 1982. We had a radiometer similar to that used in Landsat satellites, with four apertures that registered reflectance from four separate light bands. A steel frame was bolted to the back of my Landcruiser. Three oregon planks were on top of this frame, to provide a platform on which to stand while you erected a steel ladder held in position by steel cables. This ladder projected beyond the rear of the vehicle. To the top of this ladder the radiometer was attached, pointing at the ground. Recordings were taken from the four light band sensors over as many different coloured ground, rock and vegetation surfaces as could be found. A metre diameter steel ring was placed on the ground or other surface as a target area for the radiometer. A photo was taken of each target, and a Munsell reading taken for non-vegetative targets.

At first I began the work with an offsider to place the target ring in position, and to assist with a device known as a "Data Logger" on which results were recorded. As I had done many times before, I adapted operations to enable them to become a one-person system. I practiced until I could position the target circle correctly before climbing the ladder. The Data Logger was unreliable so it was replaced by a bank of switches, a voltmeter and data sheets.

I roamed far and wide taking readings from the radiometer. I went south to Orange Creek, north to Ti Tree, northwest to Napperby Lakes (now called Lake Wilson), west to Palm Valley, east along the Ross Highway and north east along the road to the Garden Station. It was a hot and rather exhausting exercise, as the best time to perform the work was between 10am and 4pm, which included the hottest part of the summer weather. I listened to the Melbourne Cup while perched upon the radiometer ladder at Undoolya Gap.

In 1983 it was decided that more aerial photo runs were to be established to the south of Alice Springs. From examination of photos and images, good prospects were evident on Umbeara, Lilla Creek and Idracowra stations. It was desirable for the transects to pass over terrain of varying colours to compare aerial data with satellite imagery. One transect was chosen to be positioned half on non-burned and half on burned spinifex country. This particular transect, 5km in length, crossed ten sand dunes and terminated on top of dune number 11. Aerial markers of strips of sisalation were laid at each end, and at half kilometre intervals along the transects.

I had assistance laying the first transect. A dumpy level was used to determine a straight line. I found I could lay a line alone much faster by using a Suunto compass and checking the line by back sighting. For most transects it was possible to drive along the line, but it was not possible to do this on one of the Lilla Creek transects due to the terrain, so I made myself a light weight dropper driver and used fibreglass droppers. The sisalation markers were lightweight anyway. So I was able to walk in to each point where a marker was to be set up without having to carry much weight. The white fibreglass droppers made sighting relatively easy.

Delays in availability of an aircraft or problems with the air camera meant that I had to make several trips to the transects to check the ground markers before flights were finally accomplished. I didn't mind this at all. The sand dune transect was good fun. Two steep dunes always required several runs at them before they could be crossed.

In April 1983 I was among a party of people and three Landcruisers which took part in an interesting experiment designed to test the efficacy of various vegetation assessment methods. Marg Friedel organised and supervised the project. Her assistant, David Liddle, did a sterling job of laying out the various sites for the research. The first place where the work was done was Kunoth Paddock where camp was established in woodland country. Work took place on woodland sites and in the mulga. During the second week work was completed on Kunoth, then we moved down to calcarious bluebush country on Maryvale. Motherhood was imminent for Marg Friedel, who guided the staff from an office consisting of a folding table and chair, complete with computer. On this exercise I was introduced to two very simple implements (there were others). One was the Bitterlich gauge for measuring tree density. It consisted of two sticks arranged in 'T' form, the Tee piece being fitted with pins. You aimed along the other stick and recorded the canopies of trees of shrubs that were intersected by the pins. The other device, perhaps the simplest of all instruments, was a metre long stick. You held this at arm's length towards the ground and at right angles to your body. You then walked a straight line and counted seedlings of woody plants as you progressed. Thus you had a metre wide transect of any length chosen.

Once again I was requested to take photos and notes at points set up on Todd River Station in 1964. Once again I was happy to fulfil this requirement and have a camp in gidgee country, my next favourite bushland after mulga.

In June and July 1983 I went on the first two of quite a number of trips through the Finke Gorge organised by Geoff Pickup. Geoff studied the geomorphology of the area paying particular attention to what are known as slackwater deposits. Graham Griffin's experiences as resident ranger at Palm Valley prior to his joining CSIRO were invaluable. Earl Saxon researched fish in the area. Scientists from NASA came on at least one trip. Their interest was centred on the similarity of Finke and Katherine Gorges to formations on Mars. Finke Gorge trips were always somewhat of a slog with much slow four-wheel low-range travelling in deep river sand, and some steep rocky terrain to be negotiated. In August 1983 one of the NASA men, Vic Baker, and I travelled up to Katherine where we went through the Katherine Gorge to enable Vic to examine this feature.

Later in August 1983 I was among a large group of CSIRO and other personnel who travelled to Uluru, still more generally known as Ayers Rock then. Demonstrations of fire control with purpose-lit fires were the subject of the exercise. I had not been in the area since 1965 so was glad of the visit, the first of a number of coming trips to Uluru/Kata Tjuta.

A number of observers had travelled into parts of the country to the west of Alice Springs, taken photos and made notes. I was given this material and asked to compile the data into a report on the western desert area. I did not consider the areas described were sufficient for the purpose, and I had doubts about some of the botanical descriptions. Although I had travelled throughout the region, such travels had taken place some time ago. I therefore decided to make my own journeys into the region to get a personal update.

I made two trips, the first beginning in late September 1983. During this trip, I retraced part of a trip I had done in the winter of 1959 when George Chippendale, NT botanist, and Ted Jackson of CSIRO Soils Division and his wife Mary, had retraced 1870s explorers' routes into the western desert. Guided by aerial photos we had little trouble travelling through the trackless desert country. We had spent quite a time at a place called Glen Edith.

In my 1983 trip I found numerous tracks had been made by oil and gas search parties. I thought one track would go to Glen Edith, but had to leave those scars to eventually find Glen Edith again. I was confronted by a remarkable "Back to the Future" phenomenon. I had explored Glen Edith carefully with George Chippendale in 1959, so in my 1983 visit I recognised a river red gum near a rockhole. The trunk was unmarked in

1959, but in 1983 it was inscribed with "E. Giles 1872". I used my tomahawk to cut the word "FAKE" below the bogus message.

I made a second trip to areas further north from the first one. I travelled to an area I had been through in 1965, and was amazed to find an extensive healthy mulga scrub that existed then was gone, the result of fires. These expeditions enabled me to get on with vegetation descriptions with confidence. Max Churchward, who had been on earlier trips into the area, described the geology of the desert regions from his laboratory in Perth. Much map and air photo interpretation was done, but the work was eventually finalised.

Due to Geoff Pickup's erosion studies we accumulated and borrowed many air photos. The idea was to obtain the earliest photos available, and the newest ones of the same area. Old and new photos were examined stereoscopically to determine areas that showed evidence of erosion. Department of Mines and Energy had photos in Darwin that they did not wish to send to us. So I drove to Darwin to spend time examining photos there. Later, while on leave down south, I took advantage of the time to study more air photos of certain NT areas at National Mapping (now Auslig) offices in Canberra.

Early in March 1984 on one of the expeditions into the Finke Gorge I assisted Earl Saxon on a fish survey. Oxygen status, conductivity and temperature of the water in various waterholes were recorded. Fish were netted and counts made. There were seven species of fish some present quite profusely.

Later in 1984, and carrying on into 1985, a very interesting project began. Geoff Pickup wanted old dams located, with a view to examining the strata of siltation deposits in them. One thing that it was envisaged could show up was the presence of Caesium. A radio-isotope of the metal Caesium was released into the atmosphere after the three atomic bomb explosions that took place in 1945. The detection of this Caesium isotope could indicate a reference point in deposits.

Information about the history and localities of dams was sought from various sources. The best source of information was Ted Hayes of Undoolya Station. Ted's grandfather was a carrier who had transported poles for the construction of the Overland Telegraph line in the 1870s. After that he had built quite a number of large earth dams in the Centre. I located and photographed many of these dams. An interesting find was the location of the original Poll and Diamond Dam on Owen Springs at quite a distance from today's group of dams which have that name.

This was another of those great jobs during which I roamed about the countryside. Bob Purvis showed me dams and dam sites made by his father in the 1920s and 30s. Some dams and borrow pits were relatively

recent. I even included the spinifex root pit dug at the CSIRO 62 Mile site by Tig Donnellan and myself in 1958. It had over a metre depth of deposit in it by 1984. Orange Creek, Deep Well, Undoolya and Maryvale had some of the oldest dams. The job took me in every direction from Alice Springs. Dams occurred in all kinds of situations and were in various states of use or repair. Some were filled completely with deposit; some had been breached, and quite a lot were still in use. At least five had concrete walls, but the great majority was earth-walled structures. The furthest afield I went on this job was to a railway dam at Alberga Siding, along the path of the original Ghan railway line in South Australia.

Samples of waste residues from nests or middens of the extinct Lesser Stick Nest Rat were brought in from the Palm Valley area. The soluble material had been removed leaving vegetative residues. The deposits had been dated to as far back as 2,700 years BP. I was asked to see what could be identified in the residues. The first requirement was to go to the area from which the specimens came and make a comprehensive plant collection. This I achieved in two camping trips. I climbed all over the hills, especially in an area called the Amphitheatre. I had been in the region many times before, but during these new trips, during which I needed to be especially observant, I became aware of the number of very old petroglyphs scattered around the sandstone hills. From the plants collected I prepared standards by putting fragments from each species into individual petri dishes. These identified fragments were compared under a binocular microscope with the midden residues. A satisfactory number of species were identified. The results were published in a University of Arizona book called "Packrat Middens".

Mark Stafford Smith came on the scene early in 1985. He set about establishing soils study sites around the countryside. David Tongway came up from Deniliquin to help with the initial setting up of the project and I was engaged to do the plant monitoring. Over 60 sites were established and some pleasant camping trips took place as sites were selected at increasing distances from town. A wide range of soil types was selected for sampling. Many sites were selected on Owen Springs Station and Kunoth Paddock. Other sites were selected to the south as far as onto Maryvale Station, to the east to the Ross River area, and west to Mitchell grass country along the Tanami Road. Later on I did further botanical surveys on the sites at different times of the year to enable the widest range of species to be ascertained.

In September 1985 I was asked to locate an area on the eastern part of Mt Willoughby Station in South Australia. A lot of variation had shown up on satellite images of this region, and I was to try to ascertain the reason for this. I travelled to this place, passing through some weird looking bare yellow country known by locals as "Moon country". The reason for the changes in the area appeared to be due to large flooding, which had broadened creek channels and increased vegetation cover.

In April 1986 an exercise was held on Kunoth Paddock which was the beginning of the development of videography as a tool for range management. I drove along the longest part of the Kunoth transects on Kunoth Paddock and recorded the cattle sighted along the way. Graham Pearce flew a small Cessna along the same route while Geoff Pickup operated a video camera. At the end of the operation Graham dive-bombed me to indicate a successful run. Another run was performed further to the west.

By this time I was 51 years old and attempts were made to get me to sit down and be absorbed into the world of computer technology. I had spent too much of my life occupied with bush work and found it difficult to adapt to the monitor and keyboard. Various ongoing projects kept me going bush and new ones arose such as a task in July 1987 when Graham Griffin and I had to go to Uluru-Kata Tjuta National Park to record perennial plants along two kilometre transects on various ecounits. You needed to be fit for this job as you couldn't drive off main roads so sometimes it was a long tramp before you got to the start of a transect. During the first week we camped in dune country amongst spinifex, Graham being a spinifex nut. Graham left so I shifted camp into the mulga for the second week, me being a mulga nut! There appeared a great many dingo tracks around my camp. Crows ate much of a bar of Sunshine soap when they visited my camp while I was on the job. One day I was confronted by a large old camel. Thankfully he must have thought I was pretty ugly as he turned away and ran off into the distance. In the early part of this job while working near Uluru we were accompanied by one or two Anangu rangers. Presumably they discerned that we must have been doing the right thing, as they didn't come along to the Kata Tjuta area transects. A report on the results of this survey was produced in February 1988.

A student, Enrique Jurado, arrived towards the end of 1987. Enrique's studies involved many facets of the physiology of seeds of Central Australian plants. I helped him as much as I could. I made many seed collections for his projects, mostly alone but at least twice we went on camping trips. I recall one into the mulga on Kunoth Paddock and another to the Harry Creek. I was always willing to be of assistance to projects that involved botany. This does not mean I was not interested in other aspects of science. Another young researcher on the scene was Craig James. Craig was studying reptiles and set up a site in spinifex country near the old Ghan railway siding, Ewaninga. I was able to be of some help to Craig. I cleared eight blocks 25mx25m at his study site using a John Deere tractor with blade and slasher borrowed from Land Conservation Section of the NT Government.

There were numerous other projects of which I was able to give some assistance. They all helped me to attain knowledge of various aspects of science.

In 1985 I had begun constructing a house on a rural block owned by my wife and myself. Things were pretty busy at work and there was plenty of fieldwork going on, with frequent camping trips. House building was fitted in to spare time, after work, weekends and public holidays. At that time there was a handy short cut along the south bank of the Todd River, which could be used to get from our part of the rural area to home at the CSIRO. Sometimes after a session of house building on a hot summer's day, I would relax in the shade with some cans of beer. Sometimes Geoff and Liz Pickup would invite me to their rural block to indulge in a whisky or three. The Todd bank back track was free of breathalyzers so all would be well. The house was completed in 1988. Our two sons and elder daughter had flown the coop from our CSIRO residence. We moved to our new house with our younger daughter after 13 years of residence at CSIRO, a large slab of our family existence and a time full of pleasant memories. During that time I did regular fence checks of the CSIRO fences and repaired them when necessary. Fractious racehorses sometimes blundered through our fences and wayward vehicles injured fences on a few occasions. I looked after the chemical balance in the CSIRO emergency fire fighting water supply (syn. swimming pool). I attended to water pipeline breaks. One quite serious break (they nearly always occurred at weekends) I plugged by hammering a green log into a fractured pipe to plug the leak then drove a dropper into the ground behind the log to hold it in position. Fallen trees were towed away when they fell onto fences or over internal roads. When not out bush, I would check the laboratory at night to make sure it was locked and turned off lights that had been left on. Before taking up residence at CSIRO I had asked our then Divisional Chief, Ray Perry, what would I do about stray dogs. Straying dogs were sometimes a nuisance on the neighbouring AIB Farm. Ray said simply, "shoot them". By the time we left CSIRO I had shot 12 dogs and 1 cat. Kevin Jones and Angela moved into the CSIRO house.

In 1989 came another "plum" job. The road from Uluru to Kata Tjuta had been relocated and the former road in regular use was to be rehabilitated. It had replaced an older road that had gone northwest from Uluru, and then down to Kata Tjuta. The road to be examined was in many parts nothing less than a corrugated bottomed deep erosion channel or an "underground road". Once again Graham Griffin was the leader of the project. We had to describe in detail the vegetation along the road as an indicator of which species were to be encouraged to revegetate appropriate localities. It was always pleasant to work in the Uluru/Kata Tjuta National Park, but there was one drawback to this job. We were accommodated in a room in a building in Yulara instead of camping out bush. A report on this job was produced in October 1989.

In the latter 1980s I assisted with observations on a series of sites that had been established by Marg Friedel. They were positioned at varying distances from stock watering points and were designed to examine the

vegetation at these points. There were sites on Milton Park and Narwietooma while to the south were sites on Erldunda and Idracowra. These sites were located by the use of about the most unobtrusive markers that could be imagined. They were wire loops that sometimes made locating a bit difficult, but were much safer than many other markers such as metal spikes. These observations were done with the company of Marg's assistant, Pip Masters.

Computers were becoming more and more the instruments of analyses and other facilities. Attempts were made to get me to become a computer operator, but I was not made for this. I was put onto the task of map digitising. I would look out the window at the open spaces and say to myself "why aren't I out there?" So I decided to take early retirement at 55, which came due in mid 1990.

Having declared my intentions, I was given a few more bush jobs. As I knew where many obsolete sites were, I went out to collect droppers, marker pegs and aerial marker sheets. I collected many hundreds of these items. I also had to take GPS readings of the corners of the blocks of large transects on Kunoth Paddock. The technology of GPS instrumentation then meant that a sufficient number of satellites was available only very early in the morning - another excuse to camp out bush.

I had been asked where I would like my retirement party, and several town venues were suggested. I requested that it should take place in the mulga scrub on Kunoth Paddock. I was asked would I like a watch as a retirement present. I requested a bottle of rum and a new swag cover.

On the 29th of June 1990 my retirement party was held near "Winky's Mulga Site" on Kunoth Paddock. Colleagues, friends, families and children came. Several people had put in a lot of work arranging the tucker, fire pits etc. Graham Pearce had done a lot of the work. It was great fun and a memorable night. Sure enough, I was presented with a bottle of rum (a big one), a new zip-up swag cover and foam mattress, and also a CSIRO rain gauge and a metre quadrat! Many of us camped the night at that very nice mulga campsite.

My 55th birthday was on the 5th July 1990. My retirement day from CSIRO was July 11th 1990. But my involvement with CSIRO was far from over.

Here it may be fitting to pay a tribute to the staff at the Alice Springs Herbarium who were of great assistance to me during my CSIRO years. Having been trained in botany by George Chippendale in the 1950s and 60's in the local herbarium, I had always retained a great affinity with plants and ecology. Botany of Central Australia became one of my main interests, and this continues to today. I have had a happy liaison with all

local botanists - John Maconochie, Bruce Thompson, Clyde Dunlop, Peter Latz, Andrew Mitchell, David Albrecht and various assistants, notably Hilary Coulson.

I have encountered people who have retired who have been critical of the organisations for which they worked. I feel sorry for such disgruntled people. I left CSIRO with nothing but the happiest of memories and a feeling of gratitude for the treatment I had experienced from the organisation. CSIRO people were my friends. Geoff Pickup had suggested to me that after my retirement I may be granted some contract or consultancy work with local CSIRO. My wife and I went off to use up leave and airfares, having a happy time in general. Then it was back to life on our block, and for me the strange experience of not having to go to work in the mornings. Then in September 1990 a request came from CSIRO asking if I would assist Margaret Friedel and her new assistant, Janine Kinloch, with observations on sites on Erldunda and Idracowra Stations. I happily agreed. This was the first of a number of trips to these sites over several years.

I have kept a personal diary since 1950, and work notebooks since 1959. George Chippendale, NT Botanist from 1954 to 1966, had kept work notebooks that he left at the Alice Springs Herbarium. In 1991 I spent a month extracting plant phenology data from these diaries and notebooks, the result of a request from Marg Friedel.

Later that year I went with a party led by Gary Bastin to lay and describe long aerial transects on the north end of Todd River Station. These transects, up to 11km in length, passed through some thick gidgee country. I have a soft spot for gidgee country, having spent a great deal of time in gidgee country over towards the Queensland border in my younger days. A lot of research was being done then into gidgee poisoning of cattle. When the Todd River Station work was finished, the party did similar work in open country on Yambah Station.

I assisted Marg Friedel with biomass determinations along very lengthy 2 metre wide transects on Erldunda in mid-1992. Also during that year I became involved with examinations of areas on which buffel grass seed had been planted some years before. This also was a project of Marg Friedel's, who came on some of the trips involved in this work, but usually I helped Janine Kinloch, Margaret's assistant. Structures left by pitting and discing were measured and all plants recorded. Sites examined ranged from ones close to town to further afield on Bond Springs to Alcoota, Mt Riddock and Woodgreen to the north, and Erldunda and Allambi to the south.

Consulting work continued. Sometimes there were very busy periods, such as during 1994 when I was asked by people of the NT Department of Primary Industries and Fisheries to perform a wide range of field work for

them, and CSIRO work continued. I used to tell people that I wanted to go back to full-time work to get a holiday! I was also involved with several part-time private projects. Among the interesting trips begun in 1994 were a series of biological census operations. The first took place in beautiful pristine mulga country to the west of Kulgera in the NT. Subsequent parts of this program took place on Pernatty Station in South Australia, near Lake Torrens, and another session on Mahanewo Station, also in arid South Australia, near Lake Gairdner. Feral goats were encountered on Pernatty.

Kevin Jones constructed a series of five exclosures at varying distances from Old Station Dam on Allambi Station. These were for a project designed by Marg Friedel for the examination of plant and soil qualities at varying distances from a watering point. In January 1995 I was involved in the first of quite a number of bush trips assisting Janine Kinloch with this project. Quadrats 1 metre square were selected randomly inside and outside the exclosures for plant census work. Soils were tested for pH and physical properties. Randomly selected points were chosen for the collection of surface soil samples taken by means of hammering a small metal tube into the ground. These samples from inside and outside the exclosures were placed on trays in the CSIRO glass house and watered under a range of temperatures to germinate and ascertain plant species. Sunk into the ground inside the exclosures were wide plastic tubes, designed to trap seeds blown or washed along the ground surface. Landscape photos were taken on each visit and rain gauges checked. The main campsite for this project was situated on the edge of a broad tree filled channel, a most pleasant spot. My involvement with the fieldwork of this project was spread over three years. It was an interesting and enjoyable work. Similar work on selected sites on Erldunda was also performed. There were no exclosures or seed traps at these sites, but the usual rain gauges were present.

You may gather that I liked bush work, and you would be right. So, once again through a request from Marg Friedel, I was to be involved in a field project that was a fitting culmination to a working life involved with the outdoors. I was asked to perform a plant and soil survey along the southern and western sides of Uluru. The principal work took place over two months in 1995, and there were some subsequent shorter trips, the final one in 1996 when a footwalk circumnavigation of the rock was performed.

I had to walk along transects which ran from the base of the rock out across the terrain. Most were half a kilometre in length, some shorter on the western side, some almost a kilometre long on the southern side where they encompassed gorge areas. The transects were spaced 50 metres apart. There were 15 transects on the western or Kantju Gorge side of the rock, and on the southern or Mutitjulu side there were 30. I had to stop every 50 metres along each transect and make a record of

the perennial plants, and perform soil tests devised by David Tongway. It was a big task, but most enjoyable. I stayed at vacant ranger houses where I unrolled my swag on the floor. I would begin work at 7 o'clock each morning, then at 4pm I would drive to the sunset viewing area to compile notes, check data, press plant specimens and do any other ancillary tasks.

To mark the transects and to determine the spots at which I was to do the observations (these were reduced to 25 metres apart positions inside the gorges), I used a surveyor's measuring wheel which was part of Marg Friedel's equipment. This wheel resembled a bicycle wheel. It was pushed along by means of a pipe handle attached to its hub, and a digital dial scored metres and tenths of metres. A Suunto compass was used to keep the transects straight. Vegetation in parts of the gorges at the base of the rock is as thick as jungle areas of the Top End, and *Themeda* grassland on parts of the southern plain are as dense as could possibly be imagined. Pushing the measuring wheel through some of such plant profusion, while carrying equipment for recording data and making tests was quite a challenge. It was most amusing one day to see the astonished looks on a group of tourists when I burst through the scrub, shoving a bicycle wheel in front of me. At least one person thought the device was a unicycle, and asked why wasn't I riding it. I celebrated my 60th birthday while on this job. The final report in which my efforts were recorded was produced in August 1996.

After the work had proceeded for some time it became evident that there were very few birds around Uluru. This was a puzzle until I found there were a great lot of birds at Yulara. No doubt they were being fed by visitors.

After my "retirement" there had been times when I was requested to relocate certain places along the blocks of Kunoth Paddock transects. I was always willing to do this, as Kunoth Paddock is quite a favourite place for me. In September 1997 I was asked if I would take a visiting scientist for a run around the photo sites on the Kunoth transects. This I did. The visitor had a GPS instrument with him and took a reading at each site. I had been made redundant by a little receiver and some satellites!

During my association with CSIRO there were a number of OIC's and Program Leaders. Winky was Acting Leader for a year in the 1970s, and among others who had short term sessions were Barney Foran and Marg Friedel. Colin Lendon was in charge for some time, as was Vic Squires. Geoff Pickup held the reins for quite a long period. Mark Stafford Smith then took over. A feather in the cap for CSIRO Alice Springs is the fact that a local researcher, Steve Morton, became appointed as Chief of the Division, now known as Sustainable Ecosystems.

This story has been the bare bones of my involvement with CSIRO. There are a great many people and incidents not mentioned here. I have told of the NT experiences but there was also an event that took place in 1955. I had travelled south for a break. My sister Judith was employed at the Biological Control Section of CSIRO Division of Entomology in Canberra. She got me a position there and I had a memorable trip around country towns and outskirts in NSW, collecting aphids and green vegetable bugs as breeding stock for parasitic wasps being bred to combat these pests. The work was most interesting, but the experience of an ACT winter drove me back to the NT after some months.

The details of some individual trips could take up much space. I could tell of bogs, dry and wet. Such as the time I got into a huge wet bog at 9 o'clock in the morning, and finally got out onto nearly dry land on sundown. I could describe an encounter with a Min Min light on Bond Springs, or of a camp on Amburla where so many weird things happened I assumed that the place was haunted (no grog involved!)

I could tell of a great many other notable, to me anyway, events. All my family members visited CSIRO sites and my four children had school holiday camps at some of them. My two boys sometimes helped me with data recordings. And now all can be revealed - the boys learned to drive in CSIRO Landcruisers out bush.

I will ever be grateful to CSIRO, the organisation and the people. My experiences with CSIRO have been quite fulfilling, and sometimes quite exciting.

To CSIRO Alice Springs I say good on you, and thanks!

Des Nelson, 2001.