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A history of CSIRO'S Central Australian Laboratory, 1: 1953–80: pastoral land research

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ABSTRACT

CSIRO's research in the arid zone was initiated after World War 2 when a strong push to develop the sparsely populated and isolated region of northern Australia was promoted as being in the national interest. This impetus had social and political origins but implementation depended on scientific insights into regional 'potential', which was couched at the time in terms of agronomic and pastoral use. Ray Perry was a key figure in early land resource surveys of the region and later a key motivator for, and supporter of, research in the arid and semi-arid rangelands of Australia. His commitment was fundamental to the establishment of CSIRO's Central Australian Laboratory. Pastoral land use and improving the land for that purpose were the primary concerns when CSIRO's presence in Alice Springs was established in 1953. From an initial focus on 'making the desert bloom', in particular making the vast spinifex grasslands more 'useful', the focus of research shifted to maintaining the productivity of country preferred by cattle and establishing methods for monitoring its health. It was not until the 1970s that Aboriginal and conservation land management appeared in the laboratory's research agenda, somewhat intermittently, in response to important social and political changes in the wider Australian community.

Keywords: Aboriginal and conservation land management, arid zone, fire, mulga, pastoralism, rangeland monitoring, spinifex.

Introduction

The push to foster arid zone science followed World War 2, 'when there was a strong urge to develop that very sparsely populated and isolated region [northern Australia]'.[1] In a review of land research in this region, Christian and his co-authors recognised that its productivity generally was limited by climate and soils but also by lack of knowledge about natural resources and the facilities to utilise them. Under the auspices of the Commonwealth, Queensland and Western Australian governments, a Northern Australia Development Committee was established in 1946, which sought the help of the Council for Scientific and Industrial Research (CSIR), forerunner of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), to determine regional potential—'potential' being entirely production focused. Concerns for biodiversity conservation or the needs of Aboriginal people were several decades away. Formation of CSIR's Northern Australian Regional Survey Section in 1946 was the initial response to the need for determining regional potential, followed in 1950 by emergence from it of the Land Research and Regional Survey Section. This group also had responsibility for two research stations, at Katherine and Kununurra.[2] See Supplementary Material S1 for a glossary of terms used in this paper and in part 2, and Fig. 1 for a map of all research sites and regions named in both papers.

The advancement of arid zone science was given impetus by the United Nations' Educational, Scientific and Cultural Organisation (UNESCO) Arid Zone Programme, an international research project, instigated in 1949 and operating formally from 1951 to 1964 with the goal of enhancing understanding of aridity and improving agricultural

[1] Christian and others (1960) p. 217.
[2] Eyles and others (1985) p. 22.

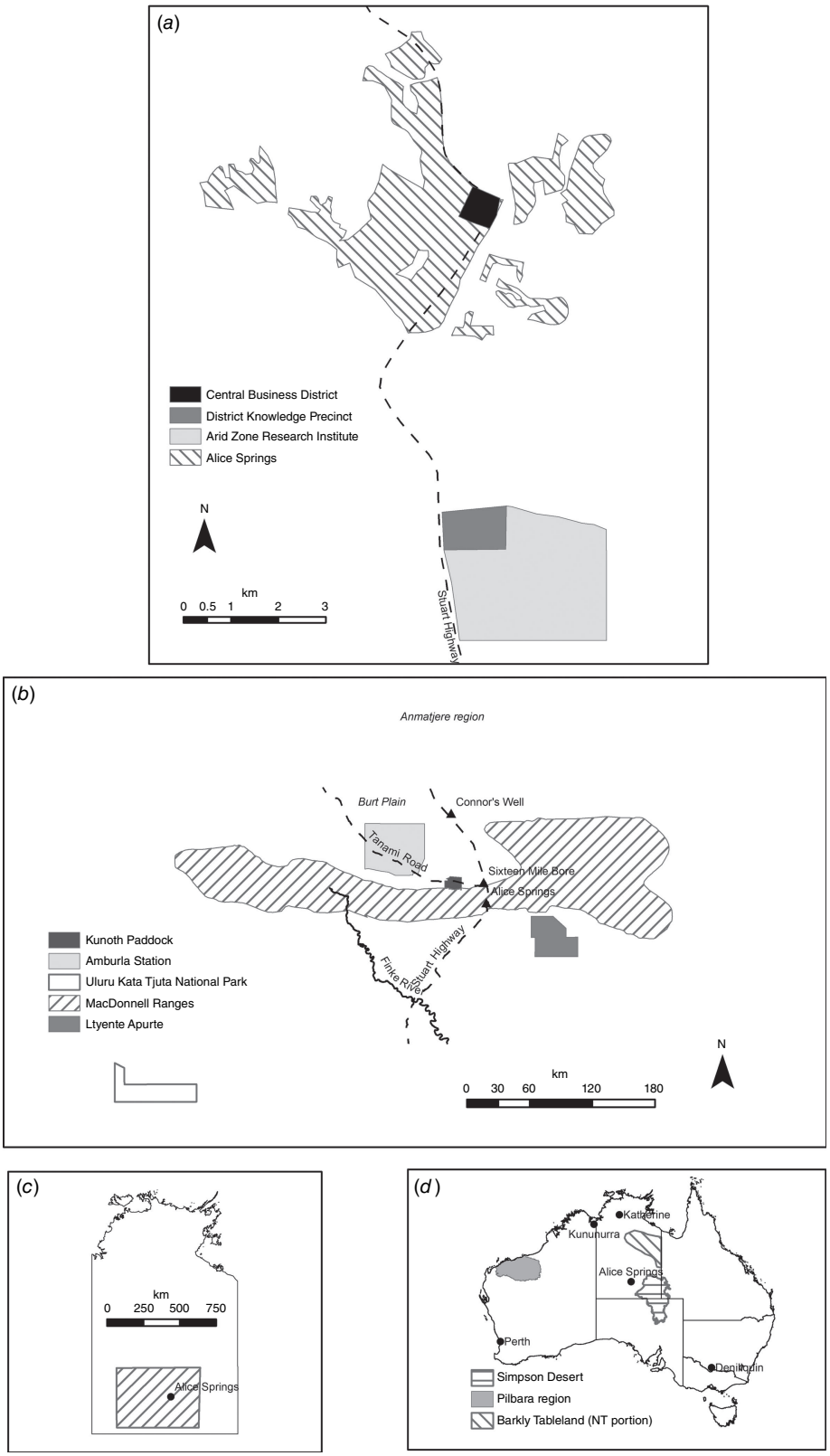

Fig. 1. A map of locations referenced in the text: (*a*) historical locations of the Central Australian Laboratory within or close to the Central Business District, and south of Alice Springs; (*b*) areas of CAL research in the southern NT; (*c*) the location of panel (*b*) within the southern Northern Territory; and (*d*) more distant locations of CAL research and collaborations within Australia, or other Australian regions listed in the text. Map created and provided by Gary Bastin.

productivity and conditions of life.[3] The programme promoted a holistic research strategy incorporating numerous biophysical disciplines, notably climatology, and including anthropology and archaeology.

The work of the Land Research and Regional Survey Section had three main facets:

> regional surveys to provide … a record and analysis of the numerous types of land and their natural environments; an assessment of their production potential … followed by intensive agronomic and pasture research in selected localities; and background research into important aspects related to potentiality assessment such as eco-climatology and hydrology.[4]

Land resource surveys were underpinned by a unique approach developed by C. S. (Chris) Christian and G. A. (Alan) Stewart, based on 'land systems' or mapping units defined by recurring patterns of topography, soils and vegetation, which could be expected to share ecological and geomorphological characteristics and, potentially, usefulness as a resource.[5]

CSIRO had determined that Alice Springs in the Northern Territory was an important location for pasture research. Ray Perry summarised the arguments for a field centre there—it represented the summer rainfall arid zone (one of four zones delineated for arid Australia), had good land and air transport, services in electricity, water and telephone, technical services for maintenance, shops and housing, medical services, education for family needs, and enough other scientists 'for the whole group to be self-critical and self-stimulating'.[6] By the late 1960s the town's population was 7000–9000.[7] Perry perceived that Alice Springs virtually selected itself as a research base.

In 1953, the Land Research and Regional Survey Section of CSIRO carried out a preliminary examination of the Alice Springs region. The subsequent report called for ecological studies of the native vegetation 'and its responses to grazing and climate crises', and for ecological studies of exotic pasture species.[8]

The following year the Land Research and Regional Survey Section established an Arid Zone Unit, the purpose of which was to study the use of native plant communities for grazing and to investigate exotic crop, pasture and tree species with potential for the grazing industry or in reclamation of degraded land. To service the unit a laboratory and field station were established at Alice Springs, where it was also expected to be a base from which staff from other units and divisions of CSIRO could engage in research.[9]

So began CSIRO's Central Australian Laboratory, a facility that supported arid zone research for almost 65 years until its closure in 2018. During that time, the focus of the scientific work conducted at the laboratory underwent continuing evolution. Research from 1953 to 1980, largely pastorally focused but including early forays into conservation and Aboriginal land management, is the subject of this paper (part 1), along with organisational and staff summaries for the period 1953–2018. Part 2 (1980–2018) addresses the shift in emphasis of research from 1980 towards integration of pastoral and conservation land management systems, the inclusion of social-ecological systems and Aboriginal livelihoods, and the creation of the Desert Knowledge Cooperative Research Centre. Our history of the laboratory aims to outline the trajectory of this research effort as an illuminating record of long-term shifts in societal expectations of the Australian inland, of scientific attempts to respond to them, and the influence of enabling technologies.

Facilities and staff

Bob Winkworth, the first resident scientist, arrived in Alice Springs at the end of 1953.[10] His house at 6 Renner Street, in the Eastside of Alice Springs, was the first CSIRO facility,[11] and a World War 2 shed in his yard functioned as the field station. Once the Arid Zone Unit was established in 1954, a house at 12 Gregory Terrace in the central town area was purchased to serve as a base, becoming CSIRO's Alice Springs Field Centre (Fig. 2).

In 1964, Winkworth left Alice Springs and, for several years, projects in central Australia were run from afar, supported by Bob Millington, the sole local employee. Then, in 1967, CSIRO's involvement in Alice Springs was renewed with the establishment of the Rangeland Research Programme, which developed in 1969 into a separate Rangeland Research Unit, led from Canberra by Ray Perry.[12] Recruitment of staff to central Australia began that same year (Fig. 3).

In July 1971, the offices were shifted into Ermond Arcade in Hartley Street, while Gregory Terrace continued to function as a field laboratory and workshop. Because the Rangeland Research Unit was growing, planning began

[3]Heymann (2020).
[4]Christian and others (1960) p. 217.
[5]Christian and others (1960) pp. 217–218.
[6]Perry (1969) p. 299.
[7]The Parliament of the Commonwealth of Australia (1971) p. 4. Australian Bureau of Statistics (2019).
[8]CSIRO (1953) p. 80.
[9]Anonymous (1958) p. 2.
[10]CSIRO (1954) p. 75.
[11]Email from Alex Nelson, 5 April 2020, to M. Friedel, Alice Springs, NT.
[12]Anonymous (1968) p. 28. Slatyer and Perry (1969) p. xii. Low (1978) p. 2.

Fig. 2. Bob Winkworth, first resident scientist, collecting monthly air samples for the International Geophysical Year 1957–8, 20 km north of Alice Springs. Photograph courtesy of John S. Turner.

about the same time for a new laboratory, the earliest drawings known to us being dated 1972 and donated in 2020 to the current occupiers.[13] The Central Australian Laboratory on Heath Road, South Stuart Highway, was officially opened by Prime Minister Malcolm Fraser on 6 April 1979, although staff had transferred from Ermond Arcade in September 1978. The house at 12 Gregory Terrace was advertised for sale in 1981,[14] and the site of the Ermond Arcade facility was later absorbed into the Yeperenye shopping complex.

In 1997, the Northern Territory Research and Development Advisory Council initiated development of an arid zone knowledge project built on multi-organisational collaboration, inclusive of CSIRO. From this initiative emerged an agency of the Northern Territory Government, Desert Knowledge Australia, which began development in the early 2000s of the Desert Knowledge Precinct on land adjacent to the Central Australian Laboratory (known by then as CSIRO's Centre for Arid Zone Research). In 2009, the Heath Road laboratory was sold to the Centre for Appropriate Technology, with the financial support of the Indigenous Land Corporation,[15] and CSIRO staff moved about 500 m away into a purpose-built extension of the Business and Innovation Centre on the Desert Knowledge Precinct. In February 2018, CSIRO Alice Springs was closed.

From 1953 to 1969 the number of resident scientists was either one or none, then grew steadily to a peak of fourteen

Fig. 3. Ray Perry, early 1970s, a driving force behind the development of rangelands research in Australia. CSIRO source unknown.

in 1990 and slowly waned until the advent of Desert Knowledge Australia, when a secondary peak of eleven developed in the mid-2000s. Technical and administrative support staff were in greatest numbers in the 1970s, reflecting the extent of fieldwork and data analysis for technicians regardless of the number of scientists and, for administrative staff, the absence of computers. Librarians were a constant, while the requirement for communications support only gained traction in the 1990s. Further analysis of staffing and research directions is provided in part 2 of this paper.[16] The officers-in-charge over the life of the laboratory, and its changing titles, are presented in Table 1.

Organisational settings

In common with many CSIRO facilities, the Arid Zone Unit and its subsequent incarnations underwent continuing change of organisational oversight through the decades. The names of the parts of CSIRO that the laboratory was

[13]Interview with Des Nelson on 28 April 2020, M. Friedel, Alice Springs, NT.
[14]Anonymous (1981) p. 20.
[15]Collected unpublished documents, held by M. Friedel, Alice Springs, NT.
[16]Friedel and others (2022).

Table 1. Officers-in-charge and laboratory titles from December 1953 to February 2018.

Period	Officer-in-charge	Title of the facility
1953–64	R. E. Winkworth	Arid Zone Unit/Alice Springs Field Centre
1964–7	Interregnum (R. W. Millington)	Alice Springs Field Centre
1968–71	R. W. Millington ('Manager')	Alice Springs Field Centre
1971–5	M. A. Ross	Alice Springs Field Centre
1975	R. E. Winkworth (Acting)	Alice Springs Field Centre
1975–8	C. E. Lendon	Alice Springs Field Centre
1979–80	V. R. Squires	Central Australian Laboratory
1980–2	B. D. Foran	Central Australian Laboratory
1982–95	G. Pickup	Central Australian Laboratory/ Centre for Arid Zone Research
1995–6	M. H. Friedel (Acting)	Centre for Arid Zone Research
1996–2002	D. M. Stafford Smith	Centre for Arid Zone Research
2002–2009	M. H. Friedel	Centre for Arid Zone Research
2009	G. N. Bastin (Acting)	CSIRO Alice Springs
2009–2014	A. D. Sparrow	CSIRO Alice Springs
2014	D. Race (Acting)	CSIRO Alice Springs
2014–5	M. Armistead (Acting)	CSIRO Alice Springs
2015–7	Y. T. Maru	CSIRO Alice Springs

attached to reflect changing research priorities over the years, as will become evident in part 2.[17] Units to which the Alice Springs facility belonged are shown chronologically below.

- 1953—Land Research and Regional Survey Section: formerly the Northern Australian Regional Survey Section of the Division of Plant Industry and renamed when it became independent in 1950;[18] led by Chris Christian as officer-in-charge.[19]
- 1957—Division of Land Research and Regional Survey: elevated in status from the preceding section, with Chris Christian as chief 1957–60[20] and Alan Stewart as chief 1960–73.[21]
- 1965—Division of Land Research: renamed from its predecessor.[22]
- 1969—Rangeland Research Unit: headquartered in Canberra with a field centre at Alice Springs; the unit had its origins in 1967 as a Rangeland Research Programme under the auspices of the Divisions of Plant Industry, Land Research and Wildlife Research, and was led by Ray Perry.[23] A second field centre, at Deniliquin, was included in 1971.[24]
- 1973—Division of Land Resources Management: formed by amalgamation of the Rangeland Research Unit and Western Australian components of the Divisions of Plant Industry and Soils,[25] with headquarters in Perth and Ray Perry as chief.
- 1982—Division of Wildlife and Rangelands Research: the Alice Springs and Deniliquin facilities of the Division of Land Resources Management merged with the Division of Wildlife Research,[26] headquartered in Canberra and with Charley Krebs as chief.
- 1986—Division of Wildlife and Ecology: an expansion of the Division of Wildlife and Rangelands Research by inclusion of units from the Divisions of Forest Research and Water and Land Research,[27] with Brian Walker as chief; the Deniliquin laboratory closed in 1991 and its staff were moved to Canberra.[28]
- 2000—Division of Sustainable Ecosystems: formed by amalgamation of the Division of Wildlife and Ecology with components of the Division of Tropical Agriculture,[29] with Steve Morton, Andrew Johnson and Brian Keating consecutively as chiefs.
- 2011—CSIRO Ecosystem Sciences, formed by merging the Division of Sustainable Ecosystems with the Division of Entomology,[30] and Mark Lonsdale as chief.
- 2014—CSIRO Land and Water Flagship, formed from the combination of CSIRO Ecosystem Sciences with CSIRO Land and Water, led by Paul Hardisty; in 2015 the term Flagship was dropped from the name.[31]
- 2018—closure of CSIRO Alice Springs facility.

[17] Friedel and others (2022).
[18] Wolff (2020).
[19] McCarthy (2018).
[20] McCarthy (2018).
[21] Walker (2018).
[22] Wolff (2020).
[23] Anonymous (1968) p. 28.
[24] Low (1978) p. 2.
[25] CSIRO Land Resources Management (1982) p. i.
[26] CSIRO Wildlife and Ecology (1999) p. 70.
[27] CSIRO Wildlife and Ecology (1999) p. 70.
[28] CSIRO Wildlife and Ecology (1999) p. 70.
[29] Ward (2016).
[30] Ward (2016).
[31] Ward (2016).

CSIRO divisions other than those with responsibility for the Alice Springs facility have been represented in central Australia. Notably, staff from the Division of Wildlife Research conducted research on dingoes during the period 1966–76. This work was based at the farm of the Northern Territory Administration's Animal Industry Branch on South Stuart Highway, in a location used earlier by Winkworth for plant introduction trials. Alan Newsome, who had previously studied red kangaroos as a wildlife biologist at the Animal Industry Branch, joined CSIRO in 1966 to lead this research. Many other non-CSIRO organisations, from local to international, have engaged with research at the laboratory, but are too numerous to detail. This does not imply that they were unimportant, rather that the scale of such a task is beyond the scope of this paper.

Pastoral land research—1953–80

The specifics of the initial research agenda were shaped by the Land Research and Regional Survey's preliminary examination of the Alice Springs area in 1953, which was in turn influenced by the UNESCO Arid Zone Programme on desertification and soil erosion, requiring research that included hydrology, climatology and soil stabilisation.[32] Ralph Slatyer, who led the Climatology Unit of the Land Research and Regional Survey Section at the time, was involved from 1956 in the UNESCO Arid Zone Programme. As Graham Farquhar later explained, the programme was based on 'an expectation that science would somehow make the deserts bloom and the arid zones of the world would provide food and habitat for the increasing world population'.[33] While this expectation proved to be misplaced, it was the core driver of early climatology research in Alice Springs, undertaken by Slatyer's team, 1956–60. John Turner, who joined Slatyer's team in 1957, recalled: 'My understanding through all the work in central Australia under Ralph was that encouragement for its initiation had come originally from UNESCO'.[34] Close collaboration between the Arid Zone Unit and the Climatology Unit meant that UNESCO's influence also contributed to the former's research agenda.

The global influence on, and exchange with, the research of the Arid Zone Unit and its later incarnations was supported by the development of the *Arid Zone Newsletter* in 1956, edited by Chris Christian for the purpose of coordinating Australia's fragmented arid zone research.[35] Also influential were researcher exchange visits and subsequent formation of the US/Australia Rangelands Panel in 1969, whose purpose was 'to further cooperation between the two countries in the rangeland sciences'.[36]

1950s–60s—maintaining or improving pastoral production from poorer quality country

Bob Winkworth was the sole representative of the Arid Zone Unit on its establishment in 1954. The role of the unit was to investigate native plant communities under conditions of grazing 'so that their full utilisation can be achieved without causing deterioration' and to investigate 'the use of exotic crop, pasture and tree species, either to replace native communities under condition of natural rainfall, to reclaim degenerate land or more efficiently utilise specially favoured localities'.[37] The most widespread pasture lands of the Northern Territory were the initial focus of research: spinifex country, comprising 57% of the area, and mulga country (7%) a distant second (see Figs 4, 5).[38]

During 1954–5, Winkworth, an expert plant taxonomist, joined a survey team led by Ray Perry that was working along 24 000 km of transects to investigate the plant ecology of central Australia, in preparation for future vegetation mapping.[39] Formal description and mapping of the lands of the Alice Springs area was undertaken 1956–7 by a team of Land Research and Regional Survey scientists including Perry (ecologist), Mike Lazarides (botanist), Jack Mabbutt (geomorphologist) and Wally Litchfield (pedologist).[40] The resultant report underpinned a great deal of subsequent research in central Australia.[41] Winkworth also began investigating the potential for range reseeding in collaboration with the Northern Territory Administration, collecting seed from native species as well as naturalised strains of buffel grass (*Cenchrus ciliaris*), and establishing a plant nursery on the Animal Industry Branch farm (which became the Arid Zone Research Institute from 1967).[42]

Collaboration with the Climatology Unit began with an exploratory experiment to determine the balance between water intake and loss in an area of natural mulga woodland.[43] The hope was 'that the results will provide

[32]CSIRO (1953) p. 80. Robin (2007). Heymann (2020).
[33]Farquhar (2020) p. 56.
[34]Letter from J. C. Turner, 18 June 2020, to M. Friedel, Alice Springs NT.
[35]Robin (2007).
[36]Heady (1976).
[37]Anonymous (1958) p. 1.
[38]Stewart and Perry (1962) pp. 14–15.
[39]CSIRO (1955) p. 77.
[40]Perry (1962).
[41]Perry (1962).
[42]CSIRO (1957) pp. 71–72. Millington and Winkworth (1970).
[43]CSIRO (1955) p.77.

Fig. 4. Spinifex (*Triodia* spp.) sand plain, Great Sandy Desert. Spinifex is a hummock-forming grass endemic to Australia and covering more than 22% of the continent—Griffin (1984). There are many species of *Triodia*, the most widespread being *T. basedowii*, *T. irritans* and *T. pungens*. They often occur on low nutrient soils in arid climates and are an important resource for arid zone fauna. The livestock grazing potential of spinifex grasslands is generally low due to their low nutrient status and remote locality. Photograph by Marg Friedel.

Fig. 5. Mulga (*Acacia aneura* complex) shrubland, Burt Plain, Alice Springs Region. Mulga is a widespread endemic across arid and semi-arid Australia and can form woodlands and forests but, in central Australia, it commonly occurs as a multi-stemmed shrub, scattered across diverse habitats or as a banded shrubland on red earths. On red earths, mulga shrublands support native fauna such as kangaroos but have low value for livestock grazing except as a drought reserve—Foran (1984). Photograph by Marg Friedel.

information on seasonal production of vegetation in relation to rainfall and soil moisture'.[44] The work took place at the '16-mile site', near a government bore named for its 16-mile distance from the Alice Springs post office, and led to more detailed work from 1957 at the '62-mile site', Connor's Well. Spinifex country was chosen for the first detailed study of the influence of climate on the characteristics and responses of arid zone vegetation. 'Spinifex was selected… because of its importance to Australia', judged by the area it covered.[45] A series of experiments on the vegetation community were planned 'with a view to increasing its utilisation'.[46] The outcomes would be compared with results from an equivalent study in mulga, covering microclimates, water balance, and ecology and physiology of plants.

Science was expected to improve the native pastures: 'The first requirement for reseeding native pastures is to find better species than the indigenous ones'.[47] In 1958, the Climatology Unit cleared small areas of mulga depressions and built ponding banks, later sowing several non-native grass species and adding fertiliser, with expectations that buffel grass could be widely established.[48] Likewise, Winkworth trialled reseeding with buffel grass and native woolly butt (*Eragrostis eriopoda*) in spinifex, using alternative seed-bed treatments including ploughing and burning, fertilising and furrowing and, in mulga, clearing trees, fertilising and furrowing.[49]

[44]CSIRO (1955) p.77.
[45]Anonymous (1957) p. 7.
[46]As above.
[47]CSIRO (1959) p. 72.
[48]Anonymous (1958) p. 22.
[49]CSIRO (1958) p. 69. Anonymous (1958) p. 6.

None of these trials was successful.[50] The mineral status of spinifex and mulga soils was found to be poor and climatic conditions were harsh, prompting Winkworth to say: 'It seems likely that it will only be possible to achieve success in localities favoured by surface run-on and soil fertility', as exemplified by mulga depression, river flood plain and outwash plains.[51] He foresaw a shift of focus to studying the ecology of native pastures under grazing.[52]

The Northern Territory Administration had established a grazing trial in 1956 on 125 km^2 (48 square miles) of 'virgin' spinifex (*Triodia basedowii*) sandplain north of the MacDonnell Ranges, on present-day Amburla Station.[53] Cattle failed to thrive despite supplementary feeding and the trial was later abandoned. Winkworth had undertaken an initial ecological survey of the site, so the failure of the trial almost certainly influenced his opinion of the lack of utility of spinifex country.

Some of CSIRO's earliest attempts to repair degraded country and understand the impact of grazing began in 1958 whereas, by contrast, previous work had focussed on 'improving' unproductive country. Winkworth tried furrowing and ploughing a 'scalded' flood plain south of the present-day airport to enhance plant introduction. These scalds were natural, and plants failed to establish despite being watered.[54] At the same time, both Winkworth and Slatyer's Climatology Unit were comparing vegetation responses inside and outside exclosures on heavily grazed mulga. The timing of these investigations was unfortunate because seven dry years, some severely dry, followed from 1958.

By 1960, all members of the Climatology Unit had returned to Canberra, although their instrumentation remained in place and recording continued.[55] Jack Mabbutt and his team returned from time to time to study regional geomorphology, the evidence of climate change and the geomorphology of Simpson Desert sand dunes.[56] Later in the decade Mabbutt transferred to the University of New South Wales but maintained his collaborations with CSIRO, including Alice Springs. During the early 1960s, Malcolm Wright, CSIRO Division of Soils, ran a lucerne irrigation trial,[57] and Tom Chapman, Land Research and Regional Survey, Hydrology Section, installed automated recording instruments in 18 catchments to assess surface run-off from different types of landscape, with a view to managing sparse water resources for increased production.[58] In 1967, Francis Jozwik, together with Nick Nicholls of the Arid Zone Research Institute, began glasshouse trials and field studies of the Mitchell grasses (*Astrebla* spp.).[59] This was not before time because, as Jozwik and colleagues remarked, 'the importance of the Mitchell grasses to the Australian pastoral industry [was] disproportionate to the research done on them' (which was very little).[60] This focus on high production pastures was a new direction for CSIRO in central Australia.

This period, in the 1960s, was the era of 'suitcase scientists', because Winkworth had been seconded to work with UNESCO in Iraq in 1964 and no scientists were permanently based in Alice Springs. The situation was not due to lack of interest, but lack of funding.[61] Alan Stewart, Chief of the Division of Land Research and Regional Survey, was regretful: 'We have reluctantly come to the decision that by about June of next year [1964] our staff at Alice Springs will be reduced to one man who will maintain established long-term experiments and look after the laboratory'.[62] This task fell to Bob Millington, who had been appointed at the start of the decade; as Des Nelson, long-term resident and later CSIRO technician, subsequently observed: 'It would be hard to imagine anyone who worked harder for CSIRO in central Australia than did Bob Millington'.[63]

Federal politician Jock Nelson, MHR, was displeased: 'Central Australian residents are incensed by the Government's action in restricting the funds available to the CSIRO for work in the Northern Territory this year' and, furthermore 'I have made many urgent protests to the Ministher [as written] on this matter',[64] but the situation remained unchanged. Members of the Northern Territory Legislative Council, Lionel Rose and Bernie Kilgariff, received unanimous support some months later for their motion to ask 'The Honourable, the Minister in Charge of the CSIRO, to reconsider his decision to close the Alice Springs section'.[65] The Minister, Senator J. G. Gorton, was unmoved.

[50]Anonymous (1960*a*) pp. 6, 8. Perry (1970).
[51]Anonymous (1961) final page.
[52]Anonymous (1960*a*) p. 11.
[53]CSIRO (1956) p. 73. Interview with Des Nelson on 28 April 2020, M. Friedel, Alice Springs NT.
[54]Interview with Des Nelson on 18 November 2005, M. Friedel, Alice Springs NT.
[55]Nelson (2001).
[56]Anonymous (1960*b*) p. 3.
[57]Wright (1963).
[58]CSIRO (1964) p. 37. Chapman (1970).
[59]Jozwik (1970). Jozwik and others (1970).
[60]Jozwik and others (1970) p. 49.
[61]Anonymous (1963*a*) p. 3.
[62]Anonymous (1963*a*) p. 3.
[63]Nelson (2001).
[64]Anonymous (1963*b*) p. 3.
[65]Anonymous (1964) p.1.

At the end of 1967, the Rangeland Research Programme was initiated, to include the field centres in Alice Springs and Deniliquin.[66] Other centres in different climatic zones were envisaged and the possibility was mooted of forming an 'Australian Rangeland Research Institute' with universities, but this did not eventuate. Two graduate positions were allocated to Alice Springs in 1968,[67] but not until the semi-autonomous Rangeland Research Unit was established in 1969 were scientific staff recruited.[68]

1969–80—management of more productive pastures

The priority of the Rangeland Research Unit was soon perceived to be maintenance of productivity in the grazing industry, with improving productivity a secondary objective.[69] Perry declared the aims of the new programme to be 'to study in depth the climate-land-vegetation-animal ecosystem, the processes operating within it, and the interaction between processes'[70] and he detailed the studies that would be required. He suggested that the resultant knowledge could be synthesised 'either in our minds, in a computer, or by a combination of both'.[71] He went on to say '[o]f course the early models will be crude but coarse predictions will be possible from them' and he envisaged the models would also highlight deficiencies in research.[72]

Perry proposed that a 'possible modern alternative' to grazing trials was the construction of mathematical models to 'simulate part or all of the system in a computer'.[73] He argued that, where climate was erratic and stocking rates low, '[t]oo often the results of grazing trials are a set of animal and plant production figures for a limited number of treatments and applicable only to the plots on which the trial was conducted and for the climate during the experimental period'.[74] It was 'more logical for arid pastoral research to concentrate on gaining a fundamental knowledge of the ecosystem, how it operates, and the factors which influence its operation'.[75] He specifically identified the need for information on animal forage preferences, plant growth and development, and differential defoliation impacts, the latter for the definition of range condition and trend.[76]

Grazing enterprises at this time were often akin to wildlife 'harvesting' and cattle were not closely managed,[77] so expertise in wildlife behaviour was judged necessary to determine the where, what and when of grazing. Bill Low was appointed to this role in 1969, joining Max Ross whose task was to elucidate vegetation dynamics and the impacts of grazing on vegetation. Complementary research was undertaken from 1970 by Bobbi Low and others, examining the competition between cattle and red kangaroos in mulga communities. At the same time, Colin Lendon collaborated with these and other colleagues to examine herbivore diets and explore criteria for range condition assessment. Winkworth was now in Canberra and extended his hydrological studies beyond mulga to include central Australian floodplains and Mitchell grasslands of the Barkly Tablelands.

Soon after his arrival, Ross outlined an integrated approach to the ecology of arid Australia, summarising his perception of the components of a simulation model and the adequacy of available data.[78] He cited David Goodall's suggestion that 'simulation should start at the beginning of a research programme, so that the data collection and model refinement may proceed simultaneously, allowing the results of each to modify the other'.[79] A gap we now recognise in system modelling from that period was fire, perhaps not surprisingly since the last extensive wildfires had occurred at least 20 years previously.

Paddock-level studies, 1969–75

A suite of studies to enable 'modelling of important aspects of an arid land ecosystem'[80] focused on Kunoth Paddock, a 153 km^2-section of Hamilton Downs Station, 40 km northwest of Alice Springs. The examination of climate, geomorphology, soils, hydrology, vegetation and animals (cattle, termites, ants, collembola, mammals, birds, reptiles and amphibians) was intended to enable modelling by Goodall.[81] Despite extensive efforts, the modelling was never completed, due to the inherent spatial and temporal

[66] Anonymous (1968) p. 28.
[67] Perry (1969) p. 296.
[68] Low (1978) p. 2 cites an unpublished report by R. A. Perry, 'CSIRO Rangelands Research Programme', Canberra ACT, 1969. Interview with Bill Low on 13 May 2020, M. Friedel, Alice Springs NT.
[69] Perry (1969) p. 301.
[70] Perry (1968*b*) p. 248.
[71] Perry (1968*a*) p. 11.
[72] Perry (1968*a*) p. 12.
[73] Perry 1967, pp. 10–11.
[74] Perry (1967) p. 10.
[75] Perry (1969) p. 301.
[76] Perry (1967) p. 9.
[77] Interview with Bill Low on 13 May 2020, M. Friedel, Alice Springs NT.
[78] Ross (1969).
[79] Goodall (1969) as cited in Ross (1969) p. 70.
[80] Low (1978) p. 4.
[81] Low (1978). M. Friedel, personal information.

complexity of the system and the impossibility of capturing the diversity of data required in a timely and affordable way.

The Kunoth Paddock studies resulted in a number of papers in an issue of *Tropical Grasslands* **7** (1973) entitled 'The Mulga Lands of Australia'. One of the papers was an early attempt at modelling a component of the paddock ecosystem,[82] the dynamics of native woolly butt in a mulga community. Interest in ecosystem modelling eventually waned for the reasons outlined above and the focus turned to the assessment of range condition and trend.

Early research in this period was undertaken in the mulga community, but it became clear from Low's animal behaviour studies that mulga country was not preferred pasture, and that pastures such as woodlands and floodplains experienced much heavier grazing pressure than mulga.[83] The woodlands and floodplains were limited in area by comparison, but they were highly productive and clearly also prone to degradation. Moreover, Newman and Condon had found that, across arid Australia, mulga was resilient to grazing following drought whereas the floodplains and alluvial fans were not.[84] Looking after land that supported the majority of animal production within a paddock or property became a priority for research.

Station-level studies, 1975–80

The earliest efforts to develop a system of range assessment in central Australia were made in the aftermath of 9 years of below average rainfall ending in 1965, the totals for four of those years being lower than the 10% decile. In 1966, George Chippendale, botanist with the Northern Territory Administration, devised an assessment system based on vegetation and soils at fixed distances from watering points, which was subsequently implemented by Des Nelson for almost half of the Alice Springs region's properties.[85] Dick Condon, John Newman and Geoff Cunningham from the New South Wales Soil Conservation Service surveyed the state of soils, pasture and browse, stratified by land system, between 1965 and 1967.[86] In 1971, a technical advisory group to the Northern Territory Administration proposed comparative testing of local approaches and those used in the United States. A collaboration between the Northern Territory Administration and CSIRO developed a method based on a 'quantitative climax' predicted by succession theory and incorporating comparison with a reference site representing the best condition. This method, 'Standards for Testing and Assessing Range Condition (STARC)',[87] relied solely on the species composition of the herbage layer and disregarded the soil and woody plant layer, despite earlier recommendations for their inclusion.[88]

Soon after, Perry declared: 'Australian scientists are beginning to accept the American conclusion that the most appropriate single index to condition is change from original botanical composition'.[89] This conclusion was tested extensively over coming decades and found wanting, but initially STARC was considered to be an effective tool for organising a new research phase. It provided the framework for studies over four stations on the Burt Plain north of Alice Springs, encompassing animal diets (Vic Squires), vegetation response to grazing (Lendon), plant productivity and nutrient cycling (Marg Friedel) and fire (Graham Griffin). While Lendon's results in relation to range condition were not published, both Friedel and Griffin concluded that the attributes they evaluated did not correlate with assessed range condition classes at the research sites[90] and Squires reported that his study 'failed to demonstrate a major influence of range condition assessed by the STARC technique, on either forage biomass or diet quality'.[91] The productive potential of country for grazing could not be assessed by species composition alone (Fig 6).

Fire could no longer be overlooked by the laboratory as a component of arid ecosystems. Record rainfalls beginning in 1973 generated such extensive vegetation growth that wildfires became commonplace and early satellite imagery detected fire scars of great size in remote spinifex country. Moreover, wider society increasingly recognised the role of traditional use of fire by Aboriginal people in the shaping of landscapes—for example, Rhys Jones' landmark paper and later a paper specific to central Australia by Peter Latz (Northern Territory Government) and Griffin.[92] In Western Australia's Pilbara region, Suijdendorp had been investigating the use of fire for pasture management since the 1950s.[93] In 1971, the Riverina Laboratory at Deniliquin had been brought into the Rangeland Research Unit to research the semi-arid rangelands. Shrub thickening in the Western Division of New South Wales had been an increasing problem for years, attributed to overgrazing and absence of fire.[94] Shrub thickening was also apparent in central Australia after the record rainfalls

[82] Ross and Lendon (1973).
[83] Low and others (1980).
[84] Newman and Condon (1969).
[85] Letter from Des Nelson, 22 July 2021, to M. Friedel, Alice Springs NT.
[86] Bastin and others (1983) pp. 152–153.
[87] Lendon and Lamacraft (1976).
[88] Bastin and others (1983) pp. 153–154.
[89] Perry (1977) p. 501.
[90] Friedel (1981). Friedel (1985). Griffin and Friedel (1984*a*).
[91] Squires and Low (1987) p. 94.
[92] Jones (1969). Latz and Griffin (1978).
[93] Ealey and Suijdendorp (1959). Suijdendorp (1980).
[94] CSIRO Land Resources Management (1980).

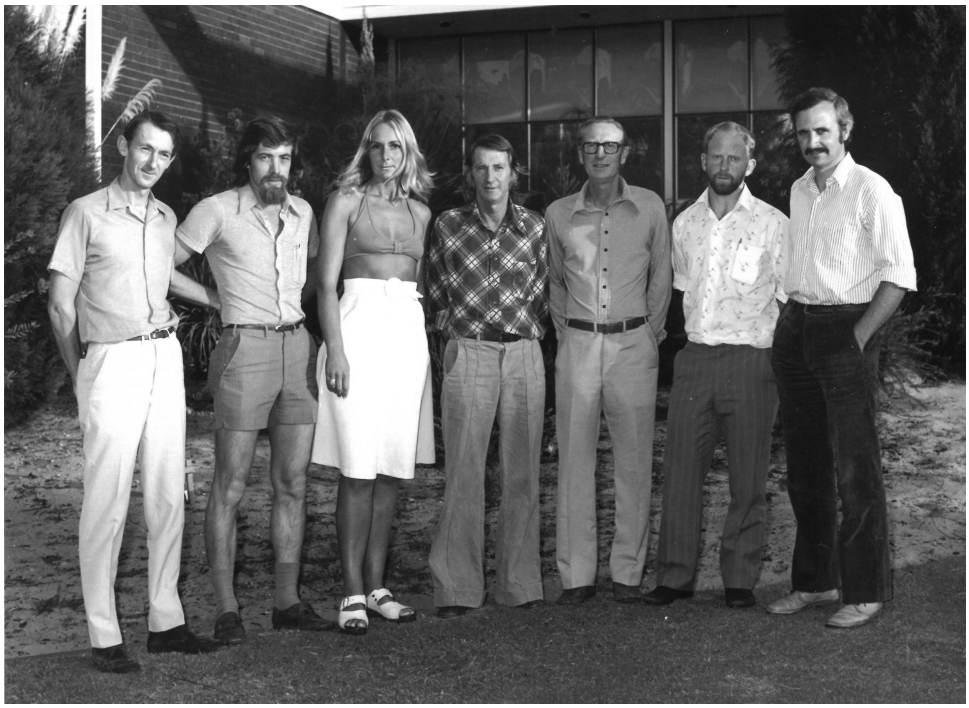

Fig. 6. Research staff in April 1975. L–R Max Ross, Bill Low, Marg Friedel, Bob Millington, Bob Winkworth, Peter Pavlov, Colin Lendon. CSIRO source unknown.

in the 1970s and so Griffin's investigation of fire as a management tool was initiated in 1977.[95]

By the end of the 1970s, pastoral land research had demonstrated that it was not feasible to 'improve' land of low grazing potential. Maintaining the productivity of better quality country demanded a holistic view of interactions amongst soils, vegetation and livestock behaviour. It also necessitated a way of monitoring the health of the country resulting from grazing. New monitoring methods were tested but found to be inadequate, and so refinement continued in collaboration with user agencies in subsequent decades. Initial experiments with fire as a management tool did not lead to uptake on pastoral lands but were the forerunner of extensive investigations and use on conservation lands. Throughout the period, research was undertaken with colleagues from other agencies and jurisdictions, enabling further improvement and adoption, so that achievements and impact cannot be attributed to the laboratory alone.

Emerging questions about non-pastoral land uses, 1970–80

Non-pastoral issues were not considered by the Rangeland Research Unit and its predecessors, except for passing references to tourism and national parks.[96] Resource maps of the 1970s showed land use as beef, wool or 'unoccupied'. Aboriginal land use was notably summarised in a sentence: 'The Aborigines were hunters who grew no crops and kept no herbivorous animals; they adapted to the environment and had little effect on it';[97] almost all descriptions of rangelands ignored the human dimension and confined themselves to biophysical attributes.

However, the social and political environment of the nation was changing. In 1967, 91% of Australians had voted to change the Australian constitution so that Aboriginal and Torres Strait Islander peoples would be counted as part of the population and the Commonwealth would be able to make laws for them.[98] The South Australian *Aboriginal Lands Trust Act* of 1966 and the Western Australian Aboriginal Lands Trust created by the *Aboriginal Affairs Planning Authority Act* of 1972 recognised Aboriginal rights to land in those states, although they did not provide inalienable rights.[99] In 1976, after years of community activism, federal parliament passed the *Aboriginal Land Rights (Northern Territory) Act*.[100] Aboriginal people were granted inalienable freehold title to extensive lands that had formerly been reserved for their use, and were progressively granted such title to other lands where their traditional ownership was proven.

[95] Griffin and Friedel (1984*a*, 1984*b*).
[96] CSIRO Rangelands Research Unit (1970) p. 5.
[97] Perry (1969) p. 293. Perry's view was typical for the period.
[98] Anonymous (n.d.*a*).
[99] Government of South Australia (2022). Government of Western Australia (2022).
[100] Anonymous (n.d.*b*).

Concern for conservation of the natural environment also burgeoned during the 1960s. Fears for the outcome of overpopulation, its effects on the environment and human society and the excessive use of pesticides drove the rise of environmental movements worldwide,[101] and the establishment in 1965 of the Australian Conservation Foundation, supported by numerous high-profile Australians.[102] Clearly societal expectations were shifting, but how arid zone research should respond was not immediately apparent.

Effective engagement by CSIRO with Aboriginal people on research of relevance to them remained decades away, the early efforts being well-meaning but patronising. In 1975, the CSIRO Division of Human Health proposed a project entitled 'Better Nutrition for aborigines [as written] through a new Eco-system in Central Australia', envisaging 'the development of an Eco-system suitable for 50–100 people which will enable them to produce their own food, generate their own energy… a limited cash economy could be superimposed on the subsistence economy through handicrafts'.[103] The proposal troubled a number of individuals and organisations in central Australia, who protested the absence of Aboriginal involvement.[104]

Contributing scientists and other professionals participated in a workshop held in Canberra in October 1976.[105] Dr H. C. (Nugget) Coombs summed up a second workshop in Alice Springs in 1977 by concluding that the goal of CSIRO and other agencies appeared to be the use of research results, not for Aboriginal people, but rather for white entrepreneurs and commercial markets.[106] He foresaw that the future outside major administrative and mining centres would be increasingly Aboriginal, and that research should take greater account of the constraints of a predominantly Aboriginal lifestyle and priorities.[107]

To celebrate the opening of the new Central Australian Laboratory in 1979, a symposium on 'Man in the Centre' was convened.[108] Papers were delivered on mining, tourism and Aboriginal land use, but with little indication of what aspects might benefit from research: Albrecht said 'it would seem to me then that traditional [Aboriginal] management concepts are inapplicable today—unless of course we all want to return or adopt the traditional lifestyle of hunting and gathering'.[109]

Nevertheless, the late 1970s saw the beginnings of a shift away from the laboratory's almost total focus on pastoral use of rangelands to a broader suite of land resources, including Aboriginal land use and conservation. In the year following the 1976 workshop in Canberra, a quarterly newsletter, *Aboriginal Nutrition*, was established, edited by Griffin, Sam Miles (Department of Aboriginal Affairs) and Trevor Cutter (Central Australian Aboriginal Congress). After the Alice Springs workshop in 1977, a number of technical resource people from Aboriginal and government agencies formed a Technical Advisory Group for Aboriginal Lands (TAGAL), which included Barney Foran and Griffin from the Central Australian Laboratory. TAGAL initiated a further workshop in 1980 (and subsequently in 1985) to address land use and management, health and appropriate technology.[110] Foran's and Griffin's engagement with Aboriginal issues foreshadowed later development of research programs with Aboriginal people in CSIRO.[111] Likewise, Griffin's research in fire and conservation land uses, and Friedel's examination of tree and shrub dynamics in the late 1970s were forerunners of CSIRO conservation research in later decades.[112]

By 1980 the annual report of CSIRO's rangelands research group was calling for a multidisciplinary approach to rangelands research, explaining that 'management decisions are made by a diverse group of people—owners, managers and administrators', and hence expertise was needed in economics and sociology.[113] Appointments in these disciplines were made to the Deniliquin laboratory but this more holistic view of research had also permeated the Alice Springs group. Undoubtedly shifts in societal expectations and political settings were influencing the directions of the laboratory's research but it was also apparent that the skills of individual researchers were helping to shape the research agenda.

Conclusion

Despite multiple changes in institutional structure and research agendas, the first 27 years of research at the Central Australian Laboratory generated valuable insights in arid land science. An expectation in the 1950s that science could make the deserts bloom was proven misplaced when the vast spinifex grasslands and much of the mulga country could not be converted to productive pastoral

[101]For example, Carson (1962). Erlich (1968).
[102]Anonymous (n.d.*c*).
[103]Unpublished proposal 24 February 1976, held by M. Friedel, Alice Springs NT.
[104]Collected unpublished documents, held by M. Friedel, Alice Springs NT.
[105]Hetzel and Frith (1978).
[106]Coombs (1978) p. 3.
[107]Coombs (1978) p. 4.
[108]Crook (1983).
[109]Albrecht (1983) p. 187.
[110]Walker and Foran (1986).
[111]For example, Latz and Griffin (1978). Griffin and Lendon (1979). Walker and Foran (1986).
[112]For example, Griffin and Friedel (1981, 1984*a*, 1984*b*). Griffin and others (1983). Friedel (1985).
[113]CSIRO Land Resources Management (1980) p. 3.

country through 'improvements'. Instead, attention shifted to identifying where cattle preferred to graze and to maintaining the productivity of that country. While the focus was firmly on pastoral land use research in the first two decades, by the end of the 1970s the expectations of Australian society had broadened to include considerations of Aboriginal and environmental needs. In response the laboratory's research agenda shifted progressively towards inclusion of non-pastoral themes. Part 2 of this paper outlines the multiple strands of research which developed through the 1980s, and the key influences on these research directions.

Supplementary material

Supplementary material is available online.

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