Wandoo in health and decline: a history

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By Andrea Gaynor
prepared on behalf of the Wandoo Recovery Group

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Cover image Land selected by H.S. Ransford near Kojonup, c.1906.
Photo – Courtesy State Library of Western Australia, The Battye Library (20659P)

Contents

Wandoo is one of the most important eucalypts of south-west Western Australia, and is endemic to the region. It is an important tree for wildlife, a source of high-quality honey for apiarists, yields first-class structural timber, and plays an important role in watershed protection and amenity.

However, since at least the 1980s, a large number of wandoo trees across their range have suffered deteriorating health, indicated by a decline in the tree crown, which sometimes leads to the death of the tree. At present the cause is unclear, though it appears that climate change, changes in land use and management, and pest populations may be relevant factors. The failing health of the trees is a source of significant community concern.

This booklet brings together the results of historical research involving interviews with people who have lived and worked in wandoo areas, as well as photographic, archival and other documentary sources. In all, 24 interviews were conducted with 31 people, in addition to informal communication with several others. Although this review sought evidence of crown decline anywhere in the range of wandoo, two focus areas were chosen for more detailed study: Kojonup and surrounds, and the areas north and east of Mundaring (including Julimar). Interviews were also conducted with interested and knowledgeable people living near or between these areas, and those who have worked with the tree across its range. The aim of the research was to find out whether the current decline problem is historically unique or cyclical and to canvass possible causes, as well as creating a record of the past relationships between people and wandoo.

The virtues of wandoo

Wandoo, also known as white gum, is an extremely important species for wildlife. Hollows in mature trees provide homes for brush-tailed wambengers (or phascogales), bats and a range of birds; while fallen hollow logs house possums, numbats, chuditch, echidnas, pythons and monitors, to name just a few. The crown of the tree provides food for a multitude of insect species, which in turn provide food for predatory insects and insectivorous birds. Possums feed on the leaves, and nectar-eating birds and insects are attracted in large numbers when the tree is in flower. Many kinds of bird, including wedge-tailed eagles, build nests in the canopy. In fact, wandoo is used by so many animals it has earned it the name 'nature's boarding house'.[1]

Wandoo is also valued by people. Its flowers are often rich in nectar and produce a fine honey, so wandoo woodlands are prized by beekeepers. The timber is extraordinarily durable: a wandoo pile that was used in the construction of the old Serpentine Bridge in 1854 remained, when drawn in 1899, in 'a remarkable state of preservation', and cogs of wandoo used in Ellen's Brook Flour Mill since 1837 showed very little wear in 1899.[2] By the mid twentieth century, wandoo had 'a well deserved reputation for sleepers and wagon construction', and was also 'recognised as an excellent timber for building and particularly flooring, because of its good wearing qualities and low shrinkage'.[3] In addition, the timber was used in a range of applications where superior strength and durability were required, including poles, bridges, wharves, boat building, insulator spindles, mallets, and wagon scantling.[4]

An American architect in Western Australia in 1940 visited the recently constructed St John Ambulance building in Wellington St, Perth, and was captivated by the 'remarkably beautiful floor', of which he had never seen the like. He sought to assure local authorities in an article in *The West Australian* that 'they have in wandoo one of the most remarkable timbers for flooring I have ever seen, and I have both practised and travelled extensively… Your readers should see this floor for themselves. I can assure them they will behold a thing of beauty'.[5]

Little wandoo is now harvested for timber. Instead, it is valued more for its role in maintaining biodiversity as well as catchment protection. Wandoo is the dominant tree on the parts of Perth's water supply catchments that are most at risk from salinity.[6]

The historical woodlands

Wandoo occurs over much of the south-west of Western Australia, in open woodlands where it is the principal tree species, or, more often, mixed in with jarrah and marri. It does not, as C.A. Gardener noted in 1923, 'present a uniform woodland. Rather does it form a series of associations in which the tree takes a leading part'.[7] In the early nineteenth century, Swan River colonists found some of these landscapes highly attractive. James Henty, for example, wrote during his journey over the Darling Ranges in October 1830:

> *'The grandeur of the scene occasionally among the valleys surrounded by increasingly tall white gums and the solemn silence prevailing in the bush, totally unaccompanied by any signs of civilization imparts ideas that it is impossible to reflect on without awe and reverence and which those who have not experienced it can scarcely appreciate.'*[8]

Like many of his time, Henty failed to recognise Aboriginal occupation and management of the area, even though his party encountered Nyoongar people and carvings they made on the trees. But his journals, and those of his contemporaries, provide insights into the structure and composition of wandoo woodlands under Aboriginal management.

Henty noted that where white gum occurred on 'ironstone gravel', the ground was 'without a vestige of grass'. Similarly, John Septimus Roe, on an expedition to York, found that on country with 'much rusty coloured gravel and rock – a species of white gum tree coloured with a reddish tint on the bark was observed to occupy the places most bare of vegetation – and may possibly have so much astringency in its bark as to destroy the vegetation'.[9] Different understoreys, however, occurred on other soil types. Captain Thomas Bannister, on a journey from Fremantle to King George Sound (Albany) in February 1931, wrote:

> *'The trees are the Mahogany in the rugged higher lands but among them, the white and red gums, I should remark that in this district it most frequently happens that under those trees, herbage generally which affords excellent feed for stock at this unfavourable season of the year: many parts have been recently burned probably last season, and this year the herbage I speak of was quite green and fresh.'*[10]

Bannister also encountered broad, shallow valleys with scattered marri and wandoo, with abundant fine grass (p. 209). By December 1831, John Septimus Roe, on an expedition to the north and west of King George Sound, recognised white gum as 'the harbinger of good soil'.[11]

In May 1832, surgeon Alexander Collie ventured to the north and west of King George Sound; on the second day of the expedition he encountered trees that 'are commonly designated the white gum. They are of moderate size and have the greyish white uniformity of their bark varied with ferruginous warty Spots, and their branches much bent. Their native name is Wornt (the r is soft)'. These trees were generally 'sufficiently wide apart to admit of agriculture without any clearing' (or, later '15 yards apart'), with an understorey of 'scanty herbaceous and grassy vegetation nearly free from shrubs', and often showing evidence of the 'spreading conflagration' of the Aboriginal people. In this landscape, 'kangaroos were abundant'.[12]

Land selected by H.S. Ransford near Kojonup, c.1906.
Photo – Courtesy State Library of Western Australia, The Battye Library (20659P)

Some of these features are still recognisable in remnant wandoo woodlands today, although many of these landscapes described by the explorers would undergo radical change.

Woodlands into farmlands

After the initial excitement generated around its establishment, the Swan River Colony languished for decades. Although its prospects would ultimately be boosted by the gold rushes that began in the late nineteenth century, there remained a strong faith in agricultural development as the path to long-term prosperity, and a conviction that populating the western third's 'agricultural land' with 'sturdy yeomen' would be the ideal means to this end. Governments, therefore, did all in their power to 'open up the land' and encourage closer settlement. Once the land was alienated, wandoo woodlands were cleared to make way for farming. The clearing of large areas as quickly as possible was encouraged firstly by conditional purchase regulations laid down in 1887, and later by the Agricultural Bank policy of advancing money for the acreage cleared.

Joe and Jack Norrish, Land Selectors in Horse and Cart, in Bush Country near Kojonup, c.1907.
Photo – Courtesy State Library of Western Australia, The Battye Library (4045B/19)

The perception that uncleared land harboured pests supported this approach. Clearing might involve ringbarking or felling, then burning the dead trees. By the 1920s, some farmers were able to sell the standing timber to sleeper-cutters, who paid a royalty to the farmer for the sleepers, and who were required to 'cut all timber usually considered suitable for sleepers'.[13]

The extent of the alienation of wandoo woodlands was such that in 1911, when a forest ranger was asked to find good wandoo country to reserve between Noggerup and Kojonup, he was at first unable to do so. He later found an area suitable for a reserve, but by 1924 this had been made available for use under grazing leases. By 1927, the pressure to release land in the district was such that the reserve was revoked, and the land all opened up for selection.[14]

Reserving wandoo

Some local people took a longer-term view, and agitated for areas of wandoo woodland to be set aside in reserves that could not be made available for selection. One example comes from Toodyay. In 1922, Sam Cook, of Coondle Bee Farm, wrote to the Conservator of Forests:

> *'Dear Sir*
>
> *I wish to draw your attention to the quantity of valuable timber (Wandoo) growing in the forrest [sic] here within about 10 miles of the Toodyay-Bolgart railway, nearest point Coondle Siding. I am of the opinion that this timber ought to be reserved as a valuable asset to the country. There are thousands of acres of it and it is the only thing of value on the land as it is very poor land. Lately some of this land has been taken up and good timber rung and I understand that more is being taken and more timber will be destroyed. In my opinion the land will never produce anything like the value of the timber that is being destroyed. It was in this forrest that girders and piles were cut for use in the construction of the Toodyay Bolgart line.*
>
> *This timber is also very valuable in the bee-farming industry and the destruction of it means ruination to this industry.*
>
> *I think that any applications should be held over until the country be inspected… I write in the interest of the State as there is no doubt of the enormous value of the timber, perhaps not so much at the present as in years to come…'*[15]

The Acting Conservator discussed Cook's request with the Lands Department, and told Cook that the Conservator would send an inspector to assess the value of the timber the following year. In July 1932, Sam Cook wrote once again to ask where the inspector was, adding that 'a considerable amount of wandoo has been destroyed during the past 10 months'. The following year, Conservator S.L. Kessell wrote to the Under-Secretary for Lands to ask whether Cook's blocks could be reserved. Although four of the blocks were deemed to 'contain too much land suitable for settlement' for them to be set aside as reserves, two of the blocks were described as 'very poor', being largely gullies, so the Under-Secretary had 'no objection' to their reservation if they contained sufficient

Portion of land selected by J.C.G. Foukes MLA, near Kojonup, c.1907.
Photo – Courtesy State Library of Western Australia, The Battye Library (20660P.)

timber. These blocks, and part of another, were then inspected in December 1925 – with Cook's assistance. Head Forester Douglas McVicar described the area as 'one of the best belts of wandoo forest that I have seen for many years. A striking peculiarity about it is the small number of over-mature trees. Most of the trees are solid and in prime condition'. All along the Julimar brook, the wandoo was deemed to be 'first class'. York Road poison (*Gastrolobium calycinum Benth.*) was found throughout the area; McVicar noted that 'on some of the blocks it is almost the only shrub growing on the forest floor'. This plant is very toxic to livestock, so 'poison lands' were not suitable for grazing. This, along with the nature of the soil, meant that some of the blocks had already been taken up and abandoned. The area, comprising about 13,248 acres, was finally reserved in March 1926 (res. 19177). It would later form part of the Julimar State Forest.

Throughout the 1940s and 50s, requests to alienate wandoo lands in the Julimar area continued to come before the Forests Department. In each case, the department recommended that such requests be rejected. The beekeepers' section of the Farmers' Union of Western Australia in 1948 resolved that certain areas of wandoo woodland (including the Julimar, northern portion of the Helena catchment, and the south-east corner of Canning and Serpentine catchment) should be dedicated as State forests; the Conservator agreed, and agitated for the dedication of the northern and eastern wandoo forests as State forest (including Julimar).[16] Julimar State Forest was dedicated on 6 July 1956.[17] Later that year, the Toodyay Road, Health and Vermin Board demonstrated a precocious conservation-mindedness when it wrote to the Minister asking whether a reserve for flora and fauna could be created in the area. The Conservator replied that the newly declared State forest would serve that purpose well.[18]

The Jingalup and South Jingalup nature reserves, near Kojonup, came into being in a similar way. First reserved in 1921 after a local settler, H. A. McKenney, suggested that part of a pastoral lease be reserved for timber for settlers' requirements. By 1954 the wandoo patches in the reserve had been cut over for sleepers, with remaining trees in among heavy ironstone, which made extraction too difficult. Repeated requests for the land to be opened up for settlement were rejected by the Conservator of Forests, as the area was one of the 'sole remaining islands of timbered crown land in an extensive area of alienated land'. Furthermore, the ironstone made it unsuitable for agriculture. By 1960, the Conservator considered the area suitable as a 'reserve for local flora and fauna'. Locals, too, were showing an increasing interest in conservation, petitioning the Minister in 1965 to request that 'the rest of the timber be preserved on any reserves' within Kojonup Shire. However, this was not considered inconsistent with grazing, and a grazing lease on the area was approved in 1969, but revoked in 1970, when the area was declared a flora and fauna reserve.[19]

Qualeup saw mill 1958. *Photo – Courtesy Reno Guidi*

Reno Guidi and fellow sawmillers, Qualeup 1956. *Photo – Courtesy Reno Guidi*

In a colony, and later State, bent on agricultural development, it was often a struggle to reserve rural land for other purposes. However, through the efforts of individuals and the Forests Department, some areas – generally those unsuitable for agriculture – were protected from selection and clearing. But these areas were subject to other uses, including grazing and timber harvesting, at least until some were converted into nature reserves from the 1970s.

Harvesting wandoo

In the nineteenth century, sawmill permits covering large areas of crown land had been bought by timber companies. In many cases these were renewed well into the twentieth century. After the Second World War, such companies also won contracts to remove timber from prospective farmlands, as the Forests Department sought to ensure that it was not wasted. Siro Manolini undertook this kind of work for Bunnings after the Second World War, and also cut timber in bushland. There, his gang would only cut out the good trees, maybe six or seven in the acre: 'Firstly it's got to be nice, then it got to be without any lumps or things. Then we got to hit him [to see] if he's solid'. Faulty trees wouldn't pass inspection, so weren't cut. Inevitably, even such selective cutting had an effect on the structure of the woodland.

In 1957–58, 19,855 loads of wandoo were cut in State-managed forests by 31 mills (of which 16 were sleeper mills), in addition to several mills cutting exclusively on private property.[20] Wandoo was not exported from Western Australia before the Second World War, but as the number of sleeper mills increased in the 1950s there was a significant increase in the volume of sleepers produced, and they were exported – firstly interstate and then overseas. However, by 1959 Regional Superintendent Peter Hewett recognised that wandoo was a

'dwindling asset' that was coming 'mostly from alienated land', and recommended that it 'should be retained for local railways'.[21]

Wandoo bark and wood are rich in tannins; and at a time when plant extracts were widely used for tanning, wandoo extract was prized as second only to that of European chestnut as a tanning agent.[22] The first factory in the State to exploit this resource was established by Industrial Extracts Ltd at Belmont in 1935, with another opened at Boddington two years later. Together, they processed more than 31,000 tons of wandoo in 1938. Industrial Extracts cut timber on private property as well as in State forest (including the Julimar), taking all trees that were not suitable for poles or mill logs, down to those with a minimum diameter of eight inches. The Second World War increased demand for vegetable tannins, and the factories processed 64,000 tons in 1948. Demand remained strong after the war, and a third extracts factory was opened at Toodyay in 1954. In 1962 it was anticipated that the Toodyay plant would have a life of 35 years, but as synthetic products replaced leather in a range of applications, demand for vegetable tannins fell, and the Boddington factory closed in 1964. By 1968, only about 44,000 tons of wandoo were processed,[23] and the industry wound up in the early 1970s.

Wandoo was also used by a plant established in 1948 at Wundowie, 65 kilometres east of Perth; an integrated operation that produced sawlogs as well as charcoal for high quality pig iron production. Although this plant relied mainly on jarrah, wandoo tops and trees unsuitable for other purposes were also taken for use in charcoal production. However, by 1981 local timber supplies were virtually exhausted, so the operators cancelled their timber licence.[24]

Overall, from 1976–77 to 1985–86, an average of 750 hectares of wandoo was harvested for timber annually. Between 1981–82 and 1985–86 this fell to 550 hectares per year,[25] with harvesting involving 'selective cutting of varying intensity', depending on the condition of the woodland.

Twentieth century recollections

The woodlands

By the end of the twentieth century, most of the wandoo woodlands had been cleared for farming or placed in forest reserves, where the timber was harvested with varying degrees of intensity. Some wandoo was also found in road reserves and in shelter belts and bush blocks on farms. In the 1970s, some reserves were converted to flora and fauna reserves, and no further timber was harvested. As we have seen, the remnant wandoo woodlands were generally those areas unsuited to agriculture such as those with gullies, rock outcrops or the presence of York Road poison or other poisonous plants in the understorey. What remains is therefore quite unrepresentative of the original vast expanse of wandoo woodlands.

One of the enduring characteristics of the remaining wandoo woodlands is their variability, both within and between the woodlands. Roger Underwood recalls the wandoo forests of the Julimar and Helena catchment, which he was involved in mapping in 1963:

> *'The wandoo forest is not like the jarrah forest. You go into the jarrah forest and for miles in every direction it's quite a uniform forest. It's jarrah on the ridges and slopes, in the gullies you will occasionally find some blackbutt or bullich, and on sandier soils you get a bit more marri, but it's basically a uniform forest dominated by one species. The wandoo country is different, it's quite a variable forest, and that's why we were doing that mapping. Mostly we found that wandoo grows on the broad open flats with shallow clay soils. On the ironstone country in the gravelly soil you'd get low quality jarrah occurring and then when you got up on to the breakaways you'd find powderbark growing, or occasionally brown mallet. There are very large granite outcrops through that country and around the granite outcrops you'd get the rock sheoak and other species like that. So that as you were walking through the forest the scene would be changing around you constantly. You might sometimes get to walk for perhaps a kilometre or so through a pure wandoo stand across a long open flat but then as soon as the ground rose the forest type would change and in the undulating country it was changing all the time.'*

Sawmillers working around the Kojonup district from the 1950s recalled that the understorey in some areas was very sparse, while in others it included very thick grass trees: 'Some patches... some they were beautiful nice and clean, you go out and easy to do it and some they were really [thick with] blackboys, they were the good white gum, the really good white gum with the blackboys, they were really beautiful' (Reno Guidi). However, on some soils the tannins in the

^ Catchment Rd - east of Mundaring - South of Mt Observation. *Photo – Courtesy Len Talbot*

leaves of the wandoo could prevent grass from growing: 'the white gum is very bad, he's got poison on his leaves… No grass grows under the white gum' (Siro Manolini). Forester John Meachem also recalled that the wandoo forest 'was the most open forest in the State… there's very little ground vegetation in much of the wandoo forest'. In some areas, the understorey also changed over time. For example, Ray Garstone saw the understorey of two-leaf hakea (*Hakea trifurcata*) disappear in a reserve near Woodanilling around 10 to 15 years ago. Another element of the wandoo's environment that has undergone obvious change is the bird life. Many Kojonup-based interviewees noted a decline in some types of bird. Keen birdwatcher Wayne Zadow, who has seen fewer smaller wrens, robins and thornbills since the 1970s. Ralph and Siro Manolini remembered large flocks of a small green parrot – 'millions of these little birds' – on flowering wandoo in 1951 or 52, but haven't seen them since.

The trees

As well as the changing characteristics of the woodlands, the people interviewed for this project were able to provide insights into the nature of the tree itself. Some recalled the apparently unique way in which the tree uses water. Eric Hopkins, for example, described the way in which wandoo is usually the only tree that will survive on the winter-wet wandoo flats: 'So it's obviously got a rather unique water relation compared to the eucalypts around it'. Don Spriggins agrees:

> *'I think it [wandoo] has the ability in summer to be able to close its stomata down a bit and reduce its rate of transpiration whereas the jarrah further up the slope, it just doesn't know when to stop, it just drinks and drinks and drinks till the last drop… it will be healthy one day and it will be dead the next.'*

Others described the variation in the tree across its range. In the Manolinis' experience, the wandoo to the east of Albany Highway were in soils with more clay, the rainfall was lower, and they seemed to be more susceptible to white ants, so many were hollow: 'they weren't a nice healthy tree like some other area you know' (Anna Manolini). Siro Manolini felt that the wandoo grows best in the valleys, and that even small trees on granite have hollows, reducing their value as timber trees. Ralph Manolini also observed that the trees east of Albany Highway were lower and harder; the best wandoo (in terms of timber) was that mixed in with jarrah. Furthermore, he found that the sap wood of paddock wandoo is much thicker (up to five centimetres) than the bush wandoo (at only about 0.5 centimetres). Beekeepers like Harry Cook distinguished between different varieties of wandoo according to when they flowered. In the Julimar, there were two 'varieties':

> *'When you go right on the western boundary is what we termed winter white gum, it flowered in April, May, June but further in, back this other way, it was termed spring white gum because it didn't flower until about October, November, December. They were the same, virtually the same tree one would have thought, but they just seemed to flower at different times.'*

The wandoo around Cranbrook was known as the 'summer white gum' because it only began to flower in January or February.

Wandoo is a tree with unusual flowering habits. Harry Cook described the way in which it often carries two crops – buds that are about to flower, and buds that may not flower for perhaps 18 months. Des Bailey also noted that wandoo may hold its buds for three years, but in that time is susceptible to heat stress, and may drop them. It used to be said that when the wandoo flowered early, it would be a good season for the farmers (Reno Guidi). Ominously, perhaps, several interviewees remarked on the scarcity of wandoo blossom in recent years. Ralph Manolini says that he hasn't seen the flowers 'for a long, long time'. Similarly, Winston Griffiths says that the trees now flower 'very, very sparsely', and that they only flower well every five to six years, when they used to flower a lot more often. A local Cranbrook family, the Lawrences, used to keep bees for a living, but saw the yield decline and stopped selling honey around the late 80s. Eric Chapman, in Dinninup, has not had any wandoo honey since 1984. This is a marked contrast to the big honey flows of the 1930–40s and 1960s, remembered by Des Bailey.

The climate

Harry Cook reckons that dry years affected the honey flow, and several interviewees remarked on the decline in rainfall in recent years. As Lois O'Halloran put it: 'I used to have to wear rubber boots when I first got married, in the winters and the grass was long and wet. I wouldn't worry about rubber boots these years'. Some also described the rainfall patterns, and how they varied over space and time. In the Kojonup district, for example, rainfall is localised, so some areas in the district might be in good condition while others were struggling with drought (Des Bailey), and two farms only 20 to 30 kilometres apart have a difference of four inches in their average rainfall (Des O'Halloran). However, the 1970s were undeniably dry in the district. Wayne Zadow remembers the lakes drying up for years, in a marked contrast with the wet 1960s. In terms of the distribution of rainfall over the year, Kath Mathwin recalls that 'quite regularly in February… we would get a lot of summer rain and we don't seem to have done that so much lately'. Nor, according to Des Bailey, does the district receive as many thunderstorms between October and December as it used to – which he feels has been to the detriment of wandoo, as a tree that likes a drink around that time.

Wandoo flat, Dryandra.
Photo – Courtesy Eric Hopkins

Ken Mead, in nearby Chowerup, similarly feels that during the past 30 years, rain has been very patchy, arriving mostly in storms that would put a lot of water in one area, but deliver nothing to adjacent areas. He has also witnessed the dramatic impact of reduced rainfall on the amount of runoff:

'It did get drier over the years but probably that wasn't so much from rain I didn't think as clearing… See up until the 1950s you only used to clear with little tractors and axes and burn it up and then after that bulldozers came. But when we were going to school we'd drive down the road and there was bush all down the side of the road, and water would run out of that bush all year into the road and drain down the road because it was bush and the rainfall in there couldn't run away, so it would just soak in and just soak out through the bush, but uphill. But then it all got cleared and the rains would go whoosh down the drain, finished, no more. Just all gone… I think myself that [in] bush, the rain can't run away because there's all little dams formed up there and it just soaks in. We used to go out in the bush and creeks would run, you know, little creeks would be running and for months… we'd dam them up and that. I've walked through lots of bush in looking for trees and that and most of the creeks are always dry even when it's raining. They don't run any more. Didn't run any more after, probably, after the 1950s into the 60s… A little bit, not much.'

Fire

Another significant change in wandoo woodlands was the frequency and timing of fire. As journals of exploration show, Aboriginal people frequently burnt the country for hunting and to renew grassy areas, keeping them attractive to game.[26] Fires were also started by lightning. It is therefore likely that prior to the arrival of Europeans, wandoo woodlands with sufficient understorey to burn would have been subject to frequent, low-intensity fires. People continued to burn the bush into the twentieth century, but in forest managed by the Forests Department (and later the Department of Conservation and Land Management), fire protection was the priority. In the 1920s, when grazing leases were issued over timber reserves, the lessees were not permitted to 'light, or cause to be lighted, or permit any other person whatsoever to light any fire or fires on the said land', and were required to extinguish any fire on the land. In the event of a fire, the lessee even had to prove that they played no part in starting the fire, otherwise the lease would be cancelled.[27] Resources to manage fire were also an issue. As Jack Bradshaw recalls: 'In the early days of the department they had very few staff and so forth so they concentrated on protecting the regrowth in the jarrah forest. Fires to the east they essentially ignored and they let them run'. These fires were lit by lightning, as well as kangaroo and brumby hunters cultivating grass for their quarry, and farmers clearing land (Roger Underwood). In some areas, beekeepers also burned the bush around their sites. Harry Cook recalls that from about 1940, beekeepers would walk through Julimar lighting grasstrees, though only when cool weather was expected for a week or two, mainly in spring and autumn.

Wayne Zadow recalled lots of fires in the Kojonup district in the 1950s, though fewer in the 60s. Ralph Manolini links the 1950s fires with the opening up of the land: 'There was always fires because the farmers they were clearing at that time and they would just light the fires and the fires would just go mad. We had fires from Yarraminup that went all the way to Frankland in one day. Burnt everything'. Later, after much of the land was cleared, the fires were 'more

contained… say if they pushed down say 100 acres of bush they would make sure they had good fire breaks to burn it and contain it'. Siro Manolini remembers that 'we used to burn in summer time, in February. The 16th of February the fire season used to start and we had to clean the land. But we never burnt when it was a bad day and there was fire everywhere'. However, some farmers had stopped burning by the mid 1960s. 'Probably [the bush] gets burnt less now than it did years ago. People often used to... they called it "letting the bush go"; that was just sort of considered a good idea, to just let the bush go… since I've been farming [1963] we haven't been in the habit of letting bush go, it was more down west of Kojonup people used to let the bush go' (Des O'Halloran). In Williams, Geoff Higham says that they don't get bush fires like they used to, and in adjacent bushland, the kangaroos keep the understorey so sparse that it won't carry a fire.

In the mid 1950s, when J.B. Campbell was conducting research for his Bachelor of Science thesis, *A Silvicultural Note on Wandoo*, he found:

> *'Those areas which have been burnt regularly and have not, therefore, had severe fires, show little outward effect from fire. Trees still have healthy crowns, good solid logs, and there has been no obvious effect on the soil, such as erosion.'*[28]

However, in spite of the prevalence of fire from various sources, not all areas were regularly burnt. In 1957, a year after the Julimar State Forest was created; the local fire control superintendent reported that build-up of fuel was such that the area was 'a serious worry to local settlers'. There were no local fire control organisations to do a controlled burn, though Cook Bros apiarists had undertaken 'considerable controlled burning'. The Forests Department therefore began constructing roads, tracks and firebreaks, and by 1960 had completed burning of tops following sawmill operations (more than 11,400 acres), and controlled burning (including that 'done by arrangement with local settlers') over 3,200 acres. Together, this accounted for burning in 20 per cent of the forest, with the department hopeful that it could burn the remainder in the autumn of 1961.[29] In March 1967, however, there was sufficient fuel to sustain wildfires that burned more than 500 acres. Although fire research was a higher priority within the department after the Dwellingup fire of 1963, by 1967 still not a great deal was known about fire in wandoo woodland (Roger Underwood).

Although it appears that fire is essential for the health and regeneration of wandoo woodlands, the timing and intensity of fire are critical. Don Spriggins explains:

> *'Wandoo's got a nasty habit; it sheds its bark down in a big sort of circle around the base of the tree and particularly where the fuels build up over a large number of years… I've seen this out the back of Collie, where all that accumulated bark, it might be six inches thick all around the… base of the tree – if that gets alight, it might burn for a week and that can be pretty deadly on the tree.'*

Ken Mead, too, has observed that if wandoo 'burns heavy around the bottom they will die'. It is therefore necessary to avoid an excessive build-up of fuel. However, if fires are too frequent, they can kill off young regrowth. Len Talbot recalls that when he started at Mundaring, the department was doing controlled burns in wandoo woodlands on a seven-year rotation, but that killed or damaged much of the regeneration that had sprung up after the last burn. It then moved to a 12-year rotation, then burning whenever the fuel loads built up to a certain level, to enable more of the regrowth to survive. However, because of the 'patchiness' of wandoo woodland, fuel load measurements could be deceptive:

> *'Much of the wandoo bush had very little or no litter and readings could be as low as one ton per hectare or even less, but good regeneration clumps… mostly carried about 30 tons. So if you took eight or nine measurements of one or two tons and one of 30 tons in a plot you could get an average of about four or five tonnes. This of course gives a distorted fuel loadage. Of course all of the wandoo was not like this but I believed that the heavily fuelled clumps should have been burnt separately in the winter. Some of the old hands at Mundaring told me that years ago under another District Forester they used to go out and do this at night.' (Len Talbot)*

Burns to dispose of the residue from mill falling operations and promote regeneration would be carried out in wandoo areas two summers after trees were harvested. The subsequent pattern of regeneration was remarked upon in several interviews. One forester, John Meachem, recalls that when he was Superintendent Northern Divisions (which included Mundaring):

> *'the most interesting factor to me was that the regeneration of wandoo was, well it could be described perhaps as difficult in that after logging and burning there would be seed and seedlings, quite a few seedlings, but during the summer they would burn off, they would die. And it was only about every tenth year on average that a new regeneration got away, and that would be when we got a year… or a summer which was unusually cool and moist, and particularly where seedlings were shaded they were able to survive the heat of summer. So that would have given rise to the younger generation of wandoo that exists today among the dead older generation'.*

However, several observers consider that the regeneration that did 'get away' was too dense, particularly in the context of a changed fire regime. For example, Eric Hopkins recalls that when Industrial Extracts' cutters went through an area, 'they took vigorous straight stems and all the old gnarled wandoo they left; they didn't want them so they left those standing. Now, when they took the vigorous young stems they heaped the litter up and then under Forests Department control

they burnt it…'. Where this was done, 'there are very dense stands of regrowth'. Alex Hart also noted that following fire, in the Julimar and 'all through that area, through the Mundaring and further south, the regeneration was so thick that it was choking itself, you know, and there wasn't enough water', but the Forests Department didn't have enough money to thin it out, leading to suppressed trees. Another forester, Don Spriggins, considers:

> *'A huge proportion [of remaining wandoo woodland] is national park now which is… in a way I think it's not good because if a lot of these stands [have] got too many stems. The best thing you can do is to thin them out a bit, you know, share the water around the remaining trees, but of course you can't do that in a national park.'*

Published accounts also point to dense regeneration. After the 1958 autumn 'top disposal' burns, it was found that 'upwards of 100,000 seedlings germinated from a single crown burn', though the seedlings were 'reduced to about 200 per crown by autumn 1963'.[30]

People living and working with wandoo provide significant insights into the nature of the tree, and changes in its context over time, including changes to the understorey, bird life, climate, frequency of fire, and density of trees. Observers also described the appearance of salt, and the presence of insect pests. Whether these features and changes form part of the explanation for crown decline is a subject for further experiment and investigation.

> Mature wandoo, Dale River catchment. *Photo – Liz Manning*

Wandoo in decline

In order to establish when wandoo crown decline first appeared, and whether it is a cyclical or unique problem, an extensive review of available sources was conducted. This included archives held by the State Records Office, photographs held by the Battye Library and the Department of Environment and Conservation, published accounts by early explorers and colonists, and other relevant publications (see reference list on page 49). A key component of the project involved recording oral history interviews with people who have lived and worked in wandoo country during the past last century, and were willing and able to recount their observations of changes in wandoo trees and their ecological context.

The documentary record

In the early colonial period, explorers were generally interested in describing the landforms, soil and vegetation in so far as they might provide clues as to the potential of the land for grazing or agriculture. On the whole, they were not looking at the condition of the vegetation, though occasionally this was recorded. For example, surgeon Alexander Collie, while exploring the area around the Canning River in September 1829, noted 'a general blight of shrubs above six feet high occasioned probably by some exceedingly dry season, although the whole plain at present is marshy' (p. 86). No evidence of a similar observation of disease or decline in wandoo was found in any of the journals reviewed.

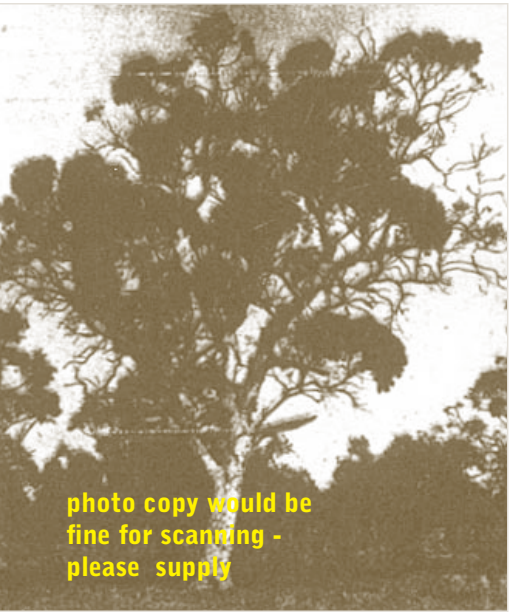
A search of relevant archives held by the State Records Office also failed to yield any evidence of crown decline. When forested Crown land was applied for, local forestry staff inspected the bush in the locations concerned. Their reports, preserved in archived files, provide an estimate of the quantity of timber on the lot (large trees as well as 'poles') and extent of regeneration (or potential for it). Many also include information on the understorey and soil, and the extent of fire damage on trees. None, however, described wandoo in decline. A report on the Julimar reserve in 1948 made passing reference to crown damage, but only apparently in relation to fire:

> *'This wandoo forest has not been so severely knocked about by fire as the jarrah forest. The crowns, while damaged somewhat like the karri, bare [sic] considerably more foliage than the jarrah trees in the main jarrah belt.'*[31]

This report appears to be linked to a plan identifying and classifying the forest as good height wandoo forest; medium height wandoo forest; poor wandoo forest; mixed species forest; flats; and according to dense, open or sparse density classes. Further research would indicate whether there was any correlation between the present incidence of crown decline in the area, and any of these classifications, which are now some 60 years old.

In his 1956 Bachelor of Science thesis, J.B. Campbell remarked that 'the stagheadedness of jarrah crowns is not evident for

Wandoo, c.1920-25.
Photo – Courtesy State Library of Western Australia, The Battye Library (91315P)



Mature wandoo tree. Mundaring, 1957.
Photo – Courtesy State Library of Western Australia, The Battye Library (BA866/279)

Wandoo, Yama Road, Mundaring, November 1970.
Photo – DEC

wandoo'.[32] Three years later, an article by Frank Podger appeared in *Forest Notes*, in which he described 'patches of dying wandoo' in the eastern wandoo forest.[33] The patches were usually small, though one covered 10 acres. They were found as far apart as the Dale-Brookton Road and the 60 mile mark on Albany Highway. Once affected, trees generally died within a year. Some years later, Bryan Shearer revisited some of these sites, and found that the culprit was the fungus *Armillaria luteobubalina*.[34]

A survey of tree health conducted by Forests Department researchers in Tammin and Wyalkatchem shires in 1983 found that 45 per cent of the trees surveyed showed symptoms of decline, 'from discoloured or dead leaves, through massive dieback in the crown, to dead trees'.[35] Introduced species were less affected than native ones, and wandoo was the worst affected species. Although 'weedkillers, drought, salinity, physical damage, insect damage, old age and fire' were believed to account for many instances of decline, there was no apparent cause in a third of all affected trees. The researchers believed that the decline was recent, having started perhaps in the late 1960s or early 1970s. By the mid-1980s, crown decline of wandoo was recognised as a specific problem, and formed the focus of a study by Paul Brown, with Joanna Tippett and Paul Albone. The results of this study were not published.

The earliest unequivocal evidence of wandoo crown decline dates from the early 1980s, with the condition of the trees at that time suggesting that the decline began some years earlier. This historical review located three dated photographs of trees with sparse crowns and dead limbs, dated c.1920–25, 1957, and 1970 (see photos on pages 22–23). However, photographs cannot tell us whether the condition of these trees was due to drought, fire history, soil, insects, fungi, or old age. The testimony of observers, in conjunction with the documentary record, can perhaps offer more insight.

Wandoo in health and decline: some observers speak

Hector Wood

Hector Wood was born in Toodyay in 1926, and the district has been his home ever since. His parents arrived at the Coorinja winery and vineyard in 1919, and the family then cleared most of the rest of the land for grazing, mainly with an axe, leaving trees (including wandoo) along the creek lines. Although it was necessary to clear the land for farming, Hector has long appreciated the area's bushland. In the 1960s, as Secretary of the local Farmers' Union, he tried to have some excellent wildflower country along the Toodyay Road reserved, though unfortunately without success. Hector has seen the trees in the area's gullies suffer from rising watertables and salt over the past three to four decades – a problem that has affected not just wandoo. However, he has noticed that the wandoo on the higher ground has always had branches die off as it gets older; these produce the hollows or 'pipes' that are so essential for nesting birds.

Harry Cook

Born in 1924 in Toodyay, Harry Cook left school at 15 and, with his brothers, became a beekeeper like their father Samuel Cook. Incredibly, Harry continued commercial beekeeping until he turned 80. As migratory beekeepers, the Cook brothers worked around the State, in the Midwest, South West, Wheatbelt and Goldfields regions. In the Helena catchment, they kept bees on Roberts and Yarra roads, as well as a few sites further north. From about 1946 they also worked the Cranbrook-Kojonup area quite extensively. Harry says it 'used to be a wonderful area for bees', but they stopped keeping bees there 'in the early 1950s because the sites were disappearing pretty rapidly. They were using the ball and chain for the clearing and got rid of a fair bit of timber'. The brothers continued, however, to work around Popanyinning and Darkan into the 1960s. 'The Julimar forest out here too was another area that we worked extensively with bees. The site had a good source of wandoo out there but never ever did produce as well as the southern wandoos.' Interestingly, within the Julimar, honey yield was very variable: 'in the Julimar gully itself where Julimar brook runs it always yielded pretty well. Yet the same, seemingly the same trees perhaps 10 miles away in other gullies mightn't yield at all'. Similarly, a site on the York Road never yielded as well as a similar site down on the Brookton Highway, for some reason they could never determine. The Cook brothers knew their sites and roughly when they were likely to flower. They would then scout to check for buds, and take the bees when flowers appeared.

They 'thought that jarrah was the one that suffered with dieback, wandoo always seemed to be pretty healthy', but Harry says 'quite a fair number of years ago I think, might be 10 years ago I suppose that we first noticed a few trees that weren't looking as healthy as they might. But there are some there that are looking particularly poorly'. There didn't seem to be much in the environment that had changed – the understorey, for example, remained sparse, with only a few balgas – though of course there have been more dry years in recent times. Harry thinks this would have affected the honey flow, and initially thought that it might have explained the dry limbs in some of the wandoo.

Catherine and Geoff Higham


Catherine

Geoff Higham's father was born in Narrogin in the 1920s, and parkland cleared the farm, south-west of Williams, where Geoff grew up. Geoff's wife Catherine, a sculptor who works with wood, arrived at that farm in 1991. Together the Highams moved to their present farm at Williams, near Dryandra, in 1996. Geoff recalls that for a time, the remnant wandoo on his family's farm grew magnificently, because of the lack of competition and access to fertiliser. But in the early 1980s, Geoff began to see the trees decline. In the Williams area, much of the wandoo has been cleared, with most of the remnants left standing on rocky outcrops or along the creek lines. The creeks are where Geoff noticed crown decline first, mostly among the younger trees:

> *'Yes it's probably true the creeks… seemed to be damaged before the higher, drier areas. Perhaps because the ones on the ridge lines had grown under a fairly stressful situation all along, perhaps they were more resilient. Whereas the others, you know, because they were growing close to water all along, they… had a pretty healthy and pretty easy lifestyle and suddenly whammo!'*

Marks on wandoo, Williams

Decline was noticeable in trees that were otherwise apparently healthy, though Catherine, with a sculptor's eye for detail, has noticed 'lots of marks on the wandoo' from bugs, whose activity is evident on both the sap wood and the heart wood. In the older trees, there are often dead branches and hollows, and it's hard to know whether they were caused by fire, insects, disease or just old age. Geoff thinks that at their present property, 'the damage has been done' and the trees either recovered or died.

Bill Butler

Bill Butler was born in Wickepin in 1924 and has remained in the area ever since, living just four kilometres from where he grew up. Bill has always had a keen interest in plants; even in primary school he would ask old-timers to name the plants he saw, and has been looking at trees all his life. Bill vividly recalls that when he was about five years old his father was talking to a small group of local men on the Gillimanning Road, which runs on the north side of their farm. They were talking about the wandoos, and 'how there were dead twigs on them'. It was probably in the 1940s that Bill himself started to take notice of the twigs dying back – the leaves would go grey, and later epicormic shoots would appear; the trees never seemed to die, even if they had mistletoe in them. In his district, it mainly seems to affect trees more than 40 years old, and not many trees are affected by it. Wandoo appears most susceptible, though Bill has noticed 'a little bit of it in other trees'.

Des Bailey


Des

Des Bailey has a long history of working with wandoo around Kojonup. Born in the town in the 1930s the son of a sawmiller, he began working for sawmillers himself in 1946, cutting timber for telephone poles. He continued cutting wandoo – for firewood and sawmilling – in the 1950s and 60s. Then, in the early 1970s, he took up beekeeping, working around the south of the State. Des doesn't remember his parents talking about problems with the wandoo, and didn't notice anything like crown decline while he was working as a sawmiller. Though in the 1940s and 50s, he noticed that some old trees between Kojonup and Boyup Brook had dead limbs – 'some of these poles that we were cutting had to have a six inch crown, that's the small end had to be six inches. Well halfway up them there would be a [branch] nearly as big as my arm, dead'. Although this might indicate a possible earlier occurrence of wandoo crown decline, it might also have been due to other causes, like attack

by *Phoracantha* beetles. Des first started to notice the symptoms of the current decline episode in the 1970s when he was working as a beekeeper, and thinks it has worsened since. Des recalls that in the 1980s there was a plague of bud-attacking insects in Yate country on the Beaufort River and between Kojonup and Cranbrook, though it is not clear whether these played any role in the decline.

Des and Lois O'Halloran

Des O'Halloran was born in Kojonup during the Second World War and grew up in Muradup, helping his father to clear a farm there. He moved to his own farm, south of Kojonup, in 1963. He has worked closely with the trees for many years, firstly clearing and cutting strainers, and later fencing off bushland reserves on his property. The wandoo he is familiar with was healthy, where it existed, back to at least the 1950s. Des said: 'I had never seen white gums, with just odd branches dead, until some time in the last 10 years', when he noticed a problem on the western boundary of their farm. 'What I actually picture is a little branch, probably only three or four or five feet across, just dead, maybe three or four, maybe 10 of them on a big tree,' he said.

Lois O'Halloran, who has lived in Kojonup some 40 years, says the problem came to her attention in 2000, when she started working in Landcare. Her recollection of the issue points to the way in which communities collectively become aware of environmental problems:

> *'Everyone seemed to be talking about it about the same time, you know, someone mentioned, "have you noticed the white gums? They look sick". And because the flooded gums always look very sick through the summer people started saying, "Oh the white gums look sick," and then people said, "Oh it's like the jarrah dieback, you know in the crown". Suddenly everybody was talking about it and people who had seen it but hadn't registered suddenly were noticing it everywhere.'*

John and Kath Mathwin

John and Kath have always lived in the Kojonup region, John having grown up in Boscabel, and Kath near Jingalup. They took up their present farm north-west of Jingalup in 1962. Though there is not much decline on their property, Kath remembers seeing a lot of trees dying off down the Albany Highway just after Cyclone Alby (1978), though it's not clear whether that was related to the cyclone, or an episode of tree decline. In any case, Kath is confident that wandoo crown decline is 'something moderately new… because it's just something we didn't notice growing up'.

Anna and Ralph Manolini


Anna and Ralph

Ralph Manolini, brother of Siro (see page 30) was born in Collie just after the start of the Great Depression. The Manolinis went to Italy to visit family in 1939 but got caught up in the war, and were not able to return to Western Australia until 1949. With his father and three brothers, Ralph started one sawmill near Frankland in 1950; another in 1952 in Gordon River; and a third in Kojonup itself in 1959–60. They also operated (but did not own) another two sawmills in Jingalup and Boyup Brook Road. The fallers, who were migrants from Italy, cut no more than 15 kilometres from each mill. Ralph was mainly responsible for the business side of the operation, though he also sharpened the saws. He retired from sawmilling in 1994, when there were no more trees available for timber. Ralph has noticed declining wandoo only in the last three to four years. He describes it as looking similar to salt damage.

Anna, Ralph's wife, arrived in Australia in 1953. The new setting, in a corrugated shack out in the bush, was quite a shock, but as Anna says, 'you learnt to appreciate what you got around… like the trees, different from the ones in Europe. The bush is so different. Everything is different here. And you learn to love this country, you know'. Anna also observed the decline in the last three to four years, but adds that the wandoo has always struggled in some areas:

> *'I heard my father-in-law say farming the timber, they were so hard that they couldn't even cut them but according to him it was the area, you know, some area they grow better, some are like that [photo right]. Some are not so healthy… Even in the 1950s they have a problem.'*

He thought this was because of the soil: 'he said, "Oh the soil is not too good there. It's not deep soil, you know, where the roots can't go down"'. He thought the best area for wandoo was around Frankland. Ralph adds that east of Albany Highway, where there is more clay, the trees have never grown as fast or as well.

Wandoo in decline

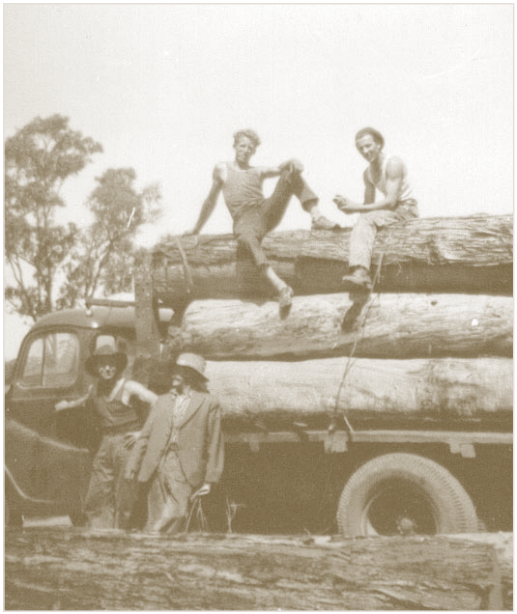
Siro Manolini


Siro

Siro Manolini, brother of Ralph (see page 29), was born in Wiluna. After returning from Italy in 1949, he spent some time cutting timber at Mundaring Weir, then Darkan, then in the Kojonup district, where the Manolinis started their first mill. That mill, which was about 12 kilometres away from where Siro now lives at Mobrup, cut sleepers under contract for Bunnings for about 20 years. Siro first noticed the symptoms of wandoo crown decline – leaves dying and epicormic growth – about 10 years ago. The year after symptoms first appeared, about five per cent of the affected trees died. Siro says the whole area was affected, 'like it's been sprayed', with the damage appearing to come from the north-west. At first he wondered, like his brother, whether the problem was due to salt damage, but it didn't occur down by the creek, like salt damage elsewhere, and the trees recovered (at least initially), instead of dying like salt-affected trees did. Bigger trees seem to be affected more than smaller trees. Siro suggests that this may be because their crown area is larger and taller. Interestingly,

V Wandoo crown decline, Siro Manolini's farm, Mobrup.

V Reno Guidi and fellow workers, Kojonup sawmill 1958. *Photo – Courtesy Reno Guidi.*



affected trees still produce good timber (provided, of course, the tree survives). When the problem first appeared, for two to three years lots of the trees had epicormic growth then died. But now they're not dying any more. Siro thinks that perhaps there was some windborne infection and the trees are still suffering the consequences, but no more are dying because the most susceptible trees already have. It seems likely to Siro that it involves an imported disease. Certainly, in his extensive experience, it's historically unique. Siro is familiar with a borer that lives on wandoo. Having seen it 'for a long time', he thinks it may be native, and did not link it to crown decline.

Reno Guidi


Reno

Reno Guidi has had a long and varied career, including significant involvement in sawmilling in wandoo country. Arriving in Australia in 1951, and in Kojonup the following year, Reno worked odd jobs and got into sawmilling for Worsley Timber Company. During the following 50 years, hard-working Reno bought and ran two butchers shops, two sawmills, three farms and a restaurant. He also worked as a wool buyer, and developed property in his native Italy. He bought his first sawmill at Qualeup in the mid-1950s, though it burnt down in 1963 and had to be rebuilt. Later, in the early 1970s, he bought mills in Kojonup and Muradup off Worsley Timber. Timber for those mills came from as far afield as Unicup. He quit working with timber in 1976–78, to pursue his various other interests.

Reno first noticed wandoo trees in poor health down towards Katanning about 30 years ago. At that time, there wasn't much of a problem around Kojonup, but further east, the trees looked sickly and 'the timber wasn't much good':

> *'I think the jarrah start on that sort of thing and some of the white gum got him too see. Pity, because few years ago was only the odd one. The odd bad one was on some of the poor ground, the very hard ground or very clay, that hard clay, you know… That's where there were poor stuff and they used to go something like that. [Photo page 29]. They grow for a while and then they sort of crinkle up because of the soil… some die, some come back, they just put leaves out again and but they never do any good. Especially where the mallet is'.*

In the 1950s, Reno also noticed a fungus on the side of the trees that would create burls, which sometimes they sawed off to make tables. He also noticed 'dry rot' on wandoo (though more on jarrah). Dry or wet rots could sometimes make the trees hollow. At that time, however, none of these appeared to produce the symptoms of crown decline.

Wayne Zadow

Wayne Zadow moved with his family from South Australia to Kojonup as a young boy in 1951. Thirteen years later, he bought a 5,000-acre bush block in Boscabel and began clearing it, then moved there when he married in 1975. Although much of the block had to be cleared for farming, he still has 1,500 acres of bush on it. Long interested in bird life, Wayne became a keen birdwatcher in the 1970s. He recalls that it was in the late 1970s that the wandoo started to suffer, with insects attacking the new growth on the trees. Then 'probably in the 1980s' he started to see some dry patches and whole branches dying – the older leaves as well as the new growth.

> *'When I first saw it I thought, "oh I wonder what's this?" It seems to be all on the north east side or north side. I thought "oh, must be the wind bringing something through" and we thought it was acid rain there for a start, you know, that was affecting this, through the wind carrying some spray or something like that. But then it wouldn't affect every tree though it would just affect, you know, one individual here and one individual there.'*

Most of the wandoo on his property is fairly young regrowth, and he hasn't noticed much decline there. In his experience, the younger trees seem less susceptible than the older trees. Speaking of his parents' farm in the 1950s, which had 100 acres or so of predominantly old wandoo, he says 'you always noticed a few sticks sticking out the top but I think it's got worse in the past 20, 30 years'.

Winston and Jan Griffiths

Winston and Jan

Winston and Jan Griffiths have been on their Cranbrook farm since the mid-1960s. Barely a third of the farm was cleared at that time, though the Griffiths retained significant areas of bushland, including a block of about 200 acres. Jan fondly recalls the wandoo in her birthplace, Gnowangerup: 'they were beautiful, great healthy white gums out there'.

The Griffiths first noticed dying branches in wandoo trees in the early to mid-1990s. Jan remembers that 'after winter and then the first few hot days of summer was when those branches would show up'. Winston recalls that the problem didn't happen overnight, but built up over five to six years; just small twigs on the odd tree at first, then it 'took off', affecting larger parts of more trees by the mid to late 1990s. Its impact has been reduced only during the last two to three years. More generally, Jan noted

> Wandoo in decline, Griffiths' farm, Cranbrook

^ Healthy young wandoo, Griffiths' farm, Cranbrook

that the problems started to occur about the same time as a lot of tree planting was done, and wondered whether it was a kind of disease imported on trees for revegetation projects. In their area, it didn't seem to affect taller more than shorter trees, or arrive from a particular direction, though Winston recalls that by the time they noticed it at their property, they were also seeing it 'for a long way around'. Though it also seemed to occur in different districts at different times, it seemed particularly severe around their area. However some of their trees – including some 'really nice specimens' – were unaffected, just as some local trees were unaffected by lerp. Winston wondered whether the lerp outbreaks may have contributed to the problem, by upsetting the ecological balance in the area. He also points out that the problems need to be placed against the backdrop of natural cycles of growth and decay in the trees:

> *'My guess is that virtually any white gum that you look at, except for the young ones, has got a lot of dead wood in it. It's just the natural thing that happens. And I was wondering… whether they have a tendency to go through phases of dying back either caused by bushfires or something else… And then it sort of gets over it and then has a good old grow session'.*

However, evidence of these past episodes of death of limbs and smaller branches remains in the dead wood and hollows on the trees.

Ken Mead

Ken

Ken Mead has always lived and worked in the Chowerup area. He began work sawmilling wandoo sleepers in 1954 and finished in 1990 (when there was 'not much left'). He cut the timber mainly on private property, but also had a concession of about 15,000 acres that belonged to Bunnings. Up to the 1970s, Ken would be called out to different places to cut wandoo, for example where a road was being built, and there would be wandoos that were 'big, and solid. No rings, nothing, it was beautiful timber. But mostly we used to cut them small because big ones were all gone ringy and hollow in the middle'. In the Chowerup area, at least, the trees do not age well, in terms of the timber. Ken recalls having seen some trees 'dying on tops', but didn't place too much emphasis on it, because he was mainly interested in looking for good timber. More generally, Ken says, the problem with the local wandoo is the density of the trees:

> *'When we first started we used to drive the truck around the bush, chop a few blackies and a few trees and stuff out and back the truck into the logs and load them. When we finished we used to have a tractor to push the trees out of the road to get through. Because… we caused that as well by knocking trees down and they suckered up and all that sort of thing. I think before that, before my time when they were cutting sleepers by hand, they would probably drive their old truck through anywhere and pick them up. But because it was thinner and they only used to fall the trees that they'd want, the good ones, they didn't knock so much down either, you know. And when it got burnt up it didn't cause so much regeneration as what we caused because we had machines that just knocked things down and that's how you were and that's what you did, you didn't worry too much about it. But I think that's why it got thicker. But it certainly has got thicker over… even over that period of time that I'm saying… The first people that came out there to Chowerup, the Spencers, they pulled a wagon from Albany to there through the bush with horses, you know. So I mean it had to be pretty open didn't it?… What I've observed anyhow is that it's getting thicker all the time and that's not a good thing.'*

Ken has observed that wandoo grown so close to each other are small, even when they're 50 years old, and they have no sap wood.

Ray Garstone

Born during the Depression years, farmer and naturalist Ray Garstone spent all his life in Woodanilling until retiring to Albany 15 years ago. A keen observer of

nature, who has created thousands of nest records and photographs of bird life since the mid-1960s, Ray regards wandoo as one of his favourite trees:

> *'Wandoo is a tremendously useful tree for honey and also for the hollows… practically every bird that nests in hollows – and that's a lot – use the wandoos; it's a very, very important tree.'*

Ray has noticed the health of wandoo trees slowly declining over the past 40 years or so, with crowns thinning out and no heavy flowering since at least 1974. Swarms of brown beetles used to attack new growth on wandoo, but he hasn't seen them for the past 10 to 15 years. Against this backdrop, he first observed crown decline in the mid-1980s around Woodanilling, and east of Katanning, mostly on road reserves as he travelled around.

Roger Underwood


Roger

Roger Underwood is a forester who has worked closely with the wandoo forest, particularly in the early part of his career. As part of the conditions of his State Forestry scholarship, he worked summers in Dwellingup, Mundaring and other locations from 1958–59, but 'really came to know the wandoo forest' after he graduated. His first posting was for some months in early 1963 at Mundaring Weir (headquarters of the Mundaring Division, which oversaw the Helena catchment as well as the Julimar). There he was involved with research trials on wandoo regeneration, and regeneration work in Julimar and the eastern wandoo forest after selective cutting by Industrial Extracts and the sawmill at Wundowie. He was also involved in mapping of wandoo forest because it wasn't possible then to distinguish jarrah from wandoo using aerial photographs,

> *'… it was necessary for us to go into the bush and walk assessment lines through the forest with a field book and actually measure and map the occurrence of wandoo. The maps that came out of that have survived to this day and are still the basis of all of the big decisions about the conservation of the wandoo forest. It was lovely work. I mean imagine for any young person, let alone a young forester, having a job where you went out every day into the forest and walked around measuring and mapping trees! We weren't only recording the occurrence of wandoo, of course, we were also recording understorey species, unusual sightings of fauna – in those days you would still occasionally see a numbat in the wandoo forest. And there were also extensive occurrences of wild horses at that time… And we would record rock outcrops and creek crossings, so we were conducting an ecological survey as well as a forest distribution study.'*


^ View from Mt Dale lookout, showing wandoo by the track. *Photo – Brian Stevenson*

Later, as Divisional Forest Officer at Mundaring from 1967, he oversaw tree marking of logs for cutting, regeneration and fire control; one of his responsibilities was a fortnightly inspection and patrol in the Julimar. Roger fell in love with the wandoo forest:

> *'I can remember just being spellbound by the sheer beauty of the place and I think I would have noticed had there been areas of sick trees. I just can't recall them. In any case we would have recorded them in the field books I feel sure.'*

He did see one patch of dying trees, on Yarra Road, in 1968, though Frank Batini identified the cause as the fungus *Armillaria luteobubalina*. Roger only began to notice crown decline after he and his wife bought a property at York:

> *'We started going out along the York Road every weekend. And all of a sudden I was back in the wandoo forest again and I couldn't help myself. We'd be drawn off, we'd be meant to be driving to York but we'd turn off and we'd go in and we'd visit old haunts and other spots. About 1992 I first started to notice a really serious decline in the wandoo crowns – sick looking trees in all directions.'*

Roger's concern, along with that of Bruce McGregor and Liz Manning, would ultimately lead to the formation of the Wandoo Recovery Group.

Roger considers that major ecological changes have occurred in the wandoo forest, in addition to the problem of declining rainfall. Firstly, due to regeneration after logging, the wandoo has turned 'from a forest of old trees, into a forest of

middle-aged and young trees', which are much thirstier and more dense. The forest therefore, in his view, requires thinning. Additionally, less burning has been done, which 'enabled a very substantial thickening up of the understorey and... parrot bush and rock sheoak are now starting to move right out into the forest where they never were seen in my day and they've been allowed to move out by the fact that they are relatively fire sensitive species when they're young'. The forest has therefore suffered a 'triple whammy':

> *'The rainfall is declining, there's more trees and the understorey has changed from an open grassy understorey into a thick shrub understorey with heavy blackboys and heavy stands of sheoak and parrot bush. It's just dried the whole forest out and the older trees can't cope with that and now they're looking very sick.'*

Alex Hart

Alex Hart was born in Kojonup and had a somewhat nomadic childhood, moving between Kulikup, York, Quairading, West Narrikup and Northam. Having decided to embark on a career in forestry, he attended The University of Western Australia and the Forestry school in Canberra. Then, after a stint in New Guinea and New Britain, returned to Manjimup in 1957. He stayed there until 1964, when he became manager of Hamel nursery (including responsibility for the department's inland arboreta) until 1975, when he moved to the Como seed store, which he operated, as well as doing some rural extension work, until he retired in 1987. As a child in Kojonup, farmers paid him to pull wandoo seedlings out of ash beds. He remembers the wandoo forest then as an open forest with a lot of buggery bush (*Acacia pulchella*) in the understorey but doesn't recall seeing any dead or dying wandoo (though as a young boy, he was not exactly looking for it!). He saw some sickly looking trees in the course of his work with the arboreta and, when travelling through Julimar, thought those problems were pretty clearly due to insects and salt. In 1980, while at Como, he conducted a literature review on the status of wandoo silviculture. But it was only really through the work of the Wandoo Recovery Group that he became aware of the crown decline problem.

In Alex's view, crown decline is the result of a range factors, including overstocking (of trees and understorey), proximity to saline watercourses, reduction in rainfall, and presence of pest animals and plants including mistletoe (*Amyema* spp.). These factors may interact differently in different areas to produce similar results. Alex also notes that there are two species of wandoo, and that wandoo will hybridise with *Eucalyptus astringens*, *falcata* and *gardnerii*. This genetic diversity could be part of the reason why some trees are affected and some are not.

< Mundaring. *Photo – Chris Garnett/DEC*

Eric Hopkins

Eric Hopkins began a long association with wandoo woodlands when he was at university in 1949–50. Then, he did a six-week stint at Dryandra during the university holidays 'surveying for what was known as a leaf necrosis disease to the mallet plantations… And whenever I had a chance throughout my life I'd get back to Dryandra'. In the 1950s he completed his forestry training and took up a post with the Forests Department, coordinating research programs. In the early 1960s he completed a PhD in Melbourne, and then returned to forestry in Western Australia as a research administrator. He was appointed Chief of Research in 1974–75, before moving into planning. He retired in 1989. Eric describes wandoo as:

Wandoo near Katanning.
Photo – DEC

'the worst treated forest formation in Western Australia, and to my mind it was the gem in the forest formations… Wandoo is magnificent country from the viewpoint of the trees, the aesthetic value, fauna and also the flora. Unfortunately perhaps for it, but also wandoo… was arguably the top and premier timber in Western Australia.'

When he first joined the Forests Department, Eric would visit Dryandra at least two or three times a year. He also spent a period up to 1974, while involved in research, looking at sick trees on farms and in the city. Up to about 1985, he neither saw nor heard of any systematic problem with wandoo.

'I don't think anyone saw any serious decline problem. There were mistletoe problems and there were odd little patches where you'd get the odd… death or sick looking tree.'

Eric thought that some of the latter problems were probably due to disturbance of a closed stand of wandoo – where there was heavy cutting, the balance of light and water was altered and the remaining trees struggled. In general, however, he noticed the wandoo wasn't quite as good as it used to be once the rainfall began to decline, beginning with the drought of the mid 1970s.

John Meachem

John Meachem began his involvement in the wandoo woodlands when he was based in Dwellingup as Assistant Divisional Forest Officer from 1945 to 1950; a role that included some supervision of milling activity in the wandoo areas out towards Boddington. Then, after some years in the south of the State, he returned to Perth in 1960 as Regional Superintendent North (covering Wanneroo to Collie to Narrogin). In this capacity, he went out into each division, including the bush, about once a month, between 1962 and 1966. He later handled a range of portfolios, including housing, building and plant, before retiring in 1980. John says that the wandoo forest out towards Boddington after the war was 'in good shape, good condition'. Although he recalls that 'a dieback from the top, there would always be a little of it, the odd branch that would die', he never before saw trees in decline like they are now.

John Beard

John

John Beard was born in England and took a degree in forestry at Oxford before working in the West Indies, where he became 'a sort of authority on the vegetation of tropical America for a time'. From there he moved with his family to South Africa, and a job in the wattle industry, then in 1961 he took up the challenge of establishing a new botanical garden for native plants in Kings Park. While he was Director of Kings Park and Botanic Garden, he published a descriptive catalogue of Western Australian plants. He also started mapping the vegetation communities in Western Australia, a project that would occupy him for some 17 years. His vegetation mapping required field work across the State, and John found himself driving thousands of miles along country roads and tracks making notes on the vegetation, as well as interpreting aerial photographs. John does not recall seeing wandoo in poor health during his reconnaissance for the vegetation mapping. His notebooks, which date back to 1963, are held by the WA Herbarium. They contain only one reference to dying wandoo: during field work in the Wheatbelt in October 1977, John noted scattered dying wandoo and flat-topped yate at two sites on tea-tree flats east of Albany Highway, south of the Beaufort River bridge. However, the context, and the fact that both wandoo and yate were affected, suggest that this was salt damage rather than crown decline.

Len Talbot

Len Talbot has the distinction of having found two plants new to science, both in the wandoo woodlands: a dryandra, the other an orchid. In 1978, he also noticed grass trees dying in the Julimar (as it turns out, from damage caused by 28 parrots). A keen observer of the plant world, Len's career has involved a lot of forestry field work, much in wandoo areas. He was based at Kirup from about 1969 to 1976, where his responsibilities included forest assessment (including marking out jarrah dieback quarantine areas) and fire control, Then, after two years in Pemberton, he worked at Mundaring for 14 years, again undertaking forest assessment work as well as putting in recreation sites. From 1985 he was involved in managing nature reserves and rare plants, until his retirement in 1991. Len doesn't recall seeing any signs of wandoo crown decline while working at Kirup, where most of the wandoo was on pasture and being grazed underneath, with a lesser amount in bush (mixed with jarrah). He did, however, observe two problems with wandoo in the late 1970s at Mundaring. The first was the fungus *Armillaria luteobubalina*, which occurred in the Rally Australia track area and the other was *Phoracantha punctipennis* (also known as *Tryphocaria punctipennis*), a beetle, which occurred around Brigadoon. *Armillaria* usually killed the tree whereas, according to Len, *Phoracantha* 'would kill everything above where it ring-barked. It might get into a limb and it would circle [a] ring underneath the bark in the cambium there and ring bark it and then that limb would die, but then the rest would be healthy'. Following damage by *Phoracantha*, there would often be green epicormics growing out from beneath the dead parts; the beetle also left scars on the trees.

Frank Batini

Frank Batini's long and varied career in forestry began with summer work for the Forests Department in 1958, when he was involved in Peter Hewett's wandoo mapping project. After completing his training as a forester, he took up a post as Assistant Divisional Forest Officer at Harvey in 1963, before a six-month stint in Tallanalla, 40 kilometres inland of Harvey. He then returned to Harvey, to a job in Working Plans, for about five years. From there he joined the research branch, training in plant pathology at UWA in 1967. In 1972 he completed his Masters degree at Oxford, then returned to the Forests Department, first in land use planning, then extension, then as regional planning officer for the area from Collie north. Subsequently, he moved into environmental protection, working first for the Forests Department, then the Environmental Protection Authority, and the Premier's Department, before managing the Environmental Protection Branch of CALM for 15 years.

Frank always liked the wandoo forest and describes it as 'a beautiful forest… absolutely attractive'. He doesn't recall seeing any problem with health of the trees in 1958; nor to the east of Tallanalla while he was working there, although not all of the trees were in prime condition. As Frank notes 'you will always have some decline in the mature trees anyway. There's just old age, there's fire damage, there's… you will always have some damage in older trees. What you don't expect to see is young trees showing it as well'. From 1967 Frank was involved with dieback interpreters, mapping dieback from aerial photos and checking symptoms from the ground. They identified *Armillaria luteobubalina* as a problem in wandoo and probably around the early 1970s, Frank started to include it as a separate part of the dieback mapping. He thinks it unlikely that dieback interpreters would have mistaken crown decline for *Armillaria*, though this is a possibility. Frank himself first encountered crown decline in 2003–04, on the Perth to York Road.

In the mid 1970s, he undertook work on logging and salinity in the Helena catchment with Andy Selkirk. Frank travelled to the forests once a month; Andy once a week. Neither noticed a problem with the trees at that time. In 2004, when problems with the health of wandoo were a concern, Frank re-measured the watertables from his previous study, and found that they had fallen significantly.

Frank's experience with jarrah dieback (caused by a water-mould, that was more prevalent in the wet decades of the 1950s and 60s) has led Frank 'to think that we should look at environmental factors in relation to wandoo much more closely'. Having reviewed the possible causes of crown decline, Frank's assessment was that 'we're dealing with a chronic drought problem, that other things that we observe, particularly the fungi and the insects, are secondary to that'. Furthermore, he says

> *'the forest is different to what it was, now. It's being converted from largely mature, widely spaced trees to younger, faster growing [forest with] more cambial area and more transpiration potential. The understorey has increased through a reduction in prescribed burning'. If indeed climate change is a factor in crown decline, and Frank is convinced that it is, then prompt action is necessary:*
>
> *'The forecast is that it [climate change] is going to get worse rather than better, so we should be actively seeking to do some experiments to try and redress that.'*

Steve Quain

Steve Quain's involvement with forestry stretches back to the late 1940s, when he was awarded a Commonwealth Forestry Scholarship. Graduating in 1952, Steve began his work in the wandoo forest with a posting at Gleneagle from 1958–59 to 1966, first as Assistant Divisional Forest Officer (ADFO) then, from 1962–63, as Divisional Forest Officer (DFO). As ADFO he spent a lot of time in

the forest, particularly in controlled burning trials. As DFO (and a married man), he spent less time in the field, but oversaw forestry operations including tree marking by staff, fire control plans; road contracts; and liaison with mills (there were three small sleeper mills operating in the wandoo country when Steve was at Gleneagle). He also observed the forest in the course of travelling to and from Gleneagle. After 1966, Steve spent most of his career in Manjimup and Bunbury, effectively ending his association with wandoo.

Steve recalls that when he was at Gleneagle, the wandoo was pretty healthy: 'it was a fine forest at that stage'. However, like other observers of the species, he notes that there is a pattern of natural decline in old wandoo, where branches at the top die off, leaving dead sticks that may last for a long time. He also recalls that you would see trees showing symptoms like that of crown decline on the western fringe of the wandoo, where 'the soil type was grading off into jarrah', though not much in the forest itself: 'I haven't seen any big areas [dying out]. You used to get little patches occasionally but they'd only be small and isolated. They might be, you know, quarter of an acre... But they'd usually come back again'. This was apparently not senescence, as smaller trees might be affected, and it did not seem to be associated with any changes in the weather or environment. At the time, it was thought to be dieback, but as it turns out, the organism responsible for jarrah dieback does not have much effect on wandoo. The problem was not investigated further.

Don Spriggins

After joining the Forests Department in 1962, Don Spriggins was DFO for the Kelmscott–Jarrahdale District from 1967. His responsibilities included overseeing the harvesting operations of several sawmills including two sleeper sawmills that operated entirely in wandoo forest in the Dale River area, prescribed burning, pine plantation establishment, visitor surveys and assessment and supervision of bauxite mining. Don liked to get out of the office as much as possible, spending around six hours a day in the field, where he always made general observations on tree health. His staff also kept an eye on the condition of the forest as they marked trees for the mills. Don says that during his time at Kelmscott, based on his personal observation and feedback from others, all the wandoo stands as far as he can recall were very healthy. Had there been a problem, Don is certain he would have recognised it and contacted an expert to investigate. There were some exceptional wandoo areas, such as that in Russell Block, adjoining the Brookton Highway. Don remembers that the wandoo stands in this area were outstanding and he and Joe Havel nominated Russell Block to become a conservation reserve. Don says the sawmillers 'weren't very happy about this because it contained a large sleeper timber resource'.

Don has more recently been working in the Boyup Brook area for clients who have large areas of wandoo on their properties. Interestingly he has noticed that, probably due to declining rainfall, jarrah trees in these stands are dying out but the wandoo trees show no signs of being affected and remain healthy.

Per Christensen


Per

Per Christensen began his Western Australian career in forestry with the Forests Department in Manjimup in 1968 as an ADFO carrying out research on karri silviculture and dieback. Two years later, he began work on the effect of controlled burning on plants and animals. From the early 1970s, for over 10 years, Per organised annual biological surveys, collecting local plants and animals from different areas of the forest. During this time, he completed a PhD thesis on the effects of fire on the woylie and the tammar wallaby. This involved significant fieldwork in the Perup area, which included small areas of wandoo. He also worked in wandoo areas east of Manjimup when undertaking the first research work on numbats, which he radio-tracked through jarrah-wandoo forest in the late 1970s after completing his thesis. Throughout this period of working in wandoo country, he did not notice any change in the wandoo.

From the mid 1970s, Per was working as a research scientist (though formally, he was a 'forester'). From this position he would advance to senior and then principal research scientist. In the mid 1980s, Per supervised the forest research of Paul Brown into wandoo decline. Throughout his career with the Forests Department, he remained in Manjimup and spent most of his time out in the field, as he considers fieldwork vital to forestry and ecological research.

Per says 'it is possible that animals like the woylie play a major role in the "health" of the woodland systems, including

V Wandoo woodland, Perup area, Winter 1973. *Photo – DEC*

wandoo, and their absence has contributed to the wandoo decline'. This is due to their digging and eating habits, which are important for the mycorrhizal fungi that benefit tree growth. Per says fire may also play a role: 'The numbers and distribution of fungi certainly were affected by fire and the numbers of woylies were affected by fire', though the main cause of decline in woylie numbers was foxes.

Jack Bradshaw


Jack

Jack Bradshaw was born in wandoo country at Boddington, though his first forestry posting was as ADFO in the karri country at Pemberton, in 1963. The following year he was posted to Manjimup, where he remained (other than a short stint at Kelmscott in the mid 1970s), until his retirement in 1998. In the 1970s Jack was involved mainly in planning. In the 1980s he was an inspector, and from 1986 he moved into management. Therefore, although Jack has not had intimate involvement with wandoo, he has long been a part of forestry circles, and has considerable silvicultural knowledge (of wandoo and other commercial species). He did not, even while at Kelmscott, encounter wandoo crown decline until Paul Brown's team started to look at declining wandoo on farms in the mid 1980s.

< Virgin wandoo, Beraking. Looking south from Patten's Hut. 3 May 1938.
Photo – Courtesy State Library of Western Australia, The Battye Library (BA866/186)

Conclusion

Several of those interviewed commented on the long-standing tendency for twigs and branches to die off in some trees, particularly as they age. It is therefore against this backdrop of 'natural' dieback in the crown (whether due to insect attack, drought, or old age) that some have seen crown decline emerge. At least five interviewees observed the health of the trees deteriorating in the 1970s, most likely in association with a decline in rainfall, though most placed the emergence of actual crown decline in the 1980s, mid to late 1990s, or early 2000s. Earlier reports of possible crown decline include those of Bill Butler (c.1929 in Gillimanning) and Steve Quain (c.1959-66 on the western edge of the wandoo forest east of Jarrahdale), though the causes of the observed decline in each case remain unclear.

Although it has not been possible to unequivocally rule out any historical incidence of wandoo crown decline occurring, the testimony of so many keen observers, in conjunction with the documentary record, strongly suggests that it has only emerged at a significant level from the 1980s. This study has also unearthed some fascinating insights into wandoo and its woodland settings, which may provide a useful context for further scientific research into the problem.

Finally, wandoo has rarely been granted the kind of status enjoyed by jarrah and karri, and it is hoped that this review will help us and subsequent generations to be mindful of the unique qualities and significance of this marvellous tree.

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> Wandoo on farmland near York. *Photo – Liz Manning*

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