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Land Improvement or Institutionalised Destruction? The Ringbarking Controversy, 1879–1884, and the Emergence of a Conservation Ethic in New South Wales

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SUMMARY

Ringbarking, as a means of destroying trees, was known and practised from the earliest years of British settlement in New South Wales. The practice became controversial as it accelerated across the pastoral lands of the colony from the 1870s. This controversy was mainly the result of fears that ringbarking, carried out speculatively by pastoral lessees, might defeat the object of the land settlement policy of the colony. Parliament responded by enacting legislation to regulate the ringbarking of trees on Crown lands, and in so doing provided a forum for the expression of a wide range of contemporary attitudes towards deforestation. These ranged from the mundane questions of pasture improvement and timber destruction, to the loftier issue of climate deterioration. Examination of these attitudes, as expressed principally in the parliamentary debates in connection with the *Ringbarking on Crown Lands Regulation Act* 1881, reveals the emergence in late-nineteenth century New South Wales of a vibrant conservation ethic. This opposed, albeit unequally, the environmental exploitation or 'development' ethic which continued for many decades thereafter to dominate the relationship between nature and human culture in the colony.

INTRODUCTION

The destruction of trees by ringbarking,[1] to promote the growth of native grasses and hence improve stock carrying capacity, became common practice across the pastoral lands of New South Wales and Victoria during the 1860s and 1870s. During the latter decade, the acceleration of the practice, and the indiscriminate manner in which it was being carried out, became the cause of great concern, especially among scientists who believed that deforestation caused a diminution

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of rainfall.[2] In New South Wales, a substantial controversy arose over ringbarking towards the end of the 1870s. This was less a product of the deforestation-desiccation debate, however, than of concern for the effective operation of the colony's land settlement policy. Nevertheless, an analysis of this controversy is invaluable in elucidating late-nineteenth century attitudes towards the forests.

THE ORIGINS OF RINGBARKING IN NEW SOUTH WALES

As a means of destroying trees, ringbarking was known and practised in the early days of settlement in the colony of New South Wales. Peter Cunningham, in 1827, described several methods of clearing the land of timber and making it fit for the plough. If government gangs of convicts were available to assist in the task, the trees could be grubbed out. Alternatively, a row of trees could be cut half through, then a heavy one at the end felled against the second, causing the whole row to collapse progressively like 'a pack of cards placed on edge'. Burning then completed the job. Most often, however, the trees were spaced at too great a distance to enable this labour-saving method to be carried into effect. A third and cheaper method, especially if the settler used his own men, and was in no great hurry, was to 'girdle all the trees right through the sapwood, and let them stand for three years, when they will burn like tinder'. Although Cunningham was primarily interested in clearing for cropping, he added that:

> The mere girdling of the trees improves the pasture a full fourth; it becoming sweeter from not being exposed to the droppings of the leaves, and more luxuriant from the nourishment formerly taken up by the trees being now applied to the grasses.[3]

John Dickson, the founder of Dickson's mill and brewery in Sydney, has been described as the first person in New South Wales to practice ringbarking on 'anything like an extensive scale'. Dickson possessed estates in what is now south-eastern New South Wales, comprising 'many thousands of acres of the ordinary eucalypt forest-land' which he ringbarked in about 1820 with the object of improving the land for grazing purposes. Despite Dickson's observations that his land would carry four or five times the number of stock when the trees were killed than it would do previously, graziers of this period tended to ridicule the idea of ringbarking, and it was many years before the procedure became generally adopted. Thus, from Dickson's time until about 1860, ringbarking was practised to a limited extent only in New South Wales.[4]

The early lack of enthusiasm for the use of ringbarking to encourage pasture growth probably explains alternative claims that the practice began much later, about 1860 in the Hunter Valley, where its first exponent was Thomas Hungerford. Such claims undoubtedly refer to the widespread adoption of the procedure, in contrast to its initial limited and tentative use. According to William Abbott, who read a paper on 'Ringbarking and its Effects' before the Royal Society of New

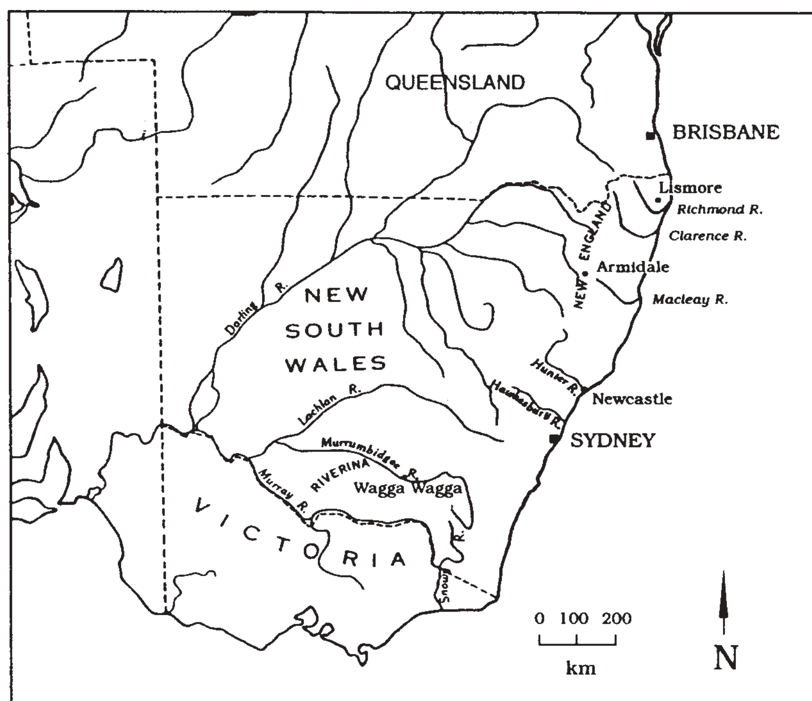

FIGURE 1. Map of south-eastern Australia showing localities mentioned in this article.

South Wales in 1880, Hungerford was immediately followed by James White, after which 'the new process for improving the grazing capacity of the runs spread rapidly in every direction'.[5] Abbott's account of the introduction of ringbarking tends to be confirmed: by James Brunker, according to whom, in 1859 'Thomas Hungerford … sapped a large portion of the timber on land held by him, which up to that time was almost a barren waste';[6] by Sir John Robertson who, in 1881, said:

> I remember the origin of ringbarking about twenty-three years ago. I believe the first man to ringbark was Mr Thomas Hungerford, on land at the junction of the Hunter and Goulburn Rivers. The land was of very inferior quality, and thickly covered with trees. I was then not far from him, and had very good land, although I could not fatten my bullocks. But he bought my store bullocks from me and fattened them on his land at the junction of those two rivers, where, by ringbarking, he had greatly increased the grazing capabilities of his land;[7]

and by Forester Siddins of Armidale, who put 1862 as the year in which Hungerford 'commenced sapping', his example soon being followed by James White, on his Martindale Estate.[8]

Abbott, himself a grazier,[9] observed a 'very great increase' in the grazing capacity of White's runs following ringbarking, and in 1869 commenced ringbarking on his own property near Murrurundi in the upper Hunter.[10] About this time the practice became 'general' on the Hunter, and by 1880, Abbott estimated, 'at least three-fourths of all the purchased land on the Hunter [had] been ringbarked, besides a very considerable area of [leased] Crown lands'.[11]

By the mid-seventies the adoption of ringbarking by Crown lessees had become sufficiently widespread to attract the attention of the colonial Government. In August 1875, specific controls over ringbarking in New South Wales were adopted when a passage on that subject was included in the timber regulations issued under the *Lands Acts Amendment Act* of that year.[12] This regulation prohibited the ringbarking of trees on Crown lands by pastoral lessees without the special permission of the Minister. The first such permission to ringbark was granted on 20 December 1875 by Thomas Garrett, then the Secretary for Lands, and the practice was continued by succeeding Ministers. Towards the end of the 1870s ringbarking became the subject of considerable controversy in New South Wales; not in relation to forest conservation, however, but in connection with the effective operation of the land alienation policy of free selection.

The policy of free selection before survey was instituted in New South Wales in 1862 through the *Crown Lands Alienation Act* 1861. Its avowed purpose was to substitute large numbers of yeoman farmers for the relatively small number of pastoral lessees or 'squatters' who occupied the vast tracts of territory beyond the original settled districts of the colony.[13] This change was to be effected by allowing each individual 'selector' to appropriate any portion of any pastoral leasehold at any time.[14] Thus, although the squattage was a holding recognised by law, it could be obliterated at any time, in accordance with the new law, if enough selectors wanted the land. In essence, the new policy 'offered for sale to one class of occupants the same land which was simultaneously assigned under lease to another class'.[15] The general result of the policy was to create a class contest for the public lands of the colony.

RINGBARKING AS 'IMPROVEMENT'

The practice of ringbarking trees to promote the growth of grass had become rife across the pastoral lands of New South Wales by the end of the 1870s. In 1881 William Lyne claimed that 'in most of the unsettled districts, and in some of the settled districts, three-fourths of the country had already been ringbarked'.[16] In that year ringbarking achieved legal status as a form of land improvement when

the Supreme Court ruled it so in terms of the *Lands Acts Further Amendment Act* 1880. This status was embodied in statute when Parliament passed the *Ringbarking on Crown Lands Regulation Act* 1881. This was the first legislation to establish that ringbarking was an 'improvement' under the provisions of the lands Acts, thus enabling Crown lessees to recover from selectors limited compensation for ringbarking carried out by them on their runs. This principle was subsequently incorporated into the *Crown Lands Act* 1884 under which ringbarking on Crown lands in New South Wales became well and truly 'institutionalised'.

Under the *Crown Lands Alienation Act* 1861, certain classes of land had been exempted from conditional sale by selection, and these included lands containing 'improvements' to the value of not less than £1 per acre.[17] Where improvements were of less value, however, and the land was therefore not exempt from selection, no provision existed for the pastoral lessee to obtain compensation for improvements made by him on land subsequently selected. This apparent injustice was addressed in the *Lands Acts Amendment Act* 1875.

The 1875 Act continued the exemption from free selection of lands on which improvements to the value of at least £1 per acre had been made by the pastoral lessee,[18] but where land containing fencing or other improvements of lesser value was selected, the tenant had the right to remove these. Where such improvements were not 'separated, removed and carried away', the squatter was not to destroy or damage them but was to leave them for the selector who must then pay compensation.[19]

In passing this amendment it undoubtedly was never the intention of Parliament that ringbarking should be considered among those improvements not removed for which compensation could now apparently be obtained.[20] It was generally not then an issue, even to the squatters. During the five-and-a-half years after the first permissions to ringbark were granted under the regulations of 1875, the pastoral lessees, it was said, 'never dreamt of asking for compensation'.[21] This was not entirely true, and some such cases were brought before the courts, but the issue was settled – or so it seemed – in March 1879, when the Supreme Court ruled that ringbarking was not an improvement under section 40 of the *Lands Acts Amendment Act* 1875.[22]

Under this judgement, however, not only was ringbarking ruled not to be an improvement under Section 40, but it was suggested that even if the improvement were a dam, for example, no compensation could be awarded. This followed from the peculiar wording of the Act under which the only improvements for which compensation could be sought were those 'capable of being separated, removed, and carried away' by the lessee, but not. In other words, no compensation could be sought for improvements incapaple of being removed, which clearly included ringbarking, as well as earthworks such as dams.

To redress this irregularity, in June 1879 Edward Ogilvie attempted to introduce a bill,[23] the object of which was to define and declare the meaning of Section 40. He believed that the original intention of the section was:

> to give the pastoral tenant, whose improvements were selected, the right to obtain compensation for such of them as should not be removed, or for such improvements as from their nature were not capable of being removed,

and he wished to restore to it 'that vitality of which it had been deprived by the decision of the Supreme Court'.[24] Ogilvie's bill was passed by the Legislative Council, but lapsed in the Assembly when the session came to a close late in July 1879.

The anomaly was ultimately removed by the *Lands Acts Further Amendment Act* 1880[25] in which section 15 repealed section 40 of the Act of 1875. The only difference between the two sections was the addition in the latter of the words 'or which is not capable of being'. This had the effect of including non-removable improvements, such as dams, races, wells, and tanks, among those for which the squatter was entitled to claim compensation from the selector.[26] This amendment achieved the same end as was sought by Ogilvie through his lapsed declaratory bill of the previous session, and as was originally sought by the architects of the Act of 1875. Although it generally was neither intended nor foreseen, this change also made a material difference to the way the law applied to ringbarking as an improvement.

It has been claimed[27] that it was Ogilvie's unstated intention in introducing his declaratory bill to bring ringbarking within the scope of the Act, but this is not evident from a close reading of the parliamentary debates. Whether calculated or not, however, the possibilities soon became apparent to some astute squatters and their lawyers.[28] In March 1881, shortly after the Act of 1880 had come into effect, a case was tried before Henry Bayliss, Police Magistrate of Wagga Wagga, wherein two selectors were sued for improvements which consisted of ringbarking timber and which, it was claimed, had improved the value of the land to the selectors by more than 5s. per acre. The selectors had offered 1s. per acre, being the amount which they considered the squatter had expended in carrying out the ringbarking. The magistrate decided that, according to the new Act, ringbarking was an improvement for which compensation could now be sought, and, moreover, that it was the value to the selector of such improvements, and not the actual cost of effecting them, that was to be taken into consideration.[29] This decision was subsequently upheld on appeal to the Supreme Court.[30]

The confirmation by the Supreme Court that ringbarking was not only an improvement, but that the magistrates had the right to determine the amount of compensation, soon caused great alarm. There was argument over whether the courts had erred in so considering it, let alone in granting compensation far in excess of the actual cost of the ringbarking.[31] Reports were rife that in consequence of the decision a number of pastoral tenants were now proceeding to ringbark in the hope of preventing free selection on their runs. 'Crown lessees', it was said, 'have put on gangs of men to destroy the whole of the timber on their

runs, with a view to get[ting] compensation'.[32] It was claimed that:

> ringbarking was being carried on in a wholesale manner by Chinese labour, at a cost of 9d. per acre in some instances, [with the object of] the lessees recovering 5s., or even 12s. per acre for this work done on speculation.[33]

Ringbarking was allegedly being carried out without permission, contrary to the Crown lands regulations, and, more seriously, in order to discourage free selection and defeat the purpose of the lands Acts of 1861.[34] It was also feared that, far from improving the capacity of the land, such 'indiscriminate and unnecessary destruction of timber', would have the effect 'of reducing the value of the land for grazing purposes'.[35] This, however, was a secondary consideration.

In consequence of these reports, the Department of Mines undertook a close examination of a number of runs and found that:

> although there has been some cause for anxiety there has also been a great deal of needless alarm. [Of those runs examined] the total number … on which ringbarking has been carried on without authority is only eleven. The number of runs on which the conditions of the permission have been fully observed is thirty-six, and the number in which they have not been fully observed in twenty-six. The number of cases in which operations have not been commenced by those who have permission is five, and the number in which ringbarking has been carried on in excess of the area named in the permission is eight.[36]

These revelations, together with the continuing uncertainty over the land law as it related to ringbarking as an improvement, impressed upon the Government the urgent necessity of passing a measure dealing with the subject, and on 20 July 1881 the Secretary for Mines, E. A. Baker, introduced into Parliament the Ringbarking on Crown Lands Regulation Bill. This Bill was subsequently withdrawn on a technical point of order, but was reintroduced as the Ringbarking on Crown Lands Regulation Bill (No.2) on 3 August 1881. The bill was passed and became law on 24 November 1881.

It is not known to what extent ringbarking carried out before the *Ringbarking on Crown Lands Regulation Act* 1881, and especially during the year-or-so after the *Lands Acts Further Amendment Act* 1880, was performed for the purpose of defeating free selection, rather than as a legitimate means of promoting the growth of pasture. It seems probable, however, that only a small proportion of ringbarking carried out before the end of 1881 was performed other than for the latter purpose. Nevertheless, the fear that ringbarking was being or could be used to thwart free selection led to a close re-examination by Parliament of the whole issue of improvements on Crown leases. Indeed, I would go as far as to suggest that the ringbarking on Crown lands issue and the extended debate which it generated, highlighted the need for reform of the land laws, and was the catalyst which led eventually to the reforming *Crown Lands Act* 1884.

That ringbarking is given such close attention here arises not so much from an interest in the practice *per se*, but rather from the insights into late-nineteenth century attitudes towards the forests of New South Wales which the subject provides, largely through the parliamentary debates of 1881.

The Ringbarking on Crown Lands Regulation Act, 1881

Although ringbarking on Crown lands had been regulated under the lands Acts since 1875, the *Ringbarking on Crown Lands Regulation Act* 1881[37] was the first legislation in New South Wales to deal exclusively with the subject. The leading principles of the Act were: first, that ringbarking should not be allowed on Crown lands without permission; secondly, that ringbarking was an improvement and that those who carried out ringbarking should be entitled to compensation; but thirdly, that compensation should be limited to the actual cost of the work. Expression of the latter two principles would: first, uphold the decision of the Supreme Court that ringbarking was a valid 'improvement', but secondly, remove from the magistrates the right to arbitrarily grant excessive compensation, and thereby lessen the suppposed inhibitory effect of ringbarking on the operation of free selection.

The Ringbarking on Crown Lands Regulation Bill was described by the Premier, James Farnell, as a 'pettifogging Bill [which] ought to be beneath the contempt of the House',[38] but it nevertheless occupied the attention of Parliament over a period of more than three months. Not only was debate over the bill extended, but it was strongly polarised and frequently acrimonious, divided along class lines into a confrontation between squatter and selector. The right of the Crown lessee to obtain just compensation for improvements to his lease was set against the need to prevent such improvements acting, intentionally or otherwise, as an impediment to the operation of free selection and to the expression of the land settlement policy of the colony.

During the period from March to November 1881, as the subject of ringbarking engaged the attention of the New South Wales Parliament, expression was given to a great variety of opinions on the land clearance question. From these opinions it is possible to distil a picture of some prevailing attitudes towards forests and forest clearance. It is worth emphasising that ringbarking only became an issue at this time and at this level because of its use as an improvement within the terms of the land laws; as Farnell put it, 'we should not have heard a word about ringbarking had it not been a bar to free selection'.[39]

Submerged in the debate beneath the dominant social theme of squatter versus selector, two major opposing 'environmental' attitudes are discernible: first, and most commonly expressed, that ringbarking was necessary to improve the country and ought to be encouraged; and secondly, that ringbarking did more harm than good so ought to be discouraged. The first view was by far the more

widely held, although most conceded that ringbarking was not invariably beneficial, and ought somehow to be restricted and controlled. This spectrum of attitudes is discussed here under the heading 'ringbarking as improvement', and further below under 'ringbarking as destruction'.

The pastoralists, as might be expected, consistently expressed the 'ringbarking as improvement' point of view. William Brodribb said that 'ringbarking was admitted by everybody to improve the country. It doubled the value of the land. If every tree was ringbarked at a certain season it greatly improved the grass and made water more plentiful. Springs were found gushing up where they had never been known before, because the water had been absorbed by the trees'.[40] 'It is folly', he continued, 'to say that we must put a stop to ringbarking. If we do so, we shall seriously injure the prospects of the country'.[41] James Douglas believed that 'it is only by means of ringbarking that a large area of the public estate can be rendered fit for settlement'.[42] Leopold de Salis thought that:

> To forbid ringbarking *in toto* would be suicidal. A forest ranger at my invitation looked over my run and stated that instead of being punished for the ringbarking on it I ought to have been punished if I had not done it. … Ordinary trees are but gigantic weeds, choking the land and thus detracting from its value by preventing the growth of grass. … Not one-third of the live stock of the country could be maintained on our lands if it were not for the improvements which have been made. This ringbarking is one of them, and its progress ought not to be checked.[43]

It was not, de Salis continued, 'merely an assertion by squatters and others interested that ringbarking is a great improvement to the country; everybody admits it'. In this respect de Salis was substantially correct. Even John McElhone, avowed champion of the free selector and bitter opponent of the squatters, believed ringbarking to be an 'improvement'. 'There is no doubt', he said:

> that land which is heavily timbered is almost worthless for grazing purposes, and by ringbarking the land may be made to carry a large number of stock. On the slopes of the New England district, on the table-lands, and in the greater part of my electorate [Upper Hunter] a fat beast was almost a thing unknown before ringbarking came into vogue, but since the timber has been destroyed the grazing capabilities of the land have been increased four or five fold.[44]

James Hoskins, whose interests were in mining and who was therefore apparently a disinterested observer, believed that 'every one who is acquainted with our interior will admit that generally ringbarking is a great improvement, and has increased the grazing capabilities of the land to an enormous extent. And, whatever the cost incurred by ringbarking, it is evident that it leads to the employment of a large amount of labour.'[45] Charles Pilcher, barrister, said that 'anyone who knows anything about the country must be aware that for pastoral purposes – and the greater part of the country is suited for no other purpose –

ringbarking increases the value of the land immensely.[46] The case was summarised neatly by Sir Patrick Jennings when he said: 'The whole intent of our land laws was to conduce to the improvement of the country, and it was admitted by every person who had spoken that ringbarking was an improvement. It was agreed [however] that it should be done under regulations, and that if a man did it without permission he should be fined'.[47]

RINGBARKING AS 'DESTRUCTION'

It is evident from the foregoing that, in 1881, it was generally held that by ringbarking, the Crown lessees increased the grazing capability of the land and that ringbarking was therefore an improvement. There were, however, other matters to consider, and two arguments against ringbarking, or at least for controls on its practice, were commonly expressed. These can be stated simply as the 'waste of timber' and the 'hindrance of agriculture' arguments, both of which, as will be seen, are related.

Charles Fawcett, the first member for The Richmond when that electorate was created in 1880, said that 'ringbarking was not invariably beneficial to the country in which the process was carried on. The effects of ringbarking depended upon the nature of the country operated upon. In some descriptions of country ringbarking promoted the growth of [scrub], which unfitted it for sheep; and in other cases the process wonderfully improved the grazing capabilities'. He complained of the 'indiscriminate destruction of good timber which accompanied the process of ringbarking. Thoroughly good and useful timber, which was, to a certain extent, absolutely necessary to every one who settled on the soil, was inconsiderately destroyed'.[48] It was 'notorious that a quantity of timber which would be useful for building and railway purposes is being destroyed every day'.[49] Fawcett contended 'that permits to ringbark ought to contain some restrictions as to the quality and variety of timber to be destroyed' and trusted that 'the Secretary of Mines would see that the country was not indiscriminately divested of its timber'.[50] The Secretary for Mines assured the House that permissions to ringbark given by him did contain 'restrictive conditions', for instance 'that timber valuable for building purposes and for splitting and fencing should be exempted'.[51] Henry Dangar defended his fellow pastoralists:

> It has been said that owing to indiscriminate ringbarking large quantities of valuable timber have been destroyed. I do not think this has taken place to the extent alleged. I believe that as a rule the timber which is destroyed is of an absolutley worthless character. Those who are in the habit of improving land by ringbarking are far too sensible to think of destroying really good timber; they will allow it to stand because of the great value which it will inevitably acquire in a few years.[52]

Although the value of ringbarking to grazing land was generally not denied, on land suitable for agriculture it might act as an impediment to settlement, not only through the loss of useful timber already mentioned. 'The selector reaped the benefit of the [ringbarking] if he used the land for grazing purposes', McElhone said, 'but it was no improvement to him if he used the land for agricultural purposes, because it took as much labour to clear an acre of land, the timber on which had been ringbarked for any time, as it did 5 acres of land on which the timber was green. Ironbark and box timber was so hard when it was thoroughly dry that it often turned the edge of an axe.'[53] John McLaughlin, a solicitor, concurred: 'If a man selected land for agricultural purposes, the ringbarking, instead of being to his advantage, would be to his disadvantage'.[54] Michael Fitzpatrick, public servant, elaborated that 'instead of being an improvement, ringbarking is a hindrance so far as agriculture is concerned. It is much more difficult to clear off the land timber which has been ringbarked than to remove green timber.'[55]

Most of the arguments against ringbarking expressed above are utilitarian in nature, concerned with the immediate practicalities of pastoral or agricultural land use, or with the loss of commercially valuable timber. There also emerged during debate on the ringbarking bill, however, sentiment which transcended these utilitarian arguments and raised the issue of forest destruction to a higher plane. The primary advocate of this extended but minority view was insurance entrepreneur James Garvan who asked whether:

> by ruthlessly devastating and deforesting the land, we were not doing the country harm which would more than counterbalance the good which might result from ringbarking.[56]

He expanded:

> There could not be a doubt that if we ruthlessly stepped in and interfered with natural conditions by sweeping away forest timber for the sake of growing grass, we should be likely to produce evils to the best permanent interests of the country tenfold greater than any temporary advantage to be gained in allowing the Crown lessees to accumulate wealth more rapidly.[57]

Garvan quoted the Rev. W. B. Clarke[58] and a number of other authorities[59] in support of his argument that forest destruction would be followed by climatic deterioration. Garvan's views were echoed in the upper house by Robert King who was 'convinced' that if ringbarking continued to be carried out at the same rate as in the past 'it will have the effect of diminishing the rainfall'.[60] 'If this country is ever denuded of its natural timber, I am confident that the most disastrous results will be produced'.[61] Both Garvan and King were expressing concerns that were based on theories of the relationship between forests and rainfall which were being hotly debated in scientific circles at the time.

FOREST DESTRUCTION AND CLIMATE CHANGE

The idea that forest destruction modified the seasons and affected precipitation was not a new one. Theophrastus commented on the effects of human agency on climatic conditions in ancient Greece as early as the fourth century B.C.[62] Grove, in a recent review of the subject in a more modern context, traced the origin of the notion of significant human impacts on regional and global climate to the French and British colonial empires of the sixteenth century. Specifically, fear of artificially induced climate change developed in the tropical colonial context, notably in Tobago, St Vincent, St Helena, Mauritius, and western India.[63]

As early as the 1690s, John Woodward in London conducted experiments on the growth of plants from which he concluded:

> This so continual an Emission and Detachment of Water in so great Plenty from the Parts of Plants, affords us a manifest Reason why Countries that abound with Trees, and the larger Vegetables especially should be very obnoxious to Damps, great Humidity in the Air, and more frequent Rains, than others that are more open and free. The great Moisture in the Air was a mighty inconvenience and annoyance to those who first settled in *America*; which at that time was much overgrown with Woods and Groves. But as these were burnt and destroy'd, to make way for Habitation and Culture of the Earth, the Air mended and clear'd up space, changing into a Temper much more dry and serene than before.[64]

In 1799, Noah Webster speculated on the relationship between perceived climate change in the United States and the clearing of wood since the first settlement of Europeans there.[65] By the 1860s a considerable body of literature had accumulated on the climatic and other influences of forests and much of this was brought together by George Perkins Marsh in 1864 in *Man and Nature or, Physical Geography as Modified by Human Action*. Marsh's book appeared at 'the peak of American confidence in the inexhaustibility of resources' and was written to reveal the menace of human destructiveness through which 'the earth [was] fast becoming an unfit home for its noblest inhabitant', to explain its causes, and to prescribe some remedies.[66]

In Australia, Baron Ferdinand von Mueller was probably the first to warn of the possible disastrous effects on climate of forest clearance. In Victoria in 1871, Mueller used the 'warning of climate change' as well as the 'commencing scarcity of wood' to support his calls for 'regularly organised' forest administration in Australia, none having yet been initiated in any part of the country.[67] In New South Wales in 1876, the Rev. W. B. Clarke wrote at length on 'The effects of forest vegetation on climate' and, referring specifically to ringbarking, said:

> not only ought the present destruction of timber that goes on in various parts of the country to be checked and regulated by law, but provision should be made for the replanting of many a naked tract of former forest vegetation.[68]

Earlier in the same year, the botanist Rev. Dr William Woolls pointed out in a lecture to the Horticultural Society of New South Wales:

> the mischief done to the community and to individual landed proprietors by the careless destruction of the forests, and the 'murderous process' of ringbarking.[69]

Woolls told the story of:

> a gentleman [who], seeing a neighbour engaged in [ringbarking], remonstrated with him on his folly, and added that, if he annihilated the gum trees on his estate, he had better settle his affairs and order his coffin. This was certainly putting the case very strongly, but I believe it conveys a very wholesome truth. People may despise gum trees; but I regard it as one of the wonders of Australian vegetation that these trees are constantly decomposing carbonic acid gas and restoring the oxygen; or, in other words, that, in the economy of nature, they are absorbing that which is detrimental to animal life, and supplying in its place that which is necessary for health and purity.[70]

Both Mueller and Clarke were familiar with the work of the American Marsh, but it is debatable how much they were directly influenced by it in their thinking. Both eminent scientists, they probably were aware already of the wider literature on the subject. Powell, in 1976, attributed to Marsh's work great influence in Australia, particularly in Victoria. There, in 1865, the Melbourne *Age* and *Argus* newspapers both discussed the need for forest conservation and quoted heavily from *Man and Nature*. Also in 1865, a special committee was convened to investigate the whole issue of forest conservation in Victoria, and in its report the committee relied heavily on Marsh's international review.[71] In New South Wales, however, the direct influence of Marsh is less obvious. During the debate on the Ringbarking Bill in 1881, for example, it was the Rev. Clarke and Dr Hugh Cleghorn whose work primarily was used as evidence in support of forest conservation. Clarke, in his lengthy 1876 review 'Effects of forest vegetation on climate', refers only briefly to Marsh. Cleghorn's 1879 article does likewise. Joseph Maiden, in his 1902 paper 'Forests considered in their relation to rainfall and the conservation of moisture', which presents an extensive review of the literature on forests and rainfall, does not refer directly to Marsh.[72] Hence, although Marsh's work was undoubtedly a valuable synthesis, it would appear that its influence in Australia may have been exaggerated.[73]

Although the concept of forest influences was espoused by such eminent scientists as Mueller and Clarke, the idea was not universally accepted. Indeed, there were serious discrepancies between the theory and the observed facts, and some arguments were based on the most peculiar logic. Clarke, for example, 'for those who doubt[ed] the influence of trees upon the atmosphere', quoted a friend 'whose powers and habits of observation are of a high order'. 'The effects of forest vegetation on climate are most marked', the friend observed,

> in the Coast district, about the heads of the Macleay, Bellinger, and Clarence Rivers [in the north of New South Wales], where dense scrubs containing very large trees occur. In those localities it is almost continually raining. … But in the more open country, twenty or thirty miles inland from those localities, the rainfall is not nearly one-half. *This must be owing to the dense vegetation* [my emphasis] a great deal more than to the fact that the steep and high escarpment forming the edge of the table-land catches the rain clouds.[74]

Joseph Abbott in 1881, in attempting to refute such arguments during debate on the ringbarking bill, observed:

> The theory that the amount of rainfall in any country depends on the area of its forests seems to be very generally received, and may have arisen from the fact that where there is a large and regular rainfall there is pretty sure to be heavy forest growth, but *a little thought will show that the forest is the result of the rainfall not the rainfall of the forest* [my emphasis].[75]

Charles Moore, the Director of the Sydney Botanic Gardens, was also a detractor, or at least was unconvinced. Moore, who knew the vegetation of New South Wales perhaps better than any other man, argued:

> 1. That the dense jungle vegetation, which of all others is supposed to attract and hold moisture, and which for about 400 miles was so general within the coast range, has been almost wholly destroyed during the last thirty years.
> 2. That in addition to this, millions of acres of more open forest have been destroyed during the same period.
> 3. That, notwithstanding this tremendous destruction of trees, no drier climatic effect has been experienced.
> 4. So far as my knowledge extends, the only observable effect has been that in some districts in which the forest has been destroyed small rivulets usually contained water, but in many instances are now dry.
> 5. That now the larger rivers of the colony show no diminution in breadth or depth.
> 6. That the rainfall, instead of decreasing, as might have been expected from the destruction of so much forest, has been of late years more regular and greater than formerly.[76]

Clearly, the forest influences idea had problems and in the 1880s the best argument for forest conservation, and in particular for some regulation of the destructive practice of ringbarking, was the economic one of a dwindling timber resource. But to many even this threat remained invisible or trivial.

RINGBARKING AFTER 1881

Immediately prior to the *Ringbarking on Crown Lands Regulation Act* 1881, applications to ringbark on Crown lands in New South Wales were all dealt with

by the Occupation of Crown Lands Branch of the Department of Mines. Little is known of ringbarking permissions granted during this time (under the *Lands Acts Amendment Act* 1875), but it is known that during the two year period from 1 April 1879 to 31 March 1881 permission was granted to ringbark an area of 963,640 acres (about 4,000 square kilometres) across the colony.[77]

In about March 1881, pending the new legislation, instructions were issued to the Occupation of Crown Lands Branch to suspend action in connection with ringbarking applications, and these were merely received and registered until February 1882 when new arrangements were arrived at as to the mode of proceeding under the new Act. After that date, applications dealing with five year pastoral leases[78] were forwarded to the newly created Forest Branch of the Department of Mines for the report of the forest rangers, and those dealing with auction and pre-emptive leases were dealt with separately by the Department of Lands, although with reference to the forest rangers.[79]

Ringbarking on Crown lands continued to be regulated by the *Ringbarking on Crown Lands Regulation Act* 1881 until the end of 1884 when the role passed to the *Crown Lands Act* of that year. In accordance with the Act of 1881, details of permissions granted to ringbark were published regularly in the *Government Gazette* from early 1882 until the end of 1884. These published details, together with a parliamentary return prepared in February 1883,[80] reveal that during the period of operation of the 1881 Act – the three years to the end of 1884 – permission was granted to ringbark an area of 3.9 million acres (about 16,000 square kilometres) on pastoral leases across the colony.[81]

By comparison with the figure for the two year period from April 1879, it appears that the practice of ringbarking on pastoral leases accelerated greatly during the early 1880s. Although compensation for ringbarking could be claimed by lessees from selectors, this was limited by the 1881 Act to the actual cost of the operation. It seems probable, therefore, that it was the growth of pastoralism and the need for more grass, rather than a desire to thwart free selection, which caused this accelerated destruction of trees.

Some interesting details can be found in the records of permits granted for the year 1882 which were published in the parliamentary return already mentioned. Each permit issued by the Department of Mines applied to a defined area of a run, and specified both the kind of timber allowed to be ringbarked, and the kind of timber exempt from ringbarking. The former category typically included 'worthless' timber, including trees which were short, crooked, stunted, decayed, or gnarled. The latter included all timber not named in the former, and typically included all 'straight-growing' trees which were 'fit for sawing or splitting purposes'.[82]

The overriding principle applied by foresters in framing these conditions was the prevention of the destruction of timber which might be useful for building or fencing purposes. The Rev. Woolls, in 1876, had disparaged the foolish clamour of some persons for the extermination of the *Eucalyptus* trees, and lamented the

wasteful practices of the early days of the colony. Then,

> when grants of land were bestowed on settlers, and gangs of men were assigned out by the Government, the first thing which they did was to clear away right and left, as cumberers of the ground, all the unfortunate gum trees. Even women and children, the settlers' wives and families, rejoiced in the operation of what was then called 'burning off', and night after night gigantic fires were kindled for the purpose of destruction. And what has resulted from this prodigal waste of natures's resources? Why, some farms (I allude especially to those in the County of Cumberland [surrounding Sydney]) have been so completely denuded that the owners are now compelled, for the most part, to buy timber for fencing, building purposes, nay, even for fire-wood itself.[83]

This same concern to avoid waste was expressed strongly during debate on the Ringbarking on Crown Lands Regulation Bill, and was incorporated into the formalities which were created to regulate the practice after 1881.[84] Thus, the regulation of ringbarking on Crown lands from 1881 (and probably also from 1875) was carried out with a cognisance of the need to conserve timber useful for construction purposes, and to protect trees useful for fodder, shade, or ornament.

Ringbarking from 1885

The *Ringbarking on Crown Lands Regulation Act* 1881 was repealed from 1 January 1885 by the *Crown Lands Act* 1884.[85] Under section 93 of this Act, permission to ringbark timber on Crown lands, other than timber reserves or State Forests, was granted by the Local Land Boards established under the Act, under such restrictions as to them seemed advisable. Applications were sent by the Land Boards to the Forest Rangers for their report, but other than this the subject was no longer the realm of Forest Branch.[86] Persons ringbarking or stripping bark from trees without permission, or in contravention of the conditions of any permission granted, were liable to penalties of from one to ten shillings per tree (s. 94).

From 1885 onwards, summary statistics of applications to ringbark and permissions granted were published annually in the reports of the Department of Lands. Data extracted from these reports have been used to produce figure 2, which shows the annual areas of Crown lands for which ringbarking permits were sought and granted across the whole colony. During the period 1 January 1885 to 7 March 1888 a total of 1,053 permissions to ringbark were granted by the Local Land Boards under the Act of 1884. These embraced a total area of 3.9 million acres, an average of about 1.2 million acres per year for the period,[87] a similar rate to that approved during the three year period of operation of the 1881 Act. After 1887 the rate diminished until it reached a low annual figure of only about 250,000 acres in 1893. In the years which followed, until the end of the

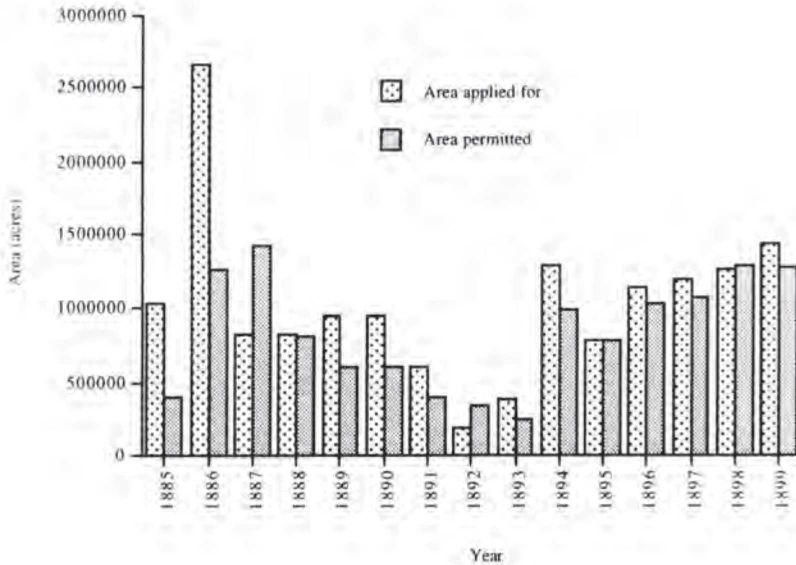

FIGURE 2. Ringbarking on Crown lands in New South Wales; area applied for and permitted, 1885-1899
Sources: Annual reports of the Department of Lands

century, the annual area permitted to be ringbarked averaged about 1 million acres (4,400 square kilometres). During the entire period 1885 to 1899, the total area permitted exceeded 12.5 million acres (about 55,500 square kilometres).

CONCLUSION: THE TREES OR THE GRASS?

Despite the various arguments against ringbarking which were being aired in New South Wales in the 1870s and 1880s – ranging from short-term practical considerations to the long-term question of climate change – ringbarking continued virtually unabated throughout the remainder of the century and beyond. It was probably the most significant contributor to deforestation in nineteenth century Australia, and was undoubtedly the most conspicuous. Of all the methods of clearing timber, Gill called ringbarking 'the most ghastly and uncanny in its effects on the landscape'.[88] This feeling was articulated to a wider public by the poet Dorothea Mackellar with the words 'The stark white ringbarked forests, All tragic to the moon'.[89] (figure 3).

FIGURE 3. A ‘stark white ringbarked forest’ in the Clarence valley of north-eastern New South Wales in 1997. These trees, eucalypts of various species, were killed in the early 1970s. They were probably regrowth following an earlier episode of ‘land improvement’. Such scenes were common across the pastoral lands of eastern Australia around the turn of the century when Mackellar wrote ‘My Country’.

The idea, widely prevalent in nineteenth century Australia, that the forests were ‘the enemy’, standing in the way of the proper development of the country, is clearly portrayed in the practice of ringbarking to promote the growth of grass. The controversy which arose over ringbarking in New South Wales during the late 1870s provides a graphic illustration of this idea. It also highlights, however, a growing opinion which deplored the waste of timber which indiscriminate ringbarking caused, and, on a higher level, demonstrates the emerging concern over the possible effects of forest destruction on the climate; of broad scale human impacts on the natural environment. It therefore provides an early case study of the emergence of a conservation ethic to oppose, albeit unequally, the environmental exploitation or ‘development’ ethic which continued to dominate the relationship between nature and human culture in the colony of New South Wales throughout the nineteenth century and beyond.

NOTES

[1] The alternative styles 'ringbark' and 'ring-bark' both appear in the literature, but the former is used exclusively in this paper.
[2] Powell (1976: 89-92) has discussed briefly this aspect of the ringbarking controversy. The most recent review of the deforestation-desiccation debate is Grove (1994); the theme is expanded in Grove (1995 and 1997); and an earlier discussion is Lull (1949).
[3] Cunningham 1827: 172-5.
[4] 'Ringbarking timber for improving pasturage', *Town and Country Journal*, 6 November 1880, p. 883.
[5] Abbott 1880: 97.
[6] James N. Brunker, NSW, *Parliamentary debates*, 3 August 1881, p. 466.
[7] Sir John Robertson, NSW, *Parliamentary debates*, 28 September 1881, p. 1352.
[8] Maiden 1894: 37.
[9] William E. Abbott (1844-1924) was several times president of the Pastoralists' Association of Australia; a member of the Executive of the Pastoralists' Union of NSW, 1890-1917; and its president, 1895-1907. He led the squatters against striking shearers in 1891. Ref. *Members of the Legislative Assembly of NSW, 1856-1901*, p. 2.
[10] Abbott 1880: 98.
[11] Abbott 1880: 97.
[12] Crown Lands Regulation no. 66, NSW, *Government Gazette,* no. 230, 28 August 1875, p. 2666. This is the earliest known regulation relating to ringbarking on Crown lands. According to E. A. Baker (NSW, *Parliamentary debates*, 28 July 1881, p. 372), a prior regulation requiring that no pastoral tenant be allowed to ringbark without permission was attached to the Crown Lands Alienation and Occupation Acts of 1861, but no such regulation has been found.
[13] See Baker 1958; Karr 1974; Robinson 1974; Gammage 1990.
[14] Except, of course, land reserved for public uses and land already purchased. Applications for conditional purchase could only be lodged at Land Offices on days when Land Agents were in attendence.
[15] 'Report of Inquiry into the State of the Public Lands, and the Operation of the Land Laws', p. 13. NSW, Legislative Assembly, *Votes and proceedings,* 1883, vol. 2.
[16] William J. Lyne, NSW, *Parliamentary debates*, 11 August 1881, p. 615.
[17] 'An Act for regulating the Alienation of Crown Lands' (25 Vic. no. 1; 18 October 1861), s. 13.
[18] 'An Act to declare and amend the Laws relating to Crown Lands' (39 Vic. no. 13; 10 August 1875), s. 5.
[19] 39 Vic. no. 13, s. 40.
[20] In debate on Section 40 in the Legislative Council (*Sydney Morning Herald*, 10 July 1875, p. 6) it is clear that fencing and buildings were its main concern. See also the comments of Messrs Michael Fitzpatrick (NSW, *Parliamentary debates*, 7 July 1881, p. 49), Thomas Garrett (p. 53 and 3 August 1881, p. 442), E. A. Baker (28 July 1881, p. 372), Charles Fawcett (3 August 1881, pp. 461-2), William Lyne (3 August 1881, p. 446), and Sir John Robertson (28 September, p. 1341).
[21] William Abbott, NSW, *Parliamentary debates*, 3 August 1881, p. 459 and Charles Fawcett, NSW, *Parliamentary debates*, 3 August 1881, p. 461.

[22] Ex parte O'Dwyer, NSW Supreme Court Reports, New Series vol. 2, 1879.
[23] Lands Acts Amendment Act Declaratory Bill.
[24] Legislative Council, 18 June 1879; reported in *Sydney Morning Herald*, 19 June 1879, p. 2.
[25] 'An Act further to amend the Lands Acts of 1861 and the Act of 1875' (43 Vic. no. 29; 25 May 1880).
[26] 43 Vic. no. 29, s. 15.
[27] See for example Frederick Darley, NSW, *Parliamentary debates*, 28 September 1881, p. 1342; also John McElhone, NSW, *Parliamentary debates*, 1 September 1881, p. 929, who alleged that Ogilvie had 'insidiously inserted' the clause in the 1880 Act with the intention of making ringbarking an improvement.
[28] Abbott thought he may have originated the idea of claiming compensation under the new Act. NSW, *Parliamentary debates*, 3 August 1881, p. 459
[29] NSW, *Parliamentary debates*, 29 March 1881, pp. 1205-18; *Sydney Morning Herald*, 28 March 1881, p. 5. The decision of Mr Bayliss was not the first to award compensation for ringbarking far in excess of its actual cost. Other examples are given in NSW, *Parliamentary debates*, 29 March 1881.
[30] NSW, *Parliamentary debates*, 7 July 1881, p. 45; Ex parte George Thomas, NSW Law Reports, vol. 2, 1881.
[31] See, for example, the argument of Charles Fawcett, NSW, *Parliamentary debates*, 7 July 1881, p. 52.
[32] NSW, *Parliamentary debates*, 28 July 1881, p. 372.
[33] John McLaughlin, NSW, *Parliamentary debates*, 11 August 1881, p. 616.
[34] See, for example, 'Ringbarking timber', *Richmond River Express*, 16 April 1881, which expresses a selector's concerns on the topic.
[35] John McElhone, NSW, *Parliamentary debates*, 3 August 181, p. 439.
[36] E. A. Baker, Secretary of Mines, NSW, *Parliamentary debates*, 28 July 1881, p. 372.
[37] 'An Act to regulate ringbarking on Crown Lands and to limit claims for compensation under the fifteenth section of the "Lands Acts Further Amendment Act of 1880"' (45 Vic. no. 8; 24 November 1881).
[38] James Farnell, NSW, *Parliamentary debates*, 1 September 1881, p. 938.
[39] James Farnell, NSW, *Parliamentary debates*, 3 August 1881, p. 455.
[40] William Brodribb, NSW, *Parliamentary debates*, 29 March 1881, p. 1211.
[41] William Brodribb, NSW, *Parliamentary debates*, 3 August 1881, p. 464.
[42] James Douglas, NSW, *Parliamentary debates*, 3 August 1881, p. 463.
[43] Leopold de Salis, NSW, *Parliamentary debates*, 28 September 1881, p. 1347-1348.
[44] John McElhone, NSW, *Parliamentary debates*, 3 August 1881, p. 438.
[45] James Hoskins, NSW, *Parliamentary debates*, 29 March 1881, p. 1208.
[46] Charles Pilcher, NSW, *Parliamentary debates*, 3 August 1881, p. 456.
[47] Sir Patrick Jennings, NSW, *Parliamentary debates*, 4 August 1881, p. 497.
[48] Charles Fawcett, NSW, *Parliamentary debates*, 29 March 1881, p. 1215.
[49] Charles Fawcett, NSW, *Parliamentary debates*, 3 August 1881, p. 462.
[50] Charles Fawcett, NSW, *Parliamentary debates*, 29 March 1881, p. 1215.
[51] E. A. Baker, NSW, *Parliamentary debates*, 7 July 1881, p. 51.
[52] Henry Dangar, NSW, *Parliamentary debates*, 3 August 1881, p. 453.
[53] John McElhone, NSW, *Parliamentary debates*, 10 August 1881, pp. 576-77.
[54] John McLaughlin, NSW, *Parliamentary debates*, 10 August 1881, p. 583.
[55] Michael Fitzpatrick, NSW, *Parliamentary debates*, 7 July 1881, p. 49.

[56] James Garvan, NSW, *Parliamentary debates*, 10 August 1881, p. 585.
[57] James Garvan, NSW, *Parliamentary debates*, 17 August 1881, p. 677.
[58] Clarke 1876.
[59] Garvan quoted extensively from the article by Dr Hugh Cleghorn on forests in *Encyclopaedia Britannica* (9th ed., vol. 9, 1879, pp. 397-408).
[60] Robert King, NSW, *Parliamentary debates*, 28 September 1881, p. 1345.
[61] Robert King, NSW, *Parliamentary debates*, 28 September 1881, p. 1346.
[62] Hughes 1994: 186.
[63] Grove 1994, 1997.
[64] Woodward 1708: 220; quoted in Chinard 1945: 452.
[65] Webster, On the Supposed Change in the Temperature of Winter, see footnote in Marsh 1864: 156.
[66] David Lowenthal, in Introduction to 1965 edition of *Man and Nature*.
[67] Mueller lectured in June 1871 on the subject 'Forest Culture in its Relations to Industrial Pursuits'. Reprinted in Cooper 1876.
[68] Clarke 1876: 212.
[69] Clarke 1876: 213, paraphrasing Woolls.
[70] Woolls, W., 'The wonders of the Australian vegetation', address to the Horticultural Society of New South Wales, Sydney, 6 September 1876; see *Sydney Morning Herald*, 7 September 1876. This address was published as a chapter entitled 'Wonders of Australian Vegetation' in Woolls 1879: 87-115.
[71] Powell 1976: 59-64 especially. See also *Age*, 3 October 1865; *Argus*, 16 October 1865; 'Report on the advisableness of establishing state forests', *Victorian Parliamentary Papers*, 1864-65, 4, no. 77.
[72] Maiden 1902.
[73] Indeed, the whole question of the influence of *Man and Nature* in Australia is one which might profitably be re-examined.
[74] Appendix No.7, 'Forest Vegetation on the Coast', in Clarke 1876.
[75] Joseph Abbott, NSW, *Parliamentary debates*, 3 August 1881, p. 459.
[76] Moore, discussion in Clarke 1876: 230.
[77] 'Return respecting ringbarking timber', NSW, Legislative Assembly, *Votes and proceedings,* 1880-81, vol. 2, pp. 481-482.
[78] Five years was the maximum term of a pastoral lease in the unsettled districts or the second class settled districts (formerly intermediate districts) under the *Crown Lands Occupation Act* 1861.
[79] 'Annual Report of the Forest Branch, Department of Mines' (combined report for 1882 and 1883), p. 6, NSW, Legislative Council, *Journal,* 1883-84, vol. 2.
[80] 'Ringbarking on Crown Lands. Particulars of permissions granted', NSW, Legislative Assembly, *Votes and proceedings,* 1883-4, vol. 3, pp. 279-288.
[81] 'Annual Report of the Forest Branch, Department of Mines' (combined report for 1882 and 1883), pp. 6, 24, NSW, Legislative Council, *Journal,* 1883-84, vol. 2; 'Annual Report of the Forest Branch, Department of Mines' (for 1884), pp. 3, 29, NSW, Legislative Council, *Journal,* 1885-86, vol. 2.
[82] 'Ringbarking on Crown Lands. Particulars of permissions granted', NSW, Legislative Assembly, *Votes and proceedings,* 1883-4, vol. 3, pp. 279-288.
[83] Woolls 1879: 91.
[84] That is not to say that permits granted from 1875 to 1881 did not also contain conditions. Little is known, however, of this period.

[85] ‘An Act to regulate the Alienation Occupation and Management of Crown Lands and for other purposes’ (48 Vic. no.18; 17 October 1884).
[86] ‘Annual report, Forest Branch, Department of Mines’ (for 1885), p. 7, NSW, Legislative Council, *Journal,* 1885-86, vol. 2. The Forest Branch Annual Report for 1885 is the last to deal with ringbarking. Lands Department Annual Reports dealt with ringbarking from 1885.
[87] ‘Ringbarking on Crown lands. Return showing permissions granted since 31 March, 1881’, NSW, Legislative Assembly, *Votes and proceedings*, 1887-8, vol. 5, p. 507.
[88] Gill 1893: 530.
[89] ‘My Country’; published in *The Closed Door* (Australasian Authors’ Agency, Melbourne, 1911), and previously in the *Spectator* (1908), but written c.1904.

REFERENCES

Abbott, W. E. 1880. Ringbarking and its effects. *Journal and Proceedings of the Royal Society of New South Wales* **14**: 97-102.

Baker, D. W. A. 1958. The origins of Robertson’s land acts. *Historical Studies* **8**: 166-82.

Chinard, G. 1945. The American Philosophical Society and the early history of forestry in America. *Proceedings of the American Philosophical Society* **89**: 444-88.

Clarke, W. B. 1876. Effects of forest vegetation on climate. *Journal and Proceedings of the Royal Society of New South Wales* **10**: 179-235.

Cooper, E. 1876. *Forest Culture and Eucalyptus Trees*. San Francisco: Cubery & Company.

Cunningham, P. M. 1827. *Two Years in New South Wales*, vol. 2. London: Henry Colburn (facsimile edition, 1966, Adelaide: Libraries Board of South Australia).

Gammage, B. 1990. Who gained, and who was meant to gain, from land selection in New South Wales? *Australian Historical Studies* **24**: 104-22.

Gill, W. 1893. Deforestation in South Australia: its causes and probable results. *Australasian Association for the Advancement of Science* **5:** 527-36 (5th meeting, Adelaide, S.A.).

Grove, R. H. 1994. A historical review of early institutional and conservationist responses to fears of artificially induced global climate change: the deforestation-desiccation discourse 1500-1860. *Chemosphere* **29**: 1001-13.

Grove, R. H. 1995. *Green Imperialism: Colonial Expansion, Tropical Island Edens, and the Origins of Environmentalism, 1600-1860*. Cambridge: Cambridge University Press.

Grove, R. H. 1997. *Ecology, Climate and Empire: colonialism and global environmental history 1400-1940*. Cambridge: The White Horse Press.

Hughes, J. D. 1994. *Pan’s Travail: Environmental problems of the Ancient Greeks and Romans*. Baltimore: John Hopkins University Press.

Karr, C. 1974. Mythology vs. reality: the success of free selection in New South Wales. *Journal of the Royal Australian Historical Society* **60**: 199-206.

Lull, H. W. 1949. Forest influences: growth of a concept. *Journal of Forestry* **47**: 700-5.

Maiden, J. H. 1894. Notes on Ringbarking and Sapping. *Agricultural Gazette of New South Wales* **5**: 14-39.

Maiden, J. H. 1902. Forests considered in their relation to rainfall and the conservation of moisture. *Journal and Proceedings of the Royal Society of New South Wales* **36**: 211-40.

Marsh, G. P. 1965 [1864]. *Man and Nature or Physical Geography as Modified by Human Action* Cambridge: Belknap Press (originally published 1864).

Powell, J. M. 1976. *Environmental Management in Australia, 1788-1914*. Melbourne: Oxford University Press.

Robinson, M. E. 1974. The Robertson land acts in New South Wales, 1861-84. *Institute of British Geographers, Transactions.* no. 61: 17-33.

Woodward, J. 1708. Some thoughts and experiments concerning vegetation. In *Miscellanea curiosa. Containing a Collection of Curious Travels as they have been Delivered in to the Royal Society* I. London.

Woolls, W. 1879. *Lectures on the Vegetable Kingdom, with Special Reference to the Flora of Australia.* Sydney: C. E. Fuller.