*Bothalia* 11, 1 & 2: 153–157 (1973)

# The effect of the wagon building industry on the Amatola Forests

M. J. WELLS*

## INTRODUCTION

Selective timber cropping has made the recognition of primary plant communities in the Amatola Forests extremely difficult. No complete record of timber cropping in these forests is available. To reconstruct the effects of this cropping a study has been made of the reasons for and side effects of the extraction of selected tree species from these forests.

King (1941) describes the intensive exploitation to which many indigenous forests in the Eastern Cape have been subjected. He estimates that the mountain forests situated mainly on the Amatolas and subsidiary ranges, and aggregating about 26 300 ha (65 000 acres) have probably yielded upwards of 340 000 $m^3$ (12 million cubic ft) of timber during the 90 years prior to 1941. The percentage composition of the cut between 1892 and 1938–39 is given as: 67% yellowwood (presumably both *Podocarpus falcatus* and *Podocarpus latifolius*), 25% wagon woods (unspecified), 3% sneezewood (*Ptaeroxylon obliquum*), and 5% other species (unspecified).

Much of the woodcutter's activities were concentrated in the lower, more accessible parts of the forests, which often contained the best timber. King writes, "To-day these parts resemble scrub and give one the erroneous impression that they never contained large sized timber trees".

From Forestry Department and sawmill records it is clear that much of the main timbers cut, *Podocarpus falcatus* (common or outeniqua yellowwood) and *Podocarpus latifolius* (real yellowwood) was used for building and mining timbers, for railway sleepers and uses other than in wagon-building. But an assessment of the other timber species selectively removed from the forests can only be obtained by a study of the wagon-building industry.

Sim (1906) states that, ever since South Africa has had a European population, wagon-making has been one of its largest permanent industries. He then quotes an article based on census figures for 1891 giving the chief localities where the wagon-building trade was carried on as:— Paarl, Worcester, Oudtshoorn, Grahamstown and King William's Town—the total output for the year being about 3 000 wagons, 4 000 carts and 450 other vehicles.

The wagon-building industry in the Eastern Cape is now extinct, with the closure of the last wagon-building firm, Robert Ballantine and Co., of Keiskammahoek. Except where otherwise indicated, the following facts have emerged from a study of this firm's operations.

*Botanical Research Institute, Department of Agricultural Technical Services, Private Bag X 101, Pretoria.

I am deeply indebted to the owner of the firm, Mr. Wiltse Ballantine who has patiently answered my questions, and placed his firm's books dating from 1886 at my disposal. Without his interest and co-operation this survey would not have been possible. My thanks also go to his staff, especially to his wagon-maker, Mr. P. L. Fourie, whose 42 years in the trade, a family one, ensures the reliability of the observations.

'Ballantines' started sawing wagon timber from the Amatola Forests in 1893, and in 1902 commenced wagon-building using local timbers only. In 1913–14 they started buying wagon wood of indigenous species from Knysna, and later exotic timbers replaced indigenous ones in some parts of the wagons. These and other developments can only be discussed, however, when the various wagon parts have been identified and described (see Figs. 1, 2 and 3). The total output of the Keiskammahoek industry will then be calculated and an attempt will be made to link it with local forests in terms of intake of sound timber and discard of unsound timber. Side effects of timber extraction including damage due to clearings about saw pits and slip paths will also be referred to in a subsequent paper.

## AN INTRODUCTION TO WAGON PARTS AND TIMBERS

### *Wagon Parts*

To aid in the identification of parts, as many names as possible have been included in the captions to Figs. 1, 2 and 3. Authority for the use of the names, many of which combine English and Afrikaans terms, is indicated as follows:— (B) Ballantine and Co. 1928–1964, Mr. W. Ballantine and staff 1965; (W) Walton, 1952; (S) Sturt, 1963, and (Sim) Sim, 1906.

There is some confusion in the use of the term 'bed' as applied to wagons. In this matter Sturt (1963) has been followed. He describes the term 'axle-tree' as having given way to 'axle-bed' when all-wood axles carved from a single tree, gave way to axles with metal, wheel-bearing arms which were bedded into wood. Now axles are all-metal but they are still bedded into the lowest piece of wood in the undercarriage, which is thus an 'axle-bed' and not an 'axle-tree'. Nor is the 'draai-board', which is not adjacent to the axle, an 'axle-bed' (see Fig. 1).

To avoid confusion, the term 'body' is preferred to the term 'bed' when referring to that part of the wagon that receives the load.

Ballantines have produced a variety of vehicles, including buck wagons, block trolleys, spring or horse trolleys, scotch carts and skey carts, and special orders such as coal carts and manure carts. This paper will concentrate on the main production line, the buck

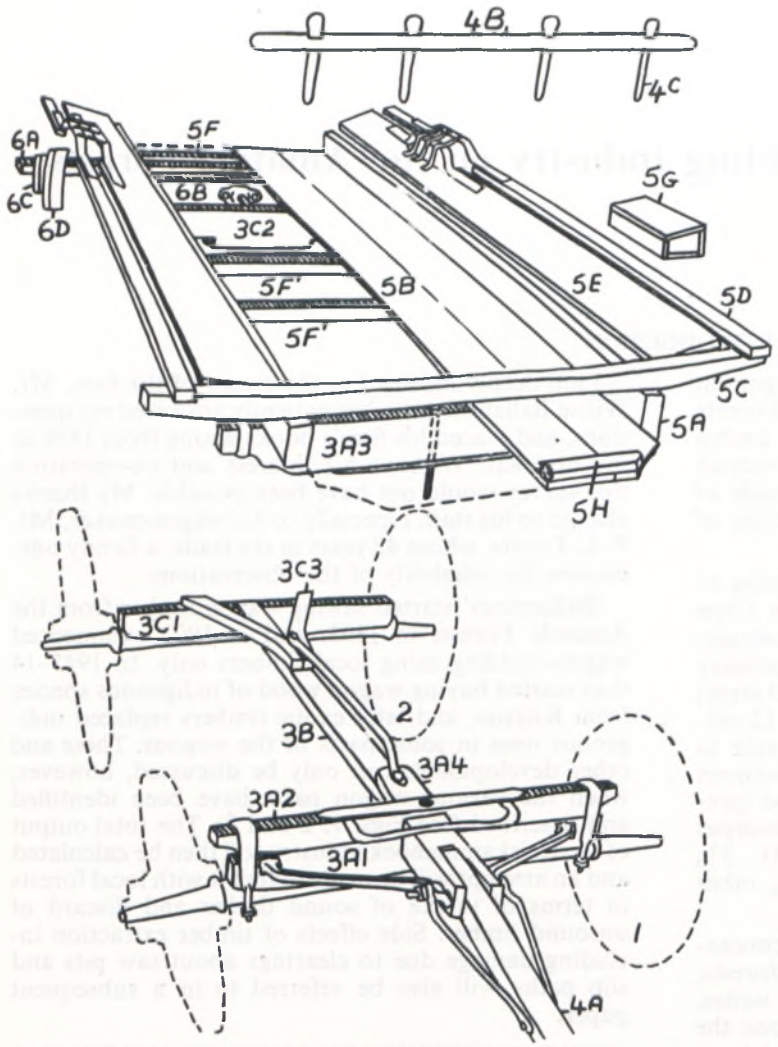


FIG. 1. The wooden parts of a Ballantine Buck Wagon with over-irons and a Cape brake

1. Fore or front wheels (B)—see Fig. 3.
2. Hind or back wheels (B)—see Fig. 3.
3. Onderstel (B,W), undercarriage (S).
   - 3 A Front or fore stel (B) fore carriage (S).
   - 3 A 1 Front axle-bed, bed (B,S), ex-bed (S), front. axle-tree, voorasboom (W).
   - 3 A 2 Draai board (B,Sim), upper axle-bed, bed (W).
   - 3 A 3 Front schamel, schamel (B), schamel (W), pillar or pillow? (S), bolster? (S).
   - 3 A 4 Foretongue (B,W), voor-tang (W).
   - 3 B Wood longwagon, longwagon (B), houtlangwa (W), pole (S).
   - 3 C Back or hind stel (B), hind carriage (S).
   - 3 C 1 Back axle-bed, bed (B,S), rear axle-tree, agterasboom (W).
   - 3 C 2 Back or hind schamel, schamel (B), skamel (W).
   - 3 C 3 Guide (B), after-tongue, agtertang (W).
4. Towing pieces
   - 4 A Disselboom (B, W), pole (W,S), shaft, sharps (S).
   - 4 B Yoke (B,W,Sim).
   - 4 C Yoke skey (B).
5. Wagon—bed (B), Body (S).
   - 5 A Buck-beam (B), side (S), onderleerboom (W).
   - 5 B Bed planks (B), wagon-bottom boards (S).
   - 5 C Krom bar (B), top head (S).
   - 5 D Buck rail, rail (B), outer rave, outrave, rave (S).
   - 5 E Rail plank (B), rave board (S).
   - 5 F Crossbar (B).
   - 5 G Side Box (B).
   - 5 H Toe Piece (B).
6. Cape brake (B).
   - 6 A Long brake bar, long brake, brake bar (B).
   - 6 B Short brake bar, short brake, brake bar (B).
   - 6 C Hard brake block, brake block (B).
   - 6 D Soft brake block, brake block (B).

wagon (Fig. 1). This vehicle in sizes ranging from 3,7 to 5,5 m (12 ft to 18 ft) beam, has been produced to an almost unaltered design by Ballantines since 1902. It is almost identical, in the wooden parts of its undercarriage and body, to the trek wagon with a foretongue, described and illustrated by Walton (1952). Rails, rail planks, krom bar and brake system are the main additions found in the Ballantine Buck Wagon, which also differs from the trek wagon in having a removable tent (Fig. 2). In the buck wagon the buck beams do not also serve as the bottom rail of the tent side, as in the trek wagon illustrated by Walton (1952) and the tent sides do not slope as in a 'kakebeenwa'. Sometimes a 'Natal' forestel, with futchels instead of a foretongue, is fitted to a buck wagon.

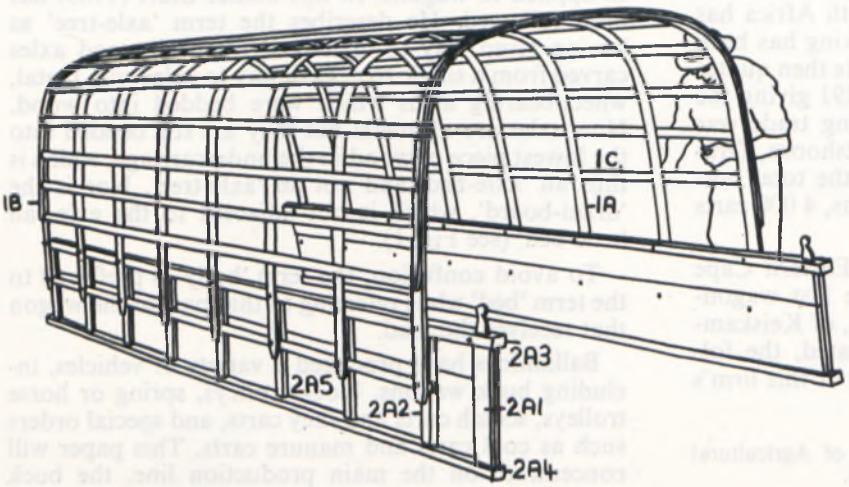


FIG. 2. The wooden parts of a Cape tent

1. Tent (B), kaptent framework (W).
   - 1 A Tent bow (B), arch (W).
   - 1 B Reinforcing bow.
   - 1 C Tent rib (B).
2. Tent sides (B).
   - 2 A Framework (B), ladder*, leer (W).
   - 2 A 1 Leermannetjie skey (B,W), oortjie or little ear skey (W).
   - 2 A 2 Skey (B), leerskei, rung (W), stand, standard (S).
   - 2 A 3 Top rail (B,W), bo-leerboom (W), top rave (S).
   - 2 A 4 Bottom rail (B,W), onderleerboom (W),
   - 2 A 5 Tent plank (B) side board (W,S).

*Sturt (1963) refers to a 'ladder' as a framework for extending the loading capacity of a cart or wagon at the back or front.

The most popular tents manufactured by Ballantines are the 'Cape' and the 'Natal'. The wooden parts of a Cape tent are shown in Fig. 2. Both Cape and Natal tents stand higher and wider than the trek wagon tent, the Cape tent being based on the sloping rail planks and the Natal tent being based on the rails– the outermost and uppermost part of the wagon body.

The Cape tent was often supplied with a cartel or portable bed. Natal tents often had seats fitted over the rail planks and the back of the tent was boarded up at the sides, covering the ends of the seats. Half tents of both Cape and Natal design were made. Wagon front-boxes which also served as driver's seats were supplied with most tented and some untented wagons. Other accessories included locally made water barrels of imported oak.

The wooden parts of a wagon back wheel are shown in Fig. 3. Wagon wheels differ mainly in the size and number of their parts. Back wheels for a 4,8 m (16 ft) wagon usually stand 1,3 m (4 ft 4 inches) high and contain 16 spokes and 8 felloes, whilst front wheels usually stand 1,0 m (3 ft 4 inches) high and contain 10 spokes with five felloes. Back wheels may contain 14, and front wheels 12, spokes.

All the wooden parts usually incorporated in a Ballantine Buck Wagon with Cape tent and Cape brake have been listed and some reference to variation in size and design have been made. In order to calculate the effect on the forests of building such a wagon it is necessary to know the volume and kind of timber used in making the parts.

Because there are many curved, rounded and interlocking parts in a wagon the volume of the finished product is difficult to calculate accurately, and varies from vehicle to vehicle. The volume of rough timber from which a wagon is derived also varies, two of the main variables being the amount of unsound timber discarded between the sawpit and the wagon shop, and the sizes of sound timber available. The only relatively stable timber volume which can be calculated accurately is that of the smallest rectangular pieces of sound timber from which wagon parts of known dimensions can be cut. This volume henceforth referred to as the minimum volume is shown in Table 1, and is standard for 4,8 (16 ft) Buck Wagons. The 'finished' volumes shown in Table 1 refer to a particular vehicle, and were calculated by deducting off-cut volumes from the minimum volume.

Since the down-cutting of sound, rough timber to minimum volume starts months or years before the parts are finished and used, the sound, rough timber volume used in a particular vehicle could not be calculated. The 'rough' volumes in Table 1 average the examples of down-cutting of sound timber, encountered at Ballantines and in the Cata forest near Keiskammahoek during 1965.

The percentage wastage or discard of sound timber during the making of a wagon can be calculated if the volume of the finished product is compared with that of the sound, rough timber from which it is derived. The figure obtained, 58 % of the rough timber volume, may seem unduly great, but several factors should be taken into account. Firstly, the tall, straight-boled

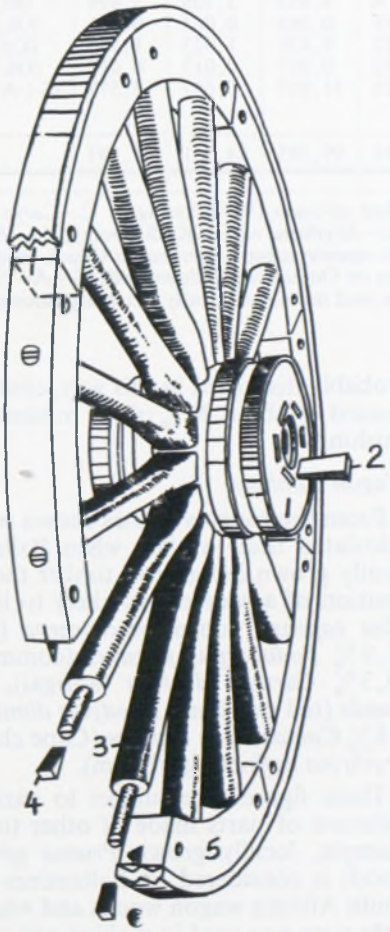


FIG. 3. The wooden parts of a wagon wheel

1. Nave (B,W), stock, hub (S).
2. Nave wedge (B).
3. Spoke (B,W,S).
4. Spoke wedge (B).
5. Felloe (B,W,S), felling (B).

TABLE 1. The species and volume of sound timber used by R. Ballantine and Co., in building a 4,8 m (16 ft) buck wagon with over-irons, Cape brake and Cape tent

| Name of part | Number of parts | Volume in cubic feet† | | | Species* | | |
|---|---|---|---|---|---|---|---|
| | | Rough | Minimum | Finished | 1902 | 1920 | 1965 |
| Front axle bed | 1 | 1,000 | 0,542 | 0,494 | (OL) | (OL) | (OL) |
| Draai board | 1 | 0,694 | 0,425 | 0,366 | (OL) | (OL) | (OL) |
| Front schamel | 1 | 1,192 | 0,621 | 0,578 | (OL) | (OL) | (OL) |
| Foretongue | 1 | 3,472 | 2,250 | 0,905 | (OL) | OL | OL |
| Long wagon | 1 | 1,222 | 1,139 | 1,009 | (OL) | OL | *Em* |
| Back axle bed | 1 | 1,000 | 0,541 | 0,489 | (OL) | (OL) | (OL) |
| Back schamel | 1 | 1,192 | 0,621 | 0,552 | (OL) | (OL) | (OL) |
| Guides | 2 | 2,812 | 1,312 | 0,656 | (OL) | (OL) | (OL) |
| Disselboom | 1 | 1,333 | 1,278 | 1,116 | (OL) | OL | *Em* |
| Back yoke | 1 | 0,791 | 0,703 | 0,317 | (Cc) | (Cc) | (Cc) |
| Other yokes | 3 | 2,000 | 1,806 | 0,810 | (Cc) | (Cc) | (Cc) |
| Yoke skeys | 16 | 0,389 | 0,336 | 0,254 | (Cd) | (Cd) | (Cd) |
| Buck beams | 2 | 5,333 | 4,664 | 3,886 | (OL) | (OL) | *Em* |
| Bed planks | 5 | 8,590 | 7,965 | 7,226 | (Pf) | (Pf) | *P* |
| Krom bar | 1 | 1,217 | 0,730 | 4,87 | (OL) | (OL) | (OL) |
| Buck rails | 2 | 1,333 | 1,168 | 1,021 | (OL) | OL | *Em* |
| Rail planks | 2 | 3,000 | 2,630 | 2,190 | (Pf) | (Pf) | *P* |
| Crossbars | 3 | 1,563 | 1,248 | 1,043 | (OL) | (OL) | (OL) |
| Side box | 1 | 0,999 | 0,916 | 0,573 | (Pf) | (Pf) | (Pf) |
| Toe piece | 1 | 0,124 | 1,04 | 0,082 | (OL) | (OL) | (OL) |
| Long brake | 1 | 1,276 | 0,949 | 0,800 | (OL) | OL | OL |
| Short brake | 1 | 0,911 | 0,678 | 0,470 | (OL) | (OL) | (OL) |
| Hard brake blocks | 2 | 0,340 | 0,292 | 0,270 | (OL) | (OL) | (OL) |
| Soft brake blocks | 2 | 1,166 | 0,626 | 0,358 | (Ec) | (Ec) | (Ec) |
| Tent bows | 8 | 1,596 | 1,376 | 1,368 | (Cc) | *C* | *Ed* |
| Reinforcing bows | 2 | 0,344 | 0,186 | 0,180 | (Cc) | *C* | *Ed* |
| Tent ribs | 18 | 1,350 | 1,350 | 1,332 | (Pf) | (Pf) | *Ed* |
| Leermannetjie skeys | 2 | 0,104 | 0,070 | 0,062 | (Dc) | (Cd) | (Cd) |
| Other skeys | 16 | 0,833 | 0,480 | 0,439 | (Cd) | (Cd) | (Cd) |
| Top rails | 2 | 1,169 | 1,120 | 0,854 | (OL) | OL | *Em* |
| Bottom rails | 2 | 1,335 | 1,280 | 1,114 | (OL) | OL | *Em* |
| Side boards | 3 | 3,976 | 3,810 | 3,627 | (Pf) | (Pf) | (Pf) |
| Naves | 4 | 4,853 | 3,105 | 2,499 | (Pf) | Ba | (Pf) |
| Nave wedges | 48 | 0,063 | 0,063 | 0,031 | (OL) | (OL) | (OL) |
| Spokes | 52 | 8,829 | 1,923 | 1,543 | (Cd) | Cd | Cd |
| Spoke wedges | 52 | 0,017 | 0,017 | 0,017 | (OL) | (OL) | (OL) |
| Felloes | 26 | 31,967 | 5,687 | 2,579 | (S+A) | (S+A) | (S+A) |
| Total | 288 | 99,385 | 54,031 | 41,597 | | | |

*The following initials have been assigned to species: Ba—*Burkea africana* (Wild Syringa); C—*Carya* sp. (Hickory); Cc—*Calodendrum capense* (Cape Chestnut); Cd—*Curtisia dentata* (Assegai); Ec—*Erythrina caffra* (Kaffirboom); Ed—*Eucalyptus diversicolor* (Karri); Em—*Eucalyptus maculata* (Australian Spotted Gum); OL—*Olea capense* subsp. *macrocarpa* (Black Ironwood); P—*Pinus* sp. or spp. (Baltic deal and Oregon Pine); Pf—*Podocarpus falcatus* (Common or Outeniqua Yellowwood); S+A—*Socolopia mundii* (Red Pear) and *Apodytes dimidiata* (White Pear). Initials of exotics are in italics, and initials of locally cut indigenous species are in brackets

†1 Cubic foot = 0,028 316 8 m.

forest trees available in South Africa, together with changes in wagon design favouring the use of more straight parts have eliminated from the art of wagon building in South Africa the practice described by Sturt (1963) of cutting curved wagon parts from similarly curved tree trunks. Secondly, the decline of the wagon trade has made it uneconomic to keep a large variety of sizes of wagon timbers in stock.

Wagon parts are often cut from unnecessarily large timbers, but the larger offcuts from e.g. foretongue timbers, are sometimes used for making small parts such as hard brake blocks and wedges.

Thirdly, the wagon maker aims to reduce the weight of his vehicle as far as possible without reducing its strength. Sturt (1963) estimates that in making a Surrey farm wagon . . . "the eighth part at least of the weight of squared wagon timber was taken away with the draw-shave". Timber discard of this sort is certainly not as great as one eighth of the weight of a Ballantine wagon, but several cubic feet of timber are probably discarded in this way, contributing to a total discard of about 24% of the minimum volume during finishing.

*Wagon Timbers*

From the rough volumes shown in Table 1 it can be calculated that in 1902 when Ballantines used only locally grown indigenous timber the percentage composition of a wagon was likely to have been: 28,7% *Olea capensis* subsp. *macrocarpa* (black ironwood), 22,9% *Podocarpus falcatus* (common yellowwood), 10,3% *Curtisia dentata* (assegai), 32,1% *Scolopia mundii* (red pear) and *Apodytes dimidiata* (white pear), 4,8% *Calodendron capense* (Cape chestnut) and 1,2% *Erythrina caffra* (kaffirboom).

These figures are subject to variation due to the inclusion of parts made of other timber species. For example, locally grown *Prunus africana* (red stinkwood) is considered by Ballantines to be the best of South African wagon woods and when available in the right sizes was used in making any part of a wagon.

Between 1913 and 1914 Ballantines found that the longer wagon timbers were best made of timber from Knysna, a fact which was attributed to the Knysna wood being of longer and straighter grain than that locally grown. From this date disselbooms, longwagons, buck beams and buck rails, representing 9,3% of the total rough volume of wood in a wagon, were often made from Knysna timber, mainly *Olea capensis* subsp. *macrocarpa* (black ironwood). More recently, as timber cutting in local forests slowed down, foretongues, long brake bars and other wagon parts have also been made of black ironwood from Knysna. Spokes and felloes of other indigenous woods, the species not always known, have also been obtained from Knysna.

Hardwood naves of *Burkea africana* (wild syringa), from the Transvaal, were also sometimes used in preference to naves of locally grown *Podocarpus falcatus* (common yellowwood). In the 1920's a wagon made entirely of indigenous timbers might have had a local timber content of as little as 42% of the rough volume. But, as local felloes were preferred, the local timber content was usually nearer 74% of the rough volume.

Up until the 1920's some wagons were made entirely of indigenous timbers but thereafter exotic timbers, especially *Eucalyptus maculata* (Australian spotted gum) and *Eucalyptus diversicolor* (karri) replaced Knysna timber in the disselboom longwagon, buck beams and buck rails. After 1924 some bed planks and rail planks were made of Baltic pine and of Oregon pine in preferance to *Podocarpus falcatus* (common yellowwood) which often warped, resulting in split and wastage, when sawn into 3,75 cm (1½ inch) thick planks. Only 2,5 cm (1 inch) thick planks of common yellowwood are now used—in making the tent side, and side box. The total contribution of indigenous timber to the last Ballantine wagons made was usually about 80% of their rough timber volume, about 66% being locally grown.

## REFERENCES

WALTON, J., 1952. *Homesteads and Villages of South Africa*. Pretoria: J. L. van Schaik. 71–78.

BALLANTINE, R. & Co., 1928, 1931, 1942 and 1964. Price lists of wagon wood.

STURT, G., 1963. *The Wheelwright's Shop*. University Press: Cambridge.

SIM, T. R., 1906. *The Forests and Forest Flora of the Colony of the Cape of Good Hope*. Aberdeen: Taylor & Henderson, 58, 60–62, 295.

KING, N. L., 1941. The exploitation of the indigenous forests of South Africa. *J. S. Afr. For. Ass.* 6: 26.