Department of
Primary Industries and
Regional Development
GOVERNMENT OF
WESTERN AUSTRALIA

Journal of the Department of Agriculture, Western Australia, Series 4

Volume 10
Number 12 *December, 1969*

Article 2

1-1-1969

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A L. Prout

Recommended Citation

Prout, A L. (1969) "Water storage has not kept pace with stock numbers : South Stirling survey finding," *Journal of the Department of Agriculture, Western Australia, Series 4*: Vol. 10: No. 12, Article 2.
Available at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol10/iss12/2

WATER STORAGE HAS NOT KEPT PACE WITH STOCK NUMBERS

SOUTH STIRLINGS SURVEY FINDING

By A. L. PROUT, Adviser, Soils Division, Albany

RESULTS of a survey* on water storage capacity in the South Stirlings area indicate that farm water storage has not kept pace with increased clearing and stock numbers. This has resulted in many farmers requesting advice on water conservation projects following two consecutive years of low rainfall runoff.

Results of the survey, of 35 farms, show a wide variation in the amount of water storage per farm, and per sheep equivalent.† A summary of the survey results is given in Table 1.

Table 1.—Water storage survey results

	Average	Range
Total area	2,723 acres	1,010–7,000
Cleared area	1,647 acres	510–6,000
Sheep equivalents (S.E.)	4,444	700–16,000
S.E. per cleared acre	2·7	0·6–4·5
Water storage capacity	16,853 cu. yds	4,000–54,000
Water storage capacity per S.E.	3·8	0·9–22·3
Dam size	1,960 cu. yds	1,000–4,850

Description or the area

Rainfall

The official recording station for the area is situated at Kojaneerup. Table 2 shows the average monthly rainfall at the recording station.

Table 2.—Average rainfall—Kojaneerup

J	F	M	A	M	J	J	A	S	O	N	D	Year
67	71	119	137	212	251	212	203	188	182	115	85	1,842

The rainfall is well distributed and very light. The incidence of heavy rain is rare and over the last 15 years, records show that the average number of days per year receiving more than 30 pts. is only 13. The average number of days receiving more than 50 pts. is 7, and the average number of days receiving more than 100 pts. is 2.

Soils

Soils are generally sandy with up to three feet of sand overlying clay. Minor soil types have clay closer, varying from 6-30 inches below the surface.

Farming

Sheep grazing for wool production is the main enterprise with some cropping of oats and barley.

Water storage and stocking rates

The climatic conditions normally enable good pasture growth but this, together with deep sandy soils and low intensity rainfall, leads to reduced runoff and unfilled dams. Excavated earth tanks are the main means of water storage in the area but the average size is only 1960 cubic yards and their depth less than 12 feet.

Farmers who relied only on dams said, in the survey, that 3.8 cubic yards was insufficient to carry stock through a summer preceded by a dry winter. Half the farmers who had storage ratios greater than 3.8 cubic yards per S.E., also stated that they had insufficient water.

The amount of water storage available per head of adult stock decreased as stock numbers increased. It also decreased as

* The survey was conducted to supply a basis for the formation of accurate recommendations. It is emphasised that the survey was undertaken in early 1969 when prospects for 1969 appeared normal.

† A sheep equivalent is taken as a wether or ewe plus lamb until weaning. For the purposes of this survey a cattle unit was considered equivalent to 10 sheep equivalents.

the area of cleared land increased. The relationships between water storage and these factors are illustrated in Figures 1, 2 and 3. Note that the figures are intended only to show general trends; they could not be fitted to individual farms.

Discussion

Figure 1

Where only a small area has been cleared, farmers provide sufficient water for their stock. However as more land is cleared the water storage per head decreases, i.e., dams are not built as fast as land is cleared.

Figure 1 indicates that where only 1000 acres has been cleared, seven cubic yards of water are stored per head. Where the area cleared reaches 3000 acres, the water stored per head falls to 1½ cubic yards—a dangerous situation.

Figure 2

This graph is similar to Figure 1 in that it again points to a lag in water storage.

Figure 2 indicates that where sheep numbers are low, say 1000, the water stored per sheep equivalent is about 10½ cubic yards. However, as sheep numbers increase to 6000 the water stored per head falls to two cubic yards. This is again a dangerous situation in low rainfall areas.

Figure 3

When stock numbers and cleared area are combined to form a stocking rate, the picture on water storage remains the same. As stocking rate increases, the amount of water available per head decreases.

Where the stocking rate is two sheep per acre, the water available is 6½ cubic yards. Where four sheep per acre are carried the water available per head falls to one cubic yard.

Dam failures

Of the 300 dams included in the survey, 17 per cent. failed because of inadequate or poor catchment. An additional three per cent. failed for other reasons.

Catchment problems

Results of the survey indicated that farmers who provided "roaded catchments" of sizes ranging from one-half to two acres per 1000 cubic yards of excavation did not have success in filling dams.

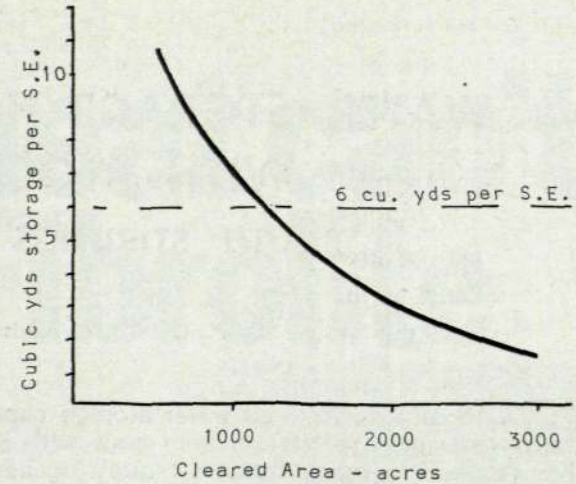


Figure 1.—Relationship between water storage and cleared acreage

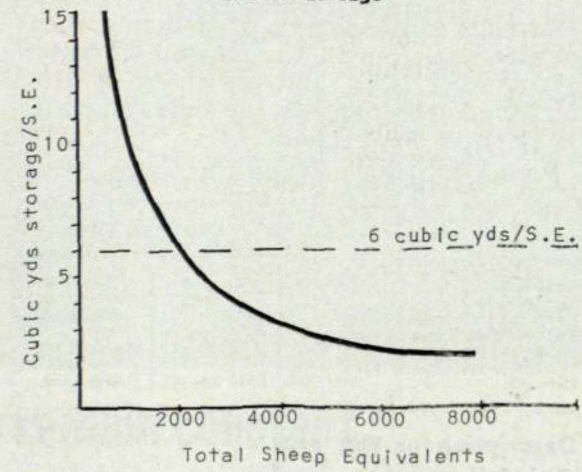


Figure 2.—Relationship between water storage and stock numbers

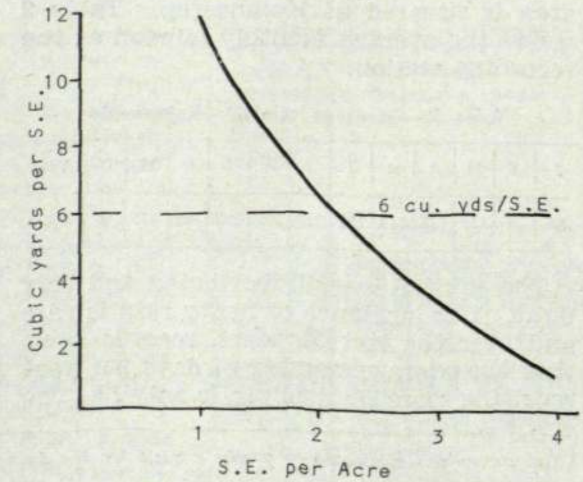


Figure 3.—Relationship between water storage and stocking rate

Catchment problems

Inspection of roaded catchments revealed that they failed for the following reasons:

- Poor construction.
- Unsuitable soil type.
- Wrong grades.
- Lack of maintenance.
- Insufficient area.

Because of the deep sandy soils in the area, "roading" of catchments is expensive and difficult. However, even where soil types were suitable, mistakes had been made in that insufficient clay was brought up and spread over the crowns. Where the clay was not brought up, the area of effective catchment was reduced to narrow strips in the troughs.

Gravelly soils had not sealed well over the "roads" with the result that runoff was reduced.

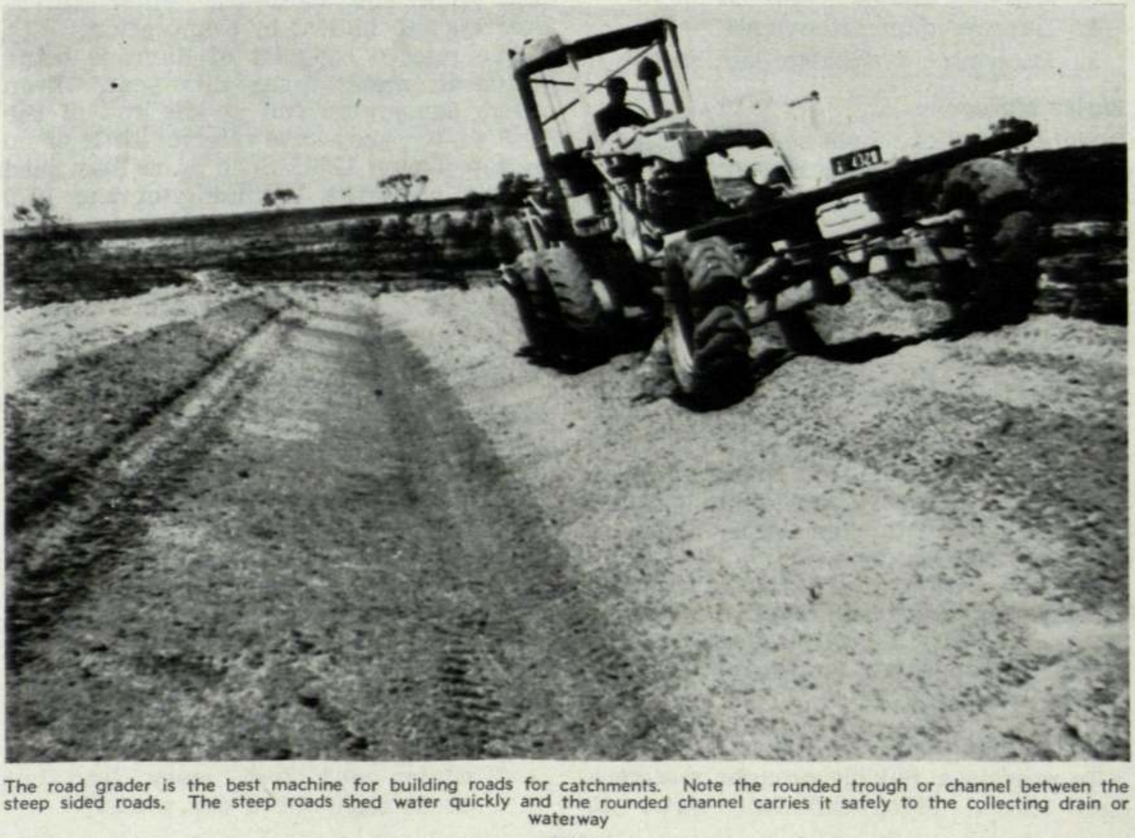
Grades along the roads varied but in most cases in the South Stirlings area, use must be made of whatever natural slope is available.

Contour drains were used on some farms but, because of the deep sand, were not very effective except when intense falls of rain were recorded, or when runoff was caught from rocky ridges or from roads.

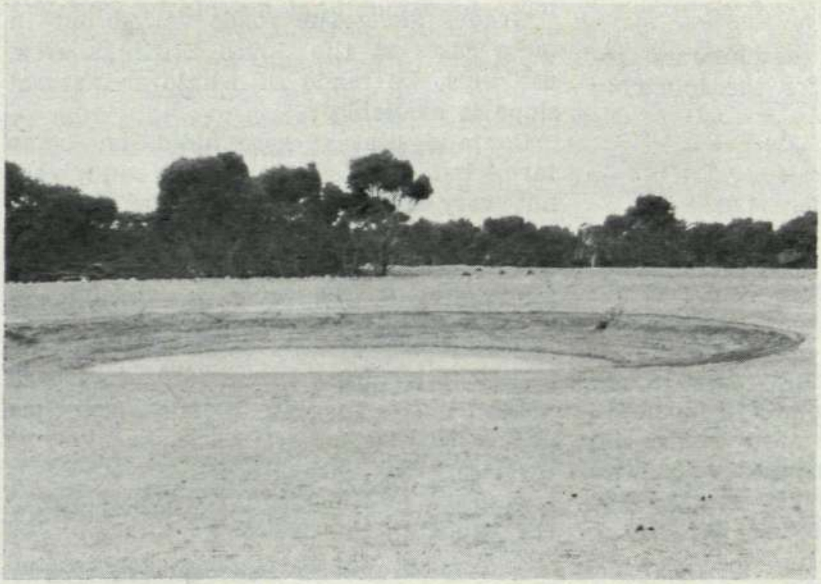
Dam design

Flat batter dams whose banks had been pushed out to increase their surface area were used with moderate success by some farmers. Clay excavated from such dams and spread on the batters further improves the runoff in the dams.

A circular, flat batter dam constructed in the area as a trial had batters 90 feet wide with a slope of slightly less than two per cent. This dam filled during the 1968 winter when other dams on the same property did not.



The road grader is the best machine for building roads for catchments. Note the rounded trough or channel between the steep sided roads. The steep roads shed water quickly and the rounded channel carries it safely to the collecting drain or waterway



A flat batter dam. The banks have been pushed out and covered with excavated clay to increase runoff

Recommendations to prevent a water shortage

1. Provide water storage first.
2. Plan dam sites.
3. Increase storage capacity.
4. Improve dam catchments.
5. Determine a suitable dam design.

Water storage

Water supplies should be made available on new land before stock numbers are increased. By not increasing water supplies as stock numbers are increased a dangerous water shortage could develop. Water shortage could also mean the expensive, forced sale of livestock.

Dam Sites

Dams should be located before fences are built. Because of catchment problems, good dam sites are hard to find and **maximum** use should be made of those available. Paddocks should be arranged so that each dam can supply water to several paddocks.

As reticulation is often cheaper than constructing dams and improving catchments, the possibility of planning paddock layout around a few large capacity dams should be considered.

Increased Storage

To provide a reliable drought reserve a dam should store sufficient water to supply stock and allow for evaporation over two summer periods with a winter of little or no runoff in between. Over two summers the sheep will drink only about one-quarter of the total depth of water lost from the dam—the other three-quarters will be lost by evaporation.

The reserve capacity of dams is being tested in many areas this year. Even where dams were full at the end of the 1968 winter, they have received little or no in-flow during 1969. Such dams may need to last until the beginning of the 1970 winter, a period of 22 months. A more common situation would be to encounter two winters in succession with low runoff during both of which the dam failed to fill to capacity.

According to the best present knowledge, the seasonal consumption of adult sheep is as follows:

- Spring—92 days at $\frac{1}{2}$ gal. per head per day.
- Summer—92 days at $\frac{3}{4}$ gal. per head per day. (May rise to one gallon or more on hot days with drying winds.)
- Autumn—92 days at $\frac{1}{2}$ gal. per head per day.
- Winter—92 days at $\frac{1}{4}$ gal. per head per day (perhaps a little high for a winter with lush green feed but about right for a dry winter).

With this information, together with an appreciation of the great losses by evaporation, the following recommendations are given for drought reserve dams: in districts south of a line through Katanning and Ravensthorpe:

- **A minimum water depth of 15 feet.**
- **A storage ratio of six cubic yards of water per adult sheep.**

Where these conditions cannot be met, bores or other piped water supplies should be installed as drought reserves.

Dams shallower than 15 feet should not be regarded as safe drought reserves but can be stocked at the rate of three cubic yards of water per adult sheep to make the best use of water for one season only. The stocking rate of three cubic yards per head allows 650 adult sheep to be watered on a 2,000 yard dam, or 1,300 sheep on a 4,000 yard dam, on a year round basis.

Catchment quality and dam depth are important factors when providing water storage. The better the catchment and the deeper the dam, the less need there is for additional storage capacity.

Improved catchments

Catchment areas should be increased where possible by building contour drains. These drains should be cut down to clay and have flat channels.

Roaded catchment should be provided at a rate of at least 2 acres per 1,000 yards of excavation. This rate assumes some runoff from batter and pasture areas and the roads must be well made and maintained.

Roads must be designed and constructed to yield maximum runoff without the problem of erosion. Correct, safe grades must be surveyed for the roads and collecting drains, using the same standard grades as for contour drains.

Discharge end—$1\frac{1}{2}$ inches per 50 feet—for 150 feet.

Main section—3 inches per 50 feet—variable length.

End furthest from dam—6 inches per 50 feet—for 200 to 300 feet.

Roads should be spaced far enough apart to allow enough clay to be obtained for spreading over the crowns. Rolling is essential because it compacts the clay and helps seal the surface to provide better runoff.

Roaded areas should be fenced to exclude stock and kept free of weeds and regrowth. Growth on thinly sealed catchments quickly breaks up the surface and allows rain to penetrate instead of running off.

The table below sets out the road centre widths depending on the depth to clay. Also included is the approximate cost per acre.

Depth to Clay	Distance apart of Roads	Cost per Acre
inches	feet	$
18	60	90
15	50	60
12	40	50
9	30	40

Dam design

Where roaded catchments cannot be formed, dams should be designed to have wide batters. This type of dam depends on clay being reasonably close to the surface to provide enough to seal large areas. These dams, **in fact all dams,** should therefore have small surface areas and be as deep as possible. Deep dams also reduce the proportion of water lost due to evaporation.

Acknowledgments

Acknowledgment is given to those farmers of the South Stirlings area who completed and returned the survey questionnaires. Without this co-operation, recommendations could not have been made.