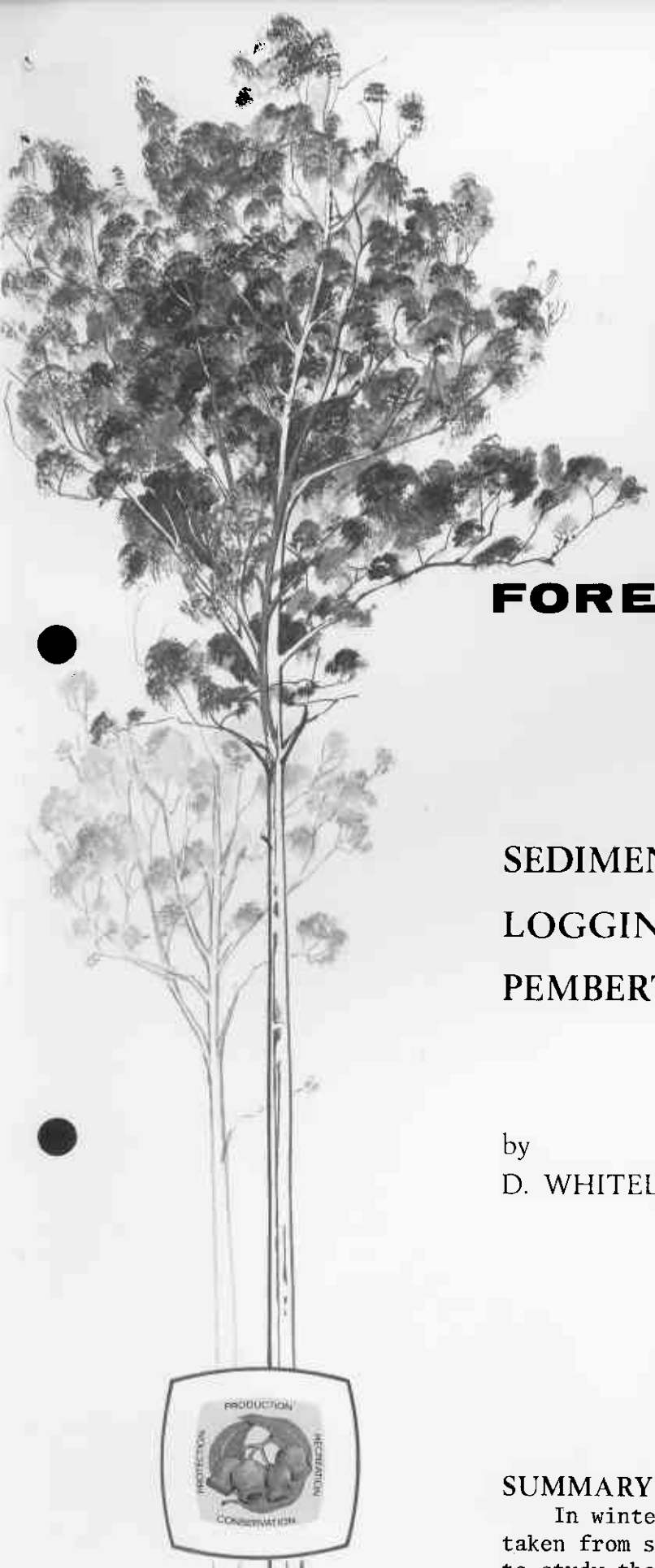

ODC 116.28

Research Paper 43
1978

FORESTS DEPARTMENT
OF WESTERN AUSTRALIA

SEDIMENT IN STREAMS NEAR LOGGING AREAS IN THE PEMBERTON DISTRICT

by
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SUMMARY

In winter 1976 and winter 1977 samples were taken from streams in the forests around Pemberton to study the effect of woodchip logging on stream sediment concentrations. In some cases the concentration of sediment was found to be higher immediately downstream from the logging area than upstream from it.

INTRODUCTION

In 1976 and 1977 studies were conducted to measure sediment concentrations in certain streams in the forests around Pemberton. These studies were part of a programme to monitor the effect of logging undertaken by the woodchip industry. The streams sampled were those passing through areas of forest where logging was in progress. This paper presents the results of these studies.

METHOD

Most samples were taken where road crossings allowed easy access to the stream. Wherever possible, the stream was sampled where it entered the logging area, where it left the logging area and further downstream from the logging area. Each sample was collected in a 300 ml polythene bottle.

The weight of each bottle and its contents was determined. The water was poured through a filter paper of known weight with a pore size of 0.45 μ. The filter paper, with any collected sediment, was then dried in an oven and weighed. Finally the empty sample bottle was weighed. These weights were used to calculate the concentration of sediment in the streamwater in milligrams per litre.

In 1976, samples were taken from the cutting coupes on a rainy day, whereas in 1977 samples were taken from each coupe in both wet and dry weather in order to check the possible variation of results in the same season.

RESULTS FOR 1976

The dates on which streams in the different areas were sampled, the rainfall on that day and on each of the three days preceding the visit, are shown in Table 1.

TABLE 1

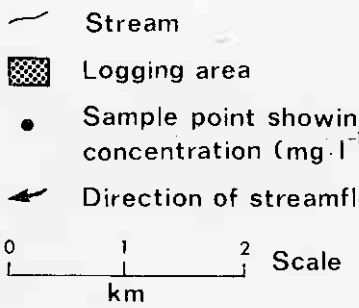
Sediment studies in winter 1976

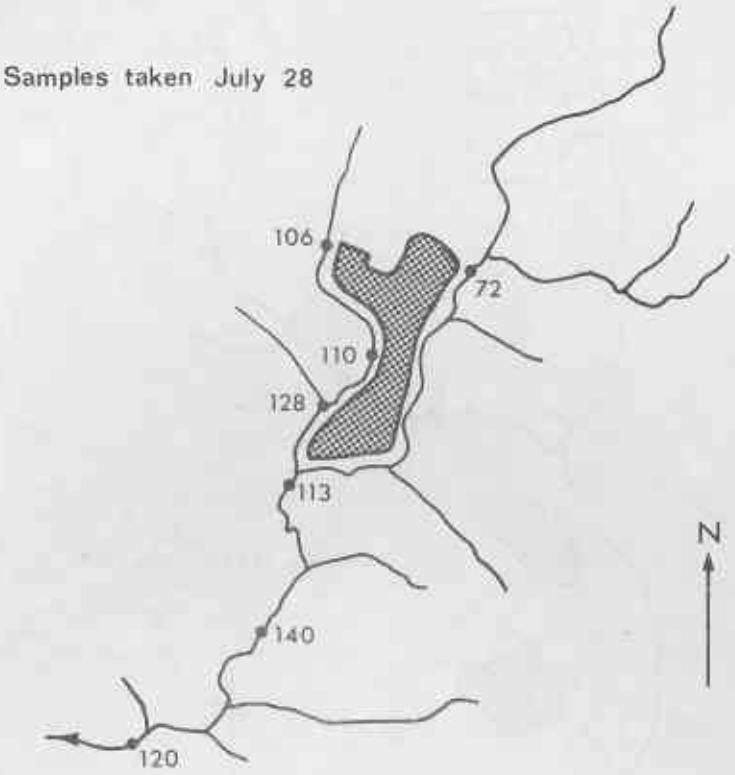
Block	Date		*Rainfall (mm)
Shannon Westcliffe	July	25	Nil
		26	11.2
		27	9.4
		**28	13.6
Iffley	August	10	0.4
		11	Nil
		12	Nil
		**13	6.8
Dombakup Warren	August	13	6.8
		14	10.6
		15	3.3
		**16	5.2
Boorara	August	30	1.6
		31	3.0
	September	1	Nil
		** 2	2.6
Sutton	August	31	3.0
	September	1	Nil
		2	2.6
		** 3	9.0

* as recorded at Forests Department office at Pemberton

** date of stream sampling

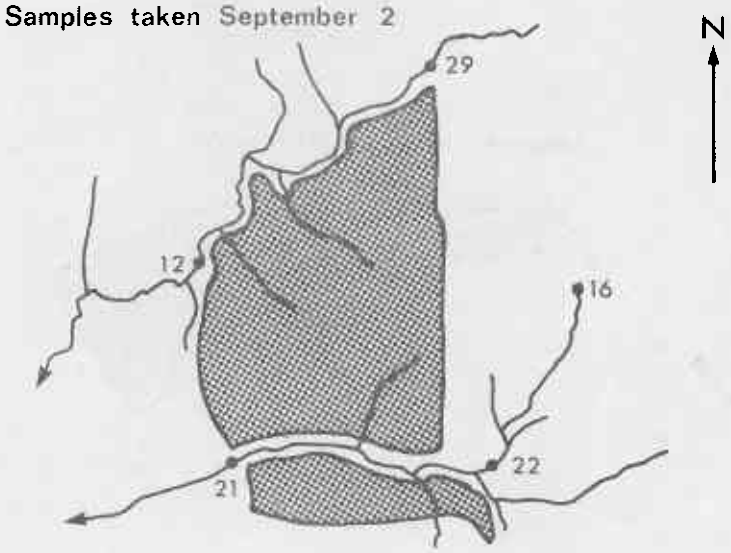
The sediment concentration in each sample taken for the study is shown plotted on the map of the appropriate stream on the following pages. The legend throughout is shown below.





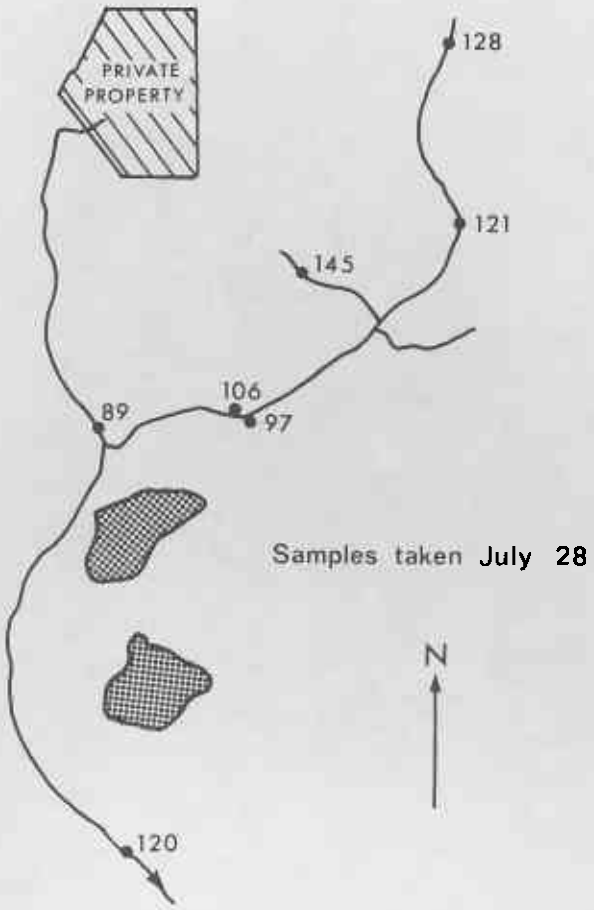
Shannon Block Coupe 8

There was a higher concentration of sediment in the samples taken within, and downstream from, the logging area than upstream. There was enough sediment to give the water a creamy colour.



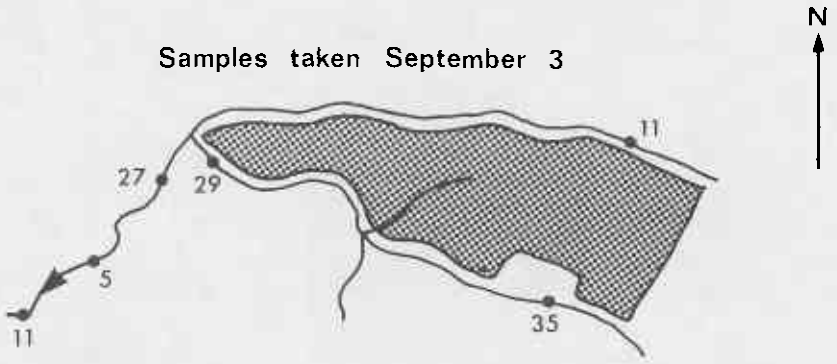
Boorara Block Coupes 9 & 14

There was no increase in concentration of sediment in the streams passing these logging areas, in spite of the fact that these coupes were much larger than Shannon 8.



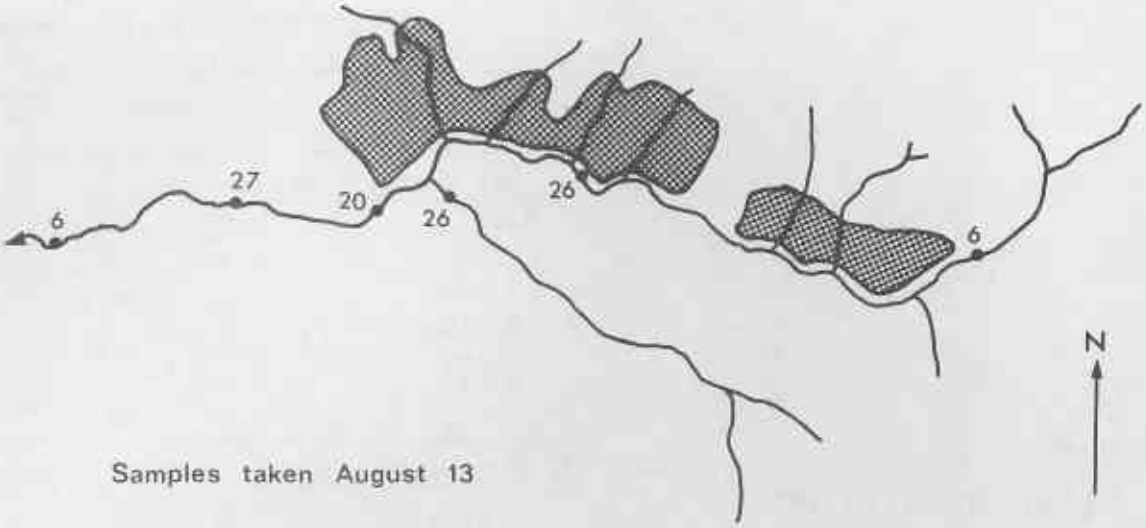
Westcliffe Block Coupe 10

High sediment levels were observed in this area (90 - 140 $mg \cdot l^{-1}$) yet the water was clear. There was no evidence that stream sediment concentration increased downstream from the logging area.



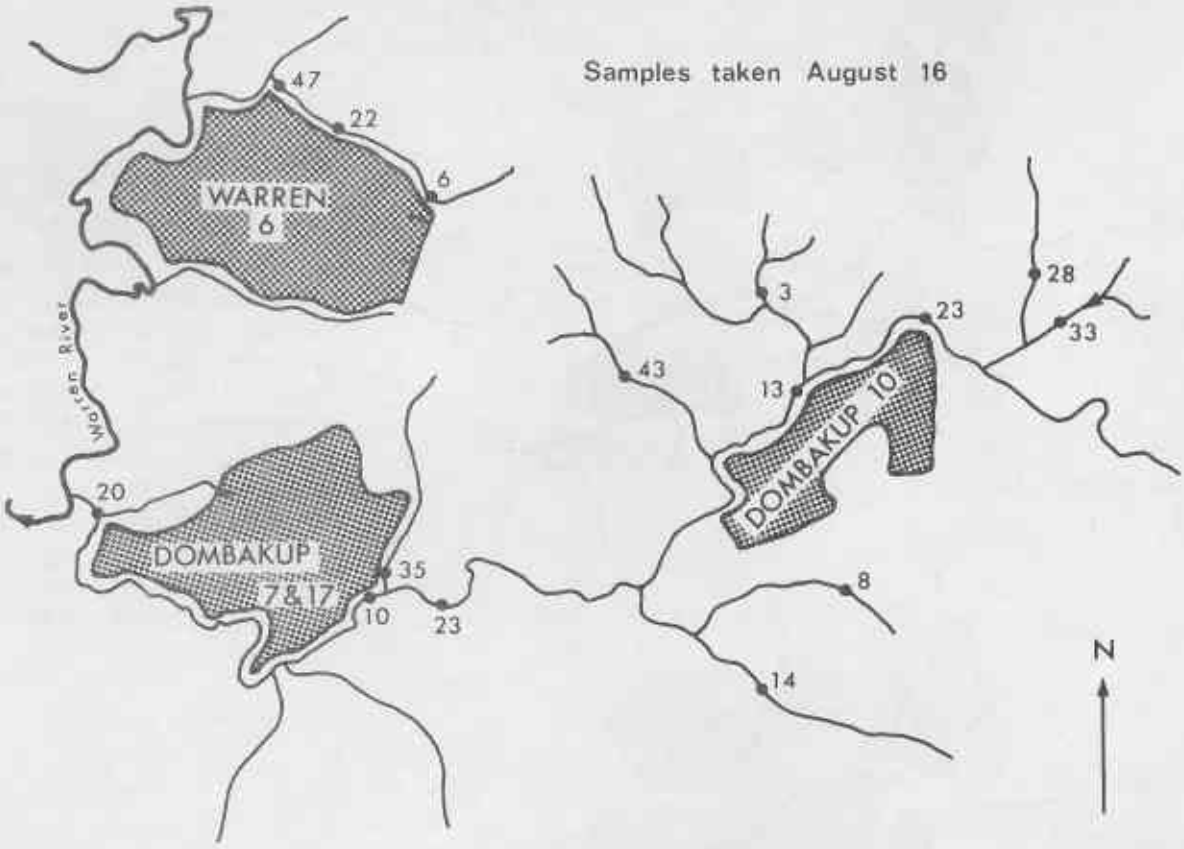
Sutton Block Coupe 12

The two streams passing this coupe showed different concentrations of sediment upstream from the logging area. The concentration of sediment immediately downstream from the logging area was higher than in one tributary, lower than in the other. The sediment concentration decreased further downstream.



ffley Block Coupes 2 & 3

There was a higher concentration of sediment in the samples taken immediately downstream from the logging area than upstream.



Warren Block Coupe 6

Three samples were taken from the stream on the northern boundary of this logging area. These samples showed a steady increase in sediment concentration along the stream in the downstream direction.

Dombakup Block Coupes 7, 10 & 17

There was no evidence of any increase in the concentration of sediment in the streams passing these logging areas.

TABLE 2

Sediment studies in winter 1977

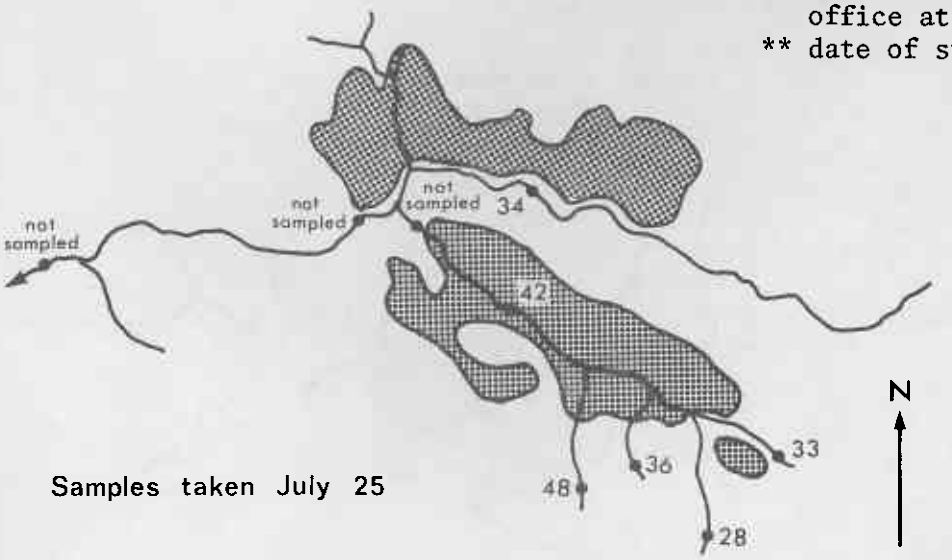
Block		Date	*Rainfall (mm)
Dry weather sample			
Iffley			
Gray	July	22	5.8
Sutton		23	0.8
Brockman		24	1.0
Nairn		**25	Nil
Weld			
Wet weather sample			
Iffley			
Gray	July	29	2.6
Sutton		30	9.0
Brockman		31	Nil
Nairn	August**	1	15.4
Weld			

* as recorded at Forests Department office at Pemberton

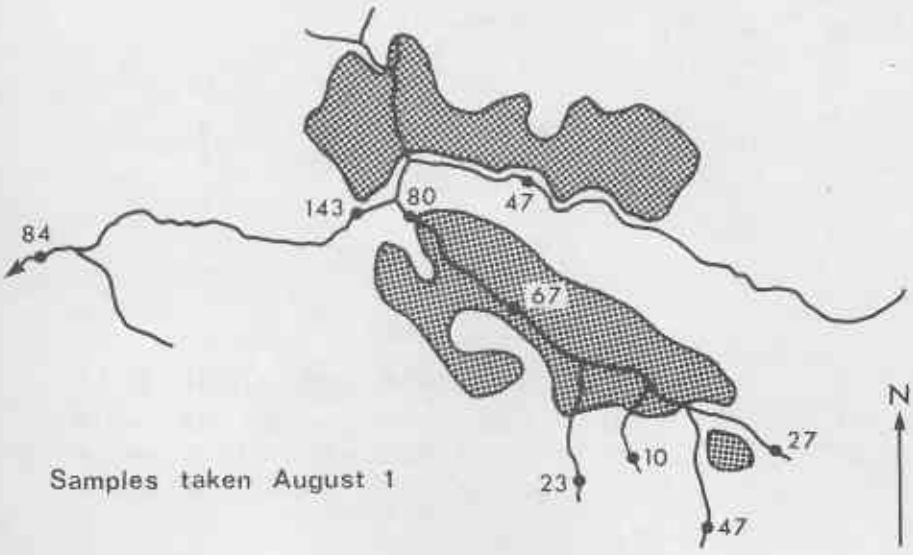
** date of stream sampling

RESULTS FOR 1977

The dates on which streams in the different areas were sampled, the rainfall on that day and on each of the three preceding days are shown in Table 2. Each area was sampled twice, the first time in dry weather and the second time in wet weather a few days later.



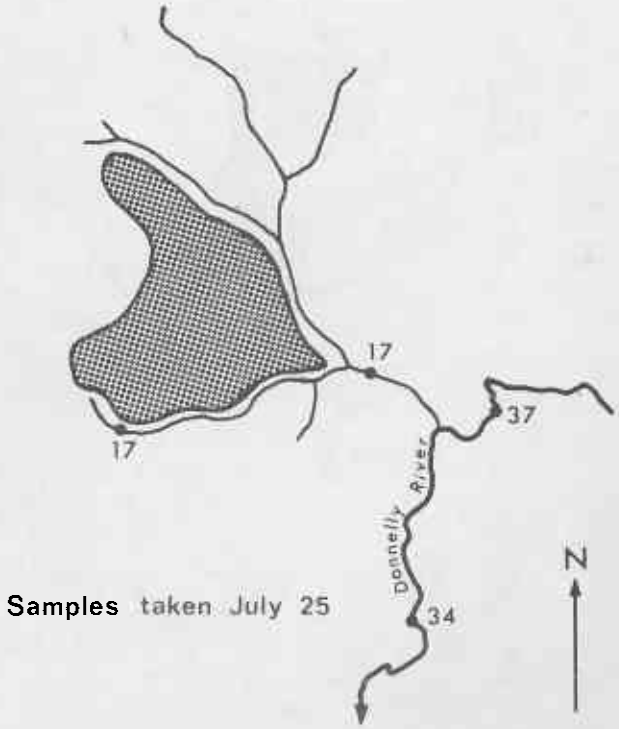
Samples taken July 25

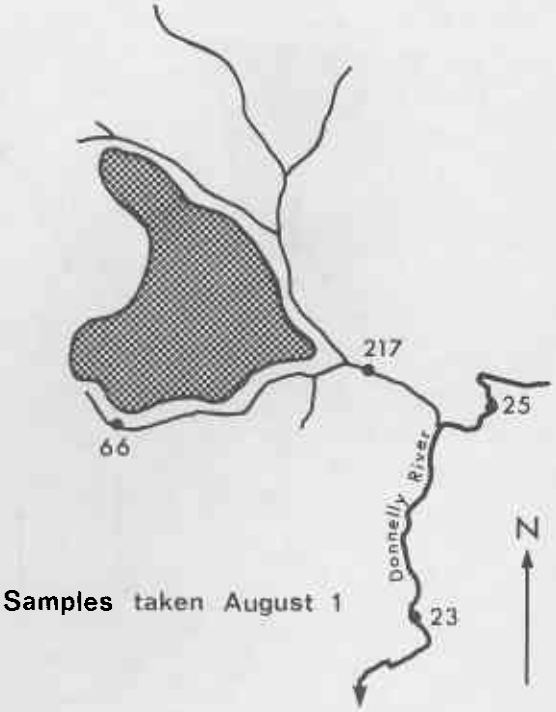


Samples taken August 1

Iffley Block Coupes 2 & 6

Sediment concentrations upstream and downstream from the logging area were much the same in dry weather. In wet weather, the sediment concentration downstream from the logging area was higher than that upstream. When the highest concentration of sediment (143 $mg.l^{-1}$) was measured the stream water had a strong creamy colour.

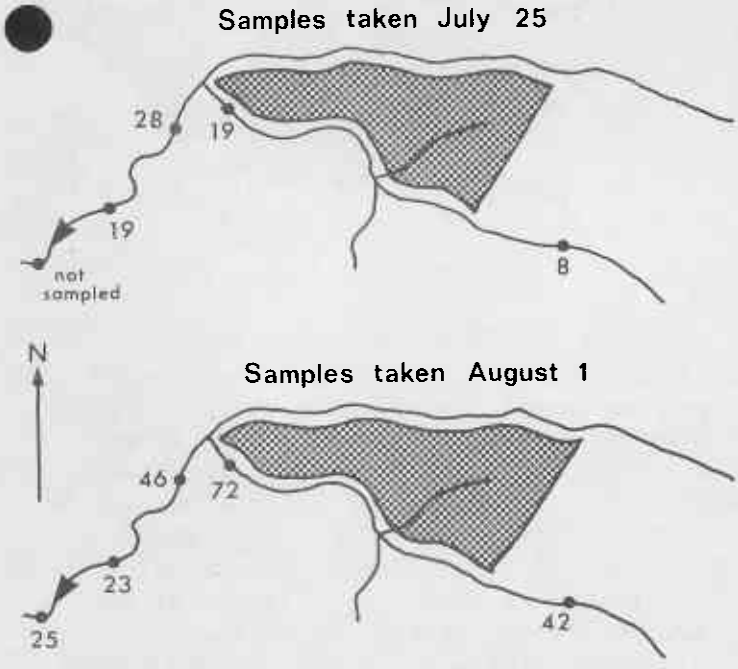




Gray Block Coupe 5

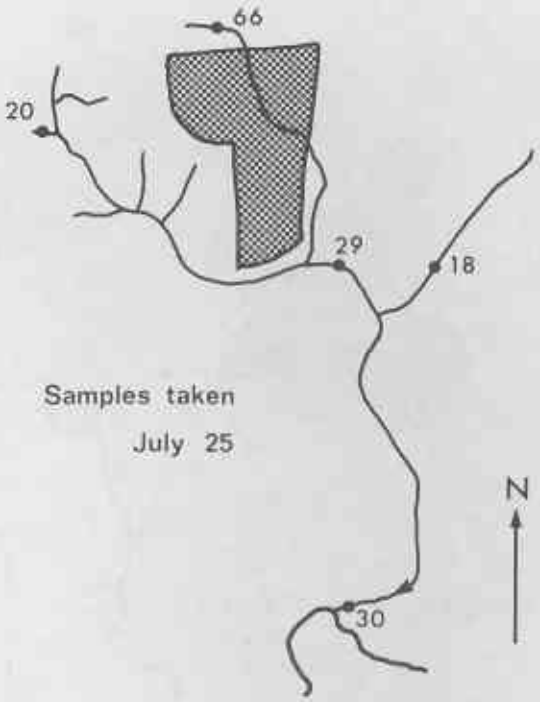
The sediment concentration downstream from the logging area in wet weather was much higher than that upstream and was also sufficiently high (217 $mg \cdot l^{-1}$) to colour the water a strong creamy colour. One kilometre from the logging area the stream joined the Donnelly River, which was not noticeably affected by the sediment.

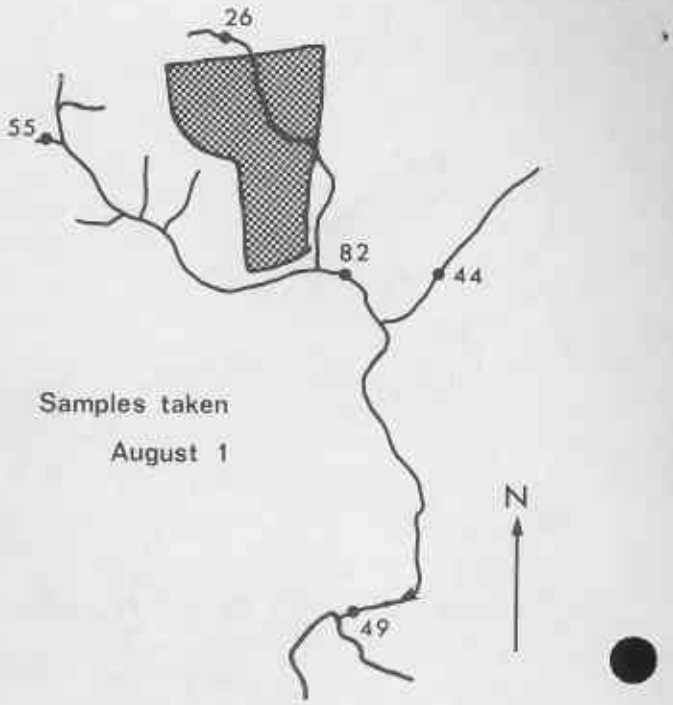
In September, during a heavy rainstorm, the Donnelly River was visibly affected by sediment and the whole river in the vicinity of the Gray Block Coupe had a noticeably creamy colour. Three contributing sources of sediment were observed: the stream flowing from the Gray Block Coupe, the stream flowing from Graphite Block Coupe 8 (a recently logged area) and Pine Creek which crosses the new road constructed for the woodchip industry and also passes through a recently logged area.



Sutton Block Coupe 12

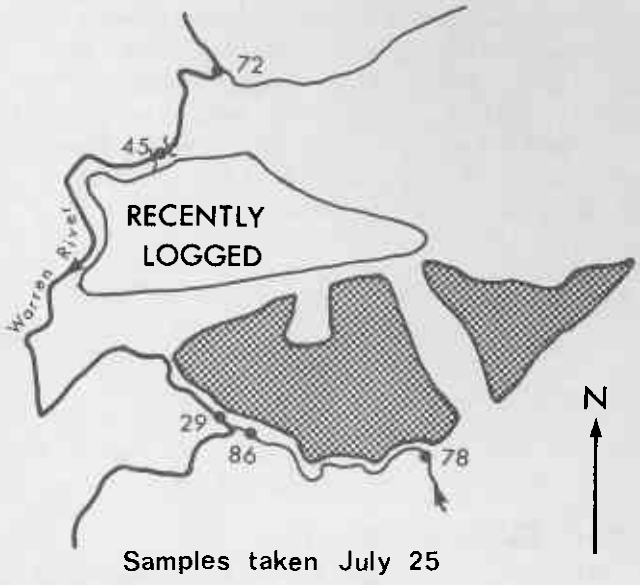
The sediment concentrations immediately downstream from the logging area were greater than those in unlogged forest upstream in both dry and wet weather. Sediment concentrations immediately downstream from the logging area were higher than those further downstream.

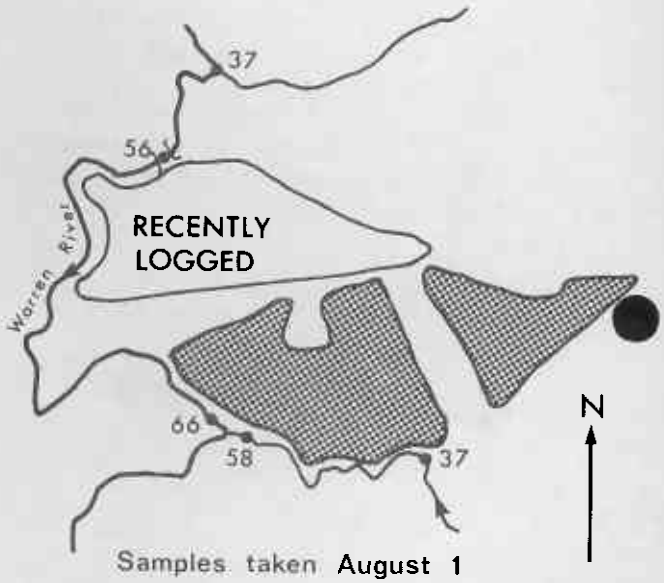




Brockman Block Coupe 9

There was no noticeable increase in sediment concentration downstream from the logging area in dry weather. The sediment concentration downstream from the logging area in wet weather was higher than upstream and also higher than three kilometres further downstream.

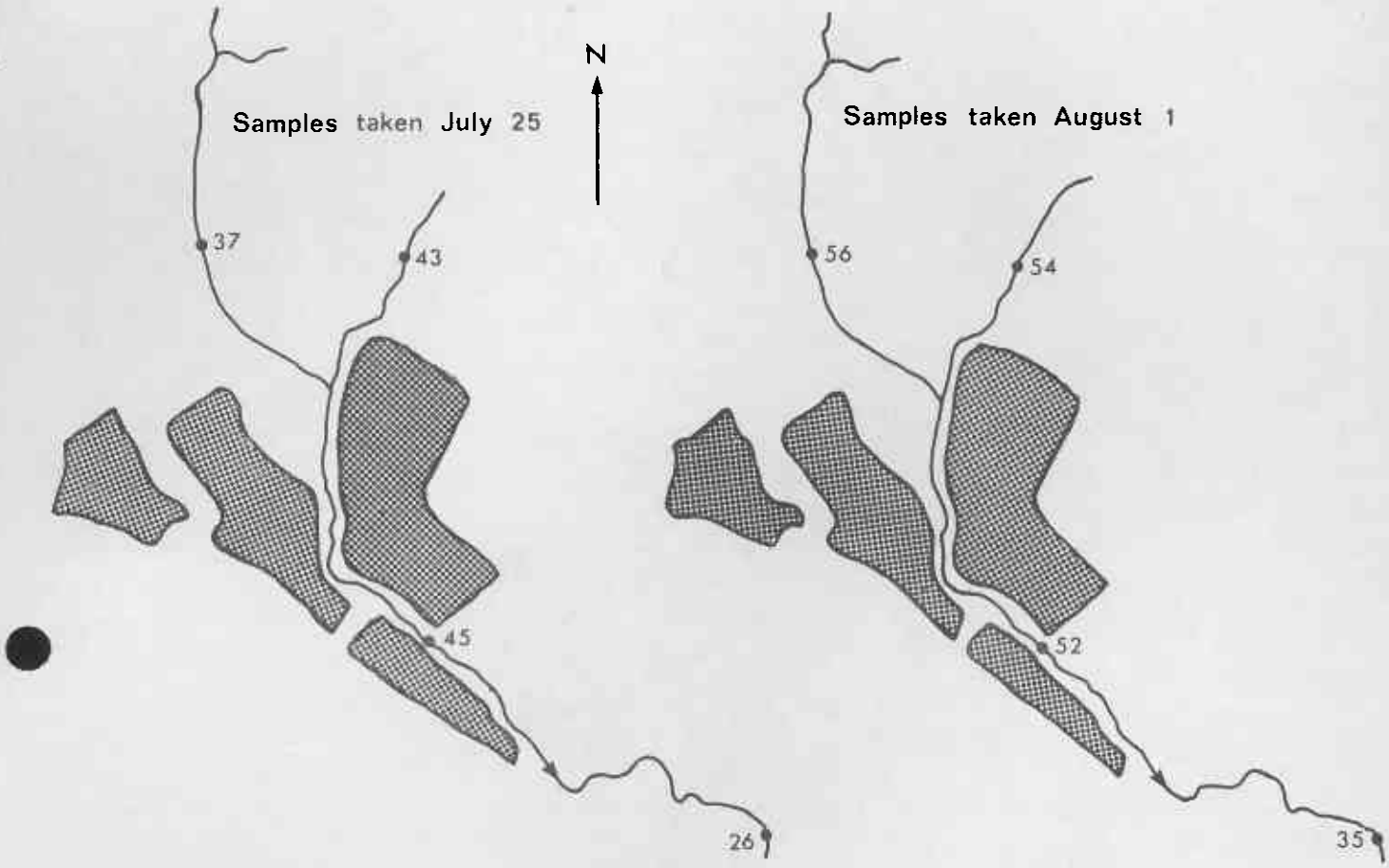




Nairn Block Coupe 9

Samples from three places along the Warren River on the western boundary of the logging area showed no clear pattern of sediment concentration. However, a noticeable increase in sediment concentration did occur in a small stream running along the southern boundary of the logging area during wet weather.

A small concentration of sediment was observed at a sampling point near the bridge over the Warren River on the wet weather sampling day. The bridge carries a newly constructed logging road from which water drained into a nearby stream, which in turn flowed into the river 100 m upstream from the bridge. The stream water had a strong creamy colour which contrasted with the clear waters of the Warren River. Beneath the bridge the river ran over a rapid and the two waters were mixed.



Weld Block Coupes 4 & 5

The sediment concentration downstream from the logging area was much the same as that upstream.

CONCLUSIONS

In 1976, three of the eight coupes studied showed increased sediments immediately downstream from the logging area. In one case the increase was slight indeed (Iffley 2 and 3) and in another it was considerable (Shannon 8). There was marked variation in the "natural" sediment concentration of the streams studied here, varying from 6 $mg \cdot l^{-1}$ to 128 $mg \cdot l^{-1}$. Where there was an increase passing through the logging area, the sediment loads generally returned to the "natural" level within about 2 km downstream.

The 1977 data gave a somewhat different picture. In the dry weather sampling, four out of six coupes showed no increase in sediment concentration, but during wet weather only two of the six coupes had no increase. It was also noticeable in most coupes that the "natural" sediment increased upstream from the coupes during the wet weather.

This paper reports only a preliminary investigation of forest stream sediment concentrations. There is clearly wide variation in natural stream sediment concentrations and there is also variation in concentrations throughout the period of flow. It is evident that logging, particularly during rainy periods, results in greater quantities of sediment reaching the streams in some logging coupes. Why some coupes should show more sediment losses than others is not clear. All streams in the area receive the same protection: no logging is permitted within 100 m of rivers such as the Warren and Donnelly, nor within 50 m of main streams. The differences may be due to the proportion of steep country in certain coupes or to variation in soil properties and logging techniques. Further investigation of these aspects is in progress.