COCOS, (1983) 1, 31–34
Printed in Sri Lanka

Ground water in the coconut triangle

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INTRODUCTION

The major part of Sri Lanka's coconut production comes from the Coconut Triangle, which is the area between Puttalam, Kurunegala and Colombo. More than half the coconut lands in the Coconut Triangle are in the dry and intermediate climatic zones, where the productivity is relatively low due to insufficient rainfall. It was therefore conceivable that the provision of irrigation facilities, sufficient to over come the rainfall deficit and meet the water requirement of the coconut palms, would lead to a substantial increase in coconut production. In addition the intercropping of the coconut lands would be feasible if there is sufficient ground water for these crops as well. It was against this background that this study of the ground water potential was initiated.

In 1973 the author prepared a reconnaisance level map of ground water potential in Sri Lanka. (Anonymous, 1973) This was a first approximation, as it was based on hydrogeological boundaries at a lower scale of mapping. In 1981 a semi-detailed Hydrogeology map was prepared by the author with more sub-divisions of the hydrogeological categories. Based on this map which was of greater accuracy and on a larger scale, a second approximation of the ground water potential was determined.

HYDROGEOLOGY

The accompanying Hydrogeology map of the Coconut Triangle (Fig. 1), which includes parts of the districts of Puttalam, Kurunegala and Gampaha, has been divided into the following major categories, viz.;

1. River Alluvium and Lagoon Deposits.
2. The Littoral Depoists.
3. Laterite Formations.
4. Miocene Limestone.
5. Synclinal Troughs and
6. Rock Outcrops.

These categories have different permeabilities or infiltration capacities and, therefore, for the same rainfall, would have different potentials for ground water extraction. Similarly, different amounts of rainfall would bring about different potentials for ground water extraction within a given category.

There is hardly any ground water available for extraction in the Rock Outcrops. The other five categories have been further subdivided. It must be noted that even within a category there are areas with better ground water recharge, such as those having faults, fractures and joints in the underlying rock and would therefore have a greater accumulation of ground water, in relation to adjacent areas.

In the valley bottoms as well as in the alluviums, surface water is brought in from outside. The ground water potential in these areas are therefore relatively greater as in addition to the recharge from rainfall, there is also infiltration from surface drainage.

GROUND WATER POTENTIAL

On the basis of the hydrogeology of the area as well as on the long term rainfall records the ground water potential was determined for the catchments of the river basins in the coconut triangle. This was computed at the regional scale and the annual average ground water yields in million cubic metres for each basin is given in Table 1., together with the annual average yield per hectare which could be taken as the second approximation.

Table 1 *Ground Water Availability in the Coconut Triangle*

No.	*Basin*	*Area sq. km.*	*Basin Yield* million cu. m. per yr.*	*Annual Average* yield per ha. in cu. m./ha.*
103	Mee Oya	1533.0	113	772
104	Madurankuli Aru	72.5	6	887
105	Kalagamuwa Oya	152.8	12	815
106	Rathambala Oya	217.6	19	913
107	Deduru Oya	2648.9	282	1068
108	Karambala Oya	595.7	70	1176
109	Ratmal Oya	217.5	29	1374
110	Maha Oya	1528.1	189	1243

*Second Approximation.

The average yield per hectare of a catchment may be low because of excessive rock outcrops and other low yielding formations. For the purpose of extraction of ground water it is necessary to know the availability of ground water in the various hydrogeological formations and rainfall regimes within a catchment. This information is presented in Table 2.

The Ground Water Potential Map (Fig. 2) gives the location and boundaries of the various categories and their ground water potentials.

Generally, the water table in the valleys and the depressions is higher than in the hilly areas or at higher elevations in the topographical sequence. The water table from the ground surface is within three metres in the river alluviums

NOTE

In areas that are irrigated there is a further addition of water to the ground water body by artificial means trough percolation and is estimated that around 10% of the irrigated issues could be considered further available for extraction.

Littoral. Deposits of both old and recent formation. Near coastline areas fresh water lens present. Salinity is brought by tidal intrusion. Good water bearing formation.	WZ 1800 IZ 1500 DZ 1100		Within 6.m.
Laterite formed by decomposition and leaching of the parent pre cambrian rocks mainly by rainfall. The weathered zone is very deep in the wet zone (over 15 m.) In the intermediate zone it is strongly lateritic and the weathered zone is around 10m. In the dry zone the Red earth overlie the crystaline rock - which is shalowly weathered around 5.m.	WZ 1200 IZ 1000 DZ 800		From 6m. to 20m.
Moderately good water bearing in the W.Z. to poor in the DZ. If parent rock is jointed and fractured even in DZ it would be a moderately good water bearing formation.			
Miocene Limestone with thin overburden of old to recent beach sands. Good water bearing formation.	DZ 1100		Within 6.m.
Synclinal trough Good water bearing	WZ 2400 IZ 2000 DZ 1500		Within 6m.
Rock outcrops poor water bearing			
Faults, Good water bearing			
Rivers			
Basin boundary			
Isohyet			

Source:- 1. The ground water resources of Sri Lanka. By A. D. N. Fernando 1973

2. The water table map of Sri Lanka By A. D. N. Fernando 1975

3. Hydrogeological Map of Ceylon By A. D. N. Fernando 1968

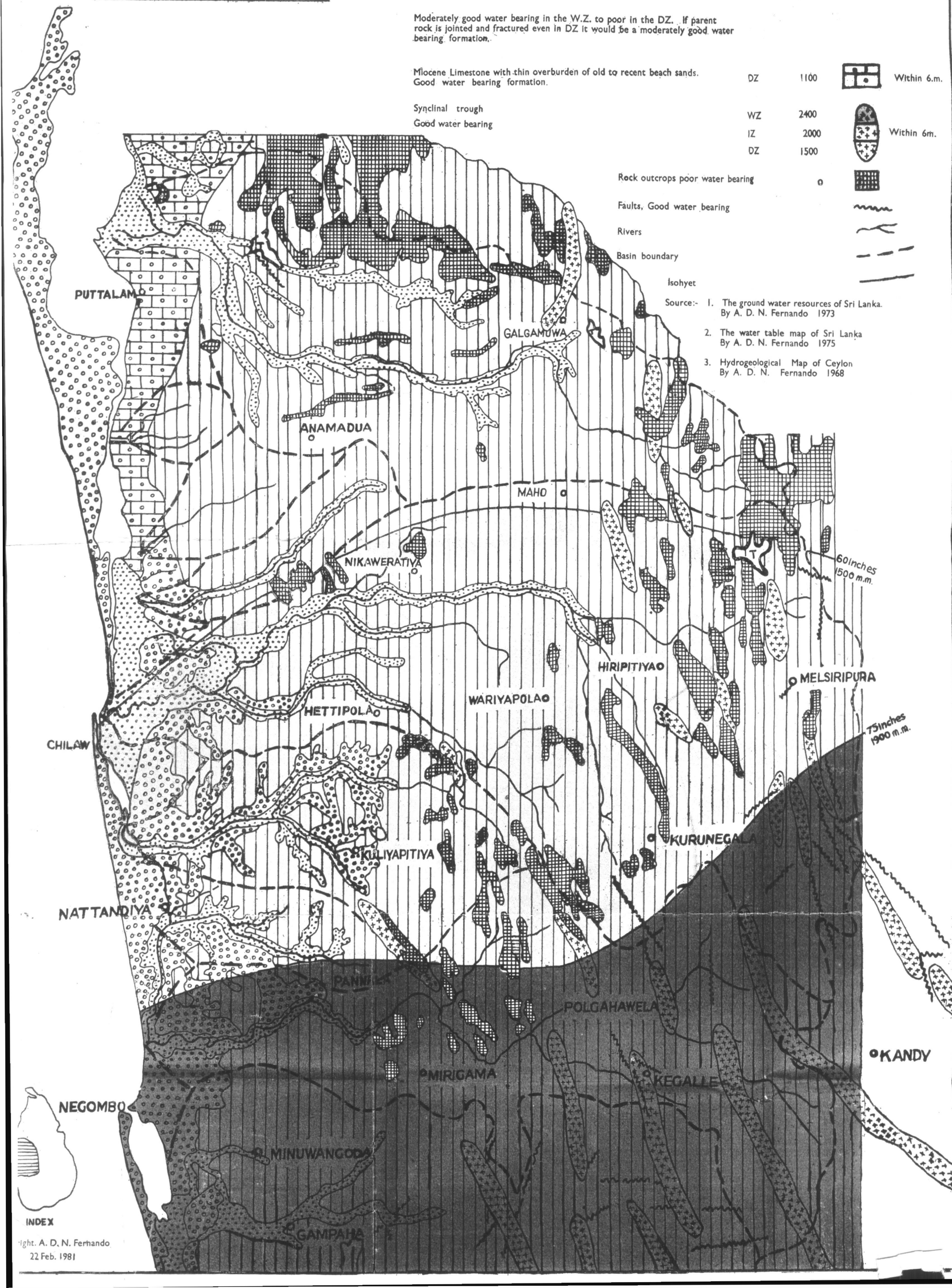

Table 2. *Ground Water Availability in Different Formations*

Basin No.	Basin		Climatic Zone	River Alluvium	Littoral Deposits	Laterite or Lateritic	Miocene Limestone	Synclinal Troughs	Rock Outcrops
				Mean Annual ground water yield Cu. m. per ha.					
103	Mee Oya Catchment	..	DZ	1500	1100	800	1100	1500	0
104	Madurankuli Aru	..	DZ	—	—	800	1100	1500	0
105	Kalagamuwa Oya	..	DZ	—	1100	800	1100	—	0
106	Ratamabala Oya	..	DZ	1500	1100	800	—	2000	0
107	Deduru Oya	..	IZ	2000	1500	1000	—	2000	0
108	Karambala Oya	..	IZ	2000	1500	1000	—	2000	0
109	Ratmal Oya	..	IZ	2000	1500	1000	—	—	0
110	Maha Oya	..	WZ	2400	1800	1200	—	2500	0

Note: DZ — Dry Zone IZ — Intermediate Zone WZ — Wet Zone and within six metres in the littoral deposits. In the miocene limestone formations too it is within six metres while in the lateritic formations, it varies from six to twenty metres depending on the topography. In the structural synclinal formation the water table would vary according to the formation. Semi artesian conditions and even artesian conditions could be met and generally the pesometric surface could be expected within six metres. It has been observed that in deep river alluvium where there are impervious formations beneath, artesian and semi artesian conditions can be expected.

The annual ground water recharge or the availability of ground water annually, varies both with formation and rainfall. It could be generalized that there is less ground water available for extraction as we go further north in the same type of formation, in the Coconut Triangle, as there is less rainfall and therefore less recharge.

Available ground water ranges from around 2400 cu.m. per hectare annually in the river alluvium and the synclinal troughs in the wet zone to 800 cu. m. per hectare in the lateritic formations in the dry zone. There is no extractable ground water in the rock out-crops. The river alluviums and valley bottoms are the most productive sites as these are recharged from drainage waters and the river flow itself in addition to rainfall, and their yields would therefore exceed the values in Table 2.

The ground water potential indicated in the map is the amount of water that could be extracted annually on a long term extraction programme, at micro level and when the whole region is exploited, without affecting the ecology or the environment and the water table. However, it must be mentioned that since ground water has hardly been exploited in these regions, more water than is indicated as the potential could in fact be drawn out without ill effects to the environment.

CONCLUSION

It is well known that long dry spells are harmful to the coconut palm and that generally the yields are best in the wet zone, and lowest in the dry zone. In the intermediate zone, there are areas of both good as well as poor production depending on the soil oonditons and availability of ground water within the root zone.

Although the estimates of the annual rainfall required by the coconut palm have a wide range, it is generally agreed that an even distribution throughout the year is more important than the total rainfall. In areas where there is a bimodal distribution of rainfall in the intermediate zone of the coconut triangle there are two short stress periods between monsoons. While in the dry zone with a single monsoon there is a longer and more intense stress period. In areas where there is ground water or seepage water from tanks available within the root zone the production of the palms are not likely to be adversely affected by the dry spells. However, where ground water is not available within the root zone stress conditions would prevail and the productivity affected considerably. The results of this study indicate that in many areas in the coconut triangle sufficient ground water could be tapped to meet the requirements of the palms during the stress periods.

If there is an excess of ground water available it would be possible to inter-crop coconut lands with pasture. The irrigation of coconut and pasture as a mixed crop has many advantages from the point of view of water utilization. The pastures would act as a good cover crop ~~and~~ improve the organic matter content of the soil thus improving water retention. Also, the pastures have access to the irrigation water at the higher levels, whereas the coconut palm can reach to levels of about five metres thereby making full use of the irrigation water.

Moreover, in the present context of shortage of tillage power for paddy cultivation, beef and milk for human consumption, it would appear that the best strategy for the use ground water in the coconut triangle would be for the mixed cropping of coconut and pasture.

REFERENCES

Anon. (1973). The ground water Resources of Sri Lanka, Ministry of Irrigation Power and Highways, Government Press, 1973.

COCONUT RESEARCH INSTITUTE OF SRI LANKA (CEYLON)

LOCATION

The Head Office, Laboratories and Library of the Coconut Research Institute are situated at Bandirippuwa Estate, Lunuwila, 51 km from Colombo, 27 km from the Colombo International Air Port, Katunayake, 16 km from Negombo, 6 km from Dankotuwa, 5 km from Wennappuwa, and 3 km from the Lunuwila Railway Station.

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(2) Pottukulama Research Station—61 km from Head Office.

(3) Isolated Seed Garden—56 km from Head Office.

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Guest House facilities are available to those visiting the institute, at reasonable rates. However, advance bookings are essential.

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