

# Agronomic, biochemical, flora and fauna analysis of surangam- a traditional, sustainable agrarian water harvesting system of lateritic hillocks of Kasaragod Dist of North Kerala-South India

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## ABSTRACT

Present study focuses on Agronomical, biochemical, flora and faunal analysis of Surangam –a traditional, sustainable agrarian water harvesting system of laterite hills of kasaragod dist of North kerala. Surangam is a horizontal tunnel dug in the slope of lateritic hills. There may be 5000 surangam present in kasaragod district. The construction of surangam are carried out by people having certain indigenous knowledge. Some special flora and fauna are taken as indicator of water where to dig the surangam. Surangam produce cold, crystalline, clear and non-polluted water (No Chemical Oxygen Demand ,chloride, fluoride and iron). Surangam constructed soil is hard, lateritic and have more iron content (2.98 mg/Kg). Flora observed nearby the surangam are Bryophytes (*Pallavicinia sp*), Pteridophytes, Gymnosperm (*Cycas circinalis*) and Angiosperms. Endangered threatened Fauna inside the surangam are *Paradoxurus hermaphroditis*, *Varanus bengalensis*, *Pteropus maxima*, *Hystrix indica*, *Rana tigrina*, *Rana malabaricus*, *Polypedatus maculatus* and *Bufo melanostictus*. Most of the people of hilly rural areas of Kasaragod dist still depend on this traditional water source where there is no public water supply. Surangam is natural erosion of water from top laterite hills need conservation.

**Key words :** Laterite hills, Surangam, Traditional, Agronomy, Flora, Fauna, Conservation

## Introduction

Surangam (Mal-thurangam, Eng-tunnel well) is a traditional Sustainable and agrarian water management system used to provide a reliable supply of water for human settlements and irrigation in Kasaragod District of Kerala. Surangam basically a horizontal tunnel dug in the slope of a laterite hills for about 30 m to 40m, which uses gravitational force for extraction of the underground water and collect in to a storage tank. Most of the surangam of this area where constructed during 1950. There

may be 5000 surangams in Kasaragod dist of kerala. The word 'surangam' derived from kannada word for tunnel .It is also known as 'thurangam', 'thorappu' and 'mala' etc in different parts of Kasaragod dist.

The construction of surangam are carried out by people who have the indigenous knowledge which is passed from one generation to another. Detection of the water flow is done by taking in to account the slope and elevation, growth of certain hydrophilic plants , termite mounds and structure of the soil. The digging of surangam mainly takes place dur-

ing dry season in between February and May to prevent collapsing of wall due to presence of the moisture in the soil.

CWRDM reported functions of Surangam (1991) for agricultural and domestic purpose and Dr. Kamalakshan Kokkal (2002) reported the hydrogeology of surangam. Kamamma *et al.* (2010) reported sustainability of tunnel wells in a changing agrarian context from South India. Hardly no detailed works were done about the surangam except these scanty reports. So it is a innovative work and this study aims detailed study of Agronomic, Biochemical, Flora and Fauna analysis of the surangam of rural lateritic hillocks of kasaragod district of South India.

## Materials and Methods

**Study area:** Surangam is a special agrarian water harvesting structure present in lateritic hillocks of kasaragod and this district lies on the North West boundary of Kerala between 11°48' N and 74°52' E. Physiographically kasaragod district is divided in to 3 units- Coastal land, Mid land and eastern high land region.

Field visit carried out in 2011-2012 duration and interview with surangam holders and collected details. Photos of suranga in their magnificent natural habitat were took and flora (inside and around) and fauna (inside) of the surangam hillocks were studied.

### Physico chemical Analysis of water

The water samples to be tested were collected in sterile glass bottles from surangam. After collection of the water sample the bottle is tightly capped and were immediately transported to the laboratory to avoid any unpredictable changes in the Physico chemical characteristics.

Seasonal water quality monitoring was carried out during 2011-2012. Selected parameters like pH, EC, Acidity, Hardness, Alkalinity, Ca, Mg, Fluoride, Iron, Chloride, Nitrate, Chemical Oxygen Demand (COD) were analysed. All the test were done in the lab of Kerala Govt Water Authority Vidyanagar Kasaragod, Kerala.

### Physico chemical Analysis of Soil

Soil structure is important to dig the suranga. Soil sample were collected from the wall of surangam. All the soil samples were put in a sterile polythene

cover labeled and taken to the laboratory at Kerala Agricultural University campus Padannakad, Kasaragod for further processing and analysis. The soil sample were air dried in the shade and a part of its were ground manually with wooden blocks and passed through 2 mm mesh prior to determination of physico chemical properties. Selected properties like pH, EC, Ca, Mn, Organic carbon, P, K, Mg, Zn, B, Fe, Cu were analysed.

## Results and Discussion

Surangam is a special water harvesting structure found in lateritic hills. There are two types of suranga one is dug horizontally in the hillocks (Fig. 1 A-F) and the other is the bottom of the rectangle shaped open well of 4m width and 7m length. (Fig. 2C). Parameter of Surangam (Table 1) reveals it has 3-300m length, 0.9-15m height, 0.5-0.8m width. Tunnels are generally rectangular with an optimal height and width which allows a man to work and pass comfortably. Usually several subsidiary surangam are also excavated inside the main tunnel. The main advantage of suranga is water flows without pipe and can store in mud pond commonly called '*Madaka*' (Fig. 2B). During rainy season water flow is more. Suranga is suitable for hard lateritic soil. Surangam have a similarity in a structure used in Mesopotomia several millennium Ago and '*qanats*' which are still in use in rural parts of Iran.

**Table 1.** Parameters of of surangam

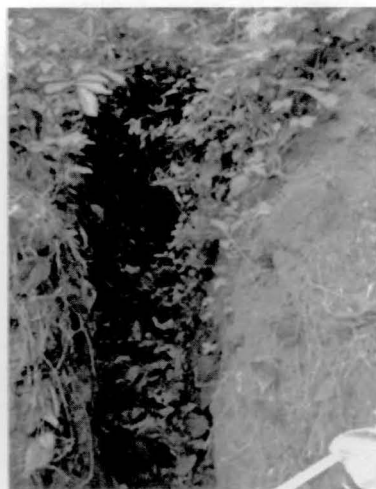
S No	Parameters	Surangam
1	Water source	Ground
2	Type	Horizontal
3	Length	3-300M
4	Height	0.9-15M
5	Width	0.5-0.8M

### Physico- chemical properties of surangam water

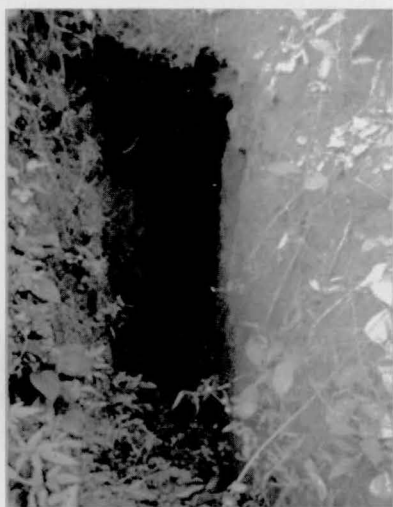
Most of the fresh water bodies all over the world are becoming polluted decreasing the quality of water. Nowadays with rapid age of urbanization and industrialization most of these water bodies bearing sink for waste discharge resulting in deterioration of water quality. From day to day all the sources of drinking water were started to polluted. At this circumstances the source of drinking water surangam is have an unavoidable position as a source of



A



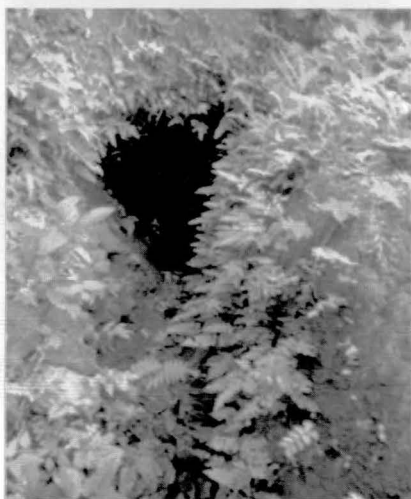
B



C



D



E



F

Fig. 1. A-F .Different horizontal surangams of Kasaragod Dist

drinking water. Physico chemical properties reveals (Table 2) surangam water is a crystal clear non-polluted water without any contamination (Chemical oxygen demand(COD), iron, chloride, fluoride were Nil).

**Table 2.** Surangam-water analysis

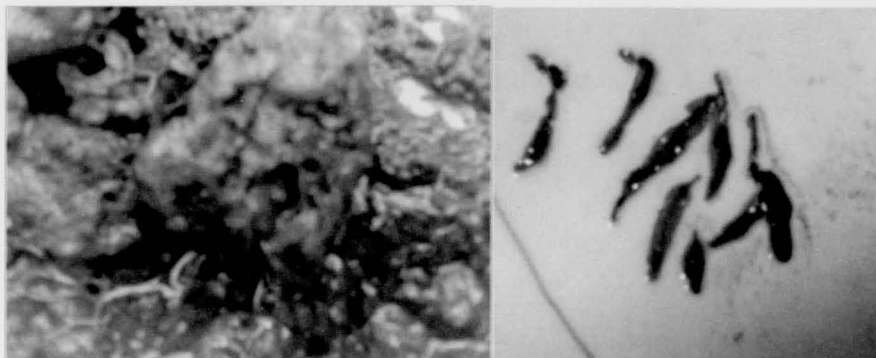
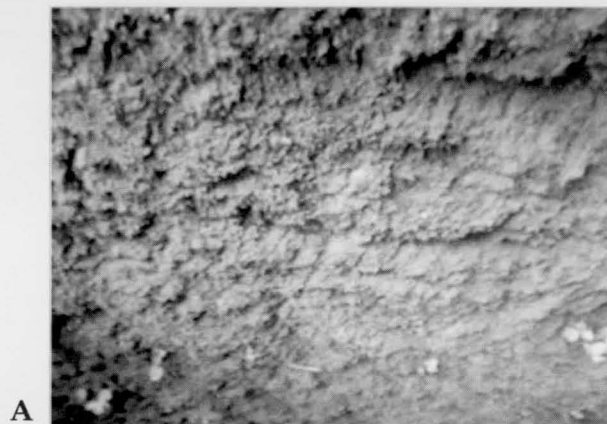
Physico- chemical properties	Value
Turbidity (NTU)	0.1
pH	6.22
colour	Hazen
EC	50
Temp	Nil
Acidity	2
Alkalinity	12
Hardness	4
Ca	0.802
Mg	0.486
Chloride	10
Fluoride	Nil
Iron	Nil
Nitrate	Nil
COD	Nil

### Physico-chemical properties of soil

The quality and structure of the laterite soil is suitable for suranga construction. There were people who were the masters of this suranga craft. They know the slope of the hill, soil structure, geosystem, rain water catchment area of the hill exactly where to dig the surangam. Chemical properties reveals surangam soil (Table 3) has more Fe content (2.98 mg/kg). It gives more strength to the laterite soil.

### Flora nearby the surangam and Fauna inside the surangam

Midland laterite hills have good vegetations and are seasonally different and have various ecological attributes. The construction of surangam is carried out by people who have the indigenous knowledge. Detection of the water flow is done by taking in to account the slope and elevation, growth of certain hydrophilic plants like *Macaranga peltata* Roxb, *ficus hispida* L, *Alstonia scholaris* (R.BR). Seasonal vegetation studies reveals around the surangam of laterite hillocks have many plants includes Bryophyte (*Pallavicinnia* sp)( Fig 2A), Pteridophytes (*Adiantum*



**Fig 2A.** Wall of the surangam shows Bryophyte *Pallavicinnia* sp with enlarged view.



*lunulatum*, *Lygodium palmatum*(Bernh), *Selaginella kraussiana* kuntze, *Pteris cretica* Linn), Gymnosperms (*Cycas circinalis* Linn) and Angiosperms(*Alstonia scholaris*(R.BR), *Ficus hispida* Linn, *Glycosmis*

*pentaphylla* (Retz), *Macaranga peltata* Roxb, *Holigarna arnottiana* Hkf, *Lindernia crustacea* L and *Ficus virens* (Table 4).

Some animals can live inside the surangam . They can adjust the cold climate inside the suranga. Observed endangered threatened fauna are *Paradoxurus hermaphroditis*, *Varanus bengalensis*, *Pteropus maxima*, *Hystrix indica*, *Rana tigrina*, *Rana malabaricus*, *Polypedatus maculatus* and *Bufo*

**Table 3.** Surangam – soil analysis

Physico- chemical properties	Value
pH	4.75
EC	0.056
Organic carbon (%)	0.8842
Phosphorus (kg/ha)	2.4
Potash (kg/ha)	0.3
Mg (Mg/kg)	0.027
Ca (Mg/kg)	0.906
S (Mg/kg)	3.67
B (Mg/kg)	0.4
Fe (Mg/kg)	2.98
Zn (Mg/kg)	0.0548
Cu (Mg/kg)	0.09
Mn (Mg/kg)	0.009

**Table 5.** Fauna inside the surangam

Sl No	Fauna inside the surangam
1	<i>Paradoxurus hermaphroditis</i>
2	<i>Rana tigrina</i>
3	<i>Pteropus maxima</i>
4	<i>Hystrix indica</i> ,
5	<i>Rana malabaricus</i>
6	<i>Polypedatus maculatus</i>
7	<i>Varanus bengalensis</i>
8	<i>Bufo melanosticus</i>



**B**

**Fig. 2B.** Mud pond collects surangam water



**C**

**Fig. 2C.** Surangam dug in the rectangle open well

**Table 4.** Flora around and inside the surangam laterite hillocks

Sl No	Angiosperms	Sl No	Gymnosperm	Sl No	Bryophytes	Sl No	Pteridophytes
1	<i>Alstonia sacholaris</i> (R.BR)	1	<i>Cycas circinalis</i> L	1	<i>Pallavicinia</i> sps	1	<i>Adiantum lunulatum</i>
2	<i>Ficus hispida</i> L*					2	<i>Lygodium almatum</i> (Bernh)
3	<i>Glycosmis pentaphylla</i> (Retz)					3	<i>Selaginella kraussiana</i> kuntze)
4	<i>Macaranga peltata</i> Roxb*					4	<i>Pteris cretica</i> L
5	<i>Holigarna arnottiana</i> Hkf						
6	<i>Lindernia crustacea</i> L						
7	<i>Vateria indica</i> L						
8	* <i>Ficus virens</i> *						

\*Hydrophilic plants

*melanosticus* (Table 5) in some periods of the year.

### Conclusion

Surangam is a traditional sustainable agrarian ecofriendly water harvesting system of laterite hills of kasaragod district of kerala. Most of the people of rural hillock areas of kasaragod district still depend on this surangam where there is no public water supply for agricultural and domestic purposes. Even though the quality of suranga water is good , nowadays construction of surangam are neglected due to the intricacies and lack of experts, fragmented land holding, lack of proper management due to poor economy of our rural farmers to dig the well diligently and most of the people are depend on mechanized bore well construction that leads to desertation of our earth. So strong civil laws to be implemented by Govt to prevent the unnecessary bore wells without keeping minimum distance and there is urgent need of reviving this water harvest-

ing system of surangam.

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