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PREDICTION OF DEPTH OF GROUNDWATER STREAM BELOW UNUSUAL GROWTH OF TWIGS OF NEEM AND TAMARIND TREES

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ABSTRACT
All plant growth is connected with solar lights. The trees grow symmetrical in shapes, but sometimes they are irregular. In the case of irregular shapes, some of the twigs of these trees are bent downward in a straight line. These bends of twigs will have some specific reasons. The trees, neem, tamarind, show such unusual growth. Some of the twigs of these trees are bent in the downward direction in a straight line. The Growth index ratio (GIR) with a growth index from the usual and unusual growth of the twigs of the same tree is calculated. The value of GIR greater than one indicates the presence of the stream below the unusual growth twigs of the tree. This unusual growth of trees is due to the increased gravitational force on these twigs.
The GIR for different Neem and Tamarind trees were calculated, and depth of the stream at those particular twigs was measured. It is found that the plot between GIR of trees and Depth of the stream is a straight line. This suggests that the GIR of a tree is directly proportional to the depth of the stream present under that tree. In this paper, I propose to outline the body of research that gives a relation between GIR of trees and depth of the stream under that tree, which is useful for prediction of depth of stream by calculating GIR for that tree.

KEYWORDS: unusual growth of the tree, groundwater stream, Growth index ratio, depth of the stream, or aquifers.

INTRODUCTION:

The growth of trees is connected with daylight. In trees, the trunk brings the tree up into the light-field atmosphere. A tree trunk grows straight, and it is not directed towards the sun. The trees are symmetrical in shapes, but sometimes they are asymmetrical. You might even call them misshapen or unusual growth. The twigs of trees are bent downward in a straight line. From the growth index of usual and unusual growth, we can calculate the Growth Index Ratio (GIR) [1].
Groundwater is defined as underground water found in the pore space of rocks. Groundwater does not stay underground forever, and it does not lie still waiting for us to draw it from a well. Groundwater moves as part of the hydrologic cycle; the endless circulation of water from the atmosphere onto the surface and into the subsurface regions of the earth and then back from the surface to the environment [1-6]. The regions below the water table are called the saturated zone and water in this saturated zone is called groundwater [2-4]. In the rainy season, the water table is high, due to this canal, and wells give a good amount of water. But in the summer season, as the water table goes down, we have to depend on bore wells.
There are no simple solutions, no detailed maps of groundwater presence, and no guarantee. So, quite confusing to decide whether to drill or where to drill [1, 5- 8]. In this paper, I will present the relationship between the unusual growth of trees and the presence of a groundwater stream under the unusual growth. A numerical solution for getting the depth of the groundwater stream.

METHODOLOGY:

Growth of Trees: Neem tree in Fig. 1 gives the usual growth of the tree, and the crown now relies symmetrically on the shape. In case of unusual growth of branches, their twigs are bent downward as shown in Fig. 2.

Investigation of groundwater Stream: The unusual growth from trees is useful for finding groundwater streams. The tree which has twigs bent downward gives ground surface direction groundwater Stream. To calculate the depth of the stream, we have to take the following measurements and calculation of the Growth Index Ratio (GIR) of Trees.

Measures of Length of Twigs of Tree

i) **Usual growth**: The length of twigs is marked between two sub-branches of twigs of usual growth as shown in Fig. 3.

ii) **Unusual growth**: The length of twigs is measured between two sub-branches of twigs of unusual grown as shown in Fig. 3

Measures of Diameter of Twigs of Tree

i) **Usual growth**: The diameter of usual growth twigs is measured at two ends of twigs where length is noted and the average diameter is considered for further computations as shown in Fig. 3.

ii) **Unusual growth**: The diameter of unusual growth twigs is measured at two ends of twigs where length is measured and the average diameter is considered for further computations as shown in Fig. 3.

Growth Index for Usual Growth (GI1): The growth index for usual growth (GI1) is estimated by taking the ratio of the length of twigs with usual growth to the diameter of twigs of usual growth.

Growth Index for Unusual Growth (GI2): The growth index for unusual growth (GI2) is estimated by taking the ratio of the length of twigs with unusual growth to the diameter of twigs of unusual growth.

Growth Index Ratio (GIR) of Trees: The Growth Index Ratio (GIR) is determined by taking the ratio of Growth Index unusual growth (GI1) to growth Index of Usual growth (GI2).

$$\text{GIR} = \frac{\text{GI2}}{\text{GI1}} \quad \text{--------- Eq.1}$$

The GIR for various Tamarind and Neem trees are determined by using the above method. Depth of Stream: The depth of the stream under unusual growth of various Tamarind and Neem trees are measured while drilling bore wells.

RESULTS AND DISCUSSION

Growth Of Trees: The Neem tree in Fig-2a shows unusual growth with their twigs bent downward in a plane. The growth depends on sunlight. In trees, the trunk brings the tree up into the light-filled atmosphere. The tree genetic leaning is to capture as much light as possible, which increases its capacity to do photosynthesis and grow. Since every tree has this leaning and creates growth, competition with its neighbor to increase light uptake [5-6].

Additional Gravitational Force On Twigs Of Tree: A gravitational force, acting on all the branches of the tree, is against the growth of trees. The neem tree in Fig-2a shows unusual growth with their twigs bent downward in a plane as drawn in Fig-2b. The twigs which bent downward direction should have an extra gravitational force acting on it. This extra gravitational force is because of the underground water stream below, these twigs [5-8]. Due to extra gravitational force acting on unusual growth twigs, they stretched in a downward direction. The effect of this additional force gives an increase in length and a decrease in the diameter of twigs [5-8].

The value of Growth Index (GI) for usual and unusual growth of twigs and that of Growth Index Ratio (GIR) are calculated for different Neem and Tamarind trees.

GIR Prediction Of The Presence Of Groundwater Streams Below Unusual Growth Of Twigs Of Trees: If GIR ≤ 1, the growth index of the usual and the unusual growth is the same or unusual growth index less than the usual growth index. This means no additional gravitational force is acting on the twigs of unusual growth and no hope of the presence of the groundwater stream under unusual growth of twigs of the tree. If GIR > 1, that is,

in unusual growth the length of the twig increased while its diameter decreased, meaning GI unusual > GI usual. The extra gravitational force is acting on the twigs with unusual growth, which gives the presence of a groundwater stream under an unusual growth tree.

Process Of Marking Of Groundwater Stream Under Unusual Growth Of The Tree On The Ground Surface: A plane drawn parallel to the twigs of unusual growth and the intersection of this plane with the ground surface gives the line along which the groundwater stream presents [5-8]. The Fig-4a is a photograph of the Neem tree with a plane drawn parallel to unusual growth twigs and its intersection with the ground surface. The Fig-4b is the photograph of drilled borewell at the intersecting point. Table-1 gives estimated values of GIR for different trees with unusual growth and the values of depth of groundwater stream under unusual growth measured while drilling borewells.

Process Of Predicting The Depth Of Groundwater Stream Under Unusual Growth Of Trees: To divine the depth of groundwater stream the graph of GIR values of different unusual growth trees and depth of groundwater stream measured for respective GIR values is plotted Fig.5. The graph gives a straight line with a linear equation of type as.

$$y = mx+c \text{ ----------Eq.2}$$

where y- a depth of groundwater stream, x- Value of GIR calculated from an unusual growth of trees, m- a slope of the line passing through the points and c- constant. The slope of this straight is m=107 and the value of the constant is c = -130. The straight line is with the resulting equation.

$$y = 107x -130 \text{ --------Eq.3}$$

From eq.3 for the various values of GIR, the value of depth of the stream is determined. Calculations of the depth of the stream are done for the values of $1 < GIR < 3$ by variation of 0.1 Values. The determined depth ranges from 0 to 200 m as given in Table No 2. It is found that as GIR values increase for any type of tree the depth stream also increases.

For the $GIR \leq 1$ values there is no possibility of stream presence, therefore is no depth calculations. To predict the depth of the groundwater stream under unusual growth of twigs of the tree. First, determine the values of GIR by measuring the length and diameter of twigs of Unusual and Usual growth. Secondly, by substituting the value of GIR in Eq.3, we will get the value of depth of the groundwater stream under the unusual growth of twigs of the tree.

CONCLUSION

This study shows that the growth of a tree is always towards sunlight with branches growing radially from the trunk called usual growth. Sometimes the twigs have an unusual growth and bend downward. This is caused by extra gravitational force acting on these twigs. This extra gravitational force caused unusual growth of twigs of the tree with GIR > 1, indicating the presence of groundwater stream under unusual growth of twigs of the tree. It is also found that the depth of the groundwater stream of the unusual growth of twigs of the tree is closely related to GIR values of unusual growth of twing of that tree. The higher the values of GIR of unusual growth, the higher will be the depth of the groundwater stream.

The straight-line graph between GIR values of unusual growth of twigs of the tree and measured depth of groundwater stream suggests that depth of groundwater stream of twigs of unusual growth of the tree is directly proportional to its GIR values. By calculating GIR values for the unusual growth of twigs of the tree and substituting these values in the equation of the straight line, we can determine the values of depth of the groundwater stream under unusual growth twigs of the tree.

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Fig. 1- Photograph of Neem tree with usual growth of which twigs grown radial towards the light.

a) b)

Fig. 2- Photograph of the tree with unusual growth of which twigs bent downward. 2a- Neem tree with unusual growth and 2b- a plane drawn parallel to bent twigs showed by red color.

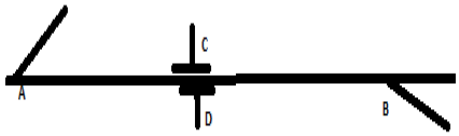
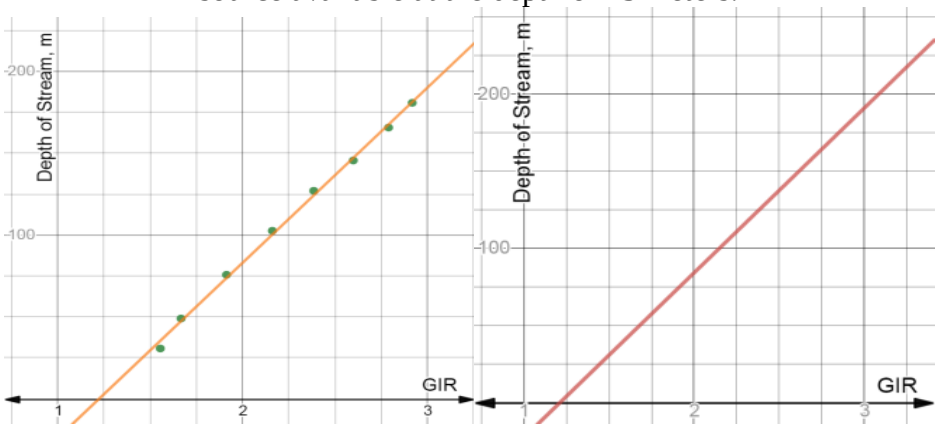


Fig.3. Measurement of Length and Diameter of Twigs. AB- Length of twigs and CD- Diameter of Twigs.

a) b)

Fig. 4- Photograph of Neem tree showing twigs bending downward 4a- Bore-well point 'E' identified by drawing ABCD plane, parallel to twigs bent downward and 4b- a bore well drilled at the 'E' point giving water source available at the depth of 75 meters.



a) b)

Fig. 5- a) Graph between GIR different trees versus depth of stream under unusual growth that tree is a straight line.

b) This line has a linear equation (y ~ 107x – 130) from which for different values of GIR the depth of stream is calculated as given in Table 2.

Table 1- The various trees with its GIR values and depth at which stream found during drilling of borewells.

Types of Tree	GIR	Depth of Stream m (± 2 m)
Neem 1	1.55	30
Neem 2	1.67	50
Neem 3	1.91	75
Neem 4	2.16	105
Neem 5	2.39	130
Tamarind 1	2.80	170
Tamarind 2	2.92	185

Table 2- Determination of Depth of streams (up to 200 m) from various values of GIR (1 < GIR< 3) based on linear equations of a line (y ~ 107x - 130). The graph between GIR trees and Depth of Stream for that unusual growth of trees.

Sr No	Values of GIR Calculated from an unusual growth of the tree	The determined depth of Stream under unusual growth of the tree (± 2 % of given value), m
1	1.1	-12.3*
2	1.2	-1.6*
3	1.3	9.1
4	1.4	19.8
5	1.5	30.5
6	1.6	41.2
7	1.7	51.9
8	1.8	62.5
9	1.9	73.3
10	2.0	84
11	2.1	94.7
12	2.2	105.4
13	2.3	116.1
14	2.4	126.8
15	2.5	137.5
16	2.6	148.2
17	2.7	158.9
18	2.8	169.6
19	2.9	180.3
20	3.0	191

*These values are illegal.