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The Application of Topographical Survey and the Arcgis Spatial Analys "Darcy Flow" Tool in Managing the Nurseries of Rubber Tress

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ABSTRACT

Farmers often rely on the physical appearance of rubber tree seedlings to decipher on growth rate. In situations of doubt especially when there is obvious reduction in chlorophyll or coax decay of roots, the most likely situation is induction by flooding. A sound nursery management technique which is both responsive to continuous monitoring of the terrain and also able to generate data for restoration is most desired. This study therefore employs a geospatial technique whereby topographical survey was used to pick field data while Geographical Information System analyses was able to generate accurate information on areas likely to both surface and underground discharge of materials. This method was also able to sum up all affected areas, alongside other attributes like the direction of surface flow and the rate of discharge.

***Keywords*:** Topographical Surveying; Darcy Flow and Rubber Tree Nurseries

1. INTRODUCTION

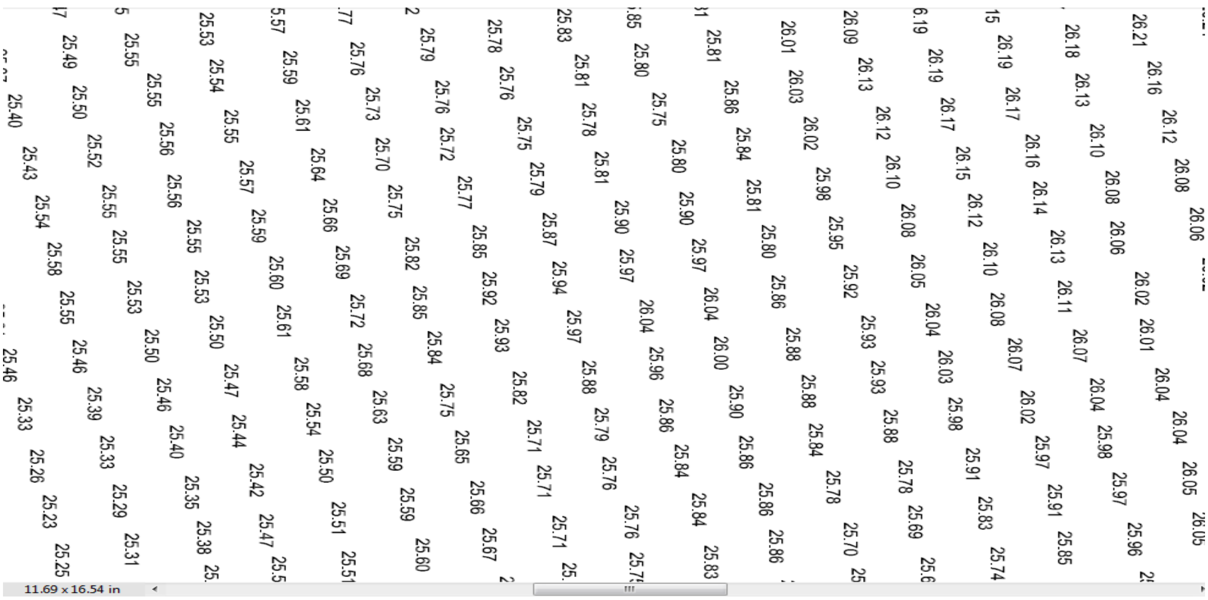
Also Know as Hevea brasiliensis, the rubber tree has a diverse of economic importance (Mesquita et al, 2006). According to Agriculturist, the best practices in taming new seedling and shrubs are those which have concerns about the topographical nature of the terrain (Norris et al, 2008). "Soil reinforcement and protection is best achieved haven a grasp on the plants height and the presence of a local species among the nurseries" (Norris et al, 2008). This is why this study has become necessary to ascertain a more practical and evaluative method of nursing rubber tree shrubs especially in a versed land where there could be thousands of shrubs. Scientifically, the best practices in taking care of the tree involve disbudding, pruning and replacement of missing ones. All these involve checking of the plant height (yardstick) and it also helps to monitor weed and other biological interference with the rubber tree (Guzzo et al, 2014). There are also evidences that the rubber trees strive more with plenty of water but with good irrigation for “subsurface flow and underground water table dynamics” (Claramonte et al, 2010). The importance’s therefore attached on a controlled and monitored terrain for rubber tree nursing especially for the first one year is indeed enormous as it remains one of the best practices to avert and control early stage diseases (Farid et al, 2006).

“Topography is an important factor affecting soil erosion” (Baoyuan et al, 2002). The amount of soil erodibility is relative to both slope length and slope steepness (Baoyuan et al, 2002; Wolock and McCabe, 1995). With Topographical surveys, horizontal and vertical points on the earth surface are determined relative to some control network. Consequently, the slope length and the slope steepness are determined to minimal centimetres. According to Darcy’s law, discharge is also proportional to ground area and direction of flow (Bengtson, 2011). Haven precisely determined the relative positions of ground points; the geometry and flow direction for all the channels of underground discharge will then be computed for applying ArcGIS spatial analyst tool “the Darcy flow”. One other advantage of this method is the creation of a digital spatial database required for further analysis (Parida et al, 2012).

Study Area

The study site 19.5 hectares of land is located in Ikpoba Okha local government area of Edo state, Nigeria. The climatic situation is tropical with a dense rainforest. Temperature ranges from about 25 °C during rainy season to about 28 °C in the dry season. The Land mass is used to nurse rubber trees less than one year of age before they are budded and transplanted. The land is steeply and it is obvious there is gradual wearing off of surface soil. There is also evidence of leaf diseases which could be as a result of deficiency in nutrients as fertilizers are applied to these immature plants all the way through the poly bags. The white root rot disease is also very common for rubber tree nurseries’ in Nigeria (Omorusi, 2012) and it is a consequence from poor land management (Farid et al, 2006).

Topographical Survey



The entire plot was gridded at 5meters intervals. The geographical position of every gridded point alongside their heights above mean sea level were picked and recorded using the total station equipment. With the topographical survey, all parameters needed to compute the Darcy's flow and discharge rate for all fluid materials are gotten. These are the area (A), the length between two gridded points (L) and the difference in heights between such points (ΔH) (Wolock and McCabe, 1995). Q = KA (h1 – h2).

Darcy Flow Computation

This was done by the ArcGIS software. Two things are achieved. One is the geometry for each point prone to underground and surface discharge and secondly is the direction of such flow.

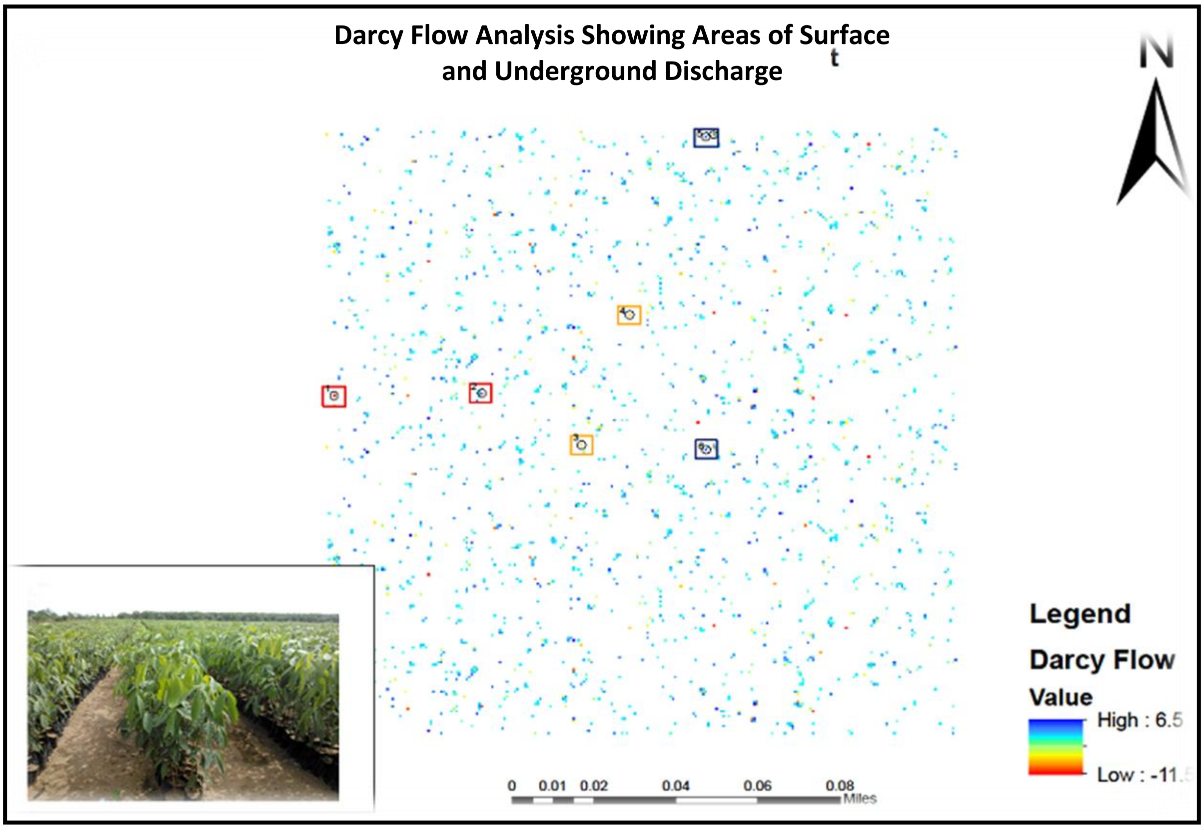
S/No.	Northing's (m)	Easting's (m)	Area of Consideration (Square meters)	Description of Steepness	Direction of surface flow
1	xxxx56.218	xxxx61.401	9.576	high	NNW
2	xxxx68.677	xxxx19.096	5.954	high	NE
3	xxxx63.001	xxxx53.791	11.600	low	ENE
4	xxxx74.498	xxxx12.031	10.450	medium	SSE
5	xxxx49.481	xxxx04.215	9.004	high	SSW
6	xxxx50.006	xxxx57.772	8.881	high	WNW
7	xxxx01.210	xxxx18.996	12.450	low	NW

In total, 182 points were picked and the total area under consideration is 2215.09 sq·meters. For each area under consideration, the direction of flow was determined by applying the flow direction spatial analyst tool. Rasters were created for each of the gridded cell showing the slope for each cell values. Compares were made with their corresponding contour values. In the diagrammatical representation below, each cell are areas of underground discharge of water. Points 5 and 6 are severe areas, 3 and 4 not too severe while 1 and 2 are mild. The colours in the legend show the steepness and compactness of the surface material and this makes an easy visualization on the flow pattern of the study area.

2. DISCUSSION AND CONCLUSIONS

This method of determining areas which are pro to both surface and underground discharge yields a comprehensive and precise result. As shown below, each colour is a true representation of the terrain and when compares were physically made, the results were all correct. With coordinates, the affected areas were computed alongside the volume of material needed to stabilize such areas. The summary of how results obtained were utilized is:

a) The total area of recharge and discharge were easily ascertained which makes it possible to determine the volume of material required for (i) control of underground and surface discharge of materials and (ii) control of fertilizers and other surface material needed to manage the nurseries.
b) Understand the direction of flow of surface water. This helps to control surface flooding and other irrigation activities.
c) Develop a geospatial database for all topographical activities in the farm
d) Predict the growth rate of the young rubber trees.



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