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Sustainable development through proper land utilization Case study: Ratnapura, Sri Lanka

P G R N I Pussella, R M K G S P B Koswatte, R K A Ariyarathne, D S Munasinge, H R S Thilakarathne and T M N Tennakoon
Faculty of Geomatics, Sabaragamuwa University of Sri Lanka, Sri Lanka

Since the land is a scarce resource, the utilization of land effectively would be directly affected to the sustainable development of any country. A proper system of land utilization is very essential especially for a country like Sri Lanka which is very small in size and the majority of the people are depending on the land related activities such as farming, grazing etc. as their major source of income. Unfortunately, land is in the state of under utilization in Sri Lanka. This paper attempts to study the importance of the effective land utilization using Geographical Information Systems (GIS) for the sustainable development.

The study was mainly based on the data gathered from Ratnapura Divisional Secretary area, The area is consisting with natural vegetations such as forests, shrubs. and man -made cultivation such as tea, rubber, paddy. Also the area has a high economic value and it is well known for natural disasters such as floods and earth slips. Primary data was collected using semi-structured questionnaires, interviewing people and relevant officers and field surveying using hand held Global Positioning System (GPS). The study supplemented with secondary data such as remote sensing satellite images, existing maps. GIS technique was used for the data analyses.

The study identified 4 major issues in the specified area.

1. 20 % of the total area is under utilization
2. 25 % of the total area is misused
3. 05 % of the total area is over utilized
4. Continuous loss of land due to the natural disasters

According to the results, the land has not used effectively in the area. 45% of the area is not used effectively. Since the country is very small, proper land utilization is very important. The study suggest that an immediate action should be taken to overcome the matter. And also it is very important to get the active participation of the general public to stop the loss of land due to natural disasters and for future decision making.

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Performance of seedlings of tree borne oilseeds and their response to fertilization in problem soils

R Santhi, M Sathiyadevi and A K Mani
Forest College and Research Institute, Tamil Nadu Agricultural University, India

The aim of the present investigation was to screen the seedlings of tree borne oilseeds (TBOs) suitable for alkali and saline soils and to optimize their fertilizer requirement under different soil environments. A nursery experiment was conducted at Forest College and Research Institute, Mettupalayam with four TBOs *viz.*, neem, pungam, simaruba and jatropha on three soil types *viz.*, neutral, alkali and saline soils with four fertilizer levels (0:0:0, 100:75:100, 200:150:200 and 300:225:300 mg N, P_2O_5 and K_2O seedling^{-1}). The soils were sandy loam in texture with 195, 170 and 165 kg ha^{-1} of available N; 13.6, 10.9 and 9.8 kg ha^{-1} of available P; 182, 200 and 176 kg ha^{-1} of available K and 0.48%, 0.33% and 0.30 %organic carbon for neutral, alkali and saline soils respectively.

The biometric observations *viz.*, collar diameter, shoot, root and total dry matter production and root: shoot ratio were recorded at 180 days after sowing. The total dry matter production of neem, pungam, simaruba and jatropha (13.49, 12.19, 11.20 and 17.29 g seedling^{-1}, respectively) in alkali soil was 88.9, 96.3, 75.0 and 64.9 per cent respectively as that of neutral soil. Application of 200:150:200 mg N, P_2O_5 and K_2O seedling^{-1} (N,P,K) excelled all other levels for neem (15.37 g seedling^{-1}), pungam (14.03 g seedling^{-1}) and simaruba (12.84 g seedling^{-1}) which has resulted in 40.0, 50.2 and 46.1 per cent increase over control. With regard to jatropha, the highest total dry matter was recorded with

300:225:300 mg N,P,K seedling^{-1} (19.04 g seedling^{-1}) which has registered an increase of 39.2 per cent over control.
The total dry matter production of neem, pungam, simaruba and jatropha (10.89, 13.66, 8.76 and 13.07 g seedling^{-1}, respectively) in saline soil was 71.7, 107.9, 58.6 and 49.1 per cent as that of neutral soil. Neem, pungam and simaruba recorded the highest total dry matter production with 200:150:200 mg N,P,K seedling^{-1} (14.02,16.79, and 9.74 g seedling^{-1}, respectively) recording a percent increase of 35.1, 70.1 and 21.9, respectively over control. In the case of jatropha, the highest total dry matter (16.33 g seedling^{-1}) was recorded with 300:225:300 mg N,P,K seedling^{-1} with an increase of 74.7 per cent over control.

The present study suggests that pungam and neem were the best suited species for alkali and saline soils followed by simaruba and jatropha. The performance of the crops was relatively better in alkali soil than saline soil. The fertilizer requirement under neutral soil was 300:225:300 mg N, P_2O_5 and K_2O seedling^{-1} for all the crops. Whereas for alkali and saline soils, the fertilizer requirement for neem, pungam and simaruba was 200:150:200 mg N,P,K seedling^{-1} and for jatropha, the requirement was 300:225:300 mg N,P,K seedling^{-1}.

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Impact of forest types on soil properties

A K Mani, S Manivasakan and R Santhi
Forest College and Research Institute, Tamil Nadu Agricultural University, India

Soil and vegetation have a complex interrelationship, in which one influences the other. Both in natural forests as well as man-made plantations cycling of nutrients is an important aspect as considerable amount of nutrients are returned through litter fall are made available for re-absorption. The nature and amount of organic matter produced depends on the dominant tree species present and the site characteristics of the area, which regulate the physico-chemical properties of soil. Thus, the percentage return of nutrient varies with species, site conditions and topography.

The present study investigates the effect of forest types on soil properties. Soil samples were collected from different forest types covering different forest ecosystems *viz.*, dry deciduous forest, moist deciduous, shola forest, grassland, pine plantation, eucalyptus + wattle plantation, each at three depths *viz.*, 0-15, 15-30 and 30-45 cm and were analyzed for their physical and chemical properties.

The soil pH ranged from 3.52 to 7.60 and the dry deciduous forest registered a maximum pH of 6.54 and the minimum was recorded in shola forest. With increase in depth, there was a slight increase in pH under dry deciduous forest, pine plantation and eucalyptus + wattle plantation. Dry deciduous forest registered a maximum EC of 0.946 dSm^{-1}at top layer followed by shola forests. In general, grassland recorded lower EC values than other vegetations. Organic carbon content was higher under shola forest. With increasing depth, there was a progressive reduction in organic carbon.

Soil available nitrogen was in the range of 229 kg ha^{-1} to 1919 kg ha^{-1}. A higher value of available nitrogen was recorded in grassland soils followed by shola forest. Available nitrogen was found to occur in a decreasing order with soil depth in all the study sites excluding sholas and grasslands. The highest available phosphorus was recorded in sholas and minimum was found in moist deciduous forest. With increasing depth, there was a great reduction in soil available phosphorus in all locations. This may be due to increased uptake and less contribution of P by the litters. Soil available potassium ranged from 90 kg ha^{-1} to 941 kg ha-^{1} The maximum amount of potassium was recorded in tea plantations and the minimum was under pine plantations. With increasing depth soil potassium decreased drastically.

Bulk density (BD) increased with increasing depth in all vegetations. Sholas recorded lesser BD. This is because of more organic matter addition to the top layer of the ground floor. Particle density (PD) of top layer of grassland was the lowest followed by sholas. Like BD, PD also increased with increasing depth of soil. Percent pore space was maximum in the top layers of shola forest and it decreased with increasing depth.

From this study a very good fertility status of soil was observed under sholas and grasslands. The lower amount of nutrients was recorded under dry deciduous and moist deciduous forest and this is because of higher absorption of nutrients by the trees and erosional losses. Hence it is concluded that the soil physical and chemical properties are markedly influenced by vegetation.