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A GIS-based decision support tool for the renewable energy resource planning in Sri Lanka

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With the global shortage of fossil fuels and significant environmental damage through its extraction, the need of switching to renewable energy sources has been identified as a timely endeavour. A careful screening is essential when selecting potential locations for wind and solar farms, keeping in mind the significant land use limitations for harnessing these energy sources optimally. The present research has made an attempt to develop a GIS based Weighted Overlay Model to identify potential locations for the development of Wind and Solar power plants, which are rapidly advancing renewable energy resources in Sri Lanka. Among the different land use types available, four types of land use patterns which are barren lands, sand areas, open forests and scrub lands were identified as sites with least productivity and were considered as potential lands for solar and wind power plant establishment. Forest reservations, wildlife reservations, archaeological sites, water bodies, coastal conservation areas, distance to roads and railway lines, urban centers, building extent including houses and distance from airports and seaport were identified as constraints for the power plant development and were subtracted the land use map to obtain the total restricted area map. Based on the criteria identification process, wind speed, distance to road, distance to urban centers, distance to houses, distance to transmission line, land use pattern, elevation, slope and bird fly path were selected as major parameters that influence the installation wind farms in Sri Lanka. The parameters considered in the solar model were solar irradiance, distance from the roads, distance from the urban centers, distance from the houses, transmission line, elevation and slope. Weightages for each of the parameters were obtained through consulting experts in Sustainable Energy Authority. The suitability map for the areas of potential wind plants was represented with 3 main suitability criteria. Accordingly, 5 major suitability criteria were identified in site suitability map of solar energy. The model validation performed by overlaying the developed site suitability map with the existing solar and wind power plants showed a significant accuracy with the current Sri Lankan renewable energy resource distribution.

Keywords - Land suitability analysis, Wind energy, Solar energy, GIS, Weighted Overlay

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