TIMBER HARVEST PLANNING USING GEOGRAPHICAL SYSTEM/DECISION SUPPORT SYSTEM

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Introduction

This research investigates the application of Geographical Information System (GIS) as a Decision Support tool in timber harvest planning. The current planning scenario in timber harvesting in Malaysia is increasingly complex as many economic and environmental restrictions are imposed. Hence, a speedy and efficient method for spatial information analysis is needed, and the advent of computer and GIS enables a new dimension in the processing and analysis of georeferenced data required in timber harvest planning. The specific objectives of this research were: To develop a GIS database design and resources for forest planning in the study area; to identify key decisions in timber harvest planning; to develop models for the key timber harvesting decisions, manipulate the GIS database in using the models to identify suitable forest site for timber harvesting; and to locate suitable optimum road access that meet economic and en*vironmental criteria and to develop a graphical user interface or GUI to enable user interaction with the decision models.*

Materials and Methods

The study site was H.S.Pasir Raja, forest concession areas belonging to KPPK Terengganu, Peninsular Malaysia, with an area of 37617 hectares comprising 129 forest compartments. The ARCINFO GIS software was used to develop the timber harvesting database, data model generation, data analysis and presentation of modelling results. In the database, eleven basic spatial information layers or coverages were digitised using ARCINFO software. Forest compartment, contour, district, village, outcrop, permanent forest estates, rivers, road, spot heights, state boundary and vegetation cover are basic coverages developed. Next, non spatial attributes concerning the features in the coverages were entered by keyboard entries. From the contours, DEM was generated to derive slope information. The rivers in the study site were buffered to denote areas excluded from harvesting. Stock information in each compartments were entered using previous tree marking inventory data. All coverages were rasterized using the GRID module of ARCINFO to enable the application of developed timber harvesting decision models. The models will be run, to show areas suitable for harvesting that meet slope and river buffer restrictions and those which are profitable for harvesting after considering on site timber value and extraction costs. The graphical user interface, which enables user interaction with the models, was developed using the AML programming language of the ARCINFO software. Presentation of analytical and modeling results was done both as maps layouts and textual reports using the plotting capabilities of the GIS software.

Results and Discussion

Through the use of developed GIS database and modelling, timber harvest planning can be done efficiently. Information on sites unsuitable for harvesting were easily retrieved, for example, 4329 ha or 11 % of study area cannot be harvested because they are greater than 35 degrees in slope, and 6738 ha or 18 % of total areas are not harvestable because they lie within 20 meters river buffers zones. The results showed that this 29 % of area not harvested is a substantial loss of revenue to the concessionaire. Decision questions like "which compartments are profitable to harvest based tree stocking and prevalent extraction costs?" and "where are the least cost roads to build?" are easily analysed and results presented through the developed GIS models (Ahris Yaakup et al. 1996; 1997) More importantly, scenarios of outcome from alternative timber harvesting decisions are generated by the GIS models prior to their actual implementation, which reduces the risk of poor decisions. Data modelling clearly showed that blanket restriction from slope and river buffer may not be equitable to both forest owner and concessionaire, hence, require some modifications. Blanket slope restriction requires further research as many trees can be harvested even on slopes greater than 35 degrees. Different buffer distances are recommended for different river widths and this should link with terrain characteristics surrounding the river as the impact of soil erosion on rivers on different slopes may differ. Speedy analysis demonstrated by the GIS models, clearly outlined the importance of GIS as a decision support tool for timber harvesting planning.

Conclusions

GIS clearly demonstrated that it can support decision making in timber harvesting planning in the study site. It is a useful tool to evaluate key harvesting decisions such as "where to harvest and where to build access road" prior to actual implementation, hence reducing the time and costs due to errors in decision making. The developed Graphical User Interface enables easy access and application of the timber harvesting models by intended users.

References

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