USING THE ECOLOGICAL PLANNING METHOD FOR ENVIRONMENTAL IMPACT ASSESSMENT

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The National Environmental Policy Act of the USA, enacted in 1970, requires a detailed statement of environmental impact before federal agencies can proceed with any major action that may significantly affect the quality of the human environment. In order to comply with this requirement many different methodologies have been developed in the course of the numerous impact assessments that have been completed in the USA and elsewhere. These have been reviewed by Warner and Preston (1), Munn (2), Jain, Urban and Stacey (3), Canter (4) and others. It appears that no single method has been found to be universally applicable since projects of different scale or nature result in different types of impacts.

In South Africa no statutory requirement for environmental impact assessment presently exists. However, recognizing its responsibility towards the environment, the environmental planning professions established an interdisciplinary committee (EPPIC) in 1974 which has been working in liason with the Council for the Haoitat towards a code of practice that includes environmental assessment as an essential component of the planning and designing processes. The joint EPPIC-Habitat working committee recommended that the matrix technique, originally developed by Leopold (5), be used by all groups undertaking such assessments.

In the method proposed, the magnitude and significance of the major project actions on each environmental characteristic are evaluated numerically and entered into cells of a matrix. The scores for magnitude and significance are then multiplied and aggregated.

The matrix method presents a simple and comprehensive way of identifying and evaluating impacts of specific actions, and can be very useful in comparing the effect of different alternative actions on the environment so that the form of development having the lowest negative impact can be derived.

While the matrix technique appears to be very suitable for projects covering a relatively small and homogeneous surface area such as a building, dam, quarry or an open cast mine, the author doubts whether the matrix approach will be useful for projects that encompass large areas such as a major transportation network or extensive urban development. While it makes sense to score the magnitude and significance of the effect of a new structure on the natural vegetation by a value of (say) 5, it becomes meaningless in the case of a large-scale project such as a regional plan where the effect on the vegetation may be negligible in some areas and severe in others.

Similar considerations apply in the case of the other environmental elements. The problem can partly be solved by dividing a regional development project into its constituent parts of residential, commercial, industrial and agricultural development, infrastructure etc., and subdividing these further into smaller units such as townships, factories, roads etc., but this makes the matrix method a very cumbersome way of evaluating the impact of regional development.

In contrast, the ecological planning method of McHarg, (described by Giliomee(6)), seems to be very useful in identifying and quantifying the impacts of large-scale projects. At the same time it is less suitable for the smaller projects mentioned earlier. It cannot be used to adequately answer the question as to what the impact of a building on the environment would be.

The ecological planning method sets out to locate sites for the proposed land uses where they would fit best ecologically, a principle expounded by McHarg(7) in Design with Nature. First the phenomena or factors which constitute the environment are identified and mapped (Fig. 1). Next the characteristics of the natural phenomena which affect and can be affected by human use are derived and mapped. These maps can now be interpreted in terms of opportunities and constraints presented for each of the proposed land uses. By overlaying them, areas can be identified where most or all of the desirable aspects converge, without any or many of the undesirable ones. This represents the most suitable areas for that particular land use and is repeated for each prospective land use in turn. Finally the suitability maps for the different land uses are overlaid and a composite suitability map or plan is obtained by allocating land to different uses according to suitability on the one hand and demand on the other.

It is clear that when the ecological planning method is followed strictly, maximum use is made of opportunities presented by the environment. At the same time constraints or adverse effects are minimized. Often, however, sensitive areas cannot be avoided altogether when alternatives are lacking or when small sensitive areas are consolidated with adjacent, less sensitive areas when allocated for a particular land use.

Should an impact assessment of the proposed developments now be required, the ecological planning method lends itself to the following technique : overlay the composite suitability map on each of the maps of the environmental characteristics. It will immediately become clear how each of the proposed land uses will affect each of the environmental factors. Therefore by reversing the ecological planning process, impacts on the environment can be identified and described, often in quantitative terms.

In a recent study this method was used to determine some of the impacts of future residential, commercial and transportation developments around a large metropolitan complex. By overlaying the proposed plan for future development on the maps of the environmental characteristics, the following impacts were evident (given here in summary form) :

(a) Effect on agricultural land. The proposed urban developments avoid all the soils with a high potential for perennial crops, but will extend over a few small areas totalling 2,5 km² of soils with a medium to high potential. About 400m of high potential soil is traversed by a proposed freeway while 3,5 km of a proposed railway line and 5 km of roads will extend over soils with a medium to high potential. The proposed residential development also avoid the areas with a high potential for annual crops, but will cover extensive areas with a medium to high potential for such crops. The latter is unavoidable since most of the soils of the urban perimeter fall in this category.

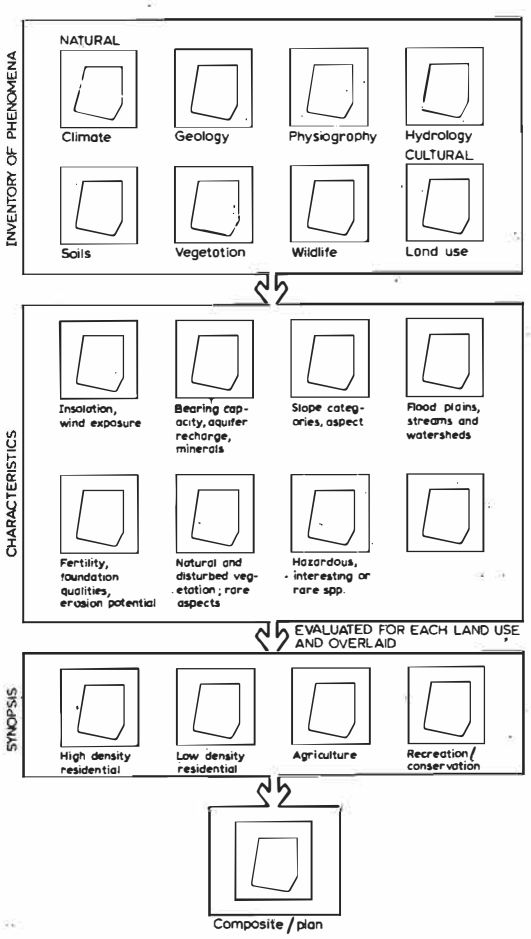
(b) Effect on fauna and flora. The proposed developments are generally not in conflict with the areas designated to be of importance for the conservation of fauna and flora. However, one area designated as a first priority area for botanical conservation will be turned into residential and industrial development while an area containing threatened plant species is allocated to residences. Part of a proposed freeway will cut through an area containing a high orchid population and rare Erica species.

(c) Effect on geotechnical factors. One of the proposed townships will be located in an area indicated as "sensitive due to dunes, sand and fine vegetated cover". Special precautions will be needed here especially during the construction phase.

(d) Effect on construction materials. Some of the proposed developments will be on clay and sand suitable for brickwork and glass respectively. However, extensive areas with valuable building materials are avoided.

(e) Effect on drainage. The natural drainage system of the area will be affected by the covering of large areas with impervious material, requiring special precautions and facilities.

(f) Effect on historical buildings. No buildings of historical interest or known archaeological sites will be affected by the proposed developments.



Diagrammatic presentation of the ecological planning process.

The method makes no provision for assessing the impact of the proposed developments on aspects such as sound, air and water quality, nor on the socio-economic factors (population characteristics, employment, income levels etc.). These will have to be assessed on an ad hoc basis, if required.

The method of impact assessment described above appears to be very suitable for evaluating projects of a regional scale, especially as far as it is systematic, flexible (can be used for various types of project), objective, reasonably comprehensive and quantitave, and allows for comparison of alternatives. Also, since all the relevant information is available in the form of maps, problems can easily be pinpointed and displayed.

The aim of the ecological planning method is to provide a plan that will fit developments harmoniously into the environment. As shown above, the method can also fruitfully be used to assess the environmental impact of the developments proposed in the final plan. It is therefore suggested that this method of environmental impact assessment be used wherever possible and that the matrix technique not be made the only and mandatory way of carrying out these studies in South Africa.

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