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DEVELOPMENT IN MALAYSIA: A LANDSCAPE APPROACH

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Geographers have much to contribute toward solving problems of major environmental concern if they return to some of the traditional roots of their discipline and develop these in a scientific way by applying them in an integrated, synthetic manner and focus upon a holistic approach to environmental problems. This approach is illustrated by reference to the land development process in Peninsular Malaysia from c. 1850 to the present. Questions discussed revolve around the issue of environmental stability of changing land use patterns. A basic question relates to how natural process dynamics have, or have not, been replicated as the landscape has become increasingly humanized. The overall consequences of these developments raise further questions concerning the internal stability and diversity of individual land uses, their mix in the regional land use spectrum and the importance of retaining areas of natural forest within planned land uses.

In his recently published introductory essay to the special issue of *GeoJournal* devoted to landscape synthesis Professor Mazúr noted many issues concerning our limited knowledge and our abilities to interpret landscape in any scientific way (Mazúr, 1983). To many geographers in Europe and the U.S.S.R. such a statement may appear somewhat misplaced since the long standing tradition of a focus upon the interpretation of the landscape appears — to outsiders at least — to have persisted from the birth of modern geography in the late 19th century up to the present. In the English-speaking world, however, Mazúr's statement no doubt seemed to be a *crie de coeur* for a return to the days of regional geography and for a revival of interest in geography as the science which synthetizes information on various components of man's environment. Yet an examination of Mazúr's work, and that of his colleagues, shows that both European and English-speaking geographers have much to learn, and to contribute by following some of the directions outlined. And that in developing methods of scientific synthesis of environmental components, both physical and biotic (including man), modern geography has much to contribute toward our understanding of many current environmental problems.

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Likewise, it can be shown that geography has much to offer in many fields of environmental and regional planning and management (Drdoš, 1983).

The following paper attempts to satisfy several of the demands posed by Mazur in that it seeks to take a regional, synthetic approach to a particular set of environmental problems. It does this at a national level and in so doing differs from somewhat similar approaches to environmental problems conducted at a more local scale (see for example, Snacken and Antrop, 1983). This is not to say that the two scales are incompatible. Here an attempt is made to identify local and sub-regional problems and trends within a hierarchy of larger spatial units. The methods suggested have been derived from several of the environmental and ecological sciences and applied in a geographical context — to a societal problem with certain critical relationships to a defined land resource-based system (Moss, 1983). These ideas will be developed in the context of the major rural land developments that hove taben place Peninsular Malaysia over the past 150 years.

LAND DEVELOPMENT

Studies of land development have traditionally focussed upon either the changing nature of land utilization or the impact of specific land uses upon the biophysical components of the land developed. Increasingly attention needs to be redirected to a more functional and holistic approach to issues of land development, to questions of the long-term impact of specific land uses, and to questions concerning the ecological significance of patterns of land use functions within particular environments. Ultimately these, and others, land use related questions must be, in part, directed toward the issue of the long-term stability of the environment being developed. How, for example, can the inherent productivity and carrying capacity of the land be maintained or enhanced? And, how can this maximizing goal be achieved without problems of land degradation developing to a point beyond which the costs of maintaining the natural functions exceed the benefits obtained by land development?

In this particular case the question of the long-term stability and the viability of the humid tropical environment to sustain economically critical biotic land use functions is raised. Such a question must look for an answer in an understanding of the environmental processes which characterize the region and which are responsible for its natural stability. Any long-term uses of the natural resource base must appreciate such functions so that land management can at least maintain, if not enhance, the role of these processes which have maintained the environment in a stable condition for millennia. This means that those environmental processes which, as a consequence of human interference, cause deterioration, or instability, must become the focus for land development and land management strategies. We are able to appreciate this problem much more readily when we are dealing with one land use function but we need to develop such notions in a broader, regional context where many different land use functions are involved. Here an attempt is made to provide an overview of the issue of regional land use/landscape development and to bring out the relevance of ideas of environmental dynamics and ecosystem functions as they may apply to such questions of stability, interaction, resistance to impact or resilience to change (perturbations), and the conse-

quences of this to the present-day Malaysian economy. Such ideas must be developed from an understanding of the natural resource base. This must inevitably focus on those aspects of the tropical rain forest ecosystem which revolve around the issue of stability, itself a topic of ongoing debate.

STABILITY OF THE NATURAL RESOURCE BASE

The source of conflict in views expressed about the stability of the biophysical resource base in humid tropical environments tends to be based on the ideas of specialists who are familiar with specific environmental components rather than from those who have emphasized a holistic approach to this environment. Douglas (1969), however, effectively dealt with this conflict by placing the role played by vegetation in the context of the landform denudation system.

The fact that there normally exists a thick weathered mass of unconsolidated material (regolith) beneath the rainforest led many to argue that the environment itself was very unstable since the existence of such a weathered mass must be related to very active erosion. However, evidence to the contrary indicates that not only has this environment been one of the least affected by climatic and environmental change throughout recent geologic time but also the evidence for heavy erosion (high sediment loads and high solute content in rivers) does not exist (Douglas 1969). Weathering is active but the products of that process are largely taken up by the vegetation and cycled within the biotic component. The great depth of weathering is, in part, a reflection of time but also a reflection of role of the vegetation in supplying carbon dioxide, organic complexes and weathering agents. Hence the rate of supply of weathered materials is largely controlled by the vegetation cover.

Provided this natural balance is maintained there seems to be no real evidence of environmental instability. However, this is not to suggest that environmental stability is a non-dynamic situation. Many have outlined the significance, for example, of the opening of the forest canopy to permit forest regeneration (Poore, 1968; Whitmore, 1975, p. 13). The causes of such canopy opening are often related to non-biotic events and the significance of these random events in the environment are now generally accepted by ecologists and geomorphologists to be important in maintaining environmental stability. In this environment the number of factors causing these events is minimal and generally revolve around the recurrence of high magnitude climatic events. In addition to the opening of the canopy by windthrow which topples small areas of forest these events also result in the occurrence of mass movements of weathered materials on slopes (Douglas 1970) and may indirectly affect river channel changes due to flooding (Douglas 1977, p. 162).

Opening the canopy permits seeds on the forest floor to germinate. These germinating seedlings are of two types, the primary seedlings of the forest dominants and secondary species of short-lived importance primarily in providing shade during early regrowth periods. However, primary seeds tend to have limited dispersal ranges (Gomez—Pompa et al., 1971) so that with increasing fragmentation of the forest cover by human activities any regrowth in intervening areas is increasingly likely to be dominated by these secondary species. These form a savanna like vegetation community whose role in the

environmental system differs significantly from the role of forest cover. This process is already well advanced in parts of the Amazon basin but has not yet developed in Malaysia since areas cleared have, so far, been replaced largely by plantation crops of rubber and oil palm. The normal environmental rhythm is, therefore, one of periods of semi-dormancy in the vegetation and long periods of land surface stability suddenly broken by extreme events, such as severe storms, causing sudden changes to both the biotic (vegetation) and abiotic (e. g. landslips, river channel changes) environmental components.

Such observations point to the importance of the concept of stability, both from an ecological and from an environmental viewpoint. The distinction between the two being one of scale and degree of process interaction. But of critical concern are the recent sudden and dramatic changes imposed upon the natural system by the nature and extent of human activities. Immediately the questions raised concern not only the degree and nature of impact at the source but also the broader spatial implications as well as the long-term effects of current activity on the environment. Are increases in the number and frequency of man-induced environmental perturbations likely to endanger the environment of the Peninsula as a whole or even of the environment beyond the national boundaries and into offshore regions? What are the links, for example, between forest clearance in one location and terrestrial and aquatic ecosystems in another location? An important related question must also concern the links, for example, between land development in one area and the human ecology of related areas. Many of these are fundamental questions of man/land relationships which are undergoing radical change at the present time and which have serious implications for land use development.

RURAL LAND DEVELOPMENT IN PENINSULAR MALAYSIA 1850—1990

Structurally the Malay Peninsula is made up of the relatively narrow west coast lowlands and the wider east coast lowlands, separated by the mountainous Main Range which reaches elevations up to 2000 m above sea level (see inset, Figure 1). This basic structure has had an important control over the location of the region's development over the past century or more. Initially, the whole Peninsula was covered by dense tropical rain forest but until mid-nineteenth century human impact was restricted to the coastal strip and a few inland river valleys. Otherwise impact on the interior was due entirely to small numbers of hunters, gatherers, and shifting cultivators. By the mid-nineteenth century traditional Malay agricultural systems had expanded quite extensively but the main thrust of extensive land use development came with the establishment of commercial agriculture by the Chinese in the early nineteenth century (gambier, pepper, tapioca etc., later coffee, sugar). The first really extensive impact came in the early 1900's with the rapid rise of rubber plantations — restricted in location primarily to the west coast lowlands. By 1940 oil palm had also become a major plantation export crop.

The main thrust of land development came after independence (1957) particularly with the establishment of agencies concerned with rural land development such as the Federal Land Development Authority (FELDA). These and other agencies will be responsible for the conversion of the 7.0 million hectares in the Peninsula (total 13.5 million hectares) considered suitable for agri-

cultural development. Much of this is to be allocated to two plantation crops, rubber and oil palm (Aiken et al., p. 156). Of the remaining rain forest only 1.9 million hectares will be left as protective forest.

The consequences of this development are such that the environment is being rapidly changed from an ecologically diverse, virgin tropical rain forest to a rural landscape of extensive, uniformly aged plantations of extremely low ecological diversity with its many associated changes in fundamental man-environment relations and attitudes.

EVOLVING LANDSCAPE ECOLOGIES

What now exists is a spectrum of land uses from units which remain in a natural or unaltered form through to those which are most drastically modified — the urban land uses. Any region of the country has a range of examples from this spectrum, each of which reflects regional land use diversity but which changes in relative balance between components from region to region.

To appreciate some of the functional significance of this concept of landscape diversity one must look to the ecological concept of community diversity. The basis of this concept is that the more species there are in a community the greater is the possibility that the community will be able to adapt to changing conditions either in the short or long term. This can be restated as follows; the greater the diversity, in general, the greater is the resilience of that community in adapting to change. By substituting the individual land use functions in a landscape for the individual species in a community some of the notions of landscape ecology and the significance of landscape diversity in the Malaysian context can be developed. In this way possible inter- as well a intra-land use functions, their resilience, and their overall environmental stability in the Malaysian landscape can be brought out.

The types of questions that one can now raise, if not answer, are, for example: What is the environmental significance of the greatly reduced species diversity within a rubber plantation compared with the far greater diversity of the original rain forest? What different degrees of external pressure or environmental change are required to disrupt the functioning of these two examples of land use? At what expense, for example, is the rubber plantation maintained in its present state compared with the natural forest or the traditional Malay agricultural system when fertilizer and herbicide application, man-hours etc. must be considered. At the regional scale what, for example, are the functional and biophysical interrelationships between a rubber plantation, an adjacent forest, and an adjacent rice padi or urban settlement? How do these different land use components interrelate and how have these spatial interrelationships, as expressed through changing landscapes, been modified through time?

At this stage it appears that such questions can only be raised. There are very few models to offer direction although Odum (1970) and Klopatek et al. (1979) have made some general deductions as to the ideal land use mix for maintaining existing living standards for the state of Georgia (U.S.A.). Hampicke (1978) has reviewed the consequences of changing agricultural practices for ecological and environmental stability and change for western Europe. These sources both offer some observations relevant to Malaysia. For instance,

Klopatek et al., using Odum's original calculations, suggests for Georgia an ideal land use mix of 40 % natural environment, 20 % fibre-producing land, 30 % food production and 10 % urban-industrial land. Odum concedes that in rice-growing areas, with higher per land unit food yields, only 3 % of the land may be required for food production. This, however, neglects to consider the

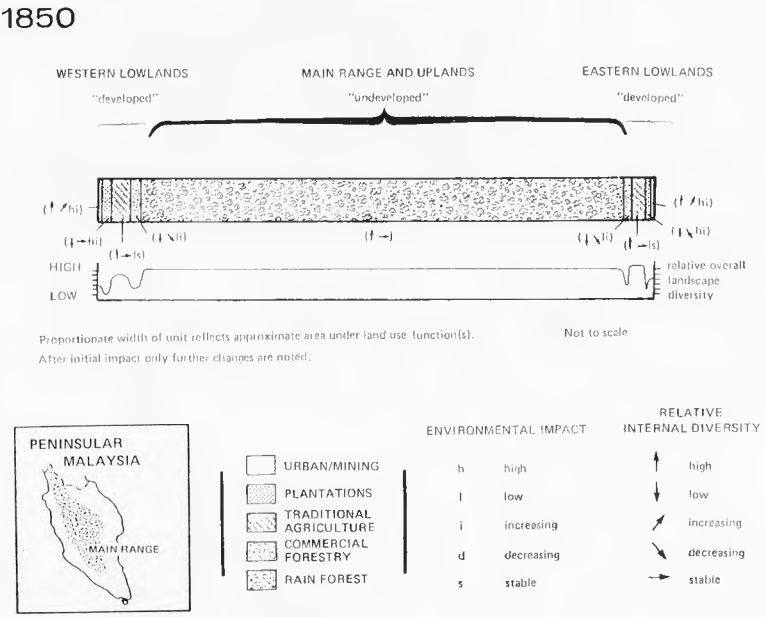

Fig. 1. Major components of land use in Peninsular Malaysia, 1850.

rapidly increasing population size to be fed in Malaysia and the need to increase living standards rather than merely maintain existing living standards. Nevertheless, the relatively high proportion of land to be retained in its natural state to maintain the system is quite significant and it is useful to refer to the proposals for the land use patterns of Pahang Tenggara, Trengganu Tengah etc. (see Aiken, et al., chpt. 6) to note the fate of much of the natural forest cover. Hampicke stresses the undersirable ecological and environmental consequences of increasing monoculture and land consolidation which have direct implications for the major land development schemes of the Peninsula with their heavy commitment to extensive plantation agriculture.

Perhaps the significance of some of these issues can be strengthened if one considers some of the possible environmental consequences that could occur if there was a sudden drop, for example, in the world demand for palm oil. How would this be reflected in the different regions of the country with their different landscape diversities and what would be the implications of this to environmental stability in these different regions? In the western lowlands the consequences may be much less significant because the percentage acreage

and the size of individual units and holdings devoted to oil palm production are generally smaller and more dispersed than in the eastern lowlands. Smaller areas of land going out of production of one crop where there exist alternative uses that can readily expand into these abandoned areas, will inevitably mean less change in, for example, surface water runoff, nutrient losses, flooding

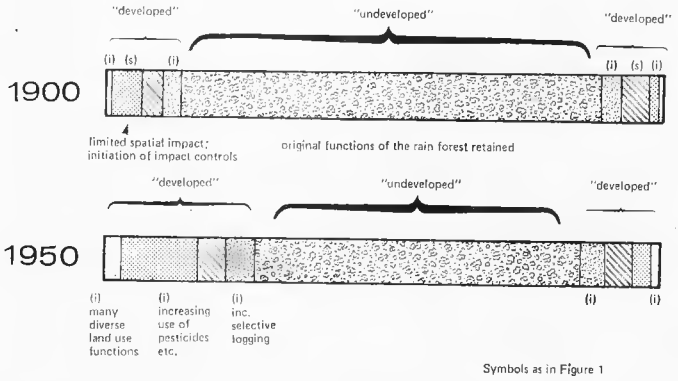

Fig. 2. Major components of land use in Peninsular Malaysia, 1900 and 1950 (for key to symbols see Fig. 1).

etc. etc. That is, the environmental impact will be spatially „contained". However, on some of the new extensive land development schemes of the eastern part of the country, were oil palm suddenly to go out of production, the consequences to runoff changes, flooding, siltation, soil erosion etc. would inevitably mean quite catastrophic environmental disruption. Few other crops or possible land uses exist, or are needed, to replace the oil palm plantations and their environmental and biophysical functions. The economic and societal consequences resulting from such a situation could be devastating. If random perturbations are considered essential to maintaining long-term environmental stability then they have effectively disappeared from the developed landscape. How can they be incorporated into plans for more diverse land use patterns?

Little attention has been paid to the value of the more traditional Malay approaches to land use. In terms of evolving land use patterns and the advantages to ecological and environmental stability, perhaps an examination of the various traditional systems and a greater understanding of their biophysical significance and role in a landscape diversity context could have value and offer direction to future land use planning. But in Malaysia, as elsewhere, achievement of short-term goals and return on investment inevitably overrides concern with long-term environmental stability.

A further dimension to be gained from this landscape diversity concept is an appreciation of time in landscape and land use evolution. Generally, the longer a land use function has survived the more resilient or resistant that function is to withstanding pressure and change. The older, established, and more highly diverse functional patterns of the west contrast in their periods of evolution with the short-time scales and low landscape diversity patterns

of the east. With this added temporal dimension we can now examine Figures 1 to 3.

Each of these figures has been drawn to illustrate and summarize the main points of the argument as it may be expressed from 1850 (Figure 1) to 1980 (Figure 3). Each schematic cross-section of the Peninsula from west to east

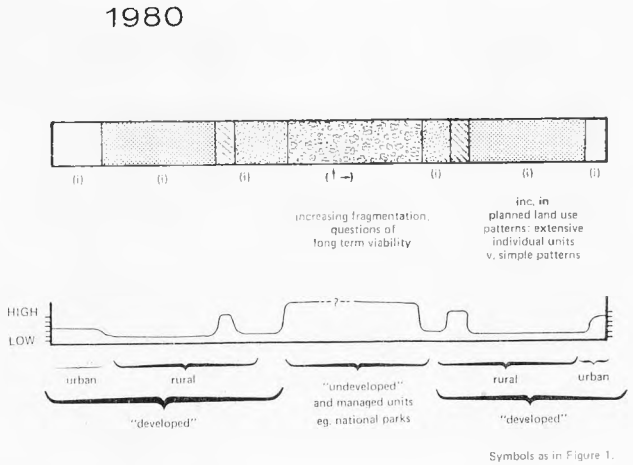

Fig. 3. Major components of land use in Peninsular Malaysia, 1980 (for key to symbols see Fig. 1).

coast contains information on certain ecological attributes for each land use function. These are, for example, the degree of relative internal diversity of the land use function and the direction of this diversity (increasing, decreasing, or stable). Additionally information is provided on the degree of environmental impact (high or low) and the trend of this impact (increasing, decreasing, or stable). The graph beneath the cross section indicates the relative degree of overall landscape diversity — in this case high in the case of the rain forest, relatively high in association with traditional agriculture, and low with respect to commercial forestry and plantations. This also expresses the consequences of the internal diversity of these land use functions and the degree and direction of human impact.

Figure 2, for 1900 and 1950 A. D., also summarizes some of the other major environmental trends during this period until the situation circa 1980 is reached (Figure 3). By this date several themes and national trends have become quite evident. There is a trend to the evolution of greater diversity in the western lowlands as the number of different land use functions increases from the mid-nineteenth century. There is also the survival of a number of these functions which has implications for resilience of these regions. But there is also the trend towards increasing man/environment disequilibrium as the newer functions, particularly plantations and urbanization, have evolved. On the other hand in the eastern regions generally the late date of development initiation has tended to preclude the evolution of the more resilient

functions. It is the lower diversity functions, particularly extensive plantation monocultures and those with greatest man/environment disequilibrium, that are rapidly being imposed upon the environment producing a landscape of low diversity and little resilience which can only be maintained at high expense.

As each new land use function develops we esentially move further and further away from the inherent advantages of the natural resource base. Consequently each of these new land use functions can only be maintained and remain productive when man artificially replaces the natural inputs and attempts to manage the processes related to energy flow, moisture regulation and the lands inherent fertility. This can only be achieved by expenditure of human and fossil fuel energy, irrigation and water control and massive doses of fertilizers and herbicides, pesticides etc. As this type of environmental impact increases it vecomes even more apparent that for successful land planing much greater emphasis must be placed on understanding the environment through appropriate land evaluation procedures, land capability assessment, conservation, and environmental legislation and control.

The more immediate consequences of these trends become evident if reference is made to examples of the regional land development schemes of Jengka, in western Pahang (122,200 ha), now fully developed and to Pahang Tenggara, a 1 million hectare scheme being developed over the 1970—1990 period. (The precise details of these and other regional schemes are outlined in Aitken et al. (1982) pp. 130—158). The large and extensive uninterrupted tracts of land to be given over too plantation monocultures and for forestry are considerable. (In Pahang Tenggara this will be 637,500 ha compared with 199,200 ha which will remain as unusable land — swamp, conservation areas, and protective forests on land too steep to cultivate).

But what is of perhaps the greatest concern is the local distribution of landscape elements — the local tracts of forest, their size, shape, and distribution; the size of monoculture plantations and their spatial relationships with each other and other land use functions. The developing field of landscape ecology again perhaps has much to direct to questions of land development. But at this stage the most effective work is being done in North America and Europe where natural areas are being examined from the point of view of their own long-term viability (Forman, 1981; Sharpe et al., 1981). The problem is to apply these types of results to more general issues of total landscape preservation by not only identifying their overall significance but the significance of their spatial interaction with other biotic elements in the agroecosystem component of the landscape. These questions are difficult to persue in developed areas but at least questions are being raised both in the developed world and in developing countries such as Malaysia (Joseph, 1980).

What emerges from these interconnected and often conflicting themes is that if development strategies are to satisfy both the present and the long--term needs and goals of a region they must be geared to four clear objectives. These are; (a) the wise exploitation of natural resources; (b) sustained productivity from ecosystems; (c) observation of the carrying capacity of land and water; (d) avoidance of the degradation of environmental quality (Carpenter, 1980). Each of these goals cannot be viewed separately but must be treated in the context of a holistic or synthetic approach to natural resource evaluation which requires an understanding of regional environmental pro-

cesses and dynamics as one of several contributory factors in land use planning.

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ROZVOJ V MALAJZII: KRAJINNÝ PRÍSTUP

Geografia môže významne prispievať k riešeniu hlavných problémov prostredia, ak sa pre tieto účely vráti k niektorým zo svojich koreňov a rozvinie ich do syntézy s fókusom na holistický prístup k prostrediu.

Tento syntézový prístup, motivovaný československou krajinnou syntézou, autor aplikuje na skúmanie procesu vývoja využívania zeme na Malajskom polostrove od r. 1850 do súčasnosti. Zameriava sa pritom na otázky stability krajiny a zmien v štruktúre

využívania zeme. Skúma, ako sa uplatňuje dynamika prírodných procesov v krajine, ktorá sa postupne stále viac antropogénne mení.

Štúdium týchto zmien vedie k otázkam vnútornej stability a diverzity jednotlivých foriem využívania zeme, v jeho regionálnom spektre a k otázkam zachovania relatívne zachovaných prírodných priestorov v krajinnom pláne.

Pri skúmaní zmien štruktúry využívania zeme používa 4 časové profily: roky 1850, 1900, 1950, 1980. Pri jednotlivých formách využívania zeme sleduje intenzitu antropických vplyvov (5 stupňov: vysoký, nízky, stúpajúci, klesajúci, stabilný) a vnútornú diverzitu (vysoká, nízka, stúpajúca, klesajúca, stabilná). Vo vývoji štruktúry využívanie zeme možno pozorovať pomalú tendenciu zmien v období rokov 1850—1950 a veľmi urýchlenú tendenciu od r. 1950 do súčasnosti. Zároveň má vo väčšine prípadov silne stúpajúcu tendenciu antropogénna premena a nízka hodnota vnútornej diverzity pri klesajúcej tendencii.

Obr. 1. Hlavné komponenty využívania krajiny na Malajskom polostrove, 1850.
Obr. 2. Hlavné komponenty využívania krajiny na Malajskom polostrove, 1900, 1950.
Obr. 3. Hlavné komponenty využívania krajiny na Malajskom polostrove, 1980.

Майкл Робер Мосс

РАЗВИТИЕ В МАЛАЙЗИИ: ЛАНДШАФТНЫЙ ПОДХОД

География может внести важный вклад в разработку главных проблем среды, однако для этих целей она должна вернуться к некоторым своим прежним позициям и развернуть их в синтез с ударением на исторический подход к среде.

Этот синтезный подход, мотивированный чехословацким ландшафтным синтезом, автор применяет при рассматривании процесса развития использованя земель на Малайском полуострове начиная с 1850 г. до наших времен. При этом он делает упор на вопросы устойчивости ландшафта и на изменения структуры использования земель. Он исследует каким образом проявляется динамика природных процессов в ландшафте, которая постепенно все больше антропогенно изменяется.

Изучение этих изменений приводит к вопросам внутренней устойчивости и диверситы отдельных форм использования земель в его региональной разнообразности и к вопросам сохранения относительно сохранившихся природных пространств в ландшафтном плане.

При изучении изменений структуры использования земель автором применены 4 исторические сроки: 1850 г., 1900 г., 1950 г. и 1980 г. Для отдельных форм использования земель он прослеживает интенсивность антропогенных влияний (5 градаций: высокая, низкая, возрастающая, понижающаяся и устойчивая) и внутреннюю диверситу (высокую, низкую, возрастающую, понижающуюся и устойчивую). В развитии структуры использования земель можно наблюдать замедленную тенденцию изменений в период с 1850 по 1950 г. и усиленно убыстренную тенденцию с 1950 г. до нашим времен. Одновременно наблюдается усиленно возрастающая тенденция антропогенных изменений и низкое значение внутренней диверситы при понижающейся тенденции в большинстве случаев.

Рис. 1. Главные компоненты использования ландшафта на Малайском полуострове, 1850 г.
Рис. 2. Главные компоненты использования ландшафта на Малайском полуострове, 1900 г. и 1950 г.
Рис. 3. Главные компоненты использования ландшафта на Малайском полуострове, 1980 г.

Перевод: Л. Правдова