UDC 911 (438 "Warsaw" — 192) = 20

LANDSCAPE APPROACH TO THE STUDIES OF SUBURBAN ZONES

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Introduction

A characteristic trait of our times is the increasing complication of all ranges of life and human activity, including also processes connected with the use of the surrounding environment and production in a wider sense. Numerous specialists /see Schumacher 1976/ indicate that technology and production are developing in accordance with their own dynamics and law which significantly differ, and are frequently contrary to the laws of human development and the development laws of nature in general. In such a situation particular importance may be ascribed, on the one hand, to an analysis of the problem of the range and intensity of the influence of man on the surrounding environment, and on the other hand — the problem of the resistance of this environment with the renewal of resources. This problem is of particular importance in conditions of suburban zones, where there is an intense and multidirectional human activity and the geographical environment fulfills different functions, frequently contradicting ones.

It has been known for a long time that vegetation as a component subordinated to other components of the geosystem constitutes a synthetic expression of the condition, phenomena and processes taking place in the landscape. The picture of the natural landscape, obtained on the basis of vegetation cover, is of an average character, which is related not to a given moment, but to a certain range of time. The vegetation condition in almost 80% determines the state and functioning of the remaining elements of the spatial system, including also anthropogenic origin /Kostrowicki 1982/. Therefore, analyses of the condition of the spatial system may

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be based to a large extent on studies of vegetation, taking into consideration other components only in the required range.

In the exploited and anthropogenically transformed geosystems of the suburban zone there are vegetational mosaics consisting of communities with a verying degree of naturalness, often of different dynamics, origin and ecology. An analysis of the floristic composition, distribution in space and ecological requirements of the elements of such a mosaic may provide a lot of information, not only concerning abiotic elements of landscape, but also the type and intensity of anthropogenic influences. Each anthropogenic activity apart from influencing the matter cycle and energy flows, introduces into the vegetational system a certain amount of information most frequently alien to the structure of the given system. It is assumed that under the influence of an information flow alien for the given system, the spatial organisation undergoes a decrease /Ciplea, Ciplea 1980/, and then changes in order to be able to adapt to the character of the stimuli.

Numerous different models may be imagined which would represent connections between various elements in the "man-environment" system. For this elaboration it is enough to assume are of the most simple ones, which stresses the role of energy balance and the spatial structure of the natural environment /Fig. 1/.

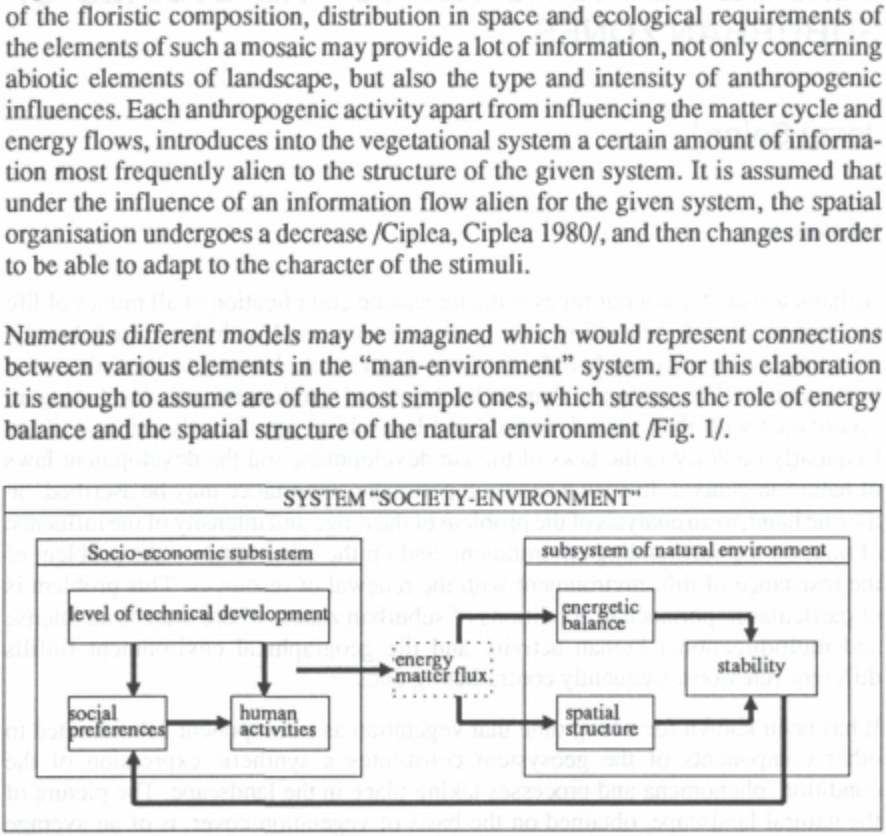

Fig. 1. *Simplified model of chosen interrelations between subsystems in "society-environment" system*

In accordance with that model, as a result of anthropopressure, the energy balance of the natural subsystem is changed, as well as its spatial structure. This as a consequence leads to changes in the stability of the whole spatial system /often leading to degradation/, and as a sort of feedback reaction influences the social and economic subsystem.

The presented scheme is general to such an extent that it includes various types of influences in different types of landscape.

The main task of this elaboration is: /A/ a comparison, short one as a necessity, of landscapes in suburban zones with urban and rural landscapes from the point of view of selected components of the energy balance and aspects of spatial structure, and an effort at distinguisheing these background specific characteristics of the suburban zone, and /B/ presenting a qualitative model of connection between changes in the energy balance and spatial structure on the one hand, and stability on the other.

Energy Balance

A theoretical basis for an analysis of the energy balance is constituted by the concept of open systems, understood as thermodynamically unbalanced systems /Prigogine 1965/. At present the energetical approach is one of few methods enabling an analysis of the condition and functioning of anthropogenic systems and allowing a summarical concept of the natural and socio-economic environment in the same measuring units.

Energy reaching the landscape originates from two sources:

— solar energy, which in Poland amounts to 2.8 to 3.5 x 10^9 x J x m^{-2} x y^{-1}, of which only 0.5 to 2.5% is transformed into chemical energy in plant tissue;

— energetic subvention, in the form of fuels, good and services of a determined accumulated energetic consumption; the size of this subvention is different in various types of systems.

Within the system only a small part of energy /less than 1%/ is utilized for satisfying the physiological demands of the human population, and the rest undergoes various transformations which are accompanied by losses in the form of heat. The final stage of those transformations is a determined amount of energy stored in the primary production of plants and in defined goods. This part of the energy may be used within the system or carried outside of it.

In rural landscapes /Table 1/ the main functioning aim of which /from the anthropocentric viewpoint/ is the production of food, the energetic subvention is relatively small and amounts to a little over a dozen percent of the total energy coming into the system. On the other hand, rather high /about 70%/ is the efficiency

Table 1: *Chosen characteristics of energetic balance in three types of landscapes*

type of landscape	*population density (persons/sq.km)*	*Energy (x 10 MJ/sq.m/year)*			*B:(A+B)*	*Efficiency of primary production*	*case study*	*recalculated on the basis of data from*
		solar available for plants	*subvention*	*total*				
		(A)	*(B)*	*(A+B)*				
rural	70	4.67	0.70	5.37	0.13	0.7 -0.8	Drweca River Basin	Barcikowski et all. 1979 suburban
suburban	353	4.20	3.14	7.34	0.43	0.4 -0.5	Lomianki commune	Kostrowicki (in print Litynski (in print)
urban	1495	2.94	5.27	8.21	0.64	0.05-0.15	Kielce Town	Brzozowska-Starczewska 1985

i.e. the relation of the stored energy in the primary production of plants to the total energy comming to the system.

In systems of the suburban type /Table 1/, which are to fulfil simultaneously numerous varied, often contrary, functions, energetic subvention constitutes slightly less than a half of the total energy amount, while the efficiency of primary production amounts to 40 — 50%.

Completely different is the situation in urban systems, which are moderately and highly urbanised. The subvention amounts to over 60% of the total energy, and the manufacturing efficiency of primary production /most frequently not utilised by the human population, as it is not production that is the aim of the functioning of the system/ is very low and seldom exceeds 15%.

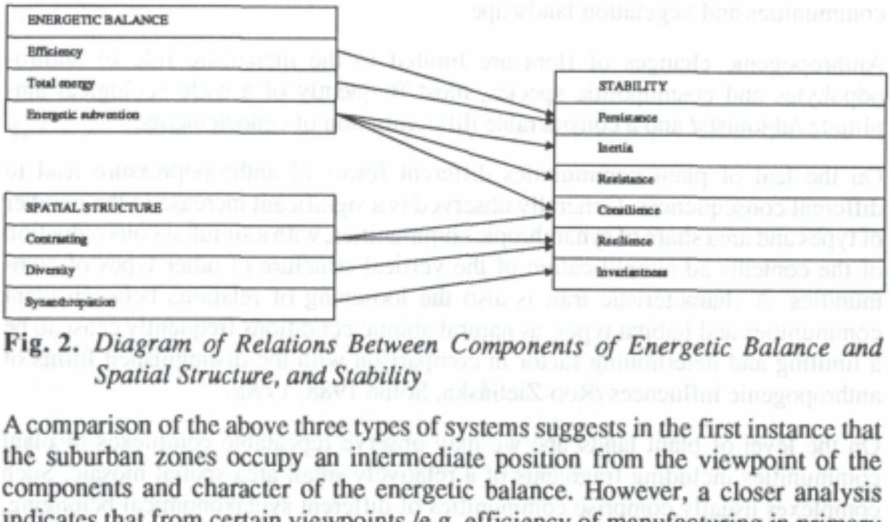

Fig. 2. *Diagram of Relations Between Components of Energetic Balance and Spatial Structure, and Stability*

A comparison of the above three types of systems suggests in the first instance that the suburban zones occupy an intermediate position from the viewpoint of the components and character of the energetic balance. However, a closer analysis indicates that from certain viewpoints /e.g. efficiency of manufacturing in primary production, solar energy accessible for plants/ suburban zones have a character close to that of rural landscapes, while other characteristic traits /e.g. absolute value of energetic subvention/ are distinctly of an urban character.

Characteristics presented in table 1 have a double character. They enable a comparison of systems of various kinds, and at the same time they are indicators of the state and potential possibilities for transformations of the system. The size of energetic subvention is a specific measure of the technical development of the society, and in an indirect way it describes the intensity of influences on the environment. The share of energy of natural origin in the total energy supply constitutes a measure of the balancing and independence of the system from anthropogenic factors. The manufacturing efficiency of primary production may be considered as an indicator of the degree of maintenance of natural mechanisms regulating the functioning of the system.

The two first types of evaluations describe in an indirect way the stability of the system, and all of them lead to the determination of a maximum permissible energetic subvention, not causing yet irreversible changes in the system.

Spatial Structure of Vegetation

Changes of vegetation cover conditioned by purposeful and directed human activities or which are an intermediate and accidental effect of the constant incoming of energy of anthropogenic origin, may be observed on the level of local flora, plant communities and vegetation landscape.

Anthropogenic changes of flora are limited to the increasing role of anthropopohytes and cosmopolitic species, most frequently of a wide ecological amplitude /ubiquists/ and a considerable differentiation of cenoelements.

On the leal of plant communities different forms of anthropopressure lead to different consequences. Generally observed is a significant increase in the number of types and area share of synanthropic communities, with a simultaneous reduction of the contents ad simplification of the vertical structure of other types of communities. A characteristic trait is also the loosening of relations between plant communities and habitat types, as natural abiotic conditions frequently cease to be a limiting and determining factor in comparison with the distinguished forms of anthropogenic influences /Roo-Zielińska, Solon 1988, 1990/.

On the level of plant landscape we may observe repeatable complexes of plant communities including fragments of a relatively small area spatial mosaic. Such complexes usually comprise communities of different syntaxonomical belonging, varied ecological character, origin, different dynamics, vertical structure and being in various stages of transformations taking place in ecological mechanisms, which is connected with a different degree of resistance to external influences and a varied demand for energy coming from the outside, which is indispensable for correct functioning. Various complexes differ also in stability and may be considered as "segments" of the landscape with differing stability /Buczek et al. 1984/.

During a complex analysis of the spatial structure of vegetation landscapes, several aspects come to light, namely:

/A/ synanthropisational degree of vegetation, as a measure of deviation from the natural condition and simultaneously an indicator of the intensity of anthropogenic influences. Those phenomena may be evaluated with the help of one of the existing indices /e.g. degree of hemeroby — Jalas 1955, Billwitz 1980; anthropisation index — Kostrowicki, Plit, Solon 1988/.

/B/ contrasting of borders as a measure of the degree of structural balancing, but also, in an indirect way, of the functional totality of the system /Romme 1982/. Evaluation may be carried out for contrasting in an ecological, physionomical, syntaxonomical or for another concept.

/C/ spatial variety of communities /relative and absolute/, which constitutes a reflection of differentiation in the use of forms and, indirectly, of regenerational possibilities of the system. It may be evaluated most easily with the help of information indices /Solon 1988a/, based on the formula:

$$H = -\sum p_i \log_2 p_i$$

where p_i — share in area of "i" component.

Table 2: *Sample Values of Selected Indices of Vegetation Spatial Structure in Various Landscape Types*

Indices	Landscape Types		
	rural	subur-ban	urban
Synanthropisation /+/	3-5	6-7	8-9
Border contrasting /+/	2-3	5-7	2-3
H /P/	2-3	3-5	1-3
H /P/ : H_m /P/	0.6-0.7	0.7-0.8	0.4-0.6
H /P/ : H /E/	2-4	3-7	1-4
U /P/	0.2-0.3	0.2-0.3	0.2-0.3

/+/ in the conventional 10-grade scale

The most frequently used indices of this group include the following:

— index of surface diversity of actual vegetation H/P/, determining the likelihood that a hazardly selected plant stand represents a defined community type, in other words, this is an inex determining a total variety of community types and their spatial distribution,

— index of uniformity of actual vegetation H/P/:Hm/P/, determining the surface distribution of vegetation. The closer the index value is to 1, the more types of communities show a close surface share,

— /H/P/:H/E/ index, which determines the relative variety of actual vegetation in relation to habitat differentiation /one of the aspects of the spatial organization of vegetation/. This is simultaneously a measure describing the level of vegetation transformation /Solon 1988b/,

— the U/P/ index, determining the degree of organization /repeatibility/ of the structure of community bordering, i.e. simultaneously their spatial pattern.

In accordance with the concept of an urban-rural continuum, the suburban zone should indicate an intermediate character between rural landscapes and areas with a high degree of urbanization. Data contained in Table 2 contradict that thesis. Apart from the degree of vegetation synanthropisation, which really has an intermediate value, other indices, particularly informative ones, indicate for suburban zones decidedly higher values than in other types of landscape.

Apart from a direct usefulness for characteristic and identification of spatial patterns of various types, and analysis of values of various indices with an analysis of the hierarchical structure of the vegetation landscape /Solon 1983, 1988c, 1989/ and degree of vegetation organization may be useful for the determination of a barrier and contact function of borders in the landscape, both in relation to flows of energy, matter and information, as well as for an analysis of another environmental gradients. This is a problem of particular importance while evaluating the complication degree of spatial patterns as one of factors influencing the degree of stability in the system.

The evaluation of the above presented aspects of spatial structure may be conducted in a various spatial units, i.e. among others simultaneously for the whole studied area, or within previously defined structural spatial hierarchical units /local complexes of phytocenoses and vegetation landscapes — se Solon 1983, 1989/, different from the viewpoint of stability, a priori defined landscape segments sensu Buczek et all. /1984/, on given habitats or on units determined in accordance with other criteria /e.g. administrative ones — Roo-Zieninska, Solon 1990/.

Landscape stability

The essence of the phenomenon of stability in natural patterns has still not been explained up to now, which often leads to various misunderstandings, as different authors use the same name in relation to different attributes of spatial systems. Several of them believe that the system stability is conditioned by the unchangeability of lithological and hydro-climatic conditions /Danewa et all. 1981/. Such an approach, although correct in essence, is not useful for an analysis of landscapes under anthropogenic pressure, as it is related to problems of an another type and in another scale. Most frequently it is assumed that the ecological stability of the landscape to a large extent depends on the condition of the biotic component, which may be best defined on the basis of vegetation.

In many elaborations there appear definitions of separate "stability types" depending on the geosystem type and extent of external influence. This is not the appropriate place for reporting all differences of views, but it is worthwhile to quote a few opinions representing distinctly varying points of view. For example, Preobrazenski /1981/ discerns the stability of natural systems, which he defines as an ability for renaturalisation of the system, and the stability of anthropogenic patterns, defined as an ability for a correct fulfillment of assumed socio-economic functions.

Petersen /1975/ is of a different opinion: he distinguishes stability as a reaction of the system to disorders originating from the outside, and stability determining the lasting of the system in an unchanged state.

It seems to be obvious that the above signalled ways of looking at the stability essentially concern different aspects of a single phenomenon, and not different "stabilities". Stability is a single but differently manifesting feature of ecological patterns of varying ranks. To put it in a very general way, this is the ability of a system for lasting or to return to the initial state after influences of external disorders /*Hurd etall. 1971*/. *This definition* may be amplified and an assumption can be made that stability is a notion embracing the following complex properties of ecological systems, and namely:

— in the case of environment parameters assumed as a standard, the system remain unchanged /PERSISTENCE/,

— in the case of deviations of the environment from standards, but not exceeding a certain determined level, the system does not indicate any change /INERTIA/,

— in the case of larger deviations of the environment from standards, which remain in a determined range /AMPLITUDE/, the system undergoes reversible changes, however, it maintains to a maximum degree certain basic traits /INVARIANTNESS/, even at the cost of changes, which remain in a certain permissible range /RESISTANCE/ of other attributes,

— those changes are insignificant in comparison with the degree of deviations of the environment from standards /HOMEOSTASIS/,

— after the return of external parameters to standard levels the system returns, in a determined rate and in a determined way, to the initial state /RESILIENCE/,

— in the case when the environment does not return to the initial state, the system continues in hitherto form for a longer or shorter period /CONSTANCY/, and then transforms into another system better adapted to a new conditions,

— to return to the initial condition is often impossible, or is connected with the provision of a large amount of energy and information of an anthropogenic character.

It seems that various aspects of stability are dependent in a differing way to components of the energetic balance and spatial structure of vegetation. Figure 2 presents a simplified model of such relations.

This model requires a fuller verification, but already now it seems that on the basis of a knowledge of relations between various components of an energy balance and spatial structure, in a relatively simple way it is possible to evaluate, although in an indirect way, the condition and perspectives of ecological changes in the spatial systems of different types. The above diagram also enables, through means of active operating, the controlling of landscape stability. It appears that in relation to suburban zones such control factors may comprise of the energetic subvention, contrasting of borders and the surface diversity of vegetation, i.e. factors which are reasonably easy to transform, and which influence the majority of aspects of the stability phenomenon.

Conclusion

The presented approach to an analysis of the specifics and character of suburban zones is a certain methodical proposition, which in the future may undergo changes and may become more detailed. However, on the basis of the selected examples quoted in this elaboration, we may assume that:

— suburban zones are an ecological pattern which is well characterised and distinctly differing /at least from the spatial view point/ from urban and rural areas,

— changes in time and space of the indices of the spatial structure and to a smaller extent, the energic balance are useful for an objective delimitation of suburban zones and for an analysis of their development,

— anthropogenic activities /influencing, among others, the flows of information and the energetic balance/, cause changes in the spatial structure, and the changes are not of a directly proportional character, but rather an alinear one,

— it seems that suburban zones are of an unstable character /moreover, of a low inertia/, in which its lasting depends on the constant and determined inflow of anthropogenic energy,

— the possibility exists of a conscious influencing of the stability level through changing spatial structures of the vegetation and components of the energetic balance.

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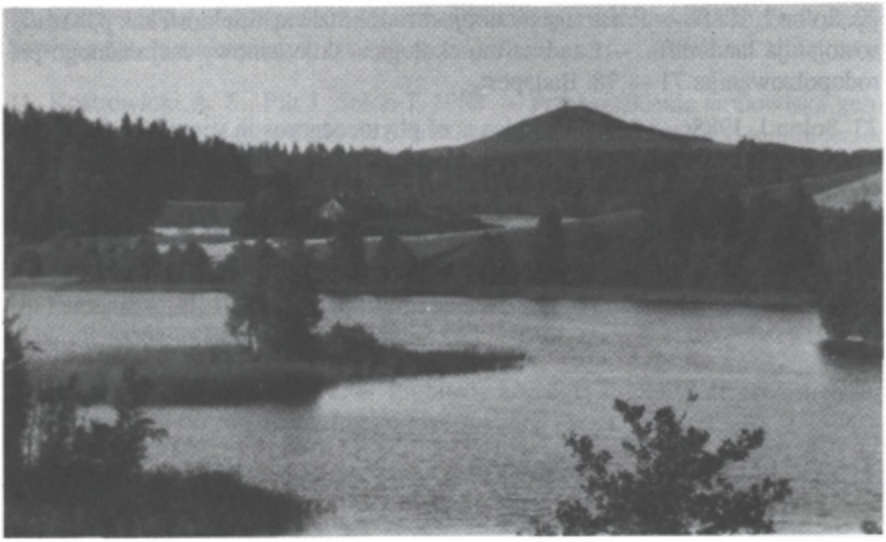

Rural and urban landscapes: two opposite ways of the utilisation of environment
Podeželska in mestna pokrajina: dve različni rabi okolja
***Foto:* J. Solon**

Pokrajinski vidiki proučevanja suburbanih območij

Jerzy Solon

Povzetek

Že nekaj časa vemo, da predstavlja vegetacija kot komponenta, ki je odvisna od drugih sestavin geosistema, sintetični odraz stanja dogodkov in procesov v pokrajini. Podoba naravne pokrajine, ki jo dobimo s pomočjo vegetacijske odeje, ima splošen značaj, ki se ne nanaša na določeni trenutek, temveč na daljše časovno obdobje. Stanje vegetacije v skoraj 80 % določa stanje in delovanje ostalih elementov prostorskega sistema, vključno tudi antropogeni vpliv (Kostrowicki 1982). Zatorej lahko analize stanja prostorskega sistema izvajamo v veliki meri s študijem vegetacije, s tem da druge komponente upoštevamo samo do zahtevane mere.

V izkoriščenih in antropogeno spremenjenih geosistemih suburbanega območja imajo vegetacijski mozaiki, sestavljeni iz združb z različno stopnjo naravnosti, često različno dinamiko, izvor in ekologijo. Analiza floristične strukture, prostorske razporeditve in ekoloških zahtev elementov takšnega mozaika lahko da veliko informacij, ne samo o abiotičnih elementih pokrajine, temveč tudi o tipu in intezivnosti antropogenih vplivov. Vsaka antropogena aktivnost vpliva ne samo na tok ciklusov in energije, temveč dodaja v vegetacijskemu sistemu tudi določeno količino informacij, ki so pogosto tuje strukturi danega sistema. Predvidevamo, da pod vplivom informacijskega toka, ki je tuj danemu sistemu, prostorska organizacija doživi padec (Ciplea, 1980) in se nato spremeni, da se lahko prilagodi značaju vspodbujevalcev.

Zamislimo si lahko tudi številne druge modele, ki predstavljajo povezavo med različnimi elementi v sistemu "človekovega okolja". Za ta prispevek smo obdelali enega izmed najbolj preprostih, ki poudarja vlogo energetskega ravnotežja in prostorske strukture naravnega okolja (sl.1).

Glavna naloga tega elaborata je:

/A/ kratka primerjava pokrajine v suburbanih območjih z mestno in podeželsko pokrajino glede na izbrane komponente energetskega ravnotežja ter vidikov pros-

torske strukture, pri čemer smo poskušali razločevati specifične značilnosti suburbanega območja in

/B/ predstavitev kvalitetnega modela povezav med spremembami v energetskem, ravnotežju in prostorsko strukturo na eni ter stabilnostjo na drugi strani.

Energetsko ravnotežje

Za teoretično osnovo analize energijskega ravnotežja smo vzeli koncept odprtih sistemov, ki pojmujejo kot termodinamični neuravnoteženi sistemi (Prigogine 1965), Sedanji energetski pristop je eden izmed redkih metod, ki omogoča analizo stanja in delovanja antropogenih sistemov in dovoljuje sumaričen koncept naravnege in socialno-ekonomskega okolja v istih mernih enotah.

Energija v pokrajini ima dva izvora:

— sončna energija, ki na Poljskem dosega od 2.8 do $3.5 \times 10^9 \times J \times m^{-2} \times y^{-1}$, od katere se samo od 0.5 do 22.5 % spremeni v kemično energijo in rastlinska vlakna;

— energija v obliki goriv, blaga in uslug določene, akumulirane energijski porabe; velikost le-te je različna v različnih tipih sistemov.

Primerjava treh tipov sistemov (sl.1) v prvem trenutku odraža vmesno pozicijo suburbanih območij s stališča komponent in značaja energijskega ravnotežja. Vendar natančnejša analiza pove, da imajo suburbana območja z dololočenih vidikov (n.pr. uspešnost primarne proizvodnje, dostopnost sončne energije do rastlin) značaj, ki je blizu podeželju, medtem ko imajo druge lastnosti (n.pr. absolutna vrednost energijske podpore) izrazito mestni karakter.

Značilnosti predstavljene na sliki 1 imajo dvojni namen. Omogočajo nam primerjati sisteme različnih vrst, istočasno pa so indikatorji stanja in potencialnih možnosti za spremembe v sistemu. Količina energije je posebno merilo za tehnični razvoj družbe, ki indirektno prikazuje intenzivnost vplivov na okolje. Količina energije iz naravnega vira in celotna dobava energije pomenita mero za ravnotežje in neodvisnost sistema od antropogenih faktorjev. Proizvodna učinkovitost primarne proizvodnje je lahko pokazatelj za stopnjo ogranjanja (vzdrževanja naravnih mehanizmov, ki uravnavajo delovanje sistema.

Prva dva evaluacijska tipa označujeta stabilnost sistema indirektno, vsi skupaj pa vodijo k opredeljevanju maksimalno dovoljene energije, ki še ne povzroča nepreklicnih sprememb v sistemu.

Prostorska struktura vegetacije

Spremembe vegetacijske odeje, nastale zaradi človekove aktivnosti in ki so posredna in slučajna posledica stalnega dotoka energije antropogenega izvora, lahko opazujemo na stopnji lokalne flore, rastlinskih združb in vegetacije v pokrajini.

Pri kompleksni analizi prostorske strukture vegetacije smo izpostavili nekaj vidikov:

/A/ sinantropizacijska stopnja vegetacije kot mera za odstopanje od naravnih pogojev in je istočasno indikator intenzivnosti antropogenih vplivov. Te pojave lahko ovrednotimo s pomočjo enega od znanih indeksov (n.pr. stopnja hemerobije — Jalas 1955, Billwitz 1980; indeks antropizacije — Kostrowicki, Plit, Solon 1988).

/B/ povdarjanje mej za ugotavljanje stopnje strukturnega ravnotežja, na indirektni način pa tudi funkcionalne enotnosti sistema (Romme 1982). S povdarjanjem mej je možno vrednotenje v ekološkem, fiziognomskem, sintaksonomskem ali kakšnem drugem konceptu.

/C/ prostorska različnost združb (relativna in asolutna), ki odraža različnost v uporabnosti oblik in posredno regeneracijske možnosti sistema. Najlažje jo ocenimo s pomočjo informacijskih indeksov (Solon 1988 a), na osnovi formule

$$H = -\sum p_i \log_2 p_i$$

kjer je p_i soudeležen na področju komponente "i".

Indeksi, ki jih iz te skupine najbolj pogosto uporabljamo, vključujejo:

— indeks površinske različnosti pri dejanski vegetaciji H/P/, ki določa verjetnost, da bo na slepo izbrana rastlina predstavljala določen združbeni tip, ali drugače, to je indeks, ki določa celotno različnost tipov združb in njegovo prostorsko porazdelitev,

— indeks enotnosti aktualne vegetacije H/P/:H_m/P/, ki določa prostorsko razporeditev vegetacije. Čim bližje je indeks vrednosti 1, toliko več tipov združb je zastopan na proučevanem na proučevanem območju,

— indeks H/P/:H/E/, ki določa relativno različnost dejanske vegetacije v odnosu do rastiščne različnosti (eden izmed vidikov prostorske organizacije vegetacije). Istočasno z njim izražamo stopnjo vegetacijske transformacije (Solon 1988 b),

— indeks U/P, ki določa stopnjo organizacije (ponavljanja) strukture pri mejnih združbah, to je istočasno tudi njihov prostorski vzorec.

V skladu s konceptom o ruralno-urbanem contimuumu bi moralo imeti suburbano območju vmesni značaj med podeželjem in območji z visoko stopnjo urbanizacije. Vendar podatki iz tabele 2 nasprotujejo tej tezi. Razen podatkov o stopnji vegetacijske sinantropizacije, ki imajo vmesno vrednost, kažejo vsi ostali indeksi, posebno informacijski, za suburbano območje izrazito višje vrednosti kot za druge pokrajinske tipe.

Stabilnost pokrajine

Bistvo fenomena stabilnosti pri naravnih vzorcih še do zdaj ni bilo razloženo, kar pogosto vodi k napačnemu razumevanju, kajti različni avtorji uporabljajo ta pojem v zvezi z različnimi označbami prostorskih sistemov. Nekaj avtorjev meni, da sistem stabilnosti pogojuje nespremenljivost litoloških in hidroklimatskih pogojev (Danewa et all. 1981). Čeprav je pristop v bistvu pravilen, vendarle ni uporaben pri analizi pokrajine pod antropogenim pritiskom, ki je povezan s problemi drugega tipa in druge lestvice. Najbolj pogosto je mnenje, da je ekološka stabilnost pokrajine v veliki meri odvisna od stanja biotske komponente, kar se da najboljše definirati na osnovi vegetacije.

Zelo je na splošno rečeno stabilnost sposobnost sistema, da se nadaljuje ali povrne v prvotno stanje pod zunanjimi vplivi (Hurd et all. 1971). To definicijo lahko razširimo in dodamo domnevo, da je stabilnost pojem, ki vključuje naslednji sklop lastnosti ekoloških sistemov:

— če vzamemo parametre okolja za standard, ostane sistem nespremenjen /VZTRAJNOST/

— če upoštevamo odklone okolja od standardov, pri čemer le-ti ne presegajo določenega nivojo, sistem ne pokaže sprememb /INTERNOST/

— če upoštevamo večje odklone okolja od standardov, ki ostajajo v določenem obsegu /AMPLITUDA/, doživi sistem popravljive spremembe, vendar ohrani v odnosu do maksimalne stopnje osnovne poteze /STALNOST/ celo na škodo spremembam, ki ostajajo v določenem dovoljenem obsegu /UPORNOST/ drugih značilnosti,

— te spremembe so nepomembne v primerjavi s stopnjo odklonov okolja od standardov /HOMEOSTAZA/,

— po vrnitvi zunanjih parametra standardne nivoje, se sistem na določen način in do določene mere povrne na začetno stanje /PRILOŽNOST/,

— če se okolje ne povrne na začetno stanje, sistem še traja v takšni obliki krajši ali daljši čas /KONSTANTNOST/, nato pa se spremeni v drug sistem, ki je bolje prilagojen novim razmeram,

— vrnitev na začente stanje je često nemogoča ali pa je povezana za dobavo velike količine energije in informacij antropogenega značaja.

Zdi se, da so različni vidiki stabilnosti povezani s komponentami energijskega ravnotežja in prostorske strukture vegetacije na različne načine. Slika 2 predstavlja poenostavljen model takšnih odnosov.