

## AN ECOLOGICAL FRAMEWORK FOR THE AMENITIES OF THE CITY

An ecological study of the city is a new endeavor. Up to now, we have mostly been given inquiries dealing with transportation, housing, economic activity, recreational facilities, etc. All of this adds up to an attempt to reach partial solutions for problems affecting sub-systems. Urbanists and city planners have tried to reach a synthesis of these data whenever they were available.

There is an ever increasing need to approach urban problems by borrowing the concepts and the methodology of ecology<sup>1</sup>

Translated by Paul Mankin.

<sup>1</sup> The ideas proposed in this article have already been defined, at least in part, in other publications: "The hope of human ecology" (Bull. Canad. Comm. for UNESCO, 12 (1-2) Suppl., 14 pp. 1969); "Ecology and the escalation of human impact" (Int. Soc. Sci. Jour., 22 (4):628-647. 1970); "Dimensions of environmental quality" (Sarracenia No. 14, 109 pp. 1971); "Inscape and landscape" (Massey Lectures 1972, CBC Learning Systems, Toronto, xiii + 118 pp. 1973); "Man-environment interaction at the settlement level" (United Nations Conf. on Human Settlements, A/CONF.70/B/4, 46 pp. 1975); "Harmony and disorder in the Canadian environment" (Canad. Env. Adv. Counc., Ottawa, Occ. Paper No. 1, 146 pp. 1975); "EZAİM: Écologie de la Zone de l'Aéroport International de Montréal. Le cadre d'une recherche écologique interdisciplinaire" (Presses de l'Univ. de Montréal, xviii + 343 pp. 1976); (with Gilles Paré) "Ecological grading and classification of land-occupation and land-use mosaic. I. Presentation of a new system. II. Mapping methods and problems" (Fisheries & Env. Canada, Lands Directorate, Geogr. Paper No. 58, x + 63 pp. 1977).

## *An Ecological Framework for the Amenities of the City*

The origins of this science stem from the research pertaining to plant and animal behavior in their natural habitat. Highly complex adaptation patterns could frequently be observed which allowed a large number of species not only to survive but also to attain a certain level of compatibility with other species. One need not be a determinist to recognize the common basis of adaptation for man and other animals and to tie together the physical and biological needs which underlie more complex individual and group behavior. Thus, for instance, von Frisch<sup>2</sup> and Wilson<sup>3</sup> have recently redefined the biological bases of the noosphere.

Perhaps the most useful phenomenon to point out is the *sharing* of resources. In a given habitat, in what ecologists call an *ecosystem*, a certain number of living populations (plants, animals, men) are fed by a limited stock (which is more or less replenishable) of *resources*, and they may reinvest them more or less in that same ecosystem, or, on the contrary, they may export them to other ecosystems. In certain situations a lasting harmony can be established, while in others there may be a balance deficiency which undermines the system.

It is from such a critical viewpoint that the ecologist looks at the town, just as he has studied a peat-bog or a farm, and he tries to measure the resources, their origin, their utilization and their amount. The study begins with the quality of air and water and it proceeds to the level of vegetal and animal productions to the extent that they answer the need to feed a human population which is more or less stratified and plentiful.

But it is not enough to draw up heat charts, to calculate energy and foodstuff needs, and to map transportation and housing demands. Certain psychological functions of the human community have to be identified as controlling levers. Among animals what controls the cycling of resources, and thus imposes a very special kind of sharing, is made up of certain factors: hunger, hunting, reproduction, gregariousness, the ability to handle instruments and to elaborate structures. These same priorities exist

<sup>2</sup> Karl von Frisch, *Animal Architecture*, New York and London, Harcourt, Brace, Jovanovich, 1974.

<sup>3</sup> Edward O. Wilson, *Sociobiology, the New Synthesis*, Cambridge and London, Harvard Univ. Press, 1975.

among humankind as well, although they reach a higher level of complexity. But other human needs (some of which may be called imaginary) burden the "humanized" milieu, and the urban milieu even more, with additional weight.

Those things which have been called the *amenities*, whether they be the comfort, commodities, recreational facilities, culture, education, social contacts and so on, can be found in a city with a great deal of variety, especially in a large city. However, the resources which allow certain needs, at times complex, to be satisfied and which facilitate the accomplishment of valuable endeavors, are often difficult of access for most city dwellers. It is precisely these paths leading to a common treasure which the ecologist tries to track down and to chart.

Pollution, the monopoly of wealth, social stratification, outdated laws, faulty city-planning, all of these are obstacles to resources, from the quality of the air all the way to the participation in cultural events. A correct ecological examination of our cities will show the relative efficiency of nutrition cycles, of transportation systems, of communications and decision-making, and it will lead to better planning and better sharing.

The physical environment of the city is all too frequently seen as hostile to the individual and his domestic establishment. This is mostly the result of a disorderly growth allowing the development of clustered structures and dysfunctional space allocation.

The urban ecologist, who gladly extends a helping hand to the architect and the city planner, assumes the fearful task of analysis and critical evaluation. As far as he is concerned, an explicitly ecological analysis must replace the purely space-oriented definitions which we already possessed. As a matter of fact, this analysis goes back to the origin and the separation of mineral resources, it enumerates the survival rates and the activities of plants and animal and connects these findings to present and past human investments.

Such an evaluation cannot be based solely on physical and biological inventories. It must consider values whose force is as strong as floods or natural disasters may be in the allocation of resources and in the recycling efficiency within the urban ecosystem.

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Eco-planning methodologies are now emerging.<sup>4</sup> During the past ten years multidisciplinary teams have sprung up advocating impact matrices of different types. These experiments will go forward for some time yet before we can claim to have a uniform list of criteria. It is best to allow free rein to the real exigencies of each area. From Calcutta to Montreal, from Casablanca to Irkutsk, a vast range of areas show certain peculiarities which make it imperative to shift the focus of the *problématique*.

The most clearly apparent leitmotif, however, is the parallel inventory of available resources and human needs. The latter include various sorts: physiological, psychological, social, economic, political and ethical. It is easy to prove that the individual's demands in any community are not equally satisfied, whether the cause be the scarcity of a vital resource or its lack of accessibility. Individual and collective poverty depend on systems of sharing. These systems can be defined by comparing the degree of satisfaction of various groups within the same community and by comparing one human settlement with another.

But how will we be able to classify the types of participation? Obviously by applying distinct and independent measures to the resources themselves and to their utilization. By correlating these two sets of data we may arrive at an estimate of relative satisfaction. This ability to tap the resources is the true moving force of cycling within the ecosystem. This applies equally to all environments, be they wild, rural, industrial or urban. Thus, can one say that the struggle for the consumption of oxygen and water is more urgent and more important, in the setting up of human ecosystems, than the acquisition of property, the joys of isolation and the pleasures of music? The latter have often been called amenities. But wherein lies the distinction between needs and surplus? between necessity and amenity?

From an ecological viewpoint, it may be well to disregard the boundary. Now that we try to have computers evaluate circuses as well as bread, water and shelter, maybe we can succeed in replacing our inquiry within the center of human consumption by incorporating such value systems as ecological

<sup>4</sup> See Ignacy Sachs. "Environnement et styles de développement" in *Annales: Economies, Sociétés, Civilisations*, fasc. 3, 1974, pp. 553-570.

levers capable of activating or inhibiting the mechanisms of cycling.

Such is therefore the task of human and urban ecology. *The two visual models presented here, have as their aim to group the characteristics of the milieu and the human responses.*

\* \* \*

#### THE STRUCTURE AND THE FUNCTIONS OF THE ECOSYSTEM

It is indispensable to set down the meaning of terms and concepts to be used in my exposé, especially since they are not necessarily of current usage, neither among biologists nor among sociologists.<sup>5</sup> The *ecosystem* is a limited space wherein the cycling of *resources* through one or more trophic levels is effected by more or less fixed and numerous *agents*, utilizing mutually compatible *processes* simultaneously and successively, which engender *products*, that are usable on short or long term. (The patient reader is encouraged to reread this paragraph after having absorbed the following sub-headings).

The terms of this definition may be analyzed as follows:

*Resources*: the elements which are variously fed into the cycling process, whether they be mineral, biological or functional (iron, wheat, cattle, lumber, information).

*Agents*: elements or organisms capable of powering the various processes by absorption, transformation, storage, channeling, or transport of resources (wind, plant, animal, man, bank, state).

*Processes*: mechanisms whereby the resources undergo all and any kind of change, metabolism or transformation; anabolic, metabolic or catabolic, they all imply an energy flow (pedogenesis, photosynthesis, absorption, predation, damming, electricity transmission, marketing, stock exchange, speculation, legislation).

*Products*: objects or services resulting from the processing of resources by agents; they are consumed, stored, lost or reinvested for further cycling (humus, starch, flesh, automobile, poem). (The product arising at a given level will thus become a resource at another level).

<sup>5</sup> See Figure 1.

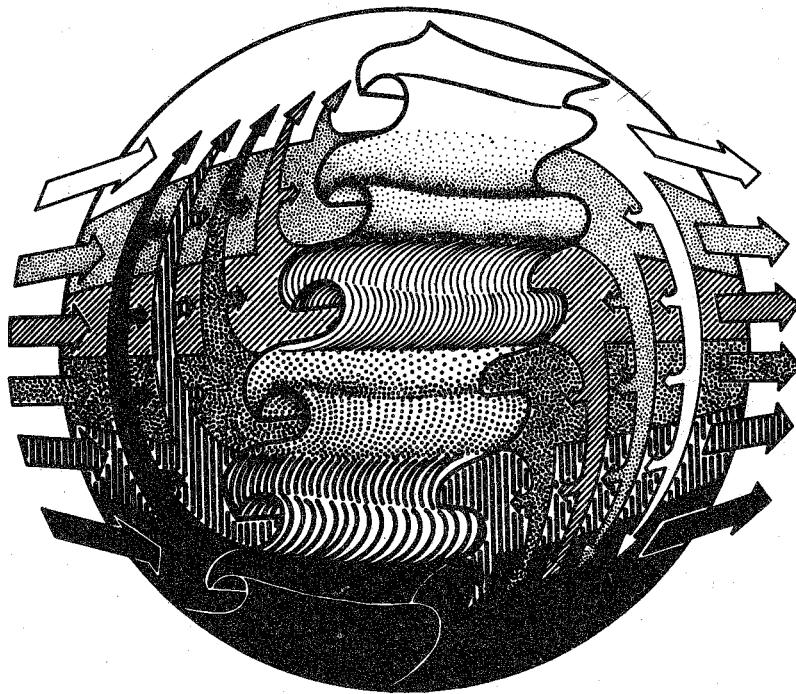
*Trophic levels:* more or less determined stages which are stratified in time and space, wherein the cycling processes carry the resource from one state to another (e.g., from the mineral to the animal). Each level is characterized by associated and more or less exclusive processes which make up a *regime*: (I) minerotrophy (disaggregation, weathering, erosion, pedogenesis,...); (II) phytotrophy (photosynthesis, respiration, rooting, dispersion,...); (III) zootrophy (H) (herbivory or phytophagy); (IV) zootrophy (C) (carnivory or predation); (V) investment (damming, ploughing, construction, urbanization); (VI) control or nootrophy (zoning, planning, financing, legislation).

All landscapes can be approached by trying to identify these five factors within them, whether wild, rural, industrial or urban. An inventory of its resources and of their origins will precede a qualitative analysis of the exploiting agents and the processes that insure the cycling. A balance of losses and gains to other ecosystems and of the productivity as it relates to each one of the trophic levels will be compiled. Thus an ecosystem will distinguish itself from another according to its tendencies to be more or less open or closed, productive or non-productive, diversified or uniform, temporary or permanent, stable or unstable, balanced or unbalanced, etc.

Figure 1 is a general model of the ecosystem where energy currents are traced being relayed from one trophic level to the next: the mineral material (I) is transformed into vegetal tissues (II), then into animal flesh (III), which is itself consumed by other animals (IV): whereas, for instance, bulbous plants, migratory birds, bees and mankind store up and redistribute (V) diverse substances and control (VI) their possible re-utilization. An ecosystem also contains ascending transfers (on the left) and descending ones (on the right). Many ecosystems are maintained due to the import of resources (arrows entering, on the left) and the export of products (arrows exiting, on the right).

Table I presents the same scheme in another form.

The application of these definitions, their criteria and of the model shown by the "ball-of-arrows" in Figure 1, puts us in the presence of human ecosystems, such as a campsite out in the wilds, a farm, a factory, a village or a town which will manifest the following ecological differences.



- |     |  |               |    |  |               |
|-----|--|---------------|----|--|---------------|
| III |  | ZOOTROPHY (H) | VI |  | CONTROL       |
| II  |  | PHYTOTROPHY   | V  |  | INVESTMENT    |
| I   |  | MINEROTROPHY  | IV |  | ZOOTROPHY (C) |

Figure 1: A model of the ecosystem showing six trophic levels: I, minerotrophy; II, phytotrophy; III, zootrophy (herbivorous); IV, zootrophy (carnivorous); V, investment; VI, control. On the inside of the sphere, the major current of the energy relays is indicated at the center, whereas at the left one can read the capture of the resources at each level starting with the lower levels, and on the right the reinvestment in the other direction. The arrows entering, at left, indicate the input of resources coming from another ecosystem, while the arrows exiting, at right, indicate the output of products toward other ecosystems.



TABLE I. Resources, agents, processes and products at six trophic levels within an ecosystem

TROPHIC LEVEL	REGIME	RESOURCE	AGENT	PROCESS	PRODUCT	Consumption or Utilization	
						agent	quantity
VI	control	auxiliation, information	animals, mankind	transportation, cleaning, services	water, soil, mi-grants, artefacts, information	animals, man	variable
	investment	minerals, vegetal and animal organisms, transformed objects	soil, plants, animals, man	propagation; reduction, technique, transformation	fertilization population shelter, dams, etc.	soil, plants, animals, man	variable
IV	zootrophy	animal tissues air, water, soil	carnivores	carnivory	flesh, chitin, muscle, bone, skin, etc.	parasites, animals	variable
III		vegetal tissues air, water, soil	herbivores	phytophagy			
		soil: mineral and organic nutrients; substratum		absorption, transpiration, nutrition, excretion			
		water	plants	rooting, growth, breathing, reproduction	starch, sugar, fiber, tissues, fruit, rind, bark, wood, etc.	parasites, animals	variable
II	phytotrophy	air: light heat oxygen					
		energy carbon dioxide	green plants	photosynthesis			
		nitrogen	bacteria, algae	fixation			
I	minerotrophy	air, water, parent rock	climate, plants, animals	pedogenesis	soil	plants	variable



1. *Structures* composed of resources and agents, quite different in their identity, their number, their strength, their renewability.
2. *Tropic levels* of very unequal weight, since, for example, animal life (levels III and IV) will be completely absent in an orchard, in a factory, while it will be a strong presence on a livestock farm.
3. A degree of *autonomy* will prevail where the circuits are practically closed, as in a peat bog or an island village or a mountain village and, on the other hand, there will be a marked dependence in a specialized settlement such as a mining town, a forest colony or an orchard. An even greater dependency would occur (for its vital needs) in the case of a large city.
4. *Power* of control in relation to other ecosystems: this is practically the contrary of the preceding category. If the city is dependent on the countryside for its foodstuff, then it holds decision levers which govern production and control the markets.

By using either the figure or the table herewith, we can bring out the contrasting elements of the ecosystems. As a matter of fact, adhering to the underlying criteria we shall arrive at a classification of the environment on an ecological basis. Since, in the final analysis, the energy charge is the starting point and since man is more powerful than the other agents in his ability to harness the forces of the land, one can justifiably recognize four major panels within the distribution of the occupied space on the globe, namely:

- A. the wild domain,
- B. the rural landscape,
- C. the industrial space,
- D. the urban developed area.

Table II presents an attempt to classify human settlements according to the above distribution.

#### MAN'S RESPONSES

The above framework will enable us to formulate an analysis as it encompasses an encampment of nomads, a monoculture of wheat, a mining town, a village or a metropolis. Such an inventory will show us the potential stock of resources and the possibilities of

TABLE II. A repertory of human settlement

Panel	Type of settlement	Mobility	Density	Autonomy	Diversity	Power	Example
A. WILD	1. nomadic	very high, erratic	low	total	variable	low	Innuit, Bedouin
	2. transhumant	high, regular	very low	very high	variable	low	Graubunden, Brazilian, Spanish peasants
	3. gatherer	narrow range	low	total to high	variable	very low	African Pygmy, Paraguay Guayakis
	4. hunter/fisher	variable range	low	very high	variable	low	Maori, Masai, Pacific Indians, Portuguese fishermen
	5. hunter/farmer	narrow range	low	very high	variable	low	Micmac, Ashanti, Ik
	6. pastor/ranger	limited range	low	medium high	fairly high	low	Texas, Argentina, New Zealand, Saskatchewan
	7. planter/sower/gardener	very low	low to medium	high	high	low	Guatemala, Martinique, Tahiti
	8. farmer	almost none	low to medium	medium high	fairly high	low to medium	W. Europe, USA, Philippines, Canada
	9. monoculture	none	low	very low	very low	high	Saskatchewan, Hawaii, Colombia
	10. horticulture	almost none	medium	low	high to low	low to medium	Japan, Israel, Italy, Holland
B. RURAL							

	11. non-producer	none	fairly high	none	variable	low to medium	Côte d'Azur, Florida
C. INDUS- TRIAL	12. mining	none	high	very low	very low	very low	Wales, New Caledonia, S. Africa, Rio Tinto, Therford, Murdochville
	13. heavy industrial	none	high	very low	very low	low	Flanders, Rhur
	14. craftsman	none	variable	medium to low	medium	very low	Atatlan, Kairouan
	15. engineering	none	low to high	none	low	low to medium	Manicouagan, Aswan, Panama
	16. manufacturing	none	high	none	low	medium	Dearborn (USA), Twizel (New Zealand), Drummond- ville (Canada)
D. URBAN	17. service	variable	low to medium	very low	low	low	Gander (Newfoundland)
	18. village	narrow range	medium	low	medium to high	low	Bontoc (Philippines), Salgueira (Portugal), Bolgatonga (Ghana)
	19. town	narrow range	high	very low	medium	medium	Evora (Portugal), Gap (France), Sausalito (USA), Bruges (Belgium)
	20. city	variable	very high	none	medium to low	high	Dunedin (New Zealand), Bordeaux (France), Albany (USA)
	21. metropolis	variable	extremely high	none	medium to high	very high	Tokyo, New York, Paris, São Paulo

exploitation and cycling as well as the existing pattern of resource sharing. In a deciduous forest of the Montreal Plain, it can be seen that the sugar maple monopolizes an amount of air, water and nutrients which is larger than the amount remaining available for all the other trees. In a city like Winnipeg or Montreal, it can be ascertained that the number of calories consumed by the more affluent 20% of the human population exceeds by far the part allotted to the remaining 80%.

Food, space, housing, services, recreational facilities, etc., can all be distributed according to a plan which is more ecological than sociological, if one considers the origin of the resource needed for each one of these needs. One shall have to accept the fact that, in many cases, it is the resource itself which is lacking (water in the Sahara), while in other situations a state of privation may be caused by poor distribution (grain in Ethiopia).

But *what are* the needs, and how can they be met according to the conditions of fulfillment offered by the different ecosystems?

Figure 2 represents the "environmental pie" (since it is a matter of sharing). It is normally divided into three sections, since the needs and the rights of individuals (A) are subject to the society's potential (B) of which they are a part, and they must ultimately be geared toward the well-being of the entire species (C). On the other hand, from the center to the periphery, one can indicate, through the ever-increasing area of the boxes, the relative extent of satisfaction of a need. Thus, on the inside, there will be the circle of *deprivation*, then the one of *need*, the third circle of *fulfillment* and the outer circle of *surplus*.

This perspective on ethology (or mankind's behavior) can be summarized by a rapid explanation of Figure 2, where the number and the key-word can be found. For each of the needs and the rights: (A) of the individual; (B) of society; (C) of the human species, are given a brief identification, then (in parentheses) reference to the forces opposing these needs and restricting these rights, and finally, between the diagonal lines, the trophic level from which the required resource stems (see Figure 1 and Table I).

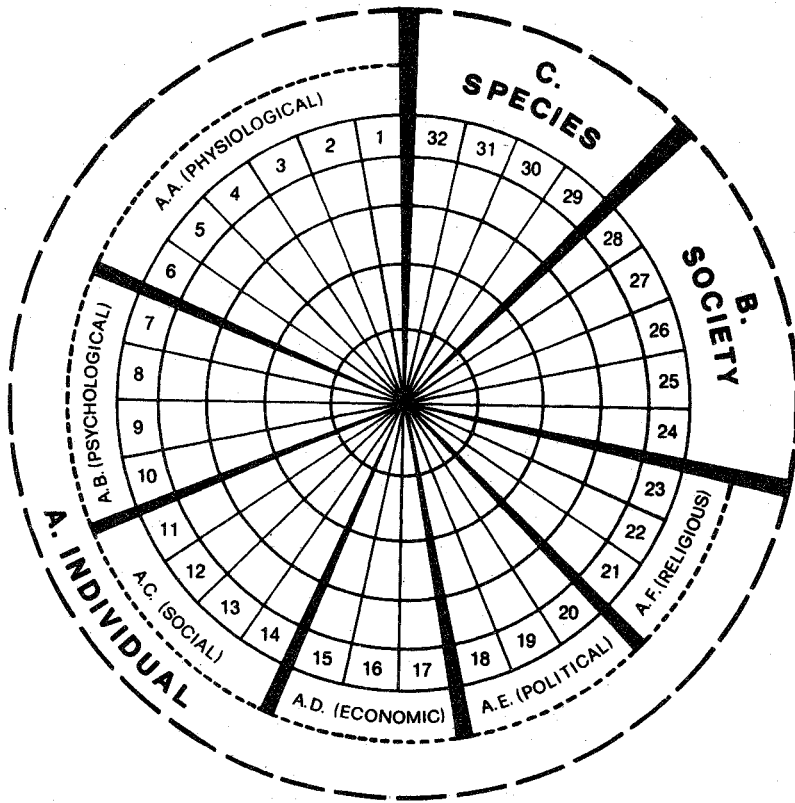


Figure 2: *The environmental pie* (from Dansereau 1971). (A) the rights of the individual, (B) the duties of the society, and (C) the responsibility of the human species are represented by numbers corresponding to those set out by Dansereau (1971) and which can be characterized in one word, as follows: 1. light, 2. air, 3. water, 4. food, 5. shelter, 6. offspring; 7. space, 8. peace, 9. sex, 10. intercourse; 11. abode, 12. household, 13. work, 14. association; 15. income, 16. decision, 17. property; 18. education, 19. information, 20. participation; 21. faith, 22. worship, 23. ethic; 24. management, 25. investment, 26. planning, 27. legislation, 28. culture; 29. diversity, 30. productivity, 31. aid, 32. health. The spaces will be filled in (see Figures 4-10) according to the degree in which the need is being met, values increasing from the small triangle at the center to the large rectangle at the periphery (deficient, poor, good, excellent).

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A. NEEDS (AND RIGHTS) OF THE INDIVIDUAL

(a) *Physiological needs*

1. Normal *light* at a certain latitude (artificial lighting, fog, smog) /I/
2. *Air* containing the normal proportion of oxygen, and free from toxic substances (air pollution) /I/
3. Periodical access to a minimal quantity of *water* or equivalent liquid for thirst and personal hygiene (drought, water pollution) /I/
4. Periodical access to *food*, that is to say to a minimal amount of vegetal material and/or edible animal fat, digestible and not harmful (scarcity, inaccessibility, toxicity, decay, pollution) /II, III, IV/
5. Sufficient *shelter* against the cold, heat, wind and other natural adversities (scarcity or inaccessibility of building materials, lack of purchasing power or ability) /I, V, VI/
6. *Procreation* or the freedom to give birth to *offspring* (overpopulation, civil or religious legislation, economic hardship) /V/

(b) *Psychological needs*

7. Minimum of *space* for movement and circulation (overcrowding of the population, imprisonment) /VI/
8. *Peace*, that is to say an absence of sensorial effects which could impair or threaten eyesight, hearing, speaking, touching, tasting (blinding light, vibration or excessive noise) and physical violence (especially stemming from humans) /V/
9. Fulfillment of *sexual* functions (taboos, harsh legislation) /V/
10. A range of personal involvement allowing *relationships* or exchanges at various levels (social customs, economic and political relations) /V, VI/

(c) *Social needs*

11. The free choice of residing in an acceptable *neighborhood* (immigration laws, economic constraints) /V/
12. The furnishing of one's lodging or one's property, making

it a *domestic establishment*, including a minimum of space, exclusive rights and hospitality privileges (personal incompatibilities, social restraints, economic hardship) /V, VI/

13. Dedicating one's energy and one's *work* to the exploitation of a resource with the proper technical expertise (unemployment, lack of competence, various pressures) /V/

14. Choice of personal and professional *associations* (restrictive covenants, social discrimination, problems of communication, isolation, overcrowding) /VI/

(d) *Economic necessities*

15. Minimum *income* to allow satisfying other needs and assuring adequate participation in the regional or national wealth (exploitation of social classes, breakdown of social communication, tyranny or excessive power of political factions, excessive control exerted by distant ecosystems) /V, VI/

16. A certain influence on the *decisions* which control the channeling of resources and the priorities of exploitation (ignorance, isolation, economic and political oppression) /VI/

17. Conservation and disposal of *property* (poverty, legislation, theft, social unrest) /V, VI/

(e) *Political needs*

18. An *education* which assures a minimal access to the common store of information and knowledge (poverty, isolation, economic oppression, political, cultural and religious repression, inadequate social structures) /VI/

19. Proper and timely reception of *information* concerning exploitation and husbanding of all the resources (private or public plots which infiltrate or distort information) /VI/

20. Some minimal *participation* in the decision-making process (lack of information and communication, inadequate social and economic structures) /VI/

(f) *Ethical needs*

21. Adherence to a doctrine or a *faith*, whether it be personal or historically defined (laws and customs which are culturally and/or politically outlawed) /VI/



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22. The *right to assemble* with others of similar persuasion for the occasional practice of common functions and to do this in a place which is properly set up for it (hostile legislation, socio-economic forces, poverty, isolation) /VI/

23. The husbanding and utilization of resources in a manner which is compatible with the prescribed accepted *ethical* practice (acculturation, economic and political pressure) /VI/

B. NEEDS (AND RIGHTS) OF THE COMMUNITY

24. The *administration* of the exploitation of mineral resources /I/, vegetable /II/ and animal /III, IV/, the handling of the investments /V/ and the distribution of information /VI/ (monopolies, conspiratorial activity, imbalance of economic, social and religious forces, outside interference at all levels) /V, VI/

25. The tendency toward a maximum *investment* of its own resources to benefit the members of the community (foreign influx and investments, ignorance, socio-economic ineptness and failure) /V, VI/

26. *Planning* and implementation throughout the entirety of the occupied area (restricted zoning, speculative operations, special interest groups, distribution of tenures and of some types of development) /V, VI/

27. *Legislation* which is based on valid propositions and the means of enforcing it (internal and external socio-political-religious pressures) /VI/

28. Promoting and implementing freely *cultural* and religious events (internal and external socio-political-religious pressures) /VI/

C. NEEDS (AND RIGHTS) OF THE SPECIES

29. Preserving the *diversity* of living things not interfering in the life cycle at the most critical points. Genocide is forbidden for plants /II/, animals /III, IV/ and human communities (racial or ethnic) /V/ (pesticides, poor sanitary conditions, inadequate land distribution, industrialization, war, economic pressures) /II, III, IV, V, VI/

30. Continuing *productivity* at different levels, without irreversibly upsetting the balance of any ecosystem within the entire region occupied (agriculture, industry, urbanization, recreation) /I, II, III, IV, V, VI/

31. Unconditional *aid* for the development of under-privileged societies (advantages acquired by rich societies) /VI/

32. Restricting the introduction and circulation of radio-active elements, or those toxic or harmful to *health* in whatever manner in air, water or soil /I/ or in foodstuff /II, III, IV/ (public health techniques, measures affecting agriculture, industry, urbanization, mass transportation) /V/

These 32 points are not being proposed without some measure of arbitrariness. Undoubtedly they should be defined and illustrated to a greater extent (which I have tried to do in some of my other essays: see the foot-note on page 1). I count on their being accepted at least as reference points and that one may try to fill in the boxes of the drawing (Figure 2) by considering the points as intersecting just where the supply or the *availability* of the resource and its acceptance or *ability* to be utilized meet, so that it may be introduced into a cycle which is profitable to the individual, to society and to the species. In such a test one is inevitably faced by three factors:

(a) the difficulties of the resource's *availability* (insufficient output);

(b) the *deficiencies* of aptitude (a *receptive inability*);

(c) the *compensatory invention*, which is a response to the critical state of a given resource (artificial light, canning, etc.).

This will have to be kept in mind when, in each cone, the box corresponding to *deprivation*, *necessity*, *fulfillment* or *surplus* is being filled (Figure 3).

Figure 2 can be used in a *subjective manner*, in the course of an inquiry about the *perception of the environment*. Thus, Figure 4 was constructed by a 60-year-old tobacco merchant who lives in a poor section of Montreal. Despite the lack of air (1) and of light (2) and the poverty of his lodgings (11), he shows himself to be an optimist and gives a fairly good score to his section or to his town (24-28). A city-dweller, a professor in a British university (Figure 5), has clearly many reasons to be personally sat-

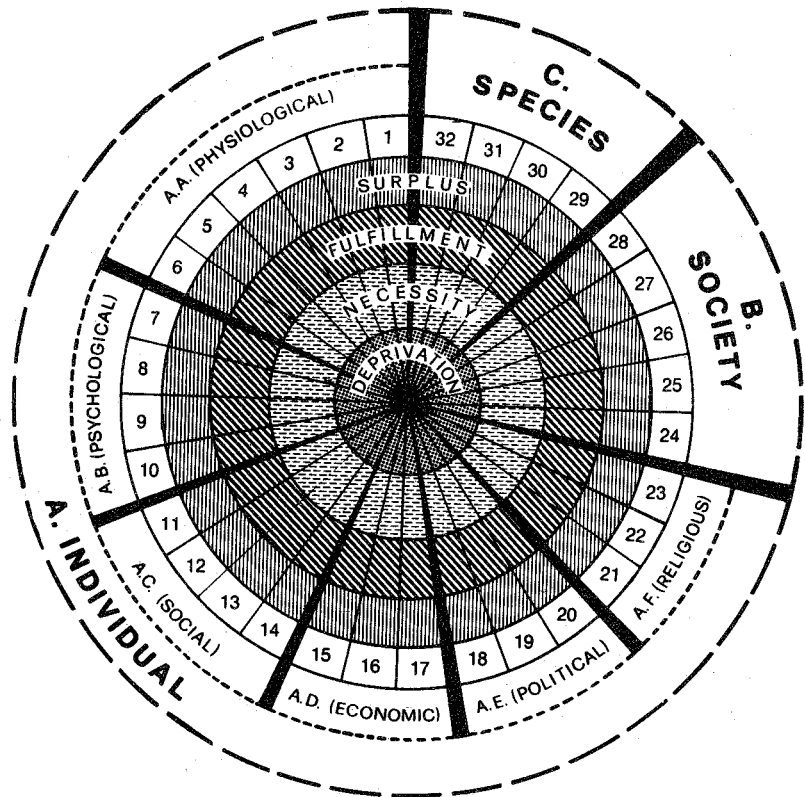


Figure 3: The four zones of progressive satisfaction of needs (see Figure 2), where the box to be filled, in a given situation, corresponds to the availability of the resource and to the use which is made of it.

ified; he gives no mark of major disapproval to his town (24-28) and shows himself to be extremely optimistic as far as humanity is concerned (29-32).

The gap between perception and reality may only be measured by an in-depth study of the milieu. One by one, the 32 items of this enumeration would have to be taken up (and especially the first 28 ones) and one would have to test, for instance, the degree of the purity of the air (2) and the water (3), the actual freedom of assembly (14), the possibility of decision sharing (16),

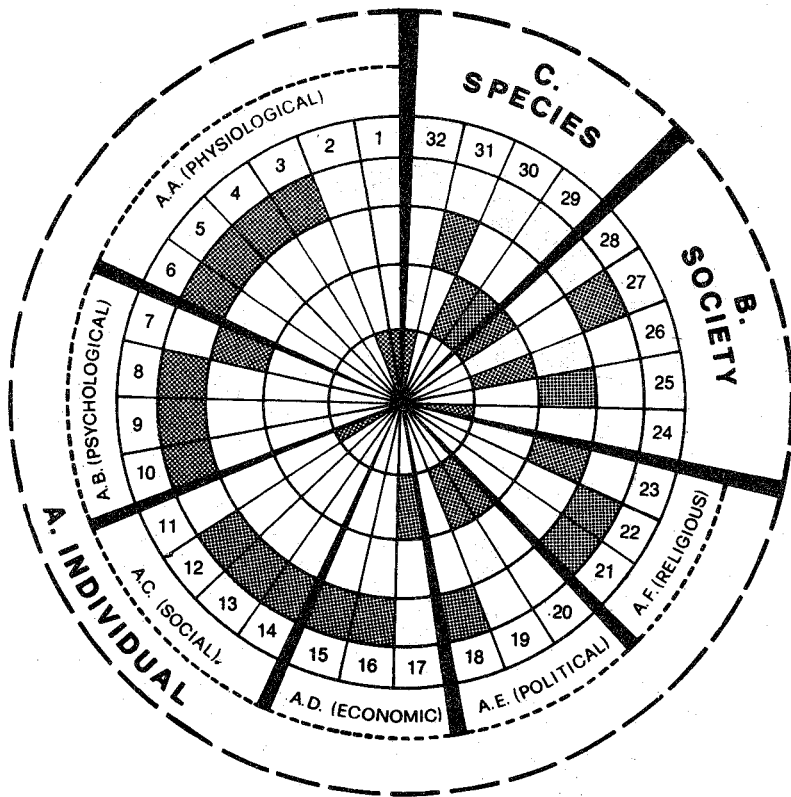


Figure 4: The environmental pie (see Figure 2) filled in by the owner (age 60) of a tobacco shop in a lower-class area of Montreal (Quebec, Canada).

the quality of education (18), etc.

Although at this time, such *objective studies* are not available, we may perhaps be allowed some generalizations concerning some homogeneous human settlements if we look at the four concentric circles of Figures 2 and 3. In such a perspective, Figures 6 and 7 represent respectively the case of a nomad settlement of the Inuit of Baffin Island and one in the town of Dunedin in New Zealand. Our generalization is based on a non-critical body of knowledge set down with an objective intention.

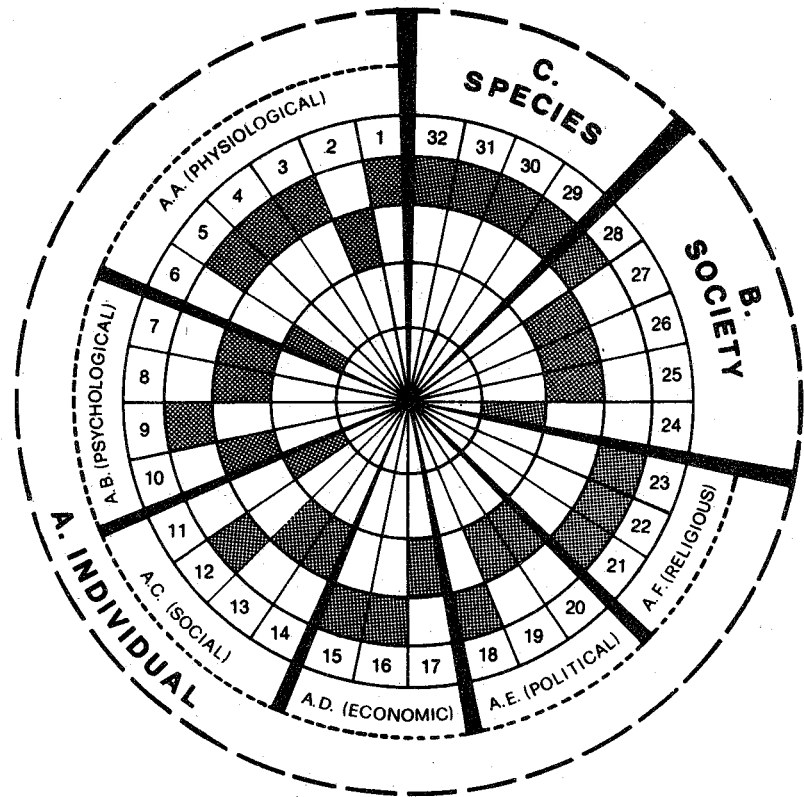


Figure 5: The environmental pie filled in by a British university professor residing in a large town.

THE ZONE OF AMENITY

Where then can amenity be placed? Does it represent a precise point on the deprivation/necessity/fulfillment/surplus scale? Or does it have a parallel dimension? One could say that amenity exists where a state of fulfillment obtains, and even more justifiably, where there is surplus. Isn't amenity the enjoyment of the superfluous? I am inclined to reject such a quantitative evaluation. I believe that the over-consumption (at the surplus level) of a rich middle class brings little amenity with it, while the frugality of

a rural society (at the necessity level) may be associated with a remarkable graciousness in its life-style. On the other hand, it is not necessary to reach a state of euphoria.

In order to pinpoint amenity, within the framework that I am suggesting, one will have to determine the degree of satisfaction as it applies to each of the twenty-three individual numbered needs by evaluating for each resource the following:

- (a) the quality (purity, diversity),
- (b) the quantity (scarcity, plentiful supply),
- (c) the availability (expense, dependence),
- (d) the compatibility of the needs with each other, and the accompanying determination of the exploiter's ability:
- (e) efficiency (ability to use),
- (f) wisdom (ability to achieve satisfaction),
- (g) creativity (capacity of invention).

The following questions must successively be asked concerning the following:

A. the *individual*

- (a) does the *physical* man have a sense of well-being?
- (b) is the *inner* man at ease in his material and moral space?
- (c) is the *social* man integrated in the human milieu?
- (d) does the *economic* man have sufficient power?
- (e) does the *political* man have access to adequate means of expression?
- (f) does the *moral* man succeed in communicating and acting according to his convictions?

B. the *society*

- (g) is it structured in such a way as to understand its own needs?
- (h) does it know its own resources and their potential?
- (i) does it know how to assign and enforce the rights and the duties of those who are under its jurisdiction?

C. the *human species*

- (j) does society recognize the limitations imposed by a superior power?

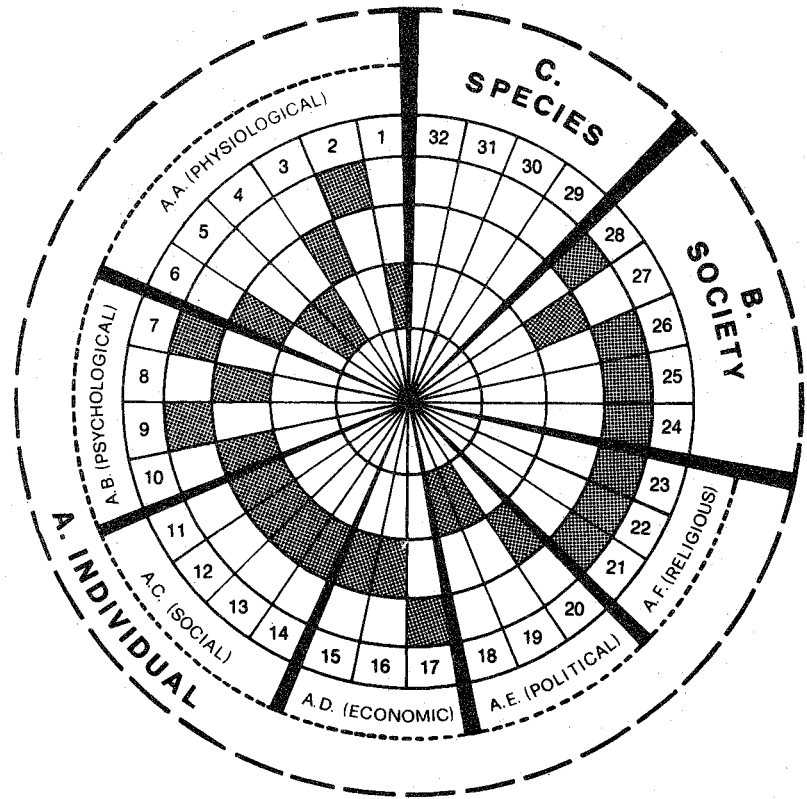


Figure 6: The environmental pie in an undisturbed nomadic settlement: Baffin Island, Canada (see No. 1, Table II).

(k) is the individual in agreement with the society? with the species?

Since our concern here is to apply an ecological framework to problems that are essentially social and political, I shall not endeavor to answer each one of these questions, except in the examination of the four examples provided by Figures 4, 5, 6 and 7. Figures 2 and 3 indicate 4 zones for the gratification of needs: *deprivation*, *necessity*, *fulfillment* and *surplus*. *Deprivation* (of light, lodging, education, religious practice) brings about a sense



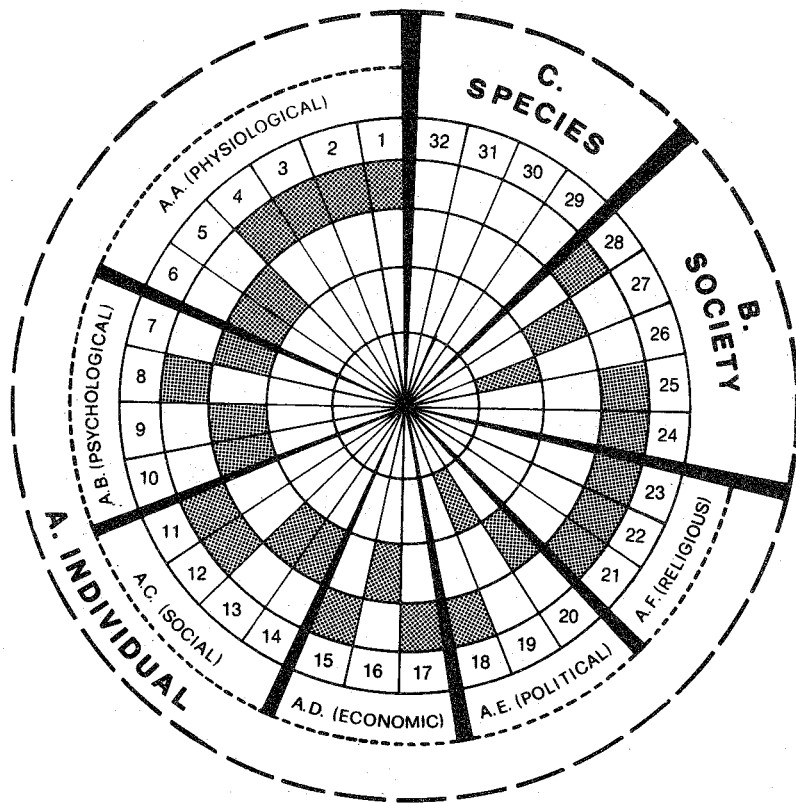


Figure 7: The environmental pie in Dunedin, a New Zealand city (see No. 20, Table II).

of frustration, impedes an individual's development and reduces his productivity. It may even lead to disease and death. The satisfaction of pure and simple *necessities* does not eliminate aggravations (slightly polluted air, excessively small living quarters, a poorly equipped school, an overly conformist church), but it does not involve the great tensions brought about by deprivation. *Surplus* by itself does not guarantee fulfillment: there may well be as many rich and privileged people suffering from personal and social ills as there are poor people. Surely this elusive *amenity* is to be found at the level of *fulfillment*, but it seems to me that

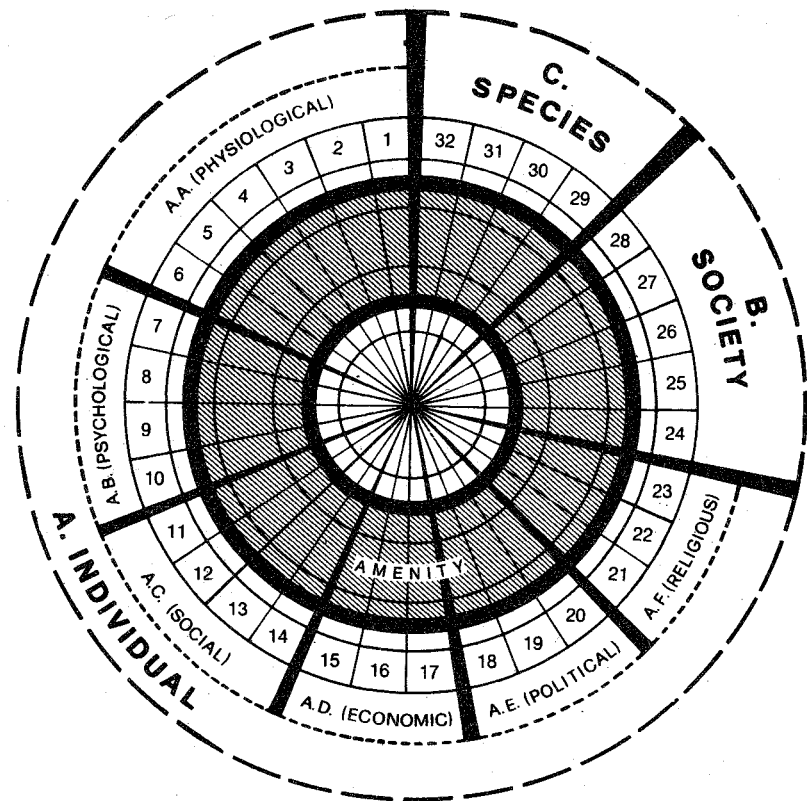


Figure 8: The amenity zone is located this side of total surplus and at the upper limit of necessity.

it extends beyond this zone, both below (necessity) and above (surplus). That is what I tried to indicate in Figure 8 and in Table III, where I extended the upper limit of amenity below the upper limit of surplus and its lower limit below the upper reaches of necessity.

If we superimpose Figures 4, 5, 6 and 7 over Figures 3 and 4, we can note the following:

Our Montreal tobacco merchant (Figure 4) believes he is living in "amenity," except in so far as light, air and his immediate neighborhood are concerned. The same thing applies for the town

TABLE III. The scale of human responses according to the degree of satisfying needs (see Figs. 2 and 3).

ZONE OF SATISFACTION	DEGREE OF SATISFACTION	HUMAN RESPONSE	
Surplus	+	Saturation	
	-	Euphoria	A M E N I T Y
Fulfillment	+	Health	
	-		
Necessity	+	Disorder	
	-	Depression	
Deprivation	+	Disease	
	-	Death	

he inhabits, except for its administration. Those are indeed serious reservations!

The English professor (Figure 5), whom I already qualified as an optimist, finds himself entirely in amenity.

The Inuit nomads (Figures 6) also know amenity, but there are shortcomings in so far as light, foodstuff, shelter and education are concerned.

The population of Dunedin (Figure 7) is decidedly very well off. Only a slight lack of potential in the realm of information is singled out.

In order to provide a contrast to these somewhat overly reassuring figures, I have added Figure 9 which illustrates, according to a student of the University of Montreal, the fate of a worker living in a poor section of his city. There are numerous areas of frustration, extending from deprivation to pure and simple necessity, with very little fulfillment and surplus.

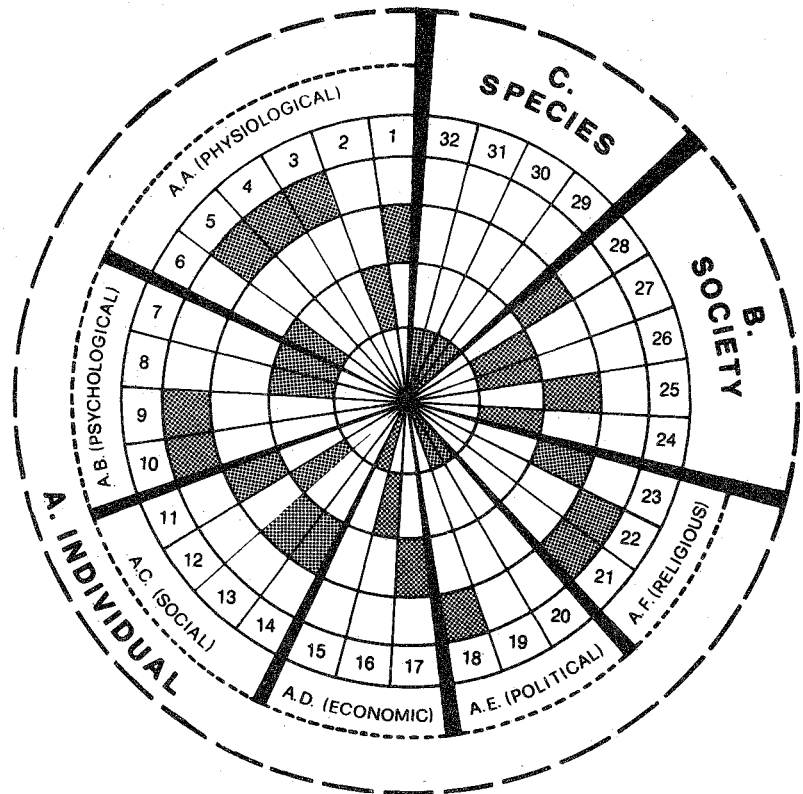


Figure 9: The environmental pie for a worker living in the poor section of Montreal.

Certain neighborhoods and even certain oriental cities come to mind as presenting an extreme state of deprivation. Figure 10 represents the "environmental pie" in Calcutta. It is readily seen that, outside of the weather and certain aspects of the religious cult, there are no amenities at all!

The present article tries to focus on the study of human settlements (and especially in towns) by stressing a format which is more ecological than sociological and economic. In other words, the socio-economic pressures are seen as ecological levers which affect the cycling of resources. It is also a work program since

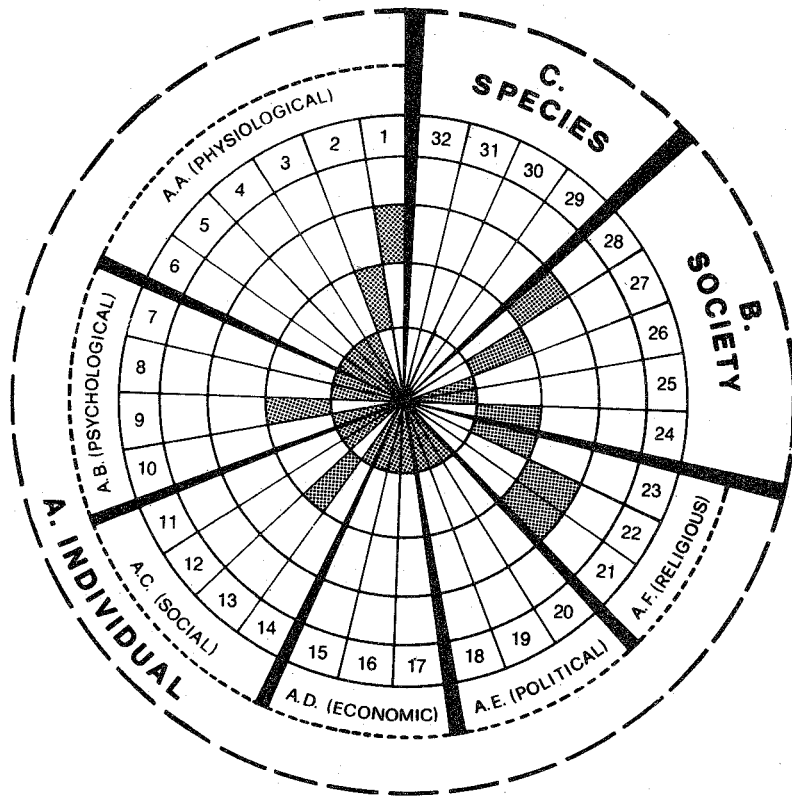


Figure 10: The environmental pie as it is shared in Calcutta.

certain questions are paired with certain criteria that have been selected, and since an attempt at integrating these findings is suggested for purposes of comparison.

The Conference-Exhibit on Human Settlements which took place in Vancouver in 1976, under the auspices of the United Nations, reaffirmed the fact that, on the level of analysis, the presence of ecologists is of primary importance. It is to be hoped that many contributions will be forthcoming, within the next few years, with the purpose of developing a methodology which is seeking an original expression. The conceptual framework of the environmental sciences is solid enough to support such an inquiry.