

NATURAL RESOURCES AND HUMAN IMPACT

LESZEK STARKEL

Institute of Geography and Spatial Organization
Polish Academy of Sciences
31-018 Kraków, św. Jana 22, Poland
e-mail: starkel@zg.pan.krakow.pl

ABSTRACT: It is rotational movement of the Earth that decides on the climatic zonation of natural resources, as modified by the positions of the continents and oceans and the irregular spread of fossil fuels. Intensive human activity poses threats to the development of natural geoecosystems. The last century also brought growing civilizational threats to the environment on the global, regional and local scales.

The author characterise the prospects in regard to global changes, and discuss the solutions needing to be pursued if human geoecosystems are to be protected (through management and education).

KEY WORDS: Earth, natural resources, civilizational threats, prospects.

THE DISTRIBUTION OF NATURAL RESOURCES ON THE EARTH

The Earth is a unique planet governed by the laws of physics and biology, while its resources are managed by the intelligent human species. Human beings must learn the laws of nature if they are to rule the Earth. Amongst these rules and resources a crucial role is played by rotational movement deciding upon changes in the position of the Earth's axis and the annual rhythm to the seasons. Climatic zones in turn determine zonation where the water cycle, vegetation and soils are concerned.

The attached figure (Fig. 1) shows humid and warm regions that concentrate in intertropical zones, as well as humid and cold regions at higher latitudes and the dry and generally warm regions that dominate in the tropical zone.

The reason behind diversity in the distribution of natural resources is the positioning of continents and oceans associated with the movement of continental plates that modifies the pattern of climatic-vegetation zones, especially in the intertropical belt.

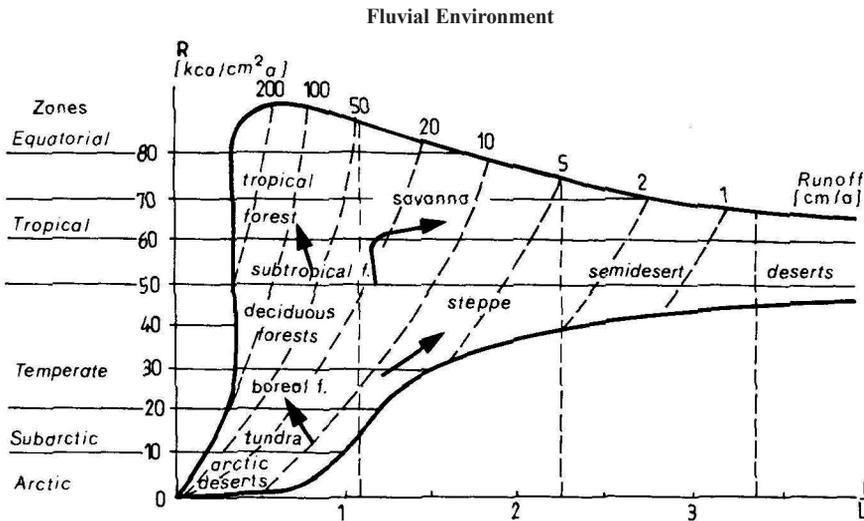


Figure 1. Climatic conditioning of vegetation and water-circulation zones (after Starkel 1990)

This pattern is overlain by an irregular spread of raw materials and fossil fuels that have been discovered successively, and exploited by human beings, and shaped by uneven economic development.

Finally, regional economic growth is modified by intellectual, social and political developments that take place in particular parts of the world.

Human beings demand ongoing progress. The need for air, water, food and clothing extends further, into a desire for housing, work tools, and – due to technical advances – also into a demand for raw materials and fuels, as well as means of transport and telecommunications. The attached table (Tab. 1) shows various terrestrial geocoecosystems (climatic-vegetation zones) and their water storage, thermal, soil and energy potentials. Of greatest benefit to human beings are the temperate, Mediterranean and subtropical zones.

Intensive human activity in these zones is posing threats to the development of natural geocoecosystems, especially where a severe lack of water and soil degradation take hold.

In humid areas, deforestation leads to agricultural cultivation, as well as resultant water erosion of soils or pasturage and erosion. In dry areas, pasturage and cultivation, regardless of irrigation implemented, leads to diversified soil degradation including salinification. On the global scale, various types of soil erosion have been activated and zones of desertification have spread out (Fig. 2).

Table 1. Continental Geoecosystems – Resources Economically Profitable or not, Climatic–Vegetation Zones

C	Zone	T	W	G	R	E	K
1	tropical forest	–	++	+	++		+–
2	subtropical – humid	+	++	++	++		++
3	savanna – semiarid	+	+	++	+		+
4	arid deserts	–	–	–	–	+	–
5	steppe	+	+–	+	+	+	+
6	Mediterranean	++	+	+	++		++
7	temperate (forest)	++	++	++	++	+	++
8	temperate continental (permafrost)	–	–	–	+		–
9	tundra	–	+	–	–	+	–
10	Polar deserts, high mountains	v	v	v	v	v	v

Explanations: **T** – temperature, **W** – water, **G** – soils, **R** – vegetation, **E** – energy resources, **K** – profitable from the point of view of the human economy; ++ very good, + good, +– different, – unfavourable, v – excluded.

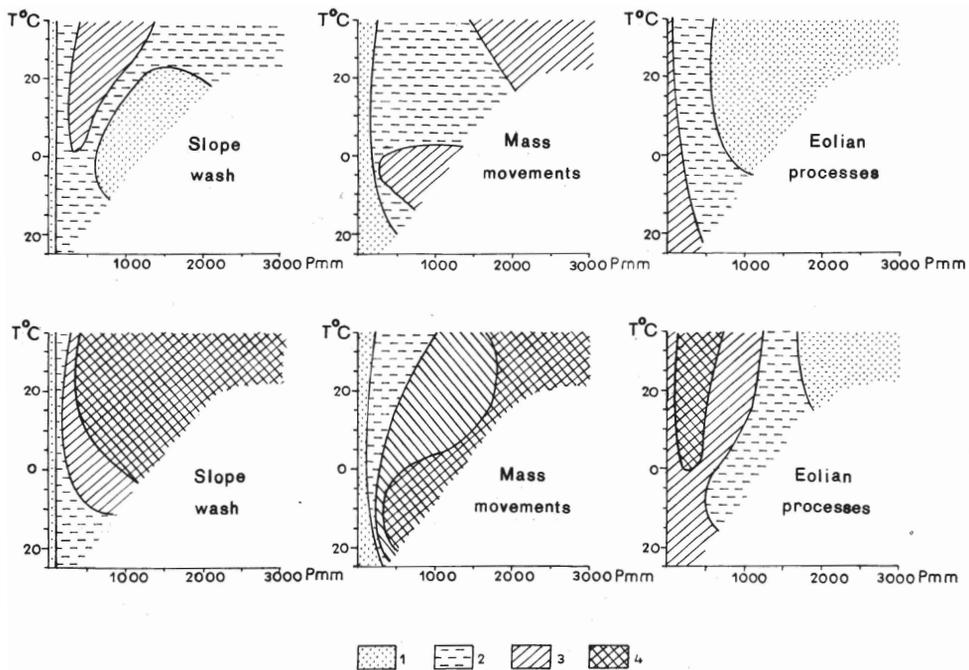


Figure 2. Morpho-climatic diagrams of intensity of fundamental relief-forming processes
 upper graphs – under natural conditions (after Wilson 1968),
 lower graphs – accelerated by human management
 Scale of process intensities: 1 – low, 2 – intermediate, 3 – high, 4 – very high (Starkel 1977).

CURRENT CIVILIZATIONAL THREATS TO THE ENVIRONMENT

In the last century we have observed growing civilizational threats to the environment. Human activity there environment is focused around three fundamental domains:

- Accelerated circulation of matter;
- An input of new substances and energy into the circulation;
- Disturbance of the circulation of matter due to the fragmentation of previously continuous natural spatial systems (e.g. river catchments).

Irregular development has three fundamental causes:

- Unwise management of natural resources;
- An irregular distribution of fossil fuels;
- A diverse level of technical advances.

Current threats to civilization can be of a global, regional or local nature.

GLOBAL

1. Progressing degradation of natural ecosystems (deterioration of biodiversity, water resources, etc.);
2. Demographic boom – an uneven increase in human population in different climatic zones;
3. Increased emission of CO₂, methane and other greenhouse gases and resultant consequences:
 - a) increased air temperature;
 - b) changes in atmospheric circulation;
 - c) increased frequency of extreme events (downpours, floods, typhoons, etc.);
 - d) melting of glaciers, sea ice and permafrost;
 - e) raised sea levels globally.

REGIONAL

1. Degradation of geosystems in different climatic zones – desertification;
2. Irregular distribution of raw materials, especially fossil fuels – depletion of old resources (exploitation effects) and discovery of new occurrences;
3. A large gradient of changes, especially at the borders of climatic zones, as well as shifts therein, resulting in:
 - a) colonial exploitation of zones underdeveloped economically;
 - b) domestic social revolutions and those between neighbouring societies;
 - c) migration (voluntary and forced);
 - d) armed conquests of neighbouring (richer) areas.

LOCAL

1. Extreme events (downpours, floods, droughts, hurricanes, whirlwinds, earthquakes, volcanic eruptions, catastrophes triggered by human activity);
2. Pollution of water and air, as well as noise in large agglomerations.

The overlapping of extreme local events on global ones is particularly dangerous, as it leads to catastrophic consequences. The lack of a basic livelihood, overpopulation and catastrophic events can together lead to civilizational cataclysms, bringing peril to the whole global system managed by humankind. People also try to ride roughshod over the laws of nature and social balance, due to an incessant desire for improved living standards manifested by privileged individuals, social (lobbying) groups and nations.

QUO VADIS TERRA?

- A. The prospect of cataclysms – imbalances in the circulation of energy and matter in the global system – ongoing global warming.
- B. The prospect of class and nation struggles for survival and for the right to live with rich.
- C. The prospect of consensus among the world's rulers (and stakeholders) as regards a restraining of our planet's headlong rush into the unknown.

SEEKING SOLUTIONS

What should be done to protect humankind and people's living space on the Earth?

- A. Reduce emissions of greenhouse gases to a minimum;
- B. Adjust the exploitation of raw materials and alter demography to correspond with qualities and resources characterising climatic zones;
- C. Detailed actions:
 1. Management of natural resources of the environment:
 - the termination of forest exploitation and pursuit of reforestation;
 - the termination of over-grazing;
 - the search for renewable sources of energy (in response to the depletion of fossil fuels);
 - wise water management – water storage, irrigation and drainage;
 - a change in land-use structure – adjustment to variations in weather and climate;
 - abandonment of areas prone to floods and other hazards.
 2. Education and social attitude:
 - the building of public awareness about the forces of nature as fluxes of energy and matter;
 - a reduction in the regional disparities in living standards;

– capacity building for sustainable development: nature protection and wise land management;
but also tolerance, justice and charity changes in the prioritization of demands: water storage to be ranked higher than space flights; protection of human life ahead of genetic manipulation.

REFERENCES

- Starkel L., 1977, *Paleogeografia holocenu*, PWN, Warszawa, pp 361.
Starkel L., 1990, *Global continental palaeohydrology*, *Palaeogeography, Palaeoclimatology, Palaeoecology*, 82, 73–77.
Wilson L., 1968, *Morphogenetic classification*, [in:] R.W. Fairbridge (ed.), *Encyclopedia of Geomorphology*, *Encyclopaedia of Earth Science Series*, Reinhold Book Corp., New York, 717–729.