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# Gaia Infiltrata: The Anthroposphere as a Complex Autoparasitic System

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## ABSTRACT

This paper compares the heuristic potential of three metaphorical paired concepts used in the relevant literature to characterise global relationships between the anthroposphere and the ecosphere. Methodologically, the guiding question is whether and to what extent metaphorical theses can support an arrival at hypotheses which accurately reflect reality and possess explanatory force. The predator-prey model implies that the populations of two species in such a relationship in principle exhibit coupled oscillations, giving prey populations the possibility of periodic regeneration. For some time, however, the most important indicators of human destruction of nature have been showing a relentless upward trend which appears to render the tumour-host metaphor more appropriate. Another fact which favours this analogy is that a tumour develops within its host and from its host's normal cells, in a similar way to the emergence of the anthroposphere from within the biosphere. But the parasite-host analogy also allows the formulation of fruitful hypotheses, since ecological parasitology is equally familiar with varieties of autoaggressive interaction and provides a means of focusing particularly on the adelphoparasitic hierarchy within the anthroposphere.

## KEY WORDS

Gaia hypothesis; metaphor; predator-prey interaction; tumour-host dynamics; autoparasitism.

## 1. KEY METAPHORS FOR EARTH SYSTEM DYNAMICS

Metaphors – according to a dictum of Ivan Illich – are ‘ferries of meaning to semantic shores’. In principle there is little dispute that they can be heuristically fruitful. However Khalil (1996) has pointed out the importance of paying careful attention to the kind of metaphor chosen in each particular instance, and which type might be appropriate to the particular case. Primarily citing subjects and examples from evolutionary research, he distinguishes four basic types: superficial metaphors, heterologous or analogous metaphors, homologous metaphors and unificational metaphors. The precise definitions and distinctions drawn by Khalil suggest that the predator-prey metaphor, frequently used to characterise relationships between the anthroposphere and the ecosphere, belongs in the analogous class. In Khalil’s typology, heterologous or analogous metaphors designate a similarity stemming from analytic functions and selection mechanisms which are comparable but occur in different contexts.

To clarify and to examine the relationship of the anthroposphere and the ecosphere, metaphors and analogies are not absolutely essential. Nonetheless, if the potential of such mental transpositions to stimulate heuristic insights is utilised, attention should indeed be given, with reference to the criteria postulated by Khalil, to the relevance and appropriateness of the particular comparison. The current article seeks to prove that the *predator-prey* analogy, presented in the following section, does not completely reflect the nature of human interaction with the ecosphere. In the next two sections, two alternative metaphoric conceptions are discussed which more adequately account for the substantive relationship between the two spheres and the special features of their coevolution: the *parasite-host* conception and the *tumour-host* analogy.

These ideas proceed from an extensive tradition of using metaphors to characterise humankind’s relationships with the natural environment. To mention just two examples:

- the notion of ‘Spaceship Earth’, figuratively casting all of us as members of a crew of cosmonauts whose survival depends upon the effort contributed by every single person to maintain the life-support capacity of the system as a whole;
- the image of the ‘war against nature’ which people – it is claimed – have fought with devastating success for more than 5000 years but which is unwinnable because to destroy their ‘enemy’ would be to undermine their own capacity for survival.

The temptation to clarify how these metaphors relate to the analogies analysed in this paper will have to be resisted in the present context.

‘Hypotheses are nets: only he who casts will catch.’ In keeping with this programmatic statement by the German poet, Novalis, in what follows, the

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heuristic fruitfulness of a metaphor or analogy will be assessed according to whether and to what degree it facilitates and promotes the formulation of scientifically founded hypotheses. A terminological distinction will be maintained between *theses* as metaphorical propositions, and substantial, scientifically testable *hypotheses* which derive from them.

Where reference is made in this context to the Gaia thesis developed by Lovelock and Margulis – ‘The Earth System is a superorganism’ – let me categorically emphasise that the reference is not to the disputed, teleologically tainted ‘strong Gaia’ sub-set of hypotheses, but to the variant which Kirchner (1991) labelled *coevolutionary Gaia*. This states that the biotic and abiotic subsystems of the ecosphere develop in co-operation and exert an active and reciprocal influence on one another.

## 2. THE PREDATOR-PREY MODEL

Gaining general insights into predator-prey abundances and accounting for the features specific to individual cases are among the most important tasks of ecology. (Begon, Harper and Townsend 1996: 369) Since the first half of the 20th century, the accomplishment of these tasks has been greatly assisted by the use of *population ecology models* as a heuristic tool. These initially deduce the effects of partial interrelationships in isolation, and subsequently combine these effects to reach an understanding of the overall process in question.

Models of predator-prey relationships fall into two main types (Begon, Harper and Townsend 1996: 371–375):

- The first type – of which the Lotka-Volterra model is the best known variant – is based on *differential equations*, relies mainly on simple, graphic models and is best suited to populations with continuous reproduction.
- The second type – founded on the Nicholson-Bailey model – uses *difference equations* in order to represent host-parasitoid relationships with discrete generations that do not overlap.

Both types of model share one *underlying dynamic*: the tendency for *cycles* and for the *coupling of oscillations* in predator and prey populations. The populations are dependent upon each other and are subject to common, infinitely enduring fluctuations in abundance:

Predators increase in abundance when there are large numbers of prey. But this leads to an increased predation pressure on the prey, and thus to a decrease in prey abundance. This then leads to a food shortage for predators and a decrease in predator abundance, which leads to a relaxation of predation pressure and an increase in prey abundance, which leads to an increase in predator abundance, and so on. (Begon, Harper and Townsend 1996: 374)

In *reality* however, such regular cycles cannot be expected. Instead there are persistent changes as a consequence of disturbances caused by varying environmental conditions. It is also the case that *models* of predator-prey relationships, as soon as the restrictive assumptions of the basic models are relaxed and modified, no longer show infinitely enduring stable fluctuations or stable limit cycles. Potentially there are widely differing kinds of abundance patterns which can also be encountered in real populations: stable-point equilibria, multigeneration cycles, one-generation cycles, chaos, etc.

The predator-prey models – it must be emphasised – are primarily heuristic instruments of *population ecology*. Thus in accordance with the research they were originally intended to pursue, they relate to a very particular, clearly identifiable stage in the organisational levels of matter in the hierarchy from atomic particle to universe. It is important to keep in mind that the predator-prey dynamic is ascribed to the population level, because this raises the question of how and under what conditions such models can usefully and feasibly be transposed onto the study of *global* relationships between the ecosphere and the anthroposphere, several levels of organisation further up this hierarchy.

One of the first authors to have applied the *predator-prey terminology* of population ecology to the relationship between *world population* and *global resources* was the economic theorist Goodwin (1978). His version puts a small number of human couples in the Garden of Eden, nourishing themselves on animal protein as hunters and fishers, so that the mortality rate of prey animals thereafter is determined not only by environmental conditions but also by the number of human predators. If the prey animals are the only source of food for the human population, how that population develops is dependent on its level reached so far, which determines the reduction of the prey population. Out of this emerge the cycles and coupled oscillations which are typical of predator-prey relationships in population ecology (Goodwin 1978: 194 f.).

Since the industrial revolution, development has brought about changes of both quantitative and qualitative kinds, which persuade Goodwin, terminologically at least, to subscribe to Thom's catastrophe theory. The reduction in mortality rates coinciding with static or rising birth rates and the expansion of production have transformed the previous dynamic stability of the global system into dynamic instability. In consideration of the limiting role of non-renewable finite resources, the problem once formulated by Malthus now acquires significance in another guise:

This is the prey-predator mechanism with the vital difference that the prey, once consumed will not regenerate, even when the predator population is decimated for lack of sustenance. A simple analogue is provided by the so-called Dutch elm disease. A single shipment of timber introduced into England a small number of the carrier beetles. By now there are thousands of millions of these beetles destroying at an increasing rate the elm population on which they depend. As the

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elms disappear so also will the beetle that uses them. It is a clear case of a small parametric change leading to total, or near total, disappearance of one population, in parallel with an enormous growth and eventual disappearance of another (Goodwin 1978: 196).

However the example is more characteristic of a parasite-host relationship than of a predator-prey interaction. Admittedly, in 1925 Alfred Lotka already – as Rosser reminds us (1991: 262) – indicated the possibility of global catastrophe of a neomalthusian type, yet such a collapse is not necessarily typical of the predator-prey dynamic. Hence using this variation of enemy-prey relationships as an analogy seems only to have limited import for an understanding of the developmental linkages among global human-environment interactions. To make a differentiated appraisal of its heuristic fruitfulness, it is useful to proceed from the distinction drawn earlier between a *metaphorical thesis* and the more specific *substantial hypothesis*. The metaphorical thesis in the present context is:

- Human communities act as predator populations in the ecosphere which is conceived of as prey. (*predation thesis*)

A first tentative attempt to derive substantial hypotheses from this metaphorical proposition which are compatible with the general structure and underlying pattern of predator-prey dynamics results in the following hypotheses:

- 1) The anthroposphere is an *autonomous-external* aggressor attacking the ecosphere.
- 2) The process dynamic manifests itself in *coupled oscillations* with periodic drops in the human predator population due to a reduced quantity of prey, followed by a time delay in recovery of stocks of prey in the ecosphere.

The untenability of these two hypotheses is plain to see: Firstly, *Homo sapiens* and human communities are not external aggressors but have emerged out of the biosphere and are dependent on it to this day for their capacity to survive. Secondly, every key data series for population development, landscape consumption and natural resource consumption has for some time shown an unbroken rising trend.

From the metaphorical predator-prey thesis, then, no substantial predation hypothesis can be derived which aptly characterises the relationship between anthroposphere and ecosphere. In the next section, I will investigate whether a similar deficit discredits the parasite-host analogy.

### 3. THE PARASITE-HOST ANALOGY

The question, then, is whether the relationship of the anthroposphere to the ecosphere is described and interpreted adequately if it is characterised as

*parasitic*. This interpretation gains initial support from the argumentation of Rees to that effect. In the context of debate on the valuation of 'ecosystem services' he poses the question, 'How should a parasite value its host?' In this connection he states – making reference to the second law of thermodynamics – that the economic system behaves parasitically in relation to the ecosphere, and in what way:

In particular, modern interpretations of the second law suggest that all self-producing systems, including the economy, can maintain or increase their internal order only by importing available energy/matter from their host environments and exporting degraded energy/matter back into them . . .

By this interpretation, the economy is but one level in a nested hierarchy of systems in which the survival of each subsystem is dependent on the productivity of the system immediately above . . . In effect, the economy has become parasitic on nature – its growth and vitality are increasingly purchased at the expense of the health of the ecosphere (Rees 1998: 50).

If we accept this characterisation then the general diagnosis of the condition of the Earth System is obvious: This system is suffering from a *parasitosis*, a disease induced by parasitic infestation. This interpretation is also found – alongside another which will be discussed later – in Lovelock (1991: 153 f.) and in Peacock (1995: 18 f.). Both authors, however, rightly designate not just the economy as the pathogenic parasite, but the whole of humankind along with all its destructive activities.

Ecology and biology have developed a series of distinctions which enable us to describe the properties and behaviour of parasites. These distinctions allow a precise definition of the parasitic properties of the anthroposphere:

- 1) Humankind is a *stationary* and *permanent* parasite on the ecosphere, being compelled to reside constantly within this sphere.
- 2) Since in normal circumstances humans act within the Earth's atmosphere, they are to be viewed as *endoparasites* (internal parasites) of the ecosphere.
- 3) Humans do not have the option of giving up their relationship to their host and draw all the resources they depend on for survival from the ecosphere; this makes them *obligate holoparasites*.

Along with these characteristics, another important distinguishing aspect is worthy of special consideration: All the manifestations of parasitism discussed so far follow the pattern of *allopasitism* in the sense that hosts are infested with alien organisms (or organism communities). In nature, especially in the case of flowering plants, there is also the phenomenon of *self- or autoparasitism*. In fact, many parasitic flowering plants attack not only potential host plants or organs of neighbouring plants of the same species, but even their own organs, because the parasitic shoots or roots are not capable of discriminating between these and

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alien organs (Yoder 1997). Special relevance accrues to these phenomena and the associated terminological distinctions insofar as, from the Gaia perspective – i.e. from the viewpoint of the Earth System, out of which the anthroposphere developed and within which it continues to be localised – the parasitic relationship between the anthroposphere and the ecosphere is an obvious case of autoparasitism: *Homo sapiens* in relation to the global ecosphere is not – as I have already explained – an exogenous aggressor but a ‘side shoot’ of a ‘parent plant’ to which it is inseparably joined by virtue of its evolutionary history; an offshoot which seems to lack the facility to perceive what is required to ensure the host plant’s survival and hence its own.

Furthermore it should be mentioned that the term autoparasitism is also used for a second situation in biology, as indicated above, namely when one organism’s activities are detrimental to the habitat conditions of other individuals of *the same* or closely related species. In this case, the term *adelphoparasitism* is also used, a variant of parasitism which can be observed in, for instance, the Aphelinidae, a very species-rich family of predominantly tiny chalcid wasps. The females partially develop as primary endoparasites by laying fertilised eggs in scale insects. The males later lay haploid eggs in or on the previously parasitised hosts and develop as secondary ecto- or endoparasites at the expense of their own females.

Adelpho- or autoparasitism of this kind is encountered repeatedly throughout human history: wherever an indigenous population is temporarily or permanently cut off from its means of existence by invaders who take complete control of the natural resources, it is a manifestation of this ‘sibling parasitism’, both upon the humans affected and the natural host system.

It is noteworthy that in natural ecosystems, while parasitic relationships may have one or two links in a chain (host-parasite or host-primary parasite-secondary parasite), other longer parasitic chains are also found consisting of an ascending sequence of parasites (*hyperparasites*). This distinction can be transferred directly to the anthroposphere: wherever a clearly identifiable hierarchy of power and coercion has been created, nationally or internationally, it is possible to speak of hyperadelphoparasitism, in which the human ‘siblings’ parasitise one another in a hierarchical sequence. For example, when in a rainforest region such as Amazonia the indigenous hunters and gatherers, subsistence farmers and fishers, functioning as ‘prudent’ primary parasites, have been displaced by small farmers who have entered their forest regions as a result of government settlement projects or spontaneous migration flows; and when these small farmers then have to make way for national or transnational corporations from agribusiness, the timber industry or other economic sectors; following the frame of reference of ecological parasitology, an adelphoparasitic chain has developed which already has three links at the very least.

If the interaction between the anthroposphere and the ecosphere is understood in principle as a parasite-host relationship, then the possible future



outcomes of this relationship can be outlined by referring to the four fundamental *courses of parasitic infections* (Lovelock 1991: 154):

- 1) The parasitic organisms are destroyed by the host's immune defences.
- 2) Host and parasite fight a long war of attrition which leads to chronic sickness.
- 3) The parasites destroy the host, which means that they also perish.
- 4) Host and parasite find a new, symbiotic form of relationship.

According to Peacock (1995: 19 f.) and Lovelock (1991: 154, 171), rational behaviour would be determined by insight and the will to strive for a symbiotic relationship as the only method of preventing the acceleration of damage or premature destruction of both partners in the relationship. Upon realistic consideration, however, symbiosis, or mutual facilitation, is probably too ambitious a goal. Even so, a great deal could still be gained by opting for a far-sighted, prudent parasitism which, while not exactly strengthening the viability and productive capacity of the global host ecosystem, at least does not fundamentally weaken it (Levin 1999: 150–5).

The thoughts put forward in this section are pulled together in the following *summary*:

1. The *metaphorical thesis* which serves as the departure point for the discussion states that: 'The anthroposphere is like a parasite that attacks and exploits the host system, which is the global ecosphere' (*parásitos thesis*).
2. From this thesis, it is possible to derive the following *substantial hypotheses* which are compatible with reality:
  - a. The entire ecospheric system is attacked by the anthropospheric subsystem, which has evolved out of this 'parent system', and develops at its expense (*autoparasitism hypothesis*).
  - b. The exploitation of the ecosphere by human primary parasites may be overlain with invasions of others acting as secondary parasites, to the detriment of both the specific host ecosystems and the humans whose lives depend on them (*adelphoparasitism hypothesis*).
  - c. The adelphoparasitic chain in the anthroposphere may include multiple links and develop into a complex vertical hierarchy, which exhibits a structure similar to the food or predation pyramid in the biosphere (*hyperparasitism hypothesis*).
3. So far, the medium- and long-term trends of anthropogenic nature degradation support the assumption that, out of all the courses which a parasite-host dynamic can take, the most likely outcome is that which ends in the destruction of the host system – the ecosphere – and thus the premature demise of the anthroposphere (*autodestruction hypothesis*).

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There is no evident aspect of these hypotheses – apart from the future-referenced autodestruction hypothesis – which contradicts the structural features and the evolutionary history of the Earth System. Although without exception they go no further than the black-box stage of modelling – in accordance with the intentional focus of this study on establishing general connections – they are thoroughly accessible to ‘deep’ causal analysis and the development of a white-box model which specifies the relevant mechanisms in each instance.

If use of the parasite-host analogy can be accompanied by a concentration on the two manifestations of autoparasitism known as self- and adelphoparasitism, then considerable heuristic fertility can be ascribed to this metaphor, as demonstrated by the above hypotheses which are substantial and compatible with reality. However, since autoparasitism in whatever form ranks as a comparatively rare form of parasitism, it would seem worthwhile before I finish to deal with one more constellation in which the features of autoaggression and self-destructiveness have constitutive significance.

## 4. THE TUMOUR-HOST METAPHOR

The tumour-host analogy expresses the idea that a connection exists, to a greater or lesser degree, between medicine and the social sciences, between individual therapy and wider political intervention, an idea that dates back to the pre-Socratic era. The French ethnologist and social scientist Emmanuel Terray (1990) engaged with the origins of this link in his study, *La politique dans la caverne*. In the context of an in-depth study of the *Corpus hippocraticum* he pointed out the close connections, characteristic of Greek thinking of that era, between examination of the state of human health and investigation of the political and social conditions.

Pursuing this perspective here, I will attempt to understand the basic structure and the more recent development of global humankind-nature relationships not as a predator-prey interaction or a parasite-host relationship, but as a *tumour-host conflict*. Such a view is implied for example by the two-phase diagram used by Goodland (1992: 17) to illustrate the dangerous expansion of the socio-economic sub-system within the finite global ecosystem, an image which gives apt expression to the real conflict constellation.

*Malignant tumours* are fundamentally characterised by three central criteria:

- *Infiltrative, invasive growth*  
Benign tumours exhibit expansive, displacing growth similar to that of a potato, whereas malignant tumours penetrate the surrounding tissue by degrading the basal membrane.
- *Destructive growth*  
Enzymes in the tumour cells assist in the destruction of the infiltrated tissue.

- *Metastasis*  
Tumour cells are carried around the organism and take hold at locations at a distance from the primary tumour, forming metastases which are usually characterised by a higher malignancy and growth kinetic than the primary tumour.

TABLE 1. TNM Classification

<b>Primary Tumour (T)</b>	
T 0	• <i>No evidence of primary tumour</i>
T 1	• <i>Evidence of increasing size and extent of primary tumour</i>
T 2	↓
T 3	
T 4	
<b>Regional lymph nodes (N)</b>	
N 0	• <i>No regional lymph node metastasis</i>
N 1	• <i>Evidence of increasing lymph node metastasis</i>
N 2	↓
N 3	
<b>Distant metastasis (M)</b>	
M 0	• <i>No (known) distant metastasis</i>
M 1	• <i>Distant metastasis present</i>

The system in most common use to describe the anatomical spread of malignant tumours is the internationally accepted classification of the *Unio internationalis contra cancerum* (UICC). The TNM System, reproduced in abridged form in Table 1, sets out the expansion of the disease in the form of graded statements on each of three features:

- *T = Tumour*: the extent of the primary tumour
- *N = Node*: the absence or presence or extent of regional lymph node metastasis
- *M = Metastasis*: the absence or presence of distant metastasis

Whether and in what way this classification can be transferred to global socio-economic development could be the subject of fascinating discussions. The thesis put forward by McMurtry (1999) is certainly problematic in stating that it is only in the past two decades, determined by money sequences in the course of a neoliberal advancement of globalisation, that the Earth System has developed an obviously cancerous potential. At most, the accelerated globalisation process could be interpreted as a parallel to the stage of distant metastasis formation, but even this classification would be far more applicable to the commencement, centuries earlier, of colonial incursions into the societies and ecosystems of the New World and the southern hemisphere, perhaps even the expansion dynamic of the empires of the ancient Mediterranean region.

As well as observing the stages into which the tumour dynamic is divided, the biomathematicians who are engaged in modelling the tumour-host conflict should be aware of at least the main findings from more recent *microbiological* and *immunological oncology*, demands Forni (1996). Doubtless this requirement also applies to social scientists who attempt to make use of the heuristic potential of the tumour-host analogy. In the present context, I would underscore two aspects as having particular significance:

(1) According to the level of understanding currently attained in molecular biology, normal tissue homeostasis is regulated by the subtle interplay and balance of *growth promoting proto-oncogenes* on the one hand and *growth inhibiting tumour-suppressor genes* on the other. When a tumour comes into existence it is usually by (malignant) transformation of a single cell (Eckhart 1997: 673). By virtue of one initial event, this gains a growth advantage over the neighbouring cells. The decisive factor in producing this constellation is the accumulation of function-altering mutations in the proto-oncogenes and/or the tumour-suppressor genes. The former are actively and dominantly involved in the malignant transformation as a consequence of mutations or faulty regulation, whereas the latter contribute to degeneration through *deactivation* of their cell-growth-inhibiting effects. In the course of tumour genesis and tumour progression, central mechanisms are gradually deregulated or inactivated so that ultimately proliferating, aggressive, invasive cell lines emerge.

(2) Recent verdicts from tumour immunology on the role of immune surveillance in the genesis and progression of tumours are not entirely consistent. At the turn of the 19th to the 20th century, Paul Ehrlich suspected that the incidence of tumours in humans was relatively frequent – he called them ‘aberrant germs’ – and that they would overwhelm us if they were not kept in check by the immune system. Burnett and Thomas developed this idea into the *Theory of Immune Surveillance*, which assumes that the immune response to a tumour takes place at an early stage and that most tumours are destroyed in this way before they become clinically evident (Beverly 1996: 20.1 f.). According to this theory, the immune system also plays an important role in delaying tumour growth and in

promoting the regression of established tumours. Meanwhile, on the other hand, there are grounds for the assumption that the immune system primarily prevents the spread of potentially *oncogenic viruses*, and that the defences are directed more against such viruses than against tumour cells, to which any response which occurs is relatively late and ineffective.

Mention should be made in this context to a *specific of causality theory*: both the microbiological and the tumour-immunological perspective of the genesis and progression of tumours give precedence to a particular form of causation – *dialectical determination* (or qualitative self-determination), in which the coaction of opposing contributory processes results in an overall process (Bunge 1979: 19). In the one perspective we have the interpenetration of effects of oncogenes and suppressor genes (which of course are subject to potentially mutation-inducing extrinsic influences), while in the other we have the conflict between the immune system and tumours or oncogenic viruses. But one important aspect should be remembered in this context, when considering such a conceptual transfer: In accordance with the assertion by Bhaskar (1993: 395) that causal mechanisms in the sociosphere are always determined by intentional human action, it is vital not only to establish the key effective-mechanical causal connections, which are dialectical in nature, but also to integrate the *final-purposive causal connections*.

One serious objection to the tumour-host analogy might be that it suggests a situation of hopelessness which fails to do justice to individual and social possibilities for learning and rethinking. This argument can be countered with the point that the sum total of major global trends over the past few decades gives little reason to attribute special importance to any such capacity for learning.

On the other hand it should be emphasised that while the tumour-host metaphor stands for a wholly serious threat, not only are possible treatments for this disease constantly improving, but also spontaneous remissions do occur (i.e. organic reduction of disease which cannot be explained by medical intervention) and are increasingly a matter for medical research (Heim and Schwarz 1998).

What *empirical grounds* and *theoretical considerations* can be cited which indicate a progressive, malignant infiltration of the ecosphere by the anthroposphere? In this connection, particular empirical relevance attaches at all hierarchical levels of the Earth System – local, regional and global – to trends in land-use changes and the continual increase in *landscape* or *land consumption*. No other contributory phenomenon of global change equates better to the growth and metastasis of tumours than the process – clearly documented by numerous comparative maps and images – of proliferative expansion of the land area dedicated to settlement and traffic use and the conversion of primary forest into agricultural land. Landscape consumption is the more comprehensive term: It includes not only the *conversion of open space* into sealed and reformed settlement and traffic areas, but also *landscape impairment* by reduction in biodiversity, and *landscape devaluation* through impoverishment of cultural

diversity. 'Landscape consumption therefore always represents a – normatively neutral – change in the three area-related components: open space consumption, landscape impairment and devaluation of cultural landscape' (Dosch and Beckmann 1999: 493).

Divergent use of terminology and methods of data collection greatly obstruct a consistent overview. The available data nevertheless convey such a clear message that reference to the gaps that exist cannot in any way be used to justify political inaction. I will cite some examples of basic global data to illustrate this point.

(1) The distribution of the Earth's *total land area* available for human use (133.4 million km<sup>2</sup>) has changed substantially over the past three centuries. The proportion of grassland and pasture has remained largely constant and amounted in 1980 as in 1700 to some 51%; in contrast the proportion of woodland and forest area decreased over the same period from 46.6% to 37.9%, while the proportion of agricultural land rose from 2% to 11.3% (calculated from data given in Groombridge 1992, p. 253). Furthermore the quantitative changes were accompanied especially in the second half of the last century by degrading *qualitative* effects: In all three types of land cover, biodiversity declined as a result of the introduction of monocultures and processes of intensification.

(2) A stocktaking exercise concerning the development of *global forest cover* spanning a period closer to the present day (Abramowitz 1998) reveals a massive acceleration in forest destruction: Of the original coverage of 62.2 million km<sup>2</sup>, in 1995 only 33.4 million km<sup>2</sup> remained (53.6%), thus more than 46% had been replaced by other forms of vegetation or by settlement use; of the remaining forested area, the proportion of primary forest was around 40%.

(3) A total of only 27% of that part of the Earth's surface covered with vegetation can be seen as *undisturbed*; the remainder can be classified in roughly equal proportions as either *partially disturbed* (36.7%) or affected by *irreversible anthropogenic impact* (36.3%) (Hannah et al. 1994).

Just how dangerous the continued reduction and fragmentation of vegetation cover could become for the global biosphere is indicated by the findings of simulations of modelled systems, which have been run and published by a group of researchers at the Potsdam Institute for Climate Impact Research, Germany (PIK):

In a two-dimensional model planet a negative feedback between climate and biosphere is simulated in which the plants influence local temperatures by means of the distribution of their albedo, thermal energy is spread via diffusion processes and the growth probability of plants is in turn dependent on local temperatures (von Bloh et al. 1997). By way of a disruption, the growth area is gradually fragmented. . . Although the degraded areas increase, the biosphere can maintain the 'climate' almost constant up to a critical fragmentation threshold through

dynamic adaptation of the reflective capacity. When that threshold has been reached the model biosphere dies and a rapid change in global temperature occurs (WBGU 2000: 239).

Thus the study of the self-regulation capacity of the model biosphere under increasing 'patchiness' revealed a considerable capability for stabilisation of the planetary temperature in the region of the optimum value: Only on passing a fragmentation and degradation threshold of 0.4 (40% of total area) did the average global temperature start to rise, but this was a rapid and major increase to a new average value of around 50°C and was associated with the collapse and loss of the model planet's biosphere (von Bloh, Block and Schellnhuber 1997: 259). This threshold value – the authors claim – is universal in character and, importantly, is not influenced by the size of the model system.

If it is accepted that the tumour-host analogy holds productive heuristic potential then it is indispensable to examine a study which places this analogy at the centre of its socio-economic analysis. The vehemence and destructive force of the recent money-accumulation dynamic has already provoked the statement by McMurtry that the 'capital sequences' have now reached a manifestly *cancerous stage*. This attitude coincides – albeit on the basis on different details of reasoning – with the assessment by Lovelock (1991: 153 f.): As an alternative diagnosis to the parasitic infection which he mentions to start with, Lovelock brings up the potential interpretation that the Earth System, given the increasing scope of its occupation by the anthroposphere, is subject to the influence of *neoplastic cancer cells*.

McMurtry (1999: VII) however – unlike Lovelock – emphatically underscores that he would not wish for the title of his study (*The Cancer Stage of Capitalism*) to be understood as a provocative metaphor but as an analytical characterisation of an actual isomorphic development. To an extent far beyond the consequences foreseen by Marx he believes that pathogenic monetary mechanisms have formed, which threaten both the conditions for social life and evolution and the future existence of the biosphere:

These life-attacking money sequences have typically invaded their social and environmental life-hosts by the non-living vehicles of corporate conglomerates, and have become dominant through leveraged and credit-money demand without a gold standard or legal-tender reserve requirement to inhibit their decoupled and borderless circuits of self-multiplication. They have been propelled and metastasised by ever more deregulation, velocities and volumes of cross boundary transaction advancing and spreading in new and proliferating vehicles and forms of self-increase (McMurtry 1999: IX).

According to this approach, the essential *invasive agent* which is infiltrating both the sociosphere and the ecosphere is the complex of *self-multiplying money sequences* which fulfil no productive functions. The dynamic of these money

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transactions and their destructive potential has been decisively promoted by an active policy of liberalisation, and concomitant interventions into a social infrastructure which had taken shape through many generations of social conflict and developmental processes.

The social immune system – the ensemble of specific monitoring, detection and defence organs – should really be in a position to halt the progression of the disease. McMurtry investigates and documents in great detail the fact that it is not adequate to the task and the reasons for this. However, a detailed appraisal of his theses is not possible here (even in this presentation of his ideas, I have had to sacrifice numerous fine distinctions of argument). I will just make reference to two concerns:

- McMurtry takes the view – as I have mentioned before – that the malignant degeneration of the global market system began *around 1980* and has continued progressively ever since. This would make all preceding stages of this system’s development no more than precancerous stages, at most. To take this view is to ignore or undervalue the historical fact that, from its inception, the market system stimulated by the profit motive owed its successful expansion largely to the infiltration and destruction of social and natural milieus which had previously enjoyed a relatively independent and unspoiled existence.
- In defining and demarcating the canceroid core process and its centre of action, McMurtry clearly distances himself from Lovelock who conceives of the *anthroposphere* in its *entirety* as a malignant tumour and explosive population growth as a primary factor in this threatening development. According to McMurtry, in contrast, the real danger emanates not from the reproductive sphere but from the deregulated financial sphere.

Thus McMurtry’s perspective proves to be too limited, both in historical and spatial terms: While the ‘finance-led growth regime’ (Boyer 2000) certainly plays a key role in the acceleration of social and natural erosion processes, it does not by any means constitute the sole relevant phenomenon which might explain the increasingly severe degradation and reduction of the biosphere. Once again I would stress the specific aspect of *dialectical determination*, the fact that tumour growth arises from a disturbance of the interaction of growth-promoting and growth-inhibiting genes. The identification of an analogous interplay of opposing forces in the infiltratively expanding anthroposphere could bring to light some grounds for appropriate intervention strategies and assessment of their prospects of success.

To deliver an appraisal of the heuristic potential of the tumour-host analogy, I will conclude once again by clarifying and assessing the relationship between the metaphorical thesis and the substantial hypotheses derived from it. The *tumour thesis* states, as I have said, that:



- The anthroposphere is a malignant tumour in the host system of the global ecosphere.

This metaphorical expression gives rise to the following more precisely defined hypotheses:

1. Human communities, having originated in the ecosphere as sustainably acting entities, converted at some phase of their evolution into infiltrative-destructive entities of activity (*mutation hypothesis*).
2. Since then a relentless expansion of the anthroposphere has taken place – significantly accelerated over the last three centuries – to the detriment of the ecosphere (*progression hypothesis*).
3. Disturbance of the balance between expansion-stimulating and growth-controlling factors and motives must be seen as the central force driving the bivalent proliferation dynamic (*bivalency hypothesis*).
4. Medium and long-term trends of destructive expansion of the anthroposphere heighten the probability of the premature destruction of the biosphere, or of an ecosphere that supports human life (*lethality hypothesis*).

Each of these hypotheses is compatible both with the basic features of the tumour-host interaction and with the reality of the development dynamic of the anthroposphere. The bivalency hypothesis even – admittedly to a modest degree – crosses the boundary from black-box to grey-box model: It implies that the complete process of anthropogenic destruction and degradation of nature arises from dangerous mutation in the interaction of opposing contributory processes. An example that can be mentioned is the demographic population dynamic, arising from the interaction of the contributory processes of fertility and mortality.

From this perspective, it will be critical to the future development of the overall system whether, and at what speed, success is achieved in weakening the main factors promoting ‘oncogenic’ progression of the anthroposphere (especially the dynamics of accumulation, population and technology) and in strengthening the expansion-inhibiting factors of suppression, such as efforts to control the ‘self-referential’ money dynamic and possibilities of replacing a ‘technique of invasion and dominance’ with a ‘technique of alliance’ (Bloch).

## 5. CONCLUSIONS

‘I am life which wants to live in the midst of life which wants to live’, declares Albert Schweitzer in the course of his deliberations on an ethics of reverence for life. He concludes that humans, as thinking beings, must consider other life with

the same reverence as their own. However, the fundamental insight common to all the metaphors analysed here is that the reality of human interaction with nature is far removed from this postulate.

The upshot of the above considerations is that we can affirm: where metaphors and analogies are used for heuristic purposes to characterise global interactions between the anthroposphere and the ecosphere, they should be examined carefully to see whether they reflect appropriately the real quality of the relationships between the two spheres, and whether the metaphorical thesis permits the derivation of scientifically founded hypotheses. The *tumour-host* metaphor comes far closer to meeting this test than the *predator-prey* analogy. Even greater suggestive potential is contained in the *parasite-host* analogy, once account has been taken of the double sense in which *autoparasitism* applies: Firstly, to the aggression of the anthropospheric sub-system, threatening the entire system of the ecosphere to which it owes its genesis and its capacity for survival, and secondly, to the way that this sub-system has conspicuously propagated detrimental treatment of members of the same species by inflicting damage on natural host systems and in doing so, has developed a remarkable vertical complexity of adelphoparasitic hierarchies.

We may thus certainly speak of a 'complex adaptive system' (CAS, as it is known in complexity theory), but at this point I propose a more precise reinterpretation of that term's content: The anthroposphere can be understood in respect of its internal differentiation and the basic character of its interactions with the ecosphere as a *complex autoparasitic system*.

The fact that humans behave (auto)parasitically in the manner outlined stems partially from biological necessity, as heterotrophic top-predators integrated within the biosphere's food webs and pyramids, which are a product of the evolution of life itself. Nevertheless the quality and, moreover, the intensity of the predatorial or parasitic activities are not wholly dictated by biology but are socio-culturally determined to a great extent. The drastic differences between the average ecological footprints of different nations (for example more than 10 ha for the United States of America, less than 1 ha for countries such as Bangladesh) clearly demonstrate that, above and beyond biological necessity, there is broad scope for impact dependent on socio-economic and socio-cultural influences (Chambers et al. 2001: 120–3).

'The 'good' or 'better adapted' parasite does not unduly harm its host', state Toft and Aeschlimann (1993: 1), though they do not accept the view that evolution necessarily leads to ever-lower stages of pathogenicity. Accordingly, we may speak in terms of 'adapted' and 'prudent' parasites if virulence remains below the threshold where the premature death of the host is brought about. Suitable mathematical models can be used to determine and represent the optimum level of virulence. (Poulin 1998: 68–71) In the real world, whether *Homo sapiens* will prove to be *Homo prudens* in that sense remains to be seen.

The critical factor is whether success can be achieved in improving the efficacy of forces and efforts which foster sustainability, and in breaking the dominance of destructive forces which militate against it.

## REFERENCES

- Abramowitz, Janet N. 1998. *Taking a Stand: Cultivating a New Relationship with the World's Forests*. Worldwatch Paper 140. Washington, DC: Worldwatch Institute.
- Begon, Michael, John L. Harper and Colin R. Townsend 1996. *Ecology: Individuals, Populations and Communities*. Oxford: Blackwell.
- Beverley, Peter 1996. 'Tumour Immunology', in Ivan M. Roitt, Jonathan Brostoff and David K. Male, *Immunology*, 4th edn, pp. 20.1–20.11. London: Mosby.
- Bhaskar, Roy 1993. *Dialectic: The Pulse of Freedom*. London: Verso.
- Bloh, Werner von, Arthur Block and Hans-Joachim Schellnhuber 1997. 'Self-stabilization of the Biosphere under Global Change: A Tutorial Geophysiological Approach', *Tellus* 49B: 249–62.
- Boyer, Robert 2000. 'Is a Finance-led Growth Regime a Viable Alternative to Fordism? A Preliminary Analysis', *Economy and Society* 29: 111–45.
- Bunge, Mario 1979. *Causality and Modern Science*, 3rd, rev. edn. New York: Dover.
- Chambers, Nicky, Craig Simmons and Mathis Wackernagel 2001. *Sharing Nature's Interest: Ecological Footprints as an Indicator of Sustainability*. London: Earthscan.
- Dosch, Fabian and Gisela Beckmann 1999. *Siedlungsflächenentwicklung in Deutschland – auf Zuwachs programmiert (Development of Settlement areas in Germany – Programmed towards Growth)*. Bundesamt für Bauwesen und Raumordnung, ed. *Informationen zur Raumentwicklung*, Heft 8: 493–509.
- Eckhart, Walter 1997. 'Viruses and Cancer', in Renato Dulbecco (ed.) *Encyclopedia of Human Biology*, 2nd edn, Vol. 8, pp. 673–8. San Diego, Cal.: Academic Press.
- Forni, Guido 1996. 'Tumor-Host Relationship: The Viewpoint of an Immunologist towards Applied Mathematicians', *Mathematical and Computer Modelling* 23: 89–94.
- Goodland, Robert 1992. 'The Case that the World Has Reached Limits: More Precisely that Current Throughput Growth in the Global Economy Cannot Be Sustained', in Goodland, Robert, Herman Daly, Salah El Serafy and Bernd von Droste (eds) *Environmentally Sustainable Economic Development: Building on Brundtland*, pp.15–27. Paris: UNESCO.
- Goodwin, Richard 1978. 'Wicksell and the Malthusian Catastrophe', *The Scandinavian Journal of Economics* 80: 190–8.
- Groombridge, Brian (ed.) 1992. *Global Biodiversity: Status of the Earth's Living Resources*. Compiled by World Conservation Monitoring Centre. London: Chapman and Hall.
- Hannah, Lee, David Lohse, Charles Hutchinson, John L. Carr and Ali Lankerani 1994. 'A Preliminary Inventory of Human Disturbance of World Ecosystems'. *Ambio* 23: 246–50.
- Heim, Manfred E. and Reinhold Schwarz 1998. *Spontanremissionen in der Onkologie: Theoretische Modelle und klinische Befunde (Spontaneous Remission in Oncology: Theoretical Models and Clinical Findings)*. Stuttgart: Schattauer.

## GAIA INFILTRATA

- Khalil, Elias L. 1996. 'Social Theory and Naturalism', in Khalil, Elias L. and Kenneth E. Boulding (eds) *Evolution, Order and Complexity*, pp. 1–39. London: Routledge.
- Kirchner, James W. 1991. 'The Gaia Hypotheses: Are They Testable? Are They Useful?' in Stephen H. Schneider and Penelope J. Boston (eds) *Scientists on Gaia*, pp. 38–46. Cambridge, Mass., and London: MIT Press.
- Levin, Simon A. 1999. *Fragile Dominion: Complexity and the Commons*. Cambridge, Mass.: Perseus.
- Lovelock, James E. 1991. *Gaia: The Practical Science of Planetary Medicine*. London: Gaia.
- McMurtry, John 1999. *The Cancer Stage of Capitalism*. London and Sterling, Virginia: Pluto.
- Peacock, Kent A. 1995. 'Sustainability as Symbiosis: Why We Can't Be the Forehead Mites of Gaia', *Alternatives* **21** (4): 16–22.
- Poulin, Robert 1998. *Evolutionary Ecology of Parasites: From Individuals to Communities*. London: Chapman and Hall.
- Rees, William E. 1998. 'How should a Parasite Value its Host?' *Ecological Economics* **25** (1): 49–52.
- Rosser, J. Barkley Jr. 1991. *From Catastrophe to Chaos: A General Theory of Economic Discontinuities*. Boston, Dordrecht and London: Kluwer.
- Terray, Emmanuel 1990. *La politique dans la caverne*. [Paris] Éditions du Seuil.
- Toft, Catherine A. and André Aeschlimann 1993. 'Introduction: Coexistence or Conflict?', in Catherine A. Toft, André Aeschlimann and Liana Bolis (eds) *Parasite-Host Associations: Coexistence or Conflict?* pp. 1–12. Oxford: Oxford University Press.
- WBGU 2000. German Advisory Council on Global Change. *World in Transition: Conservation and Sustainable Use of the Biosphere*. Report 1999. London: Earthscan. Internet: <[http://www.wbgu.de/wbgu\\_jg1999\\_engl.html](http://www.wbgu.de/wbgu_jg1999_engl.html)>
- Yoder, John I. 1997. 'A Species-specific Recognition System Directs Haustorium Development in the Parasitic Plant *Triphysaria* (Scrophulariaceae)', *Planta* **202**: 407–13.

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