[IMAGE]

The mega-city Tokyo as an example of urbanisation and globalisation. A metropolis that is constantly expanding not only outwards to the peripheries, but also into the third dimension upwards (photo: Breckle)

[IMAGE]

Coal-fired power station near Leipzig operated by opencast lignite mining, one of the anthropogenic contributions to the additional greenhouse effect (photo: Breckle)

**II Special part**

**Part M - Summary, conclusions**

1. **Phytomass and primary production of the individual vegetation zones and the entire biosphere**
2. **Conclusion from an environmental point of view**
3. **The population explosion**
4. **The over-technification**
5. **Sustainable land use**
6. **Confessions**
7. **Literature**

[IMAGE]

Garden art in the Oriental city Shiraz, Iran (photo: Breckle).

1 **Phytomass and primary production of the individual vegetation zones and the entire biosphere**

The geo-biosphere covers the Earth's surface as a thin shell, as the thinnest little skin; it includes the uppermost rooted soil layer and the air layer near the ground, as far as the organisms protrude into it, as well as all waters. The entire biological material cycle thus also takes place in it.

Of the total biomass on land, phytomass accounts for over 99%, so that we can confine ourselves to the distribution of the same in our considerations. It shows clear relationships with the zonobiomes.

The exact determination of phytomass and primary production encounters difficulties. As early as 1970, Bazilevich et al. published calculations, evaluating the relevant literature, for the individual thermal zones and bioclimatic areas of the Earth. The mean phytomass and the mean annual primary production per hectare (t/ha) are calculated for the individual areas as dry mass in tons (t). After measuring the area of each region, not including the area of rivers, lakes, glaciers and firns, the total phytomass and the total annual primary production are also given for each region. Summing these figures gives the phytomass and annual production of the Earth's land surface. To this, the ◘ Table M-1 also adds the corresponding data for water bodies. These are potential values, i.e. based on natural vegetation that has not been altered by humans.

Bazilevich et al. (1970) distinguish five thermal zones: 1. polar (arctic), 2. boreal, 3. temperate, 4. subtropical, and 5. tropical. The first two zones have a humid climate, while three areas are distinguished for each of the other three: a humid (h), a semiarid (s), and an arid (a) (cf. map in ◘ Fig. M-1, and ◘ Table M-1).

This outline differs somewhat from the zonobiome outline, as the comparison shows (◘ Table M-2).

If we compare the conditions on land with those in the oceans, we see that the production of the latter at 60**·**109t is only about ⅓ of that on land, although its area is almost three times greater. It is also noticeable that the phytomass in the oceans is infinitesimal, especially in relation to the primary production, which is 300 times greater. This is understandable if one takes into account that the producers, the plants of the plankton, consist of unicellular organisms that are constantly dividing. In contrast, the primary production on land is only about 7% of the phytomass.

◘ **Fig. M-1** Thermal zones and bioclimatic areas (modified from Bazilevich et al. (1970): **1** glaciers and firn areas; **2** Arctic zone; **3** boreal zone; **4-6** temperate zone: **4** humid areas, **5** semiarid areas, **6** arid areas; **7-9** subtropical zone: **7** humid areas, **8** semiarid areas, **9** arid areas; **10-12** tropical zone: **10** humid areas, **11** semiarid areas, **12** arid areas.

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| Table M-1 Distribution of the potential productivity of the Earth (after Bazilevich et al. 1970) | | | | | |
| Climate zones | Area | Phytomass | | Primary production | |
| [106 km2] | Total  [109 t] | Mean  [109 t·ha-1] | Total  [109 t·ha-1] | Mean  [109 t·ha-1L·a-1] |
| Polar | 8,05 | 13,8 | 17,1 | 1,33 | 1,6 |
| Boreal | 2,20 | 439 | 189 | 15,2 | 6,5 |
| Temperate | | | | | |
| humid | 7,39 | 254 | 342 | 9,34 | 12,8 |
| semiarid | 8,1 | 16,8 | 20,8 | 6,64 | 8,2 |
| arid | 7,04 | 8,24 | 11,7 | 1,99 | 2,8 |
| Subtropical | | | | | |
| humid | 6,24 | 228 | 366 | 15,9 | 25,5 |
| semiarid | 8,29 | 81,9 | 98,7 | 11,5 | 13,8 |
| srid | 9,73 | 13,6 | 13,9 | 7,14 | 7,3 |
| Tropical | | | | | |
| humid | 26,5 | 1166 | 440 | 77,3 | 29,2 |
| semiarid | 16,0 | 172 | 107 | 22,6 | 14,1 |
| arid | 12,8 | 9,01 | 7,0 | 2,62 | 2,0 |
| Geo-biosphere | | | | | |
| Landmass | 133 | 2400 | 180 | 172 | 12,8 |
| Glaciers | 13,9 | 0 | 0 | 0 | 0 |
| Hydro-biosphere | | | | | |
| Lakes/Rivers | 2,0 | 0,04 | 0,2 | 1,0 | 5,0 |
| Oceans | 361 | 0,17 | 0,005 | 60,0 | 1,7 |

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| ◘ Table M-2 Comparison of Bazilevich's (1970) thermal climate zones with zonobiomes. | |
| Thermal zones and climatic regions | Zonobiome |
| Zone 1 | ZB IX |
| Zone 2 | ZB VIII |
| Zone 3 h, s, a | ZB VI and VII |
| Zone 4 h, s, a | ZB V, IV and III (outside the tropics) |
| Zone 5 h, s, a | ZB I, II and III (within the tropics) |

If we add up the total active carbon stocks of the Earth, we get about 800 Gt C (mainly CO2) in the atmosphere, about 700 Gt C in the biosphere, 38,000 Gt C in the hydrosphere and about 1,600 Gt C in the pedosphere. The proportion of carbon stocks in the lithosphere is enormous (◘ Table M-3). If one asks about the mass of consumers and decomposers, only 20**·**109 t of dry mass is given for all continents together, i.e. less than 1% of the phytomass, whereas in the oceans one reckons with about 3**·**109 t, which is more than 15 times the phytomass there. Unlike unicellular plants, consumers in the oceans are also large animal organisms that are exploited for human consumption.

We have shown by various examples how small, in contrast, is the zoomass of the great terrestrial consumers. The phytomass on land consists mainly of the wood mass in the forests, which accounts for 82% of the total phytomass on all continents, although the forests occupy only 39% of the area. The bulk of forest phytomass, about 50%, is found in tropical forests, about 20% in boreal forests, and about 15% each in subtropical and temperate forests. These figures should also be kept in mind for the "global change" discussion.

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| Table M-3 The carbon quantities [Gt C] in the individual global reservoirs (after Ittekkot et al. 2002) | | |
| Storage | Form | Amount of CO2 [Gt C] |
| Atmosphere | Carbon dioxide (CO2), carbon monoxide (CO), methane (CH4) | 790 |
| Biosphere | Organic compounds in terrestrial  and in marine organisms respectively | 700  3  3 |
| Hydrosphere | Carbon dioxide (CO2), hydrogen carbonate (HCO3), carbonate (CO32-) | 35.000 |
| Lithosphere | Calcium carbonate (CaCO3, calcite), calcium-magnesium carbonate (CaMg(CO3)2, dolomite | at least 60,000,000 |
| Sediment | Kerogen  Gas hydrates | at least 15,000,000  10.000 |
| Fossil fuels | Coal, oil, natural gas | 4.100 |
| Pedosphere  Soil | Dead biomass (humus, peat) | 1.500 |

Kerogen: The polymeric organic material from which hydrocarbons are formed as geological subsidence and heating increases.

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| Box M-1 Primary production of different ecosystems |
| The total annual potential primary production of the biosphere on land, in the oceans and lakes and rivers is about 233·109 t. Of this, the land mass accounts for 172·109 t, the lakes and rivers for 1·109 t, and the oceans for 60·109 t. |

The phytomass of deserts is very low (0.8%) compared to the large area of more than 22% that they occupy in the total land area.

The mean phytomass in t/ha of the forests (humid areas) increases steadily from 189 t/ha in the boreal zone to 440 t/ha in the tropics with increasingly favourable temperature conditions. In contrast, the mean phytomass in the tropical arid regions is lowest at 7 t/ha; this is because drought with permanently high temperatures is particularly unfavourable for plant growth.

If we look at the average annual primary production, it is more than seven times higher on land than in the oceans, at 12.8 t/ha·a, and about two and a half times that in lakes and rivers with their aquatic and marsh plant populations.

The primary production of the humid areas per hectare also increases equatorwards on land, doubling from the boreal to the temperate zone and from the latter to the subtropical in each case, but then increasing little further to the tropical zone. The differences between the humid and semi-arid zones are not as great as in the case of the values for phytomass, since the wood masses in the forests do not produce and it is the leaf area that is more important (comparison of meadow and forest in the Solling). The relatively high production in the subtropical semi-arid and arid areas with 13.8 and 7.3 t/ha·a, respectively, is striking; it is due to the often very lush and productive ephemeral vegetation that can develop during the favourable cooler season.

Lieth & Whittaker (1975) arrived at somewhat different values. They start from the vegetation formations and do not calculate the potential but rather the real production taking into account the cultivated areas. Therefore, the values for terrestrial production are lower. Lieth gives a primary production of 121.7**·**109 t of dry matter on a land area of 149**·**106 km2 as the most accurate figure.

Finally, if we ask ourselves how high the consumption of mankind was with a population of three billion with a biomass of 0.2**·**109 t, we can put it approximately equal to the total agricultural production at that time, which accounted for 0.7% of the primary production of the biosphere. Energy consumption is given as 2.8**·**1018 cal, since only part of the energy taken in with food is utilized. These figures do not seem high, but consumption has now risen sharply with the rapid increase in population to about eight billion.

2 **Conclusions from an ecological point of view**

The preceding chapters provide a concise overview of the major natural ecological interrelationships of the geo-biosphere. Their knowledge is the prerequisite for a correct assessment of the dangers arising from the increasing human intervention in natural processes.

These are so manifold and profound that they cannot be dealt with within the framework of this overview. Thanks to his intellectual abilities, man has built up his own, seemingly independent world alongside the natural one, that of a technically oriented world economy.

He has become more and more alienated from nature through progressive urbanization. In the process, he loses the ground under his feet, considers everything technically feasible and believes in unlimited economic growth.

The Club of Rome (http://www.clubofrome.org) pointed out the utopian nature of this attitude as early as 1972 on the basis of many studies and predicted an economic crisis if countermeasures were not taken immediately (cf. also Gruhl 1975). But nothing substantial happened. The crisis has occurred in the meantime, locally for a long time, regionally in many places. People are still on the lookout for the first pink streaks on the horizon of economic growth. While "ecology" is on everyone's lips, there is no fundamental shift in mindset. The so-called economic constraints still have priority. Almost all economic theories assume necessary growth. How is constant growth to be sustained? It cannot be sustainable. Only an economic system in dynamic equilibrium (steady state) without exploitation of nature can last in the long run. The destruction of the environment, on which man's existence depends, continues almost unabated throughout the world. Attempts are made only to cover up local damage by cosmetic means. But these are global problems. The two greatest dangers must be briefly pointed out here:

* the population explosion
* over-technification

The question must be asked and clarified how sustainable land use is possible, i.e. land use that preserves the basis of human life for many generations of mankind (i.e. for centuries to millennia). This can only be done through education, rational insight, modesty and humility.

3 **The population explosion**

In 1981, Aurelio Peccio, President of the Club of Rome, in the German edition of his paper "Die Zukunft in unserer Hand" (The Future in Our Hands), again pointed out that the world population is increasing at such a rate that something must be done about it immediately. According to Peccio, 223 children are born in the world every minute, which is 321,000 in a day or 120 million in a year. However, this number is much higher in 2021! However, the exponential increase has leveled off somewhat in recent years. Between 2010 and 2014, the population increased by 82 million per year, so that at the end of 2014, there were exactly 7 billion people living on our planet. This number has increased by about 160 million at the end of 2016 (UN 2014).

At the moment, the population of the Earth is increasing by one billion in less than 15 years. If it were possible to keep all the children born alive, and that is what we are trying to do, then in barely 10 years there would be 1.2 billion children under the age of 10 in the world. These would have to be fed and educated. After another 10 years, it would be necessary to obtain jobs for them, and soon after that they in turn would bring more children into the world.

The population explosion occurs with exponential growth (◘ Fig. M-2). 2,000 years ago, there were an estimated 200 to 300 million people across the globe. Until the year 1800, the population increased only slowly.

Today, the situation in very many countries is catastrophic. Diseases and epidemics were also successfully fought there. The mortality rate fell, but hardly the birth rate. As a result, the population increased and continues to increase rapidly, and this within a few decades. In the context of human development, this is only a moment. If millions are malnourished or starving as a result of today's catastrophic situation in these countries, the population explosion is the direct cause that must be addressed first and foremost. Starvation is only a symptom - the natural law consequence that applies to all living beings in ecological systems, including humans, that no species may reproduce indefinitely at the expense of other living beings. No development aid can eliminate this law. Man with his earthly body, which must be nourished, is and remains a part of nature. That is why well-intentioned food aid is particularly harmful, because it fuels the population increase even more, as if one wanted to extinguish a fire with oil (Walter 1990).

◘ **Fig. M-2** The population explosion on Earth (shown as an atomic bomb mushroom cloud) from the year zero of our era: It took millions of years since the appearance of man until there were a billion people on Earth in the middle of the 19th century. After another 100 years there were already 2 billion, then after another 37 years 3 billion, but already 13 years later 4 billion. Around the year 2000 there were 6 billion and around the year 2025 one must reckon with 8billion. The number around 2100 could not be shown, because if the increase remained the same, one would have to double the width of the fungus above to over 20 billion. According to recent calculations, however, the number should settle at 11-14 billion as early as 2050 (BIRG, oral comm.), while in Europe the population is already shrinking as of 2005 (without immigration). Both is very hypothetic.

A graduate farmer at the university of Hohenheim, who later became a university professor of agricultural sciences in his country, exclaimed in a radio lecture: "Hands off the developing countries, they must carry out their own recovery; all development aid prevents that".

Remarkably honest is also in this respect the statement of the development adviser of the World Council of Churches Jonathan Freyers on the basis of his experiences. It caused outrage in wide unsuspecting circles. For in a newspaper article he expressed the view that food shipments cause devastating damage. They would be distributed to the poorest, the buyers in the markets would stay away, causing the arable farmers to stop struggling and become aid recipients as well. Domestic production would collapse and the number of aid recipients would increase more and more - a vicious circle!

If one issues the slogan "help for self-help" or "stimulation for self-initiative", then one again misjudges the attitude as well as the way of thinking of many natives. Through thousands of years their way of life was regulated by strict moral laws, and these were optimally adapted to the environment, according to the cultural level, thus sustainable. Otherwise, survival would not have been possible for thousands of years.

Even colonial rule did little to change this, the power struggles among the tribes were stopped, farms or plantations with certain earning opportunities for the workers were established on still unsettled areas. A slow incorporation into the European economic system was starting and in the offing. The hasty release into independence with the requirement to create unified states according to democratic rules within the former colonial borders led to chaos and tribal struggles everywhere. The unschooled masses could not cope with the leapfrogging of a development that had taken over a millennium in the West. Our ancestors at the beginning of our era probably wouldn't have been able to accomplish this. The very strict moral and cultural rules regulating sexual intercourse and population were abolished, the unbridled urge to multiply set in, and with it the enormous increase in the number of births. Private property in our sense was unknown, everything belonged to the great clan and was regulated by it; thus there was no incentive for individual initiative. Most development workers return deeply disappointed. As long as one gives the necessary guidance in a project, people work very willingly and eagerly. However, if the guidance stops, then in most cases nothing happens anymore, only the outer facade is maintained, but this is not enough. "But you have to do something, you have to help the developing countries", is the argument of those who have never worked practically in the developing countries themselves. However, we must not forget that these are sovereign states that are very suspicious and immediately interpret incisive advice as neo-colonialism. This is particularly true with regard to advice on curbing the population explosion. However, until this problem is solved, any help will be in vain or harmful. Of course, the establishment of commercial enterprises, SOS Children's Villages, care for the blind, etc., is a help and laudable for the people covered in the process. But it does not change the catastrophic overall situation, which is getting worse and worse and is triggering an avalanche of refugees into the industrialized countries. Even if it is pointed out (more in passing) that the purpose of development aid is to open up new markets for our industrial products, for which there is an unlimited demand in the developing countries, this calculation is unlikely to work out.

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| Box M-2 Exponential economic growth as an "interglacial fallacy". |
| Colonialism and communism, as well as capitalism with its dogma of exponential economic growth, are perhaps nothing other than an "interglacial error" (to paraphrase Succow). |

Delivery can only be made on credit, with little expectation of repayment or interest. The examples of countries rich in raw materials such as Brazil and Mexico make this clear. In addition, an economic form and monopolization is being imposed on the developing countries, of which it is impossible to say today whether it will guarantee man a lasting existence at all, or whether it will not itself burst like a shimmering soap bubble. All civilizations of the past that were alienated from nature collapsed and were replaced by "barbarians" who were close to nature. Today, however, alienation, and the problem of boundless egoism, is no longer merely regional, but global.

4 **The overtechnification**

Technical development makes it possible to raise the so-called standard of living in the industrialized countries more and more, which is seen as great progress. This progress is measured by the level of the gross national product (including, for example, all accident car repairs) or the mean per capita income (which per month ranges from barely 500€ pension to outrageous and impudent millionaire's bonus fees in Europe and USA).

The aim is also to reduce working hours as much as possible and thus to extend leisure time in order to give everyone the opportunity for "self-realisation".

This ideal had already been achieved, but not in an industrialized country, but by the small island nation on the coral island of Nauru in the Pacific Ocean (about 2° S and 164° E). The happiest people should live there. Their median per capita income exceeded that of the richest industrialized countries. Weekly working hours were zero, free time all year (IWZ report, January 8-14, 1983). The children are born there as pensioners.

The island is 21.4 km2 in size and rises up to 60 m above sea level. It is inhabited by 4000 Nauruan people (2015: 10,000). On it were many meters thick fossil guano deposits. These are the purest phosphate deposits known.

These were discovered in 1900 by the German colonial administration, which also began mining. After the First World War, Great Britain, Australia and New Zealand took turns to continue mining on an increased scale. In 1968, Nauruan chief Hammer de Roburt succeeded in asserting the island's independence within the British Commonwealth, and in 1979 the phosphate deposits became the property of the Nauruans. Since then, no Nauruan has needed to work. This was done by guest workers from Australia, New Zealand, Hong Kong, Taiwan and others, but they were not allowed to obtain citizenship. About two million tons of phosphate were mined annually and sold at the world market price.

The main occupation of Nauruans was sleeping, eating (corpulence is the ideal of beauty) and sitting in front of the TV (Mickey Mouse, Wild West and Australian commercials were the most popular). Sports are too strenuous with the fullness of the body. Nauru is the country with the highest percentage of diabetes sufferers in the world. People drove around the island in the most modern car models on the 18 km long car road. Empty beer cans decorate the landscape. A hobby was fishing with high-powered motorboats. One allowed oneself the luxury of a loss-making "Air-Nauru" with six jets flown by Australian pilots to Melbourne, Hong Kong, Manila and Samoa, and a luxurious shipping line. Currently (2015) it now looks like this (according to Wikipedia), " *The people of Nauru were long able to live off the mining of the rich phosphate deposits. When this ran out, it becomes apparent that the state and most of the citizens had not invested the profits in a future-proof way. Nauru, which at the time of phosphate mining still boasted the highest per capita income in the world, became increasingly impoverished after the complete depletion of its only resource. As a result, the state's finances regularly hover on the brink of bankruptcy, but have been stabilised in recent years by support measures coordinated by the Pacific Islands Forum*".

Naru was only accessible by sea from December 2005 to September 2006, as Air Nauru, the only airline serving the island, had to cease operations. In September 2006, however, the airline, which was simultaneously renamed Our Airlines (now Nauru Airlines), was able to resume operations with the help of Taiwanese funding.

To secure the future, two thirds of the income was transferred to the Nauru Royalties Trust and supposedly safely invested abroad in land, hotels and commercial buildings. The "Nauru House" in Melbourne with 50 floors is the highest commercial building in Australia. But there is a "but": According to estimates, the phosphate deposits will only last a few more years, some new deposits have been discovered, but what remains is a sterile coral landscape with 10 to 20 m high tooth-shaped rocks. When asked why mining is not done more sparingly, the answer is that the Nauruans are no different from the rest of the world, they love money like the Europeans and Americans and live selfishly into the day as long as they have it.

In fact, it is not that much different in the industrialized countries. All the warnings that resources are running out have changed almost nothing; people are only thinking until the next election date and putting off unpleasant decisions, including the increasingly pressing environmental and climate problems.

It is hard to deny that most people in industrialized countries do not know how to use leisure time properly themselves. Leisure time is organized and commercialized. Leisure activities have become a lucrative business ("tourism industry"). Just think of the many travel agencies and the mass accommodations in the rapidly growing domestic and foreign "resorts" with their entertainment venues. The vacationer does not have to take care of anything, he can passively let everything happen to him and only has to pay the price. In foreign countries he lives in a ghetto, as much as possible as he is used to, although the misery in the developing countries cannot be overlooked.

What is the profit of this mass tourism? The cost of memory cards for digital cameras. Otherwise only a passive taking in like the stream of manipulated information through the mass media. It rushes by and cannot be processed at all. The same applies to teaching, both in schools and universities. The amount of information is constantly growing, and there is not enough time to critically process the problems.

Independent thinking is not only not stimulated, but deliberately prevented by new study reforms. Thinking, many believe, can be left to the computer. And electricity comes from the socket. Science, fragmented into special subjects, threatens to become a Tower of Babel. "Massification" means that fruitful discussion in smaller circles is no longer possible. A mass lecture is not much different from a television presentation. Listeners passively let everything wash over them, cramming only a few weeks before the exam. Knowledge that doesn't last long. Comprehension is lacking. Besides all these shortcomings, in some federal states (e.g. in NRW) students are even exempted by law (http://is.gd/qwf7fL) from compulsory attendance at courses under the pretext of "freedom of study", and you can no longer fail exams.

One draws attention, however, to an increasingly hostile attitude of people towards technology. But it would be more correct to speak of an increasingly anti-human mechanization of all areas of life. Technology, which should help people to make the course of life easier and more pleasant, has developed a momentum of its own and forces the masses of people more and more under its spell and into a relationship of dependence.

It must be remembered that the purpose of technology has always been primarily the manufacture of weapons. Acts of war always gave technology the greatest impetus for further development. New inventions were immediately used for weapons technology. Without the two world wars, technology and mass production would not have reached their present state. Although the stockpile of weapons of destruction is sufficient to wipe out humanity ten times over, rearmament still continues and there is no end in sight. Unfortunately, experience teaches that newly developed weapons have mostly been used, more recently in self-created conflict areas such as the Middle East.

**Military budget** (or **military expenditure**), also known as a **defense [budget](https://en.wikipedia.org/wiki/Budget" \o "Budget)**, is the amount of [financial resources](https://en.wikipedia.org/wiki/Finances" \o "Finances) dedicated by a [state](https://en.wikipedia.org/wiki/Sovereign_state" \o "Sovereign state) to raising and maintaining [armed forces](https://en.wikipedia.org/wiki/Armed_forces" \o "Armed forces) or other methods essential for defense purposes. Generally excluded from military expenditures is spending on [internal law enforcement](https://en.wikipedia.org/wiki/Law_enforcement" \o "Law enforcement) and disabled veteran rehabilitation. Despite that the expenditures are incredibly high. How could this enormous amount be used for peaceful and ecological and sustainable purposes?

In 2018, the United States spent 3.2% of its GDP on its military, while [China](https://en.wikipedia.org/wiki/China" \o "China) 1.9%, [Russia](https://en.wikipedia.org/wiki/Russia" \o "Russia) 3.9%, [France](https://en.wikipedia.org/wiki/France" \o "France) 2.3%, [United Kingdom](https://en.wikipedia.org/wiki/United_Kingdom" \o "United Kingdom) 1.8%, [India](https://en.wikipedia.org/wiki/India" \o "India) 2.4%, [Israel](https://en.wikipedia.org/wiki/Israel" \o "Israel) 4.3%, [South Korea](https://en.wikipedia.org/wiki/South_Korea" \o "List of countries by past military expenditure) 2.6% and [Germany](https://en.wikipedia.org/wiki/Germany" \o ") spent 1.2% of its GDP on defense (acc. to the [Stockholm International Peace Research Institute](https://en.wikipedia.org/wiki/Stockholm_International_Peace_Research_Institute" \o "Germany)). In absolute figures it is shown in Table M-4.

Table M-4. According to the [Stockholm International Peace Research Institute](https://en.wikipedia.org/wiki/Stockholm_International_Peace_Research_Institute" \o "), in 2018, total world military expenditure amounted to 1822 billion [US$](https://en.wikipedia.org/wiki/United_States_dollar" \o "United States dollar), the main countries are listed.

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| Ranking No. | Country | Military budget 109 US-$  (*italics: estimate figures*) |
| 1 | USA | 649 |
| 2 | China | *250* |
| 3 | Saudi-Arabia | *67.6* |
| 4 | India | 66.5 |
| 5 | France | 63.8 |
| 6 | Russia | 61.4 |
| 7 | Great Britain | 50.0 |
| 8 | Germany | 49.5 |
| 9 | Japan | 46.6 |
| 10 | S Korea | 43.1 |
| 11 | Iran | 12.2 |

The misanthropy of technology is also expressed in the destruction of the environment. While almost everywhere in the world large areas of forest are falling victim to technology every year, in Japan environmentally conscious large corporations are trying to increase the area of forest: All the steel mills of Nippon Steel Coop, all the operating complexes and research centers of Honda Motors Co. and Topay Industries, the power plants of Tokyo Electric Co. and Kansai Electric Co. among others are reforesting the areas around their operating complexes as air filters and recreational areas. Native tree species have already reached a height of 10 m (Miyawaki 1983). However, wood can be fetched in Borneo, after all.

In Germany, the concrete blocks are surrounded by asphalt parking lots and mostly bare lawns. The rest of the remaining environment is poisoned. Although maximum values for individual toxins should not be exceeded, no one knows whether they are still valid when many toxins are added together. Think of the increase in allergies or the accumulation of pollutants and heavy metals in cultivated soils. In the 1970s the pollutants were finally so high even in mother's milk that one did not advise against breastfeeding children only because the substitutes were not lower in pollutants or the advantages also had to be considered.

In the 1990s, however, the contamination of breast milk dropped to considerably lower levels thanks to a correspondingly more conscious diet and lower limit values. It has been done quite a lot, but achieved not really much.

The mechanisation of agriculture is particularly serious. The larger, largely self-sufficient farms, which managed without external energy, were the only farms that were in a certain harmonious balance with the environment. They are now being replaced by agricultural factories with huge masses of organic waste that are difficult to dispose of. Cleared, monotonous landscapes were created. Fauna is more and more on the „Red List”.

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| Box M-3 Modesty is needed |
| A new modesty is needed: better poorer and healthy than rich and half dead. |

One of the serious consequences is the greatly accelerated decline in the diversity of native species since 1960, also in Germany. The "Red Lists" show not only an increasing endangerment of rare, mostly specialized species, but also a decline of formerly widespread and common species within very few decades (Ruckdeschel 1996). Agriculture, but also forestry and hunting, tourism, open-cast mining, and industry are the main causes of a sharp decline in the diversity of small habitats (► Fig. J-35 and ► Fig. J-39).

Farms have been drawn into the vortex of the global economy, with the result that agriculture is losing its resistance to crisis. Technology is increasingly depriving man of the natural basis of life. Therefore, ecologists cannot be expected to be friendly to and to accept excessivetechnology. It is their duty to point out the impending dangers again and again.

Man can, if he must, do without much and get along with very little, but he needs pure air to breathe, clean water to drink, and a poison-free diet, as well as a natural use of his physical powers.

What technology produces are, for the most part, things that are not essential to life and serve only convenience or prestige. Often it is frippery. Needs are artificially fueled by worldwide propaganda and intrusive advertising. Everyone should be able to have everything. Millions of tons of food are destroyed in Germany every year, and use of food from rubbish bins is forbidden. Not the interests of the people are in the foreground of technology, but the profit thinking and the purely economic interests, especially of the large corporations. More and more the human being is pushed out of the production process as a worker by rationalization (robots, microelectronics) and degraded to a mere consumer of mass production. But how are the masses supposed to buy industrial products if they are not guaranteed an income and become unemployed? One speaks of economic constraints of competition - a vicious circle!

People have become neither happier nor healthier as a result of technology. Civilisation diseases of a physical or psychological nature are constantly on the increase. If average life span is rising, it is through more and more medicines and expensive treatments, the cost of which is rising immeasurably.

Walter commented as follows: "If one were to look over the eight decades of one's own life and pass judgment on the blessings of technology, it can only be a very subjective one. By what criteria should it be done? In any case, there was a lack of stress. Also, the crossing of the oceans in the research voyages by ship were a nice rest before and after work and allowed for a slow changeover, whereas in today's air travel that is not the case; even the changeover to the different climate, the different environment, the different time of day is too sudden."

Without technology, "massification" would not have been possible. It has now led to the growing number of unemployed, who are a heavy burden on the future. The solution to this problem is a simple milkmaid's calculation, which would only require a little more solidarity and less egoism in order to divide the available "cake" more equally. But even in Europe the population is too large.

5 **Sustainable land use**

Every living being is influenced by its environment, but conversely every living being also influences its environment. The latter becomes more obvious the greater the population density of a species.

Man has now reached a frightening population density. Consider the future plans for the city of Beijing. The impact on the environment increases exponentially with population density (►Fig. M-2 and ◘ Fig. M-3).

Land use always changes soils and promotes erosion. However, soil formation is a lengthy process. Soil erosion destroys valuable resources for centuries or millennia. However, this varies greatly between zonobiomes. A worldwide problem is water shortage, soil erosion and salinization (Breckle 2009, 2021a,b).

Such sustainable land use can only be achieved if population density (including in cities) does not exceed a certain level and if land use methods for arable farming, livestock breeding and forestry are based on natural processes, i.e. if a circular economy is consistently introduced at all levels. This necessarily includes industrial processes.

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| Box M-4 Sustainable land use systems |
| Only in those areas where it is possible to use, settle and live in harmony with the existing vegetation and fauna over many generations can one speak of sustainable land use. This also includes the preservation of the yield capacity of the soils over long periods of time. |

The global changes that have become apparent in the meantime (global change and climate warming), the main effects of which are summarized in ► Fig. M-3, include in particular the changes in the chemical composition of the atmosphere. The increase in CO2 and also in other trace gases (CH4, N2O, CFCs, etc.) must lead to a change in the equilibrium of the Earth's radiation budget. The seasonal fluctuations through the seasons in the northern hemisphere, shown by the so-called Mauna Loa curve (◘ Fig. M-4), have been known for a long time, but the steady increase in CO2 contentfrom about 280 ppm (in pre-industrial times) to currently (2021/22) about 420 ppm CO2 is detectable worldwide. The fact that, in addition to this, other global material cycles are now also undergoing a change as a result of growing anthropogenic activities has so far been taken less notice of. Fig. M-5 compares the natural N fixation with that caused by humans.

**Fig. M-3** The components of global change. The thick arrows indicate strong effects (modified after Vitousek 1994).

In addition to the changes in global material cycles, the effects of climate-relevant gases in the atmosphere (H2O, CO2, CH4, N2O etc.) must be taken into account not only for the effects on the climate system (which have always been effective), but also for the effects on the equilibrium in the cryosphere. The changes in ice masses on land surfaces (in the Arctic, Antarctic, high mountain glaciers) due to temperature and precipitation changes in recent decades has led to a significant sea level rise being observed since the middle of the 19th century. Sea level rise is mainly due to two phenomena: Warming of the oceans leads to the expansion of water (expansion coefficient 1.0002 per K, roughly three times in terms of volume), and increased air temperatures lead to the melting of glaciers and ice sheets, releasing water from the mainland into the oceans.

◘ **Fig. M-4** The concentration of CO2 in theatmosphere at Mauna Loa in Hawaii (A) and at the South Pole (B). The annual oscillations are caused by the seasonal activity of land plants in the northern hemisphere, the steady increase by the burning of fossil fuels and deforestation (added and modified after Keeling & Whorf 1994).

◘ **Fig. M-5** The global N budget is characterized by the largely constant natural N fixation (biological nitrogen fixation in terrestrial ecosystems and binding of N in electrical discharges) as well as by the strongly increased anthropogenic N fixation (industrial fertilizer production e.g. Haber-Bosch process, N fixation in fossil fuel combustion and N fixation by legume cultivation) (after Vitousek 1994).

Between 1901 and 2010, sea level rose by 1.7 mm per year, and by an average of 3.2 mm per year between 1993 and 2010 (IPCC 2014). For 2018, the record value of 3.7 mm was measured (Nerem et al 2018).

At the end of the last ice age (20,000 years ago), sea level was about 130 m lower than today, allowing for diverse floral and faunal exchanges via land bridges (Dogger Bank, Bering Strait, etc.). Today, with many large cities and densely populated areas directly on the coasts, a rise of only 1 or even more 2.5 metres is a huge problem; a problem that will have to be dealt with until 2100. Sea-level rise is a particular threat to island states and countries with broad coastlines, as well as low-lying hinterlands such as Bangladesh and the Netherlands.

Logically, exponential economic growth will not be able to offer any solutions; only a rethinking of globally sustainable and more modest economic practices can help.

Sustainable use of forests is possible for centuries in temperate latitudes under climatic conditions that do not exhibit any particular extremes, but even in Central Europe there are the problems of game damage by too high game density. In regions with more variable moisture, the rate of erosion on deforested land is a major problem. Soils are heavily washed away after logging, making reforestation more difficult. In the tropical rainforests, logging with European methods is economically a nonsense.

Almost two thirds of the earth's original primary forests as a whole have been lost forever. Of the 8.08**·**109 ha that were still covered by forest about 8000 years ago, only 3.04**·**109 ha remain today (◘ Fig. M-6). This is the alarming conclusion of a study by the WWF (World Wild Life Fund) on the global state of forests. The preservation of what remains is by no means certain. Today, some 17**·**106 ha of virgin forests are destroyed each year by large-scale clearing, industrial logging, road construction and other human interventions, or are replaced by species-poor timber plantations or cattle ranches or soybean fields of little ecological value. Of particular concern is the fact that destruction has accelerated rather than decreased in recent years. The WWF therefore proposes the creation of a global network of protected zones, each comprising 10% of tropical and subtropical forests and 10% of temperate and boreal forests. For Europe alone, 100 forest areas are proposed for this purpose. Who can enforce this?

◘ **Fig. M-6** The original and present forest cover on Earth (source: http://tinyurl.com/n4p6bm9).

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| **Box M-5** Arespecies conservation and climate protection mutually exclusive? |
| Where is the insight that species protection is even more important than climate protection? Climate changes are reversible, but extinct species have irreversibly disappeared! |

6 **Confessions**

How can we remedy the situation and achieve a development towards sustainable use that will enable our children's children to live a life worth living?

This is not a problem of natural science and ecology, but a question of the sociological-political system as well as of the prevailing respective religion. Nature and its preservation play a significant role in the scriptures and ideas of all world religions (Barthlott 2019). Religions consciously or unconsciously shape the value systems and actions of many people. But there is no impression of either politics or religion to treat the mass of the population as mature citizens. One shies away from the long overdue drastic measures and prefers instead to constantly take out "loans" in the broadest sense at the expense of the grandchildren and regards the state as a self-service shop. Positive role models have become very rare, as have groundbreaking parliamentary resolutions and court decisions. Remedial action is only possible if everyone pulls together and treats each other with respect and empathy, putting aside claims to sole representation. Remedial action is possible at the level of the individual; at the level of the intact family, sustainable behaviour can be handed down from generation to generation.

However, the loss of values and tradition is leading to worrying developments. In Hungary, Taiwan, Afghanistan and many other countries, around 90% of the population consider children to be a prerequisite for a fulfilled life. In the USA (46%) and in Germany (49%), only just under half of adults attribute a meaningful meaning to children. But this so-called self-realization of the individual, the exaggerated liberalization and boundless pleasure lead to chaos.

In the last few years, neurophysiological research in the USA has been able to show how enormous the imprintability of the human brain is in the early stages of development and unfolding.

In earlier times it was absolutely clear that the profession of the mother in an intact family is the best guarantor for the spiritual and mental prosperity of the children and thus for the future of humanity. This has been forgotten in some Western countries in recent decades.

The humanity and the close contact between people is more and more lost, it is limited to short and mostly meaningless telephone conversations or even to short e-mail notes and SMSs. The individual human being becomes a number: a personnel number, a tax number, a health insurance number, many customer numbers, etc. The name only appears on letters, which have now rapidly lost their significance. How much longer? What used to mean the relationship to nature to most people, today's youth in landscapes saturated with technology no longer knows; they do not know what has been taken from them. For it is not the material standard of living that matters, but the quality of life - not the outward appearance, but the inner being.

The state, but even more so the individual, is challenged. Walter formulated thoughts on this at an advanced age, which will be taken up briefly in the concluding section. They are more relevant than ever.

Standard of living and quality of life need not be opposites. But experience teaches that the more one attaches importance to outward appearances, the more one usually impoverishes the inner life, of which one therefore does not speak.

Quality of life is also expressed outwardly, through a healthy and natural way of life, the sensible use of one's life forces and the renunciation of all addictive substances, the preference for a quiet way of life in modesty and with self-control. For this, one does not need a God and certainly not wars waged in his name. He who is truly connected with nature and knows it in all its diversity and vastness does not feel himself to be the centre of creation. He knows that he is only a tiny blob of protein in the infinity of the universe.

To this, Walter says, mutatis mutandis:

"Not only the outer world (which is the subject of this book) to which we belong with our body and which we explore with our thinking intelligence, but also the other side of man, his inner world, which is not subject to logic, for which various complicated terms are used by philosophers, but which is commonly called "soul", opens up to him. This cannot be put into words, nor can it be proved. To profess it is an act of free choice on the part of each individual, without which there is no true freedom for man. Only it gives him independence from the judgment of others and thus inner security, calm and serenity, and inner cheerfulness. It is not a question of this world or the next. The Absolute knows no boundaries. It is within us and also outside us. This is the most important conclusion for the youth searching for the meaning of life, the result of a long life dedicated to the exploration of the living all over the Earth, a life full of miracles, in an age that does not believe in miracles and has lost touch with the center of all things. One must always swim against the polluted or dirty current until one reaches the pure source that comes from the deep" (► Walter 1989: "Confessions of an Ecologist").

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| **Box M-6** The foundation of a person's personality is laid in the early stages of their development |
| Whether clever or lame, whether vigorous or feeble, whether mentally resilient or impaired, whether strong-willed or prone to addictions, criminality and mental illness, whether optimistic or despondent, whether, in other words, happy or lifelong unhappy - this depends largely on what impressions the human brain stores in its early phases of development. |

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Adenium obesum (Apocynaceae) in the Dhofar Mountains (Zonobiome III) in southern Oman (Photo: Breckle)

Cultural landscape in the middle Moselle valley (Zonobiom VI) with intensive vine cultivation, Rhineland-Palatinate (Photo: Rafiqpoor)