RISK AND LANDSCAPE CHANGES

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REZUMAT. - Riscuri şi schimbări environmentale. Pentru pagube fizice sau implicaţii geomedicale, o evaluare generală a riscurilor la scară globală este orientată în special, către schimbările climatice viitoare ca o reacţie la efectul de seră. Acesta duce la neglijarea schimbărilor majore din peisajul sistemelor dezvoltate. Un exemplu în acest sens îl reprezintă ruderalizarea şi dezvoltarea ecosistemelor cu caracter pioner. În combinaţie cu acest schimbări există o multiplicare a suprafeţelor de apă (polderizare), fiecare conectată la irigaţii sau aquacultură sau la mlaştini şi bazine în zone neadecvate. Aceasta se întâmplă simultan cu reducerea generală a accesului spre apele subterane şi cele potabile. Toate aceste procese au cauzat o reorganizare generală a biocenozelor şi au îmbunătăţit condiţiile de diseminare a paraziţilor. O schimbare climatică va duce la o accentuare a acestor situaţii. Discutând posibilităţile unor politici sănătoase şi de organizare a lor, ele trebuie să se adapteze capacităţilor limitate a spaţiilor largi şi fezabilităţii unor programe majore privind impactul şi dezvoltarea durabilă ce trebuie reevaluate, în multe cazuri, chiar cu restricţii la scară locală.

1. Introduction

Risk and risk assesment in a relation to landscape change are more and more recognized by insurances or re-insurances (Münchner Rück 1996,1999). This is far from philosophical reasonings whether certain psychological perceptions will guide the behaviour of people in certain areas (Schoeneich et al. 1997) or whether risk may be equal to inpredictibility as it is mentioned by Hagget (1994). In so far risk has a twofold aspect. This is on the one hand the probability of damage itself and on the other hand the behaviour of man or his adjusment to the situation of possible damages. Risk calculation will evaluate possible benefits as it is mentioned by Lacoste (1987). He described the exploitation cycles in the Volta river valleys (West Africa) by traditional societies, where the danger of onchocercosis is accepted in exchange of suitable terrain for cultivation. This worked as long as the number of blind people was not considered as unacceptable high. Comparable is the situation of polders in coastal areas where the reclaimed cultivation surface demands an high amound of work and social organisation to maintain and preserve the constructions against marine inondation.

Archaelogy and prehistory gave another example of risk-oriented behaviour in eliminating the dangerous situation. Gifford-Gonzales (2000) and Schulz (2002) explained the retarded southward expansion of cattle keepers in the Middle Holocene of the present South Sahara as the struggle against the deadly danger for man and cattle by testse flies and sleeping sickness. It manifested in a boundary situation between saharan and sudanian

environments (Schulz et al 2000) where humid and shady places along rivers or brooklets as breeding placesfor the Glossines were plenty. Tstetse flies have only a small radius for their excursions and so it was clear how to cope with these dangers. Clearing by felling and burning to get rid of the breeding places and also to create new pasture grounds. Since it was necessary to maintain the region permanently open it finally turned into a cultural landscape based on a risk resolution behaviour of a population endangered by a deadly disease. A block diagramm (Fig. 1) explains this situation from the clearing activities to the creation of park savanna structures as an productive cultural landscape.

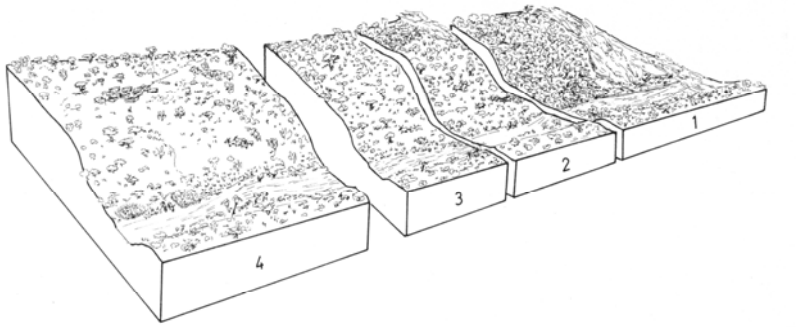

Fig. 1. Hypothetic model of the development of cultural landscape in the Mid-Holocene contact of South-Sahara-North Sudan. Transformation of the sudanian savannas into open park savannas as a risk oriented measurement against sleeping disease (Schulz 2002, modified)

2. Global change, globalisation and catastrophies

There is much reasoning about the meaning or realities development of globalisation and global change. However there is a clear cut interest of insurances connected to these items and it is based on the the questions what kind of landscape changes already did happen and what will come additionally in the future to be prepared for. If one looks to the hazards/ risk maps of these institutions they show their clear bases: number and the dimension of catastrophies- in the sense of huge damages – depend on the concentration of people and their economic situation. This points to the basic assumption of the cultural landscape as an entity. The prediction of future damage risks concentrates around the questions, which are the world wide landscape changes of the last decades and which are those of the near future. Mapping is considered as the basic to predict damage risks, even they empty or poorly inhabitated areas are excluded, since the term catastrophy stands for huge damage for man (within the insurance system (Münchner Rück 1996,1999). The

rising number of catastrophies is often misunderstood as a general trend of climatic change. It is also explained that these growing numbers of regulation cases are caused by the increasing concentration of commercial values in some areas together with a growing demand for recompensations.

There is a second assumption as base for the prediction models. The global warming as a result of greenhouse effect is accepted as a fact even there remain several arguments which relativate the ideas concerning CO_2 -influences (Berner and Streif 2000). There also might be some questions whether the growing number of hurricanes in the Carribean are not only a result of a southward deplacement of the hurrican belt (Kimberlain und Elsner 1998). Large floodings are often taken as indicators of an already changed climate, if they are sufficiantly recorded – mediatized and recognized in the First and Second world, whereas huge damage floods as in Orissa (NE-India) during the last years were less recognized in Europe and North America and consequendly not taken as an example of growing risks. On the other hand the 1993 Missisipi flood made people to accept that man has only limited chances for permanent interfering and stabilizing a dynamic system (Bethemont 2000, Mutin 2000).

Looking to the catalogue of future global risks established by Münchner Rück (1996,1999) which is based on the climate change scenarios one may notice that increasing temperatures in the lower atmosphere, melting and retreat of inland glaciers are considered having a high scientific confidence whether changes in fauna and flora, expansion of drought and desert zones and spread of tropical diseases are regarded to have a lower proof.

Especially the last points are astonishing since they contradict most descriptions of global change and considerations also connected to the Agenda 21 discussions.

The reasoning about emerging or re-emerging infectious diseases of the last years (Epstein 1998, Hagget 1994, McMichael 1998) sheds another light to the global scene. At least it underlines that the assumptions connected to the demographic transition of the First and Second World and in future also of the Third World and to the epidemiologic transition with its changes from predominating infectious diseases to chronic and degenerative diseases are not as rigid as proposed (Omran 1971 cited from Schaerström 1996, Hauser 1981).

Geomedical or medico-geographical investigations of the last decades point more and more to the interrelations of landscape changes and development of diseases (Flessa 1999, Gomes et al. 1998, Stich 200). On the other hand there is a number of investigations dealing with the spread of vector-born diseases under a future global warming. Especially it concerns malaria (Epstein 1999, Martin and Lefebre 1995) since the vector *Anopheles* answers immediately to temperatures changes as well as it does the parasite (*Plasmodium*). However some of these investigations are done with no epidemiological reflections at all as Martin and Lefebre (1995) openly state.

Most of the authors predict a spread of malaria with an maximum of change in the middle and higher latitudes

Following desasters malaria, cholera and dengue /dengue haemorhagic fever are always mentioned in the first row. (Borroto 1998, Diesfeld 1997, Epstein 1998, 1999, 2000, Gomes et al 1998, Gubler 1998). Common to all of them is that they are bound to water either as a direct distribution medium (cholera) or as a necessary milieu for vectors like *Aedes* or *Anopheles* for malaria and dengue fever. Moreover they are similar in their expansion on new ways and to areas. Some regions which were already cleaned of them are reconquered now, as it is the case for the yellow fever in South Amerika and the South of

the United States (Löwy 1997). The most important discovery in cholera reasearch of the last decades is the enormous persistancy of the vibriones in gallertic films of green algae or blue green bacteria (Borroto 1998, Colwell et al 1973, Epstein 2000, Glass et al 1991, Siddique et al 1991, Sullivan et al 1998). This may work in stagnant parts of rivers or even in extended algae mats in the oceans (Epstein et al. 1993). It is not clear, whether the transocenaic distribution is a valuable model, however a repeated infection of coastal waters and the subsequent extension of vibrions in coastal regions well explains the cholera epidemy in South America during the 90ies of the last century (Ruiz et al 2000).

Malaria and dengue follow most spectacular climatic phenomena leading to huge damages as it concernes ENSO with its episodic changes of droughts and inondations in South and Central America (Epstein 1999, Feldmeier 1999) or huge hurricanes like „mitch" in october 1998 (Sandner 1999). In 1974 Schweinfurt alredy mentioned the seasonal inondations and their alternations with more important droughts and precipitations in Ceylon. People were weakened by severe droughts and so they got more succeptible to malaria. In a twofold way they were affected: by reduced harvests and by persistant water surfaces forming breeding areas for mosquitos and consequently to malaria. These interdependencies of landscape changes and vector born diseases again point to the fact that the monolithic discussion on climate changes may obscure the understanding of ecosystems and new developments.

3.The radical change of the earth´s surfaces during the last decades

Most prediction models of the future development of the earth surface are cenrered around the anthropogeneous inforced greenhouse effect (Schönwiese 1995, Martin and Lefèbvre 1995) but several authors already pointed to the explosive population development, the enlarged and intensed economic evolution of the continents leading to connections of formerly separated ecosystems and important factors too (Epstein 1998, Hagget 1994 or Löytonen 1994).

Individual and collective mobility increased with technical evolution making the individual traveltime often shorter than the incubation time of infectious diseases and consequently giving chances to cross formerly existing barriers for vectors and parasites. This makes an important difference to the mobility modes of previous times.

Directly connected to the demographic evolution there is a wordlwide extension of exploited and cultivated areas. This deveopment includes not only the enlargement of exploitation areas but also the transformation of formerly varied cultivation systems in uniformous one. Cultural landscapes developed already since millenia (Harris and Hillman 1987), but it is that trend to monotonous systems which again changes the continents. Parallel to it there is an other trend, that of decay. Formerly complicated and labour intensive cultivation systems often collapse out of overpassing bearing capacities, physical damages, change of economic ideas or military interference. It also goes along with a change of settlement systems leading to the overall process of urbanisation

This combination of developments may be characterized as the general process of **ruderalisation.** It describes the disturbing or destruction of formerly interconnected ecosystems and their transformation to lower levels of development. This degradation mostly induces a regeneration in the sense of successions (Forman 1987, Odum 1980).

Bound to human activities it leads to the resettlement of disturbed / influenced areas by pioneer organisms. The disappearence of areas of formerly higher organized organisms provokes a complicated mosaic of invasion- ingression lines of organisms, which are not obliged to aline to well established systems. Diversity is a main characteristic and the evolution from pioneer to secondary systems leads to combination of organisms oftern originated from formerly separated regions. As already mentioned in most cases these developments are induced by man either by modified ecomomies, by their degradation or by large scale military activities. In this connection one should mention that during the last century the Hagh war regulations or the Geneva conventions were rarely respected and civil populations were the principal target in military or „revolutionary" conflicts. The strategy of „burned earth" and the systematic destruction of economic and settlement basesd got more and more generalized (Bollig 1998, Le Monde Dipl. 1996).

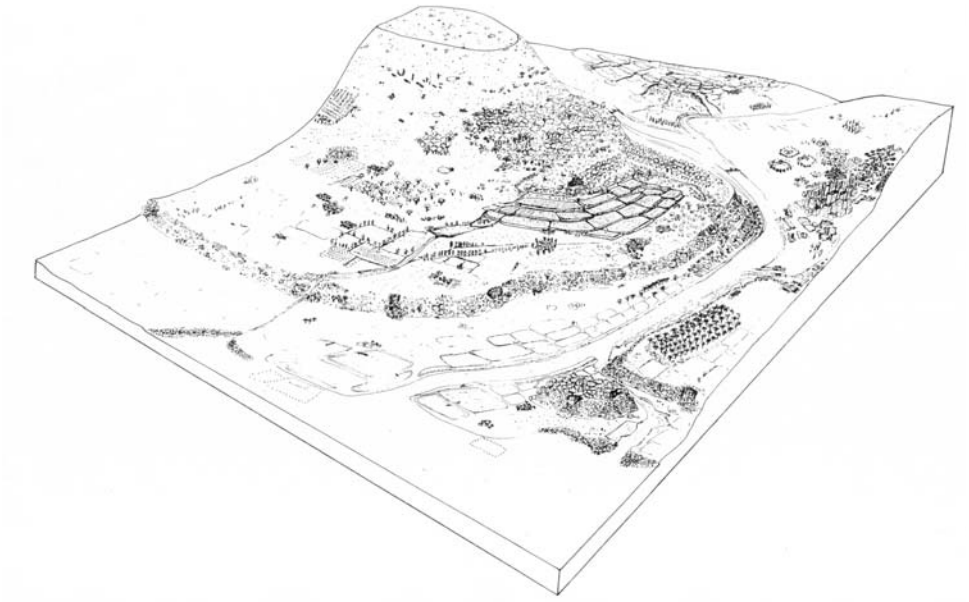

Fig. 2. Blockdiagram of a synthetic tropical landscape.
The twofold transformation of the main units of the traditional cultural landscape is explained: the increase of large scale and monotonous of agriculture units including aquaculture and irrigation systems and the development of small scale units either as garden plots or as chaotic plots of "desesperation" agriculture. Equally the growth of cities and of unplanned settlements in rural areas are shown. Both of them include the processes of ruderalisation, ponderisation and squatterisation.

In all this resulted in the establisment of pioneer systems with a variable regeneration potential conformal to the ruderal systems and their intense connection to agrarian and pastoral ecomomies (ref. Frey and Lösch 1998, Odum 1980). It is characteristic for the tropics as well as for the extropical regions. The demographic development enforced on the one side intensifications of food production but on the other side the extension of production areas which often are used in an extensive or chaotic mode (Galais 1994, Manshard und Mäckel 1995, Uhlig 1991).

Former forests or wooded areas are reduced and cultivated areas are abandoned Small scale production areas and dense vegetation areas are interfingered as well as the sucessions lines of abandoned areas. It also includes all the phenomena of desertification which is now defined as a general land degeneration in arid and semiarid regions (UN 1992). It should no longer be misunderstood as the extension of deserts ecosystems is adjacent region (Mensching 1992, Schulz and Hagedorn 1994).

Two blockdiagrams (fig. 2 and 3) shall summarise and illustrate these developments. The first (fig. 2) represents a schematized tropical landscape system explaining the increase of monotonous agriculture/silviculture units, the extension of irrigation and aquaculture schemes as well as the develoment of small scale units either as garden plots or chaotic desesperation agriculture. It also indicates the general growth of cities and more or less unplanned settlements in rural areas.

The second blockdiagram (Fig. 3) shows the transformations following natural or social destructions and catastrophies. The most obvious phenomena are decay and abandon of labour intensive production systems causing an accellerated soil erosion.

Concerning geomedical implications various and new contacts evolved between animals and man which formerly were completely separated. It included several hitherto unknown mammal- insect- protozoa-virus- systems which got access to newly established open areas. These systems may incorporate new partners in their life cycles or the organisms may break their traditional cycles since new and potent hosts offer assured life conditions (Fleischer and Rieke 1995).

The **squatterisation** as a general decay of formerly organised settlement and economical structures and installations results in low level settlement types. This is connected to the above explained phenomena of ruderalisation. Common to them are the rare or even absent water and evacuation systems. It leads to an intensive mosaic of small puddles and open water surfaces providing permanent breeding areas for viarios insects (Vaguet und Vaguet 1993). A certain luxury version results from irrigated lawns in high standard housing areas or from water containers at cemeteries (Brandely 1998, Löwy 1993). Just these phenomena caused the redevelopment of the yellow fewer in the Americas.

The world water situation today shows two contradictonary developments. The ressources of sane ground and drinking water diminish since the 70ies of the last century dramatically (Global 2000 1980, Hoff 1998) but in the same time the worldwide extension of irrigation schemes more and more new open water surfaces and consequently leads to rising mosquito population in the tropics and ectropics. Similar developments are typicals for the growing cities in the „Third World“, where small puddles follow the desolate situation of settlements. This may be called **ponderisation**.

Fig.3. Blockdiagram of the a synthetic tropical landscape with transformations due to physical or social catastrophies. The decay of labour-intensive terrace- and irrigation cultures due to physical damages or to the enforced population concentration around the cities causes progressive soil erosion. The concentration of population and settlements again increases again the problems of the population, i.e. processes of ruderalisation, ponderisation and sqatterisation are augmented.

These processes are reinforced by the great and still increasing number of civil wars passing largely the „natural" catastrophies in their consequences. They cause massive refugies tracks, the concentration of people at the margins of towns, a decay or brakedown of formerly well organized economic systems. People live under a general stress and a very precareous water and sanitary situation loosing their economic and social perspectives. Moreover these problems are even more enlarged by the extension of mined areas. Whether in Afghanistan, Mozambique, Angola, Laos or Bosnia-Herzegowina people are generally deprived of their chances of food production and the risk of death or of physical injuries has turned to a large probability since long times. This might be the most persistent damage in regions of war (fig. 4). Again it underlines the general position of the civil population as a main target in open military, „revolutionary" or civil wars.

The parallel decay of former developed health systems in the affected regions support the expansion of formerly harmless diseases and easily turns local outbreaks of infection diseases into epidemies hardly to manage.

Fig. 4. Advertising of an anti-landmine campaign describing the permanent thread for people in several regions (Afr. Business 2,1999)

The map of physical and health hazard-regions also summarises these reflections (fig. 5). It tries to evolve the principal reasoning of the re-insurances (Münchner Rück 1996) The above mentioned landscape changes created a situation where malaria and cholera developed to a background phenomenon of several regions leading to a general weakening of people. The distribution of marine plancton shall underline the worldwide proliferation chances of cholera.

Multidrugresistent tuberculosis evolved to one of the most dangerous new infecteous diseases (Anderson 1999, Kalk 2001). Moreover the combination of physical risks like earthquakes or inondations with active or smouldering wars /civil wars and their longliving heritages as mines and destruction of cultivation systems gives an idea of high risk areas, which are concentrated in the tropics and subtropics. These are regions which will regularly be mentioned for damages or conflicts in the future and which would demand interational or at least border transgressing intervention. It also supports the explosive development of HIV/AIDS as a further thread of those regeions (Rüppel 2001).

However te present situation pricipally differs from that of the 50ies to 70ies of the last century. In those periods worldwide concerted actions like smallpocks eradication were still possible. The present general decay of organized provision systems and the restricted accessibility of large areas of the world out of military of other political reasons simply interdict ideas of such overegional interventions

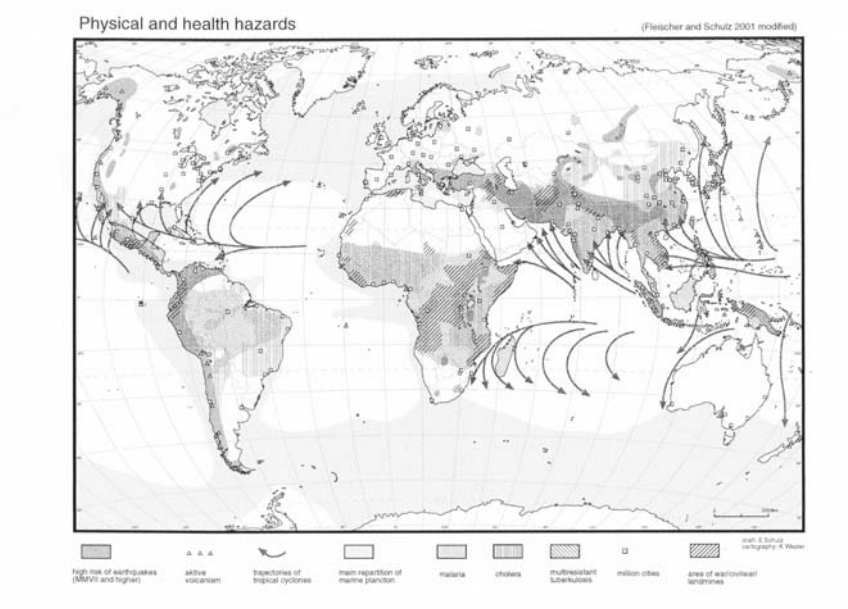

Fig. 5. Map of regions of physical and health hazards.
(Fleischer and Schulz 2001, modified)

Conclusion

Global changes of and on the earth´s surface occured during the last decades and they may be reinforced by a climatic change too. The risk assessments of re-insurance societies shed a flashlight to the general problem of all planning whether it is locally, regionally or globally focussed: which chances and possibilities are present to intervene to buffer risks or to reduce them as well as to repair damages already manifested? There are severel facts to accept. There is no longer a general accessibility and consequently interventions or projects to buffer risks have to be designed for a local or regional scale. Regarding the results of the processes of ruderalisation, squatterisation and ponderisation a concentration on the general problems of water supply, water schemes will be the most important subject of future planning. Regarding to the general transformations of the earth´s surface one also has to conceive all interferences in a holistic way since it might create even more damages if one does not accept the interconnections of processes in an ecosystem. Two examples may illustrate these circumstances.

The desertification /land degradation problems in the sahelian savanna in south western Niger resulted in severe soil erossion and loss of soil fertility as well as pasture possibilities. Investigations and intensive contacts of researchers and the population concerned revealed that also the adapted intervention schemes of stome lines, small dams and barrages to impede further soil erosion and to enhance the grass and herb cover may easily create further problems if these interventions are not planned for the whole landscape (Bender and Ousseini 2000). It is also necessary to implant them into the local population since it needs to be accepted by them and to be persecuted in a permanent way. A diagram

(Fig 6) explains these circumstances. Overgrazing and increasing agriculture resulted in an accelerated soil erosion and a filling of valleys and ponds. The construction of stone lines and small barrages on the slopes resulted in a regeneration of soil and pasture but it provoced a regressive erosion in the valleys. Only the understanding of the function of the whole landscape systeme and an consecutive treatment of all parts of it could stop these negative effects and lead to a general reneration as long as these interventions are accepted and respected by the local population.

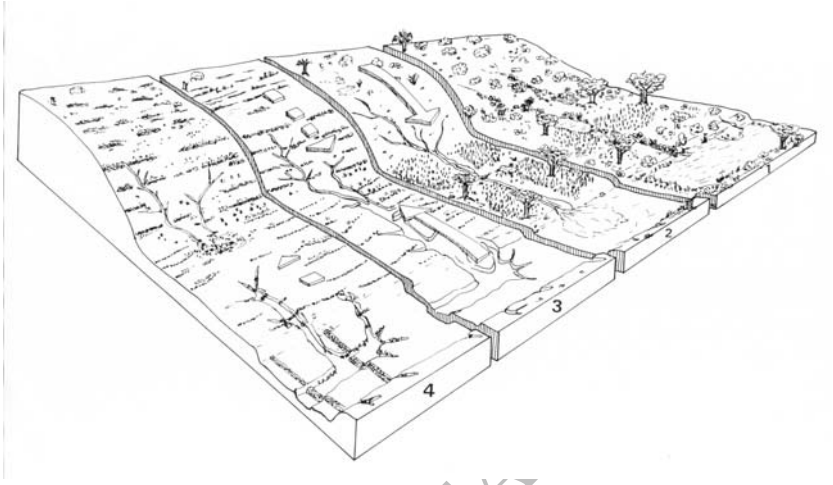

Fig. 6. Desertification scheme showing the intensification of exploitation and possible rehabilitation measurements in southwestern Niger
(Schulz after Bender and Ousseini 2000)

The nefarious cyanide and heavy metal spills of 2000 in the Thisza river system and the acclerated inondations of River Thisza in the last years evidenced the consequences of large scale deforestation and of badly managed technical installations in the upper reaches of the Tisza river and its tributaries (Benedek et al 2002, Hamar 2000, Hamar and Sharkany-Kiss 1999, UNEP/OCHA 2000). It generally changed the discharge system of the river Tisza. It also made clear, that local or regional interventions to protect against these damages will not be sufficiant or successful and a newly shaped river management system, in the parts as well as in the whole, has to incorporate the general transformations of the catchment area and t adjust to them if it will not be possible to repair or reduce them.

Finally it confirmes that risks must be evaluated on the background of the landscape changes of the last decennia in the region and that consequently it will be necessary to concentrate on the scale of about 200 years (or more) events since the traditional 100 years scale will be no more sufficiant. It is necesary to abandon the attitudes of possibilism. Responsilbility demands and accordance to and cooperation with the people concerned. Moreover the maintenance of constructions and measurements is one of the most important points.

Even when there are only reduced chances of interventions one has to incorporate the holistic implications of these activities. It evidences the necessity to connect locally possible activities into a network and to assure the long activity of any interference. For the geomedical implications it also became clear, that wordwide eradication plans are less realistic now. Anyway, it will the a main task to develop strategies in a cooperation between different disciplines in order to limit diseases and to improve or reconstruct watrer supply and health systems according to the local conditions.

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