

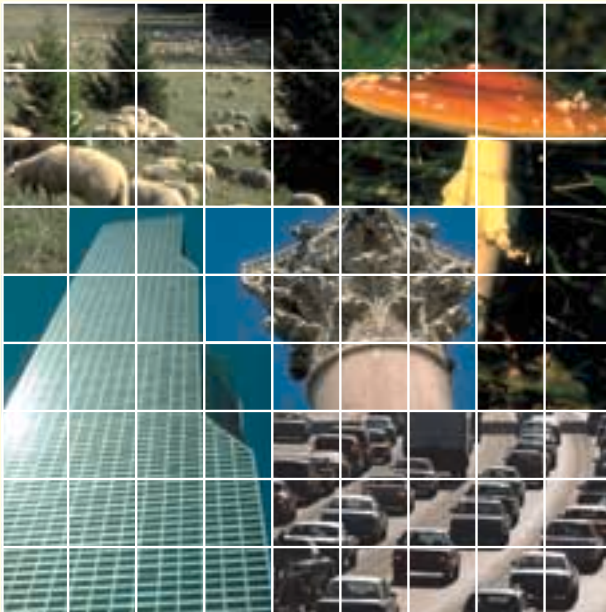


German Advisory
Council on
Global Change

World in Transition

Environment and Ethics

Special Report
1999



**Members of the German Advisory Council on Global Change
(As of: 1 June 1999)**

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German Advisory Council on Global Change

**World in Transition:
Environment and Ethics**

Special Report 1999

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Contents

1	The fundamental issue	3
2	Basic ethical issues	8
2.1	Overview of ethical approaches	8
2.2	The problems of last justification	11
2.3	Transferring ethics to the environment	13
3	Special principles and standards for the use of the biosphere	24
3.1	The need for human interventions in the biosphere	24
3.2	The use of categorical principles in biosphere protection	25
3.3	The use of principles and standards capable of being compensated in biosphere protection	28
3.4	Knowledge and values as a basis for appreciation processes	29
4	Economic valuation of biosphere services	31
4.1	Economic valuation as an expression of specific valuation ethics	31
4.2	Methodological foundations and the need for explanation of economic valuations	32
4.3	Overview of the procedure with an economic valuation of the biosphere	35
4.4	Value categories of biosphere services from an economic point of view	36
4.5	Limits of the applicability of the economic calculation to the valuation of biosphere services	43
4.6	Economic methods for an overview of environmental valuation	47
4.7	Attempt to order the value categories from a global perspective	51
4.8	Summary: linking economic valuation methods to the goal of sustainability	55

5	Empirical studies on the importance of the environment	58
5.1	On the comparison of acceptance and acceptability	58
5.2	Nature and the environment in the public perception	60
5.3	The perception of adverse environmental effects	64
5.4	Environmental conduct	68
5.5	Intercultural differences in dealing with nature	73
6	Methods for creating and justifying standards for biosphere protection	77
6.1	The value tree method for recording social values	77
6.2	The ethics of conducting negotiations	85
7	Conclusions for biosphere protection	96
	Bibliography	100

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1 The fundamental issue

Should people be allowed to do everything that they are capable of doing? This question is posed in connection with new technologies, such as genetic engineering, or with human interventions in nature, such as the clearance of primeval forests so that the land can be used for agriculture. Intuitively everyone answers this question with a definitive „No“: no way should people be allowed to do everything that they are capable of doing. This also applies to everyday actions. Many options in daily life, from lying to minor deception, from breaking a promise up to going behind a friend's back, are obviously actions that are seen by all well-intentioned observers as unacceptable. However, it is much more difficult to assess those actions where the valuation is not so obvious. Is it justified to break a promise when keeping the promise could harm many other people?

Actions where there are conflicts between positive and negative consequences or where a judgement could be made one way or the other with equally good justification are especially common in environmental policy. There is hardly anyone who wilfully and without reason pollutes the environment, releases toxic pollutants or is cruel to animals. People who violate existing environmental standards for selfish reasons or place themselves above the principles of environmentally sound action are obviously acting wrongly and every legislator will sanction this behaviour with the threat of punishment or a penalty. But there is a need for clarification where people bring about a change in the environment with the best intentions and for plausible reasons and, in the process, harm the environment. In ethics we talk about „conflicting values“ here.

Most interventions in the environment are made for some reason: the actors who make such interventions want to secure food for a growing population, for example, to ensure long-term jobs and adequate incomes, to use natural resources for products and services or to use nature for recycling waste materials from production and consumption that are no longer needed. None of this is done for reasons of brotherly love, but to maintain social interests. Even improving one's own financial resource is not immoral mere for this reason. The list of human activities that change the environment perpetrated for existential or economic reasons could be carried on into infinity.

Human existence is bound to the use of nature. The more people populate the world, the more intensive this use will be.

Here are just a few figures: around 12,000 years ago about 5 million people lived on the earth. Under the production conditions those days (hunter-gatherer culture) this population level was the limit for the human species within the framework of an economic form that only interfered slightly with man's natural environment. The neolithic revolution brought a dramatic change: the carrying capacity of the world for human beings increased by a factor of 10 and more. This agrarian pre-industrial cultural form was characterised by tightly limited carrying capacity, in around 1750 the earth was capable of feeding approx. 750 million people. Today the world supports 6 billion people – and this figure is rising. The carrying capacity in comparison to the Neolithic age has thus increased thousand-fold and continues to grow in parallel to new changes in production conditions (Fritsch, 1993; Kesselring, 1994; Mohr, 1995). The five „Promethean innovations“ are behind this tremendous achievement of human culture: mastering fire, using the natural environment for agriculture, transforming fossil fuels into thermal and mechanical energy, industrial production and substituting material with information (Renn, 1996a).

With today's settlement densities and the predominantly industrial way of life, the human race is therefore dependent on the technical remodelling of nature. Without a doubt, it needs this for survival, especially for the well being of the innumerable people, goods and services that reduce the stock of natural resources. With regard to the question of the responsibility of human interventions in nature, the question cannot be about „whether“ but – even better – about „how much“, because it is an anthropological necessity to adapt and shape existing nature to human needs. For example, the philosopher Klaus Michael Meyer-Abich sees the situation as follows: „...we humans are not there to leave the world as though we had never been there. As with all other life forms, it is also part of our nature and our lives to bring about changes in the world. Of course, this does not legitimise the destructive ways of life that we have fallen into. But only when we basically approve of the changes in the world can we turn to the decisive question of which changes are appropriate for human existence and which are not“ (Meyer-Abich, 1997).

Therefore, to be able to make a sensible judgement of the balance of the consumption of nature by human economic activity, the range of products and services created by the consumption of nature has to be considered in relation to the losses that are inflicted on the environment and nature. With this comparison it can be seen that even serious interventions in nature and the environment did not occur without reflection, but to provide the growing number of people with goods and services; these people need them to survive or as a prerequisite for a „good“ life. However, at the same time it must not be forgotten that these interventions often inflict irreversible damage on the environment and destroy possible future usage potentials for future generations. Above and beyond this, for the human race, nature is a cradle of social, cultural, aesthetic and religious values, the infringement of which, in turn, has a major influence on people's well being. On both sides of the equation there are therefore important goods that have to be appreciated when interventions in nature occur. But what form should such an appreciation take?

If the pros and cons of the intervention in nature have to be weighed against each other, criteria are needed that can be used as yardsticks. Who can and may draw up such criteria, according to which standards should the interventions be assessed and how can the various evaluative options for action be compared with each other for each criterion?

This Special Report by the WBGU intends to provide some information to these questions. The Report is based on the idea that human interventions in nature are as much a question of impact assessment as of impact valuation (Renn, 1996b). In the first case, the issue is what consequences are to be expected if option for action A is chosen instead of option B? An example would be the decision whether a raw materials deposit in a semi-natural area should be exploited or not. On the credit side there are economic utility gains, on the debit side ecological utility losses. Both sides of the balance sheet should be specified as far as possible so that a balanced assessment of the consequences can be made. If the consequences of planned interventions are more or less known then it is time for the second fundamental question: How desirable are these consequences if generally recognised criteria of „good“ life on the individual level and the „common“ good on the collective level are applied to them? Whereas the estimate of consequences broadly falls in the

domain of scientific research and expertise, with uncertainties and ambivalent judgements in the environmental area in particular having to be taken into account, the question about the foundations for evaluating various options for action and about drawing up standards guiding action is a central function of ethics. Ethics can provide an answer to the question posed at the beginning („Should people be allowed to do everything that they are capable of doing?“) in a consistent and transparent manner.

In the first part of this Special Report, environmental ethics will be briefly introduced. This review is inspired by the need for a pragmatic and policy-oriented approach. It is not a replacement for a comprehensive and theoretically driven compendium of environmental ethics. Environmental ethics will then be applied to evaluate environmental assets. In this process, a simple distinction is made between *categorical* principles – that must under no circumstances be exceeded or violated – and *compensatory* principles, where compensation with other competing principles is allowed. This distinction consequently leads to a classification of environmental values, which, in turn, can be broken down into criteria to appreciate options for designing environmental policies.

In the second part of the Special Report these ideas of valuation will be taken up and used to translate the value categories into economic behaviour. At the heart of the considerations here is the issue of how the aims of ethically founded considerations can be used to support and implement economic valuation methods.

The third part of the Special Report contrasts the normative considerations on the valuation of environmental action and environmental goods with the factual attitudes and conduct of individuals and groups of society. Normative principles have little force if they are not accepted and implemented by the people who are supposed to follow them.

The fourth part of the Special Report continues the ideas of the operational implementation of normative and factual valuations and describes two complementary procedures that largely implement the results from the previous chapters and integrate ethical, economical and empirical inferred valuation criteria into proposed procedural orientation. The Special Report ends with some conclusions for biosphere protection.

The ethical considerations in this Special Report refer to the worldwide acute problem of the conservation and sustainable use of the biosphere. The choice of this point of reference is easy to understand since the Council dedicated its main special report to this subject in 1999 (WBGU, 2001). What does the term biosphere mean? The biosphere is the space of the earth filled with life, from the top layer of the earth's crust (including the water) right up to the bottom layer of the atmosphere (habitat for birds) (Bahadir et al., 1995). Functionally, it is closely linked to the other spheres of the world, the atmosphere, the pedosphere, the lithosphere and hydrosphere. Within the context of the WBGU's Annual Report on the subject „Protection of the Biosphere“ three levels of reference are addressed with priority: I. genetic and species diversity, II. ecosystem and landscape diversity and III. the global geochemical cycles caused or influenced by the biosphere (such as the carbon cycle).

In addition to the essential importance of the biosphere to people and all other living things on the earth, whose existence depends on other living things lower down or higher up a chain as well as on the ability of many abiotic cycles to function, biosphere protection with all of its facets is also a suitable test area for the effectiveness and applicability of ethical valuation methods and those derived from economic reasoning. After all the valuation of genetic and species diversity, ecosystem and landscape diversity as well as geochemical cycles is hotly disputed on the political level and far removed from a consensus among the actors involved. The basic deliberations and derivations of this report can also be transferred to other environmental problems.

The Council hopes that, in response to the question as to whether people should be allowed to do everything that they are capable of doing, this Special Report will provide more than an „it depends“ assessment that would be worthy of Solomon. At the same time, however, we may have to disappoint any possible hopes that clear guidelines for moral environmental action can be drawn in a pluralistic world, characterised by a variety of values and competing lifestyles. Much rather, everything is about the draft of a reflected procedure that is supposed to ensure that humankind correctly and efficiently masters the challenges of sustainable development, i.e. satisfying economic efficiency, social justice and the conservation of ecological functions.

2 Basic ethical issues

2.1 Overview of ethical approaches

Answering the question about the right action is the field of practical philosophy, ethics. Following the usual view in philosophy, ethics describes the theory of the justification of normative statements, i.e. those that guide action (Gethmann, 1991; Mittelstraß, 1992; Nida-Rümelin, 1996a; Revermann, 1998). A system of normative statements is called „morals“. Ethical judgements therefore refer to the justifiability of moral instructions for action that may vary from individual to individual and from culture to culture (Ott, 1999).

Basically, man is a purpose-oriented and self-determined being who acts not only instinctively, but also with foresight, and is subject to the moral standard to carry out only those actions that he can classify as good and necessary (Honnfelder, 1993). Obviously, not all people act according to the standards that they themselves see as necessary, but they are capable of doing so. In this context it is possible for people to act morally because, on the one hand, they are capable of distinguishing between moral and immoral action and, on the other, are largely free to choose between different options for action.

Whether pursuing a particular instruction for action should be considered as moral or immoral is based on whether the action concerned can be felt and justified to be „reasonable“ in a particular situation. Standards that cross over situations and that demand universal applicability are referred to as principles here. Conflicts may arise between competing standards (in a specific situation), as well as between competing principles, the solution of which, in turn, needs justification (Szejnwald-Brown et al., 1993). Providing yardsticks for such justification or examining moral systems with respect to their justifiability is one of the key tasks of practical ethics (Gethmann, 1998).

In ethics a distinction is made between descriptive (experienced morality) and prescriptive approaches, i.e. justifiable principles of individual and collective behaviour (Frankena, 1963; Hansen, 1995). All descriptive approaches are, generally speaking, a „stock-taking“ of actually experienced standards. Initially it is irrelevant whether these standards are justified or not. They gain their normative force solely from the fact that they exist and instigate human action (nor-

mative force of actual action). Most ethicists agree that no conclusions about general validity can be drawn from the actual existence of standards. This would be a naturalistic fallacy (Akademie der Wissenschaften, 1992; Ott, 1999). Nevertheless, experienced morality can be an important indicator of different, equally justifiable moral systems, especially where guidance for cross-cultural behaviour is concerned. This means that the actual behaviour of many peoples with regard to their natural environment reveals which elements of this environment they value in particular and which they do not. However, in this case, too, the validity of the standards is not derived from their factuality, but merely used as a heuristic in order to find an adequate (possibly culture-immanent) justification.

But given the variety of cultures and beliefs, how can standards be justified intersubjectively, i.e. in a way that is equally valid to all? Is it not the case that science can only prove or disprove factual statements (and this only to a certain extent), but not normative statements? A brief discourse on the various approaches in ethics is needed to answer this question.

First of all, ethics is concerned with two different target aspects: on the one hand it is concerned with the question of the „success“ of one's own life, i.e. with the standards and principles that enable a person to have a happy and fulfilled life: eudemonistic ethics; on the other hand, it is concerned with the standards and principles of living together, i.e. with binding regulations that create the conditions for a happy life: the common good based on normative rules (Galert, 1998; Ott, 1999).

Within normative ethics a distinction is made between deontological and teleological approaches when justifying normative statements (Höffe, 1987). Deontological approaches are principles and standards of behaviour that apply to the behaviour itself or the association convictions on the basis of an external valuation criterion. It is not the consequences of an action that are the yardstick of the valuation; rather it is adhering to inherent yardsticks that can be used against the action itself. Such external yardsticks of valuation are derived from religion, nature, intuition or common sense, depending on the basic philosophical direction. Thus, protection of the biosphere can be seen as a divine order to protect creation (Rock, 1980; Schmitz, 1985), as an innate tendency for the emotional attachment of people to an environment with biodiversity (Wilson, 1984), as a

directly understandable source of inspiration and joy (Ehrenfeld, 1993) or as an educational means of practising responsibility and maintaining social stability (Gowdy, 1997).

By contrast, teleological approaches refer to the consequences of action. Here, too, external standards of valuation are needed since the ethical quality of the consequences of action also have to be evaluated against a yardstick of some kind. With the most utilitarian approaches (a subset of the teleological approaches) this yardstick is defined as an increase in individual or social benefit. In other schools of ethics, intuition (can the consequence still be desirable?) or the aspect of reciprocity (the so-called „Golden Rule“ „do as you would be done by“) play a key role.

In the approaches based on logical reasoning (especially in Kant), the yardstick is derived from the logic of the ability to generalise or universalise. Kant himself is in the tradition of deontological approaches („Good will is not good as a result of what it does or achieves, but just as a result of the intention“). According to Kant every principle that, if followed generally, makes it impossible for a happy life to be conducted is ethically impermissible. In this connection, it is not the desirability of the consequences that is the main interest, but the logical inconsistency that results from the fact that the conditions of the actions of individuals would be undermined if everyone were to act according to the same maxims (Höffe, 1992).

A number of contemporary ethicists have taken up Kant's generalisation formula, but do not judge the maxims according to their internal contradictions; rather they judge them according to the desirability of the consequences to be feared from the generalisation (Jonas, 1979 or Zimmerli, 1993 should be mentioned here). These approaches can be defined as a middle course between deontological and teleological forms of justification.

In addition to deontological and teleological approaches there is also the simple solution of consensual ethics, which, however, comprises more than just actually experienced morality. Consensual ethics presupposes the explicit agreement of the people involved in an action. Everything is allowed provided that all affected (for whatever reason) voluntarily agree. In sexual ethics at the moment a change from deontological ethics to a consensual moral code can be seen.

The three forms of normative ethics are shown in Fig. 1. The comparison of the basic justification paths for normative moral systems already clearly shows that professional ethicists cannot create any standards or designate any as clearly right, even if they play a role in people's actual lives. Much rather it is the prime task of ethics to ensure on the basis of generally recognised principles (for example, human rights) that all associated standards and behaviour regulations do not contradict each other or a higher order principle.

Above and beyond this, ethics can identify possible solutions that may occur with a conflict between standards and principles of equal standing. Ethics may also reveal interconnections of justification that have proved themselves as examination criteria for moral action in the course of their disciplinary history. Finally, many ethicists see their task as providing methods and procedures primarily of an intellectual nature by means of which the compatibility or incompatibility of standards within the framework of one or more moral systems can be completed.

Unlike the law, the wealth of standards of ethics is not bound to codified rules that can be used as a basis for such compatibility examinations. Every normative discussion therefore starts with the general issues that are needed in order to allow individuals a „good life“ and, at the same time, to give validity to the principles required to regulate the community life built on common good). But how can generally binding and intersubjectively valid criteria be made for the valuation of „the common good“?

2.2 The problems of final justification

In modern pluralistic societies it is increasingly difficult for individuals and groups of society to draw up or recognise collectively binding principles that are perceived by all equally as justifiable and as self-obliging (Hartwich and Wewer, 1991; Zilleßen, 1993). The variety of lifestyle options and subjectification of meaning (individualisation) are accompanying features of modernisation. With increasing technical and organisational means of shaping the future, the range of behaviour options available to people also expands. With the increasing plurality of lifestyles, group-specific rationalities emerge that create their own worldviews and moral standards, which demand a binding nature and validity only within a social group or subculture).

Basic ethical issues

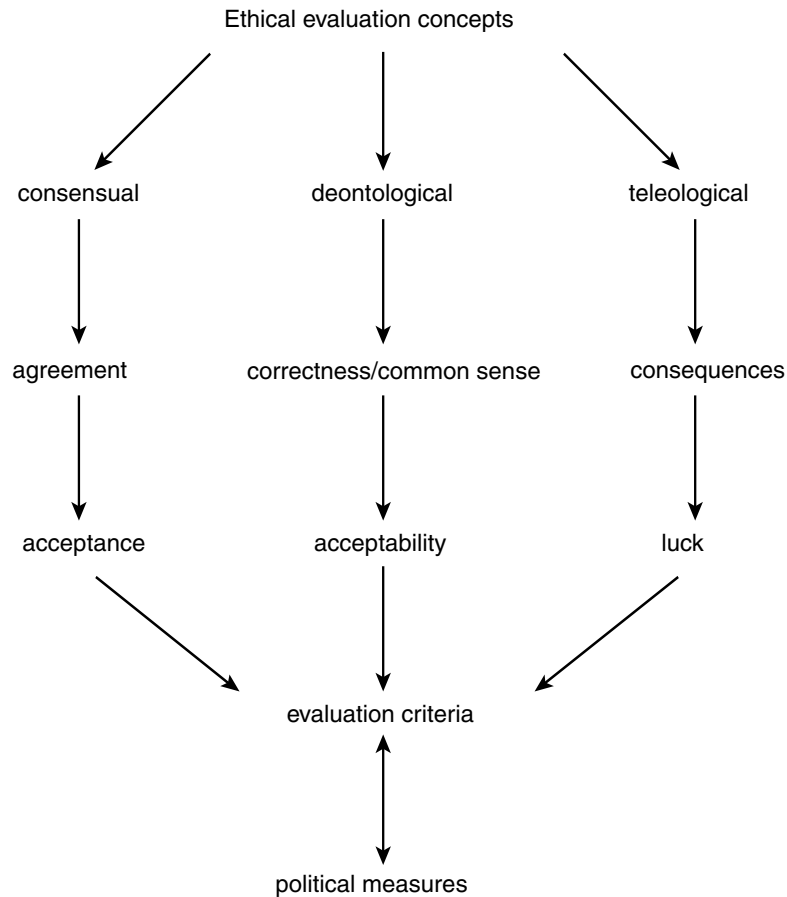


Figure 1: Ethical valuation concepts

Source: Renn, 1997

The fewer cross-society guiding principles or behaviour orientations are available, the more difficult is the process of agreement on collectively binding orientations for action. However, these are vital for the maintenance of economic cooperation, for the protection of the natural foundations of life and for the maintenance of cohesion in a society. No society can exist without the binding specification of minimum canons of principles and standards.

But how can agreement be reached on such collectively binding principles and standards? What criteria can be used to judge standards? The answers to this question depend on whether the primary principles, in other words the starting point of all moral systems, or secondary principles or standards, i.e. follow-on standards that can be

time or the search for third solutions can help without, however, being able to convincingly solve this conflict in principle to the same degree for all (Szejnwald-Brown et al., 1993).

These considerations lead to some important conclusions for the matter of the application of ethical principles to the issue of human action with regard to the biosphere. First of all, it contradicts the way ethics sees itself to develop ethics of its own for different action contexts. Just as there can be no different rules for the logic of deduction and induction in nomological science, depending on which object is concerned, it does not make any sense to postulate an independent set of ethics for the biosphere (Galert, 1998). Justifications for principles and moral systems have to satisfy universal validity (Nida-Rümelin, 1996b).

Furthermore, it is not very helpful to call for a special moral system for the biosphere, since this – like every other moral system – has to be traceable to primary principles. Instead, it makes sense to specify the generally valid principles that are also relevant with regard to the issue of how to deal with the biosphere. At the same time standards should be specified that are appropriate to the object of biosphere use and that reflect those principles that are valid beyond the biosphere.

Finally, it is neither helpful nor practical to assume a principal conflict between ethical and economic standards, as is frequently done in popular statements. Economic action is just as much determined by moral standards as environmentally-related action. Even an egotistical implementation of one's own individual interests may be ethically justifiable in some cases, for example as a way of freely developing one's own personality or as an incentive for an achievement that benefits society as a whole. Under ethical aspects, however, it must be asked critically whether this behaviour does not contradict higher standards or principles (such as the principle of conserving the life of other people) or whether it is in a conflict with standards or principles of equal ranking (equitable distribution of goods).

2.3 Transferring ethics to the environment

Before the specific subject of responsible action with respect to the biosphere is to be dealt with, it is first of all necessary to turn to the complex of environmental ethics in general. As implied above, it does

derived from the primary principles, are subjected to an ethical examination. Primary principles can be categorical or compensatory (capable of being compensated). Categorical principles are those that must not be infringed under any circumstances, even if other principles would be infringed as a result. The human right to the integrity of life could be named here as an example. Compensatory principles are those where temporary or partial infringement is acceptable, provided that as a result the infringement of a principle of equal or higher ranking is avoided or can be avoided. In this way certain freedom rights can be restricted in times of emergency. In the literature on ethical rules, one can find more complex and sophisticated classifications of normative rules. For our purpose to provide a simple and pragmatic framework, the distinction in four categories (principles and standards; categorical and compensatory) may suffice. This distinction has been developed from a decision-analytic perspective. But how can primary principles be justified as equally valid for all people? Although many philosophers have made proposals here, there is a broad consensus today that neither philosophy nor any other human facility is capable of stating binding metacriteria without any doubt and for all people, according to which such primary principles should be derived or examined (Mittelstraß, 1984). A final justification of normative judgements cannot be achieved by logical means either, since all attempts of this kind automatically end either in a logical circle, in an unending regression or in a termination of the procedure and none of these alternatives is a satisfactory solution for final justification (Albert, 1991).

The problem of not being able to derive finally valid principles definitively, however, seems to be less serious than would appear at first glance. Because, regardless of whether the basic axioms of moral rules are taken from intuition, observations of nature, religion, tradition reasoning or common sense, they have broadly similar contents. Thus, there is broad consensus that each human individual has a right to life, that human freedom is a high-value good and that social justice should be aimed at. But there are obviously many different opinions about what these principles mean in detail and how they should be implemented. In spite of this plurality, however, discerning and well-intentioned observers can usually quickly agree, completely in line with the WBGU guardrail concept (for details on this, see WBGU, 1998) whether one of the basic principles has clearly been

infringed. It is more difficult to decide whether they have clearly been fulfilled or whether the behaviour to be judged should clearly be assigned to one or several principles. Since there is no finally binding body in a secular society that can specify primary principles or standards *ex cathedra*, in this case consensus among equally defensible standards or principles can be used (or pragmatically under certain conditions also majority decisions). Ethical considerations are still useful in this case as they allow the test of generalisation and the enhancement of awareness raising capabilities. In particular, they help to reveal the implications of such primary principles and standards.

Provided that primary principles are not concerned (such as human rights), the ethical discussion largely consists of examining the compatibility of each of the available standards and options for action with the primary principles. In this connection, the main concerns are a lack of contradictions (consistency), logical consistency (deductive validity), coherence (agreement with other principles that have been recognised as correct) and other, broadly logical criteria (Gethmann, 1998). As the result of such an examination it is entirely possible to reach completely different conclusions that all correspond to the laws of logic and thus justify new plurality.

In order to reach binding statements or valuations here the evaluator can either conduct a discussion in his „mind“ and let the arguments for various standards compete with each other (rather like a platonic dialogue) or conduct a real discussion with the people affected by the action. In both cases the main concern is to use the consensually agreed primary principles to derive secondary principles of general action and standards of specific action that should be preferred over alternatives that can be equally justified. A plurality of solutions should be expected especially because most of the concrete options for action comprise only a gradual fulfilment and infringement of primary principles and therefore also include conflicting values. For value conflicts at the same level of abstraction there are, by definition, no clear rules for solution. There are therefore frequently conflicts between conserving life through economic development and destroying life through environmental damage. Since the principle of conserving life can be used for both options a conflict is unavoidable in this case. To solve the conflicts ethical considerations, such as the avoidance of extremes, staggering priorities over

not make much sense to talk about an independent set of environmental ethics. Much rather, general ethics should be transferred to issues relating to the use of the environment (Hargrove, 1989). Three areas are usually dealt with within the context of environmental ethics (Galert, 1998):

- *Environmental protection*, i.e. the avoidance or alleviation of direct or indirect, current or future damage and pollution resulting from anthropogenic emissions, waste or changes to the landscape, including land use, as well as the long-term securing of the natural foundations of life for people and other living creatures (Birnbacher, 1991a);
- *Animal protection*, i.e. the search for reasonable and enforceable standards to avoid or reduce pain and suffering in sentient beings (Krebs, 1997; Vischer, 1999);
- *Nature conservation*, i.e. the protection of nature against the transforming intervention of human use, especially all measures to conserve, care for, promote and recreate components of nature deemed to be valuable, including species of flora and fauna, biotic communities, landscapes and the foundations of life required there (Birnbacher, 1991a).

This Special Report is primarily addressed at nature conservation. But above and beyond this, environmental protection is also concerned, since protection of the biosphere and use of the biosphere for human purposes have to be viewed as intrinsically linked. The differing degree of use vs. protection will be dealt with in more detail below.

But before this is done, the question as to the primary principles to be applied in the field of environmental ethics has to be posed. When dealing with the environment, the traditional basic and human rights, as well as the civil rights that have been derived from them, should be just as much a foundation of the consideration as the other areas of application in ethics. However, with regard to the primary principles there is a special transfer problem for the use of nature and the environment: does the basic postulate of conservation of life apply only to human beings, to all other creatures or to all elements of nature too? This question does not lead to a new primary principle, as one may suspect at first glance. Much rather, it is concerned with the delineation of the universally recognised principle of the conservation of life that has already been specified in the basic rights canon. Are only people included in this principle (this is the codified version

valid in most legal constitutions today) or other living creatures too? And if yes, which ones? Should non-living elements be included too?

When answering this question, two at first sight contradictory positions can be derived: anthropocentrism and physiocentrism (Taylor, 1986; Ott, 1993; Galert, 1998). The anthropocentric view places man and his needs at the fore. Nature's own original demands are alien to this view. Interventions in nature are allowed if they are useful to man. A duty to make provisions for the future and to conserve nature exists in the anthropocentric world only to the extent that natural systems are classed as valuable to people today and subsequent generations and that nature can be classed as a means and guarantor of human life and survival (Norton, 1987; Birnbacher, 1991b).

In the physiocentric concept, which forms an opposite pole to the anthropocentric view, the needs of man are not placed above those of nature. Here, every living creature, whether man, animal or plant, has intrinsic rights with regard to the chance to develop its own life within the framework of a natural order. Merit for protection is justified in the physiocentric view by an inner value that is unique to each living creature or the environment in general. Nature has a value of its own that does not depend on the functions that it fulfils today or may fulfil later from man's point of view (Devall and Sessions, 1984; Callicott, 1989; Rolston, 1994b; Meyer-Abich, 1996).

Each of these prevailing understandings of the man-nature relationship has implications that are decisive for the form and extent of nature use by man (Elliot, 1995; Krebs, 1997). Strictly speaking, it could be concluded from the physiocentric idea that all human interventions in nature have to be stopped so that the rights of other creatures are not endangered. Yet, not even extreme representatives of a physiocentric view would go so far as to reject all human interventions in nature because animals, too, change the environment by their ways of life (e.g. the elephant prevents the greening of the savannah). The central postulate of a biocentric view is the gradual minimisation of the depth of interventions in human use of nature. The only interventions that are permitted are those that contribute to directly securing human existence and do not change the fundamental composition of the surrounding natural environment.

If these two criteria were taken to the extreme, neither population development beyond the boundaries of biological carrying capacity nor a transformation of natural land into pure agricultural land

would be allowed. Such a strict interpretation of physiocentrism would lead to a radical reversal of human history so far and is not compatible with the values and expectations of most people.

The same is true for the unlimited transfer of anthropocentrism to dealings with the biosphere. In this view the use of biosphere services is subjected solely to the individual cost-benefit calculation. This can lead to unscrupulous exploitation of nature by man with the aim of expanding human civilisation. Both extremes quickly lead to counter-intuitive implications.

When the issue of environmental design and policy is concerned, anthropocentric and physiocentric approaches in their pure form are found only rarely, much rather they occur in different mixtures and slants. The transitions between the concepts are fluid. Moderate approaches certainly take on elements from the opposite position. It can thus be in line with a fundamentally physiocentric perspective if the priority of human interests is not questioned in the about resources. It is also true that the conclusions of a moderate form of anthropocentrism can approach the implications of the physiocentric view. Table 1 provides an overview of various types of anthropocentric and physiocentric perspectives.

If we look at the behaviour patterns of people in different cultures, physiocentric or anthropocentric basic positions are rarely maintained consistently (Bargatzky and Kuschel, 1994; on the convergence theory: Birnbacher, 1996). In the strongly anthropocentric countries in the West people spend more money on the welfare and health of their own pets than on saving human lives in other countries. In the countries of the Far East that are characterised by biocentrism, nature is frequently exploited even more radically than in the industrialised countries of the West. This inconsistent action is not a justification for one view or the other, it is just a warning for caution when laying down further rules for use so that no extreme – and thus untenable – demands be made.

Also from an ethical point of view, radical anthropocentrism should be rejected just as much as radical physiocentrism. If, to take up just one argument, the right to human integrity is largely justified by the fact that causing pain by others should be seen as something to avoid, this consideration without a doubt has to be applied to other creatures that are also capable of feeling pain (referred to as: pathocentrism). Here, therefore, pure anthropocentrism cannot con-

Table 1: Perspectives of nature from the
human point of view

Source: Knaus and Renn, 1998

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- 1a. Anthropocentric perspectives of a utilitarian nature
- *Nature as a „horn of plenty“* for resource use: in this concept nature is the foundation of resources for meeting human needs.
 - *Nature as modelling clay or a starting point for the creation of cultivated land (garden, agriculture, forestry, substance cycles)*: in this concept shaping the environment means man's opportunities to convert natural land into cultivated land that is productive for him, using it economically and conserving it in the long term. Nature does not bring direct benefits to man, only when it has been reshaped into cultivated land. However, this reshaping depends on natural conditions and is limited by the efficiency of the natural substance cycles.
- 1b. Anthropocentric perspectives of a protectionist character
- *Nature as a wilderness worth protecting*: in this concept of nature the conservation of pristine natural land is a direct human need, regardless of the possible use of the resources contained there. Use of the environment therefore does not only mean the conservation of the resource basis, it is also the recognition of an existential value for nature protected by man as it is without human interventions.
 - *Nature as an object protected against human intervention*: according to this concept, environmental shaping is concerned less with the conservation of the foundations of human life and more about the conservation of nature (or the environment existing today) against human interventions. Any further expansion of human interventions in the environment and any intensive use of the environment should be avoided under this concept of nature.
2. Biocentric perspectives
- *Nature as a unit of creation*: in this concept all living creatures are entitled in principle to take up their place in nature. As a result of man's scope to expand the place assigned to him by nature further than would correspond to this concept of the natural order, he has a special responsibility not to excessively impair the right of his fellow creatures to live and use resources and to be so modest in his own needs as to bring about a semi-natural co-existence between man, animals and plants. But the priority of human interests in the conflict of targets between the competitors for the use of resources is not questioned.
 - *Nature as a cradle of fellow creatures with equal rights*: in this concept all living creatures are not only entitled to an adequate habitat; they also have the same rights as humans to the development of their lives within the context of the natural order. In the conflict of targets for the use of resources all living creatures should, in principle, be given the same opportunities. Only in the case of an existential threat to human life does man have priority over the immanent claims of his living environment.
-

vince. In turn, with a purely physiocentric approach the primary principles of freedom, equality and human dignity could not be maintained at all if every part of living nature were equally entitled to use the environment. Under these circumstances people would have to do without agriculture, the conversion of natural land into agricultural land and breeding farm animals and pets in line with human needs. As soon as physiocentrism is related to species and not to individuals as is done in biocentric perspectives human priority is automatically implied; because where human beings are concerned, nearly all schools of ethics share the fundamental moral principle of an individual right to life from birth. If this right is not granted to individual animals or plants, a superiority of the human race is implicitly assumed. Moderate versions of physiocentrism acknowledge a gradual de-escalation with respect to the claim of individual life protection. The extreme forms of both biocentrism and anthropocentrism are therefore not very convincing and are hardly capable of achieving a global consensus. This means that only moderate anthropocentrism or moderate biocentrism should be considered.

It would go beyond the remit of this WBGU Special Report to consider in detail the arguments for and against the moderate anthropocentric and moderate physiocentric solutions here. There are sound arguments for both views; at this point, as already mentioned in Section 2.1, decisions have to be based on exogenic criteria or own preferences. In this connection, a decision is not all that serious because in the final analysis the two versions differ only slightly in their practical implications and concrete behaviour standards (Norton, 1991; Birnbacher, 1996).

Nevertheless, the Council found it valuable to show its own deliberation on this question with its readers. It reached the conclusion that a moderate anthropocentrism should be preferred for epistemic and pragmatic reasons. The reasons for this can be summarised as possible:

Epistemic derivation: People can perceive and evaluate nature cognitively and normatively only from their own human point of view. If we assume that only man is capable of subjective recognition of the consequences of his own action (cognitive anthropocentrism) and that establishing and following ethical standards only make sense as demands of people and not of nature as a whole or its elements (normative anthropocentrism), a „moderate“ anthropocentric

view of the human-nature relationship is cognitively more convincing than physiocentric views. Physiocentric attitudes presuppose that man can recognise the objectives and interests of the living – or non-living – environment by means of insight or empathy (Birnbacher, 1991; Wolf, 1992). But this demand cannot be kept in principle because nature cannot confirm or deny such demands independent of human thought, sympathy and speculation. Even if certain similarities between creatures (for example, mammals) allow stewardship, this still remains associated with the fact that man believes that he knows what is morally good for this creature or nature as a whole. This argument also speaks against the so-called holistic natural ethics, which call for a total inclusion of nature. (cf. Galert, 1998). Although the unavoidable anthromorphism in thoughts does not force an anthropocentric view, it suggests it (Mittelstraß, 1995).

Normative derivation: In principle, standards within the framework of moral systems can also be extended to subjects that have neither given their agreement to this nor are able to express their own interests. This has also been practised for a long time, for example with regard to standards to protect embryos or for representation in trust vis-à-vis people with mental handicaps or generations as yet unborn (Gethmann, 1996; Revermann, 1998). However, here is the assumption that the criteria for a „good“ life among these target groups are not greatly different from those of the people who draw up and implement these standards. With regard to the issue of the transferability of these criteria to organisms or even to non-living nature there are at best partial overlaps, for example with the standard of not inflicting any pain or torture on creatures capable of feeling pain. Even the immediately obvious demand to leave nature as it is or better has become, gets caught up in the traps of the naturalistic fallacies. No one knows whether nature, if it could decide „freely“, would like to be shaped exactly as it is now. The normative force of the present state is a human invention, not a natural condition of ethical judgement. It will remain a mystery to us whether there is a meaning or a developmental objective to the cosmic order, even if we believe that we know the mechanisms of evolution. It is we humans who interpret nature and objectives for shaping the environment, which, in turn, cannot be derived from nature itself. Even less can we make reliable statements about how such central human values as social justice or the development of a personality can be applied to

animals or plants. Conserving variety, not destroying geochemical cycle processes, not endangering the beauty of the landscape – all of these objectives deeply affect human interests and values, which can be justified within themselves, without having to escape into the speculation of a transfer of human moral systems to nature as a whole or parts of it that is barely transparent. In the areas in which transfer undoubtedly appears plausible this is also compatible with the prospect of moderate anthropocentrism (for example with pathocentrism). The crucial question of physiocentrism is the applicability of human empathy to non-human beings. It is difficult to draw a line between those beings that are included and those excluded. The Council has opted to draw the line in a restricted way: to include individual animals capable of experiencing pain. All other moral prescriptions need to be justified by human concerns, including symbolic values. *Pragmatic justification:* In addition to the epistemic and the normative argument there are also the pragmatic advantages that in most international negotiations a moderately anthropocentric view is more likely to meet with consensus than a physiocentric view, even if a number of international documents and conventions refer to the intrinsic value of the biosphere. In particular, it is the term „sustainability“, which has established itself internationally as a guiding principle, that assumes an anthropocentric view of the world (Schellnhuber, 1998; Knaus and Renn, 1998). Interpretation of sustainability as a distribution standard between the generations in the tradition of the Brundtland Report places man and his descendents at the centre of the considerations within the meaning of a moderate interpretation of anthropocentrism.

The image of nature that is used as a basis for the considerations in this Special Report emphasises the uniqueness of man vis-à-vis physiocentric views, but does not imply *carte blanche* for wasteful and careless dealings with nature. This anthropocentrism derives man's duty to conserve nature – also for future generations – from the life-preserving and life-enhancing meaning of nature for man. This is not just concerned with the instrumental value of nature as a „store of resources“, it is also a matter of the function of nature as a provider of inspiration, spiritual experience, beauty and peace (Birnbacher and Schicha, 1996). In this context it is important that man – as the addressee of the moral standard – does not regard nature merely as material and as a way towards his own self-realisation, but can also

assume responsibility for conservation of their cultural and social function as well as their existential value above and beyond the objective and technically available benefits (Honnefelder, 1993).

One of the first people to express this responsibility of human stewardship of nature in an almost poetic way was the American ecologist Aldo Leopold, who pointed out people's special responsibility for the existence of nature and land as early as the 1930s with the essay „The Conservation Ethics“. His most well-known work „A Sand County Almanac“ is sustained by the attempt to observe and assess human activities from the viewpoint of the land (a mountain or an animal). This perspective was clearly physiocentric and, revealed fundamental insights about the relationship between man and nature on the basis of empathy and shifting perspectives. His point of view had a strong influence on American environmental ethics and the stance of conservationists. Although the Council does not agree with this physiocentric perspective, the idea of stewardship has been one of the guiding ideas for this report (Picket et al., 1997).

Man is morally required to exercise a sort of stewardship over living nature because nature cannot claim any rights for itself but nevertheless has exceptional value that is important to man above and beyond its economic utility value (Hösle, 1991).

3 Special principles and standards for the use of the biosphere

3.1 The need for human interventions in the biosphere

Although some important conclusions for the ethical valuation of human use of the biosphere can be drawn from the specification of moderate anthropocentrism and the validity of the generally recognised primary principles of the common good, they are by no means sufficient for making a comparative valuation of competing standards for using natural resources.

Since contemporary society and the generations to come certainly use, or will use, more natural resources than would be compatible with a lifestyle in harmony with the given natural conditions, the conversion of natural land into anthropogenically determined agricultural land cannot be avoided (Mohr, 1995). Many people criticised human interventions into natural cycles as infringements of the applicable moral standards of nature conservation (for example, fastened onto the postulate of sustainability). But we should avoid premature conclusions here, as can be seen with the example of species protection. For example, where natural objects or phenomena are concerned that turn out to be a risk to human or non-human living creatures, the general call for nature conservation is already thrown into doubt (Gale and Cordray, 1994).

Not many people would call the eradication of cholera bacteria, HIV viruses and other pathogens morally bad (Mittelstraß, 1995) if remaining samples were kept under lock and key in laboratories. Also, combating highly evolved creatures such as cockroaches or rats meets with broad support if we ignore the call for the complete eradication of these species for the time being. An environmental initiative to save cockroaches would not be likely to gain supporters. If we look at the situation carefully, the valuation of human behaviour in these examples results from a conflict. Because the conservation of the species competes with the objective of maintaining human health or the objective of a hygienic place to live, two principles, possibly of equal ranking, come face to face. In this case the options for action, which may all involve a gradual infringement of one or more principles, would have to be weighed up against each other. A general ban on eradicating a species can thus not be justified ethically, in the

sense of a categorical principle, unless the maintenance of human health were to be given lower priority than the conservation of a species. But this could not be justified from the viewpoint of moderate anthropocentrism.

With regard to the issue of species conservation, therefore, different goods have to be weighed up against each other. Nature itself cannot show man what it is essential to conserve and how much nature can be traded for valuable commodities. Man alone is responsible for a decision and the resulting conflicts between competing objectives. Appreciation and negotiation processes are therefore the core of the considerations about the ethical justification of rules for using the biosphere.

But this does not mean that there is no room for categorical judgements along the lines of „this or that absolutely must be prohibited“ in the matter of biosphere use. It follows on from the basic principle of conserving human life that all human interventions that threaten the ability of the human race as a whole, or a significant number of individuals alive today or in the future, to exist should be categorically prohibited. The Council calls these intervention threats to the systemic functions of the biosphere. Such threats are one of the guiding principles that must not be exceeded under any circumstances, even if this excess were to be associated with high benefits. In the language of ethics this is a categorical principle, in the language of economics a good that is not capable of being traded. The „club“ of categorical prohibitions should, however, be used very sparingly because plausible trade-offs can be thought up for most principles, the partial exceeding of which appears intuitively. In the case of threats to existence, however, the categorical rejection of the behaviour that leads to this is obvious.

3.2 The use of categorical principles in biosphere protection

But what does the adoption of categorical principles specifically mean for the political moulding of biosphere protection? In the past a number of authors have tried to specify the minimum requirements for an ethically responsible moral system with respect to biosphere use. These so-called „safe minimum standards“ specify thresholds for the open-ended measurement scale of the consequences of human interventions that may not be exceeded even if there is a prospect of

great benefits (Randall, 1988; Randall and Farmer, 1995). In order to be able to specify these thresholds in more detail the breakdown into three levels proposed by the Council is helpful (WBGU, 2001). These levels are:

- the global bio-geochemical cycles in which the biosphere is involved as one of the causes, modulator or „beneficiary“,
- the diversity of ecosystems and landscapes that have key functions as bearers of diversity in the biosphere,
- the genetic diversity and the species diversity that are both „the modelling clay of evolution“ and basic elements of ecosystem functions and dynamics.

Where the first level is concerned, in which the functioning of the global ecosystem is at stake, categorical principles are obviously necessary and sensible, provided that no one wants to shake the primary principle of the permanent preservation of the human race. *Accordingly, all interventions in which important substance or energy cycles are significantly influenced at a global level and where globally effective negative impacts are to be expected are categorically prohibited.* Usually no stringently causal evidence of the harmful nature of globally relevant information is needed; justified suspicion of such harmfulness should suffice. The Council has already laid down in detail in a proposal for risk valuation and management how the problem of uncertainty in the event of possible catastrophic damage potential should be dealt with (risk type Cassandra: WBGU, 2000).

On the second level, the protection of ecosystems and landscapes, it is much more difficult to draw up categorical rules. Initially, it is obvious that all interventions in landscapes in which the global functions mentioned on the first level are endangered must be avoided. Above and beyond this, it is wise from a precautionary point of view to maintain as much ecosystem diversity as possible in order to keep the degree of vulnerability to the unforeseen or even unforeseeable consequences of anthropogenic and non-anthropogenic interventions as low as possible. Even though it is difficult to derive findings for human behaviour from observations of evolution, the empirically proven statement „he who places everything on one card, always loses in the long run“ seems to demonstrate a universally valid insight into the functioning of systemically organised interactions. For this reason, the conservation of the natural diversity of ecosystems and landscape forms is a categorical principle, whereas the depth of

intervention allowed should be specified on the basis of principles and standards capable of compensation.

The same can be said for the third level, genetic and species protection. Here too, initially the causal chain should be laid down: species conservation, landscape conservation, maintaining global functions. Wherever this chain is unbroken, a categorical order of conservation should apply. These species could be termed „*primary key species*“. This includes such species that are not only essential for the specific landscape type in which they occur but also for the global cycles above and beyond this specific landscape type thanks to their special position in the ecosystem. Probably, it will not be possible to organise all species under this functional contribution to the surrounding ecosystem, but we could also think of groups of species, for example humus-forming bacteria. In second place there are the species that characterise certain ecosystems or landscapes. Here they are referred to as „*secondary key species*“. They, too, are under special protection that is not necessarily under categorical reservations. Their function value, however, is worthy of special attention. Below these two types of species there are the remaining species that perform ecosystem functions to a greater or lesser extent. What this means for the worthiness for protection of these species and the point at which the precise limit for permitted intervention should be drawn, is a question that can no longer be solved with categorical principles and standards but with the help of compensatory principles and standards. Generally, here, too, as with the issue of ecosystem and landscape protection, the conservation of diversity as a strategy of „reinsurance“ against ignorance, global risks and unforeseeable surprises is recommended.

It remains to be said that from a systemic point of view, a categorical ban has to apply to all human interventions where global closed loops are demonstrably at risk (WBGU guard-rail principle model). Above and beyond this, it makes sense to recognise the conservation of landscape variety (also of ecosystem diversity within landscapes) and of genetic variety and species diversity as basic principles, without being able to make categorical judgements about individual landscape or species types as a result.

3.3 The use of compensatory principles and standards in biosphere protection

In order to evaluate partial infringements of compensatory principles or standards, which are referred to in the issue of conserving specific species, ecosystems or landscapes, we need rules for decision-making that facilitate the balancing process. In the current debate about rules for using the environment and nature it is mainly teleological valuation methods that are proposed (Hubig, 1993; Ott, 1993). These methods are aimed at

- estimating the possible consequences of various options for action at all dimensions relevant to potentially affected people,
- recording the infringements or fulfilments of these expected consequences in the light of the guiding standards and principles and
- then weighting them according to an internal key so that they can be weighed up in a balanced way.

On the positive side of the equation there are the economic and cultural values created by use, for example in the form of income, subsistence (self-sufficiency) or an aesthetically attractive landscape (parks, ornamental gardens, etc.); on the negative side there are the destruction of current or future usage potentials, the loss of unknown natural resources that may be needed in the future and the violation of aesthetic, cultural or religious attributes associated with the environment and nature.

There are therefore related categories on both sides of the equation: current uses vs. possible uses in the future, development potentials of current uses vs. option values for future use, shaping the environment by use vs. impairments to the environment as a result of alternative use, etc. With the same or similar categories on the credit and debit side of the balance sheet the decision is easy when there is one option that performs better or worse than all the other options for all categories. Although such a *dominant* (the best for all categories) or *sub-dominant option* (the worst for all categories) is rare in reality, there are examples of dominant or sub-dominant solutions. Thus, for example, the overfelling of the forests of Kalimantan on the island of Borneo in Indonesia can be classed as a sub-dominant option since the short-term benefit, even with extremely high discount rates, is in no proportion to the long-term losses of benefits associated with a barren area covered in *Imperata* grass. The reculti-

vation of a barren area of this kind requires sums many times the income from the sale of the wood, including interest. Apparently there are no cultural, aesthetic or religious reasons for conversion of primary or secondary woodland into grassland. This means that the option of deforestation should be classed as of less value than alternative options for all criteria, including economic and social criteria. At best, we can talk about a habit of leaving rainforests, as a „biotope not worthy of conservation“, to short-term use. But habit is not a sound reason for the choice of any sub-optimum option. As mentioned at the start of Chapter 2, habit as experienced morality, does not have any normative force, especially when this is based on the illusion of the marginality of one's own behaviour or ignorance about sustainable usage forms.

But if we disregard the dominant or sub-dominant solutions, an appreciation between options that violate or fulfil compensatory standards and principles depends on two preconditions: best possible knowledge of the consequences (what happens if I choose option A instead of option B?) and a transparent, consistent rationale for weighing up these consequences as part of a legitimate political decision process (are the foreseeable consequences of A more desirable or bearable than the consequences of option B?) (Akademie der Wissenschaften, 1992).

3.4 Knowledge and values as a basis for appreciation processes

Adequate knowledge of the consequences is needed in order to reveal the systemic connections between resource use, ecosystem reactions to human interventions and socio-cultural condition factors (Wolters, 1995). With the Council's *syndrome concept*, a number of such systemic connections have been recorded. The ways that the individual elements of the system work are identified by findings of the various scientific disciplines and then integrated in an interdisciplinary network (WBGU, 1998). The task of applied ecological research, for example, is to show the consequences of human intervention in the natural environment and how ecosystems are burdened by different interventions and practices. The economic approach provides a benefit-oriented valuation of natural and artificial resources within the context of production and consumption as well as a valuation of transformation processes according to the criterion of effi-

ciency. Cultural and social sciences examine the feedback effects between use, social development and cultural self-perception. They illustrate the dynamic interactions between usage forms, socio-cultural lifestyles and control forms. Interdisciplinary, problem-oriented and system-related research contribute to forming a basic stock of findings and insights about functional links in the relationship between man and the environment and also in developing constructive proposals as to how the basic question of an ethically justified use of the biosphere can be answered in agreement with the actors concerned. All of these aspects are discussed in detail in the specialist chapters of the 1999 WBGU Annual Report (WBGU, 2001).

Accordingly, in order to ensure sufficient biosphere protection, scientific research, but especially transdisciplinary system research at the interface between natural sciences and social sciences, is essential. Bringing together the results of interdisciplinary research, the policy-relevant choice of knowledge banks and balanced interpretation in an environment of uncertainty and ambivalence are difficult tasks that primarily have to be performed by the science system itself. How this can happen in a way that is methods-logically sound, receptive to all reasonable aspects of interpretation and yet subjectively valid will not be discussed in more detail here. Initiatives such as the UNESCO programme „Ethics in Science“ show ways of making scientific policy advice responsible and factual.

But knowledge alone does not suffice. In order to be able to act effectively and efficiently while observing ethical principles, it is necessary to shape the *appreciation process* between the various options for action *according to rational criteria* (Gethmann, 1998). To do this it is first of all necessary to identify the dimensions that should be used for a valuation. The discussion about the value dimensions to be used as a basis for valuation is one of the most popular subjects within environmental ethics. Of the various branches of science, economics in particular has taken on the issue of finding a common denominator for comparing goods and bads and developing methods to evaluate options with different portfolios of good and bad consequences. For this reason, in the following the economic approach to the valuation of biosphere services (referred to in short as „economic valuation“ in the following) is presented and discussed.

4 Economic valuation of biosphere services

4.1 Economic valuation as an expression of specific evaluation ethics

The discussion about ethical principles and standards for the protection and use of the biosphere has shown that criteria have to be found on the basis of which there can be a breakdown into categorical and compensatory principles. In addition, decision-making aids are needed if compensatory principles are being used.

It is precisely such cost-benefit considerations, such as those that should be used with compensatory principles that are at the heart of the economic approach. This is the suitable point to link together ethical and economic valuation approaches. It is a special concern of the Council not to view the economics and ethics as opposing camps when evaluating the biosphere, but much rather as two complementary approaches, where the economic standards weighted for efficiency can be assigned to the superior term „ethics“. This means that the economic valuation approach is seen as special valuation perspective within the larger realm of ethics. Economic valuation theory also has an ethical basis in the form of the concept of „social subjectivism“. This ethical theory is largely determined by three components (Marggraf and Streb, 1997):

- *Utilitarian value theory*: According to this theory only the well being of human individuals is of value. Speculations about the utility function of institutions (state, company, etc.) are excluded from the analysis.
- *Aggregation of individual interests*: In order to evaluate a state of affairs, the individual interests are added together. There are various ways of doing this that are all subject to an intensive ethical discussion but will not be dealt with in detail at this point.
- *Consequential impacts as prime criterion of correct action*: An action is regarded to be correct if its consequences for the individuals are seen as positive on the whole. The total economic valuation of the action has to come to a positive result.

The theory that ethical and economic valuation approaches do not contradict each other, but that the economy also has an ethical basis in the form of „social subjectivism“ leads the findings for the whole of Chapter 4.

In the following economic criteria and arguments are to be found which can be applied as an integral part of the ethical valuation concept. Economics can derive criteria for the boundary between categorical and compensatory criteria and it can name criteria that can be referred to as support in a transparent, consistent appreciation process. The Council calls for greater account to be taken of economic considerations in biosphere protection. However, it is not one-sidedly in favour of the economic valuation approach; instead, it shows a clear link between ethics and the economy, without giving priority to the economic approach.

Building on these introductory deliberations on the relationship between the economics and ethics, first of all the methodological foundations and the need for explanation of economic valuation approaches will be shown (Section 4.2). Then the basic procedure during an economic valuation of the biosphere will be presented (Section 4.3). An important step here is the determination of value categories that can be assigned to the biosphere (Section 4.4). The economic calculation cannot be transferred to the valuation of the biosphere without reservations. For this reason a discussion about the limits of the economic valuation approach is necessary (Section 4.5). Once the issue of the applicability has been clarified, valuation methods to determine individual willingness to pay are needed (Section 4.6). The variety of existing value dimensions makes the choice of options for action more difficult. That is why the Council is trying – in a next step – to provide a ranking of the value categories from a global perspective (Section 4.7). The conclusion is a general assessment, associated with a recommendation for research, on the extent to which economic valuation approaches can be linked to the requirement for sustainability (Section 4.8).

4.2 Methodological foundations and explanatory potential of economic valuations

In terms of method, economic valuations build upon the monetarisation of individual preferences. For the world of politics, but also for the people affected, the „trick“ of economic valuation methods lies in that they express in monetary terms the alternative actions desired by the public and implemented by politicians. This is how the quantitative foundations for political decisions are laid. Even if monetari-

sation does not always succeed, it still remains the desirable goal. Economic valuations are often exposed to strong criticism because they determine monetary values for the natural environment. However, an economic valuation can often consist of much more than of the process of pure monetarisation; thus, the critique of this approach should always take into account what the valuation method is supposed to explain.

It is monetarisation that creates the preconditions for economic valuation methods to be applied to the environment – in this case to the valuation of biosphere services. Building on the perspective of moderate anthropocentrism, economics regards people as the central body for the derivation of monetary values. In contrast, the physiocentric view ascribes to nature an intrinsic value that exists independently of individual preferences, and it consequently rejects transferring the economic calculation to the environment. In order to somewhat tone down this conflict between anthropocentrists and physiocentrists, the methodological foundations of the economic valuation should be presented first. Besides, in this context, it is especially important to explain in more detail, which explanatory potential is seen as underlying economic valuation.

Individual preferences are the starting point of economic valuations. They are the reference points for the valuation approaches based on neo-classical welfare economics. In addition to the focus on the individual, the desire for additional utility maximisation is the second assumption underlying the economic valuation approach, i.e. individuals aim at realising those alternatives that provide them with the greatest benefits.

Based on these fundamental assumptions, the task of economic valuation is also seen in recording and valuating the benefits to be gained by various alternative political actions and reproducing them in a comparable utility equivalent – usually in monetary terms. In an expanded form this can be found in formalised cost-benefit analyses. They are conducted in the political sphere in order to increase the rationality of political decisions and contribute to objectivisation (Cansier, 1996).

When assessing economic valuations it is essential not only to have a critical look at the methodological foundations but also to consider the explanatory potential of the economic valuation approach. In this way, economics by no means pretends to assign a value to all

things. Rather, an attempt is made to make the usually implicit valuations in a society transparent and thus relevant to decisions (Burtraw and Portney, 1991; Kosz, 1997).

This explanatory potential of economic valuations can also be applied to the valuation of the biosphere. Decisions on protection of the biosphere are unavoidable. For example, the whole of biological diversity cannot be conserved in its current state. It will be essential to consider carefully the extent to which man wants to conserve biological diversity. On the one hand, such decisions occur explicitly if, for example, the areas and their associated species inventories to be designated as protected areas are at stake. On the other hand, implicit considerations are made if a road is built through a semi-natural ecosystem for the purposes of the economic development of a region, for example. If corresponding ecological considerations have not been included in the plans for the road-building, an implicit valuation and prioritisation should be included in the decision for construction along the lines that the economic benefit should or should not be given higher priority than the loss of biological diversity that may be associated with the construction of the road.

No one can escape from the need to act and to make a decision. Implicitly or explicitly, valuations are conducted constantly (Perrings et al., 1995; Goulder and Kennedy, 1997; Weikard, 1998). Because of this inevitability of decisions, especially when protecting the biosphere, the issue of valuation should be viewed pragmatically. Emphasising that nature has intrinsic values is of no help with most decision problems that have to be taken in political reality (Pearce and Moran, 1998). The anthropocentric approach thus has higher operability because it does not set intrinsic values of nature as absolutely. Instead, the anthropocentric approach aims at weighing up different values of human societies (Heister, 1997). Another strength of anthropocentric justifications for the conservation of biological diversity lies in the fact that anthropocentric approaches can be derived directly from central (liberal-democratic) principles.

With the stance of moderate anthropocentrism advocated by the Council it is at the same time possible and intended to link ecological aspects to the individual cost-benefit rationale. Because of its integrating function, moderate anthropocentric nature ethics appears to be the only perspective that can acquire social and thus legal binding force. Only this approach builds almost entirely upon

the rules that already exist in and justify a civilised society (Geisendorf et al., 1998).

Along these lines, the attempt by economics to render such decision-making situations more transparent by means of monetarisation should be viewed as an approach that contributes to demonstrate the economic relevance of biosphere services. In this connection, the exact calculation of the benefits granted by the biosphere is less important. The *demonstration function of economic valuations* is decisive (Fromm, 1997). That way, valuation studies indicate the economic relevance of environmental problems (Repetto, 1993; Costanza et al., 1997) and thus greatly help to increase public awareness of environmental issues (Hampicke, 1991). The conversion, or more modestly, the attempt at conversion of biosphere services into monetary values also makes sense because the value is expressed in a „currency“ that can be understood and further processed in the political decision-making process (Daily, 1997). The results of economic valuations can, thus, not only be used as arguments for anthropocentric conservation. Instead, they can also be helpful for physiocentric viewpoints, especially because monetary values are more convincing than variously perceived intrinsic values (Hampicke, 1991).

4.3 Overview of the procedure for economic valuation of the biosphere

The following procedure would be suitable for an economic valuation of the biosphere (Fromm, 1997):

- *Identification of the benefits granted by the biosphere*, i.e. the economically relevant functions (on a quantitative scale): In terms of content, reference can be made here to the functions of the biosphere drawn up and discussed in the 1999 Annual Report of the Council (WBGU, 2001). In terms of method, reference can be made to the concept of the total economic value, which is presented below as a heuristic instrument for determining the different benefits granted by the biosphere (Section 4.4).
- *Reviewing the applicability of the cost-benefit rationale to the biosphere*: Here the criteria of the limited substitutionability and of the irreversibility of damages are the ones that place limits on the application of the economic rationale. This point will be discussed in detail because of the importance of this step in the analysis (Sec-

tion 4.5).

- *Monetarisisation of the benefits created:* There are various valuation methods that attempt, indirectly via an analysis of market data or directly via survey methods, to derive an economic value from individual preferences (Section 4.6).
- *Calculating the present values of the monetarised benefits:* If monetarisation is desired, the time profile of the benefit flows or of the impairment should be taken into account, i.e. future utility or disutility factors should be discounted to the present value. However, at this point it is not intended to go into the complicated problems associated with the choice of the appropriate discount rate needed to weighing up the inter-generational costs and benefits. Although these problems are central to all valuation issues, in this Report the valuation aspects specific to the biosphere should be at the fore.

If a monetarisation procedure is used as a basis for an economic valuation, it is immediately clear that an economic valuation does not have to, and should not, remain limited to monetarisation. Instead, in an economic valuation many other quality aspects should be taken into account besides monetarisation, for instance the identification and description of the services of natural assets, in this case specifically the biosphere services (Section 4.4). An aspect of quality of this kind is also the second stage of analysis that indicates the limits of the economic rationale (Section 4.5).

4.4 Value categories of biosphere services from an economic perspective

INDIVIDUAL VALUES AND „TOTAL ECONOMIC VALUE“

The various individual „values“ that have been developed in economic valuation theory cover different dimensions of the problem (e.g. in terms of time, the short-term foreseeable versus the long-term hoped for use) and various sections of the biosphere. In a kind of imaginary experiment one can assume a „Total Economic Value“ (TEV) along all sections and across the time axis. This „Total Value“ is supposed to include all value aspects that determine demand for environmental goods (Pearce and Turner, 1990). Its intended elements are shown in Fig. 2. In summary they show (Meyerhoff, 1997):

$$\begin{aligned}
 \text{TEV} &= [\text{use-dependent values}] + [\text{non-use dependent values}] \\
 &= [\text{direct values} + \text{indirect values} + \text{option values}] + \\
 &\quad [\text{existence value} + \text{other non use-dependent values}]
 \end{aligned}$$

In this context, the (mathematically unnecessary) brackets indicate a certain affinity of certain types of values; these will be explained now (with respect to the value categories, cf. the deliberations on the economic valuation of freshwater; see WBGU, 1998). Furthermore, in each case the link between these value categories and the properties of the biosphere services as „goods“ will be shown. The extent to which they are a private or a public good will therefore be examined. Public goods (collective goods) differ from private goods in that there is no rivalry in consumption. Moreover, the exclusion principle cannot be applied to them. This distinction between the two types of good (although in reality there are mostly mixed forms) is important both in the development of suitable approaches for the protection and use of the biosphere as well as for the attempt to determine the economic value of biosphere services. The determination of individual preferences and the conversion into monetary values heavily depends on whether the preferences are expressed on markets (biosphere services with predominantly private good character) or whether the preferences have to be determined in another way, i.e. with corresponding valuation methods (biosphere services with predominantly collective good character).

The breakdown into use-dependent and non-use dependent values is at the fore in Fig. 2. However, a breakdown of this kind only makes sense if use is defined very narrowly. The term „non-use-dependent values“ is not supposed to suggest that no gain in benefits is associated with these values. Much rather, a limited definition of use is applied that aims at a direct use of the biosphere linked to a personal proximity to the biosphere service. Thus, for example, the use of the symbolic value (if instrumental usefulness of the symbolic value is assumed) or of the economic benefit value, presupposes physical proximity to the biosphere, whereas with the existence value the mere knowledge of a section of the biosphere far from one's personal habitat is enough to create social utility, without directly using biosphere services.

The *direct values* comprise an *economic instrumental value* and a *symbolic value*. The economic value can be seen in the fact that bios-

phere services can be used for production and consumption purposes. If nature is used for biosphere production services such as wood, grain, cotton, etc., this is a private good. A frequently underestimated value of the biosphere is the *experience value* (in the sense of event or „great experience“). The experience value is termed a consumption value because the individuals use the aesthetics of nature directly as a consumer good. This means that the experience value is just as much an economic value as the use of resources for the production of goods. In contrast to the dominant case of the private good properties of economic use values, the collective good character of the biosphere tends to predominate the experience value.

Symbolic values are assigned by individuals to certain elements of the biosphere. For example, this includes holy animal and plant species, possibly also parts of the non-living biosphere, such as holy rivers or mountains. On the whole, the symbolic value comprises the religious or spiritual values assigned to sections of the biosphere. A clear designation of the symbolic values as public or private goods is not possible at a fundamental level. A decision about the predominant good components can only be made on a case-by-case basis.

The *indirect values* also include the varied ecological services that the biosphere performs for man (e.g. many functions in bio-geochemical cycles, flood control, etc.; Fig. 2). The maintenance of the specific efficiency of ecosystems is usually a good that should be secured publicly because no potential users can be excluded from the ecological services that people tend not to perceive constantly and consciously, but rather notice only when they are lost. As a consequence, there are also no private providers who take care of the maintenance of the ecological functions.

The *option value* of biological diversity is specified with the intention of keeping open the future use of a resource. In this sense, the option value can be seen as a sort of insurance premium. Provided that it refers to future uses it is one of the economic values. In a broader definition, the option value can refer to all value categories because it indicates the possibility of a future realisation of a value category (Table 2). If the option value refers to a non-use-dependent value, such as the existence value, the option value could also be assigned to the category of non-use-dependent values. In Fig. 2 this fuzzy assignment is indicated by the broken line.

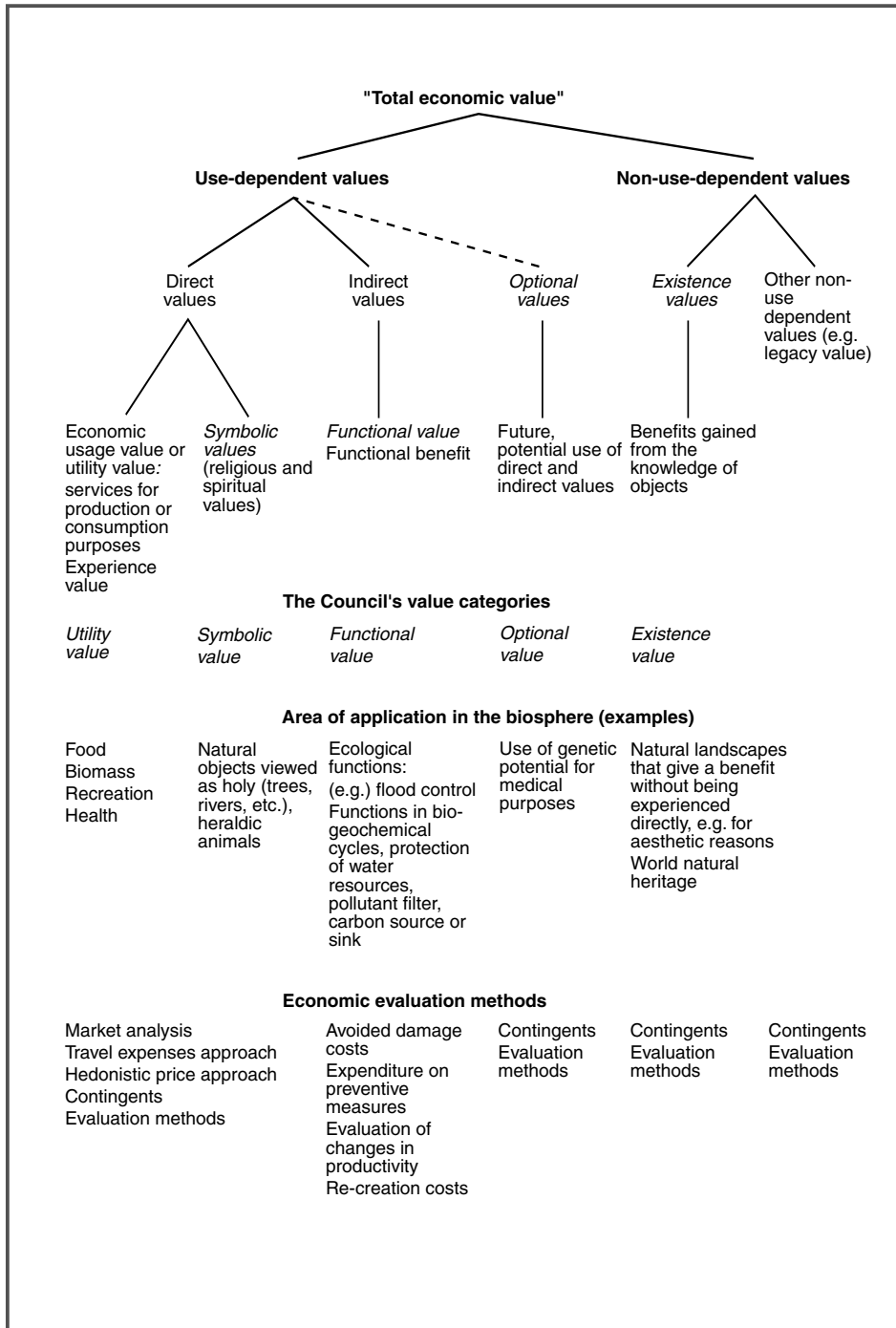


Figure 2: The composition of the total economic value of biosphere services

Source: WBGU on the basis of Pearce and Moran, 1998; Meyerhoff, 1997

The *non-use-dependent values* are – as described above generally – of a different kind, as the comparison of experience and *existence values* shows. In contrast to the experience value, the existence value does not relate to any use. Instead, the awareness of the mere existence of natural goods causes satisfaction or a feeling of well-being. For example, many people give donations for the protection of tropical rainforests or the conservation of coral reefs without ever having used them in any way whatsoever, not even as a cradle of aesthetics or recreation. A separation from the symbolic value, which is included in the use-dependent values here, is not always clear and has to be decided on a case by case basis. The intrinsic value can be clearly differentiated from the existence value. The existence value is anthropocentrically defined and is derived from individual considerations of assigning a value to the mere existence of something, whereas the intrinsic value should be understood from a physiocentric point of view and cannot be traced back to individual preferences. Since no one can be excluded from this value and there are not any rival relationships, either, there is very rarely a purely public good to be seen here.

The *bequest value* results from the desire to pass on elements of the biosphere to future generations because of their symbolic and identification values. As with the existence value there is a close link to the use-dependent symbolic value. For example, the bequest value is expressed in the fact that voluntary contributions are used for nature conservation areas. But, at the same time, this example clearly illustrates that it is very difficult to separate the bequest value from the other value categories. There may be many reasons for the use of voluntary contributions for nature conservation areas. For example, such contributions may be related to the experience value, the existence value, the symbolic value or – among educated individuals – the functional value. These difficulties in classifying the bequest value can also be seen in the literature, where it is viewed both as an inter-generational option value and as a special form of the existence value (Pommerehne, 1987). For this reason, the bequest value is listed in Fig. 2 only for reasons of completeness and will not be explicitly included in the following as a value category given major consideration by the Council.

Other values, such as information values, values with respect to scientific research interests, amenity values, biophilic values, etc.

(Ott, 1999) can be found in the literature. However, they can be assigned to the categories listed above.

HUMAN PERCEPTION OF BIOSPHERE VALUES

From Fig. 2 and the deliberations on the good characteristics of the value categories it can be seen that there are great differences in the degree to which the value categories for an economic valuation can be measured. For example, individuals perceive the various services of the biosphere very differently. Whereas direct values are directly accessible for consumption or production purposes and are therefore known, the function values in particular (indirect values) usually escape human perception. Awareness of the importance of these biosphere services usually only manifests itself when the service in question is no longer provided to the usual extent, e.g. as a consequence of anthropogenic interventions.

This varying perception of biosphere services has two important consequences for an economic valuation:

- The results of a market valuation and the economic value of biosphere services differ in most cases. In a market valuation only the preferences revealed on the market are taken into account. Because of the collective nature, the preferences for many biosphere services are not included in a market valuation. Nevertheless, the biosphere has an economic value, which, for example, can be seen in the fact that if there is an impairment of biosphere services, there is damage to human health and to assets created by man that can cause high financial losses. Examples are flood damage or the reduced natural protection against avalanches as a result of human interventions in ecological systems. In these cases, it is the task of economic valuations to identify the difference between market valuation and the „true“ economic value.
- In many cases the limited individual perception or market valuation of biosphere services results in a massive underestimation of the value of the biosphere to people. Insofar as individuals do not recognise ecosystem links and do not assign the appropriate value to biosphere services, the limits of the economic rationale become clear. However, such limits do not fundamentally throw the economic approach into question. But they do make it clear that the result of an economic valuation cannot alone be the only criterion for political decisions and still need interpretation within the con-

text of democratic decision-making processes.

THE FUNCTION OF THE CONCEPT OF TOTAL ECONOMIC VALUE

The Council sees the concept of total economic value primarily as a heuristic instrument. The aim of the concept of total economic value in this context is not to derive an arithmetical factor from the valuation procedure and to divide this proportionately among experience, existence, option, function, symbolic values, etc. These attempts would remain unsatisfactory because there would be too much overlap in the contents of the value categories (Geisendorf et al., 1998). Furthermore, a quantitative value would feign a degree of exactness that the concept of total economic value cannot deliver. For this reason the Council does not regard the purpose of this procedure to determine total economic value solely as a challenge of quantification. Instead, this procedure is understood as a system of arguments in which elements of quality should, and must, be taken into account (Section 4.5). In addition, the procedure to determine total economic value includes the call for completeness when considering value categories. In this context, total economic value also implies an assessment of natural assets, thus once again emphasising the heuristic character of the approach.

In this context, reference can be made to the respected, but also criticised, study by Costanza et al. (1997). Here, an attempt was made to evaluate globally relevant ecosystem services. As a result of this study, an estimate of US-\$ 33,000 billion per year was determined, i.e. globally relevant ecological functions, such as regulating the carbon cycle, the water cycle or food production, have a total value that exceeds the value of all goods and services produced worldwide by a factor of 1.8. Even if the various methods of determining the monetary values of the ecological services can be criticised, the study forced the authors to list as far as they could all ecological services. In addition, the discussion following the publication showed that, regardless of the exactness of the results, the relevance of the ecological services is increasingly being considered. This, too, is an example of the above-mentioned demonstration function of economic valuations.

Advantage of the concept of total economic value is to be seen in the possibility to apply it – mentally – to regions. Economic values for

certain areas can be determined intuitively or as estimates, and types of land use can be derived from this (WBGU, 2001).

4.5 Limits to the applicability of the economic rationale to the valuation of biosphere services

THE SUBSTITUTION PARADIGM AND THE ESSENTIALITY OF BIOSPHERE SERVICES

The assumption of the substitutability of goods and production factors is characteristic of the economic method. The environment is also subjected to this substitution paradigm within the context of the neo-classical theory, which is the foundation of the economic valuation approach. It is assumed that biosphere services are substitutable. Viewing the substitutability of species, however, clearly shows that a complete substitution of a species is not possible, because every species performs highly specific tasks in the ecological system context. Actually, one can talk about substitutability only with respect to genetically identical species, although then, logically, there are no longer two different species, but just one identical species (for detailed information on the substitutive and complementary relationship between species: Fromm, 1999). Thus when the economic rationale is applied, the question arises whether the biosphere service, which is to be valued, is an essential service, i.e. that it cannot be dispensed with (Beirat Umweltökonomische Gesamtrechnung, 1995; Fromm, 1997). In the literature the term „critical nature capital“ is also used for the essential functions of nature (Geisendorf et al., 1998).

For the applicability of economic valuation these considerations mean that it has to be decided which biosphere services are indispensable in a narrow sense. This task cannot be solved by recourse to the preferences of the citizens because these do not usually have the required level of knowledge for identification and adequate value assignment. This means that an external valuation body independent of individual preferences is needed (Farnworth et al., 1981), which may also be able to correct the individual preferences meritocratically (Common and Perrings, 1992). In this connection about the so-called „ecological gap“ in the economic valuation of ecosystems was pointed out (Pearce, 1976).

Thus, with respect to the valuation of many biosphere services a great deal of scepticism prevails as to whether individuals have the skills to assess and value ecological systems appropriately. The Council recognises the significance of expert knowledge in the valuation of biosphere services. Many valuation issues cannot be solved without recourse to expert knowledge. This applies in particular to the valuation of those biosphere's ecosystem services that are beyond immediate perception and thus cannot create any individual willingness to pay. However, it has to be checked through which procedures of the experts enter political decision-making. It should not work the way that small groups of experts make decisions that may have noticeable economic consequences for the majority of the population without there being democratic control over this process (cf. the various methods for recording and justifying standards for biosphere protection in Chapter 6).

In an ideal situation it should be ensured that individuals, at least in their majority, would come to the same valuation as the experts if only they are fully informed of the consequences. Meritorial interventions should therefore always be checked critically. This necessary recourse to expert knowledge is, however, not a fundamental reservation about economic valuations, but much rather a problem of information that should be solved within the context of the processes of forming social decision-making (Sections 4.8 and 6).

THE PROBLEM OF IRREVERSIBILITIES

In addition to the non-substitutability or the essentiality of biosphere services, the problem of irreversibility of impairments to the biosphere occupies a key position in the discussion of problems relating to economic valuation. In association with economic and ecological criteria for irreversibility, damages to the biosphere can be termed irreversible if they

- cannot be compensated by natural regeneration mechanisms and
- cannot be reversed or substituted by the use of anthropogenic-technical resources (WBGU, 1995; Fromm, 1997)

within planning periods relevant to man.

The core problem of irreversible environmental damage can be seen in the combination of (1) the irretrievability of the benefit, which can be realised with „good“ environmental quality and can be lost through environmental damage, and (2) the uncertainty about the

level of this loss of benefit. A currently unavoidable irreversibility leads – in the case of positive future benefits – to inevitable concessions to the welfare of future generations, expressed in increased damage and in the elimination of options for action (Fisher and Krutilla, 1974). For this reason, it is largely undisputed in the literature that the conventional cost-benefit rationale is unsuitable for the valuation of irreversibilities (Fromm, 1997).

With respect to irreversibilities the „safe minimum standard“ has been proposed as an alternative decision-making rule (Ciriacy-Wantrup, 1968; Bishop, 1978). This is based on the fact that future generations should not have imposed on them any unreasonable cost in the form of irreversible damage. At the same time, however, measures should be taken to avoid the current generation having to bear high opportunity costs resulting from the avoidance of irreversible burdens on the biosphere. In this context, irreversibilities could be avoided provided that the opportunity costs of the current generation were not unacceptably high. Consequently, with a view to safe minimum standards, there is a call for binding guiding principles to be set for the application of the economic cost-benefit rationale. This guarantees a minimum level of protection provided that the social cost of the protection of the biosphere do not become unacceptably high (WBGU, 1994).

Within the context of safe minimum standards using the example of species protection would mean: How many potential benefits are lost to man if a safe minimum of protection for species is guaranteed? If it is assumed that every species has a positive value, the problems of systematic recording of the benefits are avoided by concentrating on the opportunity costs. At the same time, the burden of proof is placed on those who want to exploit natural resources or prefer alternative uses that destroy species (WBGU, 1994).

CONCLUSIONS ABOUT THE APPLICABILITY OF THE ECONOMIC VALUATION APPROACH

Both, the problem of the non-substitutability and the risk of irreversibilities, linked to the uncertainty about future benefits, reveal the limits of the economic rationale based on individual preferences. As a consequence, a complete determination of the value of biosphere services by means of individual valuations should be assessed sceptically. Two conclusions can be drawn:

- A determination of values of all biosphere services that is based on individual preferences is practically impossible. The only benefit of calculating a monetary value is to add to the overall economic value an „appropriate“ supplement that has been determined on the basis of individual valuations – directly via interviews of indirectly via market valuations. But suitable scientific criteria for measuring such an „appropriate“ supplement are largely not in place, with the result that this supplement can only be derived qualitatively from expert knowledge. However, the important demonstration function of economic valuations remains in place. The exact level of the economic value determined does not play the decisive role then. Instead, an approximate idea about the extent of the problem can be created without the determined value as such having to be taken too seriously.
- The inaccuracies that are unavoidable in the determination of an economic value for biosphere services (on the basis of their character as a collective good) and the insufficient knowledge of ecosystem interconnections illustrate that economic valuations cannot be the sole basis for political decisions. Economic valuation methods are thus only one of many assisting factors that can be used to make decisions. Here, in particular, ecological and social criteria should be included in the weighing up process, unless they can be integrated in an economic valuation. The results of valuation studies therefore need further interpretation within the context of the democratic decision-making process, irrespective of whether monetarisation occurred, as was implied in this section when the limits of the applicability of the economic rationale were discussed. Furthermore, it has become obvious that valuation issues are always an economic-ethical problem (Hampicke, 1991), because the partial solution of the idea of an individual valuation needs an ethical justification just as much as the economic approach itself. The confrontation of economics and ethics in the form of a conflict does not lead any further, anyway. Instead, economics should be understood as an expression of certain valuation ethics.

4.6 Overview of economic methods of environmental valuation

The literature about economic methods for environmental valuation is diversified and extensive. A comprehensive overview of the various valuation methods with their respective strengths and weaknesses would go beyond the limits of this Special Report. For this reason, only a brief introduction to the foundations and typical problems of economic valuation methods is given. A very good overview of the level of scientific discussion of the dominant valuation methods with respect to their application to problems of relevance to the biosphere can be found in a Federal Environmental Agency study (Geisendorf et al., 1998; see also Marggraf and Streb, 1997; Endres and Holm-Müller, 1998).

In principle, a distinction can be made between direct and indirect methods. *Indirect methods* rely on market data in order to reach, on the basis of these data, conclusions about the individual willingness to pay for the elements of the natural environment to be valued. The term „indirect“ was chosen because values for environmental goods are derived from the demand patterns for goods traded on markets. This approach builds upon the premise that the environmental good is in a complementary or substitutive relationship to goods traded on markets.

This category includes, for example, approaches that (1) take avoidable damage cost into account when determining the value (replacement cost approach), (2) infer an economic value for the environment from the expenditure for preventive measures (remedial or compensation cost approach), (3) calculate values on the basis of changes in productivity (production function approach) and (4) use as an economic value the cost needed to replace the degraded section of the biosphere (replacement cost approach) (Cansier, 1996; Geisendorf et al., 1998). However, most frequently the travel cost method and the hedonic price method are used for environmental valuation. These are presented in more detail below and briefly subjected to an evaluation.

Direct methods use special interview techniques to ask the economic subjects about their willingness to pay or their compensation demands (Cansier, 1996). Here, in particular, the contingent valuation is of interest, which is also dealt with in more detail below.

TRAVEL COST METHOD

As the name of the procedure implies, the complementary relationships between private travel costs and environmental goods are used as a basis to determine the individual valuation. The expenditure in terms of money and time that individuals use to travel to a nature conservation or recreation area are used to draw up a demand function (price-quantity-function) that makes the frequency of a visit (quantity) to a nature conservation area dependent on the costs incurred (price). The consumer's surplus, as an expression of the overall valuation, is equal to the area below the demand function. With this simple variant of the travel cost method, demand is explained only through travel expenses. Implicitly this also assumes that all people react to cost variations in the same way. For a more realistic analysis, the assumption of identical individual demand functions should be given up and further determinants of demand for frequency of visits, such as income, age, sex and educational level, should also be considered (Pommerehne, 1987).

Even if such an expansion of the travel cost method succeeds, other problems remain: For example, difficulties arise when an valuation of alternative degrees of quality is to be carried out. As a result of the use of current market data this approach initially calculates only the value of a nature conservation area at a given quality. However, for environmental policy it is much more interesting to see how a change in the quality is evaluated. Other difficulties are: A visit to a conservation area does not have to be the sole purpose for a journey. Several places can be visited in one journey. Or: The visit is a by-product of a journey with a completely different destination. If, in these cases, all the travel costs were taken into account in determining the full extent of the demand function, the willingness to pay determined may considerably exceed the actual willingness to pay (Cansier, 1996). Furthermore, it is not possible to record option, bequest and existence values with this approach (Pommerehne, 1987). Nevertheless, the method is assessed as viable for determining the willingness to pay for a public good of limited space (Smith and Kop, 1980).

HEDONIC PRICE METHOD

The basic idea of the hedonic price method is the consideration that the price - in this case representing a piece of property – is dependent beside of its standard and size on the quality of the residential surroundings. The residential surroundings also encompass the quality of the environment. The aim of the method is to isolate the influence of environmental quality from the large number of factors determining price. In this way, there is an opportunity to derive from market reactions information about the benefits that individuals ascribe to a higher environmental quality (Cansier, 1996).

The first step of this method is an estimate of the dependence of rents or property prices on the environmental quality (e.g. noise levels, air pollution). A so-called hedonic price function is drawn up from this. This represents the monthly rent as a function of the individual elements relevant to (housing) demand (size, age, environmental quality, etc.). If one imagines that there are homes that are identical except for the factor of environmental quality, then – in a second stage – the partial derivation of the hedonic price function with respect to the environmental feature results in the marginal price of environmental quality. This price reflects the amount by which expenditure for environmental quality (e.g. clean air) increases, if this quality rises by one unit (e.g. if the sulphur dioxide content in the air falls by one unit) (Cansier, 1996).

The hedonic price method is impressive because of its theoretical basis. In environmental theory it is well established that changes in the quality of public goods have an impact on the market prices of private goods. This explains the frequent application of this method and its constant further development and fine-tuning. But there are also reservations about this method: For example, the complete mobility of individuals is presupposed. The method can be used only with local pollution. If there is ubiquitous environmental damage, there is no possibility for individuals to react, in market terms, to the loss of quality of the collective good by moving homes. Furthermore, environmental changes also have to be perceived subjectively by individuals. In spite of the problems, viewed globally, the hedonic price method should be regarded as promising with regard to its application for environmental valuation (Pommerehne, 1987). More

methodological fine-tuning and further developments will probably increase the applicability of this method in the future.

CONTINGENT VALUATION

If it is not possible to derive economic valuations of the natural environment indirectly from market patterns that can be observed, it is unavoidable to ask individuals *directly* about their willingness to pay for the conservation of a certain environmental quality or about the level of compensation required if the environmental quality deteriorates. Contingent valuation provides reliable (though verbal) results if the individuals interviewed are familiar with the environmental good and thus have information about this good upon which they can base their preferences. If a highly abstract valuation object is concerned e.g. the issue of the existence value of a distant mangrove coast, the results of a contingent valuation are less reliable (Munasinghe, 1994).

Many distortions can occur if contingent valuation methods are used (e.g. strategic behaviour, hypothetical bias, information bias, aggregation bias, influence of the payment instrument, etc.; Geisendorf et al., 1998). For example, at this point it is only necessary to mention the different effects of a demand for compensation: Usually, the demands for compensation will be higher than the willingness to pay. There is another distortion in the fact that poorer individuals are limited in their ability to pay. This does not apply to compensation demands (Munasinghe, 1994). In spite of the existing methodological problems, which in particular specify the limits of these methods for the comprehensive valuation of ecosystem services, the contingent valuation methods are faced with far-reaching application methods. Thus, the value components which are not use-related, such as the existence value and the symbolic value, can be recorded – at least in terms of trends only – with the help of this direct method (Geisendorf et al., 1998).

FINAL COMMENTS ON THE VALUATION METHODS

Many benefits emanate from the biosphere. It is practically impossible to evaluate these different functions with a single method. The values determined by indirect methods are seen as especially reliable from an economic point of view, because they are not subject to the risk of distortions to the same extent as those derived by direct

methods. But ultimately the direct methods in the form of the contingent valuation method are also indispensable, because those value components, which are related to use, can only be determined with their help. In summary, it remains to be said that even if a method has methodological problems „it should not be rejected immediately *per se*, the caution involved in interpretation of the results is much more decisive“ (Geisendorf et al., 1998). This also corresponds to the conviction that the implementation of economic valuations should always be advocated – in spite of the necessity for further interpretation – rather than dispensing with them altogether, because economic valuations force people to deal with the economic aspects of decision-making problems.

4.7 An attempt to rank the value categories from a global perspective

The large number of value dimensions clearly illustrates that decisions for weighing them are needed. This need for putting weights on them can be visualised if the value categories are brought into a relation with the three types of landscape use described in the WBGU 1999 Annual Report. The land use types refer to three categories: Type „W“ means adequate protection in spite of intense use. Type „N“ means dominance of protectionism over use. Type „E“ means protection through sustainable use of resources. Whereas with landscape use type „W“ (protection in spite of use) the economic benefit dominates, with landscape use type „N“ (protection against use) it is mainly the symbolic value, the option value and the existence value. The functional value is generally assigned special significance because it plays the decisive role with regard to the maintenance of the dominant goal for each landscape use type, be it that it creates the ecological foundations for the maintenance of the economic benefit (type „W“), or be it that the function value determines the protection requirement of a landscape (type „N“). With the landscape use types therefore the question arises which values are used in the decision about the land use – and to what extent – because not all values can be maximised at the same time.

However, the more value dimensions have to be considered in an appreciation process, the more complex the decisions become and the more likely there are to be distortions in the weighting because

most people tend to perceive certain value categories more consciously and to assess their value subjectively as higher than it actually is objectively. Moreover, the individual weight of the „actual“ especially relevant valuation factors becomes more marginal if more dimensions are included. For this reason it is advisable to limit oneself to the key value dimensions. The discussion about the limits of the applicability of the economic rationale to the valuation of the biosphere, which was conducted above, provides two important criteria according to which the value categories can be ranked – also justified from an economic point of view. These are the criteria of non-substitutability (essentiality) and irreversibility.

Furthermore, now a distinction should be made between a weighting of the value categories from a global vis-à-vis a regional perspective. At the regional level practically no generally valid statements can be made about a ranking of the value dimensions, given the variety of the different landscapes to be found in reality. Therefore the ranking has to be specified for each individual case. To do this, the criteria outlined above should be applied. One rule to determine a ranking could, for example, be like the following: The greater the uncertainty about the damage, the higher the probability of irreversibility and the greater the probable monetary undervaluation, the greater should be the weight given to the value category concerned in assessing options for action.

The task of the Council is to describe and analyse global change and to derive recommendations for action by global environmental policy. That is why the Council considers it important to abstain from the relativising statement that ultimately the concrete application case has to decide on the weighting of the value categories. Instead, the Council decided to specify a certain ranking of the various value categories from the perspective of such a global environmental body. For the valuation of options for action that have an impact on the biosphere the Council proposes the following ranking of the value dimensions (Table 2):

- *Function value*: It refers to the influence of the intervention in question on the ability to function of the given ecosystem. As outlined above function values at a global level have a categorical character where they refer to global ecosystem cycles. There they cannot be compensated and thus they correspond to the criteria of essentiality. At regional level, although they can be compensated in

principle, this only holds when there are serious reasons for such an intervention. The infringements of the function value should be weighted most strongly, because without maintaining the function all other value dimensions are negatively influenced, but the maintenance of the function itself still exceeds these values. The outstanding significance of the biosphere's function value becomes clear if one imagines the functions which the biosphere – mostly beyond human perception – provides. A simple thought experiment may illustrate that the above mentioned TEV of the biosphere's ecological services is almost infinite (Daily, 1997). Imagine that it appears desirable to spend a pleasant day on the moon and that it is only necessary to think about the effort needed to create the same living conditions on the earth's satellite that enable human beings to live a pleasant life on earth. Even if it is assumed that the technology needed to create a climate and an atmosphere suitable for humans were in place, one can immediately see the enormous financial effort required to create an artificial environment suitable for humans on the moon. If one was to try to make the moon habitable for humans with terrestrial flora and fauna, problems with knowledge and implementation that have not yet been solved would result (e.g. Which organisms are needed and how many?). This thought experiment also shows that the empirical determination of such a holistic economic value for biosphere service would hardly promote findings because the value is practically infinite due to the outstanding significance for human life on this planet. At the fore of an economic valuation of the biosphere is thus a marginal valuation, i.e. the question is which benefits are lost to man when the biosphere services are slightly impaired by human activity, more formally expressed: when the scope of services is reduced by one unit (Costanza et al., 1997; Fromm, 1999).

- *Economic use or instrumental value*: Unlike the global function value, no categorical character can be assigned to the economic use value, much rather this value is regarded as capable of being compensated. This means that this value may be limited in order to realise other values, if the benefit exceeds the costs of such an alternative action. From a global point of view – for example with a view to safeguarding sufficient food supply for the world's population – the economic use value can be weighted as the highest in comparison with the following values.

– *Symbolic value*: This means an aesthetic, religious or otherwise culturally determined assignment of contents to natural phenomena (or also artificial products). The symbolic value can be placed slightly behind the economic use value in this ranking. Some people are to an extreme degree willing to pay for the maintenance of landscapes or species with high symbolic value. Furthermore, people regard reductions in the symbolic value as a loss of the preconditions for a good life. Nevertheless, the Council weights the economic use value of the biosphere – especially with a view to the promotion of sustainable development processes and the safeguarding of food for the world – slightly higher than the symbolic value.

– *Existence value*: The existence value can be exchanged against other values just like the symbolic value or the economic use value; it does not, therefore, make any claims for categorical validity.

In addition to these 4 „real“ value categories, the Council especially emphasises the significance of the *option value*. This means the possibility of the future realisation of a value. The option value is linked to all other value dimensions by means of the concept of probability. The option value cannot, therefore, be directly compared to the other value categories, but it can be linked to the other value in each case (real value) by means of the probability of it occurring (Table 2). With the explicit emphasis on the significance of the option value the Council would like to counteract the tendency for these value dimensions not to be sufficiently considered in the choice of the options for action.

Table 2: The order scheme of value dimensions.

p = probability

Source: WBGU

Real value	Corresponding option value	Ethical principle
Functional value F	$F * p_F$	Categorical principle
Utility value N	$N * p_N$	Compensatory principle
Symbolic value S	$S * p_S$	Compensatory principle
Existence Value E	$E * p_E$	Compensatory Principle

This breakdown into a hierarchy of value dimensions is supposed only to be an initial aid in decision-making when the possible options for action are evaluated, and in drawing up binding action standards. Most deviations from this hierarchy should be expected where the uncertainty about the possible benefits of biosphere services is very high. For example, in many cases a certain economic use value (such as sales of wood from forms of logging) often faces an extremely uncertain option value of a much greater extent (such as the destruction of a possible natural cancer drug) or a marginal infringement of an otherwise categorical function value (influencing the world climate). In such cases, no clear decision-making rules can be taken from the hierarchy of the value dimensions. Nor is this the prime intention: On the one hand, the above-mentioned criteria of non-substitutability and irreversibility, for example, do not make an impact on an valuation of options for action at the regional level. On the other hand the objective of this ranking can particularly be seen in the fact that attention is drawn to the general significance of the various value categories. At the same time this ranking does not claim that it holds in this form for every option to be evaluated. In difficult appreciation processes additional procedural criteria should be used that are dealt with in more detail below (Section 4.8 and Chapter 6).

4.8 Summary: Linking economic valuation methods to the objective of sustainability

Every valuation approach, whether economic or of another kind, which, based on justifiable principles, assigns a value to objects in the world, should be examined – and ultimately evaluated – as to the objective to which it is applied. After all, every valuation is intrinsically linked to the question of the contribution that the evaluating object makes towards a particular objective being achieved (Costanza and Folke, 1997). For economic valuation theory this objective can be stated clearly: Economic valuations aim at improving the allocational efficiency of decisions on action.

As a final comment on economic valuation and as a prospect for a future research these considerations are now to be related to the objective of sustainability. Sustainability as the guiding principle of global environmental policy comprises the three target dimensions

of the economy, the social justice and the environment. For this reason valuation issues have to be discussed against the background of these three dimensions. This is a multi-criteria analysis. Economic valuations aim directly at the economic dimension and they are given the important meaning of pointing out that the realisation of ecological protection objectives can go hand in hand with economic costs in the form of renouncing benefits.

Nevertheless, economic valuations do not reach far enough when questions are being considered where allocation efficiency is not the only criterion for a decision. A way out of this restriction can be seen in the removal of the assumption of given and unchanging preferences – as is frequently presupposed in traditional economics. It should be possible for preferences to change within the democratic process. This way the ethical reservations vis-à-vis those economic valuation approaches are taken into account in which the decisions about the protection and the use of the biosphere are made solely dependent on the preferences of economic subjects living today. These reservations refer especially to the fact that these preferences are not simultaneously subjected to a critical discussion in society (Geisendorf et al., 1998).

With the assumption that preferences can change in an evolutionary process and, because of the processes of the formation of will in

Table 3: Valuation of biosphere services on the basis of the sustainability objective

Source: based on Costanza and Folke, 1997

Target or value basis (sustainability dimension)	Evaluation-body	Preference-basis	Required degree of discussion	Required degree of scientific knowledge	Specific method
Efficiency (economy)	<i>homo oeconomicus</i>	Current preferences	low	low	Analysis of willingness to pay
Justice (social objective)	<i>homo communicus</i>	Community preferences	high	medium	Veil of uncertainty (Rawls)
Ecological efficiency (ecology)	<i>homo naturalis</i>	Preferences of the entire system	medium	high	Modelling with caution

society, should change under certain circumstances, the methodological approach for the valuation of biosphere services should become more differentiated (Table 3). In this context it should be noted that these considerations are only gradually being dealt with in the specialist literature. There is, therefore, a considerable deficit in research in the field of linking economic valuations, the processes for the democratic formation of will in society, and the sustainability objective.

Before Chapter 5 below deals with empirical studies for the valuation of the environment, the Council's view on the valuation of biosphere services should be summarised at this point: The starting point for an (economic) valuation should initially always be the individual preferences. A study for the Federal Environmental Agency also comes to the conclusion that „with respect to the conservation and development of biodiversity, the values and intentions of the latter [members of society] are the guideline for the measures to be taken, unless they need correcting for superior moral reasons.“ (Geisendorf et al., 1998). The starting point is therefore the valuation of the biosphere based on individual preferences. Strategies for protection and the sustainable use of the biosphere should, therefore, start with individual evaluators and reinforce their valuation of the biosphere. Only when such strategies are insufficient is an external valuation, which is not based on individual preferences, also to be integrated in the valuation process. On the whole, the importance of economic valuations is seen to be very high. Furthermore, as a result of the heuristic character of the concept of the total economic value it is clear that with every consideration of the biosphere the entire spread of the different demands – and thus of values – has to be taken into account, regardless of the methodological difficulties that occur with an exact monetary valuation. The importance of economic approaches can be seen in the Biodiversity Convention, where in many places the need and the requirement to record values more precisely and to quantify them is pointed out.

5 Empirical studies on the importance of the environment

5.1 On the comparison of acceptance and acceptability

The previous chapters were mainly concerned with the question of how human interventions in the natural environment should be evaluated according to rational and transparent criteria. In this process it has already become clear that such a valuation should not be prescribed *ex cathedra*, but only on the basis of generally applicable guidelines for appreciation. When making balanced judgments, subjective valuations about desirable conditions are unavoidable. But how do we reach such judgements without the outcome being influenced by fashionable zeitgeist ideas or unreflected preferences?

The need to include subjective preferences in normative concepts of decision-making necessitates a closer look at the problem of morality experienced everyday. In Chapter we already pointed out the possibility of purely consensual ethics. Everything is allowed provided that all concerned agree to it. This form of pure consensual ethics can, however, hardly be classed as a sensible guiding principle for the formation of moral judgements (WBGU, 1994; Grunwald, 1998). Firstly, factual judgements and preferences by individuals are dependent on time and place and do not have the degree of consistency that is needed to make far-reaching considerations. Secondly, everyday moral judgements are borne by cognitive or normative considerations that are used to justify the judgement. Thus, for example, support for the death penalty may be based on the assumption that potential perpetrators would be effectively deterred by the threat of the death penalty. The same applies to environmental ethics. Many people accept the increased extinction rate of less „charismatic“ animals (such as insects or soil microbes) because they are not aware of their function for the conservation of the ecosystems that they appreciate. Thirdly, actual environmental conduct is frequently determined by psychological or social triggers and overlaid by considerations „remote from the problem“. Thus, for example, individuals may regard something as valuable or justified only because their friends or respected representatives of reference groups consider this conduct to be correct. The media, too, play a major role in the selection of judgements about the environment and the biosphere or their

reinforcement. For all of these reasons human's factual conduct must not be the sole yardstick for evaluating options for action.

However, it would be just as wrong to regard factual conduct and the actual valuation of options as irrelevant to the moral valuation of environmental goods. In a pluralistic society preferences and the value ideas that people experience have a high normative force. No one can prevent individuals from evaluating the consequences of an action according to their own criteria.

However, the situation appears different for decisions that have a collective effect: here, the preference of a single individual cannot be the yardstick of the valuation, but rather the benefit or the moral acceptability for people affected as a whole. This, too, can be determined consensually among everyone affected. But for this a discursive method of mutual justification of views makes sense in order to ensure that hasty judgements do not dominate the valuation method.

Above and beyond this, the valuation of options and, above all, when drawing up standards for action, experienced morality must not be omitted. Ethical textbooks have rarely made humans behave more morally. The best intentions are not much use if the changes in conduct associated with the standards are not obvious or can hardly be implemented. It will not be possible either to turn around the basic elements of human conduct by setting ethically founded standards or to be able to solve conflicting values in a way that all can understand by means of an ethical discussion. For this reason it is important to deal with the factual acceptance of options for action in the context of the field of application discussed here, „Conservation and sustainable use of the biosphere“. It is only the implementation of moral considerations as conduct standards that are also accepted by those affected and integrated in their own conduct provide a guarantee for the fact that human interventions in nature can be made according to ethically justifiable patterns.

Therefore, in this Chapter people's factual conduct with regard to their environment will be discussed. In the process, it will be revealed that many of the ethical principles that came about on the basis of normative drafts of the „good“ life or community life can only be recognised indirectly in everyday life. This means that empirical research of actual conduct is mainly interested in the mediating motives and conditions for action that have an effect on human environmental conduct. Section 5.2 deals with people's fundamental opini-

ons about nature and the environment, Section 5.3 with attitudes to environmental protection and Section 5.4 with the link between attitudes and conduct. Building on the findings that were revealed in the acceptance chapter, Chapter 6 then deals with special methods that can be used to systematically record and discuss the values and criteria of social groups and constructively input them in ethical valuation and appreciation processes.

5.2 Nature and the environment in the public perception

As far as images of nature are concerned, various ideas about nature have already been dealt with in Section 2.2 (Table 1). The classification made there started from a division into anthropocentric (relating to man) and physiocentric (relating to nature as a whole) ideas. However, such a systematic classification reveals little about how people in Germany and in other countries perceive nature or what image of nature they consider appropriate. It is the perceived and experienced environment that guides people in their action with regard to the environment (Graumann and Kruse, 1990; WBGU, 1994). It is not the objective situation of the environment or the changes within the natural environment recorded by scientists that bring about a corresponding awareness of the environment and conduct with regard to the environment. Much rather, it is the images of the environment constructed from one's own sensory perception, absorption of information from fellow humans and, above all, from the mass media that are cognitive elements for one's own consciousness of the environment and, to a certain extent, conduct with regard to the environment. Individuals, social groups and entire cultures form specific images of nature and an understanding of environmental processes on the basis of individual and social perception processes (Douglas and Wildavsky, 1982; Dake, 1991). In this connection, however, it must be remembered that environmental awareness and conduct with regard to the environment, just like images of nature and the understanding of processes relevant to the environment, depend on many factors, whose weighting varies for reasons of different cultural, social and psychological contextual conditions (WBGU, 1994). There is also dispute in the specialist literature with regard to exactly what an image of nature or environmental consciousness is (Fuhrer, 1995).

Unfortunately, there is still relatively little reliable empirical material about the subjects of images of nature and an understanding of nature. This is mainly because it is not easy to record – and then consider to be valid – images of nature by questioning and observing people. Asking people what they understand by the term „nature“ or what image of nature they consider to be appropriate hardly leads to sensible results. In order to acquire a deeper understanding of the perceived and experienced images of nature we have to use differentiated and creative methods of social research (Knaus and Renn, 1998).

One example of this is the dissertation by an American social scientist that studied understanding of nature of Germans, Swiss and US Americans (Shockey, 1996). Her method was to accompany walkers in national parks and recreational woods, collect their impressions over two to three hours and then to reflect with them over what they had seen, what they had not seen and what they had missed. The views of nature differed between Germans, German-speaking Swiss, French-speaking Swiss and US American much less than the author had originally supposed they would. Most regarded nature as a refuge that had to be protected against the almighty power of technology and civilisation. Just as often, nature was seen as a location for them to find their own identities and as an anchor in a real home instead of a virtual home. Most of the people questioned understood the gradual transformation of natural land into built-up land as irreversible, but by no means welcome, change in their own world. Frequently, the walkers characterised the others, who do not want to or cannot go for walks any longer, as the driving forces of a continuous destruction of nature. However, they did not accuse these people of ill-will or deliberate intentions, just of a lack of motivation due to ignorance and an unconscious loss of experience (Shockey, 1996).

The empirical work carried out by the sociologist Michael Zwick within the context of a national compound project on genetic engineering and modernisation at Centre of Technology Assessment in Stuttgart (Zwick, 1998) shows that this impression is more than just a snapshot of talks with walkers. In a first stage, Zwick conducted detailed conversations in the form of in-depth interviews with 48 people from various walks of life (from people living on welfare benefits to captains of industry) and let the people questioned talk

about their relationship with nature. On the basis of these interviews he was able to identify a number of different images of nature.

In order to test the impressions from the qualitative studies on a national scale, he conducted a representative survey in Germany in 1997 in which the people questioned could make free associations on the subject of nature. These associations – a maximum of three per person – were assigned to the images of nature gained in the in-depth interviews. Eighteen categories were used and practically all of the associations (with exception of a residue of just under 1%) could be subsumed among them (Table 4).

Even a first glance at Table 4 clearly shows that the idea of nature among Germans is marked by a few dominant images of nature. Four out of ten people questioned have romantic ideas about nature. If the evaluative concept of nature and the ontological concept are included in the view, the images of nature that can be classified as idealistic reach around 45% of the responses. If the image of nature as a reproductive factor is added to this group, it is clear that over half of the people questioned associate nature with such matters relating to „habitat“.

The second emphasis relates to threatened, desecrated or destroyed nature. 23% of all responses fall in this category. If this category also includes its counterpart – nature as a polluted environment in need of protection – almost 40% of people questioned share the idea of nature as threatened by man and in need of protection. By contrast, a minority of fewer than 3% see nature as a productive resource. In most cases agricultural use is being thought of here, a few times traffic and road building and only four times (of a total of 1,500 people questioned) thought of nature as suppliers of raw materials. Even the sober systematic understanding of nature or the scientific image of nature were mentioned by a small minority only.

The results of the survey make it clear that two essential and complementary images of nature dominate in the population. On the one hand, people see nature as a cradle of beauty, recreation and reproduction, on the other hand as a good threatened by civilisation and in need of protection. In this context it is practically irrelevant whether nature is evaluated as anthropocentric or physiocentric. In both cases it appears to be neither a threat nor a stock of raw materials, but as a social and cultural reference system whose way of working and existence are threatened as a result of modern civilisation. The tradition

Table 4: Images of nature in Germany

Source: Biotech-Survey Biotech survey by the Akademie für Technikfolgenabschätzung in Baden-Württemberg, 1997
(representative study 1997 in Germany)

Category	Explanation	Frequency of citing
Romantic understanding of nature	Beauty, meadows, woods, love of nature, idyll, always positive evaluations	38%
Evaluative understanding of nature	Nature is good, optimum, very important, always positive evaluations	5%
Ontological understanding of nature	Creation, apotheosis of nature: nature is God or similar to God	4%
Reproduction understanding	Health, recreation, hiking, sport, holiday, food	27%
Threatened, destroyed nature	Threatened basis of life, disturbed, destroyed nature, exhausts gases, waste, noise, traffic, ozone, negative evaluations	23%
Understanding of environmental protection	Ecology, environmental protection, conserving nature	22%
Countercultural understanding of nature	Nature is the opposite of culture, inactness, naturalness, originality, foregoing human interventions in nature	9%
Productive resource	Energy, raw materials, agriculture	3%
System understanding	Interaction of living beings, plants, air, earth, movement, autopoiesis	3%
Scientific understanding of nature	Natural (sciences), laws of nature, nature as knowledge, basis of findings	1%
Nature as the foundation of life	Nature is life, nature is vital	8%
Nostalgic understanding of nature	Nature, as it used to be (usually positive evaluations)	1%
Visionary understanding of nature	Nature, as it will be, reference to subsequent generations (usually normative statements)	2%
Nature as a threat	Disasters, selection, nature can be cruel	3%
Geographical understanding of nature	Being outdoors, countryside, garden, habitat, surroundings	12%
Functional understanding of nature	Origins, growth, power, energy, death	5%
Universal understanding of nature	Heaven and earth, cosmos, space, stars	5%
Syntagmatic understanding of nature	Listing of elements without assigning a value	29%
Other and no responses		1%

of protectionist and romantic understandings of nature is certainly an important declaration for the relatively marked environmental consciousness in Germany and for the repeatedly expressed disquiet about current environmental policy.

5.3 The perception of adverse environmental effects

As revealed by the studies on the dominant images of nature, concern about an intact environment continues to be a major issue in the political debate and has united the entire population of Germany (Knaus and Renn, 1998). Unfortunately, there are hardly any surveys or social science studies that deal specifically with the perception and valuation of the biosphere or with species and landscape protection. But the key trends found in the surveys on the more general subjects of environmental protection and conduct with regard to the environment can also be largely transposed to the subject of the conservation and sustainable use of the biosphere.

The subject of the environment is no longer as popular as it was a few years ago but the vast majority of Germans continue to be in favour of an improvement in environmental protection. In a national survey in 1998 Germans were asked how important the subject of „environmental protection“ was to them on a scale of 0–10 (Table 5). The result is clear: with an average score of 7.8 (West) and 8.0 (East) environmental protection is one of the five leaders in the priority scale of those asked (BMU, 1998), even though it had fallen from third to fourth place in comparison to the survey of 1996. In response to the questions „Are you greatly concerned about protection for the environment?“ in a study from 1996 around 40% said that they were greatly concerned and another 55% that they were somewhat concerned. Only 6% were not concerned at all (Citlak and Kreyenfeld, 1999).

If we look at Europe, concern among the European population for an intact environment has always been among the five most important problems since the early 1980s. This even applies to the Eurobarometer Study conducted in 1996, in which the populations of all EU Member States are questioned in a representative survey (European Commission, 1996). In Denmark and the Netherlands environmental protection occupied top position in the list of concerns, in Germany

Table 5: Importance of political tasks in various problematic fields of social policy
(mean values on a scale of 0–10)

Source: BMU, 1996

People questioned	West	East
Cutting unemployment	9,2	9,6
Increasing the fight against crime	8,4	9,2
Improving environmental protection	8,3	8,5
Doing more to maintain the competitiveness of the German economy	8,0	8,3
Doing more to maintain the welfare state	7,7	8,8
Improving housing provision	7,4	7,6
Cutting immigration	6,9	6,9

and other Central European countries it was in the upper middle reaches of the list.

However, caution is needed in the interpretation of these survey data. Most surveys on the importance of the environmental issue in comparison to other important issues supply the response categories; i.e. the people questioned have to pick out from a list of possible problems those that appear especially important or urgent to them, or they have to give these response categories a numerical urgency value (cf. the criticism of survey research: WBGU, 1996). However, if the people questioned are free to name any problems that appear urgent to them, only a small minority names the subject of the „environment“. In a study carried out in 24 countries by Gallup International in 1992, for example, an open question was used to find out what was currently the most important problem in the country concerned (Kuckartz, 1997). Whereas around 40% of the Irish and the Dutch named the issue of the environment and even in the USA and Japan around 12% felt that the environment was the most urgent problem, in Germany this figure was only 9%. In the same survey a similar question was asked but the response categories were specified. Here Germany, together with South Korea, were the leaders among the 24 nations: around 67% considered the environmental problems to be a „very important problem“. How can this contradiction be explained?

There are three plausible explanations for the astounding discrepancy between the responses: firstly, surveys always also measure

what is desired in society. Since a response in a survey „doesn't cost anything“, most people tend to express as their own opinion something that is seen as socially desirable, even if they rarely gear their own behaviour to this wish. In an open question it is often not as easy to recognise what is desired in society and people act on their first (usually honest) impulse. If, however, the response categories are specified, people feel uncomfortable if they do not give an appropriate reference to a category that is highly appreciated in society. There can therefore be overrated scores.

Secondly, environmental protection is a long runner in political discussion, which, depending on the problem pressure, moves up or down the priority scale. The consistency with which environmental pollution has been cited as a socially relevant problem since the mid-1970s shows that this area always remains topical but that it can be suppressed by other current problems. If environmental protection is not explicitly named, the people questioned think of the problems that are currently topical, but if they are directly confronted with the issue they remember that this problem has also been around for years without being solved. Then environmental protection is given high scores in the priority scale again.

Thirdly, the gulf between the general experience of an environmental crisis and the extent to which individuals are personally affected by environmental pollution is also expressed in this discrepancy between the results of open and specific questions. Only 14% of Germans stated that they were strongly affected by pollution in the 1992 Gallup survey cited above. If the wording with regard to the degree people are personally affected is weakened („disturbed in some way by environmental pollution“) this figure rose to 63% (Kuckartz, 1997). On an international scale, however, the Germans were in the middle of the table even with this weak wording. The phenomenon that the environmental situation is judged more negatively the greater the radius for which the judgement is being made can be interpreted in a similar way. The local environment is usually assessed as relatively intact, the national environment as problematic and the global environmental as under serious threat (de Haan and Kuckartz, 1996; BMU 1998). This trend applies not only to Germany, but also to most other industrialised countries, however, only to a limited extent to developing countries (Dunlap and Merting, 1995).

The fact that the degree to which individuals are affected by damage to the environment is classified as much less than the general quality of the environment can also be seen in the 1998 national survey on environmental awareness and environmental action in Germany (BMU, 1998). In this study most people stated that throughout the world many people were suffering from the impact of damage to the environment, but that they themselves were victims of environmental pollution only to a slight extent. However, this perceived discrepancy does not apply to noise pollution. 15% of those questioned felt that they were severely affected by road traffic, 4% by air traffic and 2% by rail traffic. According to Höger (1999) as many as 80% of the population stated that they were bothered by noise. With the exception of noise the image of poor environmental quality in the world implies a much more negative view of the environment than the one that people actually perceive in their surroundings.

In the same survey from 1998 special perceptions of the state of the environment were also assessed. Here are some results: around 65% of Germans are worried when they think about the probable environmental conditions in which their children and grandchildren will have to live. This statement largely meets the concern of sustainability although this term is known only by 15% of the people questioned in western Germany and by 11% in eastern Germany (BMU, 1998). 53% of people in the west and 60% in the east of Germany react with horror and anger to environmental problems that are discovered. Furthermore, around 55% of the population believe that humanity is heading towards an environmental catastrophe. Accordingly, around 40% of the citizens questioned are prepared to make concessions in their living standards to the benefit of the environment. Obviously the concerns about a sustainable environmental situation have not reduced dramatically, although other social problems, such as unemployment, should be treated with priority in the view of German citizens. At the same time, the people questioned also see considerable improvements in Germany's environmental performance. Around 46% see great progress in water pollution control, 34% in energy saving and 30% in air pollution control. The expression of this sensitivity to the environment is the fact that some of the people questioned want to make their consumption patterns and their lifestyles more environmentally compatible.

Social research has noted the increasing willingness of German households to consider ecological compatibility in their consumption. For example, in 1975 only 18% of west German households were prepared to renounce consumption in favour of the environment, in 1980 the figure had risen to 22% and in 1990 65% (Wenke, 1993). In 1998 31% in the west and 29% in the east stated that they would accept higher prices for environmentally friendly products (BMU, 1998). Obviously, whether this verbal willingness to renounce consumption was translated into real action cannot be seen from the surveys.

On the basis of these various survey data nothing should stand in the way of a policy to benefit forced protection of the biosphere. The vast majority of Germans are not only aware of the problem and convinced of the need to change course, all the available survey data indicate that large numbers of them, at least, are prepared to change their conduct if this really benefits the environment. However, doubts are appropriate here as the next section will show.

5.4 Environmental conduct

Although most people in Germany have a positive attitude to the environment, this attitude comes up against limits if conflicting values become apparent or when too many competing directions make clear instructions for conduct more difficult. In many cases the familiar routine carries on against the background of confusion about correct and appropriate conduct: „Why should I change my behaviour when I don't exactly know what I should change and how?“

These problems occur in particular when environmentally aware behaviour is to be implemented in everyday life. There is usually a large gulf between one's own ideas and one's own behaviour (Diekmann and Preisendörfer, 1992; by contrast: Gessner and Kaufmann-Hayoz, 1995). However, in the process it must be remembered that, depending on the measurement method and research design, the link between these two factors is different. But there is largely consensus that there is not a direct link between attitude and conduct. The two social researchers Preisendörfer and Franzen summarise the results of the studies on this subject as follows: „If there is a 'quintessence of the debate so far' on the link between environmental awareness and

environmental action, then it is that environmentally oriented attitudes and values have only a limited impact on actual environmental conduct.... But on the whole, the effect of environmental awareness on environmental conduct can only be called moderate“ (Preisendörfer and Franzen, 1996).

This assessment starts with the observation of the verbal willingness to make sacrifices in favour of the environment. Although almost 2/3 of the German population is willing to change their conduct in favour of environmental protection, to make environmentally sound purchases and to live in harmony with the environment, this 2/3 majority quickly disappears when the costs are brought into the equation (Kuckartz, 1997). Where waste separation or occasionally leaving the car at home are concerned, the Germans are always at the top of the scale of the international study carried out in 1993 (Kuckartz, 1997). However, if one asks about the willingness to pay for environmentally friendly products, the Germans in the old Federal *Länder* (West Germany) occupy position 9 of 24 countries and the new Federal *Länder* (East Germany, formerly communist regime) are actually in the bottom position. Higher taxes for the benefit of the environment are not very popular in Germany either. In an international comparison, the old Federal *Länder* occupy position 13. In 1998 only 19% of Germans questioned were willing, and another 28% were willing to a certain extent, to tolerate higher taxes and duties for better environmental protection (BMU, 1998). Nor is it very popular to donate money to environmental protection groups. Around 19% of the Germans questioned stated that they had already given one donation to an environmental protection group. Among the British the figure was 30%, among the Dutch it was as high as 44%.

Further „concessions“ can be found when converting the verbally expressed willingness to act into actual conduct. For example, Diekmann and Preisendörfer (1992) report that even among those people questioned who are in the top third of the scale of environmental awareness, around 3/4 went on their last holiday by plane or car. Over half of these people questioned have a car and 1/4 of them use a tumble dryer. The discrepancy between environmental awareness and behaviour should, however, not be used as proof to defame environmental awareness as typical „eco-hypocrisy“ and to discredit the entire environmental movement. On the contrary: the empirical findings

make it all too clear that even the well-intentioned and the convinced have problems converting their attitude into actual behaviour.

But what reasons are there for the gulf between one's own demands and actual behaviour? Values and attitudes are only relevant to action when individuals are appropriately motivated to act in accordance with their attitudes (WBGU, 1994; Diekmann and Frantzen, 1995). What are the factors that influence these motivations?

- Most human actions serve purposes other than environmental protection. Only when the fulfilment of primary purposes (such as food, mobility, security) does not contradict environmentally sound action can behaviour in line with attitudes be expected. Otherwise there is a value conflict that is usually decided in favour of the primary purpose.
- Action in line with attitudes often does not suit the current situation. When a group of friends do something together, for example, the only one who is environmentally aware often has to submit to group pressure.
- Environmentally aware behaviour is often not activated if the person concerned is in a certain situation relevant to a decision. When shopping with friends the desire to consume and the shared spending spree outweighs everything else. And before you can turn around you have bought all sorts of things that end up at the flea market or in the bin. A number of studies on the choice of transport and energy conduct also show that environmental reasons hardly play a role for one way of conduct or another and, at best, are used retrospectively as a justification (Preisendörfer and Frantzen, 1996). At the moment of the decision costs, influence by others, bottlenecks just experienced or personal problems are much more important than abstract thoughts of environmental protection.
- Often there are no objective alternatives for action (WBGU, 1994). For example, tenants can only invest in energy-saving measures for the heat insulation of their homes with major financial losses, many commuters have no opportunity to use public transport and there are still many products with elaborate packaging.
- Uncertainties and the impression of the marginality of one's own conduct are added to the factors already mentioned. Regardless of how ecologically practical a course of action may appear to an individual, in our pluralistic media world there will certainly be a state-

ment that brands this measure as dubious or even counterproductive. Moreover, the contribution by an individual is often so small that it is considered to be insignificant in the consciousness of the individual (Spada and Ernst, 1992).

- Many people feel overtaxed by the overlaying of different, frequently contradictory incentives for action. In order to become effective for action, the individual options for action also have to be known and it must be possible to estimate – or at least evaluate – their impact.

Because of the complexity of the environmental issues and the uncertainty due to competing value patterns there is frequently a lack of agreement between verbal and actual conduct. In the field of environmental conduct a number of studies have been made with respect to the impact of different influencing factors relevant to action (Dierkes and Fietkau, 1988; Stern, 1978, 1992, WBGU, 1994; Stern and Dietz, 1994; Schwartz, 1994; Kruse, 1995). As a summary of these studies the following factors have a positive impact on environmental conduct, i.e. in the sense of promoting environmentally compatible conduct:

Perceived options for action: People should have several options available in order to reach the objective of an action. If they are given several options that all safeguard the purpose of the action they also tend to choose the option that is associated with lower environmental impact. For example, someone who prefers especially white washing is also prepared to use a more environmentally friendly washing powder if it cleans to the same degree.

Positive attitude: Although a positive attitude – as shown in detail – influences conduct only to a modest extent it is still an essential prerequisite for more environmentally compatible lifestyles (Schultz et al., 1995; Mosler and Gutscher, 1998). Anyone who has a negative attitude to environmental protection will not want to become involved in environmental protection.

Knowledge relevant to action: Environmentally sound action presupposed that a person is capable of having a rough overview of the consequences of his own conduct. But frequently even the most environmentally aware person is not sure about which of his actions are especially bad for the environment and which are not. There are often ritual actions that make little difference but which give people the feeling that they have fulfilled their duty to the environment.

Economic incentives: Even especially environmentally aware people have their limits with regard to their environmental conduct when economic disadvantages become noticeable. If, however, economic incentives are linked to environmentally friendly conduct there is not only a learning process, but also a confirmation of one's own attitudes. Such „rewards“ can be of a symbolic nature only; they then refer to socially desirable conduct and give orientation help. With major financial losses symbolic fees are not enough; noticeable relief is called for here. However, only using instruments based on incentives is also problematic. Combinations of positive attitudes, objective scope for action and additional economic incentives are especially effective (De Young, 1993; Mosler and Gutscher, 1998).

Moral valuation (by oneself and by others): Even uneconomic behaviour is frequently taken up when people experience a social or moral valuation with implementation of a course of conduct. For example, goods and, above all, services are often given to other people even if they would still yield a price on the free market. Even environmentally sound action could be influenced more than in the past by the guiding principle of moral valuation. This is not moral pressure, much rather it is the link between social recognition and environmentally sound action.

Unambiguity of communications and information: Confusion and uncertainty are two major barriers to the implementation of environmentally aware conduct. These uncertainties can be balanced out by means of environmental education and environmental learning (WBGU, 1996). At the same time, a specific advisory activity can help people further in uncertain decision-making situations. Above and beyond this, public relations and information can bring more clarity and unambiguity into public reporting.

Support from social networks: The more the individual learns that the social groups relevant to him foster and endorse a certain conduct, the more willing he is to make this conduct his own. Studies from the USA about the radon problem, for example, have shown that of all the measures to make people aware of the detrimental effects on health of radon, the most successful information was information through social networks (Fisher, 1987). The integration of networks in environmental education and information programmes has proved to be an especially effective method for promoting environmentally sound conduct.

Sensory perception of positive consequences triggered by one's own conduct: One of the key barriers to harmonising environmental awareness and environmental action is the insufficient perception of the positive consequences of one's own action. Someone who carefully sorts rubbish, hangs his washing on the line to dry, does not use any chemical sprays and does not travel by car or plane may personally experience the costs of environmental protection in terms of time and effort, but he is not rewarded for his action. This frequently leads to great losses of motivation. In order to balance out this deficit, people can take technical measures of their own and make savings successes directly visible (for example in the field of energy), on the other hand, public institutions can report back on the positive objectives that have been met as a result of the public's environmentally aware behaviour. It is only by means of this report, which confronts the personal effort with a positive result, that the loss of motivation can be bridged.

The combination of economic incentives, positive attitudes and objective options for action with a simultaneous visualisation of positive consequences of one's own action has proved to be especially effective for sustained changes in conduct. However, in addition the unambiguity of the messages passed on and the support by informal networks play a major role.

Attitudes to the environment and environmental conduct are therefore complex phenomena that are made up of many factors and frequently diverge wildly (WBGU, 1994). Concern for an intact environment has encompassed all levels of society in Germany and it is hard to imagine the Germans' set of values without it. However, improving the environment only comes at a price. Disappointments are certain without any understanding for the conflicting values. Improved forms of communication between politicians and the public are therefore essential to illustrate the conflicts of targets that will occur and to make real considerations of goods.

5.5 Intercultural differences in dealing with nature

Previous studies largely referred to industrial countries such as Germany or the United States. In spite of all the differences between their social structures and their cultural understanding, these societies have much in common relating to the perception of nature and

thus a cultural basis for negotiation and agreement processes. But what is the situation for other cultures and in countries with different levels of economic development?

Unfortunately there are only few empirical studies that allow a meaningful comparison of various countries and cultures with respect to environmental awareness and environmental conduct. The possibility of cultural reactions to the wordings of questions and research design calls for a high methodological level that, unfortunately, has not been met by most of the comparative commercial surveys over several countries. The Council has repeatedly criticised the problem of the dubious validity of different studies that compare cultures (WBGU, 1994). Recently a volume of essays on the issue of risk perception was published in which international comparative studies on the perception and valuation of environmental risks have been collected (Renn and Rohrman, 1999). In this volume, industrial countries such as the USA, Germany, France, Australia and Japan are represented, as are developing and take-off countries such as Brazil and China and, finally, transformation countries such as Bulgaria and Romania. African cultures however, are not included in this volume.

What are the most important insights resulting from this systematic comparison cross-national studies? Firstly, it is clear that the primary objective „conservation of life“ and the „integrity of humans“ are just as universal as the desire for further economic and personal development. Even in China, where – according to the official version – individual freedom gives way to collective discipline, a clear desire for expansion of individual freedom can be seen. However, the trust in collective risk management institutions is much higher there than in most industrialised countries (Rohrman and Chen, 1999).

A second surprising finding can be seen in the increasing differentiation of social sub-cultures that are globalising to a greater extent and thus becoming universal. The bankers, feminists, physicists, civil servants or environmentalists in this world are becoming increasingly similar, whereas they have ever less in common with their fellow countrymen. To overstate the case: the bankers of Brazil, New Zealand, Romania and Germany understand each other better than they understand their own children. Whereas national cultures are diverging ever more right up to the danger of a loss of integrative force, international sub-cultures are becoming ever more similar. The new information media, the globalisation of the economy and the

functionalisation of jobs certainly play a major role in this. Although there are still relevant differences between the representatives of similar groups in different countries, these are less marked than the differences between the groups within a country (Rohrmann, 1994).

A third aspect is especially important with regard to the debate about anthropocentric and physiocentric points of view. In all of the countries studied high-risk interventions in nature are perceived as infringements of values that are broadly capable of being compensated. Fundamentalist attitudes vis-à-vis nature (in the sense of an absolute standard of conservation vis-à-vis use) are rarely encountered, even among environmentalists. However, the compensation services considered necessary vary greatly from country to country. Whereas predominantly in the transformation countries (Bulgaria and Romania) economic benefits are seen as a sufficient counterweight to serious interventions in nature, improvements to the common good (however it is defined) in many industrial countries, but also in developing countries, are a necessary condition for permission to approve of serious interventions in nature. There is little proof for the direct influence of religion and traditional culture on the valuation of the environment. Asian ideas of a physiocentric point of view are usually meant contemplatively and not as a guide to practical action; correspondingly there is little resistance to exploitation of nature in these countries (Szejnwald-Brown et al., 1995).

Naturally, the empirical social researchers have also noted a number of key differences in the perception of environmental risks: for example, the degree of apathy towards environmental risks (perception of damage as unavoidable fate or a consequence of human activity) varies between the countries studied just as much as the extent of the fear of natural risks as opposed to technical risks. Cultural factors are certainly one of the reasons for what people say they are most afraid of when asked (regardless of the level of the risk). Nevertheless, the degree of agreement between the countries is much higher than one would suppose on the basis of the very different cultures.

What do these findings mean for the question of the ethical valuation criteria for interventions in the biosphere? The stereotypical response that these criteria would always have to be determined and viewed in relation to the culture concerned does not agree with the empirical results available so far (admittedly sparse). At least there

is broad agreement among people of all cultures with regard to the primary principles. Wherever this unity is in doubt, critical questions should be asked as to whether it is not in the interests of the governments concerned, but by no means in the tradition of the culture, to insist on deviations from the international consensus. Above and beyond this, the increasing professionalisation and globalisation of sub-cultures mean that people with similar basic attitudes and valuation backgrounds come together in international negotiations. There, too, so-called cultural differences are frequently overplayed for tactical reasons without any actual empirical evidence of them.

For this reason, the Council recommends the Federal Government to speak up for the demand for universal validity with respect to the issue of the primary principles for the protection of the biosphere. The values and standards represented in the various cultures are not so diverse factually or with respect to their normative justification that culture-specific environmental ethics should be developed or taken into account. Of course, this does not mean that every standard that exists in Germany can be transferred to the whole world. Much rather, what is concerned here are the primary principles as are described in the first section of the document.

Intercultural studies on the understanding of nature and environmental conduct continue to be important and provide essential indicators of recording individual and social human behaviour with regard to their natural environment. Without this knowledge it is difficult, if not impossible, to draw up concrete measures to flesh out environmentally relevant principles and standards and to develop and realise ways of implementing these standards in everyday action. The most urgent desideratum of research in this Special Report is to promote intercultural comparative social research on the subjects of environmental awareness, environmental conduct and institutional implementation of environmental standards.

6 Methods for creating and justifying standards for biosphere protection

6.1 The value tree method for identifying and structuring social values

Analysis of national and international environmental conduct clearly shows that many people are highly motivated to act in the interests of biosphere protection, but, on the one hand, do not quite know how to find their way in the jungle of competing values and, on the other hand, are uncertain about how they can agree, and ultimately implement, collective standards together with others. Section 6.1 deals with a method that can help players in environmental policy to acquire socially relevant orientations and to make a well-founded list of collectively binding criteria for the valuation of human interventions. Section 6.2 then shows how these joint criteria can be used in the context of conducting negotiations to reach a binding agreement on environmental objectives, appropriate instruments and their implementation. Both proposed methods, which complement each other, can be used nationally and internationally.

Illuminating underlying value conflicts and options for action on the basis of subsequent knowledge and transparent valuation criteria are two of the central tasks of an ethically evaluating process. However, the public of values and people's preferences have to be incorporated in this process. But how can this be done given the wealth of competing values and preferences? Should we simply accept the results of opinion polls as the basis for making political decisions? Can ethically justifiable decision criteria or even standards to guide action be derived from the studies described in the preceding chapters?

If environmental goods are made individual and suitable for the market by means of property rights, the price that forms on the market ensures an appropriate valuation of the environmental good, as shown in Chapter 4. Every user of this good can then weigh up whether he is willing to pay the price or would rather not use the good. With many environmental goods, however, this valuation has to be made by collective action because the environmental good concerned is a collective or open access good. In this case a process is needed that safeguards the valuation and justifies it to the collective.

However, this valuation cannot be determined with the help of survey results. Although surveys are needed to be able to estimate the breadth of preferences and people's willingness to pay, they are insufficient for a derivation of concrete decision-making criteria. Firstly, the individual values are so widely scattered that there is little sense in finding an average value here. Secondly, the preferences expressed in surveys change so much within short time whereas ethical valuations have to be valid for a long time. Thirdly, as outlined at the start of this Chapter, preferences are frequently based on flawed knowledge or ad hoc assumptions both of which should not be decisive according to rational considerations. What is needed, therefore, is a gradual process of assigning trade-offs in which existing empirical values are put into a coherent and logically consistent form.

In political science and sociological literature reference is mostly made to three strategies of incorporating social values and preferences in rational decision-making processes (Renn, 1997). Firstly, a reference to social preferences is viewed solely as a question of the method (Luhmann, 1983; Vollmer, 1996). The decision is made on the basis of formal (such as majority voting). If all the rules have been kept a decision is binding, regardless of whether the subject matter of the decision can be justified or whether the people affected by the decision can understand the justification. In this version, social consensus has to be found only about the structure of the procedures; the only people who are then involved in the decisions are those who are explicitly legitimated to do so within the framework of the procedure decided upon.

The second strategy is to, rely on the minimum consensuses that have developed in the political opinion-forming process (muddling through) (Lindbloom, 1959, 1965). In this process, only those decisions that cause the least resistance in society are considered to be legitimate. In this version of social pluralism groups in society have an influence on the process of the formation of will and decision-making to the extent that they provide proposals capable of being absorbed, i. e. adapted to the processing style of the political system, and that they mobilise public pressure. The proposal that then establishes itself in politics is the one that stands up best in the competition of proposals, i.e. the one that entails the fewest losses of support for political decision-makers by interest groups.

The third strategy is based on the discussion between the groups involved (Habermas, 1971, 1991; Renn and Webler, 1998). In the communicative exchange among the people involved in the discussion a form of communicative rationality that everyone can understand evolves that can serve as a justification for collectively binding decisions. At the same time, discursive methods claim to more appropriately reflect the holistic nature of human beings and also to provide fair access to designing and selecting solutions to problems. In principle the justification of standards relevant to decisions is linked to two conditions: the agreement of all involved and substantial justification of the statements made in the discussion (Habermas, 1981).

All three strategies of political control are represented in modern societies to a different extent. Legitimation conflicts mostly arise when the three versions are realised in their pure form. Merely formally adhering to decision-making procedures without a justification of content encounters a lack of understanding and rejection among the groups affected especially when they have to endure negative side effects or risks. Then acceptance is refused. If, however, we pursue the opposite path of least resistance and base ourselves on the route of muddling through we may be certain of the support of the influential groups, but, as in the first case, the disadvantaged groups will gradually withdraw their acceptance because of insufficient justification of the decision. At the same time, antipathy to politics without a line or guidance is growing, even the affected population. The consequence is political apathy.

The third strategy of discursive control faces problems too. Although in an ideal situation it is suitable for providing transparent justifications for the decision-making methods and the decision itself, in real cases the conditions of ideal discourse can rarely be adhered to (Wellmer, 1992). Frequently, discussions among strategically operating players lead to a paralysis of practical politics by forcing endless marathon meetings with vast quantities of points of order and peripheral contributions to the discussion. The „dictatorship of patience“ (Weinrich, 1972) ultimately determines which justifications are accepted by the participants. The public becomes uncertain and disappointed by such discussions that begin with major claims and end with trivial findings. In brief: none of the three ways out of the control dilemma can convince on its own; as so often in politics, everything depends on the right mixture.

What should a mixture of the three elements (due process, pluralistic muddling through and discourse) look like so that a maximum degree of rationality can come about on the basis of social value priorities? Adherence to this condition is usually linked to the fact that the decisions are seen as adequate for the problem, legitimate, fair and efficient. The method for coming to a decision has to ensure fair direct or indirect access of all groups concerned and the decision-making product has to be able to claim validity and a binding nature on the one hand by the force of the arguments and on the other hand acceptance by means of incorporating all relevant values and interests (Münch, 1982; Dahl, 1989). At this point a special method is to be introduced that allows the existing values in society to be brought into the decision-making process. This method is called the value tree analysis (Keeney et al., 1984; Renn, 1997).

The first theoretical proposals and practical implementations of value tree analysis assumes a given value structure of groups and individuals in a world of plural values (von Winterfeldt and Edwards, 1986). The task of value tree analysis was to put the latent values of a person or a group into a form that was logically consistent and communicatively transparent. To do this, representatives of the groups concerned were questioned in detail in individual interviews about the values and criteria they would use to make a decision about a certain object (such as drilling for oil off the Californian coast or the choice of an environmentally compatible energy system). The value tree analysts then had to transpose the interview responses to a hierarchical tree structure (top values in the trunk, lower values in the branches) and to have this attempt at making a structure confirmed by the interview partners.

Every group's value tree reflects, if it has been set up correctly and validated by the group members as complete and appropriate to the problem, a picture of the (verbally) experienced morality of this group, or rather a picture of morality as the members of the group see it as normatively sensible and appropriate. With every single value tree each group has an aid for structuring and valuation for assessing different options for action. At the same time, the individual value trees are suitable as starting points for a joint dialogue between the groups because a common basis for mutual communications can be achieved with the value trees of a similar structure (Keeney et al., 1984). However, the problem lies in finding a type of

aggregation method that can be used to integrate different value trees or with which the different value trees can be brought together in a common catalogue of criteria.

It was from this difficulty that a second, expanded version of the value tree analysis emerged, in which a value tree supported by all groups joint – a so-called value tree – is developed. Here, too, descriptive ethics sponsored this idea. Just like the individual value trees of each group, the overall value tree only gains validity when it has been confirmed by all of the groups. Once this has happened we can be sure that the central demand has been met, i.e. to have an instrument available that integrates plural values within the framework of a common valuation scale.

However elegant this solution of the additive value tree may appear at first glance, it, too, has its problems. Firstly, an outsider can never see whether the agreement of the reference group concerned was really made on the basis of understanding or whether it was made as a result of situative group pressure or simple fatigue. There is only one way out of this situation, where not only the plural values and interests are formally integrated, but also the groups' agreements are also transparently justified in front of the others (Chambers, 1992).

Fulfilling both conditions at the same time presupposes a discursive form of consultations about the common value tree. The joint value tree has to become a value tree constructed by all of the groups in a process of dialogue. After the group-specific value trees have been drawn up agreement has to be reached in a discursive procedure about which values should be included in the joint tree and why they should be chosen. Only when all the groups have outlined and defended their reasons can a (consensual) decision be taken in a joint discussion about whether and to what extent the proposed value can be included in the common value tree. Firstly, a discursive value tree promises a fair and complete record of all relevant values in a plural society, secondly an intersubjective justification of the normative assumptions entered into the value tree and thirdly an understandable and transparent form of representation of values for outsiders not involved in the discussion.

The process of drawing up a value tree can be divided into seven phases (Table 6). In the first phase the values that the group members consider to be relevant to the valuation of various options for action

Table 6: The stages of a value tree analysis

Source: WBGU

Stage	Description
1	Personal interview with the representative(s) of an interest, lifestyle or value group
2	Structuring proposal for the results of the interview in the form of a hierarchical value tree
3	Feedback of the proposal to the interest group and collecting proposals for improvement
4	Iteration of feedback and improvement until members of the interest groups agree to the value tree for their organisation
5	Developing a common additive value tree in discussion with groups involved over several sessions: <ul style="list-style-type: none"> Definition and clarification of the terms (extension) Justification for normative validity of all values Justification for applicability to valuation objects Agreement on the basic structure of the tree Developing a joint value tree
6	Reviewing the common value tree according to formal aspects
7	Validation of the overall value tree by each group (with a possibility of zero weighting for individual values)

are recorded and included. This recording process takes place in personal conversations between the analysts and representatives of the group concerned. The aim of the talks is to incorporate latent or conscious links between the individual values and the suspected consequences of the options into a logical structure that the people questioned consider to be adequate and true to their attitudes.

During the interview every effort is made to come to a hierarchical tree structure with the general values at the root and the specific criteria and attributes at the top. A key characteristic of value tree analysis is the interactive procedure. After the first questioning the analysts draw up the value tree and linked back to one or the other person questioned. All proposals for change that do not lead to redundancy or departures from the structural logic are taken up by the analysts and integrated in the value tree of the people questioned. This interactive process can be continued over several rounds.

Once the value tree for a group has been drawn up, brought into a hierarchical structure and successively improved over several sessions, it has to be presented to the other members of the group concerned and be accepted as binding by them. The role of the analysts in this process is to support the members in their efforts for inner

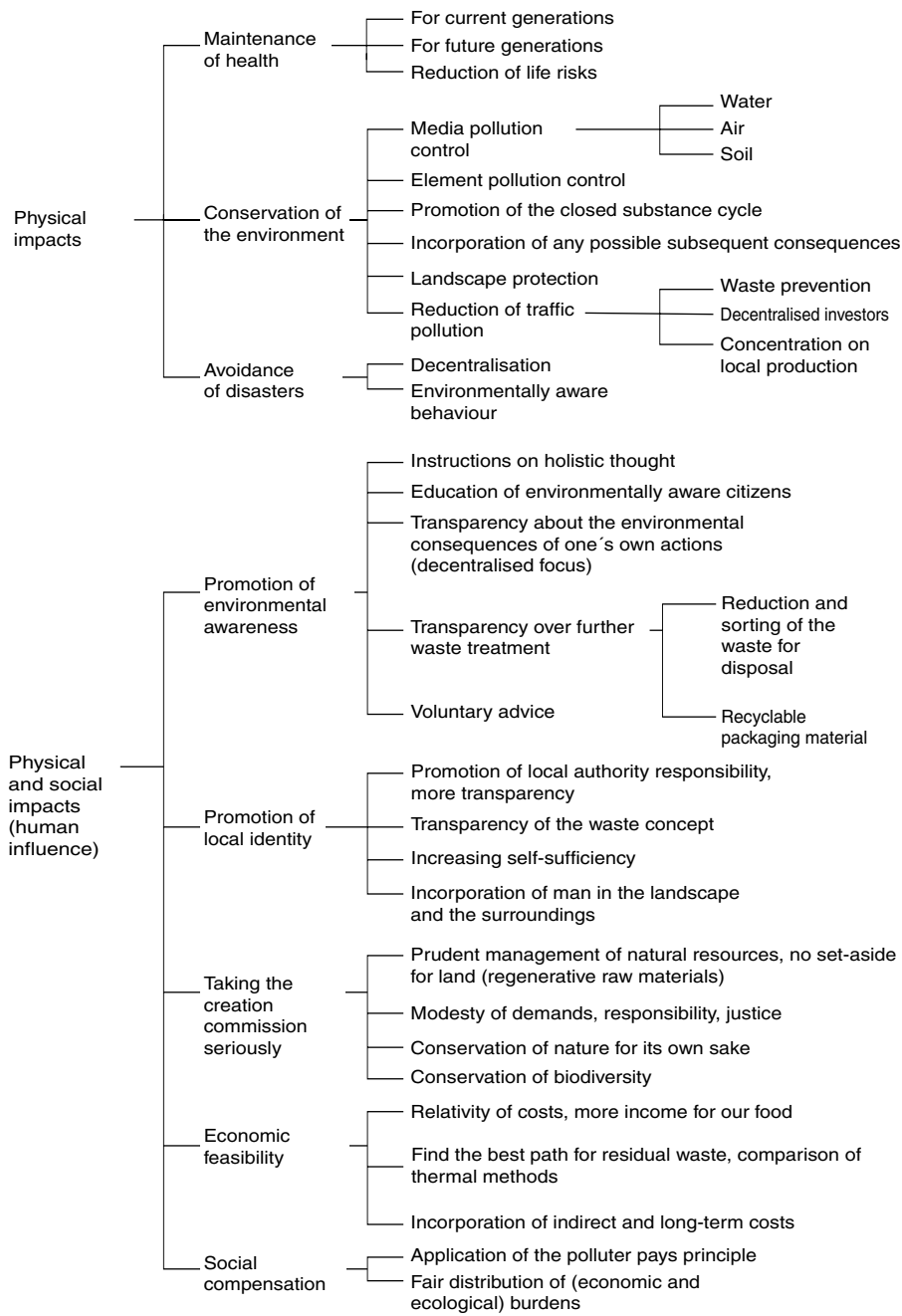


Figure 3: Value tree of the rural women association

Source: Renn et al., 1999

consistency and adequacy so that the group members can enter into discussion with other groups with confidence.

After the individual value trees have been recognised as binding by the group members, the discursive process of drawing up a common value tree follows. This stage is concerned with the semantic clarification of the terms, the discussion about the normative correction or justification of individual categories, the specification of minimum objectives or exclusion criteria and the drawing up of a joint logical structure in upper and lower values. This structure is by no means a depiction of the importance of the individual criteria (that is only specified by weights), it represents the logical inclusion of partial quantities of upper quantities. Fig. 3 shows an example of a value tree that was drawn up in the course of a procedure on public involvement for waste treatment (Renn et al., 1999). This is the value tree of the rural women association. The various value trees of the groups involved are then used to draw up a joint value tree that all groups can agree to.

After a merged value tree has been drawn up it makes sense to check the structure once again from a formal point of view, to identify weaknesses and make modifications. For this purpose Keeney and Raiffa (1976) propose the following test criteria:

- Completeness,
- Operationalisability,
- Independence,
- Lack of redundancy,
- Compactness.

In a final stage, the common value tree has to be confirmed by all groups and recognised as a starting point for the further review of options. This recursive instrument of validation ensures that the representatives of the individual groups do not feel like objects of a social science method, but rather like subjects in an valuation process that gives fair and systematic consideration to their concerns.

Value tree analysis can be used as an important element within the context of a complex decision-making process. Its most important function is systematically recording the assessment criteria for options for action and specifying them in the interplay between plural values and interests in harmony. By agreeing on a list of common criteria the decision naturally remains uncertain. Conflicts are not dealt with in this way, let alone solved. But drawing up value trees is a sen-

sible and productive precondition for diagnosing conflicts over issues and values and for introducing appropriate discursive forms of dealing with the conflicts. Section 6.2 below turns to the question as the how value tree analysis can be integrated as part of a more comprehensive decision-making process.

6.2 The ethics of conducting negotiations

The explanations about the various value categories in Chapter 4 and their application on the biosphere have shown that very often a justifiable, clear valuation of options for action is not possible. How should we proceed in these cases? According to which criteria can a process of assigning trade-offs be made? Conflicts with regard to appreciation cannot usually be solved by ethical considerations alone (with the exception of dominant cases, sub-dominant case or cases with absolutely equal infringements of values on every dimension). Ethics would be overtaxed if it promised that it could derive binding conclusions for all concrete standards for. Subjective valuations are always entering the trade-off process itself, which, although they can be justified ethically, claim no universal validity vis-à-vis third parties or do not force clear prioritisation for all.

How do we deal with competing ethical valuations? In this dilemma ethics have concentrated on procedural rules for dealing with proof and negotiations (Ott, 1996). These rules are supposed to ensure that people who have to weigh up between the various value dimensions do so in a fair and competent way (Renn and Webler, 1996). Here, fair means that everyone who takes part in an appreciation process has the same chance to present his arguments and justifications and criticise others; competent means that the process of testing arguments is made according to logical and transparent criteria. Ethics offers testing procedures for delineating judgements and setting priorities according to rational-logical methods in accordance with the primary principles that they recognise. Such a consistent valuation strategy can be implemented either by an individual evaluator himself or in negotiations with different groups of evaluators. Because conservation of the biosphere is largely an object of political negotiations and involves many players, in the following we will deal only with the process of conducting negotiations.

A report by the American Academy of Sciences on the subject of „Understanding environmental risks“ (Stern and Fineberg, 1996) comes to the conclusion that scientifically valid and ethically justified procedure for the collective valuation of options for action can only be realised within the context of an analytic-deliberative process. *Analytic* means that the best scientific findings about the possible consequences and conditions of collective action are incorporated in the negotiations; *deliberative* means that rationally and ethically transparent criteria for making trade-offs are used and documented externally. Moreover, the authors consider fair participation by all groups concerned is necessary to ensure that the different moral systems that can legitimately exist alongside each other should also be incorporated in the process.

How can ethical considerations provide help for a rational and fair way of conducting negotiations? How can general binds be specified in spite of the plurality of moral systems and preferences and in spite of the insurmountability of the problems in final justification? A few important standards for shaping the conducting of negotiations are listed below (Renn and Webler, 1998).

Pragmatically, it makes sense in negotiations to specify the essential *primary principles*. These principles are usually laid down in the generally recognised human rights. The American bioethicists Beauchamp and Childress (1994) have set up their own guiding principles that they feel have proved themselves as primary principles in discourses. These principles, in turn, should be understood in the sense of a hierarchy (quoted after Revermann, 1998):

- Principle of no damage (no damage to life, limb or property)
- Principle of autonomy (consideration of human self-determination)
- Principle of doing good (avoidance or remedying damage or improving a situation seen as unacceptable)
- Principle of justice (at least formal equality when assigning rights and duties with parallel cases).

Long, drawn-out discussions about anthropocentric or physiocentric perspectives, however, are mostly counterproductive because the implications of both points of view are less far apart than appears obvious from the fundamental positions. Even with the further explanation of primary principles we advise to use mild wording and then pay attention to concrete distinctions and precision in the stan-

dards for action. Serious conflicts between industrialised and developing countries should not usually be expected with regard to the question of primary principles, even though different priorities make agreement about the relative importance of the primary principles difficult. However, this relative weighting can be better approached constructively when dealing with the secondary principles.

Even though the primary principles may not be disputed it is often useful to list these principles in advance within the framework of a preamble. In the process, wording can be used that has already been used in international conventions. This sets a reference frame that can always be used as an orientation guide in the event of a conflict. Ethically dubious proposals can also be averted more easily and more quickly with back reference to applicable primary principles than by means of fundamental debates.

When *incorporating secondary principles and standards* mutual understanding of the contents and implications and a detailed debate about the corresponding implementation conditions are needed. Above all, the bandwidth of validity and the binding nature of normative statements should be specified. This means restriction to the standards and principles that are relevant to the action for the problem concerned. Various methods, such as the value tree analysis presented in Section 6.1, are suitable for this in principle and have already proved themselves in international negotiations (von Winterfeldt and Edwards, 1986). On the one hand it is necessary only to allow those criteria that have an internal connection to the subject matter, on the other hand the requirement for fairness means that all values and standards advocated by the parties concerned should be considered as far as possible. A broad interpretation of the values and criteria also ensures that the weaker negotiating partners in discussions also feel that they are adequately represented and thus have higher motivation for reaching agreement.

Mutual respect has proved to be a central condition for successful negotiations, i.e. mutual assurance that the primary values of the respective other partners are recognised and appreciated, without having to share them individually (Luhmann, 1978). Mutual respect is linked to personal appreciation. This facilitates the formulation of compromises without consensus having to be reached in the matter.

Once the normative criteria and value dimensions that should be used to assess options for action have been jointly specified, it is

necessary to record or research the current level of knowledge about the possible consequences of different options for action. In the process, the criteria can act as heuristic orientation to identify those elements of knowledge from the entire wealth of knowledge that allow an assessment of different options for action (such options also include generally binding restrictions of action as expressed by standards and agreements). In this process, in analogy to the Council's classification of risks, attention must be paid to representing the extent, the probability of occurrence and the breadth of the remaining uncertainties of subsequent effects (WBGU, 2000). Only on the basis of a solid and honest overview of the expected consequences of action can an ethically justifiable process of balancing the pros and cons be carried out. If the possible consequences are highly disputed or extremely uncertain, it makes sense to deploy special methods for reaching consensus among experts.

Of the dialogue-oriented methods for assessing the impact of options for action, the *Delphi questioning* has proved itself especially useful (Renn and Oppermann, 1995). This method was developed by the RAND Co. in the mid-1960s and was initially used to evaluate defence technologies. Later it was mainly used as a prediction instrument within the context of assessments of the consequences of technology (Mintroff and Turoff, 1975; Benarie, 1988). The Delphi method is made up of the following stages:

- A research team draws up a catalogue of questions dealing with the expected consequences of a measure or a decision options.
- The questionnaire is sent to a group of recognised experts in the field concerned. Here, attention has to be paid to balanced representation of different countries and points of view. The experts answer the questions to the best of their knowledge and give an estimated mark to „subjective certainty“, i.e. the estimated validity of their own responses.
- The research team determines the average scores, the extreme scores and the variance of the responses.
- The original questionnaire is returned to the experts together with the valuation of the first questioning. In this process, all of the names of the experts are kept anonymous in order to rule out biases by status or seniority. The people questioned are asked to complete the questionnaire a second time, but this time with the instruction to incorporate the results of the first questioning as a

correction to their own judgements in the new assessment. The purpose of this second question is to reduce the variance of the possible responses and the collective certainty of judgement.

- Steps 2, 3 and 4 are repeated so often until the experts do not change their judgements any more.

In an ideal case the Delphi method identifies the valuations that are capable of achieving consensus among a group of experts or that justify dissension. By making the participants anonymous and as a result of the iterative questioning process the current level of knowledge can be shown without taking account of the prestige of each participant in the Delphi process.

One of the serious disadvantages of the traditional Delphi method is the lack of justification for judgements that deviate from the median of all participants (Hill and Fowles, 1975). That is why Webler et al. (1991) proposed a modification of the method. In this, the experts are not linked to each other by means of postal questioning and feedback; they are invited to a joint workshop for one to two days. Here it is important that the invited experts represent the bandwidth of different opinions and interpretations discussed in the specialist circles. At the same time, no more than 16-20 experts should be invited. In the run up to or, at the latest, at the start of the workshop, the task and the structure of the questionnaire are explained to the participants. Then the participants are split up into 3-4 groups in a first round. Each of these small groups of 3-4 people is given the same task, i.e. to fill in the questionnaire. The aim is for consensus, but deviating votes are possible. In the plenary, those experts whose valuations significantly deviate from the mean value of all other participants have to justify their point of view in front of the others and defend them in arguments among the expert group. This procedure is based on the intention of using the scarce time to divert communications to the subjects where there is obviously the most discrepancy in assessments. The aim of the discussion is to find out where the roots of this dissent can be found and whether the discrepancies can be resolved by information and arguments from the other experts.

In a second round the process is repeated in new small groups. When putting together the new small groups, representatives of the extreme groups from the first round have to be included in each group. The sequence of individual group sessions and plenary meetings is continued until there are no more significant shifts in opini-

ons. At the end of a group Delphi there is usually a much clearer spread of response patterns. The experts' assessments are either scattered around a mean value or there is a distribution of viewpoints showing several peaks. In the first case consensus has been broadly achieved, in the second case we can clearly see several, separate positions (consensus on dissent). At the end of this stage we have a profile, supported by the experts, of suspected or estimated consequences of action for each decision option on the basis of the criteria proposed as relevant by the parties involved (for example, as the result of a preceding value tree analysis). On the basis of discussions among experts, the verbal justifications for different assessments are also stored as additional information on the profiles.

In order to be able to sensibly discuss normative criteria and principles in practical negotiations, it is necessary to point out *certain rules for justification forms* to the participants. Adherence to formal criteria such as consistency (lack of contradiction), logic and coherence are called for. In addition, substantial criteria such as the golden rule of reciprocity („Do as you would be done by“) or the subsumption of a criterion to be examined below another upper criterion that has already been recognised are valid. Parallel to this, compatibility with statutory provisions or international agreements should be examined, which both ideally reflect the previous community agreements about collectively binding values and objectives based on consensus or majority decisions.

In the course of the negotiations different conflicts arise that have to be dealt with in different ways. The main conflicts occur at the process level (how should the negotiations be conducted?), on the cognitive level (what is factually correct?), the interest level (what benefits me?), the value level (what is needed for a „good“ life?) and the normative level (what can I expect of all involved?).

First of all, negotiations begin by specifying the method that structures the dialogue and the rights and duties of all participants. It is the task of the chairman or organiser to present and justify the implicit rules of the talks and negotiations. Above and beyond this, the participants have to specify joint rules for decisions, the agenda, the role of the chairman, the order of hearings, etc. This should always be done according to the consensus principle. All partners in the negotiations have to be able to agree to the method. If no agreement is reached here the negotiations have to be interrupted or reorganised.

Once the negotiation method has been determined and, in a first stage, the values, standards and objectives needed for judgement have been agreed jointly, then follows the *exchange of arguments and counter arguments*. In accordance with decision theory, four stages of validation occur:

In a first stage, the values and standards accepted by the participants are translated into criteria and then into indicators (measurement instructions). This translation needs the consensual agreement of all participants.

Experts are asked to assess the available options with regard to each indicator according to the best of their knowledge (factual correctness). In this context it makes more sense to specify a joint methodological procedure or a consensus about the experts to be questioned than to give each group the freedom to have the indicators answered by their own experts. Often many potential consequences remain disputed as a result of this process, especially if they are uncertain. However, the bandwidth of possible opinions is more or less restricted depending on the level of certainty and clarity associated with the issue in question. Consensus on dissent is also of help here in separating contentious factual claims from undisputed ones and thus promotes further discussion. The group Delphi method described above may be suitable for constructively dealing with conflicts at the cognitive level.

The parties then have to interpret bandwidths of impacts to be expected for each criterion. *Interpretation* means linking factual statements with values and interests to form a balanced overall judgement (conflicts of interests and values). This judgement can and should be made separately for each indicator. In this way each of the chains of causes for judgements can be understood better and criticised in the course of the negotiations. For example, the question of trustworthiness of the national and international supervisory bodies may play an important role in the interpretation of an expected risk value. Then it is the duty of the participating parties to scrutinise the previous performance of the authority concerned and propose institutional changes where appropriate.

Even if there were a joint assessment and interpretation for every indicator, this would by no means signify that agreement is at hand. Much rather, the participants' different judgements about decision-making options may be a result of different *value weightings* for the

indicators that are used as a basis for the values and standards. For example, a committed environmentalist may give much more weight to the indicator for conservation than to the indicator of efficiency. In the literature on game theory this conflict is considered to be insoluble unless one of the participants can persuade the other to change his preference by means of compensation payments (for example, in the form of special benefits), transfer services (for example, in the form of a special service) or swap transactions (do, ut des). In reality, however, it can be seen that participants in negotiations are definitely open to the arguments of the other participants (i.e. they may renounce their first preference) if the loss of benefit is still tolerable for them and, at the same time, the proposed solution is considered to be „conducive to the common good“, i.e. is seen as socially desirable in public perception. If no consensus is reached, a compromise solution can and should be reached, in which a „fair“ distribution of burdens and profits is accomplished. Table 7 provides a brief overview of the methods of conflict resolution.

Table 7: Different conflict types and discursive strategies for processing them gradually

Source: Renn and Webler, 1998

Type of conflict	Explanation of this type	Example(s)	Contents of the conflict	Processing methods
Agreement on methods and procedures	Structure of decision-making	Majority voting, agenda	Procedural justice	Consensus
Assessment of appropriateness of values	Criteria selection to evaluate options	Objectives such as: efficiency, environmental compatibility	Legitimacy of values and standards	Acceptance of all authentically represented values
Assessment of the factual evidence	Criteria to evaluate factual knowledge	Physical measurement, expert judgement	Dissent among experts	Methodological specification, selection of experts Delphi method
Assessment of the value relevance of statements	Subjective interpretation of all consequences	Specification of reasonable risk	Variability of preferences	Agreement on rules to justify judgements
Weighting of values	Relative priority of values	Relative weight of environment versus efficiency	Relative importance of values	Higher-level standards, common wellbeing, compensation

Normative conflicts pose special problems because different evaluative criteria can always be classified as equally justifiable or unjustifiable. For this reason, most ethicists assume that different types and schools of ethical justification can claim parallel validity, it therefore remains up to the groups involved to choose the type of ethically legitimate justification that they want to use (Ropohl, 1991; Renn, 1997). Nevertheless, the limits of particular justifications are trespassed wherever primary principles accepted by all are infringed (such as human rights). Otherwise, standards should be classed as legitimate if they can be defended within the framework of ethical reasoning and if they do not contradict universal standards that are seen as binding for all. In this process conflicts can and will arise, e.g. that legitimate derivations of standards from the perspective of Group A contradict the equally legitimate derivations of Group B (Shrader-Frechette, 1988). In order to reach a jointly supported selection of standards either a portfolio of standards that can claim parallel validity should be drawn up or compensation solutions will have to be created in which one party compensates the other for giving up its legitimate options for action in favour of a common option.

When choosing possible options for action or standards, options that infringe *categorical principles*, for example to endangering the systematic ability of the biosphere to function for human use in the future and thus exceeding the limits defined by the Council as guard rails. At the same time, all sub-dominant options have to be excluded. Frequently sub-dominant solutions, i.e. those that perform worse than all other options with regard to all criteria at least in the long term, are so attractive because they promise benefits in the short term although they entail losses in the long term, even if high interest rates are assumed. Often people or groups have no choice other than to choose the sub-dominant solution because all other options are closed to them due to a lack of resources. If large numbers of groups or even peoples act in this way, global risks become unmanageable (Beck, 1996). To avoid these risks intermediate financing or compensation by third parties should be considered.

In connection with the relative weighting of the various valuation dimensions it is sensible to carry out hierarchisation of values in the way described in Chapter 4. Here it should become clear that the symbolic values for subjective well being and the design of a „good“ life have just as much normative validity as the material benefit

values; at the same time, however, safeguarding basic economic functions is often the precondition for symbolic assignments taking effect. When evaluating option values, first of all it should be ascertained whether there is any information about probabilities and use potentials. If there is, the level of discounting of current use vs. future use should be determined. For many forms of ecological risks it may be justified to indicate discount rates of zero or almost zero. If there is no information about the probability or use potentials – and this is often the case – valuation can only be conducted according to functional aspects (existence of function equivalents) or experts' estimates. At the same time, decentralised incentive systems and liability agreements can be used to give impetus to the provision of knowledge and constant adaptation processes. In addition, the existential value must be taken into account in the appreciation process after the other criteria have been included.

When weighing up options for action *formal methods of balancing assessment* can be used. Of these methods, the cost-benefit analysis and the multi-attribute or multi-criteria decision have proved their worth. The first method is largely based on the approach of revealed „preferences“, i.e. on people's preferences shown in the past expressed in relative prices, the second on the approach of „expressed preferences“, i.e. the explicit indication of relative weightings between the various cost and benefit dimensions (Fischhoff et al., 1982). But both methods are only aids in weighing up and cannot replace an ethical reflection of the advantages and disadvantages.

When deciding on options for action and, above all, standards for action it is important to ensure that implementation conditions and review criteria are specified together with the standards. Standards are valid only to the extent that they can also be implemented.

In order to reach an understanding about the inner logic of the arguments and their justification, participants of negotiations should have the ability to, or be instructed in how to, formulate their ideas, statements and criticisms in such a way, and communicate them to others, that these others can understand the meaning and the legitimacy within the meaning of justification logic of each group presenting the ideas. Sociologists and philosophers have been arguing for many years about whether such a level of mutual understanding is realistic (cf. Habermas, 1989; von Schomberg, 1992 on the one hand and Luhmann, 1984, 1993, 1998 on the other hand). In this argument,

both parties agree that because of the functional differentiation of society, understanding processes between players of different social sub-systems within a society and especially between different cultures are becoming increasingly difficult. The claim that understanding of this kind cannot be brought about actively has been falsified and verified in numerous international negotiations, especially with globally relevant subjects such as the protection of the biosphere. The few successes demonstrate that, at least in principle, people from the most varied groups and cultures are capable and willing of formulating arguments about standards, values and options for action and exchanging them (similar to Habermas, 1992). It is the task of the organisation of such negotiations to set the conditions for a discussion based on arguments, where the standards of finding the truth are met and empirical subsequent knowledge are taken into account.

7 Conclusions for biosphere protection

What contribution do ethics make towards clarifying the prospects and limits of biosphere use? The use of (cultivated) nature is an anthropological necessity. Human consciousness works reflexively and human have developed a causal recognition capacity that enables them to record cause and effect anticipatively and to productively incorporate assessed consequences in his own action. This knowledge is the motivating force behind the cultural evolution and the development of technologies, agriculture and urbanisation. With power over an ever-increasing potential of design and intervention in nature and social affairs over the course of human history, the potential for abuse and exploitation has also grown. Whereas this potential was reflected in philosophical considerations and legal standards at a very early stage with regard to moral standards between people, the issue of human responsibility towards nature has only become the subject of intensive considerations in recent times. Ethical considerations are paramount in this respect. On the one hand, they offer concrete standards for human conduct on the bases of criteria that can be generalised, and on the other hand they provide procedural advice about a rational and decision and policy making process.

A simple breakdown into categorical rules and prohibitions that are capable of being compensated can assist decision makers for the justification of principles and standards on biosphere protection. As soon as human activities exceed the guidelines of the categorical principles there is an urgent need for action. How can we detect whether such an excess has happened and how it can be prevented from the very outset that these inviolable standards and principles be exceeded? Here are four central considerations on this:

1. In almost all of its reports of recent years the Council (WBGU, 1996, 1998) has called for international functional units to perform a monitoring and early warning function (e.g. the proposal for a UN Risk Assessment Panel in the 1998 annual report; WBGU, 2000). Such functional units should not be organised as new authorities, but much rather as a network of scientists and professional observers who can quickly and reliably make a diagnosis of cases where the guide rails have been exceeded or are about to be exceeded. This function is also, and especially, needed in the field of biosphere use because only by evaluating global data and devel-

- opments can infringements of the categorical values be identified.
2. The implementation and, where appropriate, the expansion of such international mechanisms, which help to protect the categorical values, are urgently required. Since arguments for an infringement of values will hardly endure in the discussion with respect to categorical risks, there is a great prospect of consensus there. This procedure is called the triage strategy in the literature (Rolston, 1994a). Mechanisms that promise effective protection and appear clearly justified ethically have priority.
 3. The Council sees the implementation opportunities of the ethically required actions for the low-impact use of the biosphere much less as secured by compulsory measures of any kind (with the exception of categorical standards). Much rather, it trusts to a greater extent in the creation of decentralised incentive systems that, on the one hand, give impetus to the required provision of knowledge and, on the other hand, offer economic incentives for ethically required conduct. Since the protection and conservation of the biosphere represents global goods and the beneficiaries and bearers of the costs are frequently not the same people, negotiations on an international and a sub-political level (multinational companies, NGOs, etc.) are also needed. The Council outlines in detail how this can be implemented in practice (WBGU, 2001).
 4. The Council considers an analytical breakdown into three strategies of biosphere protection to be helpful for the implementation of categorical guidelines. It can be assumed that the breakdown into the three categories will not be made without conflicts. A discursive method of decision-making could be used here, the basic rules of which were outlined in Chapter 6. The Council has drawn up the following strategies:

The first strategy is that of complete protection with severe restrictions of all use by humans (*Noah strategy*). The second strategy provides for a balanced relationship between protection and use, where extensive resource use should go hand in hand with the conservation of the ecosystems concerned (*sensor strategy*). The third strategy is based on optimum use involving assurance of continuous reproduction. The guiding principle here would be an intensive and, at the same time, sustainable, i.e. with a view to the long term, use of natural resources (*Demiurg strategy*).

- a. The *Noah strategy* is recommended when categorical values are at

stake or, when weighing up, clear protection interests have priority over use interests. Since in such cases the interests for resource use are frequently found in different population groups than the protection interests, it is essential for compensation payments or at least compensation services to be made, by means of which the expected gain in benefit for the international community is shared with those who have had their rights restricted by the protection. For example, if a landscape that absolutely has to be conserved is to be kept largely free of economic use so that humanity as a whole can benefit from it in the long term, the local population, whose income scope is considerably limited as a result, has to be adequately compensated with an additional income or an additional benefit. In this case, self-supporting structures in the areas concerned are ideal, in which a protection function is performed by means of economic incentives and decentralised control mechanisms. The Council has outlined in detail how this can happen effectively and efficiently (WBGU, 2001).

Compensation payments ensure that this strategy is not implemented at the expense of the mostly poor local population. At the same time, the willingness of the rich countries to renounce some of their own income in favour of a global benefit is also put to the test. This mechanism of compensation payments is also an effective way of regulating a prohibition on far-reaching use in those cases where categorical values are really infringed or there are clear results of weighing up benefits and risks.

- b. The *Censor strategy* is always of benefit when there are value conflicts in weighing up between economic benefits and. In this case it makes sense to find creative solutions in the sense of protection through use. Here too, economic incentives have to be created that ensure that the users do not exploit the maximum potential, but prefer extensive forms of land management to the benefit of long-term protection. The Council outlines how this should be implemented in practice in the Chapter „Protection through use“ (WBGU, 2001).
- c. Like the first strategy, the *Demiurg strategy* assumes categorical values or clear appreciation judgements – but this time in the opposite direction. 6 billion people in the world have to be provided with enough food and other products and services. On the land where intensive farming is possible without serious impair-

ment to the biosphere it is not only ethically tolerable, but practically obligatory, to use these potentials intensively. However, here it must be ensured that the natural preconditions that make intensive use possible in the first place will continue to be in place in the future. Intensive use of nature taking account of sustainable framework conditions is called for.

Following these three strategies should not just be understood on a global level. Even within a regional area (maybe a town) the three different strategies can be pursued in partial areas or in certain functional spaces. The analytical breakdown into three strategies should thus be applied sensibly at local, regional and national level. However, the Council is convinced, as far as dealing with the global dimensions of biosphere protection is concerned, that the simple breakdown into three fundamental strategies that can be derived logically from the ethical considerations is an important step for the diagnosis and for the design of appropriate policy options

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