Hanns Seidel Stiftung

Landscape Planning, Ecological Database and Assessment, and Ecological Compensation of Interventions - Useful Tools on the Way to Achieving Ecological Civilization

Chinesisch-Deutsches Bildungs- und Forschungszentrums für Flurneuordnung und Landentwicklung Qingzhou, China (BFL)

Landscape Planning, Ecological Database and Assessment, Ecological Compensation of Interventions - Useful Tools on the Way to Achieving Ecological Civilization

Academic Exchange Between

Land Consolidation and Rehabilitation Center, the Ministry of Natural Resources, China

And

Hanns-Seidel-Stiftung, Munich, Germany Representative Shandong / BFL Qingzhou, China

2018-10-22

DISCLAIMER

This paper is written on behalf of the Hanns Seidel Foundation e. V. Munich, being requested by the Land Consolidation and Rehabilitation Center, The Ministry of Natural Resources of the People's Republic of China.

The contents of this paper, esp. statements, opinions, and recommendations are made on the responsibility of the author alone and do not represent the views of the client.

Author:

Dipl. Ing Karl Spindler
Planning Office Spindler
Free Landscape Architects

Am Mennersberger Weg 1
92280 Kastl
Germany

0049 9625 91270
karl@spindler-kastl.de

Edited by Dr.-Ing. Michael Klaus, HSS

TABLE OF CONTENTS

ABBREVIATIONS

ANR	Agency for Natural Resources
CLSPI	Chinese Land Survey and Planning Institute
CPC	Communist Party of China
HSS	Hanns Seidel Foundation e.V. Munich
LCRC	Land Consolidation and Rehabilitation Center
MNR	Ministry for Natural Resources

1. INTRODUCTION

This report is based on the lecture given by the author during an academic exchange between the Land Consolidation and Rehabilitation Center (LCRC) under the Ministry of Natural Resources (MNR) in the People's Republic of China and the Hanns Seidel Foundation (HSS), Representative Shandong / BFL Qingzhou. The meeting took place in the Office of LCRC on 22nd October, 2018.

The content of this paper may relate to statements of the 18th CPC Party Congress concerning the term goals of ecological civilization:

"An order of ecological civilization must be established and expanded in order to systematically protect the environment and ecology. It requires sound systems that govern the ownership and use of natural resources. There must be a red line to protect the ecology. A system is to be implemented, which pays for the use of resources and compensates for damage to the ecology. The ecology and environmental protection administration needs to be reformed."

Ecological aspects and landscape planning have always been important aspects in the cooperation projects with China, supported by the HSS.

It began with the Zitong Project in Chonqing, in 2007, first field reviews with the goal of assessing a mapping of ecological relevant structures to achieve a systematic structure image and to represent in an area-wide-plan, and continued with the Sanbaishan Project in Jiangxi, in 2014, with the first systemic approaches of ecological evaluation. However, for various reasons, such as lack of administrative bases and funding, this approach could not be continued. Thus, general survey typical landscape structures were separated and scored in a value index system.

In the recent Project in Nanchong city (Jinyuan in Xichong county and Baoping in Ylong county), Sichuan, these approaches were adopted and further developed. A modern database module is created and available to serve as a starting point for solutions at provincial and national levels.

This report, prepared from the German point of view, has the intention of:

- Providing important basics for understanding the terms: Ecology, Landscape Ecology, Ecological Database, Environmental Goods, Ecological Value System, Theory and Practice of Intervention and Compensation;
- Demonstrating approaches to the current state of planning cooperation in the field of ecology and landscape planning;
- Indicating the grand variation of ecological zones of the earth in which the People's Republic of China participates; and
- Giving recommendations from the author's point of view.

In addition, the report also seeks to encourage further academic exchanges and further deepen the cooperation between the MNR and the HSS.

2. LANDSCAPE PLANNING AND LANDSCAPE ECOLOGY

2.1 Landscape Planning

Landscape planning is the application of an instrument to secure and implement a "healthy and intact" environment. It provides suggestions for the sustainable development of nature and landscape. Humankind and its needs lie at the core of landscape planning. It is often an area of conflict between urban and regional planning as well as ecological and economic interests.

The essential basis of landscape planning is the understanding of landscape ecology. Landscape ecology examines ecological relationships in their spatial manifestations. Depending on the underlying concept, a landscape and the causal structure of effects, that is referred to in some directions as a natural household, is perceived as an objectively given spatial-functional wholeness or a methodological construction.[1]

Landscape planning is precautionary and pursues a holistic, comprehensive approach to the protection, care, development and, as far as necessary, the restoration of natural space and cultural landscape. It does not only refer to the free, undeveloped landscape, but it also integrates landscape parts such as villages, settlements, cities, traffic routes and industrial areas into the planning work. [1]

Landscape planning generally is to consider:

- the local ecological structures, biotic and non-biotic
- the spatial-ecological functions of landscape areas/ units up to ecosystems and biosphere
- non-material values
- the relationship between a good and sustainable environment, and human needs and desires

2.2 Ecology

Ecology is a scientific discipline of biology that studies the interactions among organisms and their environment. The objects of study include interactions of organisms with each other and with abiotic components of their environment.

Topics of interest include the biodiversity, distribution, biomass, and populations of organisms, as well as cooperation and competition within and between species. Ecosystems are dynamically interacting systems of organisms, the communities they make up, and the non-living components of their environment. Ecosystem processes, such as primary production, paedogenesis, nutrient cycling, and niche construction, regulate the flux of energy and matter in an environment. These processes are sustained by organisms with specific life history traits. Biodiversity means the varieties of species, genes, and ecosystems, enhance certain ecosystem services.

Ecology is not synonymous with environmentalism, natural history, or environmental science. It overlaps with the closely related sciences of evolutionary biology, genetics, and ethology. An important focus for ecologists is to improve the understanding of how biodiversity affects the ecological function.

Thus, ecologists seek to explain:

- life processes, interactions, and adaptations
- the movement of materials and energy through living communities
- the successional development of ecosystems
- the abundance and distribution of organisms and biodiversity in the context of the environment.

[1]https://www.anwalt24.de/lexikon/umweltschutz_prinzipien_des_umweltrechts

Ecology has practical applications in:

- landscape and biology, biodiversity conservation,
- wetland management,
- natural resource management (agroecology, agriculture, forestry, agroforestry, fisheries),
- city planning (urban ecology),
- community health,
- economics, basic and applied science, and
- Human and social interaction (human ecology).

The word "ecology" (in German "Ökologie") was coined by the German scientist Ernst Haeckel in 1866. Ecological thought is a derivative of established currents in philosophy, particularly ethics and politics.

Modern ecology became a much more rigorous science in the late 19th century. Evolutionary concepts relating to adaptation and natural selection became the cornerstones of modern ecological theory.

In China the term “ecology” also seems to be used in many different ways and it is appropriate to differentiate and specify the term in its respective meaning.

2.3 Landscape Ecology

Landscape Ecology examines the ecological relationships in their spatial manifestations, whereby, depending on the underlying concept, a landscape and the investigated causal structure of the "natural household" are regarded as an objectively given spatial-functional wholeness.https://en.wikipedia.org/wiki/Ecological_civilization - cite_note-ecocivdebate-1

Landscape ecology is the science of studying and improving the relationships between ecological processes in the environment and particular ecosystems. This is done within a variety of landscape scales, development spatial patterns, and organizational levels of research and policy.

As a highly interdisciplinary field in systems science, it integrates biophysical and analytical approaches with humanistic and holistic perspectives across the natural sciences and social sciences.

Landscapes are spatially heterogeneous geographic areas characterized by diverse interacting patches or ecosystems, ranging from relatively natural terrestrial and aquatic systems, such as forests, grasslands, and lakes, to human-dominated environments including agricultural and urban settings.

The most salient characteristics of landscape ecology are its emphasis on the relationship among pattern, process and scale, and its focus on broad-scale ecological and environmental issues. These necessitate biophysical and socioeconomic sciences working together. Key research topics in landscape ecology include ecological flows in landscape mosaics, land use and land cover change, scaling, relating landscape pattern analysis to ecological processes, and landscape conservation and sustainability.

3. PROCEDURES IN LANDSCAPE PLANNING

3.1 Basic Principles of Environmental Law in Germany

Without going into the comprehensive field of environmental law in Germany at this point, the basic principles of environmental law are briefly described here:

3.1.1 Precautionary Principle

As a material guiding principle of modern environmental protection, the precautionary principle aims at eliminating or minimizing possible environmental burdens and risks from the outset by means of early and forward-looking action. This not only includes the prevention of possible risks, but also the careful use of natural resources.

3.1.2 'Polluter Pays' Principle

The 'polluter pays' principle states that, in principle, the person causing (or having caused) the environmental damage should be obliged to eliminate or reduce it. Thus, the "environmental troublemaker" as the material responsible should bear the costs of avoiding, eliminating or compensating for environmental pollution as well as being the addressee of corresponding prohibitions, requirements and conditions.

3.1.3 Cooperation Principle

The cooperation principle is understood as a procedural principle, which demands attention in the fulfilment of environmental protection tasks. The state should not primarily exert pressure to achieve environmental protection (as has been widely done by means of environmental legislation), but cooperate with the social forces, for example in the form of (mutual) information and consultation, as well as negotiations, votings, conclusions and execution of agreements.

3.1.4 Other Environmental Laws and Principles

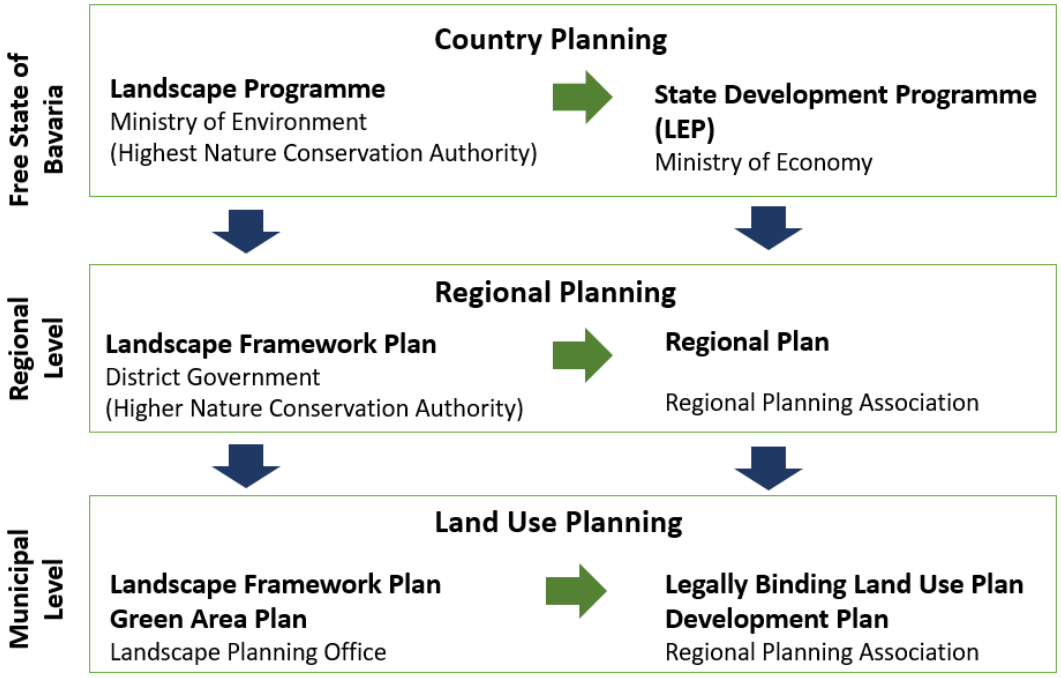
In addition to these three principles, which are at the forefront of environmental policies, a number of other principles have been developed which are intended to guide environmental protection - or certain aspects of environmental protection - and so on. Among others:

- the community load principle,
- the stock protection principle (prohibition of deterioration),
- the protection principle ("in dubio pro securitate"),
- the principle of sustainability,
- the principle of controlled self-responsibility,
- the principle of cross-border environmental protection,
- The "cradle-to-grave" principle (environmentally hazardous or harmful substances always to be controlled during their entire production, use and disposal processes).

3.2 Integration of Landscape Planning into Spatial Planning

Following figure shows the integration of landscape planning into spatial planning.

Figure 1: Integration of landscape planning into spatial planning levels



4. ECOLOGICAL DATABASE

4.1 Basic Remarks

In order to carry out a planning process, aimed at ecological measures, it is, as in every planning discipline, necessary to collect and evaluate relevant data.

Technically, one can usually distinguish between two types of data:

- geometrical data
- factual data

Both types of data can be spatially combined into GIS-supported databases and displayed. The nature, detailing, spatial representation and technical performance of GIS databases have developed rapidly over the last 20 years and will continue to evolve, also through insights offered by Artificial Intelligence.

In principle, it is absolutely necessary to collect data for ecologically relevant planning decision-making processes.

An ecological inventory has the following important functions:

- to provide the basics for evaluations, analyses and planning processes, and
- to preserving evidence for the field of action "interventions and ecological restoration": whether a measure has worsened or improved the ecological status can be assessed only it has the important function of preserving evidence: only if the state is recorded before the measure. In other words, whether or not an ecological restoration can equal the intervention.

In China, according to the author, when taking action on nature through extensive infrastructure development, great efforts are being made to implement environmental measures to mitigate or counteract the interference. In particular, planting trees is are being carried out to a large extent in order to re-plant the respective measures and integrate them into a beautiful landscape. The diverse welfare effects of tree planting are of course completely undisputed, important for climatic and air improvement, as a habitat and a beautiful landscape. The question remains as to whether other ecological functions can be restored by planting alone. Due to a lack of ecological stocktaking, it is not possible to scientifically assess or prove whether and how a measure is ecologically balanced. Thus, the only the possibility left is a verbal appreciation.

4.2 Public, Environment, and Area-Related Databases in Germany

In Germany, spatially relevant data is available from spatial planning institutes, but also from offices, governments, academia or national and international institutions. For example, the state offices for environmental protection, but also the offices responsible for planning the space, offer data in the form of factual data or maps. In Bavaria, the Bavarian State Government's "Geoportal Bayern" bundles central access to data, services and applications of the geodata infrastructure in Bavaria, which is accessible by internet.

Figure 2: Public internet database geoportal Bayern

Source: https://geoportal.bayern.de/geoportalbayern/

The public data from all the ministries and offices is summarized in this portal. It covers the topics of geospatial reference data, planning and construction, infrastructure, natural hazards, education/ social issues, homeland, historical maps, leisure time, administrative atlas and the environment.

Figure 3: Themes of public internet database Geoportal Bayern: infrastructure, natural hazards, education/ social issues, homeland, historical maps, leisure time, administrative atlas and the environment

The variety of data provided is almost unmanageable to mention. Of these, only a few are named:

Figure 4: Flooded areas and ecological status assessment of running waters

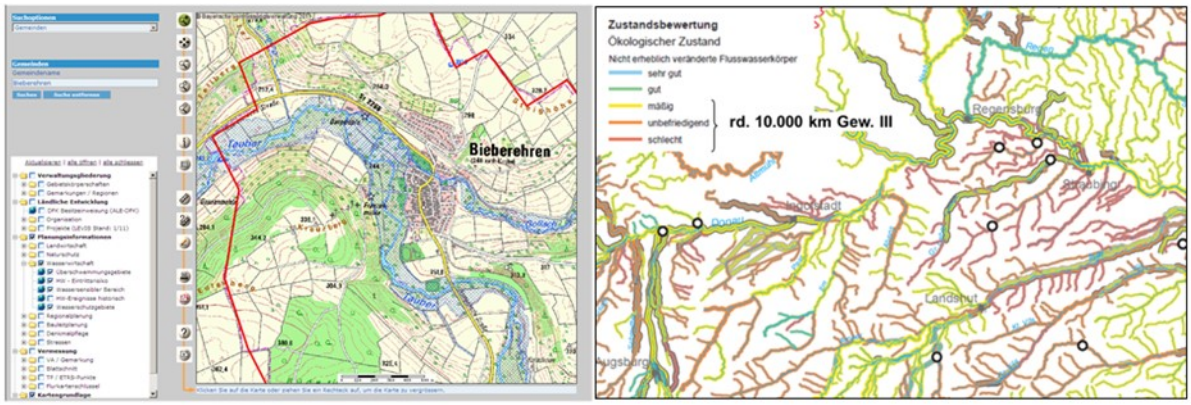
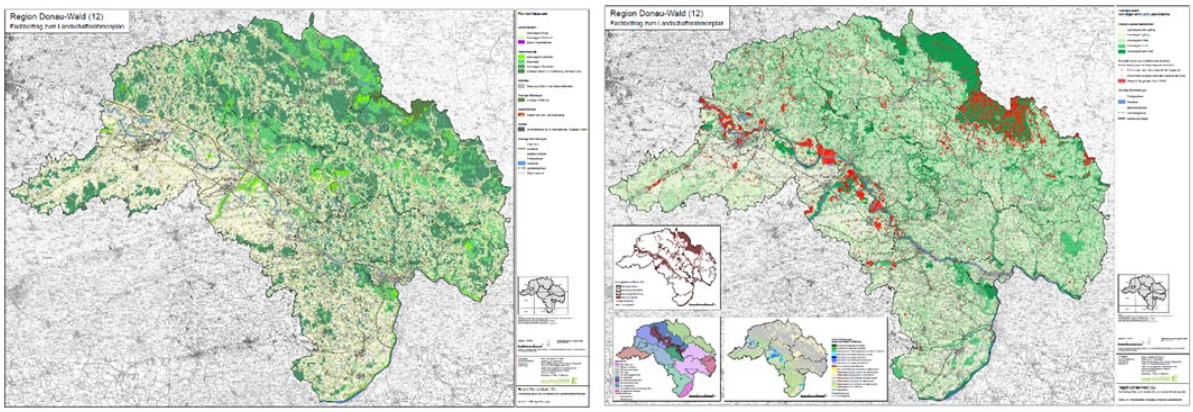


Figure 5: 'Landscape and species protection' from the landscape master plans of the regional planning level



4.3 Project-Related Local Databases for Landscape Planning

As in any planning discipline, it is necessary to compile factual and geometric relevant to assessments and planning decisions.

As mentioned earlier, higher-level data is available from spatial planning, but also from national and international institutions.

In local planning, such as a land-use plan or land-use planning, the objectives of spatial planning must not only be taken note of, but always be observed and implemented in a planning process in a balancing process. In Germany, for example, there are various GIS-based database concepts for ecological planning tasks, for which several GIS platforms are available on the market.

As a basis for landscape planning in land consolidation, the department for central tasks of the Bavarian Administration for Rural Development has introduced a database concept for ecologically significant areas and objects since the 1980s. This database structure has been continuously developed with the help of new knowledge and advancing technology. It already correlates with the landscape structures categorized in the Bavarian Compensation Ordinance.

Figure 6: Example of an input mask for an ecological database (structure and land use mapping)

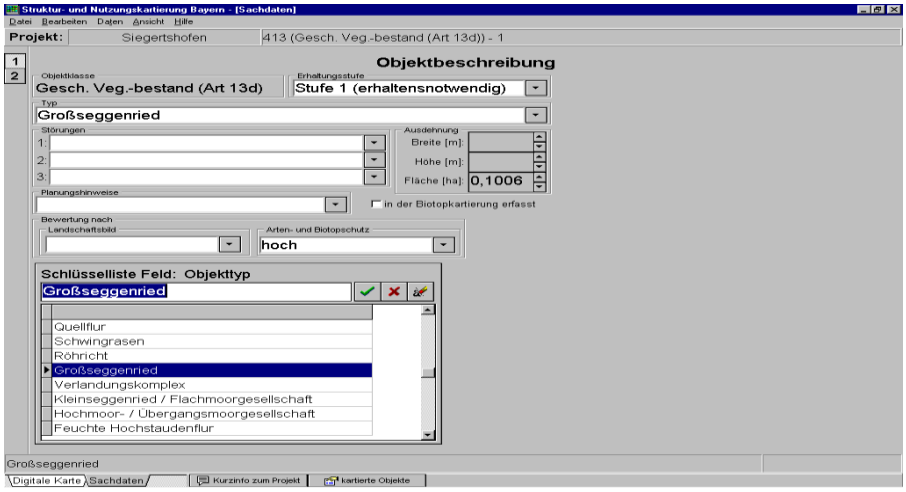
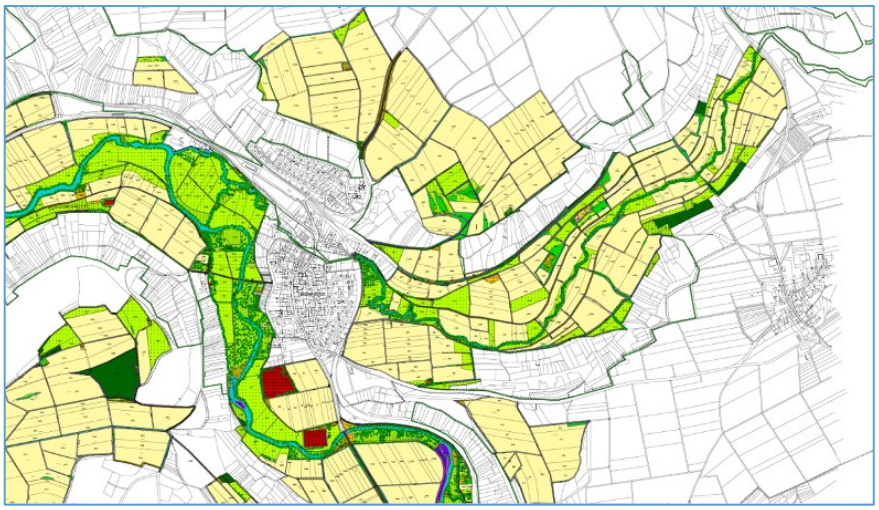


Figure 7: Example of a structure and land use mapping, combined database



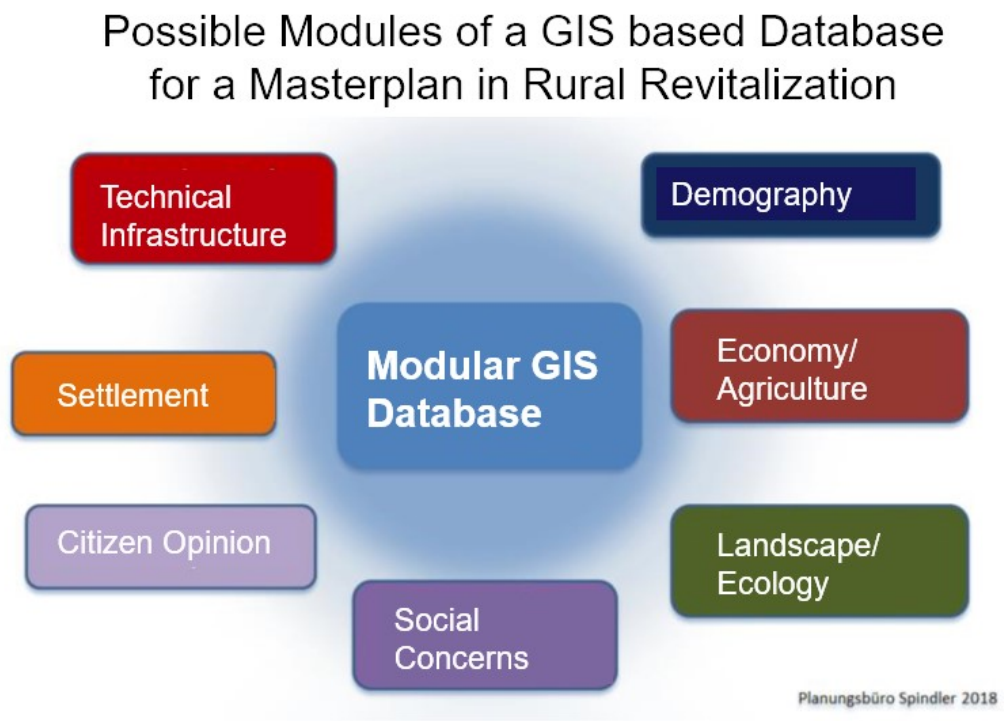
As a rule, these database concepts are available in Germany as solitary solutions alongside databases of other disciplines, e.g. road construction or water-engineering.

In the cooperation project for rural revitalization in the city of Nanchong / Sichuan, it has already been possible to combine several fields of action in a GIS platform, such as civic participation, settlement structure, demography. This is already a very good performance by Sichuan's lead agency for natural resources and the contracted planning companies.

In an improved and integrated approach, it would be conceivable and desirable to integrate a database of landscape and environmental content as a module of a complex database.

The modules of such a database could look like this:

Figure 8: Ecological database as a module of a comprehensive database



Of course, the components of an ecological database must be developed in a problem-oriented and task-oriented manner. Copying of a German database is therefore not meaningful and expedient, because Central Europe is located in only one eco-zone of the earth, but, the People's Republic of China includes several eco-zones. The development of a Chinese database solution tailored to the needs and conditions of China is necessary if ecological landscape planning is to be introduced, also taking account of the intervention regulation.

5. THE PRINCIPLE OF THE ENVIRONMENTAL ASSETS

The six "environmental assets" (also called "protected goods") occur in several environmental regulations of the Federal Republic of Germany. They are mentioned explicitly at the provincial level, as a technical term in the "Ordinance on the Compensation of Interventions in Nature and Landscape", which the Bavarian State Government issued on 7 August, 2013. The six "natural assets" can also be called, "natural resources".

5.1 Ecological and Economical Value

The environmental assets have a component of ecological value. This is the component that human beings need for life, sustainability and well-being. From that perspective, the component of economic value is required to satisfy the material needs such as food, cloth and other equipment.

The Natural assets of climate, air, soil and species, have also a transnational global dimension (as the climate change drastically shows). The People's Republic of China contains a large range of ecological zones, with very different conditions regarding their environmental assets.

As economic value can be calculated rather quickly and easily, it can be long term and sustainable.

5.2 General Strategic Conservation Objectives

General conservation objectives are governed by legal requirements, i.e. by laws, guidelines, regulations, spatial planning etc., at the respective national and provincial levels of competence. As a rule, they include goals for maintaining or restoring a favourable state of preservation. In Germany, in particular, the principle of the "prohibition of deterioration" is binding for practically all environmental regulations.

5.3 Territorial Conservation Objectives

Territorial based conservation objectives are area-specific and can be found, for example, in environmental regulations. An example would be the conservation objectives of the European network "Natura 2000" (Flora-Fauna-Habitat areas and EU bird sanctuaries).

For a specific "Natura 2000" site, these conservation objectives describe species and habitat types of the appendices and how they should be preserved, or in which direction they should develop. In particular, in landscape planning, area-based conservation objectives are formulated at regional and local level.

5.4 The Six Environmental Assets

The following six environmental assets are particularly well known. That means, each of them has specific science, knowledge, planning, data, and so on. The main terms will be mentioned below, without further explanation.

The point in the sphere of landscape planning, including intervention and ecological compensation, is the networked consideration of the environmental assets in an ecological context.

The general conservation objectives given here are only examples! They must be determined by the relevant governments and administrations.

From the Chinese perspective, the whole nation spans a network of different ecological zones, whose ecological conditions are very different and therefore, the general objectives should be, in part, formulated differently.

The pictures chosen from Germany symbolize the environmental character, but should be adapted and transferred to Chinese conditions.

Figure 09: Asset soil and fertility

Figure 10: Asset water above and below ground

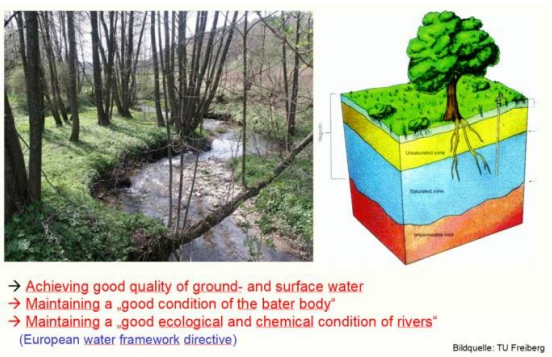


Figure 11: Asset air and climate

The asset 'species and habitats' is crucial for the 'ecological point system' in terms of intervention and compensation.

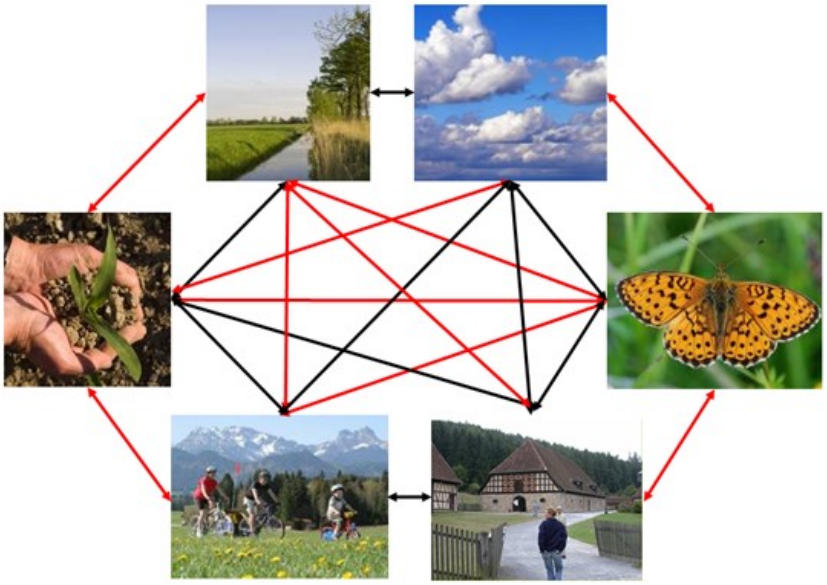
Figure 12: Asset species and habitats

Figure 13: Asset scenery and identity

Figure 14: Asset cultural heritage

5.5 Networked Consideration of the Environmental Assets

Figure 15: Networked consideration of environmental assets



In the sphere of environmental planning, the networked consideration of the environmental assets in an ecological context is crucial. Thus, the ecological functions shall be recognized and holistically appreciated. That means, experts have to work in different disciplines; or in other words, the skilled landscape planning expert is not required to be a specialist for all domains, but must have basic universal knowledge of all environmental assets and an understanding of their mutual relationships.

6. INTERVENTION AND ECOLOGICAL COMPENSATION

6.1 Basic Idea

The topic of Intervention and ecological compensation is an instrument, used in ecological landscape planning. At a higher level, it is a strategy to avoid long lasting damage to human's quality of life, caused by human intervention and use.

The basic idea of the "Intervention and Compensation Scheme" is a general prohibition to deteriorate nature and the landscape. With this intervention rule, negative consequences of interventions in nature and landscape should be avoided whenever possible, or at least minimized. Unavoidable interventions should be compensated. Eco-accounts and eco-points are the tools with which compensation is organized.

6.2 Legal Requirements in Germany

In Germany there are a number of laws that influence the protection of nature and the environment at the planning level.

Among others, they lead the following nature conservation procedures:

- Environmental Intervention Assessment
- Special protection of species
- Impact assessment according to the European Fauna-Flora-Habitat Directive in the European protected area system "NATURA 2000"
- Special areas or property protection for landscape parts

§13 and §15 of the National Federal Nature Conservation Act are relevant to the "Intervention and Compensation Regulation''.

6.2.1 Procedures of the "Intervention and Compensation Scheme"

The Federal Nature Conservation Act is briefly described here. The respective planning principles for assessment, particularly for

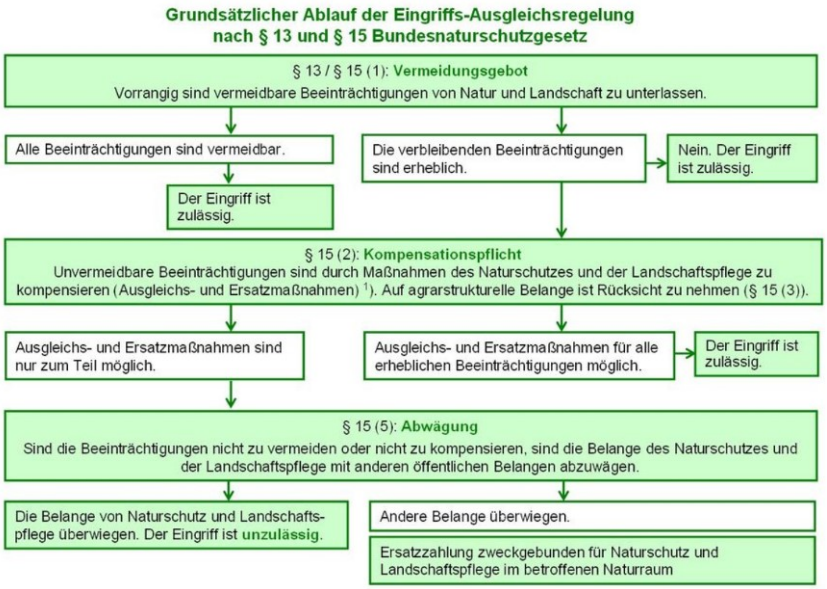
- environmental goods
- expected impairment of nature and landscape,

as well as compensation and replacement measures are to be provided by the initiator, i.e. the applicant project developer or investor in a timely manner and to the extent required by the technical staff.

The following process steps must be followed:

1. Bid of prevention
2. Compensation obligation
3. Balancing public interests

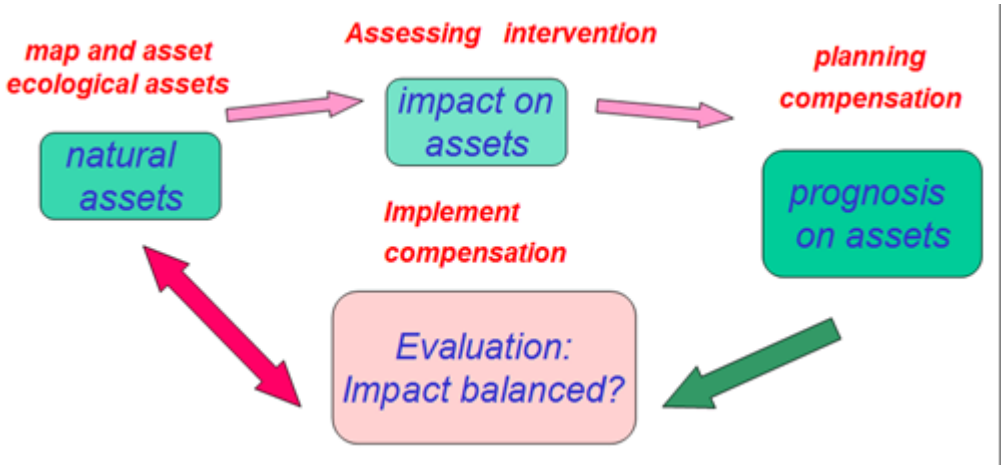
Figure 16: Basic procedure of the 'Intervention - Compensation Scheme'



After undergoing the above steps the intervention can be approved only by the authority responsible for the approval. Additional expert appraisals, such as on the biological species inventory, soil or groundwater conditions, air exchange paths, noise pollution, etc. may be required.

- Natural assets: mapping six ecological assets
- Impact on assets: assess interference into ecological assets
- Prognosis: to plan the avoidance and compensation measures
- Evaluation: compensation payment; can impact be balanced?

Figure 17: Operational procedure of the 'Intervention - Compensation Scheme'



Depending on the quality of the assets and the complexity of the impact and interference of the project several professional contributions have to be made concerning geology and soil, species and habitats, water and wastewater, climate and air pollution and so on.

6.2.2 The Principle of the Ecological Universality

It should be noted that, in principle, every type of ecologically active area is to be regarded as a potential habitat or biotope. (In Latin, habitare means to live; in Greek, bios topos means place of life)

The intervention regulation therefore, does not only refer to areas with special ecological or protection status (such as protected areas, classified biotopes, particularly attractive landscapes). It also involves intensively used, desert or ruderal surfaces. These can in turn be the starting point for ecological upgrades that is to say for compensatory measures.

In the case of approval, the following planning process has to be carried out, which must be represented by expert reports and planning, and must use instruments like "Green Building Plan", "Environmental Report" or "Landscape Management Plan" in Germany.

6.2.3 The Impact of the Interventions of Constructional and Operational Reasons

Basically there is a difference between

- the Impact of intervention by constructional reasons, and
- the Impact of intervention by operational reasons

Constructional impacts may be temporary, for example, lowering groundwater at construction phase or sealing a green area that can be restored easily. Here prevention measures are defined and fixed.

In Germany those measures can be fixed as early ecological measures, for example for the protective measures or habitat transfers of special or rare animal or plant species, before construction begins. Constructional interventions can also bring a definite intervention, for example removing old trees because of the construction site.

Operational impacts are still long lasting effects of project operation, as development sealing the soil, the fragmentation effect of a highway, drain acceleration because of by roads and buildings, noise or exhaust pollution due to traffic infrastructure and so on.

6.3 Costs for Ecological Compensation

Due to the principle of "polluter pays", it is evitable that an investor - either private or public - as a carrier of an infrastructure measure that intervenes in landscape, or nature will be the cause of an intervention. They must compensate and pay for this intervention in accordance with applicable laws.

An investor must therefore, from the outset, take accountability of the compensation for the encroachments caused by measures undertaken as a cost item in the total investment.

What kind of costs will there be, in addition to the actual project costs?

- Planning costs: Costs for project-related landscape planning, reports, investigations and certificates of all kinds with regard to environmental goods, citizen participation, public information and all legal procedures
- Execution costs: Measures (possibly even preferred) for protective measures of all kinds, costs for the restoration or creation of new landscape structures, transfer or replanting, special greening, etc.
- Caring costs: Costs incurred to achieve or maintain a desired habitat status over several years. This can be e.g. biotope care by mowing / keeping wet areas.

- Property costs: Costs required for purchasing a land on which ecological compensation measures are to be taken.

In the German system, the polluter himself must bear the compensation costs, and he cannot claim any public subsidies. To a community of investors (e.g. home builders), the cost of compensatory measures can be allocated to the infrastructure contributions.

In principle, an investor must already consider a share of the cost of ecological compensation measures (5 percent – 10 percent or more) while financing the project.

In return costs can be spared if interventions are avoided and the project allows for an environmentally friendly implementation, to be fixed in binding plans.

6.4 Ecological Assessment of Landscape Structures (Habitat Value System)

A big scientific and operational problem is to find and fix a scaling for the assessment of ecological structures, especially for species' habitats.

6.4.1 The Principle of Restoration of Ecological Functions

As pointed out above, for the intervention into ecological assets, a specific method of compensation has to be found. Basically the ecological function of the asset should not be deteriorated (in German Verschlechterungsverbot means prohibition of deterioration)

For example:

- If retention space is used by a project, then the same or nearly the same space should be provided nearby in the Flood zone.
- If there is drain acceleration by soil sealing (road, settlement) it has to be compensated by nearby retention pools on the basis of a hydraulic calculation
- Pollution of the ground or river water has to be avoided using devices for wastewater treatment. In industrial processes it is a water recycle process, and so on.

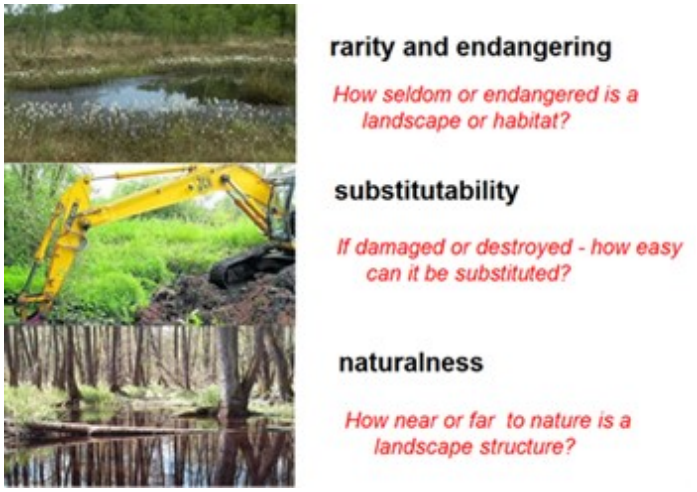
So, the biotope-value-point system is to ensure, by planning, that after an intervention the respective ecological functions are compensated. Thus, it is not appropriate to dry a wetland and to plant ornamental shrubs as compensation.

6.4.2 Criteria for the Assessment of Landscape Habitat Structures

What can be considered as criteria for the assessment of landscape structures, concerning mostly the assets "species and habitats", but also water, soil and scenery?

It is obvious that this criteria should be fixed on a higher professional and administrative level. In Germany it is performed by spatial planning and accompanying documents and order. For that reason, it is important to ensure that assessment is not left to the local forces, to the intervention-causing investors alone, and that at least some comparability between different projects has to be established.

Figure 18: Criteria for assessment of habitat structures



So, rarity and endangering should be elaborated by higher-level authorities involved in natural resources, supported by science and universities.

For the Chinses system in particular, it is advisable that the scientific work should not be political and administrative-boundaries oriented, but based on the ecological zones.

6.4.3 Recoverability and Naturalness (Hemeroby)

In terms of substitutability, usually there are national experiences of cultivation and renaturation. Good practices are usually seen in the field of green restoration and planting in devastated or destroyed areas. It is more difficult to renature ecological structures that took a long time to create, such as high moors, fens or highly specialized habitats with endemic species combinations. International cooperation with an exchange of good practices may be an advantage here.

The term of naturalness can be fixed by the "Index of Hemeroby", introduced in 1974 by Prof. Sukopp, Technical University of Berlin (the author was a student to him). The index of hemeroby is a measure of the total human impact on natural ecosystems and is used interchangeably with the terms close to nature or natural distance. In the parlance of the specialist in nature protection, hemeroby is reduced to the degree of naturalness of the vegetation to ecological factors.

Figure 19: Hemeroby system according to Prof. Jalas and Prof. Sukopp

Hemeroby system by Prof. Jalas and Prof. Sukopp

6.4.4 Habitat Value Method

Biotope or the habitat value methods are well known, but not uniformly used in Germany. Assessment methods of biotope or types for planning are used in the "Intervention and Compensation Scheme", according to the Federal Nature Conservation Act and in the environmental impact assessment.

With such a procedure, the institution causing the interference demonstrates to the nature conservation authority and the approval authority that, or to what extent the compensation measures planned (compensatory and substitute measures) to compensate for an intervention caused by a project are sufficient and appropriate.

Furthermore, the biotope value methods serve to shift unrealized or realizable compensation measures in the process itself. They then help determine appropriate compensatory measures within the framework of a pool of measures or an eco-account.

6.4.5 Assessment of the Habitat (Biotope) Value in Value Points

"Currency" in biotope value methods means value points, which are usually (somewhat casually) called "eco-points". The implementing planner or assessor first determines the sum of eco-points in the (previously defined and coordinated) effective space of the intervention in the current state, i.e. before the realization of the project.

The effects of the project on nature and the landscape are forecasted and also converted into eco-points. Based on the difference before-after, the assessor determines the extent of the compensation measures the procedure requires.

Finally, the appraiser compares the state "before" with a predicted state "after", which corresponds to the state after the realization of the project including the planned compensation measures. If the "after" sum is at least as large as "before", proof of the legally required compensation has been provided.

6.4.6 Step-by Step Procedure for Determination and Calculation

A simple and easy-to-understand procedure serves to determine the value points:

- Step 1: The planar space is divided into a mosaic of quasi-homogeneous partial areas, so that each partial area corresponds to a biotope type. The biotope types are defined in a list that is an integral part of the procedure. Only biotope types listed there may be used.
- Step 2: The surface area (in square meters) of the faces is determined (using a Geographic Information System). When summed, they correspond to the size of the plan space.
- Step 3: Each biotope type is assigned a list of value points by the procedure, which varies according to the assumed value of the type. Many procedures contain supplementary rules that allow individual assessment or devaluation.
- Step 4: The value of each homogeneous sub-area is calculated as "area in square meters" times "specific value points for the assigned biotope type". For example: a meadow orchard is 5,000 square meters in size. Orchard meadows receive 8 out of a possible 10 value points according to method 8. The examined orchard then receives 40,000 eco-points. When added, the value of the planned space is calculated.
- Step 5: The same procedure is carried out for the plan area after the realization of the project. It is evident that to assess the proposed ecological quality, the time factor is eventually considered. Many methods use different (usually lower) value points for newly created biotopes than for existing ones.

If compensation cannot be included in the procedure, the same method can be used to calculate the equivalent of areas and measures from an eco-account or eco-area pool. In addition, "excess" compensation measures can be booked on the credit page of the "eco-account". To convert to a substitute payment, an eco-point is multiplied by a predetermined amount of money per point.

All habitat value methods in principle work indiscriminately according to this scheme. The only relevant difference between common methods lies in the underlying list of biotope types and possibly in the value points assigned to each biotope type.

There are very simplistic methods with short lists, among others, as well as, the very long lists with z. T. complex defined types, such as the "Bavarian Compensation Ordinance".

6.5 "The Bavarian Compensation Ordinance" (Bayerische Kompensationsverordnung, BayKompV)

According to the Federal Nature Conservation Act, significant damage to nature and the landscape must be avoided by the polluter, and unavoidable damage must be compensated for by compensatory or substitute measures.

The BayKompV substantiates national regulations and ensures a nationwide uniform application practice of the nature conservation intervention regime. It is in use since September 2014.

The Bavarian State Office for the Environment has edited a working aid for the implementation and application of the Bavarian Compensation Ordinance. The workbook provides a generally accepted basis for planners, investors as well as technical authorities for all planning components that lead to ecological, intervention and compensation assessments.

6.5.1 Biotope Categories According to the Bavarian Compensation Ordinance

The categories of habitat types present in the Bavarian Compensation Ordinance are basically divided according to a letter code:

Figure 20: Habitat categories according to the Bavarian Compensation Ordinance

Gewässer		**Waters**	
Q	Quellen		Wells
F	Fließgewässer		Flowing waters
S	Stillgewässer		Still waters
Äcker, Grünland, Verlandungen, Heiden, Moore		**Arable land, greenland, heath, swomps**	
A	Acker / Felder		Arable land
G	Grünland		Green land
R	Röhrichte, Gross-Seggenriede		Reeds, greatsedge reeds
K	Ufersäume, Säume, Ruderal - und Staudenfluren		River banks, hemlines, ruderal perennial reeds
M	Moore		Swomps
Z	Zwergstrauchheiden		Dwarf shrubs
Höhlen, vegetationsarme Standorte, Gletscher		**Caves, vegetation-free locations, glaciers**	
H	Höhlen		Caves
O	Felsen, Block- und Schutthalden, offene Bereiche		Rocks, block piles, scree slopes, open areas
Wälder und Gehölzstrukturen		**Forests and woody structures**	
B	Feldgehölze, Hecken, Gebüsche, Gehölzkulturen		Field shrubs, hedges, bushes, wood culture
W	Waldmäntel, Vorwälder, spezielle Waldnutzungsformen		Forest coats, forests, special foresting
L	Laub(misch)wälder		Deciduous forests
N	Nadel(misch)wälder		Coniferous forests
Siedlungen, Industrieflächen, Verkehrsanlagen		**Settlement, commercial areas, traffic areas**	
P	Freiflächen im Siedlungsbereich		Open areas in settlement
X	Siedlungsbereich, Industrie-, Gewerbe- und Sondergebiete		Settlement, industrial, commercial, special areas
V	Verkehrsflächen		Traffic areas

These biotope categories are divided and differentiated according to the phytocommunities, so they are listed in an articulated system of more than 200 different subordinated coded habitat types, with short descriptions and indicated species.

Every code has a combination of vegetation types, a short description, assessment points and overall value points.

The BayKompV differentiates the assessment results and total value points into different categories.

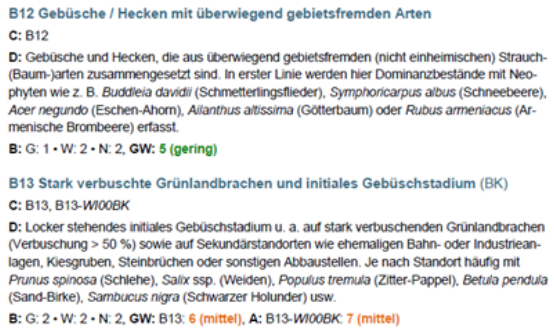
B: Assessment
G: rarity and danger
W: recoverability
N: naturalness

A biotope value of 1 - 15 points are assigned to 200 different types of biotype.

GW: The total values are categorized into following three groups:

1 - 5 points: low total value
6 - 10 points: medium total value
11 - 15 points: high total value

Figure 21: Example of coded description of a habitat type according to the Bavarian Compensation Ordinance



B12 Gebüsche / Hecken mit überwiegend gebietsfremden Arten

C: B12

D: Gebüsche und Hecken, die aus überwiegend gebietsfremden (nicht einheimischen) Strauch- (Baum-)arten zusammengesetzt sind. In erster Linie werden hier Dominanzbestände mit Neophyten wie z. B. *Buddleia davidii* (Schmetterlingsflieder), *Symphoricarpus albus* (Schneebeere), *Acer negundo* (Eschen-Ahorn), *Allanthus altissima* (Götterbaum) oder *Rubus armeniacus* (Armenische Brombeere) erfasst.

B: G: 1 • W: 2 • N: 2, **GW:** 5 (gering)

B13 Stark verbuschte Grünlandbrachen und initiales Gebüschstadium (BK)

C: B13, B13-*W100BK*

D: Locker stehendes initiales Gebüschstadium u. a. auf stark verbuschenden Grünlandbrachen (Verbuschung > 50 %) sowie auf Sekundärstandorten wie ehemaligen Bahn- oder Industrieanlagen, Kiesgruben, Steinbrüchen oder sonstigen Abbaustellen. Je nach Standort häufig mit *Prunus spinosa* (Schlehe), *Salix* ssp. (Weiden), *Populus tremula* (Zitter-Pappel), *Betula pendula* (Sand-Birke), *Sambucus nigra* (Schwarzer Holunder) usw.

B: G: 2 • W: 2 • N: 2, **GW:** B13: 6 (mittel), **A:** B13-*W100BK*: 7 (mittel)

It should be mentioned that the State of Bavaria, Germany, and even the whole of Central Europe use single eco-zone, while China has several of them.

6.5.2 Ecological Phytosociology

The key to distinguishing the landscape structures and determining their biotope values is the scientific discipline called "ecological plant sociology". Generally it is seen as an overall indicator of ecological quality.

The book "Ecological Phytosociology" by Otti WILLMANS, published in 1978 (now at its 6th edition) is the most influential scientific standard work in Germany. Further works by ecology scientists ELLENBERG, POTT, DIERSCHKE, BRAUN-BLANQUET, OBERDORFER and others are concerned with the scientific recording of natural phytocommunities, biocenoses and ecosystems in Central Europe. All are standard works for studies in ecology.

Figure 22: Books focusing on ecological phytocommunities and geobotanics

6.6 Ecological Compensation and Rehabilitation

A very important field of consideration is the ecological compensation or the overall ecological rehabilitation of the land. This topic has wide range and shall not to be analyzed into detail here. Only an example of compensation may be mentioned.

Compensation is a measure which tries to restore the impaired functions of the natural balance and the landscape. The compensation must be in a factual-functional relationship with the intervention; the impaired functions must be restored in the same way. The compensation does not have to take place at the site of the intervention itself, but also it has an effect there.

A central role for compensatory measures in Germany is played by measures for restoration, i.e. the ecological restoration of waters.

This happens for the following reasons:

- The European Water Rule Directive gives a strategic goal to communities, provinces and nations to aim for a good morphological, biological and chemical status of streams;
- Watercourses have often been changed and polluted in the past, so there is often good potential for recovery or ecological improvement;
- Running waters have a variety of ecological services that are also revitalized (flood discharge, fresh air formation, habitat, recreational function); and
- Running waters play an extremely important function for the biotope network and species exchange.

Figure 23: Die out rate of species in Germany over centuries

The renaturation of straightened rivers, tries to restore the original river bed and shore, reduce flow velocity and thus the risk of flooding and resettle the original animal and plant species. Exemplary measures include the meandering of the riverbed, the creation of gravel banks, river divisions, islands and kingfisher walls. The goal of ecological restoration focuses to both small rivers, medium rivers and large streams.

A further important goal in ecological compensation and rehabilitation targets conservation measures for species.

Under European and German Law, biodiversity concerns must be taken into account in projects if in planning, relevant protected species are affected by an intervention.

Figure 24: Example of river rehabilitation

Figure 25: Example of renaturation of ecological compensation

Figure 26: Steps of ecological rehabilitation

7. ECO-ACCOUNT AND ECOLAND CADASTRE

7.1 Legal Basics

The legal basis for the eco-account is anchored in the Federal Nature Conservation Act. The procedures for implementing eco-account systems in Germany are governed by the laws of the respective federal state; the Federal Government does not have direct intervention.

Responsibility of the ecoland cadastre systems is in the hands of states. Thus, the Bavarian Nature Conservation Act law is to remain the sole legal basis in Bavaria.

7.2 Eco-Account

The eco-account is an instrument for the early security and provision of compensation and substitute measures, with which future impairments of nature and landscape can be compensated. It includes concepts for stockpiling land and implementation measures. For example, communities with an eco-account can increase their planning security and speed up planning procedures.

Eco-accounts are voluntary inputs without legal binding effect. In the case of an intervention, the areas of an eco-account are rededicated as compensation or replacement areas. As long as eco-account areas are not "booked" as compensation areas, other use is also possible.

7.2.1 Elements and Procedures of an Eco-Account

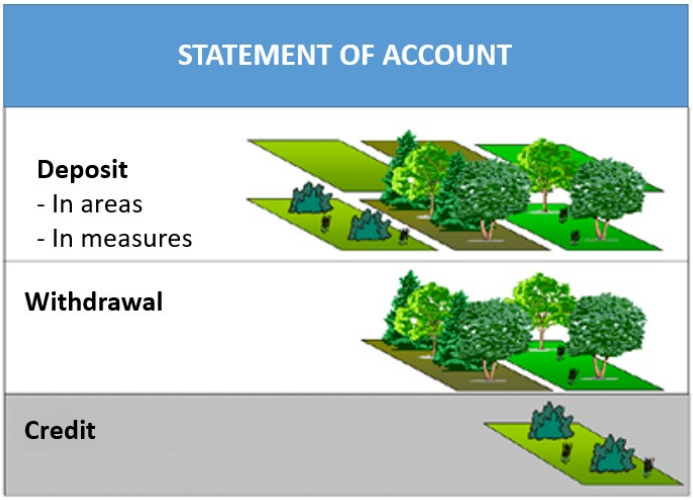
However, there are some similarities in approach and principles in the diversified management models, assessment criteria and compensation methods. An eco-account may consist of the following key elements and procedures:

- A landscape planning, usually a communal landscape plan, provides areas or area functions with ecological remediation needs. For example, the renaturation of rivers, wetlands or the network-greening of intensive agricultural areas.
- Among other points, the landscape plan sets technical goals for the ecological enhancement of these areas. This results in a pool of land that can extend beyond the community area. According to the provisions of the regulation in Bavaria, the compensation area may be outside the municipal area, but must be in the same landscape type area.
- The surface pool includes areas that are suitable for ecological compensation. These are sites with the potential of ecological value creation, as defined in the objectives of municipal landscape plans. The determination of these parcels is subject to a detailed investigation, planning and suitability assessment and is the material basis for the creation of ecological accounts. However, while the question of ownership is not necessarily clarified, if measures are to be implemented, legal access via property, lease or other regulations must be clarified.
- The "currencies", or booking units, in the eco-account are the areas of particular ecological value or eco-account points. The size of an ecological account is usually measured by the number of ecological indicators for plots, which vary with different ecological values. The ecological compensation of land improves the ecological value of

the land and the upgraded part of the ecological value can be converted into an ecological account, which is deposited in a certain area of a municipality, city or other organization.

- Some cities or investors also purchase ecologically valuable land outside their territory to provide environmental compensation for interventions in their community area. This is often a necessary planning strategy to be followed in order to act for one's own development. There is also the possibility of inter-municipal eco-accounts.
- The actual monitoring platform is the ecological account, based on a GIS-supported database. It is similar to a bank account, and the ecological indicators obtained through ecological compensation are cached. Ecological compensatory measures, which are executed and booked before a concrete intervention, can be "interest-charged" in this account, as on a passbook at 3 percent per year.
- The nature conservation-relevant interference, which is triggered by a development measure, must be evaluated professionally in the previous licensing procedure and its effects on the environmental goods should be justified. This is done through a technical plan, which can be described as a "Landscape Management Plan with Environment".
- If a development measure, i.e. an intervention, is carried out, the units of value determined in the landscape management plan are deducted according to the remaining ecological impact. In order to allow the recording of log-ons by ecological measures (+) and debits by intervention effects (-), the eco-account must be based on the database already mentioned above. All account transactions must be coordinated with the responsible nature conservation authorities.

Figure 27: Procedures of eco-accounting



Areas dedicated to a compensation or replacement measure may not be subject to future change of land use, but, should be ecologically dedicated and protected in future.

Figure 28: Example of a pool of land in an eco-account

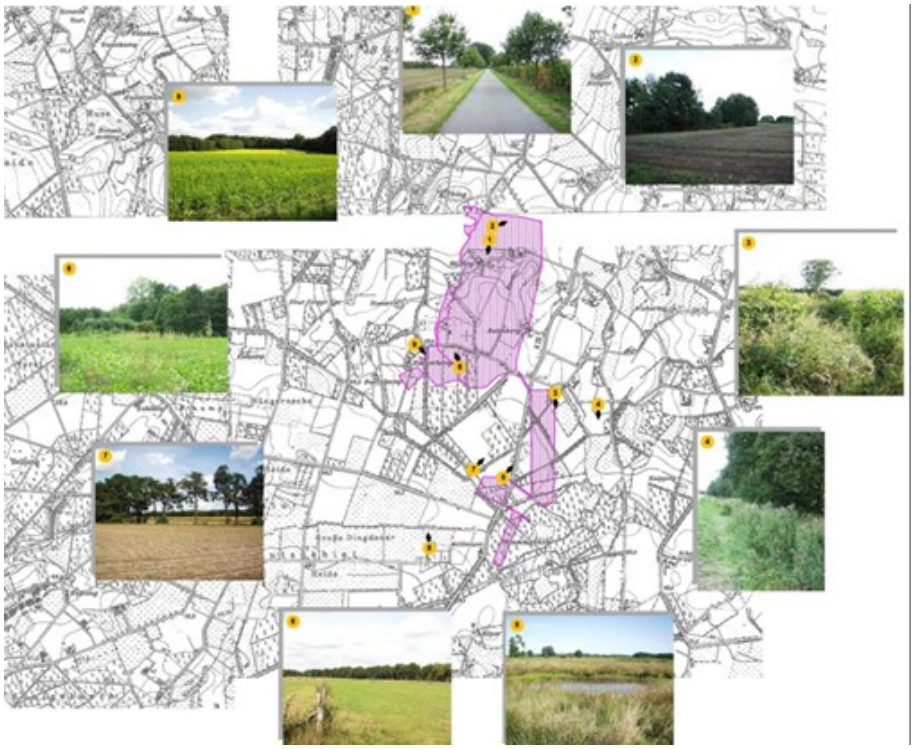
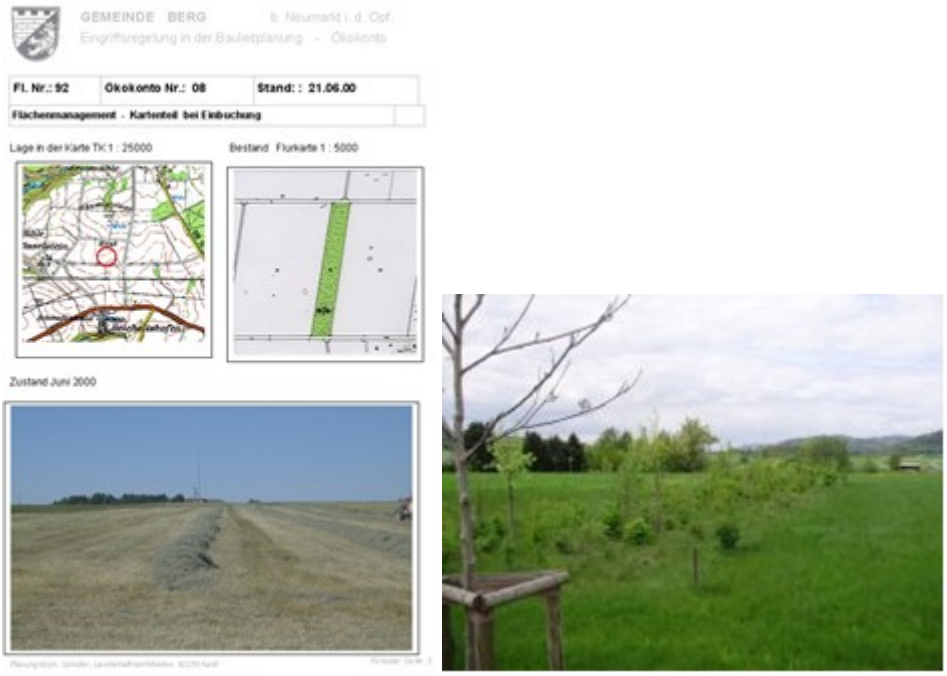


Figure 29: Example of eco-account planning and implementation



7.2.2 Remarks as to the Eco-Account System

The costs for the eco-account and ecological compensation are always borne by the polluters in accordance with the polluter-pays principle. If a municipality develops a new building area and sells private individual plots, the costs for ecological compensation must be added to the property or development costs, and thus, transferred to the owners as the final polluters. The promotion of ecological compensation measures through public subsidies is basically not possible!

Overall, the entire intervention compensation scheme, including eco-account management, is based on the developmental goal of preserving the environmental functions of the human environment and limiting land use. Unfortunately, even after decades of application in Germany, the latter goal could not be achieved without further regulatory and spatial planning measures.

7.3 Ecoland Cadastre

The Ecoland Cadastre is a GIS database for the management of ecologically important areas, which also includes eco-account areas. The cadastre supports the nature conservation authorities in the execution of the intervention regulation.

In the Bavarian Nature Conservation Act, the Bavarian State Office for Environment is assigned the task of maintaining a list of ecologically significant areas and of updating them on an ongoing basis. All approval and intervention authorities or municipalities are obliged to report the compensation and replacement areas from intervention projects to the Ecoland Cadastre.

The nature conservation authorities report the substitute use of money as well as the areas of the eco-accounts. The inclusion in the Ecoland Cadastre means no change in their legal ties or their previous uses for the area.

8. APPROACHES ADOPTED IN PILOT PROJECTS IN CHINA

In response to having inadequate reading materials on ecology, the author prepared a simplified literature on ecological evaluation systems that could be understood emphatically by well-trained planners.

8.1 Landscape Evaluation in Sanbaishan, Anyuan (Jiangxi)

A systemic approach to ecological evaluation was first adopted in the pilot project of Sanbaishan in Anyuan county in Jiangxi province.

After a general survey, typical landscapes were separated and estimated on selected, exemplary locations. After checking the environmental assets in situ, ecological functions were evaluated and explained to the Chinese planning experts.

The following landscape structures were classified, including a picture and short description, into environmental functions and associated hazards:

- Streams and rivers
- Standing waters
- Open wetlands
- Bamboo stocks
- Mixed forests on local steep slopes
- Deciduous trees along roads
- Special individual trees and feng-shui sites
- Wild grass open surfaces
- Habitats of rare species

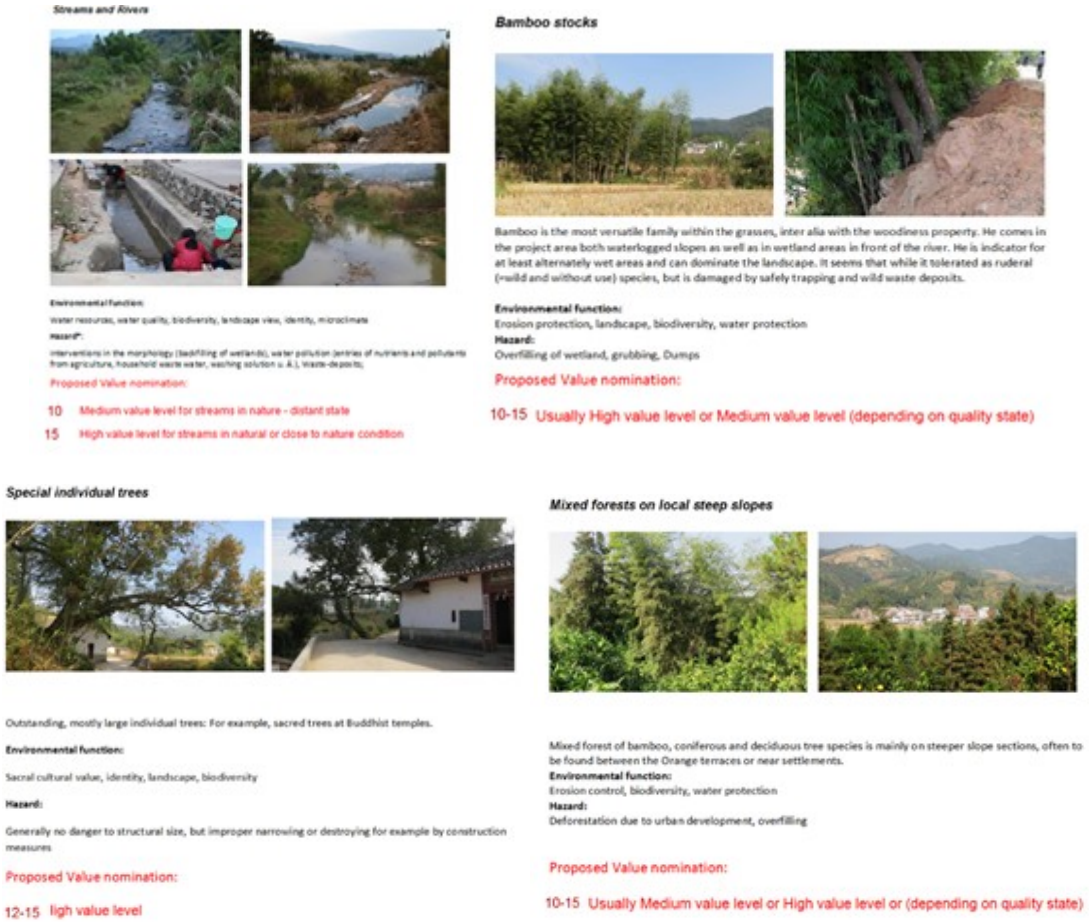
All landscapes categories were assigned a score index of 1 - 15 in three overall value categories:

1 - 5 Low Value; 6 -10 Overall Value; 11 - 15 High Value

Due to inadequate capacity and funding, and lower administrative performance, it was only possible to carry out a mapping of a partial project area, concerning to an intervention by a National Park road. A summarization of the intervention and compensation demand values was designed without evaluating its further consequences.

Although this procedure can be seen as a beginning at local level, the establishing of distinctive landscape structures can be used as a base for scientific deepening as well as in further projects in the same eco-zone. Therefore, it is important to check the preliminary results by Chinese ecological scientists and bring these into a higher level evaluation index system.

Figure 30: Example of simplified landscape evaluation in Sanbaishan Project, Jiangxi



8.2 Landscape Mapping and Assessment in Jinyuan, Nanchong Sichuan

Based on the defined landscape structures, an on-site briefing was performed to differentiate and classify the respective structures. The Chinese planners then applied this instruction analogously with the help of aerial photo evaluations. For the first time, this resulted in an area-covering mapping of the project area in the community of Jinyuan, which was later incorporated in a GIS system.

The classification of the landscape structures, according to a system of 15 value points, was carried out by the Chinese side, d. H. the ANR Sichuan and the assigned planners.

It is important to note that, although no rating system was deliberately set in the valuation system applied in Germany, it is necessary to develop such a system by the Chinese authorities for the evaluation system in China.

How should it be continued? The achieved rating system and the representation in the maps and databases must be used in the further planning, i.e. the implementation of projects accordingly.

Figure 31: Example of landscape mapping and assessment in the Project Jinyuan, Sichuan

8.3 Further Requirements

It is indispensable that the values set here are checked, scrutinized and, if possible, determined at the provincial level by the Chinese science and administrative authority.

It is very important to establish a uniformed system of values, at least at provincial level, in order to create a comparative starting point for ecological planning – in balancing interventions, ecological development plans or restorations.

It should be emphasized that the scoring system presented above may lead to false results, in particular to over-optimistic assessment of the impact of an environmental measure, when the procedures were not properly applied. This can be due to misjudgments by inadequately trained professionals (planners and examining officials), by imprecise work or intentionally. In other words, in the case of improper and professional application, ecological results can be falsified or manipulated.

However, it undoubtedly can be seen as an encouraging success for the consultant of the Hanns Seidel Foundation that the ecological assessment model was taken up in the project in Nanchong and applied in a pilot-like manner in a first step, namely an inventory.

Based on this, new experiences can be gained and further developed, which can be of use to the province of Sichuan and, ultimately, to the whole nation for ecological civilization.

9. ECOLOGICAL ZONES OF CHINA

9.1 Meaning of Ecological Zones

The ecological division of the earth is based primarily on natural spatial criteria. Cultural-spatial aspects are only significant insofar as there are references to natural resources, for example in land use. After that, the ecological zones ("eco-zones") can be defined as follows:

According to Schulz (2005), "eco-zones are areas of the earth, each of which is characterized by its own climate, morphodynamics, soil formation, ways of life of plants and animals as well as yields in agriculture and forestry. Correspondingly, they differ in a striking manner according to the daily and annual climate change, the exogenous landforms, the soil types, the plant formations and the agricultural-forestry use systems. Their distribution on the earth is dependent on the area and shows a mostly fragmented distribution."

9.2 Ecological Zones of China

According to Schulz (2005), China has six out of nine eco-zones worldwide. By contrast, Central Europe, with Germany, Denmark, Poland, the Benelux countries and large parts of France and England, have a single eco-zone only.

Figure 32: Ecological zones worldwide and in China

*Eco-zones in China marked red

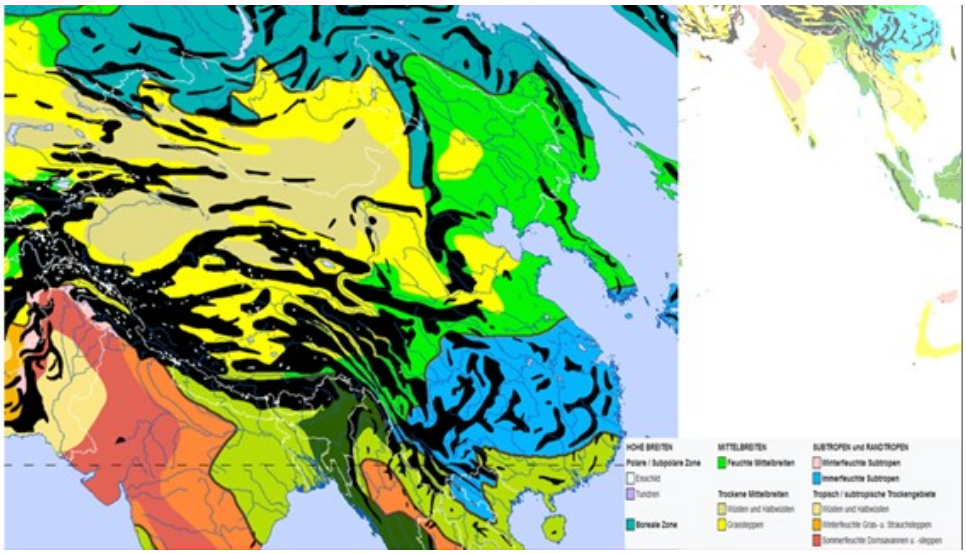
Source: Schulz (2005)

For each eco-zone, the adapted types of soil conditions, plant communities and other characteristics for an ecological assessment system are to be defined

For each eco-zone, overarching objectives for the conservation and ecological development of the sub-areas are to be defined, also according to the criteria of rarity, danger, and recoverability.

Since several provinces may be affected by several eco-zones, it seems appropriate to set a national assessment framework across the country in order to achieve uniform objectives and / or comparable scientific and planning results.

Figure 33: The eco-zones of China



Source: Schulz (2005)

9.3 Short Description of Ecological Zones of China

The following figures describe the eco-zones of China in short profiles. The assignment of eco-zones to the individual provinces is to be understood only as a non-binding information, which is based on extensive map excerpts.

Figure 34: Boreal Zone

Figure 35: Humid mid-latitudes zone

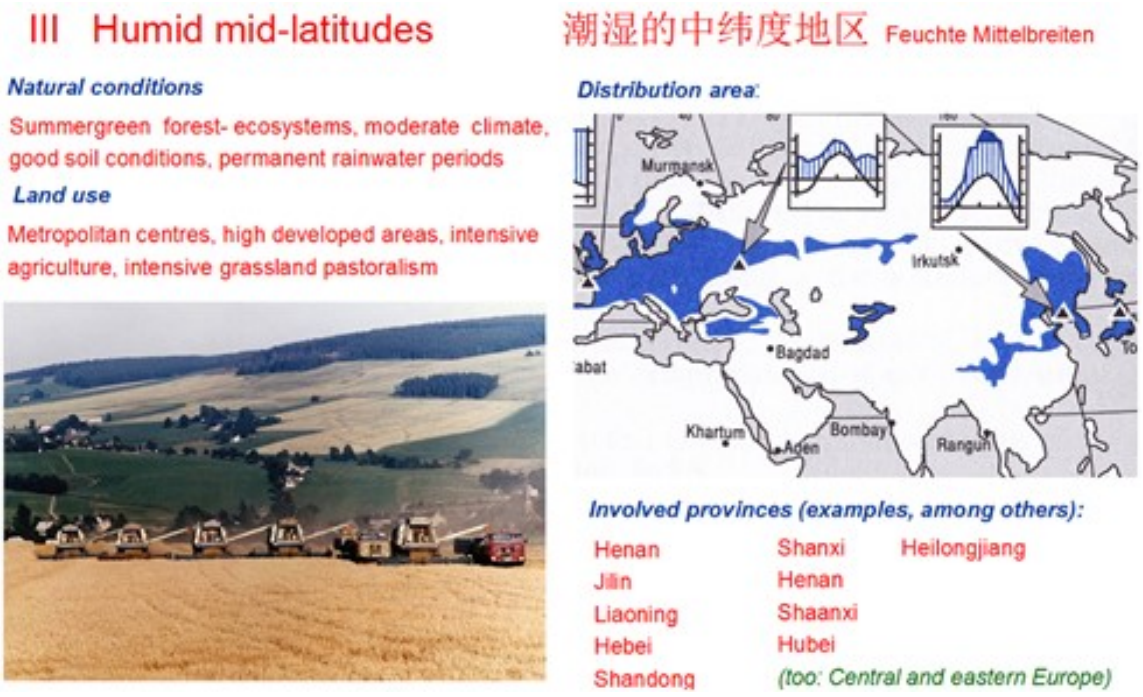


Figure 36: Dry mid-latitudes zone

Figure 37: Ever humid subtropics zone

VI Ever humid subtropics 潮湿的亚热带地区 Immerfeuchte Subtropen

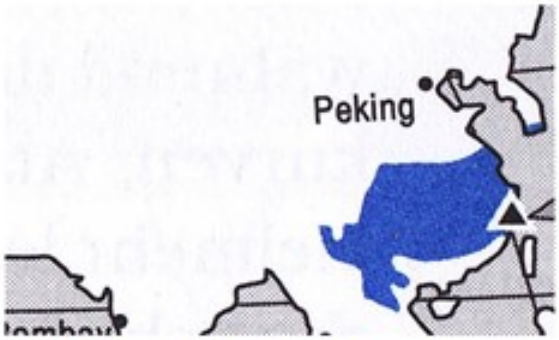
Natural conditions

Less than 5 humid months, red acrisil / alisoils, variety of summer / evergreen forests,

Land use

Developed, settlement / industrial zones, 2 harvests, intensive agriculture, citrus, tea, rice,sorghum, corn, peanut, sesame, cotton, tobacco

Distribution area:



Involved provinces (examples, among others):

Yunnan	Hunan	Zejiang
Guangxi	Hubei	Fujian
Guizhou	Guangdong	
Sichuan	Jiangxi	
Chongqing	Anhui	

Figure 38: Summer humid tropics zone

VIII Summer-humid tropics 夏季潮湿的热带地区 SommerfeuchteTropen

Natural conditions

Wet and dry savannas, rainseasons and dryseasons warm, some good soil fertility, good argri - capability

Land use

rainfed agriculture, rice,sorghum, corn, millet, peanut, cotton, tobacco, tropical fruits

Distribution area:

Involved provinces (examples, among others):

Zhejian	Anhui	Taiwan
Fujian	Hubei	
Guangxi	Sichuan	
Guangdong	Yunnan	
Hainan		

Figure 39: Ever humid tropics zone

IX Ever humid tropics 热带季风气候区 Immerfeuchte Tropen

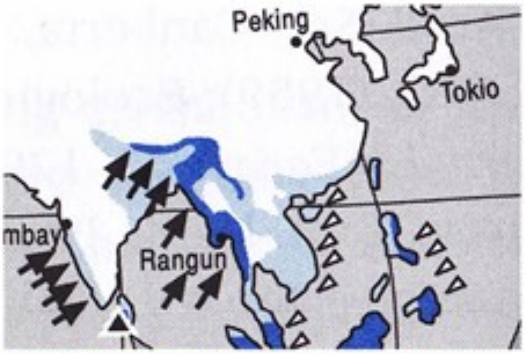
Natural conditions

Warm, continous seasonless, rainseasons, in China passat wind influence, evergreen tropical rainforests,

Land use

rainfed agriculture, rice,sorghum, corn, millet, peanut, cotton, tobacco, tropical fruits

Distribution area:



Involved provinces (examples, among others):

Fujian
Guangdong
Guangxi
Yunnan
Hainan
Taiwan

10. CRITICAL REMARKS AND RECOMMENDATIONS

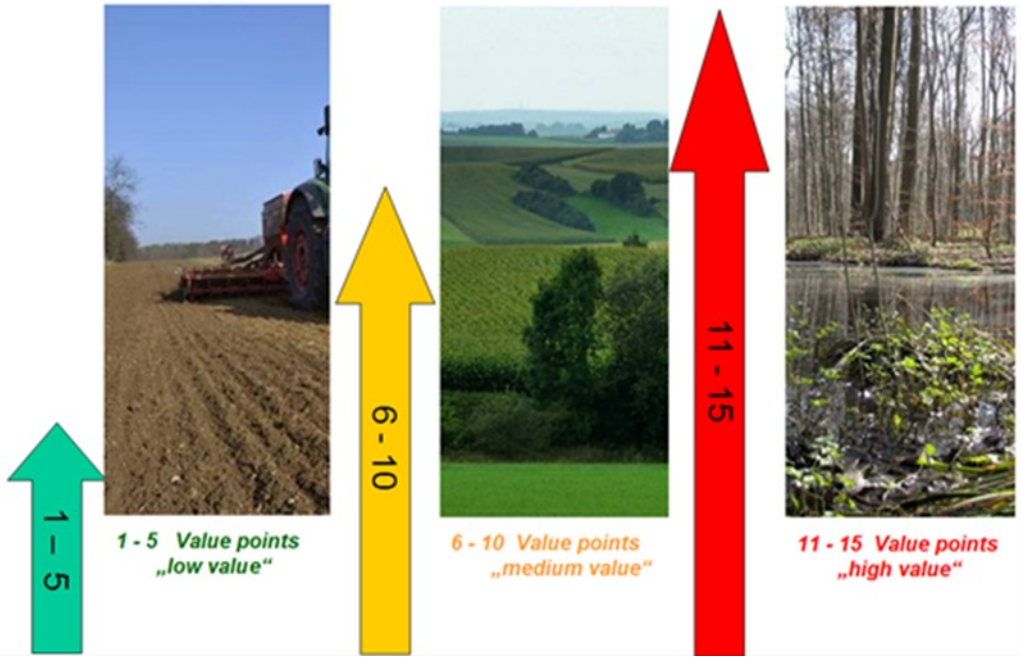
10.1 Some Critical Remarks as to the Topic

10.1.1 Regarding the Term "Ecological Value"

The term "value" is mostly used in the economic sense to describe a valuable or useful thing. As far as agricultural values are concerned, undoubtedly, there are valuable land that provide the best possible yields.

In the ecological value system, a change in thinking is necessary in that ecological values often stand in the opposite direction to economic values. For example, a wetland is very valuable for the groundwater budget, or a lean rock or grass country location is significant for the diversity of certain species of birds, reptiles or insects, whereas it appears economically irrelevant.

Figure 40: Evaluation of landscape due to the biotope-value index



This "rethinking" must be learned and understood by all those involved in planning decisions, i.e. experts, ordinary citizens, administrative staff or lower cadres should understand this value system, at least in principle. This should be understood as a part of a long-lasting process.

For non-scientific or uneducated people, the theme may be even more incomprehensible when they experience difficult times, and their value system has to be geared to the basic human needs of food, clothing, and shelter.

The most protracted, but most promising and most sustainable measure is certainly to incorporate environmental values in the environmental education for future generations. If children in kindergarten or elementary school are already learning the basics of ecology, they will consider them in their future lives. In the reality of planning practice and implementation, one has to reckon with problems of misunderstandings or incomprehension of the respective counter-part, which can be scientifically taught.

10.1.2 Towards an Ecological Biotope Value System

The "value" of intervention and compensation cannot be determined in all its damage and welfare effects for the natural balance in the context of landscape planning with the most elaborate scientific investigations according to current knowledge. Values decisions are always normative, so they cannot be scientifically wrong or right; they can be only appropriate or not appropriate.

The problem with all methods is that they are based on the definition of ranks, with which the value is then calculated. This problem is known in the technical discussion. However, the procedures continue to be used in Germany because they are naturalized and accepted by the relevant administrations as an Ordinance (such as the Compensation Ordinances of the States of Bavaria and Hessen).

The validity of such a procedure can, therefore, only be politically prepared in legislation. However, anyone who subjects himself to the inner logic of such a system, assigning numerical values to ecological structures, does so in the awareness that the "crude" original values cannot stand in the right balance due to a lack of knowledge of the effect structure in the natural balance.

As stressed in Section 6.5.3, the possible scientific inaccuracy of this system can also lead to false results or even be misused for fakes if it does not have sufficient underpinned scientific foundations, or if applied by poorly trained experts, or if the authorities responsible for the approval do not expertly and properly assess.

10.1.3 What can be adopted?

In the western hemisphere, especially in Germany, the USA, the United Kingdom, Scandinavia, and also other countries, several models and procedures have been developed over the decades.

The question may be, what can be adapted from the experiences of those countries?

- First of all, fundamental principles of environmental protection can be adopted, as presented in Section 3.1 (these are possibly taken into account in national environmental laws);
- Particularly important for planning projects appears to be the polluter pays principle. Thus, an investor - be it private or public - has to compensate and pay for this intervention;
- The idea and the system of the six environmental goods and their networked consideration, as shown in paragraphs 5.4 and 5.5;
- The point system to the biotope value system, if it is applied correctly and conscientiously.

However, China has to create its own Chinese index system!

10.2 Recommendations

10.2.1 Research and Education

Environmental awareness

It can be concluded from the history of Germany that, after an economic upswing with increasing prosperity, the concern and sensitivity of the population towards the environment will increase. On a broad scale, and even in scientific circles, awareness of the environment and ecology should be developed and sharpened. This, as in other societies, can ensure a long-lasting process that can begin and should be taken into account when raising children.

Training and education of landscape planners

In order to master the environmental planning processes, there are three requirements besides the legal, scientific and financial basis:

- Hard and software for planning, but, above all, well-trained planners.
- China has a long and deep tradition in the conception of landscape and its elements, which is reflected in traditional Chinese garden art. In the course of the rapid urbanization during the last 40 years, the discipline of garden planning in the sense

of Urban Green Planning has also been very well developed.

- What seems to be largely missing so far is the subject of environmental planning. Universities and colleges should include the field of landscape planning and landscape ecology in their program. Focusing on the classical disciplines of geology, soil science and botany, landscape planning specialists should be trained as generalists, who will understand the networking of environmental goods and be able to translate them into high-quality planning.

10.2.2 Biotope Value System

In order to be able to cover the entire area of environmental planning in a systematic and scientifically proven way, the development of an ecological assessment system is essential. This means that an index system should be built on a scientific basis.

Due to its assemblage, China has the requirement and also the opportunity to use this system nationally, i.e. to develop and introduce across provinces.

There is the opportunity to develop a national, strategic network of an ecological index system in which the "sub-systems", i.e. provinces, regions, cities etc., can be hooked up and can be systematically improved gradually, supplemented and further developed. This requires a strategic lead, which should lie with a suitable ministry or overarching institution.

On the basis of eco-zones, a network of strategic ecological goals is to be developed, which should be incorporated into the spatial planning of the provinces. Based on these national goals, subordinate objectives can be developed at provincial, prefectural or city level.

This system should not and must not be based on administrative boundaries, but on the ecological zones of China. This means that an evaluation target system must be developed for every eco-zone in China. These systems take into account the specific ecological conditions, such as geology and soil, water conditions, climatic conditions, biocenoses, and land use systems.

First, a system for recording the status quo state is to be developed, which comprehensively describes and documents an inventory of a planning area at a specific point in a certain time. Here, it can be helpful to adapt the scoring system as used in Germany.

Decisive is the unified and scientifically proven definition of ecological structures and the sharpness of their scaling. In the compensatory ordinances of the German provinces of Bavaria and Hessen, this system is very well-developed and demanding. With this, it is necessary to come close to a scientific claim and an exact estimate. However, this also means that, with increasing detail, the requirements of planners and those involved increase, while the grandeur of transparency, i.e. the comprehensibility of laymen, decreases.

It is also necessary to develop a system for the ecological assessment of remediation measures. This can serve both for a concept of ecological compensation of the improvement and rehabilitation of ecologically degraded areas. As with the assessment of the status quo, recovery requires a complex view that may re-quire the combination of different technologies. This should also apply to the ecological restoration effect of a unitary assessment system.

It should be pointed out that the application of ecologically optimized construction methods will generally reduce the intervention in nature and landscape. These should be considered in infrastructure planning from the beginning. It is advisable to strengthen methodological research on the effectiveness of ecological rehabilitation measures, again in relation to the various eco-zones.

The development of methodologically sound design methods, rehabilitation planning and testing procedures is also required to present a status quo

and to conduct an environmental assessment that will meet scientific objective standards.

In order to identify and define ecological redevelopment areas, a demand planning should be established, from which sales planning for ecological reorganization can be initiated. Again, an evaluation index makes sense.

From the author's point of view, it is, therefore, recommended to start with simplified systems and tests, and to evaluate them step-by-step. In a development process, there is a need to refine, deepen and improve.

The author considers that development of environmental planning systems and index assessment tools needed decades in Germany (with a different legal and administrative system). In the face of today's advanced methods, improved technology and, perhaps, some foreign system components are carefully adapted, but, above all, through creative manpower (including women) China can achieve the target. Nevertheless, there is considerable work to be done to solve the challenges.

10.3 Concluding Remarks

With the decisions of the 18th and 19th CPC congress, after decades of rapid economic growth, China is on a conscious and stringent way to meet and solve environmental problems, to alleviate and eradicate poverty, to revitalize the countryside, and to protect, develop and rehabilitate natural resources.

With the series of academic exchange, the cooperation between the Land Consolidation and Rehabilitation Center under the Ministry of Natural Resources in the People's Republic of China and the HSS Representative Office in Shandong province has been continued.

The HSS's Institute for International Cooperation is standing up for democracy, peace and development, and, being represented by the Shandong / BFL Qingzhou, it will continue the cooperation in terms of academic exchange and pilot projects in the field of ecology and environment. This deepening of partnership will lead to fruitful mutual results in the global context.

REFERENCES

Literature

- Bastian, O.: Landschaftsökologie – auf dem Wege zu einer einheitlichen Wissenschaftsdisziplin?. Naturschutz und Landschaftsplanung 2001/33 (2-3).
- Ellenberg, H.: Vegetation Mitteleuropas mit den Alpen in ökologischer, dynamischer und historischer Sicht. Ulmer, Stuttgart 1996.
- Finke, L: Landschaftsökologie. 3. Auflage. Westermann, Braunschweig 1996,
- Forman, R.T.T. and Godron, M: Landscape ecology. Wiley, New York 1986.
- Ingegnoli, V.: Landscape Bionomics. Biological-Integrated Landscape Ecology. Springer 2015
- Leser, H.: Landschaftsökologie. UTB-Taschenbuch, Ulmer-Verlag, Stuttgart 1997
- Schultz, J: The Ecozones of the world: The Ecological Divisions of the Geoshpere; Spinger, Berlin/Heidelberg/New York 2005
  Chinese Edition: Higher Education press, Beijing 2010
- Von Haaren, C: Landschaftsplanung. Stuttgart 2004
- Willmann, O. : Ökologische Pflanzensoziologie, UTB Stuttgart, 2002

Websites

- Bayerische Landesamt für Umweltschutz: Arbeitshilfe zur Anwendung der Bayerischen Kompensationsverordnung, München 2015:
  https://www.bestellen.bayern.de/application/applstarter?APPL=eshop&DIR=eshop&ACTIONxSETVAL%28artdtl.htm,APGxNODENR:34,AARTxNR:lfu_nat_00327,AARTxNODENR:350303,USERxBODYURL:artdtl.htm,KATALOG:StMUG,AKATxNAME:StMUG,ALLE:x%29=X
- Bayerische Landesamt für Umweltschutz: Ökokonto + Ökoflächenkataster
  https://www.lfu.bayern.de/natur/oefka_oeko/index.htm
- Christian Stein und Ulrich Walz: Hemerobie als Indikator für das Flächenmonitoring. Methodenentwicklung am Beispiel von Sachsen, Naturschutz und Landschaftsplanung, 44(2012)/9: 261-266.
  www.nul-online.de/Artikel.dll/NuL09-12-Inhalt-261-266-1_MzM4NTA4Nw.PDF
- GeoPortal Bayern:
  https://geoportal.bayern.de/geoportalbayern/
- Theory and method of ecological restoration of the land area
  Original: Chinese country today:
  https://mp.weixin.qq.com/s?__biz=MzAwODY5MTU5OA==&mid=2650115220&idx=1&sn=6b3839b9ae9a6edf4ce4a734db405314&chksm=836a2675b41daf63f7b21b50f3c79da23ab65f6350af7368119465601a8120c163c46d5e9059&mpshare=1&scene=2&srcid=1227DELNsn4bO7vsunPUn9O4&from=timeline#rd
- Umwelt Bundesamt: Strategien zur Optimierung von Fließgewässer Renaturierungsmaßnahmen und ihre Erfolgskontrolle
  https://www.umweltbundesamt.de/publikationen/strategien-zur-optimierung-von-fliessgewaesser

Hanns Seidel Foundation
Representative Office Shandong
Ling Long Shan Nan Lu 7399
262500 Qingzhou, PR China
Tel. 0086 536 2130 855 Fax: 0086 536 2130 800
E-Mail: info@hss.de
URL:http://china.hss.de