

MONITORING ASPECTS OF INTERDISCIPLINARY STUDIES ON THE RIVER DANUBE

Georg A. Janauer

Abstract

Monitoring can be any series of measurements, if the interval between the individual readings allows for a correct description of a system and its variation in time. Also implicit is the concept of continuous and regular registration. To define the type of monitoring used to address a specific problem one has to specify the where, what and how.

Two large interdisciplinary studies were conducted on the Danube east of Vienna. Between 1987 and 1990, the "Interdisciplinary Study Danube" investigated environmental steering factors and biota in a vertical profile across the riverine forests. Several types of monitoring data were used to achieve the results, e.g. hydrological data, fish data, mapping of macrophytes and so on. Starting with a preliminary study in 1989, another interdisciplinary scientific project running on the UNESCO MAB programme "Land/Inland-Water-Ecotones" was introduced under the supervision of the Austrian Academy of Sciences in 1990. This programme runs on different levels of investigation: at first, key-processes are investigated in special ecotone-types as a basis for further investigations. Later on, landscape pattern analysis will be used to describe more efficient monitoring of the whole floodplain. Information is given on some monitoring aspects of these studies, which aim at the scientifically sound management of riverine landscapes.

Janauer, G.A.: Monitoring-Aspekte interdisziplinärer Studien an der Donau

Jede Meßreihe kann als Monitoring betrachtet werden, wenn die Intervalle zwischen den Einzelmessungen eine korrekte Beschreibung des Systems und seiner zeitlichen Variation zulassen. Monitoring bedeutet immer auch andauernde und regelmäßige Messung. Monitoring ist problemorientiert und braucht deshalb Definitionen über das Wo, Wann und Wie. An der Donau östlich von Wien wurden zwei große interdisziplinäre Studien durchgeführt. Zwischen 1987 und 1990 wurden steuernde Faktoren und Biota in einem Vertikalprofil durch die Auwälder untersucht. Verschiedene erhobene Datengruppen wurden analysiert, z.B. hydrologische Daten, Fischdaten, Kartierungsdaten von Makrophyten, usw. Im Rahmen der Österreichischen Akademie der Wissenschaften wurde nach einer vorläufigen Studie 1989 ein weiteres interdisziplinäres wissenschaftliches Projekt als UNESCO MaB-Programm „Land/inland-water-ecotones“ im Jahr 1990 begonnen. Dieses Programm beinhaltet verschiedene Untersuchungsebenen: Zuerst werden Schlüsselprozesse in verschiedenen Ökoton-Typen untersucht, um eine Basis für weitere Untersuchungen zu finden; später soll eine Analyse von Landschaftsmustern zu einem effizienten Monitoring des gesamten Überschwemmungsgebietes führen. Dieser Beitrag enthält Informationen über einige Monitoring-Aspekte dieser Studien, deren Ziel ein wissenschaftlich begründetes Management von Flußlandschaften ist.

Janauer, G.A.: Aspekty monitorování v interdisciplinárních studiích na řece Dunaji

Pod pojmem monitorování si můžeme představit jakoukoli sérii měření, pokud tato umožní korektní popis daného systému a jeho proměny v čase. Nepřetržitý a pravidelný záznam dat je podmínkou. K určení metody monitorování specifického problému je třeba si odpovědět na otázku: kde, co a jak.

Dvě rozsáhlé interdisciplinární studie byly provedeny na Dunaji, východně od Vídně. V letech 1987 až 1990 "interdisciplinární studie Dunaj" sledovala řídicí abiotické faktory a výskyt organismů ve vertikálním profilu na transektu lužním lesem. Mimo jiné, byla získána hydrologická data, data týkající se výskytu ryb a provedeno mapování makrofytní vegetace.

Předběžná studie vypracovaná v roce 1989 byla počátkem dalšího interdisciplinárního vědeckého projektu pod hlavičkou UNESCO/MaB programu "land/inland-water ecotones" (ekoton mezi suchozemským a vodním prostředím), který byl zahájen pod vedením Rakouské akademie věd v roce 1990. Tento program se týká několika úrovní: nejprve jsou zkoumány klíčové procesy charakteristických typů ekotonů, které pak slouží jako podklad pro modelové analýzy krajiny a povedou k efektivnímu monitorování celé nivy.

Některé aspekty monitorování v těchto studiích, jejichž cílem je aplikace vědeckého hospodaření v inundační oblasti, jsou uvedeny v tomto článku.

Monitoring can be any series of measurements, if the intervals between the individual readings allow for a correct description of a system and its variation in time. In most cases this implies regular and continuous registration.

At the onset of a monitoring programme, three principal decisions have to be made: the where, the what and the how!

This paper deals with investigations on the river Danube in the province of Lower Austria. All three studies mentioned below (Table 1) were multidisciplinary with respect to the numerous scientific fields involved in the investigations. But, proceeding from one study to the next in a process of succession, the significance of interdisciplinarity increased.

Table 1:

1	<p>Ecosystem Impoundment Altenwörth (HARY & NACHTNEBEL, 1989) (Ökosystemstudie Donaustau Altenwörth / ÖD) Changes caused by the hydroelectric power plant at Altenwörth, River Danube</p> <p>funded by: The Austrian Academy of Sciences National Committee of MaB-UNESCO</p> <p>initiated by: Austrian National Committee of the International Association for Danube Research (IAD - SIL)</p>
2	<p>Interdisciplinary Study Danube (JANAUER 1989) (Interdisziplinäre Studie Donau / ISD) An interdisciplinary approach to steering factors and biotic variables at the river Danube</p> <p>funded by: Österreichischer Wasserwirtschaftsverband</p> <p>initiated by: Janauer, Humpesch</p>
3	<p>Ecotones River Danube - River March (Ökotone Donau March / ÖDM) Identification of characteristic processes and steering factors in ecotones of fluvial corridors exemplified at the River Danube and River March</p> <p>funded by: The Austrian Academy of Sciences National Committee of MaB-UNESCO</p> <p>initiated by: Austrian National Committee of the International Association for Danube Research (IAD - SIL)</p>

The first study, the ÖD, which was conducted by Herzig, assisted by Grosina, Hary and Nachtnebel, dealt with ecosystems as distinctive parts of the landscape modified by a power plant on the river Danube. The power station is situated close to the village of Altenwörth in the province of Lower Austria.

Several parts of the landscape complex were studied in detail, like river banks in the fast-flowing sections of the impoundment, soft-sediment sections close to the power plant, parts of the riverine forests and a series of physical and chemical environmental factors.

Systems of considerable area extent were studied, with the points of investigation preferably located in homogenous entities of the surrounding landscape.

Monitoring was conducted on a large scale with respect to the time and data base used. Apart from regular hydrological registrations, the differences before and after the construction of the power-plant were investigated, concentrating on agricultural and woodland uses, recreation and several economic interests.

At a smaller, more detailed scale, hydrology, microclimate, animal and plant life were monitored. Several seasonal and/or historical aspects, e.g. bird counts, were included.

The ISD, which I was asked to lead as scientific project manager, took place in a free-flowing section of the river Danube. Environmental steering factors were correlated with biological elements of the river and the riverine forests. Points of investigation were arranged at different levels on a gradient extending from the river bed to the highest elevations in the floodplain forest.

The study set out to gain more knowledge for the scientifically sound, practical management of landscape units within the flood plain. It also gave some insight on whether, if at all, management may simulate the present hydrological regime of the river corridor by technical means. This was

possible because even the free-flowing sections of the river Danube in Austria had already been regulated in the last century, and numerous technical constructions like levees and groins have shaped the appearance of the river for over 100 years.

At the different levels of the gradient, plant life and animals were studied, concentrating on riverine vegetation, aquatic plants, fish, birds and zoobenthos. Different aspects of the hydrological regime and land uses were correlated with the biotic data by multivariate statistical procedures.

Monitoring took place over a period of two years with in situ investigations including organisms. The results were combined with data from studies conducted in the years before, including mapping of macrophytes, fish counts, etc..

Interdisciplinarity was achieved to a very great extent, and the product - a 500 page final report - surpassed a plainly multidisciplinary approach by far. This was achieved by very strict project management and the obligation to produce a text attuned in detail to the last word in plenary sessions. This took a rather long time and lots of nerves and patience for all members of the group, but it produced what remains one of the most valuable data-sources on this stretch of the river Danube. The study has never been accused of any major errata, as has happened to other information on this politically sensitive area where contradictory concepts of future use - ranging from a National park to just another hydroelectric power-plant - are still being discussed.

The current study, the ÖDM (general scientific manager: Janauer), situated in the same section of the fluvial corridor as the ISD but working on a larger scale, is part of the UNESCO-MAB "Land/Inland-Water-Ecotones" project series. This study concentrates on the structure of ecotones (HOLLAND, RISSER & NAIMAN, 1991) and their functioning within the whole system. After identification and understanding of processes, landscape management with an

improved scientific basis is one of the primary objectives.

In this four year study, several important groups of organisms are being monitored in addition to abiotic factors. The areas of investigation are of rather different size, ranging from one square metre plots (microbiology) to several kilometres (Particulate organic matter (POM), fish, macrophytes, phytoplankton, terrestrial vegetation and animals), resulting in a considerable expenditure of manpower, money and time.

In the last year of the programme the team will concentrate on recognizing ecotones as landscape elements - "fractals" of the fluvial corridor. Monitoring of ecotones has the potential to reduce the need to monitor individual groups of organisms continuously - at least for some time. And it can be a step closer to better interpretation of remote sensing results, attractive for monitoring large, highly diversified landscape units like fluvial corridors.

Tracking back the line of studies from the ÖDM via the ISD to the ÖD, key abiotic and biotic factors have been monitored for almost eight years now. These data can be embedded into time series lasting back to the last century. This data base will deepen our knowledge on the history of the landscape and it may help to predict its future more precisely.

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Address of the author:

Georg A. Janauer

Institut für Pflanzenphysiologie
Biozentrum, Universität Wien
Althanstraße 14
A-1090 Wien
AUSTRIA