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All's Well that Ends Well? A Tool for Outcome Evaluation

The excavators have gone, the plovers have returned and the local community is enthusiastic. Does this mean that the rehabilitation work has been successful? The outcome evaluation handbook for watercourse rehabilitation projects is designed to help answer this question.

Unfortunately, the completion of a rehabilitation project does not necessarily spell its success. For example, a US study showed that numerous habitat enhancements have been ineffective and short-lived [1]. Nonetheless, in many cases, the outcome of a rehabilitation project has never been evaluated. It remains unclear whether the objectives have been achieved, or whether cost-effective use has been made of the resources committed to the project. The result is a loss of valuable inputs for future projects, since favourable assessments provide motivation and trigger further efforts, while experiences from less successful projects are also instructive. In addition, an opportunity to make specific adjustments to the management concept following rehabilitation (adaptive management) is missed, thereby remedying any remaining deficiencies. An outcome evaluation may not be performed for various reasons:

- inadequate funding,
- poorly defined project objectives,
- fear of failure,
- a lack of appropriate guidelines.

It was therefore decided, as part of the Rhone-Thur research project, to prepare a handbook offering step-by-step guidance on the conduct of an outcome evaluation [2, 3].

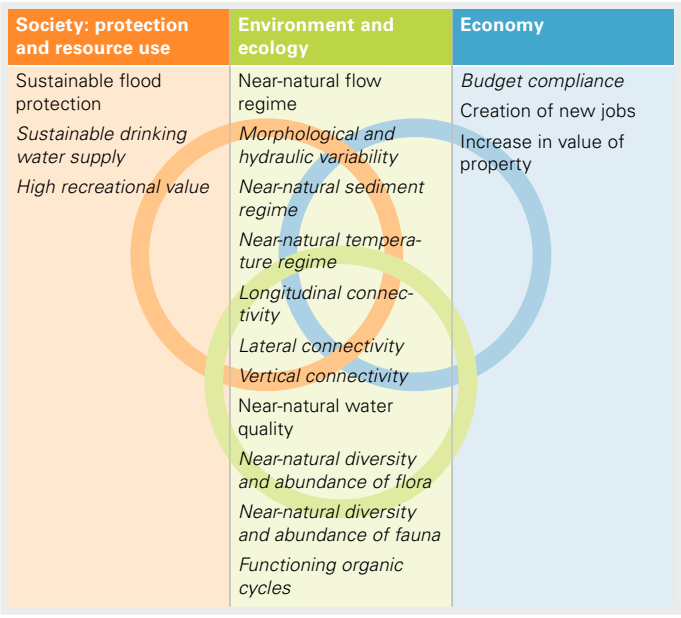
Outcome Evaluation Based on Project Objectives. Rehabilitation projects may pursue a wide variety of objectives. However, they all specify an optimum state that is to be attained through habitat enhancement measures. For example, the aim may be to promote the plant communities typical of the locality, to secure supplies of drinking water and to create an attractive recreational area for the local population. The objectives of a sustainable project will not be one-sided; rather, they will accord equal consideration to all three domains of sustainability (Fig. 1).

An outcome evaluation will check whether the individual objectives have indeed been achieved. Given the multiplicity of possible project goals, it was necessary for outcome evaluation in the handbook to be restricted to 14 objectives (12 objectives shown in italics in Fig. 1), with the emphasis being placed on the "environment and ecology" area. Another topic covered by the handbook is that of project implementation, based on the objectives of "political acceptance" and "stakeholder participation".

Assessing Objectives on the Basis of Indicators. One important condition for the definition of project objectives is that they should be evaluable. This requires the use of specific, practical parameters – or indicators – which should be easy to measure and interpret, cost-effective and non-destructive [4].

In addition, reference values should be available for every indicator. These are to be derived from reference systems, describing

Fig. 1: Possible objectives of a watercourse rehabilitation project, classified under the three headings of sustainability [5]. The items in italics are discussed in detail in the handbook.



the optimum state that is to be attained through rehabilitation. Ideal reference systems are natural or scarcely affected sections of watercourses from the same geographical region. Unfortunately, such reaches are few and far between, especially in the intensively managed areas of the Swiss Central Plateau. For this reason, recourse is made – if possible – to historical references, e. g. old maps showing the original path taken by a river, or records of former species distribution. Alternatively, a theoretically reconstructed reference system may be used, based on hydroecological concepts and general scientific knowledge – although this method introduces considerable scope for interpretation.

The outcome evaluation handbook describes a total of 50 indicators, with reference values. Also included is important procedural information, e.g. the survey method and the expected time required. Many of the indicators, such as shoreline length (see Box), were specially developed for the handbook. Others are based on established international methods. Each indicator characterizes one or more project objectives: for example, the indicator "fish – species numbers and frequency" provides a direct measurement for the project objective "near-natural diversity and abundance of fauna"; at the same time, the fish species detected permit indirect conclusions as to the longitudinal connectivity of the watercourse (presence or absence of migratory species). If possible, each project objective is assessed against various indicators (Fig. 2).

Standardization of Indicators and Evaluation Procedure. The various indicators have specific units, such as the number of individuals per square metre or Swiss franc. To make the different quantities amenable to a joint evaluation, they have to be converted into standardized, dimensionless values. These lie on a scale from 0 to 1, reflecting the degree of naturalness or satisfactoriness for the indicator in question. For most indicators, naturalness is determined with the aid of mathematical standardization functions (Box). In cases where this is not possible, the degree of naturalness is

Project objectives											
High recreational value	Morphological and hydraulic variability	Near-natural sediment regime	Longitudinal connectivity	Near-natural diversity and abundance of flora	Near-natural diversity and abundance of fauna	Functioning organic cycles	Budget compliance	Project acceptance	Stakeholder participation	**Indicator**
			●							Fish passability
	●	●	●		●					Age structure of fish populations
	●	●	●		●					Species numbers and frequency
	●	●	●		●					Ecological guilds of fish
			●	●						Typical alluvial plant species
			●	●	●	●				Composition of floating organic matter and colonization by organisms
	●	●		●	●					Variability of flow velocity
	●	●		●	●					Variability of maximum discharge depth
	●	●	●		●					Sediment regime
●										Visitor numbers
								●		Project acceptance among stakeholders
									●	Stakeholder satisfaction with participation in decision-making process
							●			Project costs

Fig. 2: Recommended set of indicators for assessing the outcome of measures intended to improve longitudinal connectivity.

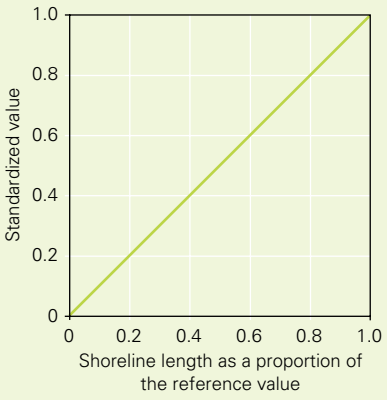
Example: the "Shoreline Length" Indicator

The length of the land/water interface (shoreline) is used as an indicator of lateral connectivity. The longer the shoreline, the more near-natural the state of the watercourse. But what exactly is the procedure for using this indicator in outcome assessment? By way of example, data from the widening of the Thur at Schäffäuli is given.

► Data gathering: three values are determined. The reference value describes the length of the shoreline per kilometre of river prior to engineering works, ascertained from historical maps. For the Thur, this value is 4.47 km/km (Zurich cantonal game map, 1862). Pre- and post-rehabilitation shoreline lengths are measured in the field. The pre-project value is 2.00 km/km and the post-project value 2.90 km/km.

► Standardization: The pre- and post-project values are each divided by the reference value, and the results are converted into dimensionless pre- and post-project indicator values, using the function shown. The indicator value calculated for the pre-project state is 0; after the widening, the value is 0.4.

► Evaluation: The indicator values are compared in the evaluation matrix (Fig. 3), which enables the success or failure of a measure to be read off. In terms of shoreline length, the Schäffäuli widening project can be rated as a minor success.



assessed semi-quantitatively or qualitatively, using several different criteria and classes.

In order to detect a change after rehabilitation, at least two comparison points are required, describing the degree of naturalness prior to implementation (pre-project state) and after the completion of rehabilitation (post-project state). This before/after comparison of the standardized indicator values is the essential task of the outcome evaluation. It is performed with the aid of an assessment matrix (Fig. 3). Depending on the change in the value, the outcome may be assigned to one of five "success categories". The procedure takes into account not only the magnitude and direction of the change but also the starting point. Depending on the initial state, an increase of 0.3 will be considered a minor success (e. g. initial value rising from 0.1 to 0.4) or a moderate success (e. g. from 0.5 to 0.8) (Fig. 4).

The assessment matrix can be applied either for individual indicators or for all the indicators relevant to a project objective. For this purpose, the results of the before/after comparisons are averaged for all the indicators relating to the same objective. In the "environment and ecology" area, a large number of objectives exist, and these cannot be readily combined into a whole. Accordingly, further aggregation may be performed, based on qualitative criteria.

To simplify the various steps involved in the outcome evaluation process, the handbook includes an Excel tool.

Consistent and Simplified Outcome Evaluations. The handbook is conceived as an aid and an initial step towards the standardization of outcome evaluation practice in Switzerland. After a 2- to 3-year period of application, the interim results are to be reviewed and, if necessary, the handbook is to be revised. ○ ○ ○

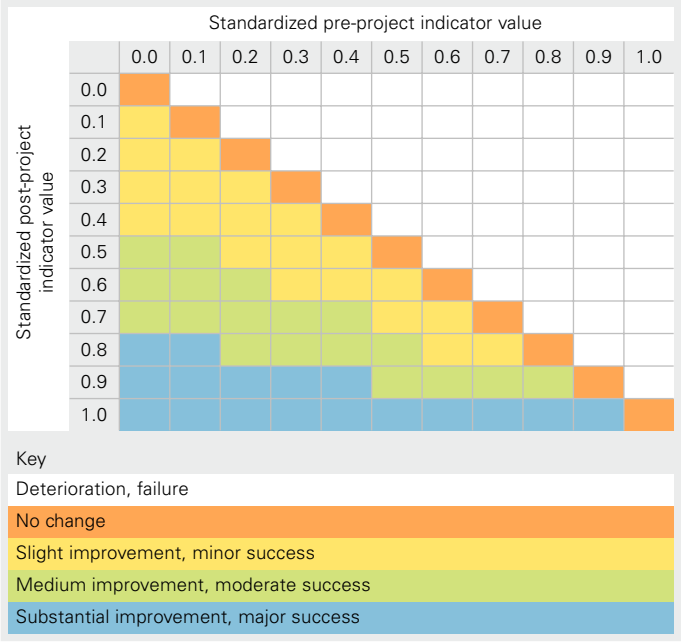
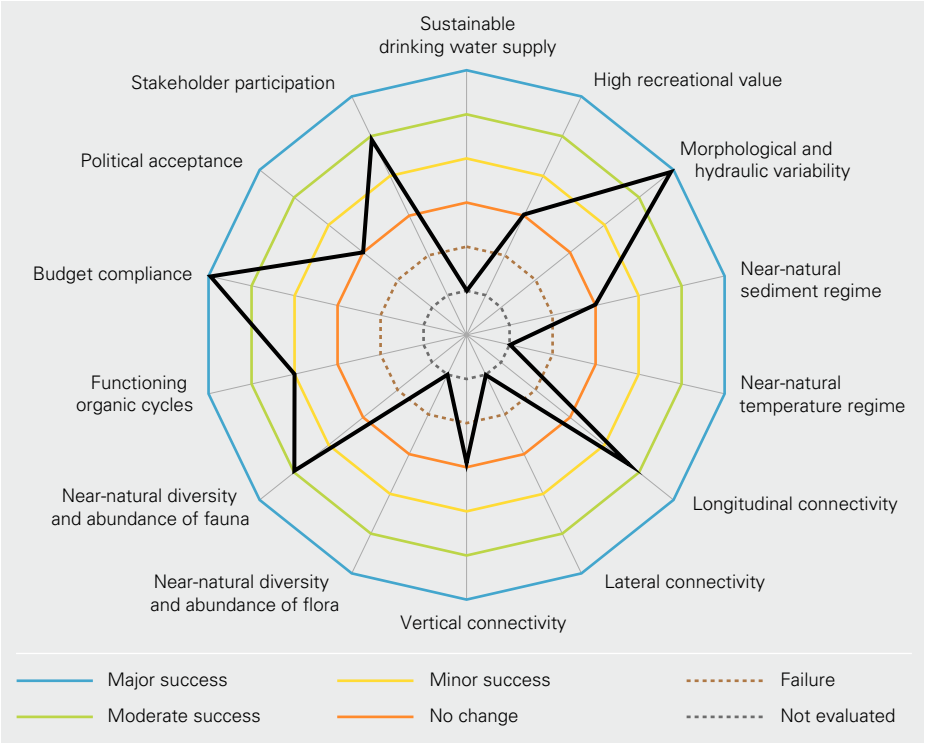


Fig. 3: Matrix for assessing the outcome of a watercourse rehabilitation project.

Fig. 4: Radar diagram showing the results of an imaginary outcome assessment.



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