# Loss-Gain calculations in German Impact Mitigation Regulation

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## 1 Introduction

The use of natural resources is often in conflict with nature protection and biodiversity conservation. With the enactment of the German Federal Nature Conservation Act in 1976 the “Eingriffsregelung” (Impact Mitigation Regulation IMR) entered into force. Since then, it has become the major landscape conservation instrument to address mitigation and compensation for impacts from developments and projects. Its overall objective is to ensure the preservation of the existing ecological situation as a minimum standard by avoiding any impairment of nature and landscape and compensating for residual unavoidable impacts. It as an instrument both for assessment and impact mitigation following a mitigation hierarchy (see Figure 1 for the consecutive steps).

As a result of more than 30 years practice German IMR is a compensation approach which is outstanding due to its comprehensive character and the broad scientific base and discussion. One of the core issues of this discussion has - since the beginning - been the debate on appropriate balancing and evaluation methods to put into relation impact and offset.

After briefly introducing the surrogate of loss-gain calculations in chapter 2 and an overview on steps in loss-gain calculations (chapter 3) this paper will shed some light on the most common types of simplified balancing and evaluation methods in chapter 4, namely Biotope valuation procedures (chapter 4.1), Compensation area coefficients (chapter 4.2) and Cost-of-restoration approaches (chapter 4.3). In the end a summary of the advantages and disadvantages and a brief outlook on the current practice is given (chapter 5).

The paper largely builds on a PhD thesis by Elke Bruns that has been prepared in 2007 at Technische Universität Berlin.

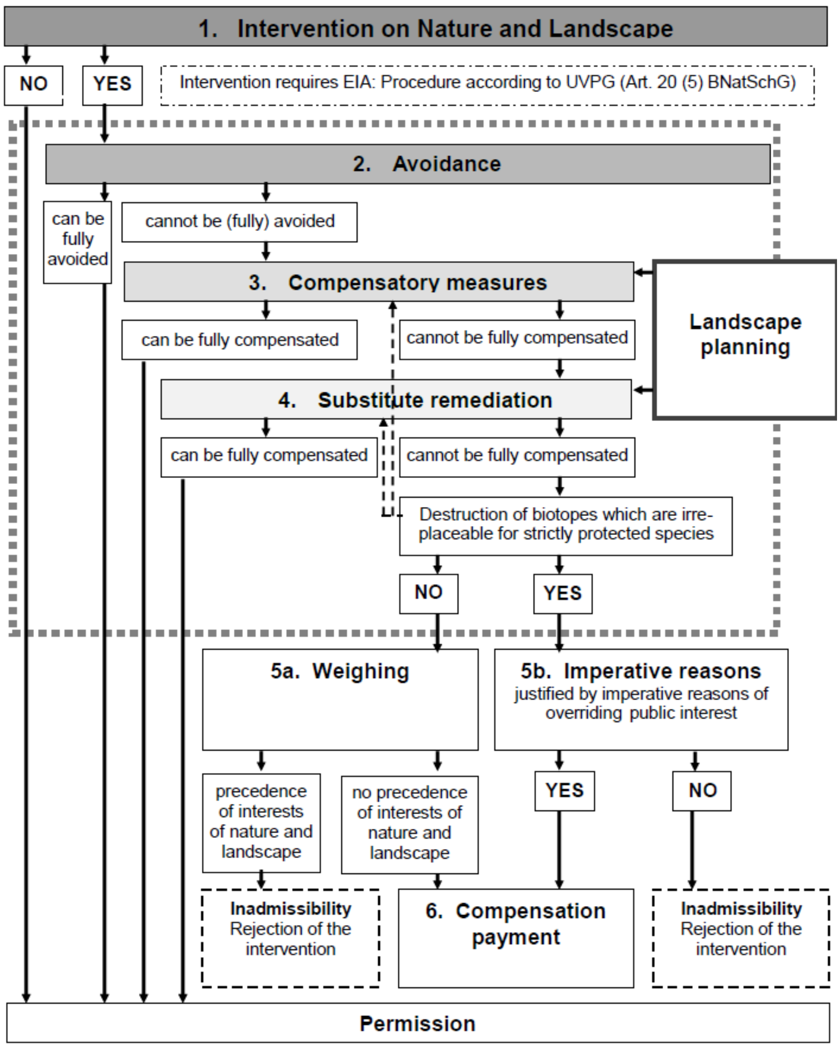


Fig. 1: Steps of the German Eingriffsregelung (Darbi et al. 2009; modified after Köppel et al. 2004 and Bundesamt für Naturschutz 2007)

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## 2 Surrogate of loss-gain calculations in IMR

According to the Federal Nature Conservation Act in general nature and landscape are used as surrogate to determine loss and gain, this involves in particular the natural assets (species and habitats, soil, water, climate, air quality) and the aesthetic quality and recreational functioning of the landscape (see Fig. 1).

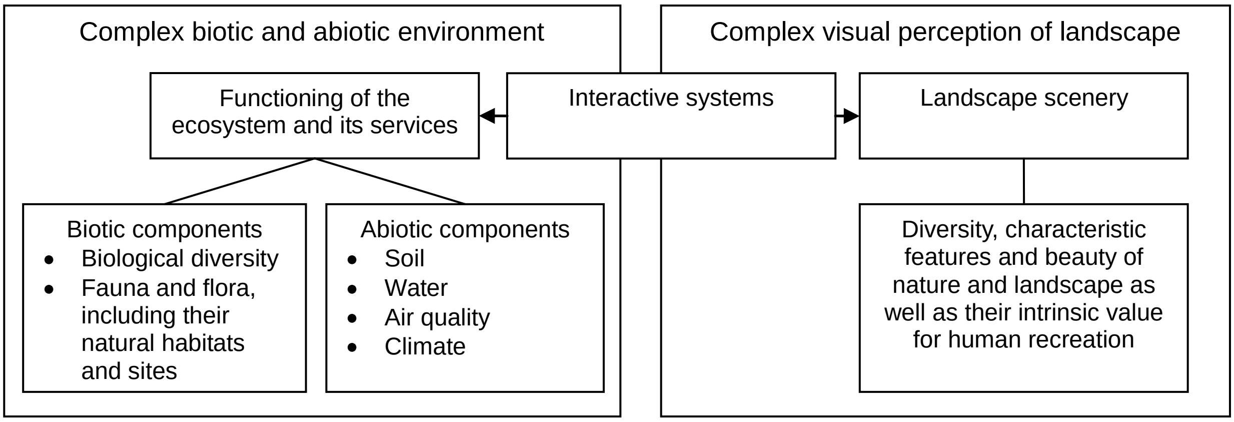


Fig. 1: Surrogate of loss-gain calculations in IMR according to Federal Nature Conservation Act

In practice different approaches building on natural assets or ecological functions (selective approach) or biotope types (modular approach) or combinations of those are applied to measure the initial situation and to determine and analyse the loss due to the intervention (see Fig. 2).

In Germany the mapping of biotopes is established as standard in practice. By contrast, habitats are specific for single species and therefore have to be considered for a number of different species, resulting in a disproportional high amount of work, which is hard to handle in practice. Nevertheless, the habitat approach may be reasonably applied for selected “key species” or “umbrella species”, in addition to the biotope approach as the main tool. These “key species” should be identified for each specific case, together with responsible persons and experts.

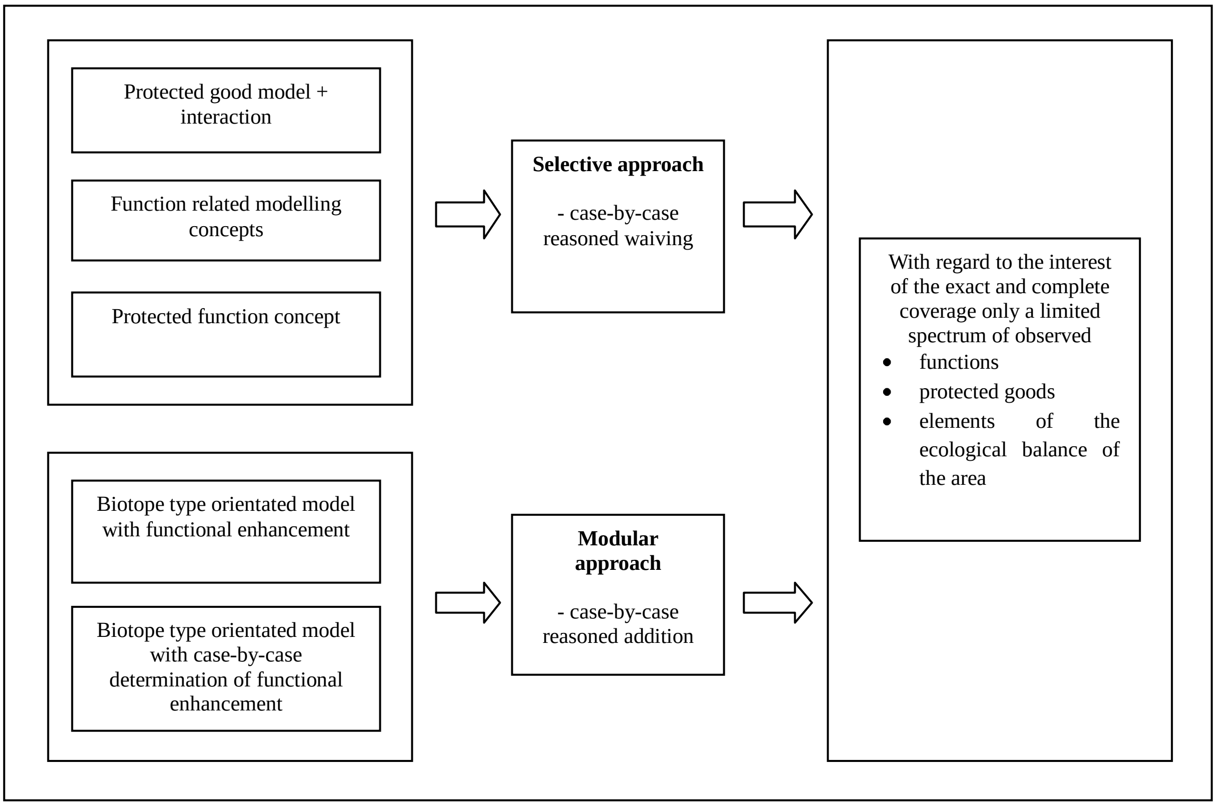


Fig. 2: selective and modular approach to detect the framework of the study (Bruns 2007: 151)

## 3 Steps in Loss-Gain calculation

The procedure of impact mitigation requires different valuations steps (Köppel et al. 1998: 94; see Table 1):

1. Determination/description of the initial situation
2. Estimation of the likely effects of the intervention (impact)
3. Determination of compensation (offset)/Balancing of impact and offset

The description and evaluation of the initial situation of the initial situation with regard to the worthiness of protection and the vulnerability is the necessary precondition for the estimation of the likely effects and for the decision regarding the significance of impairments. The estimation of the likely effects of the intervention includes the determination and evaluation of the impact, the comparison of alternatives and mitigation and minimization of impacts and the determination of the appropriateness of compensation measures (Köppel et al. 1998: 94). The third step includes the determination of compensation measures in terms of quality and quantity and the balancing of loss due to the impact and gain resulting from compensation measures.

Table 1: Methodical task complexes in IMR (Bruns 2007: 68)

| TASK COMPLEXES | ASSESSMENT OBJECT AND PURPOSE |
|---|---|
| *'State determinination'*<br>(determination and) assessment of performance and functionality of the ecological balance of the area and the scenery | Assessent of the impact area aiming to differentiate the importance of values and function attributes<br>- as base of the impact assessment (state comparison)<br>- as reference state (origin and planned state)<br>- as base for explanations of prevention measures |
| *'impact assessment'*<br>determination and valuation of caused impacts | Assessment of the changes, which were caused by the project induced impacts, as a part of the impact assessment<br>- in regard to type and amount/intensity<br>- in regard to matching with normative goals and principles of the nature conservation act or local nature conservational plannings |
| | Assessment of site connected and building technical prevention options |
| | Assessment of improvements caused by compensation measures (upgrades)<br>- in regard to type and amount of achieveable upgrades<br>- in regard to matching with normative goals and principles of the nature conservation act or local nature conservational plannings |
| 'Compensation determination'<br>assessment in the course of determination of type (qualitative equivalence) and amount (quantitative equivalence) of impact and compensation | Assessment of upgrades caused by compensation measures (as part of impact forecast)<br>- with regard to their input to value gain and function upgrades<br>- assessment of equivalence of functions of type and amount ('equality') |

## 4 Balancing and evaluation methods

At federal level no legal provisions (laws, ordinances etc.) exist that specify which balancing and evaluation methods shall be used to determine appropriate compensation under the IMR. As a result, at least 40 published evaluation approaches exist in Germany. In addition to national level guidance, each federal state has its own regulations on how to implement the IMR and how to handle required environmental offsets in practice (e.g. Thüringer Ministerium für Landwirtschaft, Naturschutz und Umwelt 2005; Sächsisches Ministerium für Umwelt und Landwirtschaft 2003; Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen 2003). The guidance includes specific evaluation and calculation methods.

No commonly accepted classification of evaluation methods exists (this due firstly to the fact that the term ´evaluation approaches/methods/procedures` is not properly defined, and secondly the seamless transition between several methods). However, a distinction can be made between a qualitative descriptive (extensive) approach, the so-called "verbal argumentative" method' (which builds on a case-by-case expert judgement taking into consideration the specific affected natural assets, functions or biotopes and the possible interactions; which is especially useful when data is lacking or heterogeneous or the impact is very complex) and more quantitative more or less formalised 'biotope valuation procedures', approaches using compensation area coefficients and cost-of-restoration approaches. The latter are simplified approaches which can either be applied in their pure form, in various combinations or taking into account additional criteria and qualitative (argumentative/descriptive) reasoning.

## 4.1 Biotope valuation procedures

### Description of the environmental baseline

Biotope types are used as complex indicators for the capacity and functionality of the ecological balance of the area and even their scenery, thus building the assessment basis. Biotope values constitute the value equivalent. The biotope value in a narrower sense labels a simplified approach: exclusively the biotope type is responsible for the value during the balancing procedure. Wider biotope-value-based methods complement the biotope value by further values and functions of the ecological balance of the area using a value equivalent for the compensation assessment. Indirect assessments are explained solely on the type level, direct assessments require a modification of the type (Bruns 2007: 199).

Biotope types are described in biotope type lists (Biotoptypenlisten) which assign a specific value (value point, increment value or value range) to each biotope type. These created units differ within different lists in the grade of distinction and their attributes of types, which makes any comparison complicated. As the appropriateness and validity of the assessment depends on the biotope type lists these have to be comprehensive and sophisticated on the one hand and on the other hand the resulting value range for a specific biotope type has to be taken into consideration carefully (Bruns 2007: 198, 200)

### Estimation of the likely effects of the effects of the intervention / assessment of impacts

The impact-assessment, i.e. the estimation of the likely effects of the intervention is usually replaced by a comparison of values before and after comparison. Values are grouped on an ordinal scale and the accumulation of values is done as a mathematic accumulation of values after a transformation in quasi-cardinal figures. These biotope values together with the area affected are then used for loss-gain calculations After uniting these value points with the area sizes dimensionless figures result (see Table 2).

Table 2: Calculation example from Thuringia (Thüringer Ministerium für Landwirtschaft, Naturschutz und Umwelt 2005)

| | | | |
|---|---|---|---|
| IMPACT | Biotope type before impact | | New extensive grassland |
| | Biotope value before impact | $vb_1$ | 25 |
| | Biotope type after impact | | 100 % sealed road |
| | Biotope value after impact | $va_1$ | 0 |
| | Difference between biotope values | $vd_1= vb_1-va_1$ | 25 |
| | Area size | $a_1$ | 10 ha |
| | Resulting value loss | $v_1=vd_1*a_1$ | 250 |
| COMPENSATION | Biotope type before commpensation | | Fallow field |
| | Biotope value before compensation | $vb_2$ | 20 |
| | Biotope type after compensation: | | Shrubbery |
| | Biotope value after compensation | $va_2$ | 40 |
| | Difference between biotope values | $vd_2= va_2-vb_2$ | 20 |
| | Area size | $a_2$ | 12,5 ha |
| | Resulting value gain | $v_2=vd_2*a_2$ | 250 |
| BALANCE: | | Value loss impact = value gain offset | |

### Determination of compensation/balancing of impact and offset

As Fig. 3 shows the value loss that has to be compensated for is the difference between the values of the biotope before and after the impact. The value of the related compensation area is determined by a comparison of the values before and after the implementation of the measures (value increase). Thus, an increased value identically equal to the loss of value determines a complete compensation (Bruns 2007: 201). It is thereby most important that these calculations build on a common basis, i.e. similar semantics specified by biotope types. A simplification of the equivalence of values is possible by omitting the determination of the increased value in the compensation area as shown in Fig. 4. Further simplifications (see Fig. 5) have to be considered insufficient.

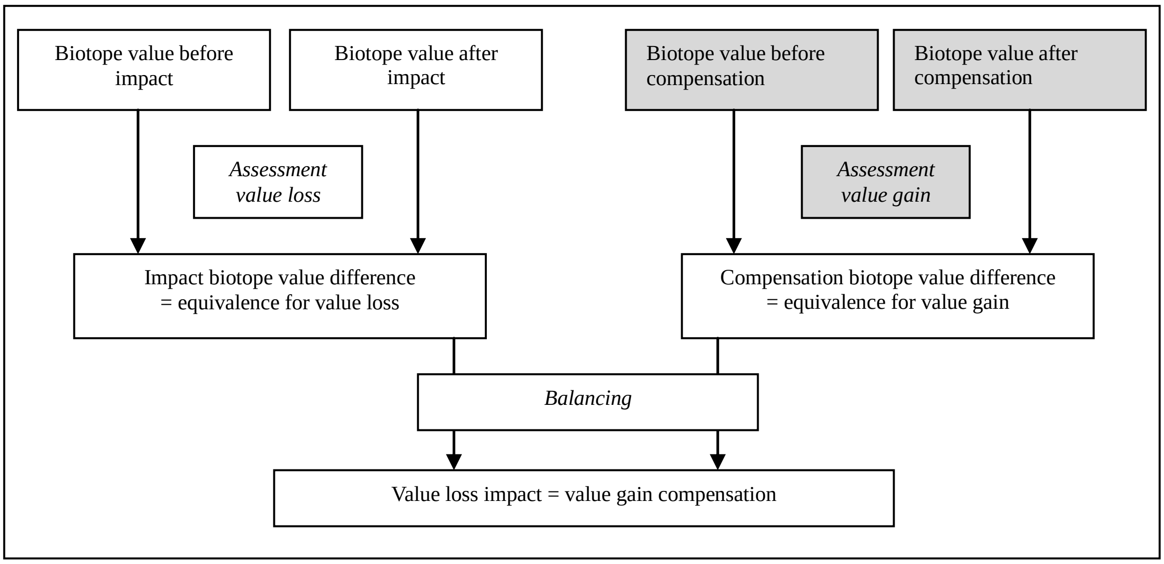


Fig. 3: Difference value method based on biotope values (Bruns 2007: 202)

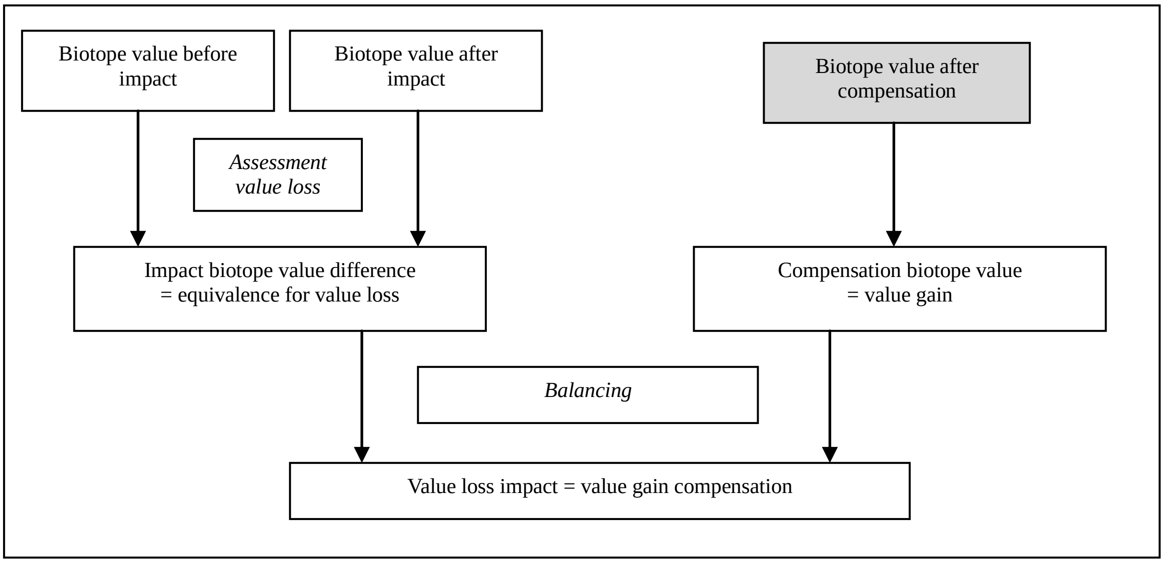


Fig. 4: Simplified value equation (difference value method) without determination of value gain (Bruns 2007: 203)

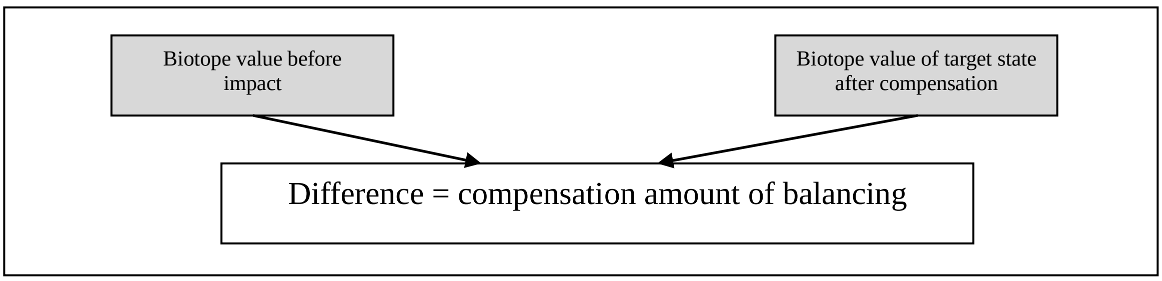


Fig. 5: Simplified balancing by value equation without determination of value gain and value loss (Bruns 2007: 203)

Biotope valuation procedures building solely on the biotope type are only qualified for fields of “common meanings of value and function characteristics" due to the limited capability of this indicator, i.e. only in cases of uniform areas and conform mitigated and enhanced functions a sufficient assessment is ensured. Implementation restrictions arise with regard to abiotic functions in areas notably shaped by their usage, where inadequate indicator capability can be overcome by the following strategies (Bruns

2007: 204):

1. choose the biotope-synopsis as sophisticated as the benchmark-level, customize and extend it,
2. pick ranges of values enabling the modification of types and the addition of attributes to the object-level,
3. enhance the quantitative scale of compensation by textual explanations and the reasons for the measures.

The comparison of conditions replaces a detailed assessment of impacts, which requires a textual analysis (Bruns 2007: 205). Hence, the integration of non-area-based aspects during the assessment of compensation has to be implemented argumentative.

A time-lag has not to be compensated (judicial decision BMVBW).

**Enhanced biotope value orientated methods**

Enhanced biotope value orientated methods are a specification and extension of biotope-value methods with regard to the underlying model for the ecological balance of the area, the assessment of values and the assessment of compensation. The basic model of a list of biotope types with respectively assigned values is enhanced by further values and function characteristics of special relevance (see Fig. 6). The assessment is carried out on a numeric base with integration of function characteristics of special relevance. Through weighting with their importance every function characteristic is integrated into the biotope-value (Bruns 2007: 208). Table 3 illustrates a calculation example.

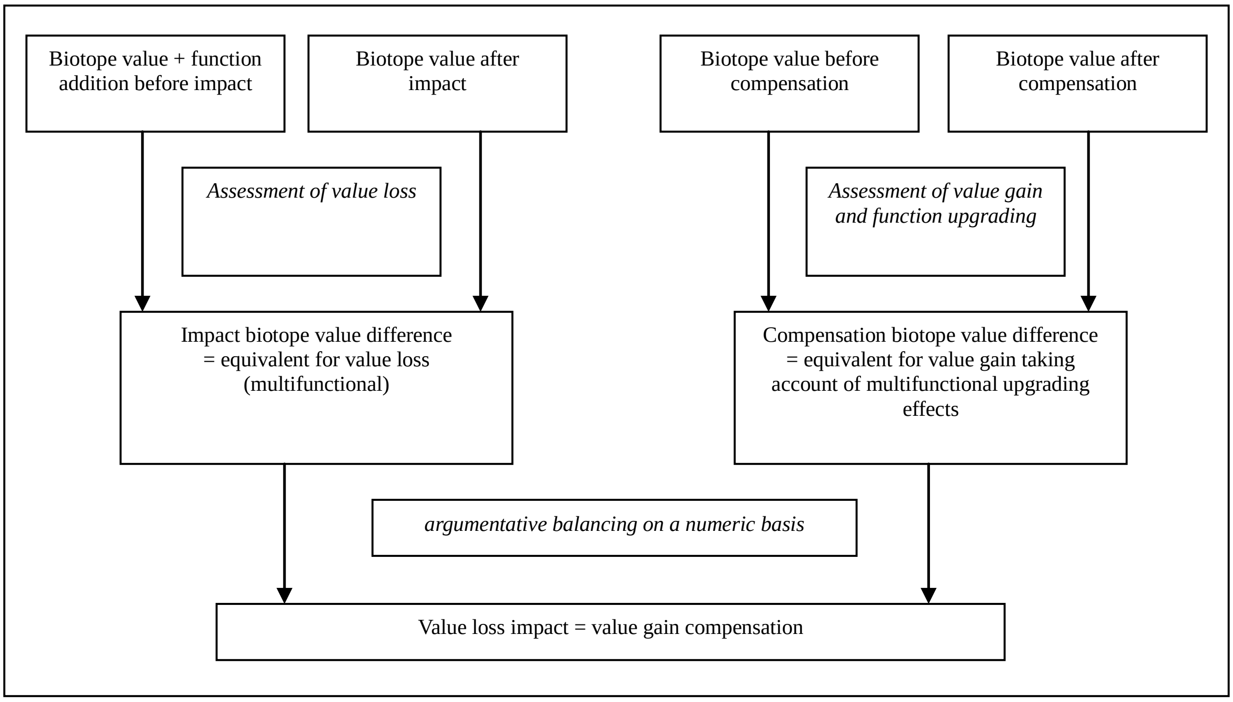


Fig. 6: Simplified Value equation and argmentative balancing on a numeric basis (Bruns 2007: 208)

Table 3: Calculation example from Saxony (Sächsisches Ministerium für Umwelt und Landwirtschaft 2003)

| | | | |
|---|---|---|---|
| IMPACT | Biotope type before impact | | Holiday resort |
| | Biotope value before impact | $vb_1$ | 5 |
| | Biotope type after impact | | Business park |
| | Biotope value after impact | $va_1$ | 1 |
| | Difference between values | $vd_1 = vb_1 - va_1$ | 4 |
| | Functions of special relevance | | Impaired aesthetic function |
| | Function value | $vf_1$ | loss: -1 |
| | Function affected area | $aa_1$ | 5 ha |
| | Area size | $a_1$ | 50 ha |
| | Resulting value loss | $v_2 = vd_1 * a_1 + vf * aa_1$ | 195 |
| COMPENSATION | Biotope type before commpensation | | Railroad system |
| | Biotope value before compensation | $vb_2$ | 2 |
| | Biotope type after compensation: | | Nearly natural spruce forest |
| | Biotope value after compensation | $va_2$ | 30 |
| | Difference between values | $vd_2 = va_2 - vb_2$ | 28 |
| | Functions of special relevance | | Removal of electricity pylon |
| | Function value | $vf_2$ | (gain: +) 1 |
| | Function affected area | $aa_2$ | 5 ha |
| | Area size | $a_2$ | 6,8 ha |
| | Resulting value gain | $v = vf_2 * aa_2 + a_2 * vd_2$ | 195 |
| BALANCE: | | Value loss impact = value gain offset | |

## 4.2 Compensation area coefficients

**Description of the environmental baseline**

Compensation area coefficients express the relation between impaired and compensated area in a coefficient or a ratio. They are benchmarks defining maximum and minimum thresholds for defining compensation area demand, thus laying emphasis on the major resource for compensation: land. In general the extent of the compensation area coefficient relates to the importance/value of the area affected (area-value-relation). As such compensation area coefficients do not form a method on their own but are usually part of other methods e.g. enhanced biotope value oriented methods.

The ranges of compensation area coefficients are usually broad and are usually set standards. In individual cases a duplication between minimum and maximum limit can occure, thus requiring further argumentation in detail. In the case of the procedure according to BayStMLU (2003) compensation area coefficients are fixed according to the importance of the affected area (high, medium, low) and the severity of the impact (high and medium-low). Coefficients are defined based on experience and confirmed by experts in practice rather than being deduced scientifically. Usually biotope types specify the compensation area coefficients; further coefficients are considered in case of affected soil functions.

**Estimation of the likely effects of the effects of the intervention / assessment of impacts**

A before-after-comparison of functions and values is not necessary. The compensation amount is deducted directly from the initial value of the affected area (value prior to the impact).

**Determination of compensation/balancing of impact and offset**

The assessment of the compensation amount solely builds on the obtained value after compensation, thus not considering the value gain. Due to this, the simplified approach is only appropriate for simple cases, i.e. the more similar the impaired and upgraded functions are, the more appropriate are compensation area coefficients. In such cases good suitability to standardize the area amount is given and simultaneously flexibility regarding the result is kept (Bruns 2007: 212). Table 4 shows a calculation example from the state of Bavaria.

Table 4: Examples from Bavaria (Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen 2003; BaySTMLU; Bearbeitung der naturschutzrechtlichen Eingriffsregelung und Berechnung des Ausgleichs. Minimal Garching.)

| ASSESSMENT OF INITIAL STATE BEFORE IMPACT | | | | |
|---|---|---|---|---|
| Agricultural landscape lacking in structure, sealed soil with roads and buildings, species-poor grass verges beside the roads | | | Category I: Areas of little importance for the ecological balance of the area and the landscape | |
| ASSESSMENT IMPACT INTENSITY TO DETERMINE COMPENSATION COEFFICIENTS | | | | |
| High sealing or utilization ratio, permitted building area >0,35 | | | Type A | |
| Small or middle sealing or utilization ratio, permitted building area <0,35 | | | Type B | |
| ASSESSMENT OF COMPENSATION AMOUNT | | | | |
| Impact | Type | Area size | Compensation area coefficient | Offset area size (area*coefficient) |
| building land and sealed areas | A I | 6 ha | 0,6 | 3,6 ha |
| newly sealed roads | A I | 1 ha | 0,3 | 0,3 ha |
| green spaces with strong reshaping | B I | 0,5 ha | 0,3 | 0,15 ha |

## 4.3 Cost-of-restoration approaches

### Description of the environmental baseline

The '(Wieder)Herstellungskostenansatz' (cost-of-restoration approach) involves estimating the costs that would be required to restore a comparable state or condition (in relation to the lost one), i.e. the costs of natural compensation amount are determined using the fictive costs for the impairment offset. This monetary approach to depict impairments and compensation capacity builds on the equivalence of costs to determine the compensation amount: Thereby costs-of-restoration are fictive costs of measures to restore the condition before the impact and costs-of-production are costs for the accomplishment of compensation measures. The offset is achieved when costs-of-restoration equal costs-of-production (see Fig. 7). The assessment of fictive costs of measures allows to determine the losses through the impairments quite specific, when done comprehensive and realistic.

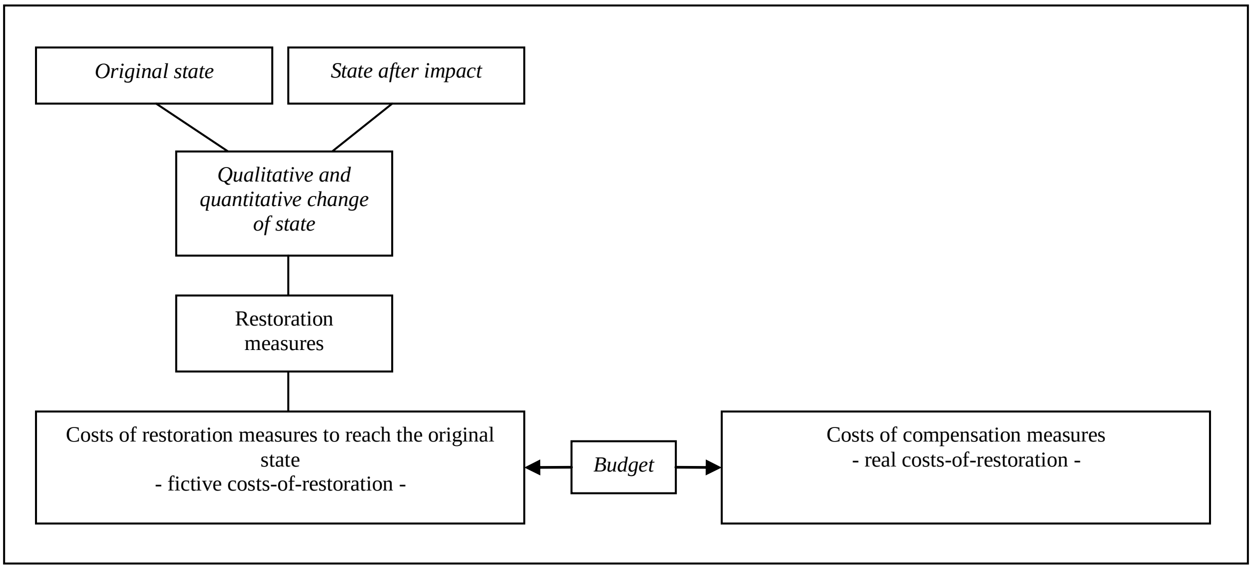


Fig. 7: Balancing components of the cost-of-restoration approach (Bruns 2007: 215)

### Estimation of the likely effects of the effects of the intervention / assessment of impacts

In the case of the cost-of-restoration approach the equivalence of functions or values is replaced by the equivalence of costs. The calculation of costs thereby includes costs for property, production, maintenance, utilities, surcharges because of function deficits at year x and a flat rate for unsealing costs (Bruns 2007: 214). Table 5 shows a simplified calculation example.

Table 5: Calculation of the compensation amount using cost equivalents (Köppel & Müller-Pfannenstiehl 1996; Bosch und Partner 1993)

| | |
|---|---|
| For an impact 2,5 ha of semi-arid grassland would have to be created as compensation. As this is impossible to realize and the intervention is still being considered necessary an orchard meadow is proposed as offset. The calculation below illustrates how to determine the area size of orchard meadow that has to be created. | |
| CALCULATION OF COSTS OF THE IN-KIND COMPENSATION (SEMI-ARID GRASSLAND) | |
| Creation of 2,5 ha of semi-arid grassland from farmland | 175.000 € |
| Planning costs | 11.000 € |
| Maintenance costs | 27.500 € |
| TOTAL COSTS = COST EQUIVALENT | **213.500 €** |
| CALCULATION OF COSTS OF THE OUT-OF-KIND OFFSET (ORCHARD MEADOW) PER HA | |
| Creation of orchard meadow from farmland (ha) | 27.500 € |
| Planning costs (ha) | 3.800 € |
| Maintenance costs (25 years) (ha) | 45.000 € |
| TOTAL COSTS PER HA | **75.800 €** |
| NECESSARY AREA SIZE OF THE OUT-OF-KIND OFFSET | **2,82 ha** |

**Determination of compensation/balancing of impact and offset**

Due to the replacement of function or value equivalents by cost equivalents this approach includes a risk of alienation of funds. However, this mostly depends on the compensation management and personal responsibility (Bruns 2007: 215f). Furthermore, the actual proximity to the offset fee seems to counter the decision-making cascade following the mitigation hierarchy. Therefore, this approach is inappropriate the more specific function characteristics are and the higher their importance, because it will be less probable that the equivalence of costs represents the nature conservational relevance of this biotope type. The more costs of production and nature conservational value differ from each other, the less the assessed costs can ensure the restoration of a lost value.

In addition (and similar to the value ranges used in biotope valuation procedures and ranges of coefficients) wide differences of costs influenced by the start-conditions are limiting the standardization-effect (Bruns 2007: 216).

## 5 Criticism and current situation

Several authors (e.g. Peters & Ranneberg 1993, Jessel & Tobias 2002) deal with a number of points of criticism with regard to balancing and evaluation methods. As most important can be cited (Spang & Reiter 2005: 48):

- Inappropriate use of simplified area balancing approaches using value points,
- Negligence of components of the natural balance, in particular the abiotic components soil, water, climate air and the landscape scenery,
- Lacking cross-sectional evaluation and consideration of the natural balance and landscape as a complex,
- No consideration of cumulative effects,
- Lacking distinction between object-level and value-level.

More specific critique in terms of advantages and disadvantages of the presented balancing and evaluation methods is summarized in Table 6.

Table 6: Advantages and Disadvantages of the different balancing and evaluation methods

| Method | Advantages | Disadvantages |
|---|---|---|
| **Biotope valuation procedures** | • legal certainty with comprehensive approaches and increased justice for individual cases (connected structural and functional approach)<br>• modular approach with modification possibilities to the planning situation in individual cases<br>• consideration of biotope-independent spatial correlations and not biotope type-indicated functions possible<br>• unification by use of a standardized basic module as basis for the compensation assessment<br>• good effort-effect-relation (area-based informational value)<br>• good availability of needed data (CIR-aerial photographs, nationwide mapping of biotopes) | • methodical difficulties by connecting calculated area-value-equivalences and for example qualitatively determined function-equivalences<br>• minor standardization of selection and consideration of specific functions (number, extent)<br>• extension of the assessment basis is connected with insufficient operationalized requirements (mitigation of values and functions of special relevance) |
| **Compensation area coefficients** | • Standardisation and flexibility<br>• Reduction of complexity<br>• Good benefit-cost relation with regard to need for compensation area<br>• Strengthening of adjusted judgement made by planners through defining ranges<br>• Amount of land needed for compensation is easy to define in advance | • Justification of the size of the compensation coefficient is unclear<br>• Area-value-relation is doubtful<br>• Orientation on area may lead to lacking consideration of functional relations |
| **Cost-of-restoration approaches** | • Monetary valuation of costs (focus very much on practical implementation)<br>• Facilitates implementation through flexible planning and execution of compensation measures<br>• Avoiding the problematic biotope value x area calculation | • Risk that the preference for avoidance may be weakend<br>• Risk to support financial compensation and to weaken natural compensation (on the ground)<br>• Fuzziness due to differences in cost calculations |
| ***Verbal argumentative methods*** | • *qualified individual-case-related decision- and problem solving orientated approach*<br>• *high justice in individual cases*<br>• *heterogenous data and information can be connected by factual logical argumentation*<br>• *deficits in data and information can be balanced by knowledge from experts or experience*<br>• *strengthening of the position of the planners*<br>• *in complex cases compatibility of administrative procedures of weighing of interests and decisions* | • *high requirements to ensure transparency in complex decisions: announce value scales and planning goals*<br>• *not coherent among laymen*<br>• *a few possibilities to anchor minimum standards or standardized modules (Bruns 2007: 220)* |

With the 2002 and 2009 amendments to the Federal Nature Conservation Act the spatial and functional relation between impact and offset (in-kind/onsite vs. out-of-kind/offsite) was loosened which led to the emergence of advanced and aggregated offsets (compensation pools and “eco-accounts”). In recent years several of the federal states have enacted ordinances in support of this practice, enabling the occurrence of professional public and private providers of compensation services (“compensation agencies”). These implement offsets independently of an impact in a first step and only in a second step (after an impact has occurred) impact and offset are put into relation. On the background of this new tendency in IMR practice reliable balancing and evaluation methods have an increasing importance. It is therefore extremely important but also challenging that these are comparable and transparent. Hence, one major point of criticism is the existing multitude of balancing and evaluation methods which makes this aim hardly impossible to achieve. A survey in 2003 found that more than 80% of all compensation pools use quantifying methods (which have been presented in this paper) and among these biotope valuation procedures are (with almost 70%) most commonly used in practice (Böhme et al. 2005: 186ff).

Discussions regarding a standardization of methods are ongoing. However, no results are expected in the medium term. Nevertheless, institutions such as the Federal Association of Compensation Agencies (BFAD) are working on (at least) a number of common quality standards (see BFAD 2007).

## 6 References

ADAM, K.; NOHL, W.; Valentin, W. (1986): Bewertungsgrundlagen für Kompensationsmaßnahmen bei Eingriffen in die Landschaft. Düsseldorf: Minister für Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen. 399 S.

Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen (2003): Bauen im Einklang mit Natur und Landschaft. Ein Leitfaden (Ergänzte Fassung). Arbeitsgruppe „Eingriffsregelung in der Bauleitplanung“ beim Staatsministerium für Landesentwicklung und Umweltfragen. - München. Page 28. http://www.stmug.bayern.de/umwelt/naturschutz/doc/leitf_oe.pdf. Pageview: 10.03.2010.

BAYSTMLU. Page 13. http://www.stmug.bayern.de/umwelt/naturschutz/doc/leitf_oe.pdf. Pageview: 10.03.2010.

Bearbeitung der naturschutzrechtlichen Eingriffsregelung und Berechnung des Ausgleichs. Minimal Garching. Page 6. http://www.garching.de/iwadis/tmpFormulare/iwd46FA.pdf. Pageview: 10.03.2010.

BFAD (2007): Qualitätsstandards für Flächenpools. Pageview: 16.03.2010. http://www.verband-flaechenagenturen.de/Downloads/BFAD_Qualitaetsstandards_Flaechenpools.pdf

Böhme et al. (Böhme, C.; Bruns, E.; Bunzel, A.; Herberg, A.; Köppel, J.) (2005): Flächen- und Maßnahmenpools in Deutschland. Naturschutz und Biologische Vielfalt 6. Bonn - Bad Godesberg.

Bosch und Partner (1993): Faktische Grundlagen für die Ausgleichsabgabenregelung (Wiederherstellungskosten). Umweltforschungsplan 1992, F+E Vorhaben 10801151, Forschungsendbericht i.A. des BfN, Bonn-Bad Godesberg.

BRUNS, E. (2007): Bewertungs- und Bilanzierungsmethoden in der Eingriffsregelung. Analyse und Systematisierung von Vorgehensweisen des Bundes und der Länder. Dissertation. Pageview: 15.03.2010. http://opus.kobv.de/tuberlin/volltexte/2007/1565

BRUNS et al. (Bruns, E.; Herberg, A.; Köppel, J.) (2001a): Typisierung und kritische Würdigung von Flächenpools und Ökokonten. - UVP-report, H. 1/2001, S. 9-14. oder

BRUNS et al. (Bruns, E.; Köppel, J.; Peters, W.) (2001b): Verfahrensvorschlag für die Bewertung und Bilanzierung von Eingriffen in Natur und Landschaft in Sachsen. Teil I: Verfahrensvorschlag; Teil II: Erläuterungen zum Verfahrensvorschlag. Im Auftrag des Sächsischen Landesamtes für Umwelt und Geologie (LfUG). Unveröff. Mskr.

BUNDESAMT FÜR NATURSCHUTZ (ed.) (2007): Bestimmung des Verhältnisses von Eingriffsregelung, FFH-VP, UVP und SUP im Vorhabensbereich. Endbericht des gleichnamigen Forschungs- und Entwicklungsvorhabens. Available at: http://www.bfn.de/fileadmin/MDB/documents/service/skript216.pdf. Download: 23.05.2008.

Jessel, B.; Tobias, K. (2002): Ökologisch orientierte Planung. Verlag Eugen Ulmer, Stuttgart.

Köppel et al. (Köppel, Johann, Peters, Wolfgang, Wende, Wolfgang) (2004): Eingriffsregelung - Umweltverträglichkeitsprüfung- FFH-Verträglichkeitsprüfung. UTB 2512, Stuttgart.

Köppel et al. (Köppel, J.; Feickert, U.; Spandau, L.; Straßer, H.) (1998): Die Praxis der Eingriffsregelung. Schadenersatz an Natur und Landschaft? Stuttgart. S. 218

Köppel, J. & Deiwick, B. (2004): Verfahren zur Bewertung und Bilanzierung von Eingriffen im Land Berlin. Im Auftrag der Senatsverwaltung für Stadtentwicklung des Landes Berlin. S. 102ff

Köppel, J.; Müller-Pfannenstiehl, K. (1996): Perspektiven des Herstellungskostenansatzes. Ein vielseitig verwendbarer Baustein der Eingriffsregelung? Naturschutz und Landschaftsplanung 28 (11).

Peters, W.; Ranneberg, T. (1993): Umweltwirksamkeit von Ausgleichs- und Ersatzmaßnahmen nach § 8 Bundesnaturschutzgesetz: Defizite und ergänzender Regelungsbedarf anhand exemplarischer Nachuntersuchungen. Berichte. Umweltbundesamt 7, Berlin.

Sächsisches Ministerium für Umwelt und Landwirtschaft (2003): Fallbeispiel zur Handlungsempfehlung. Pages 6-7. http://www.smul.sachsen.de/umwelt/download/natur/fallbsp.pdf. Pageview: 11.03.2010.

SPANG, W.; REITER, S. (2005): Ökokonten und Kompensationsflächenpools in der Bauleitplanung und der Fachplanung. Anforderungen, Erfahrungen, Handlungsempfehlungen, Bamberg.

Thüringer Ministerium für Landwirtschaft, Naturschutz und Umwelt (2005): Die Eingriffsregelung in Thüringen. Bilanzierungsmodell. Pages 9-12. Pageview: 10.03.2010. http://www.thueringen.de/imperia/md/content/tmlnu/themen/naturschutz/bilanzierungsmodell.pdf.

## 7 Annexes

Table 7: Category attributes of compensation assessment and balancing (Bruns 2007: 221)

| TASK | CATEGORIES/TYPES |
|---|---|
| Compensation assessment | Planning-argumentative |
| | formal-qualifying, enhanced by planning-argumentative deduction |
| | formal-quantifying |
| Equivalence for the assessment of the compensation amount | Area-values-equivalent |
| | Area-equivalent |
| | Cost-Equivalence (restoration) |
| | Factual-functional equivalence |
| Balancing | Mainly numeric (area-equivalents, area-values-equivalents) |
| | Numeric with textual explanation (coefficients) |
| | numeric, with planning-argumentative explanation or addition (coefficients) |
| | Mostly planning-argumentative comparison and allowability justification of compensation performance |

Table 8: Category attributes of compensation assessment and balancing (Bruns 2007: 221f)

| EQUIVALENCE APPROACHES FOR OPERATIONALISATION OF IMPACT LENGTH AND SEVERITY | |
|---|---|
| Area-values-equivalent | Value and amount of impaired protected goods, functions or biotopes determine compensation |
| | abstract from object level by comparison on the base of value categories and area sizes |
| | numeric compensation assessment (e.g. coefficients) |
| | e.g. biotope value or enhanced biotope value based methods |
| Area-values-equivalence approaches | pure area balancing without considering any protected goods or just in a minor value (e.g. compensation area coefficients) |
| Object – or function related equivalence approaches | equivalence explained objectively or deducted argumentative |
| | mostly connected with an enhanced model of the ecological balance of the area and an argumentative compensation assessment |
| EQUIVALENCE APPROACH TO OPERATIONALIZE THE REAL COSTS OF MEASURES | |
| Cost equivalence approach | deduct the equivalent, determining the compensation assessment, from the costs-of-restoration |
| | e.g. costs-of-restoration approach |

Table 9: Category attributes of tasks of the impact mitigation regulation (Bruns 2007: 187)

| TASK | OPERATIONALISATION TYPE |
|---|---|
| Mapping of performance and functionality/situation determination | Protected good model |
| | Function model |
| | Protected-good-function-concept (comprehensive or selective) |
| | Protected-good-function-groups-concept |
| | Biotope type model |
| | Enhanced biotope type-based concept (modular) |
| Impact assessment/impact models | Causal impact analysis (factual functional) |
| | Ecological risk analysis (spatial interference) |
| | State comparison (before-after-comparison on factual level) |
| | Value equivalence (before-after-comparison on value level by equivalents) |
| Assessment frame:<br>- Level of measurement | Nominal and ordinal /verbal; mostly descriptive value judgements |
| | Ordinal/mostly verbal value judgements |
| | Ordinal; quasi-cardinal/numeric value judgements |
| Assessment frame:<br>- Aggregation form | Logic argumentative |
| | Formal logic |
| | Arithmetical logic |
| | Arithmetical with argumentative enhancement |
| | Mostly argumentative |

**assessment before the intrusion**

| criteria of value / biotope type / area size in ha | | oak mixed forest | crop fields |
|---|---|---|---|
| | | 18 | 30 |
| assessment rate 50 % | rarety of community of plants | 7 | 2 |
| | rarety of plant and animal species | 7 | 2 |
| | diversity of biotope tpes in natural space | 8 | 2 |
| | diversity of layer structure | 8 | 2 |
| | biodiversity | 7 | 2 |
| | degree of biotope naturalness | 7 | 2 |
| | degree of biotope integrity | 7 | 1 |
| | representation of the biotope in natural space | 9 | 2 |
| | relevance in biotope compound system | 9 | 2 |
| | area size, length (minimum area, buffer zone) | 8 | 1 |
| | average | 8 | 2 |
| | **trend of biotope types** | | |
| 50% | degree of danger | 7 | 2 |
| | degree of compensability | 9 | 1 |
| | average | 8 | 2 |
| | overall average | 8 | 2 |
| | disqualification of the intrusion | | |

**intrusion assessment and compensation accounting**

| impaired areas / impaired biotope types | impairment coefficient | oak mixed forest ha1 | oak mixed forest ha2 | crop fields ha1 | crop fields ha2 |
|---|---|---|---|---|---|
| structure and building belt | 1,0 | 3 | 3 | 3 | 3 |
| zone I: 0 - 10m | 0,80 | 2 | 1,6 | 2 | 1,6 |
| zoneII: 10 - 25m | 0,45 | 3 | 1,35 | 3 | 1,35 |
| zone III: 25 - 50m | 0,25 | 5 | 1,25 | 5 | 1,25 |
| zone IV: 50 - 100m | 0,10 | 10 | 1 | 10 | 1 |
| zone V: 100 - 150m | 0,07 | 10 | 0,7 | 10 | 0,7 |
| zone VI: 150 - 200m | 0,05 | 10 | 0,5 | 10 | 0,5 |
| zone VII: > 200m | <0,05 | insignificant from intrusion impact | | | |

| | oak mixed forest | crop fields |
|---|---|---|
| area compensation for impaired biotope types | 9,4 | 9,4 |
| in present value level | 8 | 2 |
| conversion of area size to value level 5 | | |
| value level change to | 5 | 5 |
| result area compensation | 15,04 | 3,76 |
| **overall area compensation after biotope value level 5** | 18,8 ha | |

example for a freeway constuction by Adam, Nohl, Valentin (1986): Bewertungsgrundlagen für Kompensationsmaßnahmen bei Eingriffen in die Landschaft. S.302.

Fig. 8: Impact-Offset balance sheet (Adam, Nohl, Valentin 1986)