

Trade-off management: a tool to create universal value in landscape development

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Abstract

Managing multiple interests in landscape and land use management is an element critical to sustainable economic and social development. Structuring and visualizing conflicting interests in a such a way as to drive the constructive engagement of multiple stakeholders is, however, a difficult task. With the aim of addressing this challenge, an initial concept on how to benchmark different landscape management models based on their ability to minimize trade-offs was presented in 2020 at the Swiss Landscape Congress, using the UNESCO Biosphere Entlebuch (UBE) as case example. During 2021–2022 the author further developed the methodology and framework to assess trade-offs, updating and complementing the UBE characterization with new data and insights. This paper describes the results and conclusions of this deep dive work.

The UBE exercise indicated that since its creation there has been a simultaneous improvement of various social, economic and environmental aspects at the biosphere region, with a visible minimization of trade-offs and a fair distribution of the value created. It remains open how many of these positive developments can exclusively be attributed to the UBE model. Comparisons with similar areas are therefore key to allowing a better interpretation of mechanisms and achievements and this paper is an invitation to other parks to participate in a similar exercise.

Profile

Protected area

UNESCO Biosphere

Entlebuch

Mountain range

Alpes, Switzerland

Introduction

Involving aspects of physical and human perception, the *landscape* represents an essential component of people's surroundings (cf. European Landscape Convention 2000). At the same time, landscapes are a result of deliberate choices made by multiple individual actors who often act in a unilateral and siloed way. As the conservation and regeneration of natural resources come increasingly into focus, coordination among multiple stakeholder groups becomes essential and increasing attention is dedicated better to understand and address the various, often conflicting interests that are involved in land use management (Bradford & D'Amato 2012; Sylla et al. 2020; Vogel et al. 2024).

The central challenge therefore lies in managing and mitigating these conflicts in order to guarantee distributed value creation. Yet, bringing important trade-offs to the surface in such a concrete way and at an adequate level of granularity so as to drive constructive dialogue among decision makers is not straightforward, especially considering the complex data environment.

The methodological approach proposed here intends to tackle this challenge by means of a structured and practice-oriented framework that facilitates the identification and characterization of conflicting interests and associated trade-offs. The ultimate goal is to equip decision makers with tools to decide consciously

on the best combination of actions and interventions to create shared value.

The award-winning UNESCO Biosphere Entlebuch (UBE) has been used as a case study to test the concept and applicability of the proposed methodology.

The methodology and framework proposed to assess trade-offs

In 2020 an embryonic idea of how to assess different landscape management approaches based on their ability to minimize trade-offs was presented as a joint research effort at the Swiss Landscape Congress (Affonso et al. 2020). It had been built on the hypothesis that the better the trade-offs are managed, the more successful the drive for resilient regional development will prove and the more egalitarian the value created among different segments of business and society. Building on this preliminary work, the author has further elaborated the methodology and enhanced the trade-off analysis with a monetary quantification. The UBE case, pre-populated in 2020, has been complemented with new indicators, updated information and new insights from local research, in close coordination and exchange with Florian Knaus and UBE stakeholders.

The proposed, so denominated *trade-off framework* offers a fit-for-purpose tool that connects the main transformational levers that constitute a landscape model with the actual impact observed in the field, and

1	2	3	4
Mapping the key components of a landscape unit	Assessing impact	Characterizing the trade-off pairs	Critical analysis and interpretation
• Strategic pillars • Development pathways • Trade-off pairs	• Systemic changes • Front-end impact	• Trade-off intensity • Benefit distribution based on monetary value	• Minimizing trade-offs • Creating shared value

Figure 1 – Trade-off framework.

it is applicable to landscape units with discrete physical boundaries and an established development plan (e.g. a natural reserve, a tourism region, an energy park, etc.). The framework is composed of four main steps, see also Figure 1:

1) Mapping the key components of a landscape unit and identifying trade-offs, by describing the essence and the key pathways for transformation embedded in the design or in the development plan of a given landscape unit. By complementing this assessment with interviews with key local stakeholders, the main conflicting interests are identified and a set of key trade-off pairs is identified.

2) Assessing the impact of implementation based on measurable indicators, by identifying and creating a historical series of representative indicators that are directly measured. The impact is represented as the percentage variation of each indicator compared to a baseline, ideally covering the timeframe between the present state and the start of the project's implementation. The indicators are analysed from two perspectives:

Systemic changes of socio-economic fundamentals, equivalent to *leading indicators* clustered into: i) access to basic services (e.g. education, health care, housing, mobility and connectivity; ii) sectorial productivity (e.g. manpower-, land- and animal productivity; practice intensification); iii) business-supportive environment (e.g. business-related infrastructure, job creation, sectoral investments, public / private interaction, regulations).

Front-end impact, equivalent to *lagging indicators* and clustered into: i) natural resources and biodiversity; ii) human well-being; iii) local economy; iv) local attractiveness; v) culture and identity.

3) Characterizing the trade-off pairs, composed of two complementary analyses:

Trade-off Intensity: calculated based on measurable indicators and by trade-off pair, it is defined as the distance to the line of benefit equivalence (Bradford 2012). The main objective is to identify areas of attrition.

Benefit distribution based on monetary value: assessed by stakeholder group, it reflects the perceived benefit or harm from the perspective of each stakeholder category, associating the temporal change of

key indicators with a monetary gain or loss over the same period. The main objective is to identify if the value generated has been fairly distributed among the multiple stakeholder groups and / or economic sectors.

4) Critical analysis and interpretation, based on the effectiveness in minimizing trade-offs and in creating shared value.

Results: The UNESCO Biosphere Entlebuch (UBE) case example

Mapping the key components of a landscape unit and identifying trade-offs

UBE characterization and key trade-offs

The UBE encompasses an area of 395 km² at the valley of the *Kleinen Emmen* river between Bern and Lucerne, in Switzerland's alpine region (Figure 2). It includes 7 communes and 17,000 inhabitants, with ag-

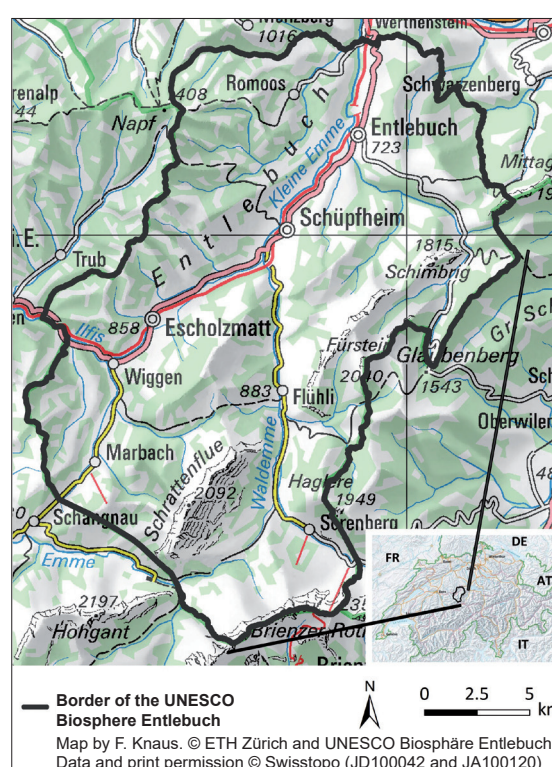


Figure 2 – UBE geographic situation. Data source: UBE and Swisstopo.

Headlines of economic model	Key systemic changes (transformational levers)	Categories of front-end impact	Trade-off pairs
• Premium products • Regional value chain • High value tourism • Differentiation through multi branding and certification of origin	• Improvement of public transport: network and schedule • Tourism infrastructure • Higher Education, support to local research • Higher productivity in livestock keeping • Change of animal portfolio in livestock • Professional and coordinated marketing	• Natural resources and biodiversity – Waste management – Air quality – Soil & water quality – Natural habitats – Fauna and flora biodiversity – Land use and landscape preservation • Human well being – Economic sustainability – Literacy • Attractiveness – For people – For business • Local economy – Tourism & services – Agribusiness – General	• Agribusiness vs Conservation • Tourism vs Conservation • Rural vs Urban development • Functionality vs Heritage

Figure 3 – Overview of the key components of the UBE model.

riculture (mainly livestock) and tourism being the two main pillars of the local economy. The region obtained the designation as a UNESCO Biosphere Reserve in 2001 as a response to national top-down peatland conservation activities in the late 1990s during which large parts of the region were set under conservation. Since then, it has tried to integrate conservation and regional development in a participative and integrative fashion.

The overarching UBE concept consists in leveraging its natural and cultural landscape as an instrument for sustainable regional development, following the premise of *protecting by using*. It approaches conservation with a broad scope, covering natural, as well as semi-natural and culturally influenced landscapes, explicitly targeting the equilibrium between environmental, social and economic aspects, with particular attention to the needs of the local population. It is backed by 3 leading strategic pillars: Conservation; Economic Development; and Education and Research (REP UBE 2012).

This comprehensive *sustainability* principle is underpinned by key development pathways adapted to the local conditions and covering all sectors of the economy (UNESCO Biosphäre Entlebuch 2017), i.e.:

- strengthening the regional production chain, building on circular resource management and elevating local products to a premium segment combining tradition + quality + provenance;
- boosting traditional, family-driven agricultural businesses through product improvement and the creation of side activities that generate additional sources of income;
- leveraging the natural landscape to amplify the value created by leisure and tourism, promoting tourism close to nature, with special attention to stimulating long-term visitors;

- extracting value from a region-specific, multi-brand strategy reinforcing sustainability and certification of origin;
- leveraging research and education to multiply local professional opportunities and increase sense of ownership of local population.

These go hand-in-hand with a thought-through mobility concept based on effective road and public transport infrastructure to facilitate access from – and to – regional centres, as well as on slow and low noise mobility solutions within UBE boundaries, prioritizing alternative power systems derived from local renewable energy sources (UNESCO Biosphäre Entlebuch 2012).

Based on a critical analysis of the UBE model and on interviews with people that were part of the implementation process, four main trade-off pairs have been defined: 1) agribusiness vs conservation; 2) tourism vs conservation; 3) rural vs urban development; 4) functionality vs heritage.

Assessing the impact of implementation based on measurable indicators

An extensive series of indicators directly or indirectly associated with the UBE strategic pillars and pathways have been assessed, covering the period between 2006 and 2019 (for which most of the recurring statistics and non-recurring survey data are simultaneously available) and merging relevant data from various sectors and on various topics. Statistics associated with demographics and business have been gathered in the federal and cantonal websites for statistics, in which UBE is described as an individual analytical unit. These have been complemented by UBE research and biodiversity studies, local opinion surveys and inter-

Category	Subcategory	Indicators and metric	-50	0	50	150%
Natural resources and biodiversity	Waste management/reduction	Waste subject to recycling (as % total waste) Household waste per inhabitant (kg/yr)				
	Air quality	NH ₃ gas in the air (m ³) Daily cars to/from main commune Schüpfheim (#)				
	Soil & water quality	Rate of fertilized area (% of agricultural area) Nitrate in water (mg/m ³)				
	Natural habitats	Forest reserves area and wooded land (hectares) BFF area, ecological protected (hectares)				
	Fauna & flora biodiversity	Birds' indicator species (#) Butterflies' indicator species (#)				
	Land use & landscape preservation	Urban area and Agricultural area (hectares) Individual and high-stem trees (#)				
Human well-being	Economic sustainability	Employment rate (% population in working age) Taxable income of individuals (SFr) and evolution vs canton's average (% pts)				
	Literacy	Rate professional education (% population) & evolution vs canton's average (% pts)				
Attractiveness	For people	Local population 15–24 yrs age (# people) Net population increase due to migration (#): average 5 yrs & change in the period Commuters living at UBE and working elsewhere (#)				
	For business	New companies established (#)				
Local economy	Tourism & services	Number of summer tourists (#) and Overnight stays (#) Number of hospitality businesses (#) Employment of sector 3 (# people)				
	Agribusiness	Employment of sector 1: Total & in agriculture (# people) Agriculture businesses (#) Revenues of premium agricultural products (SFr) Payments associated to BFF (ecological protected) area (SFr)				
	General	Taxable income of companies (SFr)				

Figure 4 – Summary of UBE front-end impact indicators. Bars represent the relative magnitude of variance in %, calculated as the average change of individual indicators in the period, predominantly 2005–2018. Natural habitats: indicative range above 100%, driven by very strong increase of forest reserve area, partially distorting the average value. Data source: Federal (BFS Bern) and Cantonal (LUSTAT Luzern) Office for Statistics; Knaus 2012, 2013, 2017; Hugi 2015; von Lindern et al. 2019; von Lindern 2020; Wiesli et al. 2020; Seidler et al. 2020. SFr = Swiss Francs, BFF = biodiversity promotion areas

views with local business stakeholders (Knaus 2012, 2013, 2017; Hugi 2015; von Lindern et al. 2019; von Lindern 2020; Wiesli et al. 2020; Seidler et al. 2020).

a) Systemic change of socio-economic fundamentals: The indicators of systemic change focused on the key aspects of transformation described in the UBE plan, i.e. mobility and physical connectivity; operational productivity and practice intensification in agriculture; business-supportive investments in basic and tourism infrastructure; the creation of new jobs; the production of scientific and academic work.

The analysis indicated that, consistent with the UBE plan, there was a significant improvement in agricultural-related productivity (animal husbandry) and a visible expansion of the transport infrastructure, supported by a continued flow of investments and a multiplication of local research activity.

b) Front-end impact: The indicators of front-end impact have been selected to best reflect the impact of the UBE strategic pillars and associated initiatives (e.g. multi-brand strategy, intensified summer tourism, premium products) and have been clustered into the following categories i) natural resources and biodiversity; ii) human well-being; iii) local economy; iv) local attractiveness. The analysis indicated that there

was a predominant positive impact in almost all the parameters and categories analysed. Figure 4 shows a consolidated view of the front-end indicators as an illustrative example of the assessment; more details can be consulted upon request.

Characterizing the trade-off pairs

a) Trade-off intensity was calculated based on measurable indicators that most directly influence or compete with each other within a trade-off pair, as follows:

1. *agribusiness vs conservation*: indicators related to the land use of forests and agriculture; to the intensity of agricultural operations (e.g. fertilization; animal intensity) and their potential impact in nature (e.g. pollution in water and air; biodiversity); to the revenues of premium products; and to the intensity of subsidies relating to sustainable agricultural practices;
2. *tourism vs conservation*: the focus was on the intensity of summer tourism businesses, tourist-related traffic and waste vs changes in the shape and coverage of the protected area and related species;
3. *urban vs rural development*: the focus was on land use, the number of businesses and the employment rates associated with each category.

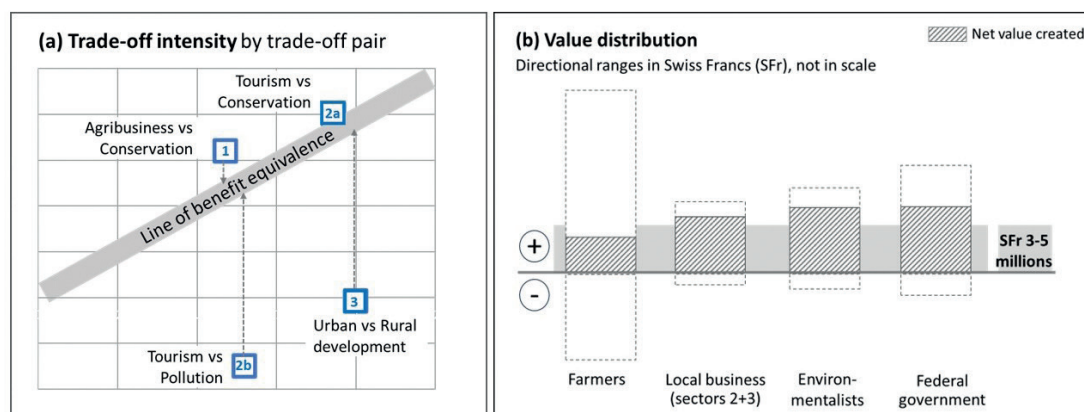


Figure 5 – Summary of the UBE trade-off analysis: (a) Trade-off intensity. Methodology based on Bradford 2012; (b) Monetary value distribution by stakeholder group. Comparative analysis based on directional ranges. Data source: see Figure 4. SFr= Swiss Francs

The trade-off *functionality vs heritage* has not been analysed due to the lack of representative indicators. Instead, the impact of tourism on pollution was deep-dived as a supplementary analysis of the *tourism vs conservation* trade-off.

The analysis indicated a low trade-off intensity (low attrition) between conservation, agriculture and tourism (Figure 5, trade-offs 1 and 2a), with the positive development of multiple aspects underlying both trade-off pairs, despite indications of worsening pollution associated with tourism (Figure 5, trade-off 2b). On the other hand, there are signs of an uneven development between the rural and urban environment, mainly concentrated in urban activity (Figure 5, trade-off 3).

b) Benefit distribution based on monetary value: At the UBE, four main stakeholder groups have been selected for value concentration analysis, for which an individualized rationale for the monetary calculation has been established as follows:

- *farmers* (sector 1): net revenues resulting from the positive impact of the premium price of UBE-branded products and higher operational productivity, and the negative impact of the closure of operations, loss of agricultural land and livestock losses on account of wild animals;
- *local business holders* (sectors 2 & 3): net balance of the positive impact of higher tourism and services revenues due to *green tourism* as well as the sustainable exploration of areas of conservation, and annual commune contributions to UBE maintenance;
- *environmentalists*: equivalent economic value of the net CO₂eq storage and emissions balance derived from the positive effect of less agricultural land, increased tree density and the shift to smaller animal portfolios, and the negative impact of increased tourism-related traffic and waste;
- *federal government*: net revenues resulting from the positive impact of higher taxable income and a lower social cost burden due to positive economic development, as well as lower risks of natural dis-

asters, and the negative impact of the subsidy payments associated to biodiversity promotion areas (BFF) and the annual federal contribution to UBE maintenance.

The analysis indicated that value of the order of magnitude of at least mid-single digit millions of Swiss Francs has been simultaneously created for each of the stakeholder categories over the considered time frame, with no major disproportionate concentrations of benefits or burdens.

Critical analysis and interpretation – UBE case study interpretation and concluding remarks

In the 1990s the region of Entlebuch was characterized by a disadvantaged position when compared with other Swiss regions in terms of economic power and attractiveness. A significant gap was perceived in the provision of basic infrastructure and retaining the young population was seen as a major challenge (Wicki & Kaufmann 2003). The analysis indicates that during the last 10 to 15 years there has been a simultaneous improvement of multiple social, economic and environmental aspects, paired with a relative improvement compared to the canton's averages, reflecting a successful implementation of the transformational drivers embedded in the UBE model. UBE has put forward a successful regional development concept, whereby competing sectors support and complement each other, and universal value has been created and fairly distributed across the various economic sectors. Critical trade-offs were minimized or eliminated, most visibly between agriculture and conservation. The monetary evaluation of trade-offs indicates that significant and equitable value has been created in all economic sectors, despite the reduction of the regional agribusiness footprint. The drop in livestock area and operations has been compensated by productivity increases and by the shift towards premium products and smaller animals. Conservation has been transformed into a key universal value creator, foster-

ing high value segments of business and customers inside the different sectors, serving therefore as a key driver for a more egalitarian value distribution across segments. In addition, the Biosphere has fostered the unification of the region, operating today synergistically as a tourism cluster, nature conservation agency and regional production chain, as well as acting as a pool of attraction, innovation and labour for the young population.

It is recognized that many aspects analysed here are not exclusively and casually related to the UBE model but also influenced by national and cantonal regulations. It is likewise acknowledged that trade-offs between sectors have been partially mitigated by federal intervention.

It is nevertheless considered that UBE was able to amplify the benefits of national sectorial policies, this success being attributed to a mix of thought-through concepts linking business and nature, and a superior governance archetype effectively engaging with various actors and constructively tackling major conflicts in a pro-active manner.

The UBE case study endorses the underlying belief that the success of a landscape model is directly associated with the ability to reduce trade-offs. It also indicates that managing the landscape through trade-off mitigation implies that a central coordination is required to engage with all stakeholders and siloes, aiming to steer/align their approaches and activities towards a common goal. Benchmarking with other protected regions and parks will be required to elaborate this thesis better and gain more insights in the functioning of parks and other socio-economic contexts.

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