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Innovation Report

Ecosystem Services in Policy Impact Assessment

SEVENTH FRAMEWORK PROGRAMME

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EC Project Officer: Georges Deschamps

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EDITORIAL

Dear Reader,

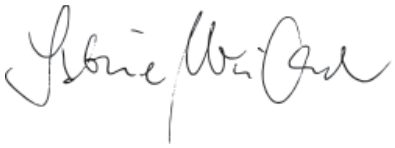
This is the 4th issue of the LIAISE ('Linking Impact Assessment Instruments to Sustainability Expertise') Innovation Report. The aim of this series is to shed light on the science-policy interface and the interaction going on at that interface when it comes to policy Impact Assessment and the use of scientific knowledge in policy making. This issue of the Innovation Report deals with the concept of ecosystem services as it was developed in the Millennium Ecosystem Assessment. The fundamental step forward for ecosystem and biodiversity maintenance can be seen in the link the concept makes between ecosystems and human well-being. This is an asset – the authors argue – that makes it relevant for the science-policy interface. It allows the translation of the scientific concept into the rationale of policy making, and of scientific knowledge such that it is relevant and useful for decision making. Hence, it can serve as a means of mainstreaming conservation of natural resources in policy making.

The authors analyse where exactly in the policy process ecosystem services can be taken into account. The focus lies on the procedures of policy impact assessment as they are institutionalized, for example, in the European Union. Here an integrated approach is followed that strives to account for policy impacts in the economic, environmental and social spheres in a balanced way. Ecosystem considerations can in principle be taken into account for two groups of policy cases: firstly, for environmental policies that explicitly aim at the preservation and/or improvement of ecosystems services; and secondly, for policies that serve other purposes but may implicitly affect ecosystem services, be it intended or unintended.

The authors come to the conclusion that the application of the ecosystem services concept to the process of policy impact assessment could be seen as a step forward in the effort to account for ecosystem based goods and services. The concept of ecosystem services is generally understood to refer to the environmental pillar of sustainable development. At the same time, through the relation to human well-being, the concept allows for a conceptual linkage to the other two pillars and, hence, allows for the mainstreaming of the ecosystem services concept in the process of policy development.

The second part of the Innovation Report contains a number of short reviews of interesting recent publications, among others dealing with principles and methodologies of sustainability assessment, topics of data access and uncertainty in policy making, and the nexus of transparency and perceived legitimacy of political decisions.

We wish you an interesting read!
Yours,



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RESEARCH ARTICLE

Integrating the concept of ecosystem services in European policy impact assessment

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Introduction

The concept of ecosystem services was developed to display the value of nature's ecosystems for human societies. Coined by ecologists, the focus of scientific investigation was on natural functionality and changes therein. Costanza et al. (1997) then undertook an attempt to calculate in monetary terms the value of the world's ecosystems. In their effort to link nature's performance in systems under human influence to economic thinking they started making the concept of ecosystem services operational for economic and policy sectors (MA, 2005a). This provoked criticism as well as fruitful discussion and triggered an interdisciplinary worldwide discourse on the value of the world's ecosystem to human wellbeing (Ring et al., 2010). To date, the Millennium Ecosystem Assessment (MA) is probably the most extensive international scientific study dealing with ecosystem services, their interaction with human well-being and changes to the world's ecosystems. Apart from state and trend analyses it also proposed response options (such as policies and regulations) to advance the future state of ecosystems and to promote their contribution to human well-being (MA, 2005b). Being recognised as a consistent, conceptual framework at global, regional and local scales the ecosystem service approach was an important step on the way to an analytical standard that would enable comparability and transferability of multi-scale assessments worldwide (EEA, 2006; MA, 2003). The approach has been used in numerous national and regional studies since. For example, in 2010 an ecosystem service management strategy for China was elaborated (CCICED, 2010). In Europe in 2011 the Joint Research Centre (JRC) of the European Commission provided a refined European Assessment of the provision of ecosystem services (Maes et al., 2011).

The analytical framework of the ecosystem service concept is based on the dynamic systems approach linking indirect drivers (e.g. economy, demography, technology, policy) and direct drivers (e.g. land management) to ecosystem changes, and linking ecosystem changes to ecosystem service changes. Consecutively, a link is made between ecosystem services and human well-being. The latter may lead to policy recommendations (MA, 2003). The fundamental step forward is seen in the relevancy of the concept at the science-policy interface, where it can fulfil two roles. It can translate the link between ecological processes and human wellbeing in a way that is understood by decision makers in other sectors than conservation, and it can communicate the relevant scientific knowledge such that it is relevant and useful for decision making (Carpenter et al., 2006; Schößer et al., 2010 ; Burkhard et al., 2012). This could meet the policy makers articulated

need for science based information that can be used for the assessment of the impacts of their decisions on human well-being (De Smedt, 2010). However, in practice the integration of ecosystem services in day-to-day policy making is still far from being achieved (Carpenter et al., 2009). We define 'integration into policy' as the consideration of ecosystem services into all sectors of policy making at all stages. This includes both policies aiming at the preservation and improvement of ecosystem services (e.g. natural resources conservation policies), and policies that do not explicitly address ecosystem services but where unintended impacts on ecosystem services may occur as a side effect. The latter may cover a very wide range of policies and sectors.

Key to the integration of ecosystem services into policy making is a framework that allows the transition of the analytical rationale of ecosystem services into the vindicatory rationale of policy assessment. This brings up two questions.
1) Where in the process of policy making can ecosystem services be taken into account?
2) What instrument can be employed to ensure that the impact on ecosystem services is accounted for?
For the example of European policy making this paper sets out to identify a conceptual framework by first analysing the policy making process at the European Commission level in regard to mainstreaming ecosystem services and then sketching out a solution for making integration feasible without disrupting established work processes in the jurisdiction.

European policy making – explicit and implicit cases for ecosystem services integration

The European Union in interaction with its member states practices a complex system of multilevel governance, in which the European policy system represents just one level.

Policy making at European level is generally devoted to overarching visionary goals laid down in comprehensive strategies such as the Sustainable Development Strategy (CEC, 2006) and the more recent Europe 2020 Strategy (CEC, 2010). The instrument of ex-ante impact assessment was institutionalised by the European Commission as an obligatory step in EU legislation with the aim of better regulation and making sustainable development operational. The requirement was towards the balanced consideration of development targets against the three pillars of sustainability (Hertin et al. 2009). The three-pillar-approach to sustainable development was based on the understanding that economic, social and environmental dimensions are equally crucial, interconnected, and urgent (CEC, 2006). Following this balanced approach, the instrument of ex-ante impact assessment implies the examination of potential social, economic and environmental impacts of all European Commission proposals, in order to provide a better evidence base for internal Commission decision making. The question

of whether or not the instrument of impact assessment is actually capable of promoting sustainable development depends on a number of factors and frame conditions that have been discussed elsewhere (Bäcklund, 2009; Nykvist and Nilsson, 2009). In this paper we focus on the question of how scientific evidence provided through the concept of ecosystem services can support the impact assessment.

The integrative process of undertaking an impact assessment in the paradigm of sustainable development required a frame to ensure basic comparability while being adaptable to all policy sectors. The Commission published a first guideline in 2005, and updated it once in 2006 and again in 2009 after a process of public consultation (CEC, 2009). The guidelines introduce a six step standardised basic procedure and describe the organisational structure of the process. In order to meet the claim of an integrated approach the guidelines also lead the user through a number of so called impact areas that in whole consider economic, environmental and social impacts in a balanced way.

The procedure is outlined in Fig. 1. Each policy proposal starts with a thorough identification and analysis of the policy problem (step 1). This is the basis for the justification of the policy intervention. The procedure continues with the definition of the policy objectives (step 2). Step 3 covers the development of a choice of alternative policy options for reaching these objectives (step 3). This involves a baseline scenario describing the development without policy intervention (inaction). The alternative policy options may include different levels of intervention (in budgetary terms), different levels of regulation (mandatory, incentive-based, awareness increasing), or different jurisdictional levels of implementation (European, national, regional). In step 4, the impacts of the policy options are to be analysed with respect to the three pillars of sustainable development. This includes intended and unintended impacts, short term and long term impacts, direct and indirect impacts. It is followed by the comparison of the policy options with regards to the analysed impacts and against the baseline scenario (step 5). The last step involves the outline of a set of recommendations for indicators, monitoring procedures and the evaluation of policy implementation (step 6). The latter finally provides for the transition from ex-ante to the ex-post assessment of the policy.

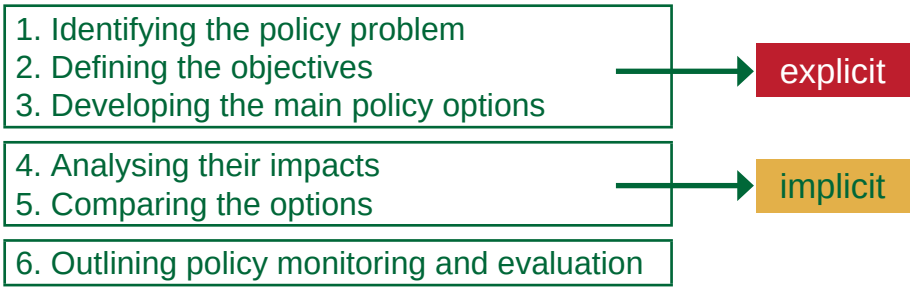

Fig. 1 The six steps of European impact assessment and entry points for explicit and implicit consideration of ecosystem services (adapted from IA Guidelines 2009).

Within the procedure of impact assessment, the concept of ecosystem services can be considered at two levels (fig. 1): the first level is in step 1 when it comes to environmental policies that explicitly aim at the preservation and/or improvement of ecosystems services thereby counteracting trends that are otherwise biased towards the economic and/or social pillar. The second level is in step 4 when it comes to policies that serve other purposes but may implicitly affect ecosystem services, be it intended or unintended.

To the first level of explicit policy measures we can count most environmental policies (e.g. biodiversity strategy, water framework directive, air emission regulations etc.) as well as accompanying measures to sector driven policies such as those to the Common Agricultural Policy (CAP) of the European Commission. The CAP budget still takes a considerable share of the entire EU budget, which makes CAP decisive for the agricultural, forestry and land use sectors in Europe. The foremost aim of CAP is to support farmers' income, maintain and improve economic competitiveness of the European farming system and produce high quality products (CEC, 2007). But the promotion of these social and economic dimensions of agriculture often came at the costs of environmental degradation. To counteract, the instrument of agri-environmental schemes was implemented within the CAP system. It remunerates farmers for environmental services that come alongside with agricultural production but that may inhibit optimisation of management towards economic return. This instrument of agri-envionmental schemes is one example of the system of Payments for Ecosystem Services (PES) which is increasingly gaining momentum in a number of policy areas in Europe and worldwide (Van Hecken & Bastiaensen, 2010; Engel et al., 2008; Zhen & Zhang, 2011). In its recent proposal for a CAP reform 2014-2020, the European Commission proposed to reinforce its measures towards the sustainable management of natural resources and climate action (CEC, 2011).

The second, implicit level of considering ecosystem services in policy making covers those policy cases where conservation or restoration of ecosystem services is neither a direct objective, nor may it be thought of in the policy design. But these are the cases of numerous policy areas (e.g. transport, energy, trade, construction, etc.), where policy decisions could actually have considerable effects on ecosystem services, particularly when they affect the spatial system of land use (Lambin and Meyfroidt, 2010). The effects come across as externalities in a positive or negative sense. They may appear only after a considerable time lag, they may be non-linear, and they may exhibit a spatial dimension in that their appearance may not be uniform across space. This makes anticipation difficult. The mainstreaming of ecosystem services at this level means that possible impacts of a wide range of policy options on ecosystem services are anticipated in the design of the policy and in the analysis of a choice of alternatives. At this level, the integration of ecosystem services is more complex than at the explicit level. Here is where science based evidence can best

be made use of in policy design. In the following we further analyse the formalised procedures of the impact assessment process to learn how the concept of ecosystem services could be integrated here. We propose a conceptual framework for linking the procedure of policy impact assessment to an analytical approach of ecosystem service assessment.

Framework for integrating ecosystem services into policy impact assessment

The above described formalised procedure of policy impact assessment is only as good as the analytics behind it. Impact assessment practitioners and policy desk officers being responsible for the impact assessment increasingly ask for science based evidence that may support this process (Thiel 2009). Numerous research projects emerged in Europe during the last five years that developed tools and methods in support of the policy impact assessment (Helming et al., 2011a; Van Ittersum et al., 2010; Jacob et al., 2008). De Smedt (2010) analysed the characteristics needed in scientific tools to be useful and acceptable in the policy making process. Following an approach of the US Environmental Protection Agency (US EPA, 2000) he used three criteria for the analysis: accuracy, relevancy, and legitimacy. While accuracy is inherent in scientific models it often comes at the cost of transparency. Scientific tools are often so complex that they appear as black boxes to decision makers rather than as transparent analytical tools. Political relevancy is often hindered by the fact that research-based tools are generic and not specific enough to be of direct use in a political decision process. Legitimacy can only be achieved if policy makers are involved at an early stage in the tool development and, vice versa, researchers are involved at an early stage in the policy making process (De Smedt 2010). The criteria are comparable to the three criteria credibility, saliency, legitimacy developed by Cash et al. (2003), and often taken for the analysis of policy relevancy of research.

Taking the criteria into consideration, approaches to scientifically support the existing impact assessment process may be categorised into two major groups: positivist approaches applying e.g. simulation modelling tools, and normative approaches. While the first are meant to support the impact assessment process through analytical evidence thereby focussing on the criterion of accuracy (credibility), the second bring stakeholder views and perceptions into the policy process thereby focussing on the criterion of legitimacy (Cutts et al., 2011). Both types of information are complementary and can support the impact assessment process at various steps. The most recent concepts also tried to synergise the two approaches, thereby revealing their complementarities, by mimicking the analytical steps of the modelling approaches with participatory research (Morris et al., 2011; Helming et al., 2011b).

To fulfil the criteria of credibility and relevancy (saliency) it is necessary to bring scientific evidence into a causal relation with policy action. We

found the Driver-Pressure-State-Impact-Response (DPSIR) framework (Gabrielsen and Bosch, 2003) to be a widely adopted method to structure causal chain relationships within impact assessments. It helps to assign the various components affecting human ecosystem interactions to single steps within the causal chain and was used widely in programmes and projects at the science policy interface (Tscherning et al., 2012).

We used the DPSIR system to link the analytical rationale behind the concept of ecosystem services with the analytical rationale of Impact Assessment (Fig. 2). The application of DPSIR forces the user to perceive a system according to Drivers (demographic trends, global economic trends) and Pressures (economic and strategic stresses). This is followed by analysing the State and the expected Impact according to all three sustainability dimensions (economy, society and environment). Then a valuation of the expected impacts is undertaken by reflecting the impact against the overall concept of society (as for example the strategy for sustainability). The anticipated policy impacts become visible for decision makers and can thus be compared and evaluated. The political Response goes hand in hand with the definition of indicators for monitoring and ex post evaluation.

By following this analytical string we come close to the linkage of the analytical approach to ecosystem services (MA, 2003) with the six steps of the impact assessment process (Fig. 2). Thereby, the first three steps address the driving forces. In the ecosystem service concept, no distinction is made between trend like drivers such as, e.g. demography, economy, technology, climate change and strategic drivers which could actually be the policy option. Step four of the impact assessment process may be related to pressures and states of DPSIR, where pressures relate to direct drivers, e.g. land use change in the case of bioenergy policies, and states relate to ecosystem and ecosystem service changes in the ecosystem service concept, respectively. The Impact side of DPSIR is reflected with step 5 of impact assessment (comparing the options), where normative value systems come into play that serve as leitbild against which policy options are compared. In the ecosystem service concept this normative side is reflected by the notion of human wellbeing. The Responses of DPSIR finally are covered by the monitoring and evaluation scheme analysing the performance of the policy intervention.

By linking the three frameworks (Fig. 2) we obtain a conceptual framework for mainstreaming ecosystem services into the policy making process. The following three basic questions can now be posed to link policy action with ecosystem services:
- What kind of ecosystem changes are to be expected as a consequence of policy intervention? (step 4 of impact assessment)
- What changes in the provision of ecosystem services would they induce? (step 4 of impact assessment)
- Would the expected changes matter in terms of human well-being? (step 5 of impact assessment)

Impact Assessment	DPSIR	Ecosystem Service Concept
1. Identifying Policy Problem	**DRIVERS**	**Indirect Drivers**: Demography, Economy, Technology…
2. Defining the Objectives		
3. Developing Policy Options		**Indirect Drivers**: Policy
4. Analysing Impacts	**PRESSURES**	**Direct Drivers**: Land Cover Change…
	STATES	Ecosystem Changes
		Ecosystem Services Changes
5. Comparing Options	**IMPACTS**	Human Wellbeing
6. Outlining Monitoring and Evaluation	**RESPONSES**	Policy Recommendations

Fig. 2 Linking the concept of ecosystem services (MA, 2003) with the impact assessment steps (CEC, 2009) via DPSIR (Gabrielsen and Bosch, 2003).

Following the European guidelines of impact assessment (CEC, 2009) the analysis of intended and unintended impacts (step 4) is undertaken by a screening of so-called impact areas. Impact areas are those thematic fields that are to be analysed when assessing the impacts of a policy option. The Impact Assessment Guidelines list a total of 11 economic, 11 social and 13 environmental impact areas. They have been compiled with the rationale to treat the three dimensions of sustainable development equally, and to cover all possible topics that could be of relevance in relation to the policy. The guidelines propose to use the list of impact areas as a check list for the assessment. However, not all of the impact areas and key questions may be relevant for a specific policy option. Vice versa, additional areas and questions may be identified that are relevant for a specific policy option.

To see how the notion of ecosystem services fits into this system we analysed how the ecosystem services are covered by the 13 environmental impact areas of the IA guidelines (CEC, 2009). We used the five MA categories of ecosystem services: supporting services, regulation services, provision services, cultural services, and biodiversity as intrinsic value (MA, 2003). The analysis of the relation between categories of both systems was performed with the help of background documents defining and characterising in detail the categories of both systems (MA, 2003; CEC, 2009). The results are displayed in table 1. Note that only direct relations between impact areas and ecosystem service categories are listed. In order to avoid double counting we omitted indirect relations such as between land use (impact area) and supporting services (ecosystem service category).

The cross comparison in table 1 shows that all five ecosystem service categories are covered by eight of the 13 impact areas.

Environmental Impact Areas EC Impact Assessment System (CEC, 2009)	Ecosystem Services Categories (MA, 2003)				
	Supporting	Regulating	Provisioning	Cultural	Biodiv. (Intrinsic Value)
	Nutrient reycling, soil formation, primary production	Climate, flood, disease and water regulation	Fresh water, food, timber, fiber&fuel, products & industry from biodiv	Spiritual enrichment, cognitive dev., reflection, recreation, aesthetic	Biodiv. (Intrinsic Value)
Soil quality or resources	X				
The climate		X			
The likelihood or scale of environmental risks		X			
Air quality		X			
Land use			X		
Renewable or nonrenewable resources			X		
Biodiversity, flora, fauna and landscapes			X		
Animal welfare				X	X
The environmental consequences of firms and consumers					
Waste production / generation / recycling					
Transport and the use of energy					
International environmental impacts					

Tab. 1 Ecosystem Service Categories (MA, 2003) versus Environmental Impact Areas of European Commission Impact Assessment Guidelines (CEC, 2009).

Two services, regulation services and provisioning services are each related to three impact areas, thereby covering all aspects of those services. Two services, supporting services and cultural services, are related to one impact area each, respectively. The supporting service category is related to the impact area (1) soil quality and resources, while issues of nutrient recycling and primary production are not covered. The cultural service category is related to the impact area (8) Biodiversity, flora, fauna and landscapes. The latter is a wide impact area that covers cultural, spiritual, aesthetic and cognitive aspects of landscape as well as the ecological aspects of biodiversity (CEC, 2009). Thereby, the ecosystem service category of biodiversity as an intrinsic

value is also covered by this impact area. Given the fact that both systems could present further issues and causal chain relationships, it can be concluded that the five categories of ecosystem services are well covered by those eight impact areas.

For the five remaining environmental impact areas of the European impact assessment system a direct linkage to the ecosystem services categories could not be drawn (Tab 1). These are (9) transport and the use of energy; (10) the environmental consequences for firms and consumers; (11) waste production/generation/recycling; (12) animal welfare; and (13) international environmental impacts. Among those, (12) animal welfare stands out. It deals with ethical considerations of the stewardship of animals and with health issues of human nutrition. Both topics are not directly covered in the concept of ecosystem services. The other four impact areas could be classified in a different systemic level than those eight impact areas that are directly linked to ecosystem service categories. They come across as pressures for ecosystem services rather than services themselves. The impact area of international environmental impacts (13) also addresses the fact that environmental impacts of policy interventions may occur in areas outside the geographical scope of the policy. A typical example is the biofuel policy in Europe, which was accused to cause indirect land use effects in other continents, particularly deforestation in Brazil (Di Lucia et al., 2011; Prins et al., 2011).

To conclude, from an ecosystem service perspective there are two groups of environmental impact areas in the EC guidelines for policy impact assessment (CEC, 2009). The first group is composed of the first eight impact areas of Tab. 1 all having a direct analogue to the ecosystem service concept. They could thus be substituted by the five ecosystem service categories. The second group covers the impact areas 9 to 13 which are all cross cutting to the others and, from a systemic point of view, may be regarded as pressures for ecosystem changes. A substitution of the subset of impact areas by ecosystem service categories would have numerous assets: (1) the reduction of the number of categories from 8 to 5, which makes the system more transparent and clear; (2) a linkage to state-of-the-art concepts of scientific assessments, which would improve the credibility of the policy assessment; (3) a logical transition to the fifth step of the impact assessment, which is the comparison of options (Fig. 1). This step entails a normative valuation of impacts with regards to strategic targets. The ecosystem service concept coins this strategic aspect with the category of human wellbeing. With this latter step we close the gap to the third of the above posed questions that read “do the changes matter?”.

Valuation in these circumstances enables policy makers to address trade-offs in a rational manner, correcting the bias typical of much decision making today, which tends to favour private wealth and physical capital above public wealth and natural capital (TEEB 2010). Whether valuation of the human benefits that ecosystem services provide is in

the context of policy making better undertaken in monetary terms or by applying a non-monetary system of appraisal shall not be discussed here, since both approaches would be applicable in the framework put to discussion. But we want to stress that since the concept of linking environmental impacts to human wellbeing is already inherent in the ecosystem service concept it can be directly related to the framework of impact assessment thereby ensuring the relevance of the scientific analysis.

Conclusions

We propose the application of the ecosystem services concept in the process of policy impact assessment as one further step in the effort to account for ecosystem based goods and services. Ecosystem services as described in the TEEB report (2010) constitute a large part of what is generally understood as the environmental pillar of sustainable development. At the same time, through the relation to human well-being, the concept allows for a conceptual linkage to the other two pillars (De Groot, 2010). In this sense, the mainstreaming of the ecosystem services concept in the process of policy development can be seen as an operationalisation of the otherwise vague concept of sustainable development. The benefit in our view is twofold: first, it can improve the credibility of the existing process of policy making, and second, it would help facilitate early cooperation in the design of policies already in the phase of theme setting and policy scoping. The sooner possible externalities are identified in the stages of policy design, the better options can be elaborated to help alleviate negative externalities and identify optimised solutions.

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IN BRIEF

Pintér, L., Hardi, P., Martinuzzi, A., Hall, J. (2012), Bellagio STAMP: Principles of sustainability assessment and measurement. Ecological Indicators 17: 20-28.

A number of indicator systems have been developed to measure progress towards sustainable development. In 1997, the Bellagio Principles were developed to provide guidance in this context and have become an often used point for reference. However, recent developments in science and technology, policy and civil society showed the need for revising and updating these principles to reflect the changing context of their application.

In this paper, the updated version of these principles, the STAMP (Sustainability Assessment and Measurement Principles), is introduced. It takes the Bellagio Principles as a starting point for developing an updated set of principles. The set was reduced to eight principles summarizing some of the already existing ones and adding some new points of emphasis. The principles include: Guiding Vision, Essential Considerations, Adequate Scope, Framework and Indicators, Transparency, Effective Communications, Broad Participation as well as Continuity and Capacity.

Promoting the STAMP can support the dissemination of principles of sustainability science in “conventional” research, strengthen interdisciplinary research and highlight the importance of the participation of societal experts in the research process. Moreover, the STAMP can contribute to improving the standardisation of impact assessments. Therefore, the authors identify three target groups for whom the application of the STAMP can be of particular use, namely for communities that conduct policy or project focused evaluations, those that concentrate on integrated assessment and reporting, and those that are concerned with developing alternative metric systems.
Overall, the paper concludes, the STAMP principles serve the needs of practitioners. Their applicability goes beyond monitoring systems and indicators but can also be of use in the review of assessment design options.

Singh, R.K., Murty, H.R., Gupta, S.K., Dikshit A.K. (2012), An overview of sustainability assessment methodologies. Ecological Indicators 15: 281-299.

Sustainability indicators are an important tool for policy makers to base their decisions on and to communicate them to the public. Their main achievement is the simplification and quantification of complex information. Furthermore, they allow for comparisons across countries and time. The authors stress the significance of sustainable development indicators and elaborate on the methodologies that have been used to develop them. They also provide guidelines for the construction of new

indicators, particularly emphasising the need for a clear definition of policy goals and for the latter's careful deconstruction into components and sub-components. A further section deals with the difficulties that might occur when trying to construct composite indicators for sustainability.

The main part of the article consists of a comprehensive listing of various sustainability indices with a short description of their respective purpose and formation. The indices are grouped under main headings, e.g. innovation, development, economy, eco-system, products, environment, and cities. The authors conclude with an appeal to construct sustainability indicators that comprise all of its three dimensions, namely environmental, economic, and social aspects. Furthermore, they underline the importance of carefully constructing efficient and robust indices so as to avoid misleading results. Ideally, they should be revised by an appropriate community of interest.

Beniston, M., Stoffel, M., Harding, R., Kernan, M., Ludwig, R., Moors, E., Samuels, P., Tockner, K. 2012, Obstacles to data access for research related to climate and water: Implications for science and EU policy-making. Environmental Science & Policy 17: 41-48.

This article provides an overview on the conclusions of a workshop on science and data gaps in EU-funded projects related to water resources and management. Various obstacles can be identified that limit the access to data in research on water management and use. The paper summarises the main reasons which are geographical sparseness of environmental information, the temporal sparseness of data, the limited access of researchers to numerical models and institutional barriers to data access.

The article continues to identify some implications for European and national policies and develops recommendations on how to improve the access to data and their flow. There is a need for a more comprehensive and integrated approach to water management and water use to be able to consider other socio-economic factors and the interaction of water policies with other policies at different levels. However, socio-economic and physical data sets are often incompatible because they are collected for different purposes. This is why future research should address the conversion of different formats, the development of compatible data sets as well as toolboxes.

Ultimately, a centralised data clearing house, where information generated by ongoing or recently completed EU projects is archived and accessible in a common data format, would be a major step forward towards removing obstacles to data availability and access. Also, the implementation of guidelines on good governance of data could be a possible framework for advice on data use, data standards and formats, and accessibility.

Maxim, L., van der Sluijs, J. P. (2011), Quality in environmental science for policy: Assessing uncertainty as a component of policy analysis. Environmental Science & Policy 14: 482-492

The paper gives an overview on the interdisciplinary field of uncertainty analysis and the different notions and classifications of uncertainty. The attempts to classify and define uncertainty are manifold. However, there are shortcomings in these classifications as most of them ignore qualitative aspects of uncertainty, like the properties and roles of scientific knowledge within social, political or economic contexts although these aspects are regarded to be decisive for making scientific knowledge socio-politically relevant. Hence, the practice of uncertainty analysis is currently incorrectly focused from the perspective of the science-policy interface.

Therefore, the authors propose a conceptual framework that includes substantive, procedural and contextual criteria for the quality of knowledge while also including the various classes of uncertainty identified in the literature.

The paper starts with literature reviews on the objectives of uncertainty analysis and the typologies of uncertainty in environmental science for policy, which have already been developed. The conclusion from these reviews is that there is neither a shared terminology in uncertainty analysis nor a full agreement on a typology of uncertainties. The paper identifies six objectives assigned to uncertainty analysis from the literature. However, there is currently a strong focus on the objective of identifying gaps in knowledge and improving the precision of scientific knowledge.

As the frameworks that can be found in the literature still lack procedural and contextual dimensions – which are seen as full components of knowledge quality, just like methodological or technical components – the paper suggests a framework including four axes: the dimension, the step in the knowledge lifecycle, and the nature and location of the research addressed. This framework could incorporate existing frameworks that various disciplines prefer while acknowledging the strong points of other typologies identified in the literature study. Hence, this framework could offer a structured opportunity to promote collaboration among researchers from the natural and social sciences.

Dramstad, W., Fjellstad, W. (2011), Landscapes: Bridging the gaps between science, policy and people. Landscape an Urban Planning 100: 330-332.

As landscape changes today occur with increased speed and extent, they are increasingly perceived as threats. Consequently, policy makers asked for more research concerning landscape change and its effects and, as a result, many tools were developed to link research

results with policy activities. However, the authors criticise that despite the efforts made by researchers and policy makers, most of the real world effects of landscape change do not reflect these efforts; many landscape changes continue unrelieved.

The article studies one exemplary case of this gap between scientific findings and policy reality, namely the loss of agricultural land worldwide, which is continuing despite existing scientific evidence demonstrating the importance and various functions of well-managed agricultural landscapes. This example can help understand the challenges to communication between researchers, policy makers and stakeholders. The studies demonstrate how the scientific appeal for landscape protection of agricultural land was commonly understood as a call to completely stop human activity and the use of new technologies. Also, this was seen as a threat to individual property rights of land owners. These interpretations brought forth conflicts with local people.

The authors emphasise that with a growing demand for sustainable development, the need to mediate and balance individual versus collective interests of society and future generations has become an increasingly important challenge for landscape change research and policy. They stress the need to communicate the consequences of landscape change in a sustainability perspective and show several approaches that try to meet that task. Finally, the article calls for more ideas and efforts to establish a lasting and comprehensible dialogue between science, policy and the implementing levels in the field of

De Fine Licht, J. (2011), Do We Really Want to Know? The Potentially Negative Effect of Transparency in Decision Making on Perceived Legitimacy. Scandinavian Political Studies 34(3): 183-201.

One of the greatest societal challenges arguably is decision making on the allocation of resources and the partition of burdens. The question of who gets what, when and how is usually a highly controversial issue. For this reason, a number of scholars and policy makers argue that increased transparency in the decision-making process would lead to a greater public acceptance of the policy choice. Transparency in this regard should reveal who is responsible and why the particular choice was considered a priority vis-à-vis alternative paths.

The author scrutinises this widespread assumption by questioning whether transparency in the decision-making process really increases the legitimacy of the policy choice. She does so by reporting the results of an explorative experimental test in which citizens were confronted with public health care decisions. Whereas one group was given no information at all on the process that led to the choice of a policy, six other groups were given full information with regard to the decision-making process (representation, direct participation, or expert decision-making) and its framing by the media (positive or negative).

Reactions of the groups that were given different kinds of information revealed that the form of decision-making, i.e. by politicians, professionals, or citizen participation, does not make a difference for the test persons. The respective framing in negative or positive terms, however, does influence their perception of the procedure's and decision's rightfulness. Positive framing by the media leads to a significantly higher perceived legitimacy as compared to negative framing.

Subsequently, the effect of transparency is being evaluated. Surprisingly, the study finds no indication for a higher acceptance of policy decisions when the underlying procedure and reasons are open to the public. On the contrary, it even finds a slightly negative effect of full information on decision-making. Even though the author does not want to overestimate the latter, she concludes that the experimental test clearly implies that transparency about priority-setting does not increase perceived legitimacy. In a final discussion, the author calls for further exploration of this puzzle and particularly stresses the need to identify other sources of perceived legitimacy that turn out to be more effective than (only) transparency.

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