Cost of Policy Inaction

Scoping study for DG Environment

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Executive Summary

In the context of the environment, the cost of policy inaction (COPI) is defined as the environmental damage occurring in the absence of additional policy or policy revision. Inaction not only refers to the absence of policies, but it also refers to the failure to correct misguided policies in other areas. The costs of policy inaction may be greater than just the environmental damage, if the same inaction also creates societal and economic problems. An 'extended' COPI could be designed to include these non-environmental damage aspects and so estimate the total societal (private and external) costs of inaction.

Depending on the possibilities, COPI can qualitatively identify damages ('loss of traditional coastal areas around the Baltic') or quantify them in their own units ('twenty thousand premature deaths per year') or express them in monetary terms ('2 per cent of the projected GDP by 2030'). The typical application of COPI addresses costs in the future – often related to a baseline or similar projection.

The main questions posed by DG Environment that led to this scoping study are:

In the light of related experiences,

- is assessment of COPI something that would make sense for DG ENV to undertake in the context of a communication strategy?
- in which areas can useful information be provided by carrying out COPI studies?

This scoping study portrays COPI as an instrument that can typically be used in the early phases in policy development, when the emphasis is on identifying problems, warning, communicating the need for policy action, and perhaps also sketching the urgency relative to other issues and indicating which sectors need to take action or revise their policies. It is not suitable for comparing and choosing between different policy options, or for judging on the efficiency of policies.

For these early phases, COPI seems to be a powerful tool. It amounts to a head-on statement of the problem and spells this out in economic language. COPI is concerned with more than just the monetary valuation of costs; it covers all costs, some monetized, some expressed quantitatively, and some qualitatively.

The COPI concept comes with two key challenges. Firstly, if we assume that the current interest in applying COPI to environmental issues at EU level is particularly about using the results as part of a communication strategy, then its key application cannot avoid large issues; these being characterized by divergent views across the globe and/or by little certainty about

the knowledge available, for example climate change. Secondly, it will be difficult for users of COPI to avoid confusing COPI with Cost-Benefit Analysis (CBA). This confusion in itself may lead to unproductive communication even with supporters. In addition, as CBA always has a narrower and more concrete focus than COPI, CBA tends to work with more specific data. A possible pitfall for application by DG ENV would be if the two methods were to be mixed and COPI studies restricted (even in large, as yet unstructured problems) to certain, undisputed data and to those aspects that can be monetized. The results may well be unimpressive and still vulnerable to criticism.

In contrast, a better option would be to distinguish between the various roles a COPI study could play in DG ENV's work with other parties, depending on the issue. A useful tool to map out these roles can be found in work of Hisschemöller and Hoppe on problem types. As a function of the level of consensus and the level of certainty of the knowledge available, they distinguish between the different roles science can play – for example as 'advocate' or 'problem solver'.

Deciding on a baseline entails the usual issues; it is an important factor in determining the results and always raises discussion. However, this is not specific to COPI and it has been done many times before.

Other pitfalls are listed in this study in section 3.3. They include aspects such as a Northern bias in the valuation studies, lack of data monitoring for some issues, and of course the discount rate. In all, we have identified about ten of these 'banana skins'. None seem to be insurmountable, but the length of the list suggests that there will always be plenty of arguments for those who want to be unconvinced by a COPI study.

The following points are suggestions of where it would make sense for DG Environment to apply the COPI concept:

- The total of environmental cost of policy inaction
  In an easily accessible format and mostly not monetized
- Key sectors causing environmental losses
  For example, Land Use decisions, Transport, Fisheries
- Wider policy targets
  For example, COPI of not meeting the 2010 biodiversity target within the first half of this century as well as COPI of not curbing excess nitrogen loading
- Specific environmental goods and services
  For example, COPI of not protecting groundwater including protection against over abstraction as well as COPI of not preventing soil degradation

Multiple, small-size studies could be considered – each tailored to a specific issue and purpose while fitting in an overall framework. The above examples have been described with this in mind.

Further aspects addressed in this scoping study are:

- a review of experience with environmental work to build on, such as partial COPI studies, quantified scenario-analysis and disseminating monetized information;
- methodology: essential steps and design choices;
- a brief sketch of how changes over time fit into the COPI concept – among other things, this could be used to illustrate cost of policy delay;
- existing valuation databases;
- pitfalls, knowledge gaps and good practice.

On balance, we see a certain use for the COPI approach for DG ENV, if carried out correctly, for issues where the data is available (even if contested) and where there seems a story to tell. COPI is a means to getting important messages out in a meaningful and accessible manner. For specific issues where immediate negative consequences will occur if left unattended, information on the cost of policy inaction can help to raise awareness of the importance of the issues and the urgency of doing something. As with most of these tools, it is realistic to say that COPI studies by themselves will be insufficient to win over hardened critics of any environmental policy.

A particular application of the COPI approach that DG ENV could consider is studies into the environmental COPI associated with other sectoral policies that have not integrated environmental concerns to a sufficient degree – typically corresponding with a Commission portfolio such as transport, energy or agriculture. In fact, this seems the COPI application with the highest added value. It focuses on the question ‘whose inaction?’

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1 Introduction

The objective of this study is to lay out reasonable expectations of COPI as an assessment instrument. This includes aspects such as potential messages; important technical issues; limitations; issues of focus, direction and process; key information gaps; added value.

The scope of this study is environment policy at the EU level, touching on policy areas that are not labelled ‘environment’ but are nevertheless relevant to the issue of cost of policy non-action regarding the environment.

The study reflects on methods to assess COPI in money terms but also considers non-monetary endpoints, such as the number of premature deaths. The study aims to illuminate which stages of the policy making process the concept of COPI can best support.

Our interpretation of what DG ENV seeks, in relation to COPI, is: economic thinking, but not too narrow, as an element of a communication strategy. This led us to consider inter alia the possibilities to apply the COPI concept to environmental-related policy as a whole – next to, or contrasted with, other EU priorities.

Realism has been an important consideration: this study tries to provide ideas to DG ENV for pragmatic use of the COPI concept. That requires a balance between, or a proper combination and sequencing of, the quick-and-simple and the thorough-but-costly. The study reflects on both and eventually recommends a combination of mostly smaller studies in four distinct categories.

In view of this we included in this scoping study elements of COPI methodology that can be of practical use in designing and committing follow-up work. This includes a two-page methodological summary, a section on important design choices, a framework for a COPI program, populated with some examples of good topics for COPI studies that seem doable.

Although the production of this scoping study has been a small project, it was nevertheless undertaken by five organizations in order to connect with as much practical experience as possible. GHK experience extends well outside the domain of environment or environmentally sustainable development. MNP has additional experience in forward-looking studies from sub-national to global scale. The interim report of the scoping study contains details, examples and annotations to relevant studies in which the contributing organizations

were directly involved. This has been summarized in the present report. More elaborate material can be found in the interim report of this scoping study[1].

[1] MNP/RIVM, IEEP, Ecologic, GHK and IvM. Scoping study for DG Environment on the cost of policy inaction. Interim report May 2006. Report to DG Environment of the European Commission. Contract ENV.G.1./FRA/2004/0081 – task 9.

2 What is COPI?

This chapter aims to clarify the concept of COPI and to suggest its use in policy-making. Specifically, what is its place in the life cycle of policies and what are its relations with other assessment tools?

2.1 Definition

In the context of the environment, the cost of policy inaction (COPI) is defined as the 'environmental damage costs occurring in the absence of additional policy or of policy revision'. These damage costs are projected to accrue under existing (sectoral and environmental) policy commitments. Various damage cost estimates are possible to take account of different levels of implementation of the existing commitments – higher damage costs with lower levels of implementation. In addition, it is possible to conceive of an 'extended COPI' where the costs of inaction are extended to include wider societal and economic costs, and where the definition of COPI is the 'total social (private and external) costs occurring in the absence of additional policy or policy revision'.

COPI estimates are therefore based on:

- Estimates of the future (non-marginal) loss of environmental capital and services, calculated by comparison to a reference point. The reference point can be either the current stock of environmental capital or some definition of prior environmental capital stock - which might be some previously existing level of environmental services
- Projections of (non-marginal) environmental change measured against the defined reference point
- The translation of this environmental change into an economic assessment recognizing the total (use and non-use) economic value provided by the environment
- A combination of qualitative, physical and monetary estimates of environmental damage, employing conventional measurement methods and data, taking account of the methodological and data problems associated with the estimation of environmental damage costs.

COPI is focused on the total gross loss of environmental services over the projected period, and the time profile of this loss over the period (linear or non-linear). It is conceivable that in a particular COPI exercise benefits of inaction are factored in (net COPI). Figure 1 provides a basic characterization of a COPI assessment.

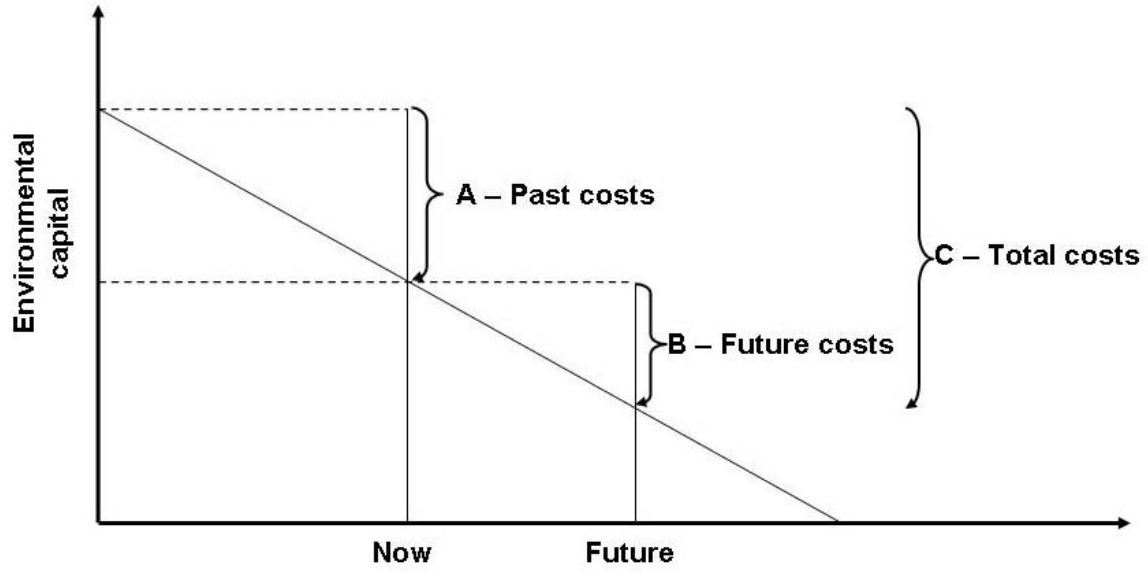


Figure 1: A basic characterization of costs of policy inaction

2.2 Place in the policy life cycle

The purpose of estimating the costs of policy inaction (COPI) is to highlight the need for action, prior to the specific development and appraisal of policy instruments. COPI is therefore concerned with problem identification, and with understanding the dynamics of environmental change and the attendant damage costs in the absence of new or revised policy interventions.

Hence, the need for COPI arises from an a priori concern that current policy commitments (either in relation to economic sectors or to environmental domains) are inadequate in preventing serious environmental damage, unlikely to be offset by benefits arising from the status quo. COPI is directed to testing the hypothesis that too much environmental damage is occurring and to establishing the level of (or lack of) evidence for this concern; and where evidence permits, COPI is directed at triggering the requirement for policy review and the development of new policy options, see Figure 2.

COPI has been defined for the purposes in this study in a way that makes it a distinctive and separate evaluation tool. COPI is intended to inform problem definition. This means that the tool is essentially applied as an ex-ante evaluation. However, given the need to understand the dynamics of environmental change and the impact of existing policy it is also likely that, depending on the nature of the problem concern, in addition, the ex-post assessment may contribute to estimates of COPI. This is elaborated in section 3.5.

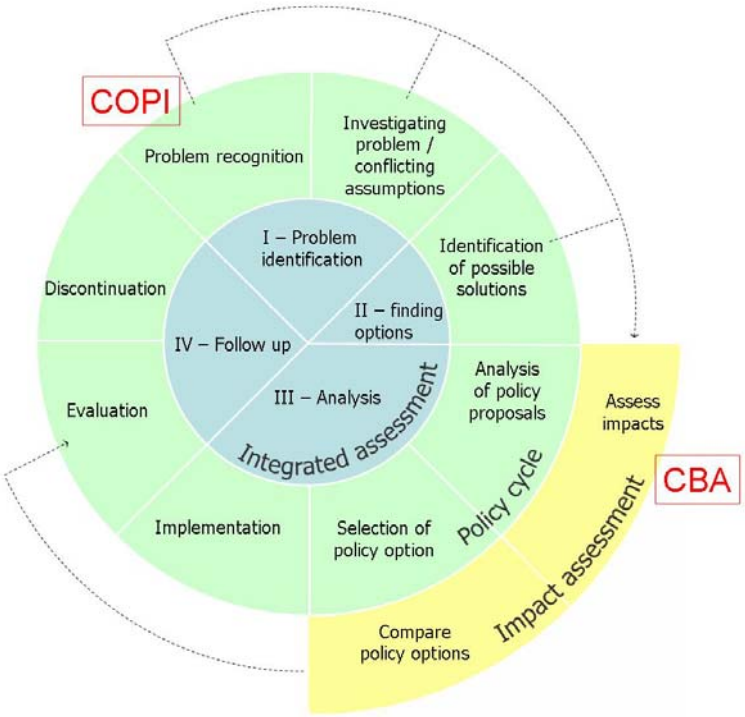


Figure 2: Place of COPI in the policy life cycle

Analysis of the cost of policy inaction (COPI) typically supports the policy recognition phase, i.e. early in the policy life cycle. In contrast, Cost-Benefit Analysis (CBA) typically supports the later phases of the selection of policy options.

Sources: This diagram: Sust-A project (Sustainability Advanced Test), contribution from RIVM-MNP;
ISA framework: MATISSE project (Methods and Tools for Integrated Sustainability Assessment), contribution from DRIFT (Rotmans, 2005);
Policy cycle: Brewer and Deleon, 1983;
UA procedure: EC, 2005

2.3 Why undertake a COPI study?

The decision to prepare a COPI study, rather than a conventional welfare analysis of specific policy options, has to be taken with some care – a COPI study is intended to define a problem not recommend a solution. Where possible solutions are identifiable then a COPI is inappropriate. There are therefore some basic questions to consider when scoping a potential COPI study as shown in the following diagram:

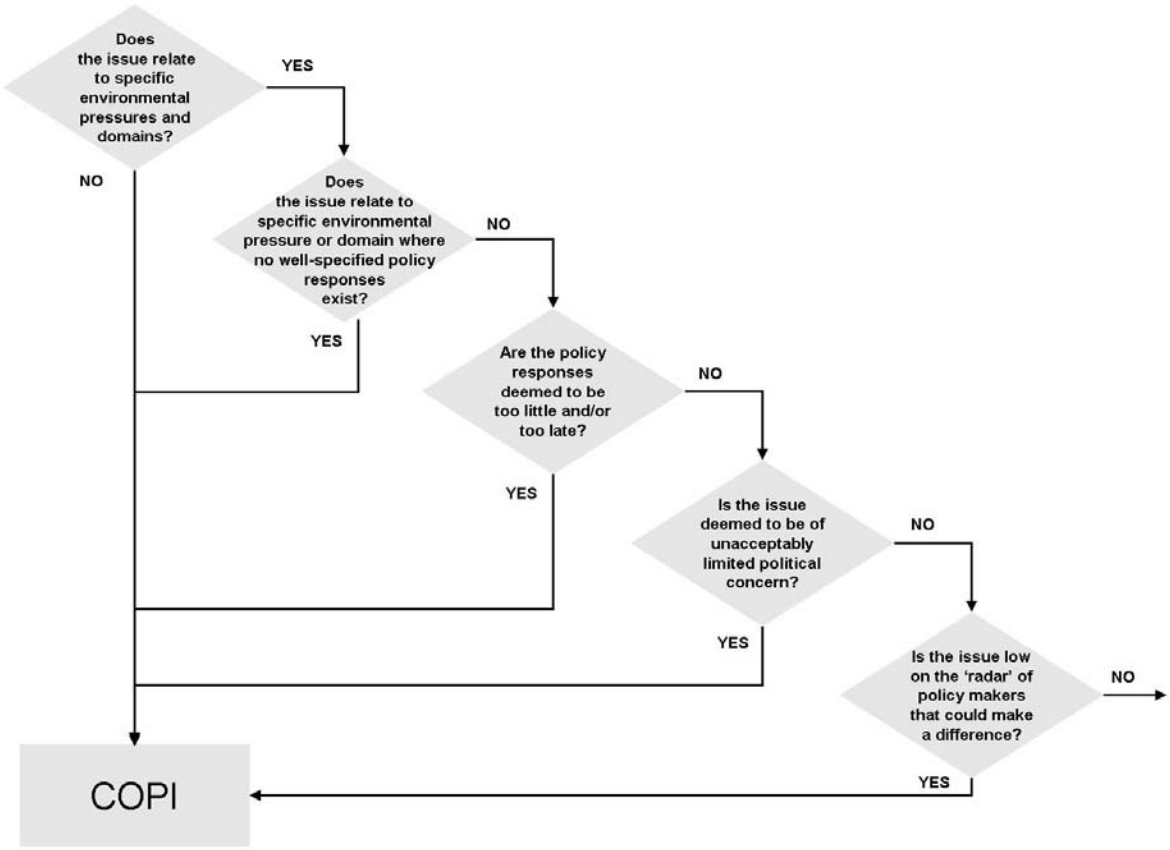


Figure 3: Basic considerations for deciding whether to undertake a COPI study

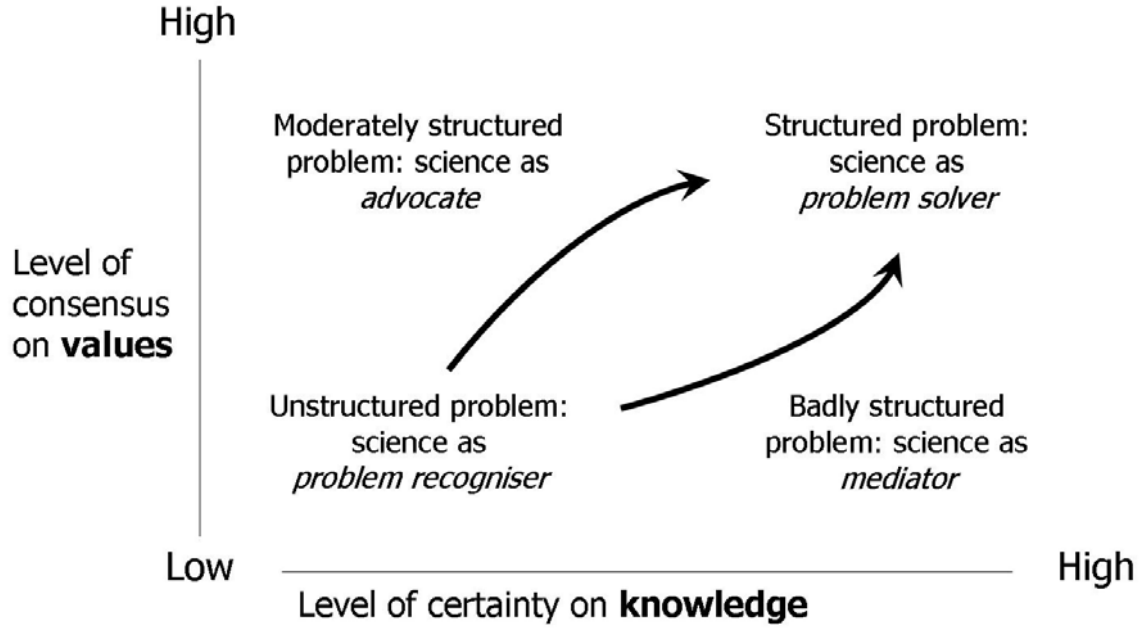
In addition, at a practical level COPI studies are generally non-trivial exercises that cost time and effort and should not be entered into lightly. General, obvious rules of the thumb apply such as the following.

- Is there a message? *Is there a story to be told?*
- Is there a likely audience for the work and the time right to input to this audience?
- Do methodologies exist and are data available to allow suitable analysis? In other words, *can the story be told?*
- Is there a political window of opportunity, a nascent process which the COPI study could promote. In other word, *will the story be listened to?*
- Is there sufficient time and resources to do an appropriately detailed study?

2.4 Problem recognition

COPI is an approach relevant for problem identification and recognition. Distinguishing between different problem types is helpful as an extra dimension for understanding the possible applications of COPI and messages it can help to convey.

Hisschemöller (1993) distinguishes four types of problems on the basis of two dimensions, see Figure 4; one dimension refers to the degree of certainty concerning the kind of knowledge required for a problem, the other dimension refers to the degree of consensus on relevant norms and values. The four types of problems that emerge are structured problems (consensus on relevant norms and values and certainty on knowledge[2]), moderately structured problems (consensus on values, uncertainty on knowledge), badly structured problems (no consensus on values, certainty on knowledge) and unstructured problems (no consensus on values and uncertainty on knowledge) (Hisschemöller and Gupta, 1999; Hisschemöller et al, 2001: 447ff). Political processes would typically seek to structure a given problem, moving from bottom-left in the diagram to top-right.



Adapted from Hisschemöller (1993) and Hisschemöller and Hoppe (1996)

Figure 4: Different problem types

[2] Note that structured problems could also refer to problems for which it is known what uncertainty and what dissent exists. With sustainable development issues, often dealing with complex systems and multiple perceptions, problem structuring is perhaps mostly about understanding uncertainty and dissent, rather than creating certainty and building consensus.

For example, one could say that of the various issues that will be discussed in this report, climate change would reside somewhere in the lower left corner of the diagram; perhaps soil degradation issues as well.

Marine environment issues could be located in the upper left quadrant (greater consensus on values but little certainty on knowledge).

Air pollution issues would be located in the top right-hand corner; groundwater issues as well.

Sectoral issues (transport, fisheries, demography/migration) would each be located somewhere in the bottom, right-hand quadrant – relatively much consensus on knowledge but little on values.

Global biodiversity would perhaps be situated in an in-between position as well as nitrogen loading.

Of course, an objective positioning of an issue in this framework requires measurement and will depend, among other things, on the scale at which the problem is portrayed – local or global.

We have defined COPI as a broad approach to problem definition. As such in principle COPI should address all four categories of problem in Figure 4. It will require that in the application of COPI to a potential problem that some consideration is given to the two dimensions (values and knowledge), and the extent to which uncertainty of impacts and/or differences in values exist. Note that the measurement of uncertainty and value differences is concerned with the degree – there is always a level of uncertainty or disagreement; but by consideration of these two dimensions the specific formulation of COPI, especially the design of scenarios and research methods can be improved.

If there is uncertainty with respect to knowledge, there could be uncertainty with respect to which impacts matter and/or how to calculate the magnitude of these impacts. Estimating the benefits of air quality improvement, e.g. the number of human lives saved, can be seen as an example of such situation. If there is no shared perception on values, there could be disagreement in the stakeholder group with respect to the relevance and/or measurement of certain impacts. The perceived risks associated with radioactive waste is an example where despite scientific research stakeholder interpretation of risks differs widely. The choice of attaching a value to human life is another example where stakeholders may disagree.

The four cases can also be seen to frame the application of COPI to cases ranging from highly uncertain and contested problems (such as the role of nuclear power as a response to climate change) to better and well defined problems (such as the role of public transport as a response to climate change). Understanding the type of problem is clearly important; a clear

and explicit definition of the problem context is required in order to apply and interpret the results from COPI.

In particular, COPI can be concerned with either an approximation of the environmental cost of policy inaction as a whole, or of a much more specific and immediate issue within the environmental policy domain. Within this context the conventional methodological issues of quantifying costs apply: the analysis of cost can sometimes go no further than an identification of impacts; sometimes cost can be quantified, sometimes even monetized. Some care needs to be exercised when more specific issues are defined as the basis of COPI – it is possible that the level of specificity (and by implication existing policy analysis) allows a conventional welfare analysis of possible options, making a COPI analysis redundant.

This categorization of problem types allows some appreciation of the different applications for, and utility of COPI; i.e. as an aid to advocacy, mediation, as well as simple problem recognition. To the extent that there is a high degree of certainty and consensus it follows that COPI has less utility, and where more conventional policy development and appraisal tools can be applied.

2.5 Relationships with other assessment tools

This purpose of COPI in problem recognition essentially distinguishes it from the more conventional policy application of 'non-action' as the policy counterfactual in a standard policy evaluation. In the policy evaluation, a policy option is tested in terms of its ability to secure a change in a baseline 'do nothing' trend and the associated costs and benefits of this change. This is the conventional identification of the marginal costs and benefits from a policy change.

COPI differs from the standard counterfactual analysis – in particular Cost Benefit analysis - in that:

- COPI is undertaken prior to the identification of policy choices (although some appreciation of the possible 'policy-on' is necessary to frame COPI - for example COPI of the marine environment pre-supposes scope for action to improve the marine environment), while counterfactual analysis relates to a defined policy option and choice;
- COPI addresses the total costs of not changing, while standard counterfactual analysis is concerned with the marginal net benefits of change or the marginal costs of not changing;
- COPI is concerned either with a range of pressures on an environmental domain (such as fishing, pollution, etc on the marine environment); or with the effect of a given pressure

on a range of environmental domains (such as transport emissions on different environmental media), or some combination; while standard counterfactual analysis relates to the specific policy options and the related defined pressure and a particular aspect of the environment (such as a policy option to reduce vehicle exhaust emissions to improve air quality, ancillary benefits included).

The distinction is made in order to differentiate COPI from the standard analysis conducted as part of the policy appraisal process; and to locate COPI as a discrete tool for the early warning of the need for (unspecified) policy action. Thus COPI is not concerned with specific policy appraisal and is not directed to understanding the social welfare benefits of some policy proposal. As such COPI is concerned with describing a particular problem and not directly concerned with explaining the cause of problems (although this may be included in a COPI study) or with advising on courses of action or with illuminating why in a particular case none of the actors involved is inclined to move – as can sometimes be illustrated with marginal cost-benefit analysis. In other words, COPI is not directed to advising on changes required by particular stakeholders.

COPI stops short of advising on specific proposals, although possible options might be identified for subsequent detailed welfare analysis. A COPI assessment does not, in itself, justify policy action. Even if the cost of inaction is large, the cost of action may be even larger. But if COPI turns out to be large or strongly increasing over time, a different policy assessment, perhaps a Cost-Benefit Analysis or Multi-Criteria Analysis, may subsequently be called for. In such a policy assessment, the COPI baseline (that was measured in the COPI assessment) can be used to measure the cost and benefits of the potential policies against.

The application of COPI can also be defined by reference to the assessment of the benefits of some broad policy action. The costs of inaction can be interpreted as the total potential benefits forgone because of the failure to take action. It does not mean that policy can or should achieve these benefits. Policy responses will have technical constraints - it is impossible to substitute all car based travel with public transport or all fossil fuel based energy sources in any meaningful timescale. On the other hand, a concrete assessment of specific measures will perhaps also reveal co-benefits that need to be taken into account (for example, some climate-inspired energy policies can have large positive effects on air quality). COPI does not seek to take account of the costs of the policy response. It is conceivable that the costs of the policy response are greater than the costs identified in COPI. It will be a matter for conventional impact assessment tools to establish the welfare benefits of a policy response.

The application of COPI assumes no change in existing policy. This does not preclude COPI from taking into account socio-economic changes or changes in technology that might either

exacerbate or mediate a particular environmental change. Rather it is likely that COPI should explicitly address these types of changes to provide a robust assessment of the future situation.

Given the inherent uncertainty of these types of future changes and their effects on the environmental change under consideration it seems sensible to apply complementary tools in undertaking COPI assessments. In particular it might be expected that COPI exercises would make use of scenario based approaches that seek to make transparent the effect of different assumptions on environmental change and the subsequent environmental damage. It would be expected COPI would also form the basis of risk assessment, examining the risks of environmental damage by considering different probabilities of events occurring and the range in scale of potential hazards.

2.6 Cost of Policy Inaction (COPI) in a Nutshell

We briefly summarise the idea of the cost of policy inaction (COPI):

COPI is the environmental damage cost arsing from a policy not to change course and not to change from measures that are already committed to. COPI is mainly concerned with future damage costs of inaction.

The purpose of COPI is to highlight the approximate ‘orders of magnitude’ of environmental problems as the basis of communicating and disseminating problems. COPI should focus on ‘big ticket’ items as the basis of further policy development. Consequently too much detail should be avoided.

COPI is different from a cost-benefit analysis, that is concerned with the marginal costs and benefits from changes in policy. COPI is an estimate of the total damage costs compared to a specified baseline (usually the current environmental situation).

Whether any benefits from inaction are taken into account in a given study should be stated explicitly. For example, improved agricultural productivity in a given region and the timeframe because no action is taken on climate change.

COPI is NOT concerned with estimating the economic impacts of alternative options for action. COPI might be used to calculate a baseline which is then used in subsequent (and more conventional) economic analyses and impact assessments. COPI estimates the total

extent of a problem – not the marginal change. Consequently, the role of COPI in the policy cycle is in problem definition - before options are developed and compared.

The table below summarises the concept of COPI. The concept is fully developed in the report.

Table 1: What is and is not COPI

	COPI is:	COPI is NOT:
Policy application	Relevant for environmental and sectoral policies	Only applied to EU environmental policy
Policy focus	Forward looking, assessing the dynamics of change under current policy commitments	An analysis of policy changes / new policy options
Evaluation system	Principally ex-ante, but also ex-post	Largely ex-post
Impact assessment / Evaluation use	Problem identification and baseline descriptions / projections	A social welfare assessment or priority assessment
Spatial scale	Sensitive to relevant spatial scales	Constrained to given spatial scales
Economic concept	AN estimate of the total economic value of environmental change – use (direct / indirect) and non-use values	Partial (marginal) economic assessment
Economic measurement	Not unique in estimating qualitative, quantitative and monetisation costs	Just estimating the monetised costs of environmental change
Reference points	Based on 'clean' environment or some assessment of past / current environmental conditions	Marginal or incremental analysis
Attribution of cause and effect	Based on D-P-S-I-R framework to attribute damage to specified pressures	Indifferent to cause and effect
Distributive effects	Sensitive to actors / incidence of cost	Indifferent to where the costs fall
Gross and Net Costs	Total damage cost – and change in total cost over time (incremental costs of delay)	Indifferent to benefits of inaction – these can be included in calculating COPI
Policy baseline costs	Equal to the counterfactual 'do-nothing' costs of a proposal assuming the definition of policy interest in COPI and as the basis of the proposal is the same	Driven by policy proposals – but a concern that action may be needed
Technical change	Sensitive to projected changes / lags and implications of delays in technology	Locked into fixed or current technologies
Socio-economic change	Sensitive to projected changes / lags	Locked into fixed or current socio-economic conditions
Irreversibility	Concerned with identifying possibilities and risks	Assuming damage can be repaired
Uncertainty	Scenario based where uncertainty is significant	Supporting fixed ideas of damage costs
Risk assessment	Concerned with Identifying qualitative or probabilistic risk of future damage from pressures	Indifferent to future risks
Data	Intensive user of data / modelling of environmental change / economic values where available / appropriate	Partial assessment of baseline changes

Short observations from a user perspective can be found at the very back of the report, in Annex XI - Cost of Policy Inaction –Advantages and disadvantages.

3 Methods

This chapter provides different ‘cuts’ through the available methodology for COPI studies. Section 3.1 takes the reader, in as few words as possible, along a number of essential choices to define what cost a study will be about precisely, and about what inaction. It builds on OECD work.

Sections 3.2 through 3.4 are about do’s and don’ts. They draw on various parts of this report such as the reflections on earlier studies. Specifically, section 3.2 summarizes COPI methodology in twelve steps. It is concise (three pages) and could be used to quickly establish terms of reference for future studies. Section 3.3 summarizes on slightly less than a page the ‘banana skins’ in COPI land. Again, section 3.4 deals with do’s and don’ts but now in a practical sense, including presentation issues.

Sections 3.5 to 3.7 take a closer look at some methodological possibilities. First of all, time aspects are examined; how to deal with delayed effects; and can we imagine cost of policy delay. Then, how to place partial results in perspective; and can we imagine a modular system of COPI studies if they need to be developed one by one for some reason. Finally, on the specific step of monetization: which databases are available and which is of key significance?

3.1 Main degrees of freedom in designing a COPI study

When committing future studies into the environmental cost of policy inaction, it is important to be specific about a couple of design choices. This is particularly so if the idea is that successive small studies would eventually be combined in a modular fashion. Section 3.6 briefly describes this idea. But also if a study can stand on its own, the following choices are important as they determine whether the result answers the right questions.

One can ask what the cost of policy inaction *would have been* had current environmental policies not been implemented (*ex post* assessment), or one could ask what the cost of policy inaction would be in future without (additional) environmental policies (*ex ante* assessment). Both questions can be useful, but for strategic planning the second, *ex ante* question seems to be most relevant. Chapter 3.5 - The baseline briefly discusses this further.

To better understand the concept of cost of policy inaction, the concepts of “cost” and “policy inaction” are examined separately.

3.1.1 Important distinctions with respect to COST

Private/social cost:

If we are not focussing on the cost for one particular group of agents, e.g., farmers, we are focussing on the cost for society as a whole, i.e., the total costs to all economic agents (present and/or future) as a consequence of the environmental problem. In general, a COPI study will assess social costs, although it might be valuable in some cases to also assess private costs to the most affected groups or individuals.

Market/Non-Market:

Some of the impacts of environmental degradation may directly affect market goods (e.g., reduced fish catches because of marine pollution), other impacts may affect non-market good and services, such as human health and non-market ecosystem services. While damage to market goods can be valued by their market prices, no such prices exist for goods and services that are not traded in markets (non-market goods). In some cases, their economic values can be assessed by non-market valuation methods. These methods can be divided into methods that derive the value of environmental goods from the observation of individuals acting in real-world settings (Revealed Preference methods) or from individuals' responses to hypothetical questions that aim to elicit individuals' preferences with regard to the environmental good or service (Stated preference methods). The choice for one or the other method depends on the characteristics of the good or service (see below), practical considerations (e.g., the availability of sufficient data to 'reveal' preferences), and some subjective preferences on the part of the researcher. In most cases, however, a COPI study will not allow the researcher enough time and/or money to carry out original valuation studies. He or she will therefore have to rely on values from existing studies, that are as good as possible adjusted to the situation of the COPI at hand (Benefits transfer).

Use/Non-use values:

The total value of non-market environmental goods and services may be divided into use and non-use values. The use value of a good is the value attached to the current, future or potential use of the good, while its non-use value is independent of its use. Use values include the use of environmental services for production, health, recreation, waste recycling, etc. Non-use values are not related to any specific use of the environmental good, but to its mere existence. It is widely acknowledged to be a legitimate component of value in the economic valuation literature, but it is also sharply criticized by others. A practical suggestion to COPI researchers would be to use a conservative estimate of non-use value in their estimate of total value of an environmental good.

WTP/WTA:

In the academic literature on economic valuation there is discussion on two different methodological approaches to economic valuation and their theoretical and empirical differences. The most common measure of the value of a good to an individual is the willingness to pay (WTP) of that individual to acquire one unit of the good. WTP is also the most common approach to measure the value to an individual of a change in environmental quality. An alternative approach to measuring value is to estimate the

willingness of an individual to accept compensation (WTA) to depart of the good. While the two measures should be approximately equivalent in a perfect market, they have found to be very different in the context of the valuation of environmental goods. There is a fairly large literature on this 'WTP/WTA divide'. For the COPI researcher, this is of little practical consequence as almost all value estimates in the literature are based on the WTP approach.

Monetary/Physical:

While impacts on market goods can be relatively easily expressed in money terms, impacts on non-market goods are often more difficult to value, as was explained above. Many applied studies report "costs" in a mixture of monetary and physical indicators. Even if the costs can be totally expressed in a money metric, a COPI study should also report the key physical indicators.

Direct /Indirect/Ancillary:

Environmental pollution can reduce the productivity of an environment-related economic activity (direct cost), but, through market transactions, also affect other economic activities (indirect cost). If one economic activity generates two (or more) joint types of pollution, mitigation policies for one type of pollution could simultaneously reduce the other type(s) of pollution as well. Inaction to deal with one pollutant would then not only result in more emissions of that pollutant but also in more emissions of the joint pollutants. The damage costs of the joint pollutants are called ancillary damage costs. Inaction in greenhouse gas mitigation from industrial sources could, for example, through its effect on climatic conditions lead to reduced crop yields in vulnerable regions (direct cost), leading to migration of affected populations (indirect cost), and also to a lack of reduction in conventional air pollutants (ancillary cost). This distinction is necessary to avoid double counting, if COPI is calculated for different sectors / problems separately and the results are to be aggregated.

Opportunity costs:

Opportunity costs can be defined in this context as the forgone production and utility because of environmental change. This is the same as our definition of damage costs. The term 'opportunity costs' is often used to emphasize that costs are not limited to changes in monetary transactions but also encompass decreases in utility that are not directly related to changes in monetary flows (such as damage to health or losses in recreational amenities).

Total/Marginal

One can distinguish between "total" cost and "marginal" cost, where marginal cost is the damage cost of a small increase in environmental pressure. Total cost is the integral of the marginal cost function over the total change in environmental pressure. In policy evaluation, marginal cost is the most useful concept (because of the optimality implications of equating marginal damage costs to marginal control cost); in COPI studies total cost is the preferred format as the basis of problem definition. It may also allow direct comparison with well-known economic indicators such as GDP. COPI is not intended to consider the optimality implications. The Stern Review on the economics of climate change reported both the marginal cost of inaction ($85 per ton

of carbon dioxide) and the total damage costs (5% of world GDP to 20% of world GDP in a worst case scenario) (see Annex IV).

Present Value/Annual (Snapshot):

There is a difference between environmental "stock" problems and environmental "flow" problems. The degradation of environmental stocks, such as the atmosphere, ground water or ecosystems, reduce their environmental services over a period of time (or even permanently) even if the source of the pollution has ceased to exist. Environmental flow problems (such a noise pollution) do not last after the source of the problem has been removed. If the environmental problem is a stock problem, i.e., one unit of pollution now affects the future flow of services of the environment, the damage cost of that unit of pollution is the present value of future damages, i.e., the discounted flow of damages over the relevant time period[3]. Instead of reporting in present value, one can also report the damage cost in a particular future year, a sort of "snapshot" - "in year X the cost would be € Y million". The latter statistic may be more illustrative for the general public, but it contains less information than the present value. The COPI researcher can report both statistics.

Adaptation

The damage cost of environmental degradation is the sum of costs (expenses) that economic agents incur to (optimally) adapt to the changing environmental conditions, and the residual damage costs for which adaptation is no option (because of economic, technical, or other reasons). In some cases of environmental degradation, the possibilities for adaptation may be limited and the residual damage to human health and ecosystems may be an important damage post – if not the most important. In some cases (e.g. climate change), adaptive behaviour may be both important in terms of costs and difficult to predict.

Net/Gross

It is important to distinguish between "gross" and "net" costs. Gross costs refer to the sum of all welfare-decreasing impacts of some policy or lack of policy. "Net" costs usually refer to the balance of positive and negative welfare effects to all economic agents. Assumedly most COPI studies would report "gross" costs, as this is where the focus is. However, it is advisable to include an explicit statement in each COPI study as to whether any benefits of inaction are considered.

3.1.2 Important choices with respect to POLICY INACTION

Whose inaction

EU, Member States or other policy areas? If we assume policy inaction at the EU level in some environmental area, do we also assume policy inaction of Member States or foreign countries or sub-national authorities or firms and NGOs? Obviously, a COPI study requires very clear identification of existing policies here.

[3] The Commission uses a standard discount rate of 4% per year in real terms.

"Status quo"

This depends on the type of policy regime, i.e., differences in environmental effects over time and space between eco-taxes, cap-and-trade, technology standards, etc. Therefore, the assumptions on the nature of policies-to-be-continued in the baseline may need to be explicit not only concerning their level of ambition but also with respect to their instrumentation.

Temporary inaction (delay)?

Must we assume inaction forever or a delay of action – even if a COPI study would not define concretely what that action would be? What about the (potential) information benefits of waiting (quasi option value)?

Autonomous adaptation/mitigation?

What do we assume about 'autonomous' adaptation and/or mitigation by people, firms, wildlife, ecosystems…

Central or multiple baselines?

In modern scenario 'science' a scenario (including a baseline scenario) is essentially a 'storyline'. Many storylines are possible. Multiple COPIs?

A useful, succinct overview of possible definitions related to COPI has been put together by Nick Johnstone of OECD (OECD document ENV/EPOC(2005)18 of 28 October 2005).

3.2 Recommended method for COPI assessment

The methodology of a COPI assessment resembles that of a Cost Benefit Analysis, but it is not similar to that. In this section, we divide a COPI assessment into twelve steps in a logical order. The relative weights of the steps may differ across different COPI assessments, but it is imperative that they are all addressed in each assessment. In some assessments, certain steps may be addressed more than once, in an iterative manner. In general, it is recommended to let a COPI assessment be preceded by a feasibility study. The successive steps of a COPI assessment are as follows.

Scoping of the exercise

Problem analysis

Any COPI should start with a problem analysis: what is the issue and how does it work? The main purpose of the problem analysis is to translate the social/political problem into an analytical problem. It is of vital importance that the problem is pictured at the appropriate level, i.e., not too broad such that the analysis will become intractable, and not too narrow such that the problem becomes irrelevant from a policy perspective.

Boundaries in space and time

A problem delimitation should be drawn up, enumerating all elements that are connected to the problem. It should define the geographical boundaries of the problem and its time horizon. In specifying the time horizon, a distinction should be made between the planning horizon (the period of policy inaction) and the effect horizon (the time period over which environmental effects are evaluated). In environmental problems involving stock pollutants (e.g. climate change, groundwater pollution), planning and effect horizons will usually not coincide.

What cost?

Potential effects to be considered as ‘cost’ should be identified - broadly beforehand and in-depth as part of the study. It is important not only to identify the types of effects (e.g., human health, eco-system damage, defensive expenditures), but also their distribution among different target groups (including economic sectors, households, vulnerable groups within the general population), generations and regions (including in some cases foreign regions). The basic analytical framework for this step is the conventional DPSIR (driving force – pressure – state – impact – response) model, reproduced in Figure 5 below.

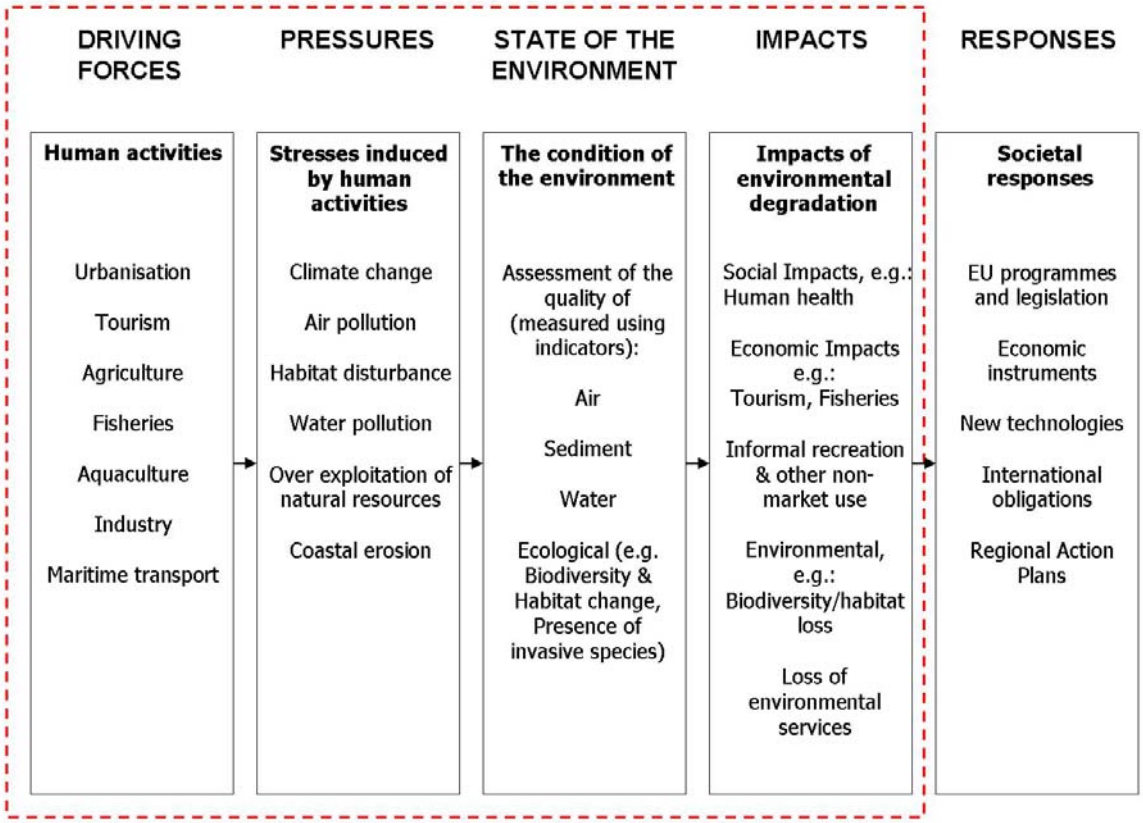


Figure 5: The driving forces ... responses framework

The reference

A ‘reference’ or ‘undamaged environment’ situation should be identified. For some dimensions of environmental problems the reference is more obvious than for other dimensions. For pollution that affects human health a ‘no effect’ situation can be chosen, but only if non-anthropogenic pollution is not an important factor. For some forms of pollution that affect ecosystems, critical thresholds have been defined. For many other forms of environmental degradation, an explicit ‘reference’ should be constructed, which could be the historical quality of the environment in a certain base year, or a target quality.

The baseline

Typically, COPI is a about the cost of ‘continuing as we do’. In other words, a baseline, or to be more precise, a ‘no new policies scenario’. This comprises the following two elements.

Baseline: the undercurrent

The baseline will usually project independent or quasi-independent developments such as economic developments in national and international markets, technological, demographic, social and spatial developments as well as developments in adjacent policy areas that may affect the problem under analysis. If possible, it is preferable to make use of an existing and politically-endorsed scenario as starting point – perhaps a recent forward-looking study at the global level.

Baseline: what inaction?

The baseline involves assumptions on continuation of certain policies; absence of policies; or absence of change in policies. The study should describe explicitly what this means for the policy field where it is supposed to focus (for example, the energy sector).

Other design choices

Other design choices as outlined in section 3.1 have to be made and argued. For example, the default choice would be gross total cost; a single no-new-policies-anywhere baseline; and current implementation levels. But these would have to be argued, even if they are default choices

Assessment

On the basis of the above, the COPI study should determine, for the effects identified a priori as relevant, the distances between the 'no-new policies' baseline scenario and the reference situation in a certain target year or over a certain period. The findings can be expressed in terms of either an identification of the effects, or quantification in physical terms, or monetary value. If the focus of the study is on a particular sector or particular development, a discussion is required as to whether the effects are causally related to that sector or development.

Reporting

Transparency

It is of critical importance for the credibility and acceptance a COPI assessment that its results are presented in a clear and transparent manner, giving due attention to its underlying assumptions, its data, its assessment methods, its major risks and uncertainties, and its distribution among target groups and regions. Different audiences will prefer different presentations of the results, from very simple and aggregated to detailed and disaggregated over pollutants, groups and regions. The COPI assessment may provide useful information (such as the definition of appropriate indicators) for the future monitoring and management of the problem.
In particular the following three elements deserve attention

Causality

The assessment of environmental effects in the no new policies baseline is a critical and difficult step in any COPI analysis. The physical pathways of environmental pollution from source to receptor are often complex and bound with uncertainty; the same holds for the physical effects of disturbances to natural eco-systems and biodiversity. Simplified methods

may need to be used, involving correlation instead of causality; proxies; and highly aggregated impact indicators. The bottom line is that as COPI studies are completely dependent upon the availability of relevant scientific knowledge. Thus, a clear choice of the analytical route along the DPSIR chain needs to be taken and documented with references.

Valuation

The assessment of physical effects on health and the environment in step 8 typically provides 'cost' estimates of policy inaction in diverse and often ill- or non-comparable units. A common approach to make these multi-dimensional cost estimates comparable and suitable for mathematical operations (such as summation) is to map them onto the one-dimensional vector of real numbers by use of a utility function. Estimating a (social) utility function that maps environmental effects onto (social) utility is difficult and often controversial. In some cases, the COPI assessment can make use of 'values' of health and environmental effects that have been produced by dedicated and specialized research (such as the ExternE projects or its successors). Because of the controversial nature of some these 'values', it is advisable let these values be subject to independent scientific review.

Treatment of uncertainties

Ex ante (and even ex post) assessment of COPI is bound with risks and uncertainties. Risks and uncertainties play a role in many of the previous steps (e.g., projections of exogenous developments, assessment of effects and valuation). In reporting a COPI assessment it is useful to

i) identify and report the major sources of risk and uncertainty;
ii) assess the relative effects of varying critical parameters on the overall COPI estimate.

3.3 Pitfalls

A number of methodological issues can cause a COPI study to get stuck in its development or cause it to be not sufficiently accepted. Most of these pitfalls, or banana skins, also effect the estimate of environmental damage costs in the conventional welfare analysis. Even the EU competency in the issue could be contested, as in a COPI on soils – but that is hardly specific to the application of COPI methodology. Pitfalls of particular significance in COPI are the first three described below. Other pitfalls are also listed.

1. Disagreement can easily arise about the reference point, as in coastal zones being pristine or as they are now or as they were in 1950. Such disagreement may be difficult to solve as it may hinge on differences in ideal envisioned by the various players.
2. If costs of policy inaction decrease over time, as in air pollution, the message becomes ambiguous.
3. The simplification needed for forward-looking EU-wide studies may remain controversial for some issues whatever the level of care taken to describe the issues. Biodiversity is an example.

Other pitfalls:

4. Resistance may exist on ideological grounds, for example the transatlantic difference of views on precaution. This could translate into disagreement on the weight to be given to costs in the longer-term future and to small-chance large damage risks.
5. Monitoring data can be lacking, for example on marine environment, or data coverage may be very uneven across the EU, as in nature valuation studies being almost all from Nordic countries.
6. Coverage by the literature can be problematic. For a number of issues, only a small part of the damage that a COPI study needs to see is covered. Some issues are in fact quite diverse and reports and articles form a non-fitting jigsaw puzzle. Soil degradation is an example.
7. Monetization of non-use values, for example of traditional landscape, will always attract criticism based on differences in viewpoint. This is not easily bridged.
8. Discount rates have long been the primary point where Cost Benefit Analyses ran into opposition. Time-variable discount rates have been proposed as a means to reconcile the various perspectives but are by no means standard yet.
9. The baseline needs to be realistic in its assumptions on implementation of existing commitments but this can diverge from the proverbial ‘Official Future’ as laid down in EU scenarios. (Chapter 3.5 contains a discussion on choosing the baseline.)

3.4 Good practice

The most important guiding principle for COPI is to say what can be said, in terms that are clear, understandable, with results that are useful and defensible; always be transparent about assumptions and never try to overplay the message. It is important that the constructive messages are not hostage to avoidable weaknesses in the argument. In practice, it is valuable to present the costs of policy action in all three manners – in qualitative terms, in quantative terms and monetary terms – all the while understanding what each of these covers and presenting the results in context. See Figure 4 – note for some areas the only a little can be monetized (pyramid wide and flat) and in others areas more can be monetized (pyramid less wide and taller).

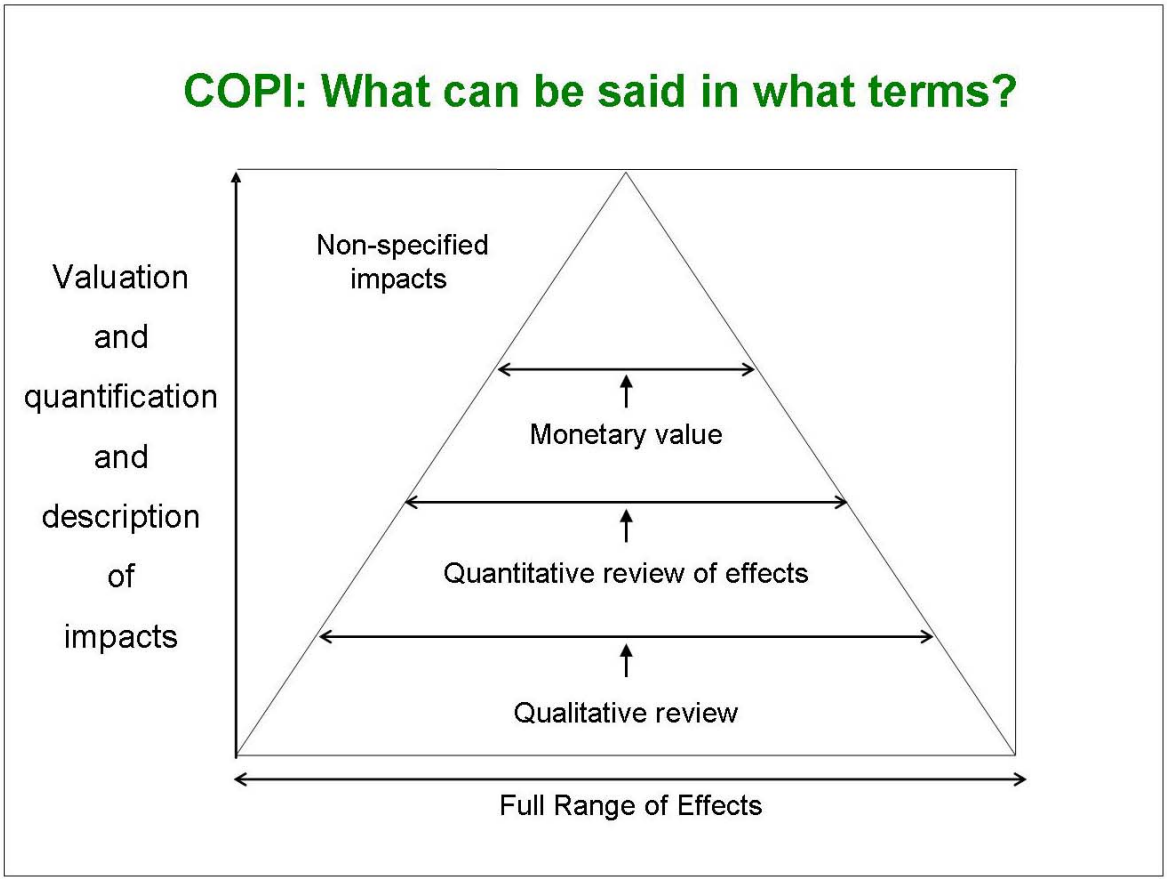


Figure 6: COPI: what can be said in what terms

General rules of thumb when doing a COPI study

- **Be realistic about what can be said in what terms and to what audience.** Overplaying what can be said with the results can undermine the whole work.
- Always remember and note explicitly that **less can be said in monetary terms** than can be said quantitatively or qualitatively**, even if monetary terms speak louder.** It will be

important to present the results in the right perspective. The key messages may not always be at the monetary level – and it is the key messages that should be given the prominence.

- There are also p**roblems of identifying and allocating causes -** in that there are often multiple causes for a given environmental change (e.g. exposure to pollution) that lead to changes in cost. It is important to be clear as to what the inter-linkages are and not try to untangle issues beyond a point at which they can be untangled. The choice is to either take bigger issues, or to take specific issues but note the inter-relations with other issues.
- **Some areas can be monetized, others much too tricky for that level of analysis – do not attempt to monetize something that will be too difficult,** especially if one can say sensible things elsewhere. One weak or exaggerated area can lead to suspicion as to the quality or good analysis elsewhere and hence undermine the work.
- There is a **need for a practical framework; simple is** often **better.** Any decision requires (convincing) explanation, and failing that the whole work can get undermined - hence important to set a simple defensible framework.

Practical considerations on the analysis framework

A core issue is to set the basic analysis framework. Key lessons from practice partly overlap with other sections of this chapter. They are:

- Understand state of environment 'now' – chose a **reference year** for which **data exists**. In practice this may be one to three years into the past.
- Understand **business as usual developments** (e.g. future transport growth, agricultural outputs, demographics, tourism levels, water demand) – important to understand **modelling availability**, robustness, assumptions and implications as well as existing **scenarios** as their qualifications.
- Understand the existing and committed plans for policies and policy instruments affecting the issues as well as external issues (economic growth, changes in likely exposure levels etc) – and what implications their use or non use would have – e.g. new pollution levels. This can be used for the business as usual or for policy scenarios, depending. **It will be important to check whether the business as usual already integrates (the expected effects of) existing policies and policy instruments** and structure the COPI question accordingly.
- Understand relationship between issue and impact, e.g. the causal connection/pathway. For example for air pollution and impact, we need to know the dose response functions. Dose response functions are better known for air than for other areas. Other tools valuable

for other types of problems (E.g. willingness to pay[4] estimates needed for amenity value; hedonic pricing useful to estimate benefits of location quality, e.g. access to green areas). The field is quite fast developing (new ones come out all the time) and a fast improving 'science[5]'. **Obtain the latest data/results and see which data/results are suitable for the question being addressed.**

- When estimating likely impacts (e.g. calculating the number of cases of bronchitis by multiplying the number of people exposed by the dose response function and by the level of pollution exposure) it is important to **make clear and explicit note of the uncertainties** and to **give ranges** for the answers.
- For monetization, it is often helpful to use transfer values, and build in external cost estimates. Time and budget constraints, in combination with a wide angle of the study, would make it inevitable to draw on the results of existing valuation material – though **beware that externality cost is not a clear science and developing**. E.g. climate costs estimated now are larger than those estimated a few years ago. The transfer of existing values (benefits transfer) comes with its own pitfalls and problems (see also chapter 3.7 Benefits Transfer and Valuation Databases). Again make sure that assumptions and insights on the level of accuracy are noted and where relevant explore the sensitivities.
- Exploring the implications of assumptions can be done through the use of **suitable scenarios and sensitivities** and cover potential 'realities'. It will be important to explore different time scales discount rates, value of loss of life, different economic growth forecasts.

Presenting the results in practice

Not only do useful results have to be obtained, but they have to be presented properly:

- **Note ranges** – these are valuable to give honest answer. **Do not pretend that figures are more accurate than they are.**
- Note that costs or benefits types are different and hence not easily comparable. (Monetization helps to make effects comparable by expressing them in one common unit, but at the price of masking the uncertainty inherent to the estimates.)
- Given uncertainties:
  - important to show range
  - important to explore insights using both lower and higher estimate and if the lower estimate already gives a clear message, then start with that one so as to avoid being accused of choosing the higher options.
  - important to underline what is covered and what not

[4] Or willingness to accept compensation (WTA) in case of loss of environmental capital.

[5] Some of course regard this more as an art form than a science, given the range of assumptions and uncertainties.

- It is important to remember that in the event that monetary values in one area are smaller than in another, does NOT necessarily mean that costs or benefits are smaller. Methodological and data limitations need to be understood and clear. Air pollution issues are better understood – there are more and better dose response functions. It is therefore likely that numbers will be higher for air than for areas where less can be said, e.g. waste. Monetisation comes especially to its limits in the case of irreversible changes. Hence, if some kind of irreversibility should emerge, this has to be directly addressed in non-monetary units.
- Changing the way quantities are expressed can help in comparability – e.g. per capita or per GDP can help put big numbers in context and allow comparison across countries.
- Certain impacts are more easily quantified and monetized than others, some impacts – especially on human health – are more likely to yield large cost figures.
- Irreversible changes (loss of environmental stocks) need to be made explicit, even if monetized results take such changes into account – see section 3.5.4 - Irreversible loss of environmental stocks.
- A COPI study should include a statement as to whether any benefits of inaction are included in the results.

Interpretation of results in practice

It is valuable to provide insights to help readers understand what they see:

- The money value for the benefits is **not** the final measure of these benefits;
- The aim of the monetary value is to identify the **choice** that people want and to demonstrate that there are **real benefits** to be had from implementing EU directives in the candidate countries;
- No single figure can be given due to data limitations, and **broad ranges** are needed for an honest analysis;
- However, the **meaning of the range** can be taken seriously and the reader should be aware that the true value may be outside the range given here;
- Given the uncertainty in the numbers, it is important to focus first on the **lower value** when drawing conclusions regarding implications of the study and then double check with the upper value.
- Use whichever combination of (appropriately robust) qualitative, quantitative and monetary data/arguments needed to present the ‘story’.
- Be aware that results, especially the “One Single Big Number”, tend to get quoted out of context and take on a life of their own. This tendency can be counteracted only so much by attaching many warning signs to the presentation of the results.

3.5 The baseline

When calculating the costs of policy inaction, choosing a baseline for comparison is a critical step, which could involve the issues outlined below.

3.5.1 Business as usual

Often, there will be a tendency to use a single baseline for COPI studies in an attempt to keep the results as simple as possible. One conventional solution is to use a “business as usual baseline”.

The “business-as-usual” baseline does not equate to a “no-policies” scenario, because in almost any field, there is always some amount of policy involvement that currently exists. This existing action needs to be reflected in the baseline, which may require assumptions about its effectiveness and the success of its implementation into the future. This could mean, for example, that one would need to speculate the level of compliance that an existing air pollution regulation will elicit, and this level of abatement must be taken into account to determine the baseline scenario. In this sense, COPI studies could be used to determine the cost of the failure to implement (or implement adequately) policies that have already been decided.

It is a matter of choice, depending on the purpose of the study, whether a single baseline can best be constructed to reflect “business as usual” or “no new policies”. For example, for a topic where worldwide coverage is important it can make a large difference whether it is assumed that sulphur oxide emissions in continental Asia decrease with increasing income per capita (following an environmental Kutznetz curve) or whether this would only happen under the impact of new policies that are not foreseen under the baseline. What is more, the assumed absence of new policies could also be interpreted to apply to fundamental, but policy dependent drivers as free trade and globalization and would therefore make a ‘no new policies ‘baseline somewhat conservative in its assumptions about longer-term economic developments.

Needless to say, concretely deciding on the baseline scenario is never without discussion. The assessment can be biased because official assumptions about the effectiveness of regulations and the degree of compliance may be over-optimistic for political reasons. Establishing a fair baseline involves determining which policy commitments have been believably instrumented and what level of implementation is realistic. These may be sensitive issues. However, as will be argued in Chapter 4 ‘Experiences to build on’, it has been done more or less successfully many times.

3.5.2 Private action in lieu of policy

The baseline should take into account any pollution abatement, public good provision, or other action that would be done privately in the absence of policy changes. COPI should be adjusted according to the private costs incurred if the policy is not implemented. Suppose, for example, that policy makers are considering setting aside land for biodiversity conservation. This could mean taking into account land that would be privately purchased and protected by conservation groups in lieu of preserving the land as state-run protected areas. The costs that would be incurred by the conservation group should be accounted for when calculating the baseline scenario.[6]

3.5.3 Delayed impacts and avoidable vs. unavoidable costs

One of the most important dynamic considerations when calculating COPI and defining a baseline is whether or not unavoidable costs – environmental damage that has its roots in the past and cannot be mitigated by current action – is taken into account. In terms of the DPSIR scheme of Figure 5, this is the case when there is long delays between changes in driving forces and changes in pressures and/or between changes in pressures and changes in impacts – which is so for many environmental issues. Here we get different results with completely different implications for their interpretation. Both are very useful but a clear distinction has to be made to make sure that the results are interpreted correctly.

In a “narrow” definition, COPI is solely the costs that would be additionally incurred if a given form of policy inaction has not ended. This can be referred to as *avoidable* COPI, or *time-marginal* COPI. In a “broader” sense, COPI could be understood as all costs associated with an environmental problem, regardless if the damages are still avoidable or not. Hence we talk about *total* COPI.

In Figure 7 Area A represents the costs of political inaction in the past. This is the easiest case, but of minor interest for a political decision. Area B represents the avoidable portion of COPI for the future. This takes the current state of the environment as the baseline for the analysis. Area C represents future costs of inaction that are by now unavoidable, because the sources of this damage are in the past (e.g. released ozone-depleting chemicals that are still reactive). Area B+C gives us the total future costs of an environmental problem that has not been addressed by political action; a part of this is still avoidable today. This would take the state of the environment at a previous time *t* as the baseline for the analysis.

[6] In the case that the costs of privately preserving the land exceed the costs of doing so with policy action, the difference should be included in COPI as a positive sum. In the case that the costs of privately preserving the land are lower than the costs of doing so with policy action, the difference should be subtracted from the COPI calculation, as policy action in this case would not be as efficient as private action for this plot of land. Another issue to consider here is the level of provision that would be provided privately—would the conservation under private ownership match that of public control?

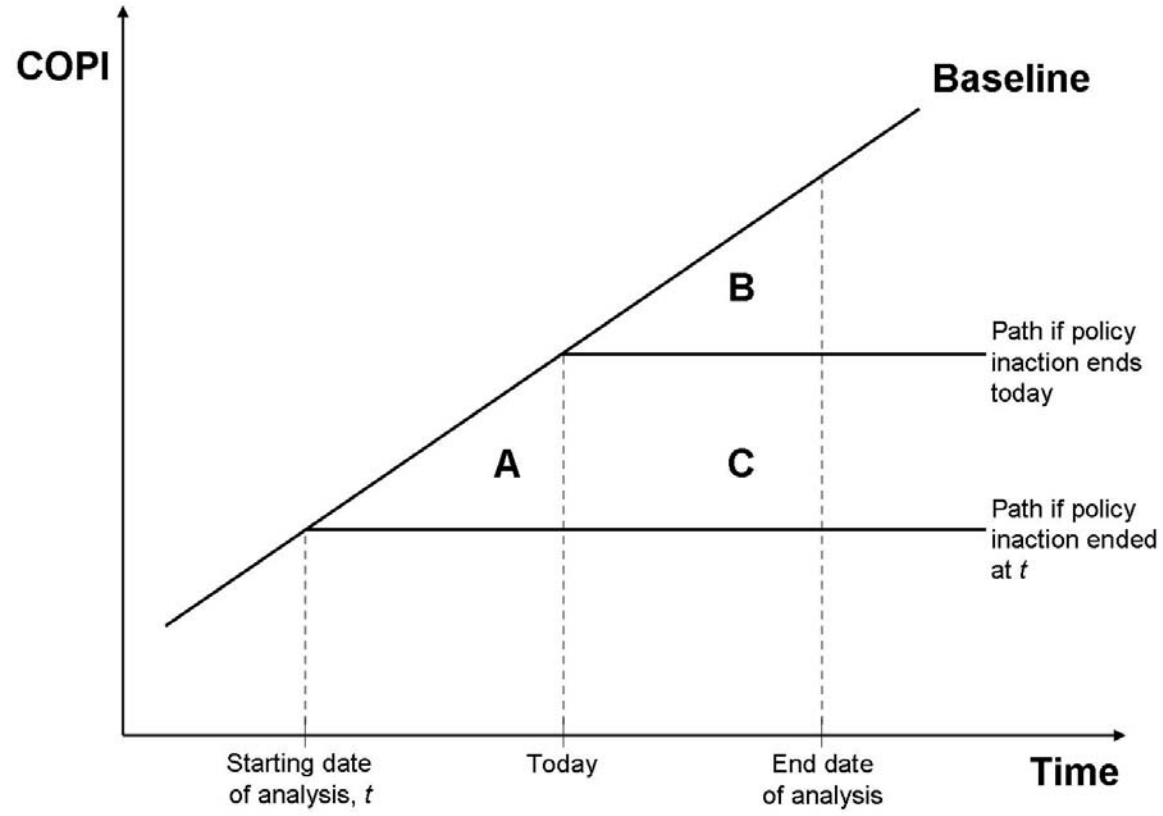


Figure 7: Total, past and avoidable Costs of Policy Inaction

The different calculations are of different value for political decision makers. The figures of total COPI give information about the overall importance of an environmental problem for society. To decide whether taking action should be considered or not, the narrower concept of COPI (area B) is the most suitable information. Only this figure provides information about the maximum gross benefits foregone that are associated with a given description of policy inaction. And only on the basis of this figure should policy makers attempt to rank different environmental problems.

Nevertheless one should recognize the following caveat when using only area B for COPI studies in the case of ongoing damage: if past costs of inaction are not included in COPI estimates, the longer one waits, the lower the COPI becomes. While single numbers would give a wrong impression about the problem, the dynamics of the time series indicate the importance of acting early. The use of different measures of costs regarding to this environmental problem are summarized in the following table.

Table 2: COPI measurements and implications

Area	Measured COPI	Implications
A	*Past COPI:* Costs of inaction that occurred *in the past*	Of minor importance for the actual decision making. Allows just an ex-post evaluation of environmental policy. (Have the right priorities been set?)
B	*Avoidable COPI:* Costs of inaction in the future that are avoidable	Indicates the gross costs that can be avoided in the future by political action now.
C	Costs that will occur in the future but have their roots in the past and can not be avoided by action now	Shows the importance of an environmental pressure and the consequences of not taking action in the past but gives no information about the usefulness of action in the future.
B+C	*Total COPI:* Total costs that an environmental pressure induces in the future	Shows the overall importance of an environmental pressure in the future by adding up all costs. Figures give only limited information about the usefulness of action – but emphasise the significance of the problem. Damage that is no longer avoidable may add to the necessity for policies to act on those damages that can be avoided.
A+B+C	Total costs of an environmental pressure: past and future	Shows the overall importance of an environmental pressure and gives information about the total costs caused by the ignorance of the problem (no action in the past or future). This information could be valuable if trying to decide if action should be taken sooner in a similar case, but it gives no information about the usefulness of action here.

3.5.4 Irreversible loss of environmental stocks

As has been briefly mentioned in section 3.1, some environmental damages that a COPI study would address are in principle reversible, other damages are not. For example, air pollution or noise would quickly disappear as soon as the source is removed. On the other hand, when a stock of deep groundwater is wholly or partly gone it is usually gone for the foreseeable future. This is true for most ‘stocks’ – for example, complete fisheries or a specific landscape. The environmental functions from such stocks fall away.

There are two aspects to this: a revenue stream that is gone for the foreseeable future as well as the ethical aspect of irreversible loss. Both can be addressed in terms of identifying or physically quantifying COPI. Even a COPI estimate in monetary terms would in principle take the irreversibility of loss of a stock into account, as good WTP (willingness to pay) studies comprise this. However, a proper COPI study would make this aspect explicit in its presentation in order to enable its users to judge the findings with this in mind and perhaps

apply their own weight. In particular, if irreversible loss is involved, the way discounting has been applied becomes crucial, as it determines how long in the future the loss counts.

3.6 Modular design of a COPI series

As we already mentioned, COPI studies are non-trivial exercises that need considerable data input. Often the available data is insufficient to derive COPI figures directly. Hence COPI assessments should be designed in such a way that as much of the data available can be used as possible, while new COPI studies collect data in such a way that it can have multiple uses. The following modular system of data collection will ensure these requirements are met.

The main advantages of this system are that a COPI study will produce multiple numbers, which may be difficult to communicate and may lack acceptance by the relevant decision makers, but it:

- allows sector specific costs (sectoral COPI) to be calculated
- allows component costs or service specific costs to be calculated, if a given political action would affect different environmental goods and services
- allows the quality of the numbers produced to be assessed
- provides valuable information for planning and designing actions.

For this purpose the costs of political inaction are broken down to potential sectors and components or services, see the following figure. In the figure the sectors refer to administrative sectors such as nature conservation, agriculture, human health etc. and topics stand for environmental goods and services. The topics and sectors chosen will depend on the kind of COPI undertaken.

In the modular system for COPI assessments, we recommend that partial assessments be placed in context. The grid is designed to classify the consequences of political inaction with respect to three criteria:

1. type of available data are environmental effects quantified or even monetized
2. type of impact (which environmental goods or services are affected)
3. sector.

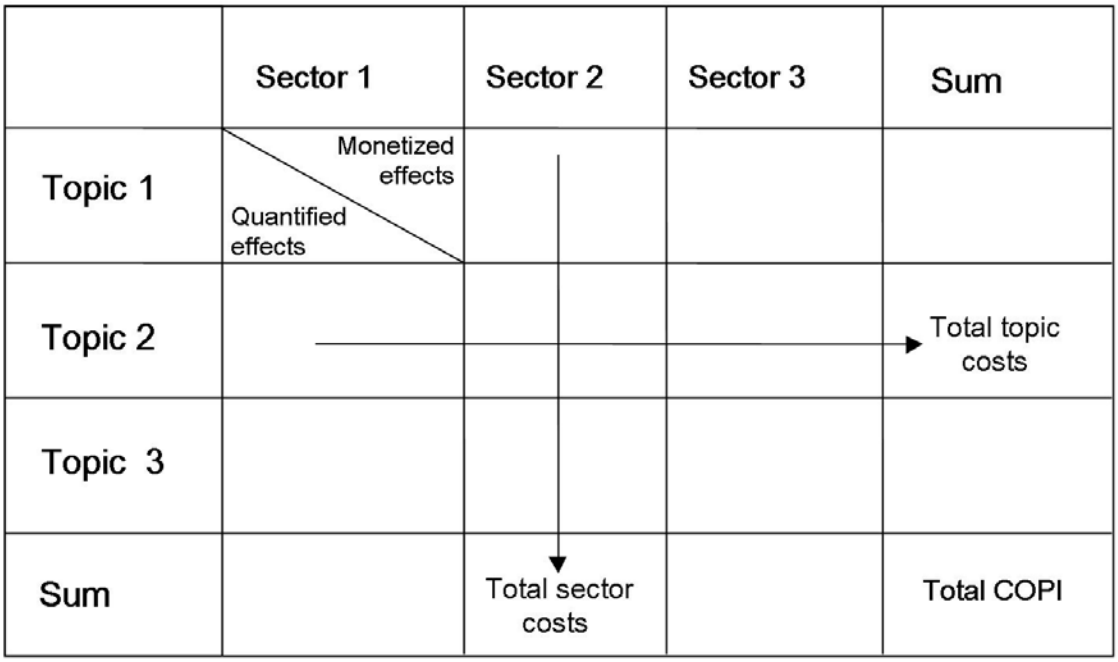


Figure 8: Modular system for COPI assessments

In principle, there is a choice as to choosing ‘sectors’ to represent sectors impacted by environmental degradation or sectors causing a problem . We recommend the latter, as this information is deemed politically more useful.

The matrix is set up with sectors as columns and specific components or services as rows, and every cell leaves the possibility to enter costs in monetary terms or quantified in physical or social terms. For any given row, summing across columns yields the total costs of that effect (e.g. the total costs of an invasive species in all sectors or the grand total). Similarly, in any given column, summing over rows gives the total costs of all components or services (e.g. invasive species or ecosystem service) in that sector. It is orientated along the line of green accounting.

Obviously, as with every system aimed at information aggregation, essential choices along a number of dimensions have to be coordinated. For example, base year, baseline, discounting system, mapping of driving forces, pressures, state and impacts would have to be consistent throughout the various partial COPI studies.

Organizing the available information in this way has two advantages:

1. by representing the specific costs related to the sector and component or service, one can quickly gain a general idea of how complete the current database is and where there are information gaps in the damage assessment.
2. the data-set can be used for partial COPIs. By examining the total costs of inaction per sector, one gets an impression of how relevant the environmental problem is for each sector. Thus a prioritization of action and better design of possible action is possible.

3.7 Benefits Transfer and Valuation Databases

Unlike smaller-scale Cost-Benefit-Analysis, COPI studies are generally likely to cover large regions, diverse sets of environmental impacts and extended time frames. At the same time, since COPI estimates will be used to assess the significance of a problem – and not to inform a choice between several alternative policy options, as a CBA would – the quantitative assessments in a COPI study need not have the same level of reliability and rigour as a CBA. Therefore, COPI studies will not usually involve the commissioning of original valuation studies, whereby the value of a particular environmental good or service is measured on-site.

Under certain conditions, previous studies of the value of environmental assets or ecosystems services can be employed to estimate the costs of policy inaction. This is referred to as 'benefit transfer', a method that has recently attracted some attentions by economists and policy makers. Pearce et al. (2006) define benefits transfer as "the use of values of a good estimated in one site (the "study site") as a proxy for values of the (same) good in another site (the "policy site")."

There are several advantages to benefits transfer. In cases where the time span and spatial area considered are large, it is easier and less costly to employ benefits transfer than to conduct an original study. Moreover, benefits transfer schemes are useful as a first approximation to determine if further investigations are warranted. This recommends it for the use in COPI studies, which are often about approximating the *magnitude* of an environmental problem rather than the exact level of expected costs.

However, several conditions need to be fulfilled if benefits transfer is to be successful:

- The conditions at the study site need to be reasonably similar to those at the policy site. This applies to the characteristics of the environmental good or service in question as well as to the socioeconomic conditions in the areas, etc. (see Bateman et al. 2000 for a more

thorough discussion)[7]. In particular, the transferability of results across country borders remains heavily contested – while this may be justifiable among similar, neighbouring countries (e.g. Sweden and Norway), a cautious approach is warranted for transfers across the EU or even for the transfer of results obtained outside Europe.

- The results of a benefit transfer can only be as good as previous estimates. Thus if previous estimates were not done well, i.e. if the methodology was flawed and the estimates are biased, the new estimates will not likely reflect the true values. Moreover, it is important to recognize that only small, incremental changes in the policy should be considered, because environmental valuations are done on a marginal basis. If marginal values are used to estimate total values or costs, the estimates will not be reliable.
- In order to search for relevant previous studies, there are several database sources available[8]. There are five main databases available for searching for previous studies. The largest database, the Environmental Valuation Reference Inventory (EVRI), was developed by Environment Canada and the US EPA. Over 1250 studies are available in this collection, including more than four hundred European studies. There are four other databases, each significantly smaller than EVRI, that are freely accessible on the internet. The information available in the databases, as well as organizational aspects and search methods vary by database. Annex IX - Valuation databases provides short descriptions.

Among the various databases available, EVRI sets the standard and is likely to be most useful in benefits transfer studies in the EU. It contains the largest number of studies, covers a wide range of environmental topics, and has the greatest geographical coverage. It is also a very well-organized database, well-worth the nominal fee required for access. If the study of interest is in Scandinavia, ValueBaseSWE is a good source for finding previous studies. RED is of limited usefulness because it covers very few studies. The Australian EnValue database and the NZNMV database from New Zealand are good sources for information for Australia and New Zealand, but neither are very relevant for applications in the European Union. A more thorough evaluation of their relative qualities is available in a recent survey by Lanz and Slaney[9].

[7] Bateman, I., A.P. Jones, N. Nishikawa and R. Brouwer (2000), Benefits Transfer in Theory and Practice: A Review and Some New Studies, Norwich, Centre for Social and Economic Research on the Global Environment (CSERGE) and School of Environmental Sciences, University of East Anglia.

[8] Clearly other relevant studies may exist that are not found in the databases mentioned, such as those by independent organisations or students. But one must be careful in choosing studies that were methodologically sound when using benefits transfer.

[9] Lanz, V. and G. Slaney (2005).

4 Experience to build on

This chapter looks at experiences with a number of studies that are relevant to the application of the COPI concept to environmental issues at the EU level. Some of these studies were actual COPI studies, like the ones on the marine environment and climate change. Experiences with one benefits study are included, because it resembles the COPI studies considered, in width, scale, monetization issues and perhaps in some communication challenges. Experiences with continental and global scenario studies are addressed, but only briefly, as this is in fact about several thousands of staff years over the past decades.

The following descriptions focus on what can be learned from these studies from the point of view of environmental COPI in the EU. They do not attempt to summarize the results of the cases. The final section of this chapter identifies a couple of insights from the material presented and for this chapter in particular, details and examples can be found in the interim report of this project.

4.1 Description of the cases studied

4.1.1 Marine Environment

The European marine environment is highly varied in its physical character, climate and biodiversity. The state of the marine environment continues to face a number of threats either from direct human activity (e.g. fishing) or from the impact of human activity (e.g. climate change) which have modified many aspects of its natural state in ways that are complex and often not fully understood.

The GHK report Costs of Non Action in the Marine Environment (2005) has explored the various pressures on Europe’s seas and provided an over-view of the way in which they have influenced the state of the environment in the past and are expected to do so in the future. It describes the costs that one would expect to be incurred if use of the European marine environment continues on a business-as-usual and policy-as-usual basis. The report adopts the Driving Forces, Pressures, States, Impacts, Responses (DPSIR) framework as a means of structuring the valuation approach given the variety of multifarious interfaces, their impacts and the costs arising.

A challenge in defining a ‘policy inaction’ scenario, and quantifying the associated risks and costs, is that it is, in reality, unlikely that there would be no new sectoral policies relevant to

the marine environment in the absence of the Marine Strategy. It is possible to explore the incremental benefits of policies that have been recently adopted, and of those in the pipeline which we might expect to come into force. The expected value of the future damage costs cannot, however, be adjusted for the impacts of policies that are not yet known about. A further challenge in quantifying the present level of costs and the projected trend of the policy inaction scenario is the need to define this in relation to the clean or pristine environment in which such costs would not be expected to arise. This definition of a 'clean' environment is likely to be highly controversial, requiring a judgement as to what is deemed to be 'clean'.

For example, coastal waters have, for many centuries, been used to transport goods and people and for fishing. What level of activity and related impacts from the past should be regarded as representing a 'clean' environment? Some comparisons with undeveloped areas might be possible, but there is an important judgement to be made about the reference baseline. This judgement was in part informed by the perceived risks of inaction since this dictates those features of the environment that should form the basis of the cost estimate. For example, the concern with the costs of failing to control over fishing, meant the baseline had to consider the 'natural' or 'normal' level of fish populations. One outcome of the COPI was that some of the perceived risks were found to be not well aligned with the available evidence base.

Of course it would have been possible to define the baseline with reference to known current marine conditions, and focus on future decline in the absence of action, but this would omit past costs and assumes marine policy action would only sustain current conditions rather than improve on them.

The report identifies social impacts (e.g. damage to human health), economic impacts (e.g. damage to tourism or income from fisheries) and environmental impacts (e.g. habitat loss or reduction in the diversity or abundance of species), although the links of cause and effect from driving force to impact are documented with varying degrees of precision. Natural processes shape marine ecosystems in ways that are not always fully understood and require many years of careful study. These uncertainties impact on the certainty with which the consequences of human action can be stated and changes in behaviour or anthropogenic pressure linked to environmental benefits.

The gaps in the results presented in the report illustrate that our collective understanding of marine ecosystems, and how specific parts of them would respond to particular pressures or stimuli, is imperfect. In practical terms this means the confidence limits around predictions of how the marine environment will respond to a particular set of pressures (and the damage costs arising) may be quite wide. Some of the recognized impacts on the marine environment arise from activities on which solid data are necessarily difficult to obtain but could be

improved with greater surveillance and monitoring – such as illegal discharge of oil and discards in the fishing sector. The data collected in this study, whilst imperfect, are sufficient to suggest that the cost-benefit equation of programmes to increase monitoring of such areas is likely to show a positive net benefit. The economic costs of use of the marine environment have received comparatively little attention.

4.1.2 Air Pollution

Air Pollution in Europe negatively affects human health and ecosystem services. A recent study estimated that in the year 2000, 370,000 people in Europe died prematurely, thousands of people were admitted to hospital with breathing problems, millions of people had to restrict their activities at least for some days because of minor air pollution related symptoms, damages to crops and materials totalled almost 4 billion euros, and thousands of square kilometres of European forests, semi-natural, and freshwater ecosystems were exposed to pollutant loads above critical thresholds.

The Cost of Policy Inaction in this area is that until 2020 there will remain very significant adverse impacts on human health and the environment from air pollution in Europe, even with effective implementation of current policies.

The Baseline Scenario of the Impact Assessment of the EU's Thematic Strategy on Air Quality is a good example of a COPI study[10]. It sets out a credible baseline, which takes account of the main economic and social drivers of air pollution and the effects of current policies. The quantitative assessment and valuation of impacts is based on a valid methodology and an up-to-date review of scientific and economic literature and has been exposed to international peer-review. In case of uncertainty over the correct valuation approach, the results of both approaches were presented. In case of difficulties in monetary valuation (or too much controversy around such a valuation), no monetary valuation was pursued. These pragmatic solutions to well-known problems in environmental impact assessment seemed to have worked quite well.

Assessment of the Policy Inaction Baseline constituted a major research project, involving many research institutes and also involving major consultation and review processes. The credibility and impact of the COPI estimate in this area can to a large extent be attributed to the thoroughness and transparency of the entire process. In this politically sensitive area, it is doubtful if a much simpler approach could have achieved the same impact.

[10] Amann, M., Bertok, I., Cofala, J., Gyarfas, F., Heyes, Ch., Klimont, Z. Schöpp, W., Winiwarter, W. (2005). Baseline Scenarios for the Clean Air for Europe (CAFE)

We therefore do not recommend to carry out an extra COPI study in the area, but to rely on the existing Thematic Strategy study.

4.1.3 Climate Change

Global Policy Inaction in Climate Change could lead to serious environmental, economic and social risks for Europe and the world. Global Policy Inaction can be defined as the failure of the world community to stabilize greenhouse gas concentrations in the atmosphere at a safe level, for example by the failure to restrict global temperature increase to a maximum of 2˚C above pre-industrial level.

A large body of research, periodically summarized by the Intergovernmental Panel on Climate Change (IPCC), has tried to identify, quantify, and to a lesser extent, monetize the damage costs of climate change. Some of the findings of the latest IPCC report are:

- Regional changes in climate have already affected a diverse set of physical and biological systems in many parts of the world.
- Natural systems are vulnerable to climate change and some will be irreversibly damaged.
- Many human systems are sensitive to climate change and some are vulnerable.
- Changes in climate extremes could have major consequences.
- The potential for large-scale and possible irreversible impacts poses risks that have yet to be reliably quantified.

Global estimates of damage costs are available for market impacts of gradual changes in mean climate variables (temperature, precipitation, sea level rise). Global estimates of market damages due to changes in the variability and extremes of climate change variables are scarce, while those of large-scale system changes and singularities are practically absent. Global estimates of non-market damages exist, but they are almost never expressed in money metrics.

COPI information on climate change is very useful as it reminds policy makers and the public at large on the urgency of the problem. Information on COPI of Climate Change is periodically reviewed in IPCC Assessment Reports. This includes specific information on Europe. According to IPCC (2001), risks for Europe include negative impacts on water resources, natural ecosystems, health and safety, with vulnerability highest in the south, in the European Arctic, and in mountainous regions. The IPCC Assessment Reports identify major risks and quantify them to the extent possible. They do not, however, try to express all risks in one common metric, such as money.

A COPI for Europe could be carried out along the lines of a methodology that offers flexibility in the selection of impacts, metrics, populations affected, and geographical areas (see Appendix on Climate Change). One issue that would certainly deserve further attention is the vulnerability of Europe for climate change impacts in other part of the world, through social and political instability and through trade and migration flows. A strictly monetary COPI for Europe, or even a monetary COPI range, would probably do injustice to the variety and basic uncertainties of the risks of climate change and would be very vulnerable to (justified) criticism, and therefore run the risk of defying its purpose.

4.1.4 Soil degradation

Soil provides a number of valuable ecological services, and various attempts have been made by agricultural and environmental economists to estimate the value of soil. The costs of soil degradation can be substantial, both in terms of on-site costs for the immediate users of the soil, and in terms of off-site costs, caused e.g. through the loss of ecological functions that soil provides. However, the economic assessment of soil degradation processes is complicated by a number of factors:

- There is a multitude of soil degradation processes: in its communication “Towards a European Strategy for Soil Protection, the European Commission distinguishes between eight soil threats: erosion, contamination, salinization, compaction, sealing, loss of soil biodiversity, loss of soil organic matter, and floods and landslides;
- Soil performs a multitude of environmental, economic, social and cultural functions that can be affected by soil degradation processes, and which can be grouped into food and other biomass production; storing, filtering and transformation; habitat and gene pool; physical and cultural environment for mankind; and source of raw materials. Not all of these functions are of direct social economic value, and not all of them are sufficiently understood. In addition, soil functions may be interdependent.
- The experiences in attaching monetary values to soil functions are unevenly distributed and generally limited. In the past, soils and their functions have mainly been researched from an agronomic perspective, so that e.g. the impacts of soil erosion on agricultural productivity are understood fairly well. Other aspects with less direct economic impact, such as the role of soil in the global carbon cycle, or the impacts of a loss of soil biodiversity, are much less understood. In many instances, it is not only the economic value of soil functions that is unclear, but even the soil functions themselves that lack a clear understanding.

To support the development of the Thematic Strategy for Soil Protection, the European Commission launched a research project to better understand the economic consequences of soil degradation in Europe. This research documented the agronomic focus of the existing empirical literature: most estimates of the cost of soil degradation focus on yield losses associated with soil erosion or soil salinization. For erosion in particular, some research has also tried to assess the off-site losses, e.g. through eroded sediment that leads to the siltation

of dams and waterways[11]. However, while the available evidence suggests that off-site costs can form a substantial proportion of the total cost of soil degradation, on the whole, the off-site impacts of soil degradation are not well understood. This applies in particular to non-use values attached to soil and to the valuation of the ecosystem services that soil provides. For soil contamination, there is some evidence on the clean-up cost, but very little on the costs of non-action, i.e. of leaving contaminated sites without remediation. Finally, for some other soil threats like soil compaction, loss of soil biodiversity, loss of soil organic matter or soil sealing, there are virtually no attempts to assess their economic impacts.

For an assessment of the costs of policy inaction related to soil degradation, it therefore appears that some soil threats more susceptible than others.

- Of all threats, **soil erosion** is best understood for on-site damages, with some evidence for off-site damages. Erosion is a dynamic and potentially irreversible process: if a certain part of the topsoil is lost, the process may become self-aggravating and impossible to reverse. Also, the driving forces and pressures are fairly well understood, as are the policy options to halt or limit erosive soil management practices. These aspects make erosion the most suitable soil threat for a COPI-style assessment.
- **Soil salinization** is a more isolated phenomenon than erosion, but is still fairly well understood and documented. Some research on the economic impacts of soil salinization, including impacts on ecosystem services, has been conducted in Australia. In Europe, experience is limited. A COPI-assessment of soil salinization is therefore feasible, but would require some original valuation work.
- Regarding **soil contamination**, the cost of failing to clean up contaminated land is highly site-specific. It depends largely on characteristics of the contaminant and its environment (type of soil, water saturation, solubility / mobility of the contaminant), as well as the socio-economic characteristics of the area. If, for a mobile contaminant, a failure to clean up leads to a spread of the contamination plume, e.g. thereby affecting water supply, the costs of inaction can be substantial. For other pollution episodes – e.g. an immobile contaminant in a clay-rich soil – the cost of cleaning up now or later may be the same. COPI studies related to soil contamination are therefore only feasible at the local level; an extrapolation of contamination-related COPI for larger areas is fraught with uncertainties.

Some common problems that a COPI study for any type of soil degradation will be facing are:

- **Establishing a baseline**: often, the knowledge is limited to the current state of the problem, whereas the future development – e.g. the impact of climate change on soil functions – is unknown;
- **Defining a policy action**: soil degradation is largely determined by land use policies and agricultural practices, which in turn are affected by agriculture policy. Rather than a lack

[11] see e.g. Evans 1996, Hartridge and Pearce 2001, Pretty et al. 2000, Riksen and De Graaff 2001

of policies (policy inaction), costs will rather be associated with the failure to correct flawed existing policies;
- **Aggregating different types and different qualities of information**, in order to account for the fact that some impacts are much better understood than others – but that the best-understood impacts are not necessarily the most sincere;
- **Dealing with the "known unknowns"**: some factors, such as the non-use-values of soils and dependent ecosystems, and the ecosystem services provided by soils, could account for a substantial part of soils' total economic value, but have been researched only very sporadically.

4.1.5 Terrestrial Biodiversity

The loss of biodiversity and its consequences for ecosystems have been extensively studied by ecologists and natural scientists, and much information exists about the drivers and consequences of biodiversity loss.

In recent years there have been several avenues of research on this theme:

- Analysis of species eco-system losses and consequent eco-system service losses – which have focused on the qualitative and quantitative, with a view of understanding the interconnections between nature and societal welfare.
- In some instances the above analysis has been extended to also look at the monetary value of the biodiversity and related services losses
- There have also been specific monetization- focused attempts at assessing the consequences of biodiversity loss on human welfare.
- In particular at the global level, progress has been made in communicating the concept of ecosystem goods and services as well as in producing world-wide projections.

The recent 'Value of Biodiversity Study' for DGENV has focused on the first two. This study looked at the whole set of eco-system services, whereas most other studies to date have focused on only at a small subset of eco-system services. For the former study, the lesson learnt was that there is in fact little monetary data of the cost of losses. From all studies, it is also clear that they focused on the existing value of existing eco-systems or species, rather than looking at and evaluating the losses. There have been very limited comprehensive ex post 'what was lost' type analysis

With regard to the third point above, the concentration has been on specific ecosystems and species (which are often outside the EU). So far the knowledge base of the costs associated with biodiversity loss is of varying quality, and such case studies are often of limited scope. The reasons can be considered on two levels:

1. Changes in biodiversity stock are difficult to quantify and to predict, because of uncertainty related to ecological “dose response curves” (such as minimal viable population, etc.); the input of external drivers (political framework, etc.); and the quantification of ecological services.
2. The monetization of these changes is a methodologically difficult task, since biodiversity generates a variety of benefits.

This is especially the case for non-use values of ecosystems/species, and option values (see the concept of the Total Economic Value, TEV). A further methodological problem that must be overcome is the irreversibility of biodiversity loss. Yet another problem is that economic tools cannot fully respond to the complexity of eco-systems. This does not mean that analysis is not helpful, just that the results from any evaluations using existing tools must be presented in the appropriate context. In additional, the links between biodiversity and eco-systems and eco-system services from the ecological side is in most cases still not fully understood (some interactions are multiple step, complex interactions, with various elements key to system stability) and again the analysis must make mention of its limitations and tools must take into account inter-temporal actions as well as irreversibility problems.

Due to the above mentioned methodological problems, monetized COPI studies are more viable for studies in which more ecological knowledge exists, and in which direct use values are involved. A common example where this is the case is the loss of biodiversity that can be used for pharmaceutical purposes or breeding. Another field of application would be the impacts of invasive alien species. Here direct use values often are found in the form of management costs or losses in for example agricultural production, or damage to infrastructure and human health.[12] If biodiversity is considered on the broader habitat scale, the assessment of costs and benefits becomes more difficult as the systems become more complex. Nevertheless for these systems, partial monetized COPI studies could be undertaken with respect to their direct use values (such as timber production). In addition, for these systems several case studies with respect to certain ecosystem functions are already available (such as nutrient retention for wetlands, water storage, carbon sequestration for forests). Of course these partial COPIs will only serve as a rough estimate of COPI for forest or wetland conservation, and are likely to largely underestimate the total costs of inaction. Nevertheless, these studies are useful to raise the cost issues, though care should be taken as to how the results are presented so that the right message comes across. Here it is vital that the results speak not only in economic terms, but also in terms of the types of services, the scale and number of the services (that exist, are at risk or are lost), the level of species and ecosystem and also identify who are the current beneficiaries and potential losers from this loss.

[12] This is only true for Europe where IAS are less responsible for the extinction of native species than in Australia or other regions. Here non-use values would come into action.

Invasive Alien Species (IAS) provides a good case to apply COPI to the problem of biodiversity loss. Globally IAS are one of the main causes of biodiversity loss, and the Convention on Biological Diversity urges each contracting party to develop a national strategy against IAS and gives a mandate as to what must be done to stop damage from IAS[13]. Therefore there have been many economic studies done on the topic, and further COPI studies would serve the purpose of giving an idea of the magnitude of the costs of inaction with respect to IAS control.

With regard to the fourth point above, the Millennium Ecosystem Assessment (see Annex VI - Terrestrial Biodiversity) in particular was successful in mainstreaming the notion of ecosystem goods and services. This assessment as well as the lesser-know second Global Biodiversity Outlook, which was commissioned by the secretariat of the Convention on Biodiversity, made progress in producing and presenting projections on a sufficient time horizon to see impacts of changes in key drivers and policies. The relevance for COPI is that as forward-looking COPIs require projections, they require spatially explicit modelling in a manageable form, and a brutally simple metric to evaluate the results over time and over biomes. The latter has to be much more aggregated than for example the current SEBI proposals. A metric like this is not easily agreed by ecologists. The Millennium Ecosystem Assessment applied species-area curves and the second Global Biodiversity Outlook uses mean species abundance, a new incarnation of the Natural Capital Index.

4.1.6 Environmental Acquis in Central Europe

This case - on the benefits of compliance from the implementation of the EU environmental acquis - is not a COPI study, though it does offer some very valuable lessons for COPI as it involves partly the same issues.

The benefits of compliance (with the EU environmental acquis)[14] work that covered the then 13 candidate and accession countries (2004 entrants, Bulgaria, Romania and Turkey) for the enlargement unit of DGENV of the European Commission proved to be a very valuable political tool for DGENV in its discussions with the then candidate countries. It was also understand to be a useful tool to improve the profile of the environment in the countries and give the environment ministries a tool to argue for greater funding. Key extracts from the work was also used by the Commissioner and Directors of DGENV in missions to the candidate countries. The work was also aired at Green week and also taken up by other

[13] Article 8h of the Convention on Biological Diversity stipulates that “each contracting party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species.”

[14] *Benefits of compliance with the Acquis Communautaire* by Ecotec, IEEP et al for DGENV. 2003

networks (green spider network) and received interesting from policy-academic field (institutes in Germany and Austria were keen on papers to discuss enlargement benefits[15]).

A subsequent study has already taken place – *the Benefits of Compliance with the EU Environmental acquis for Croatia* – and a further compliance study on FYROM and other Balkan countries has now been launches. It is not inconceivable that further benefits studies will be requested for further candidates. It Depending on political developments, it could make sense to have similar studies for Moldova and the Ukraine, if only to encourage them to adopt similar environmental laws, even if it turns out that the prospects of enlargement are not short or even medium term possibilities.

Within the benefits of compliance studies it was clear that certain things were 'easier' to do than others, and this realism was reflected in the Croatian benefits study, where the focus – on the monetary level – included only air pollution and water. Waste had been dropped as too complex and unlikely to come up with numbers that would be suitably understood. Budgetary limitations also played a part.

4.1.7 Integrated Environment Assessment on continental and global scale

Assessing the cost of policy inaction in the environmental domain largely builds on the assessment methods that have been developed over the past two decades. In the consortium, extensive experience exists with the compilation of environment assessments at European and global level. In fact, much of the modern assessment methodology in the environmental domain has been pioneered at these scale levels. From a perspective of the possibilities of carrying out COPI studies, the following observations apply.

Most of the studies referred to, such as the IPCC assessment reports; the Global Environment Outlook; and later the EEA State and Outlook reports, were scenario studies. Overall, there is now sufficient experience with forward-looking studies to develop a baseline or a different scenario as the basis for a COPI study. Making a no-new policies projection concrete will always involve widely varying opinions, but it has been demonstrated many times before that it is feasible and that the results are acceptable.

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[15] ten Brink P and A Farmer *Enlarging the EU and the Environment: Commitments, Progress, Benefits and Challenges* RAUM – Journal of the Austrian Institute for Regional Planning (OIR) Vol 53/2004 (March)

ten Brink P (2002) *The Benefits from the Implementation of the EU Environmental Acquis in the Candidate Countries.* Intereconomics, Review of European Economic Policy, Volume 37, No 6, November/December 2002 pp 287-292 Hamburg, Germany.

The model-based coverage of the various impacts (biodiversity, air pollution, etc.) has proved to be comprehensive enough for defendable overall assessments. This is so, even though quite a few themes are typically insufficiently covered or not at all, marine biodiversity, toxics, noise and industrial risks, to name a few, and a different scale of the analysis might have changed some of the messages of the assessments. In particular, infrastructure development seems underrepresented in the assessments available. Nevertheless, the results have been defendable.

One aspect that is very striking, when looking over the various assessments that have been developed in the last two decades, is the considerable delays between action and impacts that play a role. Intergenerational transfer seems to be the rule.

Regarding monetized benefits studies, it seems that findings in terms of money do not guarantee political attention, and the wrong timing of the study can still be fatal.

4.2 Insights gained from work done

Reviewing these experiences, what do they tell us about their respective areas of work?

The marine environment is one of those areas where there is less models and data than one would expect. Perhaps this has to do with policy being in a relatively early development phase. There is a Northern bias in the information, in particular in the availability of valuation studies. The example of the marine environment underlined that for some topics every reference point in time can be questionable. It also showed that a COPI study in this area can be done although it would not be easy and would require design decisions up front.

For air pollution, COPI studies can be done, be it that they prove to be amazingly model-intensive if consensus is to be obtained. Much can be monetized. A falling baseline may lead to the usual ‘half-full’, ‘half-empty’ interpretation issues.

For climate change, COPI studies can be done and can be useful but will not remain uncontested. Working towards a range of results can be considered. A COPI study that limits itself to monetizing damages for market values will not do justice to the issue and will run into all sorts of trouble. Distributive effects are very important.

Soils remain one of the most difficult topics, because of the diversity in local situations and in their problematic nature. Of the different degradation processes, erosion is best understood, both in terms of soil science and associated impacts. The facts that erosion is near irreversible and may lead to substantial on-site and off-site impacts recommend it for a COPI study.

Terrestrial biodiversity is – of course – a diverse issue. This is also true in the sense that available case studies form a jigsaw puzzle of non-fitting pieces and even a meta-analysis is difficult. What can be done quickly in terms of monetized COPI studies is the tip of an iceberg. The practitioners caution against single numbers and emphasize that results should be placed in perspective. A baseline scenario should be possible to construct but there is always a feeling of insufficient knowledge, in particular about what is causing what. The good news is that comprehensive model-based outlooks in physical terms are beginning to appear. In addition, valuation work can expect a boost over the coming years as a spin-off from the implementation of the Directive on environmental liability.

The study on the benefits of reaching the environmental acquis in accession countries showed that this type of study can be very effective if a number of traps are avoided. In particular, the lesson from this study is that aiming for The One Number is not a good idea. In the case of ranges, lower bound numbers were presented and placed in perspective. The team that did the study was selective in including environmental goods and reported to be happy with that approach. The study showed that monetized benefits studies can be done (this was not a COPI study). A baseline could be constructed. The study brought reminders that science moves all the time.

There is now some fifteen years of experience with integrated environment assessments. Constructing scenarios for baseline, do-nothing-extra and do-something-extra should not be a problem (although the approval process can be resource-consuming). As with the marine case, it can be hard to agree on the reference point in time from which costs will be counted. Quantitative models exist for many issues and are defendable even if they have big holes in thematic coverage. Striking in global studies over the past few years is the enormous delays between action and effect. (Section 3.5 outlines how to go about this in a COPI study.)

5 Examples of potential areas for analyses on the cost of policy inaction

One aim of the scoping study has been to generate ideas for the potential application of the COPI concept in relation to the environment and EU policy making. This chapter responds to this in three ways.

1. A simple administrative delimitation is provided for the sub-areas WITHIN the environmental domain that could be considered.
2. Four groups of COPI studies are distinguished.
3. Examples are given of COPI studies for each of these groups. The description of the examples focuses on the story that a COPI study would tell. Details will be given in Annex 1.

5.1 Which sub-areas to consider within the environmental policy domain

An important objective of this project is to generate ideas on how to assess the total of all environmental costs of policy inaction. In order to assess these costs, it is important to know what is meant by “environment”. A useful starting point is the website of the European Union that distinguishes the following environmental themes and sub-themes.

Environmental Issues/Themes of Concern to the European Community (case studies of this report are marked by **bold** print)

1. General Provisions
   a. Action Programmes
   b. Principles of Environmental Policies
   c. Environmental Instruments
   d. Application and Control of European Environmental Law
2. Sustainable Development
   a. Sustainable Development Instruments
   b. Integration of Environmental Policy
3. **Climate Change**
4. Waste Management
   a. Hazardous waste
   b. Waste From Consumer Goods
   c. Waste Issuing from Specific Activities
   d. Radioactive Waste and Substances
5. Air Pollution
   a. Atmospheric Pollution
   b. Land Motor Vehicles
   c. Other vehicles
   d. Industry

6. Water Protection and Management
   a. Specific Uses of Water
   b. Marine Environment
   c. Marine Security
   d. Inland Water
   e. Discharges of Substances
7. Protection of Nature and Biodiversity
   a. Biodiversity
   b. Fauna and Flora
   c. Forests
   d. Genetically Modified Organisms
8. Soil Protection
   a. Management of Specific Soil Types
   b. Discharges of Substances
   c. Activities Leading to Specific Risks
9. Chemical Products
   a. Dangerous Substances and Preparations
   b. Pesticides
   c. Fertilisers
   d. Control of the Risks
   e. Management of Pollutants and Waste
10. Civil Protection
    a. Environmental Accidents
11. Noise Pollution
    a. Sources of Noise Pollution
12. Environment: Cooperation with Third Countries
    a. Applicant Countries and the Community Acquis
    b. Enlargement of May 2004
    c. Cooperation with Other Third Countries
    d. International Conventions
13. Land use change
    a. Land use change. This is not listed as such as an environmental theme but is a dominant ‘intermediate’ factor for many endpoints such as biodiversity and civil protection, as in flood protection.
    b. Landscape. The aesthetic and cultural value of landscape is not listed either but is an important aspect when it comes to valuation.

Many of the sub-themes are themselves split-up in sub-themes of sub-themes and specific action programmes and Directives. The classification might help to prioritize COPI studies on the basis of the position of the themes and sub-themes in the policy cycle. Concretely, on which themes and sub-themes are important decisions expected in the near future? In a recent preliminary EU work program for 2007 the following key areas of action are mentioned. These sub-themes are therefore of immediate importance for the EU (without suggesting at this moment, of course, that other sub-themes are not).

5.2 Concrete examples of potential application of the COPI concept

For a number of examples, a brief suggestion is given below of what the potential story from a COPI-based study could be. For some of these examples somewhat longer descriptions, including initial suggestions for the methodology, are given in Annex 1.

5.2.1 The total of environmental cost of policy inaction

An easily accessible non-monetized overview

Quite a number of integrated environment assessments have appeared in the past ten years. In parallel, the applied science of making these assessments has developed into a 'school' with its own scientific journals, conferences and a place in university teaching and research. The assessments typically work down a series of issues and regions, allocating smileys or traffic lights. Very roughly speaking, the picture remains mixed in Western and Central Europe, not deeply analyzed in pan-Europe; and outright gloomy in non-OECD regions. But it remains difficult to convey the overall picture in a way that reaches the general public. This is because of the complexity, delays, regional specifics etc. Arguably, it would be in the spirit of COPI to make an ambitious attempt at simplification. This could be based on a drastic selection of issues and this idea is somewhat elaborated in Annex I. We can imagine two approaches. Firstly, European issues for the next 25 years could be summarized as the average picture of the assessments that have appeared over the last five or ten years. Secondly, a little more focused, a panel-based rating of the risk to economies in the various regions of the world in the format that credit-rating tends to use. In the latter case, the story to be told would be that a large problem, such as a political liability, is growing because of the unequal distribution of these impacts.

5.2.2 Key sectors causing environmental losses

Transport

The road transport sector accounts for 19% of EU-25 greenhouse gas emissions. Despite long-standing policies to change travel behaviour, too little is being done at too slow a pace to control the growth in vehicle kilometres. In 2003, these totalled more than 6.5 billion km, having grown at an average of 2% per year since 1995. Improvements in fuel emissions and the efficiency of vehicles are being offset by growth in the distances travelled so that road carbon dioxide emissions continue to increase over time. This not only has a negative impact in terms of the environment and human health through global warming and air pollution but also has costs on economic competitiveness as the congestion wastes time and impedes connectivity.

Fisheries

Fish are a source of important nutrition and welfare and our fish stock and those of other countries are routinely being over-fished, leading in cases to the collapse of the stock itself

(e.g. Cod). Short term gain by individuals led to tomorrow's loss by all. It is an increasingly well known story that needs to be retold – how there is a need for proper governance of our common good, and decisions need to reflect the true sustainable development goals; decisions that compromise the future of this common good should not be allowed – whether in by-catch, wrong use of techniques, illegal over quota fishing, or indeed the overall allocation itself. Examples of where it went wrong and the costs associated (lost earning, lost jobs, lost livelihoods) are need as are estimates of the costs of what could go wrong. This is a story not just for EU fish, but also for EU fishing and the international dimension, given the inter-linkage between development and fishing. The new sustainable development strategy requires the international dimension to be taken into consideration, and a COPI on fisheries is a good case to put this into action. Modelling to support this is becoming available.

Household consumption

Household consumption has become increasingly important as a driving force of environmental pressures – partly because classical sources of pollution such as in manufacturing have been brought under control over the past decades. Moreover, consumption by households is increasing more than proportionally to the number of consumers. Household electricity use is a case in point. Globally, the increase of meat consumption with income is a key factor in the near impossibility to prevent the ever-continuing decline of biodiversity. Past and present housing preferences, together with a considerable involvement of national governments and other players, are already determining an important part of our future domestic energy use – reducing future options. On the other hand, household appliances lend themselves to relatively quick improvements and policy interventions can be helpful in securing these gains. A story to be told could be that direct, on-site pressures from household consumption are bound to increase both in relative and in absolute terms. However, rather than through a COPI study this story could probably be more convincingly be told through life-cycle analysis of consumer products – perhaps even the ecological footprint. In addition, the behavioural aspect could be more effectively put on stage by highlighting differences among comparable groups of consumers than by an aggregation-based method as COPI. In short, COPI does not seem the most logical method for this issue.

Demographic change in Europe

Of the demographic developments in the EU in the medium term, two components are important because they will change pressures on the environment. Firstly, ageing. Among the possible effects will a change in housing preferences, in particular location preferences. A boom in tourism for the next decades is also being quoted. The concern is that a temporal strong increase in demand for housing and other facilities in semi-rural areas is not well managed and lead to changes in settlement pattern that later on might be found undesirable but irreversible. Secondly, migration. Assumedly, environmental aspects of migration within the EU can best be addressed in the more complete context of regional economic development – for example, in new member states (from EU-25 to EU-27). On the other

hand, there is the environmental impact of labour migration to the EU. To the extent that future policies on population and labour supply make a difference for the effective population of the EU, they make a difference to the aggregate pressure on the EU environment and the same holds true for an absence of effective policies. Cost of policy inaction could provide a methodological starting point if for example an issues paper would need to be produced or part of an impact assessment. Whether it would be politically sensible to estimate for example the environmental cost per extra inhabitant is another matter.

Land use decisions

Land use changes in the EU at a fast rate. The potential for future change is particularly large in central Europe, in view of structural change in agriculture, influx of regional support and the like. But also in Western Europe the rate of change is high. The dynamics are complex, with various driving forces that mutually react as well. Important factors are settlement trends, location trends for medium-size enterprises; leisure; mobility and many other ingredients of regional economy. Policies at every scale level influence European land use change in some way: from global agreements on reform of agricultural subsidies, to EU level decisions on cohesion funds to local zoning decisions. Spatial patterns in relation to mobility are theme in the Sustainable Development Strategy. A key reason to consider COPI for highlighting the overall issue of land use decisions is that many of the changes involved (broadly termed artificialization) are in practice irreversible. Given the complexity and variation across the EU, a COPI study can only flag the importance of the issue – but that seems precisely fitting. Two stories can probably be told. Firstly, that current land use change is rapidly diminishing future options, for biodiversity, adaptation to climate change and preservation of heritage. In a way, land use change is the common factor between many issues. Secondly, that there are many policies influencing land use change in the EU, including an indirect but powerful influence from global and EU-level policy decisions.

5.2.3 Wider policy targets

COPI of not meeting the 2010 biodiversity target within the first half of this century

Biodiversity provides benefits for society on different levels as many economic valuation studies have demonstrated. Hence the avoidance of further losses should be a priority item on the political agenda. Nevertheless the political action in the past has not been sufficient as it becomes clear that the 2010 biodiversity target will not be met. One reason for this is that the drivers of biodiversity loss are manifold, related to various sectors outside nature management. Next to the raising awareness of the consequences of not meeting the 2010 target globally, COPI studies could help in setting priorities within the field of biodiversity conservation in the EU. This could be done by the use of highly aggregated physical indicators, showing changes per biome and per pressure factor.

COPI of not curbing excess nitrogen loading

Failure to address nitrogen run-off from agriculture will lead to groundwater pollution, more eutrophication and more 'dead' zones in rivers, lakes and coastal areas, which in turn will lead to loss of animal life, and the destruction of eco-system services (fishing, recreation etc). Related ammonia emissions add to acidification. Farmers gain, elsewhere pain. Nitrogen loading from other sources (power generation via deposition from the air, human consumption via waste water effluent) does not help, but agriculture dominates the issue. This is a problem with long history of political discussion, high pressure, good information basis and many studies; this is a good opportunity to estimate the cost in monetary terms. COPI results could directly feed the high-level policy relevance discussion about further CAP reforms.

5.2.4 Specific environmental goods and services

COPI of not protecting groundwater

COPI related to over-abstractions of groundwater – high pressure in some regions (like Spain, Mediterranean Islands), good information basis/many studies, high confidence of results – policy impacts fairly predictable (e.g. extra costs for agriculture or water services when saline intrusion occurs); BUT problems in estimating the non financial costs of saline groundwater or dropped groundwater levels.

Invasive Alien Species

COPI of not taking action or no effective action against Invasive Alien Species – relevant topic (high pressure and no real idea how much effort should be spent in the mitigation), good information basis/many studies, BUT: high degree of non-use values involved and hence tricky to generate numbers. Also: no clear linkage to any particular policy programme / strategy.

COPI of soil degradation

COPI of not protecting soils – a neglected topic where a COPI could stimulate a discussion. Some benefits pay off in real monetary terms. The information base is fairly well developed for erosion, but less so for salinization or other threats. There is some urgency in the case of erosion.

6 The scope for COPI studies

It is highly conceivable that DG ENV will use the concept of cost of policy inaction (COPI) to raise awareness of the importance of certain issues and the urgency of taking action on these issues.

COPI has to be applied correctly. The most important aspect is to design a COPI study for a given issue according to the nature of the problem: how much consensus is there on the issue and how hard is the information available? A COPI study should be tailored as follows.

For issues such as climate and biodiversity that are characterized by divergent views across the globe and little certainty about the knowledge available, it is particularly important to keep including difficult aspects such as non-use values, risks and critical stocks. In other words, the tendency to limit such COPI studies to indisputable elements should be resisted.

On the other hand, there is also scope for COPI studies on specific, hard-to-dispute issues in the environmental domain that will have an impact in the near term if no action is taken – for example, specific soil degradation and groundwater problems.

A promising option is to carry out COPI studies for key sectors on all environmental damage caused by each of these sectors.

It is important to remember that many people will associate Cost of Policy Inaction with Cost-Benefit Analysis. This is wrong, but the confusion seems unavoidable. While Cost Benefit Analysis is a standard part of policy appraisal, which is applied once options have been identified, Cost of Policy Inaction is a typical instrument of the early phases of policy development. In presenting information on the Cost Of Policy Inaction this is perhaps a lesser problem. However, contractors need to be steered precisely. For this purpose a methodology checklist is included in this study.

A possible structure for a programme of studies that could be carried out by DG ENV into the Cost Of Policy Inaction is as follows:

- The total of environmental cost of policy inaction
- Key sectors causing environmental losses, such as transport
- Wider policy targets, such as the 2010 biodiversity target
- Specific environmental goods and services, such as groundwater over abstraction

For developing such a program, a start could be made with small to medium size projects. Examples of promising topics are provided in chapter 5. COPI studies on key sectors causing environmental losses are also a promising option, both in terms of the knowledge available that can be expanded for some sectors. In this cases it also clear who the report is targeted at.

It is realistic to see individual COPI studies as essentially one-off projects, providing input into an agenda-setting discussion.

Possibilities to be considered for deepening the method include using a time-explicit COPI analysis to illustrate cost of delay of policy action. This can be done if the delay is somewhat independent of the specifics of the policy action, as in climate change. Furthermore, a modular set-up can be considered in areas where many partial studies are typical, such as soil degradation. This would allow a body of information to be built up over time and would help to put partial results in context.

Annex I
Elaborated examples of potential areas for analyses on the cost of policy inaction

The examples that were briefly mentioned in chapter 5 are somewhat elaborated here to give an idea of the methodology and the level of effort.

In the spirit of producing ideas an important output of this study, not all of the examples have been fully integrated. For example, on the issue of biodiversity loss, a short write-up on model-based possibilities has been added to a description of a literature-based approach.

In the same vein, no attempt has been made to harmonize the styles in which ideas on possible stories have been formulated. Thus, neutral and activistic wording co-exist in this annex.

The total of environmental cost of policy inaction

An easily accessible non-monetized overview of the total of environmental cost of policy inaction

What is the story that can be told?

Variant A) The environmental cost to the EU of worldwide policy inaction can be bearable but large, if risks and adaptation costs are considered.

OR

Variant B) The environmental cost of policy inaction can be large and will be very unevenly spread between the regions of the world. In an increasingly globalized world, letting this develop will build a liability.

What are the issues and context?

Some issues move in the right direction, such as long-range transboundary air pollution or specific chemicals. But most issues are either stagnant problems or moving in the wrong direction – for example, urban air pollution, landscape, biodiversity, climate change. In particular for climate change, some sectors and areas in the EU will have larger problems relative to the US; for other sectors and areas it will be the other way around.

Specific to variant B) Differences in vulnerability

Links to existing legislation or policies

Speaks to the objectives of most EU policies including cohesion policy. Will illustrate that for example multilateral environmental agreements and the sustainable development strategy are not effective if the undercurrent of societal trends runs the other way.

Specific to variant B) External dimension of the sustainable development strategy

Who is the audience?

‘Brussels’, including lobbyists. Financial press. Banks and insurers. General interested public.

Methods

Variant A)

Step 1: from recent outlook studies (GEO, EEA 2005, ACACIA, INFRAS, EURURALIS) and draft upcoming global assessments, filter the outcomes that are most serious in terms of

- human population impacted;
- area impacted;
- severity and duration of impact.

Step 2: Take an average of the scenarios up to 2050

Step 3: Write up the story in terms of damage incurred (text, illustrated with numbers in physical terms)

OR

Variant B)

Step 1 and 2 as variant A

Step 3: By global region (e.g. Western Europe, North Africa, ….) identify

- Exposed sectors (agriculture, tourism, open sea fisheries, …)
- Size
- Wealth as GDP/cap in a PPP
- Institutional strength
- Educational attainment if available

Step 4: Let a panel duly protocollized assign risks to the economies by region on a semi-quantative scale:

AAA = no significant risk
AAB = some risk in one sector
…..

Things to be careful about

The panel should be set up in consultation with, or by, experienced people from the financial sector. A strict protocol should be developed and applied.

Review: whether or not to go for review should be a conscious step. Distribution as a draft could be considered.

A risk to be avoided is to leave aside hard-to quantify risks.

Data needs and availability

Recent assessments and drafts of upcoming assessments including the underlying economic projections

Institutional strength: Indicator set for Global Economic Forum (Esty) and Institutional Development database of Kaufman & Kraay

Outputs

- a 30 page booklet
- downloadable PowerPoint presentation
- a regional contribution to the 2007 global environment-related assessments

Likely timescale and costs

Sizeable effort and production time. In variant A, editing and artwork will require most resources. In variant B, preparing and operating the panel will require most resources; if a review needs to be carried out, this will add to resource requirements and production time.

Key sectors causing environmental loss

Growth in private transport

Growth in private transport is unsustainable, leading to environmental impacts, congestion and related health, social and economic burdens

What is the story that can be told?

Headlines could be:

No move to accelerate reductions in private transport / increase use of public transport will lead to no movement on the roads!

Inaction implies unsustainable development with increasing GHG (climate / environment), worsening air quality (environment) and health (human), less time for other things in life (social), and a failure of cities as efficient economies and loss of related economic prosperity (economic).

Failure to limit growth in private road traffic has a major impact on climate, health, social cohesion, viability of urban areas and hence competitiveness

What are the issues and context?

Road transport (passenger, goods) is growing and problems associated with it also – GHG/climate, urban pollution, health impacts, congestion, competitiveness losses. Despite long-standing policies to change travel behaviour – too little is being done at too slow a rate of change. Changes are not enough to control growth in vehicle kilometres, with increasing congestion, attendant environmental costs and with the costs of a loss of competitiveness as congestion wastes time, constrains the efficiency of cities and impedes connectivity.

Stories can be told focusing on emissions and climate, health and health impacts, social impacts, congestion and impacts on output and competitiveness. All stories are valuable to communicate and can be used to encourage action at EU, member state and municipal level. Solutions to the issues – climate, health and congestion – are the same in some cases, but can be different – but that is an issue for policy appraisal.

Links to existing legislation or policies

EU – road pricing framework – PPP. Also EU wide technology. Public transport investment. Also DG Region – use of Structural Funds and ESPON to influence policies to curb travel demand.

Other policy links:

- Euro IV etc already there and useful. More pressure needed on NOx.
- CARS21 high level group
- Passenger car strategy – Automotive manufacturer self commitments + national fiscal measures + labelling.
- ETAP and ambitions for green public procurement

Member states – current policies not working – accelerate technology and 'hearts & minds' adoption of road pricing and public transport investment

Who is the audience?

- Other DGs – especially Region and Transport – also DG Emp (health/exclusion)
- Member states - link to Sustainable Development and climate change planners and Lisbon leaders.
- Regions / Municipalities – spatial planning, economic development, transport planning

Methods

a) availability and suitability

- Impacts of emissions on climate and health
- Impacts on competitiveness

There is quite solid data on vehicle emissions, the dose-response function for exposure to pollutants and also generally quite good information on pollution levels in cities. It would be possible to develop an order of magnitude picture of what numbers of respiratory diseases and cases of early mortality could be expected from lack of policy action.

There is also increasing information on congestion levels and some prognoses for future congestion for certain cities. It should be possible to come up with a loss of time and loss of equivalent output estimate so as to highlight the issue. Qualitative analysis of the costs of congestion on economic efficiency of cities.

b) things to be careful about

Attempts at too great accuracy – misleading, time consuming and not really possible. Also:

- availability and suitability – Q of spatial unit of analysis – for emissions and related costs it is vehicle or passenger /tonne km, aggregated to the level of a city of given population and density. For benefits foregone of more efficient cities – the unit of analysis of the city
- units and measurement – the focus is on highlighting the order of costs and forgone benefits of a failure to take more radical action. These do not need to be additive – the focus is on the individual parameters (e.g. GHG from vehicles will be x% higher than current levels on present trends)
- trends – argument is about delays (in reducing GHG, in improving connectivity), instruments – we are not evaluating the specifics of particular instruments such as pricing so we do not include estimates of revenues for given prices / and implications for diversion / public transport
- use of case studies rather than first principles – London is obvious example – to identify possible order of costs from not taking action

Data needs and availability

For a certain number of cities where the focus is to be:

- population numbers (conceptually trivial but surprisingly much work in practice)
- vehicle emissions (easily available)
- dose-response functions for pollutants (easily available)
- level of pollution in cities (general numbers easy, detail for where in cities more difficult – would lead to time consuming estimates)
- actual exposure levels (a broad estimate is needed; though could check dispersion models to see if nuance is possible)
- actual extended journey times due to congestion and value of time (readily available from traffic models)
- ‘added value’ of efficient cities – investment, connectivity – use of comparative use of case studies

What can be said?

The failure to stabilise the use of cars / private transport is costing the EU X billion euros a year, and leading to a loss of competitiveness with US (where land is more freely available).

Focus on 'big picture' numbers to gain attention.

Monetary: Private transport share of carbon emissions and related impacts. Heath costs due to morbidity and mortality. Congestion losses and loss of time, and impacts on economic efficiency.

Quantitative: number of hours wasted in traffic jams, numbers of cases of chronic bronchitis, asthmas and early mortality from exposure to pollutants.

Qualitative: Social impacts from reduced time for other things in life. Economic costs from loss of connectivity, and related loss of the development of business linkages and competitiveness.

Methodology

- Agree coverage of work and methodology, which includes type of messages and level of data robustness behind it.
- Literature review to get up to date dose response functions.
- Literature review to get up date on methods applied and results.
- Obtain data on selected cities (Which raises the question as to whether the cities should be part of the steering group/volunteers etc).
- Calculate probability of increased morbidity and mortality from the combination of population and pollution levels – which leads to probably numbers of different illnesses and gravity of these.
- Calculate the monetary values of the impacts.
- In parallel, look at number of hours in traffic and traffic levels (share of population, number of cars) and losses from congestion.
- For the x-million hours loss apply an average wage and average productivity value and use as a basis for calculating losses.

Outputs

- Messages that city health and welfare is sensitive to decisions taken and that decisions can be taken. It is not a case of simply accepting the inevitable. Congestion and health impacts are not inevitable.

If we, the policy makers, municipal authorities and regional development funders fail to take the decisions, we will be faced with unsustainable development, with loss of economic, human, social and environmental capital. Loss for economics in terms of output and competitiveness losses from congestion, social losses due to time lost for family/friends/amenity/social interaction and contributions, human losses due to illness, and environmental losses (GHG and climate change, pollution on health, on city surfaces etc).

Likely timescale and costs

Depends on the focus and the ambitions

COPI of not meeting the 2010 biodiversity target (not halting biodiversity loss). A literature-based approach

What is the story that can be told?

There are a number of different stories that can be told here, with headlines such as:

- Tipping over the edge – what a loss of ecosystems and species means for humanity.
- Fewer eco-systems, fewer services, fewer benefits, more costs
- Losing species, weaker eco-systems,
- Diversity of species, diversity of use.
- Losing ecosystems and species, eroding our natural capital, compromising our future
- Declining species and populations, lesser genetic diversity and higher risk of food security problems

Overall suggestion: Missing the target will lead to losing ecosystems, losing species, losing some of the natural capital that underpins our societies and hence compromising our future. Goods and services from the ecosystems will be lost, leading to economic losses and social losses. We undermine our development potential and societal welfare by not halting biodiversity loss.

What are the issues and context?

Species and habitats and associated ecosystems are being lost and the losses are compromising the sustainable development of our societies and economies. The loss of a habitats and species generally has a much greater impact that simply a habitats/species lost, but there are also losses due to the value of that habitat/species – in the provision of goods or services – e.g. fishing, or bees for honey, amenity, attraction for tourism, and the often complex inter-relation with other parts of the ecosystem (e.g. the species lost may be a predator that kept a pest in check).

It would be useful to look at cases where species loss leads to losses of eco-system services – and going beyond the cases in the *Value of Biodiversity* study which started this work – with a broader selection of cases and ideally a more in-depth look at several cases to allow real local progress with the issue. It is also worth reiterating and developing more the arguments demonstrating that nature and ecosystems are a key foundation of our societies and important to safeguard. It would also be useful to look at

the decision making processes and tools which could be improved to help avoid the wrong decisions. This would therefore be a type of three part COPI – with:

- Part A: Not meeting the 2010 targets – what are we losing? Looking at where there are losses that will not be stopped, and the range of reasons for this, the general consequences and values associated. This is a context setter based on MA and biodiversity value report and also is the place where we make the explicit link to the 2010 target.
- Part B: Case Studies. This would expand the past work to make sure that the full range of losses / problem areas are covered (for example also consider grasslands and agricultural ecosystems that have been less covered so far) and also look more in depth at half a dozen specific cases of particular interest (e.g. demonstrating the inter-connection of species and the knock on effect when one is lost). The case studies would be a type of mini-COPI.
- Part C: that looks at decision making (e.g. use of SWOTs in regional development) and tools (e.g. payments for environmental services). This part is not really a COPI, but rather a response to a COPI.

The lessons should be such that SD strategists should integrate this more into their thinking.

Links to existing legislation or policies

- 2010 target of halting biodiversity losses
- Natura 2000 and Birds Directives
- Regional development funding

Who is the audience?

- EU and national policy makers
- Regional and local policy makers and planners
- SD strategists
- Evaluation Community

Methods

- Could build on the Value of Biodiversity work and the Socio-economic benefits of Natura 2000 work.
- Methods would include: literature review; case study interviews; economic valuation.

Things to be careful about

Be careful not to do simply ‘grossing up’ calculations to come to EU overall values without thinking carefully about how representative the selected species choice was

Data needs and availability

- General data on species/habitats loss for the context setting and link to 2010 – this would be a literature review / synthesis. There should be the data out there (EEA etc)
- Availability: very much species, ecosystems and country dependent. There is often less monetary data available, and real efforts would be needed to develop this (not infeasible for the more in-depth cases).
- A selection of different ecosystems / species types and associated mini COPIs would have to be made to ensure suitability for the type of message that can improve the decision making

What can be said?

Monetary: It should be possible to come up with some useful examples from across Europe from existing studies. Some own research would be needed to obtain new data, but this could be worthwhile. Depending on the budget some new monetisation should be doable.

Quantitative: It should be possible to have reasonably good data for selected species/eco-systems – in terms of number lost, and losses of eco-system services and related activities associated with these. It will not be possible to do a whole EU wide assessment.

Qualitative: as per description – a range of different messages possible.

Outputs – present likely outputs and points of emphasis and key value added

- Synthesis report – with Parts A, B and C as noted above.
- Stand-alone case studies.

Note that it could be possible/appropriate to develop some thematic synthesis mini-COPIs – e.g. focus on certain ecosystems with particular stakeholders/target audience involved (e.g. grasslands or agricultural ecosystems).

The overall report would be a general tool to make the point that losing ecosystems and species, eroding our natural capital, and compromising our future – in other words it is a call for action. The 2010 is the first serious target and we are in serious danger of missing it – even if (when) we miss it, we should not simply give up but use the failure as a motor for action.

In it is possible to have a thematic synthesis - grasslands ecosystems losses or agricultural ecosystems or natural capital in risk prevention – then it would be possible to have a more focused report, targeted at a specific audience and hence get more traction. For the agricultural side this could be valuable given the potential links to and payments for environmental services. For grasslands it would be valuable as many argue that an often overlooked eco-system.

Ideally there would be an overall report + two or three targeted reports.

Likely timescale and costs

- A simple extension of the value of biodiversity work and to build up into a COPI could be a moderate piece of work over a moderate time period.
- Additional in depth cases studies – could be small assignments, spread out in time –including involving local stakeholders in the work to as to ensure that there is some influence on decision making. Particularly interesting could be:
    - Water purification and avoided pre-treatment cost
    - Floodplains and flood prevention/mitigation *(this is now a key a key area for regional development funding)*
    - Grass lands
    - Agricultural biodiversity
    - Avalanches/mud-slide avoidance
    - Forestry and fire avoidance *(this is now a key a key area for regional development funding)*
- Targeted reports – could be an additional small assignment each, assuming that it will be possible to build on the above cases studies and 'simple extension'. If these were deliverables on their own then it would take a moderate assignment (one would need two in depth case studies, complemented by a wider selection of lesser detailed case studies and a general issues section).
- Decision making module, could be an extra small assignment depending on how comprehensive one wishes to be as regards decision making processes and recommendations and the level of involvement of different stakeholders in the process so as to obtain some active involvement/buy-in

There are therefore options. Given the importance of the loss of biodiversity and the 2010 target, it makes sense to go in-depth to provide new and stronger argument for action. The specific focus reports are of particular value added – for example in synthesising the data on the natural capital in risk management. The particular benefit of the last example is that it focuses on practical management and policy aspects rather than taking an eco-system focus (in the title) that would lead to a different audience being interested.

Useful References

Kettunen, M. & ten Brink, P. 2006. Value of biodiversity- Documenting EU examples where biodiversity loss has led to the loss of ecosystem services. Final report for the European Commission. Institute for European Environmental Policy (IEEP), Brussels, Belgium. 131 pp.

MA - Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC. 100 pp.

ten Brink P, C Monkhouse and S Richartz *Promoting the Socio-Economic Benefits of Natura 2000.* Background Report for European Conference on *"Promoting the Socio-economic Benefits of Natura 2000"* Brussels 28-29 November 2002 IEEP 2002, www.ieep.org.uk

Cost of not halting the long term loss of biodiversity in the EU. A model-based approach

What is the story that can be told?

The measures currently put in place will be largely insufficient to halt the loss of biodiversity Europe. This is because pro-biodiversity policy is not sufficiently integrated in other policies, in particular agriculture and cohesion policy.

Policy inaction threatens to erode biodiversity policy. Turning that around is a long-term challenge. Therefore, a mechanism of monitoring and correction needs to be put in place.

What are the issues and context?

Biodiversity provides benefits for society on different levels as many economic valuation studies have demonstrated. Hence the avoidance of further losses should be a priority item on the political agenda. Nevertheless the political action in the past has not been sufficient as it becomes clear that the 2010 biodiversity target will not be met. One reason for this is that the drivers of biodiversity loss are manifold, related to various sectors outside nature management.

Links to existing legislation or policies

In May 2006 the EC presented its Communication on halting the loss of biodiversity by 2010 and beyond (COM (2006) 216 final), including an Action Plan. The proposal will be discussed by Council and European Parliament in late 2006 and early 2007. It emphasis the need to apply existing instruments in a more biodiversity targeted way. Implementation of the plan will certainly be long-lasting and complicated because it asks for the broader integration of biodiversity conservation in sectoral policies. So far, political engagement for specific actions related to this integration is limited. The Commission will annually evaluate progress on implementation of the Action Plan, including quantitative date relating to a set of headline biodiversity indicators (developed by SEBI 2010). For post 2013 the Commission announced to develop a longer term policy vision. The study outlined in this note is intended to feed particularly into the debate on the post-2013 policy. But it also supports pre-2013 implementation because it helps to understand time lags between actions now and future impacts.

Who is the audience?

The Commission; NGOs; national implementing agencies of nature conservation; the European Parliament

Methods

A combination of modelling (GLOBIO); results of model-based scenario analysis at EU-level currently being carried out (EURURALIS and Scenar 2020). If regional and sub-regional detailing is required, this would be based on expert judgement.

Things to be careful about

The analysis will not provide costs estimates in monetary terms but percentage loss of biodiversity relative to the undisturbed state, per biome.

Controversy is to be expected about the simplification by using one aggregated indicator.

The results make it possible to produce maps, as the underlying analysis is GIS-based. However, in the context of COPI results should not be published as maps, but as fairly aggregate numbers broken down by pressure category.

Outputs

Projection of loss of terrestrial biodiversity in terms of change in mean species abundance up to 2050. Development over time.

Per region for six regions of pan-Europe; separate aggregation for Western+ Central Europe. The same per biome (11 biomes).

Graphical display of loss per category of pressure (agriculture, infrastructure, climate change, etc.).

Likely timescale and costs

Moderate if only based on models & existing monitoring data and if limited policy analysis has to be included.

Sizeable if regional expert judgement needs to be involved in order to present more regional detail and/or stakeholders need to be consulted.

Specific environmental goods and services

COPI of not protecting groundwater

What is the story that can be told?

Conceivable headlines:

- A bitter story: we are inviting the salty sea into our sweet water aquifers.
- What was a resource for all has been spoilt by a lack of will to save it
- That extra drop extracted is costing us millions, why?

What are the issues and context?

Groundwater is a very valuable resource that has been more and more used in the last decades. Groundwater pollution is characterised by long time lags and considerable inertia: Due to the high residence time in the soil, many pollutants discharged long time ago are now entering the aquifers. For this reason a farsighted environmental policy is necessary. Often enough actual pollution levels are not high enough to call for immediate political action, but when pollution levels have reached critical levels, it is too late to do something about it: then, natural attenuation may take decades. COPI studies could help here to sensitise.

Next to the qualitative dimension (polluting substances), there is also a quantitative dimension: in many of the coastal areas and islands of Southern Europe, over abstraction of groundwater leads to an inflow of salt water into groundwater aquifers (saline intrusion). Here, lack of a proper regime for groundwater means that the resource is lost to all – a classical case of the tragedy of the commons.

Links to existing legislation or policies

- Water Framework Directive and Groundwater Daughter Directive.
- Nitrate Directive
- Common Agricultural Policy (Good Farming Practice as the basis for Cross Compliance)

Who is the audience?

- Regional and local authorities
- Water suppliers
- Farmers (as those responsible for diffuse pollution and as self-abstractors)
- Chemical Industry

Methods

- Assessing groundwater bodies at risk (now, in the next 10, 20, 50 years)
  Categorisation of different ways groundwater can be polluted
  Identifying select number of cases of saline intrusion

Things to be careful about

High uncertainty of the used hydro-chemical models. Non-use values very difficult to assess. Interaction between groundwater and surface waters, and with groundwater-dependent ecosystems not well understood.

Outputs

- Input to the REACH discussion
- Adaptation of Good Farming Practice

Likely timescale and costs

Moderate for a rough overview

Soil Degradation

What is the story that can be told?

Headlines could be:

- Soil – the big unknown variety of ecosystem services
- Loss of a fundamental, but poorly understood resource
- Soil value – much more than just land value

What are the issues and context?

Soil degradation is a creeping process that has not attracted much attention. However, since soil provides a number of valuable ecological services, the costs of inaction related to soil protection could be substantial, A COPI study of this issue would look at both the on-site costs for the immediate users of the soil (e.g. impacts on agricultural productivity), and in terms of off-site costs, caused e.g. through the loss of ecological functions that soil provides. The latter includes water pollution and sedimentation from eroded soil, but also loss of soil functions like carbon sequestration, filtering and buffering of rainfall etc.

Links to existing legislation or policies

EU Thematic Strategy for Soil Protection is underway and has also looked at economic impacts of soil degradation. Issue of soil protection may become more relevant in the context of climate change – both regarding soil as a massive carbon pool (sequestration capacity, carbon release from mismanaged soils), and soil being health one main victim of climate change (desertification processes).

Who is the audience?

- Regional and local authorities
- The Commission (Thematic Strategy for Soil Protection)
- Farmers

Methods

Meta-analyses of existing literature launched by the European Commission documented the agronomic focus of the existing empirical literature: most estimates of the cost of soil degradation focus on yield losses associated with soil erosion or soil salinization. For erosion in particular, some research has also tried to assess the off-site losses, e.g. through eroded sediment that leads to the silting up of dams and waterways

Methodology would be patchwork: modular COPIs for single ecosystem services as the knowledge basis is very heterogeneous, with some functions well-documented, others insufficient. More easy COPIs would be for the functions food and biomass production, storing, filtering and transformation or source of raw materials. Fraught with high uncertainty are habitat and gene pool and physical and cultural environment for mankind.

COPI for the costs of forgone income of agricultural production as a first step

Things to be careful about

Many soil functions and especially their interaction are not sufficiently understood so far, can at best be described in qualitative terms.

Definition of the baseline is challenging, since impact of climate change is unknown and future land use practices will highly depend on the political frame.

In the case of contamination, pollutants may be inert so that the cost of temporary inaction can be rather small or nil.

Outputs

Knowledge of the costs of the different soil threats will help to develop a sound strategy for soil conservation.

Likely timescale and costs

Modest cost per soil function investigated, moderate cost for a more comprehensive assessment of the most relevant soil functions.

Cost of poor land use decisions

What is the story that can be told?

For example:

If the National Trust had not been established when it was in the UK, and similar organisations elsewhere, … % of valuable landscape would have been lost by now and … % of terrestrial biodiversity. Of the EU's coastline, …. % would be artificially constructed landscape.

If present trends continue, over the next 25 years, much of the EU's valuable landscape, biodiversity and relatively unspoilt coastlines that are not protected in this way will be changed for ever.

Over the next 50 years, an estimated $$$ of real estate will be built in areas that are at risk because of climate change. This refers to constructions still to be built.

What are the issues and context?

Land use changes in the EU at a fast rate. The potential for future change is particularly large in central Europe, in view of structural change in agriculture, influx of regional support and the like. But also in Western Europe the rate of change is high. The dynamics are complex, with various driving forces that mutually react as well. Important factors are settlement trends, location trends for medium-size enterprises; leisure; mobility and many other ingredients of regional economy. Policies at every scale level influence European land use change in some way: from global agreements on reform of agricultural subsidies, to EU level decisions on cohesion funds to local zoning decisions. Spatial patterns in relation to mobility are theme in the Sustainable Development Strategy. A key reason to consider COPI for highlighting the overall issue of land use decisions is that many of the changes involved (broadly termed artificialization) are in practice irreversible. Given the complexity and variation across the EU, a COPI study can only flag the importance of the issue – but that seems precisely fitting. Two stories can probably be told. Firstly, that current land use change is rapidly diminishing future options, for biodiversity, adaptation to climate change and preservation of heritage. Secondly, that there are many policies influencing land use change in the EU, including an indirect but powerful influence from global and EU-level policy decisions.

Links to existing legislation or policies

None and many. Agricultural policies; cohesion policy; climate change adaptation; water framework directive; habitat directive; enlargement

Who is the audience?

Commission, Parliament, private nature and landscape conservation organisations (national trusts),spatial planning organizations and platforms (such as ESPON)

Methods

A combination of

- trend extrapolation from the CORINE database of land use change (based on remote sensing, in resource-accounting framework)
- scenario analysis using nested global, regional and sub-regional modelling as is being applied in the framework of EURURALIS and Scenarar 2020.

Things to be careful about

These projections should always be presented as indicating orders of magnitude, broad trends and not precise, even though realistic.

Data needs and availability

For a semi-quantitative sketch, basic sources exist (see under methods). There is a large and almost permanent need for more detail, for example to improve the most detailed level of land use modelling.

A specific data need is compelling imagery and presentation. Obvously, input material exists; high quality presentation in order to speak to the diverse audience would require some effort.

Outputs

An illustrated report. Conceivably, this in turn could be one of the inputs into a TV documentary on land use decisions.

Likely timescale and costs

Moderate to sizeable, depending on the initial level of ambition and possibilities for a joint effort with other activities. A good part of the analytical effort would be taken up by matching the CORINE results with existing modelling.

Annex II
Experiences to build on: Marine Environment

Introduction

The European marine environment is highly varied in its physical character, climate and biodiversity. Human activity has modified many aspects of its natural state in ways that are complex and often not fully understood.

The GHK report Costs of Non Action in the Marine Environment (2005) has explored the various pressures on Europe's seas and provided an over-view of the way in which they have influenced the state of the environment in the past and are expected to do so in the future. The report presents an estimate of the costs of a non-action scenario for the European Marine Strategy and is briefly reviewed in this Annex. It describes the costs that one would expect to be incurred if use of the European marine environment continues on a business-as-usual and policy-as-usual basis. The report adopts the Driving Forces, Pressures, States, Impacts, Responses (DPSIR) framework as a means of structuring the valuation approach given the variety of multifarious interfaces, their impacts and the costs arising.

The state of the marine environment continues to face a number of threats either from direct human activity (e.g. fishing) or from the impact of human activity (e.g. climate change). These threats are grouped into four different driving forces: Fishing; Development, Urbanisation and Industry; Marine Transport; and Climate Change. The report considers the pressures, their consequential impacts and the costs arising for each of these driving forces.

The Policy Inaction Baseline

The policy inaction baseline is a reference case against which changes can be measured, and embodies the existing state of the marine environment and its projected future state as dictated by the multitude of physical and ecological pressures brought upon it by natural processes and by human actions, and assuming no new policy changes. It assumes that existing European legislation is fully implemented and delivers its intended outcomes but excludes any changes in pressure (resulting from new policy changes,

investments, etc.) that may be brought about through the development and adoption of the Marine Strategy.

For the policy inaction (or do-nothing) scenario it was assumed that current policies and measures would remain in place. The Marine Strategy would change the outcomes, risks and implementation of these existing policies but it has been assumed that no additional policies and measures would be implemented. Table 2 presents the key policy initiatives relevant to the pressures facing the marine environment under each of the four driving forces.

Table 1: Pressures and policies

Driving Force	Pressure	Key EU Policy Intervention
Fishing	Removal of target species (over-fishing)	Common Fisheries Policy Council Reg'n 1421/2004
Fishing	By-catch, discards	Common Fisheries Policy, Council Reg'n 1421/2004 COM(2004)438 on environmentally-friendly fishing methods
Fishing	Seabed damage (from trawlers)	Common Fisheries Policy, Council Reg'n 1421/2004 COM(2004)438 on environmentally-friendly fishing methods
Development & urbanisation	Pathogenic contamination of water	Bathing Water Directive 76/160 & revision Urban Wastewater Directive 91/271
Development & urbanisation	Eutrophication	Nitrates Directive 91/676 Urban Wastewater Directive 91/271 Water Framework Directive 2000/60
Development & urbanisation	Pollution from extractive industries	No specific EU Directives Regulation via OSPAR
Development & urbanisation	Hazardous substances	Numerous measures include Water Framework Directive, IPPC, New Chemicals Policy
Development & urbanisation	Radioactive substances	Dumping at sea is banned in EU. Euratom Treaty. Other release regulated via regional conventions
Development & urbanisation	Litter	EU Directive 2000/59/EC on port reception facilities General litter governed by local laws
Marine transport	Chronic oil pollution and accidental spills	EU Directive 2000/59/EC on port reception facilities Regn 417/2002 accelerating phase of double hull or equivalent design measures for single hull oil tankers. Other measures Global context - MARPOL Convention
Marine transport	Invasive species	Global context -MARPOL Convention
Climate change	Change in water temperature	EU adoption of Kyoto Protocol to the UNFCCC
Climate change	Change in frequency of extreme climatic events, rainfall, currents etc.	EU adoption of Kyoto Protocol to the UNFCCC

A challenge in defining a ‘policy inaction’ scenario, and quantifying the associated risks and costs, is that it is, in reality, unlikely that there would be no new sectoral policies relevant to the marine environment in the absence of the Marine Strategy. It is possible to explore the incremental benefits of policies that have been recently adopted, and of those in the pipeline which we might expect to come into force. The expected value of the future damage costs cannot, however, be adjusted for the impacts of policies that are not yet known about. A further challenge in quantifying the present level of costs and the projected trend of the policy inaction scenario is the need to define this in relation to the clean or pristine environment in which such costs would not be expected to arise. This definition of a ‘clean’ environment is likely to be highly controversial, requiring a judgement as to what ‘clean’ is deemed to be. In many instances this will be a ‘clean’ marine environment, or at least that at which no ‘significant’ impact arises.

The report identifies social impacts (e.g. damage to human health), economic impacts (e.g. damage to tourism or income from fisheries) and environmental impacts (e.g. habitat loss or reduction in the diversity or abundance of species), although the links of cause and effect from driving force to impact are documented with varying degrees of precision. Natural processes shape marine ecosystems in ways that are not always fully understood and require many years of careful study. These uncertainties impact on the certainty with which the consequences of human action can be stated and changes in behaviour or anthropogenic pressure linked to environmental benefits.

The report defines the marine environment as comprising a number of sub-regions around the coast of the European Union and relevant adjacent seas. To facilitate calculation of an overall set of costs the study area is considered as comprising: the European part of the Arctic Ocean; the Baltic Sea; the Black Sea; the Celtic Seas, the Mediterranean; the North Sea; and the North East Atlantic.

Approach to valuation

No primary valuation research was undertaken for the study and the results are instead based on use of data in the existing literature. Some damage costs cannot be measured, as there are no clear data. In such cases a general description is provided. In other instances there are some data describing the impact but a monetary value cannot be determined. Determination of how existing valuation data support present requirements is one of the main challenges of this study. Valuation research is typically directed to a discrete and highly focused change in a particular aspect of an ecosystem in a particular location. This

study, however, is seeking to gain an understanding of the costs of a baseline scenario across all aspects of the marine environment for a region stretching from the Arctic to the Mediterranean.

There remain significant gaps in the knowledge and understanding of the marine environment, its state and trends, the impacts and effect of existing policy and regulatory measures, and the economic implications and values associated with the changes taking place. In particular, and despite a large number of regulations and investments made to improve the marine environment, the valuation issues are under-researched in a European context.

Impacts

The report explores the various pressures on Europe's seas and provides an over-view of the way in which they have influenced the state of the environment in the past and are expected to do so in the future. Table 2 summarises the main impacts against the topic headings used in the 2002 Communication from the Commission on the proposed Marine Strategy.

It is clear that many of these impacts on the marine environment have economic repercussions, not all of which are fully documented in the literature or can be aggregated at EU level due to a lack of physical impact or economic value data. These economic repercussions may be directly measurable in markets, or might require capture of non-market data for estimation. Examples include:

- Changes in the economic value of tourism, which can be directly measured in the changes in income experienced in the regions affected;
- Water pollution causing loss of ecological services and recreational opportunities for the general public, which does not 'show up' in economic transactions.

The 'controllability' of risks to the marine environment through marine sector policies varies from near-full control in the case of fishing, to limited impacts in the case of climate change. Some of the recognised impacts on the marine environment arise from activities on which firm data are necessarily difficult to obtain but could be improved with greater surveillance – such as illegal discharge of oil and discards in the fishing sector. The location of primary or relatively significant risks is also changing, examples being:

- Changes in the relative significance of oil tanker routes as oil exports from Russia increase;
- Bathing water quality in areas of the Mediterranean and Black Sea being poorer than in EU-15 waters for want of investment in higher standards of wastewater treatment.

Whereas recent decades have seen gradual improvement in a number of pressure indicators, such as the compliance of bathing waters with the mandatory limits of the 1976 Bathing Water Directive, other areas have not shown the same aggregate improvement. In particular, ICES analysis points to a continued deterioration in the overall state of fish stocks (notwithstanding improvements in some cases). Sustainable management of European fisheries is critical to the health of the marine ecosystem. Much rests on the extent to which the recent reforms to the Common Fisheries Policy reduce the risk of stock collapse for specific species, and the aggregate stability of fish stocks as a whole.

There are many policies and programmes in action that are intended to address existing impacts on the European marine environment as they are implemented. However, the evidence suggests that despite these measures, pressures, impacts and costs will remain. Much of the existing legislation also perpetuates the historical sector-based, or issue-based, response to marine environmental problems at a time when many of those involved believe that an integrated ‘ecosystem’ approach offers a more promising path towards sustainable management of the seas.

The gaps in the results presented in the report illustrate that our collective understanding of marine ecosystems, and how specific parts of them would respond to particular pressures or stimuli, is imperfect. In practical terms this means the confidence limits around predictions of how the marine environment will respond to a particular set of pressures (and the damage costs arising) may be quite wide. Some of the recognised impacts on the marine environment arise from activities on which solid data are necessarily difficult to obtain but could be improved with greater surveillance – such as illegal discharge of oil and discards in the fishing sector. The data collected in this study, whilst imperfect, are sufficient to suggest that the cost-benefit equation of programmes to increase monitoring of such areas is likely to show a positive net benefit. The economic costs of use of the marine environment have received comparatively little attention. The analysis also gives some indications that public perception of risk may not be well aligned with the evidence base.

Table 2: Valuation summary (net present values)

Driving Force	Pressure	Arctic Sea	Baltic Sea	North Sea	Celtic Seas	North Atlantic	Mediterranean	Black Sea	Total
Fishing	Over-fishing	€	€	>> €750m - €1200m revenues	€€	€€€	€€	€	Efficacy of CFP reforms in changing the health of the fishery is critical.
Fishing	Discards & by-catch	€	€	€€ >500kt/yr by-catch	€€	€€	€	€	Inaction damage costs expected to impact on income, ecology, recreation and non-use values.
Fishing	Seabed damage due to trawling			€	€	€			Wide-ranging direct and indirect ecosystem effects.
Development & Urbanisation	Pathogenic contamination		€€	< €47 billion for England & Wales only		€€	€€€	€€	Risk of illness from bathing is falling in Community areas, but remains at measurable rate. Case study data indicate damage costs on non-action scenario may be sizeable
Development & Urbanisation	Eutrophication	--	< €77bn	€	€		€	€€	Cost data patchy but localised strong indications of willingness to pay for clean-up (e.g. Baltic)
Development & Urbanisation	Hazardous substances	€	€	€	€	€	€	€	No data on cost impacts.
Development & Urbanisation	Radioactive substances								No data on ecosystem or cost impacts
Development & Urbanisation	Litter		€	> €37m	€	€	€	€	
Marine transport	Oil pollution – spills & illegal discharges		€€			€€		€€	Present value of expected damage from spills 2005-2015 in excess of €1 billion
Marine transport	Invasive species								No general cost data
Climate change									

NB: Size and number of € indicate expected scale/significance of cost

Annex III
Experiences to build on: Air Pollution

Introduction

Air Pollution in Europe negatively affects human health and ecosystem services. A recent study estimated that in the year 2000, 370,000 people in Europe died prematurely, thousands of people were admitted to hospital with breathing problems, millions of people had to restrict their activities at least for some days because of minor air pollution related symptoms, damages to crops and materials totalled almost 4 billion euros, and thousands of square kilometres of European forests, semi-natural, and freshwater ecosystems were exposed to pollutant loads above critical thresholds. Due to economic, technological and demographic developments, and due to current air pollution policies, the negative impacts of air pollution will diminish in the future, but will remain significant.

The Baseline Scenario of the Impact Assessment by Amann et al. (2005) can be read as a COPI study. It describes a no-additional policy baseline for air pollution in Europe. In this Appendix, we will briefly review some of its methodological aspects and its reception by policy-makers.

Policy Inaction Baseline

For the Impact Assessment a Policy Inaction Baseline for the period 2000-2020 was constructed for the enlarged EU (EU25). The Policy Inaction Baseline took account of the main drivers of air pollution (economic growth, energy supply and demand, transport, and agriculture) and of the expected effects of current policies and measures with respect to air pollution. Several specialised economic sector models were used to calculate pollutant emissions as a result of forecasted economic and technological developments over the period 2000-2020.[1] The outputs of these specialised models were then fed into the RAINS model to simulate emission control strategies, chemical formation and atmospheric dispersion from the source of the emissions to receptor sites at a 50 km x 50 km spatial grid level, and to calculate per grid the health damages from fine particulates and ground-level ozone and the risk of ecosystem damages from acidification, eutrophication, and exposure to evaluated ambient levels of ozone.

[1] Including the PRIMES model for energy, the TREMOVE model for transport and the CAPRI model for agriculture.

For the Policy Inaction baseline it was assumed that current policies and measures would remain in place, but that no additional policies and measures would be implemented. It was further assumed that new member States would have fully implemented the 'acquis by 2105 to 2020. Current policies and measures included no less than 12 EU Directives with their specific targets and timetables (see Table 3).

All Baseline calculations were reviewed by experts from Member States and by independent experts.

Table 3: measures considered in CAFE Baseline

Limitations of emissions from large combustion plants	Directive 2001/80/EC
Integrated Pollution Prevention and Control	Directive 96/61/EC
Reduction in sulphur content of certain liquid fuels	Directive 1999/32/EC
Quality of petrol and diesel fuels	Directive 98/70/EC
Control of emissions of volatile organic compounds from the storage of petrol	Directive 94/63/EC
Limitations of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations	Directive 1999/13/EC
Limitations of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes	Directive 2004/42/EC
Incineration of waste	Directive 2000/76/EC
Reduction of the emissions of two- and three-wheel motor vehicles	Directive 2002/51/EC
Air pollution by emissions from motor vehicles	Directive 1998/69/EC
Approximation of laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines in non-road mobile machinery	Directive 2002/88/EC
Approximation of laws of the Member States relating to measures against the emission of gaseous pollutants from diesel engines for use in vehicles	Directive 88/77/EEC

Source: CEC, 2005: 147

Quantification and monetization of costs

Quantification and monetization of the impacts of air pollution remains a challenging task. There is a growing body of scientific evidence on the adverse effects of particulate matter (PM) and ozone on human health, summarised, for example, in the World Health Organization's "Systematic Review of Health Aspects of Air Pollution in Europe". Still, uncertainties remain, both with respect to dose-response functions as to the atmospheric modelling of the pollutants. For the monetization of mortality effects, the Impact Assessment

used two alternative approaches: the Value of a Statistical Life (VSL) and Value of Life Year (VOLY)[2]. The monetary value (cost) of mortality differs by a factor of two between these approaches. The Impact Assessment even increased this range by also considering mean and median estimates of VSL and VOLY.

The Impact Assessment used the concept of "critical loads" to assess the impact of air pollution on natural ecosystems. Critical load is a measure of how much pollution an ecosystem can tolerate or the threshold above which the pollutants load will cause damage to the environment. Different regions and ecosystems have different critical loads. Amann et al. (2005) note that excess of a critical load is an indicator that cannot be directly interpreted as the actual damage occurring at ecosystems. For an assessment of such damage, the history of deposition and the dynamical chemical processes in soils and lakes should also be taken into account.[3] The Impact Assessment did not assess actual (physical) damage, nor did it estimate the willingness to pay to prevent this damage.

Table 4 shows the cost of air pollution damage in 2020 of the Impact Assessment. The cost assessment uses different units for different effects and the high and low estimates of monetary costs differ by a factor of 3.2.

Table 4: Cost of Air Pollution Damage in 2020

Impact		Unit	2020	
			Low	High
Mortality		Euro billion	130	550
Morbidity		Euro billion	58	58
Crop damage		Euro billion	2	2
Materials damage		Euro billion	1	1
Area of ecosystems at risk to acidification	Forests	1000 km^2	119	119
	Semi-natural	1000 km^2	8	8
	Freshwaters	1000 km^2	22	22
Area of ecosystems at risk to eutrophication		1000 km^2	590	590
Area of ecosystems at risk from ozone		1000 km^2	764	764

Source: CEC, 2005

[2] Krupnick et al. (2004) discuss the relative merits of the two approaches.

[3] This is in contrast with the optimistic claim of the European Commission: "In theory, it would be possible to go straight from critical loads or critical levels exceedance to valuation of benefits for ecosystems, were suitable data available from willingness to pay studies. Although the literature in this area is growing, it is not currently adequate for a European-wide appraisal such as this." (CEC, 2005, 61)

Impact of the Assessment

Despite of the non-uniformity and the wide uncertainty ranges of the Assessment, the message is clear: Current policies will not meet the objective of the 6th Environment Action Programme (6EAP) to achieve 'levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment'[4] Confronted with this evidence, the European Council of 9 March 2006 concluded that, even with effective implementation of current policies, there will remain very significant adverse impacts on human health and the environment from air pollution in 2020. The Council therefore expressed its conviction that the magnitude of these impacts would be such that additional action must be taken to combat air pollution in the EU. In a speech to European Parliament on 4 July 2005, Mr. Stavros Dimas, the Commissioner of the Environment, quoted all monetary figures of the Impact Assessment (health, ozone damage to crops) as well as the non-monetary figures (number of premature deaths, working days lost due to air pollution, area of natural ecosystems at risk) to stress the importance of the Commission's Thematic Strategy on Air Quality. Members of the European Parliament also liberally quoted economic figures to stress the importance of the problem and the need for further action.

Conclusions

The Baseline Scenario of the Impact Assessment of the Thematic Strategy on Air Quality is a good example of a COPI study. It sets out a credible baseline, which takes account of the main economic and social drivers of air pollution and the effects of current policies. The quantitative assessment and valuation of impacts is based on a valid methodology and an up-to-date review of scientific and economic literature and has been exposed to international peer-review (Skinner et al., 2006). In case of uncertainty over the correct valuation approach, the results of both approaches were presented. In case of difficulties in monetary valuation (or too much controversy around such a valuation), no monetary valuation was pursued. These pragmatic solutions to well-known problems in environmental impact assessment seemed to have worked quite well. Although from the perspective of the objectives of the 6EAP, monetary valuation was not strictly necessary to argue for increased action on air pollution, politicians often quoted the monetary figures from the Assessment to strengthen their case.

From the brief discussion of the construction of the Policy Inaction Baseline it is clear that this constituted a major research project, involving many research institutes and also involving major consultation and review processes. The credibility and impact of the COPI

[4] Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme

estimate in this area can to a large extent be attributed to the thoroughness and transparency of the entire process. In this politically sensitive area, it is doubtful if a much simpler approach could have achieved the same impact.

Box 1 Speech of Mr. Dimas to the European Parliament on the subject of the Thematic Strategy on Air Quality

Stavros Dimas, *Member of the Commission*. *(EL)* Mr President, I am most grateful for the opportunity to inform you about the thematic strategy on air pollution. This thematic strategy is the first in a series of seven strategies which represent a new way of preparing coordinated environmental policy. The strategy on air pollution is now in the final stages of preparation, having passed through the extensive consultation procedure in which the European Parliament was actively involved.

It is a known fact that air pollution has very harmful consequences on human health: respiratory problems, bronchitis, lung cancer and premature death in both young and elderly people. Nowadays, approximately 350 000 premature deaths a year are linked to air pollution. Even and when the present policies and current legislation have been fully applied, we shall still have over 270 000 premature deaths in 2020.

Air pollution has an adverse effect on the environment and on ecosystems. Thus, up to 1 million square kilometres of natural ecosystems will continue to be at serious risk. In short, the damage to health and the environment is so acute – over EUR 200 billion a year in repercussions on health alone – that we need to step up our action. We need to bear in mind that well prepared environmental policies can make a positive contribution to competitiveness and to the creation of high quality jobs. Air pollution has serious adverse financial repercussions. The health problems which it causes and the poor quality of the air that we breathe lead to the loss of 150 000 million working days a year, to losses in productivity and, as a result, to serious health spending. The agricultural sector loses 2.5 billion a year from the damage caused by ozone.

Nor should we forget that the environment is an issue which attracts constant support from European citizens. In addition, European citizens themselves judge that, in the environmental sector, Community action performs better, providing and creating added value.

Action such as this in connection with air pollution will have direct benefits for European citizens. It will bring about an important improvement in the quality of air that we breathe. It is something we owe European citizens. I trust I can count on your support at this new stage of environmental policy now starting and I hope soon to be able to present the strategy on air pollution.

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Annex IV
Experiences to build on: Climate Change

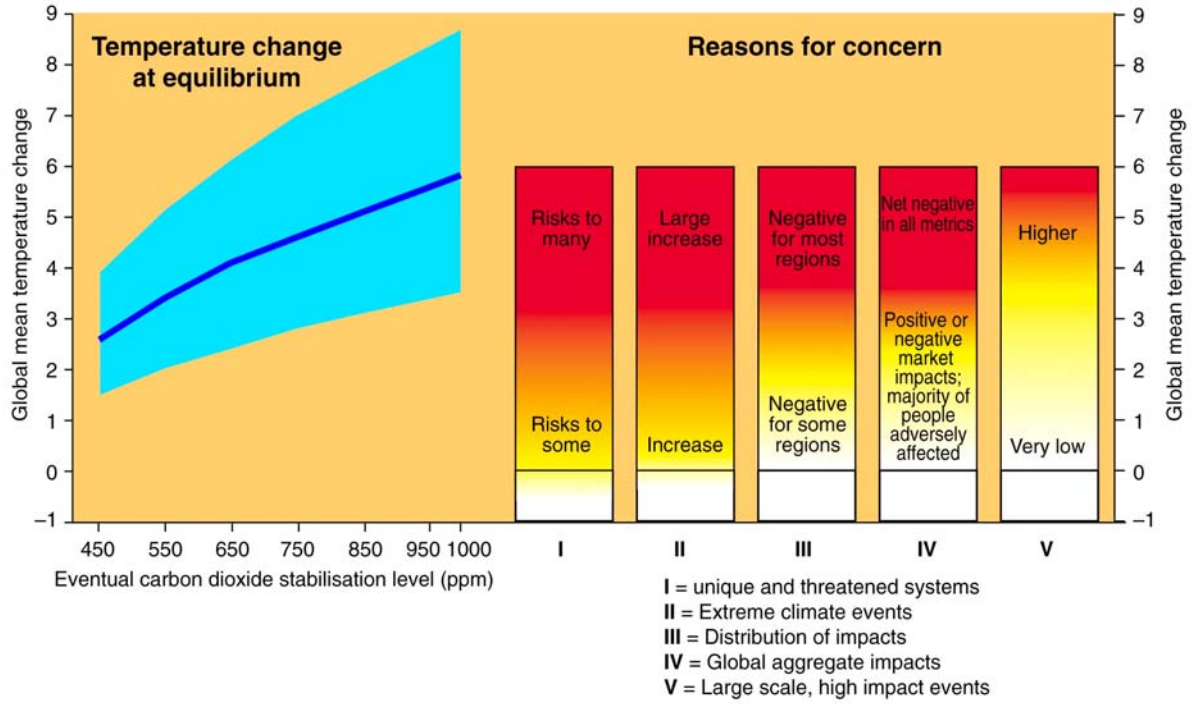
Introduction

The Cost of Policy Inaction in Climate Change is uncertain but may be very large. Policy Inaction is likely to prevent the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. In practical terms, the European Council has suggested that preventing such dangerous anthropogenic interference would imply to restrict a global temperature increase to a maximum of 2˚C above pre-industrial level (EC, 2005). Policy Inaction could be defined in this case as the failure of the world community to implement policies to reach this target.

A large body of research, periodically summarised by the Intergovernmental Panel on Climate Change (IPCC), has tried to identify, quantify, and to a lesser extent, monetize the damage costs of climate change. Some of the findings of the latest IPCC report are:

- Regional changes in climate have already affected a diverse set of physical and biological systems in many parts of the world.
- Natural systems are vulnerable to climate change and some will be irreversibly damaged.
- Many human systems are sensitive to climate change and some are vulnerable.
- Changes in climate extremes could have major consequences.
- The potential for large-scale and possible irreversible impacts poses risks that have yet to be reliably quantified.

A well-known graphical illustration of the potential costs of climate change is the “Reasons for Concern” graphic of IPCC. It shows how certain risks to natural and human systems increase with global warming (see Figure 9).



Source: IPCC, 2001

Figure 9: Reasons for Concern

The *quantification* and *monetization* of these risks differs between the different dimensions of climate change and between the different natural and human systems affected. Jones and Yohe (2006) present a classification of the uncertainties in quantification and monetization (or valuation) in Table 5. Global estimates of damage costs are available for market impacts of gradual changes in mean climate variables (temperature, precipitation, sea level rise). Global estimates of market damages due to changes in the variability and extremes of climate change variables are scarce, while those of large-scale system changes and singularities are practically absent. On the valuation axis we see global estimates of non-market damages (divided into indirect use & option values and existence & bequest values) are non-existent.

On the basis of an extensive review of literature Downing et al. (2005) conclude that:

> "Our understanding of future climatic risks, spanning trends and surprises in the climate system, exposure to impacts, and adaptive capacity, is improving, but knowledge of the costs of climate change impacts is still poor. Some of this lack of knowledge arises from uncertainties that will be impossible to resolve prior to the need to make relevant policy decisions.

The lack of adequate sectoral studies and understanding of local to regional interactions precludes establishing a central estimate of [the cost of climate change] with any confidence.

The balance of benefits and damages in the social cost of carbon shifts markedly over time, with net damages increasing in later time periods.

Estimates of [the costs of climate change] are particularly sensitive to the choice of discount rates and the temporal profile of net damages

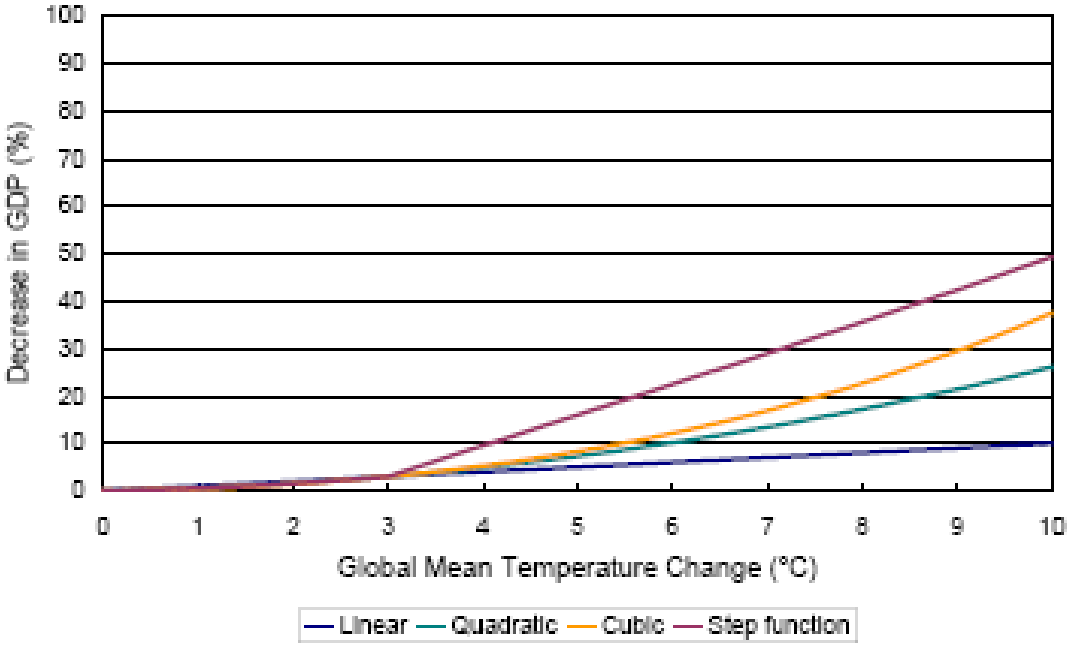
Vulnerability and adaptation to climate change impacts are dynamic processes responding to climatic signals, multiple stresses, and interactions among actors. Large scale impacts, such as migration, can be triggered by relatively modest climate changes in vulnerable regions."

Table 5: Quantification and valuation uncertainties in assessing the damage costs of climate change

	Valuation uncertainties			
Climate change uncertainties		Market (direct) value	Non-market (indirect use and options)	Existence and bequest value
	mean climate	Global studies	Some global studies (as WTP)	None
	Climate variability and extremes	Regional studies, some allowance in global studies	Some local and regional studies	None
	System changes and singularities	Few sensitivity studies	None	None

Source Jones and Yohe (2006), adapted from Downing et al. (2005).

A study on market damages of global warming find economic damages of about 3 percent of GWP (Gross World Product) at a doubling of the pre-industrial greenhouse gas concentration in the atmosphere, or a mean global surface temperature increase of 3˚C (Nordhaus and Boyer, 2000; Nordhaus, 2005; 2006). Jones and Yohe (2006) use Nordhaus' central result to construct damage curves that relate market damages to temperature increases (Figure 10). The key message of Figure 10 is that while global market damages below temperature increases of 2 to 3 ˚C may be limited, further increases in global warming may increase market damages disproportionably.

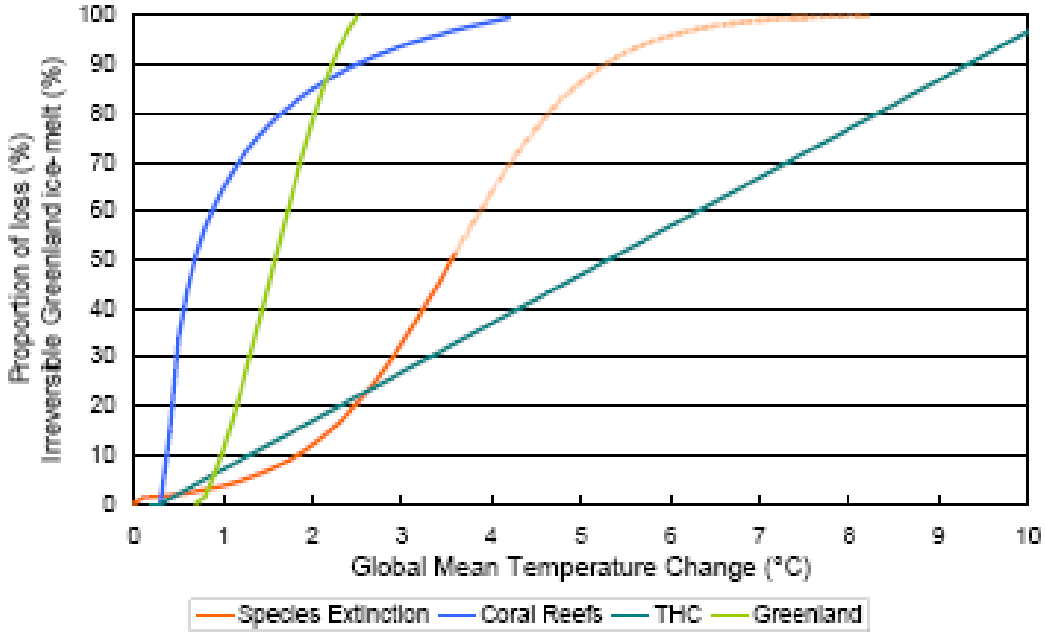


Source: Jones and Yohe, 2006

Figure 10: Market damages associated with global mean temperature changes

The global market damages of Figure 10 hide the important differences between countries and regions. Various studies, e.g., Tol et al. (2004) and Mendelsohn et al. (2006), suggest that poor countries will suffer the bulk of damages from climate change. An important reason is that current temperatures of low latitude poor countries are already too high. Global warming would push temperatures in these countries further away from the optimum in many sectors. Other reasons include the larger share in GDP of climate-sensitive sectors in poorer countries and lower capital, technology and adaptation options (Mendelsohn et al., 2006). The skewed geographical distribution of global market damages means that even at relatively moderate levels of global warming, where aggregate market damages are low, market damages in poor, low latitude countries may already be considerable.

Even at relatively low increases in global warming, vulnerable natural systems may be already at risk of extinction. Somewhat tentatively, Jones and Yohe (2006) suggest the following relationships between global temperature increases and impacts such a species extinction, coral reef damages, the risk of a slowdown of the North Atlantic Thermohalice Circulation (THC), and the probability of the start of irreversible melting of the Greenland ice-sheet (Greenland) (Figure 11).



Source: Jones and Yohe, 2006

Figure 11: Some non-market risks associated with global mean temperature changes

The recent Stern Review on the economics of climate change take the Nordhaus and Boyers' assessment one step further by explicitly assessing the costs of wide variety of non-market impacts of climate change over the next two centuries. Stern et al. (2006) conclude that the Costs of Policy Inaction (or Business as Usual as he calls it) are at least 5 percent of global per-capita consumption, and may even reach 14 percent if all non-market impacts and recent findings on natural feedbacks are included. Taking account of the negative distributional impacts of climate change would increase its welfare costs to 20 percent of per-capita consumption, even without accounting for socially contingent impacts such as migration and conflict. (Stern et al., 2006).

Opportunities and challenges for COPI of Climate Change

COPI information on climate change is very useful as it reminds policy makers and the public at large on the urgency of the problem. A sense of urgency may sometimes be lost in the rather difficult and slowly-progressing negotiations on international co-operation and the highly technical discussions on economic and technical responses.

Information on COPI of Climate Change is periodically reviewed in IPCC Assessment Reports. This includes specific information on Europe. According to IPCC (2001), risks for Europe include negative impacts on water resources, natural ecosystems, health and safety, with vulnerability highest in the south, in the European Arctic, and in mountainous regions (see Box 2 below). The Fourth Assessment Report of IPCC is due in 2007, and will have

summarised the latest information on impacts, adaptation and vulnerability. The IPCC Assessment Reports identify major risks and quantify them to the extent possible. They do not, however, try to express all risks in one common metric, such as money.

Jones and Yohe (2006) propose an interesting methodology to express and quantify non-market risks across multiple metrics (see Figure 11 above). A COPI for Europe could be carried out along the lines of their methodology that offers flexibility in the selection of impacts, metrics, populations affected and geographical areas. One issue that would certainly deserve further attention is the vulnerability of Europe for climate change impacts in other part of the world, through social and political instability and through trade and migration flows (see also Downings et al, 2005). A strictly monetary COPI for Europe, or even a monetary COPI *range*, would probably do injustice to the variety and basic uncertainties of the risks of climate change and would be very vulnerable to (justified) criticism, and therefore run the risk of defying its purpose.

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- The adaptation potential of socioeconomic systems in Europe is relatively high because of economic conditions (high gross national product and stable growth); a stable population (with the capacity to move within the region); and well-developed political, institutional, and technological support systems. However, adaptation potential for natural systems generally is low. [very high confidence]
- Present-day weather conditions have effects on natural, social, and economic systems in Europe in ways that reveal sensitivities and vulnerabilities to climate change in these systems. Climate change may aggravate such effects. [very high confidence, well-established evidence]
- Vulnerability to climate change in Europe differs substantially between sub-regions; it is particularly high in the south and in the European Arctic. This has important equity implications. More marginal and less wealthy areas will be less able to adapt. [very high confidence, established but incomplete evidence]
- Water resources and their management in Europe are under pressure now, and these pressures are likely to be exacerbated by climate change [high confidence]. Flood hazard is likely to increase across much of Europe, except where snowmelt peak has been reduced, and the risk of water shortage is projected to increase particularly in southern Europe [medium to high confidence]. Climate change is likely to widen water resource differences between northern and southern Europe. [high confidence, well-established evidence]
- Soil properties will deteriorate under warmer and drier climate scenarios in southern Europe. The magnitude of this effect will vary markedly between geographic locations and may be modified by changes in precipitation. [medium confidence, established but incomplete evidence]
- Natural ecosystems will change as a result of increasing temperature and atmospheric concentration of carbon dioxide (CO2). Permafrost will decline, trees and shrubs will encroach northern tundra, and broad-leaved trees may encroach coniferous forests. Net primary productivity in ecosystems is likely to increase (also as a result of nitrogen deposition). Diversity in nature reserves is under threat from rapid change. Loss of important habitats (wetlands, tundra, and isolated habitats) would threaten some species (including rare/endemic species and migratory birds). Faunal shifts as a result of ecosystem changes are expected in marine, aquatic, and terrestrial ecosystems. [high confidence, established but incomplete evidence]
- In mountain regions, higher temperatures will lead to an upward shift of biotic and cryospheric zones and perturb the hydrological cycle. There will be redistribution of species, with, in some instances, a threat of extinction. [high confidence]
- Timber harvest will increase in commercial forests in northern Europe [medium confidence, established but incomplete evidence], but reductions are likely in the Mediterranean, with increased drought and fire risk. [high confidence, well-established evidence]
- Agricultural yields will increase for most crops as a result of increasing atmospheric CO2 concentration. This effect would be counteracted by the risk of water shortage in southern and eastern Europe and by shortening of growth duration in many grain crops as a result of increasing temperature. Northern Europe is likely to experience overall positive effects, whereas some agricultural production systems in southern Europe may be threatened. [medium confidence, established but incomplete evidence]
- Changes in fisheries and aquaculture production from climate change embrace faunal shifts affecting freshwater and marine fish and shellfish biodiversity. These changes will be aggravated by unsustainable exploitation levels and environmental change. [high confidence]
- The insurance industry faces potentially costly climate change impacts through the medium of property damage, but there is great scope for adaptive measures if initiatives are taken soon. [high confidence]
- Transport, energy, and other industries will face changing demand and market opportunities. Concentration of industry on the coast exposes it to sea-level rise and extreme events, necessitating protection or removal. [high confidence]
- Recreational preferences are likely to change with higher temperatures. Outdoor activities will be stimulated in northern Europe, but heat waves are likely to reduce the traditional peak summer demand at Mediterranean holiday destinations, and less reliable snow conditions could impact adversely on winter tourism. [medium confidence]
- A range of risks is posed for human health through increased exposure to heat episodes (exacerbated by air pollution in urban areas), extension of some vector-borne diseases, and coastal and riverine flooding. Based on current evidence, climate change would result in a reduction in wintertime deaths, at least in temperate countries. [medium confidence]
- In coastal areas, the risk of flooding, erosion, and wetland loss will increase substantially—with implications for human settlement, industry, tourism, agriculture, and coastal natural habitats. Southern Europe appears to be more vulnerable to these changes, although the North Sea coast already has high exposure to flooding. [high confidence]

Box 2 Impacts, adaptation and vulnerability in Europe (IPCC, 2001)

Annex V
Experiences to build on: Soil degradation

Introduction

Soil performs a multitude of functions that are essential to human life. Apart from providing food, biomass and raw materials and serving as a habitat and gene pool, soil also performs storing, filtering and transformation, as well as social and cultural, functions. In this way, soil plays an integral part in the regulation of natural and socio-economic processes that are necessary for human survival, such as the water cycle and the climate system. Because soil forms the basis of many different human activities, it also has a significant economic value. However, this "fundamental" economic value of soil is barely recognised.

Like other parts of the environment, soil has come under increasing stress as a consequence of human activities. Intensive agriculture, land consumption for building, the contamination of soil through pollutant emissions and changing climatic conditions are but a few of the man-made pressures on soil. In the Thematic Strategy for Soil Protection, the European Commission (2006) distinguishes between eight soil threats: soil erosion, decline in soil organic matter, soil contamination, soil sealing, soil compaction, decline in soil biodiversity, salinisation, and floods and landslides. While “healthy soil” can withstand these pressures to a certain degree, the combination and the extent of the stresses has resulted in a slow, but widespread, degradation of soils in many parts of Europe.

In 2004, DG Environment commissioned an assessment of the economic consequences of soil degradation,[5] in preparation of the Soil Thematic Strategy. The assessment was mainly based on existing literature and a limited number of case studies for different soil threats. It found that the knowledge about economic impacts of soil degradation is fairly limited in Europe. In particular, some of the soil threats are poorly understood, both in terms of their physical impacts, and in terms of the economic damage they lead to. For those soil threats that are better understood – in particular soil erosion, soil contamination and salinisation – the analysis produced some indicative estimates of the cost of non-action.

The results of the economic study have contributed to the Impact Assessment that was carried out for the Thematic Strategy for Soil Protection and the proposed Soil Framework Directive (European Commission 2006b). Around the release of the Thematic Strategy and the Impact Assessment, the monetary estimates provided in the Assessment received some attention by media and stakeholders. In addition, results of the economic estimation were presented at the “Vital Soil” conference organised by the Dutch council presidency in November 2004, and from there found their through the conference conclusions to the Environment Council.

[5] Görlach et al. (2004): Assessing the Economic Consequences of Soil Degradation. Berlin: Ecologic

The Policy Baseline

As the policy baseline for the assessment, a situation with “no policy change” assumed. The baseline was not modelled explicitly, but instead current trends and pressures were described and extended into the future. This was done in a verbal-descriptive way, discussing the impact of driving forces and resulting pressures (e.g. climate change, urban sprawl) in qualitative terms. Against this background, the costs were described as the current costs per annum in the base year for which most recent data could be obtained (2002). These annual costs were deliberately not extrapolated into the future. One reason for this was the lack of quantified evidence that could be used to construct a baseline scenario for soil threats, another reason were concerns about discounting. Instead, the likely future development of the annual costs was discussed verbally.

Approach to Valuation

Since the information basis differed substantially for the differed soil threats, it meant that effectively, separate analyses were conducted for each soil threat, following a similar but slightly adapted approach.

- In the case of erosion, the distinction between off-site costs and on-site costs plays a central role. Off-site costs are usually external costs, and concern those effects of erosion that are transmitted through the water cycle. They include the cost of sedimenation of dams, canals and irrigation infrastructure, damage to transport infrastructure from eroded sediment, impacts on water quality from eroded soil-bound pesticide or phosphorous particles, etc. On-site costs mainly accrue to the land users (farmers) themselves and include income losses as erosion reduces soil fertility and crops are uprooted.
- In the case of contamination, the largest share of the costs consisted of the costs of dealing with contamination – i.e. the costs of measures to clean up contaminated land, or to contain the spread of a contaminant. This was mainly done because economic data on the actual impact of contamination – such as health impacts, impacts on house prices in the neighbourhood of a contaminated site – is virtually non-existent in Europe. Since many measures to clean-up or contain contamination are funded from public budgets, it can be discussed whether these should indeed be considered as cost of policy *inaction*. One argument for including them as COPI is that these costs arise because of a policy failure in an earlier stage.
- Salinisation is a fairly localised problem in Europe, which is only found in some parts of Spain, Hungary and Bulgaria. There are very few empirical studies that have assessed the economic impact of soil salinisation, and most of these tended to focus on the on-site cost (i.e. the impact on soil productivity and crop yields).
- For the remaining five soil threats identified by the Commission, the impacts of soil degradation were mainly described in a qualitative way, supported by physical data,

selected examples and a discussion of the future development. This discussion was structured along different cost categories (on-site and off-site costs, private and social costs).

The assessments for the different soil threats were based on extensive review of the academic and grey literature in the field. Where possible, impacts were assessed in economic terms through a simple form of benefit transfer. E.g. in the case of erosion, some evidence on the economic impacts can be found in the agronomic literature. For these, the distribution of damage figures per hectare per year were analysed. Based on this evidence, different weighted averages were calculated (lower bound, upper bound and best guess), differentiated for four categories of erosion severity, and extrapolated for a set of 13 countries for which soil erosion data was available.

However, it must be noted that the majority of impacts were not quantified in monetary terms. For five of eight different soil threats, impacts are described in qualitative or non-monetary physical form only, sometimes supported by selected pieces of evidence. In addition, some types of impacts were much more readily quantifiable than others. Especially those types of impacts that had been researched in agronomic studies – e.g. impacts of erosion on crop yields – were fairly well documented. By contrast, the external costs of soil degradation (including off-site effects) are surrounded by much more uncertainty, even though it has been argued repeatedly that these impacts are much larger than the on-site effects (see e.g. Furtan and Hosseini 1997, Pretty et al. 2000). In addition, some types of impacts escape a monitory quantification altogether – for example, there is hardly any literature that has assessed the monetary value of the ecosystem services that soil provides. It therefore appears that the “known unknowns” in the economic assessment of soil degradation still remain substantial.

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Annex VI
Experiences to build on: Terrestrial Biodiversity

Introduction

High pressure on biodiversity resulting from a variety of threats has led to an unstoppable loss of biodiversity in Europe and world wide. There are a great number of economic evaluation studies that are trying to measure the economic value of biodiversity and its ecosystem services. The underlying motivation is either to bring the topic of biodiversity decline to the political agenda or to justify specific conservation measures. To date there are no COPI studies in the narrower sense available.

Nevertheless, the results of some studies can be used as a starting point for further COPI assessments. The following studies will be described:

- Value of biodiversity- Documenting EU examples where biodiversity loss has led to the loss of ecosystem services (Kettunen & ten Brink 2006);
- Economic evaluation of biological invasions – a survey (Born et al. 2005)
- Cross-roads of Planet Earth's Life. Exploring means to meet the 2010 biodiversity target. Study performed for the Gobal Biodiversity Outlook 2. (MNP, UNEP WCMC and UNEP/GRID-Arendal 2006)

These studies describe different aspects of biodiversity conservation and offer different possibilities for COPI studies. They reflect popular ideas in the current discussion about biodiversity conservation. Ecosystem services and their values are gaining increasing attention, as can be seen with several initiatives such as the Millennium Ecosystem Assessment (MA 2005) explicitly addressing this issue. In respect to Invasive Alien Species (IAS), the CBD demands the development of national strategies against IAS. So far many countries fear the costs of such a strategy and hence have not started a policy against IAS.

Example 1: Value of biodiversity (Kettunen & ten Brink 2006);

This study brings together EU examples where biodiversity loss or the modification/loss of habitats accompanied by biodiversity loss in the recent past has led to the loss/degradation of ecosystem services and consequently to economic costs and/or social losses.

Altogether the survey identified 37 relevant examples from 18 Member and Accession States within the EU. Ten of them have been analysed and documented in detail.

Table 6 below summarises the 37 examples from 18 countries of affected ecosystems investigated in the survey. According to the report, the most frequently threatened services include food and fresh water (e.g. marine and fresh water resources), water purification and waste management, water regulation, erosion control, and a range of cultural services (eg recreation and tourism).

Table 6: Available information about the costs associated with losses in ecosystem services in the EU Member and Accession States. The table summarises 37 examples from 18 countries.

TYPE OF ECOSYSTEM SERVICE LOST	Examples of the service being lost in Member States (no of examples where mentioned)
Provisioning Services	
Food and fibre	YES (19)
Fuel	YES (2)
Biochemicals, natural medicines, and pharmaceuticals	YES (4)
Ornamental resources	YES (1)
Fresh water	YES (13)
Regulating services	
Air quality maintenance	YES (1)
Climate regulation (e.g. temperature and precipitation, carbon storage)	YES (8)
Water regulation (e.g. flood prevention, timing and magnitude of runoff, aquifer recharge)	YES (11)
Erosion control	YES (13)
Water purification and waste management	YES (10)
Regulation of human diseases	YES (2)
Biological control (e.g. loss of natural predator of pests)	YES (8)
Pollination	YES (6)
Storm protection (damage by hurricanes or large waves)	YES (4)
Fire resistance (change of vegetation cover lead increased fire susceptibility)	YES (2)
Avalanche protection	YES (2)
Other (loss of indicator species)	Yes (2)
Cultural services	
Cultural diversity, spiritual and religious values, educational values, inspiration, aesthetic values, social relations, sense of place and identity	YES (22)
Cultural heritage values	YES (9)
Recreation and ecotourism	YES (27)
Supporting services	
Primary production	YES (9)
Nutrient cycling	YES (7)
Soil formation	YES (4)

Source: Kettunen & ten Brink (2006)

According to the case studies, habitat alteration and destruction appears to be the most common direct reason behind the loss of biodiversity and related ecosystem services. Additionally, over-extraction of resources, pollution, eutrophication and changes in ecosystem species composition (e.g. introduction of invasive alien species) have often contributed to the loss. As regards to the underlying reasons behind the loss, unsustainable resources management combined with sectorally oriented development initiatives (e.g. neglecting the tradeoffs between different ecosystem services) could be distinguished as the main drivers.

Implications for COPI studies

Most of the examples in this study are case studies, which have investigated single resources or nature conservation programs on a local (project) level. To use these results for COPI assessments an up-scaling and/or a connection to real policy scenarios is necessary. In some cases this is quite easy, e.g. the case study of the economic losses of the decline in native crayfish species from the Atlantic. Here a COPI assessment of a sustainable fishery policy has just to incorporate other relevant species or use the available data as an estimate of the lower limits of costs.

As soon as in the investigations are not only involving direct or indirect use values but also non-use values, up-scaling becomes more complicated. This is also the case if the estimated changes of ecosystem services or biodiversity assets are not marginal. In these cases, simple up-scaling is not possible if no information about the demand curves of the asset/service in question exist. For example, the value of Danube protection can not be multiplied with the number of river basins in Europe to assess the costs of inaction regarding river basin protection (This is also the case for the crayfish example if the sustainable fishery scenario would lead to price changes for crayfish).

This study concentrates on ecosystem services, and hence many of the case studies focus on use values. Since biodiversity loss is also associated with the loss of non-use values, these costs have to be incorporated to a COPI study.

Example 2: Invasive Alien Species (Born et al. 2005)

As mentioned, the Convention on Biodiversity (CBD) requests for national strategies to deal with IAS. The primary aim of this study is to evaluate whether existing economic literature is suitable to act as a decision aid for policy advice.

For this investigation the authors distinguished between decision aid studies (defined as studies that evaluate measures) and impact assessment studies. The latter can be seen as COPI studies, since they consider the costs IAS cause under the assumption of a laissez-faire strategy.

The studies have very different scopes. While some are limited to specific habitats, others try to assess nation or world wide effects (see. Table 7)

The studies have very different scopes. While some are limited to specific habitats, others try to assess nation or world wide effects (see. Table 7)

Table 7: Selection of economic studies of biological invasions.

Study	Area	Costs per year
Pimentel, et al., 2001	Economic evaluation of invasive species, Australia, Brazil, British Isles, India, New Zealand, South Africa, USA	**US$ 336 billion**
Pimentel, et al., 2002	Economic impacts in the USA	**US$ 137 billion**
Reinhardt et al., 2003[1]	Economic impact assessment of 20 invasive species, Germany	**€ 160 million**
Turpie and Heydenrych, 2000	C&B of invasive species' impacts on fynbos ecosystem, South Africa.	**US$ 65 million**

Source: after Born et al. 2003

Implications for COPI studies

The high number of studies dealing with many different species and areas allow a very rough extrapolation of the costs of inaction in the case of IAS. While doing these case studies, it has to be kept in mind that there are some methodological shortcomings. Some studies use costs for mitigation and control strategies as an indicator for the overall costs of IAS. Furthermore, the majority of studies concentrate on the agricultural and forestry sector. Hence it has to be assured that no relevant effects in other sectors are ignored.

On major problem of IAS is their impact on native biodiversity. If ecosystems or species are threatened, not only use values– like in the agricultural sector –but also non-use values are involved. Due to the well known methodological problems, only a limited number of studies consider and/or try to measure non-use values so far. COPI assessments based on the available information have to ensure that no substantial underestimation of COPI will take place. Nevertheless, the available data on costs should give valuable information about the urgency of the problem.

Example 3. Cross-roads of Planet Earth's Life. Exploring means to meet the 2010 biodiversity target.

Cross-roads of Planet Earth's Life is the first assessment using the analytical machinery of the newly expanded GLOBIO consortium. It was compiled on request of the secretariat of the Biodiversity Convention. The assessment projects a single biodiversity indicator ('mean species abundance') towards 2050 as a function of changes in drivers such as agriculture and demand for food and biofuels; growth in the impact of infrastructure; climate change; and nitrogen loading. The focus is on terrestrial biodiversity; results are available for 24 world regions (map-based if necessary) and 11 biomes.

The main thrust of the study is towards the potential of broad policy packages related to biodiversity on issues such as biofuels, poverty alleviation, trade liberalisation and protected areas. Underlying this policy analysis is a baseline projection.

Figure 12: Development of global biodiversity 1700-2050, Mean Species Abundance in various natural biomes and Figure 13: Biodiversity development for the world, and contribution of stress factors to the decline give an impression of the baseline results for the planet as a whole; the bar chart for OECD (Figure 14: Biodiversity losses in OECD) shows OECD Europe separately.

Loss of the biodiversity quality in the natural biomes started already many centuries ago, as can be seen in the historical graph from 1700 to 2000; see Figure 12. The strongest declines occur in the temperate en tropical grasslands and forests. The remaining biodiversity is found more and more in biomes that are less suitable for human development and thus less likely to be affected, such as deserts and polar biomes. This trend continues with an anticipated and accelerating further loss of biodiversity. At the global level, there is a substantial biodiversity loss in the baseline: the remaining mean species abundance drops from 68% in 2000 to 60% in 2030 and 55% in 2050. The rate of decrease for this period is even higher than in the period 1970 to 2000.

The role of agricultural land-use change remains the largest of all pressure factors, which is clearly related to the strong increase in crop areas (see Figure 13). The major contributors to the additional biodiversity loss from 2000 to 2050 are: expanding infrastructure (7% additional loss), agriculture (additional 6%), and climate change (additional 3%). The influence of nitrogen deposition and fragmentation does not increase, even though these factors share similar indirect divers as the other factors. In fact, through expanding agriculture, less natural biomes are left where these stresses can exert their influence.

The overall biodiversity level in the OECD group is strongly influenced by the vast natural areas in USA, Canada and Oceania with relatively high biodiversity levels (see Figure 14). By contrast, biodiversity levels in the densely populated regions Japan and especially OECD Europe are much lower. The further decline to 2050 for the OECD group is mostly due to agricultural expansion (additional 6%) in Central Europe (the new EU members) and Turkey, and expanding infrastructure in the densely populated countries of this cluster (additional 4%).

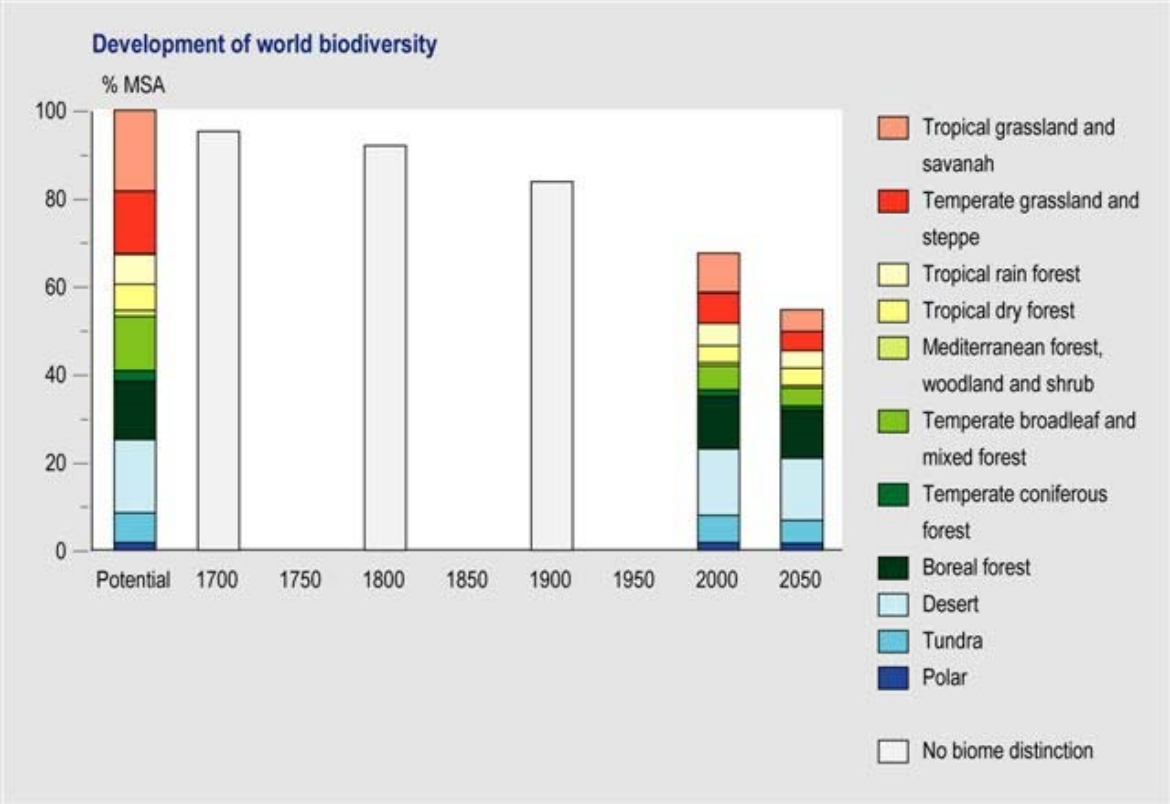

Figure 12: Development of global biodiversity 1700-2050, Mean Species Abundance in various natural biomes

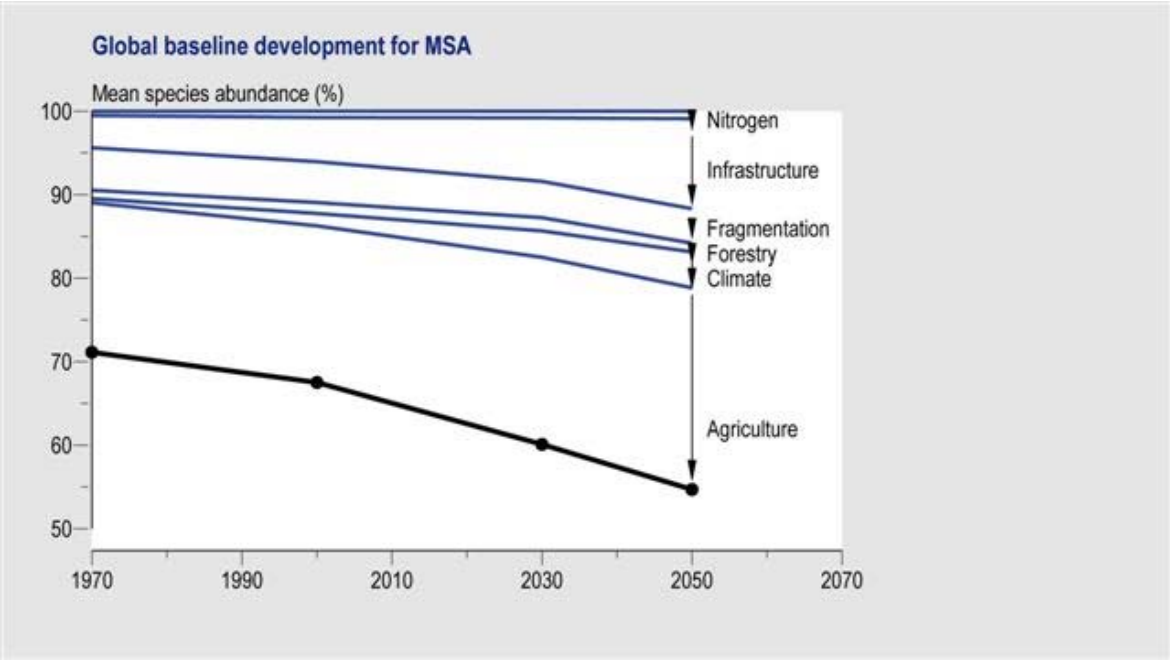

Figure 13: Biodiversity development for the world, and contribution of stress factors to the decline

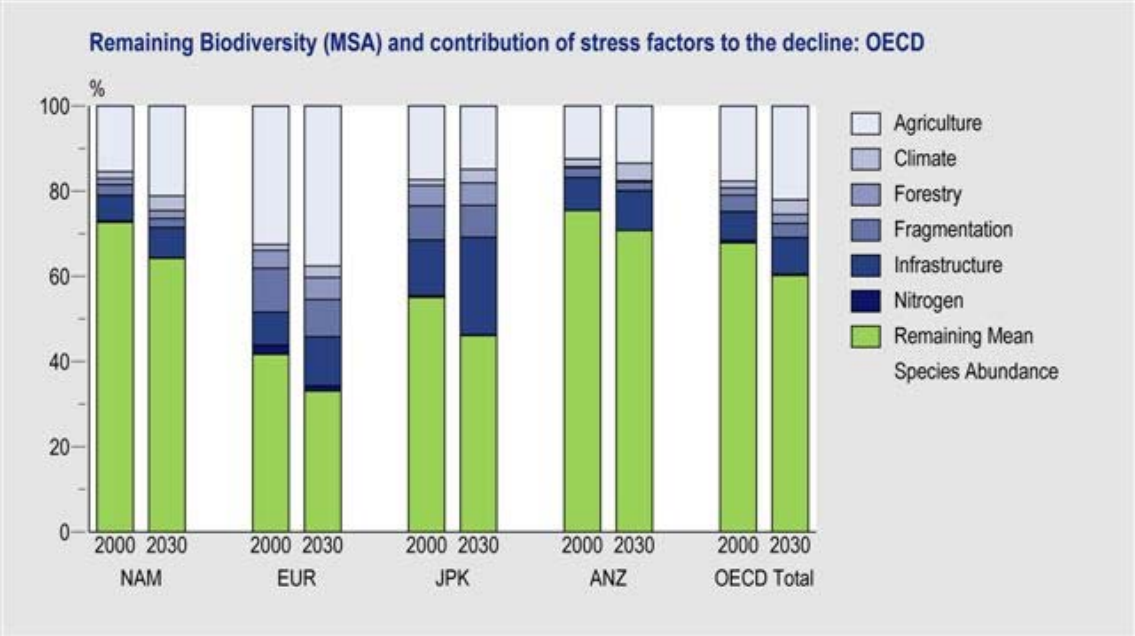

Figure 14: Biodiversity losses in OECD

Implications for COPI studies

For all the simplification that has to go into it, this type of study demonstrates that it is possible to construct a quantified baseline for terrestrial biodiversity with a relevant time horizon and considerable detail. It is supported by three ‘blocks’ of knowledge, on current biodiversity (World Conservation Monitoring Centre); on worldwide modelling (MNP); and on correlation between biodiversity and pressures, as reported in literature (knowledge base of the original GLOBIO project, now at GRID Arendal). The results are quantified, in physical units only. For future work on valuation, the breakdown into biomes can be very useful. A key step permitting the projection into the future is the single indicator, mean species abundance. This far-going simplification is crucial but by the same token controversial.

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Annex VII
Experiences to build on: Environmental Acquis in Central Europe

Box 3: Introduction to the Benefits Study work

The benefits of compliance (with the EU environmental acquis)[6] work that covered the then 13 candidate and accession countries (2004 entrants, Bulgaria, Romania and Turkey) for the enlargement unit of DGENV of the European Commission proved to be a very valuable political tool for DGENV in its discussions with the then candidate countries. It was also understand to be a useful tool to improve the profile of the environment in the countries and give the environment ministries a tool to argue for greater funding. Key extracts from the work was also used by the Commissioner and Directors of DGENV in missions to the candidate countries. The work was also aired at Green week and also taken up by other networks (green spider network) and received interesting from policy-academic field (institutes in Germany and Austria were keen on papers to discuss enlargement benefits[7]).

A subsequent study has already taken place – *the Benefits of Compliance with the EU Environmental acquis for Croatia* – and a further compliance study on FYROM and other Balkan countries has now been launches. It is not inconceivable that further benefits studies will be requested for further candidates. It Depending on political developments, it could make sense to have similar studies for Moldova and the Ukraine, if only to encourage them to adopt similar environmental laws, even if it turns out that the prospects of enlargement are not short or even medium term possibilities.

Within the benefits of compliance studies it was clear that certain things were 'easier' to do than others, and this realism was reflected in the Croatian benefits study, where the focus – on the monetary level – included only air pollution and water. Waste had been dropped as too complex and unlikely to come up with numbers that would be suitably understood. Budgetary limitations also played a part.

What can be done quickly & effectively; what would warrant targeted research?-

Health impacts with exposure to airborne pollutants: There is already quite a strong literature on the dose-response functions linking a range of health impacts with exposure to airborne pollutants. Some key dose-response functions are given in Annex 1.

[6] *Benefits of compliance with the Acquis Communautaire* by Ecotec, IEEP et al for DGENV. 2003

[7] ten Brink P and A Farmer *Enlarging the EU and the Environment: Commitments, Progress, Benefits and Challenges* RAUM – Journal of the Austrian Institute for Regional Planning (OIR) Vol 53/2004 (March)

ten Brink P (2002) The Benefits from the Implementation of the EU Environmental Acquis in the Candidate Countries. Intereconomics, Review of European Economic Policy, Volume 37, No 6, November/December 2002 pp 287-292 Hamburg, Germany.

These can be used quite quickly for studies looking at urban impacts from urban pollutions – actual or projected. In fact, regularly, estimates are made for numbers of health impacts from urban pollution.

More can be done with this, indeed given the challenge of city traffic, congestion, pollution, and contributions to climate change, a strategy of regular impact studies and benefits of doing something about it studies could be very valuable.

Water quality: As regards water based dose responses and valuation studies, there is a lesser literature on dose-response functions in Europe given low impacts on health of water in Europe. There is however, a greater literature on valuation studies – eg the value people attribute to access to suitably quality water resources – eg clean rivers for recreation. Annex 2 give water related evaluation studies

The data here can be quickly used to get some figures to underline benefits of safeguarding rives from pollution or making efforts to improve water quality in rivers, coastlines etc. There are of course methodological concerns (see later section), but the underlying valuation studies are there and more are being added. Regular use is made in working out what tariffs could be deemed affordable and contribution of charges to payback in water supply infrastructure investments.

Waste; as noted above this is a much more difficult field as generally not easy to do significant wide reaching cost of inaction studies or benefits studies. In the earlier benefits studies, estimates were made for recycling savings and associated avoided impacts of externalities, as well as developments of landfill / composition and avoided impacts depending on the choice. It is unclear whether this field has developed sufficiently in recent years for quick useful COPI type studies to make sense (if COPI is going to be costs of policy inaction and not simply burden of policy inaction (BOPI), which would be easier to do, and useful).

Nature conservation and Eco-system services: in the benefits of compliance work, monetisation of benefits of nature conservation and eco-system services was not done, given that it was too controversial, that there would be too little easily useable data and the with the little data that there was, the final results could be misinterpreted. Subsequently, more efforts have been make at looking at the benefits of Natura 2000[8], and also at the value of eco-

[8] See, for example, ten Brink, P., Monkhouse, C. and Richartz, S. 2002 Background Report for European conference on 'Promoting the Socio-Economic Benefits of Natura 2000', Brussels, 28-29 November 2002. Institute for European Environmental Policy (IEEP), Brussels, Belgium. 28 pp.

system services[9]. Both of these took more case study approaches and few serious attempts have so far been made to derive EU-wide benefits (the controversial Constanza[10] study on global benefits of ecosystem services being a global exception). In the benefits study, discussion focused on the qualitative benefits and quantification of benefits – in the simplest terms – imply in areas protected.

Chemicals: at the time of the benefits studies, chemicals policy was regarded as too difficult to evaluate the benefits of – the existing legislation being very slow on new chemicals, and at the time there was but a white paper on REACH, in a form not easily conducive to benefits of compliance type studies. Other studies have taken place since and separately and are not noted here.

Key characteristics of the problem area that influence how a COPI statement on that area should be derived – for example, important non-linearity.

When it comes to health impacts, current knowledge suggests that the impacts from exposure is more or less linear – at least when looking over a wide sample population. This is not the case for a range of other issues, where there irreversible or difficultly reversible cases:

- road building leads to irreversible destruction of unique habitat
- when oxygen levels drop below certain levels in rivers
- population sizes below critical levels.

COPI studies can also deal with these issues – by being aware that they exist, identify them, and also quantify them. For these the choice of discount rate will be important as there is likely to be relatively low cost of policy inaction up to the threshold and often very high costs of policy inaction as one goes across the tipping point and a critical threshold is passed.

In general, the term 'Critical thresholds'[11] can be applied to those limits where a small pressure can lead to non-linear change to a system and lead to a critical result – i.e. where

[9] See for example Kettunen, M. & ten Brink, P. 2006. Value of biodiversity- Documenting EU examples where biodiversity loss has led to the loss of ecosystem services. Final report for the European Commission. Institute for European Environmental Policy (IEEP), Brussels, Belgium. 131 pp.

[10] Costanza, R., d'Arge, R., de Groot, R.S., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. Nature, 387: 253–260.

[11] See also the following document from which discussion on critical thresholds has been taken: ten Brink, P., C. Miller, K. Ramsak and J. Anderson 2006 Review of Trade-offs and Critical Thresholds. A working document within DGResearch Contract: Methods and tools for evaluating the impact of cohesion policies on sustainable regional development (SRD) Institute for European Environmental Policy (IEEP), Brussels, Belgium. 19 pp.

there are major implications, often irreversible. If changes are easy to reverse, use of the term ‘critical threshold’ may not be appropriate – this will not often be the case if non-linear change has occurred. Below are two examples of natural critical thresholds.

- Habitat size - below a certain size, areas of habitat (e.g. forest, woodland etc) will not sustain certain species. For example, building roads through forests may change the character of the habitat from being one contiguous area to several ‘patches’. While roads remain in place, the effects of this fragmentation may be irreversible.
- Algal blooms and fish kills – excessive nutrient loading may fertilise freshwater and coastal systems. Once a threshold of nutrient loading is reached, changes can be abrupt, causing algal blooms (including blooms of toxic species) and sometimes leading to the formation of oxygen depleted zones, killing much aquatic animal life. Marine life may return if oxygen levels are restored, but restoration is difficult and expensive, and may not be possible in some cases.

Where there are critical thresholds, it is important to understand that further damage (over the threshold) is unsustainable (eg because of irreversibility) and decision-makers should ensure the policy choice (ie the decision about whether to proceed with a project) respects the threshold by avoiding a change that would breach the threshold. This is not to argue that only change at the critical threshold counts, as there are also losses and trade-offs to be taken seriously from changes which do not breach the critical threshold, but the bottom line is that the changes which result from crossing the threshold are critical and cannot be compromised.

Annex VIII
Experiences to build on: Integrated Environment Assessment on continental and global scale

Making and using a COPI study builds on the methodologies that have been developed and applied for the broad, forward-looking environmental assessments that have been produced in the past ten to twenty years. These methods are a mixture of science and process know-how. For example, they consists of scenario development, modelling, handling gaps and uncertainties, involvement of stakeholders and networks, policy-oriented interpretation and presentation.

As part of the scoping study, the consortium reviewed its own experiences in many of these assessments. This was done using the ‘analytical sieves’ reproduced in Annex X Analytical framework used to reflect on COPI-related experience.

Section 4.1.7 summarizes the conclusions that could be drawn from a point of view of feasibility of COPI studies. The following table lists specific observations for each of the assessments.

Table 8: Observations about COPI assessments

	Crucial element	Pitfall
Potential for COPI, monetized or otherwise (identification / quantification / monetization)		
IPCC 3rd assessment report	Process	Battle for acceptable statement
First ACACIA report (Assessment of Potential Effects and Adaptations for Climate Change in Europe)	Multi-scale analysis of impacts	No sound bites
GEO-1 (Global Environment Outlook)	Wall-to-wall regionalisation	'a modellers world'
EU Priorities study (a broad Cost Benefit Analysis)	Meticulous quantification	Took too long, politically
Valuing the benefits of environmental policy (of The Netherlands)	Extensively quantified as well as quick	Benefits only. No policy follow-up
Potential for COPI in terms of policy relevant dimensions		
Water GAP studies	Convincing physical reality (drainage basin as the unit of analysis)	Disagreement about irrigation scenarios (therefore only canonized scenarios)
World Energy Outlook 2004 statement: the power plants that will be emitting in forty years time are on the drawing board now	Speaks to the techno-believers	An isolated fact
Global Biodiversity Outlook 2	Comprehensive projection with a single indicator showing the effect of various driving forces	Brutal simplification, will remain controversial. Slow physical system is a hard sell, politically.
IMAGE and ISRIC risk of water-induced soil degradation	Can be projected into the future	Physical risk might be offset by better management
GEO-3 (Global Environment Outlook 3)	Comprehensive + regionalized + history + outlook	No costing. UN regions are politically void entities
TERM enlargement edition ('Paving the way for EU enlargement')	Factual	Low profile. Points out expected growth in pressures but not the eventual impacts and costs
Potential for COPI in terms of policy relevant dimensions		
Millennium Ecosystem Assessment	Connects to issues of the developing world	Remains abstract
GEO-2 alternative policy study West Asia (On water availability in the Middle East)	Easy to follow, factual	Non-controversial actions are shown to be inadequate - an identification of adequate policy action is beyond de study's mandate
Genuine Saving	Intuitively understood at power ministries	Covers all countries → data compromises → environment undervalued. Current calculation tailored for developing countries

Annex IX Valuation databases

1. Environmental Valuation Reference Inventory EVRI[12]

EVRI, developed by Environment Canada in collaboration with US EPA, is the most well-established database providing the most studies (over 1,200 studies in US, Canada, Europe, Asia, South America) and greatest detail. Use of the database is not for free: residents outside France, the US, Canada and the UK have to pay $900 Cdn (approximately €625) for a one-year subscription. It summaries environmental and human health valuation studies in order to assist policy analysts to estimate economic values for changes in environmental goods and services or health effects. The searching protocol provides various options to search by type of environmental good or service valued, the environmental stresses, the geographical characteristics and the economic measures. A wide variety of topics are covered, including water, animals, land, plants, air, non-extractive uses, extractive uses, passive uses, ecological services, and human health. Furthermore, the database provides study reference, information about the study area and population, environmental focus, methodology, estimated values, and abstract (including alternative language summaries).

2. ValueBase Swe[13]

ValueBase Swe is the valuation study base for environmental change in Sweden, originally constructed in 1996 and updated in 2003An effort was made to collect information together in a similar manner as is done in EVRI in order that it could be added to EVRI at a later date. The database is downloadable and organised as an Excel spreadsheet and contains over 170 records. The topics covered include manmade environment, water quality, forests, air quality, fish, agricultural land, mountains, wetlands, animals, plants, and general environmental quality. Statistics are provided on the type of studies included in the database. A bibliography and summaries of the valuation studies are included in the appendices. Search results provide reference, methodology, the environmental good or service, sample, year, and economic value.

3. EnValue database NSW[14]

The database was developed by the New South Wales Environment Protection Agency (NSW EPA) and first released in 1995 and updated in 2004, and is slightly more dated than the other databases. Around 400 studies are covered, mostly environmental valuation studies from Australia. In contrast to other sites (for example ValueBase), only peer-reviewed studies are included, which is meant to provide some quality control. Access is immediate and free, and

[12] http://www.evri.ca/

[13] Developed by Sara Sundberg and Tore Söderqvist at the Beijer International Institute of Ecological Economics for a project funded by the Swedish Environmental Protection Agency. Available online at http://www.beijer.kva.se/valuebase.htm

[14] http://www.epa.nsw.gov.au/envalue/

search results include reference, methodology, location, and value. Location and population summaries are usually, but not always, provided. There is also a “Conceptual Studies” section which includes background reading on benefit transfer.

4. Review of Externality Data (RED)[15]

The establishment of RED took place between 2002-2003 and was funded by the EU Commission under the Energy, Environment and Sustainable Development Programme of DG Research. This was done through a literature review of predominantly European studies and the establishment of a database summarising the information. RED is aimed at industry, agriculture, policy-makers, international institutions and universities, but should particularly assist policy-makers in capturing the effects of externalities produced from new policies which have sustainable development as their core concern. The design of the website is dated and the database is not as user-friendly as others, according to a recent survey by Lanz and Slaney (2005)[16], and only 38 studies are covered in the database. Use of RED is free of charge, and results provided include reference, study area, value and summary.

5. New Zealand Non-Market Valuation Database[17]

This database, which is free to use, contains around 413 non-market valuation studies that have been undertaken in New Zealand. It consists mainly of stated preference studies which measure community willingness to pay to prevent a specified change in the environment. Most studies address proposed changes to rivers or other water-related issues, though the database is not necessarily limited to these. To allow easy comparison, only the nature of the item valued and the value has been recorded in the database, which makes searching for studies simple. While summary and background information is lacking, it is possible to search for the contact details of practitioners and analysts of non-market valuation within New Zealand. Since the studies are only for New Zealand, however, this is of minimal usefulness for benefits transfer studies in the European Union.

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[15] http://www.red-externalities.net/

[16] Lanz, V. and G. Slaney (2005) An evaluation of environmental valuation databases around the world. Benefits transfer and valuation databases: are we heading in the right direction? Proceedings of an international workshop sponsored by the US EPA’s national centre for environmental economics and Environment Canada.

[17] NZNMV was established in 2003 by Geoff Kerr of Lincoln University. It is available online at http://learn.lincoln.ac.nz/markval/

Annex X
Analytical framework used to reflect on COPI-related experience

For reflecting on COPI-related experience, the study team used the three tables reproduced in this annex as 'analytical sieves'.

During the study, slight modifications were made to these tables themselves (land use was added as an environmental issue). Related elements were developed and included in the scoping study report; e.g. a list of environmental issues mostly based on DG ENV's presentation of itself (section 5.1); suggestions for key sectors to focus on (section 5.2) and a description of the place of COPI in the policy life cycle (section 2.2 including the diagram in Figure 2). Table 2 in this annex first listed policy relevant dimensions for a COPI study; the corresponding part of the scoping study is the various sections of chapter 3 – Design choices and methods.

Table 9: Potential for assessments based on COPI, monetized or otherwise

	Qualitative identification of problem and drivers	Quantification of impacts, not monetized	Monetization of impacts
Fresh water			
Air Pollution			
Waste			
Climate Change			
Biodiversity *[terrestrial; marine]*			
Soils			
Chemicals, GMOs			
Human health in relation to environment			
Natural resources			
Noise			
Radiation			
Ozone depletion			
'Industrial' hazards			
Landscape			
Land use change			
Environment as a single theme *[if necessary distinguish EU and world]*			

Table 10: Potential for assessments based on COPI, in terms of policy-relevant dimensions

	Current situation	Future	Distributive aspects	Multi-scale aspects	Dynamic aspects
Fresh water					
Air Pollution					
Waste					
Climate Change					
Biodiversity *[terrestrial; marine]*					
Soils					
Chemicals, GMOs					
Human health in relation to environment					
Natural resources					
Noise					
Radiation					
Ozone depletion					
'Industrial' hazards					
Landscape					
Land use change					
Environment as a single theme *[if necessary distinguish EU and world]*					

Current situation: in some cases a point can convincingly be brought across on the basis of the current situation or trends over the past decades. Although less creative, this avoids the complexities and distractions of scenario work.

Future: distinguishing between medium and longer term – for example 10 years, 25 years and beyond.

Distributive effects: between countries/regions, income classes; specific sectors, ecosystems etc

Multiscale aspects: for some issues it is important to understand and factor in what is happening at another scale level. For example, a COPI assessment of biodiversity and landscape in the ten new member countries by 2030 will, among other things, have to take into account how the world trade in agricultural products will develop until now and ten.

Dynamic aspects: for some issues, the dynamics are an important part of the story because they may shrink the effect of current policies (e.g, because travel behaviour erodes the effect of cleaner vehicles) or limit the policy window (e.g. the 2040 powerplants being designed now).

Table 11: Potential for assessments based on COPI, in terms of policy-phases

	Scoping		Envisioning		.....	Learning	
	Problem recognition	Investigating the problem	Strategic prioritisation	.....	.....		Discontinuation
Fresh water							
Air Pollution							
Waste							
Climate Change							
Biodiversity							
Soils							
Chemicals, GMOs							
Human health in relation to environment							
Natural resources							
Noise							
Radiation							
Ozone depletion							
'Industrial' hazards							
Landscape							
Land use change							
Environment as a single theme *[if necessary distinguish EU and world]*							

Annex XI
Cost of Policy Inaction – Advantages and disadvantages

The purpose of COPI

- Improving problem definition (clarify underlying values / levels of uncertainty)
- Awareness raising of a particular problem to policy makers
- Highlight the need for action & accelerate policy response (esp. by non-environmental policy actors)
- Support for 'passive' policy stance (by environmental policy actors)

The nature of COPI

- COPI is the environmental damage cost of doing nothing more than we're already committed to – OR the costs of NOT acting beyond current commitments
- Some questions follow:
- Do we think we know what will happen if we do nothing more?
- Can we attribute those changes to influences which are themselves sensitive to policy interventions?
- What is the reference against which the change in the state of the environment, the impacts and the costs are measured?
- To what degree can the costs be monetized?

Defining the 'do-nothing' baseline for COPI

- What is the current state of the environment?
- How is this state expected to change?
- What is affecting this trajectory of change?
- How are **existing** policies expected to impact on the situation?
- What are the current/future costs of the current state of the environment and trajectory of change?

Focus of COPI on the total costs

- Asks a different sort of question …. to which answers are not always available, for example:
  - The probability that you will get sick if you bathe off an EU beach
  - The probability of a severe oil tanker spill in EU waters in any given year
- Focus on the total 'stock' of a problem – not the marginal change
- There are inevitable gaps and uncertainties in the science – as with conventional welfare analysis

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Possible contexts and rationale for COPI

- Scaling the costs of inaction - Where are reductions in environmental services likely to be greatest?
  - Essentially a science led debate – reducing the scope to use uncertainty as a brake on policy
- The implications of driving forces - Where are pressures greatest / increasing fastest?
  - Essentially a socio-economic led debate – engaging / challenging with non-environmental / sector policy
- The need to meet / accelerate targets - Where are the costs of policy action a brake on achieving existing commitments?
  - Essentially a policy led debate – respond / anticipate inaction because of concerns about costs

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Using COPI has advantages & disadvantages

- Advantages
  - Clear role in the policy cycle – don't confuse with CBA
  - Scoping problems – not dealing with detail
  - Explicit temporal focus – use specific baselines and scenarios of futures
  - Simplicity as the basis of communicating and disseminating problems
- Disadvantages
  - 'So what' – tell us how we deal with the problem – scoping can however 'second-guess' some of these questions
  - 'You would say that' or 'what's new' – COPI to emphasise changes in perspective – 'it's getting worse' or 'act now before its too late'
  - 'But the solution is worse' – focus on problems – don't say whether its more costly to respond – OK – lets examine further

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COPI as communication tool – plan!

- Advantages
  - Deal with contested issues – unlock new perspectives / act as a catalyst for change
  - Avoid too much detail – 'big ticket' items – keep it simple
- Disadvantages
  - Deal with contested issues – unlock new opponents / counter-arguments
  - Not sufficient detail to convince sceptics
- COPI commissioned with some care and with a clear idea of what the political gains and losses might be – tailor to specific debates

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Methodology for COPI has advantages & disadvantages compared to CBA

- Advantages
  - Similar issues as conventional welfare analysis - defining dose-responses and estimating the value of damage costs BUT concerned with 'ball-park' descriptions – not attempting detail
  - Use of scenarios to address and integrate uncertainties
- Disadvantages
  - Baseline definition – specified in terms of state of the environment (past, present), rather than by reference to policy (and policy counterfactual)
  - Concerned with 'stock' questions – such as the probability of an oil spill – rather than with 'change' – e.g. change in probability of oil spill

COPI as economic analysis – define!

- Advantages
  - Use of scenarios allow uncertainties and futures that would be excluded in CBA – content with qualitative descriptions
  - Use of a clearly defined baseline (esp. recent past) allows clear description of the starting point
  - Dynamic 'time-marginal' COPI adds value to welfare analysis
- Disadvantages
  - Has to deal with total not marginal change
  - Can't advise on responses – only imply responses may be needed
- COPI is not a CBA – make it clear in scoping and as the basis of communication

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