Creating a Network of Knowledge
for biodiversity and ecosystem services in Europe
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Final knowledge assessment reports of the 3 case studies and lessons learned
(Deliverable 3.1 of the KNEU project, contract No. 265299)

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We strongly acknowledge the voluntary contribution of all involved stakeholders, mainly requesters and experts such as scientists, reseachers, policy-makers, decision-makers, and practitioners.

Date of finalization (version 1): 7.6.2013

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1 Outline and purpose of the Deliverable

This Deliverable reports on WP3 of the FP Communication Actions KNEU. It aims at testing the developed Prototype European Network of Knowledge for Biodiversity and Ecosystem Services (hereafter NoK-Prototype, see KNEU D.2.1) in practice. For this purpose three case studies were performed with the intention to cover a broad range of relevant sectors of research and policy making. The performance of the NoK-Prototype during the conduction of the case studies will be evaluated by WP4 and, based on the conclusions of WP3 and WP4, a final set of recommendations for the governance and methodological approach of the Network of Knowledge will be elaborated in WP 5.

The specific objectives of the three case studies reported in this Deliverable are:

- to test in three case study areas, namely agriculture, biodiversity conservation and marine biodiversity, different knowledge assessment approaches and different approaches for communication, consultation and cooperation between knowledge providers and requesters;
- to provide an assessment of available knowledge about the specific questions regarding biodiversity and ecosystem services of three policy relevant topics (one topic per case study);
- to identify strengths and weaknesses of the tested approach and to draw key principles and guidelines for developing efficient knowledge assessment processes;
- to enable the overall evaluation of the performance of the NoK-Prototype from the points of view of requesters, expert group members and other knowledge providers, and other project participants (this overall evaluation will be conducted in WP4 and reported in Deliverable D.4.1)

Thus, the test cases aim at evaluating the virtues, limitations and the sphere of applicability of different approaches to knowledge assessment and communication, and how the NoK-Prototype can address these issues. This is achieved by applying the procedures and methodologies proposed in WP2 and provide knowledge-based answers to the questions about biodiversity and ecosystem services posed within each specific case study area.

In the case studies different combinations of the knowledge assessment approaches expert consultation, systematic review, and adaptive management were explored. The test cases also differed strongly in respect to the kind of request, the kind of requesters and the way of choosing of the topic. The specific research questions developed and agreed on in the frame of a scoping process with experts and policy makers during the first stages of the case studies were:

- marine case: *Current trends in kelp forests in Europe and evidence that these trends will affect the ecosystems biodiversity and the provision of ecosystem services;*

- agricultural case: *Effectiveness of interventions aiming at manipulating non-crop habitat or landscape features to maintain or support natural (indigenous) population of pest control agents;*
- conservation case: *Impact of multifunctional floodplain management on biodiversity*

2 Structure and Use of this Report

This Deliverable has the following structure:

After this Chapter on Structure and Use of the Report (Chapter 2), we present an overall summary of the three case studies, considering knowledge assessments, and lessons learned for the NoK-approach, and completed and planned dissemination activities (Chapter 3). Then each of the three case studies is presented separately, starting with the marine case (Chapter 4), followed by the agricultural case (Chapter 5) and the conservation case (Chapter 6). For each case study, background and introduction are presented (Chapters 4.1, 5.1, 6.1) followed by a summary of the main results and conclusions of the case studies covering both aspects, the knowledge assessment reports and the lessons learned in respect to the process (Chapters 4.2, 5.2, 6.2).

Then abstracts of the knowledge assessment reports are presented (Chapters 4.3, 5.3, 6.3), which include in the **marine case** an expert evaluation of the status and trends of the European kelp forests (Chapter 4.3.1), a systematic review protocol (Chapter 4.3.2) and a systematic review (Chapter 4.3.3) on the effects of kelp changes on fisheries, and first results of an adaptive management exercise on the drivers of changes in kelp forest (Chapter 4.3.4).

In the **agriculture case**, the knowledge assessment reports include a literature review on one specific intervention, the effects of linear set-aside patches on natural pest control agents (Chapter 5.3.1.) and a protocol of a systematic map that was written and submitted to the Journal *Environmental Evidence* (Chapter 5.3.2).

In the **conservation case**, we produced knowledge assessment reports, dealing with a systematic review protocol entitled *Floodplain management in temperate regions: Is multifunctionality enhancing biodiversity?* (Chapter 6.3.1), a country specific expert consultation on the multifunctional floodplain management approaches and evidence for their impact on biodiversity (Chapter 6.3.2.), a second expert consultation dealing with the effects of floodplain interventions on ecosystem services and the interventions level of multifunctionality (Chapter 6.3.3), and a draft systematic map on the impact of multifunctional floodplain management on biodiversity (Chapter 6.3.4).

The knowledge assessment reports are followed in each case study by a chapter about the lessons learned from the implementation of the NoK-Prototype (Chapters 4.4, 5.4, 6.4), which is following the structure of the NoK-Prototype as far as possible. The Deliverable is completed by an annex (Chapter 7) containing the full versions of all knowledge assessment reports of the marine (Annex A), the agricultural (Annex B) and the conservation (Annex C)

Knowledge assessment reports, which have been partly submitted for publication to scientific journals, were kept in their original formats and authors, acknowledgements and references are specified at each specific chapter. Readers of this Deliverable particularly interested on particular topics should mainly read the Chapters 4.1-4.3 (marine), 5.1-5.3

(agriculture) and 6.1-6.3 (conservation), while readers keen for the lessons learned for the development of the European Network of Knowledge for Biodiversity and Ecosystem Services should focus on the Chapters 3 (overall), 4.4 (marine), 5.4 (agriculture), and 6.4 (conservation).

All knowledge assessment reports that have yet not been accepted for publication in a scientific journal have neither yet passed the external quality control check and must therefore be seen as preliminary versions. They should not be considered as definitive evidence for political decision-making on environmental issues at this stage.
The lessons learned for the development of the European Network of Knowledge for Biodiversity and Ecosystem Services presented in this report are drawn from an "inside-perspective" of the WP and test case leaders. In addition to this, WP4 has conducted a detailed evaluation together with involved stakeholders which will be summarized in the WP4-Deliverable. They just form a major input in the development of the recommended design of the NoK in WP.5

3 Overall summary of the three case studies and dissemination

3.1 Overall summary of the three case studies

The three case studies covered a broad range of relevant sectors of research and policy making. They also differed strongly in respect to the request and the choice of the topic. The marine case study was research-driven and provided an example of an important, urgent and policy-relevant question that was not considered by the current policy agenda. On the other hand, in the agricultural and the conservation case, we aimed at indentifying policy-makers who were interested in being requesters for the case studies. This procedure does not comply to the situation envisaged by the NoK- prototype, where a requester pro-actively contacts the Knowledge Coordinating Body with a question. This led to several difficulties, because interest was low to participate in test cases for an approach that was untested, existed only on paper as a prototype, and for which it was unclear, if it will ever be fully implemented.

In the agricultural case, potential requesters was contacted at EU-level, in France and in Austria, while in the conservation case the focus was at the EU-level with some persons being approached also in Austria. Finally, policy makers from France and Austria were requesters of the agricultural case and from DG Environment for the conservation case. The specific topics developed at the beginning of the case studies with requesters and experts were for the marine case '*Current trends in kelp forests in Europe and evidence that these trends will affect the ecosystems biodiversity and the provision of ecosystem services'*; for the agricultural case '*Effectiveness of interventions aiming at manipulating non-crop habitat or landscape features to maintain or support natural (indigenous) population of pest control agents*'; and for the conservation case '*Impact of multifunctional floodplain management on biodiversity'*.

Different methodological approaches were tested in the three case studies. In the marine case, testing the combination of different approaches was a clearly stated aim from the beginning. It started with an expert assessment to obtain a first overview of the emergent topic and to identify the necessity of going more into depth on specific issues and their implications. A systematic review was added to address those implications for which there was a reasonable expectation to find enough published evidence in the scientific and grey literature, and the adaptive management approach was applied at the end to draft policy recommendations that would address current knowledge gaps and uncertainties by proposing robust management procedures specifically tailored to provide best-known-practices that accommodate conflicting interests among stakeholders and facilitate learning along their implementation.

In the agricultural case, the focus was at different aspects of reviewing procedures. A systematic review protocol was compiled and particular effort was dedicated to identify and screen the entire literature relevant for the chosen topic. A literature review was initiated on a subtopic of the question, and a systematic map was planned and the respecting work is currently conducted. During the agricultural case, it was found out that a research team from Cambridge University was working on the same topic, applying the reviewing approach termed 'synopsis of evidence'.

In the conservation case, the focus was on a systematic review that should also consider non-english and grey literature. While compiling the systematic review protocol, we detected that two complementary expert consultations were required. One of them was required to cover non-english and grey literature because resources (e.g. time availability of voluntary experts) were much too low to cover these issues by the systematic review approach. The second one was required to assess the multifunctionality of the interventions as this information was hardly reported in the primary literature. Given the broad topic that includes for instance all kinds of floodplain interventions and all biological taxa), a systematic map was compiled in a preliminary version, while work on the systematic review is ongoing.

The **main results** of the marine case are that trends in kelp abundance were different depending on the region considered and the species of kelp. A map of trends in kelp forests in Europe was produced that revealed many gaps of knowledge, mainly due to lack of monitoring data, lack of coordinated studies at European scale, lack of time of the involved experts to deal with not easily available information, and problems of mapping general knowledge of experts that was based on their personal overall expertise rather than on spatially explicit data. In the systematic review 3886 records were retrieved, and 78 of them were kept after reading the abstracts, and 44 were analyzed up to now. Most of them were completed rather recently in the US, and were dealing with the impacts of changes in kelp forests on fisheries. 86% showed evidence for positive and 9% for negative relationships between kelp abundance and associated fish populations, respectively. These results support the important role of kelp for fisheries. The Adaptive Management of kelp forests was discussed in a workshop that aimed at bringing together a representation of different stakeholders. The workshop was preceded by a preparatory phase in which participants were interviewed using a semi-structured questionnaire. Techniques of collaborative modelling were applied to build a joint conceptual model to identify key constraints, knowledge gaps and uncertainties and a final set of recommendations was derived that included for instance the establishment of a European monitoring scheme for kelp forest sites, a coherent European system to record harvest effort and yield, a monitoring program based on citizen science, and a research program assessing the effects of kelp farms on neighboring kelp forests and their ecosystem service provision.

In the agricultural case an extensive literature search based on a large set of search terms was performed and produced 39000 literature references, which provided the basis for the intervention classification and the evidence extraction. In a series of exclusion steps, based

first solely on article titles, then also on abstracts, the selection was narrowed. 60 different interventions related to pest control in agricultural landscapes were identified and it became clear that the available evidence was highly heterogeneous, with some interventions having been treated extensively in a large amount of literature (e. g. organic farming), while other interventions having been largely neglected. Ten of these interventions were considered as highly important by experts and stakeholders, and a set of 15 interventions related to landscape patterns were finally chosen for a systematic map approach to classify the evidence referring to these measures. A small expert group was set up to deal with the topic of linear strips in agricultural landscapes in closer detail. Thirteen pest control interventions will become available by early June by the collaborating team of the University of Cambridge, and further 4-5 interventions will be added in the coming months up to September. The list of interventions will be also finalized and published along with the systematic map of references found for each intervention. Further preliminary results are that linear weed or flower strips seem to increase overall biodiversity within the landscape but that they also enhance the abundance of generalist predators. Ambiguous results were reported in respect to the spillover effects from weed/flower strips into adjacent fields. We found very few significant results showing the pest reduction effects of pest control agent's dispersal, and no study that investigated the pest control effects of landscape structures, in particular linear strips, on yields. Most studies inadequately controlled for confounding effects from the surrounding landscape or had other shortcomings in study design. Some insignificant results are possibly caused by small sampling size, so a meta-analysis might yield a more consistent picture. In general, more research is needed to qualify landscape structures as pest control measures, but knowledge available to date indicates that such a role is possible. Establishing the evidence-base for this knowledge will require more work on the data and methods before reaching any conclusion.

The main result of the conservation case are up to now that floodplain restoration and conservation lead to multifunctional landscapes that provide a big variety of ecosystem services and potentially clear positive effects on biodiversity. While the systematic review is not ready to provide any robust answers at the time of compiling this report, we compiled and tested a comprehensive and still targeted search string and a tailor-made quality assessment scheme in the systematic review protocol, and 4131 hits were obtained in the databases Scopus and Thompson Reuters Web of Knowledge. As reported in the systematic map, 491 papers remained after screening titles and 70 after screening abstracts and full texts, most of the others could not be included at this stage for some missing information that would have been required. The journal *River Research and Applications* was the main source of evidence and most of the articles were published since 2008, reporting primarily about studies conducted in floodplains of the USA, Germany and France. Tested interventions were often related to restoration and production, and arthropods, fish and birds were the most commonly studied organisms. Most studies were carried out shortly after the intervention took place, while only a few of them evaluated long-term effects of interventions. The expert consultations provided examples for recent multifunctional

management approaches and fist evidence for their biodiversity effects for six European countries. Regional differences in management goals and approaches were detected, and multifunctional floodplain management seems to be possible under all strategies. Differences in size and number of projects mainly occur due to different levels of responsibility for water management, while there is a compelling common set of measures all over Europe, targeting not only the restoration of hydrological connectivity at different scales, but also the adaptation and extensification of land use in floodplains. Biodiversity may benefit from all these interventions but evidence is rare as only few projects have documented the respective impacts and responses. When assessing the impact on 21 ecosystem services of each of 38 floodplain management interventions, we uncovered that interventions related to restoration and rehabilitation strongly increased the multifunctionality of the floodplains and caused win-win situations for enhancing overall ecosystem service provision, but also the provision of multiple ecosystem services related to each of the sectors production, regulation and maintenance, and culture. Conventional regulation but also interventions related to extraction, infrastructure and intensive land use often caused lose-lose situations. We conclude that seemingly no alternative exist to multifunctional approaches in future floodplain management. To efficiently manage ecosystem services, win-win-situations need to be achieved and biodiversity has to play a crucial role. Multifunctional approached mainly show success where stakeholders with diverse expertise and interests are involved in all stages of planning and implementation of regarding projects. Such participatory processes are recognized as being beneficial for environmental resource management, but implementation of is still dragging behind rhetoric.

The **particular lessons learned** in the three case studies were partly complementary, but had at the same time several important issues in common. For broad questions as posed by policy-makers, large amounts of evidence could be detected and much effort was needed for its screening and categorizing. However, given the enormous variability of environmental issues, big knowledge gaps became obvious. For several specific interventions and even more for combinations of specific interventions and specific species, species groups or ecosystems, robust studies of high quality standards lacked entirely, and applied research on biodiversity and ecosystem services is heavily required to enable evidence-based policy making.

A further important insight was that despite much dedication of effort and time at the first dialogue phase with requester and experts, questions and aims of the procedure were often too broad, too little focused and too heterogeneous to be tackled in a single knowledge assessment procedure. Thus, involved stakeholders (mainly study coordinators, participating experts, requesters, policy makers, and funders of such assessments) should be strongly aware of the need to re-discuss the setting of the questions in the light of new information about volume, heterogeneity and content of the related evidence. For questions raised by academia, lack of interest from policy-makers might be an obstacle for a good performance of the NoK-prototype.

Under the setting of voluntary expert contributions, the possibilities of recruiting experts to dedicate effort and time for the assessments were limited. Some motivated experts were attracted by the networking possibilities offered by the process, the chance to participate in a larger international assessment that might be taken up by policy makers, and by the opportunity to participate in scientific publications. But despite big efforts dedicated by single experts, most potentially interested persons had been too busy with their obligatory professional tasks and could hardly dedicate time for the case studies. A formal tendering process with clear terms and supporting infrastructure may be necessary in some cases to ensure expert involvement and contributions, and to enable continuity and efficient working processes.

Workshops and too a much lesser extent teleconferences were very important in this context. They lead to a boost of motivation and were a very effective way of advancing in the assessments as they enabled deep-going interdisciplinary discussions, exchange of ideas and perspective on the matter, and face-to-face networking opportunities. Generally, bridging the gap between scientists (primarily interested in disseminating and exchanging original research) and practitioners and managers (primarily interested in applying available knowledge and being successful with it) was a major challenge in the process. Scientific knowledge was also much easier to access than other forms of knowledge, such as practical experience or indigenous knowledge. None of the tools designed for the access of scientific knowledge, such a literature databases and search engines, worked well for alternative forms of knowledge. Modular approaches, where some aspects of knowledge were assessed by means of reviewing evidence and others by expert consultations might be a solution for this challenge, and could perform particularly well, when combined with collaborative adaptive management approaches.

Testing the NoK prototype was fairly limited by resource constraints, which permitted in several situations only a simulation of the processes involved in knowledge assessments. Compared to a conduction under the frame of an established NoK-mechanism, we faced the challenge that despite considerable effort the project KNEU and the NoK-approach was not enough well-known to be a priority issue for several potential requesters or potential members of expert groups.

The **added values** of the NoK-approach can be potentially huge.

- The **negotiation/scoping process** with requesters under expert involvement seems to be able to obtain a research question that is both scientifically treatable and politically relevant.
- Due to the high heterogeneity of environmental issues and the scatteredness of the knowledge landscape, **inclusiveness** is of particular importance for assessments of high credibility and can be maximized by the NoK approach. In all stages of the assessment, from the setting the question until deriving the conclusions and recommendations of the obtained results, the broad contribution of a diversity of experts guarantees for a high level of independence and a high probability of objective (methodological) choices.

- The NoK can also be of **big support for integrating alternative knowledge** (such as grey literature, local expert knowledge, and traditional knowledge) that is not available in ISI-journals.

For these reasons, the NoK offers a significant and cost-effective added value in terms of credibility, legitimacy and independence. However, to obtain these added values, the NoK must be adequately implemented. Therefore it is required that the NoK is based on a comprehensive, continuously actualized and user friendly database of knowledge holders, and that the rationale of the NoK and its benefits for all involved stakeholders are strongly promoted. Potential funders must be aware that environmental assessments on broad topics that should enable evidence-based policy making require a low susceptibility for bias, high robustness and quality and the dedication of much effort. The NoK-approach will mainly develop its full added value and deliver a particularly well cost-benefit performace, when it is adequately funded and implemented.

We strongly acknowledge the voluntary contribution of all involved stakeholders, mainly requesters and experts such as scientists, reseachers, policy-makers, decision-makers, and practitioners.

3.2 Dissemination

As most of the knowledge assessment reports are ongoing work (as the timeline of the cases proved to be one of the major challenges), dissemination will mainly be a future task to be accomplished after the finalization of this Deliverable. However, discussions with requesters about definitive contents and formats of targeted products for policy makers have been initiated in all case studies, and several knowledge assessment reports are already rather well developed and were partly submitted to scientific journals and for scientific conferences. These activities will be integrated into the BiodiversityKnowledge dissemination strategy for the last phase of the project starting in summer 2013 that is currently being compiled. Herewith we provide herewith an overview of planned dissemination activities related to the work of WP3:

Targeted products for requester(s):
Marine case
In negotiation, but one policy brief is already compiled

Agricultural case
In negotiation

Conservation case
In negotiation with requester from DG Environment.

Scientific journals:

Marine case

Araujo R, Bartsch I, Bekkby T, Erzini K & Sousa-Pinto I. (in prep.) What is the impact of kelp forest density and/or area on fisheries? Systematic review protocol. *Environmental Evidence.*

Araujo R, Bartsch I, Bekkby T, Erzini K & Sousa-Pinto I. (in prep.) What is the impact of kelp forest density and/or area on fisheries? Systematic protocol. *Environmental Evidence.*

Araujo R, Assis J, Bartsch I, Bekkby T, Strain B, Airoldi L, Aguilar R, Puente A, Wiencke C, Fernandez C, Davoult D, Rinde E, Gevaert F, Christie H, Schubert H, Barbara I, Rico JM, Scally L, Valero M, Mieszkowska N, Derrien S & Sousa-Pinto I. (in prep.) The status and trends of kelp forests in Europe: results of an expert consultation exercise. *Biodiversity and Conservation.*

Agricultural case

In planning

Conservation case

Schindler S, Kropik M, Euller K, Bunting SW, Schulz-Zunkel C, Hermann A, Hainz-Renetzeder C, Kanka R, Mauerhofer V, Gasso V, Krug A, Lauwaars SG, Zulka K-P, Henle K, Hoffmann M, Biró M, Essl F, Jaquier S, Balázs L, Borics G, Hudin S, Damm C, Pusch M, van der Sluis T, Sebesvari Z, Wrbka T (2013) Floodplain management in temperate regions: Is multifunctionality enhancing biodiversity? A systematic review protocol. *Environmental Evidence 2:10.* http://www.environmentalevidencejournal.org/content/2/1/10/abstract

Schindler S, O'Neill FH, Biró M, Damm C, Gasso V, Kanka R, Lauwaars S, Krug A, van der Sluis T, Pusch M, Baranovsky B, Ehlert T, Neukirchen B, Martin JR, Euller K, Wrbka T (in prep.) Multifunctional floodplain management in temperate Europe and evidence for biodiversity effects: an expert consultation. *Journal for Nature Conservation.*

Schindler S, Sebesvari Z, Damm C, Hermann A, Euller K, Mauerhofer V, Kropik M, Biro M, Kanka R, Gasso V, Krug A, Lawaars SG, Pusch M, Schulz-Zunkel C, van der Sluis T, Zulka K-P, Lazowski W, Essl F, Hainz-Renetzeder C, Wrbka T (in prep.) Multifunctionality of floodplain management: a matrix relating interventions to ecosystem services. *Landscape Ecology* (Special Issue *Ecosystem Services).*

Schindler S, Kropik M, Euller K, Bunting SW, Schulz-Zunkel C, Hermann A, Hainz-Renetzeder C, Kanka R, Mauerhofer V, Gasso V, Krug A, Lauwaars SG, Zulka K-P, Henle K, Hoffmann M, Biró M, Essl F, Jaquier S, Balázs L, Borics G, Hudin S, Damm C, Pusch M, van der Sluis T, Sebesvari Z, Wrbka T (in prep.) Floodplain management in temperate regions: Is multifunctionality enhancing biodiversity? A systematic review. *Environmental Evidence.*

Conference contributions:

Marine case

Sousa Pinto I, Araujo R. et al. (accepted). Status and trends of kelp forests in Europe and their importance for fisheries. 2nd *BiodiversityKnowledge Conference "Towards a future Network of Knowledge on biodiversity and ecosystem services in Europe", Berlin, September 24th-26th, 2013.*

Agricultural case

Livoreil B, Zulka KP et al. (accepted). Which types of landscape management are effective at maintaining or increasing natural pest regulation in a context of decreased use of pesticides? 2nd *BiodiversityKnowledge Conference "Towards a future Network of Knowledge on biodiversity and ecosystem services in Europe", Berlin, September 24th-26th, 2013.*

Conservation case

Schindler S, Sebesvari Z, Damm C, Hermann A, Euller K, Mauerhofer V, Kropik M, Biro M, Kanka R, Gasso V, Krug A, Lawaars SG, Pusch M, Schulz-Zunkel C, van der Sluis T, Zulka K-P, Lazowski W, Essl F, Hainz-Renetzeder C, Wrbka T (accepted) Multifunctionality of floodplain management: a matrix relating interventions to ecosystem services. *6th Annual International ESP Conference 2013 'Making Ecosystem Services Count'. 26-30 August 2013, Bali, Indonesia.*

Schindler S, Euller K, Kropik M, Sebesvari Z, Damm C, Bunting SW, Hermann A, Biro M, Schulz-Zunkel C, Gasso V, Kanka R, Mauerhofer V, Lauwaars SG, Krug A, O'Neill FH, van der Sluis T, Zulka K-P, Henle K, Essl F, Pusch M, Hainz-Renetzeder C, Baranovsky B, Ehlert T, Neukirchen B, Martin JR, Wrbka T (accepted). Conservation of biodiversity in floodplains: Is multifunctionality the solution? *5th European River Restoration Conference. 11-13 September 2013, Vienna, Austria.*

Schindler S, Euller K, Kropik M, Sebesvari Z, Damm C, Bunting SW, Hermann A, Biro M, Schulz-Zunkel C, Gasso V, Kanka R, Mauerhofer V, Lauwaars SG, Krug A, O'Neill FH, van der Sluis T, Zulka K-P, Henle K, Essl F, Pusch M, Hainz-Renetzeder C, Baranovsky B, Ehlert T, Neukirchen B, Martin JR, Wrbka T (accepted). Impact of multifunctional floodplain management on biodiversity. 2nd *BiodiversityKnowledge Conference "Towards a future Network of Knowledge on biodiversity and ecosystem services in Europe", Berlin, September 24th-26th, 2013.*

Further dissemination in planning:

Marine case

One paper and one policy brief from the Adaptive Management results and one on the different experiences with the 3 methods.

4 The marine case – Knowledge Assessment Report and Lessons Learned

4.1 Background and Introduction

Kelp forests dominate shallow rocky coasts and are key components of coastal ecosystems, contributing to their biodiversity and functioning (Steneck et al. 2002). Kelp forest ecosystems include structuring primary producers (kelps), which provide food, shelter and habitat for a variety of associated organisms such as marine top predators (sea mammals and seabirds), fishes, invertebrates, other seaweeds and epibiota, supporting complex food webs in coastal zones (Duggins *et al*. 1989; Mann 2000). Kelp forests also play an important role on coastal defense by damping waves and on carbon sequestrationthat is used directly by grazers or made available through the detritivorous food webs based on macroalgae (Duggins *et al*. 1990). Collectively this is one of the most diverse and productive ecosystems of the world (Mann 1973).

Over the past two centuries, overfishing and extirpation of highly valued vertebrate apex predators lead to an increase in sea urchin abundances, which promoted a widespread decline of kelp forests. Losses in kelp forest systems associated with climate change have also been reported over the last decades, specially near the low latitude limits of kelp ranges, where they can become eco-physiologically stressed (Steneck et al. 2002).

Other factors reported as locally affecting kelp forest abundances are kelp harvesting, decline of water quality (pollution, eutrophication, sedimentation), diseases and invasive species.

In spite of their importance for the functioning of coastal ecosystems the available information about kelp forests in European waters is often fragmented and outdated, unlike some regions of the globe where there is a large amount of evidence available on this topic (Japan, United States, Chile, New Zeland, Australia) (Steneck et al. 2002).

Dominant kelp species in the European coasts are brown algae mainly belonging to the order Laminariales, which are distributed from the intertidal down to more than 30 m in depth, including some seamouts. These include the species *Saccharina latissima, Saccorhiza polyschides, Laminaria digitata, Laminaria hyperborea, Laminaria ochroleuca, Laminaria rodriguezii, Alaria esculenta* and *Laminaria solidungula*. Other kelp species found along the European coasts is the invasive seaweed *Undaria pinnatifida*.

In the marine case study of the WP3 the general question addressed, identified as relevant by the scientific community, was the following: “What are the current trends in kelp forests in Europe and what is the evidence that these trends will affect the ecosystems biodiversity and the provision of ecosystem services?” The Nok prototype structure was tested by using a combination of three different methodological approaches: expert consultation, systematic review and adaptive management. After some discussions that included stakeholders it was decided that the expert consultation approach would be used to assess the status and trends of kelp forests in Europe, the systematic review would focuse in the impact of kelp forests´ density and/or area on fisheries and that the adaptive management approach would addressed the main stressors affecting kelp forests in Europe.

References:

Duggins DO, Simenstad CA, Estes JA: **Magnification of secondary production by kelp detritus in coastal marine ecosystems.** Science 1989, **245 (4914)**: 170-173.

Duggins DO, Eckman JE, Sewell AT: **Ecology of understory kelp environments: effects of kelps on the recruitment of benthic invertebrates.** Journal of Experimental Marine Biology and Ecology 1990, **143 (1-2)**: 27-45.

Mann KH: **Seaweeds: their productivity and strategy for growth**. Science 1973, **182:** 975-981.

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4.2 Summary

The marine case study was planned as an example of an emergent issue – i.e., a policy-relevant question that was not included in the current policy agenda, but which was identified as potentially important and urgent by academic experts or relevant stakeholders. Moreover, we aimed at assessing the potential synergies between the three methodologies adopted by the Biodiversity Knowledge prototype: namely, the expert assessment, systematic review and adptive management frameworks. We therefore planned to use (i) the expert assessment to obtain a first overview of the emergent topic and identify the necessity of going more in depth into come of its implications, (ii) the systematic review to address those implications for which there was a reasonable expectation to find enough published evidence in the scientific and grey literature, and (iii) the adaptive management to draft policy recommendations that would address current knowledge gaps and uncertainties by proposing robust management procedures specifically tailored to provide best-known-practices that accommodate conflicting interests among stakeholders and facilitate learning along their implementation.

The identification of the original question for marine case study was done by the scientific community, to test a case study in which the research community identifies an issue that is still not a major concern at the European level but that this community thinks should be better managed in the near future. The question selected was: What are the current trends in kelp forests in Europe and what is the evidence that these trends will affect the ecosystem's biodiversity and the provision of ecosystem services? This topic was selected because a) there was evidence for reduction or even disappearance of this ecosysten in several places in Europe and around the world, b) there was no clear picture of what is happening or why, and c) the kelp forests are very important ecosystems, with high biodiversity and productivity and that provide many important ecosystem services.

When this topic was discussed with managers and policy makers the interest and knowledge found was very different depending on the person considered, ranging from not knowing what a kelp forest was (just one person) to other that already organized a workshop with different stakeholders to debate specific measures for kelp forest management. In general there was very significant interest from some managers at national level (some countries as UK, France and Norway), but not so much at European level. The knowledge available was considered highly deficient even in the countries where kelp is better studied.

Since the initial question was too broad it was decided to select 3 more specific sub-questions, and deal with them with the 3 different methods used in this project: Expert Consultation, Systematic Review and Adaptive Management. It was also decided to use them not in parallel but in sequence where the results from one would feed the next exercise. Like this we could learn lessons from each method and advance the knowledge on the question identified as relevant.

We started by identifying the experts by requesting the adequate knowledge hubs for nominations. 69 experts were nominated, mostly by a single knowledge hub: Euromarine. A questionnaire addressing their knowledge on trends, effects and drivers of changes observed in kelp forests was send. A high percentage of experts filled the questionnaire and 52 replies were received with different degree of detail in the responses. From this experience it was clear that the involvement of the study leader with Euromarine was crucial for the success of getting expert nominated and also that knowing these experts resulted in high percentage of engagement with the work. This means that in general the consulted hubs were not prepared to respond to a request coming from people/institutions they didn't know. This may be a challenge for future platforms, especially before they get well known and respected.

Experts were invited to a workshop where the results from the questionnaire and the plan for the work following were discussed. There was some difficulty to have the right number of expert in this workshop. The main reason was the days that were selected due to KNEU main meeting were not suitable for many of the experts. We found that is we want to assure the participation of the right experts their availability should be the main driver for selecting the dates for the meetings.

The questionnaire revealed that trends in kelp abundance were different depending on the region considered and species of kelp, but there were many gaps in knowledge around the questions of effects and drivers of the observed changes. It was decided that the distribution, status and trends of the European kelp forests in Europe would be illustrated by inviting selected representative experts for each geographical region to provide data about the knowledge on kelp forest status and trends in their geographical area and producing a GIS mapping of the existing knowledge. A Systematic Review would focus on analyzing evidence on the effects of kelp changes on the ecosystem service of higher interest for managers and policy makers: fisheries. The search terms and other methodological issues were also discussed and approved during the workshop, and the availability of expert time to support the work was also assessed.

The work continued for the following months and a map of trends in kelp forests in Europe, with a 10x10km grid was produced. This map revealed many gaps due mainly to

a) lack of temporal series of data in most places
b) not all the data available was used by the experts involved because lack of time to retrieve and analyze them
c) experts had problems of mapping knowledge they had but not based on scientific/published data.

It was also clear the need more and better coordinated studies at European level to understand the observed trends. Experts were asked to be more comfortable in sharing knowledge even if hard data could not be found, since other sources could also be reliable, and when knowledge is needed for management some uncertainty should be acceptable.

But this has to be better discussed and evidence of the validity of these methodologies has to be presented to improve participation in these exercises.

For the Systematic Review, the search terms agreed upon were used to retrieve 3886 records. From reading the abstracts 78 articles were retained to retrieve data and information. An analysis was done after the first 44 were read. From these studies, most where done in the US, and were quite recent (after 2000), and were done to understand the impacts of changes in kelp forests on fisheries. 54,3% produced evidence for positive relationships between kelp/algae abundance and changes in the associated assemblages of fishes, 31,4% reported positive relationships between kelp/algae abundance and only part of the fish species or life phase of organisms studied and 8,6% reported negative relationships between kelp/algae abundance and changes in the associated assemblages of fishes. These evidence supports the important role of kelp for the abundance, diversity and other characteristics of fisheries species, but also showed that this is not always true, and that can be dependent on the kelp and fisheries species considered (and life cycle stage) leading to the conclusion that more research is needed in Europe with our species and ecosystems. There were also difficulties due to the methodology of the SR that made it difficult to add information that was being found or indicated by researchers and managers and was not identified in the beginning of the study. Since there was difficulties to retrieve non-scientific literature this may be a serious challenge to the use of this method in future reviews for other knowledge platforms.

During this intersectional work we had much lower input from the experts than what had been promised. This was mainly due to lack of time, but probably also by the low priority that this work had for most experts. They were interested but had other things to do that were more important. The engagement of experts without any significant reward is one of the main challenges that will be faced by any platform. The provision of the right incentives is the only solution. But in Platforms with high prestige the cooperation is expected to be much easier.

The Adaptive Management of kelp forests was discussed in a workshop that aimed at bringing together a representation of different stakeholders (such as scientists, practitioners, policy makers, fishermen and conservation NGOs). The workshop was preceded by a preparatory phase in which participants were interviewed using a semi-structured questionnaire. Several techniques of participatory modelling were used to identify the main drivers, knowledge gaps and uncertainties involved in the aim sustainable use of kelp forests, a subsequently used to identify recommendations for the adaptive management strategy. First, the adaptive management session was prepared by a session in which the results of the expert assessment and systematic review work were presented, as well as two keynote presentations by the main data and knowledge holders from Europe (Norway and UK). This preparatory session was used to derive a first set of recommendations, which was reviewed during the second part of the workshop. Second, a keynote presentation on adaptive management and a card-sorting exercise on uncertainties were used to set the

framework for the collaborative modelling exercise that took place on the second day. Third, we used techniques of collaborative modelling to build a joint conceptual model focused on establishing the key steps necessary to achieve a commonly set goal and their inter-relationships. The model was used to identify key constrains, knowledge gaps and uncertainties affecting the achievement of such goal. Finally, based on the joined experience accumulated by the group and the materials produced (initial recommendations, conceptual model, key knowledge gaps and uncertainties), the group derived the final set of recommendations.

The participation of experts was very significant, but the participation of other stakeholders was much lower and largely reduced to the preparatory phase (interviews/questionnaire). With the adequate set of contacts, engaging the stakeholders was not difficult, although careful preparation for a number of critical questions proved important (e.g., stakeholders involved in the regulation, commercialization or extraction of kelps would have different views than those with expertise on kelp forest conservation or ecology, so that workshop objectives had to be tailored to both interest groups and adequately explained to them). However, most stakeholders outside the academic world refused to come to the workshop or cancelled in the last minute, reflecting the perception of a considerable cost for them with no clear benefits. Drawing from their comments, we may conclude that the “pilot study” or “demonstration case” of this case study exacerbated this perception: should real policy, regulations or practices be derived from the case, most stakeholders would have been willing to attend. While publications (and perhaps economic support) may be adequate incentives for academic experts, ensuring clear outcomes of the workshop/studies will probably represent the most important incentive for non-academic stakeholders.

4.3 Knowledge Assessment Reports

All knowledge assessment reports that have yet not been accepted for publication in a scientific journals have neither yet passed the external quality control check and must therefore be seen as preliminary versions. They should not be considered as definitive evidence for political decision-making on environmental issues at this stage.

In the following the four knowledge assessment reports compiled in the frame of the marine case study are presented.

4.3.1 Expert evaluation of the status and trends of the European kelp forests

Full version: Annex A.1

Expert evaluation of the status and trends of the European kelp forests

Authors:

Araujo R, Assis J, Bartsch I, Bekkby T, Strain B, Airoldi L, Aguilar R, Puente A, Wiencke C, Fernandez C, Davoult D, Rinde E, Gevaert F, Christie H, Schubert H, Barbara I, Rico JM, Scally L, Valero M, Mieszkowska N, Derrien S & Sousa-Pinto I.

Abstract:

This study combines the results of an expert opinion survey about the kelp forests status and trends in Europe and the collation of information provided by experts about kelp species in their study area. The knowledge on the status and trends of kelp forests in Europe is fragmented and not globally characterized in the scientific literature, despite the importance of kelp species for the functioning of coastal ecosystems. An expert opinion survey was conducted to gather information from European experts about the status and trends of kelp forests in Europe. A questionnaire was distributed among 69 experts identified by 6 knowledge hubs, a workshop was conducted to discuss the results of the questionnaire and agree on the next steps of the study and a mapping exercise was done with the involvement of 20 experts. The results of this study highlighted the lack of quantitative information about kelp forests for the majority of the geographical areas in Europe. The qualitative and quantitative knowledge available showed that trends vary according to kelp species identity, geographical region, distribution depth and, in some cases, expert identity. Additionally this exercise showed the difficulties of obtaining reliable information from large geographical areas on this topic and to engage part of the experts to participate in this kind of exercise.

4.3.2 Systematic review protocol on the effects of kelp changes on fisheries

During the second day of the workshop with experts in Brussels the systematic review exercise was discussed (Annex 5). It was decided that the theme for the systematic review would be "The impact of kelp forests´ density and/or area on fisheries" and not "The impact of kelp forests´ density and/or area on fisheries and biodiversity" as it was initially proposed by the organizing team. The search terms and search databases to use in the systematic review were also discussed and agreed. Three experts participating in the workshop were interested in collaborate in the following steps of the systematic review exercise.

A protocol for the systematic review was written and submited to the Environmental Evidence Journal.

Full version: Annex A.2

Systematic review protocol on the effects of kelp changes on fisheries

WHAT IS THE IMPACT OF KELP FOREST DENSITY AND/OR AREA ON FISHERIES?
Systematic review protocol

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Abstract

Background: Kelp forests are highly productive ecosystem engineers of rocky cold-water marine coastlines, providing shelter, habitat and food for a variety of associated organisms. Several factors have been related with an observed trend of kelp deforestation in some regions of the globe. The effect of this trend on fisheries has been poorly studied. The European directives addressing the conservation of marine habitats highlight the need to increase the knowledge about the relationship between kelp forests and fisheries, which will also be very valuable for the definition of fisheries management measures.

Methods/Design: This protocol describes the methods that will be used to conduct a systematic review to answer the following question: What is the impact of changes in kelp forest density and/or area on the abundance and diversity of fisheries?

Keywords: kelp forests, ecosystem conservation, ecosystem services, fisheries.

4.3.3 Systematic review on the effects of kelp changes on fisheries

Full version: Annex A.3

Systematic review on the effects of kelp changes on fisheries

WHAT IS THE IMPACT OF KELP FOREST DENSITY AND/OR AREA ON FISHERIES?
Systematic review

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Summary

1. Background

Kelp forests are highly productive ecosystem engineers of rocky cold-water marine coastlines, providing shelter, habitat and food for a variety of associated organisms. Several factors have been related with an observed trend of kelp deforestation in some regions of the globe. The effect of this trend on fisheries has been poorly studied. The European directives addressing the conservation of marine habitats highlight the need to increase the knowledge about the relationship between kelp forests and fisheries, which will also be very valuable for the definition of fisheries management measures.

2. Objectives

To assess if the changes in kelp forest density and/or area have an impact on fisheries.

3. Methods

Multiple surveys were conducted using electronic databases and the internet using a variety of keywords.

Selection criteria:
. Subjects: fisheries; all species with commercial value were included
. Intervention: differences in densities/areas ok kelp forest
. Outcome: indicators of change in health (abundance and diversity) of fisheries
. Types of study: any study providing qualitative or quantitative evidence about the importance of changes in the densities and/or area of kelp forests in the fisheries quality.
Data collection and analysis

Data were extracted from the original studies and summarized in previously designed spreadsheets to minimize bias. A description of the selected studies and their main conclusions was done.

4. Main results

Total number of studies found from databases was 3886 records. 78 studies remained after selection based on title and abstract. From these, 44 articles were included in the review, from which a total of 9 studies were removed. From the studies retained as meeting the selection criteria 54,3% report positive relationships between kelp/algae abundance and changes in the associated assemblages of fishes, 31,4% report positive relationships between kelp/algae abundance and only part of the fish species or life phase of organisms studied and 8,6% report negative relationships between kelp/algae abundance and changes in the associated assemblages of fishes.

5. Conclusions

Our results suggest that relationships between fisheries and changes in kelp forests are highly dependent on the species (kelps and fishes) considered. The majority of the studies used in the systematic review refer to the USA and thus there is not strong evidence available for the European species. As such this area needs further investigation.

4.3.4 First results of an adaptive management exercise on drivers of kelp forest

Coordinated by Luis Santamaría and Isabel Sousa Pinto

Abstract:
The Adaptive Management of kelp forests was discussed in a workshop that aimed at bringing together a representation of different stakeholders (such as scientists, practitioners, policy makers, fishermen and conservation NGOs). The workshop was preceded by a preparatory phase in which participants were interviewed using a semi-structured questionnaire. Several techniques of participatory modelling were used to identify the main drivers, knowledge gaps and uncertainties involved in the aim sustainable use of kelp forests, an subsequently used to identify recommendations for the adaptive management strategy. First, the adaptive management session was prepared by a session in which the results of the expert assessment and systematic review work were presented, as well as two keynote presentations by the main data and knowledge holders from Europe (Norway and UK). This preparatory session was used to derive a first set of recommendations, which was reviewed during the second part of the workshop. Second, a keynote presentation on adaptive management and a card-sorting exercise on uncertainties was used to set the framework for the collaborative modelling exercise that took place on the second day. Third, we used techniques of collaborative modelling to build a joint conceptual model focused on establishing the key steps necessary to achieve a commonly set goal and their inter-relationships. The model was used to identify key constrains, knowledge gaps and uncertainties affecting the achievement of such goal. Finally, based on the joined experience accumulated by the group and the materials produced (initial recommendations, conceptual model, key knowledge gaps and uncertainties), the group derived the final set of recommendations.

4.4 Implementation of the NoK-Prototype and lessons learned

4.4.1 Conclusions for the operationalized guidelines of the NoK

4.4.2 Preparation

4.4.2.1 Identify and communicate with requesters

There was some difficulty to identify the right requesters at the European level, since the question was formulated before by the scientific community and didn't address any specific piece of European legislation, even is was very relevant for several. The DG contacted were DG Environment (responsible for Habitats directive for the marine environment) and DG Mare (responsible for research). At National level it was easy to find the managers interested in this question in some of the countries, especially Norway and France. But for others it was also no very clear. In some countries the management institution that would be more interested by this study is regional and not National (e.g. Galicia region in Spain, Brittany in France). This poses a problem of the right scale for the study. A potential solution to this problem was used in the adaptive management case – namely, to explicitly address the scale in the assessment of expert opinions and during the workshop. During that phase, adequate contacts were found to link to regional/local stakeholders in some of the countries where this had been a challenge in the pevious phase (e.g. Spain). The adaptive management methodology used, which includes an explicit preparatory phase of institutional analysis and build-up of an stakeholder network (reduced here to a mere demonstration owing to time concerns) provides a method to address this, although the need for adequate time/funding and for access to key stakeholder nodes should be stressed.

4.4.2.2 Scope science and potential methods

We aimed at assessing the potential synergies between the three methodologies adopted by the Biodiversity Knowledge prototype: namely, the expert assessment, systematic review and adptive management frameworks. We therefore planned to use (i) the expert assessment to obtain a first overview of the emergent topic and identify the necessity of going more in depth into come of its implications, (ii) the systematic review to address those implications for which there was a reasonable expectation to find enough published evidence in the scientific and grey literature, and (iii) the adaptive management to draft policy recommendations that would address current knowledge gaps and uncertainties by proposing robust management procedures specifically tailored to provide best-known-practices that accommodate conflicting interests among stakeholders and facilitate learning along their implementation.

4.4.2.3 Understand the policy context of the topic

Kelp forests are part of the coastal and halophytic habitats (REEFS) identified in the Habitats Directive as a natural habitats with community interest. Given its key importance for the functioning of the reefs ecosystem by providing shelter, habitat and food for fish, mammals and invertebrates information about kelp forests is also very important for several European directives that take into consideration the conservation of marine habitats. These include the Water Framework Directive, the Marine Strategy Framework Directive and the application of the Habitats Directive to the marine environment through the Natura 2000 network.

4.4.2.4 Request

The marine case study was planned as an example of an emergent issue – i.e., a policy-relevant question that was not included in the current policy agenda, but which was identified as potentially important and urgent by academic experts or relevant stakeholders. Moreover, we aimed at assessing the potential synergies between the three methodologies adopted by the Biodiversity Knowledge prototype: namely, the expert assessment, systematic review and adaptive management frameworks.

We therefore planned to use (i) the expert assessment to obtain a first overview of the emergent topic and identify the necessity of going more in depth into come of its implications, (ii) the systematic review to address those implications for which there was a reasonable expectation to find enough published evidence in the scientific and grey literature, and (iii) the adaptive management to draft policy recommendations that would address current knowledge gaps and uncertainties by proposing robust management procedures specifically tailored to provide best-known-practices that accommodate conflicting interests among stakeholders and facilitate learning along their implementation.

4.4.2.5 Tender process

4.4.2.5.1 Call to knowledge hubs to help identifying/ nominating experts

47 knowledge hubs related with nature conservation and/or marine habitats were identified contacted via e-mail. 6 knowledge hubs replied to the call (Euromarine, UNEP- World conservation monitoring center, GEO BON, International Association for Ecology, IUCN Invasive Species Specialist Group and Diversitas) and identified 69 experts to contact in the context of the question: “What are the current trends in kelp forests in Europe and what is the evidence that these trends will affect the ecosystems biodiversity and the provision of ecosystem services?”

4.4.2.5.2 Call for evidence

The 69 experts identified by the knowledge hubs were contacted and asked to answer a questionnaire containing 8 questions about the different aspects of the status, trends,

drivers and ecosystem impacts of current trends in kelp forests in Europe. The results of the questionnaire were presented in a workshop with the participation of 8 of the experts where the steps of the systematic review and the expert consultation exercises were discussed.

4.4.2.6 Agreement on team and protocol

4.4.2.6.1 Working group settled and jointly agrees on protocol and timeframe (incl. if and how methods IIa are used and if needed integrated)

During the workshop it was decided that:

- the status and trends of kelp forests in Europe will be illustrated by inviting selected representative experts for each geographical region to provide data about the knowledge on kelp forest status and trends in their geographical area.

- the theme for the systematic review will be "The impact of kelp forests´ density and/or area on fisheries". There was a long discussion between choosing fisheries or biodiversity to analyse but, as the main interest declared by the stakeholders consulted was the connection of kelp forest health with fisheries, it was decided to analyse the impact of canges on species used in fisheries. The search terms and search databases to use in the systematic review were also discussed and agreed.

The Adaptive Management of kelp forests was discussed in a workshop that aimed at bringing together a representation of different stakeholders (such as scientists, practitioners, policy makers, fishermen and conservation NGOs). Several techniques of participatory modelling were used to identify the main drivers, knowledge gaps and uncertainties involved in the aim sustainable use of kelp forests, an subsequently used to identify recommendations for the adaptive management strategy. The goal of the participatory modelling and the adaptive management strategy was defined collaboratively during the workshop, as follows: "Kelp ecosystems are managed in a way that ensures their sustainability, defined as their capacity to provide goods and services whilst maintaining their structure and functions".

4.4.2.6.2 How will the product be linked to the requesters needs?

For the stakeholders that can use the information, data and analyses, the first studies were presented in the Adaptive Management workshop (9 and 10 of May 2013) were they were discussed with different stakeholders. In the workshop, which aimed at bringing together a representation of all different stakeholders (such as scientists, managers, policy makers, fishermen and conservation NGOs), several techniques of participatory modelling were used to identify the main challenges and uncertainties involved in the sustainable use of kelp beds. The policy brief produced during the Workshop will be presented to and discussed

with stakeholders at the European and National level. We will target mainly DG Environment, DG Mare, and different entities in Norway, France, UK, Spain and Portugal.

4.4.2.7 Communication of protocol

4.4.2.7.1 Publishing the process protocol and further inviting for comments / evidence by the NoK

The protocol was written and sent around the experts that were identified and declare their interest to give further input

4.4.3 Finalisation

4.4.3.1 Dissemination

4.4.3.1.1 Additional scientific papers

A scientific paper will be writen covering the results of the expert consultation exercise in a joint effort between the 20 experts that participated in this step of the study about the status and trends in kelp forests.

The protocol of the systematic review about the impact of kelp forest area/density on fisheries was already submited to Environmental Evidence Journal and reviewers commented on the manuscript. Additionally the full systematic review will be published in the same journal. The adaptive management work will be published in a scientific paper, which will address also the complementary use of the three different methodologies in this case study. The set of recommendations derived from the workshop was summarized in a policy brief that will be dissemainated to relevant policy-makers and stakeholders at EU and national levels.

4.4.3.2 Evaluation, lessons learned for process

4.4.3.2.1 Internal report on lessons learned from process

The first lesson learned with this work is that there is a need to moderate the ambition of a product and make it compatible with the available time and resources. This is a process that is long and involves many different people and count with everyone's good will is not wise.

More specific challenges and lessons learned:

A) **Defining the question.** Here our experience was to identify one question that the scientific community consulted believed was important for management and that was not adequately addressed at European level by lack of understanding of the importance of kelps for other marine resources and lack of knowledge about what were the trends. The question defined by the scientific community was too wide and

the need to restrict it led to a compromise to address the main issues of interest for the stakeholders consulted. But as the scientific community is not uniform, also the stakeholders, even if restriction is done for managers, have not just one voice and so there was some difficulties to decide which to work with.

B) **Identification of the experts.** We consulted the different knowledge hubs identified by the Kneu project. The response we had was substantial form just one knowledge hub: Euromarine. But this was linked with the fact that the study leader was part (and from the board) of this network. This showed how important personal connections are to be able to have the collaboration of different knowledge hubs. They are very often understaffed and not organized to e able to respond to this kind of requests. Some have many requests and will not respond if they don't know who the requester (or institution) is. Another question was the quality of the experts. Most of the researchers in the field in Europe were identified. But some of the experts nominated were expert in kelp forests other had a more general knowledge in Algae. The question was to know what to do when the opinion of 2 experts didn't coincide. Here again we learn how important is to involved people very knowledgeable in the field to be able to filter the real experts. The identification of experts from the management, practitioners or ONG side was not very efficient and only very few were identified by this method.

C) **Working with the experts.** Time and availability of experts is a difficult issue. In our case there was a real interest and enthusiasm of some of the experts in the products that were to be produced here but some of them didn't want to commit time to work for them and other were ready to do it but then had a lot of difficulties to give the input promised. Lessons learned: select the right experts and work around their time: this should be the main factor, as well as the deadline for the final product. Planning of workshops should be done after the experts are selected and according to their availability as much as possible. Other considerations (e.g. back to back with other meetings) should be used only if this helps the right experts to attend. Incentives for the collaboration are very important. Even experts with the best good will if they are good are usually overwhelmed with commitments and to see this collaboration as a priority they need some incentives: either payments or some prestige associated with being part of this group.

Regarding the identification of experts from management or practitioners, we were not able to identify good knowledge hub for this at European level. There is a need to link existing national hubs or create new ones. Another way forward is to consult the scientific experts on the managers and practitioners they know or work with. These will be usually at National, regional or local level.

D) **Methodologies used. Expert consultation.** We were able to identify most of the relevant researchers in the field. Still many were not able to emit an opinion on the

trends of the kelp forests that was based in evidence, so they didn't think they could have an opinion. Other gave an opinion even if they didn't have hard data to back it up.

Systematic review. This methodology is more rigorous and transparent that the expert consultation but is very labor intensive and does not easily integrate data and knowledge that is not in peer reviewed publications. This may leave relevant information out a skew the analysis. Is also rather inflexible and not adaptive to the on-going work and its specificities. But this inflexibility increases the transparency: we know exactly how the results were obtained and how decisions were made.

Adaptive management. This methodology works when we are able to bring together all the relevant stakeholders. This is complicated at the European level and is only possible for targeted issues. Nonetheless, the workshop carried out during the case in may 2013 can be considered successful.

5 The agricultural case – Knowledge Assessment Report and Lessons Learned

5.1 Background and Introduction

The need to provide resources to 9 billion human beings in the near future, whilst altogether preserving ecosystem services and biodiversity and facing climate change poses new challenges to agriculture (Tillman et al. 2001). The 1996 UN summit in Rome has expressed the goal to halve the number of malnourished people by 2015, which may not be attained (von Witzke 2008). The European Union, the United States, China and India have also set ambitious biofuel targets that further increase the strain on production capacities (Ravindranath et al. 2009). Without doubt, agricultural production has to be increased at many levels and in many countries.

In Europe, agricultural intensification has led to a substantial yield increase since between 1960 and 1980. It also triggered amalgamation of fields, structural simplification of agricultural landscapes and reduction of seminatural remnant areas, with severe consequences for many farmland bird species (Donald et al. 2001), farmland biodiversity (Benton et al. 2003, Tews et al. 2004) and associated ecosystem services (Tscharntke et al. 2005). Broad spectrum pecticides[1] initially used in intensive agricultural practices have caused a degradation of regulatory ecosystem services such as pest regulation by natural enemies (Bianchi et al. 2006). Modern pesticides are more efficient at targeting only the pest of concern. Even if the quantity of pesticide seems to have declined, the number and extent of applications has increased (Robinson & Sutherland 2002). Overuse of pesticides can induce new pest outbreaks (pest resurgence), selects resistant pest populations (insects, bacteria, and weeds), increases risks to human health (of the farmers as well as the consumers downstream, e.g. Buckley et al. 2011) and poses obstacles to trade in the form of residues (e.g. Pimentel et al. 1992, Fawcett et al 1994, Simpson & Roger 1995, WHO/UNEP 1989).

[1] Pesticides and pests are defined by FAO (www.fao.org) as "*any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport*".

The Food and Agriculture Organization of the United Nations (www.fao.org) acknowledges that "increasing agricultural production with little or no consideration for long-term environmental sustainability led to negative consequences such as degraded land and a reduction of ecosystem goods and services. In turn, these environmental consequences have negative repercussions on the ability of agro-ecosystems to produce desired quantities of safe and quality foods. Increased agricultural productivity can happen through improved use and management of agricultural biodiversity resources (such as seeds, pollination, beneficial fauna, etc), to achieve higher yields while promoting the sustainability of the farming systems (…) This will also contribute to implementing adaptation strategies for climate change" (http://www.fao.org/agriculture/crops/core-themes/theme/spi/scpi-home/framework/ sustainable-intensification-in-fao/four-key-areas-of-scpi/en/). New ways are sought to reconcile agricultural production and the preservation of diversity in agricultural landscapes, and changes in regulation and practices can help to achieve such goals.

Countries use policy reform to apply alternatives to pesticides. In 1992, the European Common Agricultural Policy created agri-environment programmes to encourage low input (e.g. fertilizers and pesticides), better protection of natural habitats within agricultural landscapes, and change of land use for environmental needs. (http://ec.europa.eu/agriculture/envir/report/ fr/som_fr/report.htm). Use of pesticides in agriculture has declined since the 90s in the European Community, although this varies greatly depending on crop and forecast (http://ec.europa.eu/agriculture/envir/report/fr/som_fr/report.htm). The efficiency of the Common Agricultural Policy (CAP) to meet environmental challenges remains controversial, especially for pollution and consumption of water, land conversion and wildlife destruction (EC 2006, Barbut & Baschet 2005, Kleijn & Sutherland, 2003). At the national level, Sweden and Denmark adopted policies targeting a reduction of 50% of pesticides since 1986 (Thonke 1991), but reductions were also observed in Norway and Finland without any formal policies (Gianessi et al 2001). The programme ECOPHYTO2018 in France aims at a progressive eradication of 53 of the most dangerous chemicals, and a decrease of 50% in the use of pesticides within 10 years (2018). The meta-programme SMaCH (Sustainable Management of Crop Health, www.inra.fr/les_recherches/metaprogrammes) combines research and adaptive management to favor biodiversity as a way to control diseases and decrease pesticides, via the organization and management of landscapes.

With regard to practices, Integrated Pest Management (IPM[2]) is an ecological approach to managing pests to improve crop production and protection by using less pesticides and relying on natural biological processes (e.g. www.endure-network.eu, www.pure-imp.eu). The recent concept of Functional Agrobiodiversity aims at identifying which elements of biodiversity provide key services for agroecosystems (ELN-FAB, the European Network for Functional Agrobiodiversity, www.eln-fab.eu). DIVERSITAS defines agrobiodiversity as "managed and unplanned biodiversity in agricultural ecosystems, which closely interact with wild biodiversity within the larger landscape matrix" (www.agrobiodiversity-diversitas.org). DIVERSITAS is already developing a science plan and implementation strategy on agrobiodiversity and several projects are endorsed which should end in 2012. APPEAL (www.biodiversa.org/87) is a research project funded under the ERA-Net scheme, aiming at assessing ecosystem services including biological pest control provided by natural enemies. It focus mostly on aphids and their natural predators and examines how the natural enemy's fauna is affected by land-use change.

[2] *FAO definition:* **Integrated Pest Management (IPM)** means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

Using fewer pesticides (quantity, spectrum) may prevent a strong control of the quantity and diversity of pests, but it should help restoring populations of natural enemies which will act against these pests. Aubertot et al. (2005) describe bio-control as the use of live beings to prevent or decrease damages caused by pests. They report 3 types of bio-control: a/ introduction of a new species, b/ release of captive-bred natural control agents to increase local populations, this release being massive (flooding effect) or in small quantity aiming at establishing viable population (inoculation); c/ habitat manipulation in order to enhance beneficial effect of indigenous control agents (e.g. Bianchi et al. 2006, Champlin-Kramer et al, 2011, Veres et al. 2011). This last option matches requirements of preservation of local biodiversity whilst releases of exotic species or natural species outside of their natural range may be criticized. Relying on local ecosystems to effectively provide natural pest control allows farmers not only to decrease costs on pesticides but also those linked to release of commercially captive-bred bio-control agents.

To provide an efficient regulatory service, the populations of natural enemies must be in good status. Provision of shelters, food, reproduction areas, can play an essential role in maintaining such populations (and other biodiversity as well) and this role can be filled by non-crop habitats (Bianchi et al. 2006). According to ELN-FAB, the knowledge about how to use ecosystem services is still scattered and often poorly accessible. Allocating means for sown wildflower strips, beetle banks or other landscape elements to promote natural pest control requires a clear understanding of the potentials and limitations of such measures, if possible before the launch of the new 2014–2020 Common Agricultural Policy. The goal of this work is to contribute to the synthesis of knowledge concerning agrobiodiversity and its related ecosystem services by assessing the effectiveness of interventions aiming at manipulating non-crop habitat or landscape features in order to maintain or support natural (indigenous) population of pest control agents.

Objectives of the assessment

This work will address separately the two aspects of this request:

1) To list the interventions on habitat and landscape that are favorable to natural pest control (Part I), and

2) to establish the state of evidence for each of them as far as possible (Part II).

To establish a list of interventions, a collaboration was set up with the NERC[3] Sustainable Agriculture Knowledge Exchange Programme led by the Department of Zoology, University of Cambridge (henceforth 'Cambridge'). The Cambridge team had started work on a similar topic in June 2012, taking the approach of developing a synopsis of evidence entitled "Enhancing natural pest control in food-producing ecosystems: evidence for the effects of interventions" (to be published on two websites, www.nercsustainablefood.com and www.conservationevidence.com). Cambridge contacted us after FRB launched a call to the current Biodiversity Knowledge "Network of Knowledge" as established by the first work package team (Biodiversity Knowledge WP1, 2011). The first step in developing a synopsis of evidence involves listing all possible interventions related to the topic. This is done through consultation with a multi-disciplinary Advisory Board of experts and stakeholders set up for each synopsis. For the synopsis on enhancing natural pest control, the initial list that opened the consultation process was drawn up as part of a 'solutions scanning' exercise carried out by the Cambridge Conservation Initiative (www.conservation.cam.ac.uk). This exercise listed all practical management interventions to enhance regulating ecosystem services. It involved

[3] NERC is the Natural Environment Research Council of the UK government.

14 international experts in ecosystem services research and management and their networks of colleagues. The 'natural pest regulation' part of the list was then circulated by email, with explanatory notes to the natural pest control synopsis Advisory Board (their names are published here: http://www.nercsustainablefood.com/site/page?view=methods). They were asked two questions: 1) Is anything missing from the list that you know farmers or policy makers might do? 2) Is there anything on the list that farmers or policy makers would never do?

The list of interventions was expanded or re-organised as necessary following this consultation. During the process of compiling the synopsis some interventions were also added or split according to the evidence that was found in the literature.

We will rely on this list of interventions and complement it if needed with the results of searches for knowledge conducted at FRB/INRA (see below).

To address the effectiveness of interventions, we will use the methodology of a systematic review for environmental management (www.environmentalevidence.org) combined with the synopsis approach used in Cambridge (see Appendix 1). INRA will conduct a comprehensive and systematic search using keywords and search strings and various databases based on a list of search terms provided by FRB, using the literature identified from three journals by Cambridge as a benchmark list to test the efficiency of the search. FRB and EEA will then conduct a critical appraisal (CEE 2010) of a subset of papers as a wide number of publications are expected and we will probably lack time to examine them all. Consultation with stakeholders and decision-makers will help give priority to interventions of timely policy-relevance, rather than extracting a random subset of papers. This decision will also be influenced by the availability of volunteer experts to form working groups, assess the papers relevant to the topic, and contribute to reporting results. Meta-analysis will be conducted only if good relevant data are identified and expert statistician can contribute. The BiodiversityKnowledge project does not allow to hire working groups as would normally be the case for the conduct of a systematic review.

Combining the Cambridge synopsis of evidence approach and a critical appraisal approach should lead to the establishment of a systematic map, with knowledge gaps highlighted as well as possible recommendations for the conduct of full systematic reviews.

The Biodiversity Knowledge project is related to the establishment of an EU Mechanism, linked itself to IPBES (www.ipbes.net). As a consequence, we will explore the opportunity to include in this work some non-academic knowledge (practitioners, managers, networks of farmers) as this type of knowledge will be taken into account in IPBES assessments (http://www.ipbes.net/plenary/intersessional.html, see for instance Annex 3 of http://www.ipbes.net/component/docman/doc_download/1021-ipbes-draft-procedures-for-the-preparation-review-and-acceptance-of-ipbes-publications-for-review.html?Itemid=159). A narrative synthesis of non-academic knowledge will be added as a specific chapter and its outcomes will be compared to that provided by the scientific papers. . To achieve this, collection of knowledge will be established by consultation (questionnaires) and/or workshops of stakeholders based on identification of specialized hubs (Biodiversity Knowledge WP1 work, ELN-Fab, Alter-Net and other identified networks). Synergies and discrepancies with academic knowledge will be discussed.

5.2 Summary

A substantial part of the agricultural yield increases in the past decades is the result of the application of chemical pesticides. However, with a still expanding global population, new demands on bioenergy production and essential agricultural ecosystem services such as pollination at stake, more environmentally friendly and biodiversity-conserving methods are needed. The test case presented here analysed the question "Which types of landscape management are effective at maintaining or increasing natural pest regulation in a context of decreased use of pesticides?" The question excluded the direct effect of pesticides on beneficial arthropods, but focused on the problem to what degree the mere presence, introduction or management of particular landscape elements, such as weed strips, fallows, beetle banks or unsprayed field margins can act as a substitute for chemical pest control. The political background is that large sums of money are spent for agricultural subsidies in the European Union without achieving substantial benefits for the environment: Directing those sums towards the establishment of biodiversity-enhancing landscape structures might kill two birds with one stone by creating a more diverse and resilient agricultural landscape and providing effective biological pest control at the same time. The ecological background is that such landscape elements create a buffer and reservoir for beneficial organisms, which might be able to control and to reduce pest organisms efficiently. Political and ecological perspectives converge in the key question is whether such landscape elements are truly effective in providing the necessary levels of pest control.

The question consisted of two problems:

(1) Identifying the interventions that aim to provide pest control,
(2) gauging their efficiency by retrieving the evidence that has been compiled mainly in the scientific literature, but also in other sources.

To address the first problem, collaboration with the NERC[4] Sustainable Agriculture Knowledge Exchange Programme led by the Department of Zoology, University of Cambridge, was established. To address problem (2), experts of the field identified by the NoK and citations in three recent review articles were contacted. Wedid an extensive literature search based on a large set of search terms related to the PICO scheme, with terms addressing the population P, the type of Intervention, and the Outcomes (systematic review methodology). The search technically performed by the librarians at INRA produced 39000 literature references, which provided the basis both for the intervention classification and the evidence extraction. In a series of exclusion steps, based first solely on article titles, then also on abstracts, we narrowed the selection of titles and Cambridge assigned the published articles to agricultural interventions. During the process, it became clear that the available evidence is highly heterogeneous, with some interventions having been treated extensively in a large amount of literature (e. g. organic farming), while other interventions having been largely neglected. A full systematic review on the whole set of 60 interventions possibly related to pest control in agricultural landscapes was thus neither practical nor feasible with current resources. Instead, we focused on subsets of interventions: The Cambridge group identified 10 interventions considered as highly important by experts and stakeholders in a Delphi consultation process test case workshop in Paris (January 2013). BL and PZ defined a set of 15 interventions that are related to landscape patterns and aimed at a systematic map to classify the evidence referring to these measures. PZ set up a small expert working group to look at the topic of linear strips in agricultural landscapes in closer detail. The Cambridge team is now uploading to its website http://nercsustainablefood.com/ the first of the completed interventions for which evidence has now been summarized. Thirteen pest control interventions will become available by early June, and a further 4-5 interventions will be added in the

[4] NERC is the Natural Environment Research Council of the UK government.

coming months up to September. The list of interventions will be also finalised and published via this website, along with the systematic map of references found for each intervention.

Linear weed or flower strips seem to increase overall biodiversity within the landscape. We also found many papers reporting that such landscape structures enhance the abundance of generalist predators. Several studies investigated the spillover effects from weed/flower strips into adjacent fields, with ambiguous results. Generally, it seems that pest control agent's dispersal into the field by walking is limited, but is complemented by additional generalist predators flying in. We found very few significant results showing the pest reduction effects of these movements, and no study that investigated the pest control effects of landscape structures, in particular linear strips, on yields. Most studies inadequately controlled for confounding effects from the surrounding landscape; many studies were not adequately replicated on pseudoreplicated or had no control at all. Some insignificant results are possibly caused by small sampling size, so a meta-analysis might yield a more consistent picture. In general, more research is needed to really qualify landscape structures as pest control measures, but knowledge available to date indicates that such a role is possible. Establishing the evidence-base for this knowledge will require more work on the data and methods before reaching any conclusion.

Testing the NoK prototype was fairly limited by resource constraints, which in many respects permitted only a makeshift simulation of the typical processes involved in evidence assessment with a systematic review. Nevertheless, the process provided important insight in many possible pitfalls and limitations that such a knowledge gathering procedure may incur. A very important step is the dialog stage with the stakeholder, where questions and aims of the procedure are negotiated. We found that stakeholder demands varied regarding the specificity of the evidence, but we found that usually their problems were too broad, too little focused and too heterogeneous to be tackled in a self-containing review. The possibilities of recruiting experts to contribute to the knowledge gathering process were also limited. Many experts were motivated to contribute, being attracted by the networking possibilities offered by the process, but a formal tendering process with clear terms and supporting infrastructure seems necessary to ensure expert involvement and contributions. The structures of the network worked well in informing expert and stakeholders, but the workshop with face-to-face networking opportunities was necessary to guarantee exchange of ideas and perspective on the matter. Generally, bridging the gap between scientists (primarily interested in disseminating and exchanging original research) and practitioners and managers (primarily interested in applying available knowledge and being successful with it) was a major challenge in the process. Scientific knowledge was also much easier to access than other forms of knowledge, such as practical experience or indigenous knowledge. None of the tools designed for the access of scientific knowledge, such a literature databases and search engines, worked well for alternative forms of knowledge.

5.3 Knowledge Assessment Reports

All knowledge assessment reports that have yet not been accepted for publication in a scientific journals have neither yet passed the external quality control check and must therefore be seen as preliminary verions. They should not be considered as definitive evidence for political decision-making on environmental issues at this stage.

5.3.1 Literature review: Is there evidence that set-aside linear landscape elements provide natural pest control in agricultural landscapes?

When the full INRA search (see below) was finalised, it became clear that there were lots of interventions and a lot of literature available to answer the question. . A systematic map thus seemed to be more appropriate to firstly organize the knowledge than a full systematic review which may have enconpassed so many interventions.However, a literature review on one sub-topic, the question of linear strips in the landscape, might have speeded-up the bridging of the gap between organizing and mapping available evidence on the one hand and getting an insight into the details of knowledge of the interventions on the other hand. This could facilitate the development of a first systematic review on this narrower topic, which could be complemented later on with other interventions. Moreover, organizing critical appraisal and evaluation of research designs required getting familiar with at least a part of the papers that appeared relevant after having applied the search strategies, and the literature review on a subtopic aimed at doing some preliminary assessment of the complexity of this process (note that normally critical appraisal and evaluation would be done by experts in the area, but we prefered to anticipate this ste as much as possible). Since the dialog with requesters revealed a particular interest in the importance of linear landscape elements such as flower strips and weed strips and the resources and the timeframe for a full-fledged systematic review on those sub-topics seemed insufficient, an attempt was made to perform a literature review and to incorporate aspects and requirements of a systematic review as far as possible. This would also provide the opportunity to test the adequacy of reporting formats and communication tools with the requesters after the review work was done. This review is still in progress, but insights on the process are already available and will be reported here.

Full version: Annex B.1

Is there evidence that set-aside linear landscape elements provide natural pest control in agricultural landscapes?

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Abstract

Set-aside flower strips, weed strips, field margins or beetle banks consume little farmland area, are easy to implement, may serve as migration corridors, enhance farmland species richness and are thus potential tools to reconcile intense agricultural land use and biodiversity. They also typically harbour generalist predators. We review to what degree predators in such linear elements are able to provide pest control in adjacent arable fields and thus may help to reduce chemical pesticide application. A systematic search was based on 11 search terms describing strips and field margins. It was performed against literature databases (SCOPUS, BIOSIS), an encompassing INRA search on all kinds of agricultural interventions and a summary database of the Cambridge Conservation Science Group and yielded 1400 scientific articles, of which 451 appeared relevant after closer inspection of title and abstract. The papers were categorised based on the relationship they investigated, from strips to predators, pest numbers or yield. The hypothesis that linear strips increase predator numbers and thus decrease pest numbers was corroborated in some articles, but more often test results were insignificant. Some articles found complicated patterns between pest outbreaks, spillover of surface-active generalist predators, population development of predators migrating into the field by flight and their respective population development. No information was found that related the presence of set-aside strips directly to agricultural yields. We found substantial limitations in the design of the experiments, with many studies lacking adequate control or replication. Most studies were restricted to one point in time and thus were unable to uncover the subtle details in population development of pest organisms and predators. In summary, there is basic evidence that set-aside strips can provide pest control ecosystem services, but many questions are still unsolved and additional and more detailed research is needed.

5.3.2 Protocol of a systematic map: Which types of landscape/habitat management are effective at providing natural pest control?

A draft protocol of a systematic map was written and submitted to Environmental Evidence Journal. Peer-review was completed within a month and the manuscript is now under revision. Perspective for the completion of a full systematic map need to be ascertained before the protocol is finalised, as the opportunities to conduct several full systematic reviews may affect the publication strategy of the whole case-study.

Full version: Annex B.2

WHICH TYPES OF LANDSCAPE/HABITAT MANAGEMENT ARE EFFECTIVE AT PROVIDING NATURAL PEST CONTROL ?

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ABSTRACT

Background

To provide resources to 9 billion human beings in the near future, to preserve ecosystem services and biodiversity altogether, and to face climate change are challenging agriculture. Using fewer pesticides should help restoring populations of natural enemies acting against these pests. Relying on local ecosystems to effectively provide natural pest control allows farmers to decrease costs on pesticides and to avoid costs linked to release of commercially captive-bred bio-control agents. This review aims at listing the interventions on habitat management which favour a sustainable presence of natural pest control agents. A second objective is to assess the effectiveness of such interventions on control agents and/or pests and/or yield.

Methods

Searches will be made on CAB Abstracts and secondarily on Web of Science. Consultation of stakeholders will be initiated to collect grey literature and if possible traditional knowledge in order to examine how this could be included in a systematic approach. This type of knowledge should be taken into account in future IPBES assessments. Searches will be conducted in English, on all years, and will be filtered to retain those which strictly examine habitat management intervention in terrestrial landscapes, with a measured impact on natural pest control agents.

Results

Expected results are a list of interventions on habitat and landscape elements, which will form the squeletton of a systematic map. Depending on the availability of experts, some subtopics may be developed into a full systematic review, or will be acknowledged as knowledge gaps. Reviews identified during the searches may be examined to assess their characteristics compared to a systematic review.

Conclusion

This work is conducted as a case-study aiming at testing the prototype of network of knowledge synthesis and transfer elaborated within the FP7 programme “Biodiversity Knowledge” (www.biodiversityknowledge.eu). Other aspects of this project are the evaluation of the availability of stakeholders and experts, barriers to knowledge transfer, and incorporation of various types of knowledge in the synthesis. This case study benefits from the cooperation with a current programme led at Cambridge University, UK, (www.conservationevidence.org).

- KEYWORDS

pest control, semi-natural habitat, ecosystem service, agrofunctional biodiversity, beneficial fauna, non-crop habitat

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5.4 Implementation of the NoK-Prototype and lessons learned

5.4.1 Conclusions for the operationalized guidelines of the NoK

5.4.1.1 Recognized challenges for the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence):

- The systematic review method provides a tried and tested foundation to guarantee credibility, legitimacy and independence of the process. Limitations in the testing set-up were related to available resources (constraining the availability to do a full systematic review) and the somewhat atypical testing conditions (limiting iterativity, the next review will require a formal recruitment of a review team)
- We did not experience any political interventions challenging the independence or the legitimacy of the process. Such interventions are, however, possible in highly disputed fields. A possible counter strategy could be a thorough review process of an independent body across all stages. Many critical feedback stages are already built into the systematic review process.
- Politicians, decision makers and stakeholders sometimes do not know precisely what knowledge would be necessary to support their political decisions. Thus, saliency and relevance of the NoK process could be improved by taking a proactive approach, i.e. by not waiting for requesters but by highlighting important biodiversity evidence in a concise manner. Such a baseline information provided in a regular fashion would also ease the pressure on the NoK providing complex answers in a timely fashion on all kinds of issues

5.4.1.2 Recognized added values for the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence):

- The extensive and comprehensive literature search and extraction process ensures credibility by avoiding bias and selectivity to particular sources unlike any other review process.
- The negotiation process with the requesters generally seems to be able to obtain a review question formulation that is both scientifically treatable and politically relevant. Although we observed some shortcomings in this process (see below), the NoK structure generally provides the tools and the means to ensure such a translation.

5.4.1.3 Lessons learned for the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence):

- There are several types of requesters and requests, in terms of the breadth of their concern. Some requesters have very specific demands with regard to format, scope or type of outputs that are usually requested in a very short timeframe, one requester had a rather specific question. But generally the demands are much too broad to be tackled without being rephrased and eventually cut into smaller requests. This means that the dialogue stage of the prototype is a really an important stage that needs to be fully supported by appropriate means (time, skilled people to help with rephrasing and definition of goals and expectations)

- Networking, publications, money, fame, having an influence on political decisions seem to be major incentives to ensure the contribution of various stakehoders, especially scientists. Motivations of practitioners were much more difficult to assess.
- A structure is needed to ensure efficiency of the whole process: a real working group supported by funding, a proper Knowledge Coordinating Body, supporting tools (e.g. access to a wide range of knowledge) and skills (knowledge managers, statisticians...) , a management plan (including deadlines, miletones, expected deliverables) and planned interactions with requesters and peer-reviewers. All these aspects have been envisionned in the prototype and would have improved the cost-effectiveness of our case-study. The prototype was not so much a problem than the testing set-up itself.
- The NoK worked fine to reach experts and informed them about what was going on, but it was not enough to get them involved or to get feedbacks. Personal contact worked much better, and face-to-face meetings (e.g. workshop) are one important way to get people more involved and to really exchange knowledge of various kind.
- The heterogeneity of the knowledge holders and users is a challenge in terms of achieving an efficient knowledge exchange and synthesis. Again, the gap between knowledge-oriented community (e.g. scientists) and the task-oriented stakeholders (managers, decision-makers including policy makers) was witnessed during this case-study. In each community, there are people who have skills and the mind-set which favors bridging this gap. They should be identified as they could compose a very effective working group. The challenge would be to make sure that they are acknowledged by their own community as representatives with integrity and authorisation to speak on behalf of their groups (no conflict of interest, not only promoting their own vision).
- Scientific knowledge should be prepared in a way that allows for a rapid provision of answers. The Cambridge team has developed an approach that rapidly extracts existing scientific evidence and makes it accessible to decision makers. A comprehensive assessment and synthesis of all knowledge also demands strategic planning. There is a need to anticipate the need for knowledge or evidence, through horizon-scanning exercises for example. Prioritization of requests ahead of time should be developed as soon as possible at all decision-maker levels.
- Scientific tools (search engines, libraries, databases, analysis...) are in place to implement scientific synthesis and assessment. Nothing comparable is available for traditional and technical knowledge.

5.4.2 Preparation

5.4.2.1 Identify and communicate with requesters

The procedure used for this case study does not comply to the situation envisaged by the KNEU prototype. In the prototype, a requester pro-actively contacts the Knowledge Coordinating Body with a question/concern/problem. In our case, the KCB/Working group needed to obtain a question related to a topic in agriculture, and this led to several difficulties.

The idea was to obtain a request from a possible relevant future requester, that would be policy or management-relevant, useful for the case study but also to raise interest from the stakeholders about the NoK and Biodiversity Knowledge initiative.

In France, Claude-Anne Gautier, Cécile Blanc and Aurélien Carbonnière (FRB) approached the JPI FACCE (Jean-François Soussana) to present the project and the prototype and identify a question that would suit these objectives, one of the core theme of their strategic research agenda dealing with "Assessing and reducing tradeoffs between food supply, biodiversity and ecosystem services". Jean-François Soussana, member of the Scientific Advisory Board expressed great interest and identified the assessment of methodologies to map and quantify ecosystem services in agro-ecosystems as a relevant question for the NoK, as quantification of ecosystem services in the agricultural field is at the forefront of many policies and management practices, both at European and national levels. However, this topic was deemed too complicated to tackle with limited resources and the EEA has already planned a review of the recent literature on the subject. Furthermore, Sylvia Bozse (DGENV) and Caroline Raes (DGAGRI) were also consulted and did not show much interest in having the NoK address this topic. They furthermore sent us some feedback, which was too broad to set a question for the NoK but pointed out several areas of interest for them. A consultation with the Ministry of Agriculture (MAAPRAT), in relationship with INRA, led to the topic of biological control and landscape management interventions in connection with Ecophyto 2018, the national plan to reduce pesticides (see further down).

LESSON LEARNT: From the French team's perspective, the whole exercise took 11 person days to obtain a preliminary question of interest for the KNEU exercise (see below), which was very time-consuming and should not have happened in a real situation. The question was obtained thanks to personal relationships and network of some of the French team; otherwise it may have been even more difficult to get one which was raising interest. Obviously the potential "requesters" were not used to the exercise and cautious about the project, not being able to encompass its full potential at this stage.

In Austria, Peter Zulka contacted members of the Austrian Ministry of Agriculture and Environment and discussed the matter with them. A detailed discussion about the knowledge needs in agricultural ecology emerged with Lukas Weber-Hajszan, who is responsible for agri-environmental schemes at the Ministry. Lukas Weber-Hajszan particularly emphasized flower strips, which are promoted, but of which the ecological value and potential are often poorly recognized and acknowledged. A synthesis on the services of such structures in the landscape would be important to educate farmers on the matter. Lukas Weber-Hajszlan discouraged the investigation of ecosystem services. He argued that knowledge on such a broad topic with wide ramifications might lead to an unconvincing piece of information filled with truisms and trivial statements. He emphasized that knowledge needs not only to be compiled, but also prepared for the communication to stakeholders (e. g. farmers and agricultural organizations). Another discussion, with Josef Hoppichler, Federal Institute for Less Favoured and Mountainous Areas, Vienna, Austria dealt more specifically with trends in marginal agricultural regions, mainly to sound whether knowledge needs might differ between highly intensified agricultural regions and agricultural regions that are not competitive in economic terms. The discussion revealed that intensification trends are also prevalent in such regions, and that the impact of non-used landscape elements had to be quantified and gauged against the influence of production intensification on biodiversity. The Austrian consultation thus broadly confirmed the political interest in the value of non-used agricultural green veins for the preservation of biodiversity in the agricultural landscape. The consultation did not directly lead to a narrow streamlined question to be answered in a test-case systematic review, but was motivating to set up a flower-strip subtopic later in the process.

LESSON LEARNT: Politicians and stakeholders usually have a good general knowledge of the subject they are working on, but they are unable to track specific current developments and may need to be informed about details on particular subject. The knowledge requirements of policymakers and stakeholders are task-oriented and practical. Knowledge that supports important current decisions and particular points of view is usually much more important than a broad and balanced representation of the field. Policymakers are typically unable and unhappy to read long-winded and comprehensive accounts on their topic, even if they might contain relevant information. At least some of them seemed to be more interested in precise information on some specific questions on a particular sector in a time-bound manner.

5.4.2.2 Scope science and potential methods

Scoping existing science

Scoping can be defined in different ways. Regarding the procedures put into place for IPBES after the beginning of the KNEU project, it can be a broad consultation to assess the exact scope and scale of a request. Here we initially used the definition of the Collaboration for Environmental Evidence, where scoping is defined as a feasibility assessment.

The interest of scoping is thus to assess what is already published or available and guide the requester towards the best possible decision with regards to resources (time, money) to accomplish the synthesis and the choice of approach (for instance, only a few references will guide towards an expert consultation).

Peter has preliminary scoped (6 & 12 march 2012) BIOSIS and SCOPUS (years 1969 to 2012) to assess how many hits were retrieved when using various combinations of generic terms (Table 1).

Table 1. Preliminay scoping

Search Terms	**Results**
Topic=(fertilizer input AND biodiversity)	122
Topic=(agriculture* intensificat* AND biodiversity)	417
Topic=(ecosystem services AND method*)	3194
Topic=(flower strip* AND ecosystem service*)	3
Topic=(flower strip* AND biodiversity)	33
Topic=(pollination AND ecosystem service* AND yield)	20
Topic=(set-asides AND ecosystem services)	12
Topic=(agricultural input AND biodiversity)	230
Topic=(pesticid* AND biodiversity)	2115
Topic=(agricultural intensification AND biodiversity AND biofuels)	3
Topic = (pest control AND generalist predator)	28 (BIOSIS) and 20 (SCOPUS)

Barbara ran broad searches on Web of Knowledge early April 2012 and extracted hits in EndNote

- Integrated pest management 35598 hits; not extracted
- Landscape management AND (pest control OR (bio* control))
  - **5456 hits**, extracted[5]
- (Bio*control OR integr*pest*OR lutte biol*) AND (biodivers* OR conserv*)

[5] Landscapemanagement&pestcontrol.enl (EndNote)

  - **2762 hits**, extracted[6]
- Integrated pest management AND (biodiv* OR conserv* OR restor* OR landscape)
  - **1437 hits**; extracted[7]
- Decrease* AND pesticide*) AND (biodiv* OR conserv*)
  - **1406 hits**; extracted[8]
- Integrated pest management AND edge*
  - **103 hits**, extracted[9]
- Integrated pest management AND orchard*
  - **1046 hits**, extracted[10]

There were obviously redundancies between these searches so we should not simply sum the number of hits. Merging them and removing duplicates was not a priority as these searches were just for scoping and were not proper searches using robust search strings.

The idea was to use these searches to assess the content of the literature whilst altogether getting back to the requesters and NoK to see how to refine the question. Secondly, it allowed an estimation of the workload involved for a particular level of detail in the analysis. Also, it allowed to identify experts (authors) to be contacted in order to create a working group and peer-reviewers.

Scoping methods

The KNEU project relies on 3 approaches: Adaptive management framework, Expert Consultation and Evidence-based framework.

None of the staff involved in the case-study was trained in either method, except for BL who had some experience of the systematic review methodology (evidenc-based framework).

The adaptive management approach seemed poorly feasible at the beginning of the project mainly due to the total lack of a specialized existing network at the science-policy level in Agriculture within FRB or EAA. Such an approach, to be implemented with the resources allocated to this case-study, seemed difficult given the time constraints of the project and the necessities for monitoring over a longer period. We thought it would be more relevant to keep it as a possible outcome of the project, developing an adaptive management project based on existing evidence and acknowledged gaps in order to generate new knowledge and evidence in the future. Such a perspective has been considered during the workshop held in January, where experts were invited to brainstorm about it (compare Appendix 2).

The Expert Consultation was probably the initial plan at FRB but an important change in staff made it more difficult to implement, all the personal networks making a consultation successful being gone at this time. Expert consultation was nevertheless considered during the workshop and various attempts to contact people and experts at all levels (see further).

[6] Luttebio&biodiv.enl
[7] IMP&biodiv.enl
[8] Pestic&biodiv.enl
[9] IPM&edge.enl
[10] IPM&orchard.enl

The Evidence-based approach seems suitable for the question and was considered favorably for several reasons. Firstly, the controversial potential of natural pest control required a rigorous assessment of its options and real outcomes. This meant looking for a comprehensive, balanced, unbiased and objective evaluation of all existing knowledge, which a systematic review aims at. Moreover, a trained staff at FRB, the connection with Cambridge team at an early stage of the project, and the fact this approach could encompass the two others (it is possible to organize an expert consultation during the conduct of a systematic review, if planned in advance, and an adaptive management programme can be fed or created based on the results of the review) also influenced the choice of this approach. Finally, it helped with the conduct of the case-study as it could be implemented firstly on published papers, whilst consultation of (yet unknown) experts and collection of traditional and technical knowledge was more uncertain with the resources available.

5.4.2.3 Understand the policy context of the topic

Some of the political implications emerged in the talks with the stakeholders rather than from a vivid dialogue with policymakers. We do not pretend here to report all the complexities of the policy context in agriculture at this time.

Large amounts of money are spent on agricultural subsidies in the European community year after year. There have been strategies in place to link those subsidies to ecosystem service provisions and a general enhancement of the ecological conditions in agricultural landscapes, and it is very likely that in future Eurioean agricultural programmes this link will be strengthened even further. However, it has been shown that agri-environemntal schemes, however costly they may be for the taxpayer, will not automatically provide ecological benefits under all circumstances (Kleijn et al. 2001, 2006), So a critical review of the evidence on the function of particular landscape elements on ecosystem services would be highly important for justifying subsidy programmes and, more generally, guiding future agricultural policy frameworks.

Kleijn, D., Berendse, F., Smit, R. & Gilissen, N., 2001. Agri-environment schemes do not effectively protect biodiversity in Dutch agricultural landscapes. Nature 413, 723-725.

Kleijn, D., Baquero, R. A., Clough, Y., Díaz, M., De Esteban, J., Fernandez, F., Gabriel, D., Herzog, F., Holzschuh, A., Jöhl, R., Knop, E., Kruess, A., Marshall, E. J. P., Steffan-Dewenter, I., Tscharntke, T., Verhulst, J., West, T. M., Yela, J. L. (2006): Mixed biodiversity benefits of agri-environment schemes in five European countries. Ecology Letters 9: 243-254.

5.4.2.4 Request

The following request was formulated from the interaction between Pierre Bergeret (MAAP France), Gérard Gautier-Hamon (MAAP France) and Pierre Ricci (INRA France):

REQUEST: "Within the context of a reduction of the use of pesticides, we expect a positive feedback in return on biological control of pests resulting from a better preservation of functional biodiversity. The question which could be addressed to a NoK could be to know if any landscape management interventions could sustain or improve this ecosystem service provided to agriculture". (the agricultural context may need to be refined according to the type of agriculture and/or landscape).

5.4.2.5 Scoping

5.4.2.5.1 Frame a dialogue process with requesters and some experts (from KNEU and the wider NoK, if possible and needed)

Planning a workshop at the KNEU conference, the "Call to the NoK" was sent on April 27th to all the hubs listed by KNEU-WP1 (555contacts) and on May 4th to a list of French experts (333 contacts) (*see documents Inviting Hubs-v3.doc, Mailinglist_KNEUminusFrance_corrigé.xlsx, MailinglistFrance.xlsx*).

From the WP1 list of hubs, we received:

	Positive answers (expressing interest)	Negative answers	Forwarding mail to someone else or giving name	Automatic answer	Failure of delivery
Within 1 week	0	1 (not expert)	2	39 (7%)	46 (8%)
Second week	0	0	0	0	4

From the two persons mentioning other names, we got positive feebacks (Matias Jonsson BiodiverSA APPEAL, Sweden; David MacCracken, SAC UK).

Directly contacting experts

Having identified a review on the topic (Bianchi et al. 2006 *Sustainable pest reduction in agricultural landscapes, Proc. R. Soc*. B 273, 1715–1727) from Google, and contacted the first author, he sent us back two other more recent reviews (Chaplin-Kramer et al. 2011, *A meta-analysis of pest crop and natural enemy response top landscape complexity, Ecol. Letters* 14, 922–932; Veres et al. 2001, *Does landscape composition affect pest abundance and their control by natural enemies? A review*, Agric. Ecos. Env. 2011). Peter Zulka and Barbara Livoreil extracted all references and compiled a database from the names of the first authors and their e-mail addresses. This provided an overview on all scientists currently actively engaged in the field. Peter Zulka later consolidated this database and compiled additional information, e. g. the personal homepage URL of the scientist, research interests, the possible role in a knowledge network as contributor or reviewer and information on contact status.

Peter Zulka contacted all the experts compiled in the database either by e-mail or by telephone call to discuss the matter with them and to invite them to contribute (3.5.2012). Feedback was generally positive, many experts found the project exciting and were willing to contribute to the network. However, most experts were unable to attend a workshop at his time of the year (initially planned after the KNEU Conference, on 23-24 May 2012).

The phone call with Prof. Teja Tscharnktke, Göttingen, currently one of the most productive researchers in the field, revealed interesting insight into the structure of the question. Tscharnktke pointed out that many synthesizing reviews have already been written on the subject. A phone call with Prof. Thomas Frank, another highly cited author in the three reviews, revealed that on some parts of the question, evidence is abundant, well documented and largely condensed in reviews, but that an analysis of the quantitative relationship between landscape management and pesticide

reduction may never have been undertaken and that evidence on this relationship might be scarce to non-existent. Consequently, a meta-analysis might need to combine results from several parts of the logical chain and combine them, possibly analytically, to answer the question.

In France, Barbara Livoreil used the FRB Database of expert to extract names of experts related to agriculture and contacted them by email

From the call to the French list of experts we received 29 positive/constructive feedbacks:

	Positive answers (expressing interest)	Negative answers	Forwarding mail to someone else or giving name	Automatic answer	Failure of delivery
Within 2 weeks	18	5	11	9	22

Plus a few answers irrelevant to the topic

Relay by other Hubs

A very good number of expressions of interest have been collected via the ALTER-Net hub and dissemination system (Jiska van Dijk, KNEU Partner). By early June 13 more persons had expressed interest and were added to our list.

We know that others have relayed the call as we met some people during the KNEU conference who got the mail after several “forward” procedures but this was not traceable.

Other sources of knowledge

Using Google, but also via the feedbacks and advice provided by the persons expressing interest, many different programmes or networks related to pesticides have been identified. Those are programmes currently in progress, and they allow to get in touch with experts but also take into account the work currently implemented.

Programmes and networks identified by early June

- Ecophyto 2018 http://agriculture.gouv.fr/ecophyto

  This is a programme from the French ministry of Agriculture aiming at a 50% decrease in the use of pesticides by 2018. This programme launched in 2008 and includes all possible stakeholders: farmers, researchers, engineers, technicians and local decision-makers and managers, including some gardeners.

- APPEAL : http://www.biodiversa.org/87
  This is a research project funded under the ERA-NET BiodivERsA funding scheme (Jan 2012 to Dec 2014). It aims at assessing ecosystem services including biological pest control provided by natural enemies. It concentrates mostly on aphids and their natural predators (lady beetles, ground beetles, spiders) and examines how the natural enemy’s fauna is affected by land-use changes.

- ENDURE: www.endure-network.eu

  This is a platform in charge of providing information, tools and services to scientists, policy and farm advisers and trainers concerned with Integrated Pest Management, at the European level.

- PURE: www.pure-ipm.eu

  This is a FP7 integrated project aiming at providing integrated pest management solutions and a practical toolbox for their implementation in 6 selected ey European farming systems.

- NERC Knowledge Exchange Programme, University of Cambridge:

  www.nercsustainablefood.com
  www.conservationevidence.com

  Professor Bill Sutherland's team in the Department of Zoology has received a NERC grant to produce a synopsis on interventions that enhance natural pest control and biodiversity. The team had already identified about 30 interventions by early June and planned to extract and summarise literature of a range of peer-reviewed journals according to a pre-defined protocol for developing synopses (see Annex).

- Meta-programme SMaCH: www.inra.fr/les_recherches/metaprogrammes

  INRA, the French National Institute for Research in Agronomy has launched since 2010 a series of multidisciplinary multi-team programmes based on an iterative process (similar to an adaptive management approach, ndlr). One called Sustainable Management of Crop Health (SMaCH) includes research programmes and management to favor biodiversity as a natural way to control diseases and decrease pesticides. This include the identification or development of practices concerning the organization and management of landscapes.

- ELN-FAB: www.ecnc.org/news

  This is the European Learning Network on Functional Agrobiodiversity hosted at ECNC with the participation of Diversitas. In its Newsletter N°6 (May 2012) it mentions that "there are two ways to promote natural pest control in agriculture; crop management practices at the field scale (increasing within-field diversity or reducing soil tillage) and landscape management measures, which include finding the best way to set up crop and semi-natural habitats next to each other […] there is a lack of practical guidelines to help landscape planners determine the best way of designing land use in order to reduce pest numbers" and mentions a study reporting the effect of the proportion of woodland, semi-natural habitats, grassland and other habitats (Rusch et al. 2012, Landscape & Urban Planning 105:62-73).

LESSONS LEARNT

- Directly contacting experts has proven more effective than the call to the NoK. We think one reason is that it allowed us to explain what it was all about, whilst a general mail may have not attracted attention or signaled "just one more initiative" and added to the information overflow in the inbox of the mail programme. Calls issued from IPBES or an official European KCB will

probably attract more interest. In spite of not providing many positive answers, the call to the NoK and the call to experts (mails to experts identified from Google and bibliography) worked well and was disseminated, but the number of people it reached was not traceable. The established NoK structures thus worked well in informing the experts, but not in motivating the experts to collaborate.

- Rather than spending a huge amount of time chasing people, it would be more efficient to make people aware of the opportunities offered by the IPBES/NoK/KCB via dissemination and training courses (see FP7) about grant application, and post the calls onto the KCB website with access to guidelines, and a possibility for any researcher to get an automatic message sent whenever a new add appears.
- Typically, experts are extremely busy and most of them were not available for a first workshop in May 2012. Regularly, especially with scientists, we heard questions like “is there is money for me in this programme”, or “is there any opportunity to publish out of the exercise”. Some saw the WP3 Agriculture case-study initially as a redundant programme or a competitor. It was not always easy to explain that it is aiming at a synthesis of current knowledge and its highlighting, rather than a new research programme. Incentives (such as contributions to a joint publication, exchange of information, networking benefits) may help, but typically a formal project (with tender, commissioning of the work and financial compensation) is required to obtain substantial work-intensive contributions from experts.
- An interesting comment from several high-level researchers is that “researchers are not interested in conducting synthesis”. Indeed, many of them are more “research” oriented, in the way of discovering new results and publishing them, going further, rather than having a look at previous papers (they mostly know) and trying to establish evidence, confidence or needs for more results. An exception is the perspective of conducting meta-analysis, as this is considered as a new outcome, publishable and innovative. As a consequence, the conduct of assessments (IPBES) or knowledge synthesis should be accomplished by a mixed team, researchers being involved as peer-reviewers and for the most scientific aspects of it. The remaining work could be delegated to skilled librarians (searches), digesters/briefers, evaluators, and communicators or knowledge brokers, under the supervision of a committee (KCB+experts) in charge of controlling the quality of the work, helped by clear rules for the conduct of the synthesis (like the guidelines for systematic reviews). This would also increase cost-effectiveness of the whole process.
- The existence of published reviews is very important because one can consider that the KNEU-KCB would first try to identify synthesis of knowledge that have been done already, and use/evaluate them. Structuring the search into different steps (reviews/synthesis, then primary literature) may thus be needed. In our case the reviews firstly identified did not exactly answer the question to the NoK, but served as an entry point to contact experts. We could thus try to find if there are more of them, and how they complement each other, and what value they have in terms of robustness, confidence… etc. Bangor University has developed a preliminary checklist to assess the quality of syntheses compared to standards of systematic reviews, which could be used as a template. Published reviews are, however, unlikely to provide sufficient answers to specific questions and are thus no substitute to a formal review procedure.
- Existing on-going programmes (such as the NERC Knowledge Exchange Programme led by Cambridge) are an element that has not been addressed in the NoK Prototype so far, as the prototype aims firstly at collating and synthesizing past knowledge. However, it may be of importance for the decision-maker to postpone their requests once made aware of existing

similar requests undergoing examination. Or it may be important to include these programmes and their actors into the synthesis to ensure it is as up to date as possible. Availability of experts is then a key challenge if already involved in on-going projects.

5.4.2.5.2 *Specify and adapt topics into relevant, but also suitable questions for specific methods*

Clarifying the request – Question reformulation

We worked on the previous request to phrase it as simply as possible in order to be able to identify its components as for a systematic review approach. We first got:

"Is there evidence that some landscape management favor bio-control in agricultural landscapes, so that this natural bio-control (ecosystem service) effectively replaces or compensates for a reduction in the use of pesticides?"

This was still very broad and it actually might have contained two questions in one: the first one was an assumption that a decrease in the use of pesticides is accompanied by an increase of the population of pest-controlling general predators. The second was about a list of interventions that would help supporting or restoring these populations of pest regulators through the management of habitat and landscape.

Indeed, the reduction of pesticides and its impact on the population of natural pest-control agents would need to be assessed in its own way. There is a lot of existing literature on this topic and this is tackled by the Cambridge team. However, we assumed that demonstrating that a reduction of pesticides was increasing the number of natural predators was not the key message of the requester, but that their request was more focused on knowing what could be done to support natural predators via landscape management. Furthermore, we assumed that the interest of the requester, the reason why he/she should call the NoK for help was not only to get a list of possible actions, but also to know when/under which conditions they were effective.

As a consequence, the final phrasing of the request we suggested became:

Which types of landscape management are effective at maintaining or increasing natural pest regulation in a context of decreased use of pesticides?

Validation by policy-makers

Since the question was not, as typical for the NoK-prototype procedure, pre-formulated by a stakeholder and later processed by the KCB, but already shaped and refined in an ongoing dialogue with "virtual" requesters, we saw no need for additional validation by policy-makers.

LESSONS LEARNT

- The exercise to phrase a question easy to understand, short but containing key elements should be done by the requester itself. To do this, guidelines, examples, a special form could be made available (see early version of prototype such as version 11, Annex to PowerPoint presentation to KNEU partners).
- The need for regular dialogue during the conduct of the assessment must be made clear to the requester prior to its request, in order for him to allocate time for this. Having one contact person as a representative of requester(s) (see case-study on green infrastructures) seems to favor exchanges in a rapid and effective way.
- Many stakeholders feel the need for additional knowledge to facilitate their work and substantiate their policies; however, they seem to be unsure on the exact nature of this knowledge and the precise question that needs to be answered. Discussions are thus needed to pin down the insecurity on questions that can be answered, at least in principle. A work like that of identifying 1000 questions of policy relevance (Sutherland 2008….and others) may be useful at various scale to prepare the requests.

5.4.2.6 Decide on methods to be used

(see section 5.4.2.2)

The requesters did not have to chose among the methods, and were not explained what they were all about. This was due to the lack of a clearly identified requester, plus the fact that the approach was already chosen, linked to the availability of skills, opportunities (Cambridge) and difficulty to get in touch with experts.

Thus the initial approach envisaged to address the question was that of a systematic review, and especially a form called systematic map (www.environmentalevidence.org/Mgroups.html). A systematic map benefits from the same standardised procedure as a systematic review and it allows to address a question such as ours by mapping the knowledge extracted from the systematic search, critically appraise the papers and report about knowledge gaps and possibilities for full systematic reviews (opportunities to complement by a quantitative analysis such as a meta-analysis).

The start of a synopsis of evidence project at the University of Cambridge led to several exchanges and a possibility to merge efforts. This required us to fit the synopsis approach into the NoK Prototype, which has not really been envisaged during KNEU WP2. There are many common points between a systematic map approach and a synopsis, but also divergences. They are summarized below:

Common points:

- Addressing the question of effectiveness of interventions
- Search of knowledge in the peer-reviewed scientific literature
- Extraction of information from each paper and study to describe the methodology, context and major conclusions

Divergences

- Searches: in a Systematic Review, the bibliographic search is based on search strings applied into different search engines in order to design a systematic, transparent and replicable search aimed at extracting all the relevant literature (i.e. aiming for comprehensiveness). Then this search is refined using pre-defined exclusion/inclusion criteria to extract eligible papers. In a synopsis, a selection of journals is agreed and all the titles are perused to find those indicating a relevant paper. Grey literature is taken into account in both approaches.
- A synopsis may recommend to conduct a systematic review when enough literature has been identified to allow it
- The critical appraisal of each paper is more thorough in a systematic review, based on a priori criteria assessing the quality of the scientific methodology used in each study, the identification of bias and its impact on the results, and the use of weightings (both in the narrative and quantitative analysis) to account for the value of the research methodology, providing a level of confidence in the results.

Nevertheless, the differences did not impair the use of the prototype and the synopsis of evidence is clearly within the Evidence-based Framework approach of the prototype.

5.4.2.7 Tender process

n/a. There was no tender process as no money was available to pay for experts to form a working group.

The poor availability of experts and uncertainty about how to organise the work prevented us from spending money in workshops or meeting before reaching a further stage of completion of the literature search. Moreover, the interaction with Cambridge was fruitful enough to encourage us to invest our effort in this collaboration.

The Cambridge team was able to allocate 3 person months to the synopsis of evidence on this topic and very little would have been achieved without their input and dedication.

Concerning the call to knowledge hubs to help identifying/ nominating experts and the call for evidence, please refer to section 5.4.2.2 and 5.4.2.5.

5.4.2.8 Agreement on team and protocol

The final team working on most of the reported work therein was composed of:

- Cambridge: Lynn Dicks, James Hutchison, Hugh Wright, Joscelyne Ashpole (W.J. Sutherland head of lab)
- Austrian Environmental Agency: Klaus Peter Zulka
- FRB: Barbara Livoreil
- INRA (literature searches): Sophie Leperchec and Anne-Sophie Grenier

The protocol was agreed at an early stage as being an attempt to merge a synopsis of evidence and a Systematic Map (see 5.4.2.2)

5.4.2.9 Communication of protocol

5.4.2.9.1 Publishing the process protocol and further inviting for comments / evidence by the NoK

The draft protocol was finalized by BL in August 2012 and then circulated among co-authors for revision. It was submitted to Environmental Evidence Journal on October 8th, 2012. Delays were experienced due to the lack of information concerning 2 appendixes, waiting for the experts to be back from holidays.

The protocol was revised by EEJ's peer-reviewers and received back on the 26/11/2012. So far no amendments were made and the protocol is not yet finalized, mainly because the outcomes of the systematic map are still uncertain (see further).

LESSONS LEARNT

- A draft protocol written by experts in the topic would have been much more detailed and fast. Yet they may not have relied on other contributors such as librarians. The writing surely benefits from the experience of a range of people in order to provide as many details as possible about the context, criteria for selection, but also the methodology used (SR). There should be strict guidelines to authors provided to working groups in order to guarantee the structure and quality of content (level of information required) of the draft protocol.

- Peer-reviewers should also be a mixture of people expert in the topic, others expert in the methodology / approach used, and others in the communication realm (would the draft be understandable by the requester?).We did not have the opportunity to send the draft to the requester yet. It has been made available on the Biodiversity Knowledge website for open-consultation but no specific advertisement was made (except to the participants of the workshop) and no feedback has been obtained at this date.

- Environmental Evidence Journal (EEJ) is the only official journal allowing a submission of a draft protocol of a systematic review in environmental management so far. Other journals accept reviews and probably systematic reviews (in the future especially if they increase in number). We also intended to submit the draft to Peerage of Science for a free open peer-review process but did not have the time to do so after the manuscript was sent to EEJ.

- As EEJ is an open-access journal, fees are charged to authors. FRB not being member of Biomed Central could not benefit from any discount and would have to pay about 1700€ for this preliminary manuscript. Such costs would have to be taken into account in the Dialogue stage / Project planning, unless the NoK creates its own journal. A waiver has been granted to FRB upon condition that the final systematic map or review is submitted and accepted, which has not been done yet.

5.4.3 Conducting

5.4.3.1 Communication to different groups/ knowledge hubs (e.g., reviewers, stakeholders)

Various medias were used to communicate with various stakeholders and knowledge holders, trying to outreach and get them involved:

- a flyer was designed in order to present the project and how we would like to work (see Appendix 5), in English and French.

- a forum was made available on the Biodiversity Knowledge website in order to facilitate exchange, but was not used as we feared that the constraint of having to use only English language would deter some potential participants.

- an attempt of mapping the knowledge holder community in France for this agricultural topic was conducted with Edwige Charbonnier (FRB). We sent a questionnaire to the members of the FRB's Conseil d'Orientation Stratégique, a group of about 120 stakeholders from the private sector that is a component of FRB's strategic governance. In the questionnaire, we asked if people where looking for knowledge or were generating knowlege, and whether they could cite 5 key other structures with whom they would interact to gain or echange knowledge. The preliminary results were encouraging although not surprising, citing INRA and ACTA as the key players. This initiative has been relayed since then by a project between FRB and ACTA as well as the main project ECOSCOPE (FRB) and should provide results in the coming year.

- the workshop held in January also provided other opportunities to interact with stakeholders. Please see section 5.4.3.3. for more details.

5.4.3.2 Use of evidence-based framework

5.4.3.2.1 Collection of existing knowledge

Search for scientific published literature

1. NERC Knowledge Exchange Programme, University of Cambridge

The contents (list of titles) of 3 of the most relevant peer-reviewed scientific journals was systematically trawled (all volumes, issues, and years) in order to identify titles of papers that were eligible for the request. The journal by journal search process was stopped in favour of using a larger list of references extracted by FRB/INRA. The references extracted from the three journal were later used to test the coverage of the more extensive searches conducted by FRB/INRA.

2. FRB and INRA

We benefited from the contribution of two experienced professional librarians from INRA (National Institute for Research in Agronomy), who have been involved in the past in several ESCOs (Expertises Scientifiques Collectives). ESCOs are knowledge synthesis lead by researchers and organized according to pre-defined procedures (INRA procedures currently under revision, should be available by 2013). They work within special units of INRA which are dedicated in supporting the researchers by providing them with relevant literature according to their needs. They organized several

workshops to work together, BL joining either physically or by conference call. This was a compulsory approach as FRB did not have access to any search engine except Google. Peter Zulka had access to SCOPUS and BIOSIS but this would not have conducted to a comprehensive search as these databases are more limited than Web of Knowledge or Cab abstract.

Working with INRA was also relevant because of the topic, as INRA is specialized in Agronomy and Agriculture. The searches were limited to establishing search strings and using the search engines, as well as possible descriptive analysis of the outputs. They were not allowed to provide us with PDF of the relevant titles due to our inability to establish a contract paying for their service (we were limited to workshops).

Searches were mostly done on CABAbstract because the two librarians found this database more relevant to the topic and more convenient. Search on Web of Science were experimental as the search string could not be re-configurated due to lack of time. The use of CABAbstract was not always easy to understand for BL as the librarians used technical language and were so skilled using it they were not always aware it was new to BL. Yet the relationship has been very fruitful because it was iterative and guided by preliminary work done by BL, it could thus be achieved within a month, the only timeframe available for these persons.

To help with the search and selection of relevant literature, the question was divided into components called PICO (Population, Intervention or exposure, Comparator and Outcomes; CEE, 2010).

Population	**Intervention**	**Comparators**	**Outcomes**
Any indigenous regulators of pests (all taxa)	Any intervention consisting in creating, restoring, or maintaining natural or seminatural landscape elements , improving habitat conditions for species, as well as their respective proportion at the landscape level e.g. sowing flower strips, keeping hedgerows, growing ground cover…	No intervention, destruction, other types of interventions, control plots	Species richness, abundance, density, biomass, dispersion, occupation, presence, reproduction, settlement, viability,

Search strings were designed by an iterative exchange between FRB (BL) and INRA (ASG & SL) and were conducted at INRA (Search Working Group). These searches aimed to extract a comprehensive and unbiased range of literature relevant to the topic.

Searches were only conducted in English language but may retrieve papers written in other languages (when abstracts in English are provided). The initial list of keywords is available upon

request (FRB). We could not obtain a comprehensive list of names of natural enemies of pest. In order to narrow the search to pests related to agriculture, we used a list of pest species obtained from INRA (www.inra.fr/hyppz/) using the Latin names of genus for all pests identified in this website (see search string below).

Search for grey literature:

Searching on Google was done initially by BL and PZ to get familiarized with the topic. Looking on Google for hits relevant to the topic aimed to completing the scientific search with some non academic literature.

A search in French was done on 24/10/2012 on Google using 3 keywords "habitat auxiliaires culture". We retrieved the 150 first hits.

A search in English was done on 24/10/2012 on Google using "habitat natural pest control". 3360000 hits -

Search on institution's websites

No such search was done due to lack of time

Technical and local knowledge knowledge

As the NoK prototype and the IPBeS project both highlight the need to take into account indigeneous and traditional knowledge, we tried to contact a panel of farmers in different European countries and asked them about their knowledge of practices in landscape design and management that have an impact on pest control (France, UK-Cambridge)

Search string 1: POPULATION

This string combines the list of names of pest (latin names, genus only) OR a list of natural enemies as defined by broad categories**.**

1. DE=(predatory insects OR predatory arthropods OR predatory birds OR predatory mites OR natural enemies OR predators OR Biological control agent OR pest OR predator prey relationships OR pests)
OR
2. TS=(*Acalitus* OR Acanthoscelides OR AcidiaOR Aclypea OR Acrolepiopsis OR Aculops OR Aculus OR Acyrthosiphon OR Adoxophyes OR Aegeria OR Aglaope OR Agriotes OR Agromyza OR Agrotis OR Aleurolobus OR Aleurothrixus OR Anarsia OR Anthonomus OR Aonidiella OR Aphanostigma OR Aphelenchoides OR Aphelenchus OR Aphidula OR Aphis OR Apion OR Apodemus OR Arammichnus Archips OR Argyrotaenia OR Arion OR Aspidiotus OR Athalia OR Atomaria OR Aulacaspis OR Aulacorthum OR Autographa OR Bemisia OR Blaniulus OR Blitophaga OR Brachycaudus OR Brachycorynella OR Brevicoryne OR Bruchus OR Byturus OR Cacoecia OR Cacopsylla OR Calepitrimerus OR Capitophorus OR Capnodis OR Capua OR Carduelis OR Cecidophyes OR Cecidophyopsis OR Ceratitis OR Ceroplastes OR Ceuthorhynchus OR Chaetosiphon OR Chromaphis OR Chrysomphalus OR Cirphis OR Clysia OR Cnephasia OR Coenorhinus OR Colaspidema OR Coleophora Colomerus Columba OR Conorhynchus OR

Contarinia OR Coroebus OR Corvus OR Corylobium OR Cossus OR Crioceris OR Cryptomyzus OR Curculio OR Cydia OR Dactylosphaera OR Dacus OR Dasineura OR Delia OR Deroceras OR Dialeurodes OR Ditylenchus OR Dysaphis OR Dysaulacorthum OR Empoasca OR Eotetranychus OR Epidiaspis OR Eriophyes OR Eriosoma OR Eulecanium OR Euparypha OR Euphyllura OR Eupoecilia OR Eurydema OR Euxoa OR Euzophera OR Forficula OR Frankliniella OR Fringilla OR Geoktapia OR Globodera OR Gortyna OR Grapholitha OR Gryllotalpa OR Gymnoscelis OR Haltica OR Haplodiplosis OR Haplothrips OR Hapsidolema OR Harpalus OR Hedya OR Helicoverpa OR Heliothis OR Helix OR Heterodera OR Homoeosoma OR Hoplocampa OR Hyalopterus OR Hylemyia OR Hypera OR Hyperomyzus OR Hypoborus OR Hyponomeuta OR Icerya OR Jacobiasca OR Kakothrips OR Korscheltellus OR Laspeyresia OR Lepidosaphes OR Leptinotarsa OR Leptohylemyia OR Lepus OR Leucoptera OR Limothrips OR Liothrips OR Liriomyza OR Lobesia OR Lycophotia OR Lyonetia OR Macrosiphum OR Mamestra OR Melanaphis OR Melanchra OR Meligethes OR Meloidogyne OR Melolontha OR Metatetranychus OR Metopolophium OR Metriochroa OR Micractis OR Microtus OR Monostira OR Mythimna OR Mytilococcus OR Myzocallis OR Myzus OR Nasonovia OR Oberea OR Oecophyllembius OR Operophtera OR Ophiomyia OR Ophonus OR Oryctolagus OR Oscinella OR Ostrinia OR Otiorhynchus OR Oulema OR Palomena OR Palpita OR Pammene OR Pandemis OR Panonychus OR Parahypopta OR Parus OR Passer OR Passerinia OR Pegomyia OR Pemphigus OR Peribatodes OR Phasianus OR Philophylla OR Phloeotribus OR Phorbia OR Phorodon OR Phthorimaea OR Phyllocoptes OR Phyllonorycter OR Phyllotreta OR Phytocoptella OR Phytometra OR Phytonemus OR Phytonomus OR Phytoptus OR Pica OR Pieris OR Platyparea OR Plutella OR Polia OR Polyphylla OR Pratylenchus OR Prays OR Prolasioptera OR Protrama OR Pseudaulacaspis OR Psila OR Psylliodes OR Pyrrhula OR Quadraspidiotus OR Radopholus OR Resseliella OR Rhagoletis OR Rhopalosiphum OR Rhynchites OR Ruguloscolytus OR Saissetia OR Scaphoideus OR Scotia OR Scrobipalpa OR Scutigerella OR Sesamia OR Sitobion OR Sitodiplosis OR Sitona OR Sparganothis OR Spilonota OR Spodoptera OR Stephanitis OR Stigmella OR Sturnus OR Sus OR Synanthedon OR Talpa OR Tetranychus OR Thrips OR Tipula OR Toxoptera OR Trialeurodes OR Trichodorus OR Tylenchulus OR Vasates OR Vespa OR Vesperus OR Vespula OR Viteus OR Xiphinema OR Xyleborus OR Yponomeuta OR Zabrus OR Zeuzera OR Zophodia)

Search string 2: INTERVENTION

As before, the first part of this string is composed of generic descriptors which actually target a larger number of keywords.

3. DE=(Companion crops OR Farming systems OR grassland* OR Border effects OR forest borders OR Intercropping OR crop management OR cropping systems OR crop establishment OR habitats OR territory OR biotopes OR hedges OR Landscape OR land use OR fallow OR strip* OR linear plantations OR shelterbelts OR ground cover OR trap crops OR Tillage OR agricultural land OR interspecific competition OR grazing OR cultural control)

OR

4. TS=("Banker plant* system*" OR "companion vegetation*" OR "companion plant* " OR "Buffer width*" OR "buffer zone*" OR corridor* OR "field margin*" OR farmscaping OR "integrated production" OR "repellent plant*" OR "spatial arrangement*" OR "set-aside" OR

"set aside" OR refuge OR Compost* OR "integrated crop management" OR habitat OR "crop system" OR groundcover OR "flowering borders" OR landscape OR interplanting

Search string 3: OUTCOMES

5. TS=((increas* OR decreas* OR declin* OR regulat* OR impact* OR variabilit* OR reduc* OR effect* OR intensit* OR sustain* OR maintain* OR support* OR chang* OR enhanc* OR affect* OR abundance) SAME (abundance OR "population size" OR presence OR "species richness" OR "species diversity" OR biocontrol OR "pest control"))

Final search combination: String 1 **AND** string 2 **AND** String 3

These strings were adapted for use in Web of Science by using wildcards (*) and commas to delimit expressions (see Annex 7). In Web of Science, descriptors do not exist, all keywords are identified as Topic. Due to lack of resources, we could not build a search in WoS as an iterative process and we are aware that this current search may not have been comprehensive.

LESSONS LEARNT

- The method used by Cambridge was very effective at rapidly identifying existing evidence backed-up by good scientific methodology. Indeed, one can assume that a good experiment is published in the best journal in the relevant area. This is not a synthesis yet but gives a first insight of the availability of such papers.
- The initial list of interventions provided by Cambridge was issued from a consultation with stakeholders and experts that was conducted prior to the project. This is an interesting approach as it could easily be done at anytime at the subnational and national level and could then be compiled in order to assess needs for evidence that are common at the supra-national level.
- Working with professional librairians to conduct the search was very interesting because they perfectly know the search engines, tools, and have experience in designing searches. Moreover, they enjoyed the exercise and it highlighted their skills. They were also very eager to provide results, maps of literature, analysis of publications if needed.
- A dialogue stage was also very necessary when working with librarians. They had to understand the goals, scope, scale, list of key-words… as fast as possible to engage the searches in the most effective way. This can be helped by a simple question formulation of the request, a list of search terms provided initially, and information about language, years, geographical scope, etc. Librarians used their own jargon, and an iterative dialogue was most useful to discover misunderstanding about some semantics, not obvious at the beginning (using similar words but with different meanings). Obviously a core team of permanent librarians would help achieving this cost- effectively within a structure like IPBES.
- Aiming at the comprehensiveness of the search was new to the librarians and yet rewarding (because the initial searches proved to be effective given the length of the benchmark list). Examining the reasons why a few papers were not retrieved was also rewarding as we could understand if something would have been done to improve the search (in this case, most of

the time, nothing, papers were not referenced; or changing the string for web of knowledge, see Results).

- The role of high-level experts (like IPBES MEP) in the Dialogue Stage of the prototype should help establish a good and long benchmark list (as high-level experts they must have their own long list of bibliography to make available) and discuss with the Librarians about a comprehensive yet relevant list of keywords.
- An alternative would be to start by searching for all existing reviews on the topic. They can be used to snowball and identify experts, create the benchmark list and start listing keywords.
- One identified constraint was the specialization of the librarians in the CABAbstract. This led to a good search using this engine, but there was not enough time to conduct an effective search using web of knowledge (keywords needed to be refined). Being able to use effectively all the existing search engine should be a major asset of the Librarians of the NoK.

5.4.3.2.2 Modes of analysis

Inclusion/exclusion of papers

Following the Guidelines for Systematic Reviews in Environmental Management, we first sorted the results of the searches to discard irrelevant papers, paying attention to the using of a priori criteria and assessing the consistency between people doing to selection (Kappa test between BL and PZ on a subset of papers).

The criteria used to sort the papers at title stage are explained below.

Relevance of the studies to the request was assessed initially both by Cambridge and by FRB-EAA based on title. When in doubt, a paper was kept and assessed again at next stage (abstract, full text) to benefit from more information. For the papers extracted by INRA, given limitations of resources, a decision will be made with stakeholders whether to limit selection at abstract and full text stages to some subtopics of particular interest, but the complete database (EndNote) will be available for subsequent finalization if possible.

The Cambridge team did all the sorting based on abstract and as native English-speakers their involvement 1) saved time, and 2) allowed Cambridge to keep some papers that were relevant for their long list of interventions but irrelevant to our case study.

From the list extracted by INRA, the two reviewers (BL, PZ) compared their decision-making about relevance of papers by conducting a Kappa test on a random extract of 30 papers at title (and possibly abstract) stage. The Kappa statistics (Edwards et al. 1985) needs to be lower than 0.6, otherwise the two reviewers discuss reasons for discrepancy and clarify rules for inclusion/exclusion, eventually reporting about any modification of the criteria listed above.

A priori criteria for inclusion or rejection of paper at any stage are given below. When in doubt about accepting or discarding a paper, it is retained until examined at the next stage.

Relevant populations:

Any natural (live) control agent which may impact populations of pests, except in freshwater or marine waters. Papers on pests not attacking resources (e.g. mosquitos) will not be retained. Pest control agents such as microbes, viruses, protozoans, fungi, parasites are not retained unless they are clearly native and linked to some habitat features. It is here considered that enhancing such populations rely mostly on release procedure rather than interventions on landscape elements Biocontrol of pests affecting livestock and poultry (but not captive bred animals in zoos or fur market…) are retained, as well as those affecting any resource that may not be food (e.g. timber, horticulture, pharmaceuticals, and so on).

Relevant interventions

Any modification of habitat features or landscape (maintaining, restoring, transforming, manipulating, creating) at the field scale or at a larger scale is eligible. Some studies will probably be situations of exposure, where no intervention occurs but the effect of the landscape structure/composition/design is assessed by comparing different sites or plots. Introduction of exotic biological control agents are discarded, as well as food supplementation, physical barriers (nets), artificial traps, repellent pheromones, mating disruption techniques as they are not linked to habitat features.

Relevant outcomes

Increase of indigenous biocontrol agents (ladybugs, spiders, birds...) measured as species richness, abundance, survival rates, reproduction rates, ... AND/OR eventually as a secondary effect, decreased or maintained populations of pests. It could also be a reduced latency in regulation by natural predators at the onset of an infestation by pests. In case of control-agents of very small size, cryptic or as acting as parasites or parasitoids, measuring changes in the pest population may be easier than verifying that these changes have been created by a successful infestation. Papers just reporting increase in population or efficiency of pest control agents are retained, papers measuring both an increase of pest control action and a decrease of pests would be even better but may be more difficult to find. Papers just reporting changes in the pest population may be biased by the possible lack of demonstration of direct causality between the pest-control agent and the pest population and are retained but examined only if time/manpower allow us to do so.

Relevant context

The studies should preferably include a reported decrease of the use of pesticides in the field and even in the neighborhood (no spillage). This decrease could be measured as a total quantity of pesticide used, a decreased frequency of use, a decreased range of pesticides or a change towards pesticides with a more specific and narrow spectrum, or better by some chemical proxys measured in the field and its surroundings indicating the decrease of presence of the molecules of pesticide. It

could also encompass a change from conventional agriculture to integrated pest management programmes or biological agriculture.

Relevant types of study design and papers

Any study conducted in the field. Simulations, models or scenario will be discarded. Reviews with quantitative analysis (meta-analysis or re-analysis of data) will be considered as papers. Narrative reviews will be examined as opinion papers or as a special category.

The best expected study design would be one with a BACI design (before/after/control/intervention), or with multiple replicates in time and space (beyond BACI, Underwood 1996). Plots would be far away from each other to prevent spillover but not too far from one another to introduce heterogeneity in microclimate or soil. However, a random allocation of plots to treatment/control seems rarely possible in landscape studies (Hargrove & Pickering 1992).

LESSONS LEARNT

- Establishing a list of criteria for inclusion/exclusion at title stage is relatively easy even when not an expert in the field. This is because the exclusion based on title is really obvious, the paper dealing with a subject very far away from the topic of interest. This could have been done by the librarians if time allowed doing so.

Critical appraisal: establishing the confidence in results.

We also established a priori criteria for the critical appraisal of the literature. Study quality was assessed based on a hierarchy of evidence established in medicine and conservation (Stevens & Milne, 1997; Pullin & Knight 2001) and refined to match the specificities or limitations of research designs observed in the context of this review.

A range of *a priori* criteria defining the robustness of the research design, the ideal and optimal research protocol needs to be established before the literature is read. Awaiting for the opportunity to consult experts (workshop), we merged two approaches. Firstly, Cambridge only include in their synopses studies that quantify the effects of an action(s) that was experimentally undertaken, rather than passively observed (as in correlative studies). Indeed, the impact of an intervention can only be robustly assessed if its effect is measured in comparison to what was observed before it took place or to a control treatment. Secondly, a preliminary list was proposed below, ranking study designs according to their low to high susceptibility to biases.

1. BACI experiment, replicated or not, with randomized allocation of plots to treatment, double blinded monitoring
2. BACI Experiments, replicated or not with randomized allocation of plots to treatment
3. BACI experiment, no replicate, no randomization, no blinded measurement (probably very common)
4. Time series, replicated in space, with control plots
5. Time series, replicated, without control (correlative)

6. Comparisons of two or more plots, no replication in time (correlative)
7. Time series on one plot (correlative)
8. Observations with no specific design (common in traditional knowledge; correlative)

Such a list would be examined by experts and refined thereafter (see Results).

For non academic knowledge, effectiveness of an intervention will rely on the opinion of stakeholders. As for a survey, the number of independent opinion reporting effectiveness out of the number of opinions reporting ineffectiveness or no opinion will be an indicator of the perceptions of stakeholders concerning a given intervention. Attention will be paid to the number of answers and the affiliation of answerers as we do not have resources to conduct a structured survey with samples representative of the population of farmers or conservationists.

LESSONS LEARNT

- This list of possible research designs was established without consulting experts and based on the reading of a few papers. A special workshop should have been organized to try to collect expertise on this matter, especially to decide about possible controversial research design (see other case-studies).

Potential effect modifiers and reasons for heterogeneity of observed results

Effect modifiers are confounding variables that may impact the value or sign of the effect size (i.e. intensity of the impact of the intervention calculated as a difference or ratio between a “Before” and a “After” measurement) (Borenstein et al 2009, CEE 2010). Trying to establish a comprehensive list of possible sources of bias affecting the results of an experiment or observation is important prior to the conduct of the study in order to guide the reading at full text and assessment of the quality of each study. Well-conducted studies will have a research design aiming at minimizing bias or controlling them. Less rigorous studies may nevertheless report bias and try to take them into account, which should be acknowledged.

Given the breadth of the question, we expect to identify a long list of confounding variables/effect modifiers and causes for heterogeneity. Bases on preliminary reading of some literature, a preliminary list of biases is given below:

1. The increase of populations of natural pest control agents could be simply due to the decrease of pesticides, rather than to the effect of habitat manipulation itself. The two factors can interact in synergy or in opposition. Discriminating among the respective role of each factor implies to have measured them.
2. The quality of soil, diversity of cultivars (varieties of crop), history of the use of pesticides will often vary across sites without any possible experimental manipulation of these parameters. Reporting them is an asset of any publication.
3. Wind can affect spillover of pesticides, dispersion of pests and natural enemies. Some hedges are primarily designed to stop wind (damages on orchards) rather than to favor natural pest

control. As a consequence, the existence of hedges, the linear of hedges may not be a good indicator of functional agrobiodiversity.

4. Insects move across fields or habitats, for instance for reproduction, or to overwintering sites. They can change crop according to their life-cycle or stage (egg/larvae/adult). Monitoring should take into account season, life cycle and mobility.
5. Surroundings can affect results. A pesticide-free site may be impacted by high pesticide impacted surrounding fields but also by non agricultural habitats (roads, water, other crops)… Discriminating among these confounding variable may be tricky. Similarly, creating a new landscape element in an area where there are plenty of them already (and hedge in a semi open area) may be successful in terms of rapid colonization by biocontrol agents, but may not have a huge impact on pests as regulation would have occurred already. On the other hand, creating an hedge in a widely open area may be very beneficial for biodiversity (new niche) but hard to colonize if isolated.
6. One crop may have several pests (specialists vs generalist), one pest may have several enemies, one enemy can target several pests, can switch according to season and lifecycle, one enemy also has its own enemies.
7. Parasitoids, diseases or predators do not act the same way, there may be a latency before effectiveness can be observed.
8. Eradicating one pest can create an empty niche and attract other pests, so yield may not increase in spite of effective pest control on the targeted pest.

5.4.3.3 Compilation of first results

Searches

The compiled searches conducted by INRA/FRB (CABabstract + Web of Science) identified a total of 38969 records once duplicates were removed. Of these, 14249 were specifically found in CAB Abstract and 19603 in Web of Knowledge. CAB Abstract and WoK had 5117 references in common.

Comprehensiveness of search:

The performance of the INRA search was assessed by examining the proportion of the benchmark reference lists that was retrieved by the search equation. Firstly, the comparison with the benchmark list of 83 references initially provided by scoping on Google showed that 55.4% of the benchmark references were retrieved (46 out of 83 papers). The list (c.f. Chapter 5.3.2. & Annex B.2) has been upgraded to include identification of papers not retrieved as well as comments. An examination of the 37 references not identified by the search equations showed that 4 of them were not referenced in CAB Abstracts, Web of Science or even Web of Knowledge and can probably be considered as grey literature. Nine references were not found by CAB Abstract or Web of Science but existed in Web of Knowledge. Twenty four references were not found because the search equation was not accurate enough. If we discard the 13 first references as they could not be found anyway, the performance of the search equation is thus of 65.7% (46 out of 70).

The benchmark list provided by Cambridge (initial list of 264 references retained by reading title of Biological Control) had to be narrowed down as it included interventions that were not directly relevant to our question because not acting on habitat or landscape structure and composition. The final benchmark list retained (Biological control refs according to interventions_refinedforWP3.xls) contained 39 references, and 56.4% of them were retrieved from CAB Abstract and WoS by the search equations.

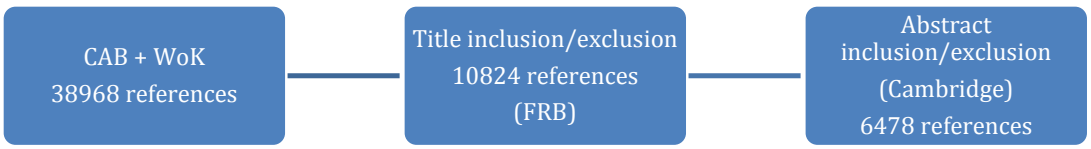
LESSON LEARNT

The searches conducted using the broad equation missed more than 35% of the potential literature on the topic. As we could not use the resources from INRA any longer, we chose to use the 39000 references but it would have been more efficient to refine the searches until comprehensiveness would have been higher. Especially, the search on Web of Knowledge, done rapidly at the end oft he collaboration, was not efficient as it simply used the search string designed for CabAbstract. More time and resources allocated to this identification of the literature will be needed in real situation (see also availability or papers later on).

Sorting out the references

Inclusion/exclusion based on title was mostly done by BL and PZ. A Kappa test was performed between BL and PZ to test for consistency on a subset of 30 papers and we reached a consistency value of 0.71 (considered to be acceptable). Discrepancies were mostly due to BL being too conservative and PZ being more intuitive in guessing that some title may be relevant.

About 2/3 of the references could be discarded at title stage, and the Cambridge team then sorted the remaining papers based on reference abstracts, sorting the papers into various interventions. A further third of papers were discarded at abstract stage.



Mapping the Synopsis (Cambridge, PZ & BL)

List of interventions

By the end of March the list of interventions identified by Cambridge was composed of 86 different practices (see table below). A description of each intervention can be requested from Lynn Dicks lvd22@cam.ac.uk, and interventions will start to be listed and explained on www.nercsustainablefood.com from the end of May 2013.

PZ and BL ranked the interventions with regard to their putative relevance to the question. Several categories of interventions were created:

- The first includes interventions creating permanent habitats specifically for the purpose of pest control. These habitats are often created around the fields and ae supplementary to the main agricultural activities. There were 9 interventions and a total of 341 papers in this category, but it is not possible to say at this stage if these papers contain suitable datasets for a meta-analysis, nor to determine the quality of the results, but it seems highly possible that a full systematic review could be conducted for at least the most frequent type of intervention in this first category: growing plants to support pest control agents (the first 7 interventions in Table 2). The low number of the remaining interventions in this category does not mean there is no strong evidence for their effectiveness, but the external validity of results (the ability to extrapolate to other conditions) will probably be low, which may indicate some knowledge gaps.

Table 2: List of interventions and the number of related papers determined by the Cambridge team by the 4 March 2013.

Number of papers	Intervention
WP3 AGRICULTURE - Directly related to the question	
123	Grow plants that provide nectar or pollen resources
113	Grow plants that provide shelter, habitat or other resource for natural enemies
21	Grow plants that provide supplementary prey for natural enemies
25	Provide grass buffer strips/margins around arable or pasture fields
23	Create uncropped field margins or plots by allowing natural regeneration
10	Create beetle banks
10	Include trees in crop fields or pasture
8	Grow non-crop plants that produce chemicals that attract natural enemies
8	Leave headlands in fields unsprayed (conservation headlands)
AGRICULTURAL PRACTICES directly related to crops	
175	Plant trap crops to attract pests away from crop
124	Intercrop with plants that are repellent or suppressive to pests or weeds
104	Grow cover crops beneath the main crop (living mulches) or between crop rows
81	Grow cover crops when the field is empty
76	Incorporate fallow periods into crop rotation
60	Include plants that are repellent or suppressive to pests in crop rotations
22	Grow cover crops that are repellent or suppressive to pests when the field is empty
21	Reduce frequency of cutting on grassland or grass margins
18	Combine trap crops and repellent crops in a push-pull system
13	Leave part of the crop or pasture unharvested or unmown
10	Use mixed pasture
2	Include short rotation coppice in the agricultural landscape
2	Allow natural regeneration of ground cover beneath perennial crops
MICROHABITAT CREATION OR IMPROVEMENT	
212	Add mulch to crops
125	Amend the soil with composts not otherwise specified
98	Amend the soil with crops grown as green manures
93	Amend the soil with organic processing wastes or their composts
59	Amend the soil with fresh plant material or crop residues
52	Grow cover crops under perennial tree crops
45	Amend the soil with materials not otherwise specified
44	Amend the soil with municipal wastes or their composts

22	Incorporate leys into crop rotation
OTHER AGRICULTURAL PRACTICES	
570	Plant more than one crop per field
442	Alter timing of sowing or harvesting
381	Reduce pesticide use
380	Use crop varieties that resist or suppress pests, diseases or weeds
379	Reduce tillage
262	Reduce synthetic fertilizer use
252	Use crop rotation
223	Use more selective pesticides
223	Amend the soil with manures and agricultural composts
182	Reduce pesticide, herbicide or fertilizer use generally (including integrated management methods)
171	Change the density at which crops are planted
131	Amend the soil with processed plant materials
128	Alter irrigation regime
105	Reduce herbicide use
88	Use organic rather than mineral fertilizers
81	Use organic farming
73	Reduce mechanical weed control
71	Incorporate pesticidal plant material into the soil
59	Induce systemic resistance to pests and pathogens
47	Avoid using genetically modified insecticidal or herbicide-resistant crops
44	Reduce grazing intensity on grassland
39	Amend the soil with formulated chemical compounds
33	Apply organic materials to crop foliage
32	Use pesticides only when pests reach threshold levels
29	Use chemical application techniques that reduce the impact on natural enemies
29	Use crop varieties with different timings or rates of growth
20	Use crop varieties that attract or enhance the action of natural enemies
19	Use synthetic chemicals to attract natural enemies
18	Plant species that compete with damaging weeds
16	Amend the soil with mineral wastes
15	Alter the timing of pesticide use
12	Incorporate plant residues into the soil that produce allelopathic chemicals for weed control
11	Delay mowing or first grazing date on grasslands
9	Mulch with plants that produce pesticidal fumes as they decay (such as mustard)
9	Use grazing instead of cutting for grassland management
8	Exclude ants from perennial tree crops
8	Use relay intercropping
7	Cull wildlife hosts of livestock disease
6	Provide supplementary food for natural enemies
6	Use grafting to combine different crop varieties
6	Intersperse different varieties of the same crop within a field.
5	Provide refuges for natural enemies
4	Raise mowing height on grasslands
3	Provide refuges from spraying for natural enemies
3	Change timing of herbicide application
3	Modify flooring in poultry houses to benefit natural enemies
3	Increase whole-farm crop diversity
3	Provide bird perches in fields
2	Use mass-emergence devices to increase parasitoid populations
2	Cut cover crops and place in perennial tree crops to move natural enemies into the canopy
2	Cut noxious weeds to increase disease incidence
1	Incorporate parasitism rates when setting thresholds for pesticide use
1	Increase the gap between orchard trees and bird cover
1	Grow pest-suppressive crops prior to planting perennial crops.
1	Use resistant livestock breeds

- The second category is related to the cultivation of crops, when these crops can themselves support control agents or at least attract them. Here there is a total of 13 interventions linked to 708 references.
- The third category relates to practices that may create or improve microhabitats for control agents. This is the case for mulch that can favor the presence of spiders for instance. Nevertheless, the outcomes of these actions cannot be considered permanent habitats and therefore contrast with the interventions of the first category. There are 9 interventions and 750 associated references, which seems a good omen for a full systematic review on this topic. However, reviewing these interventions could require a rephrasing of the WP3 Question to encompass various outcomes not previously intended for inclusion.

  The remaining category groups all the other interventions identified by the Cambridge team, but not as relevant for our case-study.

Setting up a flower strip subtopic

The main outcome of the comprehensive search at INRA and the subsequent sorting of references revealed that

1. The field appears highly heterogeneous, with some interventions intensively studies and others lacking relevant studies almost completely. This makes the evidence unsuitable for a comprehensive systematic review, but amenable to a systematic map.
2. Systematic mapping would be highly valuable to highlight the profound evidence gaps and reveal the uneven structure of the evidence in the field. It could thus clarify what is genuinely known about the implications of landscape interventions.
3. It might be posiible to analyse a particular kind of intervention in closer detail. If a formal systematic review might be beyond reach, a traditional review of one of the sub-topics might add some color to the overll systematic map.

It was thus decided to set up a small working group to analyse the intervention “flower strips” in more detail.

1) Flower strips are an attractive and frequently emplyoyed landscape intervention. They are one option within the Austrian Programme for Environmentally-Friendly Agriculture. They are not just a by-product of a particular type of landscape transformation, but they have to be actively be established, funded and managed. While designed primarily to increase overall biodiversity in the agricultural landscapes and to enhance pollination services, they might be equally important to house generalist predators as safeguards against pest outbreaks. However, evidence on the latter aspect needs to be compiled and highlighted.
2) Despite available funding and general public attractiveness, farmers have been slow and reluctant in adopting flower strips as landscape interventions on their farms. Hesitation is based on fear that strips may not only enhance pollination and pest predation, but also lead to spillover of additional pest organisms and weeds. Similarly, diverse and flower-rich strips may poorly conform to a orderly, stricty managed agricultural landscape under human oversight in all aspects

3) During the talks with the potential requesters, the issue of flower strips was particularly highlighted. A short review on a smaller subject within the wider context of agricultural landscape interventions may thus be easier to digest and to implement than a broad review on all kinds of interventions that are possible.
4) It seemed possible that, given the self-contained nature of the intervention, additional searches to complement the initial INRA could successfully increase the coverage for this particular subject.

Extracting information from papers

A template was designed to extract various descriptive information whilst reading the paper at full text. The template should inform both the Synopsis approach and the Systematic Map requirements. PZ and BL planned to read as many papers as possible in order to refine the map of knowledge, considering that the first grouping presented above was a good basis for such an exercise.

Within the sub-topic flower strips, the title exclusion was used to preliminarily categorise the papers obtained by the original INRA search, two additional searches against the databased SCOPUS and BIOSIS Previews, and additional papers obtained from Cambridge into five categories:

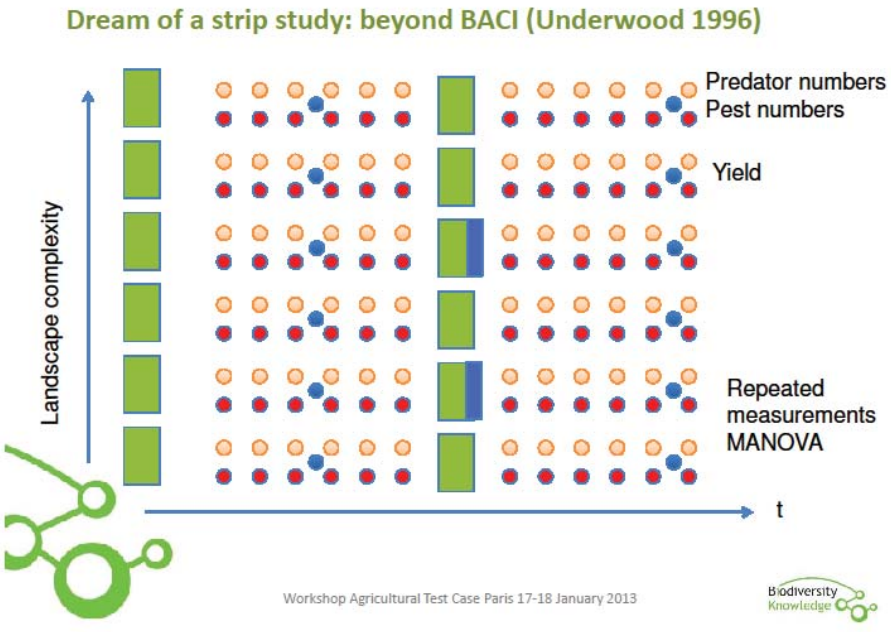
1. Papers relating flower strips to overall biodiversity in the agricultural landscape. These papers would not be extracted, since biodiversity benefits may be necessary, but not sufficient evidence for the role of strips in pest control. Moreover a review by Haaland et al. (2011) already clarified the biodiversity implications of such structures.
2. Papers relating flower strips to a change in predator numbers. These papers are being analysed, since they are important for the reasoning to use flower strips as interventions.
3. Papers relating flower strips to a change in predator numbers AND pest numbers. Experimental setups of such studies, for example, measured the correlation between distance to strip, predators' numbers and pest numbers.
4. Papers relating flower strips to predators, pests and yields. Ideally, experiments would cover the whole relationship between landscape intervention and the outcome for the farmer. Unfortunately, few papers fulfilled these requirements, as became clear already at the title exclusion stage.
5. Narrative review papers and overviews dealing with the subject, but not presenting original evidence. These papers might be important for the introduction and the discussion part of the review, but are not used in the evidence extraction.

As a second step, abstracts of papers from the categories 2, 3 and 4 were read carefully and some fields of the template were filled with the information obtained from the abstracts. It turned out that the preliminary classification based solely on titles was, in most cases, too optimistic. At a closer look, most papers did not cover the entire chain of reasoning as expected. As revealed by abstract analysis, not a single paper really tested the relationship between landscape strips and yield.

During a weekend workshop in Paris, BL and PZ read a selection of papers to identify design issues and to attempt a critical appraisal of the evidence contained therein. It became obvious that design limitations were widespread, e. g.:

1) Many studies were purely descriptive or mensurative. For example, the researchers studied predator or pest numbers in particular distance to a strip margin without control. Such studies risk confounding strip effects with other landscape effects.
2) Almost all studies suffered from pseudoreplication (no treatment replication, just one strip, many traps).
3) No repeated measurements or time series. Most studies measured possible strip effects at one point in time or aggregated over a season. Thus, most studies were unable to detect predator-prey dynamics and might have ended up with an uncorrelated pattern because researchers were at the wrong time (in the predator prey cycle) at the wrong place (predator-prey cycles far away from field margins are determined by flight-active species, cycles near the strip margin are determined by surface-active dispersal).

From these experiences, we defined a gold standard design to gauge additional studies against. A study design correcting most of the design issues observed in the papers so far would involve repeated measurements over time (orange dots indicate measurements of predator numbers, red dots indicate measurements of pest numbers, blue dots indicate recordings of yields) and randomly assigned strip interventions at the landscape level (blue strips). Landscapes with and without interventions need to be replicated. Landscapes should show variation in landscape complexity to allow for testing of this factor and its interaction with the other target variables.



Preliminary results:

Unfortunately the extraction is not complete. However, first impressions from the subset of read papers suggest:

Hypothesis 1 that flower strips enhance predator density was confirmed in several studies, but not in all. A meta-analysis would be needed to clarify whether non-significance in some studies is simply the result of a small sample size and poor statistical power.

Hypothesis 2 that flower strips reduce pest density in agricultural landscapes revealed a large number of insignificant tests. The reason might be that predators and prey are not in sync and thus a relationship could not be demonstrated (see above). Studies that carefully tried to observe the dynamics over some time are clearly advantageous and might lead to different conclusions.

LESSONS LEARNED

- Refining the search result set of papers based on title selection works well in excluding off-topic papers (which appear in the result set simply because of coincidental word identities in the title or abstract), but is mostly inadequate to sort papers based on their relevance for the subject and to classify papers according to their content.
- Refining the search results based on abstract selection is usually sufficient to classify papers into content categories and to judge what is exactly tested, but abstracts are insufficient to evaluate the research design used in the paper or to do a critical appraisal of the overall soundness of the evidence reported.
- Mapping the available evidence is thus a demanding task that requires insight into a research topic, substantial experience with research design and statistical analysis and sufficient time and privacy for a thorough understanding of the strengths and weaknesses of each approach. However, if offers unparalleled insight not only into the limitations and typical mistakes in designing adequate research for a particular question, but also into the knowledge gaps and deficiencies in a logical chain of reasoning, often created by subject boundaries and a lack of interdisciplinary work. For example, the importance of seminatural landscape elements is typically studied by ecologists with little interest in economic implications of increased higher predator diversity, while predation experiments on agricultural pest are usually performed by agricultural scientists with little background in biodiversity research.
- Systematic reviews may thus be powerful and useful tools not only to get a clear picture of a knowledge field for policymaker information, but also to get a comprehensive overview of a subject for designing research, answer open questions, identify key knowledge gaps, spot traditional approach flaws (e. g. recurring design setups doing the same kind of research over and over again and expecting different outcomes) and summarise the state of a particular art for whatever purpose.
- Owing to time constraints, the usual procedure of a systematic review, involving a draft protocol, an extensive review of the draft protocol, a written account and again a review stage was not entirely feasible. Again, parts of the process had to be mimicked to test the NoK and its procedural implications.
- Expert consultation in lieu of a systematic review might considerably lower the burden and the workload required to present the current state of evidence, but will not be able to compete regarding thoroughness, unbiasedness, completeness with a standard formal review of the matter, let alone a full-fledged systematic review.
- Even a comprehensive systematic review that meets most of the quality criteria might be unable to incorporate some sources of informal or indigenous knowledge.

Workshop and other meetings

Several meetings were orgainsed with Cambridge in order to organise the workload. Similarly, the work with INRA was a mixture of face-to-face meetings and remote working.

A large workshop with stakeholders was organised early January 2013, after the literature has been sorted out and Cambridge established the first detailled list of interventions. As stakeholders are interested in results and goals more than by the conduct of the synthesis/assesment itself, we though it was timely to invite them to join and comment on our work. Using the "Flyer", we also intended to convince them to join a working group, creating several topics and opportunities for them to contribute and exchange.

The workshop was designed with several objectives in mind:

- Inform about KNEU, NoK, and further initiatives to organize and interlink knowledge on biodiversity (such as IPBES).
- Bring together stakeholder groups with various backgrounds to better understand their interests and requirements.
- Discuss the methodologies to access and report existing knowledge on biodiversity,
- Discuss and review particular parts of evidence on agricultural interventions
- Rank agricultural interventions according to their importance and relevance for several stakeholders (see further)
- Report on the review process and discuss its (preliminary) results.

Most of these goals could be achieved. A total of 56 persons attended the workshop which was organised over 2 full days. Mornings were set-up as a series of short conferences, trying to present the variety of case-studies, experiences and needs. Afternoons left space of break-out groups and interactive activities.

The first morning session dealt with the test case, the workpackage, the KNEU project and the general political and administrative framework the exercise is couched in. It highlighted the current EU policies to communicate biodiversity knowledge and informed about the IPBES process.

The second morning session presented the main methodological approaches that are available for the test case. Andrew Pullin made the case for the Systematic Review approach; Lynn Dicks presented the Cambridge team's methodology of summaries and synopses to distill knowledge and make it available to stakeholders and policymakers. Pierre Ibisch then laid out what might be omitted by methods focusing on scientific evidence and how to deal with knowledge inaccessible by even the most comprehensive knowlegde-gathering frameworks (see Appendix 4).

The afternoon session dealt with the methodological approaches in more detail in breakout groups. Since the systematic review as of particular interest for several participants, a breakout group with Andrew Pullin was setup in the form of a Q & A session. Many aspects of systematic reviews such as meta-analyses, the advantages of systematic reviews over traditional narrative reviews, the rigor of systematic review, publication bias, pseudoreplication, access to grey literature, fragmentation of scientific literature, sensitivity analysis, comparability of studies and possibilities of presenting the outcome to the requesters were addressed. In the other breakout groups, interventions for natural pest control were prioritised (Cambridge, see further), knowledge sources and flows were examined

(M. Vandewalle & E. Balian, see below) and ways to deal with knowledge gaps and non-scientific forms of knowledge were explained (Pierre Ibisch and Peter Hobson, see below and Annex).

Marie Vandewalle and Estelle Balian led a break-out group on knowledge sources and flow, aiming to 1) to get an overview of which major sources of knowledge on biodiversity were used by participants considering their specific interest in agriculture and biodiversity; 2) to explore their perception of the biodiversity knowledge flow and major players (knowledge holders) (see Appendix 3).

Sessions on the second day brought together other networks of biodiversity knowledge (Ben Delbaere from ENCN), practical farming approaches to explore and apply the benefits of landscape structure interventions for biodiversity enhancements (A. Canet, a farmer from Southern France), scientific studies on generalist predators as pest control agents (F. Samu), methods to access indigenous and practical knowledge (D. Bartlett and J. Fisher) and the state of the test review (P. Zulka). The diverse and colourful approaches to agricultural biodiversity stimulated subsequent discussions on many aspects, for example, the gaps of knowledge on agricultural interventions were also noted by other researchers.

Prioritising interventions for natural pest control – University of Cambridge

Lynn Dicks and James Hutchison (University of Cambridge) ran a break-out excercise for stakeholders, asking them to rank a list of 60 pest control interventions (a previous version of Table 2 above) according to how useful a summary of the scientific evidence demonstrating the effectiveness of that intervention would be, if provided to them. Following a method of formal consensus development based partly on the Delphi process, participants voted on the list of interventions before the workshop (selecting their top 15 interventions) and then, guided by these initial votes, selected their top 10 interventions through group discussion during the workshop. The workshop session was repeated four times with different groups of stakeholders, and the top-ranking interventions are shown in Table 3.

Table 3. Interventions ranked in the top ten by at least one of four break-out groups. Interventions were assigned a score of 10 points for the intervention ranked first through to 1 point for the intervention ranked tenth in each group, scores were then summed across the four groups to determine a total score. Asterisks indicate interventions being summarised by the Cambridge team within the scope of their existing project.

Total score from all groups combined	Action
37	Reduce pesticide, herbicide or fertilizer use generally (including integrated management methods)
29	Grow plants that provide shelter, habitat or other resource for natural enemies
26	Provide grass buffer strips/margins around arable or pasture fields *
21	Use organic farming *
19	Grow plants that provide nectar or pollen resources
15	Reduce tillage

15	Use crop rotation *
12	Use pest-resistant crop varieties
10	Create uncropped field margins or plots by allowing natural regeneration *
7	Reduce pesticide use
5	Grow non-crop plants that produce chemicals that attract natural enemies *
5	Grow cover crops beneath the main crop (living mulches) or between crop rows
4	Alter the timing of pesticide use *
4	Intercrop with plants that are repellent to pests
4	Use pesticides only when pests reach threshold levels *
3	Plant more than one crop per field
2	Reduce herbicide use
1	Reduce fertilizer use
1	Add mulch to crops

The results of this prioritisation exercise have informed the structure of Cambridge's current natural pest control synopsis. Although the current NERC grant does not allow the Cambridge team time to summarise evidence for all these interventions, all high priority interventions with fewer than 100 related papers are set to be included in full or covering at least a subset of the literature (marked with an asterisk in the table). The results were also insightful for assessing the validity of priority setting exercises that draw on expert opinion. Comparing the rankings between groups found that all of the top eight interventions ranked by total score were chosen by at least three out of the four groups. Preliminary analysis also showed that group selections had a greater overlap than individual selections made before the workshop, indicating that the rankings were complementary between groups despite including different sets of stakeholders.

LESSONS LEARNT

- Workshop are important ways of networking and they are more effective in bringing together people of various backgrounds and exchanging knowledge at various levels than other ways of networking, such as e-mailed information. However, they also require much more resources. For certain aspects of knowledge communication, they appear indispensable.
- There is a broad interest in information on biodiversity in agricultural landscapes, as reflected by the large number of workshop attendants from practice, science, knowledge coordination bodies and policymakers.
- Even if information on indigenous and practical knowledge was exchanged and methods to access such knowledge were presented and discussed, a balanced representation of such knowledge in decision-making processes might be difficult to achieve.
- Being able to cover travel and subsistence for all participants was a major asset to their participation. More people expressed interest than the budget allowed us to welcome, and they were kept informed by email.

Post-workshop activities

LinkedIn

After the workshop a lot of participants expressed interest in maintaining contact and exchanges. A quick survey was implemented to ask them by which means they would prefer to the contacted. LinkenIn came first, followed by emails. A LinkedIn group was created to set up such exchanges and 42 people joined it (by April 30th, 2013), including some newcomers accepted even though they did not attend the workshop.

Several messages were posted but the group did not generate many exchanges later on. It would be interesting to know if some people kept in touch and eventually established some collaboration or exchanged further knowledge directly.

LESSON LEARNT

- The workshop created a positive atmosphere but was not enough to maintain a traceable level of exchanges afterwards.
- The messages posted on the LinkedIn group were probably too broad to trigger answers. Again, trying to get stakeholders and scientists involved during the conduct of the assesment was difficult. Discussing about results may have been a better option, but the synthesis needs more time to be available. Let's note that many participants did not express a strong opinion about the different interventions and whether, to their opinion, it worked or not. One coudl ask whether being in a group prevented some people to express freely, and whether an e-consultation woudl have been easier, although the rate of answers may have been slow (a survey-monkey was available and promoted by email and in the flyer, but no answer was ever collected).

Reading literature

The access to PDF versions of the literature is limited by subscription in many cases. Only Peter Zulka and Cambridge had access. Contribution of the KNEU partners was asked and some papers were retrieved. Reading and extracting information is going on, firstly to inform the synopsis of evidence (Cambridge) and the literature review (P. Zulka).

LESSON LEARNT

- Availability of literature is a well-known problem that shoudl be anticipated as much as possible in terms of time and costs. This is already true for the peer-reviewed scientific literature, but could necessitate even more time for the grey literature and official reports.
- Let's remember that all the work was conducted in English, and to some extend in French. Other languages would have required appropriate translators.

Perspective for the future

Synopsis on Natural Pest Control, NERC Knowledge Exchange Programme at Cambridge

The Cambridge team is progressing with the synopsis of evidence on interventions for enhancing natural pest control and in 2013 plans to summarise the literature for 20 actions covering a broad range of different actions across different types of farming system (Table 4). This shortlist is guided by the results of the prioritisation exercise ran at the Paris workshop (above), and by selecting those actions that can be summarised within the time frame of the existing programme. Key findings will be drawn across all relevant studies for a given action, informing practitioners of the overall effectiveness of these interventions according to the quantitative evidence available thus far. All of this information will be freely available from www.nercsustainablefood.com, appearing on this searchable website between May and September 2013.

Table 4. The list of actions being summarised by Cambridge in 2013 as part of the synopsis on natural pest control, and the number of papers for each action. The list incorporates a total of 281 individual papers.

Number of papers	Action
Reducing agricultural pollution	
32	Use pesticides only when pests reach threshold levels
15	Alter the timing of pesticide use
42	Use organic farming [a]
1	Incorporate parasitism rates when setting thresholds for pesticide use
All farming	
10	Include trees in crop fields or pasture
13	Leave part of the crop or pasture unharvested or unmown
20	Use crop types/varieties that attract natural enemies or enhance their effectiveness
20	Use synthetic chemicals to attract natural enemies
2	Include short rotation coppice in the agricultural landscape
23	Use mass-emergence devices to increase parasitoid populations
Arable crops	
40	Use crop rotation [b]
10	Create beetle banks
11	Incorporate plant residues into the soil that produce allelopathic chemicals for weed control
18	Combine trap crops and repellent crops in a push-pull system
Perennial crops	
12	Allow natural regeneration of ground cover beneath perennial crops
2	Cut cover crops and place in perennial tree crops to move natural enemies into the canopy
Livestock/pasture	
6	Grow non-crop plants that produce chemicals that attract natural enemies
10	Use mixed pasture
12	Delay mowing or first grazing date on grasslands
18	Plant species that compete with damaging weeds

[a] For the purpose of the 2013 synopsis this includes experimental studies only, and does not include site comparison studies. These wil be summarised as a later date.

[b] For the purpose of the 2013 this only include studies involving potato crops, as this is a priority issue at the moment and it is beyond the current project's capacity to consider all studies on crop rotation.

Although within the current programme, Cambridge cannot summarise the evidence for all 86 interventions (listed in Table 2above), synthesising the existing scientific knowledge for these actions is nonetheless important. In the longer term the Cambridge team hopes to extend the natural pest control synopsis to cover all of these different actions, thereby allowing practitioners to learn about all available options for enhancing this ecosystem service. Given the team's extensive work on synopses through the ongoing Conservation Evidence project (www.conservationevidence.com), which is developing wider and wider application, the team is hopeful that further work on pest control will be funded, so that the full synopsis can be completed.

Systematic map and full systematic reviews:

It has been clearly identified through this collaborative work with Cambridge that for a number of practices, there seems to be enough literature to allow for a possible meta-analysis or quantitiative synthesis of evidence. This requires more funding to be able to work with experts. Ideally, all interventions relevant to policy makers and practitioners should be assessed for evidence and confidence in results but also to clearly give indications regarding the scope and scale of this evidence, in order to guide efficient action.

The critical appraisal, which woudl be the very next step to organise in order to progress toward systeatic reviews, needs to rely on expert consultation and contribution. In parallel, a consultation of decision-makers in order to identify a series of interventions that could be assessed as a "bouquet"

Traditional knowledge, adaptive management approach

Further exchanges need to be organised with pratitioners and those directly in touch with local and traditional knowledge in order to decipher how this type of knowledge could be integrated in this work, highlight gaps and innovative practices.

Appendix 1 - Synopses of Evidence

Synopses of evidence attempt to provide practitioners or requesters with clear, simple and synthesised information on the effectiveness of different actions that they could take. Synopses draw on the scientific literature (from published and grey literature sources), which is often inaccessible or inappropriately written for practitioner audiences, and simplify the content of relevant studies down to the key findings that practitioners require for decision-making. Synopses were first developed as part of the evidence-based practice framework in medicine (see Haynes et al. 2001), where they are used to present research evidence to doctors at the „point of care". They are now being applied to conservation, and, recently, agriculture, as pioneered by the Conservation Evidence project at the University of Cambridge (www.conservationevidence.com). Synopses are a vital element of an evidence-based framework, because they compile evidence across a range of different possible options that a practitioner or decision-maker has to decide between.

There are four major steps to compiling a synopsis of evidence.

1. Constructing a list of possible actions:

   Actions recommended by experts or stakeholders or found in the literature are listed, and the list is refined through consultation with an Advisory Board of 10-20 experts in the field (comprising both academics and practitioners). All possible actions are included so long as they are or could be realistically carried out by practitioners. Actions are included regardless of whether current evidence suggests they are effective /ineffective or whether evidence is currently available.

2. Searching the literature for evidence:

   Evidence is gathered for each action by trawling through the scientific journals of revelance to the subject area, selecting studies that have quantitatively monitored the effect of carrying out a given action. Relevant journals are examined from the first volume through to the present day. Reports and unpublished literature are also searched, along with evidence provided by the Advisory Board. In some cases journal trawls are supplemented with strategic searches of abstract databases using specific search terms. If a systematic map (a sorted list of references generated by a systematic review search protocol) is available, this will be used in addition to the cumulative review process of searching journal by journal. Relevant papers are sorted by actions to create a database or matrix of all the literature gathered for the synopsis (similar to a systematic map).

3. Summarising the evidence for each action:

   The main findings on the effectiveness of an action within each paper are summarised into one paragraph in plain English. Ideally these provide practitioners with all the necessary information so that they need not consult the original paper, but the sources are cited. Summaries briefly describe the study design following a pre-defined set of terms such as ‚replicated', ‚controlled' or ‚site comparison' to indicate the potential quality of the evidence. A set of key messages synthesise the findings across all of the relevant studies for a given action, informing practitioners of the various outcomes (and their relative frequency) from the different tests of the action.

4. Disseminating and updating the synopsis:

   Synopses may be published as a book or presented online as a searchable database, structured primarily by list of actions and with links between related actions, threats, habitats, farming systems, taxa etc. Practitioners are encouraged to submit additional evidence which becomes incorporated when the synopsis is updated with the latest literature (identified by trawling the journal volumes subsequent to the initial search).

To further support decisions in practice, a subsequent stage can be to evaluate the evidence, based on the narrative synthesis provided by a synopsis. Actions can be classified according to whether they are likely to work, unlikley to be work, or inconclusive, for example. This should be done by a multi-disciplinary expert panel, involving key stakeholders and following formal consensus development processes such as Delphi surveys or Nominal Groups. Such expert panels would be similar to the panels that develop evidence-based Clinical Practice Guidelines in medicine. Once summarised in a synopsis, evidence can be evaluated in many ways to assess, for example, effects on particular taxa or crops, in specific regions or contexts, or to evaluate the relative magnitude of benefits or disbenefits, from the same evidence base.

Appendix 2 ADAPTIVE MANAGEMENT APPROACH in WP3 Agriculture case study.

Presentation and break-out group discussion at the Paris Workshop

Pierre Ibisch and Peter Hobson – Contact: Pierre.Ibisch@hnee.de

Seeking solutions to complex problems using principles of post-normal science

Evidence-based decision making can lead to neglecting the importance of non-knowledge involved in natural resource management[11]. This non-knowledge does not only encompass knowledge gaps to be filled by further research, or ignorance of decision makers who are not aware of existing knowledge or even actively deny it. Attributes that can be used to describe non-knowledge refer to intentionality, level of recognition (recognized vs. blindspots), social and geographical distribution, ambiguity, and others. The inherent complexity and dynamics in natural systems continues to throw up novelties and emergent properties that lead to indeterminacy and uncertainty.

Normal science continues to work on the assumption that environmental problems in complex ecosystems can be described as bilinear cause-effect relationships. This frequently leads to an oversimplified analysis of the situation and corresponding prescriptive measures. One of the myths inherent in the normal science model is that through a process of methodical experimentation uncertainty (error) can be reduced to testable levels of prediction.

A *post-normal* approach to investigation is deeply rooted in principles and theory of complex systems science. Characteristically, it recognizes non-linear dynamics, holarchical, self –organising systems that are deeply interconnected. Corresponding scientific methods observe and attempt to interpret patterns rather than assume concrete predictable outcomes, and seek pluralism as well as work with indeterminacy.

[11] Ibisch, P.L. & P.R. Hobson 2012. Blindspots and sustainability under global change: non-knowledge illiteracy as a key challenge to a knowledge society. In: Ibisch, P.L., L. Geiger & F. Cybulla (eds.) Global change management: knowledge gaps, blindspots and unknowables. Nomos, Sinzheim. 15-54.

Post-normal science translates into practice by employing adaptive heuristics rather than prescriptive algorithms thus leading to meta-systemic management. Practices in this field deliberately avoid direct, object-systemic manipulation of interconnected elements in complex systems, and focus on creating conditions for self-organization and regulation.

An example of a post-normal, adaptive management method is MARISCO (Adaptive Management of vulnerability and risk at Conservation sites). The process starts with a systemic conceptual analysis of environmental situations that attempts to capture knowledge and non-knowledge of diverse sources, including current threats and assumed risks. In the case of integrated pest management, MARISCO would help to identify the multiple factors leading to vulnerability of crop plants. The ultimate stage of the process is to draw up synergistic, coherent and adaptive strategies that are not expected to function independently of each other.

Appendix 3 - KNOWLEDGE SOURCES AND FLOWS in WP3 Agriculture case study.

Presentation and break-out group discussion at the Paris Workshop

Marie Vandewalle and Estelle Balian – Contact: marie.vandewalle@ufz.de

Marie Vandewalle and Estelle Balian led a break-out group on knowledge sources and flow, aiming to 1) to get an overview of which major sources of knowledge on biodiversity were used by participants considering their specific interest in agriculture and biodiversity; 2) to explore their perception of the biodiversity knowledge flow and major players (knowledge holders). The session gathered about 15 participants from a wide range of expertise in the field of agriculture and biodiversity. Participants belonged to Policy realm (2 participants), were Practitioners (5 participants) or scientists/academia (8 participants). A list of potential sources of knowledge was proposed by the facilitators and the the participants discussed and amended it. The final list of sources of knowledge agreed upon was: 1- Scientific journals, 2- Broadcast/media including “google” that was the most referred source for this category, 3-personal contacts/individuals, 4- meetings (workshops and conferences), 5- official documents (e.g. government papers), 6- EU or National research projects (temporary), 7- Grey literature, 8- Personal experience, 9- Specific Institutions or organizations. Then the participants had to select from the above list of sources their top five. The two policy makers agreed, without consulting each other, on their top 5 and their common order of priority was: 1- Broadcast and Media (2), 2- Specific organizations (9), 3- Personal contacts (3), 4- Official documents (5), 5- Meetings or workshops (4). For the practitioners, within the top 2 sources of knowledge, were most cited “Broadcast and media” and “Meetings”. After the top 2, participants identified a broader range of sources with “official documents” and “grey literature” being more cited. No participants voted for personal experience for their top 5 sources of knowledge, and only mentioned once or twice “scientific journals”, “personal contacts” and “research projects”. For researchers (academia), the most cited in the top 2 knowledge sources were “scientific journals” and then equally placed “personal contacts” and “broadcast/media”. Grey literature was most cited in the following priority sources of knowledge mentioned. The least cited were “official documents” and “specific organizations”.

The second part of the workshop was focusing on their experience related to the key actors in the biodiversity knowledge flow (questions asked: Who do you know, based on your experience, are most influencing biodiversity knowledge flow at a) the global scale, b) European scale or c) your national scale?). The two most cited players at the global scale were IUCN (with 9 votes) and UNEP (with 6 votes), while at the European scale; European Commission and more specifically DG Environment (with 6 votes) and the European Environment Agency (EEA with 4 votes).

As a conclusion, although this exercise only represents a snapshot with a very limited number of participants, this illustrates that policy makers and practitioners tend to use most broadcast/media to extract the knowledge needed for their work, while researchers on the other hand use more the scientific journals. Surprisingly, 5 out of the 8 researchers have also mentioned using grey literature, which may be related to the specific field of agriculture. As a general pattern, participants to the voting for the major players influencing biodiversity knowledge flow, agreed more for global organizations than for European ones, meaning that they might have more insights on/experience and linkages with Global organizations. The most voted global hubs were IUCN and in general UN bodies (i.e.UNEP-WCMC, FAO) and for Europe the European Commission and the EEA.

Appendix 4 Programme of the Paris Workshop

SEMINAR & WORKSHOP BIODIVERSITY KNOWLEDGE

CASE STUDY AGRICULTURE

Paris, 17-18 January, 2013

Day 1: FROM REQUESTS AND METHODOLOGIES

From 9h00 welcoming attendees

THE CONTEXT AND FRAMEWORK

9h00 The Biodiversity Knowledge project — *Marie Vandewalle (UFZ); Barbara Livoreil (FRB)*

9h50 The Agriculture case study — *Barbara Livoreil; Klaus-Peter Zulka (EAA)*

10h05 Open questions, discussion

COFFEE BREAK

METHODOLOGIES TO SYNTHESIZE KNOWLEDGE...

10h45 The Collective Expertise (Esco) at INRA — *Claire Sabbagh (INRA)*

11h05 Synopsis of evidence — *Lynn Dicks et al. (Cambridge U.)*

11h25 Synthesizing and assessing knowledge: systematic reviews — *Andrew Pullin & Neal Haddaway (Bangor U.)*

11h45 What about non-knowledge? — *Pierre Ibisch (Eberswalde U.) & Peter Hobson (C. Econics)*

Seeking solutions to complex human-induced problems using principles of post-normal science

12h05 Open questions, discussion

LUNCH BREAK

14h00 WORKSHOP, BREAK-OUT GROUPS

14h explaining how we will work this afternoon

14h10 break-out groups

We propose these three groups but others could be added if needed as a consequence of previous questions and discussions. During the afternoon you will have opportunities to move between groups

A. Prioritizing requests and interventions (Cambridge)
B. Effectiveness of interventions: evidence, confidence and working groups (Bangor)
C. Dealing with (scientific) knowledge gaps, blindspots… and local knowledge (Eberswalde)

17h30 reporting (groups B and C)

18h30 closing-up the afternoon

Day 2: TO LOCAL KNOWLEDGE AND PRACTICE

9h30 EXPERIENCE FROM THE FIELD *(coffee break as a buffet available from 10hish)*

9h30 - B. Delbaere (ECNC): The European Learning Network on Functional Agrobiodiversity (ELN-FAB) as a knowledge network.

9h50 - A. Canet (AFA): Pest control and habitat management, the agroforestry approach

10h10 - F. Samu (Hungarian Acad. Sci) : Landscape and behavioural studies together help to identify natural enemy spider species against virus vector leafhoppers (F.Samu, O.Beleznai & G.Tholt)

10h30 - D. Bartlett (Greenwich U.): Knowledge transfer between scientists and farmers

10h50 - J. Fisher (Fisher research & U. Western Australia): Traditional and Local knowledge adds value to outcomes, the Australian experience

11h10 – P. Zulka (EAA): The Agriculture case-study and the topic of strips, banks and margins

11h30 - Open discussion, questions

12h – 13h00 LUNCH BREAK

13h00 WORKSHOP, BREAK-OUT GROUPS

We propose these groups but others could be added if needed as a consequence of previous questions and discussions. During the afternoon you will have opportunities to move between groups

13h Break-out groups

E. Prioritizing interventions *(with those who will not have attended the previous day)* (Cambridge)

F. Networks of knowledge in France and abroad… how to get organized for IPBES? (Estelle Balian, Marie Vandewalle, Edwige Charbonnier)

G. Needs of managers and practitioners… do synthesis and assessment help and how to take into account local and technical knowledge? (FRB)

16h Reporting

17h Closing up.

Appendix 5 - Flyer in English

FRB
FONDATION POUR LA RECHERCHE SUR LA BIODIVERSITÉ

Biodiversity Knowledge

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

BiodiversityKnowledge, a European meta-network for collecting and synthesising knowledge about biodiversity and ecosystem services.

ENHANCING NATURAL PEST CONTROL : WHAT DO WE KNOW?

A PROJECT TO COLLATE AND SYNTHESIZE SCIENTIFIC AND NON-ACADEMIC OR TRADITIONAL KNOWLEDGE TO HELP AGRICULTURE

All over Europe, farmers are trying to decrease the use of pesticides and chemicals, whilst maintaining high yields and quality standards. Pest control agents living naturally in farmland (e.g. birds, insects, bats...) can help, by eating, parasitising or competing with pests. To attract these beneficial animals, hedgerows, ditches, holes, attractive plants and other resources can be protected or grown to provide food, shelter and space to breed.

Do we know whether such habitat management really enhances natural pest control?

- How can we collect knowledge from scientists, advisors and managers, as well as traditional farming knowledge, on interventions that favour natural pest control?
- How can we synthesize these different types of knowledge to provide a sound and reliable report to decision-makers?
- How can we organise ourselves at the national and European scales to encourage exchanges of knowledge and know-how?
- How can this work inform policy and research?
- How can we provide useful feedback to farmers, and benefit from their comments when testing our recommendations?

Join the network and contribute

LET'S MOBILISE TO...

- Create a list of possible habitat management interventions to favour natural pest control.
- Examine the evidence for the effectiveness of different interventions by synthesizing scientific, technical and traditional knowledge and experience. Highlight knowledge gaps, innovations and individual experiments.
- Use existing networks of end-users, managers, farmers, consultants and decision-makers to facilitate knowledge exchange, and strengthen our impact on decision-makers, from the local to the national and European levels.

THE EXPECTED OUTCOMES

- List of habitat management interventions, including innovations.
- List of knowledge holders and stakeholders in functional agro-biodiversity in several countries in Europe (unless one already exists).
- Evidence of « useful » or « useless » interventions, as provided by the scientific literature but also directly by networks of farmers, consultants, technicians… Increased knowledge of conditions under which an intervention works.
- Systematic review and synopsis of evidence based on scientific and grey literature (using standard methods developed in medicine).
- Identification of needs for subsequent research programmes and opportunities of collaboration to fill knowledge gaps, build capacity and broker knowledge.
- Various reports and publications about the project and its outcomes.
- Enhanced knowledge exchange and comparison of situations between European countries.

BiodiversityKnowledge is a project funded by the European Commission. It aims to establish a methodology to collect and synthesize all types of knowledge about biodiversity and ecosystem services, to inform decision-makers. It is building on existing knowledge networks, and encouraging contributions from many knowledge holders (scientists, managers, consultants, research users...). Procedures are established to make sure that the results are sound and objective, that all types of knowledge are taken into account and that all possible knowledge holders have a chance to contribute.

The Foundation for Research on Biodiversity, Paris, France, is the case-study leader for the meta-network Agriculture and biodiversity. Together with 17 other European partners, it contributes to the brainstorming and experimentation about how to exchange knowledge. It is linked to the preparation of stakeholders to contribute to the International Platform for Biodiversity and Ecosystems Services (www.ipbes.net) and the work of its possible regional and sub-regional (national) counterparts.

A prototype for knowledge synthesis has been designed in 2011 and is being tested using three case-studies in the marine realm (kelps), conservation (green infrastructures) and agriculture (natural pest control).

WORKING GROUPS TO EXCHANGE KNOWLEDGE AND GENERATE IDEAS

1. WORKING GROUP KNOWLEDGE NETWORKS

- Identify knowledge holders and their hubs or networks : where are different types of knowledge held?
- Identify end-users of knowledge about natural pest control : decision-makers, networks, businesses, NGOs…
- Build up a map or a diary of existing networks and rely on them to relay messages and facilitate knowledge exchange.
- Decide together which tools and processes to promote that would facilitate communication and knowledge exchange among knowledge holders/users.

2. WORKING GROUPS SYNTHESIS (several groups, depending on actions on habitat/landscape)

Synthesize scientific knowledge on each intervention, using systematic review and synopsis methods (see Collaboration for Environmental Evidence www.environmentalevidence.org and the Conservation Evidence project www.conservationevidence.com). These methods are derived from evidence-based approaches in medicine (Cochrane collaboration) and acknowledge by the scientific community.

- Include non-academic knowledge in this review: technical, ecological knowledge from farmers, technicians and managers.
- Make sure that the results and outcomes are relevant to policy and society, and include economic information, if available.

3. WORKING GROUP DECISIONMAKERS AND USERS

- Make sure that the reports and publications are adapted to an audience of policy-makers and users.
- Identify the best possible media and tools to transfer this knowledge to decision-makers, and get to know whether it was used or not.
- Define efficient strategies to transfer messages about needs for knowledge to researchers.
- Identify the needs for evidence expressed by users and decision makers and consequence on priorisation of programmes for synthesis, research and capacity building.

WHO CAN CONTRIBUTE ?

Scientists, managers, farmers, technical advisors, teachers... let us know, join the network and contribute.

WHEN ?

Working groups will meet between December 2012 and March 2013. Contact us to get the details about these events.

HOW TO CONTRIBUTE

To join the network of knowledge you can:

- **Contact us** and tell us about your experience, let us know about your knowledge (email, fax, mail, telephone),
- Let us know about your **network or structure/organisation,**
- **Comment on the protocol** describing the method we are using to synthesize knowledge on interventions favouring natural pest control,
- **Host one or several meetings of the Working groups,**
- **Contribute to the systematic review and synopsis**, including a critical assessment of the literature, synthesis of results and draft of recommendations,
- **Provide comments** on various documents produced by working groups, to incorporate your experience and knowledge,
- Answer our **online survey** at : http://fr.surveymonkey.com/s/WDR92QZ,
- Contribute to our **big seminar** January 17-18th, in Paris
- Join us on LinkedIn (look for the group "natural pest control").

This flyer was written by B. Livoreil (FRB), L. Dicks (Cambridge University) and D. Bartlett (U. of Greenwich). Design M. Le Jars (FRB).
Photos : INRA – Alain Fraval, Gilles Louviot / IRD – Jean-Michel Boré / MNHN – Simon Fellous/ Olivier Puccia - LPO

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Les membres fondateurs de la FRB

6 The conservation case – Knowledge Assessment Report and Lessons Learned

6.1 Background and Introduction

The European Commission proposed in its recent Biodiversity Strategy to maintain and enhance European ecosystems and their services by 2020 by establishing green infrastructure (GI) and restoring at least 15% of degraded ecosystems (EC 2011). The package of actions designed to respond to this challenge included the need to ensure no net loss of biodiversity and ecosystem services by EU-funded projects, priority setting regarding restoration, and promoting the use of GI (EC 2011). GI is defined as the network of natural and semi-natural areas, features and green spaces in rural and urban, terrestrial, freshwater, coastal and marine areas (Naumann et al. 2011). This includes for instance areas of high nature value such as protected areas, floodplains, wetlands and natural forests, natural landscape features that can act as corridors for wildlife, artificial features such as eco-ducts or eco-bridges, and multifunctional zones where land uses are favored that help maintain or restore healthy biodiverse ecosystems (EC 2010, 2012). The European Commission specified in the very recent communication on GI (EC 2013) that Green Infrastructure can contribute significantly to achieving many of the EU's key policy objectives and that an enabling framework should be created to encourage and facilitate GI projects within existing legal, policy and financial. The EC (2012, 2013) further emphasizes the ability of GI to perform multiple functions in the same spatial area, thus sustaining a range of benefits by delivering multiple ecosystem services (ESS) including air and water purification and climate regulation. ESS represent the benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza and Folke 1997), and both functions and benefits might be affected through interventions, such as reconnection of natural areas and improvement of overall ecological quality of the countryside. A combination of the delivery of multiple ESS including the conservation of biodiversity could lead to win-win situations and thus present an efficient way of achieving long-term nature conservation (Naidoo et al. 2008). Knowledge generation to promote understanding of such situations is a current research priority in conservation biology, applied ecology, and environmental sciences (Isbell et al. 2011; Maestre et al. 2012).

Floodplains develop adjacent to river channels and can be described as low-relief Earth surfaces composed of fluvial deposits (Stanford et al. 2005; Naiman et al. 2010) that are

frequently flooded (active floodplains) or formerly flooded (morphological floodplains) and are an integral part of catchments (Tockner et al. 2010). Floodplains are good examples for multifunctional landscapes and GI and their management poses multi-dimensional challenges to policy-makers and project managers (Moss and Monstadt 2008) and requires close coordination among agriculture, water use, hydrological engineering, mineral extraction, energy production, nature conservation and spatial planning (EEA 2010). Flood protection is a management priority in several European countries and is particularly relevant in light of an increasing frequency and amplitude of flood events throughout Europe, resulting in casualties and damage (Nijland and Menke 2005; Menke and Nijland 2008). While hosting important natural assets and high levels of biodiversity (Naiman and Déchamps 1997; Ward et al. 1999, 2002), floodplains have been used since ancient times by human populations, who attempted to maximize the benefits they gained by interventions such as irrigation channels and dikes (Scholten et al. 2005). In many parts of the world, human activities have altered the landscape and disrupted fluvial processes to the extent that floodplains are among the world´s most threatened ecosystems (Nilsson and Jansson 1995; Poff et al. 1997; Tockner and Standford 2002). Restoration of a river and its adjacent floodplain might generate many benefits for nature and society, including alternative economic activities, improved flood prevention, richer biodiversity and aesthetically appealing landscapes and particular recreational opportunities. However, information on implementation and outcomes of such projects is often inaccessible (Bernhardt et al. 2005and evidence for biodiversity effects of the GI approach and particularly of multifunctional floodplain management is scattered and has not been synthesized (EEA 2010). This issue is of particular relevance for large lowland floodplains, where due to high human population densities a variety of ecosystem services are in demand while at the same time floodplain biodiversity is driven by dynamic biophysical processes and feedback mechanisms over broad spatial and temporal scales (Scholten et al. 2005; Tockner et al. 2010). As climate is an important factor for ecological processes, floodplains situated in climates comparable to those occurring in Europe are of particular relevance for this case study that aims to support European decision-making. Floodplain interventions are very diverse (Lorenz et al. 2012) and in this case study we will hierarchically categorize the encountered interventions with respect to their main aims and effects. The interventions also differ strongly regarding the frequency of their implementation and the degree to which their impact on biodiversity has been assessed or results published in accessible formats (Bernhardt et al. 2005). These differences must be considered when interpreting the results of this study. The level of multifunctionality of interventions can be assessed in terms of their effects on ESS. For instance, several restoration measures aiming at a dynamic habitat mosaic are supposed to additionally increase the provision of ESS, such as water purification and lifecycle maintenance, habitat and gene pool protection (Tockner et al. 2010). Suitable indicators of biodiversity include measures such as the diversity or abundance of species, taxonomic or functional groups (Dziock et al. 2006; Haase et al. 2013; Paillex et al. 2013). The effects of the floodplain management measures on biodiversity will be prone to several

factors, the most obvious being the considered taxa and the time since intervention. Floodplain management measures can have very different effects on different taxa, for instance, a water enhancement scheme for the Danube floodplain within the city limits of Vienna showed positive effects on dragonflies and mollusks, while no significant impact was observed for fish (Funk et al. 2009). Time since intervention is a crucial parameter, and depending on several factors, such as availability of propagules for population establishment, an intervention might show its effects only after a considerable time span (Tszydel et al. 2009).

This case study aims at supporting European policy making by assessing the impact of multifunctional floodplain management on biodiversity and ESS. Our objectives are

(i) to assess (by means of an expert consultation) for a representative set of European countries the application and performance of multifunctional floodplain management approaches and the evidence for their impact on biodiversity,
(ii) to assess (by means of an expert consultation) the effects of floodplain interventions on ecosystem services and the interventions level of multifunctionality,
(iii) to assess and synthesize (by means of a systematic review) the knowledge on the impact of multifunctional floodplain management on biodiversity that is gathered in scientific literature.

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6.2 Summary

Request

In the conservation case we attempted to define a policy-driven topic in collaboration with European policy makers that should be of pan-European relevance and related to the EU Biodiversity Strategy 2020. Two science-policy conferences (The Meeting of the European Nature Directors in Hungary, Balatonfüred in June 2011 and the Conference "Planning for biodiversity" under the Polish EU-Presidency, Warsaw in November 2011) were used to present the KNEU-project and to identify potential requesters and involve them in question setting for the demonstration case "conservation". Furthermore some requesters were contacted via E-Mail to be involved in the process of question setting. Most interested in the becoming requester for the conservation case in the frame of the KNEU-project was finally one policy maker from DG Environment, and we agreed with him to focus on Target 2 of the EU Biodiversity Strategy (i.e. "By 2020, ecosystems and their services are maintained and enhanced by establishing Green Infrastructure and restoring at least 15% of degraded ecosystems") and particularly on Green Infrastructure (GI).

Several GI-related topics were discussed with the requester, experts and KNEU-partners, and a short list was compiled containing the topics:

(i) Existing networks of protected sites and to what extent they can be seen/used as Green Infrastructure?,
(ii) To which respect does technical infrastructure meet the requirements of nature conservation?,
(iii) How does Green Infrastructure contribute to multifunctional land-use and well balanced delivery of ecosystem services?

Finally we agreed on the issue of biodiversity benefits of multi-functional floodplain management under the topic (iii) (i.e. How does Green Infrastructure contribute to multifunctional land-use and well balanced delivery of ecosystem services?) and formulated the main research question as "What is the impact of multi-functional floodplain management on biodiversity?" The topic and the question are not only relevant for the EU Biodiversity Strategy 2020, but also in respect to several other policies such as the EU-Habitats Directive, the EU-Water Framework Directive, the EU-Nitrogen Directive, the EU-Directive on the assessment and management of flood risks, and the Ramsar Convention.

Call for experts

To compile an expert group, we selected 80 knowledge hubs and asked them to suggest us experts for our case study, who are willing to participate in a first workshop in Brussels and/or to support our working group in the near future with the next steps of the systematic review on multifunctional floodplain management and its impact on biodiversity. Receiving week response, we additionally used an expert database which was obtained from the

Rubicode-project. Before the first workshop, a total of 72 experts were nominated by the hubs and we contacted 58 out of them during the two stages. 16 replied positively and wanted to participate in the workshop, 26 refused their participation in the workshop, and 16 did not reply at all. Most of those that refused stated that they could not participate as it was too short in time or because of general lack of time. However, they often stated general interest in the test case and wanted to be kept updated. Finally some of the participants had to cancel their commitment and finally 14 experts attended the first workshop on the 23rd and 24th of May 2013 and formed the first working group, which suffered some changes later on.

Approaches

Based on a KNEU-internal workshop on the approaches for the assessments (expert consultation, systematic review, adaptive management), we finally decided in agreement with the established expert group and with the requester on the methodological approach „systematic review“. The main reason was that we assumed that enough evidence should be available in the literature and that this approach should deliver robust and guarantees for independence and credibility.

We started do conduct the systematic review by discussion the approach and all of its methodological details with eth expert group and compiling a systematic review protocol. This protocol specifies the methods for conducting a systematic review to answer the following policy-relevant questions: a) what is the impact of floodplain management measures on biodiversity; b) how does the impact vary according to the level of multifunctionality of the measures; c) is there a difference in the biodiversity impact of floodplain management across taxa; d) what is the effect of the time since implementation on the impact of the most important measures; and e) are there any other factors that significantly modify the biodiversity impact of floodplain management measures?

We defined multifunctional floodplain management as management approach aiming at a balanced provision of ecosystem services under efficient use of public funds, serving the needs of the local residents, but also those off-site populations that are directly or indirectly impacted by floodplain policies. We agreed that within the systematic review we will assess multifunctionality in terms of ESS that are affected by an implemented intervention. Biodiversity indicators included in the systematic review will be related to the diversity, richness and abundance of species, taxonomic or functional groups. We will consider if organisms are typical for and native to natural floodplain ecosystems. Specific inclusion criteria would be developed and the wide range of quality of primary literature would be evaluated based on the development of a tailor-made system for assessing susceptibility to bias and the reliability of the studies.

While conducting the systematic review, we detected that two complementary expert consultations were required:

(i) Originally we had planned to cover non-english and grey literature in the frame of the systematic review. This would have implied that experts from non-english speaking countries develop search strings, conduct test searches, refine search strings, and finally perform a sub-systematic review in their native languages. However, it became clear that this was totally unrealistic given the time constraints of the experts. Therefore we decided to elaborate a complementary expert consultation that synthesizes personal expertise and grey literature following a template to specify beside others the role of multifunctionality in floodplain management and evidence for effects of multifunctional floodplain management approaches on biodiversity. Finally thirteen experts from six European countries participated in this consultation. One additional advantage stressed by the expert group was that this way information can be included that was never adequately published, because commissioned studies were kept confidential or because they are part of larger and on-going floodplain management activities.

(ii) We developed the search string to find literature that assesses the impact of multifunctional floodplain management interventions to biodiversity. However, the level of multifunctionality of the interventions was hardly reported in the detected primary literature, which was a main challenge for conducting the systematic review. We tried to assess the multifunctionality by a google-search to gain more information about the underlying management project, but rejected this option as it was difficult to guarantee for the reliability of the detected information. Thus, we finally chose the approach of assessing the multifunctionality of the interventions by a complementary expert consultation, in which we defined a set 38 relevant floodplain management interventions, assessed the effects of these interventions on 21 relevant ecosystem services, and evaluated the impact of the intervention on the multifunctionality of the floodplain by calculating an index that summarizes the positive and negative effects on the provision of the different ESS.

Results

While the systematic review is still ongoing, we can report the results from the two expert consultations and the systematic map. In the country-by-country expert consultation, biophysics and management history of floodplains, examples for recent multifunctional management approaches and evidence for their biodiversity effects were presented for six European countries, i.e. Ireland, the Netherlands, Germany, Slovakia, Hungary and the Ukraine. An interesting pattern of regional differences in management goals and approaches was detected. Whereas flood protection is the top priority in floodplain management of some countries, others have a mixed agenda. Multifunctional floodplain management seems to be possible under all strategies but is showing differences in size and number of projects, which is mainly due to different levels of responsibility for water management in the countries, ranging from centralized national responsibility to region provincial governance. Regarding the management approaches, there is a compelling common set of measures all

over Europe, targeting not only the restoration of hydrological connectivity at different scales, but also the adaptation and extensification of land use in flood plains as a precautionary principle. Biodiversity may benefit from all these interventions but evidence is rare as only few projects have documented the respective impacts and responses. We conclude that there is seemingly no alternative to multifunctional approaches in future floodplain management. Integration of all existing demands is essential. In order to make efficiently manage ecosystem services, win-win-situations need to be achieved and biodiversity has to play a crucial role. Multifunctional approached mainly show success where stakeholders with diverse expertise and interests are involved in all stages of planning and implementation of regarding projects. It is recognized that such participatory processes are beneficial for environmental resource management, but a big gap remains between the rhetoric on participation and the real-life implementation on participatory processes, and administrative structures are often an important obstacle for fast improvements.

In the second expert consultation, we provide an overview of the impact of floodplain interventions on the provision of ecosystem services by defining a set 38 relevant floodplain management interventions, assessing the effects of these interventions on 21 relevant ecosystem services and evaluating the impact of the intervention on the multifunctionality of the floodplain by calculating an index that summarizes the positive and negative effects on the provision of the different ecosystem services. This multifunctionality index quantifies the overall impact on all considered ecosystem services ranging from -1 (negative impact on all ecosystem services) to +1 (positive impact on all ecosystem services). Interventions related to restauration and rehabilitation increased strongly the multifunctionality of the landscape and caused win-win situations for enhancing overall ecosystem service provision, but also all three ecosystem service-sectors (production, regulation and maintenance, and culture). Conventional regulation but also interventions related to extraction, infrastructure and intensive land use caused lose-lose situations with decrease in multifunctionality and negative effects for the provision of all three sectors of ecosystem services. The approach is based on expertise from researchers and practitioners of several European countries, and should be useful to provide an overview for decision makers at multiple governance levels. Further research should include the development of widely applicable indicators for ecosystem services and generate long-term data sets to monitor effects on ESS provision in European floodplain landscapes.

In the preliminary systematic map, we specify that from originally 4131 hits in the databases Scopus and Thompson Reuters Web of Knowledge, 491 remained after screening the titles and 70 after screening abstracts and full texts. Several papers could not be included at this stage as they neither stated the river order nor it was obvious that they complete with the related inclusion criterion of river order ≥ 4. 31 journals served as sources regarding the selected articles, and “River Research and Applications” was the journal with the highest number of relevant articles. Most of the articles were published during the last five years, and the majority of the study regions of the articles were located in the US, followed by

Germany and France. The focus in respect to the intervention was often related to restoration (especially reconnection) and production activities (including the construction of hydropower plants). Arthropods were the most commonly studied organisms, followed by fish and birds. Totally 67 analyses were performed for zoological taxa, 17 for plants and 2 for bacteria. More than half of the articles presented studies using a C-I (Control-Impact) study design, followed by B-A (Before-After) studies. 13 out of 70 articles presented studies based on a B-A-C-I (Before-After-Control-Impact) study design. Many of the articles did not provide any information about the time between the interventions took place and data sampling. 22 of the included studies presented in the articles were carried out shortly after the intervention took place (0-2 years), while only a few of them evaluated long-term effects of interventions.

The conduction of the conservation case led to several conclusions and lessons learned for the operation of a NoK. Key challenges in respect to the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence) are that the NoK must be well-known, of high reputation, inclusive in terms of geographical and sectorial coverage, and fully operational to deliver full added value. Dedicated experts must be fully aware of their benefits of participation and it must be clear that a high level of rigor and quality requires significant resources. Systematic reviews guarantee high credibility and independence when being fully implemented, but with restricted resources, there are trade-offs between practicability and rigour that can potentially undermine the high level of credibility and independence of the process. It is still particularly challenging to fully consider local and regional knowledge in systematic reviews. We suggest that modular approaches that combine systematic reviews with other knowledge assessment approaches such as expert consultations might be meaningful cost-, and time-effective alternatives, but it is important that it is entirely reproducible which part of the assessment was produced with which method and which level of rigor. When being fully implemented, the NoK-approach offers a significant and cost-effective added value in terms of credibility, legitimacy and independence of the assessments. Environmental issues are characterised by a high level of heterogeneity in conditions and a very scattered knowledge landscape. The NoK-approach is perfectly suited to deal with these constraints for reliable assessments, as it maximizes inclusiveness, the available expertize, independent internal and external feedback loops and the integration of knowledge that is not available from standard scientific media.

6.3 Knowledge Assessment Reports

All knowledge assessment reports that have yet not been accepted for publication in a scientific journals have neither yet passed the external quality control check and must therefore be seen as preliminary verions. They should not be considered as definitive evidence for political decision-making on environmental issues at this stage.

In the following the four knowledge assessment reports compiled in the frame of the conservation case are presented.

6.3.1 Systematic review protocol on the impact of multifunctional floodplain management on biodiversity

This systematic review protocol was elaborated with the expert group and specifies the approach and the methodological details for the conduction of the systematic review on "Impact of multifunctional floodplain management on biodiversity". The judgment of the multifunctionality of the floodplain management interventions, hardly reported in the primary literature, was recognized as a main challenge. For this reason, we chose the approach of extracting the biodiversity impact of the interventions from the primary literature, while assessing the multifunctionality of the interventions by a complementary expert assessment – Chapter 6.3.3 & Annex C.3.

This systematic review protocol was recently published by Environmental Evidence. It is available online under:
http://www.environmentalevidencejournal.org/content/2/1/10

Full version: Annex C.1

Schindler et al. Environmental Evidence 2013, 2:10
http://www.environmentalevidencejournal.org/content/2/1/10

SYSTEMATIC REVIEW PROTOCOL Open Access

Floodplain management in temperate regions: is multifunctionality enhancing biodiversity?

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Abstract

Background: Floodplains are among the most diverse, dynamic, productive and populated but also the most threatened ecosystems on Earth. Threats are mainly related to human activities that alter the landscape and disrupt fluvial processes to obtain benefits related to multiple ecosystem services (ESS). Floodplain management therefore requires close coordination among interest groups with competing claims and poses multi-dimensional challenges to policy-makers and project managers. The European Commission proposed in its recent Biodiversity Strategy to maintain and enhance European ecosystems and their services by establishing green infrastructure (GI). GI is assumed to provide multiple ecosystem functions and services including the conservation of biodiversity in the same spatial area. However, evidence for biodiversity benefits of multifunctional floodplain management is scattered and has not been synthesised.

Methods/design: This protocol specifies the methods for conducting a systematic review to answer the following policy-relevant questions: a) what is the impact of floodplain management measures on biodiversity; b) how does the impact vary according to the level of multifunctionality of the measures; c) is there a difference in the biodiversity impact of floodplain management across taxa; d) what is the effect of the time since implementation on the impact of the most important measures; and e) are there any other factors that significantly modify the biodiversity impact of floodplain management measures? Within this systematic review we will assess multifunctionality in terms of ESS that are affected by an implemented intervention. Biodiversity indicators included in this systematic review will be related to the diversity, richness and abundance of species, other taxa or functional groups. We will consider if organisms are typical for and native to natural floodplain ecosystems. Specific inclusion criteria have been developed and the wide range of quality of primary literature will be evaluated with a tailor-made system for assessing susceptibility to bias and the reliability of the studies. The review is intended to bridge the science-policy interface and will provide a useful synthesis of knowledge for decision-makers at all governance levels.

Keywords: Biodiversity, Multifunctionality, Floodplain management, Green infrastructure, European Commission Biodiversity Strategy 2020, Biodiversity knowledge, Ecosystem services, Flood prevention, River restoration, Systematic review, Science-policy interface, Science-practice interface

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6.3.2 Expert assessment on biodiversity effects of multifunctional floodplain management

Originally we had planned to cover non-english and grey literature in the frame of the systematic review. After the second meeting of the working group it became clear that this was totally unrealistic given the time constraints of the expert groups. Therefore we decided to elaborate this complementary expert assessment that synthesizes personal expertise and grey literature for six European countries following a template to specify i.a. the role of multifunctionality in floodplain management and evidence for effects of multifunctional floodplain management approaches on biodiversity. One additional advantage stressed by the expert group was that this way information can be included that was never adequately published, because commissioned studies were kept confidential or because they are part of larger and on-going floodplain management activities.

We plan to submit this manuscript in a modified version to the *Journal for Nature Conservation* during summer 2013.

Full version: Annex C.2

Multifunctional floodplain management in temperate Europe and evidence for biodiversity effects: an expert consultation

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Abstract

Floodplains are areas of high levels of biodiversity and hotspots in providing ecosystem services, but at the same time often prone to several sources of land use pressure. Multifunctionality is recently proposed as key concept to reconcile biodiversity and ecosystem services with economical interest in floodplains. Multifunctional floodplain management can be defined as management approach aiming at a balanced provision of ecosystem services under efficient use of public funds, serving the needs of the local residents, but also those off-site populations that are directly or indirectly impacted by floodplain policies. In this document we present biophysics and management history of floodplains, as well as examples for recent multifunctional management approaches and evidence for their biodiversity effects. We cover by means of an expert consultation the six temperate Europe countries Ireland, the Netherlands, Germany, Slovakia, Hungary and the Ukraine.

An interesting pattern of regional differences in management goals and approaches was detected. Whereas flood protection is the top priority in floodplain management of some countries, others have a mixed agenda. Multifunctional floodplain management seems to be possible under all strategies but is showing differences in size and number of projects, which is mainly due to different levels of responsibility for water management in the countries, ranging from centralized national responsibility to region provincial governance. Regarding the management approaches, there is a compelling common set of measures all over Europe, targeting not only the restoration of hydrological connectivity at different scales, but also the adaptation and extensification of land use in flood plains as a precautionary principle. Biodiversity may benefit from all these interventions but evidence is rare as only few projects have documented the respective impacts and responses.

We conclude that there is seemingly no alternative to multifunctional approaches in future floodplain management. Integration of all existing uses and demands is essential. In order to make efficient use of the management resources as well as the ecosystem services, win-win-situations need to be achieved and biodiversity has to play a crucial role. Multifunctionality mainly shows success where stakeholders with diverse expertise and interests are involved in all stages of planning and implementation of regarding projects. It is recognized that such participatory processes are beneficial for environmental resource management, but a big gap remains between the rhetoric on participation and the real-life implementation on participatory processes, and administrative structures often support the subsequent standstill.

6.3.3 Expert assessment on the effects of floodplain management interventions on the provision of ecosystem services

This expert assessment emerged from the need to assess the multifunctionality of the floodplain management interventions. As the multifunctionality of the intervention is not directly obtainable from the primary literature, the level of multifunctionality for the most important interventions was assessed based on their average effects on ESS provision. We plan to submit this manuscript in a modified version to the Journal *Landscape Ecology* (Special Issue on *Ecosystem Services)* during summer 2013.

Full version: Annex C.3

Multifunctionality of floodplain management: a matrix relating interventions to ecosystem services

Authors

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Abstract
One important approach to obtaining multiple ESS in the same area is the concept of green infrastructure (GI) that was recently strongly taken up by the European Commission. Multifunctionality is a key feature of GI which is defined as an "interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations. Floodplains of large European lowland rivers are landscapes where the need for the provision of multiple ecosystem services is particularly high. In this work we provide an overview of the impact of floodplain interventions on the provision of ecosystem services (ESS). By means of an expert consultation, we defined a set 38 relevant floodplain management interventions, assessed the effects of these interventions on 21 relevant ecosystem services and evaluated the impact of the intervention on the multifunctionality of the floodplain by calculating an index that summarizes the positive and negative effects on the provision of the different ESS. This multifunctionality index quantified the overall impact on all considered ESS ranging from -1 (negative impact on all ESS) to +1 (positive impact on all ESS). Interventions related to restauration and rehabilitation increased strongly the multifunctionality of the landscape and caused win-win situations for enhancing overall ESS provision, but also all three ESS-sectors (production, regulation and maintenance, and culture). Conventional regulation but also interventions related to extraction, infrastructure and intensive land use caused lose-lose situations with decrease in multifunctionality and negative effects for the provision of all three sectors of ESS. The approach is based on expertise from researchers and practitioners of several European countries, and should be useful to provide an overview for decision makers at multiple governance levels. Further research should include the development of widely applicable indicators for the ecosystem services and generate long-term data sets to monitor effects on ESS provision in European floodplain landscapes.

Keywords: floodplain management, green infrastructure, nature conservation,

multifunctionality index, hydrological engineering, restauration, recreation

6.3.4 A preliminary systematic map on the impact of floodplain management on biodiversity in temperate regions

This systematic map provides an overview about the scientific literature on the topic impact of floodplain management on biodiversity. The presented manuscript is a first preliminary version and will be further developed during the next months.

Full version: Annex C.4

Impact of floodplain management on biodiversity in temperate regions: a preliminary systematic map.

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Abstract

The search for literature on the topic impact of floodplain management on biodiversity in temperate regions resulted in 4131 hits in the databases Scopus and Thompson Reuters Web of Knowledge. After we screened the titles regarding the inclusion criteria specified in the systematic review protocol, 3640 papers were excluded from the study and 491 remained. By viewing the abstracts and, in a next step, the titles of the remaining articles, further 421 papers were excluded and 70 papers could finally be included in this preliminary version of the systematic map. Many of the papers excluded did not complete with the inclusion criteria, because we could not evaluate the river order, which had to be >3 to be included. 31 journals served as sources regarding the selected articles, and “River Research and Applications” was the journal with the highest number of. Most of the articles were published during the last five years, emphasising the actuality and relevance of the topic. The majority of the study regions of the articles were located in the US, followed by Germany and France and we identified a focus on studies related to restoration (especially reconnection) and production activities (e.g. construction of hydropower plants). Arthropods were the most commonly studied organisms, followed by fish and birds. Totally 67 analyses were performed for zoological taxa, 17 for plants and 2 for bacteria. More than half of the articles presented studies using a C-I (Control-Impact) study design, followed by B-A (Before-After) studies. 13 out of 70 articles presented studies based on a B-A-C-I (Before-After-Control-Impact) study design. Many of the articles did not provide any information about the time between the interventions took place and data sampling, which must be considered as quality drawback. 22 of the included studies presented in the articles were carried out shortly after the intervention took place (0-2 years). Only a few studies evaluated long-term effects of different interventions, which should be a focus of future investigations.

6.4 Implementation of the NoK-Prototype and lessons learned

6.4.1 Conclusions for the operationalized guidelines of the NoK

6.4.1.1 Recognized challenges for the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence):

- For various reasons it might be challenging to motivate experts to participate intensively at all stages of the assessment. This might have effects on the credibility and relevance of the work.
- Much effort is required to make a NoK work effectively when aiming at the gathering of ad-hoc expert groups. Awareness raising is key for good and fast response rates and the database on knowledge hubs must be extended and continuously updated.
- The most renowned experts are often very busy persons and might not be available during some stages of the development of the assessment. Fluctuations might cause a challenge for effective work, on the other hand a big squad of experts in a NoK-based expert group, increases the probability that there will always be somebody who has time and engagement.
- The systematic review guarantees high credibility and independence when being fully implemented. Depending on the breadth of the topic and the amount of literature to review the effort can vary strongly, but when implementing a systematic review in the frame of the NoK, one full person year must be dedicated, and several person years for broad topics rich of evidence. With restricted resources, there are trade-offs between practicability and rigour and compromises that might have to be taken can potentially undermine the high level of credibility and independence of the process.
- For many topics, local and regional knowledge that did not find its way to ISI-journals is a crucial part of evidence. In order to be considered, a NoK must have well developed hubs and deep roots into the knowledge landscapes of the member states.
- Inclusiveness is a key issue related to biodiversity, ecosystem services and sustainable resource management. It is a challenge to reach out beyond the bigger research institutions and manage to integrate knowledge from smaller and economically less powerful countries, from practitioners and many other groups of knowledge holders that are not yet integrated into the SPI-processes regards biodiversity and ecosystem services.

6.4.1.2 Recognized added values for the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence):

- The NoK offers when adequately implemented and applied a significant and cost-effective added value in terms of credibility, legitimacy and independence.
- Due to the relatively high heterogeneity in environmental conditions, inclusiveness is of particular importance. A well-developed NoK can maximize inclusiveness.
- In both tested methods (systematic review, expert assessment), many choices regards content, approach and specific methods have to be made, and the broad contribution of experts guarantees for a high probability of making the right choices

- The NoK approach guarantees broad participation, and enables independent internal and external feedback loops and other means for controlling and increasing quality.
- Particularly for integrating knowledge that is not available in ISI-journals (such as grey literature, local expert knowledge, traditional knowledge) the NoK can be of big support

6.4.1.3 Lessons learned for the operationalized guidelines of a NoK (i.e. credibility, relevance, legitimacy, independence):

- It is crucial that the NoK is well-known and of high reputation. Publicity in the scientific community will be a key issue and the NoK must have clear guidelines on how to deal with requests that ask for assessments that must be completed promptly or with few financial resources.
- Expert groups should be open to engaged new members. Particularly for longer assessments, time availability of the main involved experts will fluctuate, and a flexible system should be beneficial in any cases despite demanding more coordination effort.
- Workshops boost communication, group discussions and insights, and we highly recommend a setting with (at least) three workshops, one at the very beginning, one to finalize all open methodological questions and one to integrate results of all products into an overall summary and one or more policy briefs. Teleconferences can be a cheaper alternative, but if funding is possible, three en-face workshops should be completed
- Systematic reviews are still rarely used to integrate all kind of evidence (including grey literature and local or traditional knowledge), due to linguistic barriers, restricted access or other problems of adequately obtaining information. We suggest that modular approaches might be meaningful and cost-effective, where some parts of the evidence (for instance the evidence from particular countries or for particular topics that is strongly underrepresented in ISI-journals) might be considered by complementary expert assessment. This might particularly be the case when experts from these countries are available for the assessment, but don't have the resources to integrate the local evidence by following the demanding procedures of a systematic review.
- When applying modular approaches that combine different knowledge assessment approaches, it is of outstanding importance that it is entirely reproducible which part of the assessment was produced with which method and which level of rigor. The "logbook-approach", implemented during the case studies (i.e. keeping track of all related issues, major conversations, and decisions beyond the content of the assessments) was very helpful for doing so.

6.4.2 Preparation

6.4.2.1 Identify and communicate with requesters

May 2011 – March 2012

Two science-policy conferences were used to present the KNEU-project and to identify potential requesters and involve them in question setting for the demonstration case conservation: First the Meeting of the European Nature Directors in Hungary, Balatonfüred in June 2011 and the Conference „Planning for biodiversity“ of the Polish Presidency in Warsaw in November 2011. Furthermore several requesters were contacted via E-Mail to be involved in the process of question setting. The potential requesters with whom we discussed the case study were:
Marco Fritz (DG ENV, B2 – Biodiversity),
François Wakenhut (DG ENV, head of B2 – Biodiversity),
Szylvia Bősze (DG ENV, B2 – Biodiversity),
Stefan Leiner DID (DG ENV, head of B3 – Nature),
Gabriele Obermayr (BMLFUW, Federal Ministry Austria),
Chris Walzer (FIWI, scientist), and
Ernst Mattanovich (landscape and spatial planning expert).

During the Workshop on 15th of February 2012 we decided with the other test-case-leaders, that the demonstration case on biodiversity conservation should represent the situation where we try to support one requester, who has a rather specific issue. Marco Fritz (DG Environment) was selected as requester and the final decision on the subtopics and research question was discussed with him during March 2012.

6.4.2.2 Scope science and potential methods

December 2011 – March 2012

A workshop on the methods was held in Brussels on the 15th of February 2012 mainly to get deeper insights into the methods “systematic review” and “adaptive management”. A further goal was to discuss these methods (incl. “expert knowledge”) directed towards the needs and restrictions of the demonstration cases.
After a first screening of existing studies concerning GI, we decided on the methodological approach „systematic review“ for this demonstration case, as we expected to find enough evidence. We expected that the outcome of the SR should enable us to assess whether and under which conditions multi-functional floodplain management was beneficial for biodiversity.

6.4.2.3 Understand the policy context of the topic

March 2011 – May 2012

According to the EU biodiversity Strategy 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and a working group was dealing with an EU strategy for Green Infrastructure and its implementation at the beginning of this case study. The political relevance of this specific demonstration case was also based on the objectives of different European directives. The Habitats Directive, for instance,

identifies many habitat types of community interest in river floodplains. Further relevant directives are the Water Framework Directive, the Birds directive, the Nitrogen Directive and the Directive on the assessment and management of flood risks.
The requester, DG Environment, strongly supported us in the decision on the topic for our demonstration case, especially for refining the question and simultaneously keeping it policy-relevant.

6.4.2.4 Request

January 2012 – March 2012

The topic was clearly driven by one requester, DG Environment (see 6.4.2.1), since the establishment of a GI is one of the main Biodiversity targets of the European Union to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020. In the frame of the GI-topic, DG Environment was especially interested in the question how a GI contributes to multifunctional land-use and a well-balanced delivery of ecosystem services (including habitat for biodiversity) for instance in the case of river floodplains.

6.4.2.5 Scoping

6.4.2.5.1 Frame a dialogue process with requesters and some experts (from KNEU and the wider NoK, if possible and needed)

November 2011 – August 2012
From the meeting in Warsaw on (see 6.4.2.1), we framed and intensified a discussion process with DG Environment on the question for the conservation case. From March 2012 on, we included into this discussion selected experts, and intensified the dialogue process with the experts from the first meeting from the working group onwards.

6.4.2.5.2 Specify and adapt topics into relevant, but also suitable questions for specific methods

Nov 2011 – May 2012

The following subtopics and research questions for our demonstration case could be identified as a first result of the communication process with the requesters and after a first screening of existing literature and studies concerning GI:

- To what extent can existing networks of protected sites be regarded as GI?
  - -) how to prioritize restoration efforts?
  - -) how to improve functional flyways?
  - -) how to improve coherence of N2K?
  - -) how to define and further develop the new concept of „blue“ infrastructure?
- To which respects does technical infrastructure meet the requirements of nature conservation?
  - -) how to optimally perform greening “grey” infrastructure?

-) which measures of greening specifically combat fragmentation?

• How does GI contribute to multifunctional land-use and well balanced delivery of ecosystem services?

-) how to adapt to climate change and to improve resilience?

-) which are the synergies and win-win situations between flood protection measures and biodiversity conservation?

-) what is the biodiversity impact of multi-functional floodplain management compared to conventional flood control measures?

Discussing the status of our case study with DG Environment, we decided, that the question for the conservation case should concern GI performance. We decided to assess "the biodiversity impact of multi-functional floodplain management compared to conventional flood control measures".

As soon as the topic and a first draft-question was defined (March 2012), the dialogue process with the knowledge hubs was started. The knowledge hubs identified by WP1 should nominate experts for the mentioned question regarding multifunctional floodplain-management and its impact on biodiversity.

6.4.2.5.3 decide on methods to be used

January 2012 – March 2012

Based on the workshop in Brussels on the 15th of February 2012 we discussed the methods directed towards the needs and restrictions of the demonstration cases. A first screening of existing evidence for floodplain-management and its impact on biodiversity showed, that there is a remarkable amount of evidence, especially of grey literature, related to the topic. For this reason we decided for a systematic review. The approach of adaptive management seemed to be less appropriate for our purposes as floodplain management frequently deals with large spatial and temporal scales and the design and implementation of experimental research to gain new insights for the adaptive management cycle would probably be difficult to be conducted in the frame of this case study.

During the conduction of the case study we finally decide that the SR should be complemented by two crucially needed expert consultations, one to cover expert knowledge and non-english grey literature on the topic (cf. Chapter 6.3.2) and the other to relate floodplain management interventions with multifunctionality (cf. Chapter 6.3.3).

6.4.2.6 Tender process

There was no real tender process as no money was available to pay for experts to form a working group. However, we called knowledge hubs for identifying experts and for providing literature.

6.4.2.6.1 Call to knowledge hubs to help identifying / nominating experts

March 2012 – May 2012

The knowledge hubs were asked on 29th of March to nominate experts regarding the topic of our test case. Using the databases compiled by WP1, we decided for a rather broad call, asking 80 hubs to support us with their knowledge. Three members of our team (Thomas Wrbka, Michaela Kropik, Stefan Schindler) voted independently for inclusion/exclusion of hubs using the following categories:

- YES - hub to be contacted by e- mail
- NO - not focused enough on the topic
- NO - not optimal due to kind of knowledge availability
- NO - not optimal due to inappropriateness of geographical focus

We contacted only hubs that received ≥2 (out of 3 times) the category " YES - hub to be contacted by e- mail".

Expert nomination - Method:
We contacted the selected 80 hubs and asked them to suggest us experts for our case study, who are willing to participate in a first workshop in Brussels and/or to support our working group in the near future with the next steps of the systematic review on multifunctional floodplain management and its impact on biodiversity. After a first call to these 80 hubs, we got 21 replies. In several of these replies, experts were proposed to us. All in all 42 experts were proposed. We prioritized the experts according to their relevance for our topic and our purposes. We aimed at a balanced group regarding professional background and geographical origin, and applied for researchers the number and quality of SCOPUS publications as selection criterion. In a first call, we contacted the prioritized experts. Most of them had to cancel, mainly because of time constraints as they were too occupied and the workshop was rather short ahead. Most of the experts wanted to be updated, some of them announced to support us in the near future, some suggested alternative experts. All in all we got a weak response regarding workshop participation and started a second attempt by mailing to experts which were not selected as first priority.
During this second approach, we additionally used a further expert database which was obtained from the Rubicode-project. Thereof, we contacted 34 institutions/experts and received 16 replies and 30 new expert-contacts.

Expert nomination - Results:
Before the first workshop, a total of 72 experts were nominated by the hubs and we contacted 58 out of them during the two stages. 42 answered (most of them after a reminder), 16 replied positively and wanted to participate in the workshop, 26 refused their participation in the workshop, and 16 did not reply at all. Most of those that refused stated that they could not participate as it was too short in time or because of general lack of time. However, they often stated general interest in the test case and wanted to be kept updated. Finally some of the participants had to cancel their commitment. On 22th of May 2012 16 experts had confirmed their participation. Two of them refused their participation on the 23rd. Finally 14 experts attended the workshop on the 23rd and 24th of May.

6.4.2.6.2 Call for evidence

April – July 2012

Before the first expert workshop, we asked all experts who were contacted for key papers on the issue.
After the first expert workshop we asked the 18 experts that we considered as most motivated for literature, mainly for grey literature and for such dealing with studied where they personally participated. Additionally, we send this request to the members of the Austrian Platform for Biodiversity Research (BDFA). This platform has about 250 active members.
Response to these three calls for evidence was rather marginal, a few researchers sent single papers.

6.4.2.7 Agreement on team and protocol

6.4.2.7.1 Working group settled and jointly agrees on protocol and timeframe (incl. if and how methods are used and if needed integrated)

May – August 2012 (modifications in the frame of the 2nd workshop Nov 2012)

Via the call to the NoK experts on floodplain management were nominated. 14 of them finally attended the workshop on the 23rd and 24th of May, where the working group for the systematic review could be settled and basic questions for setting up the review protocol were discussed (e.g. measures for multifunctionality, adjust the question to policy needs and knowledge gaps).
Two of the workshop participants were interested in the KNEU-project and its general approach in general but did not want to further contribute to the working group, as they were no experts at all on floodplain management. Sophie Lauwaars had to clarify her participation in the working group with her superior. All the other participants agreed instantaneously to further support us in the working-group. Some experts, who could not attend the workshop in Brussels, wanted to participate as working-group-members. After the first workshop, the 12 experts who participated in the workshop constituted the core working group, 20 further experts had shown interest and were kept updated.

The 12experts agreed on the working process and the timeline, however, due to time constraints, not all issues were discussed deeply and several uncertainties remained.

6.4.2.7.2 How will the product be linked to the requesters needs?

May – July 2012

The requester (DG Environment) attended the workshop on the 23rd and 24th of May 2012 and contributed to the discussions regarding the refinement of the question for the systematic review. At the first workshop, the requester presented for and discussed with the working group the issues multifunctional floodplain management and Green Infrastructure

in the frame of the EU Biodiversity Strategy 2020. The requester also commented on the manuscript for the systematic review protocol before submission to *Environmental Evidence*. The requester was also invited to the 2nd workshop, but had to reject the invitation due to time constraints. The requester was updated about the workshop results.

6.4.2.8 Communication of protocol

6.4.2.8.1 Publishing the process protocol and further inviting for comments / evidence by the NoK

For the first version of the systematic review protocol, Stefan Schindler, Michaela Kropik and Thomas Wrbka carried out the design and coordination of the study and drafted the manuscript. Stuart W. Bunting, Klaus Henle, Maurice Hoffmann, Robert Kanka, Volker Mauerhofer, Christiane Schulz-Zunkel participated in the design of the study and commented on the manuscript. Marianna Biró, Franz Essl, Sophie Jaquier commented on the manuscript. Lukács Balázs, Gábor Borics, Viktor Gasso, Stephanie Hudin, Andreas Krug, Sophie Lauwaars, Klaus Peter Zulka contributed to the design of the study while participating in the first workshop. All authors read and approved the final manuscript.

The protocol was internally reviewed by the requester and the KNEU-partners during July and August 2012 and submitted to *Environmental Evidence* on the 13th of August 2012 for a second external review. The comments of 2 referees and the editor in chief were received at 8th of October 2012. A completely revised version of the protocol was resubmitted to *Environmental Evidence* at 30th of Aril 2013 and accepted for publication at 10th of May 2013. Also authorship and title were adapted since the original submission (see Chapter 6.3.3).

6.4.3 Conducting

6.4.3.1 Communication to different groups/ knowledge hubs (e.g., reviewers, stakeholders)

June 2012 – May 2013

In the frame of the second workshop, 32 experts were invited and 16 participated. Six new experts joined the working group due to this event. The workshop that took place in Hainburg (Austria) 7th until 9th of November 2012 was the main means of communication with the experts who represented at the same time the knowledge hubs and stakeholders such as national conservation agencies.

During the second workshop, it became obvious that the best approach to include ‘grey literature’ and other kinds of knowledge into the assessment would be to perform ‘expert assessment’ in addition to the systematic review. After the workshop we informed six further experts who could not participate at the second workshop about the new expert assessment. Additionally two Irish experts joined the team in December 2012 as they found information about the floodplain management test case on the KNEU website and have been following the development of "Network of knowledge" as their colleague, Louise Scally, is involved in the KNEU project.

Finally, experts from ten European countries were provided with a template to specify the situations of floodplains, their management and its consequences for biodiversity in their specific country. We aimed at a geographical balanced assessment and finally achieved participation from six countries, i.e. Ireland, the Netherlands, Germany, Slovakia, Hungary, and the Ukraine.

As a main means of communication and enhancement of engagement after the second workshop (i.e. between November 2012 and May 2013), a general skype-conference was conducted with the expert group. It was announced 2-3 weeks before and the date was set using a doodle. We contacted all experts that had shown s interest since summer 2012 (n = 26). 11 participated in a doodle, 8 had time today, 2 cancelled in the last moment, and finally 7 experts participated. All experts contributed constructively throughout the skype-conference (nearly 2 hours) and all of them took some additional tasks until for the next 1-2 months.

Communication with selected experts was also conducted by frequent skype-meetings. Regular email communication took place for specific issues and for general updates.

6.4.3.2 Use of evidence-based framework

6.4.3.2.1 Collection of data sources

May 2012 – December 2012

A first search was performed during May-July 2012. A second definitive search was performed in December 2012 after having received the comments of the referees of Environmental Evidence and implemented related refinements.

6.4.3.2.2 Modes of analysis

Mar 2012 – May 2012

The SR is not far developed yet to define the optimal choice for analyses. Currently we are compiling a systematic map as an intermediate step.

6.4.3.3 Compilation of first results

6.4.3.3.1 Writing draft reports / draft products (e.g. options from modeling in AM)

June 2012 – May 2013

The first version of the Systematic Review Protocol was drafted June- August 2012, the definitive version December 2012 – April 2013 (see Chapter 6.3.3).

The two expert assessments were drafted from February until May 2013 (see Chapters 6.3.1. and 6.3.2)

6.4.3.4 Review and evaluation

August 2012 – May 2013

Review and evaluation of intermediate products occurred mainly by the internal review of experts, requester and KNEU-partners. External review occurred mainly by the referees of Environmental Evidence.

The internal review must be seen as restricted, as response from KNEU-partners was very limited and we did not clearly separate the expert group in 'conductors' and 'reviewers', whereas the expert group reviewed and commented practically on their own work. However, as frequently experts were available for these evaluations, who had not been participating before when the outcomes were produced, some level of independence can be assumed.

6.4.3.5 Final report/product

6.4.3.5.1 Finalisation by working group

March 2013 – May 2013

The products presented in the report were finalized between March and May 2013. Experts were regularly updated by email and provided with actual versions of the manuscripts. They contributed depending on their skills and time availability.

6.4.4 Finalisation

6.4.4.1 Decide an outreach "strategy" together with requester and with KNB

May 2013 – June 2013

While the outreach strategy for scientific products (scientific paper and conference contributions) was discussed and decided in the working group, the outreach strategy for policy products will be discussed as soon as complete first drafts of the products are available as foundation for discussions. This will be done after the publication of this Deliverable end of May 2013.

6.4.4.2 Communication to client

Still to be definitively defined. Currently discussions with requester initiated.

6.4.4.3 Dissemination

6.4.4.3.1 Publication of report

Should be completed end of May 2013

6.4.4.3.2 Additional scientific papers

See Chapter 3.2

6.4.4.4 Evaluation, lessons learned for process

June 2011 – May 2013

LESSONS LEARNED:
In our demonstration case, we tried to mimic as close as possible the NoK-prototype in order to detect potential problems and elaborate practical solution. The following issues should be considered when designing the "recommended NoK":

- The aim of testing the NoK-Prototype under real world conditions could not be entirely achieved. Compared to a conduction under the frame of an established NoK-mechanism, we faced the challenge that (despite considerable effort) the project KNEU and the NoK-approach were not enough well-known at the beginning neither by potential requesters nor by potential members for expert groups. For this reason, it was challenging to convince requesters and experts about the importance and about their benefits when spending thought and time for the project and the case studies. This might have affected the quality and policy relevance of the knowledge assessment reports and issues specified in the lessons learned such as expert motivation and participation.
- The knowledge hubs- lists were not the most suitable for our specific question, which was finally (and after several changes) related to freshwater and floodplain issues. Waiting with the invitation for the first workshop until the program of the first KNEU-conference was set, experts were contacted rather late and had to have time rather spontaneously for participating in the workshop. This was definitively a reason, why some notable experts had to cancel.Most of the knowledge hubs that we contacted were very general hubs. Seemingly, some of the hubs were not organized for responding such requests. Some hubs provided expert names and e-mail-contacts, some mentioned or invited us to conferences, some provided names of other knowledge hubs or asked whether they should do so, some wrote that they will provide names later on, some did not answer at all.
- Contact persons of the hubs had seemingly a very important role and influence. The response was completely different depending on the contact person within the institution. In some of the cases, where we did not receive any answers, the call was addressed to someone from the hub secretariat very probably not at all involved into the topic of our case study. Easter time was not ideal for the call, a big amount of contact persons were out of office. Some of the replies could be integrated, as we received some of them so late that an invitation to the workshop did not make any sense anymore.
- We had several lists from WP1&2 and it ended up to be a little bit confusing. We propose that for a future NoK design there should be one list of knowledge hubs for EU/international level and another list for "member state level". To be suitable for the purposes of a NoK (i.e. to avoid that users must try to find experts in any case by other rather subjective means such

as checking papers, asking colleagues, etc.), these list should be more comprehensive and contain in much more detail all kinds of learned societies, expert groups, and research institutions in the fields of biodiversity and ecosystem research. Then a large amount of experts could be contacted and expert groups could really be composed by a balanced and representative selection covering a very high share of overall expertise. They should also have features such as keyword search. The actual list for the member state level contained information for only few EU member states and they are geographically not very well balanced. For example, after the entire procedure, we did not have any contact from large and biodiversity relevant countries such as Italy, Spain or Portugal. Experts from these countries would be important for our case study to cover Mediterranean floodplains. We finally selected post-hoc two Spanish experts according to their publications and their involvement in the European Center for River Restoration (ECRR), but interest and time availability was rather low from their side. Also the national biodiversity platforms are missing for most of the countries, although they would be particularly important for their good overview on experts at the member state level.

- Some contact-addresses did not work. Institution names change frequently and for a NoK it would be a rather big deal to remain updated. It would also be helpful to have more details concerning the kind of knowledge hub, e.g. if the knowledge hub is mainly doing knowledge generation, if it's a knowledge hub in narrow sense (i.e. a "knowledge junction") or a knowledge user, and last but not least, it would be important to know about any kind of experience, whether the knowledge hub can generally deal with requests such as ours.
- Expert engagement was varying strongly across persons and time. Fluctuations in the composition of the expert groups limited efficient work. Most engaged experts were those who did find and contact us themselves often at comparatively late stages of the process. We recommend that expert groups should be open to engaged new members.
- Workshops were a very important tool to boost communication with and engagement of experts. Expert engagement was highest during and after the workshops. It was also rather high for clearly defined products especially during their latest stages of development. Experts have strong time constraints and hesitated to invest effort at vague or difficult to achieve products.
- It was nearly impossible to achieve that experts would participate in a systematic review on a voluntarily base. A systematic review implies a very high level of standardization and thus an intensive effort in developing and applying agreed rules at all level of detail. For a contributor on volunteer base, it is difficult to dedicate lots of time in one piece, which is required in order to participate in conducting a highly standardized procedure such as a systematic review. Additionally, a systematic review requires many skills including a fast and deep-going understanding of all details of the primary literature, which might be challenging as experts might have particular skills and expertise, but eventually not all required ones. Thus a systematic review despite all its big advantages in terms of credibility and independence might not be an optimal solution for fast assessments based on voluntarily contributing experts.
- A overall skype-teleconference showed to be a very cost-efficient tool to enable available and interested experts to provide feedback in respect to strategical issues and contents and to agree on commitments to take some of the required tasks to achieve the common goals.

- It was difficult to know to which level of detail the requesters should be included into decisions in respect to overall strategy and content.
- The concept proposed by the NoK-Prototype was found very appropriate in its general and specific issues. The main challenge was to implement it as completely as possible with the resources that were available. It would be useful to clearly define in the recommended design, which steps should be skipped in the case of low-budget-requests.