



# BiodivERSa

## Strategic Foresight workshop

### 'Nature-Based Solutions in a BiodivERSa context'

Brussels June 11-12 2014

## Draft Report

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## 1 Introduction

The BiodivERSa consortium (ERA-Net funded by the FP7)<sup>1</sup> organized a "horizon scanning workshop" in June 2014 to **investigate key future challenges and policy needs for biodiversity research at European level**. The horizon scanning exercise also intended to serve the implementation of the *Convention on Biological Diversity (CBD) Aichi Targets*<sup>2</sup> and the tightly linked *EU Biodiversity Strategy to 2020*<sup>3</sup>, which are setting the scene for priority policy and practice actions for the next 20 years and will most likely require sound scientific advice.

<sup>1</sup> BiodivERSa is a network of national funding organisations promoting pan-European research: <http://www.biodiversa.org>

<sup>2</sup> <http://www.cbd.int/sp/targets/>

<sup>3</sup> EU Biodiversity Strategy to 2020:

<http://ec.europa.eu/environment/nature/info/pubs/docs/brochures/2020%20Biod%20brochure%20final%20lowres.pdf>



41 In 2013, several meetings were organized in support of the implementation of  
42 the *EU Biodiversity Strategy to 2020*, including:

- 43 • **DG Research and Innovation/EPBRS workshop "Investing in**  
44 **Innovative Research for Nature and our livelihoods: Strengthening**  
45 **the research strategy to reinforce the ERA on Biodiversity<sup>4</sup>**, held on  
46 April 11-12 in Brussels. The aim of the workshop was to identify ways  
47 forward to consolidate the ERA on biodiversity and ecosystem services,  
48 and to explore the research priorities in the current research and  
49 environment policy context.
- 50 • **DG Environment/Alter-Net conference "Science underpinning the EU**  
51 **2020 Biodiversity Strategy"**, on April 15-18 in Ghent. The aim of this  
52 conference was to discuss the current science underpinning the  
53 implementation of the 2020 strategy, addressing all six targets ([report](#)).
- 54 • **EPBRS Irish Presidency meeting on May 15-17 in Dublin, Ireland.** This  
55 meeting focused on (i) Research to support the implementation of Article  
56 17 of the habitats directive and target 1 of EU2020 Biodiversity strategy;  
57 (ii) Research to support the implementation of the EU biodiversity  
58 strategy ([report](#))

59  
60 Along with the *EU Biodiversity Strategy to 2020*, the "**nature-based solutions**"  
61 concept has been emerging, calling for renewed needs of knowledge and actions.  
62 The "nature-based solutions" concept refers to the use of nature in tackling  
63 challenges such as climate change, food security, water resources, disaster risk  
64 management, etc. The purpose of the "nature-based solutions" concept is to  
65 encompass a wider definition of how to conserve and use biodiversity in a  
66 sustainable manner. By going beyond the threshold of traditional biodiversity  
67 conservation principles, this concept intends to additionally integrate societal  
68 factors such as poverty alleviation, socio-economic development and efficient  
69 governance principles. The International Union for Conservation of Nature  
70 (IUCN) is currently developing guidance on what type of interventions could/  
71 should/ should not be considered as a "nature-based solution" (NBS). Other  
72 groups are also discussing the definition of the concept of NBS such as the  
73 Horizon 2020 Advisory Group (AG) for Societal Challenge 5 'Climate Action,  
74 Environment, Resource Efficiency and Raw Materials'<sup>5</sup>.

75  
76 Examples of nature-based solutions:

- 77  
78 • Naturally connected floodplains and riparian ecosystems can provide flood  
79 protection for millions of people who are likely to experience increased  
80 flood risk
- 81 • Forest protection and reforestation can provide clean water, reduce flood  
82 risk and support carbon sequestration.
- 83 • Deep-rooted, nitrogen-fixing plants can naturally replenish soil nutrients in  
84 systems helping to maintain access to food supplies. The same plants can

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<sup>4</sup> report available at: <http://www.epbrs.org/event/show/35>

<sup>5</sup><http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=2924>



85 help filter sediments and nutrients keeping our waters clean and available  
86 for human consumption while enhancing carbon sinks.

- 87 • Mangrove forests provide protection services from coastal erosion and  
88 protect human lives in the face of severe storms while providing nurseries  
89 for fish which can feed coastal populations of people
- 90 • Well-managed and conserved grasslands provide forage for livestock while  
91 storing carbon in above- and below-ground biomass.

92  
93 Yet, more research and adequate implementation strategies are needed to  
94 investigate nature-based solutions, and to further explore how societies can  
95 avoid degrading their natural environment and the wealth of valuable benefits it  
96 provides. As a consequence, the Horizon2020 program of the European  
97 Commission<sup>6</sup> (EC) is expected to tackle nature-based solutions in its 2016-2017  
98 phase; and consultations are being set-up at a pan-European scale under the  
99 umbrella of the EC.

## 100 101 **Objectives of the BiodivERsA nature-based solution workshop**

102  
103 As the concept of nature-based solutions is rising on the research policy agenda,  
104 the scientific community and national research funders should start examining it  
105 more closely. The BiodivERsA horizon scanning workshop provided an  
106 opportunity for BiodivERsA project scientists and BiodivERsA members to:

- 107 • Learn more about nature-based solutions through discussions with policy  
108 makers and a range of stakeholders (NGOs, businesses, practitioners, etc.)
- 109 • Assess to what extent nature-based solutions have already been  
110 addressed in BiodivERsA-funded research projects
- 111 • Discuss how these nature-based solutions could be further investigated in  
112 the field of interest of participants. Such an exercise could produce lists of  
113 potential research priorities that could be considered by BiodivERsA's  
114 strategic agenda
- 115 • Further strengthen collaboration with other BiodivERsA-funded research  
116 projects.

117  
118 This workshop was an opportunity to involve scientists and stakeholders in the  
119 research development process from the start (identifying gaps of knowledge),  
120 and initiates a regular consultation with the project researchers to ensure they  
121 can also contribute to the upstream discussions on emerging research issues.  
122

## 123 **2 Methodology**

124  
125 The workshop was organized in two half days with a first session of framing  
126 presentations and panel discussions followed by a session of moderated round  
127 table discussions<sup>7</sup>. The workshop started with a short ice-breaker identifying  
128 main concerns and expectations from participants that were presented at the

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<sup>6</sup> <http://ec.europa.eu/programmes/horizon2020/en>

<sup>7</sup> See Annex 1: Programme



beginning of the next morning to see how these were being addressed by the ongoing discussions.

The keynote presentations gave an opportunity to better understand the concept of nature-based solutions as defined, used and illustrated by different actors and points of view. After the series of keynote presentations, the speakers took part in a panel discussion that allowed some exchanges on opportunities and challenges of using the NBS concept, as well as its relation to other terms such as 'ecosystem-based adaptation' and 'green infrastructures'.

For the first round of table discussions organised in the afternoon of June 11 were organised around five topics:

- Climate change adaptation and mitigation
- Water and Food production
- Soil, forest, land management
- Disaster risk management
- Social and economic innovation

These discussions focused on identifying *examples of possible Nature-based solutions* related to each proposed topic from participants' expertise and from BiodivERsA projects.

The following rounds of discussions on June 12 focused on identifying *knowledge gaps and potential research priorities related to these Nature-Based Solutions*.

The same five topics were addressed but as some participants were more interested to discuss the framing and applicability of the concept of NBS, another group of discussion was added specifically dealing with "*Framing the concept of NBS and identifying challenges and opportunities of using the NBS concept*".

## 3 Results

### 3.1 Keynote presentations

**Adrian Peres** (European Commission Directorate-General for Research and Innovation) gave an overview of the potential links of Nature Based solutions to Horizon 2020 summarizing the results of the first report of the Horizon 2020 Advisory Group (AG) for Societal Challenge 5: 'Climate Action, Environment, Resource Efficiency and Raw Materials'. In this report Nature-based is referring to: "inspired by, using, copying from or assisted by Nature" and with the aim of bringing economic, social and environmental benefits all together. These NBS should have some criteria including:

- Build in resilience- providing the ability to bounce back after perturbation.
- Reversibility- designing systems that are reversible where possible, that are locally attuned (in a geographical but also a social sense) and energy and resource efficient.
- Designing NBS in ways that take into account the larger, systemic context and that maintain or augment natural capital where possible.



These NBS could address major challenges such as: re-naturing and greening cities, restoring degraded ecosystems, adapting to climate change, human health and well being issues, disaster risk reduction, land use management, etc.

**Chantal Van Ham** (International Union for Conservation of Nature) introduced the IUCN definition of NBS with seven principles<sup>8</sup>:

1. The intervention delivers an effective solution to a major global challenge using nature
2. The intervention provides biodiversity benefits in terms of diverse, well-managed ecosystems
3. The intervention is cost effective relative to other solutions
4. The rationale behind the intervention can be easily and compellingly communicated
5. The intervention can be measured, verified and replicated
6. The intervention respects and reinforces communities' rights over natural resources
7. The intervention harnesses both public and private sources of funding.

Thereafter, it was illustrated how NBS could be employed for climate adaptation, disaster risk reduction, drinking water supply, and in urban environments. Finally, the need to bridge the gap between science and policy was highlighted.

After introducing the concept of 'Green Infrastructures', **Victor Beumer** (Deltares) illustrated the potential of "nature-based engineering" solutions in the context of water management. He pointed to four types of nature-based engineering: (1) using natural processes for multi-functionality and ecological functioning, (2) using natural processes for non-ecological functions, (3) ecological optimisation and/or integration in the landscape, and (4) mimicking natural processes in a technical/engineering design; and to need to validate concepts. Some key implementation principles identified include:

- Demonstrate the functionality of the NBS and the value for nature
- Tell the story around it to engage local stakeholders
- Look at how to cope with local legacies
- Include all stakeholders from the start of a (spatial) design process
- Design a valid business case
- Monitor to improve.

After a general introduction on the BiodivERsA ERA-net and its achievements, **Xavier Le Roux** (BiodivERsA coordinator) reported on the recent consultation of BiodivERsA Project Investigators<sup>9</sup> (PIs) who replied to an online questionnaire on nature-based solutions following a request of DG Research and Innovation. The questionnaire assessed to what extent the research supported by BiodivERsA addresses/could better address the issue of NBS. There was a high level of response to the questionnaire (i.e. 22 out of the 25 projects funded since 2010 answered) and one of the main comments highlighted by the researchers was the need to remain realistic and consider that there will be few 100% win-

<sup>8</sup> [https://cmsdata.iucn.org/downloads/iucn\\_programme\\_2013\\_2016.pdf](https://cmsdata.iucn.org/downloads/iucn_programme_2013_2016.pdf)

<sup>9</sup> Managers of BiodivERsA funded projects



win situations (i.e. where environmental, social and economic benefits are simultaneously met) so that trade-offs will have to be explored. In particular, NBS can limit short-term economic gain and there is a need to revise economic benefits with a long-term perspective. They also pointed to the need to change management and governance of socio-ecological systems and to accept complexity, uncertainty and diversity.

**Thomas Elmqvist** (Stockholm Resilience Centre; BiodivERsA URBES project) illustrated the potential of NBS in the urban context, as derived from the results of the BiodivERsA-funded project URBES. The project aims to bridge the knowledge gaps on the links between urbanization, ecosystem services and biodiversity. It address, amongst others, the potential of cities for climate change adaptation, mitigation, risk management and public health provision.

**James Hardcastle** (IUCN) presented IUCN's work in the 'Blue Solutions' initiative, a global platform that aims to synthesize lessons learnt and best practices in marine and coastal management. Using examples from Marine Protected Areas (MPAs) in Indonesia and the Salomon Islands, he illustrated how the Blue Solutions project aims to enhance the evidence base of MPAs enhancing both human needs and conserving nature.

Several questions were raised during the panel discussions, such as:

- How to avoid that NBS gets confined to the environmental sector (how do we reach beyond)?
- Why do NBS need to be innovative? What does it bring to society?
- Maybe we are too hooked on terms? We use different terminologies but aren't they all serving the same goals?
- How can we involve the different stakeholders in the process?
- Why do we actually need this new concept? What has happened with the concept of "sustainable development"?
- What is the link between NBS and bio-economy?
- What aspects of nature are considered in NBS?

In their responses, the speakers pointed out various elements, such as the need of looking for synergies between the various approaches; re-using existing ('old') techniques in NBS applications; using different languages (terminologies) when addressing different audiences; doing research on the concept; changing our behaviour (culture shift); raising awareness by demonstrating the potential of NBS for the environment/economy/society; and need for dissemination of research findings, amongst others.

### **3.2 Expectations & Concerns**

On the first day, participants were asked to identify their main expectations and concerns about the workshop.

Participants expectations were mainly related to better understanding and learning about the concept of NBS, how it can be implemented, which challenges



it could address and how it can help reach multiple benefits. Participants also expected to better understand the links with other concepts such as bio-economy, green infrastructures, natural capital, etc. They were also interested to see how this concept would influence future funding. Other expectations included listening to new ideas and networking with others from different fields of expertise.

Participants concerns were mainly related to the fear of having superficial discussions leading to nothing concrete, leaving them “lost in brainstorming”. The concerns were also targeting the concept of NBS itself, which for some participants, felt as a repackaging of other terms, blurry, unclear, and nothing more than a political buzzword. Many participants highlighted the need of looking at trade-offs as NBS is not *THE solution* and its application needs to be framed. Others highlighted the risk that the workshop would focus too much on the definition of the concept of NBS, and therefore not allowing to explore its potential. Some questioned whether the audience might be too broad or on the contrary too biased towards natural sciences.

### **3.3 Results of the round table discussions**

The following reporting is based on the results of the group discussions. However we decided to structure the results in a format that follows a gradient from more general comments (made in various discussion groups in addition to the group dedicated to framing the concept) to more practical specific proposals of nature-based solutions linked to some specific topics. Likewise the second section on research priorities compiles research recommendations from all groups from the more generic to the more specific.

#### **3.3.1 Framing the concept of nature-based solutions (NBS) and its applications**

The ideas listed below come from the various groups as the first discussion session showed that many participants judged that it was premature to jump into concrete examples of NBS while the concept itself still needed some framing. In addition, we also report here the outputs from the group that specifically discussed the framing the concept (group 6 June 12)<sup>10</sup>

##### **3.3.1.1. Framing considerations regarding NBS**

- ***NBS are referred to as ‘Innovative’ but it should not only refer to ‘new’ solutions*** as NBS might be a new concept but it encompasses already existing ideas; there might be innovative components in “old ways”; it is important to look back at what has been done to identify the potential NBS.

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<sup>10</sup> All notes from discussion groups are available in Annex 2



- ***From nature-based solutions to nature-based processes:*** Specific solutions follow from the social process needed to discuss and organize solutions. The quality of the solutions is thus considered to be dependent on the quality of the social process, e.g. regarding involvement and support of a diversity stake- and knowledge holders. As such, changing mindsets towards environment friendly and sustainable solutions is considered most promising. The solutions and strategies are developed in the social process and may change along the way.
- ***A key aspect is to involve the different stakeholders from the very beginning of the nature-based solution process,*** in particular for the following steps: Identification of the problem; Identification of the natural processes occurring; Knowledge building, information gathering. In this context, how “NBS” are reaching out to its target audience is critical and requires that the message is reframed depending on each audience. As a consequence, interdisciplinarity/ transdisciplinarity should be a Nature-based solutions rule.
- ***NBS are not THE solution to all problems. It is important to clearly define the problem that could be targeted.*** For complex problems, a negotiation process with stakeholders might be needed and not only simple solutions, which would not tackle the whole issue. Depending on the problem identification, NBS can be looked at through building blocks (e.g. Landscape approaches)
- ***Knowledge on NBS needs to be made available and shared.*** Both good and bad examples should be reported from various geographical areas (e.g. not just in developing countries but also in developed ones). NBS are often case specific and cannot easily be transferred to other settings but some ideas can be useful in various contexts.
- ***Other types of knowledge should be included when exploring NBS,*** in particular one cannot ignore ‘local knowledge’ in identifying NBS.
- ***Make links with other concepts such as Green Infrastructures (GI):*** GI can be part of NBS or NBS can be used to build GI
- ***NBS should account for multiple interests (economic, environmental, societal, etc.)*** as it should be a tool to provide input for different policies through the understanding of social and economic benefits in addition to environmental ones.
- ***Before implementing a NBS, a sound risk assessment is needed*** (as well as a *Plan B*) taking in consideration a life cycle analysis and the precautionary principle; NBS need to account for future environmental changes and especially all proposed NBS should be evaluated for being “climate proof”. The analysis should cover the full set of impacts (Climate Change, Biodiversity, Social well being) but also current lines of production to avoid «wrong» solutions e.g. Biofuels. Indeed, a NBS



solution can – at some point – become a problem (cf. pest control> invasive species)

- ***Based on the risk assessment, trade-offs for NBS need to be identified and documented*** for appropriate decision making in policy and management
- ***A large part of the NBS, solutions should be based on the integration of systems diversity*** (see Thomas Elmqvist's presentation) at any integration level of biodiversity. E.g: a forest, which is diverse (from a genetic point of view, age structure, community composition and habitats), will definitely be more prone to resist to disasters.

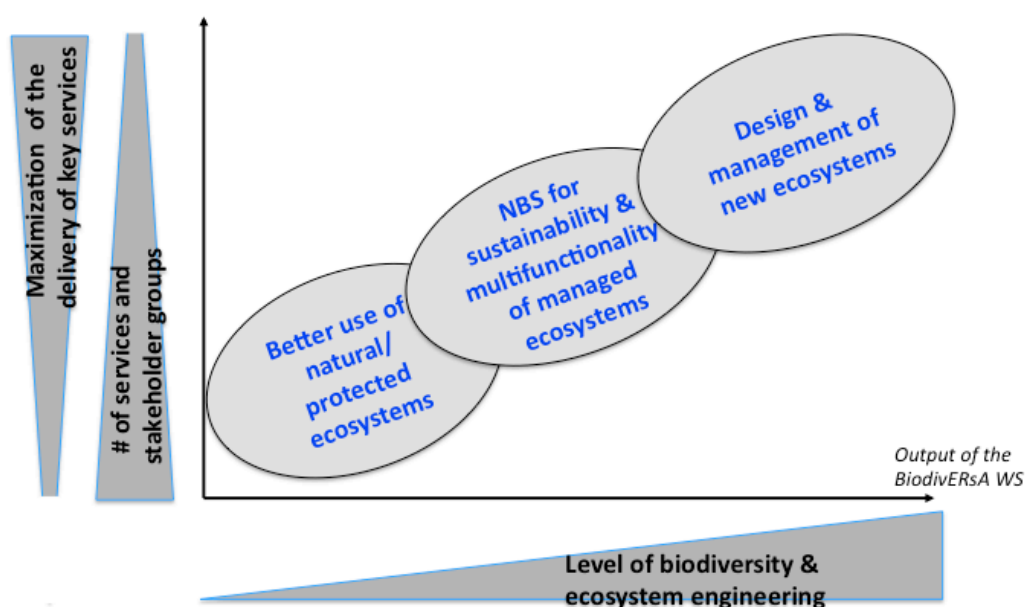
Participants highlighted that problems/issues as defined during the workshop were still too general, and that there is a need to look at more specific contexts in which NBS could be identified.

### 3.3.1.2. Proposed typology of nature-based solutions

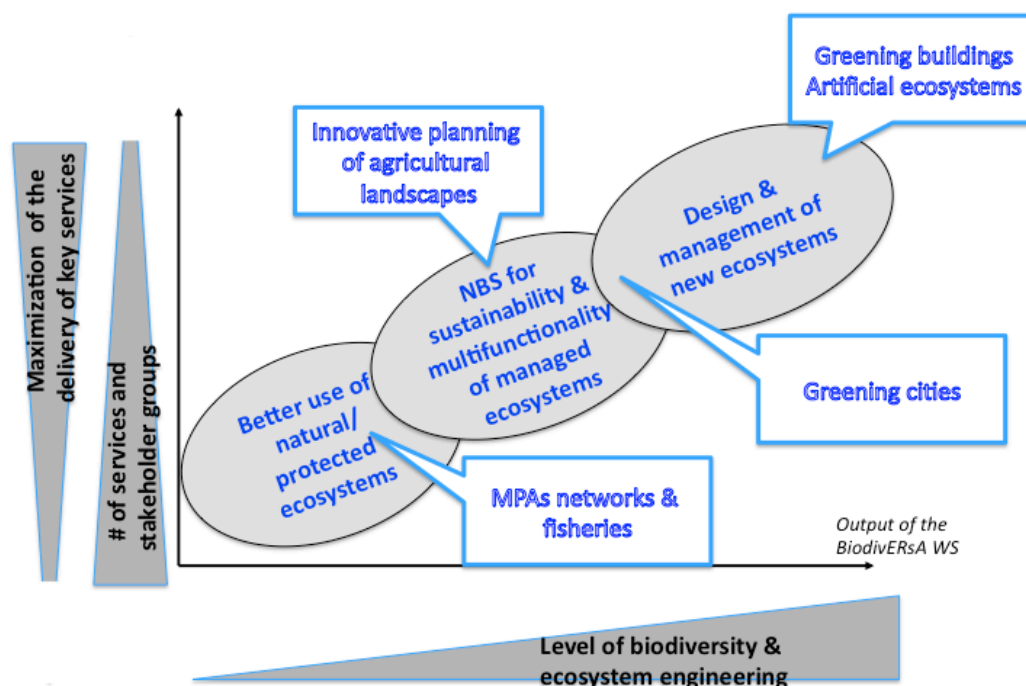
Participants proposed to categorize NBS along two gradients (Figure 1): 1) “how much engineering they involve” (modification of ecosystems) and 2) “how many services they maximize”:

- 1- NBS Type 1: They consist in better using existing ecosystems minimising the intervention on the systems themselves.
- 2- NBS Type 2: They modify existing ecosystems to better deliver selected ecosystem services
- 3- NBS Type 3: They consist in creating completely new ecosystems (e.g.: ecological engineering, green roofs, etc.)

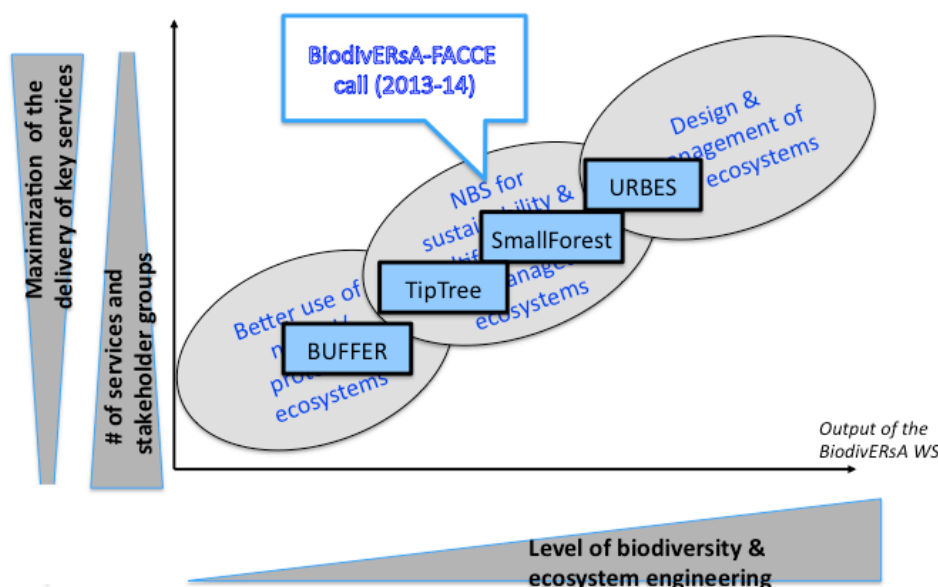
Participants identified some examples of NBS (Figure 2) for each type and some links with existing BiodivERsA projects (Figure 3)



**Figure 1 :** Schematic representation of the range of NBS approaches to be considered. Three main types of NBS are defined, differing in the level of engineering applied to biodiversity / ecosystems (X axis), and in the number of services to be delivered, the number of stakeholder groups targeted, and the likely level of maximization of the delivery of targeted services (Y axis).



**Figure 2 :** Some examples of NBS located in the schematic representation of Figure 1



**Figure 3 :** Some examples of NBS-relevant research projects funded by BiodivERsA located in the schematic representation of Figure 1. The type of NBS addressed by the BiodivERsA-FACCE call launched in late 2013 is also indicated.



### 3.3.1.3. Implementation of the concept of nature based solutions to contribute to social and economic innovation

- ***Raising awareness and building capacity in time***

Adequate implementation of nature-based processes/solutions requires awareness raising and capacity building which are time consuming, while problem solving is usually urgent. A collaborative and structured approach is needed to find a pragmatic balance between broad involvement on the one hand, and coordination (time) costs for organizing such process on the other hand. If stakeholders and policy representatives only get together when the problem has already manifested itself, setting up such process may take too much time in order to address the problem adequately. A pro-active approach would build such collaborative and structured capacity before the problems occur so that upcoming problems can be addressed timely.

- ***Trade-offs related to time pressure: technological versus natural solutions***

A major issue is the time frame in which nature-based solutions can be implemented and provide added value. On the short term, technological solutions might be considered more efficient. This raises the question of who decides on the trade-offs and what timing should be considered; whether actors are ready to accept time frames of nature-based solutions (i.e. nature decides on time frame); and what compromise is feasible, maybe by using nature friendly technologies?

- ***Up-scalability of local NBS and stakeholder importance***

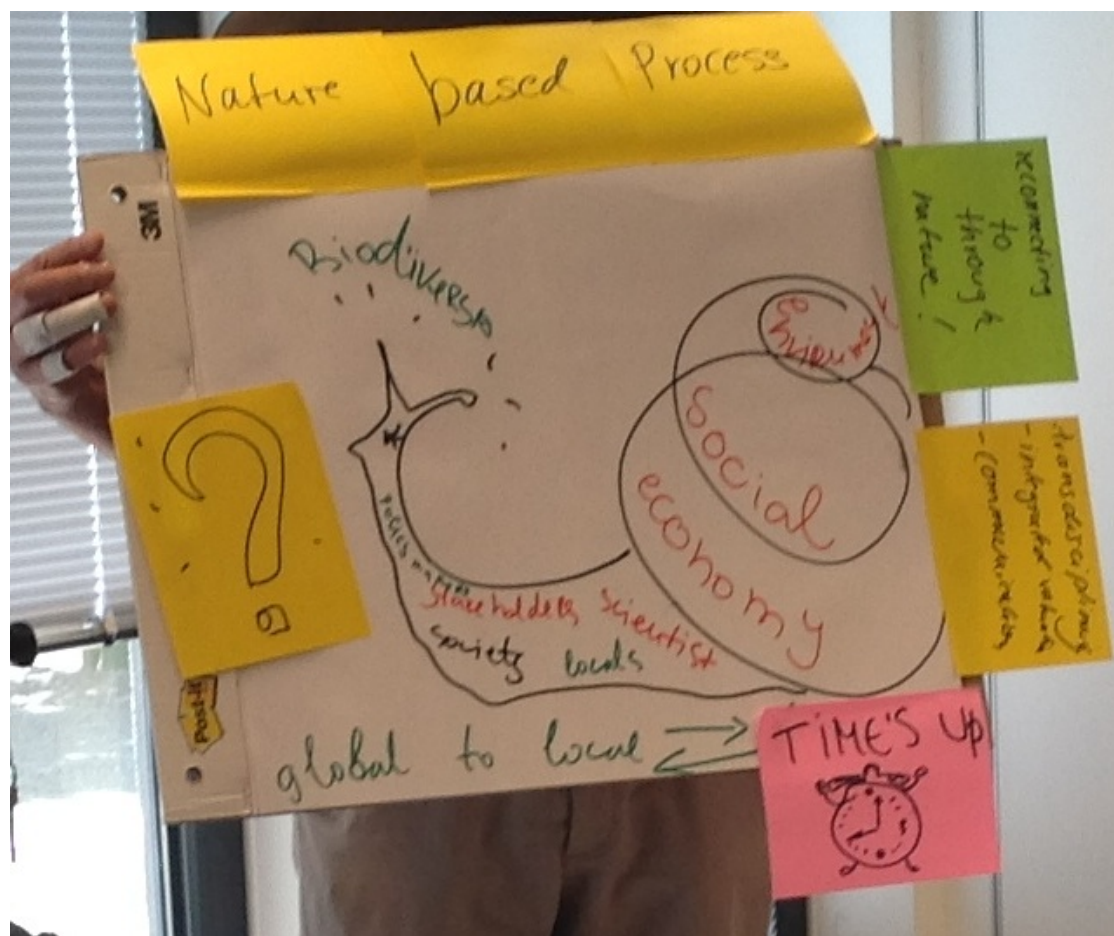
Nature-based solutions should be considered in relation to the scale at which they can be applied, and whether they could be implemented on a large scale and in a sustainable way. The question arises: What is more efficient - several local projects or a few global ones? In any case, the nature-based solutions (especially at local level) will need to use "the language of the community". They should be based on the principle of "Think globally act locally". There is a need to ensure the satisfaction of the stakeholders who participate in these actions.

- ***Changing mindset of how society evolves and contributing to reconnecting to and through Nature***

It is important to implement nature-based solutions in correct manner to have the desired results (not only to find the solutions, but to implement them). The communication towards the involved stakeholders needs to be done correctly.

To be successful, nature-based solutions/processes should contribute to "reconnect to and through nature" so that people change mindsets and behaviors. Indeed, NBS can also enhance social cohesion: an example was mentioned of people jointly planting trees (e.g. in disaster areas,) enhancing social cohesion and helping them to deal with their grief and to refocus on forward looking instead of mourning about the disaster that struck them. Also, rebuilding nature may offer jobs to a lot of unemployed people.

## The snail



- The body of the snail is made up of various stakeholders (scientists, locals, society and policy makers). They are the driving force to make the snail move
- The antennae are scientists, research organizations, and funding networks as BiodivERsA. They are sensing and giving information to the various stakeholders
- The shell represents the environment, society and economy. The upper curve is the smallest one (environment) but also the origin of the structure (that is the first part of the snail house growing). Economy is the largest one, a driving force.
- The snail moves into a direction. The destination can be based on many different things and goals.
- The time pressure is important.

***"Reconnecting to and through nature" would be an important slogan.***

**Figure 4:** A creative way to illustrate framing and implementation of NBS



### 3.3.2 Some example of nature-based solutions

For each topic below, participants discussed what could be possible nature based solutions but there was some difficulty in going to concrete, detailed examples which shows that the concept still need some maturation. Additional events and consultations would be very valuable.

#### 3.3.2.1. Disaster risk management/prevention

Participants highlighted that NBS should be rather identified and applied to risk mitigation and prevention, e.g. by reducing the intensity or extension of fires, or the economic and human impacts of land slides or floods.

A specific example of NBS:

- ***NBS such as traditional silviculture and extensive prairie and field management (now included in such management packages as agro-ecology or adaptive forestry) apply to prevent or mitigate disasters.***

A particular attention should be given to the risk of some NBS to become a “disaster” themselves after a certain period of time. Eg : [myxomatosis and related viruses introduced in Australia to manage invasive rabbits](#).

#### 3.3.2.2. Climate adaptation and mitigation

Participants highlighted several potential areas for NBS that can be broadly summarized under two headings:

- **NBS for Reducing carbon emissions:**

- ***NBS could focus on peat land conservation and restoration.***

Degraded peat land and peat land converted to agricultural land contribute significantly to global carbon emissions, restoring peat lands can at least help reduce ongoing carbon emissions, although a recent systematic review has shown that restored peat lands emit high levels of CH<sub>4</sub>. It seems very difficult and, if at all possible, it takes decades for restored peat land to regain its original capacity of carbon fixing. It should therefore be the first priority to halt all further destruction of functioning peat land.

- ***NBS to adapt/change the management of some production systems***

e.g. rice production to decrease CH<sub>4</sub>, or other agricultural production systems, particularly meat production, (see below climate smart ‘food production and consumption’).

- ***Identifying NBS options to stop ocean acidification*** could

contribute substantially to restoring the marine system, which plays an enormous role within the global carbon cycle.



## • NBS for increasing ecosystem resilience

Practically all ecosystems are affected by climate change and their resilience to changes and shocks as well as their capacity to deliver ecosystem services are often reduced. Therefore increasing resilience can be considered as a NBS for e.g. for water management. The above-mentioned conservation of natural sinks and buffers (e.g. peatlands and oceans) can contribute to this as well. Thus, both strategies (mitigating carbon emissions and increasing ecosystem resilience) are mutually re-enforcing.

- Protected Areas have proven to constitute important genetic reservoirs providing a broad diversity of cultivars. ***With the advancements of genetic identification technologies now available, this can be applied to identify well-adapted cultivars*** and use them to improve forest species composition in order to make forests more resilient to changing climate conditions.

- ***Ecosystem restoration was identified as providing considerable social co-benefits*** through increased contact with nature and by providing green jobs, often at better cost-effectiveness relation than other job creation programmes (Sweden).

- ***Greening cities*** can contribute to both strategies above and at the same time, provide significant health benefits (cf. reduced heat, more fresh air, contact with nature improves mental health).

There are significant co-benefits between the conservation of natural ecosystems and climate change adaptation. In cities almost all nature-based measures contributing to climate adaptation simultaneously contribute to climate change mitigation as well. So in this context, NBS should be a preferred policy option in both highly transformed ecosystems and e still very natural ones.

The group further discussed the need to adapt management of agricultural and forest systems so that they are better adapted to climate change and particularly for agricultural production and consumption discussed options for reducing CO<sub>2</sub> emissions. These are integrated with the results from the next group below.

### 3.3.2.3. Food production and consumption/ Food Security

Here, we report the results from several of the discussion groups that approached NBS and food production/food security through various angles:

- **“Climate-smart” Food production and consumption** based on less meat and dairy consumption. NBS should promote more “closed-cycle” production systems to:
  - Reduce CO<sub>2</sub>, biodiversity impacts, as well as “externalities” such as N or P Pollution, etc. (This would help increase resilience of ecosystems)

A huge potential for improvement could be achieved if consumer habits (especially diets and lifestyle) changed. There are some positive examples of how



more biodiversity friendly or climate change mitigating habits were achieved; it would be beneficial to systematically analyse these and learn from them. E.g. publicly known personalities can play important roles as ambassador. One example cited was of a famous chef who managed to significantly increase *Anchovis* consumption, formally considered a 'poor people food' in Peru". Similarly one could learn from the commercial introduction of new foods/habits. Key questions include: How to attach a positive image to the desired habits? How to reach the mainstream, not only niches of the population?

- **Agro-forestry as a (nature-based) way of producing sustainable food**
- **Alternative food sources (e.g. invertebrates) as a (nature-based) solution to reduce the environmental impact of food production**

The use of arthropods as a food source appears to be an emerging topic in European cuisine. At present, arthropods for consumption are farmed, so this would hardly classify as a NBS. For it to be nature-based, the animals should be harvested from relatively bio-diverse localities instead. An intriguing idea concerned the use of invasive alien arthropods as a food source, which ideally would tackle two problems at once. Examples of possible solutions: 'the blue cricket' or the 'red-veined darter approaches

- **Copying natural high-productive systems as a (nature-based) solution for maintaining soil productivity**

• **Crop rotation** (but it will need adjustment within the economical & governance framework): This technique allows replenishment of nitrogen through the use of green manure in sequence with cereals and other crops. Crop rotation also mitigates the build-up of pathogens and pests that often occurs when one species is continuously cropped, and can also improve soil structure and fertility by alternating deep-rooted and shallow-rooted plants

• **Establishment of ecological focus areas**, being areas for nature on farms. Such areas provide support for pollinators and beneficial organisms, which in turn, help with natural pest control. Such areas can also improve soil quality and soil fertility, provide erosion control, and contribute to scenic quality and cultural identity

#### 3.3.2.4. Water production

- ***Natural filtration systems and buffer zones (reed beds on local scale, wetlands on a wider scale) as a (nature-based) solution for water pollution***



### 3.3.2.5. Soil, Forest & Land Management

The major, over-arching issue (problem) identified in this area was the multifunctional use of landscape, more specifically for livestock; crop plants; recreation; wood production etc. leading to multiple stressors. This causes soil sealing, soil degradation, soil pollution; unsustainable food systems; emerging diseases; flora-fauna disturbance – to name a few.

- The main NBS identified was **“Integrated Spatial Planning/Management of the landscape mosaic”**

However, participants agreed this was still too vague. Therefore, they decided to focus on the problems of unsustainable food systems (reported above) and emerging diseases such as tree pests, Ash dieback (Chalara) and Phytophthora.

- **Possible NBS identified for emerging diseases such as tree pests included the use of resilient genotypes, increasing plant/soil diversity, and use of biological control agents.**

### 3.3.3 Knowledge needs/research recommendations related to nature-based solutions:

The research recommendations identified below are not exhaustive but indicative of some first key areas of research that could be addressed to support the identification and implementation of nature-based solutions.

#### 3.3.3.1 General research recommendations on Nature-based solutions

In relation to the concept of nature-based solutions, research is needed to:

- Assess the trio of benefits (economic, social and environmental)/ indicators for human well-being while addressing timescale for delivery of benefits
- Assess if Green Infrastructures are fit for purpose? E.g. Comparative assessments of current methodologies (especially for population genetics and functional connectivity)
- Develop risk assessments of NBS, especially for ecological risk
- Develop cost-effectiveness assessment and financial implications of NBS: focus on the valuation of some particular elements of ecosystem assessment that are not yet well investigated
- Explore political and social resistance to change what would be needed for implementing some NBS
- Further understand the drivers, correlates and incentives that drive the clash between the socio-economic and the natural environments and that could block a proposed NBS.



- Develop transdisciplinary methods and explore participatory ways of translating and sharing lessons learned on NBS (communication and collaboration with stakeholders)
- Conduct research on the governance needed to address the results of NBS risk assessments
- further understand the ecological processes and relationships between biodiversity/ecosystem functions and ecosystem services to feed potential NBS. (There is a need for an understanding of the natural processes but also on how to restore or improve them)

***A major enabling action would be to:***

- Create a European Training Network for building the interdisciplinary and transdisciplinary capacity on NBS.

**3.3.3.2 Some specific research priorities related to previously identified examples of nature-based solutions**

Here we report some research needs linked to the NBS examples identified during the discussion sessions and listed in the previous section. This is not a complete or exhaustive list of research priorities for each of the mentioned topic, but it is meant as a trigger to stimulate further discussion on NBS.

**Climate adaptation and mitigation**

**Reducing carbon emissions**

- ***Research needs on peat land conservation and restoration:*** Research needs arise with regard to optimal restoration approaches and better understanding of 'if' and 'how' peat land can regain its carbon sequestration function.
- ***Research on NBS options to stop ocean acidification:*** There are significant knowledge gaps and research needs related to both the natural science involved and the most promising policies to successfully reduce ocean acidification in practise.

**Increasing ecosystem resilience**

- One general research need is to ***increase the understanding of the role of Biodiversity for ecosystem resilience***

**Greening cities**

- Some remaining research gaps include: What are ***specific contribution of different species, potential and challenges of introducing species, creating new ecosystems?***, as greening cities often rely on newly created ecosystem.



## Food production and consumption/ Food Security

- ***“Research needs for Climate-smart” Food production and consumption*** based on less meat and dairy consumption.

The identified research gaps focussed mainly on socio-economics and policy including questions such as:

how can a more “politically viable” reform of Common Agricultural Policy (for the EU, but also globally) be derived?

Specific aspects include: How to achieve more climate and biodiversity benefits through subsidy reforms and other instruments? E.g. taxes

- ***Research on Alternative food sources (e.g. invertebrates)***

There are some knowledge needs related to alternative food sources (e.g. invertebrates) as a (nature-based) solution to reduce the environmental impact of food production:

- Feasibility within and across Europe, both climatically, ecologically and socio-economically of these alternative food sources
- Consumers acceptance is an overruling factor as there seems to be a reluctance to this kind of food, yet many details of this might represent knowledge gaps worthy of further investigation.
- Harvesting techniques & impacts on local biodiversity and ecosystem functioning

- ***Research related to copying natural high-productive systems as a (nature-based) solution for maintaining soil productivity***

Any potential knowledge gaps on natural high-productive systems are related to the domains of soil ecology and biogeochemistry. These are currently very active fields of research, so progress towards nature-based solutions for these issues should be ongoing.

In contrast to the cutting-edge advances in these fields, there might be much to learn from old (forgotten?) agricultural practices. Research into such practices might equally be recommended.

- ***Research to make our food supply/systems sustainable***

In this area, further research would be needed on

- Effectiveness of ‘green elements’ in enhancing agricultural productivity, pathways used, long-term sustainability
- Community dynamics in anthropogenic landscapes



## Water production

- ***Research on natural filtration systems and buffer zones (reed beds on local scale, wetlands on a wider scale) as a (nature-based) solution for water pollution***

The role of reed beds and wetlands in filtering out major nutrients like nitrogen and phosphorus has already been extensively studied, however, for several substances (e.g. **pharmaceuticals**), we need more on bio-accumulation/cycling... and its effects on ecosystem and species health.

A question was raised on sites where nature-based solutions and especially engineered new ecosystems would be implemented ('NBS sites'), that could favor invasive alien species, given their degree of suboptimal habitat quality and anthropogenic disturbance.

## Soil/forest/land management

- ***Research is needed to further explore "Integrated Spatial Planning/Management of the landscape mosaic",***
- ***Research is needed to improve the understanding of resilience of ecosystems (mechanisms/pathways/important of keystone species/...);*** better knowledge of the role of functional and genetic diversity; and a better understanding of community dynamics in anthropogenically modified landscapes.
- ***Research is needed to more efficiently fight pests:*** long term dynamics of resilient genotypes, effects of increasing plant/soil diversity, and effects of biological control agents.



805

## 806 **4 Conclusions**

807

808 This workshop was a good opportunity to see how experts from various  
809 disciplines (although the audience was mainly dominated by natural sciences)  
810 tackle the new concept of nature-based solutions. Clearly the first round of  
811 discussions and the analysis of expectations and concerns showed that the  
812 concept raised a lot of questions and that participants felt uneasy to just jump  
813 into identifying examples of nature-based solutions. Some discussions on the  
814 framing of the concept and conditions of implementation were necessary and  
815 these generated important recommendations such as the fact that 'Innovative'  
816 NBS can also make use of "old forgotten ideas", that NBS are not THE solution to  
817 all problems but can contribute to help develop more sustainable practices in  
818 many fields, etc.

819 An important contribution was the development of a typology of NBS :

- 820 1- NBS Type 1: They consist in better using existing ecosystems minimising
- 821 the intervention on the systems themselves.
- 822 2- NBS Type 2: They modify existing ecosystems to better deliver selected
- 823 ecosystem services
- 824 3- NBS Type 3: They consist in creating completely new ecosystems (e.g.:
- 825 ecological engineering, green roofs, etc.)

826

827 Based on 2 gradients: 1) maximising ecosystem services, 2) Increasing  
828 engineering

829

830 Another key comment related to the links between all the concepts and terms  
831 that are currently used: ecosystem based adaptation, green infrastructures,  
832 sustainable development, natural capital, etc. There is a call for clarifying how all  
833 these terms connect as they clearly serve a common goal.

834

835 Some of the (research) recommendations relate to general criteria/framing  
836 conditions of NBS, such as the need to explore risk assessments and trade-offs,  
837 and the importance of developing transdisciplinary approaches for a good  
838 engagement of stakeholders. Some specific knowledge gaps were also identified  
839 in relation to the proposed NBS examples. However, further discussion and  
840 consultation is needed to investigate in more detail the cases/issues where NBS  
841 could bring added value, and to evaluate how BiodivERSA could take these  
842 further in it's strategic agenda.

843

844



## Annex 1- FINAL PROGRAMME

### Wednesday 11 JUNE (p.m.)

13.00 – 14.00: Registration

14.00 – 14.15: Welcome (aims of the workshop & practicalities) (*Hilde Eggermont & Estelle Balian, Belspo*)

14.15 – 14.30: Nature-based solutions for Horizon2020 challenges (*Adrian Peres, DG-RTD*)

14.30 – 15.00: Nature-Based solutions from a IUCN perspective

- 14.30 – 14.45: Pioneering nature-based solutions (*Chantal van Ham, IUCN*)
- 14.45 – 15.00: Blue Solutions for marine and coastal biodiversity conservation (*James Hardcastle, IUCN*)<sup>11</sup>

15.00 – 15.15: Nature-based engineering & water services (*Victor Beumer - Deltares*)

15.15 – 15.30: BiodivERsA past and future activities, and link with nature-based solutions (*Xavier Le Roux, BiodivERsA project coordinator*)

15.30 – 15.45: Nature-based solutions in an urban context: how smart are smart cities? (*Thomas Elmqvist, Stockholm Resilience Center, URBES project*)

15.45 – 16.15: Panel discussion on the added value of the Nature-Based solution concept; challenges; concerns...

16.15-16.40: COFFEE BREAK

16.40 – 17.15: 5 min presentations by BiodivERsA project scientists illustrating nature-based solutions in their research project

17.15 – 18.00: Round table discussion I: working groups will be organized by thematic such as climate change adaptation, water management, food security etc. During the group discussions participants will identify potential Nature based solutions in their field of research/expertise, and experts from BiodivERsA funded projects will identify connections between their project and Nature based solutions.

Social event:

18:30: Guided walk from Belspo to [Musée des Instruments Musiques \(MIM\), Bruxelles](#) and 19:30 light diner (buffet) in the panoramic restaurant of the MIM.

### Wednesday 12 JUNE (a.m.)

9.30 – 9.50: Wrap-up of 1<sup>st</sup> day; Nature-Based solution (awareness) movie

9.50 – 10.30: Round table discussion II: working groups work continues. Scientists and other participants will also discuss potential research priorities (cf. key knowledge gaps) to better help developing nature-based solutions for these thematics/fields.

10.30 – 10.50: COFFEE BREAK

10.50 – 11.30: Round table discussion III: working groups' final session to compile and present discussions results and recommendations.

11.30 – 12.30: Debriefing and Conclusions

<sup>11</sup> The presentation was a narrated powerpoint displayed on the morning of the 12th of June



899

## 900 5 Annex 2- Round table discussions- Notes

### 901 5.1 Group 6 Day 2: "Framing the concept of NBS"

902

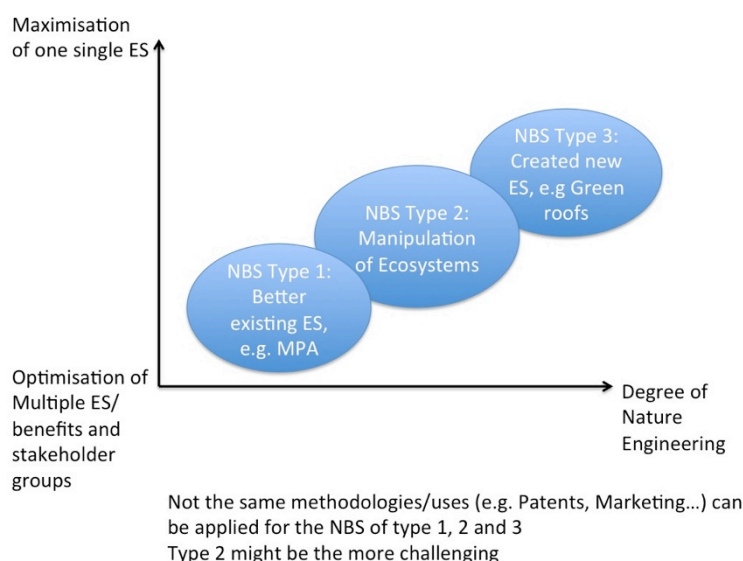
#### 903 General comments on the concept:

- 904 • Main questions/aspects to consider
  - 905 • It might be a new concept but encompassing already existing things
  - 906 • There might be innovative components in "old ways"
  - 907 • Importance to look back at what is done to identify the potential NBS
- 908 • Not just focus on "the solution" but also the nature-based process that can include improvements
- 909 • Important to clearly define the problem: if it is a complex/wicked problem there might need to be a negotiation process and not just simple solutions
- 910 • NBS can be looked at through building blocks (e.g. Landscape approaches)
- 911 • Importance of sharing existing knowledge on NBS: give both good and bad examples not just in developing countries but also in developed countries.
- 912 • Include other knowledge types than just scientific knowledge to look at NBS
- 913 • Links with other concepts such as Green Infrastructures: GI can be part of NBS or NBS can be used to build GI
- 914 • NBS is a tool to provide input for different policies (through the understanding of social and economic benefits in addition to environmental ones)
- 915 • It is important to take in consideration the target audience for NBS: reframing the message for each audience
- 916 • NBS should have a risk assessment to comply with precautionary principle

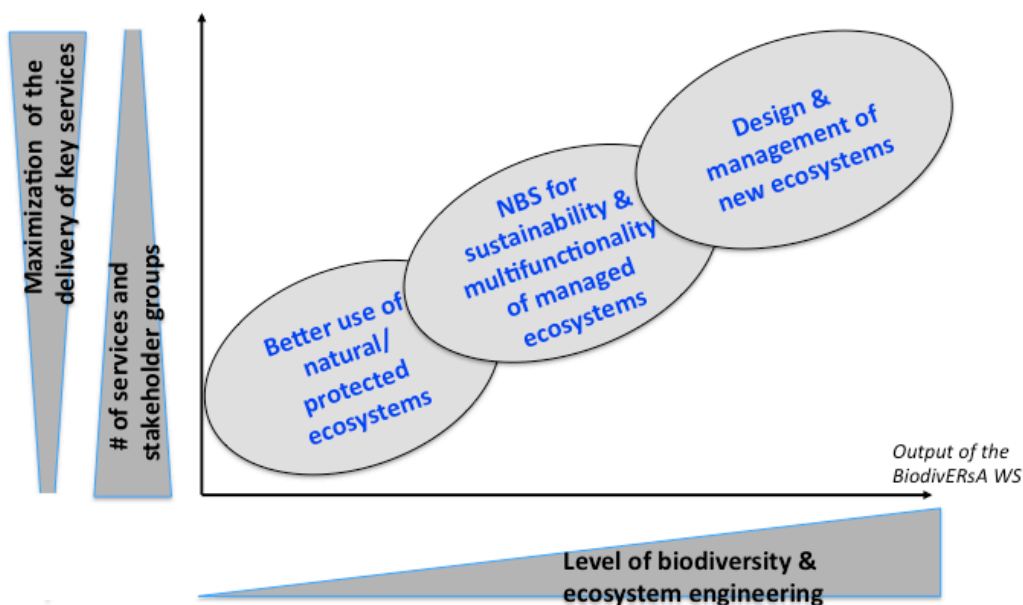
925

#### 926 Proposed typology

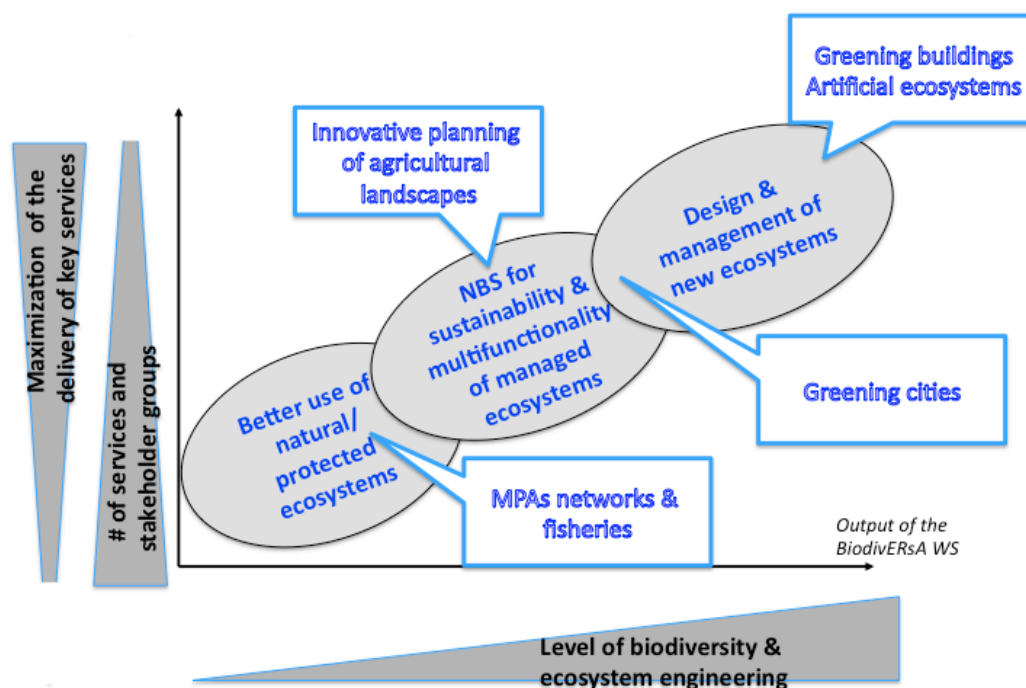
- 927 4- Better using existing Ecosystems
- 928 5- Modifying Ecosystems to better deliver services
- 929 6- Creating completely new Ecosystems ( i.e. ecological engineering)



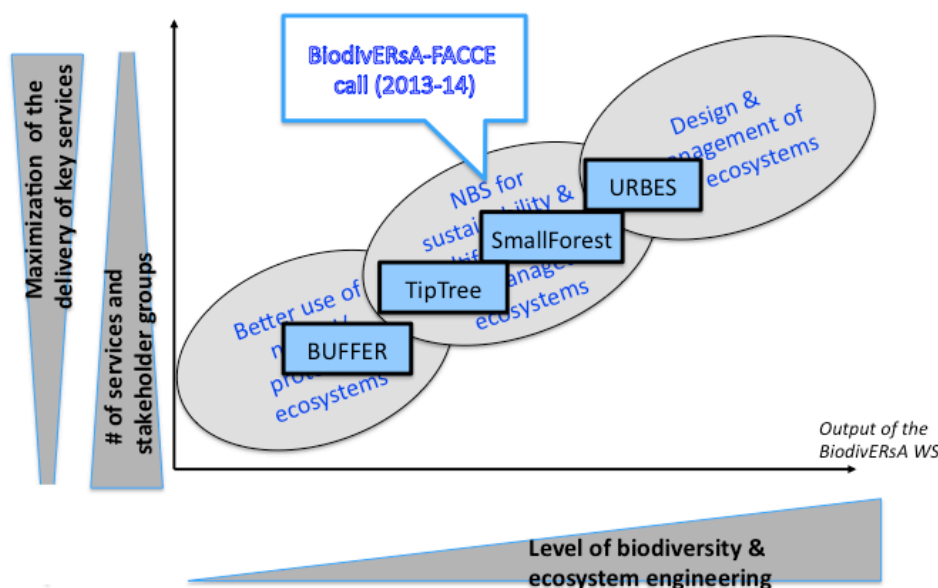
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**Figure 1 :** Schematic representation of the range of NBS approaches to be considered. Three main types of NBS are defined, differing in the level of engineering applied to biodiversity / ecosystems (X axis), and in the number of services to be delivered, the number of stakeholder groups targeted, and the likely level of maximization of the delivery of targeted services (Y axis).



**Figure 2 :** Some examples of NBS located in the schematic representation of Figure 1.



**Figure 3 :** Some examples of NBS-relevant research projects funded by BiodivERsA located in the schematic representation of Figure 1. The type of NBS addressed by the BiodivERsA-FACCE call launched in late 2013 is also indicated.

#### Knowledge needs regarding NBS :

- How do we assess the trio of benefits/ Indicators for well-being reconciling Economic, Social and Environmental, and Timescale for delivery of benefits
- How do we assess if Green Infrastructures and fit for purpose/ comparative assessments of the methodologies especially for population genetics and functional connectivity
- Risk assessments of NBS especially for ecological risk
- Cost-Effectiveness assesement: Valuation of some particular elements of ES
- Explore Political and social resistance to change that would be needed for some NBS
- Explore participatory ways of translating and sharing lessons learned on NBS
- Research on the governance needed to address the results of the risk assessment
- Still maintain research on the relationships between biodiversity/Ecosystem functions and Ecosystem Services to feed potential NBS
- Create a European Training Network for building the interdisciplinary and transdisciplinary capacity on NBS

#### 5.2 Group 1 Day 1 &2: "Climate Change adaptation and mitigation"

- Reduce Carbon Emission
  1. Peatland conservation and restoration (less effective)
    - a. Analyse full set of impacts (carbon, BD, Well being) of any solution
    - b. E.g. Water management
    - c. How to reduce N Pollution
  2. Eat less meat and dairy



a. how to turn it into something positive : use ambassadors ??

- Adapt/change management of e.g. rice production decreases CH<sub>4</sub>
- Marine Restoration: what are the last options to stop acidification
- Increase Resilience
  - Water management
  - Conservation
  - Restoration
    - Social co-benefits from increased contact with nature
    - Green jobs
  - Using genetic reservoirs from PA to improve forest? species composition
    - Better understand the role of BD for resilience
  - Greening cities
    - Health benefits (heat, air, contact with nature improves mental health)
    - What are specific contribution of different species

Develop politically ??water policy ?? more for ???

Develop closed-cycle agriculture

### Power of biodiversity for CC mitigation and adaptation

- Conserve natural sinks and buffers (e.g. Peatlands, ???) but also other natural systems (e.g. Protected Areas as genetic reservoirs)
- Restore degraded Ecosystems, watershed management, Green cities
- Benefits : health benefits, social benefits e.g. jobs, ??? to nature, biodiversity habitat
  - Which species are best suited ?
    - Potential and challenges of introducing species
  - Which policies are most promising, e.g. to reduce ocean acidification ?
  - Best approach for « in between » (very valuable-degraded) landscapes ?

Climate proof solutions

Analyse full set of impacts (CC, Biodiversity, Social well being) of all solutions but also current lines of production to avoid « wrong » solutions e.g. Biofuels

- Risk assessment
- Life cycle analysis
- Precautionary principle
  - How to ensure it is adequately included in policy?
  - Trade offs fully covered

Legend:

Research gaps-knowledge gaps

NBS, approach measure

Co-benefits

“Climate-smart” Food production and consumption

- More closed cycle production systems



- 1036 - Reduce CO<sub>2</sub>, biodiversity impacts, “externalities” such as N
- 1037 Pollution, P, etc.
- 1038 ○ Helps increase resilience of Ecosystems
- 1039
- 1040 - Politically viable “CAP” reform
- 1041 ○ How to achieve more climate+biodiversity benefits in subsidy
- 1042 reforms? + other instruments e.g. Taxes
- 1043 - Change consumer habits especially diets and lifestyle
- 1044 ○ Learn from positive examples, e.g. ambassadors, chefs,
- 1045 “Anchovis in Peru”
- 1046 ○ Also commercial introduction of new foods/habits
- 1047 ○ How to make it something positive
- 1048 ○ Reach the mainstream, not only niches
- 1049

1050 NB: similar for energy production and consumption

### 1051 **5.3 Group 2 Day 1 & 2: “Water and food production”**

1052

#### 1053 **Day 1**

1054 No participant claimed to be an expert in the fields of food production and water (the

1055 latter being defined as freshwater quality and availability), nor to work on a related

1056 BiodivERsA project. Therefore, participants seemed to approach this round table

1057 discussion rather as a brainstorm exercise. On this first day, the participants identified

1058 the following challenges (issues), and corresponding nature-based solutions.

1059

Main challenge / issue	Nature-based solution
1. Sustainable food production	Agroforestry
2. Reduce the environmental impact of food production	Alternative food sources (e.g. invertebrates)
3. Maintain soil productivity	Copy natural high-productive systems
4. Pollution	Natural filtration systems and buffer zones (reed beds on local scale, wetlands on a wider scale)

1060

1061 While doing this exercise, it appeared unavoidable for some participants to also have a

1062 discussion on the meaning (definition) and added value of the nature-based solutions

1063 concept itself. Since this was not central to the round table discussion, these outcomes

1064 are not reported here.

1065

#### 1066 **Day 2**

1067 The group of participants on day 2 largely consisted of the same people as that from day

1068 1. We therefore chose to stick to the nature-based solutions already identified and hold

1069 an in-depth discussion on them (table above).

1070

- 1071 1. *Agroforestry* as a (nature-based) way of sustainable food production

1072 The one participant that suggested this solution was not present. As the other

1073 participants were not acquainted with this discipline, no one felt comfortable to further

1074 discuss agroforestry.

1075

- 1076 2. *Alternative food sources (e.g. invertebrates)* as a (nature-based) solution to
- 1077 reduce the environmental impact of food production



An extensive and animated brainstorm discussion developed on the ecological aspects of “eating bugs” (as one participant put it simply). Indeed, the use of arthropods as a food source appears to be an emerging topic in European cuisine.

At present, arthropods for consumption are farmed, so this would hardly classify as a nature-based solution. For it to be nature-based, the animals should be harvested from relatively biodiverse localities instead. Clearly, there are some related issues for which knowledge is lacking, and further research would be needed:

- the feasibility within and across Europe, both climatically, ecologically and socio-economically
- harvesting effects on local biodiversity and ecosystem functioning
- harvesting techniques

All participants agreed that consumer acceptance is an overruling factor, here. Overall, there seems to be a reluctance to this kind of food, yet many details of this might represent knowledge gaps worthy of further investigation.

An intriguing idea raised by one participant (an expert on invasive alien species) concerned the use of invasive alien arthropods as a food source, which ideally would tackle two problems at once. This proved an interesting topic for further discussion. For instance, it inspired one other participant to put larvae of an invasive dragonfly species (a darter species) on the menu in Sweden.

This proved a fun part of the discussion. Solutions were nick-named ‘the blue cricket’ and ‘red darter approach’, and little drawings of them were made on the flipchart...

### 3. *Copying natural high-productive systems* as a (nature-based) solution for maintaining soil productivity

Any potential knowledge gaps on natural high-productive systems were perceived as falling within the domains of soil ecology and biogeochemistry. These are currently very active fields of research, so progress towards nature-based solutions for these issues seem to getting covered.

In contrast to the cutting-edge advances in these fields, it was raised by several participants that there might be much to learn from old (forgotten?) agricultural practices, here. Research into such practices might equally be recommended.

### 4. *Natural filtration systems and buffer zones (reed beds on local scale, wetlands on a wider scale)* as a (nature-based) solution for water pollution

The role of reed beds and wetlands in filtering out major nutrients like nitrogen and phosphorus has already been extensively studied, the participants agree. However, for several substances (e.g. pharmaceuticals), we need more on bio-accumulation/cycling... and its effects on ecosystem and species health.

One participant raised the question whether sites where nature-based solutions would become realized (‘NBS sites’), would not particularly favor invasive alien species, given their degree of suboptimal habitat quality and anthropogenic disturbance.

### 5. General

The discussions were mostly restricted to the very specific suggestions of solutions identified on day 1, and no general research needs were identified. Yet, the research needs listed could inspire specific BiodivERSA projects on the challenges listed in the table. Also, this proved a valuable opportunity for the participants to reflect on the conceptual bases of nature-based solutions, and how to turn these into practice.



## 5.4 Group 3 Day 1 & 2: “Soil, forest and land management”

During the discussions, some general (concept-related) issues were mentioned:

- NBSolutions are case specific; you cannot easily transfer them to other settings
- Before implementing NBS, a sound risk assessment is needed (likely also a Plan B)
- NBS need to account for future environmental changes
- NBS should account for multiple interest (economic, environmental, societal,...)
- Problem/Issues as defined during this workshop are still far too general. We need to specify/detail (i.e. various sub-issues to deal with)...
- A NBS solution can – at some point – become a problem (cf. pest control>invasive species)
- One cannot ignore Local Knowledge in identifying NBS
- A NBS for one particular problem, could also be a potential NBS for another problem

The major, over-arching issue (problem) identified in the area of “Soil, Forest & Land management” during both discussion days was the “Multifunctionality of landscapes (livestock; crop plants; ..)/multifunctional use leading to multiple stressors”.

A major NBS identified was “Integrated Spatial Planning/Management of the landscape mosaic” though participants agreed this was still too vague.

Sub-issues identified under this umbrella included:

- Sustainable food supply
- Soil sealing, soil degradation, soil pollution
- Emerging diseases
- Recreational issues leading to soil compaction/flora-fauna disturbance
- Forest logging
- ...

On day two – participants mainly focused on the issues of “Sustainable Food Supply” and “Emerging diseases/Pests”.

Sustainable Food Supply

Several aspects were considered important to ensure this:

- Flood defence
- CO2 storage
- Improved water quality
- Nitrogen uptake/release
- Animal welfare

Possible NBS solutions identified included:

- Crop rotation (but it will need adjustment within the economical & governance framework)
- Riparian buffer zones
- Ecological focus areas (contributing to pollinator diversity etc.)

Research needs identified in this area

- Studies on agricultural production systems

Emerging diseases/pests

Most importantly:

- Tree pests
- Ash dieback (Chalara)



1182 • Phytophthora  
 1183 Possible NBS solutions identified included:

- 1184 • Resilient genotypes
- 1185 • Plant/Soil diversity
- 1186 • Biological control agents

1187  
 1188 Research needs identified in this area

- 1189 • Understanding the resilience of ecosystems (mechanisms/pathways/..)
- 1190 • More research is needed in the field of functional and genetic diversity; need for
- 1191 a better understanding of community dynamics/interactions between species/...

## 1193 **5.5 Group 4 Day 1 & 2: “Disaster risk management”**

1194  
 1195 **Day 1.**

1196 From the experience of the members of the group, the examples of disasters for  
 1197 which a NBS could be developed centered around issues that turned out to be  
 1198 related to land cover, including

- 1199 • Land slides
- 1200 • Fires
- 1201 • Soil erosion
- 1202 • Floods
- 1203 • Invasive species
- 1204 • Climate change

1205 Several disaster examples came from the participants experience in Forest  
 1206 management, which is a topic where many of the above-mentioned disasters are  
 1207 occurring. However, they could not identify and provide concrete examples of  
 1208 NBS's applied to risk management in any of these areas (beyond the perception  
 1209 that these problems were caused by human changes to land cover), neither  
 1210 provide a link to any concrete BiodivERsA project.

1211  
 1212 The participants nevertheless concluded that NBS should be better applied to  
 1213 risk mitigation and prevention, e.g. by reducing the intensity or extension of  
 1214 fires, or the economic and human impacts of land slides or floods. They identified  
 1215 the need for involving the different stakeholders from the very beginning of the  
 1216 NBS process, in particular for the following steps:

- 1217 ✓ Identification of the problem
- 1218 ✓ Identification of the natural processes occurring
- 1219 ✓ Knowledge building, information gathering.

1220  
 1221 A particular attention was drawn on the potentiality of some NBS to become a  
 1222 disaster after a certain period of time. Eg : [myxomatosis and related viruses](#)  
 1223 [introduced in Australia to manage invasive rabbits](#).

1224 NBS such as traditional silviculture and extensive prairie and field management  
 1225 (now included in such management packages as agro-ecology or adaptive  
 1226 forestry) apply to prevent or mitigate disasters.

1227



A large part of the NBS solutions should be based on the integration of **systems diversity** (see Thomas Elmqvist's presentation) at any integration level of the biodiversity. E.g: a forest which is diverse from a genetic point of view, age structure, community composition as well as ecosystem and landscape involved, will definitely be more prone to resist to disasters.

## Day 2

Due to a shift in participant's contribution, the subsequent discussion focused more on disaster prevention.

Participants reasoned about knowledge gaps on a very general basis, and came up with two main ideas.

1. If a NBS is to be implemented, research may be needed on the natural side of it. Participants realized that there is a chain that starts with species which are involved in ecological processes and that these in turn provide services.

For some participants, these services are the core of the NBS, and restoring or improving them should drive the research, while for other participants, the ecological processes are the core of the NBS. The research itself should therefore be focused on unraveling the **underlying ecological processes**, and go down at the species level only when needed to elucidate a particular issue.

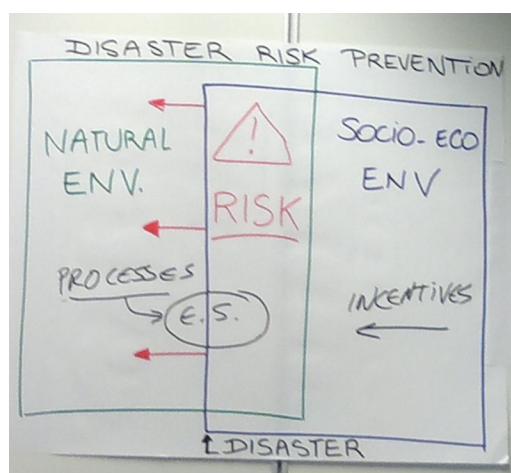
An outcome of this is that disaster risk reduction could in these cases be a justification for ecological restoration projects. As personal afterthought, one participant added that there also may be a need for research on how to go about restoring lost or damaged ecological process. This could entail ecology and engineering collaboration. So there is a need for an understanding of the natural processes but also on how to go about and restore or improve them.

2. Considering that disasters, including those listed above, arise in a certain socio-economic context and sometimes spring from human changes to the natural environment, it was also figured that research is needed on the **social and economic drivers or correlates of those changes**. This is particularly necessary because those drivers/correlates may also block any proposed NBS if not considered in the solution.

A particular concern was that NBS are more durable than technological fixes, but that they may take more time to implement. This is particularly obvious if the plan is to restore a forest, in which case the timeframe to completion is measured in decades. In that case, any NBS should include changes in time expectations from the society.

Multi/transdisciplinarity should be a NBS rule (see also stakeholders involvement from Day 1 discussions)

The figure on below was the attempt to integrate all this. In any case, the risk notion arises from a socio-economic context. Without such a context, there would only be the occurrence probability of a particular event (species invasion, fire event, flooding event, etc.) Risks are seen as increasing with /arising from the socio-economic environment encroaching (red arrows) on the natural environment, affecting the ecosystem services (E.S.) it provides through disruption of natural processes. The two areas of research needed are noted on the figure: (1) on the **ecological processes** that allow the provision of the necessary ecological services, and (2) on the **drivers, correlates and incentives**, that drive the clash between the socio-economic and the natural environments and that could block a proposed NBS.



## 5.6 Group 5 Day 1 & 2: "Social and economic innovation"

Table : Brainstorming results on which possible Nature-Based solutions for which issues:

Main challenge/issue	Nature-based solution/Example from Biodiversa project	Knowledge gaps/research needs
Job creation	Disaster risk reduction based on NBS, e.g. planting trees in watershed; investment in the insurance value of ecosystems – labor intensive	
Lack of bottom-up processes in environmental issues within the EU. How to foster mechanisms for co-production of knowledge? How to scale up?	Social- ecological restoration of degraded areas; creating pockets of social-ecological innovation – linking in a multilevel context	Transdisciplinary processes
Attitude ... Poverty	Time frame is important ...	



Promote community cohesion Food security Conserving biodiversity	Promote traditional agricultural knowledge	How to increase the economic returns of traditional agriculture How to promote agro-eco-tourism
Out breaking rodents causing damage, leading to culture of use of poison/wildlife damage	Increasing raptor density with nesting patches in otherwise industrial farmlands	Quantify impact on crop rodent population and farmer feeling they are empowered
Poverty Social interaction gaps	Public gardens in cities and towns	

The group discussed several main issues (underlined) and identified within it obstacles and knowledge gaps.

- ***From nature based solutions to nature based process***

Specific solutions follow from the social process needed to discuss and organize solutions. The quality of the solutions thus is considered to be dependent on the quality of the social process, e.g. regarding involvement and support of a diversity stake- and knowledge holders. As such changing mind sets towards environment friendly and sustainable solutions is considered most promising. The solutions and strategies are developed in the social process and may change along the way.

Awareness raising and capacity building is time consuming, but time is short, problem solving is urgent. A collaborative and structured approach is needed that finds a pragmatic balance between broad involvement and the coordination (time) costs for organizing such process. If stakeholders and policy representatives only get together when the problem has already manifested itself, setting up such process may take too much time in order to address the problem adequately. A pro-active approach would build such collaborative and structured capacity before the problems occur in order to be able to address upcoming problems timely and well prepared.

Knowledge gaps:

- -communication and collaboration between different stakeholders; how to make transdisciplinarity really work?

- ***Reconnecting to and through nature, enhancing social cohesion***

Here the example of people jointly planting trees, e.g. in disaster areas, was mentioned as a good example of enhancing social cohesion and helping people to deal with their grief and help them refocus on forward looking instead of stay mourning about the disaster that struck them. Also rebuilding nature may offer jobs to a lot of unemployed people.

- ***Integrated valuation***

When NBP and NBS are only valued in the short term and based only on monetary valuation systems, they have difficulty to compete with more technological grey solutions. When a longer time frame is taken into account as well as also other valuation systems and methods, such as public health, a different assessment can be made, showing the importance of nature based benefits.

Knowledge gaps:



- financial impact of NBS, integrated valuation method is needed (ESS plus other valuation systems and methods)

- ***Time pressure – technological vs natural solutions***

The time frame of nature based solution is key as they might be cheaper but may take more time.

Who decides on the time pressure?

How can we free us from the time pressure?

Are we ready to accept the standards of natural based solutions (Nature decides on time frame)?

Efficiency of technological vs natural solutions: definition of technical solutions: NBS include nature friendly technology

- ***Up-scalability of local solutions***

Looking for actions that can be done on a large scale and in a sustainable way.

What is more efficient: several local projects or few global?

Communication: speak the language of the community “Think globally act locally”

- ***Changing the mindset how society evolves***

It is important to implement the NBS in effectively (not only to find the solutions, but to implement them). Knowledge gap: how to communicate effectively with a diversity of actors and audiences.

#### The snail

The body of the snail is made up out of stakeholders, scientists, locals, society and policy makers. They are the driving force to make the snail move.

The antennae are scientists, research organizations, BiodivERsA. They are sensing and giving information to the stakeholders, policy makers etc.

The shell is representing environment, social and economy. The upper curve is the smallest one (environment) but the most original (that’s the first part of the snail house growing). Economy is the largest one, a driving force.

The snail moves into a direction. The destination can be many different things and goals.

The time pressure is important, but so is quality of solutions. We need to pace down in order to find better and more sustainable solutions. The pace of the snail also is dependent on the basis on which it moves. It is known that they are slower on manmade roads than in natural surroundings...

Reconnecting to and through nature as important slogan.

Three main knowledge gaps:

Transdisciplinarity (how to organize collaborative bottom up processes), integrated valuation (how to combine diverse valuation systems and methods), communication (how to communicate effectively with a diversity of actors and audiences)



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## 1412 6 Annex 3- Background reading

- 1413 • IUCN's brochure 'Pioneering nature's solutions to global  
1414 challenges: [http://cmsdata.iucn.org/downloads/iucn\\_english\\_brochure.pdf](http://cmsdata.iucn.org/downloads/iucn_english_brochure.pdf)  
1415 • Annex 1 in the IUCN Global Programme specifying the 7 principles of nature-based  
1416 solutions: [https://cmsdata.iucn.org/downloads/iucn\\_programme\\_2013\\_2016.pdf](https://cmsdata.iucn.org/downloads/iucn_programme_2013_2016.pdf)  
1417 • Weblinks: [http://www.climateactionprogramme.org/climate-case-](http://www.climateactionprogramme.org/climate-case-studies/nature_based_solutions_to_climate_change/)  
1418 [studies/nature based solutions to climate change/](http://www.climateactionprogramme.org/climate-case-studies/nature_based_solutions_to_climate_change/) and  
1419 [https://www.iucn.org/what/priorities/nature based solutions/](https://www.iucn.org/what/priorities/nature_based_solutions/)  
1420 • EC- DG ENV report: Assessment of the potential of ecosystem-based approaches to  
1421 climate change adaptation and mitigation in Europe (Naumann et al. 2011):  
1422 [http://ec.europa.eu/environment/nature/climatechange/pdf/EbA\\_EBM\\_CC\\_FinalRe](http://ec.europa.eu/environment/nature/climatechange/pdf/EbA_EBM_CC_FinalReport.pdf)  
1423 [port.pdf](http://ec.europa.eu/environment/nature/climatechange/pdf/EbA_EBM_CC_FinalReport.pdf)  
1424 • First Report of the Horizon2020 Advisory Group for Societal Challenges 5: 'Climate  
1425 Action, Environment, Resource Efficiency and Raw Materials':  
1426 [http://ec.europa.eu/information\\_society/newsroom/cf/horizon2020/document.cfm](http://ec.europa.eu/information_society/newsroom/cf/horizon2020/document.cfm?doc_id=539)  
1427 [?doc\\_id=539](http://ec.europa.eu/information_society/newsroom/cf/horizon2020/document.cfm?doc_id=539)  
1428 • An EU strategy on adaptation to climate change: [http://eur-lex.europa.eu/legal-](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0216)  
1429 [content/EN/TXT/?uri=CELEX:52013DC0216](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0216)  
1430 • Green Infrastructures (GI): Enhancing Europe's natural capital: [http://eur-](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0249)  
1431 [lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0249](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0249)  
1432 • Genetic variation in wild plants and animals in Sweden (Lundqvist et al. 2007, SEPA):  
1433 [http://www.naturvardsverket.se/Documents/publikationer/620-5786-](http://www.naturvardsverket.se/Documents/publikationer/620-5786-2.pdf?pid=3390)  
1434 [2.pdf?pid=3390](http://www.naturvardsverket.se/Documents/publikationer/620-5786-2.pdf?pid=3390)

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## 1437 **7 Annex 4- List of Participants**

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Aleksandraviciene	Asta	RCL
Articus	Kristina	DEMNA - Belgian Biodiversity Platform
Balian	Estelle	Belspo - Belgian Biodiversity Platform
Baker	Helen	JNCC
Berhault	Angélique	Belspo - Belgian Biodiversity Platform
Berwaers	Sigi	University of Antwerp
Beumer	Victor	Deltares
Blery	Claire	FRB
Born	Charles-Hubert	Université catholique de Louvain
Brodin	Tomas	Umea University (EMG)
Butt	Dominique	NERC
Clear	Jennifer	University of Liverpool
Claudet	Joachim	CNRS
Dhondt	Bram	RBINS - Belgian Biodiversity Platform
Dilbirligi	Esin	MFAL
Durao	Rui	FCT
Early	Regan	University of Evora
Eggermont	Hilde	Belspo - Belgian Biodiversity Platform
Elmqvist	Thomas	Stockholm Resilience Center
Fady	Bruno	INRA
Fayolle	Adeline	Université de Liège
Fortmann	Iris	FWF
Garcia	Claude	ETH Zurich
Gillet	Pauline	Gembloux Agro-Bio Tech - Université de Liège
Grube	Martin	University of Graz
Hardcastle	James	IUCN
Hermey	Martin	KU Leuven
Herrel	Anthony	CNRS/MNHN
Ignat	Aare	ETAG
Johnson	Jörgen	University of Gothenburg
Keune	Hans	INBO - Belgian Biodiversity Platform
Lamarque	Pénélope	Université Joseph Fourier; CNRS
Lambin	Xavier	University of Aberdeen
Lange	Henrik	FORMAS
Le Roux	Xavier	FRB
Lemaître	Frédéric	FRB
Los	Martin	NWO
Manrique	Esteban	MINECO
Manuel N. Azevedo	José	FRC
Mauser	Harald	European Forest Unit (EFI)
Megyery	Szandra	VM
Milkova	Violeta	BNSF
Nivet	Cécile	ANR
Oliva	Jonàs	Swedish University of Agricultural Sciences
Peres	Adrian	EC - DG RTD



Pugnaire	François	MINECO
Pullen	Angelika	IUCN
Reuter	Katrin	ISOE
Shepherd	Iain	EC-DG MARE
Sirami	Clelia	CNRS
Sjogren-Gulve	Per	SEPA
Smith	Matt	JNCC
Sodtke	Rainer	Pt-DLR
Soubelet	Hélène	MEDDE
Tack	Jurgen	INBO
Teller	Anne	EC-DG ENV
Tinch	Rob	IODINE
Van de Kerchove	Ruben	VITO - Vision on Technology
Van de Walle	Marie	UFZ
Van der Werf	Aline	Belspo - Belgian Biodiversity Platform
Van Ham	Chantal	IUCN
Vanderhoeven	Sonia	DEMNA - Belgian Biodiversity Platform
Wittmer	Heidi	UFZ
Zaunberger	Karin	EC-DG ENV

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