Evaluating Nature-based Solutions – a synthesis

A SEFARI project with NatureScot

Robin J Pakeman, Kerry A Waylen & Mark E Wilkinson

The James Hutton Institute, Craigiebuckler, Aberdeen, AB15 8QH
robin.pakeman@hutton.ac.uk

Summary

Nature-based Solutions (NbS) have been defined many times, but in essence are developing solutions to societal problems using natural processes. Many ways of assessing the potential benefits and disbenefits of these NbS have been put forward and, if these assessment frameworks are to be used for best results, then the most appropriate framework(s) should be identified and recommended to users.

This project searched for potential assessment frameworks and carried out a two-stage process to identify the most appropriate framework. The initial search identified 23 frameworks which were then independently evaluated by the project team. Seven met the assessment criteria and went through to the detailed evaluation of the second stage which asked 15 questions about the framework design, coverage and practicality of use.

The IUCN Global Standard was identified as the best designed framework. It is comprehensive, supported by a significant international body and will likely be widely used allowing experience to build up and comparisons o be made between schemes.

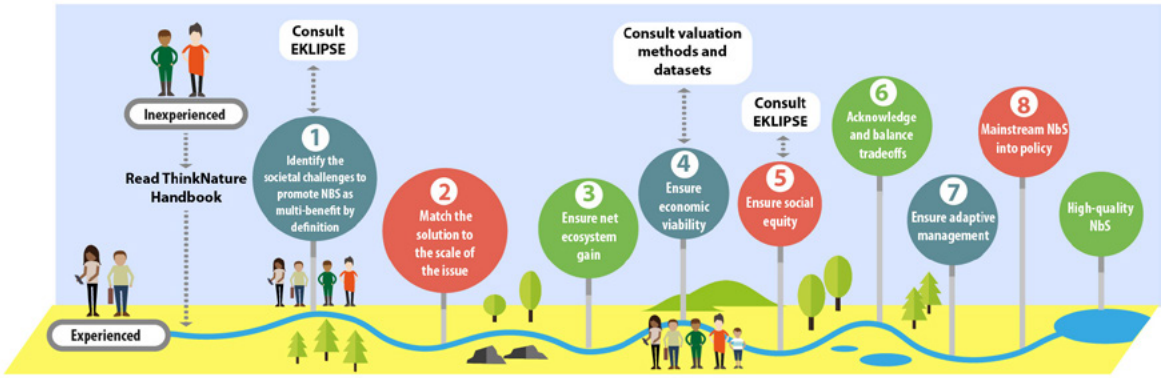
Other frameworks performed better in some areas: the ThinkNature Handbook provides a better introduction to NbS, the Interreg Building with Nature frameworks provides a simple scoring approach suitable for situations where detailed valuation of benefits and disbenefits isn't practical, EKLIPSE covers social benefit assessment comprehensively, whilst ENCA provides useful valuation data and approaches.

We recommend the adoption of the IUCN Global Standard and a number of steps to help embed it in practice, including: testing it on marine NbS assessment, develop a commentary on its use, develop versions for use by different stakeholder groups, publish example assessments from Scotland to provide a template for others to follow, provide information on available valuation data and develop ways of using the framework for investment decisions.

To help in employing the IUCN Global Standard we have developed a pictorial summary of the process of applying it to a NbS assessment. This is shown overleaf.

Navigating your route to Nature-based Solutions (NbS)

NbS are "actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits". The IUCN Global Standard and its Guidance provide a framework for designing and evaluating Nature-based Solutions (NbS). This standard sets out eight criteria which need to be met during both planning and evaluation of NbS. This overview introduces these criteria to encourage application in Scotland and provides links to further explanation and guidance. All steps of the process should involve the input of relevant stakeholder groups. For more background on NbS before you get started, you may wish to consult the ThinkNature handbook.



1. NbS must be a response to the goals and challenges faced by society, such as reducing the risk of floods and droughts or improving food security. Help in identifying social benefits can be found in the EKLIPSE framework, specifically Challenges 8 and 9.

2. NbS designs must recognise the complexity and uncertainty in how our socio-economy interacts with dynamic landscapes/seascapes. NbS design should be informed by how well stakeholders understand these systems at three scales: its component parts; the system itself; and the wider environment around the land/seascape. More information

3. NbS rely on goods and services being provided by ecosystems and so strongly depend on the health of an ecosystem. Therefore, NbS design and implementation must avoid undermining the integrity of ecosystems and instead enhance the functionality and connectivity of the ecosystem. More information

4. The efficiency and effectiveness of the intervention, and equity in the distribution of benefits and costs, are key determinants of NbS success. Appraising economic costs and benefits can support consideration of this and help identify if long-term gains justify short-term costs. A variety of datasets and valuation methods exist: choosing between them will depend on the questions, skills and resources of those implementing a NbS. Background data on valuation can be found in ENCA (Enabling a Natural Capital Approach). Or a qualitative valuation process can be found in the Interreg Building with Nature framework (Page 23).

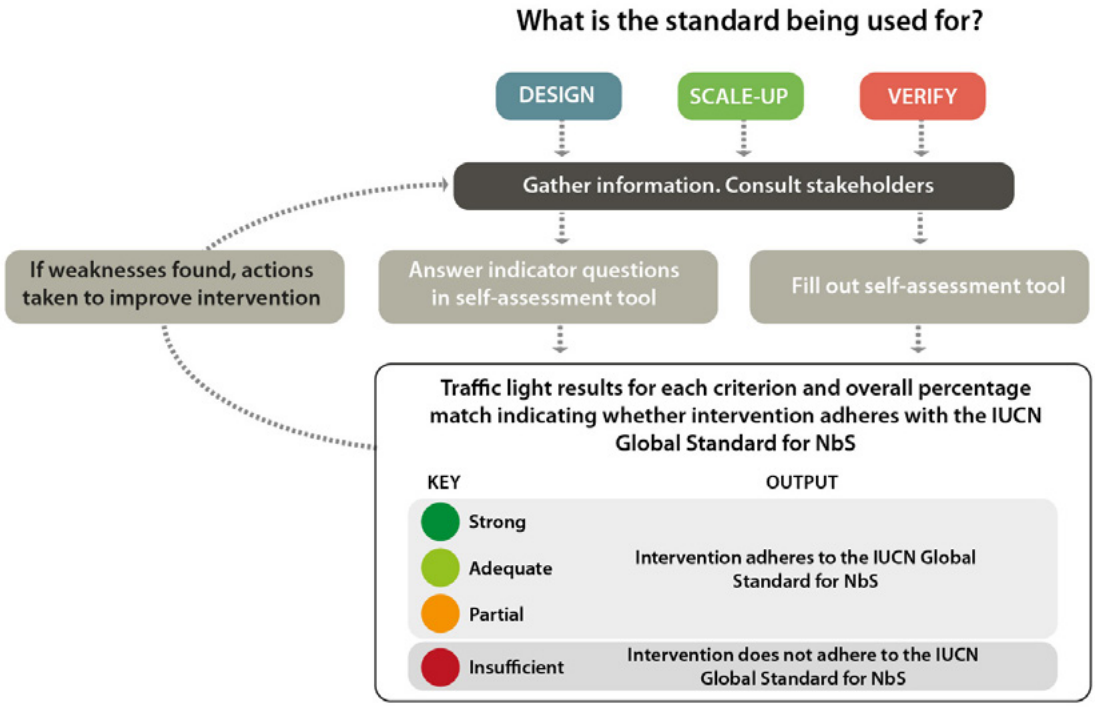
5. NbS should acknowledge, involve and respond to the concerns of a variety of stakeholders, especially rights holders. Good governance is proven to reduce an intervention's sustainability risks and to enhance its social 'license to operate'. Help in this process can be found in the EKLIPSE framework, specifically Challenge 7.

6 Trade-offs in land and natural resource management are inevitable. NbS proponents must assess and acknowledge these trade-offs, and follow a fair, transparent and inclusive process to balance and manage them over both time and space. Fair and transparent negotiation of trade-offs, and considering how to avoid or compensate where local groups may be detrimentally affected, will enables NbS that are supported and successful in the long-term. More information

7 NbS implementation must include provisions to adaptively manage the project in response to uncertainty. This requires regular monitoring and evaluation, drawing on scientific understanding as well as local and other knowledges and an agreed framework for iterative learning. More information

8 NbS interventions must be designed and managed for long-term sustainability. They must both align with and inform with sectoral, national and other policy frameworks, so these may need to adapt to fully enable NbS.

How to use the Standard and how it is linked to the self-assessment (© IUCN).



Contents

Introduction

Nature-based Solutions (NbS) have been defined many times from many different disciplinary perspectives. A simple definition is that of Raymond et al. (2017a) who give a broad definition that NbS are *"solutions to societal challenges that are inspired and supported by nature*". Similarly, the IUCN define NbS as *"actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*" (https://www.iucn.org/theme/nature-based-solutions).

NatureScot have brought together these different definitions and currently define NbS as "*interventions that protect, sustainably manage, and restore the natural environment so as to address specific societal challenges. They adapt to change and simultaneously provide multiple benefits to people and nature, and reduce whole-life costs*".

In the development of this project's specification NatureScot added "*Nature-based solutions should simultaneously provide the maximum range of benefits for people including those associated with diverse nature, sequestration of greenhouse gases and adaptation to a changing climate. Demonstrating the impact of interventions, either in terms of a return on investment, a specific avoided cost or a desired social benefit, is the key to the wider uptake of nature-based solutions across the public sector and to unlock the vast potential of private finance. The findings will inform a just transition to a net zero economy*".

The task of implementing and achieving NbS that achieve multiple benefits is not straightforward. There has been a plethora of attempts to explain and operationalise NbS and this project was developed to try and identify one or a small number of NbS frameworks that could be adopted by NatureScot and recommended to other organisations interested in designing and/or assessing NbS projects. The importance of embedding an NbS approach in decision making has been brought to focus by recent publications identifying their potential to cool the planet (Giradin et a. 2021) and the wide potential for these solutions to be employed in the UK (Stafford et al. 2021).

Therefore, the overall objective of this synthesis project was to **evaluate the methodologies for designing or assessing NbS interventions for multiple benefits at a range of scales across different settings, with the aim of developing a shared understanding between the Scottish Government Portfolio researchers and stakeholders and prioritise areas for common effort that could be supported by research within the Strategic Research Programme and wider Portfolio.**

The synthesis and appraisal were carried out over January to April 2021. Given the limited time and resources available we restricted the analysis of NbS to terrestrial and aquatic systems and did not include marine systems. This could form the basis of further development of this work in 2021-2022. A workshop with stakeholders was held in May 2021.

Methodology

An initial list of potential frameworks to evaluate was identified in the project specification. The project team added to this list through existing knowledge and a non-exhaustive web search. The list for evaluation totalled 23 frameworks, provided in Appendix 1. Many frameworks are adaptations of earlier methods or were amalgamations of various other frameworks designed to create new bespoke frameworks for that organisation's needs, and where this was obvious, the most recent adaptation was evaluated.

The 23 frameworks were too many for a full and detailed appraisal of each method, so in consultation with NatureScot and SEFARI we developed a two-stage approach for evaluation for evaluating the frameworks. A first sift short-listed the most promising frameworks for NbS assessment leaving seven frameworks to be evaluated in the second stage. This evaluation stage was more detailed, using a long list of evaluation criteria to determine the most suitable framework(s) to adopt or adapt for use in Scotland.

Stage one evaluation

The first sift of all the frameworks used the following questions to allow the frameworks through to the second, detailed, stage of assessment:

- Methodology is designed to apply to NbS or closely related concept? Y/N
- Assessment methodology for evaluation, appraisal or assessment of NbS performance, rather than academic critique/ proposal? Y/N
- Methodology builds on substantial prior analysis and discussion? Y/N
- Methodology has been tested or used? Y/N
- Potential for cross system, e.g., urban and rural, terrestrial and freshwater?
- Coverage of more than one aspect or a range of benefits/(dis)benefits of NbS? Y/N

The 23 frameworks were read by all three authors, who represent different disciplinary perspectives, scored and then the resulting scoring compared to see if agreement was reached. Where there was a divergence of views, further discussion took place to resolve whether a framework passed or failed at this stage.

The individual assessments are too detailed to present in report format but are available from the senior author. The summary of the assessments is presented in Table A1 in Appendix 1. Frameworks ranked 1 went through to the second sift. This also included Revaluation, which was scored poorly by two of the assessors, but was selected for the second sift because of its radically different approach.

Stage two – detailed evaluation

Seven frameworks were selected for detailed evaluation by an individual member of the project team. The evaluations were then discussed between the team and recommendations developed.

The evaluations were structured around the following questions and sub-questions:

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?

BENEFITS AND COSTS ARISING FROM NBS

2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
b. Does it include co-benefits as well as the main benefits, and if so what?
c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)

3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
b. Does it account for contributions to mitigation and adaptation?
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?

4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)
a. Does it include appraisal of local and distant biophysical changes (positive and negative)
b. Does it include appraisal of local and distant socio-economic disbenefits?

5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
b. Are all or some of the benefits and dis-benefits quantified? If so, how? If and how are benefits and dis-benefits combined, compared or used in decision-making?
c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?

UNDERSTANDING HOW IMPACTS OF NBS ARISE

6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?

7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?

8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?

9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?

10. Does it appraise intermediate outcomes as well as final outcomes/impacts?

WHO CAN USE THE ASSESSMENT FRAMEWORK?

11. Which part(s) of the assessment explicitly support the involvement of local communities?

12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?

13. Does it record or even favour NbS that involve the co-production of interventions?

14. Is the framework designed to allow funding/investment decisions to be made?

INTEGRATION WITH OTHER SOLUTIONS

15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?

The evaluations are presented in Appendix 2.

Workshop

To explore the findings of the report we held a 2-hour virtual workshop with staff from a range of organisations. The project findings were presented alongside a presentation on experiences with NbS evaluation. Sub-group discussions were held on how to embed NbS in current thinking followed by a wider plenary discussion.

Discussions focused around the following key areas:

- How to refine and use NbS frameworks,
- The need to track multiple aspects to understand impact,
- The need to embed NbS in existing appraisal and decision-making processes,
- How to ensure that NbS are maintained,
- How to Integrate across sectors, and
- The need for more skills in valuation and better data on costs and benefits.

The workshop report is presented in Appendix 3.

Conclusions and recommendations

The seven frameworks evaluated in the second stage each had their strengths and weaknesses (Appendix 2). In summary these were (in alphabetical order):

Ecosystem Approach – this is a well-accepted framework that predates NbS and can be seen as part of the evolutionary history of NbS. It encourages consideration of a wide range of interconnected ecosystem processes and societal impacts (off-site as well as on-site, biotic as well as socio-economic). However, it is limited in the guidance it gives on methods of assessment of actions or valuation. One further weakness is that it is difficult to account for climate-related adaption or mitigation. It does explicitly include temporal processes and is explicit in including local stakeholders. In summary, it is very flexible, which is a strength but also a weakness, as it lacks specific methods or guidance for assessing options. Its advanced guidance could be adapted for this purpose.

EKLIPSE - a NbS framework that has been developed for urban settings. It could be expanded to cover rural areas, but this would need considerable investment to achieve. It has a strong focus on community involvement and has good guidance on assessment approaches. It identifies the existence of different valuation currencies but does not advise on how to combine them. It is less strong at considering off-site impacts and would need specialist input to provide some of the data necessary for valuation. In summary, a potential framework for assessing urban projects, but it does not have the breadth to be employed for most NbS.

ENCA - Enabling a Natural Capital Approach – this framework has been developed by Defra and it has strong links to the Green Book used to make funding decisions by government. It was judged superficial in its approach in coverage of benefits and did not capture co-benefits, distributional inequity or off-site impacts. The assessment process is also provided only static assessment of benefits and did not explicitly demonstrate how stakeholders would be incorporated into the process. Values for ecosystems services are provided by ecosystem, but this would not be of use if only management was being changed. In summary, a not very flexible framework that would need a lot of input to make comprehensive in its coverage of co-benefits and stakeholder engagement.

Interreg Building with Nature – this framework was developed for a project on flood risk management but as its coverage of co-benefits is good it could have wider applicability. The framework was put together after reviewing other frameworks and pooling their effective parts to create a new, bespoke framework specifically aimed at flood management. A strength of the framework is that it should be usable by non-experts due to the simple scoring system it employs, and it is suitable for comparing with or combining with engineering solutions. It, however, does not cover distributional inequities of NbS and it only partially covers off-site impacts except for downstream ones. In summary, a simple framework for decision making around flood risk management but is limited in is coverage of some key parts of the NbS approach.

IUCN Global Standard for Nature-based Solutions – the framework was developed to apply to all types of NbS. It specifically involves stakeholders and considers the distribution of benefits as well as considering both on-site and off-site impacts. It covers the full range of benefits, including ecological, hydrological and socio-economic. There is some guidance on methodology including using models such as InVEST, but it stops short of explicit guidance on how to carry out valuation, how to integrate knowledge and how to include disbenefits. It makes clear adaptive management is important. The framework is easy to understand and the questions are clear, but scoring can be subjective, and more guidance is needed on how to answer questions.

Revaluation – this methodology is designed for any complex system or process rather than specifically for NbS. As such it does not explicitly focus on ecological, socio-economic or hydrological impacts. Instead, it focusses on bringing out visible and invisible as well as direct and indirect benefits. However, it provides no structure, so trade-offs, off-site impacts, temporal changes and external drivers all have to be brought in during the process rather than demanded explicitly. The framework's strengths are in trying to combine lots of different types of data, keeping a good systems view that is not overly dominated by one view and elicitation of a plurality of views. It is potentially usable by non-specialists, but this is hampered by a lack of available information.

ThinkNature Handbook – this framework is comprehensive in its coverage of NbS and sets out how to deliver a scheme. There is discussion of on-site versus off-site impacts and how to cover both benefits and disbenefits, however there is little guidance on how to value these, how to incorporate temporal changes or how to bring different currencies together. The balance of the focus is on biophysical benefits rather than socio-economic ones and little information is presented on how to address distributional differences in benefits. It is strong on focussing on procedure in designing and implementing NbS, in gaining the support of local communities and being simple to use.

In summary, each framework had their own strengths and weaknesses. Our recommendation is to focus on using the IUCN Global Standard. This is a comprehensive method that has the added benefit of being supported by a significant international body so it will be used widely, experience will develop, and it will be regularly updated. Its wide employment will mean future comparisons of NbS assessments will be possible.

However, the IUCN framework is not perfect. The ThinkNature Handbook provides a better introduction to NbS and would be worth being read before attempting the detail of planning or assessing a NbS. We also suggest that the simple scoring approach of the Interreg Building with Nature framework be available in situations where detailed valuation of benefits and disbenefits is outside the skills of those managing the NbS. Also, consideration of how social benefits are assessed by EKLIPSE would strengthen any NbS. Finally, ENCA provides useful valuation data and approaches.

None of the frameworks performed well against the question "14. Is the framework designed to allow funding/investment decisions to be made?" Enabling investors from beyond the usual eNGO and public agencies may be partially assisted by detailed valuation studies during NbS planning and monitoring, yet this may also cause challenges as detailed valuation approaches (see frameworks such as B£ST – https://www.susdrain.org/resources/best.html) also tend to have a narrow focus on the set of issues and values produced.

The workshop also highlighted the tension between a flexible framework that can be applied across all settings and more detailed and prescriptive frameworks which offer more support but over a limited range of contexts. Furthermore, the workshop highlighted the need to employ NbS during the planning phase, the need for co-production and inclusivity, consideration of off-site impacts, use of appropriate indicators, the need to embed NbS in the planning framework and mainstreamed into wider policy areas and, finally, the need for accounting methods to be relevant to the long-term benefits provided by NbS.

Next steps

Our analysis showed that none of the frameworks was ideal in how it was structured and what it recommended covering during a NbS assessment. Fundamentally, there is a trade-off in the design of a framework between flexibility/coverage and detailed information on specific benefits meaning that developing a comprehensive and detailed framework that is usable is not possible.

There are a number of potential next steps (in no particular order):

1. Test the conclusions from this work on whether they would work on marine NbS assessment.

2. Develop a commentary or guidance on how to embed the IUCN Global Standard into the assessment of NbS in Scotland. This could incorporate how to bring ideas from other frameworks into strengthen the IUCN approach.

3. Develop versions of the guidance for use by different stakeholder groups and/or in different situations, i.e., following a common set of principles but recommending different methodologies to implement them appropriate to the resources, skills and scope of work contemplated.

4. Publish example assessments using the IUCN Global Standard in Scotland to provide a template for others to follow in embedding NbS in future thinking.

5. Pull together information sources on valuation to be included in NbS assessments.

6. Understanding if and how a NbS framework could assist in enabling funding/investment decisions to be made by actors beyond the 'usual' eNGO and public agencies.

Appendix 1 - First sift information

Table A1. The results and the conclusions from the first stage assessment of the different frameworks. Ranking scales from 1 to 5.

Framework	**Kerry**	Mark	Robin	Conclusion	Reason	Rank
IUCN Global Standard for Nature-based Solutions	Y	Y - good example recent example - this is the first edition, so likely to be updated?	Y	Y	Unanimous	1
EKLIPSE - An impact evaluation framework to support planning and evaluation of nature-based solutions projects	Y, very EU relevant? Need to check if any update since then.	Y	Y	Y	Unanimous	1
Evaluating Nature-Based Solutions - INTERREG. 2018	Y except if/how does this relate to the EKLIPSE framework? Both products of European-level discussions and perhaps similar contributors (or maybe not). This dates from 2018 - EKLIPSE from 2017.	Y- I was part of the team (WP4) which initiated this within the BwN project. Whilst focused on NFM it takes on board wider frameworks (which are captured in this sheet e.g., Nesshover). It's been tested on three cases. It is another output from the Eddleston project (see business case docs above)	Y	Y	Unanimous	1

UNEP/CBD. (2000). Ecosystem Approach. In Decisions adopted by the Conference of the Parties to the Convention on Biological Diversity at its Fifth Meeting, Nairobi, 15-26 May 2000.	Y	This is focused on biodiversity - not much at all here on hydrology, e.g., managing floods/drought - seems other end of the scale to BwN Interreg.	Y	Y?	Two Y, but focussed on biodiversity	1
Enabling a Natural Capital Approach: Guidance, March 2020 (Note cross-refs with Green Book)	Y? This is an important method for natural capital accounting. I am wary of considering frameworks for (ac)counting natural capital/ESS as equivalent to what you need to evaluate or plan a NBS project- they are part of it, but not all of it? Indeed, page 50 of this report refers back to the Ecosystem Approach handbook by Natural England, as the means to make and implement a plan of action.	Probably, (Y if there is a case where this has been applied to)	Y	Y?	If it has been used?	1

ThinkNature NBS Handbook (2019)	Y. I like this for being a comprehensive guide to action: 'Design - Build - Operate' and for being explicitly based on the adaptive management cycle. It also talks about indicators for monitoring and evaluation of NbS projects, yay. Lastly, it seems to incorporate IUCN work on NBS framework, and Biodiversa and EC discussions on NBC - see diagram eon page 27	Y - some of the Annex sections have nice classification tools. This covers all types of NBS in all landscapes.	I found it a bit woolly, Y.	Y?		1
Revaluation: a participative approach to measuring and making change	Y I like this as having a distinct 'genealogy' to other evaluation approaches we review, yet one rigorously grounded in prior discussion and debate. A lot of other evaluation approaches in conservation have been borrowed from healthcare.	N - I cannot see much depth to this. Has it been applied to NBS in practice?	N	N?	Two N, but Kerry keen as different history of development	1

Nat Cap Committee: Natural Capital Workbook. 2017	Y? I am bit worried that lots of methods for accounting ESS/Nat Cap is part but not all of what we need for a framework to guide and/or evaluate NBS	Y, if there is a case where this has been tested	Y	Y?	If it has been used?	2
HM Gov, The Green Book, 2020	Y? This is an influential and mandated way of accounting for costs and benefits of different choices. But again, it is not, per se, a complete method for evaluating or designing NbS.		N - generic for all proposals and no focus on NbS	N	One Y? one N. Not really a framework	3
Building natural value for sustainable economic development: The Green Infrastructure Valuation Toolkit user guide	Another valuation approach but interesting as this has been more developer led	Need to discuss - I've ruled out other ones for being focused on a particular land use, but this seems a better one - so possibly Y?	Y	?	Discuss	3
McCarthy, D. & Morling, P. (2014). A Guidance Manual for Assessing Ecosystem Services at Natura 2000 Sites.	N?	N	N	N?		4
Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A.,	N but perhaps use to check and improve whatever frameworks	Maybe, as the paper has helped to inform other documents	N	N	Two N, one maybe	5

Delbaere, B., . . . Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of The Total Environment, 579*, 1215-1227. doi:10.1016/j.scitotenv.2016.11.106	we do evaluate and propose	below (e.g., Interreg)				
Waylen, K. A., & Blackstock, K. L. (2017). Monitoring for Adaptive Management or Modernity: Lessons from recent initiatives for holistic environmental management. Environmental Policy and Governance, 27(4), 311-324.	N but Perhaps use to check and improve whatever frameworks we do evaluate and propose - evaluating NBS needs to go beyond totting up the ESS delivered, which is what many other frameworks focus on. Note this paper arose in part Note there was an earlier report which was 'how to evaluate the Ecosystem Approach - so this ties more closely to evaluating EcA/related concepts.	Maybe - Kerry is best to judge this (her paper!). Like Nesshover - parts could be useful	N	N	Two N, one maybe, but useful to check	5

MAES (Mapping and Assessment of Ecosystems and their Services) and INCA (Integrated system of Natural Capital and ecosystem services Accounting in the EU)	? Unsure if this is appropriate for evaluating specific interventions - both in its scale of application and also as focuses mainly only on ES outcomes	N	N	N	Unanimous	5
Naturvation	N but Maybe use it to extend/check if another framework is suitable for urban situations (since many NbS will be placed in or designed to benefit urban settings)	N - too focused on urban.	N	N	Unanimous, but helpful to judge urban focus of others	5
Eddleston Water Interreg business case of NFM	N. This is using the B£ST framework	N - focused on developing a business case for one case study. NFM focus only. I think the Interreg BwN document is better as it presents a framework built on existing frameworks and is applied to multiple cases (still NFM focus though).	N	N	Unanimous, NFM focus	5
Integrating natural capital into flood risk	N this is a version of the	N - as per the business case above - one	N	N	Unanimous	5

management appraisal - report v3	B£ST methodology	site specific example (also, it is testing B£ST which is outlined below)				
Nature-based-solutions-Achieving-net-zero-a-just-transition-and-improved-wellbeing	N	N	N	N	Unanimous	5
NATURAL CAPITAL LABORATORY (AECOM & Lifescape project)	N. I see this as a test/case of using the Corporate National Capital Accounting framework	N	N	N	Unanimous	5
Supporting a Green Recovery: an initial assessment of nature-based jobs and skills	N. But this can help elaborate and appraise the consequences of NBS in terms of jobs, if such an evaluation is needed.	N - wrong focus	N	N	Unanimous	5
Framework for the Integration of Nature-Based Solutions into Environmental Risk Management Strategies	N. Unless have any gaps in how forests protect against "landslides, erosion, rockfall, avalanches, or debris flow"	N	N	N	Unanimous	5
B£ST - Benefits Estimation Tool – Valuing the benefits of blue-green infrastructure. 2019 version 6.	N	N, unless there are some nuggets in the new NFM guidance document - but I don't think that is due for	N	N	Unanimous	5

		another half year.				
Ecosystem services assessment: How to do one in practice (IES, 2013)	N as this/related guidance has been withdrawn on Feb 2020, and Gov.uk says we should now consult 'Enabling a natural capital approach' (https://www.gov.uk/guidance/ecosystems-services) Basically ESS has been replaced by Nat Cap!	Probably not. Not specific.	N - generic but has links to a range of other projects.	N	Unanimous	5

Appendix 2 - Second sift information

The evaluations of each framework that passed the first sift are presented below in alphabetical order. Each framework was evaluated by a member of the project team and then discussed with the other members.

Ecosystem Approach (EcA)

What is the Ecosystem Approach?
The Ecosystem Approach (EcA) consists of 12 'Malawi' principles to guide ecosystem management, supplemented by operational guidance and advanced guidance. Its principles represent a combination of insights from the science of ecology and ecosystem management together with participation and governance.
In the table below, where I refer to the "principles", I refer to www.cbd.int/ecosystem/principles.shtml and where I refer to later operational guidance the source is https://www.cbd.int/ecosystem/operational.shtml. All other sources are referenced from the list below. The CBD is explicit that its guidance on the EcA does not specify "*exactly*" how to implement the EcA (CBD, 2006), instead stating "*There is no single correct way to apply the ecosystem approach to management of land, water, and living resources*" saying the principles should be "*translated flexibly*" for different contexts. The lack of prescription is both a strength and weakness of the approach.

Evaluated by: Kerry Waylen

Source: The material provided here draws mainly from the 'original' description of the Ecosystem Approach as adopted by the CBD in 2000, as summarised by 12 Malawi principles, and its supplementary 5 principles of operational guidance, and advanced guidance (this and more available on the CBD website www.cbd.int/ecosystem). Beyond the CBD, there have been specific interpretations, notably by NatureScot (NatureScot, No date) and related by Natural England (Waters et al., 2012) and these are certainly relevant, not least as they are relevant to respective biodiversity action plans. However, there is no commonly accepted single version of the EcA that supplants the CBD, so I mostly refer here to source material from the CBD, supplanted with NatureScot.

Note my general understanding of the approach is informed by my own prior work on the EcA in the UK, and other expert analysis and commentary: (Brown & Everard, 2015; CBD, 2006; 2000; CBD SBSTTA, 2007; De Lucia, 2014; Haines-Young & Potschin, 2014; Howard et al., 2013; Kay & Schneider, 1994; Maltby, 2000; NatureScot, No date; Oates & Dodds, 2017; Österblom et al., 2010; Pound, 2008; Raum & Potter, 2015; Shepherd, 2004; Smith & Maltby, 2001; SNH, 2016; Szaro et al., 1998; UNEP/CBD, 2000; Waters et al., 2012; Waylen et al., 2015; Waylen et al., 2013; Waylen et al., 2014a; Waylen et al., 2014b).

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
The Ecosystem Approach (EcA) is intended to be relevant to the management any ecosystem. It seeks "*the appropriate balance between, and integration of, conservation and use of biological diversity*" (principle 10) in this sense, it slightly differs from NbS which explicitly focus only on

meeting societal needs - though one might expect that sustaining biodiversity is quite often required to meet many of those needs in the long-term.

The EcA consists of 12 principles to guide ecosystem management, supplemented by operational guidance and advanced guidance.

The operational guidance and other sources often seem to imply that the EcA is conceptualised as applying to relatively intact ecosystems and discusses the need to prevent their conversion to alternative land uses (that tend to degrade biodiversity). However, principle 10 talks about the approach being relevant to a range of systems from "*strictly protected to human-made ecosystems"*. However, there is no a priori reason why the principles could not apply to a variety of systems, whether or not they are 'pristine'. Even more expansively, the advanced guidance (CBD, 2006) states the EcA principles "*design and implementation of national and regional biodiversity strategies and action plans… into policy instruments, planning processes, and sectoral plans (e.g., in forest, fisheries, agriculture). At a more local level the principles of the ecosystem approach can be used to guide the development and implementation of individual projects and plans …In some cases the problems may not be related to a practical management activity. For example, encouraging the adoption of the ecosystem approach into national and regional legislation or policies."*

Principle 7 of the EcA talks about the need to undertake management at 'appropriate spatial and temporal scales', with scales to be bounded according to objectives with input from a variety of stakeholders. This may be hard to apply if a problem-area is already pre-defined. Additionally, since the EcA is focused on ecosystem management – it highlights the need to consider interactions with adjacent ecosystems /other processes (e.g., principle 3) as well as the relationships and processes within a system (operational guidance principle 2). This may make some of it hard to apply to very small sites or specific decision processes, but I would suggest that this not mean we ignore these issues – the opposite in fact, we need to tackle silos and separated-decision processes. For example, the operational guidance additionally emphasises the need for "*intersectoral cooperation"* (Operational principle #5).

BENEFITS AND COSTS ARISING FROM NBS

2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?

a. Does it focus on core/main benefits?

No, the EcA does not presuppose a focus on tackling a certain type of problem or the provision of a certain set of core benefits. Principle 1 "*The objectives of management of land, water and living resources are a matter of societal choices."* Makes clear that societal choices -especially those of local people- should be sought and expressed *"as clearly as possible".*

b. Does it include co-benefits as well as the main benefits, and if so what?

Again, the EcA is not presented in terms of main versus co-benefits, so this question does not really apply here.

c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)

Ecosystem Approach as originally formulated does not provide detailed guidance on appraising benefits though the advanced guidance makes clear the need to appraise the complexity of interacting ecosystem functions and processes before deciding management actions, including (perhaps) by using SEA or EIA. The NatureScot guidance (NatureScot, No date) refers to environmental assessments (referring to EIA, SEAs and Habitats Regulations Appraisal), mapping Ecosystem Services, and Cost-Benefit Analyses as potential tools.

3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?

Principle 1 notes that benefits can be intangible and cultural as well as material. Principle 4 notes that there is "*usually a need to understand and manage the ecosystem in an economic contex*t.",

by reducing market distortions, aligning incentives and internalising costs and benefits, in order to promote biodiversity conservation and sustainable use.
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
Ecosystem Approach as originally formulated does not provide detailed guidance on appraising benefits. As noted above, The NatureScot guidance (NatureScot, No date) refers to environmental assessments (referring to EIA, SEAs and Habitats Regulations Appraisal), mapping Ecosystem Services, and Cost-Benefit Analyses as potential tools. It also gives special note of how to appraise cultural ecosystem services.
b. Does it account for contributions to mitigation and adaptation?
Climate change is not prominent in the Ecosystem Approach concept, (reflecting its source and time of origin). Contributions to climate change mitigation or adaption are not mentioned in any of the source texts. The NatureScot guidance (NatureScot, No date) refers to climate control as one of the examples of the potential benefits from nature.
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?
Yes, the EcA emphasises the need to understand the needs and preferences of stakeholders, especially local ones, and that ecosystems should be "*Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way*." https://www.cbd.int/ecosystem/principles.shtml The operational guidance principle 2 additional emphasises the need for benefit-sharing (https://www.cbd.int/ecosystem/principles.shtml) and, where necessary, institutional and economic change to incentivise and permit local communities to benefit from ecosystems. The need to decentralise management to the lowest possible is strongly emphasised, reflected in principle #2 and operational guidance (principle #4) and in part justified by offering more equitable solutions. The first original principle notes that "*different sectors of society*" will have different needs shaping their view of ecosystems, implicitly a nod to conflict. It doesn't offer a detailed method or prescription for how distributional consequences should be appraised, nor how any conflicts of interest should be presented or resolved. The advanced guidance (CBD, 2006) does suggest some tools that can help (pg. 8) – "*social analysis, conflict management methods"* but without any more information or links.
4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)
a. Does it include appraisal of effects (positive and negative)
Yes, the EcA highlights the need to consider interactions with adjacent ecosystems (Principle 3). It highlights that some of these impacts may be unpredictable or poorly understood, so requiring new decision-making processes and potentially the involvement of other institutions. The operational guidance talks about this in terms of adaptive management. Page 9 of the advanced guidance (CBD, 2006) suggests EIA and SEA can help appraise impacts, together with modelling,
b. Does it include appraisal of local and distant socio-economic disbenefits?
Not in so many words, but the need to understand the societal costs and benefits within and beyond the system in question runs throughout the Approach. The Approach is weighted to privileging the needs and views of "local" stakeholders who are assumed to be those managing ecosystems.
5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
The CBD concept refers to both goods and services, in addition to biodiversity being intrinsically valuable in its own right.

- "economic, cultural and society needs" (principles #1)
- "intrinsic values and tangible and intangible benefits" (principle #1)
- "ecosystem services" (principle #5)
- "goods and services of economic and social importance" (operational guidance)
- "Ecosystem goods and services" (operational guidance)

The NatureScot guidance refers to *"services that ecosystems provide-such as provisioning (food, fuel and water), regulating (flooding and climate regulation) and cultural services (recreation, culture and quality of life) that ecosystems provide for people."*

b. Are all or some of the benefits and dis-benefits quantified? If so how? If and how are benefits and dis-benefits combined, compared or used in decision-making?

The operational guidance calls for the "*the proper valuation of ecosystem goods and services*." The advanced guidance (pg. 11) suggests "*participatory methods*", EIA and "*environmental valuation methods"* and "*environmental accounting"* and "*environmental assessment tools*" (page 19) but without providing more details. Whether and how benefits and disbenefits are quantified and/or valued depends on the decisions of those implementing the EcA in a particular case (e.g. Waylen et al., 2013).

c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?

The original approach talks about the need to consider a wide range of potential ecosystems (dis)benefits, services, and additionally biodiversity as a goal in itself, but does not specify exactly how this is to be done. The NatureScot guidance (NatureScot, No date) refers to Cost-Benefit Analyses and ecosystem services mapping as potential tools that could help present and compare different services/values.

UNDERSTANDING HOW IMPACTS OF NBS ARISE

6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?

Yes, principle 8 focuses on the need to manage over the long-term and to recognise "*varying temporary scales and lag-effects*". The original guidance does not specify which processes are likely to take longer than others.

7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?

Interestingly, the need to expect that ecosystem management will affect the external system is explicit as principle 3, but not so much vice versa. It is perhaps implied or related to the explicit need to understand functions and processes *within* the ecosystem, (principle 5 and operational guidance), including abiotic processes and interactions (principle 5), recognition that ecosystems have limits to what they can deliver or adapt to (principle 6). It is also implied by the advanced guidance (CBD, 2006) which talks about the need to first define the problem, and to address the causes of problems when doing that.
However, I am surprised this is not more explicitly or directly stated.

8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?

No.

9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
Not explicitly (see 11) though if all the principles and operational guidance are used as evaluation factors then this would help favour this (Waylen & Blackstock, 2017; Waylen et al., 2014a), drawing attention to aspects of the decision-making processes, especially the quality of public participation and involvement (SNH, 2016). It doesn't highlight minutia of process and project design, though converting the advanced guidance (CBD, 2006) - which deals step by step with the questions needed by someone seeking to implement the approach - into evaluation criteria might bring more emphasis on that.
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
The need to see a variety of impacts as constantly evolving is explicit in principles 7&8, and the need to continually check and update plans is inherent within the concept of adaptive management emphasised by the operational guidance point #5.
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
Principle 11 explicitly calls for all relevant sources of information – including local knowledge - to be used during decision-making, and for all information sources to be shared with stakeholders. Several places in the advanced guidance call for public participation and input, e.g., on page 19 public participation is referred to as a tool to help decide the appropriate balance between conservation and use of biodiversity (CBD, 2006). Note, the EcA is a framework to guide action, not an evaluation framework *per se*, though its principles can be adapted to be used as such – see (Waylen & Blackstock, 2017; Waylen et al., 2014a). Whether or not the approach can be involved with and by local stakeholders will partially depend on how they are interpreted.
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
I would imagine that specialist input would be required for many detailed methods for quantifying the value of some services, if that is desired – but the work of (Pound, 2008) shows that with simpler methods, based on local knowledge, local stakeholders can 'own' the whole process. Diana Pound would probably argue that quantifying some values and not others can chew up effort that could be better spent in facilitating information-sharing, perspective-sharing and building consensus. I think this point was reflected in (Waylen et al., 2013).
13. Does it record or even favour NbS that involve the co-production of interventions?
Yes, the EcA strongly and repeatedly recommends that local people not only have their needs and preferences recorded (principle 1), but also are involved and ideally take ownership, by decentralising management decisions as far as possible to the local level (principle 2, op guidance #4). Principle 12 requires the involvement of different stakeholders from across society and multiple scientific disciplines. The advanced guidance (pg. 21) notes that different stakeholders may hold different worldviews that are not easily reconciled but that should be recognised (CBD, 2006).
14. Is the framework designed to allow funding/investment decisions to be made?
No, it is not oriented to the private sector, though the operational guidance notes the need to work across sectors.

INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?
The Ecosystem Approach is focused on the management of nature and ecosystems. However, I cannot see why the 12 principles could not be applied to projects that also include prominent engineering or technological elements. The points about needing to understand ecosystem processes would become less relevant for projects that are strongly or entirely dominated by implemented engineering-based solutions – but then these projects would not be NbS?

EKLIPSE

Source: Raymond, C.M., Berry, P., Breil, M., Nita, M.R., Kabisch, N., de Bel, M., Enzi, V., Frantzeskaki, N., Geneletti, D., Cardinaletti, M., Lovinger, L., Basnou, C., Monteiro, A., Robrecht, H., Sgrigna, G., Munari, L. and Calfapietra, C. (2017) An Impact Evaluation Framework to Support Planning and Evaluation of Nature-based Solutions Projects. Report prepared by the EKLIPSE Expert Working Group on Nature-based Solutions to Promote Climate Resilience in Urban Areas. Centre for Ecology & Hydrology, Wallingford, United Kingdom

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
The EKLIPSE framework has been specifically designed for urban projects. In doing so it covers ten challenges (1. Climate mitigation and adaptation; 2. Water management; 3. Coastal resilience; 4. Green space management; 5. Air/ambient quality; 6. Urban regeneration; 7. Participatory planning and governance; 8. Social justice and social cohesion; 9. Public health and well-being; and 10. Potential for new economic opportunities and green jobs) of which only two (4 and 6) are specifically urban challenges. Other challenges, such as 2. Water Management also have a strong urban focus.
BENEFITS AND COSTS ARISING FROM NBS
2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
The framework sets out ten challenges to deliver NbS benefits. The urban focus does mean that the framework is currently not suitable for assessing NbS in the wider countryside. Some of the actions for the current challenges would need expanding, for instance, the water management focus is on urban drainage rather than action at the catchment scale. For wider use, additional challenges, actions to address them and impact assessment would need to be added to cover catchment scale management and land use change.
b. Does it include co-benefits as well as the main benefits, and if so what?
The assessment framework clearly sets out some co-benefits which might flow from the main benefits (Table 25, page 50). For example, flood peak reduction, could also benefit coastal resilience, green space, publish health and well-being and provide economic opportunities and jobs. It also highlights a small number of disbenefits and also a series of opportunities, where the design of an action for a main benefit could be adapted to ensure it also had co-benefits.
c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
Guidance is provided for each of the challenges on ways to measure benefits (sets of indicators) and how to develop monetary and non-monetary assessment of the benefits. It also covers ways to bring the co-benefits into the appraisal process.
3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
Five out of the ten challenges have a social or economic focus and, as for the other challenges, there is guidance on methods and indicators to appraise them.
b. Does it account for contributions to mitigation and adaptation?
Yes. There is a clear focus on which actions are primarily adaptive and which are focussed on mitigation. This extends beyond the obvious climate change adaptation and mitigation NbS.
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?

One challenge specifically addresses social justice and social cohesion. It acknowledges that many improvements to urban infrastructure and quality of life will benefit more affluent social groups, mainly through benefits in property prices.
4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)
a. Does it include appraisal of local and distant biophysical changes (positive and negative)
There is consideration of the scale at which impacts occur. As this is an urban focussed framework, then it covers scales from the individual building up to global impacts. However, these impacts are not assessed in a spatial framework.
b. Does it include appraisal of local and distant socio-economic disbenefits?
The framework also covers socio-economic benefits at a range of scales, but there is little focus on potential disbenefits outside the area of interest that would flow from NbS actions.
5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
The framework employs an ecosystem service-based terminology of benefits, specially building on the use of the terms by the MAES (Mapping and Assessment of Ecosystems and their Services) project (https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm) which defines a benefit as a "*positive change in wellbeing from the fulfilment of needs and wants*".
b. Are all or some of the benefits and dis-benefits quantified? If so how? If and how are benefits and dis-benefits combined, compared or used in decision-making?
The framework describes potential methods for quantification rather than explicitly sets out how to carry out a practical quantification. The framework advises that it is difficult to combine all benefits/disbenefits using methods like Cost-Benefit Analysis (CBA) or Social Costs and Benefits Approach (SCBA) assessment as the metrics generated by monitoring are in different "currencies". The framework explicitly states "*strategies which allow for assessments based on mixed methods can support the consideration of different scales and measures. In particular, methods based on multi-criteria analysis (MCA) allow for an assessment of the performance of alternative solutions built on group preferences*" (page 46) making it clear that monetary and non-monetary approaches have to be brought together.
c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?
Yes. The framework highlights this but does not prescribe an explicit means of tackling this issue.
UNDERSTANDING HOW IMPACTS OF NBS ARISE
6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?
There is an acknowledgement that the benefits form NbS have a temporal element and that there are other factors, mainly climate change, that will interact with solutions over time to either enhance or reduce their effectiveness. However, the urban focus does mean that the list of potential factors interacting with NbS is limited.
7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?
The framework does explicitly identify climate change as an external pressure. However, this is the only one that is brought into the appraisal framework.

8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?
The framework explicitly sets out the needs to appraise alternative solutions in order to identify the most effective/cost-effective. It sets out general methods to do this (CBA, SCBA and MCA), but does not provide a detailed demonstration of how to do this.
9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
The framework has a challenge, 7. Participatory planning and governance, that explicitly appraises how different sectors of society are brought together to develop the design of NbS in order to ensure wide acceptance and the spreading of benefits.
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
The framework sets out the need for continual monitoring of NbS in order to allow for modification and new technology. It also explicitly identifies the need for monitoring beyond the life of the action "*especially in the context of financed projects for the implementation of NBS it is thus necessary to plan for monitoring beyond the end of the action*" (page 47).
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
The framework sets out the need for engagement with the local community through one of its ten challenges, 7. Participatory planning and governance, and also identifies some methods to assess how this works (though without any detail or recommendations as to which to pick).
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
To a certain extent the framework is presented in clear and straightforward language and the logic behind the assessment of different challenges and their impacts is clear. However, many of the methods of assessment require the use of technology generally unavailable to non-experts or the use of computer models to estimate impacts. Also, the means of bringing the assessment together through CBA, SCBA or MCA would also require specialist skills.
13. Does it record or even favour NbS that involve the co-production of interventions?
The framework does not explicitly record co-production of interventions but highlights this as a necessary development in NbS assessment frameworks: "*development in Co-benefit assessments will require the development of new tools for assessing synergies and trade-offs outside of the ecosystem services domain, and a commitment to managing ecological and social complexity by drawing on knowledge co-production processes that engage multiple types and systems of knowledge*" (page 55).
14. Is the framework designed to allow funding/investment decisions to be made?
The framework identifies the need for methods to assess the costs and benefits of different actions but does not explicitly set out a specific methodology to do this.
INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?
Some of the challenges, specifically challenges 2 (Water management), 5 (Air/ambient quality) and 6 (Urban regeneration), address the need to link grey and green infrastructure in order to deliver societal benefits. For instance, post-build installation of green roofs may require modifications to buildings.

ENCA - Enabling a Natural Capital Approach: Guidance

Source: Department for Environment, Food and Rural Affairs (2020) Enabling a Natural Capital Approach: Guidance. https://www.gov.uk/government/publications/enabling-a-natural-capital-approach-enca-guidance

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
This framework is wide ranging and is not specific to any situations or settings.
BENEFITS AND COSTS ARISING FROM NBS
2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
The focus is very focussed on assessing the main benefits from actions
b. Does it include co-benefits as well as the main benefits, and if so what?
There is no mention of co-benefits in the main report. This seems to be a significant gap in the approaches described.
c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
ENCA is backed-up by a suite of information sources on values for different services and benefits. Most of the focus is on Cost-Benefit (CBA) type approaches, but the report does stress that non-monetary values need to be brought in through Multi-Criteria Assessment (MCA – with links to details via the Green Book (https://www.gov.uk/government/publications/green-book-supplementary-guidance-multi-criteria-decision-analysis)
3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
There is guidance provided on data sources to value the socio-economic benefits associated from cultural ecosystem services.
b. Does it account for contributions to mitigation and adaptation?
There is little coverage of mitigation and none of adaptation in the approached described.
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?
The potential for inequity in the benefits of actions between different social groups is acknowledged, but guidance on how to account for this is not presented.
4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)
a. Does it include appraisal of local and distant biophysical changes (positive and negative)
Assessing the spatial reach of interventions is highlighted, but no guidance is given on how to integrate local and wider-scale assessment of impacts.
b. Does it include appraisal of local and distant socio-economic disbenefits?
As above, it is noted that the wider impacts need assessment, but no guidance is given for their appraisal.
5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
The framework is set up in terms of ecosystems services and the approach is clearly based on the National Ecosystem Assessment (http://uknea.unep-wcmc.org/).

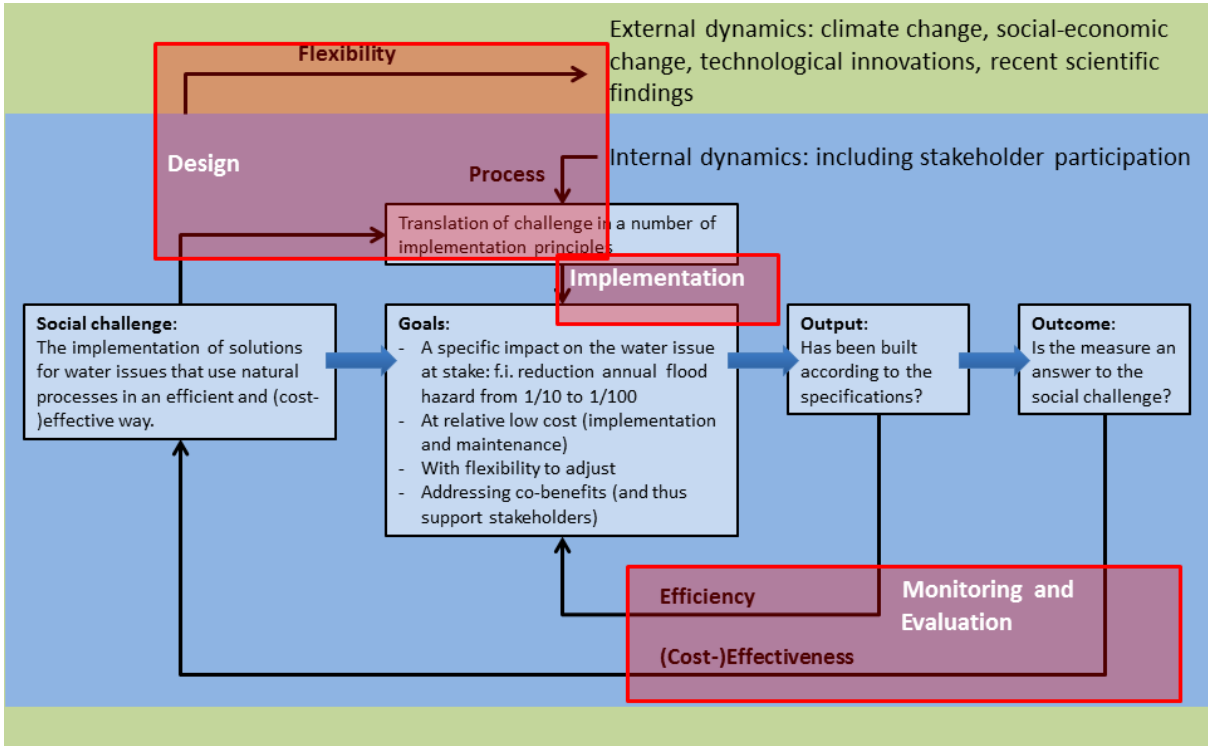
b. Are all or some of the benefits and dis-benefits quantified? If so, how? If and how are benefits and dis-benefits combined, compared or used in decision-making?
A range of figures for benefits and dis-benefits are given in an associated file ENCA – Services Databook (updated July 2020).xlsm (https://data.gov.uk/dataset/3930b9ca-26c3-489f-900f-6b9eec2602c6/enabling-a-natural-capital-approach). These are standard figures and not generated with any spatial resolution.
c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?
The figures given on values from the Services Databook (see above) are all in monetary terms. There is mention of how to bring monetary and on-monetary values together using MCA, but specific guidance is given elsewhere.
UNDERSTANDING HOW IMPACTS OF NBS ARISE
6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?
The need to consider longer timeframes is pointed out, but consideration beyond the potential for discounting is not provided. Values provided in the Services Databook are static and no methods are presented to account for changes through time or as assets change.
7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?
The guidance does mention the potential for changes in external pressure, explicitly climate change, but it does not provide guidance on how to deal with this issue.
8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?
There is no explicit methodology provided to do this, but the option to repeat analyses for different options is possible. However, there may not be the precision available from the valuations given in the Services Handbook to allow for differential assessment of similar actions.
9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
No. There is acknowledgement of the need to engage with stakeholders, but this does not extend to co-construction/co-design of NbS or any assessment of the engagement process.
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
No. This would be possible but would rely on additional data sources and monitoring/modelling for which guidance is not given.
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
There is acknowledgement of the need to engage with stakeholders, but no guidance is given on identifying stakeholders, the best means to engage and how to appraise that engagement process.
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
The main guidance is provided in straightforward terms. However, the data sources behind the framework are couched in technical language and guidance about choosing alternative values is not provided.

13. Does it record or even favour NbS that involve the co-production of interventions?
No. It takes an ecosystem services approach that does not include co-production.
14. Is the framework designed to allow funding/investment decisions to be made?
Yes. It is explicitly linked to the Green Book and the need to provide clear analysis and valuation to allow for funding/investment decision making.
INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?
This could be added but is not currently part of the framework. The link to the Green Book would make this straightforward.

Interreg Building with Nature - Evaluating Nature-Based Solutions: best practices, frameworks and guidelines

Source: https://northsearegion.eu/media/11653/report_pr3812_evaluatingnbs_final_29112018-2.pdf

THE FRAMEWORK



The assessment questions:

Efficiency:

- Has the as-is situation been defined?
- Have system considerations (integral approach) been addressed?
- Have nature-inspired processes and methods been used?
- Have nature-friendly materials been used?

- Have uncertainties been addressed?
- Are success indicators of the intervention defined? Are they defined on different timescales? For the goals and for the co-benefits?

Effectiveness:

- Is a clear and thorough problem definition available?
- Is understood which interventions could solve the problem?
- Have alternative (grey) solutions been considered?
- Are co-benefits, risk and threats addressed and identified?
- Are the advantages of a green solution identified?
- Did monitoring show that the NBS answered to the objective?

Social support:

- Is there a common understanding of the problem, solutions or goals?
- Was there wide stakeholder involvement? Throughout the project?
- Are institutional arrangements made?
- Was there attention for collaborative learning (education and knowledge exchange)
- Is review and reflection carried out in the project?

Flexibility:

- Is the intervention flexible?
- Are adaptation options included in the design?
- Is a plan available for monitoring and evaluation to guide adaptation if needed?

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
The framework was developed for the Building with Nature project. The focus was on water management objectives, in particular reducing water-related risk. However, even though the focus was floods/droughts, the framework looked at ecological degradation and pollution and as such it reflected on other water management aspects (water quality and availability). Therefore, the objective here was to create a "preferred framework" for NBS, in order to compare and evaluate projects, which would then demonstrate the added value of NBS compared with traditional (grey) solutions (i.e., in the context of flood management. It was applied to the North-Sea region of Europe in different regions (so the framework has been tested in different nations/government structures). The authors reviewed a series of existing frameworks (see reference list) to adapt an existing framework that was developed by the Netherlands Environmental Assessment Agency.
BENEFITS AND COSTS ARISING FROM NBS
2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
The core focus is on NBS for reducing water-related risks. The framework has been built with this in mind and has been trialled on those appropriate cases (e.g., Natural Flood management). It is focused on rural catchment systems rather than urban settings. However, it could be possible to test this framework in other landscapes/benefits.
b. Does it include co-benefits as well as the main benefits, and if so what?

Yes, focus is on water-related risks, but the framework has been designed to consider water on a much wider scale (and other ecosystem services). With regards to the 'design' step the authors state "In the design step the challenge, the objectives and goals should be clearly defined, and co-benefits should be listed."

c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)

Yes, section 2.3. and 2.4. set out the questions and appraisal criteria and the document contain worked examples for three case studies.
The study states:
"In summary, the essential elements of an evaluation framework for Nature-based solutions are then:

- *Output indicators that describe whether the solution satisfies the specifications and principles of the design process. A positive score gives an impression of the **efficiency** of the implementation phase (to what extent has been delivered what was promised)*
- *Outcome indicators that describe whether the solution adequately answers the social challenge at the base of this measure. A positive score gives an impression of the **effectiveness** of the solution (to what extent is the solution an answer to the social challenge)*
- *Process indicators that describe whether all the right steps have been taken to ensure that the solution addresses all envisaged co-benefits. A positive score indicates that the solution is based on the **social support** of relevant stakeholders.*
- *Flexibility (or adaptivity) indicators that describe how easy (and at low cost) the solution can be adjusted in view of the internal and external dynamics of the social challenge, and how to deal with uncertainties."*

3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?

a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)

Yes, the third main aspect of the framework is to look at *"Process: making sure NBS are (socially) accepted, and that they are efficient and effective."*
The authors use the following questions to appraise this
*"**Social support:***

- *Is there a common understanding of the problem, solutions or goals?*
- *Was there wide stakeholder involvement? Throughout the project?*
- *Are institutional arrangements made?*
- *Was there attention for collaborative learning (education and knowledge exchange)*
- *Is review and reflection carried out in the project? "*

b. Does it account for contributions to mitigation and adaptation?

Yes, as it covers a broad spectrum of measures (the proposed measures in the case studies address mitigation and adaptation.

c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?

I believe it may as the authors state "The process should fulfil particular conditions, in particular that wide stakeholder involvement is assured to make sure that co-benefits (and trade-offs) are known and considered throughout the project"

4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)

a. Does it include appraisal of local and distant biophysical changes (positive and negative)

Yes and no – it appraises effectiveness of the approach for flooding. But the questions maybe applicable to ecological context.

Effectiveness:

- *Is a clear and thorough problem definition available?*
- *Is understood which interventions could solve the problem?*
- *Have alternative (grey) solutions been considered?*
- *Are co-benefits, risk and threats addressed and identified?*
- *Are the advantages of a green solution identified?*
- *Did monitoring show that the NBS answered to the objective?*

b. Does it include appraisal of local and distant socio-economic disbenefits?

The third main aspect of 'process' states "making sure NBS are (socially) accepted, and that they are efficient and effective.

The authors use the following questions to appraise this

*"**Social support:***

Is there a common understanding of the problem, solutions or goals?

Was there wide stakeholder involvement? Throughout the project?

Are institutional arrangements made?

Was there attention for collaborative learning (education and knowledge exchange)

Is review and reflection carried out in the project? "

Where a score of +1 is given if indicator is met and 0 is given if indicator is not met (and if unclear if it is met or not then score of 0.5)

5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?

a. What terminology or language frames and refers to benefits and disbenefits?

I am not sure the framework refers to disbenefits, but it does use "trade-offs" as a term.

b. Are all or some of the benefits and dis-benefits quantified? If so how? If and how are benefits and dis-benefits combined, compared or used in decision-making?

This is looked at in the 'indicators' criteria of Efficiency, effectiveness, social support and flexibility. However, no negative score is given for dis-benefits – only a '0' if a criterion has not been met.

c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?

Yes, see 5b – the indicators are assessed on a range of questions which use different metrics to give a score if the criteria have been met.

UNDERSTANDING HOW IMPACTS OF NBS ARISE

6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?

The framework has considered 'flexibility' as a key aspect. Here, they consider external dynamics *such as climate change, technological innovations etc. Assessment criteria are:*

Flexibility:

- *Is the intervention flexible?*
- *Are adaptation options included in the design?*
- *Is a plan available for monitoring and evaluation to guide adaptation if needed?*

7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?

It has assessment questions on flexibility, but I am not sure these explicitly address external changes mentioned above.
8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?
No sure it does?
9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
Yes, the framework covers three important steps in implementing NBS. The authors state: "*In our exploration of the existing literature on definitions, frameworks and guidelines on NBS we therefore distinguish three main aspects to group recommended practices:* *1. Design: setting up and choosing a suitable NBS* *2. Implementation: putting NBS into practice* *3. Process: making sure NBS are (socially) accepted, and that they are efficient and effective."*
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
I would say this is covered via the flexibility and effectiveness criteria questions
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
The assessment questions surrounding social support cover this element, e.g., "*Was there attention for collaborative learning (education and knowledge exchange)?"*
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
I would say so – the assessment questions are easy to understand and the scoring is simple
13. Does it record or even favour NbS that involve the co-production of interventions?
N/A
14. Is the framework designed to allow funding/investment decisions to be made?
Yes, it has been developed to compare NBS against grey engineering solutions so I would say it helps with this.
INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?
Yes, the approach compares how NBS gives benefits over traditional 'grey' engineering solutions.

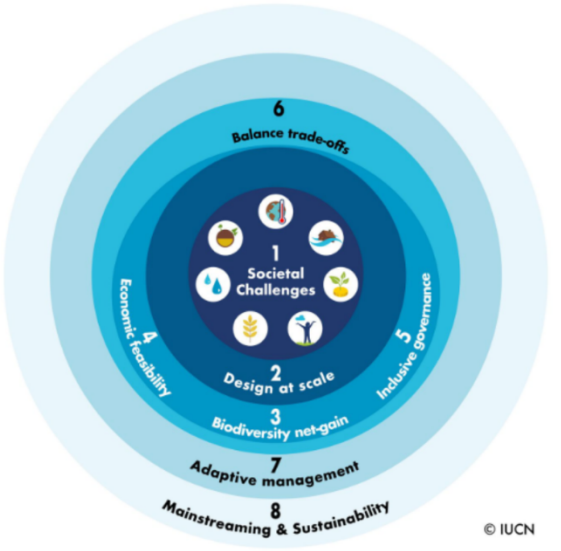
IUCN Global Standard for Nature-based Solutions

Source: (IUCN, 2016, 2020a, 2020b)
Completed by Kerry Waylen, 15th March 2021

What is this framework?
This framework is the result of extensive deliberation and consultation by the IUCN Commission on Ecosystem Management. It is intended to be used to design, scale-up, or verify interventions (pg. 11,

IUCN, 2020a). It has 8 criterion (presented in IUCN 2020b) each with 3 or more indicators (28 indicators in total):

1. **"NbS effectively address societal challenges"** (This criterion prompts collective identification and documentation of societal challenge(s) – who will be affected and needs to benefit)
2. **"Design of NbS is informed by Scale"** (The detail of this criterion highlights importance and difficult issues: recognising complexity, uncertainty inherent to ecosystems, and resultant risks (and management) during NbS design. Integrating NbS with other complementary interventions such as engineering projects or financial instruments is one of the indicators of this criterion --originally it was a criterion in its own right, I think).
3. **"NbS result in a net gain to biodiversity and ecosystem integrity"** (this requires understanding of ecosystem function, ecosystem services, and periodic revisiting to inform monitoring and evaluation. During design, promoting ecosystem integrity and connectivity should be explicitly considered.)
4. **"NbS are economically viable"** (This criterion aims to ensure NbS can operate in the long-term, by balancing long-term gains against short-term costs. Comparing it against other non-NbS solutions is considered (whilst also considered unpriced externalities). 'Resourcing options' that allow different sources of finance may help to assist achieve economic viability)
5. **"NbS are based on inclusive, transparent and empowering governance processes"** (e.g., NbS acknowledge, involve and respond to concerns of a variety of stakeholders, especially 'rights-holders'. This requires good governance – integrating with and often going beyond existing legal provisions. Requirements include that a feedback and grievance mechanism must be available before initiating an intervention, stakeholders who are directly and indirectly involved are identified and involved in "all processes" of the intervention).



6. **"NbS equitably balance trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits"** (e.g., there needs to be a "credible assessment" of Cs and Bs of intervention are documented, shared with "most affected stakeholders" to agree with them how trade-offs should be addressed)
7. **"NbS are managed adaptively, based on evidence"** (e.g., monitoring and evaluation, based on NbS, is designed, implemented throughout intervention cycle, and used to update ongoing learning. Evidence means scientific information but also local, indigenous and other forms of knowledge.)
8. **"NbS are sustainable and mainstreamed within an appropriate jurisdictional context"** (e.g., integral in the overall design of policies, and inform changes to framework of policies/policy measures).

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
Yes, it is designed to apply to a variety of types of NBS. Annex I of IUCN decision WCC-2016-Res-069 (IUCN, 2016) defines NBS very broadly as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that *address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*." Their overarching goal is "*to support the achievement of society's development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for*

renewal and the provision of services; Nature-based Solutions are designed to address major societal challenges, such as food security, climate change, water security, human health, disaster risk, social and economic development". They specifically exclude Nature-inspired solutions and nature-derived solutions (see page 6 in IUCN 2020a).
BENEFITS AND COSTS ARISING FROM NBS
2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
Yes, the first criterion of the framework encourages identification of the societal challenge(s) to be resolved (and hence the benefits to be delivered). 'IUCN recognises the 7 types of challenge: "climate change adaptation and mitigation, disaster risk reduction, reversing ecosystem degradation and biodiversity loss, human health, socioeconomic development, food security and water security ….If the societal challenge of ecosystem degradation is being addressed, at least one other societal challenge must be part of the design of the solution, to differentiate the NbS intervention from a pure conservation action." (pg 4, IUCN 2020a). Any or all of these could be the central focus of an NbS.
b. Does it include co-benefits as well as the main benefits, and if so what?
Yes, the framework encourages identification on the variety of benefits (and costs) that may arise from implementing an NbS, and that they are likely to be trade-offs between these. Criterion 6 requires NbS to maintain provision of multiple benefits not just their primary goal(s). Additionally, criterion 3 explicitly requires net gain to biodiversity and ecosystem integrity, which protects against NbS which may tend to discourage interventions narrowly focused on exploiting nature for one benefit without producing other benefits.
c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
The guidance is (similar to the Ecosystem Approach) in that it is relatively non-prescriptive in the specific methods that must be used, as it aims to be relevant to a variety of contexts, and accessible to a variety of potential user groups, and particularly local or indigenous peoples. Whatever methods are used, and their outcomes must be documented 'transparently'.
3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
The guidance on criterion 6 (pg. 32) suggests using the InVEST framework (Sharp et al, 2020). This is a well-known and credible approach to valuing different ecosystem services. An overview of Invest is at https://ecosystemsknowledge.net/invest It is open access, and no specific software is needed to view the outputs, but setting up the models for specific sites requires programming and GIS skills – it may not be suitable for processes driven by local users or small NGOs. Colleagues in James Hutton Institute have experience of using it.
b. Does it account for contributions to mitigation and adaptation?
"Mitigation and adaption" is one of the 7 categories of challenges that NbS can be applied to (see answer 2.a above). If the InVEST framework is used to assess and present ESS /changes – then carbon storage and sequestration can be shown within this approach.
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?
Implementation of criteria 1, 5 and 6 highlights the need to consider – and document - the different needs of and impacts on different groups of stakeholders. Rights holders, those local to an intervention, are considered particularly important. There is not a specific method mandated for exploring or documenting these differences.
4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)

a. Does it include appraisal of local and distant biophysical changes (positive and negative)
Yes, the guidance for criterion 2 talks about the need to appraise distant changes and interactions that may affect, or result from, an intervention (page 9, IUCN 2020a). These include natural and social changes. It has a checklist of issues needed to build a full understanding of ecosystem processes (pg. 23, IUCN 2020a).
b. Does it include appraisal of local and distant socio-economic disbenefits?
Yes, the guidance for criterion 2 talks about the need to appraise distant changes and interactions that may affect, or result from, an intervention (page 9, IUCN 2020a). These include natural and social and economic changes.
5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
Predominately "ecosystem services and biodiversity", e.g., executive summary of IUCN 2020a. Also, "ecosystem goods and services", e.g., page 4, IUCN 2020a and "benefits and costs", e.g., page 27, IUCN 2020a.
b. Are all or some of the benefits and dis-benefits quantified? If so, how? If and how are benefits and dis-benefits combined, compared or used in decision-making?
The guidance for assessing benefits and costs (page 27, IUCN 2020a) states under criteria 4.1 that these can be assessed in non-economic or economic terms. It is encouraged that they are at least quantified, if not priced - indicator 4.2 (pg. 27) recommends a cost-effectiveness study, cost-benefit analysis and/or a multi-criteria analysis – the first of these would require costs be quantified and priced, the second of these would require both costs and benefits be priced, the last of these need not entail pricing but can encourage quantifying Cs and Bs.
c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?
This is not *explicitly* addressed in the guidance, which is a potential weakness. However, the use of multi-criteria analysis is suggested, the need to scope and understand trade-offs across multiple benefits/issues is mandated (criterion 6). There is plenty of encouragement to scope a range of ecosystem properties, and stakeholder groups, and socio-economic drivers, so this would tend to encourage a comprehensive view of the system in which the NbS intervenes, and its effects.
UNDERSTANDING HOW IMPACTS OF NBS ARISE
6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?
The guidance on Criterion 3 (pg. 20, IUCN 2020a) supports consideration of long-term change, and page 23 provides a checklist of information needed to understand the ecosystem and one of these is connectivity and another is external threats to the system.
7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?
Indicator 2.3 (under criterion 3) focuses on risk identify and management 'beyond the intervention site' (pg. 20, IUCN 2020a). This explicitly requires the effect of external pressures and changes to be considered on the ecosystem and vulnerable people connected with an intervention. A 'vulnerability and resilience assessment' is recommended as the means to do this – no source is provided for this method but a few example questions to be asked are provided (pg. 21, IUCN 2020a).

8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?
Yes, it is explicitly recommended that when planning an intervention, the costs and benefits versus other approaches are considered (criterion 4). However, evaluation of an ongoing NbS does not necessarily need a counterfactual.
9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
Yes. The criteria for design and hence evaluation explicitly require good quality inclusive governance, including conflict and resolution procedures (principle 5), supported by principles about involving interested stakeholders in various stages of intervention (criterion 1), embedding adaptive management (criterion 7) and integration into other processes (criterion 8). A theory of change approach is recommended when planning an intervention, could also help identify how intended activities could support the final desired outcomes.
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
Principle 1 criteria 1.3 notes the need to specify intermediate targets where long-term impacts of a NBS may not be achieved with the intervention timeline (pg. 18, IUCN 2020a). The guidance text repeatedly encourages the use of a 'Theory of Change' approach when planning (e.g., see page 34 in IUCN 2020a, the guidance on principle 7). This involves specifying intermediate outputs and outcomes as well as outcomes, and so can help appraise progress even before long-term change can be expected to be observed.
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
Potentially all parts of the planning and implementation cycle can involve local communities. In the guidance on criterion 7 there is strong text on empowering and upskilling rights holders to enable them to participate in the design, choice and implementation and evaluation of NbS (e.g., page 35, IUCN 2020a).
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
The text around criterion 7 notes the need to work with locals/non-specialists but is a bit vague about how this may be reconciled with the ideas of carrying out cost-effectiveness analysis, or what to do if different knowledge-holders have different views about how the system works.
13. Does it record or even favour NbS that involve the co-production of interventions?
Yes. This framework strongly encourages NbS interventions to involve the input of stakeholders and their knowledges at any or all parts of the process of designing an intervention (and potentially when monitoring, evaluating and updating an intervention).
14. Is the framework designed to allow funding/investment decisions to be made?
Yes, more than one the guidance text makes clear the need for this to be accessible to investors, and for NbS to be investable solutions, and blended finance is mentioned. The ability to use the criteria for verification of NbS in progress, for investors, is mentioned (pg 36, IUCN 2020a). However, it is unclear exactly what may make a NbS an investable preposition – e.g., the different evidence needs (quality, type) of these or other stakeholders are not explicit.
INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?

Yes, indicator 2.2, under the second criterion is "the design of the NbS is integrated with other complementary interventions" such as engineering interventions, information technology or financial instruments. This prompts to identify and capitalise on synergies across sectors – and to apply risk management to adapt or mitigate the effect of any external changes may run counter to the NbS intervention.

IUCN. (2016). *WCC-2016-Res-069-EN Defining Nature-based Solutions*. Retrieved from https://www.iucn.org/sites/dev/files/content/documents/wcc_2016_res_069_en.pdf

IUCN. (2020a). *Guidance for using the IUCN Global Standard for Nature-based Solutions : first edition*. Retrieved from Gland, Switzerland: https://doi.org/10.2305/IUCN.CH.2020.09.en

IUCN. (2020b). *IUCN Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First edition*. Retrieved from Gland, Switzerland: https://doi.org/10.2305/IUCN.CH.2020.08.en

Revaluation

Source: (CECAN, 2017), https://www.revaluation.org.uk/, Plus a 1 hour talk given at https://www.tavinstitute.org/projects/revaluation-measuring-value-making-value/. Note the CECAN 2017 note promise academic papers will be published, but although a good search of Web of Science was made, no papers by these authors or on Revaluation were found. They are independent researchers/consultants, so that might explain the lack of interest in publishing papers, and in sharing details of the approach.

I have found a very interesting special issue just coming out, which collects some policy-relevant approaches for evaluation of/in the face of complexity (see https://journals.sagepub.com/doi/pdf/10.1177/1356389020976491) but Revaluation is not mentioned as part of that. (As an aside, CECAN runs until 2022 and is focused on national policy collaboration – contacting them for their views might be possible and interesting). This means there is not a lot of information to go on when describing revaluation, versus the other approaches that we have fully reviewed.

Completed by: Kerry Waylen

Description of framework: Revaluation "Is experienced by those working in a system as a simple participative process involving three phases of activity" (pg1, CECAN, 2017).:

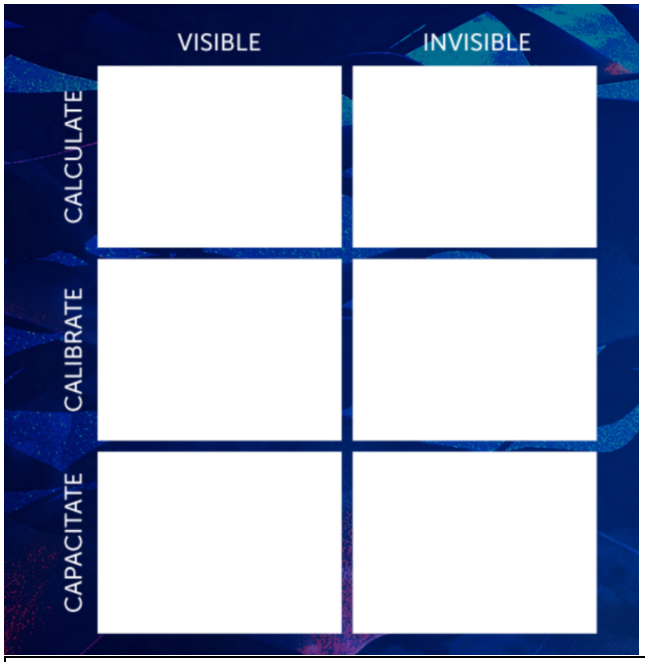
- telling their stories about the intervention or system, "why does intervention X matter to you"? iterated and cascaded between people, can be audio, video, written, anything. Once a range of stories is collected then:
- translating those stories into items of data expressing pieces of value ("how do you know Y is important?")
- then negotiating with other participants to reach a settled account of the overall value."

It can be carried out during and after a process (ideally repeatedly), builds on formative and summative evaluation methodologies. Is social – must be done by interacting/collective of people. According to their Tavistock talk, it will facilitate what they call double-loop learning: initially it prompts instrumental change (fixing existing problems) towards more transformative change in practice and behaviour.

The dashboard used as part of this process.

Calculate: The things we add up; Calibrate: the things we weigh add; Capacitate: mapping the relations entailed by the process.

Visible vs invisible = things that are and are not already observed by 'the hierarchy'.



SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
Revaluation is not focused on NbS. "Revaluation is centrally concerned with revealing the value of an activity or intervention in a complex system" (pg. 1 CECAN, 2017). As such, it could be applied to any type of NbS.
BENEFITS AND COSTS ARISING FROM NBS
2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
As far as I can tell the revaluation process does not presume there is a single main benefit or value that a process may bring – it focuses, throughout a process – on understanding how people are experiencing a process, what value(s) it has in their view.

b. Does it include co-benefits as well as the main benefits, and if so what?
Yes, the process encourages a systematic view of how different stakeholders may be affected, and explicitly encourages consideration of 'invisible' processes.
c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
Not beyond what is provided in the above overview of the method. Based on listening to the example in the talk, probing is used to explore in depth what underlies different judgements and stories.
3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
Revaluation depends on the perception that value is socially generated. But there is little specific guidance about how this is achieved.
b. Does it account for contributions to mitigation and adaptation?
No.
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?
Not explicitly.
4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)
a. Does it include appraisal of local and distant biophysical changes (positive and negative)
Not explicitly in those terms, but it prompts to consider direct benefits, and then indirect benefits that flow from that.
b. Does it include appraisal of local and distant socio-economic disbenefits?
Not explicitly.
5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
Values Direct and indirect Benefits Visible and invisible benefits. Assumes that invisible benefits are always more important than what is most obvious/visible.
b. Are all or some of the benefits and dis-benefits quantified? If so, how? If and how are benefits and dis-benefits combined, compared or used in decision-making?
'Calculate' is one of the 3 main steps in revaluation, usually entailing placing monetary values on different types of value. Prioritising measurement whilst not misrepresenting the system is a central challenge – don't want just to fund the things that can be most easily measured but do need to have measurement of some things in order to justify funding/choosing certain methods. Very focused on future value not just or more than the existing value (the 'buds and the flowers rather than the fruit').
c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?
Yes, revaluation is very focused on ensuring a systemic overview is built, which uses a 'full understanding' of value, not just focused on single issues or single metrics. It draws attention to the 'invisible' as well as the 'visible'.
UNDERSTANDING HOW IMPACTS OF NBS ARISE

6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?
The intervention to be evaluated is perceived as something evolving.
7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?
Not explicitly though this may emerge from people's stories.
8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?
Not explicit in the short, written guidance, though note that during the example discussed in the talk, the facilitators prompted the participants to report what else is happening that could be used as a measure of change – or what is not being measured but could be.
9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
Not explicit, but I think this would surely come out in people's stories- their meaning making?
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
Yes, a central focus is how a process is currently being experienced as well as what is expected to be experienced.
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
As presented the process is very focused on practitioners who are involved in an intervention– e.g., those working in the NHS, helping them to understand and improve their processes. Perhaps other examples would show how local people can be involved/lead. Regardless, it does strongly expect and encourage elicitation of a plurality of views.
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
Yes, definitely, this process is designed to be led by those affected by/leading the process.
13. Does it record or even favour NbS that involve the co-production of interventions?
Yes, definitely, this process is designed to led by those affected by/leading the process.
14. Is the framework designed to allow funding/investment decisions to be made?
Nope.
INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?
N.A.

CECAN. (2017). *Revaluation: a participative approach to measuring and making change*. Retrieved from Surrey, UK: http://doi.org/10.15126/00850620

ThinkNature Handbook

Source: Somarakis, G., Stagakis, S., & Chrysoulakis, N. (Eds.). (2019). ThinkNature Nature-Based Solutions Handbook. ThinkNature project funded by the EU Horizon 2020 research and innovation programme under grant agreement No. 730338. doi:10.26225/jerv-w202. https://platform.think-nature.eu/system/files/thinknature_handbook_final_print_0.pdf

FROM THE THINKNATURE HANDBOOK – HOW TO USE THE HANDBOOK….

The Handbook is highly recommended to all stakeholder groups that use NBS in their work, but it can also be useful for other organisations and individuals that comprise potential NBS stakeholders. Additionally, many chapters can contribute to increasing public awareness about NBS. In respect of the structure of the Handbook, each chapter focuses on a separate issue (analysed and documented through specific subtopics) and targets different types of NBS stakeholders. In general, Chapters 1-4 provide general background knowledge, useful for everyone involved in NBS initiatives; Chapters 5-7 are more specialised, addressing issues relevant to different NBS stakeholder groups (i.e., Chapter 5 for research and innovation, Chapter 6 for business sector, and Chapter 7 for policy sector); and Chapter 8 concludes with key recommendations.

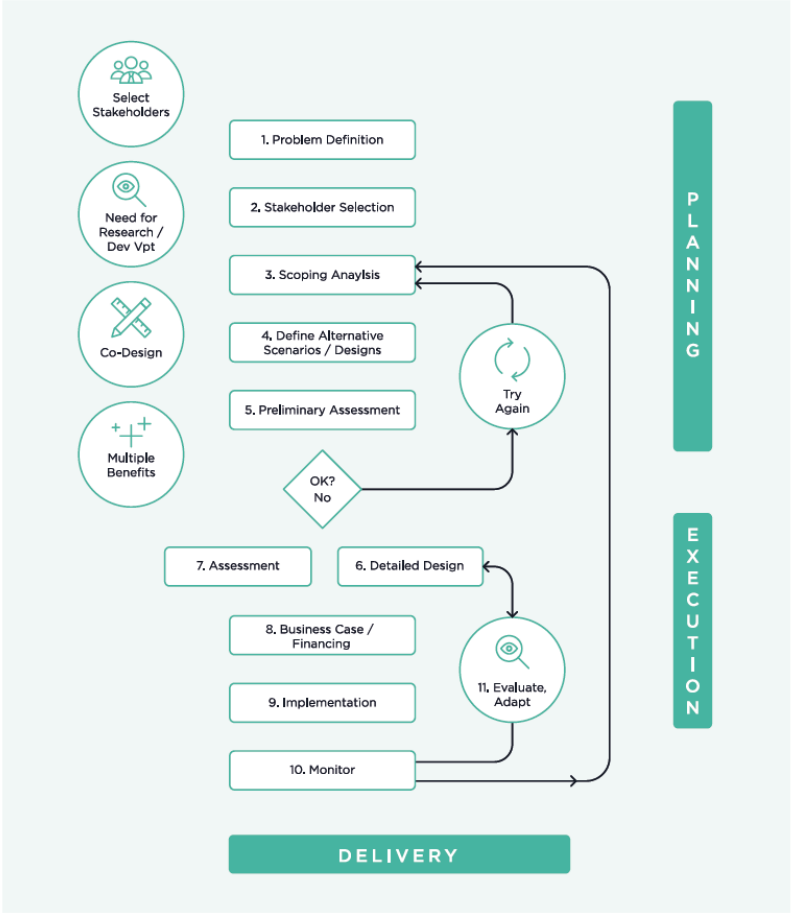


Figure 4.1. Implementation logic for NBS

SCOPE
1. Has the framework been designed to apply to different types of NbS or is it specialised for a certain type of NbS social or geographic settings, or ecosystem domain? If so what?
The Handbook was developed in the framework of the EU ThinkNature project. It is not so much a framework but a guide that brings together knowledge on NBS and promotes this to various actors.

However, the book covers all aspects of developing NBS projects from project development to financing. It also proposes a methodology for innovation. The handbook covers a wide range of NBS in all environments. It is a comprehensive overview. The authors state: *"The Handbook is highly recommended to all stakeholder groups that use NBS in their work, but it can also be useful for other organisations and individuals that comprise potential NBS stakeholders. Additionally, many chapters can contribute to increasing public awareness about NBS."*
BENEFITS AND COSTS ARISING FROM NBS
2. Is it comprehensive in its coverage of biophysical impacts (positive and negative)?
a. Does it focus on core/main benefits?
Yes – it is giving an overview of all the main biophysical impacts
b. Does it include co-benefits as well as the main benefits, and if so what?
Yes – the ethos of this handbook is to demonstrate NBS are multifunctional
c. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
Not really – this is more a handbook overview rather than offering appraisal techniques.
3. Is it comprehensive in its coverage of socio-economic benefits/disbenefits?
a. Is there guidance on methods to appraise these? (If so, how rigorous/reliable/appropriate?)
As above - not really as this is a handbook on how to go about delivering an NBS project rather than appraising it (but it offers valuable information to stakeholders).
b. Does it account for contributions to mitigation and adaptation?
It discusses these aspects.
c. Does it appraise the distributional consequences of NbS, i.e., how impacts are felt by different stakeholders and the potential of conflicts of interests?
It discusses these aspects but does not offer an appraisal framework
4. Does the framework enable appraisal of both on-site and off-site impacts? (Benefits may be felt locally or elsewhere, whilst costs may be incurred differently to benefits.)
a. Does it include appraisal of local and distant biophysical changes (positive and negative)
No – it doesn't appraise this but offers a framework on how to deliver an NBS project (see start of document).
b. Does it include appraisal of local and distant socio-economic disbenefits?
The framework clearly sets out the need to consider benefits from the fine scale to the regional scale.
5. Does it enable balanced appraisal of biophysical and socio-economic (dis)benefits?
a. What terminology or language frames and refers to benefits and disbenefits?
Yes, the handbook discusses this in detail. Section on "benefits and unwanted impacts"
b. Are all or some of the benefits and dis-benefits quantified? If so, how? If and how are benefits and dis-benefits combined, compared or used in decision-making?
These are covered in the handbook and it gives an overview of some cases on this.
c. Does it allow for different metrics/currencies/values to be brought together (qualitative and quantitative, precise and rough) so that the evidence for assessment is comprehensive rather than based only on impacts with precise estimates?
The framework does not cover this.
UNDERSTANDING HOW IMPACTS OF NBS ARISE
6. Does it cover the changes through time, both in terms of the time taken for NbS to take effect and the impact of the changing environment (e.g., climate change and the incidence of pests, disease, fire, drought, floods and storm damage) on vegetation, soils and ecosystem resilience?

Yes, as the handbook has a comprehensive coverage of all NBS types (this is mentioned).
7. Does it appraise the effect of external change and pressures (e.g., pressures from pollution loading, recreation) on the NbS initiative and its outcomes?
Note sure – again, not appraising this but highlighting this as a key step.
8. Does it assess alternatives or counterfactuals, to allow for clear demonstration of costs and benefits?
Not explicitly.
9. Does it appraise procedural factors (e.g., process of design and implementation of the NbS)?
Yes, this is covered in the handbook – the process is well covered, i.e., design, build and operate phases (with appraisal covered in the operate/monitor phase).
10. Does it appraise intermediate outcomes as well as final outcomes/impacts?
This is covered in their step approach – i.e., monitoring outcomes. Again, these are not appraised but considered.
WHO CAN USE THE ASSESSMENT FRAMEWORK?
11. Which part(s) of the assessment explicitly support the involvement of local communities?
There is a component on stakeholders and communities.
12. Is it practical to expect non-specialists to operate the assessment? / for which aspects?
I think this is a strength of the handbook – it has been developed so many different stakeholders can understand and use this.
13. Does it record or even favour NbS that involve the co-production of interventions?
There is mention made of co-design, but this is not extensively covered.
14. Is the framework designed to allow funding/investment decisions to be made?
It discusses funding and investment strategies in detail – it does not decide these for you but advises on mechanisms.
INTEGRATION WITH OTHER SOLUTIONS
15. Can it foster integration with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)?
Yes, this is covered.

Appendix 3. Workshop report

Evaluating Nature-based Solutions – Report of Workshop held on 13 May 2021

To explore the findings of the report we held a 2-hour virtual workshop with staff from a range of organisations. The findings of the project were presented, emphasising that the IUCN global framework was suitable for Scotland, but some other frameworks had complementary strengths and some knowledge gaps remained. This was followed by a presentation from Nick Everett (NatureScot) on post-hoc evaluation of NbS being carried out across the UK; the presentation identified that scoring was influenced by how much evidence was available and that many benefits might be felt away from the site being scored. There was also a tension between uniform scoring, allowing comparison, and scoring a project against the best locally possible goal. This was followed by sub-group discussions and a final brief plenary discussion.

Below we highlight some of the main points of the discussions, followed by a list of attendees and the agenda.

Main themes in discussion

Refining and using NbS frameworks

- More detail about methodologies such as for valuation is often desired (see below). However, there is a clear conflict between flexibility and specificity. It maybe that more detailed and prescriptive frameworks can be suited to specific situations or challenges, but not are not easy or appropriate to apply in other settings. More flexible frameworks may also be better at being applied across scales. However, flexibility must not be employed to enable a partial interpretation of NBS, i.e., projects must be multi-functional.
- Blue-green infrastructure is a related term, often used in relation to urban settings.
- The best point at which to start the use of any NbS framework is in the planning phase to help achieve the best outcomes, and to make later evaluation easier.
- Co-production is challenging but in the ethos of NbS – i.e., working with stakeholders to identify, plan, implement and evaluate – this must also start early.

Track multiple aspects to understand impact

- It is important to consider on-site and off-site impacts. There is potential for local impacts to be low but for downstream /wider impacts to be high.
- For each NbS there is a need for indicators to assess success, but it would help if users employed a common set of indicators.
- Projects should be inclusive, but this different stakeholder groups involved may have varied views on success – this plurality should be expected.
- Indicators perhaps should be scored in terms of the best possible outcome in that situation, for that project, rather than an abstract or 'ideal' measure of quality which cannot feasibly be achieved given wider constraints. This would make comparing projects more difficult.

Embed in existing appraisal and decision-making processes

- We need to compare NbS to existing standards, concepts and processes that already exist and are in use within the UK, to understand how NbS is similar to or goes beyond these.
- There is a need to embed NbS into the planning framework (especially with National Planning Framework 4), into farming and into forestry. There is an opportunity to do this within the Regional Land Use Partnerships.
- There is also a need to embed NbS in Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) (see similar guidance for the Ecosystem Approach).

- If a Natural Capital approach is adopted, then NbS becomes a means of identifying where natural capital can be increased. Embedding Natural Capital can support NbS and vice versa.
- It will be useful to influence or inform the development of investment priorities by Scotland's forthcoming Regional Economic Partnerships.

Maintenance and responsibilities

- Many schemes will be created by partnerships. The issues of governance and responsibilities needs addressing as part of the development of a NbS, since longevity is required. Who pays for construction, contracts for management longer term maintenance?

Integration across sectors

- NbS should not be seen as a minor bolt on to existing schemes, or a concern only for 'green' organisations. NbS can be seen as relevant to all land everywhere, to support a green recovery. Involving key players in sectors such as transport and agriculture will be essential if NbS is to be mainstreamed. Identifying how it compares and can connect to existing concerns and processes will help with this (see below) and raising the minimum standards required by regulation will also help.
- If private sector actors get involved in NbS, then any NbS framework has to be capable of helping identify and enrol new actors and resources. This will be a focus for future discussions, e.g., by NatureScot. Insights from ongoing research projects (e.g., NAIAD) may assist in tackling this challenge of involving investors and finance.
- There will be a continuing tension between the use of generic frameworks which allow comparison across projects with different contexts and the development of targeted tools that offer more support in decision making.

Valuation and economics

- Government investment decisions use a negative discount rate. However, for investments such as NbS, their societal value will likely increase through time. Could a positive discount rate be used? There needs to be a revision to the economic appraisal system to include long-term benefits of current investment.
- Frameworks call for quantification of benefits, but we also have to learn how to act in the face of uncertainty, to make decisions despite data gaps, and not to overlook issues and ecosystem services that are not or cannot be quantified.
- How to compare NbS projects to 'non-NbS' projects or decide how to integrate NbS and non-NbS projects, can be challenging. It may help to move focus from cost-benefit analysis to multi-criteria decision making.

General comments

- Will NbS still be in use as a concept in a few years, or might it be replaced by a different concept? This may happen but using it now to reach appropriate decisions can't be put off (and not using it or using it consistently will make this more likely). Language will have to be modified depending on the audience.
- Developing a suite of example project evaluations would be useful, even if not using the IUCN Global Standard. There is a need to promote good practice.

Attendees

Alan Bell	LLTNP – Loch Lomond & Trossachs National Park
Catherine Preston	SEPA – Scottish Environment Protection Agency
Clive Mitchell	NatureScot
Kerry Waylen	James Hutton Institute*

Andrew Kelloe	SEFARI – Scottish Environment, Food and Agriculture Research Institutes
Mary Christie	NatureScot
Robin Pakeman	James Hutton Institute*
Stephen Hughes	Green Action Trust
Helen Sellars	Forestry and Land Scotland
Nicola Melville	SEPA – Scottish Environment Protection Agency
Peter Mayhew	CNPA – Cairngorms National Park Authority
Ken Loades	SEFARI
Lynne Ross	Scottish Enterprise
Nick Everett	NatureScot
Scot Mathieson	SEPA – Scottish Environment Protection Agency
Beth Hadley	Scottish Government
Mark Wilkinson	James Hutton Institute*
Eilidh Henry	Scottish Government
Kirsty Gray	Scottish Government
Charles Bestwick	SEFARI – Scottish Environment, Food and Agriculture Research Institutes

* = workshop facilitators

Workshop Agenda

- 10.00 Overview and team introductions
- 10.05 Welcome from Clive Mitchell, NatureScot
- 10.10 Project findings, Robin Pakeman
- 10.40 Experiences of NbS evaluation, Nick Everett, NatureScot
- 11.05 Screen break
- 11.10 Sub-groups: to embed NbS what is already happening, what more is needed.
- 11.45 Plenary discussion
- 11.55 Final thoughts and thanks

Appendix 4 - Nature-based Solutions: working principles for NatureScot

For internal and external interest

Nature can help to fix many social problems, including health, climate change and biodiversity loss. These 'nature-based solutions' benefit both people and the natural environment. Their potential is limited mainly by our imagination, but can be applied to education, physical activity, mental health, flood management, air quality, absorbing and storing greenhouse gases, and managing pests, diseases and pathogens. This note sets out what Nature-based Solutions mean for NatureScot. Further details are here.

Nature-based solutions protect, sustainably manage, and restore the natural environment so as to address specific societal challenges. They adapt to change and simultaneously provide multiple benefits to people and nature and reduce whole-life costs. Well designed and properly managed nature-based solutions:

- are co-produced, with the diversity of benefits reflecting the diversity of people and interests involved in designing them
- deliver benefits in a fair and equitable way and in a manner that promotes transparency and broad participation
- can be implemented alone or integrated with other solutions to societal challenges (e.g., technological and engineering solutions; 'grey' and 'green' infrastructure)
- work with the grain of natural processes, taking account of changing vegetation and soil structure and processes
- maintain biological and cultural diversity
- avoid changing or simplifying ecosystems in favour of a particular services or resources
- increase nature's resilience and the ability of ecosystems to evolve over time

In short, they are an 'ecosystem approach'. Nature-based solutions are not

- monocultures
- geo-engineering (such as iron fertilisation in the deep-sea or carbon storage from bioenergy)

To illustrate, on a spectrum from intensive uses of the land and sea for single purposes on one side and nature in its 'natural' state on the other, then nature-based solutions are towards the 'nature' side. The more nature-rich, the more benefits. Enhancing soil carbon in agricultural and forestry soils would sit some way from the productive side, with more integrated agro-forestry and agro-ecological systems as examples of nature-based solutions.

For internal interest

For SNH,

- Examples include: Peatland Action, Dynamic Coast, Green Infrastructure Strategic Intervention; investing in greenspace for social housing, Our Natural Health Service, outdoor learning and play; catchment projects (e.g., beavers); place-based and landscape-scale projects
- Other examples depend on how tightly the objectives are specified, e.g., interventions for features of interest on protected areas are unlikely to serve as a nature-based solutions, but wider, landscape scale interventions delivering multiple benefits through some NNR management, species management, wildlife management, casework e.g., development management, SRDP might be good examples.

Sources: IUCN and EU definition of nature-based solutions; Cohen-Shacham et al (2019) Core principles for successfully implementing and upscaling Nature-based Solutions; Natural Capital Committee (2020) Advice on using nature-based interventions to reach net zero greenhouse gas emissions by 2050

References and information sources

References

Brown, I. & Everard, M. (2015) A working typology of response options to manage environmental change and their scope for complementarity using an Ecosystem Approach, Environmental Science & Policy, 52, 61-73. http://www.sciencedirect.com/science/article/pii/S1462901115001033

CBD (2000) Decision adopted by the Conference of Parties to the Convention on Biological Diversity at its 5th meeting; Decision V/6 Ecosystem Approach., Nairobi, Kenya. http://www.cbd.int/decision/cop/?id=7148

CBD (2006) The Ecosystem Approach: advanced user's guide. http://www.cbd.int/doc/programmes/cro-cut/eco/eco-guide-ad-en.pdf

CBD SBSTTA (2007) In depth review of the application of the ecosystem approach; 30th March 2007 note by the Executive Secretary; UNEP/CBD/SBSTTA/12/2, SBSTTA Twelfth meeting, UNESCO, Paris, 2–6 July 2007, Item 3.1 of the provisional agenda. https://www.cbd.int/doc/meetings/sbstta/sbstta-12/official/sbstta-12-02-en.pdf

De Lucia, V. (2014) Competing Narratives and Complex Genealogies: The Ecosystem Approach in International Environmental Law, Journal of Environmental Law. http://jel.oxfordjournals.org/content/early/2014/11/28/jel.equ031.abstract

Ecoshape (2018) Ecoshape guidelines –accessed online in august 2018. https://www.ecoshape.org/en/design-guidelines/ and https://publicwiki.deltares.nl/display/BTG/Guideline.

Girardin, C.A., Jenkins, S., Seddon, N., Allen, M., Lewis, S.L., Wheeler, C.E., Griscom, B.W. & Malhi, Y. (2021) Nature-based solutions can help cool the planet—if we act now. Nature, 593, 191-194.

Haines-Young, R. & Potschin, M. (2014) The ecosystem approach as a framework for understanding knowledge utilisation, Environment and Planning C: Government and Policy, 32, 301-319. http://www.envplan.com/abstract.cgi?id=c1329j

Howard, B., Waylen, K.A. & Blackstock, K.L. (2013). Does the ecosystem approach offer anything new for environmental decision-making? Report from the RGS-IBG conference workshop held on 29th August, 2013. http://ecosystemsknowledge.net/sites/default/files/wp-content/uploads/2013/12/RGS_EcosystemApproach_Session2_FINAL.pdf

IHOBE (2017) Nature-based solutions for local climate adaptation in the Basque Country. Environmental Management Agency (Ihobe), Ministry of the Environment, Territorial Planning and Housing - Basque Government. Report Klimatek Project 2016, 89 pp.

Kay, J. & Schneider, E.D. (1994) Embracing complexity, the challenge of the Ecosystem Approach. Alternatives, 20, 32-38.

Maltby, E. (2000) Ecosystem Approach: from principle to practise, IUCN. http://www.biotechnology.uni-koeln.de/inco2-dev/common/contribs/18_maltb.pdf

NatureScot (No date) NatureScot webpage on applying the Ecosystem Approach. https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/ecosystem-approach/how-apply-ecosystem-approach

Naumann, S., Kaphengst, T., McFarland, K. & Stadler, J. (2014) Nature-based approaches for climate change mitigation and adaptation. Published by German Federal Agency for Nature Conservation.

Nesshöver, C., Assmuth, T., Irvine, K.N., Rusch, G.M., Waylen, K.A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E. & Krauze, K. (2017) The science, policy and practice of nature-based solutions: An interdisciplinary perspective. Science of the Total Environment 579, 1215–1227.

Oates, J. & Dodds, L.A. (2017) An approach for effective stakeholder engagement as an essential component of the ecosystem approach, Ices Journal of Marine Science, 74, 391-397. https://dx.doi.org/10.1093/icesjms/fsw229

Österblom, H., Gårdmark, A., Bergström, L., Müller-Karulis, B., Folke, C., Lindegren, M., Casini, M., Olsson, P., Diekmann, R., Blenckner, T., Humborg, C. and Möllmann, C. (2010) Making the ecosystem approach operational--Can regime shifts in ecological- and governance systems facilitate the transition? Marine Policy, 34, 1290-1299. http://www.sciencedirect.com/science/article/B6VCD-50C5XG1-1/2/2c7ee553375f5983955312f350bcc9a4

PIANC (2018) Guide for Applying Working with Nature to Navigation Infrastructure Projects. PIANC - The World Association for Waterborne Transport Infrastructure. EnviCom WG Report No. 176.

Pound, D. (2008) From Conflict to Consensus to the Ecosystem Approach. In Governing Shared Resources: Connecting Local Experience to Global Challenges, the Twelfth Biennial Conference of the International Association for the Study of Commons, Cheltenham, UK, July 14-18, 2008.

Raum, S. & Potter, C. (2015) Forestry paradigms and policy change: The evolution of forestry policy in Britain in relation to the ecosystem approach, Land Use Policy, 49, 462-470. http://www.sciencedirect.com/science/article/pii/S0264837715002562

Raymond, C.M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M.R., Geneletti, D. & Calfapietra, C. (2017a) A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. Environmental Science and Policy 77, 15–24.

Raymond, C.M., Breil, M., Nita, M.R., Kabisch, N., de Bel, M., Enzi, V., Frantzeskaki, N., Geneletti, G., Lovinger, L., Cardinaletti, M. & Basnou, C. (2017b) An Impact Evaluation Framework to Support Planning and Evaluation of Nature-based Solutions Projects. Report prepared by the EKLIPSE Expert Working Group on Nature-based Solutions to Promote Climate Resilience in Urban Areas. Centre for Ecology & Hydrology, Wallingford, U.K.

Rogger, M., Agnoletti, M., Alaoui, A., Bathurst, J.C., Bodner, G., Borga, M., Chaplot, V., Gallart, F., Glatzel, G., Hall, J. & Holden, J. (2017) Land use change impacts on floods at the catchment scale: Challenges and opportunities for future research, Water Resource Research, 53, 5209–5219, doi:10.1002/2017WR020723.

Shepherd, G. (2004) The Ecosystem Approach. Five Steps to Implementation, Ecosystem Management Series, http://data.iucn.org/dbtw-wpd/edocs/CEM-003.pdf, Gland. http://data.iucn.org/dbtw-wpd/edocs/CEM-003.pdf

Smith, R.D. & Maltby, E. (2001) Using the Ecosystem Approach to implement the CBD: A global synthesis report drawing lessons from three regional pathfinder workshops, IUCN. http://www.cbd.int/doc/case-studies/esys/cs-esys-cbd-en.pdf

SNH (2016) An Evaluation Framework for applying the Ecosystem Approach. https://www.nature.scot/sites/default/files/2017-06/Evaluation%20Framework%20for%20the%20Ecosystem%20Approach%20-%20Final%20for%20Publication%20-%20March%202016%20-%20Copy%20with%20small%20revision%20made%2027_7_16.pdf

Stafford, R., Chamberlain, B., Clavey, L., Gillingham, P.K., McKain, S., Morecroft, M.D., Morrison-Bell, C. & Watts, O. (Eds.) (2021) Nature-based Solutions for Climate Change in the UK: A Report by the British Ecological Society. London, UK. Available at: www.britishecologicalsociety.org/nature-based-solutions

Szaro, R. C., Berc, J., Cameron, S., Cordle, S., Crosby, M., Martin, L., Norton, D., O'Malley, R. & Ruark, G. (1998) The ecosystem approach: science and information management issues, gaps and needs, Landscape and Urban Planning, 40, 89-101. http://dx.doi.org/10.1016/S0169-2046(97)00101-1

UNEP/CBD (2000) Ecosystem Approach. In Decisions adopted by the Conference of the Parties to the Convention on Biological Diversity at its Fifth Meeting, Nairobi, 15-26 May 2000. http://www.cbd.int/doc/decisions/COP-05-dec-en.pdf [Accessed 4.3.2015]

Waters, R.D., Lusardi, J. & Clarke, S. (2012) Delivering the ecosystem approach on the ground - an evaluation of the upland ecosystem service pilots, Natural England Research Reports, Number 046, Natural England, York. http://publications.naturalengland.org.uk/publication/4084624

Waylen, K.A. & Blackstock, K.L. (2017) Monitoring for Adaptive Management or Modernity: Lessons from recent initiatives for holistic environmental management, Environmental Policy and Governance, 27(4), 311-324. http://dx.doi.org/10.1002/eet.1758

Waylen, K.A., Blackstock, K.L. & Holstead, K.L. (2013) Exploring experiences of the Ecosystem Approach, Project report by the James Hutton Institute, Aberdeen. http://www.hutton.ac.uk/sites/default/files/files/Reporton%20EcA%20review%20Final.pdf

Waylen, K.A., Blackstock, K.L. & Holstead, K.L. (2015) How does legacy create sticking points for environmental management? Insights from challenges to implementation of the ecosystem approach, Ecology and Society, 20. http://dx.doi.org/10.5751/ES-07594-200221

Waylen, K.A., Blackstock, K.L. & Irvine, R.J. (2014a). Starting points for evaluating implementation of the "Ecosystem Approach", Project report by the James Hutton Institute, Aberdeen. http://www.hutton.ac.uk/sites/default/files/files/ecosystemservices/Suggestions%20for%20evaluating%20EcA.pdf

Waylen, K.A., Hastings, E., Banks, E., Holstead, K., Irvine, J. & Blackstock, K. L. (2014b) The need to disentangle key concepts from “Ecosystem Approach” jargon, Conservation Biology, 28, 1215-1224. http://dx.doi.org/10.1111/cobi.12331

World Bank (2017) Implementing nature-based flood protection: Principles and implementation guidance. The International Bank for Reconstruction and Development / THE WORLD BANK.

Information sources

Framework	**Link to framework**
IUCN Global Standard for Nature-based Solutions	https://portals.iucn.org/library/node/49070
EKLIPSE - An impact evaluation framework to support planning and evaluation of nature-based solutions projects	https://www.eklipse-mechanism.eu/apps/Eklipse_data/website/EKLIPSE_Report1-NBS_FINAL_Complete-08022017_LowRes_4Web.pdf
Evaluating Nature-Based Solutions - INTERREG. 2018	https://northsearegion.eu/media/6959/report_pr3812_evaluatingnbs_final_29112018.pdf
UNEP/CBD. (2000). Ecosystem Approach. In Decisions adopted by the Conference of the Parties to the Convention on Biological Diversity at its Fifth Meeting, Nairobi, 15-26 May 2000.	http://www.cbd.int/doc/decisions/COP-05-dec-en.pdf
Enabling a Natural Capital Approach: Guidance, March 2020	https://www.gov.uk/government/publications/enabling-a-natural-capital-approach-enca-guidance
ThinkNature NBS Handbook (2019)	https://platform.think-nature.eu/content/thinknature-handbook
Revaluation: a participative approach to measuring and making change	https://www.cecan.ac.uk/wp-content/uploads/2020/08/EPPN-No-07-Revaluation.pdf
Nat Cap Committee: Natural Capital Workbook. 2017	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957503/ncc-natural-capital-workbook.pdf
HM Gov, The Green Book, 2020	https://www.gov.uk/government/collections/the-green-book-and-accompanying-guidance-and-documents
Building natural value for sustainable economic development: The Green	https://www.merseyforest.org.uk/services/gi-val/

Infrastructure Valuation Toolkit user guide	
McCarthy, D. & Morling, P. (2014). A Guidance Manual for Assessing Ecosystem Services at Natura 2000 Sites.	http://ww2.rspb.org.uk/images/natura_2000_guidance_manual_tcm9-399208.pdf
Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., . . . Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of The Total Environment, 579*, 1215-1227. doi:10.1016/j.scitotenv.2016.11.106	https://www.sciencedirect.com/science/article/pii/S0048969716325578
Waylen, K. A., & Blackstock, K. L. (2017). Monitoring for Adaptive Management or Modernity: Lessons from recent initiatives for holistic environmental management. Environmental Policy and Governance, 27(4), 311-324.	https://onlinelibrary.wiley.com/doi/full/10.1002/eet.1758?casa_token=U9O9LpObHAYAAAAA%3A26kTK957CDrRPQ-kj29hso8gFfe0-vymoZcElexS90yLmv--GZo_cued4CnkjAj1MqQd5N4REpjU0yuSFg
MAES (Mapping and Assessment of Ecosystems and their Services) and INCA (Integrated system of Natural Capital and ecosystem services Accounting in the EU)	https://op.europa.eu/en/publication-detail/-/publication/0fd2bcda-962b-11e9-9369-01aa75ed71a1
Naturvation	https://naturvation.eu/result/briefing-economic-valuation-nature-based-solutions-urban-areas
Eddleston Water Interreg business case of NFM	https://northsearegion.eu/media/14708/deliverable-5-5-2-elaborated-business-case-eddleston-water-final.pdf
Integrating natural capital into flood risk management appraisal - report v3	https://northsearegion.eu/media/15158/integrating-natural-capital-into-frm-appraisal-practical-guide-v3.pdf
Nature-based-solutions-Achieving-net-zero-a-just-transition-and-improved-wellbeing	https://scottishwildlifetrust.org.uk/?s=Achieving-net-zero-a-just-transition-and-improved-wellbeing
NATURAL CAPITAL LABORATORY (AECOM & Lifescape project)	https://aecom.com/uk/natural-capital-laboratory/
Supporting a Green Recovery: an initial assessment of nature-based jobs and skills	https://www.nature.scot/naturescot-research-report-1257-supporting-green-recovery-initial-assessment-nature-based-jobs-and
Framework for the Integration of Nature-Based Solutions into Environmental Risk Management Strategies	https://www.mdpi.com/2071-1050/11/2/489
B£ST - Benefits Estimation Tool – Valuing the benefits of blue-green infrastructure. 2019 version 6.	https://www.susdrain.org/resources/best.html
Ecosystem services assessment: How to do one in practice (IES, 2013)	https://www.the-ies.org/sites/default/files/reports/ecosystem_services.pdf