A Literature Review on Approaches to Evaluating Place-based Environmental Projects

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Foreword

The majority of Natural England's work is in a place, ranging from agri-environment schemes, through landscape scale delivery projects, to statutory responsibilities within the planning system. A significant amount of this work is often done in partnership with others. Some aspects of our work have been subject to long-term evaluation programmes, such as legacy agri-environment schemes. In other areas, there has historically been little or no evaluation, but this is changing rapidly, given the prominence placed by government on proportionate evaluation of policy and delivery activities. This prominence is demonstrated by the creation of the Evaluation Task Force, following the 2020 Spending Review.

In recent years there has been growing awareness of the challenges around the evaluation of environmental interventions and an exploration of the range of possible methods and approaches that might help (for example the Magenta Book Supplementary Guide on Handling Complexity in Policy Evaluation). Despite a widening of the evaluation methods at our disposal there remains a preference within government for the use of experimental and quasi-experimental (over and above theory-based methods) to demonstrate robust evidence of impact.

The evaluation of *place-based* environmental interventions is particularly challenging. Spatially, no one project is similar to another, even if the overarching intervention is the same. No parcel of peatland is the same as any other and no Site of Special Scientific Interest (SSSI) is either the same size as another nor has the same morphological or biological characteristics. Temporally, environmental interventions can take many years to demonstrate impact. This is a real challenge for undertaking robust impact evaluation, given budget/resource challenges and short fiscal cycles.

These challenges increase the complexity of place-based environmental evaluation and make it difficult to apply experimental and quasi-experimental impact evaluation methodologies, resulting in a tendency to rely on largely theory-based methods.

We are keen to explore the full range of methods that are available to us, and to learn from the evaluation of place-based interventions in other sectors, to understand how we can do more robust impact evaluation. To help us to do this, we commissioned ICF to undertake an exploratory literature review of evidence relating to place-based evaluation activity, both in the environmental and other sectors. This report summarises the findings from that review.

This report is largely technical in nature, aimed at evaluation practitioners, especially those in the environment sector (although we believe other sectors will be interested in these findings).

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Executive summary

Introduction

This report presents the findings of a literature review that aimed to provide Natural England (NE) with a better understanding of the evaluation approaches available to evaluate place-based programmes or projects. The review focused on environmental evaluations but also considered place-based evaluations from social policy and health sectors.

Method

The literature review considered academic literature and grey literature. A protocol was developed to outline the parameters of the search, the research questions and the search terms that were used.

As evaluations are often published as grey literature, the research team employed a flexible approach to conducting the review to ensure that a breadth of evidence was considered. A multidisciplinary expert panel were brought together to support the identification of relevant evidence sources. Members of the expert panel had expertise in the environment, health, social policy, evaluation methodologies and technology. Two workshops were conducted to share the reviews' findings and promote methodological discussion between experts and the Natural England evaluation team.

Identified evidence was screened according to its relevance to the research questions, first by title and secondly by abstract. Evidence that progressed through these stages progressed to full text review or was excluded based on further reading. The review identified 327 evidence sources, and 161 progressed to full text review. From these, 44 were included in the evidence synthesis that is presented under the research questions below. Evidence was excluded at full text stage where it was not focused on evaluating a project, programme, or policy.

Findings

The findings from the literature review are summarised below.

Research Question 1: How are evaluation methods used to assess the success of environmental (and other) place-based projects?

Evidence identified relevant to research question one followed guidance in the Magenta Book (2020) to carry out evaluations (where a logic model was often used to underpin the evaluation methodology). Evaluations usually carried out a mixed methods approach to

data collection, and surveys, interviews, and focus groups were often reported. Environmental place-based interventions commonly followed a theory-based approach.

Case studies were often used by environmental evaluations to provide a deeper understanding of impact, specific to the place where activities took place. Environmental evaluations reported challenges that were consistent with the challenges of place-based evaluation, such as the impact of the intervention not being confined to a project boundary, and that there could be a time delay between the intervention taking place and the impact being measured.

Case studies were also used in the social policy sector to evaluate international development policies and provide a deeper understanding of the local impacts of large-scale policies. In the health space, it was highlighted that longitudinal approach to evaluations can be valuable in understanding policy impacts.

Research Question 2: How have theory-based evaluation methods been applied to environmental (and other) place-based interventions? (Including ecosystem services and natural capital approaches)

Theory-based methods were the most commonly identified approach to evaluating place-based interventions. Contribution analysis and realist approaches were identified to demonstrate how an evaluation can consider the impact of contexts and complexities inherent in different places.

Research Question 3: How have experimental, quasi-experimental, counterfactuals, synthetic counterfactuals/controls been used to evaluate place-based initiatives, including ecosystem services and natural capital approaches?

There were no environmental evaluations identified that followed an experimental approach. However, some environmental evaluations identified attempted to construct a counterfactual.

Evaluations identified in the social policy and health sector space were more likely to utilise an experimental approach to place-based interventions than environmental evaluations. This was likely because they were able to access a significant amount of data relating to health or crime.

Research Question 4: What contribution have GIS and Earth Observation data made to inform evaluations?

It was suggested that GIS and Earth Observation data can be effective to support the monitoring of agri-environment schemes and that it can be helpful to understand

characteristics of intervention areas. Utilising this available data was viewed as being effective to inform ‘before’ and ‘after’ impacts of an intervention (Wharton et al., 2022).

Research Question 5: How have place-based interventions (environmental and other) been evaluated using data models, including Artificial Intelligence and Machine Learning?

There was a lack of evidence identified which used data models, including Artificial Intelligence and Machine learning to inform place-based evaluations.

Research Question 6: How can Artificial Intelligence and Machine Learning contribute to producing predictive models to support place-based working?

There was a gap in the identified evidence on how Artificial Intelligence and Machine learning could support place-based working. Evidence suggested that there was a need to make environmental modelling more accessible to increase its role in ecosystem assessments (Galaz Garcia et al., 2023).

Conclusion

The review has identified that place-based interventions are more commonly evaluated using theory-based approaches. There was little or no evidence identified in relation to how Earth Observation, GIS, Machine Learning and AI could be used to inform evaluations and how these technologies have been applied in evaluations of place-based interventions.

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Introduction

Project Context

This report presents the findings of an exploratory literature review that aimed to provide Natural England (NE) with a better understanding of the range of evaluation methodologies that can be employed to evaluate place-based interventions. The definition of place-based interventions can vary, but for this review we have used the definition created by the Youth Endowment Fund, one of the Government's network of What Works Centres. The definition is as follows:

> "Place-based interventions are defined as collaborative long-term approaches that operate in a geographical location, focus on local needs and the attributes of the locality, involve multiple agencies, and engage multiple communities" (Smith et al., 2023).

The majority of Natural England's work is place-based, and it is delivered through four strategic programmes, described in the 2022-2023 Action Plan[1], which are:

- **Resilient Landscapes and Seas:** Creating thriving, resilient, functioning landscapes and seas rich in plants, wildlife and character that provide ranching benefits for nature, climate, and people.
- **Connecting People with Nature:** Reforming key areas of Natural England's local delivery, working in partnership to tackle barriers to protect the natural environment.
- **Greener Farming and Fisheries:** Addressing how land and seas are managed to ensure healthy fish stocks, soils, water, air and natural processes to contribute to a healthy natural environment.
- **Sustainable Development:** Enable thriving wildlife populations, with beautiful landscapes and seascapes that are enjoyed by people whilst enabling society to prosper.

These programmes are underpinned by two supporting programmes, which are:

- **Science and Evidence:** Natural England aims to be an evidence-led organisation that will be recognised, respected, and trusted for expertise and the provision of evidence-based advice on the natural environment, locally and nationally.

[1] https://www.gov.uk/government/publications/natural-england-action-plan-2022-to-2023/natural-england-action-plan-2022-to-2023--2

- **Managing the Organisation:** Natural England aims to be a values-led organisation which delivers excellent service standards to all partners, organisations and communities engaged in achieving natures recovery.

Natural England's work ranges from small individual projects in urban areas to large-scale agri-environment schemes; its interventions are also often delivered in partnership with other stakeholders by the 12 Natural England area teams.

The findings from this literature review aim to support the design and implementation of Natural England's (NE's) evaluations and inform how outcomes of projects can be attributed to NE's activities.

Objectives and Research Questions

The literature review had the following objectives:

1. To identify evaluations relating to place-based delivery. The focus of the literature review is environmental interventions, but Natural England are also interested in what can be learned from the evaluation of place-based initiatives in other sectors.
2. Methodological issues:
    - To identify theory-based evaluation methodologies that may be appropriate for NE's place-based projects and how and where these have been applied elsewhere.
    - To identify place-based interventions that have successfully used experimental or quasi-experimental evaluation methodologies; how they developed counterfactuals; and their applicability to NE's place-based projects.
    - To identify place-based interventions that have followed an ecosystem services/natural capital approach.
3. To understand how geographic information has been used to help set baselines for evaluation and in supporting indicators for evaluations (monitoring). The review should cover 'standard' GIS datasets and Earth Observation data and where data has been used to develop synthetic counterfactuals in support of quasi-experimental evaluation.
4. To identify place-based evaluations that have used data models (including the use of Artificial Intelligence and Machine Learning) to help plot trajectories towards outcomes as part of evaluation monitoring.

To fulfil the objectives of the project, the following research questions (RQs) were developed:

1. How are evaluation methods used to assess the success of environmental (and other) place-based projects?
2. How have theory-based evaluation methods been applied to environmental (and other) place-based interventions? (Including ecosystem services and natural capital approaches).

3. How have experimental, quasi-experimental, counterfactuals, synthetic counterfactuals/controls been used to evaluate place-based initiatives, including ecosystem services and natural capital approaches?
4. What contribution have GIS datasets (and Earth Observation) data made to inform evaluations?
5. How have place-based interventions (environmental and other) been evaluated using data models, including AI and Machine Learning?
6. How can Artificial Intelligence (AI) and Machine Learning contribute to producing predictive models to support place-based working?

The findings of the literature review are presented according to the research questions outlined above.

Background to evaluation

The Government has published guidance on how to appraise policies ahead of implementation and how to evaluate policies after they have been delivered. The Green Book[2] (2022) focuses on how to appraise policy options and also highlights that monitoring and evaluation have a significant role before, during and after the implementation of a policy. The Green Book (2022) states that evaluation is an assessment of an intervention's design, implementation, and outcomes, which involves:

- understanding how an intervention is being or has been implemented, what effects it had, for whom and why;
- comparing what happens with what was expected under business as usual;
- identifying what can be improved, estimating overall impact and cost-effectiveness.

The Green Book notes that monitoring and evaluation should be incorporated throughout the policy cycle to allow for interventions to be improved, learning to be utilised, and for transparency and accountability in policy development.

The Magenta Book (HM Treasury, 2020) includes more detailed guidance on how to conduct evaluation and is to be used alongside The Green Book. The Magenta Book defines the types of evaluations that should be carried out to comprehensively understand a policy intervention, as indicated below.

- **Process Evaluation:** Analysis of whether an intervention is being implemented as intended; whether the design is working; what is working more or less well and why.

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2 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1063330/Green_Book_2022.pdf

- **Impact Evaluation:** An objective test of what changes have occurred, the scale of changes, and an assessment of the extent to which they can be attributed to the intervention. Impact evaluations use theory-based, experimental or quasi-experimental approaches.
- **Value for Money Evaluation:** A comparison of the benefits and costs of the intervention.

This literature review has focused on identifying impact evaluations but evaluations that include impact and process have been considered where relevant.

Place-based methodological challenges

Natural England's variation in project and programme delivery presents significant challenges for evaluation, as set out below.

- **Temporal issues:** It may take many years for the environmental outcomes of a policy intervention to be realised.
- **Spatial issues:** Locations vary in terms of characteristics and size, which may affect how effective an intervention is in a particular location. The location of the intervention may not be where the benefit is realised.
- **Working in complex systems:** Natural England's work often takes place in areas where there are a significant number of other interventions being implemented and different stakeholders working to deliver their own outcomes, which may overlap with Natural England's aims. Therefore, attributing cause and effect to a specific intervention is challenging.
- **Defining success:** The variation of activities being delivered and the impact that different interventions may have in different locations can make it difficult to define meaningful outcomes for interventions.

An important consideration in the evaluation approach is the distinction between evaluating the impact of a policy intervention that occurs in one place, versus a policy intervention that occurs across multiple different places. This is a significant consideration for the choice of evaluation methods.

Evaluations of place-based initiatives face further challenges related to choices in how they will be delivered and rolled-out. Policy-makers have choices about how they choose where a place-based initiative is implemented, how many places are chosen and the timing of when the roll-out happens. These choices are influenced by policy goals, pragmatic considerations and considerations around fairness, priority and public expectations. These choices have an effect on the feasibility of using traditional impact evaluation methodologies, including randomised controlled trials and quasi-experimental approaches. In general, if a policy is implemented in all areas at the same time, it is very unlikely that traditional impact evaluation techniques can be used, in which case theory-based methods are often relied on. It is not the case, however, that traditional impact evaluation methods can definitely be used if an initiative is implemented in a small number of areas or in a staggered way, due to the issues discussed above and in the next section.

Background to complexity

In looking at the literature to identify ways to overcome challenges of evaluating in a place, or across multiple places, we recognise that we are covering some of the same ground that has been covered in several major projects undertaken in the last 10 years or so.

Firstly, Stern et al. (2012) reviewed the international literature to identify a broader range of approaches to impact evaluation. Stern's review had a significant impact on the evaluation community by defining a wider range of methods and approaches to evaluation and clearly delineating the situations and evaluation questions to which they were suitable.

Second, the Centre for the Evaluation of Complexity at the Nexus (CECAN), set up in 2016, was funded by a range of actors to advance evaluation in areas of policy and government where evaluation is 'complex', for example, the interface between and connections between poverty, food and agriculture, the natural environment, and energy and climate change. Since that time, CECAN has curated a series of conferences, events, and supported experts to develop new materials and innovation in evaluation. The Defra Complexity Evaluation framework emerged from this, which introduces the core principles of complexity-appropriate evaluation and sets out a practical framework of considerations and guidance for those designing, managing, and embedding evaluations.

The Magenta Book Supplementary guide on complexity (CECAN, 2020) recognised that there is no simple way to select the best evaluation design for complexity. The choice will depend on the complexity characteristics of the system, evaluation purpose and the feasibility of the available designs and methods. This chapter provides further guidance on selecting designs. It lists a wide range of methodologies that can be used in evaluation of complex policies or of policies in complex settings. It notes that there are a growing body of additional evaluation approaches that are particularly useful in addressing complexity, although knowledge of these remains patchy. It also notes that adoption of appropriate methods can be particularly challenging if the prevailing institutional culture favours evaluation approaches that do not recognise the challenges of complexity very well. The broad range of methods included is broadly similar to the range of approaches identified by Stern et al. 10 years earlier (see below) but the guidance adds more explanation and examples of different methods.

The list of methods covered in all these reviews includes:

- Randomised Control Trials.
- QEDs.
- Predictive designs based on statistical modelling: Statistical designs – regression or structural statistical methods, such as Bayesian networks.
- Longitudinal studies and econometric studies.
- Cluster analysis and artificial intelligence.
- Outcome matching.
- Outcome harvesting.
- Developmental evaluation.

- Process Tracing with Bayesian updating.
- Contribution analysis.
- Most significant Change.
- Soft systems modelling and systems mapping, fuzzy cognitive modelling.
- Realist evaluation.
- Qualitative Comparative Analysis.
- Dynamic pattern synthesis.
- Predictive designs based on simulation modelling: Agent based modelling; systems dynamics, Markov chain Monte Carlo.
- Synthesis designs (realist synthesis, systematic reviews).

All these approaches can be drawn on to address complexity, often in a hybrid design in recognition that evaluation generally requires multiple methods to address features of complexity in a place. What has not been attempted is any analysis of the ability of these individual methods to address the different features of complexity that have been identified through the various major evaluation methodology projects outlined above. This is beyond the scope of the current project but would be a fruitful area for future work.

Methodological controversies

Interest in theory-based evaluation has grown significantly over the last decade and commissioners in central government are more frequently identifying it as the anticipated or preferred approach in invitations to tender. In addition, theory-based approaches have been included among the set of options discussed in the Magenta Book. Theory-based evaluations are generally seen as those that explore the ‘causal chains’ that connect intervention activities with outcomes, often using qualitative methods, and which make an assessment of whether the intervention has been effective largely without the use of comparison groups or statistical techniques. This contrasts with counterfactual approaches, particularly randomised controlled trials (RCTs), which are primarily concerned with the identification or creation of comparison groups that avoid selection bias, without which robust impact evaluation is not thought possible. Bodies such as the government’s Evaluation Taskforce and the government’s network of What Works centres actively promote this approach to impact evaluation.

Many people feel that theory-based and counterfactual approaches can be effectively combined and doing so produces the most robust evaluation design (see Barnard, 2024); others feel that the two approaches are not compatible and favour one over the other (see Haynes et al., 2012, Tilley, 2000, Mayne 2020). This literature review has taken a descriptive rather than prescriptive approach to these issues. It has aimed to identify the literature under each research question but not to rank or comment on the methods used in terms of robustness or appropriateness. It has been left up to the reader to take their own view on the relative strengths and usefulness of the different methods identified.

Methodology

A methodology similar to that used for Rapid Evidence Assessments (REAs) was employed to undertake the literature review drawing on Defra's guide, The Production of Quick Scoping Reviews and Rapid Evidence Assessments (Collins et al., 2015). This methodology followed five stages:

1. developing a search protocol;
2. identifying and collating sources of evidence;
3. data extraction;
4. quality assessment (Note: this stage was removed when it was agreed that the expert panel workshop would feed into the critical appraisal, see section on Methodological Controversies); and
5. evidence synthesis and reporting.

The methodology sought to be collaborative and additional flexibility was incorporated to ensure that the most relevant evidence sources were identified. These were:

- initial evaluation expert panel workshop to inform review scope and the development of the literature review protocol;
- ongoing ad hoc conversations with evaluation experts and the research team;
- interim meeting with Natural England team to present emergent findings; and
- final expert panel workshop to discuss findings in relation to Natural England's work.

Combining these measures of flexibility and the structured review process allowed for a wider range of evaluation evidence to be identified. This is because evaluations are often published as grey literature and do not appear on academic journal databases, which is the focus of the review search protocol document.

A full methodology and a Prisma diagram is included in Appendix 1: Methodology.

Findings

This section of the report presents the findings from the review under the research questions.

Research Question 1: How are evaluation methods used to assess the success of environmental (and other) place-based projects?

Table 1 below provides an overview of the evaluation evidence that has been identified for research question 1. As shown in Table 1, theory-based approaches to evaluation were the most frequently identified method to carry out place-based policy evaluations across all sectors. Research question 2 provides a detailed summary of theory-based evaluations that were identified. Research Question 3 provides a detailed discussion of experimental approaches.

Table 1: Evidence identified for research question 1

Sector	Theory-based Approach	Experimental/Quasi-experimental Approach
Environment	14	0
Social Policy	6	3
Health	8	3

In addition to specific evaluations of policies, methodological evidence was reviewed for this research question. The methodological evidence discussed approaches to the evaluation of place-based policy interventions, including guidance and support for selecting methods. The flexibility inherent in the review design allowed for additional searches to be carried out beyond the Boolean search terms and allowed for grey literature to be identified. This led to evaluations of policy initiatives also being included in the evidence, as these evaluations are not commonly published in academic journals and so may be missed in the database searches. The Defra Science Search database was the most useful source for identifying grey literature on environmental place-based evaluations.

As there is no single ‘grey literature database’, evidence relating to policy evaluations tends to be dispersed across different website locations. The evaluations identified were typically conducted at a programme level, rather than being focused on specific localised project impacts.

Evaluations of environmental place-based programmes

The review focused on identifying evaluations of place-based environmental programmes/projects. Although a significant number of environmental evaluations were found, many of these were not place-based in their delivery and were excluded from the literature review. Table 6 (in Appendix 2) provides an overview of the place-based environmental evaluations, a description of the methodology, and an overview of the evaluation challenges.

Place-based environmental evaluations that were carried out for Defra or Natural England Policies followed guidance outlined in the Magenta Book (HM Treasury, 2020). The evaluation teams usually employed mixed data collection methods to collect evidence in line with the intervention logic, to provide evidence for evaluation questions. Common data collection methods used included:

- surveys
- workshops
- interviews.

Evaluations identified challenges to evaluating environmental place-based programmes. These were general challenges related to the complexity of evaluating environmental interventions. This included:

- The spatial boundary of environmental impact not being limited to the specific pilot area where the intervention was implemented (Waters, Lusardi & Clarke, 2012).
- The time lag of the impact of an environmental action to then lead to an improvement that would be reflected in monitoring data (Waters, Lusardi & Clarke, 2012).
- The impossibility of isolating the environmental intervention from other environmental factors, which was discussed in relation to air quality data being affected by the weather (Ipsos and Institute for Transport Studies, 2022).

Issues with programme level data were discussed in identified evaluations. It was highlighted that there is a challenge to ensure that data collected by individual projects that are operating as part of a programme collect data that is consistent and helpful for evaluation purposes (ICF, 2015; Breyer et al. 2020). To overcome challenges associated with understanding the impact of an intervention at a programme level, some evaluations developed indicators or objectives to understand programme impact (Collingwood Environmental Planning, 2015; Breyer et al., 2020; Twigger-Ross et al., 2015).

Intervention logic models were used to underpin the evaluations of Local Nature Partnerships (LNPs) (ICF, 2015), the Rural Growth Network (RGN) Pilot Initiative (SQW, 2016) and the European Commission's evaluation of LEADER (Dwyer et al., 2022). LNPs were established in 2011 in the Natural Environment White Paper (NEWP), and they comprised local organisations, businesses, and individuals that aimed to work together to strengthen the green economy in their area (ICF, 2015). The RGN Pilot initiative was

established to encourage business growth in the rural economy and to provide locally appropriate business support and infrastructure to support local economic growth (SQW, 2016). LEADER was a bottom-up approach aimed to encourage rural development. The outcomes of these interventions were improvements at an environmental, economic, and social level and a mixed methods approach to data collection was employed to gather evidence across different outputs in the intervention logic.

Data collection methods used in these evaluations include online surveys, in depth-interviews and workshops. A similar mixed methods approach to data collection was employed to evaluate both the Local Places for Nature Evaluation in Wales (Johnson and Vousden, 2023) and the upland ecosystem service pilots (Waters, Lusardi, and Clarke, 2012). For the latter, workshops and interviews were carried out and the evaluation also developed baseline assessments of the pilot areas using primary and secondary data. The establishment of the baseline allows for contextual factors of pilot projects to be considered when assessing their success of implementing the ecosystem services approach. Similarly, indicators were developed to evaluate Nature Improvement Areas (NIA) and secondary data, such as the Biodiversity Action Reporting System, was used to support reporting of habitat actions (Collingwood Environmental Planning, 2015). Box 1 provides an overview of how indicators were used to evaluate Nature Improvement Areas.

Box 1: Evaluation of Nature Improvement Areas (Collingwood Environmental Planning 2015)

The evaluation of Nature Improvement Areas (NIAs)

Programme description: NIAs were introduced in 2012, to create joined up ecological networks at a landscape scale and they were facilitated by partnerships to create environmental and social outcomes for a local area.

Methodology overview: The evaluation used a logic model and structured evaluation objectives under four themes: Biodiversity, Ecosystem Services, Social and Economic Benefits and Contributions to Wellbeing and Partnership working. An online reporting tool was developed to provide a structured data-entry tool for recording information related to NIA partnerships and achievements. The online tool was used to complement other systems of data recording.

Indicators: To evaluate at a programme level, NIAs were required to report on the 'core' indicators. In addition to reporting on the core indicators, NIAs were able to report on optional or local indicators, or suggest indicators, which allowed for the evaluation to be sensitive to local impacts.

To provide a more detailed insight into contexts or project activity, case studies were commonly used to qualitatively understand the impact of an intervention in locations (ADAS, 2020; ICF, 2015; SQW, 2016; Dwyer et al., 2022; Bryer et al., 2020; Risk & Policy

Analysts, 2021). Box 2 provides an overview of the CSFF evaluation and an indication of how case study findings can complement quantitative programme level data collection.

Box 2: Overview of CSFF Evaluation (ADAS, 2020)

The evaluation of Defra's Countryside Stewardship Facilitation Fund (CSFF)

Programme description: Provided funding for individuals or organisations to bring together landowners to work towards large scale landscape environmental improvements.

Methodology overview: Logic model underpinned the programme evaluation. The evaluation considered the environmental outcomes of the programme by comparing agri-environment options of those who were members of CSFF groups, with those where there was not a group. Surveys and interviews were carried out to understand social and wider impacts and group documentation was used to demonstrate how funding was used in each group.

Case studies: 28 case studies were completed to explore contextually specific impact pathways and to understand socio-economic impacts of land managers involved in CSFF.

Evaluations of social policy place-based programmes

Eight of the identified evidence sources focused on the social policy sphere, with more experimental and quasi-experimental evaluations identified than in the environmental sector.

Theory-based approaches were the most frequently identified approach used to evaluate social policy place-based interventions. These will be discussed in detail in Research Question 2. Evaluations that implemented an experimental/quasi-experimental approach were identified relating to the crime sphere and carried out in the USA. These will be discussed in detail in Research Question 3. Further international evidence identified included an evaluation of the European Union's Cohesion policy (Giordano & Greco, 2023) and an approach to localising the impacts of the United Nations Sustainable Development Goals (SDGs) (Tan et al., 2019). Box 3 provides an overview of how a case study can provide an in-depth localised understanding of the EU cohesion policy.

Consistent with the approach outlined in Box 3, case studies were identified as being a suitable method to provide insight into localised benefits of the United Nations Sustainable Development Goals (Tan et al., 2019). This approach suggested that systems approaches could be helpful to inform case study approaches to characterise local causal systems and support participation in the international development sphere (Tan et al., 2019).

Box 3: Case study of European Union Cohesion Policy (Giordano & Greco, 2023)

The evaluation of the EU Cohesion Policy by using an in-depth case study

Programme description: The EU Cohesion Policy is a place-based intervention that is focused on shaping economic development policy. The focus is on tackling territorial

inequalities by taking a spatially sensitive approach to support economic change at a local level.

Case study methodology: This journal article presents an in-depth case study of 'place-based' interventions that were made via the Interreg funding to encourage cross border cooperation between Spain and Portugal. The case study aimed to understand the extent to which the achievements made by the Interreg funding are captured by the EU performance indicators. A review of documentation, 20 semi-structured interviews and a focus group was caried out. It was identified that the programme had contributed to increased trust and positive collaboration between actors at a local level and that these benefits were not sufficiently captured by the EU performance indicators. The article suggests that theory-based approaches can operate in a spatially sensitive way that can capture casual chains and mechanisms that arise from interventions in specific locations.

It was suggested that various actors should be involved in producing case studies that are sensitive to the character of a place (Tan et al., 2019). The evidence brought together a 'systems thinker' expert and a partner who had place-specific knowledge of the case study issue. The expert, in consultation with the partner, helped to develop Causal Loop Diagrams of problems to capture the complex problems specific to the location. This example illustrates how case studies can support the evaluation of programmes that are promoted on a large scale but can be sensitive to place-based contextual factors.

Evaluations of place-based health programmes

Consistent with findings from the environment and social policy sectors, theory-based methods were the most common evaluation approach identified to evaluate place-based health interventions. However, more experimental, and quasi-experimental evaluations, were identified than for other sectors.

Evaluations in the health space covered physical health, mental health, and well-being. They were frequently carried out on programmes that were implemented by non-governmental organisations and focused on individual and community outcomes. Evaluations that were focused on well-being and longer-term outcomes typically used the evaluation to inform learning and scheme development, both during the lifetime of the programme but also to influence projects beyond the initial programme. This is illustrated by the realist evaluation of 'Arts for the Blues', which aimed to use the evaluation findings to identify mechanisms for how arts initiatives could be scaled up to support mental health and well-being (Karkou et al., 2024).

Sharing learning was a key component of the developmental evaluation of the Together for Childhood Programme, which was implemented in four socio-economic disadvantaged places in England (NSPCC, 2022). Together for Childhood worked with local organisations to prevent childhood abuse and the evaluation shared learning among the four communities to support the systems change that the programme aimed to bring about (NSPCC, 2022). The evaluation was carried out at programme and project level with the

aim of improving the implementation of the programme and contributing to long term change in the four communities (NSPCC, 2022).

The ‘Ageing Better’ programme evaluation outlined the benefits of being able to utilise a significant amount of project level data to support learning (Campbell-Jack et al., 2021). The ‘Ageing Better’ programme ran between 2015 and 2022 was delivered by 14 Voluntary, Community and Social Enterprises (VCSEs) in England. The programme used a ‘test and learn’ approach that aimed to build learning on what works and the evidence base for wider action (Campbell-Jack et al., 2021). The evaluation utilised an experimental approach to gather information on projects and participants to inform understanding of the impact on older people’s well-being. The evaluators highlighted that the length of the programme allowed the evaluation to use data collected over five years, which was valuable in demonstrating impact and provided a significant amount of information to inform wider learning on what works and why. This highlights the value of collecting data over a long period of time, which allows for a stronger evidence base for understanding how effective approaches are at tackling complex issues.

Research Question 2: How have theory-based evaluation methods been applied to environmental (and other) place-based interventions? (Including ecosystem services and natural capital approaches)

Theory-based evaluation methods were the most common evaluation approach identified in the evidence. The Magenta Book highlights that theory-based approaches to evaluation explore causal chains thought to bring about change by a policy intervention and they are focused on the extent of the change and why the change has occurred (HM Treasury, 2020). The evidence identified for this Research Question has been grouped into the theory-based evaluation methods outlined in the Magenta Book (p45) and includes Realist Evaluation and Contribution Analysis. These are the theory-based methods that were identified in the review that were focused on place-based evaluation. The Magenta Book (p45) includes a comprehensive list of theory-based approaches. Table 2 provides an overview of the evidence collected relevant to this research question.

Table 2: Theory-based approaches to evaluation

Sector	Theory-based approach	
	Contribution analysis	Realist
Environment	2	1
Social Policy	1	1

Health	0	4

Realist evaluations

Realist evaluations were used in all sectors included in the research. The Magenta Book states that realist evaluations seek to identify the mechanisms that lead to a change in behaviour because of an intervention and typically ask: “what works, for whom, in what respects, how, and under what circumstances?” (HM Treasury, 2020). Realist approaches follow a ‘generative causation’ design that seek to explain how outcomes are generated relative to the theory of their implementation (CECAN, 2020). Evidence described below highlights the different contexts within which realist evaluations were identified and the data collection methods that were used.

Realist evaluations in the environmental sector

The literature search identified one realist evaluation of environmental policies or programmes. Aspects of realist approaches were included in other evaluations that followed a logic model approach, which sought to understand the impact of interventions specific to contexts. However, the only explicitly ‘realist’ approach was the evaluation of the ten Inshore Fisheries and Conservation Authorities (IFCA) evaluation.

IFCAs are responsible for the English inshore region up to 6 nautical miles from baselines and they contribute to the national policy framework for the marine environment (Risk and Policy Analysts Ltd, 2021). The evaluation conducted case studies, which were selected using a purposive sampling technique to understand contextual factors that affected the impact of IFCAs. To develop the sampling framework the evaluation team developed four groups to categorise different experiences of the IFCAs by engaging with senior officials and stakeholders, and one authority from each group was selected to participate in a case study (Risk and Policy Analysts Ltd, 2021). To carry out case studies that fulfilled the aims of the realist evaluation, the CATWOE (Customer, Agent, Transformation, Worldview, Owner, and Environment) model was applied to inform their design. The model is a type of soft systems modelling used to consider different stakeholder perspectives of complex systems (Risk and Policy Analysts Ltd, 2021). This model underpinned the development of the interview questions and allowed for the case studies to have a detailed insight into differing perspectives to fulfil the realist aims of investigating what works, for whom and in what circumstances.

Social Policy

There was only one realist evaluation identified in the social policy space. This was an evaluation of Empowering Places, which provided funding to local organisations that were selected from deprived local authorities in England (O’Flynn et al., 2023). Empowering Places created clusters of community businesses and provided funding to catalyst organisations in local areas to channel formal funding support and informal advice support to community businesses. By funding clusters of businesses, the programme aimed to

create opportunities and strengthen local economies. The evaluation followed a realist approach and focused on the experiences of those who were involved in the programme.

The evaluation researchers described their role as being an ‘embedded evaluator’, which meant they sought to provide support to projects and people and facilitate shared learning (O’Flynn et al., 2023). This way of working is supported by the YEF recommendations on how to complete place-based evaluation (Smith et al., 2023). The evaluation carried out interviews, and completed video ethnographies with businesses, stakeholders, and work leaders. The evaluation also used secondary data from a hyperlocal version of the Community Life Survey, which is run on behalf of the government. The hyperlocal version of the survey uses a ‘difference in difference’ statistical approach to estimate change over time in places compared with matched comparison site. Using this data alongside other data collection has allowed for the evaluation to attribute some level of causality to the Empowering Places programme (O’Flynn et al., 2023). This example highlights how secondary data can contribute to evaluations and strengthen findings.

Health

There were four realist evaluations identified in the health sector. In addition, one evidence source was a critical realist review that considered the impact of place-based creative programmes in different contexts (Bellazzecca et al., 2022). This was not an evaluation of a specific intervention, but it sought to understand the role of contexts in affecting outcomes. The emphasis on understanding how contexts affected outcomes was also identified in the realist evaluation of the ‘Well North’ programme. Well North was a partnership approach to improve health in poor areas across the North of England and the evaluation carried out in-depth interviews to understand how the programme had been implemented in specific locations (Well North, 2019). The evaluation produced in depth case studies of projects to understand their settings and expected results. Additionally, the evaluation team sought to be engaged with the projects throughout the evaluation and they collated a national tool to collect the ‘critical change’ moments within projects. The evaluation team identified seven change mechanisms and they applied these at a programme level across the different projects, and projects were encouraged to share their critical change moments with the evaluation team. This allowed for the evaluation to understand how projects were progressing to realising change but was sensitive to the different contexts within which they operate and the different time scales that were faced by different projects.

A realist process evaluation was carried out on the multi-agency ‘superzone’ model, which is an emerging framework for place-based partnership working to improve the urban environment by creating 400m zones around schools in deprived communities in London (Catt and Senior, 2020). There were 13 pilot sites and this evaluation conducted interviews with lead officers for local authorities to identify Contexts, Mechanisms, Outcomes (CMOs) that affected the creation of the local plans (Catt and Senior, 2020). CMOs are a realist approach to understanding specific contextual factors and they have been used to develop an initial programme theory of superzones, which can demonstrate why the intervention may be more successful in some places and less successful in others. This evaluation

was not able to consider impact of the superzones because impacts were likely to be experienced beyond the timeframe of the evaluation, but the process evaluation allowed for the consideration of networks and partnerships and an understanding of different contextual factors that affected the establishment of superzones. This highlights how an impact evaluation in the future could build on previous learning conducted as part of a process evaluation.

An evidence source utilised a realist evaluation of the place-based programme ‘Arts for the Blues’ which was an arts-based group intervention that was designed to reduce depression and improve mental wellbeing among people suffering with poor mental health in deprived areas (Karkou et al., 2023). This academic journal aimed to develop a strategy to scale up the place-based initiative by using realist principles to understand how the intervention could be scaled up and under what circumstances. Similarly, this was not focused on impact, rather this was focused on the scalability of the intervention and how it could be adapted to different contexts.

A critical realist evaluation was conducted to evaluate the Healthy Homes and Neighbourhoods’ (HHAN) Integrated Care Initiative in Sydney (Barmaky et al., 2018). HHAN aimed to provide long term multi-disciplinary care coordination to families with complex health and social needs in Sydney, Australia. The evaluation conducted in depth interviews with patients who received the care, staff members and other stakeholders, and they were analysed using a CMO framework. The interview guide was developed to explore the contexts, mechanisms, and outcomes relating to the programme and interviewees were selected to provide a broad perspective on the programme. The interviews were analysed using the CMO framework to organise different theories for how outcomes could be achieved and how these vary depending on the interviewee.

Contribution Analysis

Contribution analysis is a step-by-step process that examines whether an intervention has contributed to an observed outcome and provides a logical line of reasoning for contribution claims (HM Treasury, 2011). Contribution analysis can be a useful approach to evaluate place-based interventions because it is sensitive to the way that effects can be produced by several causes at the same time (Stern, 2015). The six steps followed by contribution analysis and outlined by Mayne (2008) are:

1. Set out the attribution problem to be addressed.
2. Develop a theory of change and risks to it.
3. Gather the existing evidence on the theory of change.
4. Assemble and assess the contribution story and challenges to it.
5. Seek out additional evidence.
6. Revise and strengthen the contribution story.

This approach allows for consideration of the wider context and has been identified in the environmental and social policy sectors.

Environment

The evaluation of the Natural Environment Investment Readiness Fund (NEIRF) carried out contribution analysis to develop a ‘performance story’ of the programmes impact in leading to change (Bertolotto et al., 2023). The NEIRF supports 86 projects to develop models that aim to demonstrate how revenue can be generated from ecosystem services and to explore how models can be scaled up and applied to different locations.

To support the contribution analysis approach, the evaluation team carried out interviews with unsuccessful applicants to investigate whether they were successful in funding activities they planned to fund under the NEIRF and conducted semi-structured interviews with national stakeholders to understand whether NEIRF is having an influence on natural capital markets. Monitoring data provided by projects and self-reported self-assessment data was collected from projects to understand how successful they felt their participation in the project had been in contributing to programme level aims, which was to encourage/prepare for investment in natural capital markets. This evaluation analysed the various sources outlined above and compiled a narrative based on the performance of the programme.

Contribution analysis was used to evaluate the impact of Local LO2 Plans (Ipsos and Institute for Transport Studies, 2022). Local Authorities that were identified to have high levels of nitrogen dioxide concentrations were required by the government to develop Local Plans to reduce these concentrations. The evaluation outlined that it is challenging to evaluate the impact of Local Plans on health because of the timescales associated with seeing health benefits and the wide range of factors that affect health. The research team decided to undertake a contribution analysis to understand the likely contribution that local plans have made to the air quality and traffic outcomes. To do this, they carried out a before and after analysis of air quality and traffic data, monitored the external factors that affected air quality and travel and assessed a range of alternative explanations for trends observed during the implementation of the Local Plans. The evaluation also conducted mini deep dive case studies into specific local plans, which were longitudinal and aimed to capture changes as the plan was being implemented. The evaluation findings suggested that Local NO2 plans were having a positive contribution in changing behaviours and reducing the concentrations of nitrogen dioxide in local areas.

Social Policy

Contribution analysis was used to evaluate the Strength in Places Fund. The Strength in Places Fund is a UK Research and Innovation (UKRI) competitive funding scheme which took a place-based approach to award research and innovation funding (Frontier et al., 2021). Funded projects were required to identify their geographical focus and a tailored plan to achieve impact on local economic growth. The evaluation framework outlined that multiple data collection methods would be implemented to evaluate impact. This included using project level data that was submitted through the programme platform, meeting with projects to understand what evidence they could provide, workshops with projects, the collection of feedback on project impact from a group of external experts and completing

case studies. Counterfactual case studies were also scheduled to consider the impact of projects that unsuccessfully applied for funding. The evaluation framework outlined that a contribution narrative would be developed for each evaluation question, and the research team would assess the strength of the evidence, the influence of external factors and whether the programme logic is being realised. This example highlights that the evaluation framework design is important to plan and consider the complex system within which the place-based intervention is implemented. Additionally, the framework was clear about the engagement that the evaluation would have with the project team, which can contribute to building strong relationships and ensure engagement and support.

Research Question 3: How have experimental, quasi-experimental, counterfactuals, synthetic counterfactuals/controls been used to evaluate place-based initiatives, including ecosystem services and natural capital approaches?

The Magenta Book states that the core principles of experimental and quasi-experimental evaluations are that there is a 'counterfactual', which is where observed outcomes from a control group (a group that did not receive the intervention) can be compared to the outcomes observed in the intervention group. The intervention and control groups are equivalent on average in an experimental design or differ in characteristics that are accounted for in quasi-experimental design (HM Treasury, 2020).Table 3 shows an overview of evidence that was identified relevant to this research question.

Table 3: Research question 3 overview

Sector	Experimental Approaches
Environment	0
Social Policy	3
Health	2

Environmental Sector

There was a gap in the evidence on how experimental evaluation approaches were applied to place-based interventions in the environment sector.

Although no experimental evaluation approaches to place-based programmes were identified, two evaluations did highlight that they attempted to create a counterfactual. The evaluation of the Flood Resilience Community Pathfinder scheme developed a self-reported counterfactual and asked interviewees what would have happened without the

project and whether other factors had contributed to its success (Twigger-Ross et al., 2015). This was helpful to provide qualitative information that was context specific but the self-reported views of those who were involved in pathfinder projects could be viewed as a limitation of the counterfactual.

The evaluation of Partnership Funding developed a counterfactual scenario, which was compared to the Partnership Funding policy scenario, to understand the effectiveness and the value added of the policy. The Partnership Funding approach was introduced in 2011 to deliver more benefits for Flood and Coastal Erosion Risk Management Projects (Clarke et al., 2018). Previously, schemes received a full grant for their projects or did not receive any funding, whereas the Partnership Funding policy allows for partial funding and then financial contributions to be made by other organisations (Clarke et al., 2018). The evaluation was able to develop a counterfactual because they had the data on schemes that applied before the Partnership Funding policy was introduced and the previous system used to allocate money to these schemes. A limitation was identified relating to the quality of the data used because it was estimated that schemes may have been duplicated in spreadsheets. The development of the counterfactual was intended to inform the evaluation on economic benefits provided by the Partnership Funding and did not capture any place-based impacts beyond the presence of capital investment.

Social Policy

Social policy experimental approaches to evaluation were identified in the international development space and the crime sector.

The Northern Ghana Millennium Village Project (MVP) was implemented in Sub-Saharan Africa in 2006 by the Millennium Promise, Columbia University and United Nations Development Program. The project aimed to work toward achieving the Millennium Development Goals, by implementing interventions at a local scale with multiple actors (Masset and Garcia Hombrados, 2019). The evaluation identified two methodological challenges. The first was that the project was implemented in a cluster of contiguous villages, which made randomisation not possible, and the second was that the implementors of the project did not agree with an evaluation design that would identify the impact of single interventions as well as their interactions. To overcome the challenges, the evaluation followed an experimental approach by using a difference-in-difference design and they also estimated the impact of the MVP as a package, rather than attempting to understand impacts from individual interventions. Box 4 provides a detailed example of how the difference in difference approach has been used to evaluate a place-based intervention that has occurred at a local level could contribute to larger international development indicators.

Box 4: The use of difference-in-difference (Masset and Garcia Hombrados, 2019)

The evaluation of the Northern Ghana Millennium Village Project (MVP) using difference-in-difference

Evaluation overview: The evaluation assessed the impact of the MVP on multidimensional poverty using index approaches. They were able to use a large database that spanned five years and contained data on multiple welfare indicators.

Difference-in-difference design: The methodology matched all 35 MVP villages with control villages. Control villages were selected by using village level data from the year 2000 census and matching characteristics to intervention villages. The evaluation then carried out a baseline survey to collect household level data, which was matched to establish control groups that were matched to MVP villages. The evaluation used indicators developed by the Millennium Development Goals and used a sub-classification of the propensity score, which allows for the evaluation to design a non-randomized study in a way that mimics the characteristics of a randomised control trial. This allowed the evaluation to estimate the causal effects of the MVP intervention, within each sub-class, as if the assignment had been random within each sub-class of the propensity score. Sub-classes were given a weight, and the evaluation calculated the average treatment effect of the MVP intervention within the subclasses.

Findings: The evaluation found that the intervention had a limited impact on the Millennium Development Goals but a positive impact on the global multi-dimensional poverty index.

The following two evaluations identified from the social policy sector were related to place-based crime interventions. One of the interventions used a quasi-experimental synthetic control approach to evaluate the impact of a place-based intervention to reduce violent crime in Flint, Michigan (Rydberg, 2018). The intervention took a data-driven approach to crime and traffic safety, which aimed to reduce both crime and traffic incidents in areas where they overlap, allowing police to target these crimes simultaneously. Data was used to identify these hot spots and police increased patrols in these areas to proactively reduce crime. The evaluation sought to understand what would have happened to violent crime if the intervention had not occurred.

The evaluation paired violent crime data provided by Michigan police force with data from the 2010 census and then produced synthetic control weights to produce a counterfactual. The synthetic control weights considered the area of the intervention as the population and then the donor pool of comparison areas as a sample that was then weighted to reflect the properties of the population. The findings of the evaluation suggested that the impact of the intervention was a reduction in violent crime, but the treatment effects suggested that there was a null effect across hot spots and treatment effects for the program were indistinguishable from the placebo regions. The evaluation highlighted that overall violence was declining in Flint and that it was challenging to attribute a reduction in violent crime in the intervention areas directly to the intervention. This example highlights how a synthetic control approach can be applied to an intervention when data is available and allows for the development of a counterfactual.

Similarly, a synthetic control approach was undertaken to evaluate High Point's Drug Market Intervention (DMI) and used socio-demographic crime data for intervention and

comparison areas (Saunders et al., 2015). High Point is in North Carolina and DMI aimed to reduce open-air drug markets by working with partners to support drug offenders to make positive changes in their life and reduce drug dealing and usage. The evaluation developed synthetic control areas by using data prior to the intervention to develop a set of weights to match the comparison area to the treatment area. The evaluation highlighted that the impact of the DMI was greater than estimated by previous evaluations and concluded that this approach allowed for the consideration of larger effect sizes and more significant effects because the statistical controls enabled a precise indication of the intervention. This suggests that employing a synthetic control approach could be effective when considering the impact of place-based interventions and appropriate weights are established to develop a counterfactual.

Health

There were two evaluations identified in the health sector that followed an experimental approach.

The evaluation of A Better Start programme used difference-in-difference techniques, combined with propensity score matching, to evaluate the impact of the programme (Barlow et al., 2017). A Better Start programme was an area-based intervention that aimed to deliver preventative programmes comprising ante and post-natal support to equalise life chances in socio-economic disadvantaged areas across England. The evaluation matched three comparison sites to an intervention area, firstly by using indicators on children's health and then a distance score based on the Manhattan distance metric using standardised scores per indicator (Barlow et al., 2017). Surveys were conducted with mothers and partners in comparison and intervention sites at different points, once during pregnancy, and then at intervals until the child is seven. Alongside surveys, biometric data was collected on a random sample from the full population to provide information on height, weight, cortisol levels and genetics. The longitudinal data will be analysed using propensity score techniques to match individuals across intervention and comparison areas to evaluate the impact of the intervention. The results of this evaluation are not yet available but the initial protocol that has outlined how the impact evaluation will be conducted is helpful in providing an insight as to how synthetic control approaches can be implemented for place-based interventions.

The evaluation of the Ageing Better programme conducted surveys with participants of the programme and non-participants to understand the impact. Ageing Better was funded by the National Lottery Community Fund and aimed to address issues of social isolation and loneliness by engaging older people in the design of services for their communities (Campbell-Jack et al., 2021). Participants of the Ageing Better programme were asked to complete surveys throughout their engagement and almost 36,000 responses were received. The evaluation also ran surveys with a comparison group of older people who had not participated in Ageing Better activities and the same questions were included, which allowed for the evaluation to track the impact of the programme. The comparison group were selected to reflect the characteristics of the intervention group and scores on

social contact, wellbeing, loneliness, as well as demographic information, were matched from the baseline surveys. This allowed for the evaluation to conclude that changes in groups could be attributed to participation in the Ageing Better programme, and it was concluded that the programme effectively engaged with those who were experiencing social isolation or loneliness. These examples from the health sector outline how the collection of longitudinal data can be useful in assessing the impact of place-based interventions, particularly when the impacts could be long term and on a large scale.

Research Question 4: What contribution have GIS and Earth Observation data made to inform evaluations?

The way that GIS datasets and Earth Observation data can inform evaluations was a gap in the literature. GIS data is displayed on a map and different data sets can be applied to the map by adding layers. Earth Observation data is how remote sensing is used to monitor physical and biological systems of earth.

There was evidence of how GIS data has been used to evaluate national agri-environment schemes, such as Countryside Stewardship (CS). This was identified in the way that GIS information can contribute to understanding whether CS agreements have had an impact on geological features on SSSIs (Land Use Consultants, CCRI and Environment Systems, 2022). Similarly, it was suggested that GIS technology could be used to inform monitoring and evaluation of agri-environment scheme performance and national GIS datasets can be modified to be bespoke for specific area characteristics or boundaries (Holt and Morris, 2022). The evaluation of the Facilitation Fund carried out spatial analysis to understand how CS option uptake differed depending on the presence of a facilitation fund group (Short et al., 2022). Overall, evidence mostly discussed how Earth Observation and GIS could be used to support monitoring activities, but some evidence discussed how this technology could be used in evaluation design.

Most evidence discussed the use of GIS data and Earth Observation in relation to large areas. On a national level, it was identified that this data could be used to classify peatlands for national carbon accounting (Williamson et al., 2017). Similarly, it was suggested that Earth Observation data and habitat mapping could be used to assess the impact of the UK's commitment to meet 30 by 30 (to protect 30% of land and sea for biodiversity) by considering images before, and assessing change (Burke et al., 2023). Similarly, it was suggested that Google Earth Engine satellite imagery could inform policy designs on wetland interventions in specific locations (Steinbach et al., 2023). These are examples of how this technology could support policy targets and climate resilience, but they are not focused on a local level or evaluations of place-based interventions.

The use of GIS and Earth Observation to support more local monitoring and intervention progress was identified in the environmental sector. Particularly because images can be presented before, during and after an intervention which can help demonstrate impact. In urban areas, it was identified that Earth Observation data could inform the understanding of the impact of Nature Based Solutions implemented in a particular area, by providing

quantitative information on local data, such as energy use and water quality (Chrysoulakis et al., 2021). The use of Earth Observation information in tracking the progress of interventions was also identified in The PlaceMarker Survey, which is used by the Environment Agency to meet their strategic aims (Wharton et al., 2022). The PlaceMarker survey comprises a study area and one or more river surveys, which provide more specialist local information on habitats, biodiversity, heritage, landscape, and amenity indicators (Wharton et al., 2022). The evidence highlighted that if the Placemarker survey was repeated before and during a project intervention it would be possible to monitor the impact and environmental response to the intervention. Similarly, remote sensing was carried out to detect the impact of an oil spill on a mangrove site off the Brazilian coast, and it was found that 40 years after the spill, the ecosystem is still impacted (Lassalle et al., 2023). These examples highlight how GIS and Earth Observation information can inform longer term monitoring activities of interventions or events.

The evidence did suggest that GIS and Earth Observation could improve evaluation practice. Evidence suggested that GIS can show changes over time and inform policy delivery to be sensitive to local needs (Azzam et al., 2012). This was identified in the health sector, where GIS data was used to map populations, local health concerns and the availability of health resources, which allowed for the health needs of a specific population to be considered in healthcare provision. Using the GIS data over time and considering wider health data could inform the evaluation of the place-based intervention in providing healthcare focused on local needs.

Overall, there was a lack of available evidence directly relevant to this research question. However, evidence that was identified did highlight that there was an opportunity for GIS and Earth Observation data to be integrated into place-based intervention design, monitoring and evaluation.

Research Question 5: How have place-based interventions (environmental and other) been evaluated using data models, including Artificial Intelligence and Machine Learning?

The database searches and consultation with experts did not identify any evidence of how place-based interventions have been evaluated using data models.

Research Question 6: How can Artificial Intelligence and Machine Learning contribute to producing predictive models to support place-based working?

There was a gap in the evidence on how Artificial Intelligence (AI) and Machine Learning can contribute to support place-based working.

It was suggested that AI, Machine learning and cloud data could present an opportunity for understanding environmental effects of impacts. Evidence highlighted that there was a need to make environmental modelling more accessible to increase AI and Machine Learning's role in ecosystem assessments (Galaz Garcia et al., 2023). The multidisciplinary nature of ecosystem assessments and the way that data needs to be integrated was identified as a challenge for AI and data models. Using Google Earth Engine data to validate land cover maps was viewed as providing an opportunity for developing countries to maintain natural capital accounting and informing national decision making (de Sousa et al., 2020). Therefore, there is a suggestion that this data could be integrated into policy making more but there is a gap related to how it can be used in place-based evaluations.

Conclusion

The review has identified that place-based interventions are more commonly evaluated using theory-based approaches.

There was little or no evidence identified in relation to how Earth Observation, GIS, Machine Learning and AI could be used to inform evaluations and how these technologies have been applied in evaluations of place-based interventions. The evidence did highlight that there are opportunities for these datasets to contribute to policy design and ongoing monitoring. This was evident because it is possible to document a timeline of before, during and after an intervention. The spatial analysis carried out as part of the Facilitation Fund evaluation highlighted how national option uptake data could be utilised to understand the local impact of the Facilitation Fund groups and to understand whether participation led to more locally appropriate options.

Overcoming practical evaluation challenges

Environmental evaluations commonly identified practical challenges relating to the availability or quality of data to support the evaluation (SQW, 2012; Dwyer et al., 2021; Breyer et al., 2020). This has led to challenges for evaluations to determine the impact of the intervention, particularly when completing whole programme evaluations. Similarly, the reliance on self-reported data for evaluation purposes was identified as a weakness within an evaluation (Bertolotto et al., 2023). Therefore, it is suggested that monitoring data is collected to support evaluation activities, which could provide opportunities for evaluations to produce more robust findings.

It was suggested that consideration should be given to the timing of evaluation activities, to ensure that stakeholders are available to participate (Johnson and Vousden, 2023). Ensuring that evaluations can be flexible and sensitive to the context within which implementing teams operate, can be a valuable approach to ensure stakeholder engagement with the evaluation and can lead to evaluations having more rigour.

Considering place-based appropriate methodologies

Theory-based approaches were more commonly used to evaluate place-based interventions. The strength of theory-based approaches is that they allow for the in-depth consideration of context specific impacts. A limitation could be that because these approaches are resource intensive, case studies tend to be produced for a selection of projects within a programme (ADAS, 2020; Risk and Policy Analysts, 2021). To understand programme impacts, monitoring data and the development of indicators was used (Collingwood Environmental Planning, 2015). Using indicators for evaluation was criticised in some social policy evidence that focused on international development programmes. Indicators were viewed as capturing impacts within the specific parameter, which may mean that the full impact of a programme is not captured through evaluations

(Giordano & Greco, 2023; Masset and Garcia Hombrados, 2019). However, the flexible approach to using indicators, that allowed projects to select optional indicators to suit their place-based needs, could be an effective approach to incorporate quantitative metrics into evaluation (Collingwood Environmental Planning, 2015).

Similarly, ensuring the evaluation team is flexible and has a thorough understanding of the contexts within which interventions are implemented was a recommendation by the Youth Endowment Fund (Smith et al., 2023). The ability to build the relationship between evaluators and implementors in place-based projects could be a valuable way to ensure that time and input is received into the evaluation but to also be sensitive to overcoming the methodological challenge of impact occurring at different time points. An example of how an evaluation successfully implemented this approach was the Well North (2019) evaluation, that sought to capture ‘change moments’ whereby projects reported on an ad hoc basis when a specific impact took place, because of the project activities.

There was a gap in the evidence of how GIS, Earth Observation, Artificial Intelligence and Machine Learning has been used to support place-based evaluations. There was evidence to indicate that this kind of data was used to support other evaluation activities (Short et al., 2022). It appears that this could be a valuable area to explore in the future and overlaying datasets could make GIS/Earth Observation data more relevant to understanding impacts at a smaller scale (Holt and Morris, 2022).

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Appendix 1: Methodology

The review methodology followed the following five stages:

1. developing a search protocol;
2. identifying and collating sources of evidence;
3. data extraction;
4. quality assessment (Note: this stage was removed when it was agreed that the expert panel workshop would feed into the critical appraisal, see section on Methodological Controversies); and
5. evidence synthesis and reporting.

Developing a search protocol

The search protocol document outlined the parameters of the review. It was informed by an expert workshop attended by the ICF expert panel and the Natural England team. The document included the inclusion and exclusion criteria, databases to be searched and search terms to use (Table 4), and the data extraction information and synthesis.

Boolean search terms were developed for each research question, which allowed for the search to be focused on the research question aims. The Boolean operator 'AND' allows for search strings to be combined, which narrows the search results. The Boolean operator 'OR' is used to include synonyms in the search terms.

Identifying and collating sources of evidence

Boolean search terms were carried out in Google Scholar and Scopus databases and the top 20 results from each search were extracted. Simplified versions of the Boolean search terms were carried out in Defra Science Search. As the Defra Science Search database includes environmental and evaluation publications, simplified Boolean search terms allowed for a wider range of literature to be screened. There was no set number of results to extract from the Defra database, instead all results from each search were screened using the inclusions/exclusion criteria and only the most relevant were extracted.

Table 4 below shows the Boolean searches that were carried out for each research question.

Table 4: Boolean Search terms and Research Questions

Research Question	Boolean search terms
1. Which evaluation methods are used to assess the impacts of environmental (and other) place-based projects?	Area-based OR place-based AND nature OR environment AND evaluation
2. How have theory-based evaluation methods been applied to environmental (and other) place-based interventions including ecosystem services and natural capital approaches?	Theory-based AND evaluation AND applicability OR relevance OR effectiveness AND place-based OR area-based AND environment OR policy AND intervention
3. How have experimental, quasi-experimental, counterfactuals, synthetic counterfactuals/controls been used to evaluate place-based initiatives?	natural-capital OR ecosystem OR environment AND interventions OR projects OR initiative AND evaluation OR monitoring OR effectiveness synthetic counterfactual OR counterfactual OR quasi-experimental OR participatory systems mapping AND evaluation
4. What contribution have GIS datasets (and Earth Observation) data made to inform evaluations?	GIS OR Geo-spatial OR remote sensing AND earth-observation AND evaluation AND nature OR environment
5. How have place-based interventions (environmental and other) been evaluated using data models, including AI and Machine Learning?	Artificial intelligence OR machine learning AND natural-capital AND nature OR ecosystem OR environment AND evaluation OR monitoring OR effectiveness AND place-based
6. How can AI and Machine Learning contribute to producing predictive models to support place-based working?	Artificial intelligence OR machine learning AND natural-capital AND nature OR ecosystem OR environment AND evaluation OR monitoring OR effectiveness AND place-based

In addition to the Boolean searches, recommendations were sought from the ICF expert panel on additional evidence sources and specific databases to search. These

recommendations included databases from the National Lottery Fund, the National Lottery Heritage Fund, Wildlife Trusts, Rivers Trusts, UKRI, and other UK government databases (DLUHC, FCDO, Home office). Targeted google searches were also undertaken using simplified Boolean search terms. Overall, this approach ensured that the review captured both academic and grey literature whilst fully utilising the expertise and experience of the ICF expert panel. Grey literature was particularly important within this review as evaluations are often not published academically but as policy outputs.

All identified sources were then extracted into an excel spreadsheet ready for screening. Key literature information such as title, authors, year, URL, and abstract were entered into the spreadsheet.

Evidence Screening

Alongside the literature searches the evaluation team screened each piece of literature using a two-stage RAG (Red = not relevant, Amber = uncertain, Green = Relevant) review process using the inclusion and exclusion criteria (see Table 5 below) from the Search Protocol.

Table 5: Inclusion/Exclusion criteria

Inclusion Criteria	Justification
Geographical focus	The literature will consider nature place-based evaluations in any country.
Literature published from 2010 onwards	The review will limit searches to evidence from 2010 onwards. This will ensure the most up to date information is captured. Evidence produced before this time will be considered if suggested by experts or identified using a snowball technique.
Terrestrial and marine literature	The review will consider evidence referring to terrestrial and marine place-based evaluations.
Evidence written in English	The research team will only review evidence written in English.

First, the literature was screened by title. 10% of the screening results were cross checked by a different member of the research team to ensure consistency and a sample of ‘Red’ and ‘Amber’ titles were assessed by the expert panel to ensure that all titles had been thoroughly screened. Second, literature was screened based on the abstract narrative. If the abstract was unavailable because the literature was a report, the executive summary

or the first paragraph of the report was reviewed instead. Abstracts were reviewed and given a RAG rating. ‘Green’ and ‘Amber’ literature was then progressed to full text review. Irrelevant ‘Amber’ texts were also excluded at this stage with expert approval.

Data Extraction

Once screened ‘Green’ and potentially relevant ‘Amber’ rated literature were then read in full. Qualitative data was extracted into an excel spreadsheet. The extraction template included columns to enter further information about the literature such as the broad topic covered, geographic focus and methodology examined. The main columns for data extraction followed the topics of the research questions by splitting out each evaluation approach such as experimental, theory-based, and participatory/process/other. As each piece of literature was read in full a quality and relevancy score of ‘low, ‘medium’ and ‘high’ was allocated. This allowed for focus on the best quality and most relevant literature during synthesis and reporting.

During data extraction additional relevant literature was also identified through a snowballing technique whereby references of interest on key evidence sources are identified through a ‘backward and forward’ citation search. These additional sources then went through the data extraction process.

Where full texts were read and they were felt to be out of scope or lacking in detail they were excluded. Out of scope often referred to lacking in a place-based focus.

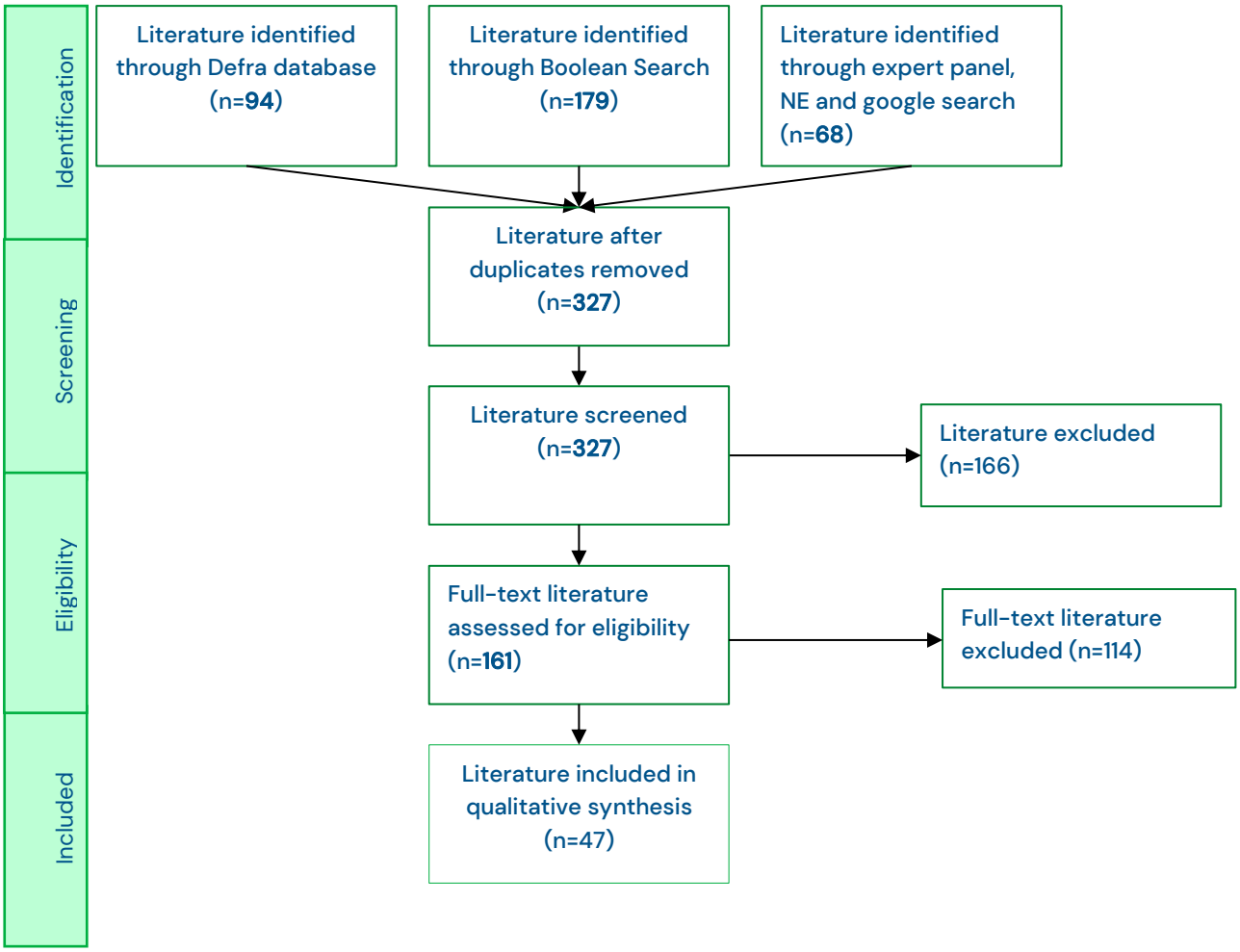
Evidence synthesis and reporting

This report focuses on impact evaluation methodologies that were applied to place-based interventions. However, the review identified a significant amount of evidence related to the applicability of methodologies to support place-based evaluation and evaluations that were participatory or focused on process. Qualitative evidence has been synthesised and presented according to the relevant research question.

Results

The Prisma diagram below (Figure 1) details the literature identified, screened, and included in the literature review.

Figure 1: Prisma diagram to show literature identification processes



Appendix 2: Environmental Place-based interventions

Table 6: Environmental place-based evaluations

Name of Programme	Evaluation approach	Data Collection Methods	Sensitivity to place-based challenges	Evaluation Challenges
Local Nature Partnerships (ICF, 2015)	Intervention logic	• Document review of information provided by Defra and obtained by desk research. • Online survey. • Interviews with LNPs. • Thematic workshops. • Thematic evaluation.	• There were 48 LNPs that covered most of England. The evaluation worked in detail with a smaller number of LNPs to provide in-depth evaluation and support on 7 key themes that were identified through interviews and surveys.	• LNPs were around two years old for this phase and it was noted that longer term impacts were not observed. • Most LNPs did not have an evaluation plan and a third did not intend to prepare one. This makes longer term impact more difficult to assess at a programme level.
Rural Growth Network Pilot (SQW, 2016)	Theory and case-based approach grounded in using logic models	• Beneficiary survey. • Longitudinal case studies. • Participatory methods for process evaluation. • Comparative methods (stakeholders in pilot and non-pilot areas).	• The overall data collection activities were flexible to reflect changing elements of the programme and the changing context. • Longitudinal case studies enabled the evaluation to understand the 'project journey' from different perspectives, and to understand how contexts had impacted delivery.	• The evaluation considered 5 areas and they did not collect data pre and post intervention in a consistent way. • The flexibility in the policy and the local management meant that delivery and scale were not consistent across areas.
LEADER (European Commission) (Dwyer et al., 2022)	Intervention logic	• Literature review. • Surveys of local action group managers and managing authorities. • Indicator analysis. • In-depth case studies.	• 36 case studies were selected from 10 member states to include reflect contexts.	• The EU Rural Development Programme collects Annual Implementation Report data from member states. It was noted that this data is not robust or comprehensive across member states. • The indicators that were developed only show a narrow picture of impact across the EU and may not show all

Name of Programme	Evaluation approach	Data Collection Methods	Sensitivity to place-based challenges	Evaluation Challenges
				impacts across social and environmental factors.
Countryside Stewardship Facilitation Fund (Breyer et al., 2020)	Logic Model	• Development of indicators aligned with theory of change. • Surveys with members and facilitators. • Case studies. • Spatial coherence of FF groups.	• Case studies were produced to provide detailed insights into specific groups. • Countryside Stewardship agri-environment agreements were used to determine whether CSFF members were delivering more landscape benefits than agreements in areas without a CSFF group.	• The quality and content of data and information collected by individual facilitation fund groups varied, which made it difficult to collate at a programme level.
Local Places for Nature (Johnson & Vousden, 2023).	Mixed methods approach	• Interviews. • Surveys. • Workshops. • Case studies.	• The evaluation held a workshop with individuals with expertise and knowledge of nature and biodiversity or community issues and discussed what scheme success should look like.	• The Covid-19 pandemic restrictions meant that the evaluation team was unable to engage with the wider community to understand the impact of the intervention. • The timing of fieldwork occurred at a busy time for projects. This meant there was a low response rate to surveys.
Nature Improvement Areas (Collingwood Environmental Planning, 2015).	Logic Model	• Existing monitoring data. • Development of indicator framework. • Online reporting tool to enable Natural Improvement Areas (NIAs) to record achievements.	• NIAs were individually evaluated using SMART objectives that were developed by each NIA on an individual level. Across the programme, the evaluation considered the aggregated contribution of NIAs and the core indicators. • Indicators were developed at a programme level and local indicators were developed by individual NIAs to consider impact specific to their area. NIAs were required to select indicators that covered themes.	• The evaluation utilised the Biodiversity Action Reporting System (BARS) database for indicators. NIAs highlighted that they would value being able to distinguish between all activity and activity that is being delivered by members of an NIA partnership. This could attribute impacts to NIA achievements rather than reflecting other activity in an area.

Name of Programme	Evaluation approach	Data Collection Methods	Sensitivity to place-based challenges	Evaluation Challenges
Delivering the ecosystem approach on the ground – an evaluation of the upland ecosystem service pilots (Waters, Lusardi & Clarke, 2012)	Process evaluation	• Established a baseline for each pilot based on maps, information on the pilot and beneficiaries.	• By establishing a baseline for each individual pilot using primary and secondary information it is possible to understand the effectiveness of management decisions and the impact specific to local areas.	• The location of beneficiaries could be outside of pilot areas, and it is challenging to ensure that neighbouring areas are effectively managed so benefits arising from ecosystem services are not lost. • The evaluation had limited time and resources for economic valuation of all pilot sites, and this was only carried out in one of the pilot areas. • There is a time lag between changing land use and benefits that are then realised in statistics.
Evaluation of Local No2 plans (Ipsos and Institute for Transport Studies, 2022)	Contribution Analysis	• Before and after analysis on intervention and control sites. • Deep dive case studies. • Telephone surveys with residents and businesses in case study areas. • Qualitative interviews with businesses and Local Authority staff. • Rapid assessment shorter term case studies focusing on area or theme. • National fleet research. • Interviews with taxi drivers in clean air zones.	• An advanced before and after analysis is being applied to assess the extent to which observed changes in air quality can be attributed to a change in road-side emissions, and contribution analysis will be used to assess the drivers of change and stakeholders' attitudes and behaviours toward the measure.	• The evaluation carried out complex analysis on air quality. The variability of air quality data and the influence of meteorology was identified as a challenge to attribute interventions to air quality improvement in an area because it cannot be isolated from these influences.
Evaluation of the Catchment based	Comparative analysis	• Online Survey. • Case studies.	• Comparative analysis was undertaken to understand differences in survey responses depending on the maturity of	• The evaluation suggested that how the policy interacts with other initiatives (such as Local Nature Partnerships or

Name of Programme	Evaluation approach	Data Collection Methods	Sensitivity to place-based challenges	Evaluation Challenges
approach (Rees et al., 2015)		• Email contact to seek further information on costs/benefits and inputs on good practice. • 15 interviews.	the catchment partnership and respondent's role.	Nature Improvement Areas) was unclear and that these relationships will interact differently in different areas.
Natural Environment Investment Readiness Fund (Bertolotto et al., 2023)	Contribution Analysis	• Semi structured interviews. • Online survey. • Project application review. • Projects were asked to complete a self-assessment tool to measure their investment readiness.	• By using contribution analysis, the evaluation sought to build a 'performance story' which aims to demonstrate whether a programme influenced the change, as well as the influence of other factors.	• The evaluation was reliant on projects' self-reported data, which could present an overly positive picture of progress.
Further evaluation of partnership funding (Clarke et al., 2018)	Logic model	• Reviewed datasets on schemes proposed for funding to develop a counterfactual based on funding being allocated through continued use of the priority score system, which was the previous method for allocating funding. • Desk review. • Survey. • Interview. • Case studies.	• Produced a counterfactual scenario to understand what would have happened without the funding. • The survey asked for opinions on local community involvement. • Case studies were selected to include different regions, risk settings (flooding or erosion) and types of schemes.	• For the development of the counterfactual, the evaluation highlighted that there was uncertainty in the datasets that were combined to create the scenarios. The evaluation noted that there was 11,661 schemes within the full dataset and that from looking at schemes beginning with the letter A there could be an over-estimation of around 15%.
Flood Resilience Community Pathfinder (Twigger-Ross et al., 2015)	Logic Model	• Rapid Evidence Assessment • Established a baseline using common indicators. • Semi-structured interviews. • Document review.	• Projects developed their own set of project objectives which were sensitive to the context that they were operating in. Objectives were grouped thematically by flood resilience capacities by the evaluation team.	• There was a lack of data available on local authority spending on flooding and emergency response, emergency shelter and property insurance cover. There was a variety in the monitoring and evaluation experience and skills

Name of Programme	Evaluation approach	Data Collection Methods	Sensitivity to place-based challenges	Evaluation Challenges
				among the project teams, which led to differences in data.
IFCA Evaluation (Risk and Policy Analysts, 2021)	Realist	• Desk based review to compare IFCAs against a set of metrics. • Case Studies. • Interviews. • Focus groups.	• IFCAs were grouped based on comparison criteria, to inform case study selection. This allowed the evaluation to understand what works, for whom, in specific contexts.	• The research identified that a lack of stakeholder availability meant that it was not possible to speak with every type of stakeholder from each IFCA.
Evaluation of Local Nature Reserves (Land Use Consultants, 2006).	Unclear on specific approach	• Desk Review of existing research relating to Local Nature Reserves (LNRs). • Review of development plan policies and Local Nature Reserve management plan. • Stakeholder questionnaire. • Strategic evaluation of LNRs in Scotland against environmental, social and economic criteria. • Case studies. • Focus Groups. • Resource evaluation to identify potential funding for LNR's.	• The review of local nature reserve management plans provided contextual understanding of the areas where they were operating. It was highlighted that challenges faced by local nature reserves were commonly attributed to contextual factors, rather than the management of them.	• The evaluation identified that no monitoring data was available that could provide information on the added value of Local Nature Reserves in comparison to other sites. It was noted that it was difficult to show the benefits of a Local Nature Reserves due to their different settings, which is a benefit for being tailored to local needs, but can also cause confusion among community groups and local authorities.

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