Natural England Commissioned Report NECR092

Learning in the Natural Environment: Review of social and economic benefits and barriers

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Foreword

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.

Background

The Natural Environment White Paper '*The Natural Choice: securing the value of nature*' (**Department for Environment, Food and Rural Affairs 2011**) sets out the need to strengthen the connection between people and nature, and gives an explicit call for every child in England to be given the opportunity to experience and learn about the natural environment. To help achieve this ambition, Government sets out several key reforms which include a commitment to removing challenges and increasing teachers' and schools' abilities to teach outdoors.

To identify and develop solutions most likely to be effective in increasing supply and demand for learning in natural environments, Natural England established a formal partnership with the Council for Learning Outside the Classroom and set up the Natural Connections Management Group. The Management Group had representation from across a range of sectors, including the Natural Environment, Green Space, Community and Volunteering, Heritage and Science sectors. Together they brought a breadth of perspectives to help resolve the challenge in new ways and made a significant contribution to the evidence reviews contained in this Report. Organisations and networks involved included all those represented by the Council for Learning Outside the Classroom plus GreenSpace, Keep Britain Tidy Group, King's College London, Science, Technology, Engineering and Mathematics Network (STEMNET), Sustainability and Environmental Education, Sustainable Schools Alliance, and Volunteering England. Some additional organisations were involved due to the scale and scope of their delivery, such as the English National Parks Authority, Farming and Countryside Education, Learning through Landscapes, the National Trust, Royal Botanic Gardens Kew and the Royal Society for the Protection of Birds.

The available evidence on the challenges that schools experience with regard to learning outside the classroom in natural environments was very fragmented, so Natural England commissioned the first summary paper in this Report (Dillon 2010.) This analysis confirmed the very local nature of the challenges, both for the delivery organisations within the natural environment sector and for schools. Those facing the natural environment sector include a failure to provide coherent, coordinated services for schools at a local level, and the relatively small proportion of schools that appear to be reached through existing services. Those challenges facing schools include the ones traditionally reported by teachers – such as the fear of accidents, cost, and curriculum pressures – however Dillon's analysis also identified another set of local challenges that exist for schools and their staff including teacher confidence, self-efficacy and their access to training in using natural environments within school grounds or further afield. Importantly these local challenges appear to underpin, and hence are more significant than those traditionally cited by schools and providers. Focus group work with teachers reinforced these as key challenges and highlighted the role that strong leadership can play in making these challenges less formidable.

There is considerable evidence to support the wide ranging benefits of learning outside the classroom in natural environments. 'First-hand experiences…can help to make subjects more vivid and interesting for pupils and enhance their understanding… [and] could make an important contribution to pupils' future economic wellbeing and to preparing them for the next stage of their lives' (Ofsted, 2008). However, the evidence on the benefits of learning outside the classroom in natural environments was, like the evidence of barriers, fragmented which inhibited communication of a compelling rationale. So Natural England commissioned the second summary paper in this Report which synthesises the available evidence of the benefits of learning in the natural environment (Dillon 2011).

Finally, in order to fully understand the benefits to society derived from learning in the natural environment, Natural England was keen to include an analysis of the economic value of the

benefits. This analysis had never been undertake and is the work addressed in the third and final paper in this Report (Dickie etal 2011). Dickie concludes that learning in the natural environment makes a significant contribution to environmental education in the current UK National Curriculum. Its value is estimated in the National Ecosystem Assessment (Mourato et al., 2011) through its contribution to greater lifetime earnings associated with educational qualifications in relevant subjects. **The estimated annual value of environmental knowledge in 2010 was £2.1 billion** (£1.6 billion for GCSE subjects and £0.5 billion for A-Level), to which LINE makes a vital and necessary contribution.

In summary, the evidence in this Report clearly pointed to the need to provide better local face to face support to schools:

- to help more schools and teachers become aware of benefits of learning outside the classroom in natural environments and to inspire them to build learning outside the classroom in natural environments into their teaching practice;
- to help them feel more confident that the challenges they perceive can be overcome;
- to help them identify where learning outside the classroom in natural environments could address some of their specific teaching needs; and
- to increase the quality of both teaching and learning.

Natural England together with the Natural Connections partnership used the evidence in this Report to inform the design of a 3 year Demonstration Project (2012-2015) to test and evaluate a new, sustainable delivery model that can support schools in England, particularly those in areas of deprivation, that are currently providing little or no learning in natural environments. Natural England's role in any future activity will continue to be in facilitating others to deliver.

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Further information
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Beyond barriers to learning outside the classroom in natural environments

Contact with the natural environment affords a wide range of benefits, from educational to health and from cultural to social. However, research has found that children are losing their connection with the natural environment and that children in urban environments are particularly disadvantaged[1]. 10% of children play in the natural environment compared to 40% of adults when they were young[2]. This 'extinction of experience'[3] has a detrimental long-term impact on environmental attitudes and behaviours.

… childhood participation in "wild" nature […] as well as participation with "domesticated" nature such as picking flowers or produce, planting trees or seeds, and caring for plants in childhood have a positive relationship to adult environmental attitudes. "Wild nature" participation is also positively associated with environmental behaviors.[4]

More than ever, schools have a role to play in providing all young people with opportunities to experience a wide range of natural environments. Working together, the Natural Environment sector and schools have the potential to inspire and enthuse young people, to provide them with memorable experiences and to empower them to make the most out of the natural spaces and places locally and further afield.

This information sheet aims to extend and develop our understanding of the nature of the barriers to learning outside the classroom (LOtC)in natural environments. It was commissioned by Natural England on behalf of the Natural Connections project Management Group.

Key Findings

1) Several barriers exist to the effective delivery of learning in natural environments. These barriers can be grouped into those that challenge the Natural Environment sector and those that challenge schools.
2) The challenges facing the sector include a lack of a coordinated effective approach to working with schools at a local level.
3) The challenges facing schools include those frequently mentioned such as the risk of accidents, cost and curriculum pressures. However, another set of challenges exists, at local, institutional and personal levels. These challenges include teachers' confidence, self-efficacy

[1] Thomas, G. and Thompson, G. (2004), A child's place: Why environment matters to children

[2] England Marketing (2009), Report to Natural England on childhood and nature: a survey on changing relationships with nature across generations

[3] Pyle, R.M. (1978), The extinction of experience

[4] Wells, N.M & Lekies, K.S. (2006), Nature and the life course: Pathways from childhood nature experiences to adult environmentalism

and their access to training in using natural environments close to the school and further afield.

Recommendations

The Natural Environment sector should take action to:

1) Provide schools with a compelling rationale for LOtC in natural environments that sets out the evidence for impact and shows how barriers, both institutional and individual, can be overcome.
2) Support staff in schools locally to develop their capacity to integrate activities and resources that promote LOtC in natural environments within their vision of effective education.
3) Develop working practices that provide schools with coherent and effective services for LOtC in natural environments, which overcome barriers and facilitate collaboration between providers as well as reflecting local needs and opportunities.

Key terms

The term 'learning outside the classroom in natural environments' encompasses a range of provision, including:

- activities within a school's or college's own buildings, grounds or immediate area;
- educational visits organised within the school day; and
- residential visits that take place during the school week, weekends or holidays[5].

Natural environments are those which, in contrast to the built environment, contain living and non-living material. They include rivers, lakes, forests, the atmosphere, coastlines, caves and mountains.

Fieldwork, for the purposes of this briefing refers to all teaching and learning activities that are carried out in natural environments.

Learning outside the classroom

The UK has a long tradition of using the natural environment for school education and a wide range of providers offer high quality and reasonably-priced experiences. The Learning Outside the Classroom Manifesto[6] and the Learning Outside the Classroom Quality Badge scheme have both raised the profile of LOtC. However, it has been clear for some time that children's access to LOtC still depends far too much on where they go to school and who teaches them. 97% of teachers believe that schools need to use outside spaces effectively to enhance their pupils' development. However, 82% do not agree that their own school is making 'as much use as it can of this valuable resource'[7].

The benefits of learning outside the classroom

The evidence for the benefits of LOtC locally and further afield is compelling and continues to accumulate. In 2004, Rickinson *et al.*'s literature review of outdoor learning concluded that: 'Substantial evidence exists to indicate that fieldwork, properly conceived, adequately planned, well taught and effectively followed up, offers learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom'[8]. Since the publication of that review, more

[5] Ofsted (2008), Learning outside the classroom: how far should you go?

[6] DfES (2006), Learning Outside the Classroom Manifesto

[7] Learning Through Landscapes (2010), Research shows benefit of outdoor play

[8] Rickinson *et al.* (2004), A review of research on outdoor learning

evidence has emerged to support that conclusion. For example, in 2008, Ofsted noted that 'When planned and implemented well, learning outside the classroom contributed significantly to raising standards and improving pupils' personal, social and emotional development'[9].

These views are echoed by the natural environment sector. The English Outdoor Council, for example, claims that 'learning outside the classroom raises educational standards' and that 'it offers for many their first real contact with the natural environment'[10]. A survey by the Countryside Alliance Foundation reported 'huge enthusiasm for outdoor education among children and teachers' with 85% of children and young people wanting to take part in countryside activities with their school[11].

Reasons for the popularity of LOtC are not hard to find. Research shows that LOtC can contribute to increased creativity and to language development[12] as well as to a sense of care for the natural environment[13]. In a comparative study in the USA, students who had taken part in conservation action 'performed significantly better on achievement tests' and that pupils 'expressed high interest and well-being and low anger, anxiety, and boredom' than students who had been taught using more traditional methods[14]. A study in Australia found that hands-on contact with nature in primary school 'can play a significant role in a cultivating positive mental health and wellbeing'[15] The evidence also suggests that the benefits accruing from using the grounds of secondary schools are broadly speaking identical to those found with any outdoor learning[16].

… high quality, out-of-classroom learning … influenced how children behave and the lifestyle choices they make. It shows the potential […] not just to change individual lives, but the lives of whole communities.
Peacock, 2006[17]

An evaluation of the impact of the London Challenge Residential Initiative[18] which involved schools from five relatively deprived London boroughs sending groups of 11-14 year-olds to field centres found that 'pupils surpassed their own expectations of achievement during the courses, and both pupils and teachers felt that the general levels of trust in others and the self-confidence shown by the pupils on the courses were higher than in school subjects'. Existing schemes such as the Field Study Council's 'Eco Challenge' encourage schools to work with local organizations to develop their own grounds or local community spaces in the context of living sustainably.

Such is the strength of the evidence base that the Teaching and Learning Research Programme (TLRP)[19] concluded as one of its ten principles for effective teaching and learning that learning in

[9] Ofsted) (2008), Learning outside the classroom. How far should you go?

[10] English Outdoor Council (2010), Time for change in outdoor education

[11] Countryside Alliance Foundation (2010), Outdoor education: the countryside as a classroom

[12] O'Brien, L. & Murray R. (2006), A marvellous opportunity for children to learn: a participatory evaluation of Forest School in England and Wales

[13] Coskie *et al.* (2007), A natural integration

[14] Randler, C., Ilg, & Kern, J. (2005), Cognitive and emotional evaluation of an amphibian conservation program for elementary school students

[15] Maller, C. (2005), Hands-on contact with nature in primary schools as a catalyst for developing a sense of community and cultivating mental health and wellbeing

[16] Chillman, B. (2003), Do school grounds have a value as an educational resource in the secondary sector?

[17] Peacock, A. (2006), Changing minds: the lasting impact of school trips

[18] Amos, R. & Reiss, M. (2006), What contribution can residential field courses make to the education of 11–14 year-olds?

[19] Cambridge Primary Review (2008), Learning and teaching in primary schools: insights from TLRP

informal contexts 'such as learning out of school, should be recognised as at least as significant as formal learning and should therefore be valued and appropriately utilised in formal processes'.

Barriers and challenges to teaching and learning in natural environments

There is a lot written about the problem of declining opportunities for outdoor education in this country … There is, however, considerably less published research into the factors (both real and perceived) that might help to explain such trends.
Rickinson *et al.,* 2004

Two groups of barriers to LOtC in natural environments can be identified. One set of barriers challenge the sector and the other set challenges schools and teachers.

Barriers and challenges to the Natural Environment sector

A common vision of LOtC in natural environments

The Natural Environment sector contains a substantial number of groups and organizations providing a diverse range of materials, training, resources and experiences. Although the diversity of the sector is a strength, in that schools can choose providers, resources and the level of support that they need, a lack of a common vision of the value of LOtC and a tendency to work in isolation means that the diversity may also be a weakness.

Recommendation 1

The Natural Environment sector should provide schools with a compelling rationale for LOtC in natural environments that sets out the evidence for impact and shows how barriers, both institutional and individual, can be overcome.

Developing such a rationale might provide an opportunity for the sector to develop its own vision for LOtC in natural environments within school grounds, in nearby locations, such as parks, and further afield.

Continuing Professional Development (CPD)

Tabbush and O'Brien note that 'schools and teachers cannot be expected to take total responsibility for environmental and outdoor education'[20] and the role of providers in providing coherent CPD must not be neglected. Developing teachers' confidence and competence as well as their self-efficacy and awareness of LOtC requires high quality CPD which will probably be school-based and mainly organised during the five statutory inset days, after-school and at weekends and in school holidays. Reviews of research into teacher CPD have established that it takes about 30 hours to make a substantial difference in pedagogy[21]. To be effective, CPD must be focused on strategies for teaching inside and outside the classroom and involve coaching and feedback[22].

[20] Tabbush, P. & O'Brien, L. (2003), Health and Well-being: trees, woodlands and natural spaces. Edinburgh: Forestry Commission

[21] Adey, P. *et al.* (2004), The professional development of teachers: practice and theory

[22] Joyce, B. & Showers, B. (1995), Student achievement through staff development

Recommendation 2

The Natural Environment sector needs to support staff in schools locally to develop their capacity to use activities and resources that promote LOtC in natural environments within their vision of effective education.

Teachers are more receptive to changing their pedagogy if they are dissatisfied with some aspect of their teaching[23]. A recent survey found that although 97% of teachers believed that schools needed to use their outside spaces effectively to enhance their pupils' development, 82% did not agree that their own school was making as much use as it can of this valuable resource'[24]. The survey also found that only 12% of respondents saw lack of support for LOtC from senior management as a major issue in their schools. Training for LOtC needs to focus on developing the confidence and competence of all teachers not just those who are already committed.

Challenges to schools

The House of Commons Education and Skills Committee's report 'Education outside the classroom (Second report)'[25] identified five groups of barriers to LOtC: risk and bureaucracy; teacher training; schools; cost; centres and operators.

Risk

The risks of LOtC have been exaggerated over many years[26]. They form part of what has been called 'a prevailing social trend, not only towards making things safer, but also towards seeking compensation for acts or omissions that result in personal injury'[27]. Schools and providers need to ensure that they inform parents about outdoor activities and reassure them that adequate safety procedures are in place.

Many of the organisations and individuals who submitted evidence to our inquiry cited the fear of accidents and the possibility of litigation as one of the main reasons for the apparent decline in school trips. It is the view of this Committee that this fear is entirely out of proportion to the real risks.
House of Commons Education and Skills Committee, 2005

Teacher training

While in-service training has been very effective in recent years, we are not convinced that initial teacher training does a good enough job in terms of giving trainee teachers the confidence they need to take their pupils out of the classroom.
House of Commons Education and Skills Committee, 2005

The evidence supporting the Select Committee statement that 'in-service training has been very effective' has to be put into context: teachers continue to report that their access to professional development is very limited[28]. A wide-ranging survey[29] of initial teacher training (ITT) institutions published in 2006 found 'substantial variation' in the amount of training for LOtC across courses and institutions. The three main factors that respondents felt had hindered training were funding, curriculum

[23] Davis, N. T. (1996), Looking in the mirror: teachers' use of autobiography and action research to improve practice

[24] Learning Through Landscapes (2010), Research shows benefit of outdoor play

[25] House of Commons Education and Skills Committee (2005), Education outside the classroom

[26] Gill, T. (2010), Nothing Ventured... Balancing risks and benefits in the outdoors

[27] Harris, I. (1999), Outdoor education in secondary schools: what future?

[28] Wellcome Trust (2006), Believers, seekers and sceptics

[29] Kendall, S. *et al.* (2006), Education outside the classroom: research to identify what training is offered by initial teacher training institutions

changes/pressures and the demands/expectations of the ITT course. However, the variation between the best and the worst providers cannot easily be explained by those factors.

Schools

The Select Committee concluded that LOtC was most effective 'where it is well integrated into school structures, in relation to both curriculum and logistics (for example, the organisation of timetables and supply cover where necessary)'. The question, though, is why is it that the most effective schools are able to integrate LOtC into school structures? The Select Committee commented that 'Positive and reliable evidence of the benefits of outdoor activities would help schools determine the priority to afford to such work'. However, that evidence exists but what is not clear is why some schools prioritise LOtC while others do not. Part of the problem might be that no reliable mechanism for measuring the full impact of LOtC activities exists as yet. Work needs to be done to establish the full value of LOtC to learners, schools and the broader community.

Costs

Though frequently mentioned as a barrier to LOtC, the Select Committee noted that 'we do not believe that cost alone is responsible for the decline of education outside the classroom, or that simply throwing money at the problem would provide a solution'. There are many examples of schools with relatively restricted budgets providing exemplary LOtC and relatively well-funded schools doing very little.

This conclusion is supported by evidence from the DfES London Challenge programme. As part of this initiative, the Field Studies Council offered full funding to schools to support an off-site educational visit. ***One third of schools did not take up this offer despite it being effectively free of charge.*** *It seems therefore that an increase in funding alone would not be enough to persuade schools to change their behaviour…*
House of Commons Education and Skills Committee, 2005

Centres and operators

Provision for LOtC varies for a range of historical, geographical and other reasons. Some local authorities (LAs) have outstanding levels of provision of service while others offer very little support. In the latter cases, private sector and voluntary sector organisations provide access to LOtC. A small number of LAs have increased their support over the years and have found that demand often exceeds supply. Again, children's access to LOtC depends far too much on where they live and often those children in the poorest parts of the country have the least access to LOtC[30][31]. A recent survey[32] reported that over 60% of children polled felt they did not learn enough about the countryside at school.

This disparity of opportunity is … particularly tragic in that most disadvantaged pupils have potentially most to gain from the transformative impact that outdoor education has for many young people.

While the Select Committee noted that 'any attempt to raise the quantity and quality of outdoor education depends crucially on the skills and motivation of the teachers involved' it neither addressed the issue of what constitutes effective CPD nor the issue of teacher motivation to take part. It is evident, particularly within the emerging picture of school funding, that if LOtC is to be more accessible to more students that the focus of efforts needs to be on teachers' needs, motivations and pedagogies.

[30] Thomas, G. and Thompson, G. (2004), A child's place: Why environment matters to children
[31] Power S. *et al.* (2009), Out of school learning: variations in provision and participation in secondary schools
[32] Countryside Alliance Foundation (2010), Outdoor education: the countryside as a classroom

I think we all recognise that whatever bureaucracy emerges or whatever curriculum changes emerges, what funding emerges, we have had to take the teaching profession with us.
Andy Simpson, Head of Education, RSPB, 2005

The variation between teachers and schools in terms of commitment to LOtC is partly explained by perceptions of risk, cost of activities and curriculum pressures. There is no doubt, for example, that much of the difference between provision between primary and secondary schools can be explained by systemic factors. However, another set of barriers must exist to explain the differences between individual teachers and schools. These barriers are centred around the following factors:

- Teachers' view of the nature of their subject[33]
- Teachers' views of the role of education[34]
- Teachers' views of effective pedagogy[35]
- Teachers' self-efficacy[36]
- Teachers' working practices (planning, teaching and evaluation)[37]
- Teachers' and school leaders commitment to school-community links[38]
- The relationship between schools and providers[39]

Teachers who see their subject as primarily laboratory-based may be less likely to exploit LOtC in their teaching than those who see it as involving fieldwork. Teachers who see the role of education as being to engage students with the outside world are more likely to value LOtC and to see fieldwork as effective pedagogy than those who see the purpose of education somewhat more narrowly. Teachers' self-efficacy may well be higher when they using familiar methods of teaching than when they are faced with novel situations, for example, in unfamiliar environments. Teachers who plan lessons collaboratively and who watch each other teach may be more likely to try out new pedagogies than other teachers. Schools that know and value their local communities may be more likely to value LOtC than other schools. Finally, those providers who build relationships with schools and teachers and who share common purposes are more likely to find that they are valued and that the relationship grows.

For LOtC to become mainstreamed for all pupils, there must be a greater awareness that without teacher commitment and adequate CPD, there will be no progress. Given the current funding arrangements and the levels of resources available to schools, the onus for prioritizing CPD for LOtC will fall on schools and, specifically, on their senior management teams. Consequently, the Natural Environment sector will need to work more closely together to provide a coherent message to school leaders, and services more likely to meet their needs. Schools should be able to see how their provision compares with the leading schools in terms of LOtC and they need to see a clear framework of provision matched to learning and other outcomes.

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[33] Akerson, V. *et al.* (2009), Fostering a community of practice through a professional development program to improve elementary teachers' views of nature of science and teaching practice

[34] Stevenson, R.B. (2007), Schooling and environmental education: contradictions in purpose and practice

[35] Lotter, C. (2007), The influence of core teaching conceptions on teachers' use of inquiry teaching practices

[36] Carrier, S.J. (2009), The effects of outdoor science lessons with elementary school students on preservice teachers' self-efficacy

[37] Vescio, V. *et al.* (2008), A review of research on the impact of professional learning communities on teaching practice and student learning

[38] Sosu, E.M. *et al.* (2008), The complexities of teachers' commitment to environmental education. A mixed methods approach

[39] Nicol, R. *et al.* (2007), Outdoor education in Scotland. A summary of recent research

It was apparent that some schools and subgroups/departments within schools had developed quite sophisticated and effective professional development learning communities, others just as clearly had not.
Hustler *et al.* (2003)[40]

Despite a range of initiatives over a long period of time, the use of school grounds and local parks for LOtC remains very variable. Schools with seemingly poor provision have made the most of their limited space while other schools have done very little. The focus for future developments including CPD will probably start with the immediate environment.

… well-designed school grounds could make outdoor learning a daily possibility. However, the continued rarity of such use in the secondary sector, partly due to the inadequate design of grounds as well as the classroom-biased philosophy prevalent in most schools, means that there is no evidence into the effect of sustained use of the school grounds for learning.
Barbara Chillman, Sussex University/Learning Through Landscapes[41]

Sources of information

There is no shortage of advice for teachers about using the outdoors. Sources of information include websites, practitioner journals and external providers. Much of the advice on offer would tally with research findings, for example, 'Effective field trips require planning, preparation, and follow-through upon returning to school as well as coordination between the host site, school, and chaperones'[42]. What teachers do not have is a lot of time to keep up-to-date with new and existing resources. A mechanism needs to be found to make access to such resources quick and easy.

Recommendation 3

The Natural Environments sector should develop working practices that provide schools with coherent and effective services for LOtC in natural environments, which overcome barriers and facilitate collaboration between providers as well as reflecting local needs and opportunities.

[40] Hustler, D. *et al.* (2003), Teachers' perceptions of continuing professional development
[41] Chillman, B. (2003), Do school grounds have a value as an educational resource in the secondary sector?
[42] Fredericks, A.D. & Childers, J. (2004), A day at the beach, anyone?

Understanding the diverse benefits of learning in natural environments

Learning in the natural environment (LINE) affords direct benefits as diverse as educational, health and psychological and indirect benefits ranging from social to financial. Yet, despite increasingly robust evidence of these benefits, many children are losing their connection with nature. Worse still, children in urban environments are particularly disadvantaged[1]. For example, nowadays 10% of children play in the natural environment compared to 40% of adults when they were young[2]. This 'extinction of experience'[3] has a detrimental long-term impact on environmental attitudes and behaviours. A cultural shift is required, both at home and at school, before the situation can be reversed. Such a cultural shift requires commitment from concerned parties and stake-holders; substantial advocacy; a long-term strategy, and an irrefutable and compelling evidence base. This report focuses on the last of these features.

For too long, though, research into the benefits of LINE has failed to address the full range of benefits. Instead, there has been a narrow focus on easily measurable outcomes and a desire to seek simple answers to simplistic questions such as 'does LINE raise standards more than learning in the classroom?' One consequence is that too many children have been denied the rich educational experiences that have been available to others. In the current financial situation, and at a time when the education system is under review, it is opportune to set out the full range of benefits which are available to all students in schools across the country.

This report aims to broaden and deepen our understanding of the nature of the benefits to learning in natural environments. It was commissioned by Natural England on behalf of the Natural Connections project Management Group. This paper complements another document, 'Beyond barriers to learning outside the classroom in natural environments', again commissioned by Natural England and published in December 2010.

Key Findings

1) The diversity of benefits of LINE offer a potentially compelling rational for increasing access to LINE for all young people. However, as yet, the findings have not been assembled into a coherent case targeted at key decision makers.
2) By far the greatest proportion of research findings focus on the impact of LINE on participants' knowledge and understanding. Specifically, students perform better in reading, mathematics, science and social studies and show greater motivation for studying science.
3) The estimated annual value of environmental knowledge in 2010 was £2.1 billion (£1.6 billion for GCSE subjects and £0.5 billion for A-Level), to which LINE can make a vital and necessary contribution.

[1] Thomas, G. and Thompson, G. (2004), A child's place: Why environment matters to children

[2] England Marketing (2009), Report to Natural England on childhood and nature: a survey on changing relationships with nature across generations

[3] Pyle, R.M. (1978), The extinction of experience

4) A broad range of skills ranging from the technical to the social have been identified as outcomes of LINE, particularly when it is integrated with the everyday school curriculum.
5) Environmental-based education makes other school subjects rich and relevant and gets apathetic students excited about learning.
6) Links between contact with the environment and personal health are well-established. Studies have shown that exposure to the natural environment can lower the effects of various mental health issues that can make it difficult for students to pay attention in the classroom.
7) Hands-on contact with nature is not only essential for protecting the environment but appears to be a means of cultivating community and enhancing the mental health and wellbeing of children and adults alike.
8) Structured activities, such as those commonly occurring in sustainability education, are powerful catalysts for creating a stronger sense of community - both within and beyond school boundaries.
9) Teachers benefit from LINE, becoming more enthusiastic about teaching and bringing innovative teaching strategies to the classroom[4]. Schools also benefit from teachers taking more ownership and leadership in school change.

Recommendations

The Natural Environment sector should take action to:

1) Assemble, promote and present the breadth of impacts of LINE, thus providing a compelling rationale to funders, schools and parents, with a view to encouraging more equitable access for all students.
2) Develop more effective strategies to collect evidence of the full range of benefits and impacts of LINE on individuals, institutions and the wider community within a common framework developed by the sector itself.
3) Share evaluations of the impact of completed and existing educational initiatives more widely with a view to building a clearer picture of the full range of educational and other benefits of LINE as well as providing an opportunity to identify issues and questions for future study. Such sharing would identify the relative effectiveness of initiatives.

Key terms

The term ‘learning in the natural environment (LINE) encompasses a range of provision, including:

- activities within a school’s or college’s own buildings, grounds or immediate area;
- educational visits organised within the school day; and
- residential visits that take place during the school week, weekends or holidays[5].

Natural environments are those which, in contrast to the built environment, contain living and non-living material. They include school grounds, local open spaces, parks, rivers, lakes, forests, coastlines, caves, mountains and the atmosphere.

Fieldwork, for the purposes of this briefing refers to all teaching and learning activities that are carried out in natural environments.

[4] The National Environmental Education & Training Foundation (2000), Environment-based Education - creating high performance schools and students

[5] Ofsted (2008), Learning outside the classroom: how far should you go?

Benefits to participants of learning in natural environments

The most authoritative survey of research into learning outside the classroom was carried out by Rickinson *et al.* in 2004. The review concluded that: 'Substantial evidence exists to indicate that fieldwork, properly conceived, adequately planned, well taught and effectively followed up, offers learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom'[6]. The Rickinson *et al.* review identified four areas of impact on students: cognitive, affective; social/inter-personal; and physical behavioural.

A recent study to begin to assess the economic benefits of LINE, commissioned specifically to inform this briefing paper from *eftec*, found that the value of LINE in England involves benefits arising from educational attainment, attitudes to other children, awareness of environment and natural science skills, behavioural outcomes and social cohesion, health benefits, school staff morale, and a more attractive school (aesthetically and to prospective parents)[7] (see Appendix 1). Furthermore, complementarity between these benefits means that the overall value of LINE to society is probably greater than the sum of these parts. The qualitative evidence linking LINE to such benefits is compelling, however, quantitative evidence linking LINE and changes in these benefits is lacking.

Even in the absence of such quantitative links, it is possible to use monetary value evidence to illustrate that LINE's contribution is significant. For example, the costs to society of the problems that are encountered in the absence of health, community cohesion, higher educational attainment and so on range from tens of millions to billions of pounds. Even if LINE has only a very small impact on these costs (e.g. reducing the relevant impacts by 0.1%), its value in reducing costs would be very large – of the order of £10m to £20m per year. Greater percentage reductions in impacts would give proportionately greater reductions of costs.

The benefits accruing from LINE can be reduced remarkably easily by a lack of adequate preparation, weak pedagogy and inadequate follow-up back in school. Fredericks and Childers note that 'Effective field trips require planning, preparation, and follow-through upon returning to school as well as coordination between the host site, school, and chaperones'[8]. Many of the outcomes are inter-related and mutually reinforcing. In a seminal study of the impact of residential fieldwork on upper primary school students, Nundy identified a positive impact on long-term memory due to the memorable nature of the fieldwork setting as well as affective benefits of the residential experience (e.g. individual growth and improvements in social skills)[9]. Perhaps more importantly, Nundy also reported reinforcement between the affective and the cognitive outcomes which resulted in students being able to access higher levels of learning.

Residential fieldwork is capable not only of generating positive cognitive and affective learning amongst students, but this may be enhanced significantly compared to that achievable within a classroom environment.
(Nundy, 1999, p. 190)

Nundy's findings are supported by a recent Ofsted report which stated that 'learning outside the classroom contributed significantly to raising standards and improving pupils' personal, social and emotional development'[10]. So, while the benefits listed below are organised into categories, it must be

[6] Rickinson, M. *et al.* (2004), A review of research on outdoor learning

[7] eftec (2011), Assessing the benefits of learning outside the classroom in natural environments. Final Report for King's College London

[8] Fredericks, A.D. & Childers, J. (2004), A day at the beach, anyone?

[9] Nundy, S. (2001), Raising achievement through the environment: the case for fieldwork and field centres

[10] Ofsted (2008), Learning outside the classroom. How far should you go?

borne in mind that many of them do not occur in isolation and, indeed, a class of 30 students exploring their local surroundings may well have 30 different individual experiences resulting in a complex and hard to measure set of personal outcomes.

The outcomes listed below are organised as follows: Benefits to individual participants (knowledge and understanding; skills; attitudes and behaviours; health and well-being; self-efficacy and self-worth); benefits to teachers, schools and the wider community, and benefits to the natural environment sector.

Increasing knowledge and understanding

By far the greatest proportion of research findings focus on the impact of LINE on participants' knowledge and understanding. Specifically, students perform better in reading, mathematics, science and social studies and show greater motivation for studying science[11]. For example, in a comparative study in the USA, Randler *et al.* found that students aged 9-11 who had taken part in conservation action 'performed significantly better on achievement tests' and that pupils 'expressed high interest and well-being and low anger, anxiety, and boredom' compared with students who had been taught using more traditional methods[12].

The impact of visits to the Eden Project in Cornwall has been reported by Bowker who examined pre- and post-visit drawings of tropical rainforests made by 9-11 year-old children. Bowker reported that the 'post-visit drawings […] demonstrated far greater depth, scale and perspective than the pre-visit drawings'[13]. In an earlier paper, Bowker (2004) interviewed children (n=72) from eight primary schools about one month after they had been on a one-day school visit to the Eden Project[14]. He noted that the children's 'opinion of plants changed, they understood the link between plants to their own daily lives and took delight in finding out where chocolate came from'. In another study, Hamilton-Ekeke compared three groups of Nigerian school students. Students who were taught ecology by taking them to the school farm, pond, and nearby stream performed better than a matched group who were taught only in the classroom[15].

The review commissioned from *eftec* found that LINE makes a significant contribution to environmental education in the current UK National Curriculum[16]. Its value is estimated in the forthcoming National Ecosystem Assessment by Mourato *et al.* (2011) through its contribution to greater lifetime earnings associated with educational qualifications in relevant subjects. **The estimated annual value of environmental knowledge in 2010 was £2.1 billion (£1.6 billion for GCSE subjects and £0.5 billion for A-Level), to which LINE makes a vital and necessary contribution.**

Developing skills

A broad range of skills ranging from the technical to the social have been identified as outcomes of LINE, particularly when it is integrated with the everyday school curriculum. In a major report on the work of outdoor education centres, Ofsted found that participating students 'develop their physical skills in new and challenging situations as well as exercising important social skills such as teamwork

[11] The National Environmental Education & Training Foundation (2000), Environment-based Education - creating high performance schools and students

[12] Randler, C., Ilg & Kern, J. (2005), Cognitive and emotional evaluation of an amphibian conservation program for elementary school students

[13] Bowker, R. (2007), Children's perceptions and learning about tropical rainforests: An analysis of their drawings

[14] Bowker, R. (2004), Children's perceptions of plants following their visit to the Eden Project

[15] Hamilton-Ekeke, J.-T. (2007), Relative effectiveness of expository and field trip methods of teaching on students' achievement in ecology

[16] eftec (2011), Assessing the benefits of learning outside the classroom in natural environments. Final Report for King's College London

and leadership'[17]. Peacock's evaluation of the National Trust Guardianship scheme, which involved students making multiple trips to sites, was that participating students developed social skills such as tolerance, caring, group awareness and self-discipline as well as research skills involving understanding and management of the natural environment. Specific skills were developed which ranged from gardening and cooking to using digital cameras and microscopes[18].

Cowell and Watkins describe the outcomes of a museum outreach programme, 'Spring Bulbs for Schools', which was established in Wales in 2006. The scheme involved setting up 160 monitoring sites across the Principality. The authors, one of whom was a project officer and the other a schoolteacher, evaluated the project and found that the students became 'aware of the world around them and the idea that human activity can have noticeable effects, even on a local scale in the school garden' adding that 'the project enabled them to undertake pattern-seeking and observational activities – aspects of scientific enquiry that are often underdeveloped throughout the science curriculum[19].

Relatively few studies have looked at the experience of early years education. However, Jones reported on the development of children aged 3-5 on a school programme in Minnesota, USA. Jones noted that the 'children learn to work collaboratively, socially construct knowledge, and develop social skills while cooperating, helping, negotiating, and talking with others'[20]. Possick reported on a small-scale study involving her kindergarten class and another first-grade class. A month-long project culminated in turning their school hall into a 'forest'. The project 'was based on observing, questioning, taking field trips, conducting library research (including the internet) and asking experts'. Possick reports that the children in the two primary classrooms 'developed skills in forming questions about what they thought they knew, wanted to know, and had learned'[21].

Changing attitudes and behaviours

Chawla's (1998) review of the qualitative and survey literature found that adults who had significant and positive exposure to nature as children—experiences, often with significant adults, that socialize them to view nature in positive and meaningful ways—were more likely to be environmentally sensitive, concerned, and active.[22]

There is abundant evidence of the positive impact of LINE on a range of attitudinal and behavioural dimensions. **Environmental-based education makes other school subjects rich and relevant and gets apathetic students excited about learning[23].** Research has identified such impacts resulting from a range of experiences including school gardening and environmental improvement; visits to local parks; farm visits and residential visits[24]. Coskie *et al.*, for example, describe the impact of a five-week intervention in which students aged 8-10 were taught how to write a field-guide to identify plants in a small area of woodland near to the school. The authors found that students 'came to understand and care for the natural world in their immediate environment.'[25]

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[17] Office for Standards in Education (Ofsted) (2004), Outdoor Education: aspects of good practice

[18] Peacock, A. (2006), Changing minds. The lasting impact of school trips

[19] Cowell, D. & Watkins, R. (2007), Get out of the classroom to study climate change - the 'Spring Bulbs for Schools' project

[20] Jones, N.P. (2005), Big jobs: Planning for competence

[21] Possick, J. (2007), An artful forest

[22] Blair, D. (2009), The child in the garden: An evaluative review of the benefits of school gardening

[23] The National Environmental Education & Training Foundation (2000), Environment-based Education - creating high performance schools and students

[24] Malone, K. (2008), Every experience matters

[25] Coskie, T., Hornof, M. & Trudel, H. (2007), A natural integration

Few studies have looked at long-term impacts of out-of-the-classroom education. An exception is a US study by Pace and Tesi (2004) that involved interviewing four men and four women between the ages of 25 and 31 about their field trip experiences while attending school from K-12 (that is kindergarten through to twelfth grade (age 17-18)). Most of the participants revealed that they experienced 'enhanced camaraderie with fellow students, teachers, and chaperones [accompanying adults]' as a result of their experiences.[26]

In another long-term impact study, Farmer *et al.* (2007) evaluated *Parks as Classrooms*, an environmental education programme in the Great Smoky Mountains National Park, USA. The programme focused on the impact of non-native species and humans on local biodiversity. The primary school participants were aged 9-10. 15 of the 30 students agreed to be interviewed a year after their visit. The authors reported that 'many students remembered what they had seen and heard and had developed a perceived pro-environmental attitude'.[27]

Evaluation of a woodland-survival skills course Warwickshire Children and Voluntary Youth Services ran with Groundwork for young people who are NEET, found they gained more than just measureable skills[28]. As well as developing their confidence, leadership skills, and perseverance, they became more motivated and tolerant of their environment, staff and each other, as well as learning to live away from their families and create their own entertainment.

Sustainable Development Commission (2010). *Improving young people's lives.*

In terms of changing attitudes to studying, Thompson (2004) argues that teachers and principals 'should not overlook the role educational travel can play in motivating students to achieve'[29]. Using a case study of the middle school in Michigan, USA, Thompson describes benefits to both the students and the school 'that come from linking trips to the science and social studies curricula'.

Heath and well-being benefits

Links between contact with the environment and personal health are well-established. Studies have shown that exposure to the natural environment can lower the effects of various mental health issues that can make it difficult for students to pay attention in the classroom. In particular Kaplan proposes the Attention Restoration Theory – the theory that exposure to nature reduces directed attention fatigue, restoring the ability to concentrate at will[30]. The symptoms of Attention Deficit/Hyperactivity Disorder are less severe when individuals (both children and adults) are regularly exposed to natural outdoor environments[31,32].

The publication in 2005 of *Last child in the woods*, by Richard Louv, appeared to touch a nerve in the public consciousness in the US and elsewhere. Louv described a 'Nature Deficit Disorder' which was meant to be a way of thinking about a society-wide problem of disconnectedness with the natural

[26] Pace, S. & Tesi, R. (2004), Adult's perception of field trips taken within Grades K-12: Eight case studies in the New York Metropolitan Area

[27] Farmer, J., Knapp, D. & Benton, G. M. (2007), An elementary school environmental education field trip: Long-term effects on ecological and environmental knowledge and attitude development

[28] Connexions Coventry and Warwickshire (2009), Connexions NEET's Bushcraft Project in partnership with Groundwork – Evaluation Report

[29] Thompson, D. (2004), Including travel in your academic plans

[30] Kaplan, S. (1995), The restorative benefits of nature: Toward an integrative framework

[31] Taylor, A.F., Kuo, F.E. & Sullivan, W.C. (2001), Coping with ADD - the surprising connection to green play settings

[32] Kuo, F.E. & Taylor, A.F. (2004), A potential natural treatment for Attention-Deficit/Hyperactivity Disorder: Evidence from a national study

environment. The book stimulated the formation of a 'No Child Left Inside' movement which has had substantial success influencing policy makers. Environmental literacy appeared in the US Department of Education budget for the first time in 2010.

Children are more likely to have hands-on contact with the natural environment during their time at primary schools than while they are attending secondary schools. A study in Australia found that hands-on contact with nature in primary school 'can play a significant role in a cultivating positive mental health and wellbeing'[33] The study involved a postal survey of 500 urban Melbourne primary schools, a more in-depth study of 12 schools and interviews with seven 'key industry informants'. Reporting only on the interviews, Maller found that 'hands-on contact with nature in primary school, regardless of the type, is an important means of connecting children with nature and can play a significant role in a cultivating positive mental health and wellbeing'. **Maller concluded that such contact was not only 'essential for protecting the environment' but that it also appeared to be 'a means of cultivating community and enhancing the mental health and wellbeing of children and adults alike'.** Maller found that her respondents identified what she describes as structured and unstructured hands-on activities, and that while structured activities 'result in greater benefits to children's mental health and wellbeing' it was the case that 'unstructured activities were thought to be important for connecting children with nature and fostering an interest in the environment that may emerge later in adult life'. **Maller also claims that structured activities, 'such as those commonly occurring in sustainability education', were seen as being 'powerful catalysts for creating a stronger sense of community - both within and beyond school boundaries'.**

Bird highlights the links between mental health and the natural environment.[34] He found over 100 studies supporting the role of the natural environment in 'attention restoration' (when indirect attention allows concentration to be held with little or no effort, allowing the brain to restore for more direct attention usage)[35], as it provided the most effective location for promoting indirect attention.

Sustainable Development Commission (2010). *Improving young people's lives.*

In 2009, following a study of sustainability education in schools, Ofsted recommended that schools should 'ensure that all pupils have access to out-of-classroom learning to support their understanding of the need to care for their environment and to promote their physical and mental well-being'[36]

Self-efficacy and self-worth

The mental and physical health benefits are closely linked to other impacts such as improvements in feelings of self-worth and self-efficacy. Swarbrick *et al.* (2004) report on a forest school initiative in Oxfordshire[37]. Although acknowledging that research into the project is in its 'infancy', the authors do report that a questionnaire sent to schools, early years settings and individuals using the forest school approach 'revealed that the project was viewed very favourably by participant adults', adding that they mentioned the 'increased ability of quiet children to express themselves, an increase in confidence, and positive participation from disruptive children'. There was also evidence of increased speaking and listening skills during the one-year involvement in the forest school programme.

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[33] Maller, C. (2005), Hands-on contact with nature in primary schools as a catalyst for developing a sense of community and cultivating mental health and wellbeing

[34] Bird, W. (2007), Natural Thinking – investigating the links between the natural environment, biodiversity and mental health

[35] Kaplan, R. & Kaplan, S. (1995), The experience of nature: A psychological perspective

[36] Ofsted (2009), Education for sustainable development. Improving schools – improving lives

[37] Swarbrick, N., Eastwood, G. & Tutton, K. (2004), Self-esteem and successful interaction as part of the forest school project

A child who had severe language difficulties (i.e. needed to attend a speech unit for four sessions a week) was extremely quiet in the nursery environment and seldom initiated conversations with other children or adults. However in the forest environment her speech was clearer and much louder! She also displayed more self-confidence and interacted with a wider circle of peers. In the nursery environment her interactions tended to be on a one-to-one basis.

Swarbrick *et al.* (2004), Self-esteem and successful interaction as part of the forest school project

Amos and Reiss's evaluation of the 2004 London Challenge Residential Initiative, which involved 51 schools from five relatively deprived London boroughs sending groups of 11-14 year-olds to field centres found that pupils 'surpassed their own expectations of achievement during the courses, and both pupils and teachers felt that the general levels of trust in others and the self-confidence shown by the pupils on the courses were higher than in school subjects'.[38]

An unusual and very thorough approach to evaluating the impact of an outdoor experience was reported by Whittington[39]. The participants in this doctoral study were a group of adolescent girls who took part in a 23-day canoe expedition as part of an all-female wilderness programme in Maine, USA. Whittington interviewed the girls twice following the expedition, once 4-5 months afterwards and the second time after 15-18 months had elapsed. Whittington reported that the experience enabled the participating girls to challenge 'conventional notions of femininity in diverse ways' including:

1) perseverance, strength, and determination;
2) challenging assumptions of girls' abilities;
3) feelings of accomplishment and pride;
4) questioning ideal images of beauty;
5) increased ability to speak out and leadership skills; and
6) significant relationships with other girls.

Implications of these results for program planners of all-female programs are discussed.

In a study of a 10-week expedition by 14 young people to Ghana organised by Raleigh International, Beames found that 'Interpersonally, young people developed an increased facility for working and living with people they did not know before'[40]. It was also noted, perhaps unsurprisingly, that participants gained a greater appreciation of the moderm conveniences they were accustomed to and learned about the economic and democratic differences between the UK and Ghana. Beames noted that the participants 'developed a certain mental resilience, became more willing to undertake challenges, and gained a greater understanding of themselves'.

Larson examined the effects of an adventure camp programme on the self-concept of 61 adolescents with behavioral problems aged between 9 and 17. Using an experimental/control group design, Larson found that the 31 participants who voluntarily attended an adventure camp demonstrated a statistically significant and positive difference in terms of their self-concept compared to the control group.[41] Similarly, Lan *et al.* reported significant long-term effects of participation in a wilderness programme including greater participant self-actualisation and decreased hopelessness. Lan *et al.* reported that:

[38] Amos, R. & Reiss, M. (2006), What contribution can residential field courses make to the education of 11–14 year-olds?

[39] Whittington, A. (2006), Challenging girls' constructions of femininity in the outdoors

[40] Beames, S. (2004), Overseas youth expeditions with Raleigh International: a rite of passage?

[41] Larson, B.A. (2007), Adventure camp programs, self-concept, and their effects on behavioral problem adolescents

‘Police recidivist data indicated that 42 of 56 youth who had prior convictions did not re-offend in the two years following the wilderness intervention’.[42]

Benefits to schools, teachers and the wider community

Teachers benefit from LINE, becoming more enthusiastic about teaching and bringing innovative teaching strategies to the classroom[43]. Schools also benefit from teachers taking more ownership and leadership in school change. Several of the studies mentioned above have already highlighted possible benefits of LINE beyond those felt by the individual. These inter-related benefits include social, economic, health and crime reduction.[44]

Maller, whose study was mentioned above, identifies a number of aims for engaging children in hands-on contact with nature noting its increasing popularity:

> Many schools, both in Australia and internationally, are including hands-on contact with nature in their curricula, usually to meet sustainability education, environmental education or science learning objectives. However, other reasons cited for the recent growth in these types of activities include beautification of school grounds, habitat restoration, and to foster qualities of stewardship and nurturing in children.[45] (p. 16)

Another Australian study, this time by Davidson, described the experiences of schools that took part in the Sustainable Schools Initiative. The initiative, which is similar to many other environmental initiatives in the UK and elsewhere, focuses on waste, water, biodiversity/school grounds and energy management.[46]

Stepath reported on the impact of a marine education research project carried out on in 2002/3 on the Great Barrier Reef, Australia. Noting the lack of impact of knowledge on behaviour, Stepath advocates community-based environmental monitoring in conjunction with experiential environmental education which ‘can work to improve responsible behavior when used in coordination with a comprehensive education strategy and media campaign’[47].

One of the most well-know examples of cross-community education aimed at intergenerational mentoring is the Garden Mosaics project. Kennedy and Krasny describe the mission of the project which is ‘connecting youth and elders to explore the mosaics of plants, people, and cultures in gardens, to learn about science, and to act together to enhance their community’[48].

The National Trust’s Guardianship scheme involved school-age students paying multiple visits to sites. An evaluation of the long-term benefits of the scheme, which involved over 100 schools, found that they saw great benefits from having a ‘classroom in the park’. Headteachers reported a development of ‘community spirit’ and valuing what was ‘in their own back yard’ as a result of the scheme.[49] A rarely

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[42] Lan, P., Sveen, P. & Davidson, J. (2004), A Project Hahn empirical replication study

[43] The National Environmental Education & Training Foundation (2000), *Environment-based Education - creating high performance schools and students*

[44] Connexions Coventry and Warwickshire (2009), Connexions NEET’s Bushcraft Project in partnership with Groundwork – Evaluation Report

[45] Maller, C. (2005), Hands-on contact with nature in primary schools as a catalyst for developing a sense of community and cultivating mental health and wellbeing

[46] Davidson, G. (2005), Sustainable schools: practising what they preach

[47] Stepath, C. (2004), Awareness and monitoring in outdoor marine education

[48] Kennedy, A. M. & Krasny, M. E. (2005), Garden Mosaics

[49] Peacock, A. (2006), Changing minds. The lasting impact of school trips

reported finding was that the scheme resulted in an increased willingness of parents to come into school for events and meetings.

Benefits to the natural environment community

The evidence suggests that the more that young people engage with the natural environment, the more they appreciate and care for it[50]. Schaaf describes how four classes of primary-aged children engaged with a water quality project. By the end of the year-long project the students had not only learned how to monitor water quality but they had 'raised salmon in the classroom for release into the river[51]. Few attempts have been made to quantify the impact of LINE on the natural environment or the benefits, financial or otherwise of being providers of education and training in LINE. The economic or environmental benefits of educational providers have not been adequately studied.

Conclusions

Substantial evidence exists to indicate that LINE, properly conceived, adequately planned, well taught and effectively followed up, offers learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom. Specifically, several studies indicate that students perform better in reading, mathematics, science and social studies and show greater motivation for studying science. A broad range of skills ranging from the technical to the social have been identified as outcomes of LINE, particularly when it is integrated with the everyday school curriculum. Environmental-based education makes other school subjects rich and relevant and gets apathetic students excited about learning.

Links between contact with the environment and personal health are well-established. Studies have shown that exposure to the natural environment can lower the effects of various mental health issues that can make it difficult for students to pay attention in the classroom. Hands-on contact with nature is not only essential for protecting the environment but appears to be a means of cultivating community and enhancing the mental health and wellbeing of children and adults alike. Structured activities, such as those commonly occurring in sustainability education, are powerful catalysts for creating a stronger sense of community - both within and beyond school boundaries.

The estimated annual value of environmental knowledge in 2010 was £2.1 billion (£1.6 billion for GCSE subjects and £0.5 billion for A-Level), to which LINE makes a vital and necessary contribution. Teachers benefit from LINE, becoming more enthusiastic about teaching and bringing innovative teaching strategies to the classroom[52]. Schools also benefit from teachers taking more ownership and leadership in school change.

[50] Coskie, T., Hornof, M. & Trudel, H. (2007), A natural integration

[51] Schaaf, S. (2005), How clean is the river?

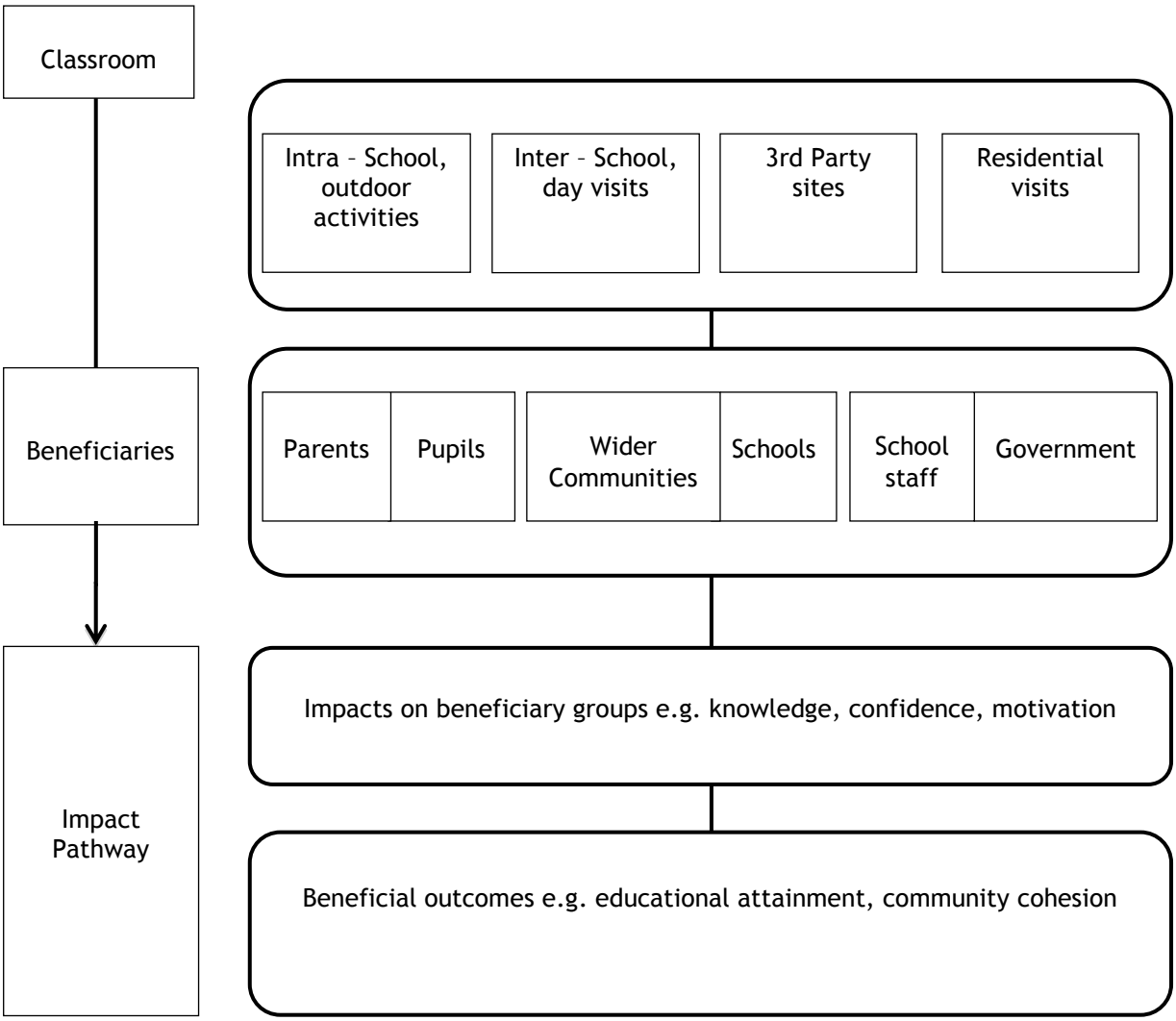
[52] The National Environmental Education & Training Foundation (2000), *Environment-based Education - creating high performance schools and students*

Recommendations

The Natural Environment sector should take action to:

1) Promote and present the breadth of impacts of LINE, thus providing a compelling rationale to funders, schools and parents, with a view to encouraging more equitable access for all students.
2) Develop more effective strategies to collect evidence of the full range of benefits and impacts of LINE on individuals, institutions and the wider community within a common framework.
3) Share evaluations of the impact of completed and existing educational initiatives more widely with a view to building a clearer picture of the full range of educational and other benefits of LINE as well as providing an opportunity to identify issues and questions for future study.

Appendix 1: Structure of Benefits From Learning in Natural Environments



The diagram shows a structure of the value of the economic benefits of LINE. It reflects a three-stage process to valuation of non-market goods, namely:

1) Qualitative assessment, identifying types of benefits;
2) Quantitative assessment, attempting to measure the impact pathway for different beneficiaries; and
3) Valuation, putting monetary values against the impacts on beneficiaries.

As with many non-market goods, we have good evidence of the existence, strength and complex nature of (1), but very little evidence on (2). Evidence on (3) is also lacking – linking to the difficulty of establishing (2) and proxies such as how much is spent on LINE need to be used, at least for now.[53]

[53] eftec (2011), Assessing the benefits of learning outside the classroom in natural environments. Final Report for King's College London

Assessing the Benefits of Learning Outside the Classroom in Natural Environments

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Executive Summary

This is the final report from eftec into the economic value of the benefits associated with learning in natural environments (LINE) through schools from a contract commissioned by King's College London to inform their wider work on articulating the benefits of LINE for the Natural Connections Partnership. It has been undertaken in a relatively short period time, with limited resources and available data, and so is intended as a starting point to allow thorough measurement of the value of LINE. The evidence is organised in the context of the Total Economic Value Framework, an approach that identifies overall economic impacts in terms of changes in welfare for society. Analysis of the economic value of LINE requires qualitative assessment of its benefits and how these benefits are linked to the provision of LINE, and a range of different economic valuation methods to estimate monetary values for those benefits.

Key Findings

The **qualitative evidence reviewed suggests the value of LINE in England is significant** and involves benefits arising from educational attainment, attitudes to other children, awareness of environment and natural science skills, behavioural outcomes and social cohesion, health benefits, school staff morale, and a more attractive school (aesthetically and to prospective parents). Furthermore, complementarity between these benefits mean that the overall value of LINE to society is probably greater than the sum of these parts. **The qualitative evidence linking LINE to such benefits is compelling, however, quantitative evidence linking LINE and changes in these benefits is lacking.**

Even in the absence of such quantitative links, it is possible to use monetary value evidence to illustrate that LINE's contribution is significant. For example, the costs to society of the problems that are encountered in the absence of health, community cohesion, higher educational attainment and so on range from tens of millions to billions of pounds. Even if LINE has only a very small impact on these costs (e.g. reducing the relevant impacts by 0.1%), **its value in reducing costs would be very large – of the order of £10m to £20m million per year.** Greater percentage reductions in impacts would give proportionately greater reductions of costs.

LINE makes a significant contribution to environmental education in the current UK National Curriculum. Its value is estimated in the forthcoming National Ecosystem Assessment by Mourato et al. (2011) through its contribution to greater lifetime earnings associated with educational qualifications in relevant subjects. **The estimated annual value of environmental knowledge in 2010 was £2.1 billion** (£1.6 billion for GCSE subjects and £0.5 billion for A-Level), to which LINE makes a vital and necessary contribution.

Only one study (Mourato et al. 2011)values educational activities in natural environments themselves. This study uses the spending on **LINE visits** (taking travel cost as a proxy of value) giving a *minimum* indication of how valuable the benefits are perceived to be. This is based on the common economic assumption that if the benefits are perceived to be less than the costs, the activity would not be undertaken. This data can be extrapolated to value total LINE visits. The estimated number of LINE site visits per year organised by just a few of the larger providers such as Natural England, the Wildlife Trusts, National Trust, Wildfowl and Wetlands Trust and RSPB in the UK is estimated for 2010 (based on latest available information between 2006 and 2010) as at least 1.29 million visits by pupils and teachers. Extrapolating the per pupil values gives an estimate of **£24.6 - £38.8 million** of benefits per year from existing **learning visits to natural environment sites**. This figure only covers one type of LINE (visits to specific sites) and as a result of limits on the available data does not cover other areas where LINE can generate value to society (e.g. activities within school grounds). As a result, **this figure is a large underestimate of the total economic value LINE creates**. Options for further research to improve the evidence base include surveys of teachers to examine changes in their motivations, and analysis of data on pupil absence or attainment to identify impacts of LINE.

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1. Introduction

The recent White Paper on education clearly sets out the need to improve the standards of teaching. Experience and a variety of evidence suggest that learning in natural environments (LINE) can be effective in delivering transformational change in outcomes for students and hence by inference to school performance. It also helps schools deliver other aims within the education White Paper.

Access to natural environments for education, and other purposes, is also relevant to the forthcoming Natural Environment White Paper. Policy developments require sound evidence about the benefits of the impacts of LINE. Current work by the Natural Connections Partnership and King's College London aims to identify and communicate the benefits of learning in natural environments more effectively to school decision makers, from policy to practitioner level.

This work is concerned with learning outside the classroom within a natural environment context. Learning outside the classroom can take many forms, including interactions with outside influences inside school buildings (e.g. a workshop with a theatre company, or a visit to a local museum). The focus of this work is more specific and can be described as 'learning (outside the classroom or outdoors) in natural environments' (LINE). The term natural environments in this context includes all accessible outdoor 'green' spaces where children can play, the spaces that enable childhood discovery and learning, adventure and escape, or simply to experience the seasons changing. It is not limited to those sites run by third parties or to spaces set aside for nature conservation, for getting 'close to 'nature' or designed for learning about the environment. It includes, importantly, school grounds that can be used for intra-school or inter-school facilities. The most important natural environments are those close to where children live that do not require transport or travel, and these areas are a focus for current developments of LINE.

Typical locations for LINE within formal education can be within a school's grounds, at other schools, and on land managed by third parties (e.g. public parks, land managed by NGOs, farms). Access to LINE can range from less than an hour (just 10 minutes as part of a lesson spent outdoors in the natural environment), to half-day or day trips visiting a site or sites, to residential experiences that enable access to different natural environments and different types of activities in England[1]. The frequency of LINE can range from one-off experiences to regular use of the natural environment. Ideally it is integrated into all school programmes to underpin the quality of all teaching and learning in the school and embedded as a way of supporting learning, like creativity etc.

This analysis is concerned with LINE as part of formal education of young people. The natural environment can of course play a role in learning throughout people's lifetimes and young people will experience contact with the natural environment in many ways. In the MENE survey (Natural England, 2010) of adults' visits to the natural environment[2], playing with children ranked third behind walking (with and without the family dog) as people's motivation to get outdoors. This puts interaction with children well ahead of all other traditional activities such as visiting attractions, wildlife watching, fishing etc. as a motivating factor in peoples' use of the natural environment.

This report sets out to provide a framework for the types of economic benefits and beneficiaries resulting from LINE. To do so it starts with some basic principles of the nature of economic value, and how that applies to the environment and other intangible impacts. It then considers the ways in which LINE produces economic benefits, and who its beneficiaries are. Economic evidence is then drawn on to articulate the value of these benefits in economic terms, in order to input to economic appraisal of associated policy options by school decision makers (Section 2). Some preliminary conclusions are also provided (Section 3).

The Nature of Economic Value

Economic values are the values placed by individuals on resources, goods and services of any kind. The values are expressed in relative terms based on individuals' preferences for given changes in the quality and/or quantity of resources and services. The unit used for economic valuation is money – as it is a

common unit making the comparison of financial and other (environmental, social) costs and benefits possible. Using this unit, preferences are measured in terms of individuals' willingness to pay (WTP) money to avoid a loss or to secure a gain and their willingness to accept (WTA) money as compensation to tolerate a loss or to forgo a gain. What is estimated by economic valuation is the value of a marginal change. In other words, individuals behave according to, or express, their WTP and WTA for a change.

For market transactions, the price paid represents buyers' WTP and sellers' WTA. However, even resources, goods and services that are not traded in markets generate economic values. A complete economic analysis should include the changes in both market and non-market values. Understanding the motivations behind people's preferences (and hence the economic values) helps with identifying the information needs for economic analysis and the appropriate valuation methods to apply.

People can have several motivations for having positive WTP and WTA for the goods and services provided by the environment. These motivations are analysed within the so called Total Economic Value (TEV) typology (Figure 1). The 'total' here refers to the sum of different motivations rather than the absolute value. Use value involves some interaction with the resource, either directly or indirectly:

- Direct use value: The environment is used in either a consumptive manner, such as industrial water abstraction or in a non-consumptive manner such as for recreation (e.g. fishing) or learning (e.g. LINE).
- Indirect use value: The value of services provided by the environment, such as nutrient cycling, habitat provision, climate regulation, etc. that indirectly support human wellbeing.
- Option value: Not associated with current use of the environment, but the benefit of keeping open the option to use it in the future. A related concept is quasi-option value which arises through avoiding or delaying irreversible decisions, where future technological and knowledge improvements can alter the optimal management of an ecosystem.

Non-use value is associated with benefits derived simply from the knowledge that the state of the environment is maintained. In other words, non-use value is not associated with any use of an ecosystem. Non-use value can be split into three parts:

- Altruistic value: Derived from knowing that contemporaries can enjoy benefits from the natural environment.
- Bequest value: Associated with the knowledge that the state of environment, and its ability to provide goods and services, will be passed on to future generations.
- Existence value: Derived simply from the satisfaction of knowing that features or condition of the environment continue to exist, regardless of use made of them by oneself or others now or in the future.

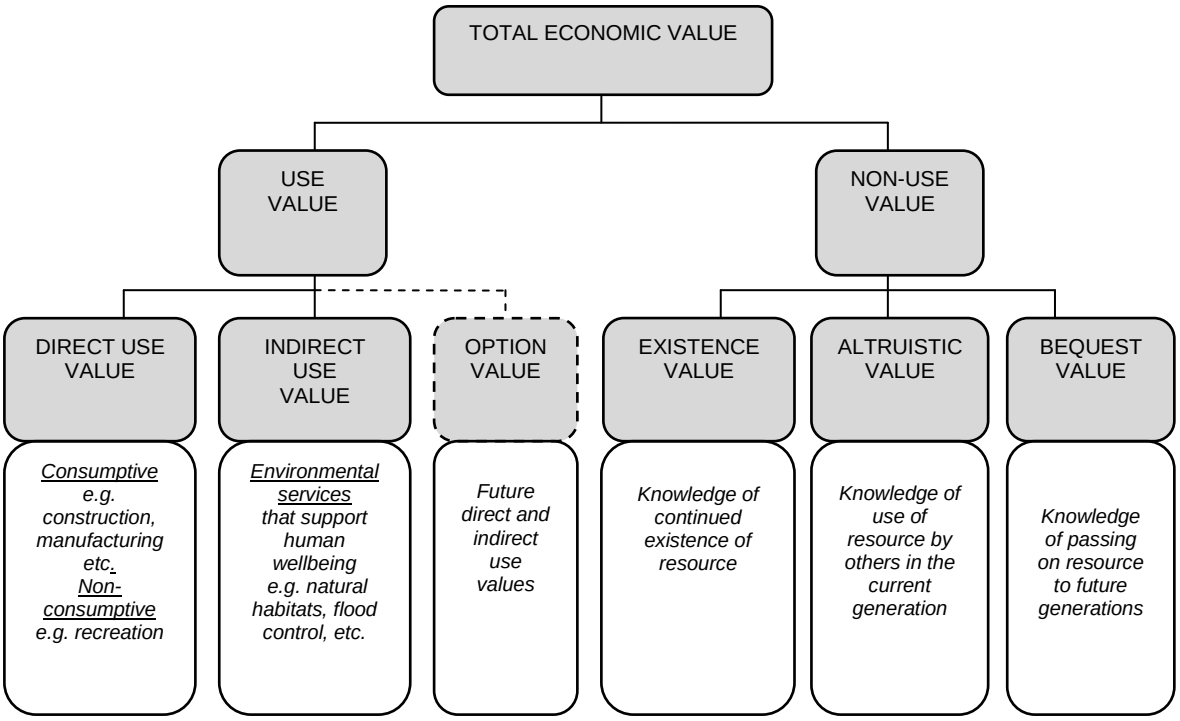
Those who make direct and indirect use of environmental goods and services, i.e. the users, are likely to hold both use and non-use values. Those who do not directly or indirectly use a good or service but still hold non-use values are called non-users. While users are relatively easy to identify, there is no theoretical definition of non-users. The definition is an empirical question which can be answered by primary research.

Where there is a market for environmental goods or services, *the price, consumption and production data* can be used to value the environment. When markets lack, two types of valuation methods are used.

The first type is *revealed preference methods* which use price and consumption information from markets that are affected by resource of interest. For example, the hedonic property pricing method estimates the premium buyers pay for properties in environmentally high quality surroundings. The travel cost method estimates the economic value of informal (free of direct charge) recreation by analysing the costs incurred by visitors to travel to and from, and at, a recreational site.

The second type is *stated preference methods* which use questionnaires to elicit individuals' WTP and/or WTA. These methods are potentially applicable to any resource and decision context and the only methods that can estimate non-use values.

Figure 1. Total Economic Value typology



Economic Benefits from LINE

Learning in natural environments is not a good that is purchased at a price that reflects its costs (or its benefits). It is what economists call a 'non-market' good, and it has 'non-market' benefits. Therefore aggregate market data about its value are lacking, and so different types of value information, relating to indirect use, option value and non-use values, must be sought. LINE is valued for it inherent value in pedagogy/increasing the quality of learning and teaching as well as its instrumental value in learning about the natural environment and other subjects. The manner in which these values arise from LINE (the 'benefits pathway') is complex. For example, it stimulates pupil participation, reducing truancy, this is a direct benefit to the pupil, but also provides an indirect benefit to the community through the reduction of anti-social behaviour associated with truancy.

These benefit pathways are important to define for two reasons. Firstly they help distinguish between different groups who can benefit from LINE (the beneficiaries). Secondly, they create a structure for types of benefits that helps ensure all the varied potential benefits from LINE are captured, but that they are not double-counted when evidence on the value of those benefits are analysed.

Figure 2 shows a structure of the value of the economic benefits of LINE. It reflects a three stage process to valuation of non-market goods, namely:

1) Qualitative assessment, identifying types of benefits;
2) Quantitative assessment, attempting to measure the impact pathway for different beneficiaries; and
3) Valuation, putting monetary values against the impacts on beneficiaries.

As with many non-market goods, we have good evidence of the existence, strength and complex nature of (1), but very little evidence on (2). Evidence on (3) is also lacking – linking to the difficulty of establishing (2) and proxies such as how much is spent on LINE need to be used, at least for now.

The remainder of this section reviews the different types of economic benefits that can arise from learning in natural environments. This information is presented in Table 1, the first two columns of which draw heavily on evidence from King's College London (J Dillon pers com, December 2010). For each benefit, the Table gives:

- A definition, including the link to LINE;
- The relevant beneficiary groups;
- What quantitative data might be available to measure the benefit; and
- How the benefit might be valued, considering relevant methods, and possible sources of evidence.

Relevant methods are discussed briefly as they link to the Total Economic Value (Section 1.1). The kind of information on economic value that can be of use here include:

- Values relating to *direct benefits*, such as the value of increased educational attainment in the subjects related to the natural environment learning experience;
- Values relating to *indirect benefits*, such as the value of increased skills in the economy;
- Measures of *spending* represent a lower bound estimate of the value of benefits from LINE based on the common economic assumption that if the benefits are perceived to be less than the costs, the activity would not be undertaken;
- *Avoided costs*, such as lower costs of dealing with reduced crime at a result of LINE; and
- *Option values and non-use values*, which can only be estimated in monetary terms through stated preference methods.

One area where evidence is available are measures of spending on LINE. This is akin to the Travel Cost Method: it uses spending as a proxy of benefit (see above), covers all motivations (within TEV as in Section 1.1) that the 'users' may have. In addition, as a catch-all measure, the 'value' involved is the sum of all the direct and indirect benefits that are gained from LINE.

The final part of Figure 2 identifies benefit categories that are analysed further in Table 1. The many benefits of LINE include many factors that improve educational and wider social *processes* (e.g. higher quality teaching, better community engagement). The benefits list focuses on those impacts which are *outcomes* that can be valued. In fact many impacts are both outcomes and processes, so this complicates the analysis. The aim is the capture all the direct and indirect beneficial outcomes is the simplest form without double-counting. The overall value of many of these outcomes may involve a benefit to society that is greater than the sum of its parts (i.e. there is complementarity between benefits that increases the total value). However, valuing this overall benefit to society is regarded as overly complex and therefore it is recognised as a benefit that must be considered qualitatively by policy makers.

In assessing the evidence laid out in Table 1, it will be important to recognise the extensive overlaps between the different benefit types and beneficiaries identified. The shared nature of the benefits means that these values are <u>not additive</u>. However, part of each benefit type identified brings potentially additional sources of value and so must be assessed in the overall analysis. Finally, all potentially relevant methods for valuation LINE benefits are provided in the final column of Table 1. However, most of these are not possible to apply at present due to gaps in the economic literature and in linking potential benefit outcomes to LINE.

Figure 2. Structure of Benefits From Learning in Natural Environments

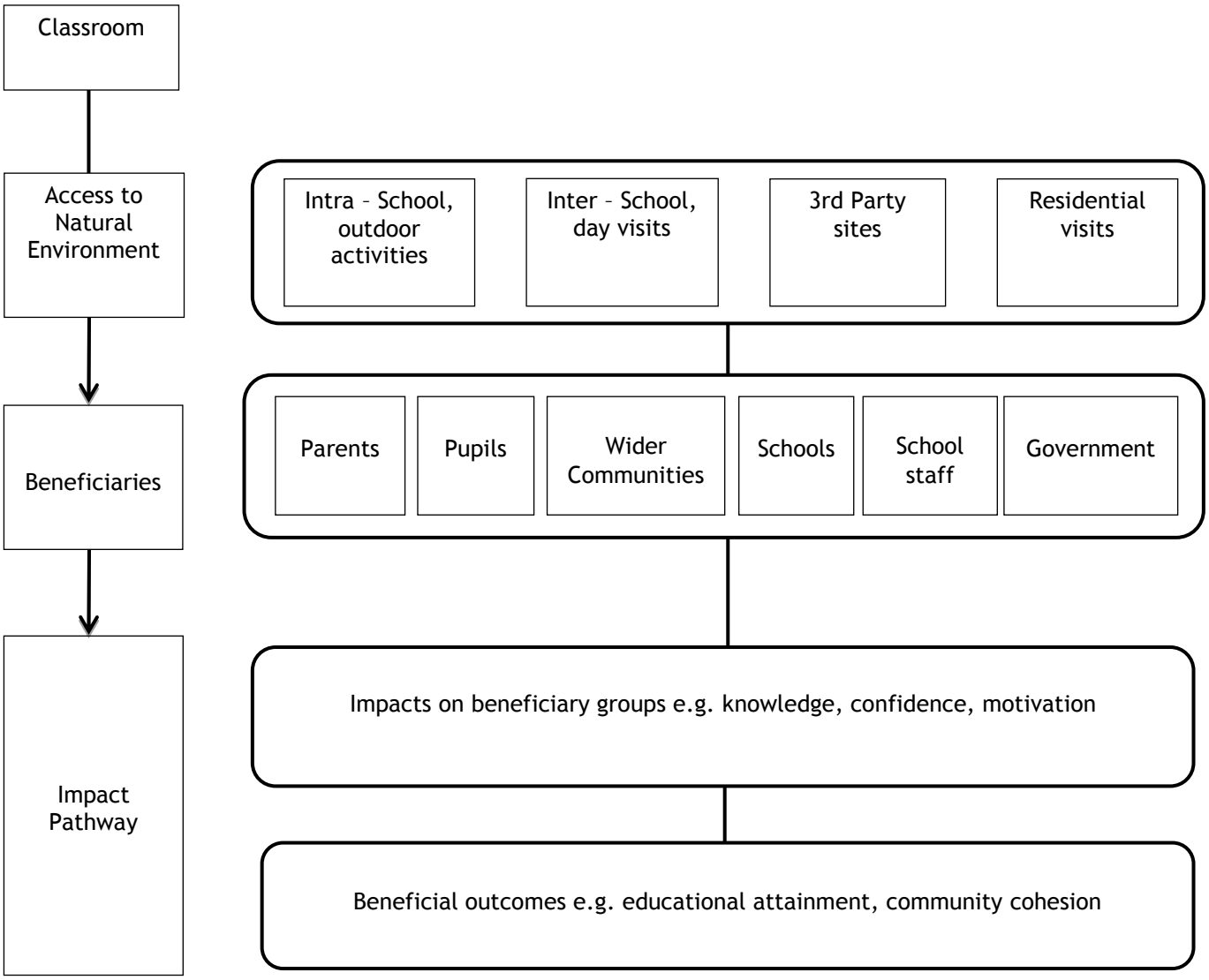


Table 1: Types of Benefits From Learning in Natural Environments

Benefit type	Definition, including link to LINE	Beneficiary groups	Data to measure the benefit (outcomes)	Valuing the benefit / Relevant methods
Educational attainment	Improved performance in educational qualifications, through direct knowledge and stimulation of outdoor learning (e.g. to long-term memory) and through generic skills development. Pupils reach potential (e.g. through development of motor skills), avoids children being under-estimated in classroom. Increases self-esteem and confidence, stimulates greater attendance in and engagement with statutory education, increases social mobility.	Pupils, Parents, Teachers, Schools, Community, Government	Increased exam performance, relative to intake, for schools using LINE School performance (e.g. Ofsted inspection results) Increased attendance for schools using LINE	Hedonics on house prices will cover the premium paid for everything that's good about the school and these cannot be disaggregated. For higher achieving schools the general value of educational attainment would be expected to be a significant factor within this total value. Government costs of supporting underperforming schools? Avoided costs of unemployment.
Awareness of environment and natural science skills	Greater awareness of ecology and related issues, increased aptitude to study STEM* subjects	Pupils, Community, Government, Businesses	Uptake of natural sciences in further and higher education. Increased career opportunities	Avoided costs of shortages of STEM-skills in workforce (e.g. of relying on imported expertise for implementing environmental policies, in particular climate change mitigation and adaptation, shortage of taxonomists)
Behavioural outcomes and social cohesion	Improved pupil behaviour as a result of exposure to natural environment	Pupils, Parents, Teachers, Schools, Community, Government	Incidences of antisocial behaviour (e.g. violence, vandalism, crime, graffiti).	Avoided costs of dealing with antisocial behaviour (e.g. costs of crime, costs of justice system)

Table continued...

Benefit type	Definition, including link to LINE	Beneficiary groups	Data to measure the benefit (outcomes)	Valuing the benefit / Relevant methods
Health benefits	Physical and mental health benefits from LINE activities in natural environment. Long term increased aptitude to use natural environment for recreation.	Pupils, Parents, Teachers, Schools, Community Government	Health outcomes from one-off and regular exposure to natural environment.	Avoided costs of ill-health (physical and mental)
Staff morale	Educational and behavioural benefits from LINE contribute to improved teaching environment.	Pupils, Parents, Teachers, Schools, Community, Government	Lower staff turnover	Avoided costs of staff turnover. Value of continuing professional development
More visually attractive schools	Use of school grounds for LINE creates more diverse learning environment and a positive visible impression – also encourage use of those grounds by the community.	Pupils, Parents, Teachers, Schools, Community	Increased preferences for attendance at school in applications process	Hedonics on house prices will cover the premium paid for everything that's good about the school and these cannot be disaggregated. More visually attractive grounds will be a just one factor within this total value.
Attitudes to other children	LINE fosters caring qualities within children – not just between children but to community and environment/nature etc	Pupils, Siblings, Schools, Community	Link to improved educational attainment, reduction of incidents of problems between pupils	Contributes to better educational attainment (see the first row of the table) and possibly avoided (direct) cost of problems between pupils
Overall value to society	All of the above	Society (including all beneficiary groups)	All of above	All the above

*STEM: Science, Technology, En

2. Review of Economic Evidence

The economic value of LINE can be quantified from the multiple types of benefits gained from it. As described in Section 1, these can affect a number of different beneficiary groups. In order to organise this evidence effectively to support economic analysis, the structure described in Table 1 is used. The benefits list focuses on those impacts which are *outcomes* that can be valued. In fact many impacts are both outcomes and processes that support other outcomes, so this complicates the analysis. The framework in Table 1 is used because it is the simplest form to capture all the direct and indirect beneficial economic outcomes without double-counting.

The direct economic benefits from LINE are its outcomes that have measurable economic benefits, for example higher achievement in Science, Technology, Engineering and Mathematics (STEM) subjects. However, LINE can also benefit learning in all subjects indirectly. For example, it is unclear if improved attention within statutory education as a result of LINE has a direct economic benefit. However, improved attention will also increase attainment in non-STEM subjects, and this indirect impact has an economic benefit. There are further potential indirect economic benefits from long-term impacts LINE may have. For-example, if it stimulates a change in attitudes to learning or recreation in the natural environment, it may be habit-forming – providing physical and mental health, wellbeing, educational and professional benefits into the long term. It should be recognised that these benefits will be difficult to attribute to LINE alone as a variety of other influences are involved.

The impacts that have direct economic benefits are reflected in the first column 'benefits' of Table 1. Indirect benefits are captured in the 'link to LINE'. Many of the indirect pathways are interlinked and influence more than one direct benefit category. The evidence that underpins these pathways is as important as the evidence on direct economic values to the overall economic analysis of LINE. This evidence is reviewed in detail work by King's College London (J Dillon pers com, December 2010). They summarise the evidence under the following headings:

- Gaining direct knowledge and stimulation (e.g. to long-term memory) of LINE;
- Generic learning skills development – LINE's benefits are not just related to environmental skills, and therefore its benefits can be felt in all subjects;
- Increasing knowledge and understanding;
- Developing skills (not just environmental/science based skills, but enquiry and skills to learn with etc);
- Changing attitudes and behaviours (to each other and school etc not just to the natural environment);
- Health and well-being benefits; and
- Self-efficacy and self-worth.

These direct and indirect benefits are reflected in the evidence reviewed in this section. It summarises the evidence base in relation to the benefits that can be valued in relation to education, mental health, others in society, life skills and indirect health.

Benefits Evidence

There are a number of studies that identify the educational benefits that can be gained from LINE. The qualitative evidence provided for some of the benefits covered in Table 1 (and other related benefits) include:

- Increased confidence and self-esteem, leadership qualities[3], social competence, resilience to changes in an individual's environment and increased environmental responsibility.
- Environmental-based education makes other school subjects rich and relevant, help students develop critical thinking skills central to science, teaches students to be real-world problem-solvers, helps students become self-directed learners and develop lifelong learning skills, and gets apathetic students excited about learning (The National Environmental Education & Training Foundation (2000); The North American Association for Environmental Education (2001); Malone (2008)).
- These benefits in turn mean that students in schools who partake in environmental education demonstrate better academic performance, and crucially, that environmental education levels the playing field, allowing students who fail in traditional school settings to "succeed when the natural outdoor environment becomes the students' classroom" (ibid).
- Specifically, students perform better in reading, math, science and social studies and show greater motivation for studying science (The National Environmental Education & Training Foundation (2000)).
- Students also develop stronger skills for the workplace, including teamwork, analytical skills and exposure to real world and complex problems, and character and leadership skills (ibid).
- Children who are engaged in learning in natural environments also benefit from greater levels of physical fitness and motor skill development (Ibid).
- Teachers also benefit from LINE becoming more enthusiastic about teaching and bringing innovative teaching strategies to the classroom. Schools also benefit from teachers taking more ownership and leadership in school change (The National Environmental Education & Training Foundation (2000)).

Studies have shown that exposure to the natural environment can lower the effects of various mental health issues that can make it difficult for students to pay attention in the classroom:

- In particular, Kaplan (1995) proposes the Attention Restoration Theory – the theory that exposure to nature reduces directed attention fatigue, restoring the ability to concentrate at will.
- The symptoms of Attention Deficit/Hyperactivity Disorder are less severe when individuals (both children and adults) are regularly exposed to natural outdoor environments (Taylor et al. (2001) and Kuo and Taylor (2004)). More generally, Tennessen and Cimprich (1995) found that viewing nature improves performance in attention demanding tasks.
- Kuo and Sullivan (2001) show that public housing residents in the inner-city display lower levels of mental fatigue, which was linked to aggression and violence, when housed in areas with higher levels of nearby trees and grass.
- Wells (2000) conducted a study that measured the cognitive functioning of low-income urban children who moved homes, both before and after the move. Their results indicate that children whose natural environment improved the most also show greater improvement in cognitive functioning after the move.

As can be seen from the studies above, increased educational attainment of students is one of the main benefits that can be gained from learning in natural environments. The general benefit of higher quality education can lead to other benefits for students and society:

- People with better qualifications tend to have healthier lifestyles and to be healthier and less prone to obesity and associated health risks. Education increases life expectancy through healthier behaviours and preventative service use, with each additional year of education adding an additional 1.7 years to life expectancy in the US (Feinstein; 2008) and Desjardins and Schuller (2006)).
- For adult learners, participation in learning has positive effects on mental health (Feinstein; 2008). A study in the UK reviewed by Desjardins and Schuller (2006) showed women whose educational level was raised from 'without qualifications' to 'Level 2 qualifications' have a 15% lower risk of adult depression.
- Success and failure at school is strongly related to the propensity to commit crime or engage in anti-social behaviour. Feinstein et al. (2008) estimate that a 16% rise in UK citizens educated to degree level could save the UK more than £1 billion in crime costs.
- The education level of a parent can affect a child's own educational progress and life chances. The effects are weaker than the effects of family context, but on average, children of parents with no qualifications are already up to a year behind the children of parents with qualifications by the age of three (Feinstein et al. (2008)).
- There is strong evidence that adult education can help to reduce racism and increase civic and social engagement, including political engagement and voting, trust, tolerance, civic engagement and political knowledge (Feinstein et al. (2008) and Desjardins and Schuller (2006)).

LINE develops science skills and helps students build leadership skills and succeed in mathematics and science subjects (The National Environmental Education & Training Foundation (2000)). Students who are encouraged by this may continue on to study STEM (Science, Technology, Engineering and Mathematics) subjects at a higher level (Association for Science Education Outdoor Science Working Group (ASE OSWG) 2011), providing a skilled workforce for the future:

- Kelly (2008) noted that 59% of employers in 2008 were having trouble recruiting employees with suitable STEM skills, and as well as other measures recommended the 'general greening' of further and higher education.
- Reports by Aldersgate Group (2009), Department for Business Innovation and Skills and Department of Energy and Climate Change (2010) and European Centre for the Development of Vocational Training (Cedefop) (2010) found that, currently, the UK (and the EU in general) workforce do not have the necessary skills or the training arrangements in place to enable the UK's transition to a 'low carbon economy'. The skills that are particularly in need are skills from STEM subjects and leadership and management skills.

Exposure to the outdoors can have indirect physical health benefits too. These will arise indirectly from LINE, through its habit-forming effects in terms of use of the outdoor environment for recreation and leisure. Physical health benefits of repeated long-term exposure to the natural environment can reinforce the mental health benefits discussed above. Ward Thompson et al. (2007) show that exposure as a child leads to life-long continual visits, which means that education in natural environments as a child can lead to life-long health benefits:

- Green space in urban environments can improve life expectancy and decrease health complaints, and it is thought that much of this effect is through providing a favourable environment for people to exercise in. People are more likely to continue participation in activities in which exercise is secondary to environmental or social benefits than activities where exercise remains the primary driver. Recurring visits to green space throughout an individual's lifetime can

therefore be a sustainable way of keeping an individual active (Bird (2004);Natural England (2009)).

- Keeping active contributes to delaying or even preventing many chronic diseases and conditions, including heart disease, hypertension, diabetes, strokes, cancers, disability, osteoarthritis, osteoporosis, obesity, depression, anxiety and sleep problems (Bird (2004);Ewing et al. (2003); Department of Health (2009); Stone (2009)).
- Simple exposure to natural environments, without physical activity, has also been shown to produce mental health benefits, including:
  - Reducing stress and tension and positively affecting mood state (Maller et al. (2008)).
  - The benefits described above which help students to perform better in their studies.
  - Residents living close to green environments and with views on natural areas have been shown to benefit from better psychological wellbeing, increased effectiveness in managing major life issues, greater life satisfaction and greater sense of connectedness to their community (Cooper et al. (2008); Maller et al. (2008)). While these are benefits connected with residential proximity to natural environments, it is likely that many of these benefits stem from interacting with and exposure to the natural environment regularly.

It should be noted that the relationship between LINE and several of the types of benefit reviewed in this section are very complex. The benefits of access to the environment in some of the categories in this Section may not have a linear relationship with the impacts described, and be linked to long-term exposure to the environment, rather than one-off events.

Valuation of Benefits

While it may be difficult to quantify exactly how much learning outside the classroom can increase educational attainment, it is possible to value educational attainment as a qualitative benefit. Valuing improved educational attainment can be done through a number of ways:

- The value of environmental education in the current UK national curriculum was estimated by Mourato et al. (2011) through approximating its subject matter to the ecological components of GCSE Geography, Biology, (Basic) Science, and A-Level Geography and Biology, and estimating the difference in the present value of lifetime earnings from participating in an additional year in formal education. The resulting estimated annual value in 2010 of environmental knowledge was £1.6 billion for GCSE subjects and £0.5 billion for A-Level, making a total of £2.1 billion for both.
- House pricing studies that estimate how higher performing schools affect the prices of houses in its catchment area. Gibbons and Machin (2008) review recent literature on the effects of crime, transportation and school quality on local house prices and finds that recent studies have valued good school quality at around a 4% premium. This is deemed to be ‘reasonable’ as, according to literature, this price does not exceed the cost of private school fees in London or Paris. With an average house price in England of £208,000[4], a 4% premium equates to £8,000 per home. Gibbons and Machin are responsible for a number of other studies exploring the effects of school quality on house prices but these are summarised in their 2008 paper.
- A more recent paper by Gibbons et al. (2009) values school quality by looking at school choice reform in Oslo County in Norway, where, from a previous rigid catchment area programme, local authorities opened up the possibility of any student to apply to any high school regardless of where they resided. Gibbons et al. found that house price premiums linked to school quality fell by at least 50%.
- Educational attainment can also be measured through the benefits to society. The Prince's Trust (2010) measured the cost of educational underachievement to be £22 billion to the UK economy, using an estimate from Dearden et al. (2004) of the average wage return of 10% for

leaving school with qualifications over leaving school without qualifications. The Family Resources Survey was used to estimate the discounted value of a 10% rise in average wages over a lifetime (£45,000) and this was multiplied by the number of young people (aged 17-24) without qualifications.

- Travel cost and cost of time can be used to estimate the benefits of educational trips and other educational activities. Mourato et al. (2011) value educational trips made by schools to the London Wetland Centre and the Hanningfield Reservoir in 2009 and bird watching activities for the RSPB-organised Big School Birdwatch. The average cost of a primary and secondary school day trip to in the UK was used to value transport costs (between £7.75 and £16.18). Teachers' in-vehicle travel time was valued using 'wage rate' – 125% of their wage (estimated at £35,000 per annum to reflect the cost of their time and labour overheads). Student time was valued at the cost to government of students in education (about £5,140 per student per year). Time spent travelling in the vehicle was calculated using GIS from the postcode locations of each school. The 'excess time' - time spent waiting or walking to and from school buses was valued was calculated at 200% of in-vehicle travel time costs, following standard procedures in transport analysis. The final values were £628 per educational trip or £19 per child for the London Wetland Centre, and £839 per educational trip or £30 per child for the Hanningfield Reservoir. Time spent on the Big School Birdwatch was valued through the same method for valuing in-vehicle time. The total value of time spent by teachers and students on birdwatching was £175,982 and £373,873 respectively, totalling up to £549,854. This corresponds to an average of £277 per school.
- PricewaterhouseCoopers (2010) use the Department for Education's "Impact Assessment – Academies Bill" to estimate that students earning 5 'good' GCSEs will earn on average £93k over their lifetime than those who do not achieve 5 'good' GCSEs.

There are established methodologies for valuing health through reductions in morbidity (incidence of ill health) and mortality and increases in Quality Adjusted Life Years (QALY)[5].

- The Walking the Way to Health Initiative (WHI) from Natural England estimates the value of the expanded WHI programme for its duration using Quality Adjusted Life Years. It uses a £30,000 per QALY upper threshold based on a study by the National Institute for Health and Clinical Excellence (Stone, 2009).
- Stone (2009) also estimates the potential value of the universal provision of green space access based on savings to the National Health Service (NHS). The study uses the estimate that 24% of people who have good perceived and/or actual access to green space are more likely to be physically active. Using estimates from a study on savings on medical expenditure in Japan from walking, the study calculates that if everybody had good access to green space, the health service savings would be £2.1 billion per annum.
- Bird (2004) estimates the cost of physical inactivity to the economy to be £8.2 billion. This is the aggregate of costs of treatment from the NHS (£1.7 billion), work absence (£5.4 billion) and early mortality (£1 billion).
- Desjardins and Schuller (2006) report that depression costs the economy £9 billion a year. The estimate that a 15% reduction in the risk of adult depression can be made through educating women from Level 1 to Level 2 qualifications was estimated to lead to a saving of £200 million.
- Mourato et al. (2011) estimate that a one percentage point reduction in sedentary behaviour would save £1.6 billion from the reduction of coronary heart disease, cancer and stroke, based on mortality and morbidity data.

Increased success in school and exposure to natural areas were shown to reduce crime and anti-social behaviour. There have been various attempts to value reductions in anti-social behaviour and crime rates:

- The Prince's Trust (2010) calculates the annual cost of incarceration of children and young people under 21 to be £587 million, including places in secure children's homes, secure training centres, young offender institutions, and prisons for 18-20 year olds. It also reports that the rate of reconviction is high, with around 75% of young men who were released from prison on 2004 reconvicting within two years of release.
- The Prince's Trust (2010) also reports an estimate of the costs to society of street crime carried out by young people. This is calculated from costs incurred in anticipation of crimes occurring (such as security expenditure) and as a consequence of criminal events (such as property stolen and damaged) and in the course of responding to crime. This figure is estimated to be £1.2 billion a year, made up of £834 million from crimes by 18-21 year olds and £391 million from crimes by 10-17 year olds.
- Gibbons and Machin (2008) review studies using hedonic pricing to value the fear of crime, based on the reaction of house prices to local crime rates. They find that highly visible, but more trivial offences such as vandalism, graffiti, arson and damage to property have large effects on house prices while high incidence of house burglary has no effect, but reason that this may be because home buyers are less informed of local burglary rates or are able to install effective security measures relatively cheaply, and that highly visible crime may act as a signal of other problems within a neighbourhood. The effects of a one standard deviation decrease in these crimes have a capitalised value of around £20,000 per home in London at year 2000 prices.
- Feinstein et al. (2008) estimate that a 1% point increase in the proportion of the working age population with Level 2 qualifications would reduce the social costs of crime by up to £320 million per year.

Using the method described in Mourato et al. (2011), and assuming the same travel costs, student-teacher ratio and the calculated travel times reflect an average of travel times for school trips, we can estimate the value of school visits to the natural environment for which data is available: 60,000 student visits to RSPB reserves, 145,000 students visited Wildlife Trusts sites; 55,500 visits to Wildfowl and Wetlands Trust sites[6]; approximately 300,000 pupils taking part in organised learning visits to National Trust sites[7]; and Natural England arranged visits for 678,000 students to farms and national nature reserves in 2010/11. Aggregating these numbers gives an estimated number of visits to natural areas of 1.29 million students for 2010. This annual figure is based on the assumption that recent years' data are a good estimate for activity in 2010 (i.e. that patterns of LINE activity for these organisations will not have changed significantly).

Using the average values per child of an educational trip to London Wetland Centre of £19 and to Hanningfield Reservoir of £30, we get an estimate of £24.6 - £38.8 million of benefits per year from existing visits to the natural environment organised by the above mentioned organisations. This result is an underestimate because it uses travel cost as a proxy to value (the limitations of this are described on page 13), and does not include all types of LINE (e.g. activities in school grounds). Further data on numbers of visits could be used to revise this estimate.

The benefits that can be gained by LINE programmes as outlined above relate to various government initiatives. "Healthy Lives, Healthy People", the government strategy for public health in England HM Government (2010) states that it aims to strengthen self-esteem, confidence and personal responsibility, positively promoting healthy behaviours and lifestyles, and adapting the environment to make healthy choices easier. They also aim to take better care of children's health and development and change the behaviour of adults to reduce premature death, illness and costs to society, avoiding a substantial proportion of cancers, vascular dementias and over 30% of circulatory diseases.

3. Conclusions

A rich qualitative evidence set identifies substantial economic values relating to a wide variety of factors that LINE can have a positive impact on. These impacts are summarised as direct educational, mental health, benefits to others in society, life skills and indirect health benefits. In each of these areas, the costs to society of the problems involved are valued in figures ranging from tens of millions to billions of pounds. While these figures may involve some overlaps, it is clear that the outcomes influenced by LINE have colossal value to society.

The economic (monetary) evidence reviewed above also suggests that the value of the benefit outcomes associated with LINE in England is significant. Even if LINE had only a very small impact on the beneficial outcomes which generate economic value or avoid costs (e.g. reducing the relevant impacts by 0.1%), its value would be very large – in the region of £10m to £20m million per year. Greater percentage reductions in impacts would give proportionately greater reductions of costs

However, there is a lack of quantitative evidence of the links between LINE and the benefit outcomes. There is in fact only one study that attempted to estimate the economic value of LINE – and that uses spending evidence as a proxy for value evidence (Mourato et al. (2011)). Using the Mourato et al data to extrapolate across the estimated LINE visits in the UK organised in 2010 by Natural England, the National Trust, Wildfowl and Wetlands Trust, the Wildlife Trusts and RSPB (involving 1.29 million visits by pupils and teachers) gives an estimate of £24.6 - £38.8 million of benefits per year from existing learning visits to natural areas. Given the limits on the available data this figure is only a small part of the economic value created by LINE.

4. Further Research

The following two options are suggested for consideration in future work on the economic value of LINE:

1 Work to elicit the value of LINE to the wider population

With appropriately structured surveys it would be possible to identify the value that the general public hold for LINE experiences for school children. Value could be extrapolated across a relevant population base to estimate the Total Economic Value (TEV) for LINE in England, across all aspects of TEV and by different beneficiary groups. The disadvantage is the cost of complex survey design and survey work – projects of this nature can cost approximately £100k.

2 Work to increase understanding of the links between LINE and beneficial social outcomes:

2a) Impact on Teacher and Pupil Outcomes from LINE

A survey of teachers and/or schools that use LINE could provide data about the links between involvement in LINE and some of the beneficial outcomes valued in eftec's report. For example, it could provide data to quantify the numbers of pupils who display increased confidence and social skills following LINE, or the numbers of teachers whose motivation is increased (and for whom turnover rates are reduced) following LINE. The key to designing this work would be to quantify changes resulting from LINE that are associated with the economic values identified in Section 2.2.

Such work could take a similar format to the July 2010 report by PricewaterhouseCoopers (PWC, 2010) that analysed the economic costs and benefits of Creative Partnerships. That work used a 'logic model', described as "a high level map of the transmission mechanism through which inputs, stimulated by Creative Partnerships, deliver impacts to each of the potential beneficiaries". This logic model seems to have the same structure as the benefit pathways used in Section 1.2.

For calculating benefits, PWC used quantitative data from research by the National Foundation for Educational Research (NFER):

- A survey that sampled 2,300 teachers, and examined the impact of Creative Partnerships on members of the teaching workforce.
- A study on the impacts to students that used national evaluation data and information collected during Creative Partnerships programmes. It sampled around 61,000 pupils who had attended a Phase 1 Creative Partnerships school and over 3.3 million pupils overall and looked specifically at improvements in educational attainment from the Creative Partnerships programme.
- A further study on the impacts on students used Department of Children, Schools and Families (DCSF) data to determine whether schools with Creative Partnerships programmes had different rates of student absences.

The PWC work is an ex-post valuation of the Creative Partnerships programme and therefore estimate values based on existing quantitative information on the direct effects of Creative Partnerships. The results of the work are that Creative Partnerships is expected to generate nearly £4 billion net positive benefit for the UK economy.

2b) Linking LINE to long-term behaviour

Some of the links between LINE and sources of potential economic value (e.g. improved health outcomes) rely on quantifying connections between LINE and long-term beneficial behaviours that use the natural environment. The MENE survey provides a possible vehicle to generate survey data about these connections from LINE to behaviour.

Two different ways that LINE can motivate visits to the natural environment could be researched. Firstly, the connection between LINE (and other environmental experiences as a child) and use of the natural environment as an adult for activities that have economic value (e.g. exercise) could be researched. However, some evidence does already exist in this area, and causation may be difficult to show. Secondly, parents could be asked what role LINE for their children has played in motivating/changing their family's use of the natural environment.

Through this kind of research, evidence on the links between LINE and long-term changes in behaviour (which is particularly important for health and some other social aspects of the potential value of LINE) could potentially be quantified.

Potential Costs of Option 2

The research described in 2a would require a survey of teachers. Any survey needs careful design of the questionnaire. Piloting of the survey is essential, and for more complex work further testing is required (possibly including focus groups to test concepts, and cognitive interviews to check respondents understanding of questions). The costs of this vary with the complexity and length of the survey, but will be at least £5,000 – 10,000.

For data gathering, a number of options with different pros, cons and costs are available:

- Face-to-face in-home or in-work surveys are expensive, could be as much as £100 per completed interview.
- Online surveys are much cheaper – two options:
  - A company like YouGov (TNS could also do this) – charges somewhere between £20 - £40 per completed interview. The larger the sample the smaller the unit cost. However, they use their own panels of survey respondents, and this approach would be dependent on this being able to identify panel members profession. Also, it would not be targeted at teachers in schools using LINE.
  - eftec can design and run an online survey, using automated survey software such as surveymonkey. The design and administration of an online survey can cost £2,000 (with further costs for testing). This depends on having email addresses for potential survey respondents and the survey being completed via an internet connection.
- A questionnaire sent by post, which would have slightly higher costs that online options, due to the need to post out the survey, and time to enter the data received into a database for analysis. Postal questionnaires often suffer from low response rates, but this may not be a problem if a sample can be targeted that are motivated by this issue and find the survey highly relevant to their own work.

Further costs then relate to the time needed to conduct the data analysis and interpretation, and report the findings. As with survey design this will vary with the number and complexity of questions. Again a minimum cost of £5,000 - £10,000 is involved.

Overall the costs could range from around £20,000 - £25,000 for the cheapest options (a simple survey design, administered online to get around 500 respondents), to £100,000 plus for more complex surveys (complex design, administered face to face, with a larger sample that allowed analysis of sub-samples covering, e.g. different geographical areas or socio-economic characteristics of school catchments).

In the design of a survey it would be important to consider contacting teachers at a suitable time of year (e.g. not around exams, close to other surveys or during holidays).

Research on the “Impact of Creative Partnerships on Pupil Behaviour” was done on a case study level by school, looking at absences. A similar analysis could be constructed for LINE, and as a desk-based study using secondary data, it could be relatively low-cost. However, this would rely on the organisations holding the relevant data (i.e. schools, Ofsted) being willing to support the research and provide access to the necessary data.

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[1] The scope of this work is limited to these activities in England, although residential trips can of course include trips to the rest of the UK or overseas

[2] In the survey, 'natural environment' is defined as the green open spaces in and around towns and cities as well as the wider countryside and coastline (but not private gardens because they are not publically accessible), and the 'outdoors' is open spaces in and around towns and cities, including parks, canals and nature areas; the coast and beaches; and the countryside including farmland, woodland, hills and rivers

[3] Leadership qualities were listed as: working in teams; listening to and accepting diverse opinions; solving real-world problems; taking the long-term view; promoting actions that serve the larger good; connecting with the community; being sensitive to issues, developing a sense of ownership and a sense of empowerment, and making a difference in the world

[4] **www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/housingmarket/livetables/**

[5] A QALY gives an idea of how many extra months or years of life of a reasonable quality a person might gain as a result of treatment (particularly important when considering treatments for chronic conditions) or another health improving factor
www.nice.org.uk/newsroom/features/measuringeffectivenessandcosteffectivenesstheqaly.jsp
[6] Anne Nichol, Head of Learning, WWT, pers comm. 01/03/11

[7] National Trust, pers comm., 28/2/11. These visits involve education based around historic properties, but all are considered to involve at least an element of outdoor learning