ASSESSING THE BENEFITS OF LEARNING OUTSIDE THE CLASSROOM IN NATURAL ENVIRONMENTS

Final Report for Natural England

February 2011

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Executive Summary

This is the draft report from eftec of research into the economic value of the benefits associated with learning in natural environments (LINE). The evidence is organised in the context of the Total Economic Value Framework, and relies on a range of different economic valuation methods to estimate monetary values.

Economic value of LINE requires qualitative assessment of what the benefits are, how these benefits are linked to the provision of LINE and how the benefits can be expressed in monetary terms.

The **qualitative evidence** reviewed suggests the value of LINE in England is significant and involve benefits from educational attainment, awareness of environment and natural science skills, behavioural outcomes and social cohesion, health benefits, staff morale, a more attractive school, and attitudes to other children. Furthermore, complementarity between these benefits mean that the overall value of LINE to society maybe 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 (e.g. how much does LINE improve educational attainment) is lacking.

However, even in the absence of such quantitative links, it is possible to use other **monetary value evidence** to argue 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 their costs (e.g. reducing the relevant impacts by 0.1%), its value would be very large – of the order of £10m to £20m million per year.

Only one study (Mourato et al. 2011) values educational activities in natural environments themselves. This study uses the spending on LINE as a *minimum* indication of how valuable the benefits are perceived to be (based on the common economic assumption that if the benefits are perceived to be less than the costs, the activity would not be undertaken). The results gives examples of £17 - £30 per pupil per visit is spent on LINE activities, and these data could be extrapolated to value total LINE visits. Based on the number of LINE visits organised by Natural England, the Wildlife Trusts and RSPB in the UK (involving 582,000 visits by pupils and teachers), this gives an estimate of **£11.6 - £17.5 million** of benefits per year from existing learning visits to natural areas. Given the limits on the available data this figure is probably a significant underestimate of what economic value of LINE could be.

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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.

This work is focussed on 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). 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.

This analysis is primarily concerned with LINE as part of formal education of young people. However, the environment can play a role in learning throughout people's lifetime. In the MENE survey (Natural England, 2010) when asked the reasons for taking a visit to the natural environment, 2% of adults cited a reason for the visit was to learn something about the outdoors. 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), and the 'out of doors' 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.

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 learning in natural environments 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 a school programme to underpin the quality of all teaching and learning in the school and embedded as a way of supporting learning like creativity etc.

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 effectively to school decision makers, from policy to practitioner level. 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 learning spaces.

[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.

This report provides 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).

1.1 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:

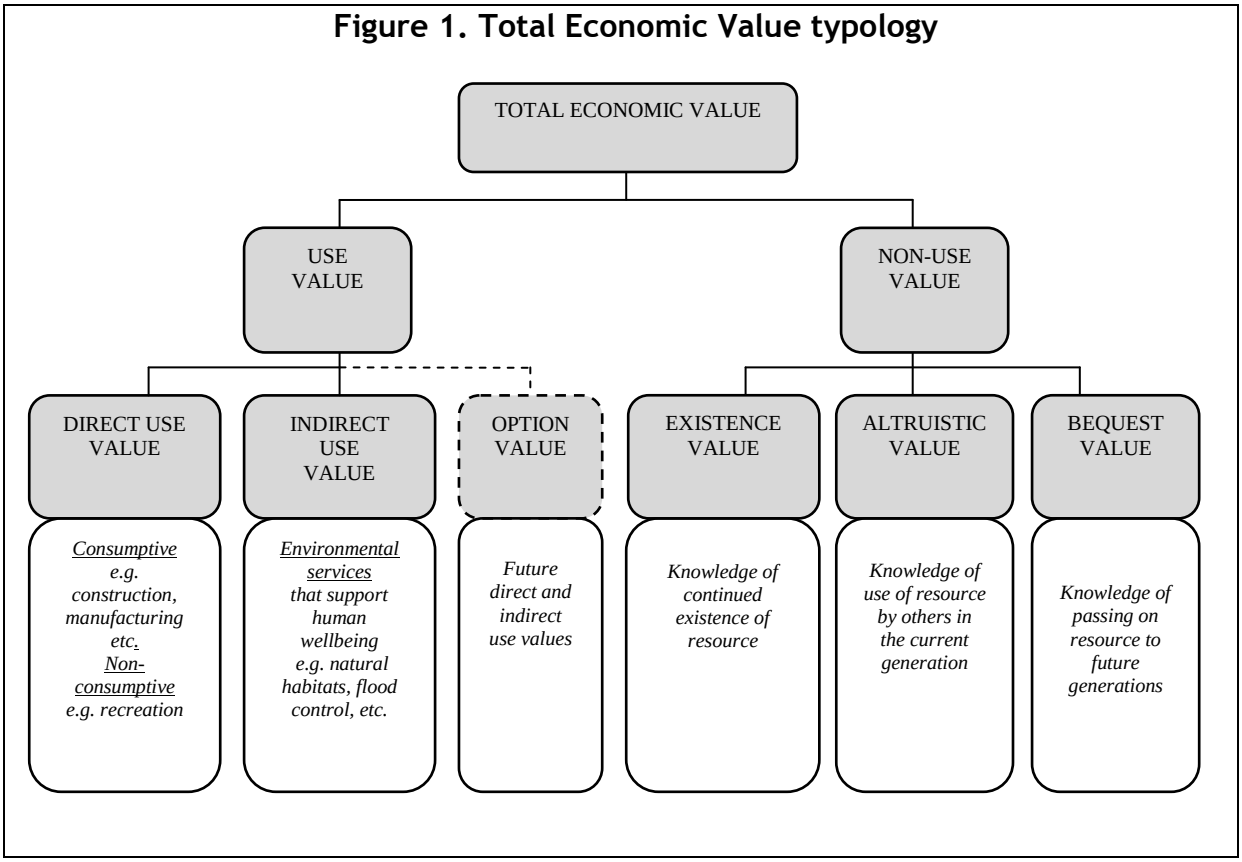
- Altruistic value: Derived from knowing that contemporaries can enjoy benefits from the natural environment.

- 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.

Figure 1. Total Economic Value typology



Where there is a market for environmental good or service, *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.

1.2 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. The manner in which the 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:

i. Qualitative assessment, identifying types of benefits;
ii. Quantitative assessment, attempting to measure the impact pathway for different beneficiaries; and
iii. 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 (i), but very little evidence on (ii). Evidence on (iii) is also lacking – linking to the difficulty of establishing (ii) 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 Kings College (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

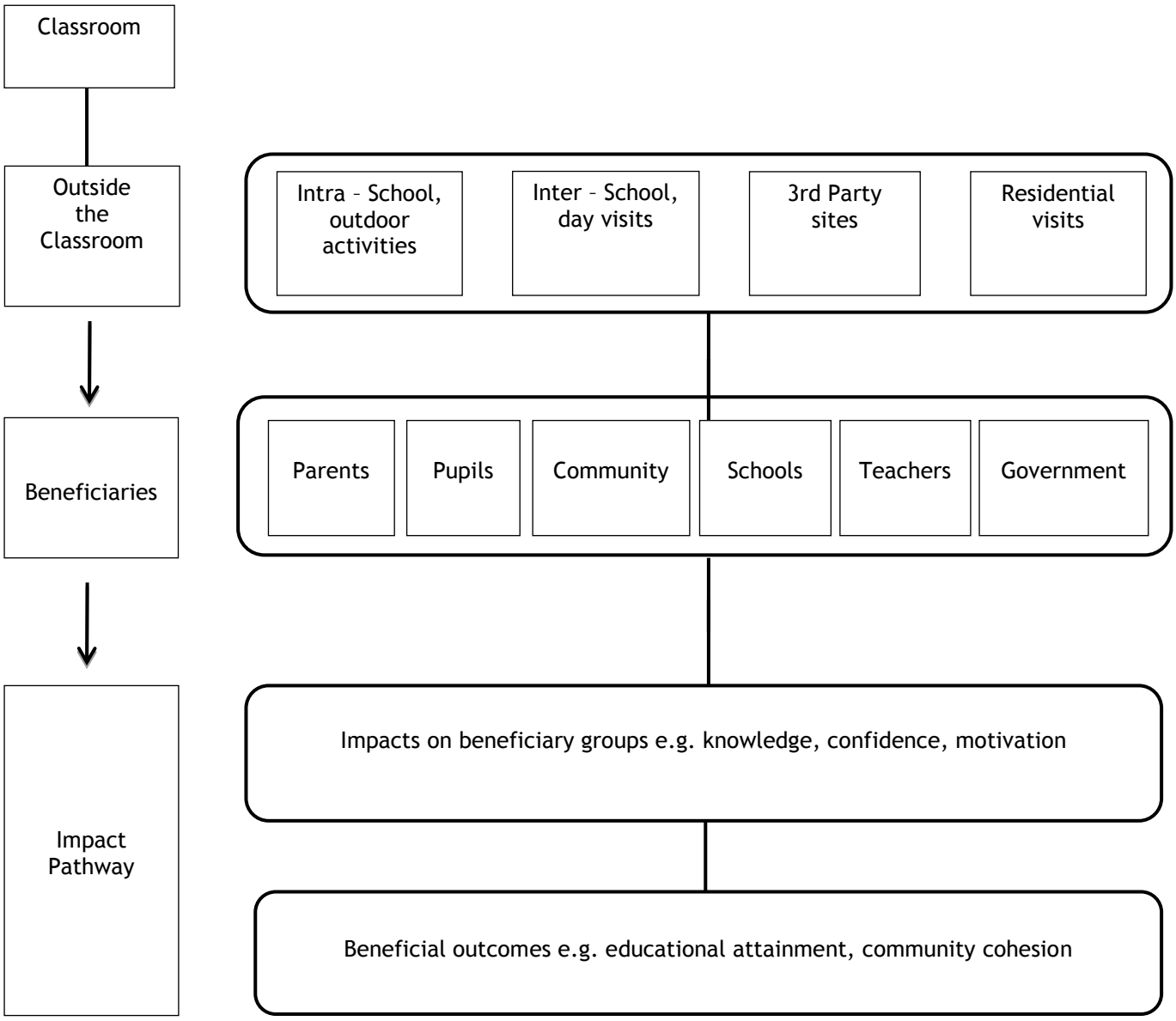


Table 1: Types of Benefits From Learning in Natural Environments

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 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)

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 Kings College (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 env);
- 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.

2.1 Benefits Evidence

There are a number of studies that identify the educational benefits that can be gained from learning in natural areas. 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 [2], 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:

[2] 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.

- 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 reviewed by Desjardins and Schuller (2006) showed that women without qualifications in the UK that are educated 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.

2.2 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 the ecological components to 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 value of environmental knowledge were £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[3], 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

[3] http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/housingmarket/livetables/

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)[4].

- 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.

[4] 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.

http://www.nice.org.uk/newsroom/features/measuringeffectivenessandcosteffectivenesstheqaly.jsp

- 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 that calculated travel times reflect an average of travel times for school trips, we can calculate an estimate of the value of schools visits to the Wildlife Trusts sites and school trips arranged by Natural England to farms and national nature reserves. 120,000 students visited Wildlife Trusts sites in 2006 (Taylor (2007)) and Natural England arranged visits for 350,000 students to farms and 55,000 to national nature reserves in 2010. Aggregating these numbers and the RSPB number of 57,000 student visits to RSPB reserves quoted in Mourato et al. (2011), we get a total number of visits to natural areas of 582,000 students.

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 £11.6 - £17.5 million of benefits per year from existing visits to natural areas. Given the assumptions employed to reach these figures, they must be taken as a guideline and an underestimate, rather than any estimate of true economic valuations. As the figures

represent only the visits recorded by Natural England, RSPB and the Wildlife Trusts, it is likely that they are minimum figures as they do not take into account school visits that have not been recorded by these organisations. Further data on numbers of visits could be used to revise this calculation, in particular on the number of visits organised by the National Trust, which is likely to be substantial.

The benefits that can be gained by learning in natural environment 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, 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.

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 LINE visits in the UK organised by Natural England, the Wildlife Trusts and RSPB (involving 582,000 visits by pupils and teachers) gives an estimate of £11.6 - £17.5 million of benefits per year from existing learning visits to natural areas. Given the limits on the available data this figure is probably only a very small part of what economic value of LINE could be. Further data on the number of visits will enable this figure to be increased.

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