

Measuring connection to nature in children aged 8 - 12: A robust methodology for the RSPB



**A Short Report
for RSPB**

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March 2013

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Acknowledgements

The research for this study was supported by the RSPB. We are very grateful for all the help and support given by RSPB staff, and would also like to thank Phil Burfield, Suzanne Welch and Carolyn Maxwell, for their hard work in administering questionnaires. The authors would especially like to thank all of the children, school helpers and teachers for generously giving up time and energy for the study. The RSPB would like to thank the Calouste Gulbenkian Foundation for funding this research. All photos are courtesy of rspb-images.com (cover: Eleanor Bentall; p5: Andy Hay; p7: David McHugh)

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Glossary

ADHD	Attention Deficit Hyperactivity Disorder
ART	Attention Restoration Theory
CNS	Connection to Nature Scale
CNI	Connection to Nature Index
UNCRC	UN Convention on the Rights of the Child
EAN	Emotional Affinity towards Nature
ESI	Essex Sustainability Institute
FACE	Farming And Countryside Education
FEI	Forest Education Initiative
FEN	Forest Education Network
FS	Forest School
INS	Inclusion of Nature in Self
IUCN	International Union for Conservation of Nature
LOTC	Learning Outside the Classroom
NCI	Nature Connectedness Inventory
NR	Nature Relatedness Scale
NR-6	Nature Relatedness Scale – 6-item version
PET	Psycho-evolutionary stress reduction theory
RSPB	Royal Society for the Protection of Birds
TCV	Trust for Conservation Volunteers
UNCRC	UN Convention on the Rights of the Child
WHO	World Health Organisation

Executive Summary

Introduction

Children today have less contact with the natural world than 50 years ago and as a result are less connected to nature. At a time when the positive effects of interaction with nature for children are being continually supported, children are spending more time indoors in front of a television or computer screen. Without the opportunity and encouragement to get outdoors and engage with nature, children are missing out on the improvements to physical and mental health, personal and social development, cognitive functioning and life chances that previous generations have enjoyed. If this decline in connection continues the consequences for nature could also be catastrophic, as children who are not connected to nature and who do not value and respect nature when they are young are less likely to see the importance of taking care of it when they are older.

There is convincing evidence to show that exposure to the natural environment positively affects health and wellbeing¹. Research from a variety of outdoor settings, from the open countryside, fields and forests, remote wilderness, parks and open spaces, to street trees, allotments and gardens has shown that engaging with nature on a number of different levels (from simply viewing nature, to incidental exposure, through to active involvement in nature-based activities) can produce mental (and physical) health benefits. Natural, green environments are often perceived as places to relax, escape and unwind from the daily stresses of modern life, thus having a positive effect on our emotional wellbeing.

Empirical research has also demonstrated that nature experiences have a positive influence on children, helping them to develop positive values about nature and increasing psychological well-being². Contact with nature is important for children, is inseparably linked to their wellbeing and also promotes healthy personal development³. Nature allows for unstructured play, generating a sense of freedom, independence and inner strength which children can draw upon when experiencing future incidents of stress⁴. Children whose homes have more nearby nature cope better with life stress than those whose homes lack nearby

natural areas⁵. Children with ADHD (Attention Deficit Hyperactivity Disorder) may benefit from more time in contact with nature. In addition children's relationship with nature is a fundamental part of their development, allowing opportunities for self-discovery and natural environmental experience⁶.

Green spaces are also ideal surroundings for outdoor learning, where engaging with nature can lead to enhanced connectedness to nature and increased ecological literacy. One way to increase children's contact with nature, is within the formalised educational

system, both in terms of i) the amount of exposure to nature in the learning environment and ii) actually learning about nature (green education). Natural environments are varied and changeable and so provide excellent opportunities for free explorative play and this type of unstructured play has been found to give greater opportunities for decision-making while at the same time promoting creative, diverse and imaginative play, which are all seen as important elements of a child's personal and cognitive development. In addition, free play in natural environments has also been shown to result in increased levels of social interactions which promote an aptitude for learning.

A number of campaigns, strategies and initiatives instigated by government, land managers, conservation organisations and educators, have recently emerged as part of this drive to re-connect our children to nature. The RSPB regularly runs education programmes and events on its wildlife sites across the country and is one of the organisations that have recognised the importance of re-connecting our young people to the natural world.

The research

To date however there has been no robust scientific attempt to measure and track connection to nature



¹ Maas et al. 2006, Pretty et al. 2006, Van den Berg et al. 2007, Bird 2007, Weinstein et al 2009, Hansen-Ketchum et al. 2009, Barton and Pretty 2010, NEA 2011

² Wells and Evans 2003, Davis, Rea, and Waite 2006;

³ Kaplan & Kaplan 1989; Kahn & Kellert 2002; Bingley & Milligan 2004; Thomas & Thompson 2004; Louv 2005; Ward-Thompson et al. 2006, 2008

⁴ Wells & Lekies, 2006

⁵ Wells and Evans 2003

⁶ Bird, 2007

amongst UK children. As a result, the RSPB commissioned the 'Green Exercise Research Team' at the University of Essex to establish a scientifically robust and logistically practical methodology to enable them to measure connection to nature in children aged between 8 and 12. In future, the RSPB aims to establish a baseline of connection to nature levels in children across the UK in order to map any longitudinal changes as a result of their nature-based education and recreational interventions. Informed by the results of this study, the RSPB will then use the most appropriate outcome measure in a UK-wide baseline survey of connection to nature in UK children, which is expected to be completed by the summer of 2013.

The aim of this present study was to review the methodology for and fieldtest 3 different measures designed to assess connection or relatedness to nature in children – with an emphasis on 'trait' measures. These measures included:

- o Connection to Nature Index – CNI (Cheng and Monroe 2010)
- o Inclusion of Nature in Self - INS (Schultz 2002)
- o Nature Relatedness Scale – short form version – NR-6 (Nisbet et al 2008)

This study adopted a 4 stage process:

Stage 1- Review of existing connection to nature measures

For each of the 3 measures of connection to nature the original context in which the measures were developed was examined, including: the validation process; original population (age range, educational level and any other relevant characteristics); whether used as a measure of state or trait; and the statistical factor analysis.

Stage 2 – Field test: Analysis of data from the study population

A field study was then designed, conducted and Stage 2 of the research process was an analysis of the study population, their connection to nature levels and an examination of whether levels of connection varied depending on a number of variables such as age; gender; location; order and format of measures within the composite questionnaire.

Stage 3 – Field test: How the 3 measures used in the study performed

Stage 3 of the research process was to assess how the 3 measures performed with the study population in terms of i) statistical reliability and effectiveness of

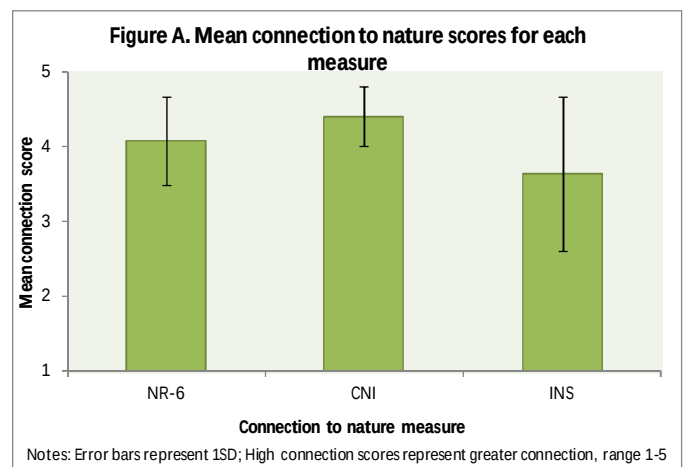
results and ii) ease of understanding and practicality of administration.

Stage 4 – Choice of most appropriate connection to nature measure for RSPB

The outcome measure deemed to be the most appropriate (i.e. most effective, practical to administer and to understand) was chosen.

Key findings

- In total, 76 children took part in the research, of which 47% were boys and 53% were girls. Ages of the children ranged between 7 and 13 years, although the majority were below 10 years old.



- The majority of children were able to understand and successfully complete all 3 of the connection to nature measures used in this field test and all 3 instruments produced acceptable results. In this study, all of the children's connection to nature measures yielded mean scores of above 3.5, with the NR-6 and CNI giving mean values above 4, implying that the children were quite highly connected to nature (Figure A). The children participating in this study appeared to have higher levels of connection to nature, when measured by CNI, than those of a similar group of children in the US.
- Although the study was not designed with a control group or as a comparison between indoor and outdoor locations, the data suggested that for all 3 connection to nature measures mean scores were slightly higher for those children who had completed questionnaires whilst taking part in outdoor sessions when compared to those who had been inside at school. This finding was not found to be statistically significant, but has implications for future research.

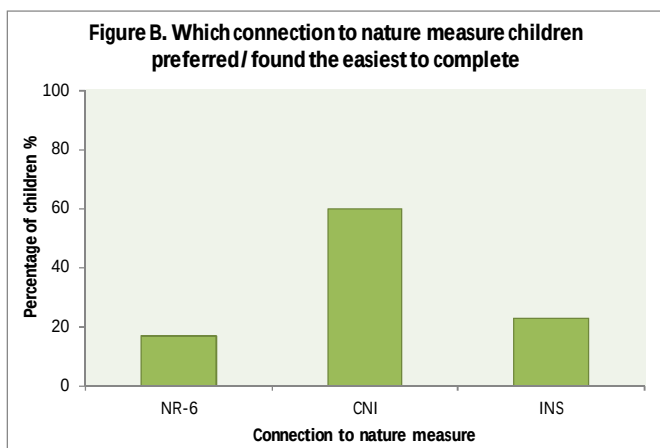
- In the examination of the performance of the 3 measures within the study, the CNI was found to have the highest internal consistency ($\alpha = .82$) although the NR-6 did display acceptable consistency ($\alpha = .77$). Of the CNI subscales, 'Enjoyment', 'Empathy' and 'Responsibility' showed acceptable internal consistency; however 'Oneness' did not.
- In terms of inter-measure correlations, the strongest, positive correlation was between NR-6 and CNI ($r = .57$). There was also a moderate, positive correlation between NR-6 and INS ($r = .49$) and a weak, positive correlation between INS and CNI ($r = .16$) which was not found to be statistically significant. The full CNI correlated strongly with all of its 4 subfactors (as expected), as did NR-6 moderately, with both measures most strongly correlating with 'enjoyment'. The subfactors of 'enjoyment' and 'empathy' correlated with INS even though the correlation with the full CNI was not significant

Conclusions

Whilst accepting that all 3 measures performed reasonably well with the study population, taking all factors into consideration, the CNI was found to be the preferred measure; being the easiest to complete; a trait measure; with both an overall nature connection score and subfactor within it; specifically designed and validated for use with children in the chosen age group; and being statistically reliable.

There has been increasing recognition of the need to cultivate a love of nature in our children. Children are the future custodians of our natural places and with the love of nature comes the urge to protect it. An ever growing array of initiatives has emerged, instigated by government, land managers, conservation organisations and educators alike, as part of the drive to re-connect our children to nature. To date however there has been no robust scientific attempt to measure and track connection to nature amongst UK children and the RSPB has acknowledged this need.

In this study the RSPB and the 'Green Exercise Research Team' at the University of Essex have fieldtested and chosen a robust and practical measure of connection to nature in children aged between 8 and 12 – the Connection to Nature Index. The RSPB will now use this measure to establish a UK-wide baseline of connection to nature levels in children across the UK to allow longitudinal comparisons and to enable further assessment of the effectiveness of such re-connection initiatives. Both this study and the planned future research will add to the evidence base, help to inform the debate on children's connection to nature and shape local and national policy.



- On the whole, the majority of children (78-85%) told us that they did not have a problem understanding any of the 3 connection to nature measures. However adults were asked more frequently to explain the INS question than either the NR-6 or the CNI. Seventeen adults also scored the 3 measures for ease of completion by children - overall the CNI scored the highest and the INS the lowest.
- Children taking part in the research were asked which connection to nature measure that they liked the best or found the easiest to complete. The clear majority of children told us that they preferred the CNI questionnaire over the other two (Figure B).



1 Key Findings

- In total, 76 children took part in the research, of which 47% were boys and 53% were girls. Ages of the children ranged between 7 and 13 years, although the majority were below 10 years old.
- In this study, all of the children's connection to nature measures yielded mean scores of above 3.5, with the NR-6 and CNI giving mean values above 4, implying that the children were quite highly connected to nature.
- Using the NR-6, the children participating in this study appear to have higher levels of connection than the average adult (although the two populations may not be directly comparable). The children participating in this study appear to have higher levels of connection to nature, when measured by CNI, than those of a similar group of children in the US.
- Although this study was not designed to assess differences in connection to nature scores between locations or with a specific 'control' group, the data did suggest that for all 3 connection to nature measures, mean scores were slightly higher for children who completed questionnaires after they had taken part in outdoor sessions when compared to those who had been inside at school. This finding, was not statistically significant, but suggests that future research could examine this difference in more detail.
- The connection to nature scores from the 3 measures: NR-6, CNI and INS in this study were not found to be significantly affected by variables such as session location; the order and format of questionnaires; and the age or gender of children taking part. As a result, data in this research were analysed as one group.
- The performance of 3 the measures with the study population was examined in terms of i) statistical reliability; ii) inter-scale comparisons and correlations; and iii) ease of understanding and practicality of administration. The CNI was found to have the highest internal consistency ($\alpha = .82$) although the NR-6 did display acceptable consistency ($\alpha = .77$). Of the CNI subscales, 'Enjoyment', 'Empathy' and 'Responsibility' showed acceptable internal consistency ('Enjoyment' particularly so – $\alpha = .79$), however 'Oneness' did not. As the INS is a single-item measure, internal consistency was not measured.
- All of the scales differed from each other and both the two multi-item scales (CNI and NR-6) gave statistically higher connection to nature scores than the single-item scale (INS), although the effect size was small.
- In terms of inter-measure correlations, the strongest, positive correlation was between NR-6 and CNI ($r = .57$). There was also a moderate, positive correlation between NR-6 and INS ($r = .49$) and a weak, positive correlation between INS and CNI ($r = .16$) which was not found to be statistically significant. The full CNI correlated strongly with all of its 4 subfactors (as expected), as did NR-6 moderately, with both measures most strongly correlating with 'enjoyment'. The subfactors of 'enjoyment' and 'empathy' correlated with INS even though the correlation with the full CNI was not significant.
- On the whole, the majority of children (78-85%) told us that they did not have a problem understanding any of the 3 connection to nature measures however; adults were asked more frequently to explain the INS question than either the NR-6 or the CNI. Seventeen adults also scored the 3 measures for ease of completion by children - overall the CNI scored the highest and the INS the lowest.
- Children taking part in the research were asked which connection to nature measure that they liked the best or found the easiest to complete. The clear majority of children told us that they preferred the CNI questionnaire over the other two.

2 Our Nature – Contact, connection and conservation

2.1 Introduction

There is a mounting body of evidence that highlights the benefits of contact with nature, such as improved health and wellbeing, enhanced connection with nature and an increase in the desire to protect natural environments. However over the last 50 years our contact with nature has decreased and we have become more and more disconnected with nature. This disconnection brings particular concerns that i) our children are missing out on nature experiences at a cost to their own health and development and ii) our natural environment will also suffer as a result. There is a need to cultivate a love of nature in our children, as the future custodians of the land, because with the love of nature comes the urge to protect it.

A number of campaigns, strategies and initiatives instigated by government, land managers, conservation organisations and educators, have recently emerged as part of this drive to re-connect our children to nature. How successful these projects are at increasing nature connection in children or in promoting environmentally sustainable behaviours is not yet clear, however evidence from the US and emergent research in the UK is encouraging.

The RSPB regularly runs education programmes and events on its wildlife sites across the country and is one of the organisations that have recognised the importance of re-connecting our young people to the natural world. Recently the RSPB have acknowledged the need to establish a baseline of connection to nature levels in UK children to allow longitudinal comparisons to be made thus enabling assessment of the effectiveness of such re-connection programmes.

2.2 Health and wellbeing benefits of contact with nature

The ‘health’ of an individual is widely considered to be multifaceted. The World Health Organization (WHO) defines health as being *“a state of complete physical, mental and social (individual) wellbeing, and not merely the absence of disease or infirmity”*⁷. Similarly the term ‘wellbeing’ (despite the lack of a universal definition) is also considered in a wider context, described by Defra (2007) as *“a positive physical, social and mental state; it is not just the absence of pain, discomfort and incapacity. It requires that basic needs are met, that individuals have a sense of purpose, and that they feel able to achieve important personal goals and participate in society. It is enhanced by conditions that include supportive personal relationships, strong and inclusive communities, good health, financial and personal security, rewarding employment, and a healthy and attractive environment”*⁸.

Scientific evidence of the positive relationship between exposure to nature and an individual’s health and wellbeing is continually increasing and as a result public bodies, government departments and voluntary organisations alike are promoting the importance of contact with nature for us all⁹.

2.2.1 The evidence base

There is convincing evidence to show that exposure to the natural environment positively affects health and wellbeing¹⁰. Research from a variety of outdoor settings, from the open countryside, fields and forests, remote wilderness, parks and open spaces, to street trees, allotments and gardens has shown that engaging with nature on a number of different levels (from simply viewing nature, to incidental exposure,

⁷ WHO 1948

⁸ Defra 2007

⁹ See Defra 2011, Natural Environment White Paper

¹⁰ Maas et al. 2006, Pretty et al. 2006, Van den Berg et al. 2007, Bird 2007, Weinstein et al 2009, Hansen-Ketchum et al. 2009, Barton and Pretty 2010, NEA 2011 ,

through to active involvement in nature-based activities) can produce mental (and physical) health benefits. Natural, green environments are often perceived as places to relax, escape and unwind from the daily stresses of modern life, thus having a positive effect on our emotional wellbeing.

Three key theories offer explanations relating to the relationship of man with nature, and all focus on the restorative effects of the natural environment¹¹: i) the Biophilia hypothesis¹²; ii) the Attention Restoration Theory (ART)¹³; and iii) the Psycho-evolutionary stress reduction theory (PET)¹⁴. The 'Biophilia hypothesis' suggests there is an innate evolutionary basis to the relationship of humans with nature and recognises man's fundamental dependence on, and desire to connect with, nature¹⁵. Attention Restoration focuses on the cognitive changes associated with restoration, while PET argues that restorative effects are derived from the reduction of stress, and acknowledges emotional changes. There is however consensus in all three theories that nature contributes to enhanced wellbeing, mental development and personal fulfilment¹⁶. Therefore nature can act as an essential health resource and so the importance of contact with accessible nature and greenspace is paramount.

Nature and children's well being

Empirical research has also demonstrated that nature experiences have a positive influence on children, helping them to develop positive values about nature and increasing psychological well-being¹⁷. Contact with nature is important for children, is inseparably linked to their wellbeing and also promotes healthy personal development¹⁸. Nature allows for unstructured play, generating a sense of freedom, independence and inner strength which children can draw upon when experiencing future incidents of stress¹⁹. Children whose homes have more nearby nature cope better with life stress than those whose homes lack nearby natural areas²⁰. Children with ADHD (Attention Deficit Hyperactivity Disorder) may benefit from more time in contact with nature²¹. In addition children's relationship with nature is a fundamental part of their development, allowing opportunities for self-discovery and natural environmental experience²².

2.2.2 Green exercise

Evidence shows that exposure to nature brings substantial mental health benefits but at the same time, participating in physical activity is also known to result in positive physiological and psychological health outcomes²³. Over the last 10 years at the University of Essex, these ideas have been combined into a programme of research investigating the synergistic benefits of engaging in physical activities whilst simultaneously being exposed to nature and this is referred to as '*green exercise*'²⁴.

From a wide variety of University of Essex research, we have discerned three broad health outcomes: i) improvement of psychological wellbeing (by enhancing mood and self-esteem, whilst reducing feelings of anger, confusion, depression and tension); ii) generation of physical health benefits (by reducing blood pressure and burning calories) and iii) facilitation of social networking and connectivity (by enhancing social capital). Research into the benefits of activities in nature for those living with dementia²⁵ has also found

¹¹ Barton et al 2009

¹² Wilson 1984

¹³ Kaplan and Kaplan 1989

¹⁴ Ulrich 1981

¹⁵ Wilson 1984; Kellert and Wilson 1993; White and Heerwagen 1998

¹⁶ Barton et al 2009

¹⁷ Wells and Evans 2003, Davis, Rea, and Waite 2006

¹⁸ Kaplan & Kaplan 1989; Kahn & Kellert 2002; Bingley & Milligan 2004; Thomas & Thompson 2004; Louv 2005; Ward-Thompson *et al.* 2006, 2008

¹⁹ Wells & Lekies, 2006

²⁰ Wells and Evans 2003

²¹ Bird, 2007

²² Bird, 2007

²³ Barton et al 2009, NEA 2011

²⁴ Pretty et al, 2003, 2004, 2005, 2006, 2007; Pretty, 2007; Peacock 2007; Mind, 2007; Hine et al. 2007a,b; Hine et al. 2008a,b, c; Hine 2008; Hine et al, 2009; Barton et al. 2009; Pretty et al. 2009, Hine 2010; Barton and Pretty 2010;.

²⁵ Mapes and Hine 2010

that green exercise can enable individuals to feel well and experience a 'dampening down' or temporary absence of their dementia related symptoms. Contact with nature was also found to contribute to the emotional, psychological and spiritual aspects of wellbeing for people with dementia²⁶.

In addition, a recent green exercise dose-response study indicated that dose responses for both intensity and duration showed large benefits from short engagements in green exercise, and then diminishing but still positive returns²⁷. The findings also suggest that those who are currently sedentary, inactive, and/or mentally unwell would accrue health benefits if they were able to undertake regular, short-duration physical activity in accessible (probably nearby) green space. Such doses of nature can contribute to immediate mental health benefits.

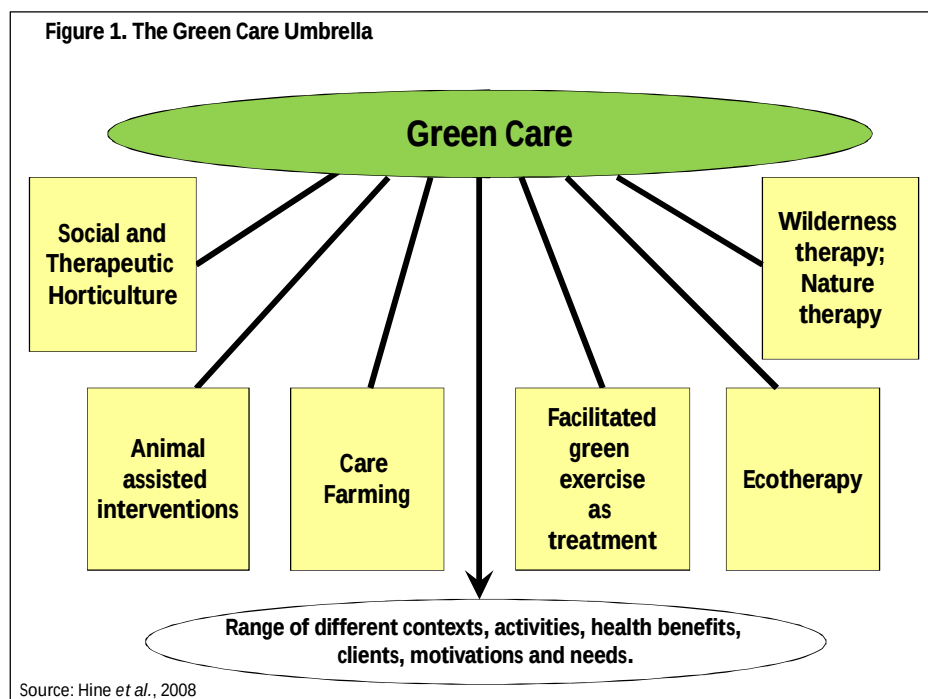
Undertaking physical activities in outdoor green environments could also offer a more viable and appealing option in maintaining long-term activity levels in adults and children alike, as often it is the interaction with nature and the social contact that are the main incentives rather than the 'exercise' per se. In this situation, the health benefits gained from the physical activity are not the main focus and so become a secondary outcome. With the current concerns over an increasingly inactive population, exploring the use of rural and urban greenspaces as ideal locations to encourage physical activity could prove to be a benefit for all²⁸.

2.2.3 Green care

Evidence also suggests that therapeutic applications of green exercise (i.e. nature based interventions) can also be effective and these applications are collectively termed 'green care'²⁹. Green care initiatives usually consist of a facilitated specific therapy or intervention, for a *particular* participant (or group of patients), rather than simply a 'therapeutic' experience.

There is a growing movement towards green care in many contexts, ranging from facilitated

applications of green exercise activities, Social and Therapeutic Horticulture (STH), Animal Assisted Therapies to Wilderness Therapy, Ecotherapy and Care Farming (see Figure 1).



Although the area of green care is very diverse, the common linking ethos is the contact with nature, which generates the health, social or educational benefits. Linking the exposure to nature with various facilitated and structured activities, in a safe way, can offer therapeutic benefits for vulnerable groups. By increasing participation and awareness, green care initiatives have the potential to improve health and wellbeing and significantly reduce public health costs by encouraging healthier communities.

²⁶ Chalfont 2006

²⁷ Barton and Pretty 2010

²⁸ Mind 2007

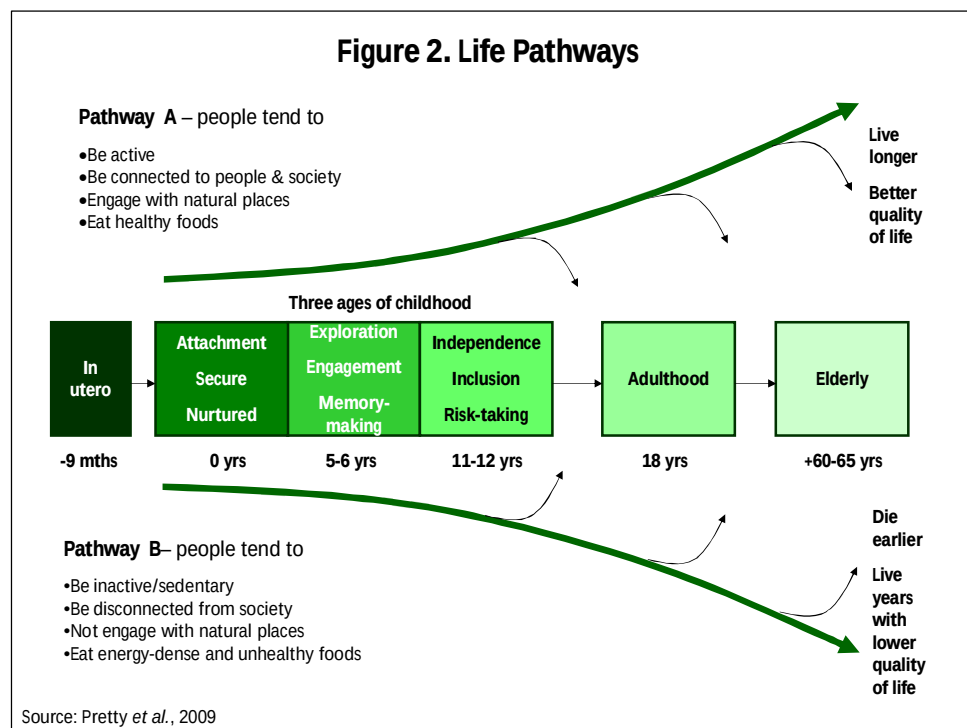
²⁹ Pretty 2006; Hine et al 2008, Sempik et al 2010

2.2.4 Life pathways

Contact with nature does not only affect immediate health and wellbeing but also can also affect health throughout a lifetime. There is growing evidence to show that contact with nature and consequent levels of physical activity in childhood affects not only wellbeing at the time but also in later life³⁰. Many of the social and environmental conditions of childhood can predict or track adult health status and childhood physical and mental ill-health is carried forward in later life³¹. Later emotional wellbeing and cognitive capacity is also profoundly influenced by early social development³².

In the same way childhood experiences in nature appear to fix environmental sensitivity (a predisposition to be interested in learning about caring for and conserving nature³³) in adults, suggesting a need to establish good behaviours early³⁴.

Further University of Essex research³⁵ has developed a funnel of pathways within which all our



lives are shaped (Figure 2). At the top, people live longer with a better quality of life; at the bottom they die earlier and often live years with a lower quality of life. On the healthy pathway, people tend to be active, be connected to people and society, engage with natural places, and eat healthy foods. As a result, they tend to have higher self-esteem and better mood, be members of groups and volunteer more, keep learning, engage regularly with nature and be more resilient to stress.

On the unhealthy pathway, people tend to be inactive and sedentary, be disconnected from society and social groups, not engage with natural places, and eat energy-dense and unhealthy foods. They also tend to have lower socio-economic status, be in more stressful jobs, live where active travel to work or school is difficult, have increased likelihood of being mentally ill, and be overweight or obese.

There are clearly numerous pathways that lie between healthy path A and unhealthy path B - the figure has been simplified for illustration purposes only. There are many other factors that affect our long-term life and health pathways but the research describes the key mediators, such as social status, mental health, social capital, physical activity, urban design and contact with nature.

³⁰ Wells and Lekies 2006, Frenn *et al* 2005, Pretty *et al* 2010

³¹ Danner *et al* 2001, Foresight 2008

³² Ainsworth and Bell 1970, Ainsworth *et al.* 1974

³³ Chalwa 1998

³⁴ Chalwa and Cushing 2007, Cheng and Monroe 2010, Ernst and Theimer 2011

³⁵ Pretty *et al* 2010

It is proposed that it is possible to shift across these life pathways – from B towards A as a result of adopting healthy behaviours, or from A to B as a result of shocks or an accumulation of stresses. Resilient individuals remain able to absorb and cope with shocks and stresses and remain on pathway A. It follows therefore that contact with nature through green exercise, green education or involvement in green care interventions can help an individual shift across the life pathways for a healthier, happier life through improving wellbeing, increasing physical activity and fostering a connection to nature, often at the same time as enabling healthy lifestyle behaviours and creating social capital.

2.3 Our connection and disconnection to nature

2.3.1 Connection to nature

Connection to nature is the degree that an individual includes nature as part of their identity³⁶ and it includes an understanding of nature and everything it comprises, both good and bad³⁷. Connectedness to nature is also an important predictor of subjective well-being and ecological behaviour³⁸. For example feelings of connectedness to nature reported after wilderness experiences range from the aesthetic appreciation of beautiful scenery and landscapes to a deep sense of belonging to the natural world. In this context nature connection has also been taken to include feelings of peacefulness and harmony; a sense of timelessness; creation of a sense of vulnerability which is humbling; learning a respect for nature and developing a sense of place³⁹.

2.3.2 Disconnection to nature

We are however as a society becoming increasingly disconnected from nature, spending more time indoors, both in our working and leisure environments and this has meant that not only are we missing out on the benefits of contact with nature but it has also contributed to the rise in sedentary lifestyles and to the obesity epidemic⁴⁰. One in eight of the UK population now works a 48 hour or more office week⁴¹ and in 2005, the average British adult watched over 2 hours of television per day, compared to 10 minutes of sport or outdoor activity⁴².

Particular concerns have arisen about children's disconnection from nature and these have been brought to the fore by Richard Louv in his book *'Last child in the woods: Saving our Children from Nature-Deficit Disorder'* (2005).

*'at the very moment that the bond is breaking between the young and the natural world, a growing body of research links our mental, physical, and spiritual health directly to our association with nature'*⁴³

The proportion of children playing out in natural spaces has dropped by as much as 75% over the last thirty to forty years⁴⁴, the average British child watches almost 2.5 hours of television per day (up 12% since 2007)⁴⁵ and spends more than 20 hours a week online⁴⁶. All of this is despite the proven positive effects that contact with nature has on children's physical and mental health, personal and social development, and even academic achievements and life pathways⁴⁷.

³⁶ Schultz 2002

³⁷ Nisbet et al 2009

³⁸ Mayer and Frantz 2004, Hine et al 2008b BTCV

³⁹ Russell et al. 1998; Russell 1999, 2001; Russell et al, 2000; Caulkins et al. 2006; Hine et al 2009

⁴⁰ Bragg et al 2012

⁴¹ TUC 2007

⁴² ONS 05

⁴³ Louv 2005 pg 3

⁴⁴ NE 2009

⁴⁵ OFCOM 2011, Moss 2012

⁴⁶ IPPR2008

⁴⁷ RSPB 2012

The term 'Nature Deficit Disorder' describes the human costs of alienation from nature such as diminished use of the senses, attention difficulties and higher rates of emotional and physical illnesses⁴⁸. The term was used for children originally but more recently it has been used to refer to adults as well. Only 10% of children today play in natural places such as woodlands, countryside and heaths, when compared to 40% of children thirty years ago⁴⁹. This loss of connection between children and nature is termed by many as the 'extinction of experience' – where each generation passes on less experience of the natural environment⁵⁰.

This continuing loss of ecoliteracy and connection to nature means that when these young people then become the policy makers and environmentalists of the future, they lack the understanding of nature and consequently its value⁵¹. As the evidence has shown, children who do not value and respect nature when they are young, are less likely to see the importance of protecting the natural environment when they are older. And as Louv again states: *"If the gap between children and nature continues to widen, where will future conservationists come from?"*⁵²

Supporting adults to reconnect with nature and engaging children with nature from a young age can therefore encourage them to participate in more outdoor exercise and make to more frequent countryside visits throughout adulthood which means accessing the health and social capital benefits associated with contact with nature⁵³.

2.3.3 Re-connecting our children to nature

The evidence base has highlighted the health and wellbeing benefits of contact with nature and this combined with the concerns that our children are becoming more and more disconnected from the natural world, has provoked a drive to reconnect children with the outdoors⁵⁴.

In 2009, Natural England examined the changing relationship between childhood and nature across generations and outlined both the beneficial effects of experiences in the natural environment and the extent of children's disengagement from nature before highlighting the need for remedial action⁵⁵. In 2010, the RSPB's Every Child Outdoors report brought together research about the wide benefits to children of being connected to nature and also revealed that the vast majority of people in an independent survey agreed that nature experiences are important to children today, and that schools should play a role in providing these to all children⁵⁶. During 2010 another environmental organisation the National Trust also opened a national debate called *'Outdoor Nation'*; commissioned research (later published as *'Natural Childhood'*); created *'Project Wild thing'* and made a documentary exploring children's contemporary relationship with nature⁵⁷.

In addition, the Natural Environment White Paper 2011 *'The natural choice: securing the value of nature'*, saw the Government acknowledging the importance of enabling children to connect with natural environments and to learn about nature and it called to ensure that every child has an opportunity to visit natural environments⁵⁸.

The National Trust published *'Natural Childhood'* in 2012 which presented the evidence that UK children are displaying signs of 'Nature Deficit Disorder' and outlined the causes and consequences. The

⁴⁸ Louv 2005

⁴⁹ Natural England 2009

⁵⁰ Pyle 2003

⁵¹ Pyle 1978, Bird 2007, Bragg et al 2012

⁵² Louv 2005, Erst and Theimer 2011

⁵³ Peacock et al 2007

⁵⁴ See for example NE 2009, RSPB 2010, Moss 2012

⁵⁵ NE 2009

⁵⁶ RSPB 2010

⁵⁷ See Moss 2012 and see: <http://www.projectwildthing.com/>

⁵⁸ Defra 2011

confirmation of the value of nature connection is investigated before highlighting some of the barriers to re-connecting our children with the natural environment⁵⁹. The Trust appealed for a wide range of initiatives to give children the opportunity to learn outdoors stating that this *“is exactly the kind of sector-wide initiative needed to achieve real and lasting change”*⁶⁰. After this report a two-month inquiry was launched from March to May 2012, seeking the opinions of leading experts and academics, a wide range of different sector organisations from land managers to educators and the general public on two main issues: i) the barriers preventing children getting closer to nature outdoors and ii) the best solutions to address these challenges⁶¹.

The findings of the Natural Childhood Inquiry showed 6 main barriers to reconnecting children to nature: i) Unreasonable health and safety culture; ii) Traffic dangers; iii) The rise of indoor entertainment; iv) Finding time and space for nature in schools and learning; v) Receding access to quality green and natural spaces; and vi) Socio-economic and cultural factors. The report also pulls together some of the roles and actions that a number of different stakeholders (individuals and families, schools, local community groups and charities, national NGOs, and policy-makers) can adopt to increase children's contact with nature either on their own or in partnership⁶².

In response to the Government White Paper, and the Natural Childhood Inquiry, Natural England commissioned a synthesis of the evidence and barriers to nature connection for young people which concluded that the barriers were often on a local level⁶³. Natural England in conjunction with National Trust, RSPB, the Royal Society of Wildlife Trusts, Volunteering England and the English National Parks Authorities Association has also launched the *‘Natural Connections Demonstration Project’* to help schools over 3 years (2012-2015) to *“become the catalyst for local action, enabling more children to have learning experiences in both their school and their leisure time”*⁶⁴.

Natural England is taking this work further by establishing a Strategic Research Programme for outdoor learning with the aim of bringing together key stakeholders to coordinate future research and evaluation programmes in this area⁶⁵. The Outdoor Nation initiative and the Natural Childhood Partnership (founded by the National Trust, National Health Service Sustainable Development Unit, Play England, Play Wales & Playboard N.I., RSPB and Arla Foods with Britdoc and Green Lions Films) continue to promote re-connection of children to nature in the UK.

It is not only in the UK that the need for re-engaging young people with the natural environment has been recognised, in the US, a similar trend can be seen with public land management agencies focusing on re-connecting children with nature. For example the national ‘Children in Nature Initiative’ (which is a collaboration between The National Park Service and the National Association of State Parks Directors) is aimed toward engaging children and families in outdoor recreation activities and rediscovering their natural and cultural heritage⁶⁶.

Furthermore the Children & Nature Network (C&NN) was created to encourage and support the people and organizations working nationally (within the US) and internationally to reconnect children with nature. This network provides “a critical link between researchers and individuals, educators and organizations dedicated to children's health and well-being”⁶⁷. C&NN also provides resources for others in this field, sharing information, strategic initiatives and success stories.

⁵⁹ Moss 2012

⁶⁰ Moss 2012 pg 10

⁶¹ See <http://outdoornation.org.uk/> for more details

⁶² National Trust 2012

⁶³ See Dillon and Dickie 2012

⁶⁴ Natural England 2012 available at: http://www.naturalengland.org.uk/Images/12-13_003_Natural%20Childhood%20Inquiry_tcm6-32639.pdf and see <http://www.naturalengland.org.uk/ourwork/enjoying/linkingpeople/learning/naturalconnections/default.aspx>

⁶⁵ Natural England 2012

⁶⁶ Ernst and Theimer 2011

⁶⁷ See: <http://www.childrenandnature.org/>

Green Education

Green spaces are ideal surroundings for outdoor learning, where engaging with nature can lead to enhanced connectedness to nature and increased ecological literacy. One way to increase children's contact with nature, as outlined earlier, is within the formalised educational system, both in terms of i) the amount of exposure to nature in the learning environment and ii) actually learning about nature (green education).

The importance of outdoor learning was originally realised by the UK government who sought to broaden and develop out of classroom education through the 'Learning Outside the Classroom Manifesto'- LOTC (2006). Currently the Council for Learning Outside the Classroom - (a national charity) exists to promote and champion Learning Outside the Classroom and it took over the responsibility for LOTC in 2009. The charity's objectives are that all children and young people can benefit from increased opportunities for high quality and varied educational experiences because research shows that children learn best through real life experiences⁶⁸.

In the UK, the Forest Education Initiative (FEI)⁶⁹ has been working for the last 20 years to further the understanding and appreciation, particularly among young people, of the potential of trees, woodlands and forests and as part of this has set up a number of Forest Schools (FS)⁷⁰. Although the Forest School concept was adopted in the UK in the 1990s, it originated in Scandinavia in the 1950s as a way of teaching children of all ages about the natural world and by the 1980s it had become an integral part of the Danish primary education syllabus. Forest Schools are essentially a specialised approach of nature based learning that any school can adopt to compliment other education programmes, rather than a specific *type* of school such as Free Schools, Academies etc. Many FS have been set up in England, Scotland and Wales with the main aim of providing regular contact with woodlands over an extended period of time for young people. These schools are led by qualified Forest School Practitioners, who are required to hold a minimum of an accredited Level 3 Forest School qualification⁷¹. The FEI in Scotland and Wales and the Forest Education Network (FEN)⁷² in England also work closely with the newly formed (2012) practitioners' and stakeholder organisation the Association of Forest Schools⁷³ in the provision of FS programmes. In 2006 there were around 150 Forest Schools in the UK⁷⁴ and this number is likely to have grown over recent years as more people become trained practitioners. Participation in the forest school improves children's confidence, wellbeing and self-esteem, motivates them to learn and encourages pride in, and ownership of, their local environment⁷⁵.

The 'Growing Schools' initiative⁷⁶ was started in 2001 in the wake of the foot and mouth crisis to support the LOTC, as the National Curriculum required teaching young people about food, sustainable development, agriculture, environmental issues and the science of plants and animals. Growing schools aims to *"give all children the opportunity to connect with the living environment, whether it is an inner city window box or a vast country estate, a school veg. plot or a natural woodland"*⁷⁷. Growing schools is managed by FACE (Farming & Countryside Education) which is a charity which aims to help young people learn more about food, farming and the countryside *"by promoting visits to farms, and to provide easy access to a wide range of high-quality educational resources and activities to complement both school-based studies and outdoor visits"*⁷⁸. The initiative encourages learning outside in three readily accessible settings: farms – to learn about food, farming and the managed countryside; gardens and green spaces – to learn about gardening and growing; and nature reserves – to learn about wildlife and the natural

⁶⁸ See: <http://www.lotc.org.uk/>

⁶⁹ which is a partnership between Trust for Conservation Volunteers (TCV), Field Studies Council, Forestry Commission, Forestry Commission Scotland, Groundwork, Timber Trade Federation, the Tree Council and the Confederation of Forest Industries (UK) Ltd

⁷⁰ See http://www.foresteducation.org/woodland_learning/

⁷¹ Forest Schools Association 2013

⁷² The successor to FEI in England from 2012. FEI still operates in Scotland and Wales

⁷³ See <http://www.outdoor-learning.org/Default.aspx?tabid=336>

⁷⁴ O'Brien, Liz; Murray, Richard (2008), *Forest School Research Summary*, Forest Research

⁷⁵ O'Brien and Murray 2006

⁷⁶ See <http://www.growingschools.org.uk/>

⁷⁷ Growing Schools 2012 see also <http://www.growingschools.org.uk/>

⁷⁸ FACE 2012

environment. At the same time, there has been a rapid growth in the number of initiatives to develop allotments in or close to school grounds to grow vegetables⁷⁹ and in the use of bushcraft skills to engage disaffected children⁸⁰.

In addition to visits through 'Growing Schools' FACE also supports around 1,100 farms in England who enable children's access to nature through educational access visits as a result of farmer participation in the Higher Level Stewardship scheme⁸¹. The work that FACE carries out with young people is thought to be successful due to the immediate and widespread benefits of visits to the outdoors, and of using food, farming and the countryside to support many aspects of the curriculum.

Environmental Education

Although there is undoubtedly much overlap between green education and environmental education, and indeed the terms are often used interchangeably both in the literature and by practitioners, formal environmental education appears to differ from 'green education' in a number of ways.

According to the The Tbilisi Declaration in 1978⁸², 'environmental education' is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action.

Green education seems to be a more holistic concept and can include learning about either a) nature or b) other subjects; but the key element is *being outside* (as it is in 'outdoor education') whereas environmental education seems to be more specific in that the aim is to primarily to change attitudes and to encourage sustainable behaviours and stewardship of the natural world; but this does not necessarily need to happen whilst outside in nature.

Importance of free play in nature

In addition to formalised education initiatives to re-connect children to nature, the importance of free play in nature to feelings of connection is also becoming increasingly accepted. Some have called for children to become 'free-range'⁸³ and free play has three functions: i) bonding social connections with friends, ii) exploration and risk-taking, and iii) connections with nature⁸⁴.

Natural environments are varied and changeable and so provide excellent opportunities for free explorative play and this type of unstructured play has been found to give greater opportunities for decision-making while at the same time promoting creative, diverse and imaginative play, which are all seen as important elements of a child's personal and cognitive development⁸⁵. In addition, free play in natural environments has also been shown to result in increased levels of social interactions which promote aptitude for learning⁸⁶. Indeed results of recent research suggest that environmental educators should provide time during their specific 'Environmental Education' programmes for children to experience nature, enabling them to bond with the natural world by just 'being' in nature⁸⁷ and another study suggested that the focus on learning in the core-subject areas may have drawn attention away from opportunities to form emotional connections to nature through free play⁸⁸.

Children's connection to nature as a human right

⁷⁹ See for example <http://www.eastfeast.co.uk/>

⁸⁰ See for example <http://www.sunrisebushcraft.com/>

⁸¹ Natural England 2012

⁸² UNESCO, Tbilisi Declaration, 1978

⁸³ Ward-Thompson et al. 2006

⁸⁴ Pretty et al. 2009

⁸⁵ Taylor et al. 1889; Kellert 2002; Bixler et al. 2002; O'Brien 2004; Rickinson et al. 2004; Berman et al. 2008

⁸⁶ Hein, 1991

⁸⁷ Chawla and Cushing 2007, pg 449 and Ernst and Theimer 2011

⁸⁸ Ernst and Theimer 2011

The importance of children's connection to and respect for nature is also recognised in the UN Convention on the Rights of the Child (UNCRC) which has been in force in the UK since 1992. Articles 29 and 31 of the Convention state that *“education of the child shall be directed to ... the development of respect for the natural environment”*⁸⁹ and that children should *“engage in play”*⁹⁰. In addition, there have been recent calls for this Convention to go even further. In September 2012, in South Korea, the World Congress of the International Union for the Conservation of Nature (IUCN) adopted a motion endorsing the ‘Child’s Right to Connect with Nature and to a Healthy Environment’ and urges Government members and NGOs to promote international acknowledgement and codification of this right within the framework of the UNCRC. This resolution recognises *“the child’s inherent right to connect with nature in a meaningful way, as a substantial part of his or her everyday life and healthy development, and to enjoy, maintain and strengthen this connection through the direct and ongoing experience of nature;”*⁹¹ and the importance of *“conservation of nature and the protection of the environment, for the benefit of present and future generations”*⁹¹.

The current drive to reconnect children to nature, outlined in this study, includes a wide range of initiatives, interventions, programmes and delivery options, comprising both educational and recreational experiences in nature.

2.4 Shaping environmental attitudes and nature conserving behaviour

Understanding environmental attitudes of young people is crucial as they will be the ones tackling the environmental problems in the future⁹². Studies have found that a number of factors that help children develop positive values about nature and that influence and stimulate interest in the environment and consequently the desire to work for its protection as adults. These factors include: engaging in nature activities, having a positive experience in natural environments; having influential family members (or other role models); and good memories in natural areas during childhood or adolescence⁹³.

There is also empirical evidence for the association of connection to nature and environmental sensitivity with responsible environmental behaviour⁹⁴. However although it is generally assumed that connectedness influences behaviour, it may of course be the other way around, with pro-environmental behaviour promoting a feeling of oneness or connectedness with the nature around them instead⁹⁵. Whatever the case, the relationship between humans and nature in terms of the way we feel about nature, how we react to it and how we look after it, is clearly complex with many factors affecting how we as individuals and communities develop our relationship with the natural world.

2.4.1 Human-Nature relationship

In the environmental psychology and environmental education literature, this relationship between man and nature has been explored in numerous ways, but 3 interrelated key aspects emerge⁹⁶:

- Affective - our emotions and feelings towards nature
- Cognitive - our knowledge and beliefs about nature
- Behavioural - our actions and experiences in nature

⁸⁹ UNCRC 29.1e

⁹⁰ UNCRC 31

⁹¹ IUCN World Conservation Congress 2012

⁹² Bradley, Waliczek and Zajicek 1999

⁹³ Hungerford and Volk 1990; Chawla 1998, 2007; Davis, Rea, and Waite 2006; Chawla and Cushing 2007; Hinds and Sparks 2008; Cheng and Monroe 2010; Ernst and Theimer 2011

⁹⁴ Sia, Hungerford, and Tomera 1985–1986; Kals, Schumacher and Montada 1999; Mayer and Frantz 2004; Ernst and Theimer 2011

⁹⁵ Ernst and Theimer 2011

⁹⁶ Ernst and Theimer 2011

Historically environmental education programmes aiming to promote an increase in pro-environmental behaviours, have concentrated largely on the 'cognitive' aspect of our relationship with nature, working on the premise that if an individual is educated about the natural world, he will then behave in a pro environmental way and thus want to protect nature. In other words that increasing knowledge is the key to creating future conservationists.

However research in to environmental sensitivity and connection to nature suggests that this approach may be limited, as the evidence shows that that the 'affective' aspect of connection is also associated with pro-environmental behaviours and so using emotional connection to nature is the key. In the same way it is also behavioural (and cognitive aspects,) particularly our experiences in nature, that have been found to shape connection and sensitivity to nature as well as the affective aspects⁹⁷, indicating a complex interaction between them.

It is becoming progressively more apparent that combining cognitive and affective approaches to foster pro-environmental and nature conserving behaviours is likely to be more successful in reaching longer term outcomes. Indeed in the field of environmental education, many programmes are now including connectedness to nature amongst their aims when they incorporate experiences in nature, as well as opportunities to learn⁹⁸.

Connection to nature is increasingly being seen as integral in encouraging environmentally responsible behaviour and environmental protection⁹⁹, a trend that is also reflected in the recent UK educational and recreational initiatives outlined in section 2.3.3.

2.5 Measuring connection to nature

Given the importance of connection to nature to pro-environmental actions and the conservation of our natural greenspaces, it is essential to examine the factors that influence connection to nature in more detail and to develop measures to assess connection, in order to establish the effectiveness of re-connection programmes and strategies.

2.5.1 Connection to nature measures

The research into the influences on connection to nature is relatively recent and as a result there are comparatively few instruments developed to measure connection to nature¹⁰⁰. However all of the measures include the three aspects of the human-nature relationship to varying degrees. The key measures for assessing connection to nature and the aspects of the human-nature relationship that they contain are listed below¹⁰¹:

- Connection to Nature Scale (CNS)- affective and cognitive aspects
- Nature relatedness Scale (NR)- affective, cognitive and behavioural aspects
- Inclusion of Nature with Self (INS)- affective (with elements of the other 2 aspects)
- Environmental Identity Scale - affective, cognitive and behavioural aspects
- Emotional Affinity to Nature (EAN)- affective aspects

Connection to Nature Scale

The Connection to Nature Scale is a single-factor measure, developed by Mayer and Frantz in 2004, and is based on the principle of the 'Land Ethic' by Leopold (1966) and defines connection to nature as "*an*

⁹⁷ Tanner 1980 and Peterson and Hungerford 1981

⁹⁸ Ernst and Theimer 2011

⁹⁹ Fisher 2002, Mayer and Frantz 2004; Ernst and Theimer 2011

¹⁰⁰ Schultz et al 2004

¹⁰¹ For related measures in this field see: <http://www.conpsychmeasures.com/CONPSYCHMeasures/index.html>

*individual's affective, experiential connection to nature*¹⁰². The CNS is considered primarily a trait measure but there is an adapted version for measuring state (which previous University of Essex research has shown to be responsive).

Nature Relatedness Scale

The Nature Relatedness Scale is a 3-factor measure developed in 2008 by Nisbet, Zelenski and Murphy. Nature relatedness describes individual levels of connectedness with the natural world and comprises the cognitive, affective, and physical connection we have with nature¹⁰³. NR has 3 factors: self, perspective and experience. The Self subscale measures “*an internalized identification with nature, reflecting feelings and thoughts about one’s personal connection to nature*”; the Perspective subscale measures “*an external, nature-related worldview, a sense of agency concerning individual human actions and their impact on all living things*”; and the Experience subscale measures “*a physical familiarity with the natural world and the level of comfort with and desire to be out in nature*.”¹⁰⁴. NR is also considered a trait measure.

Inclusion of Nature with Self

The Inclusion of Nature with Self is a single-item question developed by Schultz in 2002 and is designed to measure the extent that individuals include nature as part of their identity. Schultz considers ‘inclusion’ to involve caring about nature (affective), connectedness (defined here as cognitive) and commitment (behavioural). This question adopts the same format as the Inclusion of Other in Self measure¹⁰⁵ and asks participants to rate their connectedness to nature by choosing one of seven pairs of circles that differ in their degree of overlap. This question can be used as either a state or a trait measure (there are two different wordings¹⁰⁶).

Environmental Identity Scale

The Environmental Identity Scale was developed in 2003 by Clayton and is designed to assess the extent to which individuals identify with the natural environment and environmental causes. This 24-item scale looks at spending time in nature, enjoyment of nature, learning about nature, responsibility for nature and ‘oneness’ with nature.

Emotional Affinity to Nature

The Emotional Affinity toward Nature Scale was developed by Kals, Schumacher, & Montada in 1999 and is a 4-factor measure. Emotional affinity toward nature is described as being the love or affection towards nature¹⁰⁷ and the hypothesis is that this emotional affinity should increase nature-protective behaviours. The 16-item scale consists of four subscales: Love of nature, Feelings of Freedom, Feelings of Safety, and Feelings of Oneness with Nature. The EAN is considered a state measure.

2.5.2 Measuring Connection to Nature in children

The majority of the connection to nature measures are designed for use with adults and although some include adaptations for use with older children, very few have been designed specifically for use with children (especially younger ones)¹⁰⁸. In addition, there is a problem with converting adult connection to nature measures for use with children in that many of the nuances and subtle definitions between the sub-scales of the adult measures are considered too difficult for younger children to comprehend. There are however 2 measures that have been developed for children, the Connection to Nature Index (CNI) and the Nature Connectedness Inventory (NCI).

¹⁰² Mayer and Frantz 2004, pg 504

¹⁰³ Nisbet et al. 2009, 2011

¹⁰⁴ As 79

¹⁰⁵ Aron et al. 1992

¹⁰⁶ Schultz 2002

¹⁰⁷ Kals, Schumacher, & Montada 1999

¹⁰⁸ Ernst and Theimer 2011

Connection to Nature Index

The Connection to Nature Index was developed by Cheng and Monroe in 2010 and is a 4-factor trait measure. The CNI was influenced by the definitions of connection to nature of Mayer and Frantz (see section 1.5.1), and drew from elements that appear to influence environmental attitudes¹⁰⁹. The four dimensions in the children's connection to nature index are i) enjoyment of nature, ii) empathy for creatures, iii) sense of oneness and iv) sense of responsibility.

Nature Connectedness Inventory

There is another measure for connection to nature in children, the Nature Connectedness Inventory which was developed by Ernst and Theimer specifically for a study in 2011 in order to remove mono-method bias. This 11-item scale addressed the same areas that served as the basis for the Mayer and Frantz's (2004) Connection to Nature Scale with the addition of some items examining children's feelings when in nature. This measure showed reliability and internal consistency in the study but is not widely available for use.

¹⁰⁹ Musser and Malkus 1994; Schultz 2000

3 RSPB - Measuring connection to nature in children

3.1 The RSPB¹¹⁰

The RSPB is a charitable organisation which “*speaks out for birds and wildlife, tackling the problems that threaten our environment*”¹¹¹. The RSPB works to promote conservation and protection of birds and the wider environment through public awareness campaigns and through the operation of over 200 nature reserves throughout the UK and is Europe's largest wildlife conservation charity - with more than a million members and nearly 20,000 volunteers.

The RSPB has been providing opportunities for children to engage with, learn about and help save nature for over 100 years. Every year, thousands of children engage with nature with the RSPB, including 50,000 schoolchildren who visit outdoor learning centres across the UK and 100,000 children take part in our Big and Little Schools' Birdwatchers in their school grounds. The RSPB have over 200,000 junior members, (RSPB Wildlife Explorers) including more than 40,000 teenagers¹¹². In 2010, the RSPB's ‘*Every Child Outdoors*’ report brought together research about the wide benefits to children of being connected to nature¹¹³.

The RSPB is one of the organisations that have recognised the importance of re-connecting our young people to the natural world and recently have acknowledged the need to establish a baseline of connection to nature levels in UK children to allow longitudinal comparisons to be made thus enabling assessment of the effectiveness of such re-connection programmes.

3.2 Project rationale

Children today have less contact with the natural world than 50 years ago and as a result are less connected to nature. At a time when the positive effects of interaction with nature for children are being continually proven, children are spending more time indoors in front of a television or computer screen. Without the opportunity and encouragement to get outdoors and engage with nature, children are missing out on the improvements to physical and mental health, personal and social development, cognitive functioning and life chances that previous generations have enjoyed. If this decline in connection continues the consequences for nature could also be catastrophic, as children who are not connected to nature and who do not value and respect nature when they are young are less likely to see the importance of taking care of it when they are older.

To date however there has been no robust scientific attempt to measure and track connection to nature amongst UK children. As a result, the RSPB have commissioned the ‘Green Exercise Research Team’ at the University of Essex to establish a scientifically robust and logistically practical methodology to enable them to measure connection to nature in children aged between 8 and 12. The ultimate aim of the RSPB is to establish a baseline of connection to nature levels in children across the UK in order to map any longitudinal changes as a result of their nature-based education and recreational interventions. Informed by the results of this study, the RSPB will then use the most appropriate outcome measure in a UK-wide baseline survey of connection to nature in UK children, which is expected to be completed by the summer of 2013.

¹¹⁰ This section is taken from the RSPB website: <http://www.rspb.org.uk/> and RSPB 2012

¹¹¹ RSPB 2013 website see above

¹¹² www.rspb.org.uk/schools and www.rspb.org.uk/youth

¹¹³ www.rspb.org.uk/childrenneednature

3.3 Aims of the research

3.3.1 Aims

- To establish a scientifically robust and logistically practical methodology to enable RSPB to measure connection to nature in children.
- To pilot 3 existing output measures designed to measure connection or relatedness to nature in children in order to choose the most appropriate for use in future RSPB research.

3.3.2 Key objectives

- To review the methodology of 3 different measures designed to assess connection or relatedness to nature in children – with an emphasis on ‘trait’ measures. These measures include:
 - o Connection to Nature Index – CNI (Cheng and Monroe 2010)
 - o Inclusion of Nature in Self - INS (Schultz 2002)
 - o Nature Relatedness Scale – short form version – NR-6 (Nisbet et al 2008)
- To pilot and field test all 3 measures on a sample of UK children to establish effectiveness, ease of understanding and practicality of administration.
- The most successful, robust and appropriate measure will be chosen for inclusion in future RSPB research into effects on children's connection to nature, behaviour change and wellbeing associated with involvement in RSPB educational visits.

3.4 Green Exercise Research Team at the University of Essex

The *Green Exercise Research Team* involved in this study forms part of the *Essex Sustainability Institute (ESI)* at the University of Essex. There is growing empirical evidence to show that exposure to nature brings substantial mental health benefits¹¹⁴ and at the same time, physical activity is known to result in positive physical and mental health outcomes. Over the last 10 years at the University of Essex, we have combined these ideas into a programme of research on ‘green exercise’ (activity in the presence of nature) and ‘green care’ (therapeutic applications of green exercise). These address current concerns about the adverse health effects of modern diets, sedentary lifestyles and a disconnection with nature, along with growing evidence that stress and mental ill-health have become substantial health problems for many people in industrialised societies.

This cross-disciplinary University of Essex project team is engaged in primary research on i) the health benefits of green exercise – investigating the mental and physical health benefits of physical activities under exposure to different rural and urban environments; ii) measuring connection to nature; and iii) evaluating a wide variety of green care options in varying contexts (including care farming, facilitated green exercise, ecotherapy and wilderness therapy); and; and is currently leading research in this field¹¹⁵.

The Essex sustainability Institute is also a leading authority on the use of Participatory Appraisal and Action Research to assess the needs and opinions of communities. With over 25 years experience of participatory assessment, we have worked with a wide variety of organisations and target groups both within the UK and internationally. The ESI has developed innovative participatory techniques that engage communities as

¹¹⁴Pretty et al. 2003, 2004, 2005, 2006, 2007; Pretty, 2007; Peacock 2007; Mind, 2007; Hine et al. 2007a,b; Hine et al. 2008a,b, c; Hine 2008; Hine et al, 2009; Barton et al. 2009; ; Pretty et al. 2009; Hine 2010; Barton and Pretty 2010.

¹¹⁵ See <http://www.greenexercise.org/> for more details of this research

active participants and this approach encourages community ownership of outcomes so that they are self-sustaining in the longer term.

4 Methodology

This section provides an overview of the research process; details of training given and ethical procedure; information on the sampling strategy and questionnaire development before outlining the connection to nature outcome measures and the methods used to analyse them.

4.1 Overview of research process

Stage 1- Review of existing connection to nature measures

For each of the 3 measures of connection to nature the *original* context in which the measures were developed was examined, including: the validation process; original population (age range, educational level and any other relevant characteristics); whether used as a measure of state or trait; and the statistical factor analysis. These attributes are reported in section 2.5 and later in this methodology chapter (section 4.6)

Stage 2 – Field test: Analysis of data from the study population

A field study was designed, conducted and Stage 2 of the research process was an analysis of the study population, their connection to nature levels and an examination of whether levels of connection varied depending on a number of variables such as age; gender; location; order¹¹⁶ and format of measures within the composite questionnaire. The findings from this stage of the research can be found in Chapter 5.

Stage 3 – Field test: How the 3 measures used in the study performed

Stage 3 of the research process was to assess how the 3 measures performed with the study population in terms of i) statistical reliability and effectiveness of results and ii) ease of understanding and practicality of administration. The results of this stage of the research are shown in Chapter 6.

Stage 4 – Choice of most appropriate connection to nature measure for RSPB

Informed by the results of this field study, the outcome measure deemed to be the most appropriate (i.e. most effective, practical to administer and to understand) was chosen. The results of this stage of the research are shown in Chapter 7. This measure will then be included by the RSPB in a UK-wide baseline survey of children, which is expected to be completed by the summer of 2013.

4.2 Training and acclimatisation

In order for RSPB staff to be fully informed about the University of Essex evaluation process and to be given guidelines on how to administer questionnaires to children in an ethically sound and correct way, the lead researcher from the University of Essex held an acclimatisation session for all staff that were to take part in the research during June and July 2012. In addition an evaluation guidelines document was provided to compliment this process.

4.3 Ethics and consent

All participants in the visits to the RSPB sites chosen to pilot the questionnaires were invited to take part in the evaluation if they wished and were told that their participation was on a purely voluntary basis.

In line with University of Essex ethics procedure, as the participants were all children, informed parental and participant consent was gained prior to the visits. All participants and their parents or guardians were given (or were sent in the post) a covering letter and information sheet (see Appendix A). The Participant information sheet gives i) details of the research process; ii) details on how to withdraw from the

¹¹⁶ A potentially significant source of bias in a questionnaire type survey is the point in the survey instrument at which a question (or set of questions) is asked – to eliminate this bias, the order of questionnaire components are varied

evaluation or to contact the research team and iii) information on storage of participant data (in line with the Data Protection Act).

Once parents and young people had read the information sheet, they were asked to give their consent to take part in the research using the consent form (see Appendix B). Only participants who consented to take part in the research, and whose parents also agreed, were accepted onto the study and were then given a questionnaire. The questionnaire was designed to be anonymous with no personal data collected.

Ethical approval for the research was given by the Science and Engineering Faculty Ethics Committee at the University of Essex, which reviewed and approved the research.

4.4 Sampling strategy

4.4.1 Participants

Many children go to RSPB reserves with their families or with their local Wildlife Explorers clubs¹¹⁷ and other children aged between 8 and 12 visit RSPB reserves as part of a school visit to a field teaching site. Therefore, in order to access 70 children between 8 and 12, the majority of participants who took part in this study were at an RSPB reserve as part of a school visit during the week and others were there as part of a Wildlife Explorer club on a weekend. Another smaller group of children, who were not visiting an RSPB site, took part in the pilot study in order to act as a 'control' group. These children were taking part in normal indoor school activities as part of their school day. In all, 5 groups of children took part in the pilot study: 3 school visits to RSPB field teaching sites; 1 Wildlife Explorers club; and 1 classroom-based group.

4.4.2 Sites

The 3 school visits took place at Rainham Marshes, Essex; the Wildlife Explorers club at Boxmoor Trust Estate, Hertfordshire; and the classroom based group at Woolenwick Junior School, Stevenage.

Rainham Marshes¹¹⁸

Rainham Marshes is one of very few ancient landscapes remaining in London and is also one of the few ancient grassland and grazing marshes in the UK. Since acquiring the site in 2000 the RSPB has transformed Rainham both into an important place for nature and for people to visit. There is a visitor centre, with huge picture-windows that look out across the marshes, a shop and café, a wildlife garden and a children's adventure play area at the site. The variety of wildlife and habitats at Rainham provide opportunities for all types of field study and with the innovative and sustainable Environment and Education Centre and dedicated education areas, the marshes provide a 'living classroom', a safe and inspiring environment for children to get close to nature. Rainham Marshes has been externally verified as providing outstanding teaching and learning experiences and managing safety effectively via the LOTC Quality Badge scheme¹¹⁹

Box Moor Trust¹²⁰

The Box Moor Trust is a registered charity which was founded in 1594 to administer the land and properties of the Boxmoor Estate for the benefit of the inhabitants of Hemel Hempstead and Bovington. The Trust's holdings have many unique features, one of the most important being the only remaining area of old sheep-grazed chalk downland in Hertfordshire. Box Moor Birds RSPB Wildlife Explorers is the local junior group of the RSPB, supported by the Box Moor Trust and which meets every month at the Box Moor Estate.

¹¹⁷ Wildlife Explorers are junior RSPB membership clubs for children up to the age of 12 or Phoenix Clubs for those over 13. The aim of these groups is to motivate and educate young people to enjoy wildlife and the countryside so that they understand the importance of preserving the natural environment for future generations.

¹¹⁸ Source: http://www.rspb.org.uk/livingclassrooms/rainham_marshes.aspx

¹¹⁹ http://www.rspb.org.uk/Images/rainham_qb_tcm9-286163.pdf

¹²⁰ Source: RSPB website 2012 <http://www.rspb.org.uk/localgroups/details.aspx?id=117> and <http://www.boxmoortrust.org.uk/l-a-d/rspb-wildlife-explorers.html>

It is for children between the ages of 8 and 11 years, who are interested in nature and wildlife. The aim of the group is to motivate and educate young people to enjoy wildlife and the countryside so that they understand the importance of preserving the natural environment for future generations.

Woolenwick Junior School¹²¹

Woolenwick Junior School was opened in 1974 and is situated in the Symonds Green area of Stevenage, Hertfordshire. The school accommodates 240 children in 8 classes and around the school in addition to the playing field there are two playgrounds, play equipment, a small seating area and a range of woodland, hedgerow and wetland for environmental studies.

4.5 Questionnaires

4.5.1 For young people

A composite questionnaire containing all 3 connection to nature measures was developed by the University of Essex for children participating in the pilot study. Questionnaires were specifically designed to be easily understood, not be too daunting or time-consuming to complete and did not take up more than 1 sheet of A3 paper.

In order to avoid ordering bias, the composite questionnaires were available with the 3 outcome measures in different orders. In addition, to explore the possibility that children aged between 8 and 12 may find it easier to understand and answer likert scales with the addition of visual aids such as 'smileys', both the NR-6 and the CNI connection to nature measures were available in 2 formats, either with or without 'smileys'. The questionnaires used in this study can be found in Appendix C (without smileys) and Appendix D (with smileys).

Participants were asked to complete the questionnaires individually (unless assistance from a helper was required) and not to compare or discuss their answers with other children. Children taking part were asked to fill out questionnaires after participating in their outdoor activities unless they were in the indoor control group.

4.5.2 For staff and school helpers

A questionnaire was also developed for RSPB staff and teachers and teaching support staff accompanying the children. In this questionnaire, staff were asked i) to rate how easy they felt each connection to nature measure was for the children to complete on a scale of 1-10; and ii) to give comments on each of the measures (See Appendix E).

4.5.3 Questionnaire Coversheet

University of Essex or RSPB staff also completed a questionnaire coversheet which recorded various aspects of the day that could have an overly negative or positive effect on the visit such as the weather, duration of visit and type of activities etc (again see Appendix E). All questionnaires and coversheets were then collated and sent to the University of Essex for independent analysis.

¹²¹ For more information about Woolenwick Junior School see: <http://www.woolenwickjm.herts.sch.uk/index.htm>

4.6 Connection to nature measures

Several questionnaires have been developed to measure how connected an individual feels to nature (see section 2.5). Some of these outcome measures have been designed for use with adults, some of these have been adapted for use with children and others have been developed specifically for use with children. The 3 outcome measures originally considered for this pilot study were the Nature Relatedness scale (shorter 6-item form), the Connection to Nature Scale¹²² (short form) and the Children's Affective Attitude to Nature scale. However in a pre-pilot test of the questionnaire, the Connection to Nature scale was found to be difficult for a group of children (12-13 year olds) to understand and complete, leading to concerns that younger children would struggle with it. The 1-item Inclusion of Nature in Self scale was therefore substituted. Details of the 3 connection measures used in this study can be found in the following sections (4.6.1 – 4.6.3)

There are no formal, published 'norms' for any of the 3 connection measures, particularly from children, so norm scores were either obtained where possible from the correspondence with the authors or from mean scores in the original studies.

4.6.1 Nature Relatedness scale - short form (NR-6)

Nature relatedness scale

Nature relatedness describes individual levels of connectedness with the natural world and comprises the cognitive, affective, and physical connection we have with nature¹²³. The Nature Relatedness Scale is a relatively recent scale (2008) designed to measure an individual's level of connectedness with the natural world and is considered a trait measure. The original, full scale consists of 21 items rated on a 5-point Likert scale, from 1 (disagree strongly) to 5 (agree strongly). Respondents are asked to respond as they "*really feel, rather than how [they] think 'most people' feel.*" Items 2, 3, 10, 11, 13, 14, 15, and 18 are reverse scored. A total nature relatedness scale score is created by adding the total score and dividing by 21. Scores range from 1 to 5, with a high score endorsing a cognitive, affective, and physical connection with nature. In the original study the population used to test the measure consisted of Canadian psychology students and Canadian executives from the federal government and private sector.

The Nature Relatedness Scale also has 3 subscales (Self, Perspective, and Experience). A subscale score can be created for each subscale by averaging the items within that subscale. Scores again range from 1 to 5, with high scores endorsing the subscale. The Self subscale measures "*an internalized identification with nature, reflecting feelings and thoughts about one's personal connection to nature*"; the Perspective subscale measures "*an external, nature-related worldview, a sense of agency concerning individual human actions and their impact on all living things*"; and the Experience subscale measures "*a physical familiarity with the natural world and the level of comfort with and desire to be out in nature.*"¹²⁴

The internal reliability of the Nature Relatedness Scale using Cronbach's alpha in the original paper was .87 and for the subscales: Self = .84; Perspective = .66; and Experience = .80. Test-retest analysis was also conducted over a 6- to 8-week period and was $r = .85$. The subscales also showed good test-retest reliability (Self: $r = .81$, Perspective: $r = .65$; and Experience: $r = .85$)¹²⁵.

Short form nature relatedness scale – NR-6

There is also a short form of the Nature Relatedness Scale made up of 6 items from the original 21 items. The purpose of this scale is to measure how connected an individual feels to nature but in a shorter way with fewer questions and no sub-scales. This scale also shows good reliability, $\alpha = .87$ (students $\alpha = .89$,

¹²² Mayer and Frantz 2004

¹²³ Nisbet et al. 2009, 2011

¹²⁴ Nisbet et al. 2009

¹²⁵ Nisbet et al. 2009

community $\alpha = .85$) and test-retest stability six months later, $r = .88^{126}$. The short form NR-6 scale displays a similar pattern of correlations with subjective well-being and environmental variables as the full 21-item scale¹²⁷. The population in the original study using this NR-6 measure were Canadian psychology students and adults from all over the world recruited into an online survey. Four items assess 'self' and two items capture 'experience'. A version of this short form Nature relatedness scale, with the wording slightly adapted for children¹²⁸ was used in this study.

4.6.2 Connection to Nature Index (CNI)

The Connection to Nature Index is a 4-factor designed for 8-10 year olds which looks at children's feelings when in nature, their perception of the human–nature relationship, and their concern for plants and animals. One of the intended uses for this instrument is for program evaluation (particularly for long-term programs¹²⁹) and is a trait measure. The four dimensions within the children's connection to nature index are i) enjoyment of nature, ii) empathy for creatures, iii) sense of oneness and iv) sense of responsibility¹³⁰. The scale consists of 16 items rated on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree) and is scored by creating a mean of the 16 items, with scores ranging from one to five, with higher scores indicating a stronger connectedness to nature than lower scores. The internal reliability of the CNI using Cronbach's alpha in the original paper was $\alpha = .87$.

4.6.3 Inclusion of Nature in Self scale (INS)

The Inclusion of Nature with Self is a single-item question, designed to measure the extent that individuals include nature as part of their identity. The INS adopts the same format as the Inclusion of Other in Self measure¹³¹ and asks participants to rate their connectedness to nature by choosing one of seven pairs of circles that differ in their degree of overlap – the pair that best describes their relationship with the natural environment. In each pair, one of the circles is labelled 'self' and the other circle is labelled 'nature'. Individuals who are very connected to nature choose the pair of circles that completely overlap (scored as a 7) while individuals who are not connected to nature choose circles that are non-overlapping (scored as a 1), this scores can range from 1 to 7. The population in the original study consisted of U.S. undergraduate students. The test shows good reliability with test-retest¹³² after 1 week ($r = 0.9$).

As this is a single-item scale, internal validity cannot be measured using Cronbach's alpha but Schultz (2001) examined the validity of the INS scale by examining correlations with other measures. INS was found to be significantly correlated with subscales of the Environmental Motives Scale, Biospheric concern, ($r = .31$, $p < .01$) and Altruistic concern, ($r = .18$, $p < .05$). In addition, INS was significantly correlated to the New Ecological Paradigm Revised Scale, ($r = .20$, $p < .01$) and the Interpersonal Reactivity Index subscale Perspective Taking ($r = .30$, $p < .01^{133}$). This question can be used as either a state or a trait measure (there are two different wordings¹³⁴).

In this study, we adapted the INS slightly for use with children in 2 ways: i) the circles were labelled 'me' and 'nature' rather than 'self' and 'nature' and ii) instead of 7 pairs of circles there were only 5, enabling scores to range from 1-5 (in line with the other 2 measures we used).

¹²⁶ Nisbet et al 2009, Nisbet and Zelinski 2011a, 2011b and Zelinski and Nisbet 2012

¹²⁷ Nisbet & Zelinski, 2011a

¹²⁸ As provided by the author of the scale and shown in Appendices C and D

¹²⁹ Cheng 2008

¹³⁰ Cheng 2008; Cheng and Monroe 2010

¹³¹ Aron et al. 1992

¹³² Schultz 2001

¹³³ Schultz 2004

¹³⁴ Schultz 2002

4.6.4 Other aspects of the questionnaire

In addition to the 3 connection to nature measures, the questionnaires also included questions on age and gender. For each of the nature connection measures, children were also asked “*Was there anything about these this question that you did not understand*” – and were asked to put a circle around anything they did not understand. If assistance was given or if a helper had to explain a particular question it was also marked on the questionnaire with a circle around it. Finally, the children were asked which section that they liked best or found the easiest to understand.

4.7 Statistical analyses

Questionnaires were inputted and stored electronically on databases using SPSS/ PASW 18.0 to assist in manipulating data, detecting inconsistencies and statistically analysing the results.

4.7.1 Reliability of the measures

Measures such as the connection to nature measures used in this study can be tested for statistical reliability in a number of ways including the two most commonly used:

- Test-retest reliability - which “*reflects the extent to which similar scores are obtained when the scale is administered on different occasions [to the same participants] separated by a relatively brief interval*”¹³⁵ and
- Internal consistency – which “*assesses the consistency of results across items within a test*”¹³⁶

As this study involved a fieldtest at one moment in time, a test-retest was not performed, however the test re-test reliability of the NR-6 and INS measures in their original development were shown to be high (see 4.6). Test re-test correlations were not reported for CNI.

As the reliability of scales (such as NR-6 and CNI) can vary depending on the population sampled, the results for each of the scales in this study were checked for reliability and compared to the data for the original scales. Cronbach’s alpha coefficient was used to assess the internal consistency of both the Connection to Nature Index and the short form Nature Relatedness Scale. Coefficients can range from 0 to 1; a coefficient of 0.70 is considered acceptable for newly developed scales while 0.80 or higher is preferred and indicates that the items may be used interchangeably¹³⁷. In addition, all scale items (individual questions on the scale) should have a correlation of between 0.30 and 0.70 with the total score¹³⁸ (using the corrected item-total correlations value).

Cronbach’s alpha however is sensitive to the number of items in the scale and so for scales that have fewer than 10 items it is considered more appropriate to report the mean inter-item correlation for the items¹³⁹, which should be within the optimal range of 0.2 to 0.4¹⁴⁰. Therefore in this study, for scales and subscales with fewer than 10 items (NR-6, CNI subscales) inter-item correlations are also given.

4.7.2 Comparisons and correlations

All data measures were tested, where appropriate, for normality (Kolmogorov–Smirnov test), homogeneity of variance (Levene’s Test of Homogeneity) and sphericity (Mauchly’s Test of Sphericity). Descriptive statistics were also obtained for each measure. Statistical significance was set at $p < 0.05$. Analyses used

¹³⁵ McCrae et al 2011, pg 28

¹³⁶ See: <http://www.socialresearchmethods.net/kb/reltypes.php>

¹³⁷ Nunnally and Bernstein 1994; Lance, Butts and Michels 2006; Pallant 2007

¹³⁸ Ferketich 1991, Nunnally and Bernstein 1994, Pallant 2007

¹³⁹ Pallant 2007

¹⁴⁰ Briggs and Cheek 1986, DeVellis 2003, Pallant 2007, and <http://how2stats.blogspot.co.uk/2011/09/internal-consistency-reliability.html>

parametric techniques including one-way analysis of variance (ANOVA) – both between-subjects to compare groups; and within-subjects to compare measures; multivariate analysis of variance (MANOVA) and Pearson product-moment correlation coefficient tests.

A series of one-way MANOVAs were conducted on nature connection measure scores to see if there were any differences between different sites or different visits¹⁴¹. No significant differences were observed so data from all visits were analysed as one group. Differences in the connection to nature scores due to factors such as age, gender, format and order of questionnaire were also examined and means compared for each factor using either a one-way MANOVA or a one-way between-subject ANOVA (with post hoc Tukey comparisons where appropriate). In addition a one-way within-subjects (or repeated measures) ANOVA (with post-hoc Bonferroni analysis) was carried out to compare an individual's scores on all 3 measures. Finally to evaluate relationships between the 3 measures of connection to nature, a series of Pearson product-moment correlation coefficients were conducted.

Each of the 3 connection to nature measures included in this study give a value of between 1 and 5 for connection to nature with a score of 1 representing 'not very connected' and 5 being 'very connected to nature'. Scores of 1-2 indicate the lowest connection to nature (i.e. 'disconnected'), scores of 3 indicate neither low nor high connection (i.e. neutral) and scores of 4-5 indicate a higher level of connection (i.e. connected). To ease understanding and comparison in this study proportions of participants who scored 3 and below - 'not connected' and who scored above 3 - 'connected' are reported in addition to mean scores.

¹⁴¹ MANOVA was chosen as all three connection to nature variables were related (see correlations section 6.2.2)

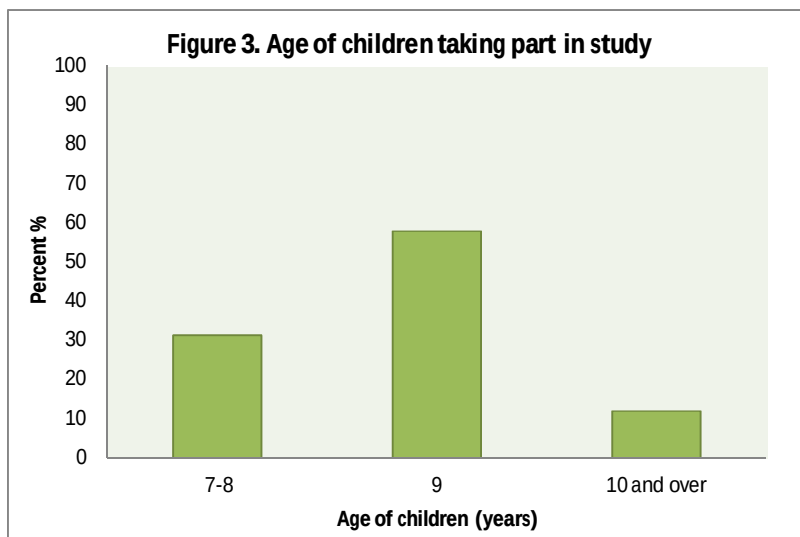
5 Results: Analysis of data from the study population

This chapter contains: details about the study population and the evaluated visits; an analysis of the connection to nature levels of the participants; and an examination of whether connection to nature varied depending on a number of variables such as - age; gender; location; order and format of measures within the composite questionnaire.

5.1 About the participants

5.1.1 Young people

In total, 76 children took part in the research, of which 47% were boys and 53% were girls. Ages of the children ranged between 7 and 13 years, although the majority were below 10 years old (see Figure 3). The average age (mean) was 8.8 years (± 0.12).



5.2 About the evaluated visits

The 5 evaluated sessions for the research took place during July 2012 at 3 different locations. Three of the evaluated sessions (consisting of the majority of the children) were school visits which took place during the week at the 'Living Classroom' at the RSPB Rainham Marshes reserve. One session was with the Box Moor Birds RSPB Wildlife Explorers group, which took place on a Saturday at the Box Moor Estate. Finally one session to represent a 'control' group, took place at Woolenwick Junior School, Stevenage.

5.2.1 Length of sessions

All of the outdoor sessions lasted for approximately 2 hours

5.2.2 Activities for visitors

Activities undertaken on the outdoor sessions included: pond dipping, mini-beast hunting, grassland net sweeping, bird watching, food chains and life cycles, biotic index, walk to identify plants, animals and birds, reptile habitat hunting. The 'control' session consisted of children undertaking usual day-to-day indoor classroom activities.

5.3 Connection to nature findings

As previously highlighted, each of the connection to nature measures included in this study gives a value of between 1 and 5 for connection to nature. Mean connection to nature scores for each measure and proportions of participants who are 'not connected' (who scored 3 and below) and who are 'connected' (scored above 3) are reported.

One of the measures, the CNI, also has four subscales: enjoyment of nature; empathy for creatures; sense of oneness; and sense of responsibility; each of which can also have a score of between 1 and 5.

In the current study, all of the connection to nature measures yielded mean scores of above 3, with the NR-6 and CNI giving values above 4, implying that the children were reasonably well connected to nature. Mean connection to nature scores for all 3 measures can be seen in Figure 4 and connection to nature findings for each measure are outlined in sections 5.3.1 to 5.3.3.

5.3.1 NR-6

The nature relatedness scores for children in this study ranged from 2.17 to 5, with 91% scoring 3.01 or higher. The mean score was 4.08 ± 0.59 , implying that the children in the study were quite highly connected to nature.

In terms of how these scores compare with the norms, there are no norms for children so our mean scores can only be compared with mean scores from all the other studies which used NR-6 in adults¹⁴² – a mean score of 3.30^{143} . Although the two populations may not directly comparable, the children participating in this study appear to have higher levels of connection than the average adult.

5.3.2 CNI

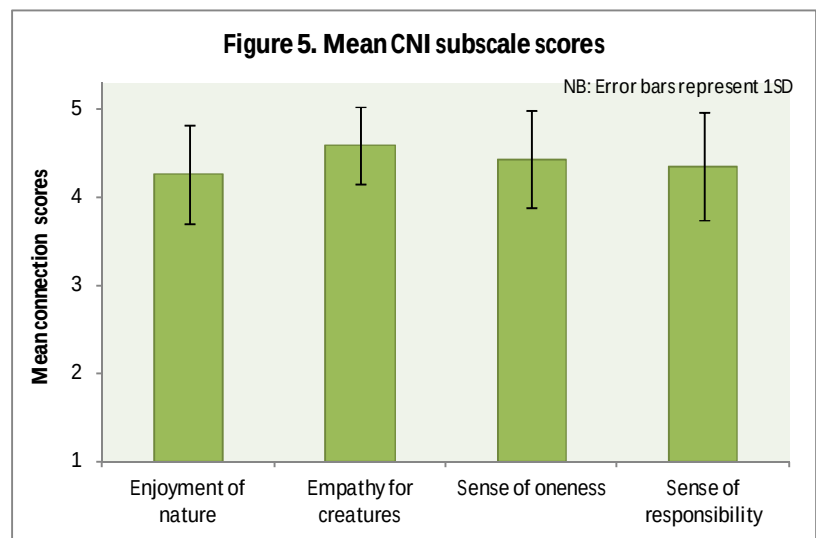
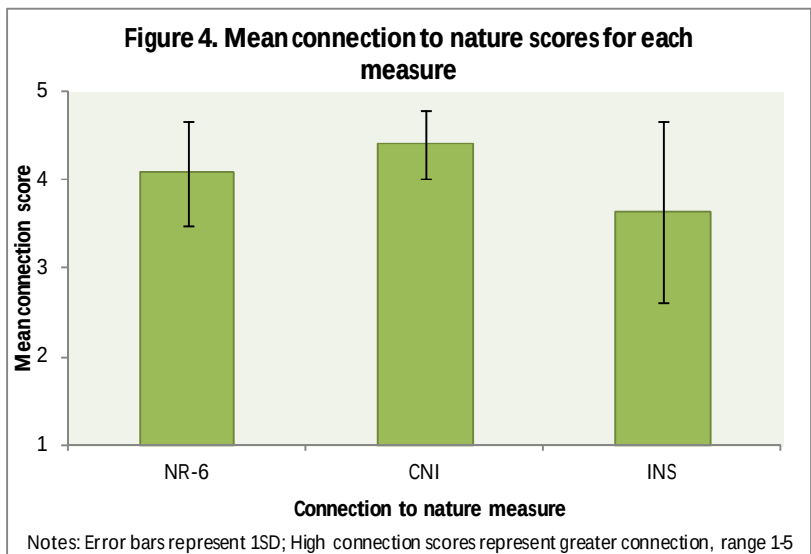
Overall connection to nature

The Connection to Nature Index scores for young people in this study ranged from 3.44 to 5, with all participants scoring above 3.00. The mean score was $4.41 \pm .39$, indicating children had a high level of connection to nature.

Again there are no formal, published 'norms' for the CNI, and no mean scores reported in the original paper, but in a recent study of 8-12 year olds in the US¹⁴⁴ the mean score (for the treatment group and for control group combined) was 3.92. The children participating in this study appear to have higher levels of connection to nature than those of a similar group of children in the US.

Subscales

Mean subscale scores varied from 4.26 to 4.59 (see figure 5).



¹⁴² Nisbet 2013 – pers. comm.

¹⁴³ For studies using the full version of the NR scale means of 3.39 - (from adults) and 4.54 - (from adults working in environmental education) were reported.

¹⁴⁴ Ernst and Theimer 2011

- Enjoyment of nature scores ranged from 2.71 to 5, with a mean of $4.26 \pm .56$ (95% scoring above 3.00)
- Empathy for creatures scores ranged from 3.5 to 5, with a mean of $4.59 \pm .44$ (100% scoring above 3.00)
- Sense of oneness scores ranged from 2.67 to 5, with a mean of $4.43 \pm .55$ (96% scoring above 3.00) and
- Sense of responsibility scores ranged from 2.67 to 5, with a mean of $M=4.35 \pm .62$ (94% scoring above 3.00)

For the children in our study all the CNI subscale factor scores were quite high (over 4) with 'empathy for creatures' scoring highest.

5.3.3 INS

The inclusion of nature in self scores for children in this study ranged from 1 to 5, with 53% of participants scoring above 3. The mean INS score was 3.64 ± 1.03 indicating a moderate level of connection to nature. There are no formal, published 'norms' for INS and as the scale was adjusted from a 1-7 scale to a 1-5 scale in this study, means from other studies (if available) would not be comparable.

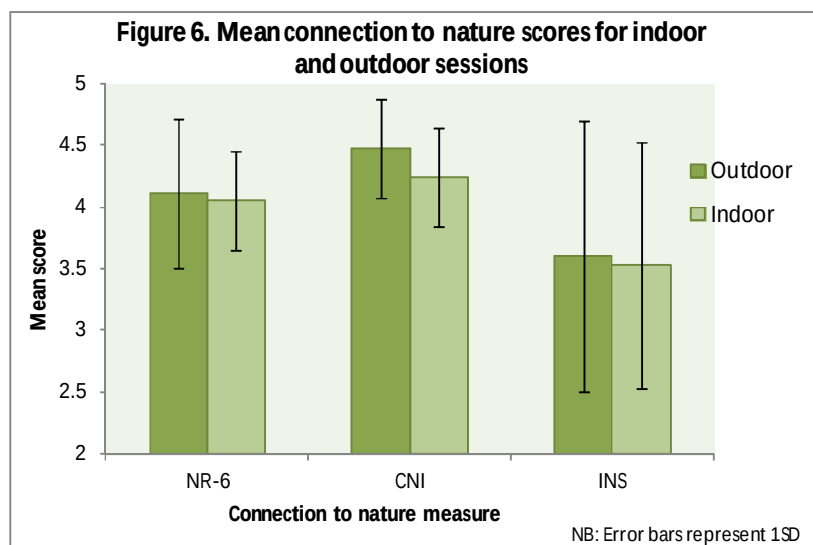
5.4 Effect of session location, questionnaire format and participant characteristics

In order to determine if children's connection to nature varied depending on a number of variables such as – age, gender, location; order and format of measures within the composite questionnaire a number of comparisons were conducted.

5.4.1 Location of visit

Although there were some small differences between scores for the 3 outcome measures between the 3 outdoor session locations, these differences were not found to be statistically significant. A one-way MANOVA was run to determine if there were any difference in the mean connection to nature scores (from all 3 measures) between the session sites and the mean scores were not found to be statistically significantly different between the 3 locations¹⁴⁵ ($p = .1$).

Although this was not designed as an indoor versus outdoor study, a comparison was carried out to see if there were any differences between children taking part in outdoor sessions and the group who had no contact with nature and remained inside for that day. Initial examination of the data suggested that for all 3 connection to nature measures mean scores were slightly higher for those children who had taken part in the outdoor sessions when compared to those who had been inside at school (see Figure 6). However a one-way MANOVA was



¹⁴⁵ $F(6, 108) = 1.807, p = .104$, Wilks' $\Lambda = .826$; partial $\eta^2 = .091$

run for the 3 outcome measures and the mean scores were not found to be statistically significantly different¹⁴⁶ between the indoor and outdoor sessions ($p = .4$).

5.4.2 Questionnaire format

Both the NR-6 and the CNI connection to nature measures were available in 2 formats, with or without 'smileys'. 57% of children in the study completed the questionnaires without smileys and 43% completed those with smileys. In order to determine whether questionnaires with or without 'smileys' resulted in different connection to nature scores, a one-way MANOVA was performed on the 3 outcome measures for the different formats. No significant differences were found¹⁴⁷ in either of the outcome measures or subscales ($p = .2$), which suggests that children's mean connection to nature scores are not affected by the two different formats (either with or without the smiley faces).

5.4.3 Questionnaire order

In order to avoid ordering bias, the composite questionnaires were also available with the 3 outcome measures in different orders¹⁴⁸. 60% of children completed a questionnaire where NR-6 was the first question and 40% where INS was the first question. So in order to determine whether the order of the 3 individual questionnaire elements on the composite questionnaire altered the results, a one-way MANOVA was performed on the connection to nature scores for each order of questionnaire. Again no significant differences were found¹⁴⁹ in any of the outcome measures ($p = .2$), which suggests that the two different order formats of the questionnaire did not affect results.

5.4.4 Age

Similarly, to see if the age of the children affected connection to nature scores for the 3 measures, a one-way ANOVA was run to determine if there were any difference in the mean connection to nature scores (from all 3 measures) between age groups. The mean scores were not statistically significantly different (p values ranged from .06 to .39) between the either the 3 age groups (7-8, 9, 10 and over) or between the age in years (7, 8, 9, 10, 11, 12, 13)¹⁵⁰.

To assess whether there was a relationship between connection to nature scores and the age of the children, i.e. whether connection increased or decreased with age, series of Pearson product-moment correlation coefficients were conducted for each measure¹⁵¹. However, the results were not significant (p values ranged from .40 to .87 and all r values were less than 0.1) suggesting no relationships between age and connection to nature in this study.

5.4.5 Gender

In order to determine whether participant gender affected children's connection to nature scores, a one-way MANOVA was performed on each of the connection measures for girls and boys. No significant differences were found¹⁵² in any of the outcome measures ($p = .3$), which suggests that connection to nature in this study was also not affected by gender.

¹⁴⁶ $F(3, 55) = 1.035, p = .384$, Wilks' $\Lambda = .947$; partial $\eta^2 = .053$

¹⁴⁷ $F(3, 55) = 1.657, p = .221$, Wilks' $\Lambda = .917$; partial $\eta^2 = .083$

¹⁴⁸ 2 different orders of questionnaires (with a total of 4 different formats) rather than 3 were used as it was felt that having 3 different orders and 2 different formats (creating a total of 6 different questionnaire formats) would make field administration overly onerous

¹⁴⁹ $F(9, 129) = 1.327, p = .221$, Wilks' $\Lambda = .806$; partial $\eta^2 = .069$

¹⁵⁰ A series of one-way ANOVAS were conducted here as assumptions/ criteria for MANOVA were not met

¹⁵¹ Preliminary analyses were performed to ensure no violation of normality, linearity and homoscedasticity

¹⁵² $F(3, 55) = 1.302, p = .283$, Wilks' $\Lambda = .934$; partial $\eta^2 = .066$

5.4.6 Outcome

The connection to nature scores from the 3 measures: NR-6, CNI and INS in this study were not found to be significantly affected by variables such as session location; the order and format of questionnaires; and the age or gender of children taking part. As a result, data in this research were analysed as one group.

5.5 Comments from children and staff

At the end of the composite questionnaire there was an opportunity for children to tell us anything about the questionnaire itself, their experience or nature and a number of comments were received. These comments can be seen in Box 1.

Box 1. Comments from children

About the questionnaire:

"Could you do one on birds?"

"In some questions I think a box that says 'depends' would be useful"

"I found it interesting to fill this in"

"Some of the questions in the questionnaire didn't really make sense like: 'my feelings about nature and earth are part of my soul.'"

"Section B I thought was in grown-up language by that I mean 'following statements' and 'relevant'"

"I enjoyed these questions. Thanks a lot."

"I liked this questionnaire because nature is epic. P.S. thanks a lot."

"I think it was a good questionnaire because it let me say it"

About the day's experience:

"I found a damselfly nymph when we were pond dipping"

"Your ponds are growing bigger each time it rains"

"I like the pond, how many fish are in it"

About nature:

"I am very friendly with nature and it helps our environment"

"I feel that it is not good to rubbish on the ground, if an animal eats it, it would die."

"I don't think people should destroy nature. I think it should be left alone for animals to go where they want without fences not allowing them to roam freely."

"I like nature"

"I like animals"

There was also opportunity for RSPB staff, school teachers and helpers to make any additional comments if they wished at the end of the observer questionnaire. These comments can be found in Box 2.

Box 2. Additional comments about the questionnaire process from RSPB staff, school teachers and helpers

"Kids were very enthusiastic about it"

"Bulk of children asked to fill out the questionnaire before they had eaten and were more distracted than the few asked after eating. - One boy did not complete it all as it was 'boring and like school!'"

"The questionnaire took 5 mins to fill out for smileys, 10 for normal"

"Boys required more help than girls"

"Help of teachers appreciated and often needed, but at times perhaps led the children too much in helping?"

"Kids liked the smiley faces"

5.6 Study population analysis: Key Findings

- In total, 76 children took part in the research, of which 47% were boys and 53% were girls. Ages of the children ranged between 7 and 13 years, although the majority were below 10 years old.
- In this study, all of the children's connection to nature measures yielded mean scores of above 3, with the NR-6 and CNI giving mean values above 4, implying that the children were reasonably well connected to nature.
- Using the NR-6, the children participating in this study appear to have higher levels of connection than the average adult (although the two populations may not directly comparable).
- The children participating in this study appear to have higher levels of connection to nature, when measured by CNI, than those of a similar group of children in the US.
- The data suggested that for all 3 connection to nature measures mean scores were slightly higher for those children who had completed questionnaires after they had taken part in outdoor sessions when compared to those who had been inside at school - however this finding was not statistically significant.
- The connection to nature scores from the 3 measures: NR-6, CNI and INS in this study were not found to be significantly affected by variables such as session location; the order and format of questionnaires; and the age or gender of children taking part. As a result, data in this research were analysed as one group.

6 Results: How the 3 measures used in the study performed

The examination of how the 3 measures performed with the study population in terms of i) statistical reliability; ii) inter-scale comparisons and correlations; and iii) ease of understanding and practicality of administration is highlighted in the following sections.

6.1 Statistical reliability

Cronbach's alpha coefficient was used to assess the internal consistency of both the Connection to Nature Index and the short form Nature Relatedness Scale and values were then compared with the original scales. As previously mentioned, Cronbach's alpha coefficients range from 0 to 1; a coefficient of 0.70 is considered acceptable, while 0.80 or higher is preferred. In addition, all scale items (individual questions on the scale) should have a correlation of between 0.30 and 0.70 with the total score¹⁵³ (using the corrected item-total correlations value). For scales that have fewer than 10 items (the NR-6 and CNI subscales) the mean inter-item correlation for the items was reported, which should be within the optimal range of 0.2 to 0.4.

6.1.1 NR-6 reliability

Both the full version and the short form versions of the NR scale have previously been demonstrated to have a Cronbach's alpha coefficient of 0.87 (see section 4.6.1). In this study the Cronbach's alpha score was 0.77, which although falls within the acceptable range, is lower than in the original study and does not fall into the preferable range. Corrected item-total correlations values were between 0.41 to 0.62 and inter-item correlations ranged from 0.21 to 0.41. The NR-6 was therefore shown to have acceptable internal consistency in this study.

6.1.2 CNI reliability

The Connection to Nature Index has also previously been demonstrated to have a Cronbach's alpha coefficient of 0.87 (see section 4.6.2). In this study the Cronbach's alpha score was 0.82, which falls in the preferred range, and is only slightly lower than in the original study. Corrected item-total correlations values were within 0.3 to 0.63 except for one item: "*people cannot live without plants and animals*". However this one item did not adversely affect the Cronbach's alpha for the scale as a whole. The CNI was therefore shown to be reliable with internal consistency in this study.

The CNI subscales were also examined for reliability and as all the subscales consist of fewer than 10 questions inter-item correlations are reported:

Enjoyment of nature

The 7 item subscale of 'Enjoyment of nature' in this study had an alpha score of 0.79 which is acceptable and the inter-item correlations values were between 0.2 and 0.42. This sub-factor was therefore shown to have acceptable internal consistency in this study.

Empathy for creatures

In this study, the 4 item subscale of 'Empathy for creatures' had an alpha score of 0.67, which is not quite in the acceptable range. However as this subscale only consists of 4 items and the inter-item correlation values were in the optimum range (values were 0.2 to 0.42), this sub-factor can in fact be considered to have acceptable internal consistency in this study.

¹⁵³ Ferketich 1991, Nunnally and Bernstein 1994, Pallant, 2007

Oneness

The 3 item subscale of 'Sense of oneness' had an alpha score of 0.11 which is not within the acceptable range. Inter-item correlations values ranged from 0.1 to 0.21, which also suggest that this sub-factor did not have acceptable internal consistency in this study.

Responsibility

The 3 item subscale of 'Sense of oneness' had an alpha score was 0.5, which is not within the acceptable range but as it only consists of 3 items and the inter-item correlation values were in the optimum range (values were 0.2 to 0.37) this sub-factor can be considered to have acceptable internal consistency in this study.

6.1.3 Outcome

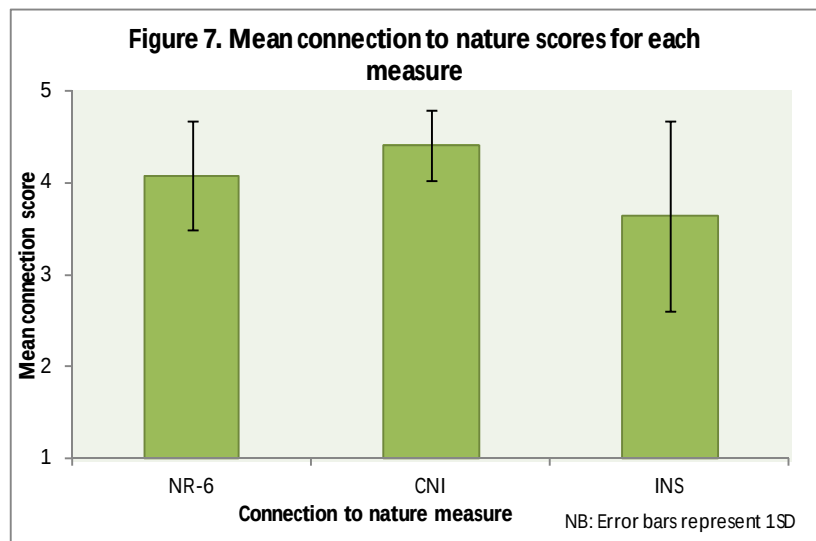
The CNI was found to have the highest internal consistency although the NR-6 did display acceptable consistency. Of the CNI subscales, 'Enjoyment', 'Empathy' and 'Responsibility' showed acceptable internal consistency ('Enjoyment' particularly so), however 'Oneness' did not. As the INS is a single-item measure, internal consistency could not be measured.

6.2 Inter-measure comparisons

6.2.1 Comparison between the 3 connection measures

In order to determine whether levels of connectedness to nature of the children in this study varied significantly depending on the measure used (i.e. did NR-6, CNI and INS produce significantly different findings from one another), the scores of the 3 connection to nature measures were compared using a within-subjects ANOVA (Figure 7). Although all the connection to nature measures gave mean scores of above 3.5, the mean scores were found to be statistically significantly different

¹⁵⁴ [Wilk's lambda .548, $F(1.33, 77.05) = 22.39$, $p < .001$].



To see where these differences lay, a Tukey post-hoc analysis was conducted and this revealed that the mean CNI score ($M=4.41 \pm .39$) was statistically slightly higher than both the mean NR-6 score ($M=4.08 \pm .59$, $p < .001$) and the mean INS score ($M=3.64 \pm 1.03$, $p < .01$); and the mean NR-6 score was also significantly higher than the INS score ($p < .001$). However examination of the partial eta squared value ($\eta^2 = 0.278$) reveals only a small effect size. All of the scales differed from each other and both the two multi-item scales (CNI and NR-6) gave statistically higher connection to nature scores than the single-item scale (INS).

¹⁵⁴ Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi^2(2) = 40.14$, $p < .001$. Therefore, a Greenhouse-Geisser correction was applied ($\epsilon = 0.664$).

6.2.2 Correlation between the 3 connection measures

To test how the 3 measures of nature connection correlate with each other, a series of Pearson product-moment correlation coefficients were also conducted¹⁵⁵. All 3 measures are designed to measure connection to nature so a positive correlation (i.e. a relationship between two variables where as one variable increases, the other variable also increases) between the measures is therefore to be expected. The strongest, positive correlation¹⁵⁶ between measures was between NR-6 and CNI¹⁵⁷ with 33% shared variance. There was also a moderate, positive correlation between NR-6 and INS¹⁵⁸ with 20% shared variance and a weak, positive correlation between INS and CNI¹⁵⁹ but it was not found to be statistically significant.

As it would be expected, the full CNI correlated strongly with all of its 4 subfactors in this study (most strongly with 'enjoyment'). The NR-6 also correlated well with all the CNI subfactors (again most strongly with 'enjoyment'). The subfactors of 'enjoyment' and 'empathy' correlated with INS even though the correlation with the full CNI was not significant. All the correlations are shown in Table 1.

Table 1. Correlation matrix for study connection to nature measures and CNI subfactors

	NR-6	CNI	CNI enjoyment	CNI empathy	CNI oneness	CNI responsibility	INS
NR-6	1						
CNI	.571**	1					
CNI enjoyment	.637**	.857**	1				
CNI empathy	.427**	.574**	.429**	1			
CNI oneness	.393**	.749**	.572**	.232	1		
CNI responsibility	.404**	.708**	.504**	.433**	.504**	1	
INS	.448**	.155	.276*	.243*	.175	.064	1

Notes: *r* values are reported. **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

6.3 Ease of understanding and completion

In order to assess the ease of understanding and completion for each connection measure used in the study, the young people and accompanying staff or helpers were asked a number of additional questions. These included: whether there was anything about each of the measures that they did not understand and which questionnaire they preferred or found the easiest to complete. Finally children were asked to give any additional comments on the questionnaires if they wished. RSPB staff, teachers and teaching support staff who accompanied the children were also asked i) in their opinion to rate how easy they felt each connection to nature measure was for the children to complete on a scale of 1-10; and ii) to give comments on each of the measures based on the experiences of the children participating in the session.

6.3.1 Aspects of the 3 measures that children did not understand

Children were asked to circle any parts of each the 3 measures in the composite questionnaires that they did not understand. In addition, University of Essex and RSPB staff, teachers and school helpers were also asked to circle any parts of a questionnaire that they had needed to explain to a child.

¹⁵⁵ Preliminary analyses were performed to ensure no violation of normality, linearity and homoscedasticity.

¹⁵⁶ Note in statistics, a perfect positive correlation is represented by the value +1.00, 0 indicates no correlation and -1.00 indicates a perfect negative correlation.

¹⁵⁷ [*r*(60)=.571, *p*<.001]

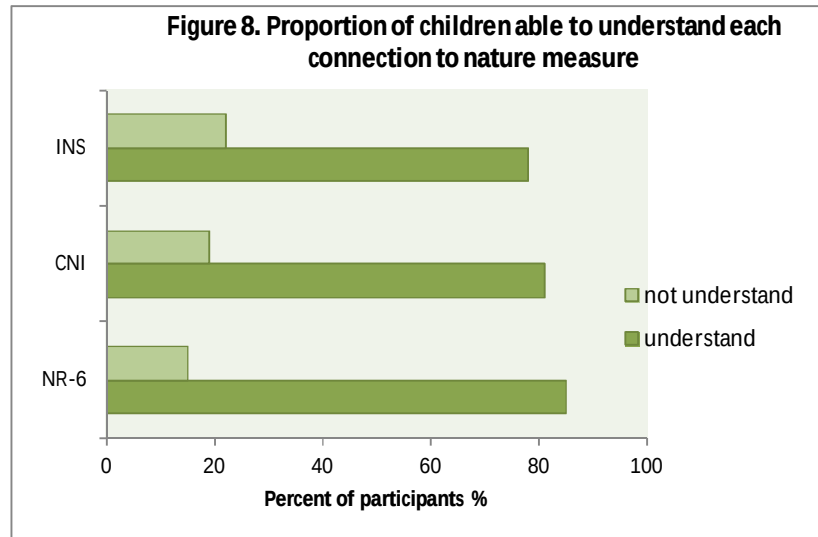
¹⁵⁸ [*r*(67)=.448, *p*<.001]

¹⁵⁹ [*r*(63)=.155 *p*=.23]

On the whole, the majority of children (78-85%) told us that they did not have a problem understanding any of the 3 connection to nature measures (see Figure 8). However, University of Essex, RSPB and teaching staff were asked more frequently to explain the INS question (28 times) than either the NR-6 (15 times) or the CNI (8 times). Specific aspects of the questionnaire that the young people did not understand are grouped by connection measure below:

Nature Relatedness short form (NR-6)

Although 86% of children said that they understood the NR-6, several children did not understand some of the wording, principally 2 questions: “*I feel very connected to all living things and the earth*”; and “*My feelings about nature and the earth are part of my soul*”. One of the older children (aged 11) told us: “*Some of the questions in the questionnaire didn't really make sense like: “my feelings about nature and earth are part of my soul”*”. This feeling was echoed by one of the teachers: “*some wording is complicated- “soul”!*”



Connection to Nature Index (CNI)

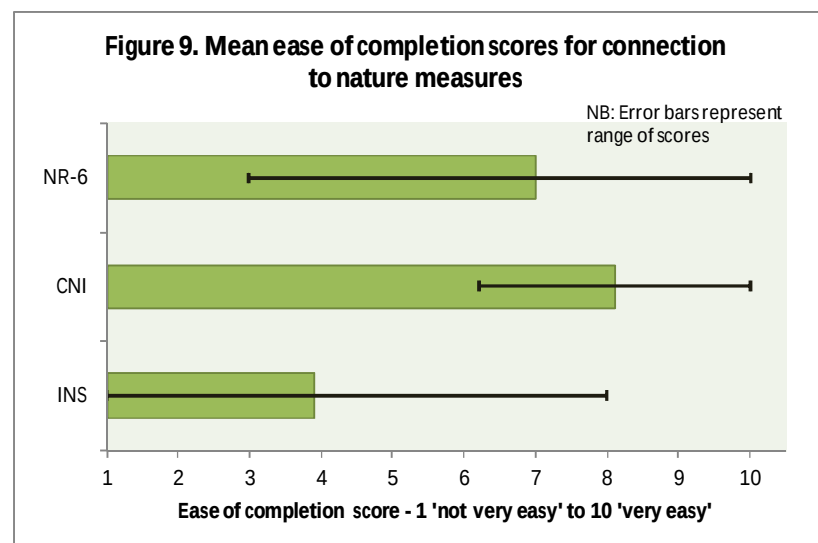
Again although 81% of the children said that they understood the CNI, 3 of the younger children had difficulty understanding 2 of the questions relating to ‘responsibility’, specifically the final statement: “*People do not have the right to change the natural environment*” and the statement: “*My actions will make the natural world different*”.

Inclusion of Nature in Self (INS)

The majority of children told us that they understood the INS but still 15 children told us they didn’t understand what they had to do in order to answer the question and staff had to explain the question to at least 28 of the children (37%) - especially to the younger children. Teachers also felt that this connection measure was difficult for the children: “*Interconnectedness? What to do? The concept is very difficult*” and “*The use of the term ‘interconnected’ and the use of the term ‘relationship with nature’- both confusing. The circles were complex*”.

6.3.2 Ease of completion

RSPB, University of Essex and teaching staff helping with the administering of questionnaires and helping to explain wording to the children if needed, were asked to score each of the 3 connection to nature measures on a scale of 1 to 10 for how easy they felt it was for the children to answer the questions, where 1 is ‘not very easy’ and 10 is ‘very easy’. Seventeen adults scored the measures for ease of completion by children and the mean



scores for each are shown in Figure 9. Overall the CNI scored the highest and the INS the lowest, of the 3 measures.

6.3.3 Children's preferred measure

Children taking part in the research were asked which connection to nature measure that they liked the best or found the easiest to complete. The clear majority of children told us that they preferred the CNI questionnaire over the other two (see Figure 10).

Although variations with age in terms of which questionnaire children found the easiest to complete were observed (see Table 2), these were not found to be statistically significant. As with the findings for the population as a whole, there was a clear preference for children aged 7-9 for the CNI. The older age group seemed to show a preference for the INS measure, but it must be noted that these differences were not found to be statistically significant and there were only 6 children in this age group who completed the question.

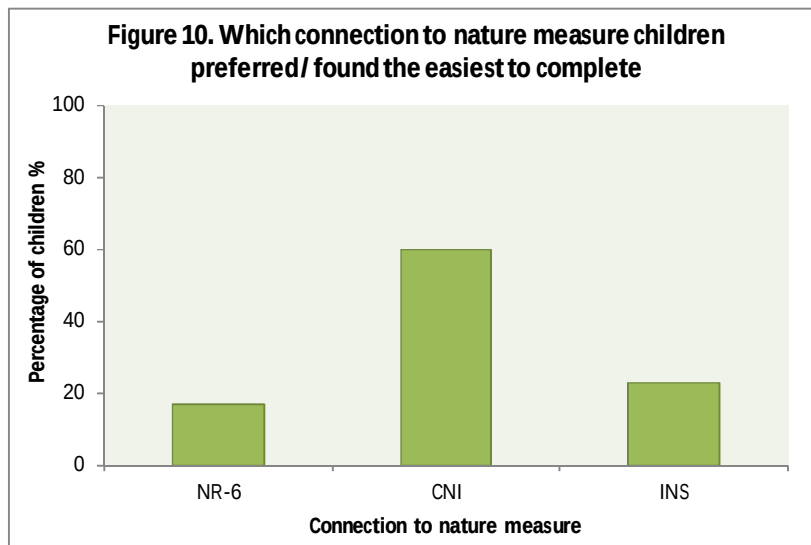


Table 2. Easiest questionnaire to complete by age group

Questionnaire	Age (in years)					
	7-8		9		10 and over*	
	No.	%	No.	%	No.	%
NR-6	3	15	7	18	1	17
CNI	12	60	25	64	2	33
INS	5	25	7	18	3	50

*Note this age group has very small numbers and may not be a true representation

6.4 Performance of connection measures: Key findings

- The examination of the performance of 3 measures with the study population was examined in terms of i) statistical reliability; ii) inter-scale comparisons and correlations; and iii) ease of understanding and practicality of administration.
- The CNI was found to have the highest internal consistency ($\alpha = .82$) although the NR-6 did display acceptable consistency ($\alpha = .77$).
- Of the CNI subscales, 'Enjoyment', 'Empathy' and 'Responsibility' showed acceptable internal consistency ('Enjoyment' particularly so – $\alpha = .79$), however 'Oneness' did not.
- As the INS is a single-item measure, internal consistency was not measured.
- All of the scales differed from each other and both the two multi-item scales (CNI and NR-6) gave statistically higher connection to nature scores than the single-item scale (INS).

- In terms of inter-measure correlations, the strongest, positive correlation was between NR-6 and CNI ($r=.57$). There was also a moderate, positive correlation between NR-6 and INS ($r=.49$) and a weak, positive correlation between INS and CNI ($r=.16$) which was not found to be statistically significant. The full CNI correlated strongly with all of its 4 subfactors (as expected), as did NR-6 moderately, with both measures most strongly correlating with 'enjoyment'. The subfactors of 'enjoyment' and 'empathy' correlated with INS even though the correlation with the full CNI was not significant
- On the whole, the majority of children (78-85%) told us that they did not have a problem understanding any of the 3 connection to nature measures however, adults were asked more frequently to explain the INS question than either the NR-6 or the CNI (8 times).
- Seventeen adults scored the 3 measures for ease of completion by children - overall the CNI scored the highest and the INS the lowest.
- Children taking part in the research were asked which connection to nature measure that they liked the best or found the easiest to complete. The clear majority of children told us that they preferred the CNI questionnaire over the other two.

7 General Discussion

7.1 Discussion of findings

7.1.1 The current study: Discussion and limitations

Although the main aim of this research was to determine the most robust and practical instrument for the RSPB to measure connection to nature in children for future research, this fieldtest of children's connection to nature instruments has produced some interesting findings from the study population. In addition, as with any type of research there were also some limitations which should be acknowledged. Firstly the study required voluntary participation, which has potential implications for external validity as participants were self-selecting and may not be fully representative of all children in this age range, however as this was primarily a field test for methods rather than an examination of connection to nature levels this is not seen as a particular issue.

In the main, the children in this study seemed to enjoy answering questions about nature and did seem to understand the affective and behavioural questions from the NR-6 and CNI questionnaires, particularly if the behavioural element referred to is 'enjoyment' of actions in nature. Although not an issue for the majority of children, some younger children appeared to struggle with the meanings of "*I think about how what I do affects the earth*" (from NR-6) and "*People do not have the right to change the natural environment*" (from CNI) which suggests that for the youngest children in particular, the concept of 'responsibility' for nature and linking this to their own actions and behaviours may not be so easy to comprehend. This finding concurs with Ernst and Theimer (2011) who highlight the lack of distinction between the nuances of what our 'connection' to nature comprises amongst children in comparison to the distinction possible for adults.

Regarding 'connection' to nature, it is more difficult to ascertain whether the children in the study fully understood the concept. Where this was asked directly: "*I feel very connected to all living things and the earth*" (NR-6) and "*How interconnected are you with nature*" (INS) it did seem to cause confusion for some of the children (albeit a minority). The questions that ask simply how the children 'feel' about nature and ask about 'enjoying', 'seeing', 'touching' and 'taking care' of nature seem to be more successful and more easily understood, which given the format of the questions in the CNI may explain why the children said they preferred this measure. The CNI subfactor of 'oneness with nature' which is designed to indirectly address the concept of 'connection' gave scores which were quite high for the children in the study at 4.43 (or 89% at one with nature), suggesting that this concept may best be approached indirectly with children. The CNI measure was also the only one in this study that was specifically designed for children aged between 8 and 10 so this finding is perhaps not surprising.

Whilst the mean connection to nature scores varied from measure to measure (INS 3.64, NR-6 4.08 and CNI 4.41) the overall mean of connection scores was just above 4, which tells us that the children in this research were quite well connected to nature (at 81% connected). Given that the majority of the young people surveyed were outdoors whilst at the end or middle of a school visit to a nature reserve this could be seen as expected, except for the fact that nature connection is considered in the literature to be more of a personality 'trait' rather than a 'state' parameter and so is not likely to change within a short space of time or between conditions. However there did appear to be a trend for lower connection scores for children who had been inside at school (our small control group) compared to those who were outside, suggesting that 'state' change may have been at work. Although this finding was not statistically significant (the results could have been affected by the small sample size of the control and the fact that children filled out questionnaires at different times - either at the end of the session or at lunchtime) it is something that would benefit from further examination in later research.

Similarly no differences in connection to nature with age were found in the present study and there was also no significant correlation between the two variables suggesting there is no link or difference with age.

However this too may have been affected by the study design in that the majority of children were 10 years or under and there were very small numbers in the older age groups in comparison.

In this study for two of the measures used (NR-6 and CNI) an alternative format with 'smileys' was included to assess whether the children found these questionnaires easier to complete. The findings suggest that there were no differences between the two formats and children could complete both, but some teachers observed that the 'smileys' questionnaires were completed in a shorter time than the regular ones. However other teachers felt that the smileys confused the children as a sad face with a teardrop did not relate to the notion of 'strongly disagree' but rather to sadness. Future research options maybe to develop visual aids such as 'smileys' which are more relevant to the likert scale of 'strongly disagree' through to 'strongly agree'.

Notwithstanding the potential limitations identified, standardised, internationally recognised questionnaires were used to collect the primary data, so their validity and reliability is already established. Data collection was obtained using a consistent a protocol as possible and therefore the findings have significant implications for the RSPB. The results can be used to inform further discussions about the evaluation of nature-based interventions and how they affect connection to nature levels in UK children.

7.1.2 Merits of each connection to nature measure

The majority of children were able to understand and successfully complete all 3 of the connection to nature measures used in this field test and all 3 instruments produced acceptable results. The merits of each measure are highlighted below, along with the researchers' recommendations for use and possible adaptations based on findings both from the literature and from the results of this study.

NR-6:

- Acceptable internal consistency and good correlation with CNI, all of the CNI subfactors and INS in this study
- Validated, increasingly widely used, norms under development, the full NR scale has subfactors and in other studies, NR-6 correlates well with the full version
- NR-6 is short, with only 6 questions
- Trait measure
- 17% of children preferred NR-6; teachers gave it a score of 7 out of 10
- Some of the wording difficult for children (especially younger kids) to understand – possibly better for use with older kids

Recommendations for use: Use with older children 12+; suggest further research to examine possible adaption of wording, especially use of word 'soul' -perhaps use adult NR-6 not the one adapted for use with children.

CNI:

- Good internal consistency and good correlations and with subfactors and with NR-6, but weak not significant relationship with INS in this study
- Validated, used in other studies, no norms as yet, contains 4 subfactors to enable more in depth investigation of connection to nature
- CNI is longer than the other 2 measures used – 16 questions
- Trait measure
- 60% of children preferred CNI; teachers gave it a score of 8 out of 10
- Less problems with understanding the wording compared to the other measures
- Good for use with target age of 8-10, worked with up to age 13 in this study

Recommendations for use: Use with children between 8 and 12; – possibly wording too 'young' for older children – suggest further research to examine adaptations for use with older children.

INS:

- Reasonable correlations with NR-6 but not with CNI (although correlated with 2 of its subfactors)
- Validated, increasingly used
- INS is short with only 1 question
- Trait or state measure
- 23% children preferred INS; teachers gave it a score of 4 out of 10
- Many children could not understand how to answer the question or the concept, without adult help – especially younger ones
- Possibly better suited to older children

Recommendations for use: Suggest further research to examine use in older children 14+; alternatively use for younger children only if the concept can be explained; use as a state measure in before and after or indoor and outdoor comparison type study.

7.1.3 **Most appropriate measure for RSPB**

In order to choose the most appropriate measure to assess connection to nature in children between the ages of 8 and 12, the 3 connection to nature measures used in this study were judged on their relative performance in terms of a number of criteria including: i) statistical reliability; ii) inter-scale comparisons and correlations; and iii) ease of understanding and practicality of administration.

In terms of statistical reliability and inter-scale comparisons and correlations all 3 of the measures performed acceptably. However out of the two trait measures, the full CNI had higher internal consistency than NR-6 and was specifically designed for use with children.

The 3 outcome measures were also judged on their relative performance with regard to practical aspects of administration: how easy children found them to understand; how many times staff had to explain various aspects of the questionnaire; how easy teachers felt it was for the children to answer the questions; and children's preferred measure. To enable choice of the most appropriate instrument, each measure has been awarded a number of points depending on its relative success for each criterion (3 for first place, 2 for second and 1 for third) and the results can be found in Table 3.

Table 3. Most appropriate connection to nature measure: scoring of practical administration criteria

Connection to nature measure	Criteria				Total scores
	Ease of understanding/ completion (children's view)	Amount of explanation by teachers/ staff	Ease of completion (teachers' view)	Children's preference	
NR-6	3	2	2	1	8
CNI	2	3	3	3	11
INS	1	1	1	2	5

Note: For each criterion, the measure that was most successful scored 3 points, the one that was next scored 2 points and the least successful scored 1 point.

Overall, in terms of ease of understanding and completion, the connection to nature measure which was found to be the most appropriate by children and staff in our study was the Children's Affective Attitude to Nature Scale (CNI).

Whilst accepting that all 3 measures performed reasonably well with the study population, taking all factors into consideration, the CNI seems to be the preferred measure; being the easiest to complete; a trait measure; with and overall score and subfactor; specifically designed and validated for use with children in the chosen age group; and is statistically reliable.

7.2 Future research

There have been very few evaluations of connection to nature levels in children, and there is to date, no baseline data of nature connection levels in either adults or children in the UK. There is also a lack of longitudinal research into connection to nature, behaviour changes and attitudes, and long-term health and wellbeing effects of this range of green education initiatives for children. The establishment of a baseline and successive long term monitoring of nature-based educational and recreational interventions for children, would provide indicators and statistics of any further or continuing changes to these parameters which, could subsequently be used to inform ideas for best practice in this field, which can be shared with other organisations in the UK and abroad.

A comparison study with similar groups of children either receiving or not receiving a green education intervention or a before and after intervention study (i.e. change in connection to nature 'state') as a result of participation in different types of nature engagement initiative, whether of a structured educational or free-play approach would also be an interesting future research direction. This could include a an examination of the range of existing RSPB initiatives such as school visits, Wildlife Explorers and Phoenix, unstructured visits and independent visits with family or friends.

Other variables which may affect nature connection levels in children that could be examined in more detail in future studies include differences in geographical location or in type of nature setting and seasonal variations for example. A larger scale survey could also investigate the relationship between connection to nature and a number of other factors such as gender, cultural identity or frequency of contact with nature. Changes to connection to nature levels with age could be scrutinised, does connection decrease with teenage years, only to re-emerge in later life as studies have suggested? It would also be interesting to assess how connection to nature is associated with environmental awareness and environmentally friendly behaviours in UK children to see if these trends vary or how they compare to other countries.

In addition it would also be useful if a similar fieldtest of connection to nature measures for adults were conducted so that a baseline could also be established for adults in the UK. Establishment of 'norms' for both adults and children, together with longer term studies tracking individuals through childhood and adulthood (i.e. along a life pathway) in the future, would help to forward research in this area.

7.3 Concluding comment

There has been increasing recognition of the need to cultivate a love of nature in our children, as they will be the future custodians of our natural places and with the love of nature comes the urge to protect it. An ever growing array of initiatives has emerged, instigated by government, land managers, conservation organisations and educators alike, as part of the drive to re-connect our children to nature. To date however there has been no robust scientific attempt to measure and track connection to nature amongst UK children and the RSPB has acknowledged this need.

In this study the RSPB and the 'Green Exercise Research Team' at the University of Essex have fieldtested and chosen a robust and practical measure of connection to nature in children aged between 8 and 12 – the Connection to Nature Index. The RSPB will now use this measure to establish a UK-wide baseline of connection to nature levels in children across the UK to allow longitudinal comparisons and to enable further assessment of the effectiveness of such re-connection initiatives. Both this study and the planned future research will add to the evidence base, help to inform the debate on children's connection to nature and shape local and national policy.

8 References

- Ainsworth M D S, Bell S M and Stayton D J. 1974. Infant-mother attachment and social development. In Richards M P M. *The Integration of a Child into a Social World*. Cambridge University Press, Cambridge
- Ainsworth M D S, Bell S M. 1970. Attachment, exploration and separation: illustrated by the behaviour of one year olds in a strange situation. *Child Development* 41 (1), 49-67
- Aron, A., Aron, E. N., & Smollan, D. 1992. Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, 63, 596-612.
- Barton J and Pretty J. 2010 What is the Best Dose of Nature and Green Exercise for Improving Mental Health? A Multi-Study Analysis. *Environ. Sci. Technol.* 44, 3947–3955
- Barton J, Hine R and Pretty J. 2009. The health benefits of walking in green space of high natural and heritage value. *Journal of Integrated Environmental Sciences* 6.4, 1-18
- Berman M C, Jonides J and Kaplan S. 2008. The cognitive benefits of interacting with nature. *Psychological Science* 19, 1207-1212
- Bird, W. 2007. *Natural Thinking*. A report for the Royal Society for the Protection of Birds, Investigating the links between the Natural Environment, Biodiversity and Mental Health
- Bixler R D, Floyd M F and Hammitt W E. 2002. Environmental socialization. Quantitative tests of the childhood play hypothesis. *Environment and Behaviour* 34, 795-818
- Bradley, J., Waliczek, T., & Zajicek, J. 1999. Relationship between environmental knowledge and environmental attitude of high school students. *Journal of Environmental Education*, 30, 17-22.
- Bragg R, Wood C, Barton J and Pretty J. 2012. Let Nature Feed Your Senses: Engaging people with nature, food and farming. ESI and LEAF, Stonleigh
- Briggs, S. R. & Cheek, J. M. 1986. The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality*, 54 (1), 106-148
- Caulkins MC, White DD and Russell KC. 2006. The Role of Physical Exercise in Wilderness Therapy for Troubled Adolescent Women. *Journal of Experiential Education*, 29, 18-37
- Chalfont G. 2006. Connection to nature at the building edge: towards a therapeutic architecture for dementia care environments. PhD thesis. Sheffield: University of Sheffield.
- Chawla, L. 1998. Significant life experiences revisited: A review of research on sources of environmental sensitivity. *Journal of Environmental Education*, 29, 11-21.
- Chawla, L. 2007. Childhood experiences associated with care for the natural world: A theoretical framework for empirical results. *Children, Youth and Environments*, 17, 144-170.
- Chawla, L., & Cushing, D. 2007. Education for strategic environmental behavior. *Environmental Education Research*, 13, 437-452
- Chen-Hsuan Cheng J & Monroe M. 2010. Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, 44(1), 31-49.
- Danner D, Snowdon D and Friesen W. 2001. Positive emotions in early life and longevity: Findings from the Nun Study. *Journal of Personality and Social Psychology*, 80:804-813
- Davis, B., Rea, T., & Waite, S. (2006). The special nature of outdoors: Its contribution to the education of children at aged 3-11. *Australian Journal of Outdoor Education*, 10, 3-12.
- Defra 2011 The natural choice: securing the value of nature, Natural Environment White Paper, The Stationery Office, London
- Defra 2007. Sustainable development indicators in your pocket 2007: An update of the UK Government Strategy indicators
- DeVellis R F. 2003. *Scale Development: Theory and applications*. Sage, California
- Dillon J and Dickie I. 2012. Learning in the. Natural Environment: Review of social and economic benefits and barriers. Natural England Commissioned Report NECR092
- Ernst J and Theimer S. 2011. Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research* 2011, 1–22, iFirst Article. DOI: 10.1080/13504622.2011.565119
- FACE. 2012. Website: <http://www.face-online.org.uk/>
- Ferketich, S. 1991. Focus on psychometrics: Aspects of item analysis. *Research in Nursing & Health*, 14, 165–168.
- Fisher, A. 2002. Radical ecopsychology: Psychology in the service of life. New York: State University of New York Press.
- Foresight. 2007. *Tackling Obesities: Future Choices*. Government Office of Science, London
- Foresight. 2008. *Mental health - Future challenge*. Government Office of Science, London
- Forest Schools Association. 2013. Website: <http://www.outdoor-learning.org/Default.aspx?tabid=336>
- Frenn M, Malin S, Villarruel A M, Slaikeu K, McCarthy S, Freeman J and Nee E. 2005. Determinants of physical activity and low-fat diet among low income African American and Hispanic school students. *Public Health Nursing* 22, 89-97
- Growing Schools. 2012. Website: <http://www.growingschools.org.uk/>

- Hansen-Ketchum, P., Marck, P. & Reutter, L. 2009. Engaging with nature to promote health: new directions for nursing research. *Journal of Advanced Nursing*, 65, 1527-1538.
- Hein G. 1991. Constructivist learning theory. Institute for Inquiry. Available at: <http://www.exploratorium.edu/ifi/resources/constructivistlearning.html>
- Hinds, J., and P. Sparks. 2008. Engaging with the natural environment: The role of affective connection and identity. *Journal of Environmental Psychology* 28, no. 2: 109–20.
- Hine R. 2008. Care farming: Bringing together agriculture and health. *ECOS* 29(2), 42-51
- Hine R. 2010. The Health Benefits of a Wilderness Experience. Short report for Discovery Quest and Julian Housing. University of Essex.
- Hine R, Peacock J and Pretty J. 2007a. Green Lungs for the East of England. University of Essex, Report for the National Trust
- Hine R, Peacock J and Pretty J. 2007b and 2008a. *Evaluating the impact of environmental volunteering on behaviours and attitudes to the environment*. Report for BTCV Cymru. http://www2.btcv.org.uk/hine_peacock_pretty_2008.pdf
- Hine R, Peacock J and Pretty J. 2008b. Care farming in the UK: Contexts, benefits and links with therapeutic communities. *Int. Journal of Therapeutic Communities* 29(3)
- Hine, R. Peacock, J. and Pretty J. 2008c. *Care Farming in the UK: A scoping study*. Report for NCFI(UK) Available at: <http://www.ncfi.org.uk/documents/>
- Hine R, Pretty J and Barton J. 2009. Research Project: Social, Psychological and Cultural Benefits of Large Natural Habitat & Wilderness Experience: A review of current literature. Report for the Wilderness Foundation. Available at: <http://www.essex.ac.uk/ces/occasionalpapers/Kerry/Literature%20Review%20for%20WF.pdf>
- Hungerford, H.R., R.B. Peyton, and R.J. Wilke. 1980. Goals for curriculum development in environmental education. *Journal of Environmental Education* 11, no. 3: 42–7
- IPPR 2008. Behind the Screen: the Hidden Life of Youth. Institute for Public Policy Research. London
- IUCN. 2012. International Union for Conservation of Nature. Child's right to connect with nature and to a healthy environment. World Conservation Congress Motion 132. Available at: <http://portals.iucn.org/docs/2012congress/motions/en/M-132-2012-EN.pdf>
- Kahn P H and Kellert S R. 2002. *Children and Nature: Psychological, sociocultural and evolutionary investigations*. Cambridge, MA: MIT Press
- Kals, E., D. Schumacher, and L. Montada. 1999. Emotional affinity toward nature as a motivational basis to protect nature. *Environment & Behavior* 31, no. 2: 178–202.
- Kaplan R and Kaplan S. 1989. *The Experience of Nature: A Psychological Perspective*. Cambridge University Press, Cambridge
- Kellert S R. 2002. Experiencing nature: Affective, cognitive, and evaluative development in children. In: Kahn P H and Kellert S R (eds). *Children and nature: Psychological, sociocultural, and evolutionary investigations*. Massachusetts, The MIT Press, pp.117-152.
- Kellert SR, Wilson EO. 1993. The biophilia hypothesis. Washington DC: Island Press.
- Kuo, F. E., Sullivan, W. C., Coley, R. L. & Brunson, L. 1998b. Fertile Ground for Community: Inner-City Neighbourhood Common Spaces. *American Journal of Community Psychology*, 26, 823-851.
- Lance, C. E., Butts, M. M., & Michels, L. C. (2006). The Sources of Four Commonly Reported Cutoff Criteria: What Did They Really Say? *Organizational Research Methods*, 9(2), 202-220.
- Leopold A. 1966. *A Sand County Almanac: With Other Essays On Conservation from Round River*. Oxford University Press. New York.
- Louv, R. 2005. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder* North Carolina, Algonquin Books
- Maas, J., Verheij, R. A., Groenewegen, P. P., De Vries, S. & Spreeuwenberg, P. 2006. Green space, urbanity, and health: how strong is the relation? *Journal Epidemiology Community Health*, 60, 587-592.
- Mapes N and Hine R. 2010. Living with dementia and connecting with nature – looking back and stepping forwards. The Clore Social Leadership Programme and Dementia Adventure. Chelmsford
- Mayer FS and McPherson Frantz C. 2004. The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24, 503-515
- McCrae R, Kurtz J, Yamagata S and Terracciano A. 2011. Internal Consistency, Retest Reliability, and Their Implications for Personality Scale Validity. *Personality and Social Psychology Review* 15(1) 28–50
- Mind. 2007. *Ecotherapy: The green agenda for mental health*. Mind week report, May 2007. London, Mind.
- Moss S. 2012. Natural Childhood. RSPB, Sandy.
- Musser, L., and A. Malkus. 1994. The children's attitudes toward the environment scale. *Journal of Environmental Education* 25, no. 3: 22–6.
- National Ecosystem Assessment. 2011. The UK National Ecosystem Assessment: Technical Report. UNEP-WCMC, Cambridge Natural England Website: http://www.naturalengland.org.uk/about_us/news/2012/090512b.aspx

- Natural England. 2012. Natural England's submission to the National Trust's Natural Childhood Inquiry. Available at: http://www.naturalengland.org.uk/Images/12-13_003_Natural%20Childhood%20Inquiry_tcm6-32639.pdf
- Natural England. 2009. Childhood and nature: A survey on changing relationships with nature across generations. London
- Nisbet E, Zelenski J and Murphy S. 2009. The Nature Relatedness Scale: Linking Individuals' Connection With Nature to Environmental Concern and Behavior. *Environment and Behavior* vol. 41 no. 5 715-740
- Nisbet E, Zelenski J and Murphy S. 2011. Happiness is in our Nature: Exploring Nature Relatedness as a Contributor to Subjective Well-Being. *Journal of Happiness Studies*, Vol 12, 2, pp. 303-322
- Nisbet E. 2011. Website. Available at: http://chat.carleton.ca/~enisbet/nature_relatedness_research.htm
- Nisbet, E. K., & Zelenski, J. M. 2011a. Bridging sustainability and wellbeing with the NR-6, a brief new measure of nature relatedness. Paper presented at the 72nd Annual Convention of Canadian Psychological Association, Toronto, Ontario, Canada.
- Nisbet, E. K., & Zelenski, J. M. 2011b. Underestimating Nearby Nature Affective Forecasting Errors Obscure the Happy Path to Sustainability. *Psychological Science* vol. 22 no. 9 pp1101-1106
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. Sydney: McGraw-Hill.
- Briggs, S. R. & Cheek, J. M. 1986. The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality*, 54 (1), 106-148.
- O'Brien L. 2004. *A Sort of Magical Place*. Forest Research, Alice Holt, Surrey
- O'Brien E and Murray R. 2006. A marvellous opportunity for children to learn A participatory evaluation of Forest School in England and Wales. Forest Research, Farnham
- O'Brien L and Murray R. 2008. Forest School Research Summary, Forest Research
- OFCOM October 2011: reported in Guardian 25 October 2011.
www.guardian.co.uk/technology/2011/oct/25/teenagers-lose-tv-internet-mobile
- ONS. 2005. The time use survey 2005. Office for National Statistics, Cardiff
- Pallant J. 2007. The SPSS Survival manual 2nd Edition. Open University Press, Maidenhead
- Peacock J, Hine R and Pretty J. 2007 Got the Blues, then find some Greenspace: The Mental Health Benefits of Green Exercise Activities and Green Care. University of Essex report for Mind week.
- Peterson, N., and H. Hungerford. 1981. Developmental variables affecting environmental sensitivity in professional environmental educators: A research abstract. In *Current issue in environmental education and environmental studies*, ed. A. Sacks, L.A. Iozzi, J.M Schultz, and R. Wilke, 111–13. Columbus, OH: ERIC/SMEAC.
- Pretty J, Griffin M, Sellens MH and Pretty C. 2003. Green Exercise: Complementary Roles of Nature, Exercise and Diet in Physical and Emotional Well-Being and Implications for Public Health Policy. *CES Occasional Paper 2003-1*. University of Essex
- Pretty J. 2004. How nature contributes to mental and physical health. *Spirituality & Health Internat* 5(2): 68-78.
- Pretty J, Peacock J, Sellens M and Griffin M. 2005. The Mental and Physical Health Outcomes of Green Exercise. *International Journal of Environmental Health Research*, 15, 319-337
- Pretty J, Hine R and Peacock J. 2006. Green Exercise: The benefits of activities in green places. *The Biologist*, 53, 143-148
- Pretty J, Peacock J, Hine R, Sellens M, South N and Griffin M. 2007. Green Exercise in the UK Countryside: Effects on Health and Psychological Well-Being and Implications for Policy and Planning. *Journal of Environmental Planning and Management*, 50, 211-231
- Pretty J, Angus C, Bain M, Barton J, Gladwell V, Hine R, Pilgrim S, Sandercock G and Sellens M. 2009. Nature, Childhood, Health and Life Pathways. iCES Occasional Paper 2009-2. Available at: <http://www.essex.ac.uk/ces/occasionalpapers/Nature%20Childhood%20and%20Health%20iCES%20Occ%20Paper%202009-2%20FINAL%20.pdf>
- Pretty J. 2007. *The Earth Only Endures: On Reconnecting with Nature and Our Place in It*, London: Earthscan
- Pyle RM. 1978. The Extinction of Experience. *Horticulture* 56, 64-67
- Pyle RM. 2003. Nature Matrix: reconnecting people and nature. *Oryx* 37(2): 206–214
- Rickinson M, Dillon J, Teamey K, Morris M, Choi M Y, Sanders D and Benefield P. 2004. A Review of Research on Outdoor Learning. Preston Montford, Shropshire: Field Studies Council.
- RSPB. 2010. Every child outdoors: Children need nature, nature needs children. RSPB, Sandy
- RSPB 2012. Press release. Available at: <http://www.rspb.org.uk/media/releases/326839-disconnected-children-mean-nature-is-at-risk>
- Russell KC. 2001. *Assessment of Treatment Outcomes in Outdoor Behavioural Healthcare*. Idaho, University of Idaho-Wilderness Research Centre
- Russell KC. 1999. Theoretical Basis, Process and Reported Outcomes of Wilderness Therapy as an Intervention and Treatment for Problem Behaviour in Adolescents. *College of Graduate Studies*. Idaho, University of Idaho

- Russell KC, Hendee JC and Phillips-Miller, D. 2000. How wilderness therapy works: An examination of the wilderness therapy process to treat adolescents with behavioral problems and addictions. *Wilderness Science in a Time of Change Conference*, 3, 207-217
- Russell KC, Hendee JC and Cooke S. 1998. Potential Social and Economic Contributions of Wilderness Discovery as an Adjunct to the Federal Job Corps Program. *International Journal of Wilderness*, 4, 32-38
- Schultz W. 2000. Empathizing with nature: The effects of perspective taking on concern for environmental issues. *Journal of Social Issues*, 56, 391-406
- Schultz P W. 2001. The Structure of Environmental Concern: Concern for self, other people and the biosphere. *Journal of Environmental Psychology* 21, 327-339
- Schultz P W. 2002. Inclusion with nature: The psychology of human-nature relations. In P. Schmuck & W. P. Schultz (Eds.), *Psychology of sustainable development* pp. 62-78. Norwell, MA: Kluwer.
- Schultz, P.W., C. Shriver, J.J. Tabanico, and A.M. Khazian. 2004. Implicit connections with nature. *Journal of Environmental Psychology* 24, no. 1: 31-42.
- Sempik, J., Hine, R. and Wilcox, D. eds. 2010. *Green Care: A Conceptual Framework, A Report of the Working Group on the Health Benefits of Green Care, COST Action 866, Green Care in Agriculture*, Loughborough: Centre for Child and Family Research, Loughborough University.
- Sia, A.P., H.R. Hungerford, and A.N. Tomera. 1985-1986. Selected predictors of responsible environmental behavior: An analysis. *Journal of Environmental Education* 17, no. 2: 31-40.
- Tanner, R.T. 1980. Significant life experiences: A new research area in environmental education. *Journal of Environmental Education* 11, no. 4: 20-4.
- Taylor A F, Wiley A, Kuo F E & Sullivan W C. 1998. Growing up in the inner city: green spaces as places to grow. *Environment and Behaviour*, 30, 3-27
- Thomas G and Thompson G. 2004. *A Child's Place: Why Environment Matters to Children*. London, Green Alliance / Demos Report.
- TUC. 2007. Ending the opt-outs from the 48 hour week- Easy steps to decent working time. Trades Union Congress, London
- UNCRC (United Nations Convention on the Rights of the Child). 1989. Convention on the Rights of the Child. Available at: <http://media.education.gov.uk/assets/files/pdf/u/uncrc%20%20%20full%20articles.pdf>
- UNESCO (United Nations Educational, Scientific and Cultural Organization). 1978. Tbilisi Declaration, *Final report: Intergovernmental conference on environmental education*. Paris: UNESCO.
- Van Den Berg, A. E., Hartig, T. & Staats, H. 2007. Preference for Nature in Urbanised Societies: Stress, Restoration and the Pursuit of Sustainability. *Journal of Social Issues*, 63, 79-96.
- Ulrich RS. 1981. Natural versus urban scenes: some psychophysiological effects. *J Environ Behav*. 13:523-556.
- Ward Thompson, C., Aspinall, P., & Montarzino, A. 2007. The Childhood Factor - adult visits to green places and the significance of childhood experience. *Environment and Behaviour*, 40, (1) 11-143 available from: <http://eab.sagepub.com/content/40/1/111>
- Ward Thompson, C., Aspinall, P. & Montarzino, A. 2008 The childhood factor: Adult visits to green places and the significance of childhood experience. *Environment and Behaviour*, 40, 111-143.
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin*, 35, 10, 1315-1329.
- Wells, N., and K. Lekies. 2006. Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children, Youth and Environments* 16, no. 1: 1-23.
- Wells, N., & Evans, G. 2003. Nearby nature: A buffer of life stress among rural children. *Environment and Behaviour*, 35, 311-330.
- White R, Heerwagen J. 1998. Nature and mental health: biophilia and biophobia. In: Lundberg A, editor. *The environment and mental health: a guide for clinicians*. Mahwah, New Jersey: Lawrence Erlbaum Associates. p. 175-192.
- Wilson EO. 1984. Biophilia: the human bond with other species. Cambridge, Massachusetts: Harvard University Press.
- WHO. 1948. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference. In, 1948 New York. 19-22 June 1946, and entered into force on 7 April 1948.
- Zelenski J M and Nisbet E K. 2012. Happiness and Feeling Connected: The Distinct Role of Nature Relatedness. *Environment and Behaviour* DOI: 10.1177/0013916512451901 available at <http://eab.sagepub.com/content/early/2012/08/03/0013916512451901>

Appendix A – Information sheet



nature's
voice



University of Essex

Children's connection to nature

Information sheet for young people and parents/ guardians

Part A Information sheet for young people

The research team:

My name is Rachel Bragg and I work at the University of Essex as a researcher. I will be working with Phil Burfield, Suzanne Welch and Carolyn Maxwell, from the RSPB, on a study into children's connection to nature.

The research:

We need your help - we are hoping to ask around 70 children between the ages of 8 and 12 to help us decide on the best way to ask young people about how they feel about nature. If you would like to take part then we will ask you to fill out a short questionnaire containing 3 different sets of questions about how you feel about nature. We will also ask you to tell us which set of questions you think is the easiest to answer and then we will ask you to circle any parts of the questionnaire that you don't understand.

We will look at all the questionnaires and comments that you and the other young people give us and use them to decide which questionnaire will be the best for the RSPB to use with young people in the future.

Some questions you may have.....

• Do I have to say 'yes' to filling out a questionnaire?

No. It is your choice. No one will mind if you don't want to take part. You can also change your mind at any time. Just let Phil, Suzanne, Carolyn or Rachel know.

• How long do I have to stay in the study for?

We will be asking you to fill out the questionnaire once only and after this your help with the research is over. The questionnaire will take around 10 minutes to complete.

• Will you tell anyone what I say?

We will not be asking for your name or address so your identity will be protected at all times. Your questionnaire answers will be kept confidential and we won't pass on the answers to anyone else.

• What will you do with the questionnaires?

The questionnaire that you fill in will be stored at the University of Essex until December 2012. All information from the questionnaires will be put onto a database on the computer and used to help us decide which questionnaire to use in the future. We will keep this database for 2 years.

• Who is organising and funding the study?

The research team is based at the University of Essex and this research is funded by the RSPB.

Part B Information sheet for parents/ guardians

Introduction

This research is being conducted by Rachel Bragg, a senior researcher at the University of Essex, in order to help the RSPB determine which questionnaire measuring connection to nature, is the most appropriate for use with children in the UK. In our research we will ask both girls and boys between the ages of 8 and 12 to fill out a short questionnaire comprising 3 different sets of questions about how they feel about nature. Whenever researchers study children, we talk to the parents first and ask them for their permission. If your child wants to be involved and if you agree to let them take part in the study, then they will then be given a short questionnaire to complete.

Purpose

There are a number of questionnaires designed to measure connection to nature in children. All of the questionnaires are written using different styles and phrases. This research aims to take 3 of the best questionnaires and ask a group of children to complete them and to tell us which one they think is the easiest to understand and to fill in. Children will be asked to circle any questions or words that they do not understand. Researchers will then take this information and use it to determine which questionnaire will be the most appropriate for the RSPB to use in the future.

Selection of Participants

We want to talk to schoolchildren who are either visiting, or about to visit, an RSPB reserve for educational purposes. We would like to ask your daughter/son to participate because she/he is a child between the age of 8 and 12 and will be visiting an RSPB reserve.

Voluntary Participation

You do not have to agree that your daughter/son can complete a questionnaire. You can choose to say no and your child will still be able to take part in the visit to the reserve. You have the right to withdraw your child from the research at any time before the questionnaire is completed. It will not be possible to withdraw from the research after the questionnaire is submitted because all the questionnaires are anonymous.

Protocol

Your daughter/son will fill out a questionnaire which will be provided and collected by RSPB educational staff under the supervision of a senior researcher from the University of Essex. We will not ask your child to tell us his/her name or address just how old they are and their gender. If your child does not wish to answer some of the questions included in the questionnaire she/he may skip them and move on to the next question. We will not be sharing information about your son or daughter outside of the research team. Even though we won't ask for any personal information, the information we do record will be confidential, and no one else except Rachel Bragg will have access to the questionnaire. The questionnaires will be kept in a locked cabinet in the University of Essex and will be destroyed at the end of December 2012. The electronic version of data will be stored for 2 years.

Duration

We are asking your child to participate in a questionnaire survey which will take about 10 minutes of their time.

Benefits

There will be no immediate and direct benefit to your child or to you, but your child's participation is likely to help us find out how best to ask children about their feelings of connection to nature in the future.

Who to Contact

If you have any questions about the research then feel free to contact the lead researcher Rachel Bragg either by email: rebragg@essex.ac.uk or by telephone: 01206 872219. This research has been reviewed and approved by the Science and Engineering Faculty Ethics Committee at the University of Essex, which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find out more about the Ethics Committee, please contact Rachel Bragg.

Appendix B – Consent Form

Consent Form



nature's
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**To be completed by young person and parent/
guardian**



University of Essex

Part A to be completed by young person:

I agree to take part in the research on 'Children's connection to nature' and would like to complete a short questionnaire

I have read and understood the accompanying letter and information sheet. I know what the study is about and how I will be involved. I know that I do not have to answer all of the questions on the questionnaire and that I can decide not to continue at any time.

Name _____

Signature _____ Age _____

Part B to be completed by parent' guardian:

I have read and understood the accompanying letter and information sheet and give permission for the child (named above) to be included.

Name _____

Relationship to child _____

Signature _____

Further information about the study is contained in the attached letter and information sheet for young people and parents/guardians.

This form must be completed and returned to the research team for the named young person to be included in the research.

Please return the form to the person who gave it to you – the school or RSPB staff
or you can send it directly to the team using our freepost address:
Freepost RSSR-TZLH-UUSG, Rachel Hine ICES, Department of Biological Sciences, University of Essex,
Wivenhoe Park, COLCHESTER CO4 3SQ

Appendix C – Questionnaire – no smileys



nature's
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University of Essex

Children's connection to Nature Please spare a few minutes to answer our questionnaire!

We need your help - we are hoping to ask around 70 children between the ages of 8 and 12 to help us decide on the best way to ask young people about how they feel about nature. We would like you to complete this short questionnaire containing 3 different sets of questions about how you feel about nature.

We will then look at all the questionnaires and comments that you and the other young people give us and use them to decide which questionnaire will be the best for the RSPB to use with young people in the future.

Anything you tell us will be in private and we will not show your answers to anyone else. You do not have to answer the questions if you do not want to. If you can't answer a question just leave it, or ask an adult for help. Then go onto the next question. When you have completed the questionnaire please hand it back to the person who gave it to you.

Thank you!

Please tell us whether you are a

Boy

☐

or a Girl

☐

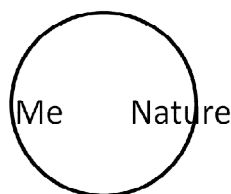
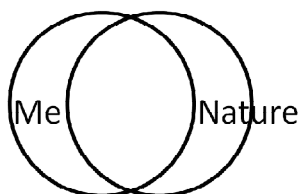
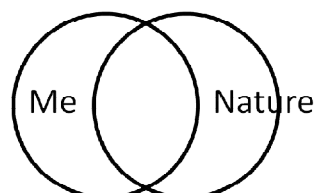
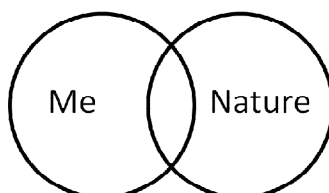
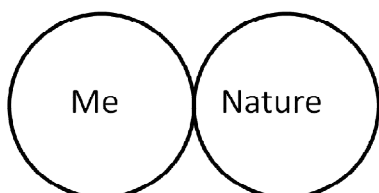
Please tell us how old you are....

Age

Now in sections A, B and C we will be asking you about nature

Section A

How interconnected are you with nature? *Please circle the picture below which best describes your relationship with the natural environment.*



Was there anything about this section that you did not understand?

Yes

☐

No

☐

If there was something in this section that you did not understand, please tell us by putting a cross by it.

Section B

Please tell us how much you agree or disagree with each of the following statements, by putting a tick in the relevant box.

Statements:	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
I like to hear different sounds in nature					
I like to see wild flowers in nature					
When I feel sad, I like to go outside and enjoy nature					
Being in the natural environment makes me feel peaceful					
I like to garden					
Collecting rocks and shells is fun					
I feel sad when wild animals are hurt					
I like to see wild animals living in a clean environment					
I enjoy touching animals and plants					
Taking care of animals is important to me					
Humans are part of the natural world					
People cannot live without plants and animals					
Being outdoors makes me happy					
My actions will make the natural world different					
Picking up trash on the ground can help the environment					
People do not have the right to change the natural environment					

Cheng and Monroe 2010

Was there anything about this section that you did not understand?

Yes

☐

No

☐

As before, if there was something in this section that you did not understand, please tell us by putting a circle around it

Section C

For each of the following, please tell us how much you agree with each statement, using the scale as shown below. Please respond as you really feel, rather than how you think “most people” feel.

Statements:	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
My favourite places are outside, in nature					
I think about how what I do affects the earth					
My feelings about nature and the earth are a part of my soul					
I take notice of wildlife wherever I am.					
My relationship to nature is an important part of who I am.					
I feel very connected to all living things and the earth					

Adapted from Nisbet 2009

Was there anything about this section that you did not understand?

Yes

☐

No

☐

If there was something in this section that you did not understand, please tell us by putting a circle around it.

Please tell us which section that you liked best, or which you found the easiest to understand.

Section A, B or C

☐

If there is anything else you would like to tell us about our questionnaire then please write it in the box below.....

That's all!

Thank you very much for sparing the time to fill out this questionnaire

Please hand the questionnaire back to the person that gave it to you

Appendix D Questionnaire – Smileys



nature's
voice



University of Essex

Children's connection to Nature Please spare a few minutes to answer our questionnaire!

We need your help - we are hoping to ask around 70 children between the ages of 8 and 12 to help us decide on the best way to ask young people about how they feel about nature. We would like you to complete this short questionnaire containing 3 different sets of questions about how you feel about nature. We will then look at all the questionnaires and comments that you and the other young people give us and use them to decide which questionnaire will be the best for the RSPB to use with young people in the future.

Anything you tell us will be in private and we will not show your answers to anyone else. You do not have to answer the questions if you do not want to. If you can't answer a question just leave it, or ask an adult for help. Then go onto the next question. When you have completed the questionnaire please hand it back to the person who gave it to you.

Thank you!

Please tell us whether you are a

Boy

☐

or a Girl

☐

Please tell us how old you are....

Age

Now in sections A, B and C we will be asking you about nature

Section A

For each of the following, please tell us how much you agree with each statement, using the scale as shown below. Please respond as you really feel, rather than how you think "most people" feel.

Statements:	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
My favourite places are outside, in nature					
I think about how what I do affects the earth					
My feelings about nature and the earth are a part of my soul					
I take notice of wildlife wherever I am.					
My relationship to nature is an important part of who I am.					
I feel very connected to all living things and the earth					

Adapted from Nisbet 2009

Was there anything about this section that you did not understand?

Yes

☐

No

☐

If there was something in this section that you did not understand, please tell us by putting a circle around it.

Section B

Please tell us how much you agree or disagree with each of the following statements, by putting a tick in the relevant box.

Statements:	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
I like to hear different sounds in nature					
I like to see wild flowers in nature					
When I feel sad, I like to go outside and enjoy nature					
Being in the natural environment makes me feel peaceful					
I like to garden					
Collecting rocks and shells is fun					
I feel sad when wild animals are hurt					
I like to see wild animals living in a clean environment					
I enjoy touching animals and plants					
Taking care of animals is important to me					
Humans are part of the natural world					
People cannot live without plants and animals					
Being outdoors makes me happy					
My actions will make the natural world different					
Picking up trash on the ground can help the environment					
People do not have the right to change the natural environment					

Cheng and Monroe 2010

Was there anything about this section that you did not understand?

Yes

☐

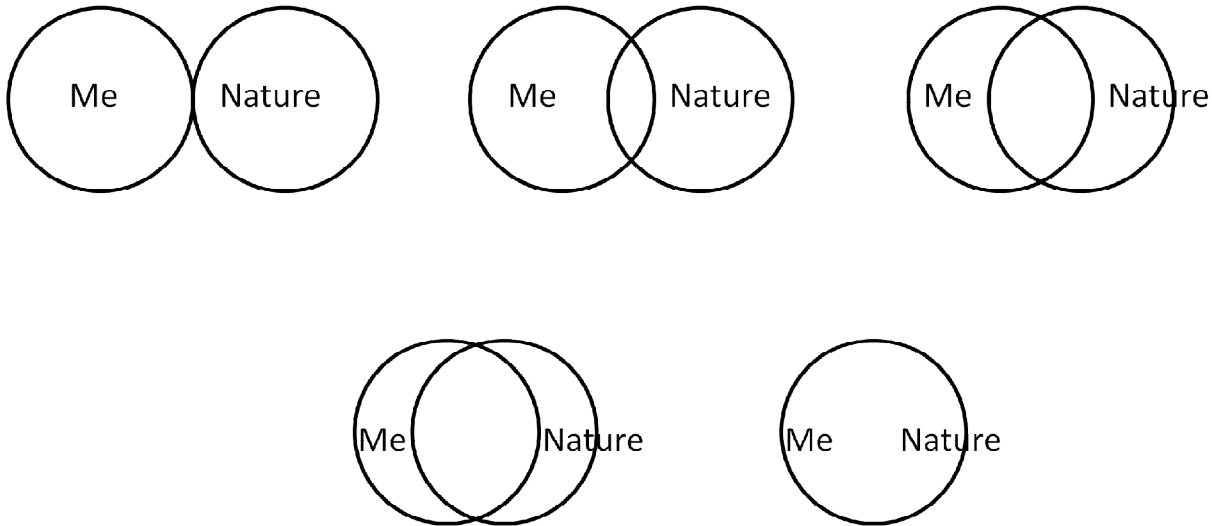
No

☐

As before, if there was something in this section that you did not understand, please tell us by putting a circle around it

Section C

How interconnected are you with nature? Please circle the picture below which best describes your relationship with the natural environment.



Was there anything about this section that you did not understand?

Yes

☐

No

☐

If there was something in this section that you did not understand, please tell us by putting a cross by it.

Please tell us which section that you liked best, or which you found the easiest to understand.

Section A, B or C

☐

If there is anything else you would like to tell us about our questionnaire then please write it in the box below.....

That's all!

Thank you very much for sparing the time to fill out this questionnaire

Please hand the questionnaire back to the person that gave it to you



nature's
voice

Appendix E

Children's connection to Nature Observer Coversheet



University of Essex

Observer Coversheet can be completed by RSPB education staff and school teaching staff accompanying children (if available) for every questionnaire evaluation session and is to be included with the completed questionnaires and consent forms for that session and returned to the University of Essex.

Please can you complete the following information.....

I am completing this coversheet as:

RSPB education staff

☐

Teacher

☐

Which questionnaire/s
were completed today?

Normal

☐

Smiley

☐

Both

☐

1. Date of session

2. Location of session

3. Age range of children

4. Approximately how long did the children spend doing activities outside during today's session?

5. What types of activities were they participating in?

6. In general, how easy did the children find the questionnaire today?

Were there many queries? Did many questions need further explanation by an adult? Was it too complex? Too easy? etc

Thinking about the section of the questionnaire containing the *interconnecting circles*, on a scale of 1 – 10, how easy do you think the children found it to complete? (please circle one number only)

Not very
easy

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Very
easy

7. Do you have any other comments to make about this part of the questionnaire?

Wording? Complicated? Hard to understand? etc

Thinking about the section of the questionnaire containing the **larger set of questions**, on a scale of 1 – 10, how easy do you think the children found it to complete? (please circle one number only)

Not very
easy

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Very
easy

8. Do you have any other comments to make about this part of the questionnaire?

Wording? Complicated? Hard to understand? etc

Finally, thinking about the section of the questionnaire containing the **smaller set of questions**, on a scale of 1 – 10, how easy do you think the children found it to complete? (please circle one number only)

Not very
easy

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Very
easy

9. Do you have any other comments to make about this part of the questionnaire?

Wording? Complicated? Hard to understand? etc

10. Approximately how long did the children take to complete the questionnaire?**11. Any other comments?**

Thank you very much for completing the coversheet for this session.

Please put this coversheet with the questionnaires and return to Rachel Bragg or just send by Freepost to:
 Freepost RSSR-TZLH-UUSG, Rachel Hine ICES,
 Department of Biological Sciences, University of Essex, Wivenhoe Park,
 COLCHESTER CO4 3SQ

Appendix F

Guide to using Connection to Nature Index¹⁶⁰

What is CNI? Who is it for?

- The Connection to Nature Index (CNI) is a questionnaire developed by Cheng and Monroe (2010) to measure connection to nature in children aged 8-10¹⁶¹.
- In this study (Bragg et al 2013), we have found that it works well with children between the ages of 8-12 years, but for older children (14 years +) the NR-6 or INS may be more suitable.
- The CNI is a 'trait' measure¹⁶² which means it has been designed and tested for use in determining changes over a relatively long period of time rather than as the result of a single intervention or session. For example it could be used to see if children's connection to nature had increased or decreased after taking part in a programme for 6 months but not to see if connection had changed after an afternoon session at a field centre or nature reserve.

How do you use CNI?

- The scale consists of 16 items rated on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree) and is scored by creating a mean of the 16 items, with scores ranging from one to five, with higher scores indicating a stronger connectedness to nature than lower scores.
- A CNI score of 1-2 indicates the lowest connection to nature (i.e. 'disconnected'), scores of 3 indicate neither low nor high connection (i.e. neutral) and scores of 4-5 indicate a higher level of connection (i.e. connected).

Table 1. Subscale score items

Subscale	Questions included within the subscale
Enjoyment of nature (7 items)	I like to hear different sounds in nature I like to see wild flowers in nature When I feel sad, I like to go outside and enjoy nature Being in the natural environment makes me feel peaceful I like to garden Collecting rocks and shells is fun Being outdoors makes me happy*
Empathy for creatures (4 items)	I feel sad when wild animals are hurt I like to see wild animals living in a clean environment I enjoy touching animals and plants Taking care of animals is important to me
Sense of oneness (3 items)	Humans are part of the natural world People cannot live without plants and animals Being outdoors makes me happy*
Sense of responsibility (3 items)	My actions will make the natural world different Picking up trash on the ground can help the environment People do not have the right to change the natural environment

*Although this question appears in 2 subscales, it is only asked once on the questionnaire

- The CNI will give both i) a connection to nature 'score', and ii) a further breakdown of 4 subscale scores for a) enjoyment of nature, b) empathy for creatures, c) sense of oneness and d) sense of responsibility

¹⁶⁰ This guide to use of CNI has been written as an aid to anyone considering using CNI in a study rather than an extensive 'how to' guide.

¹⁶¹ Full reference is: Chen-Hsuan Cheng J & Monroe M. 2010. Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, 44(1), 31-49.

¹⁶² A trait is a stable or relatively unchanging personality characteristic that identifies individual differences in people rather than a state which is a temporary way of being or feeling

- In the same way as for the overall CNI score, the four subscales scores are calculated by creating a mean from particular question items – see Table 1.

Ethical considerations when using CNI

- As with any study involving children, before using the CNI to measure connection to nature levels it is necessary to comply with various ethical and data protection requirements. This study complied with the University of Essex ethics procedure - most organisations should have an ethics procedure if they involve children in research.
- Researchers and volunteers administering questionnaires to children should have undergone DBS (formerly CRB) checks.
- Prior informed consent from both the parent and the child is usually required before conducting research with children.
- Any personal information must be stored and handled in line with the Data Protection Act 1998.