

# **Natural Neighbourhoods for City Children**

## **Report on Research Findings**



**Authors: Claire Freeman, Yolanda van Heezik,  
Aviva Stein and Kate Hand**



# **Natural Neighbourhoods for City children Report on Research Findings**

## **Report on Research Findings**

**Authors:**

**Claire Freeman**

**University of Otago, Department of Geography, Planning  
Programme**

**Yolanda van Heezik**

**University of Otago, Department of Zoology**

**Aviva Stein**

**University of Otago, Department of Geography**

**Kate Hand**

**University of Otago, Department of Zoology**

Published by the Department of Geography,  
University of Otago, Dunedin, 2015  
ISBN: 978-0-473-31872-7

**Front cover photograph: Children exploring an Auckland beach as part of a school trip**

## **Acknowledgements**

This study has been supported by the University of Otago and funded by a Royal Society of New Zealand Marsden Grant UOO1222. The team would like to thank the Royal Society Marsden Fund for providing the funding that enabled this research to be carried out.

We are indebted to the children who took part in this study, and we acknowledge the enthusiasm and helpfulness that they showed while being interviewed. The maps were provided by children from the schools and we thank them for letting us use their maps to illustrate this report. We acknowledge the support from the principals of the participating schools, their students, teachers and parents.

We would like to thank Anthony Leung for undertaking the geographic information systems part of this study and Anette Becher for creating the maps provided to the schools as part of this project. Our thanks to Chris Garden of the University of Otago Geography Department for the children's profile maps and the front cover design.

We hope that this study will play a part in enabling those responsible for designing and influencing our cities to better understand how to plan for environments with children in mind.

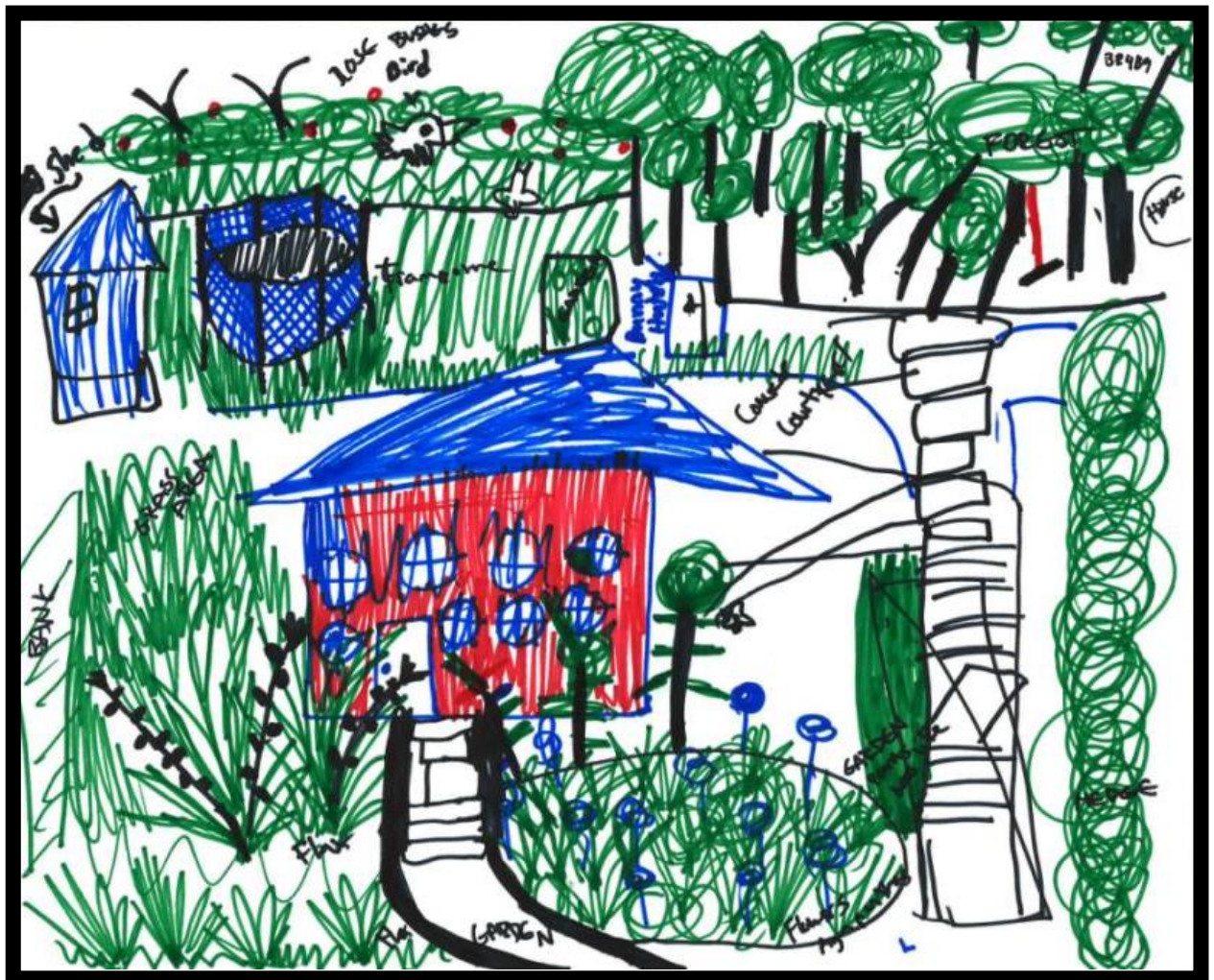
## Table of Contents

	<b>Page</b>
<b>Part I Introduction</b>	<b>2</b>
The research team	4
Setting up the project	5
The report	7
<b>Part II Background</b>	<b>8</b>
The importance of nature	10
Can and do children experience nature?	10
The need for a child's perspective	11
Urban nature	12
Implications for professional practice	13
<b>Part III Research Methods &amp; Results</b>	<b>16</b>
The study	18
Recruiting the children	20
Collecting the data: the methods	23
Results	24
A. Children's lives	24
Neighbourhood	24
Activities	24
Travel patterns	26
Independence	27
B. Children and nature	28
What is nature?	28
How much nature?	29
Natural places and activities	30
C. Connections to nature	32
Assessing children's connections with nature	34
Children's movements in relation to their nature connection scores	36
D. Scoring neighbourhood biodiversity	38
E. Children's home ranges	40
F. Are children biophilic?	43
<b>Part IV Conclusion</b>	<b>46</b>
<b>Useful resources</b>	<b>54</b>



## PART I

### Introduction to the Project







## PART I

### Introduction to the Project

#### The Research Team

**Claire Freeman** is Associate Professor in the Geography Department at the University of Otago. At the time of this project she was Director of the Planning Masters Programme. She has been researching in the field of children and planning since 1994 and published widely in this field. Claire and Yolanda were principal investigators for this research project.

**Yolanda van Heezik** is Associate Professor in Zoology at the University of Otago. She has 30 years' experience in zoological research. Her particular areas of interest are urban ecology, evaluation of species richness and abundance, spatial analysis of animal movements, resource selection, biodiversity assessment, assessing public attitudes/values towards various aspects of biodiversity and she has published widely in these and related areas.

**Aviva Stein** was the Research Assistant on this project and was responsible for conducting the interviews with the children and coordinating the interview data. She has a Masters in Zoology and works for the Yellow Eyed Penguin Trust, and Jane Goodall's Roots and Shoots as Educational coordinator.

**Kate Hand** was the Zoology Masters Research student on this project and responsible for collecting and collating all the biological data and production of the GIS biodiversity maps. Kate was awarded her MSc with Distinction for her research as part of this project.

## Setting up the project

### Project Aims

Children need nature: this study investigates children's relationship with nature in an urban environment, explores the social and biological factors that determine or limit this relationship and identifies how children can be best supported to develop connections with the natural world.

A number of questions were identified to help us develop this understanding:

1. How do children define nature and how do they self-define their connection with nature?
2. What are the social factors that support or frustrate this connection with nature?
3. Do children access biodiverse sites in their home neighbourhood environments and if not, why not?
4. Are children more inclined to seek out sites of higher biodiversity within the area that is accessible to them?

### Rationale for the study

Twenty-five years ago E.O.Wilson (1984) proposed in his book "Biophilia" that humans had evolved an inclination to affiliate with nature. Since then there has been a growing body of evidence that a fragmented human-nature relationship has detrimental impacts on human physical and psychological health. Nature connectedness has been shown to be consistently associated with personal growth, autonomy and purpose in life for both children and adults. Nature connections have also been shown to positively influence children's emotional and intellectual development, and formation of values.

While it is clear that contact with nature is vital to the health, happiness and well-being of children, what is less clear are children's perceptions of nature, and how children interact with nature in their immediate environment, particularly when the environment is urban. The current premise that children need contact with wild pristine nature has led to the coining of the term 'nature deficit disorder'<sup>1</sup> when there is a lack of such contact. The symptoms of 'nature deficit disorder' have been linked to health disorders such as ADHD/hyperactivity, overweight and obesity, stress and depression. We argue that this premise has been accepted largely uncritically, is adult-determined, and ignores the richness of biodiversity within urban landscapes. Virtually nothing is known about urban children's 'nearby nature' experience. It is our view that it is necessary to understand nature from the child's perspective; what it is in nature they value and connect with, and the biodiversity of the immediate surroundings of children where they may encounter nature on a daily basis.

Most children in developed countries live in urban areas: globally the proportion of people in urban areas is expected to rise to 84% by 2030 (United Nations 2007), however in New Zealand that proportion is already over 87% (Statistics NZ 2011). A burgeoning research literature is showing that many urban areas are in fact surprisingly nature-rich. For the

---

<sup>1</sup> Louy, R. 2005. *Last Child in the Woods*, Algonquin Books.

majority of people, children in particular, gardens are the spaces where nature is most accessible on a day-to-day basis. Gardens, parks and reserves, street trees and vacant lots are just some of the range of formal and informal green spaces present in neighbourhoods that provide enormous potential for children to make daily contact with nature.

This study integrates social and natural science approaches to understand child-nature relations in modern urban society. It investigates the natural worlds of today's children, and directly involves children in how nature is defined and assessed. It asks whether, for children, there is a different, more positive and useful way of looking at the human-nature connection than that of nature deficit disorder. It could be that children do connect with nearby nature but in ways that go unrecognised. Alternatively, it could be that the disconnect described by Louv (2005), stems not from a lack of nature, but exists because children are frustrated in their ability to access the nature that is present in their surroundings. A reduction in children's independent mobility and reduced 'free range' is well-documented. This reduction makes the nature in children's immediate surroundings especially valuable. For children 'nearby nature'; gardens, the neighbourhood climbing tree, or daisies in the lawn, may be more significant in their experience with the natural world than the more recognised 'wild space'.

### **The schools and the children**

The study was carried out by four researchers: three zoologists and a planner. One zoologist has specialist expertise in urban zoology; another has experience working in environmental education in the USA. The planner has specialist knowledge of children, environments and planning. The study was carried out in the cities of Dunedin, Auckland and Wellington. A total of 187 children between ages 9-11 took part in the study. They came from nine schools, with one low, medium and high socio-economic school selected in each city. The children were in a final year 5-6 class in each school. The schools were selected as they recruit primarily from the local neighbourhood and included Māori and Pasifika pupils and an ethnic mix representative of New Zealand's main population groups. The children attending these schools had access to environmentally comparable areas, as it was important that all children from the three schools in the city could as far as possible access the same types and diversity of natural areas.

## **The report**

### **Format of this report**

This report comprises four parts. The first part briefly introduces the project. The second provides the context for the study. It looks at the children's lives and relationships with natural environments and the factors that influence these. Part three presents the methodology and results of the study, and Part four summarises the key findings and looks at the implications of these for urban planning.

Please note that it was not the intention of this report to pass judgment on children's lives or on the role of schools or parenting methods and indeed it would be highly inappropriate to do so. The schools and children who provided the data used in this report do provide useful insights into the lives of children today, but care should be taken in using this data to extrapolate wider trends. The data reflects first and foremost the societies children live in, the schools they attend and the neighbourhood and city in which they live.

### **Using this report**

We hope that you enjoy this report and that it will enhance your understanding of the ways in which children live their lives and the ways they connect with nature. This report is only one output from the research but one that is intended primarily for feedback to the schools that participated, practitioners and for those with a general interest in the research. A number of academic papers focusing in more detail on specific topic areas will also be written and published following the release of this report. A separate summary of the results was supplied to each school. This was in the form of a written report and a large map showing areas that children use and the places they identify with nature, e.g. where birds live or where they see wild animals. In the report care has been taken to protect the identity of the children. The original maps contained additional data such as children's homes which have been removed and some of the photographic data may have been removed. The schools are referred to in the text by signifiers relating to their location, Auckland, Wellington or Dunedin, together with their indicative socio-economic status as at the time of the study. The socio-economic status was decided by reference to the school's decile as this is public information and Statistics New Zealand's census mesh block based deprivation data. Together the decile and deprivation ratings give a general, but not definitive indication of socio-economic character, and we recognise that there is variation within neighbourhoods and between the students attending the same school.

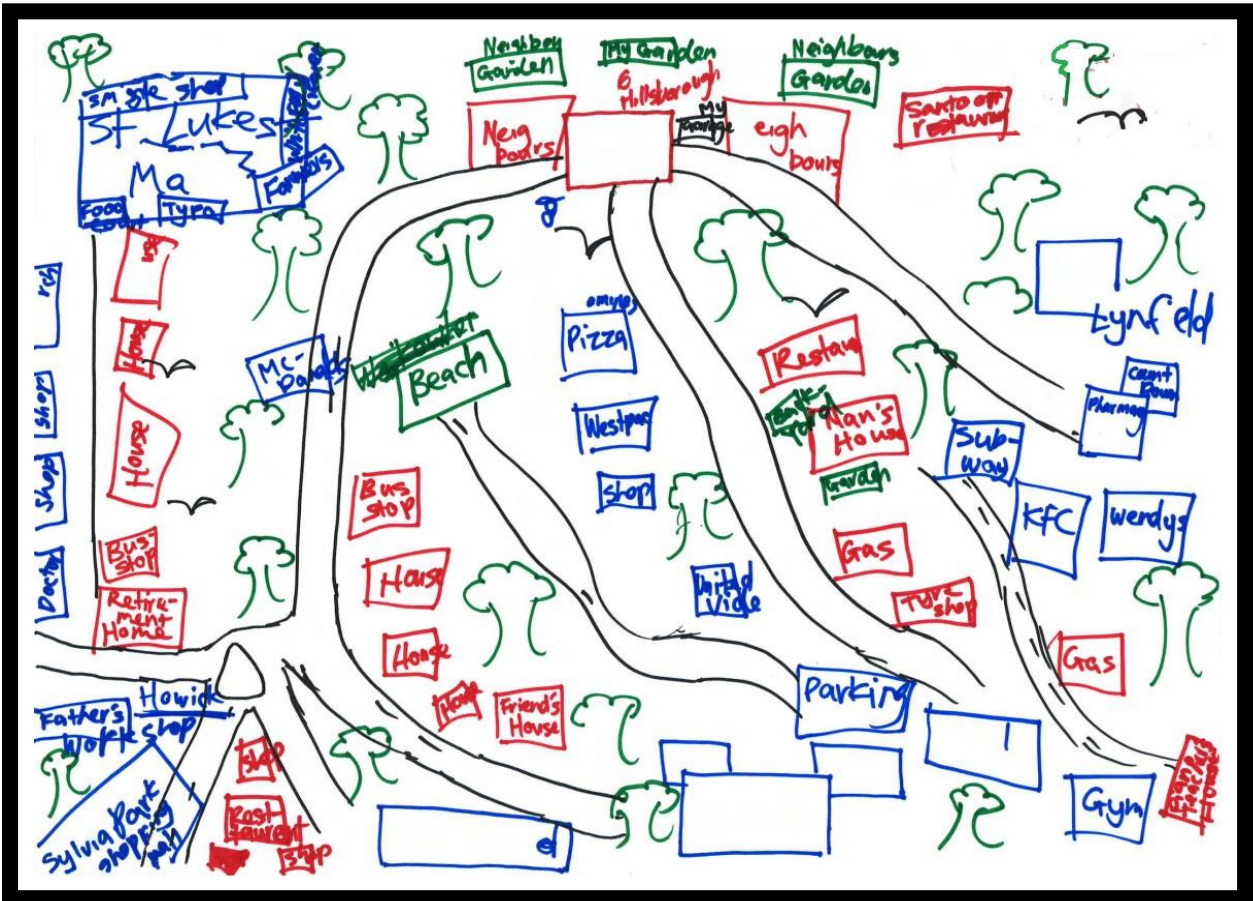
If you require any further information on any of the material in this report, which represents only a summary of a much larger research project, please contact:

Associate Professor Claire Freeman,  
Geography Department  
University of Otago;  
Ph: 03 479-8785  
email [cf@geography.otago.ac.nz](mailto:cf@geography.otago.ac.nz),

Associate Professor Yolanda van Heezik  
Zoology Department  
University of Otago  
Ph: 03 479 4107  
[yolanda.vanheezik@otago.ac.nz](mailto:yolanda.vanheezik@otago.ac.nz)

## PART II

### Background





## PART II

### Background

#### The importance of nature

The natural environment is essential to people's well-being. Studies have shown that people with pets are less stressed and need fewer health interventions than those without, office workers seeing or having access to plants feel calmer and prisoners whose cells have a view of a green landscape have reduced sickness levels<sup>2</sup>. For children, contact with the natural environment provides enormous play, adventure, and exploration benefits. Additionally it provides children with opportunities to interact with and learn about the natural world and to enhance their physical prowess through swimming in rivers, climbing trees, running and chasing. Further it supports learning skills such as patience, to be observant and to interpret cause and effect; as in ice is slippery or heavy rain leads to fast flowing rivers. Children can learn about nature in three ways, through:

- Direct contact: where they make physical contact with nature through fishing, building river dams, squelching in mud;
- Indirect contact: TV nature programmes, internet, books and stories such as when Grandma tells about her fishing trip;
- Observed without contact: the environment seen from a car, plane or bus.

Of these the most important is direct contact. A child can learn the seasonal life cycle of a tree from a TV programme but such learning doesn't have the intensity and immediacy of watching an apple grow on a tree and picking it, playing in the autumn leaves or testing the strength of branches before climbing. Neither can indirect contact provide the sensory experiences of nature; the wind in the trees, the pull of a receding tide when paddling in the sea, the joy at seeing a new-born lamb or the 'yuk' factor from stepping on a slug or snail. Not only are there immediate benefits but contact with nature also has long term benefits. Children who have direct nature contact experiences show more positive environmental behaviours as adults<sup>3</sup>.

#### Can and do children experience nature?

Much has been written about how children today are becoming divorced from nature. The best known writer in this respect is Richard Louv, whose book "Last Child in the Woods: Saving our children from nature deficit disorder", has sparked a massive worldwide movement to connect children, their families and their communities to the natural world. In the UK, the Royal Society for the Protection of Birds has launched an 'Every child outdoors

---

<sup>2</sup> Frumkin, H. 2001 Beyond Toxicity: human health and natural environment, American Journal of Preventive Medicine, 20

<sup>3</sup> Wells and Leckies, 2006 Nature and the life course: Pathways from childhood nature experiences to adult environmentalism, Children, Youth, Environments 16:1

movement' to provide natural experiences for children. In 2009 Natural England published a report about childhood and nature that showed that less than 10% of English children today play in natural places such as woodlands, countryside and heaths, when compared with 40% of children 30–40 years ago<sup>4</sup>. There is also widespread concern that as the children of today are the adults of the future, the loss of positive natural experiences from one generation to the next, known as inter-generational 'environmental amnesia', may result in future societies that lack an environmental awareness and conservation ethic.

Children today are more likely to grow up urban (87% of New Zealanders live in urban places) and they will have far less independence and thus freedom to play outside and explore than their parent's generation experienced. In New Zealand outdoor play, including play in domestic gardens is reducing for several reasons:

1. Children in New Zealand like elsewhere are less likely to play outside, have less independence and have limited free ranges;
2. Newly-built homes are getting both bigger and smaller. Higher density houses which are smaller with small back and front yards are being promoted in cities such as Auckland. House sizes for newly-built suburban houses are growing "the average size of a home built since 2010 is 205 square metres, against just 142.4 square metres in 1980"<sup>5</sup>, but these are likely to be on smaller sections leaving less garden space;
3. Some children's lives are becoming fuller, particularly with sporting, cultural and social activities leaving less free time for being outside and in nature.

On a more positive note, New Zealand schools do promote natural experiences through school camps and trips to beaches and other natural sites, and they are increasingly undertaking greening initiatives in school grounds, such as vegetable growing. New Zealand families do prioritise holidays and many families go camping, go to holiday homes and value spending time in less developed settings. A Department of Conservation study in 2006 estimated that some 80% of New Zealanders have been camping at some point in their lives, with most campers having childhood experiences of this activity<sup>6</sup>.

### **The need for a child's perspective**

Most if not all writing on children and nature is done by adults from an adult perspective. We know from the writings of Louv and others that there is wide-ranging adult concern about loss of nature contact and loss of environmental knowledge and awareness. We would argue that this predominantly negative view, whilst raising important issues and concerns, needs to be balanced with regard to the perspective of children. Do children feel and see themselves as experiencing a disconnect from nature? Virtually nothing is known about urban children's 'nearby nature' experience. It is our view that it is necessary to understand nature from the child's perspective: what it is in nature they value and connect

---

<sup>4</sup> England Marketing, (2009). Report to Natural England on childhood and nature: A survey on changing relationships with nature across generations. [www.EnglandMarketing.co.uk](http://www.EnglandMarketing.co.uk).

<sup>5</sup> Quotable value NZ 2011 and Basset, M. and Malpass, L. Priced Out: How New Zealand lost its Housing Affordability, The New Zealand Initiative, PO Box 10147, Wellington 6143, New Zealand [www.nzinitiative.org.nz](http://www.nzinitiative.org.nz)

<sup>6</sup> Department of Conservation (DoC) 2006. Review of camping opportunities in New Zealand. Report to the Minister of Conservation, September. Wellington, New Zealand: Department of Conservation



## Natural Neighbourhoods for City Children: Report on Research Findings.

---

with, and the biodiversity of the immediate surroundings of children where they may encounter nature on a daily basis. This is not to deny the importance of wilder and more pristine nature experiences but reflects the need to think more broadly, and to include different ways of thinking about nature. Nature means a wide variety of things to children as indicated in the photos below.



*Making daisy chains*



*Tree climbing*



*Sledding on a golf course*



*Meeting animals*



*Fishing in a drain*



*Fighting with flax sticks*



*Exploring the veggie patch*

### City children connecting to the natural world through nearby nature experiences

#### Urban nature

Urban landscapes are far from natural: they are both highly modified and very heterogeneous in structure. They consist of small isolated patches of remnant natural vegetation situated within a matrix ranging from nature-rich suburbs to densely populated residential areas and highly developed commercial or industrial areas that are lacking the vegetation and resources required by most animals. Given the highly modified nature of the landscape, there has been a perception that urban areas in general are nature-poor, or low in biodiversity, but this has proved to be far from true. A burgeoning research literature is showing that many urban areas are in fact surprisingly nature-rich; for example, they often support more plant species than equivalent sized rural habitats<sup>7</sup>. This diversity isn't limited

---

<sup>7</sup>Pyšek, P., Chocholoušková, Z., Pyšek, A., Jarošík, V., Chytrý, M., Tichý, L. (2004) Trends in species diversity and composition of urban vegetation over three decades, *Journal of Vegetation Science*, 15, 781-788.

to the more-or-less natural habitat that can be found in vegetation remnants, parks and reserves, but extends to modified habitat, such as domestic gardens. The modified biodiversity found in urban areas encompasses high proportions of non-native species, but we haven't discriminated between native and non-native species in this research. In terms of nature connection, there is no evidence to indicate if this is influenced by whether species are native or non-native, and many members of the public are either not interested or do not know whether species are native or not.

In New Zealand urban biodiversity has only begun to be studied in the last 10 or so years, with much research focused on private gardens and urban restoration. The New Zealand Garden Bird Survey, administered by Landcare Research, compiles information from volunteers to provide information on the relative abundance of birds across the regions<sup>7</sup>, while other research has documented which birds can be found across the entire urban gradient, from peri-urban parks and reserves to the central business district<sup>7</sup>. Studies of invertebrates reveal a huge largely undocumented diversity, while research on plants indicates a high proportion of exotic species, but also the importance of private gardens in contributing to plant diversity and volume, both of which are strongly linked to bird abundance and diversity. The biodiversity present in New Zealand's gardens is increasingly being recognised as important for enabling nature connection<sup>8</sup>. For the majority of people, children in particular, gardens are the spaces where nature is most accessible on a day-to-day basis: in the UK 87% of homes have access to gardens. Gardens, parks and reserves, street trees and vacant lots are just some of the range of formal and informal green spaces present in neighbourhoods that provide enormous potential for children to make daily contact with nature.

### **Implications for professional practice**

If it is accepted that contact with nature is good for children's physical and mental wellbeing then it is clearly imperative that those professions working with and on behalf of city children provide environments that best enable this contact to be made. To be able to respond effectively, however, there needs to be a more developed understanding of why, how and where children connect with nature. This research will provide the first child-determined evaluation of their connection to nature in an urban environment. Unlike most research to date it focuses on children's informal nature experiences, i.e. those outside an educational or formalised setting. It prioritises fine micro-scale connections, about which very little is known. In the New Zealand context there has been minimal research on children in urban areas and none at this scale of daily lived environments. Such understandings are especially important in view of urban development trends in New Zealand. Housing densities are increasing. Statistics New Zealand (2011) projects that by 2031, there will be some 110 area units with a population density greater than 4,000 people

---

van Heezik, Y., Smyth, A., & Matthieu, R. (2008) Diversity of native and exotic birds across an urban gradient in a New Zealand city, *Landscape and Urban Planning*, 87, 223-232.

<sup>8</sup> Spurr, E.B. (2012) New Zealand Garden Bird Survey – analysis of the first four years. *NZ Journal of Ecology* 36(3): 1-13.

van Heezik, Y., Dickinson, K. J.M., Freeman, C. (2012) Closing the gap: communicating to change gardening practices in support of native biodiversity in urban private gardens, *Ecology and Society* 17(1), 34 [online] URL:<http://www.ecologyandsociety.org/vol17/iss1/art34/> (2012)

km<sup>2</sup>, up from 25 area units in 2006. Families with children living in higher density housing are a major component of this growth which has as yet little understood implications for children's ability to access outdoor play, travel independently and to access nature.

Our research findings identify the social and physical constraints that impact on children's ability to experience nature. Social factors include busy lives with structured activities taking up children's 'free' play time, the degree of children's independent mobility in their neighbourhoods as influenced by societal views on what is reasonable and what is unsafe. Physical factors include considerations around road safety and traffic speed and densities, neighbourhood walkability and ease for cycling, presence of parks and natural areas and the type of vegetation in these spaces. We hope that through our research, which provides better understandings of the real ways children experience or do not experience nature in their neighbourhoods, planners, traffic engineers, educators and other urban professionals will be able to consider better and more effective ways to enable children to maximise their use of and connections to the nature that does or could exist in their home neighbourhoods.



## PART III

### Research Methods & Results





## PART III

### Research Methods & Results

#### The study

The first section of this chapter explains the research process. This is followed by a presentation and analysis of the results obtained through the one-on-one interviews with children. The next section presents and discusses the results obtained through the biological studies.

Three cities, Wellington, Auckland and Dunedin were selected for the study. Three schools from each city were selected to participate in the project. Socio-economic, ethnicity, geographic and biological criteria were used to select the schools.

1. Socio-economic criteria: School decile ratings<sup>9</sup> and the New Zealand deprivation index were used as indicators for socio-economic (SE) selection with a low, middle and socio-economic status school selected in each city. It was not possible to get exact representation of SE status for schools so the terms high/middle and low are indicative rather than exact.
2. Schools were selected that ensured we had a range of ethnicities in the study, particularly Māori and Pasifika children, although these children were largely present in Auckland and in lower decile schools. Children were asked to self-define their ethnicity.
3. Geographic criteria: the schools in each city needed to be geographically comparable such that children lived in similar areas and neighbourhoods. In Wellington and Auckland the schools were all in the same area of the city and close to each other. In Dunedin which is a smaller city, schools were not physically close but were all in a clearly identifiable suburb dominated by a mix of low density housing and similar range of open spaces. Schools were chosen where the children would mainly live in the school neighbourhood and for whom the school was their local school.
4. Biological criteria: the schools were selected that had environments with a similar range of habitat types, e.g. bush/forest, large and small parks, sports fields, gardens, wild areas, lawns, gardens and hard landscaping. Our surveys of biodiversity show there was little difference in the biodiversity present in neighbourhoods of children from the three schools in the three cities sampled (Fig. 1).

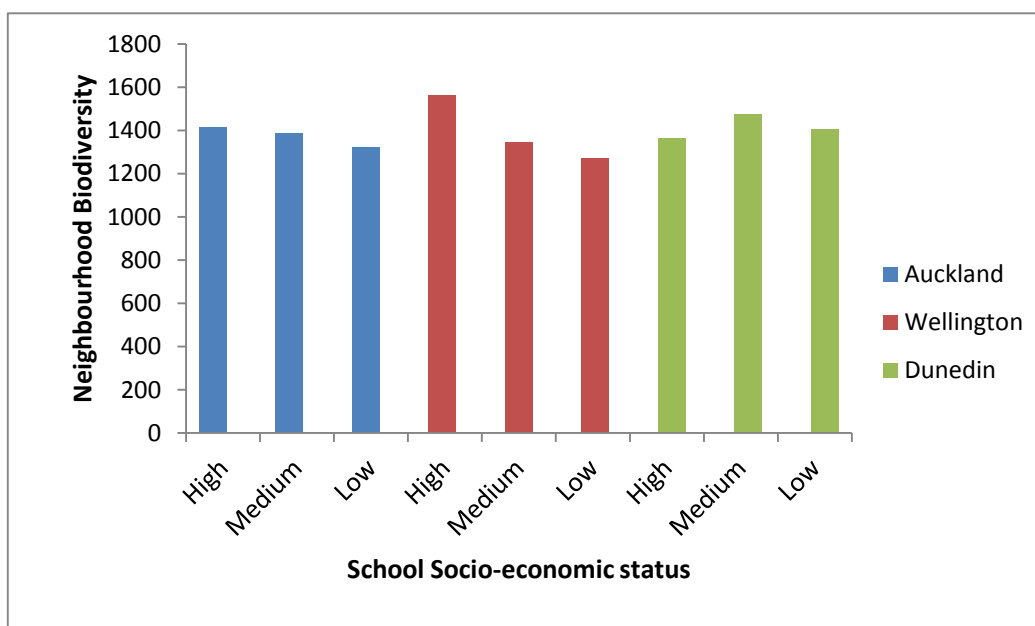
Each participating school was asked to nominate a class of year 5-6 students, i.e. age 9-11 year olds<sup>10</sup>. A total of 187 children participated in the research. See Tables 1 & 2 for characteristics of the schools.

---

<sup>9</sup> Decile 1 = lowest socio-economic level, level 10 is the highest. For the deprivation index 10 is most deprived and 1 the least deprived.

<sup>10</sup> Children in year 5 are usually aged 10 and in year 6 are aged 11 although it is normal to have variation of up to one year in the ages of children in each class.

**Figure 1. Neighbourhood biodiversity values\* for children attending all schools.**



(\*see page 38 for an explanation of how these were derived)

**Table 1. Characteristics of the participating schools**

City	Decile	Deprivation Index*	Gender		Total
			F	M	
Auckland	9	4	14	9	23
	3	6	9	12	21
	2	8	4	17	21
Wellington	10	3	8	8	16
	6	7	11	12	23
	4	8	9	12	21
Dunedin	9	4	10	13	23
	6	6	9	10	19
	3	6	11	9	20
			<b>85</b>	<b>102</b>	<b>187</b>

\*The average deprivation level using Statistics New Zealand's mesh block deprivation data for the children in the study. The deprivation index is reverse order to deciles with 10 being the highest deprivation level and 1 being lowest



**Table 2. Ethnicity data for the participating schools based on the most recently available Education Review Office School Reports**

City	School decile	Pakeha	Māori /Pasifika	Asian	Indian	Other
Auckland	9	51%	16%	10%	19%	4%
	3	27%	49%	5%	5%	14%
	2	2%	75%	3%	14%	6%
Wellington	10	65%	9%	17%	-	9%
	6	49%	17%	15%	-	19%
	4	26%	49%	13%	-	12%
Dunedin	9	83%	8%	-	-	9%
	6	72%	19%	7.5%	-	1.5%
	3	60%	17%			23%

### Recruiting the children

All participating schools were asked to send a consent form home with all the children from the selected classes. Consent had to be obtained from parents in order for their children to be interviewed as part of the study. Consent was also obtained from children who signed their own consent form indicating that they were happy to participate. Participation in the interview stages of the study was voluntary but all children in the focus class were required by the teacher to take part in the map drawing exercise as part of a scheduled class activity. The maps drawn by children who did not or whose parents did not give consent were not included in the study. The box on the next page indicates some of the information given to both parents/guardians and children in the recruitment stage. Each participating child was provided with a certificate and pen to thank them for their participation. On completion of the study each participating class was provided with a morning tea for the children. Each school was provided with a summary report of preliminary results and will receive a copy of this report. They also received a laminated A1 poster map showing the areas used by the children from their school. All the identifying data for individual children was removed from this map.

Approval for the research was obtained from the University of Otago Human Ethics committee.

**Extract from the information sheet supplied to parents who then signed a consent form for their child. One school at their request had a more simplified version.**

#### **INFORMATION SHEET AND CONSENT FORM FOR PARENTS/ GUARDIANS**

Studies have shown that contact with nature is vital to the health, happiness and well-being of children, but what is less clear is children's perception of nature, and how children interact with nature in their immediate environment, particularly when the environment is urban. This study, which is being undertaken by researchers from the University of Otago New Zealand, looks at how children connect with nature in their daily lives, around their home and in their neighbourhood. It will help us understand and plan better environments and neighbourhoods which support children in connecting with nature.

The project will involve children aged 9-11 years old from schools in Wellington, Auckland and Dunedin. We will collect information about where children go in their neighbourhoods, and relate this to information we collect about the biodiversity present in their neighbourhoods.

The children will be asked to do a drawing that shows the places they think are natural in their neighbourhood. Each child will be asked in an interview to talk about their lives, including where they live, where they go to play, places that are good for nature and what they like or don't like about their neighbourhood. They will also be asked to do a computer exercise where they will be asked to look at an aerial photo of their neighbourhood, and show the places they go and why they go there. The researchers have used these techniques over many years with children in New Zealand and the Pacific and find children enjoy talking about their lives and doing the computer exercise.

*Extract from the Information sheet given to the children, the information was explained to the children but they all read and signed the attached consent form.*

### **INFORMATION SHEET FOR CHILDREN**

Thank you for showing an interest in this study. Please read this information sheet carefully before deciding whether or not to participate.

#### **Who are we?**

We are a research team at the University of Otago. Our study looks at children's lives. Especially, we are interested in the places where children live and how children think about and connect with nature. We plan to work with children aged 10-11 years old from schools in Auckland, Wellington and Dunedin.

#### **Why do we do this research?**

This study will help us understand children's lives better and plan better environments and neighbourhoods for children to enjoy nature.

#### **What do we ask you to do?**

If you agree to take part in this study, a researcher will visit you at your school. You will be asked to take part in a class exercise and have a short (30 minute) meeting with the researcher. They will ask you a few questions about your life, where you live and about nature in your neighbourhood. Then you will do a computer task with the researcher.

---

*I am happy to take part in the research project*

### ***Nature in the city***

I understand that I do not have to take part in this study if I don't want to and nothing will happen to me. Anytime I want to stop, I can.

## **Collecting the data: the methods**

### **How the research was undertaken**

In order to gain insight into how children connect with and use natural areas in their neighbourhood, a mixed methods approach was used comprising four main methods a hand drawn mapping exercise, a one-on-one interview, and a two-stage computer mapping exercise.

#### *Hand-drawn mapping exercise*

To begin, the children were asked to hand-draw a personal map on an A3 piece of paper as part of a class exercise (examples have been used to illustrate this report). The children were given 30 minutes for the exercise. On their map they were asked to show their home, school, places they went, people they knew, what they did, and any nature areas. The main purpose of this exercise was to brainstorm, so the child would be prepared for the following one-on-one interview and GIS mapping exercise. This mapping exercise was used to engage and enthuse children about the research. In the interview the child was asked to talk about their map which helped the child feel more comfortable in the interview.

#### *One-on-one interview*

Each child completed a one-on-one interview with a researcher. Questions were asked about their lives, family background, mobility, independence, family activities outdoors, family contact with nature and their own understandings, experiences and views of nature.

#### *Geographic Information Mapping (GIS) exercise*

With the aid of the researcher each child built their own computer-based personal nature map using a Geographic Information System (GIS)/aerial photo interface using ArcGIS (v.10.0). Address point software was used to locate each child's home on a high resolution aerial photo of the child's city. On the aerial photo children were asked to point to places, moving outwards from their home, that they associate with nature and where they spend time. As children pointed to a place/feature (e.g. tree, friend's house, their school, sports field) on the air photo, a symbol was added to the map. Children were asked where they liked to play and what they did, if they knew any neighbours, if they visited those neighbours, where their friends lived, if they walked or were driven, and who went with them. In order to assess connection to nature, children were asked where they would go to find: birds, insects, "special" trees, natural water, a wild animal, a quiet nature place and a wild nature place. As children pointed to a place/feature on the air photo, an appropriate symbol was added to indicate the feature, and the point labelled with any specific verbatim information until the child felt the map was a complete representation of what they did in their neighbourhood. A "home range" was then drawn around the points on the map.

#### *Dot mapping exercise*

In order to assess where children were 'choosing' to spend time when they were outside, on the GIS map the children were asked to place at least 30 dots on their own home range to indicate the outdoor places they spend the most time, placing more dots in areas where they spent more time, and fewer dots in areas where they spent less time. The majority of students interviewed understood this process and required little extra explanation. Most were meticulous with the placement of their dots.

## RESULTS

### A. Children's lives

We first asked about their lives, their neighbourhoods and the places they visit. There has been concern expressed that children are less independently mobile than previous generations of children, they are not spending time outdoors and are thus not experiencing outdoor play or having opportunities to connect with nature. We were, therefore, interested to investigate the characteristics of children's families, the children's activities and travel patterns including their levels of independence, particularly their independent mobility. Results are presented based in graphs for the three schools with schools identified by their approximate city location and socio-economic status.

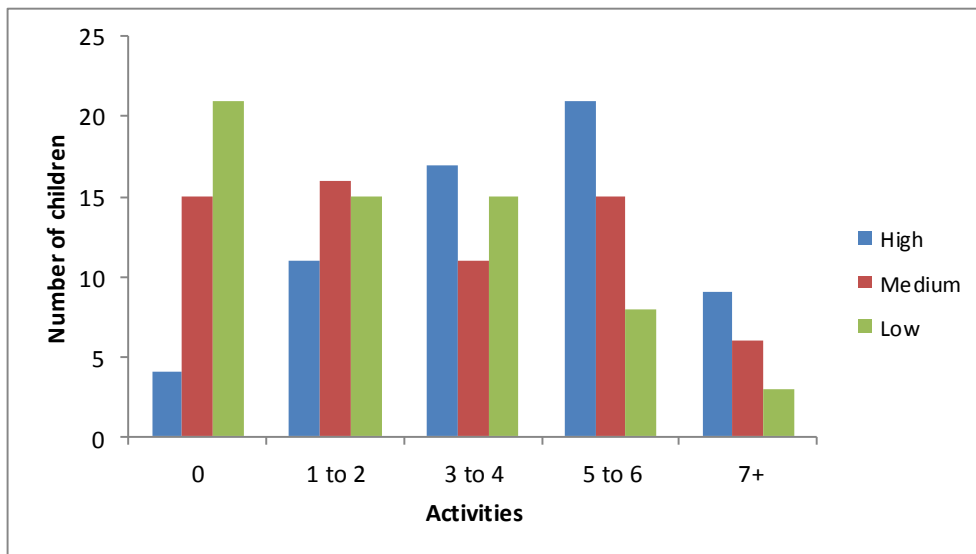
#### *Neighbourhood*

Children were invariably positive about the places they lived in and overwhelmingly considered their neighbourhood to be friendly and safe. They liked and mostly had friends close by, they liked friendly neighbours, peaceful neighbourhoods, bush nearby, low traffic, school being close and having facilities such as parks. Several Auckland children mentioned they liked that their neighbourhood was "full of Islanders, friends nearby". The commonest thing they didn't like was 'nothing', followed by, but not indicated nearly as frequently, 'noisy or fighting neighbours'. Other dislikes included cats fighting, bees, dogs, traffic and for some Dunedin children, student neighbours.

#### *Activities*

The children often lived busy lives and took part in a wide range of activities. Generally children from lower socio-economic schools did fewer activities compared to children from higher socio-economic schools. The number of activities undertaken by individual children could vary markedly within the same school. However there were a large number of children (40) who did no activities. Children in Wellington tended to do more activities than children in the other two cities, with even low socio-economic school children doing on average, 3.5 activities per week. The high income Wellington children on average did 5.3 activities per week compared to high socio-economic children in Dunedin who did 3.5. Low socio-economic school children in Auckland did 1.6 activities and in Dunedin 1.9 activities per week. The highest number of activities was by a 9 year old girl attending a low socio-economic school in Wellington who did 12 activities, including gym, taekwondo, soccer and swimming, and was mostly driven to these activities. Another girl aged 10 at the same school did 9 activities including swimming, Guides, netball, art, Wardens and when asked about her neighbourhood says she has lots of friends and can run free and scoots unaccompanied to places. Children doing lots of activities can still be closely engaged with their neighbourhoods and have good social lives. Most of the children doing the highest number of activities were 9-10 year old girls. The highest number of activities from a boy was 9, from a 9-year old attending the high socio-economic school in Wellington. He walks unaccompanied a lot, says he doesn't like the steep hills, and his activities include soccer, gym and church.

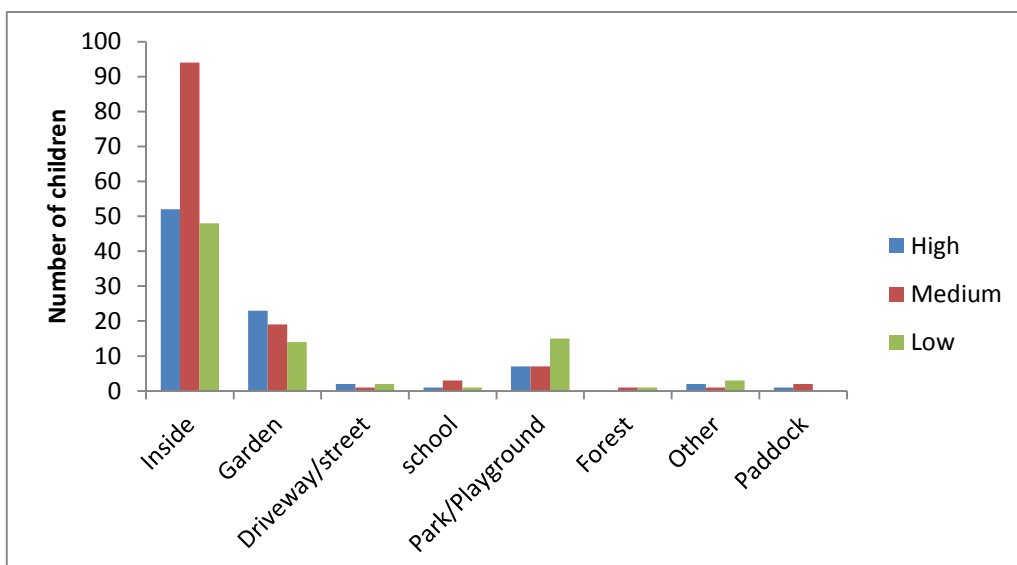
**Figure 2. Number of activities children undertaken, by socio-economic status of the school\***



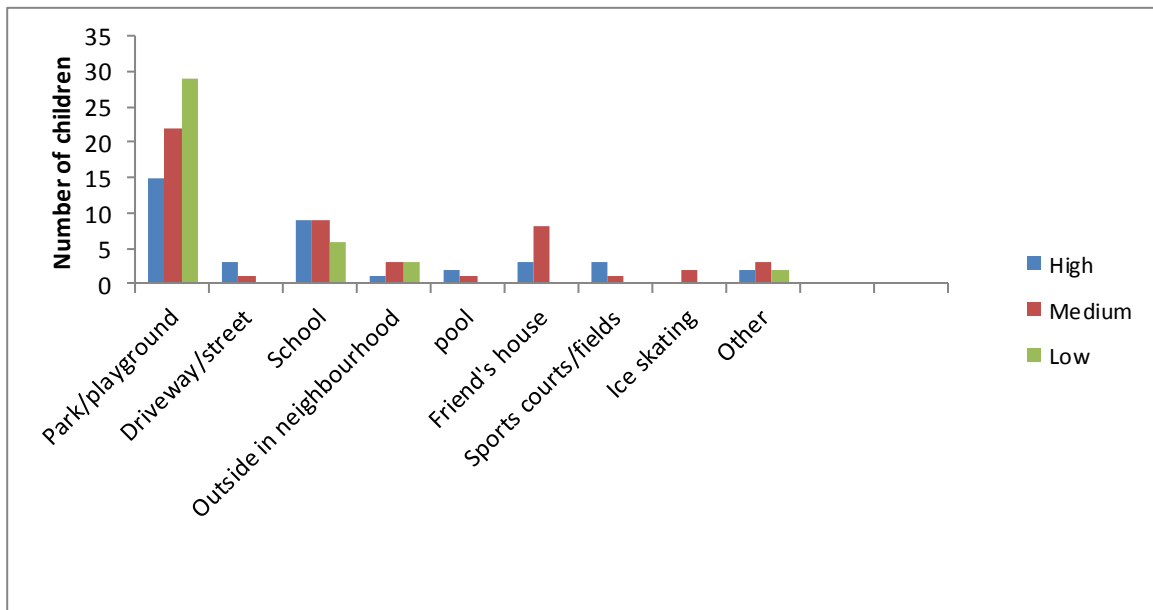
*\*In the graphs: High, medium and low refer to the school's general socio-economic status based on school decile and NZ Statistics deprivation data*

We were specifically interested in where children play. The responses were interesting as clearly children wanted to be with other children when they played outside or went to the park. When on their own they preferred to be inside or in the garden. Their response could be influenced by the fact that they may not be allowed to go outside the home on their own. For our study this finding was especially important as it showed that children being active outside was dependent on their friend network.

**Figure 3a. Where children like to play when by themselves, by socio-economic status of the school**



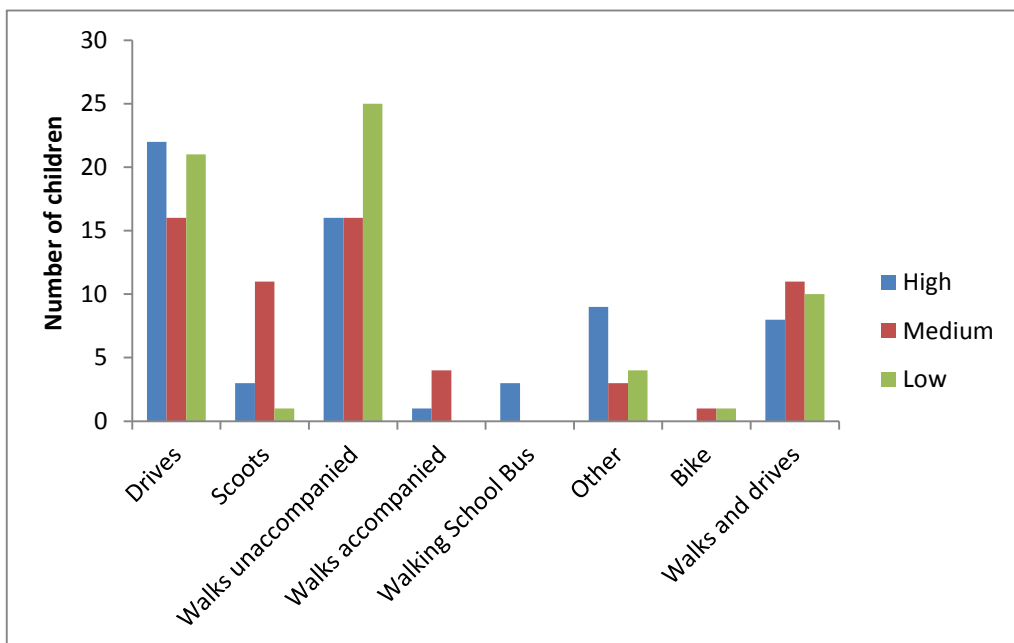
**3b. Where children like to play when with friends, by socio-economic status of the school**



*Travel patterns*

All the schools in the study were chosen because they were schools zoned such that only children living in the zone could attend, or they were schools likely to have most of their children coming from the local neighbourhood. This should mean that most children live close to the school and therefore, could come to school by walking, scooting or cycling. However, although many children did walk, large numbers are driven to school even where distances were very short.

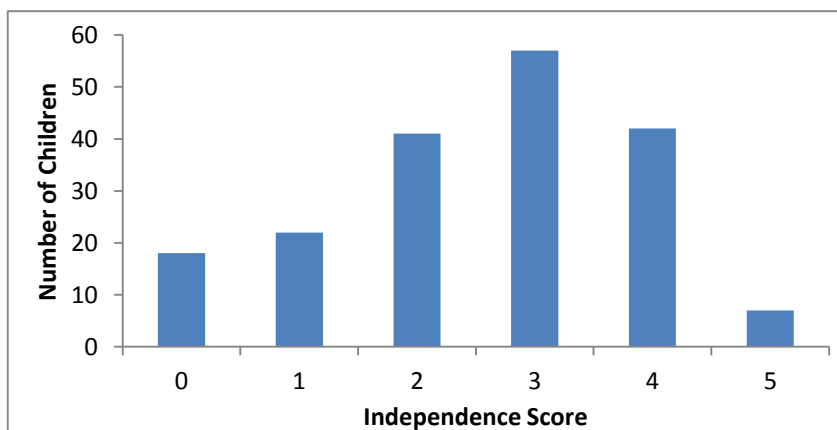
**Figure 4. Modes of transport by children on their journey to school, by socio-economic status of the school**



### *Independence*

There have been substantive changes to children's travel patterns in the last two generations from a situation where children largely travelled independently or with other children to the current scenario where children often travel larger distances across the city but are doing so in cars driven by parents to schools and activities<sup>11</sup>. We defined independence as movements made by the child without being accompanied by an adult, although they may be accompanied by their peers. We anticipated that children with greater independence would be those most likely to play outdoors and most likely to be able to make more connections with the natural biodiversity in their neighbourhood. First we needed to establish levels and influences on independence. Independence unsurprisingly increased with age, particularly for girls. Although general trends are observable between individuals, families, schools and ethnic groups, there were large differences in where children were allowed to go independently. Very few children went outside their immediate neighbourhoods. Longer journeys were usually associated with going to specific destinations, school, activities, and relatives rather than being associated with free play or exploration.

**Figure 5. Overall levels of independence of children**



The scoring system used for ascertaining independence was as follows:

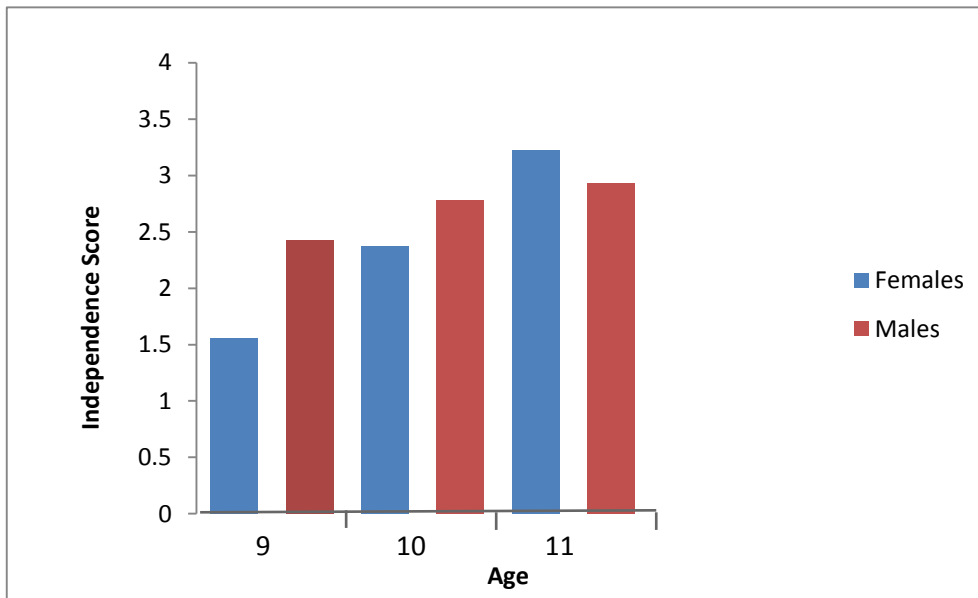
- 0-No independence
- 1-Home/surrounds/street only
- 2- Home surrounds/street and one other place (e.g. school)
- 3-Home surrounds/street and freedom within the suburb but limited to specified journeys/destinations
- 4-Home surrounds/street and freedom, within the suburb, not limited
- 5-Freedom within the suburb and specified destinations outside suburb

---

<sup>11</sup> 2009 Freeman, C. and Quigg, R. *Commuting Lives: children's mobility and energy use*, Journal of Environmental Planning and Management, 52: 3, pp.393-412.



**Figure 6. Levels of independence of children by age and gender**



## **B. Children and nature**

In this section we tried to ascertain how children perceived nature and their views on and experiences of nature.

### *What is nature?*

The children were asked how they would explain what nature was to an alien who had no idea of nature. The responses generally referred to green, plants, trees, living things, the environment, animals, everything and nature's life giving properties. Some of the responses were interesting, sophisticated and idiosyncratic:

"Nature is green, stuff and it's living and you needs water and sun, it's everywhere."

"Not manmade, usually not out there colours like pink, usually colours like green, brown, orange."

"Nature is really cool, its fun, it's beautiful, basically what keeps us alive, we can't survive without it."

"Living things, and it's our culture."

"Nature is what grows by itself, nature is things that produce oxygen and live, and you can't just destroy it."

"Plants, trees, people, animals, water."

"Friendly, it has useful resources, you can do all sorts of stuff in it, there's animals, trees and plants."

When asked if they enjoyed being in nature fifteen said they sometimes did, four said no, but three of these pointed to mixed positive and negative nature experiences. The rest all said yes, they enjoyed being in nature. The reasons given for liking natural places frequently mentioned that it was fun, they could explore, climb trees, lie in the grass, smell stuff, it was peaceful, quiet and there was fresh air.

“It's nice and sunny, you can get exercise, there's plenty of room to run about if you're feeling energetic.”

“Air is fresh, it's really green, and it's good for playing hide and seek and games with friends.”

“I like it because you can always hear the birds sing.”

“Calm, can lie down and look up and see lots of things, can walk around and look at nature, and you can make food out of it.”

“Nice place to play.”

“Because it's nice to hang around in and it's pretty.”

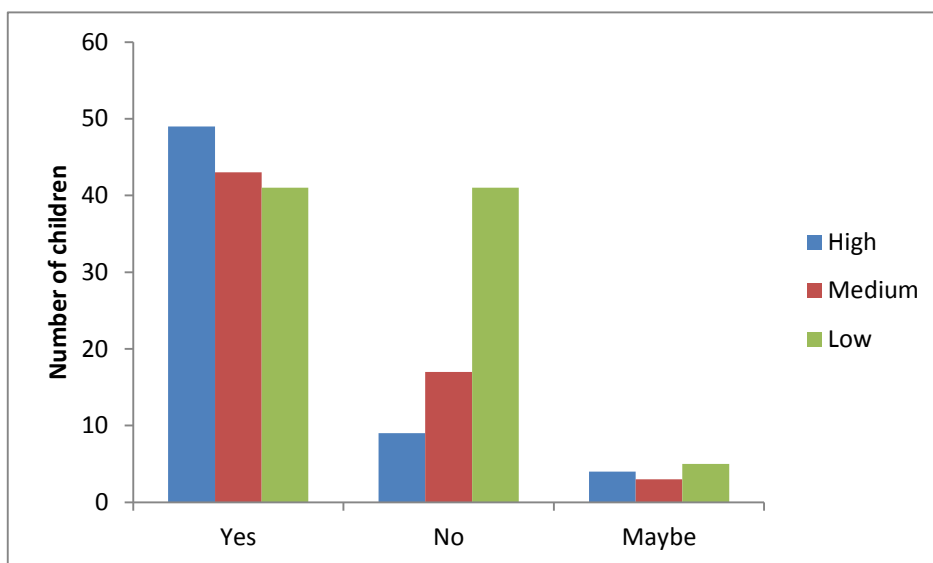
#### *How much nature?*

We were interested to ascertain children's views on whether they felt there were opportunities to connect with nature and to see if they felt disconnected from nature in the way that Louv and other environmentalists imply. Children were generally positive about their neighbourhoods, agreeing that they had a lot of nature and mostly stating that they had enough nature. Children from low socio-economic schools were most likely to respond negatively, and when the answers were compared against deprivation levels again children in more deprived locations were most likely to respond negatively. Children were aware of instances where nature was being lost:

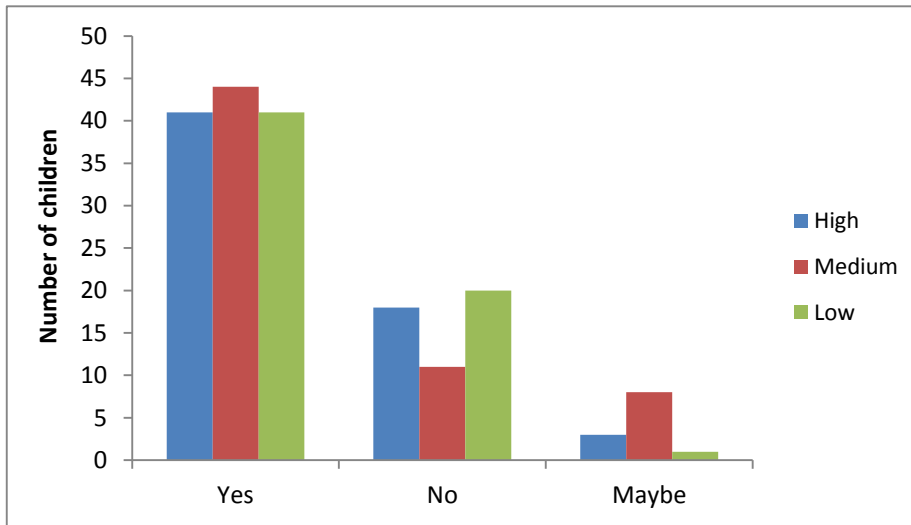
“Because all the nature in the backyard has been destroyed so they could build two new houses behind the house.”

“It would be awesome if there was a park nearby, there used to be a big vacant lot, but now the old people home was built where there used to be trees and bushes.”

**Figure 7a. Is there a lot of nature where you live? by socio-economic status of the school**



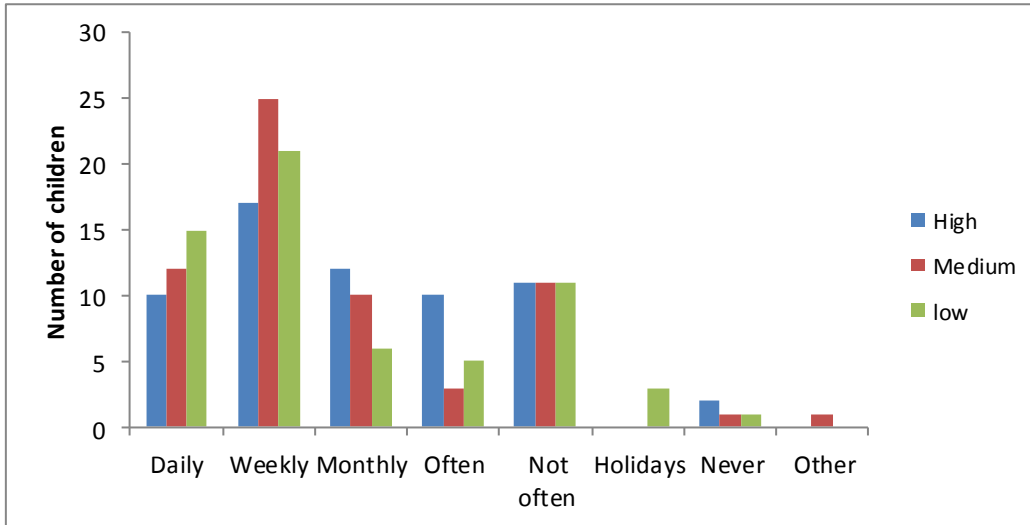
**Figure 7b. Is there enough nature where you live? by socio-economic status of the school**



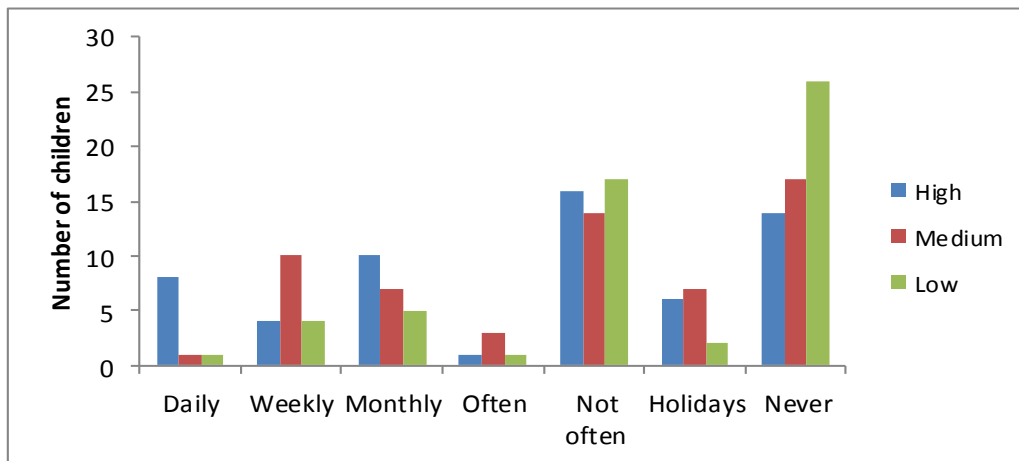
#### *Natural places and activities*

We were interested in the places that children visit and the activities they do with their families, especially activities in more natural settings both locally and further away. As well as asking where they went we also tried to get an indication of how often. The answers to this question were not always very precise so we recorded the terms the children themselves used, such as “not often”, “holidays”, “sometimes” etc. That these terms are somewhat imprecise doesn’t detract from the fact that they do, nonetheless, give an idea of whether the activity or place is one that children are familiar with. The children were able to give a clear indication of whether they went to a place such as the beach and how often; e.g. they would say that they go to the beach every holiday and they kayak, or they have only been camping once with the school. The responses to the bush/ forest question were interesting as some children would refer to small groups of trees that were locally present as forest or bush. If we had more time it would have been really useful to ask for the names of the places children visit, e.g. the rivers, to understand better where they go. The figures below show the responses to questions about places they go to and how often. The most frequently visited places were parks. These were exceptionally well used by large numbers of the children, but mainly where the parks were very local and in the neighbourhood. These parks were often dominated by mown grass, had playgrounds and showed little biodiversity with few trees, bushes or other more natural vegetation. Where more natural vegetation was available, such as in local bush, they were not well used.

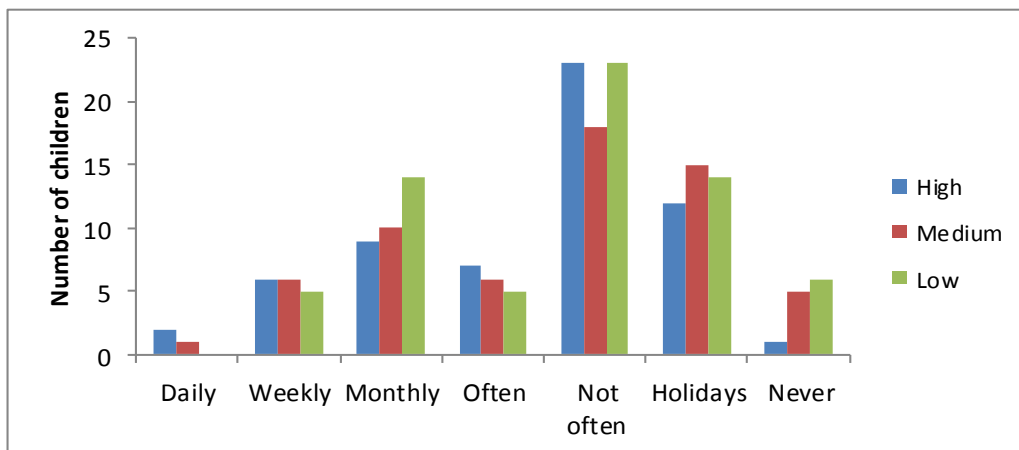
**Figure 8a. How often children visit a park? by socio-economic status of the school**



**Figure 8b. How often children visit a forest or bush area by socio-economic status of the school**



**Figure 8c. How often children visit a beach by socio-economic status of the school**



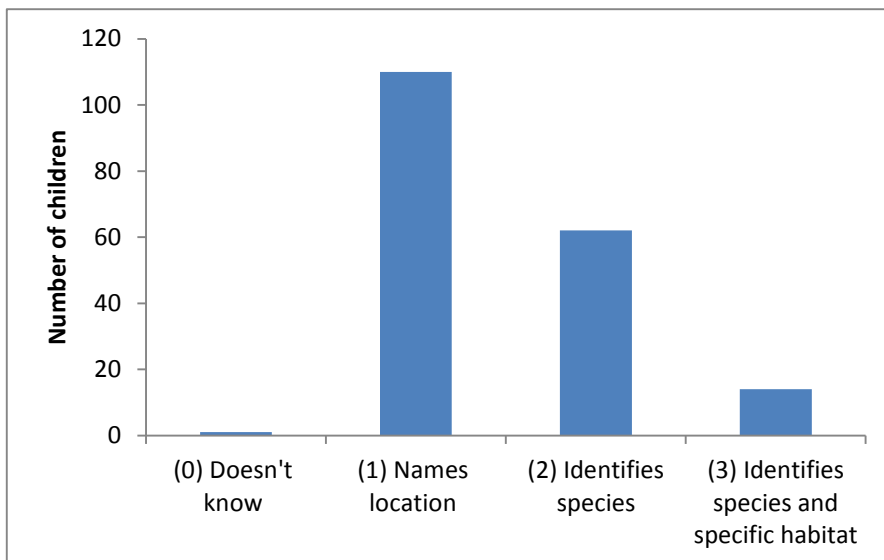
There was not a very strong relationship between socio-economic status and places where children went. Parks were most commonly visited by all children, and camping was the least common activity. Only a few children go camping frequently with family (4) and 42 went during holidays, but most never went. The lack of camping for many children reveals the importance of the school camping trip commonly undertaken by schools in years 5 or 6 as this may be children's only camping experience. While most children went to the beach, some had never visited the beach even though beaches were in easy reach of all the children's homes. The school beach trip is vital for these children. During our field work one class went on a school beach trip, walking from the school to the local beach: some of the children had never been to this beach. The fact that a place such as a beach, bush walk, or river is locally present does not mean that it will be a place children or their families visit.

### C. Connections to nature

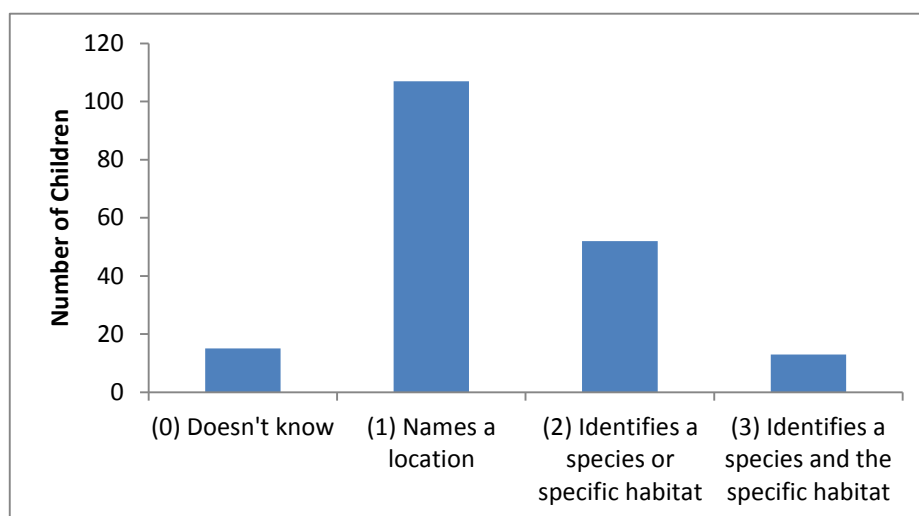
Children were asked questions that interrogated their knowledge about and their observations of various common species and natural features. Again the alien scenario was used so children would be asked, for example: "where would you take an alien to see a bird/water/wild animal...?". Children were also asked questions about their experience of nature; for example "where is a wild jungly place", "a quiet nature place" are there any "special trees you can show us". Children pointed to the location of species, features and places on their aerial photograph and were again very precise and accurate in where they wanted these to be shown on their personal map.

The figures below indicate children's responses for birds and insects. Within the area available to them children are able to seek out contacts with nature. If they only have access to their garden, they will refer to places in their garden where birds and other species can be seen. However, even when children can access wider spaces the garden was often the primary location for connecting with nature.

**Figure 9a. Where would you go to find birds?**



**Figure 9b. Where would you go to find insects?**



For some children all their identified places to see species were in their garden, but for others a large area was indicated; for example, birds could be located in Zealandia ecosanctuary or in Auckland harbour, or a nearby bush area. Most children could identify places for birds (e.g. in trees, on power lines), wild animals (e.g. rats in the attic, possums in garden), water (e.g. rivers, harbour), special trees (e.g. climbing trees, fruit trees). They found the water question (where do you find natural water) the most difficult with 86 children saying they didn't know, or they referred to inside water rather than natural water. In our study 38 children said they had no garden. This did not always mean they had no outside space, as they may have a communal space if they lived in state housing flats or apartment complexes. The children who had no open space were usually living in high rise apartments in the Wellington CBD. These children found it difficult to identify nearby places for seeing species and experiencing nature, and sometimes they put birds, rats and other species on the roof of their apartment block. The remainder of the children had gardens and most (149) described trees, bushes and other natural features and even species in their garden. The children liked to talk about their gardens and gardens in their neighbourhoods:

“Giant hedge, they don't cut the grass a lot so it's very grassy, lots of flowers grow in garden.”

“Not that much nature around, only trees, but there is a flat garden.”

“Big creek, big backyard.”

“Yes, Trees, have lots of trees and bushes on the pathway up, Neighbour does gardening.”

“Dad does a lot of gardening.”

“A lot of trees in backyard, have a park up the street, and there's a river down the bottom, sometimes go down there to have lunch, and her and sister climb trees.”

“Heaps of trees in backyard.”

“Everyone has a backyard with more than two trees.”

“Lots of bees that come to pollinate flowers they have, very friendly place, people have gardens.”

“(To the alien) I would show my garden, and next door's garden, and say my garden is colourful, next door is basically a jungle.”

“Lots of trees around house, lots of birds in garden, and once had hedgehog in the garden.”

*Assessing children’s connections with nature*

The key finding to come from our study is that children do connect with nature. Children could obtain a maximum score of 27 based on their responses to nine nature-based questions. An example of the scoring for one of the nine questions is as follows:

Question: Where would you go to find insects?

0-Doesn’t know

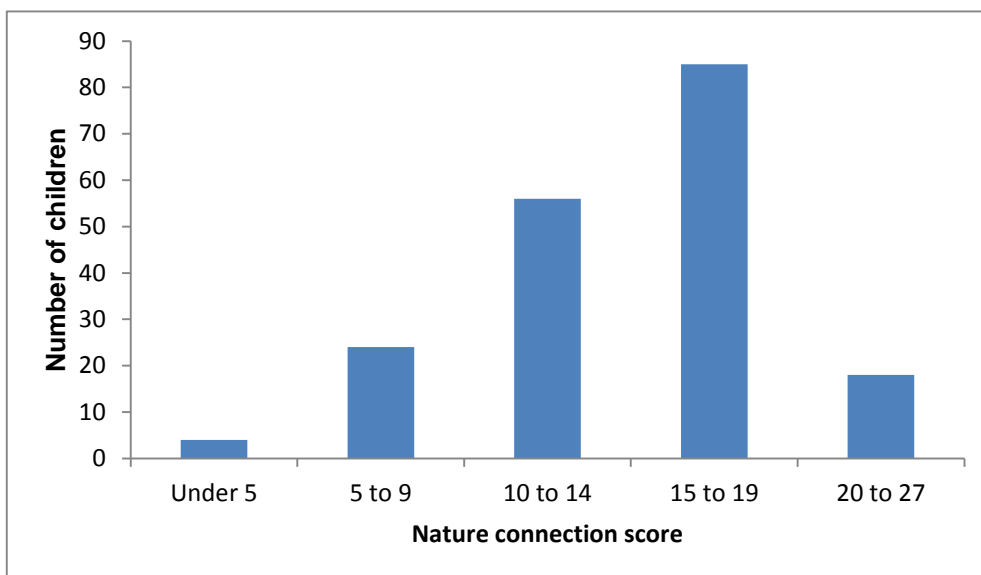
1-Names a location

2-Identifies a species or specific habitat (e.g. spiders, or “insects in the woodpile”)

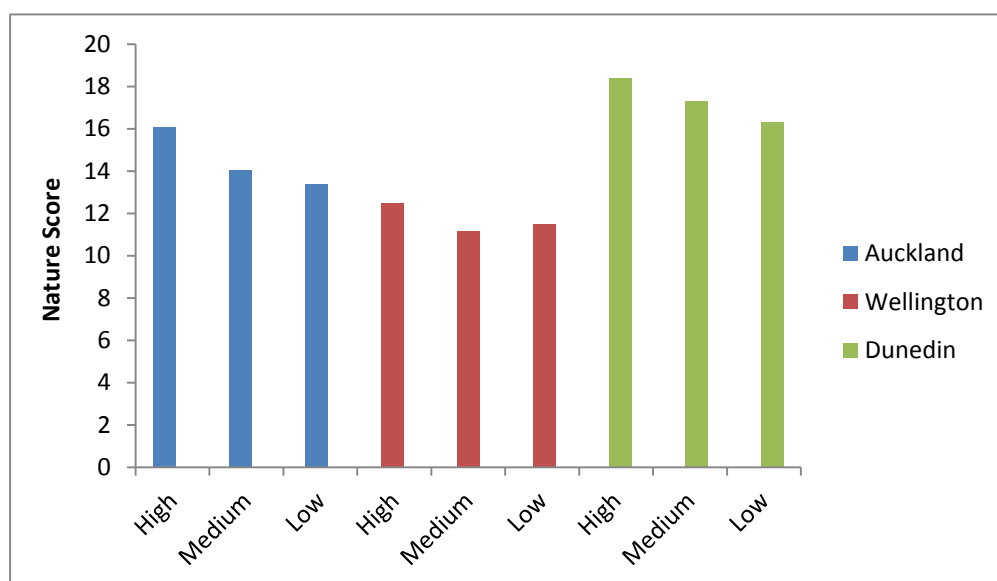
3-Identifies a species and the specific habitat (e.g. “I see spiders in the woodpile”).

The scores were then totalled up to give each child a nature connection score. There were very few children (28) who scored below 10, which is a cut-off score for children who had poor nature connections. These scores were then interrogated to see if they were influenced by a whole range of factors such as socio-economic status, ethnicity, city, and independence. There was a general trend in that children from lower socio-economic schools and areas did less well, however, children in Dunedin did better than children attending comparable socio-economic schools elsewhere. Overall Dunedin children showed the highest nature connection scores. Nature connection scores varied by ethnicity with Pakeha children scoring on average 16/27, Pacific Island/ Māori children scoring 14/27 and Asian children the lowest at 10/27.

**Figure 10. Nature connection scores for the children in the study**



**Figure 11. Nature connection scores by school by school's socio-economic status**



A modelling process was undertaken in which all the possible variables that could impact on nature connection were assessed against their relationship to nature connection scores. The model averaged the summary of effects of each variable on children's nature connection scores from nine different schools in Auckland, Wellington and Dunedin. This model identified the most important variables making a difference to children's nature connection scores as follows:

- How much of the available biodiversity was used by children
- The greater their independence, the higher their score
- Deprivation levels have a negative impact on scores
- The more social connections a child has, the higher their score
- Gender does have an influence (boys have higher scores)
- Being an only child has a negative influence (see also earlier negative impact on independence)
- Having no garden has a negative impact.
- Ethnicity
- City

Higher connection scores were found in Pakeha and Māori /Pacific Island children relative to those of Asian children and the group "other ethnicity" (often recent immigrants). Children in Dunedin had higher scores than those in Wellington. The lower average score in Wellington may have been because a proportion of children in this city lived in high-rise flats in the CBD. The Pakeha children's higher scores can be attributed to generally higher socio-economic status which was associated with more biodiverse environments especially private gardens, as well as their access to wider experiences such as visits to rivers, forests or places such as Zealandia. However, while differences existed between groups, there were greater differences between individuals' experiences: i.e. children from the same ethnic group or city can have large differences in their connections to nature.

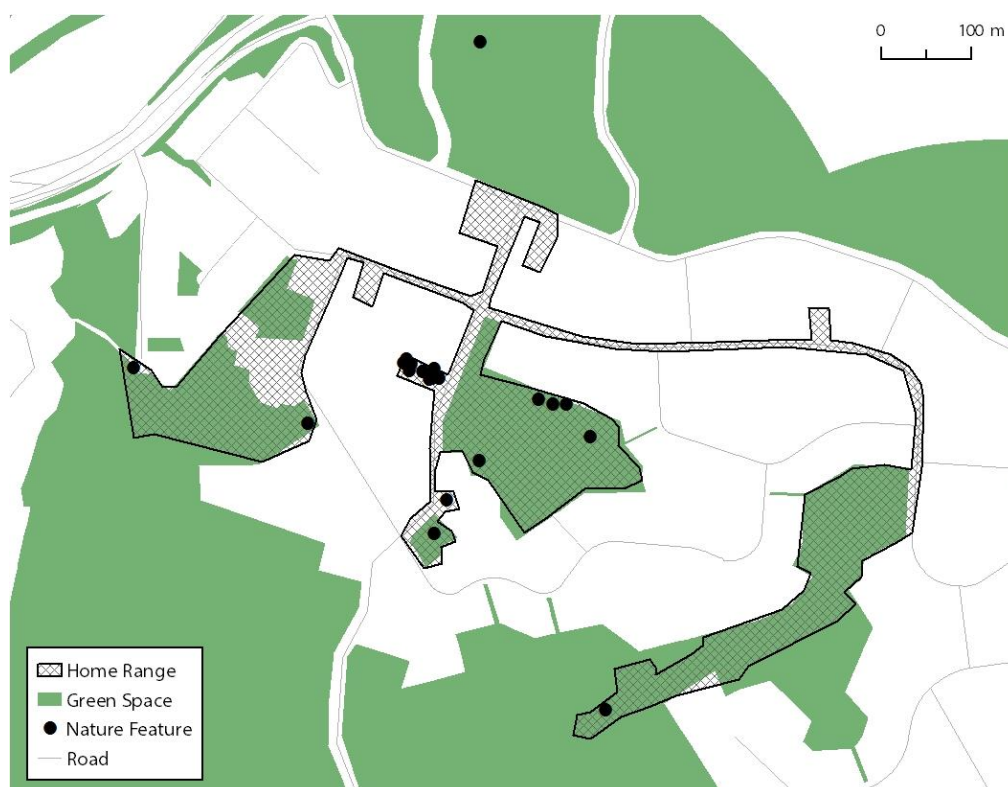


### *Children's movements in relation to their nature connection scores*

The examples below show the assortment of independent movements found amongst the children in our study. The maps show the location of general green space that they could access and the placement of their natural features, people and activity spaces that made up their personal maps. On the original GIS map and air photo specific symbols (e.g. child for friends home, rat for wild animal) were used, however, to avoid identification the scale used here is indicative only of the locations children use. Identifying features such as home or street names have been removed. The maps show where children placed their nature features. Note most are placed in the child's garden and close to home.

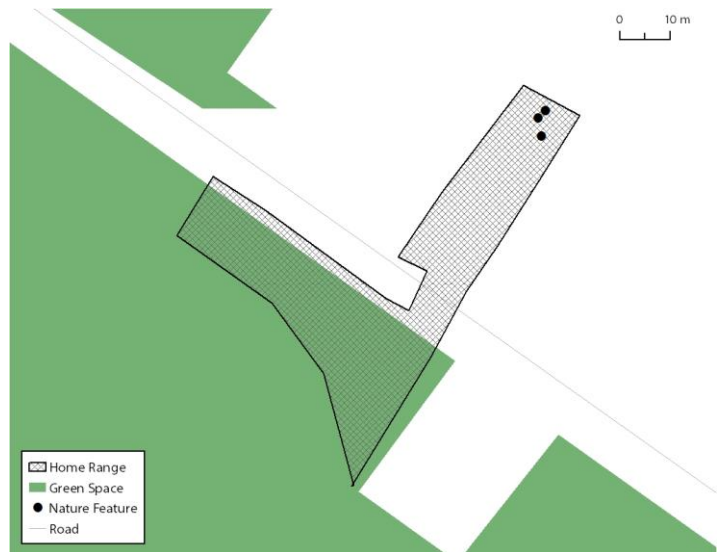
#### **Child example 1: Good nature connections with medium independent movement (nature connection score 24/27)**

Jayden was a 10 year old Pakeha boy attending a high socio-economic school who had a very high nature connection score (24/27), and average independence (3/5). He only had one after-school activity during the week, but visited friends in his neighbourhood daily, two lived within walking distance. He wasn't allowed to go many places in his neighbourhood without being accompanied by his parents but specifically mentioned visiting an organic garden and duck pond not mentioned or visited by the other children at his school. He had few parental outings with the exception of these neighbourhood walks that he described as "often". He perceived there to be lots of nature in his neighbourhood, but not quite enough. This child liked to be in nature because "it's nice and sunny, and you can get exercise, there is plenty of room to run about if you're feeling energetic".



**Child example 2: Good nature connections with limited independent movement (nature connection score 20/27)**

Kody was an 11 year old Pakeha boy with very limited independence (1/5) but high nature connection score (20/27). He was only permitted to play very close to his house, despite living across the road from a sports field and park, and just down the road from a popular park with a bush walk. Although he had lived in that house for eleven years, he had only been taken on the bushwalk once. This particular outing must have made an impact, as he cited his favourite aspect of the neighbourhood as living close to the bushwalk, and saying it was a "good walk". He liked being in nature places because they "have lots of interesting spots, there's new creatures and things I've never seen before, and are good for exploring". He also believed there to be lots of nature in his neighbourhood, saying "there's heaps of birds always flying over, the gully has lots of plants everywhere, it's practically a forest." He had no after school activities, and had attended a school camp three times. He spent the majority of outside play time in his garden.



**Child example 3: Low nature connection, small to medium independent movements (nature connection score 10/27)**

Aroha is a nine year old Pacific Island/ Māori girl, with low independence and an average nature connection score. She attends a low socio-economic school, lives in an apartment and is allowed to walk to school by herself and to some locations around her apartment complex. She prefers to play outside. She liked being in nature places because "it's fun and a little noisy", but didn't know how to describe what nature is or whether there a lot of nature. However she perceived there to be "enough nature" in her neighbourhood. Her parents took her to the beach occasionally, and she had been camping a few times. Interestingly she placed her bird in a large local park indicating that although it is not part of her home range she is familiar with the birdlife there.



## D Scoring neighbourhood biodiversity

This part of the study was about evaluating levels of biodiversity that children might encounter in different urban habitats, ranging from paved areas to those dominated by vegetation cover. We used information we collected to calculate a BioScore for each habitat, which represented social and ecological values of each habitat. We defined biodiversity as a composite of species richness (i.e. the number of species of birds, plants and invertebrates), structural diversity of vegetation (the number of height strata occupied by vegetation and the diversity of plant growth forms) and wildness (the degree of management and alteration from a native state) to create a holistic measure to encapsulate the many possible aspects of biodiversity to which people could react.

The BioScores also took into account the number of different types of features that add structural diversity to habitat sites, such as trees (single, or in groups or lines), water bodies, fences, grass, paved areas, bare ground, and low and high vegetation. We included artificial structures with natural ones, as artificial structures can support rich and unique assemblages of species, and provide additional structural diversity for children to utilise. We surveyed 150 sites across 13 habitat types in the three cities. The average BioScores were highest in woodland, horticultural or pastoral land-use areas, private gardens with many trees and shrubs, and vacant lots and fringe vegetation (e.g. verges), and lowest in private gardens with few trees and shrubs, public paved areas, and along streets, with intermediate values in private gardens with only a few trees and shrubs, parkland, and grassland managed for sport activities (see examples below).

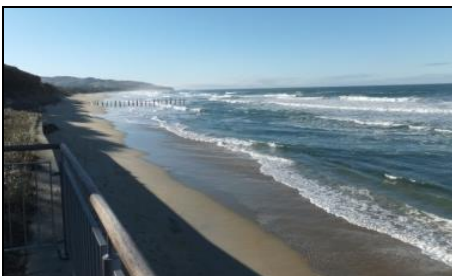
**Figure 12 Different habitat types**



Agricultural/pastoral habitat



Natural area/woodland



Natural area/ beach



Recreational green space



## Natural Neighbourhoods for City Children: Report on Research Findings.

---



Parkland



Well vegetated private gardens



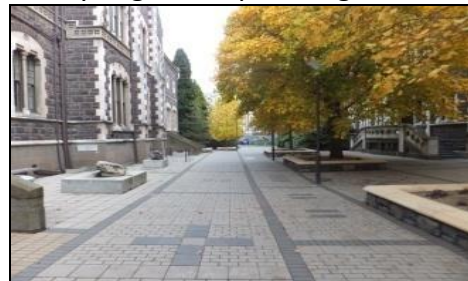
Vacant lot and fringe



Poorly vegetated private gardens



Street



Public paved area



Paved recreational area

We found the biodiversity of different urban spaces was dependent upon the habitat type and the number of features in that habitat. The habitats with high values for green cover, species richness and structural complexity were woodland, agriculture, vacant lots and garden type 1 (well vegetated), indicating both wild and human-dominated landscapes are important sites for enabling connections to nature. In contrast, the lowest scoring habitats were open public areas (OPA), recreational paved areas and streets, which had low values for amount of green cover, species richness across all three taxa, and higher levels of management.

We used these BioScores for different habitat types to predict the biodiversity content of the interviewed children's neighbourhoods. Overall, neighbourhoods in all cities contained high levels of biodiversity, and all had some form of public green space. However, neighbourhoods with a higher proportion of residents from minority-ethnicities, or rated

higher on the deprivation index, were more likely to contain greater proportions of less biodiverse habitat types in comparison to more well-off neighbourhoods. The difference however, was largely not in the quality and quantity of public space, but because residents of more affluent neighbourhoods tended to have more biodiverse gardens. This effect of deprivation level on biodiversity in the neighbourhood was most strongly found in Wellington and least in Dunedin. Poorer neighbourhoods in Wellington tended to be in more urbanized settings with less public green space and smaller gardens, while in Dunedin the lower socio-economic school was located in an outer lower density housing suburb. Figure 13 illustrates the distribution of different habitat types in Auckland in relation to the nearby neighbourhoods drawn around each child's home (radius of 500m).

### **E. Children's home ranges**

While studies have shown urban areas can be surprisingly biodiverse, this biodiversity may not be present at a scale that is accessible to urban children. Independent home ranges of children can be confined by barriers such as major roadways and parental restrictions on movements. Over the past few generations these factors have caused a significant decline in children's scale of movement, with a more pronounced reduction recorded in urban areas. Parent's concerns for safety are thought to be a key driver of children's declining independence, particularly regarding the dangers of traffic; now a dominating presence in today's cities. Consequently, many neighbourhood green spaces are now unreachable for local children despite being accessible when first designed, with the result that children have fewer opportunities to interact with nature. Most children do not travel far from home independently. Therefore, children's use of biodiverse areas needs to be evaluated against both availability and accessibility of green areas in the urban domain.

The children showed us on the aerial maps where they went, and we calculated home ranges from this information. We defined their neighbourhood as a circular buffer with a radius of 500 m centred on their home because the average maximum distance travelled from home independently, determined in a pilot study, was 500 m (see Fig 14a for an example). We then assessed how much biodiversity was available and accessible at both a neighbourhood and home range scale for the children in this study. We used our BioScores to compare the biodiversity content of children's home ranges and neighbourhoods between different socio-demographic groups. Given that much of the space in urban areas is not accessible to children because it is private land, we defined accessible areas as public spaces that the child is allowed to visit independently and any privately owned areas that the child indicated they were allowed to visit, such as a friend's garden. This information was added into the habitat map for each child: the change to the availability of habitats in the home range is shown in Figure 14b.

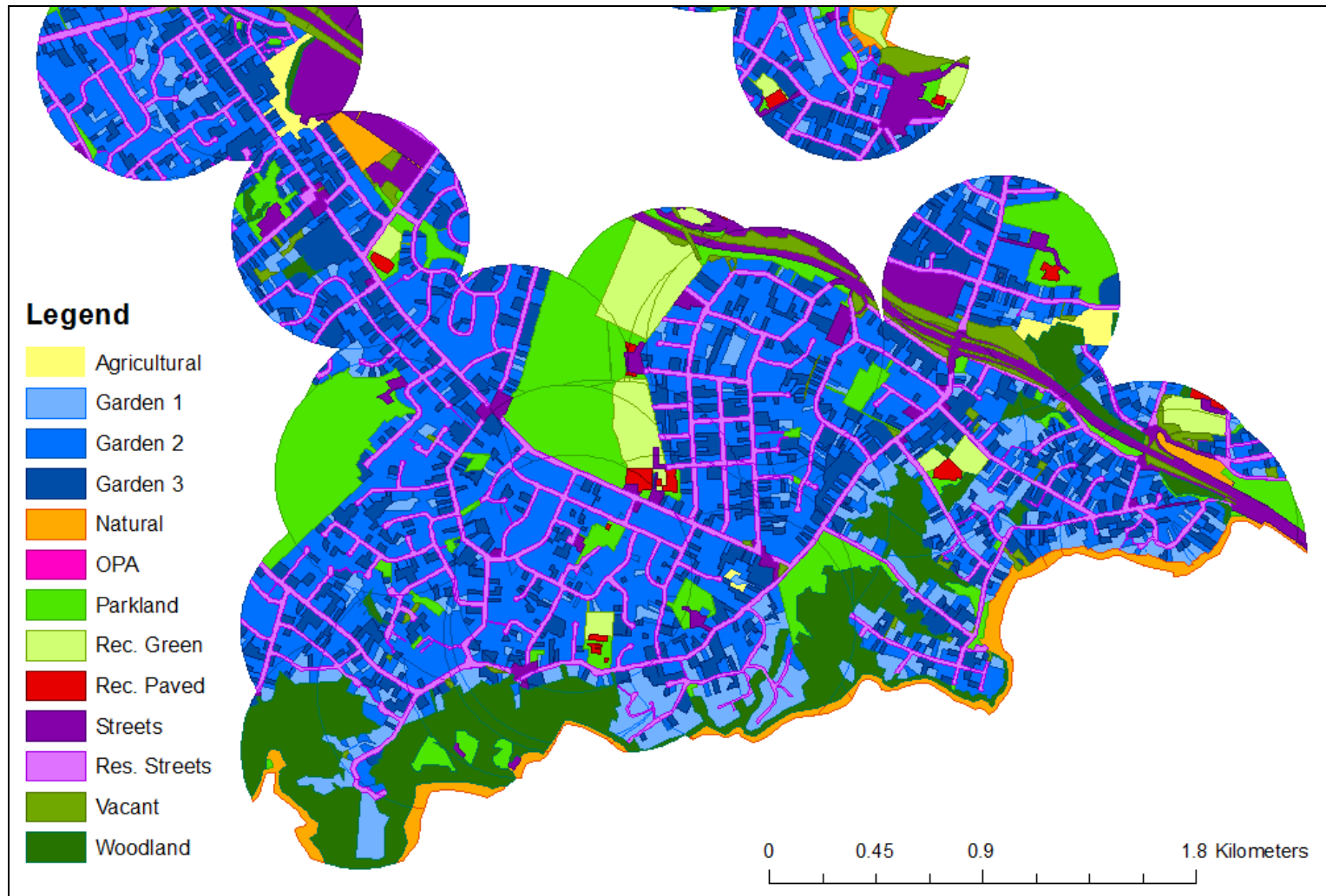
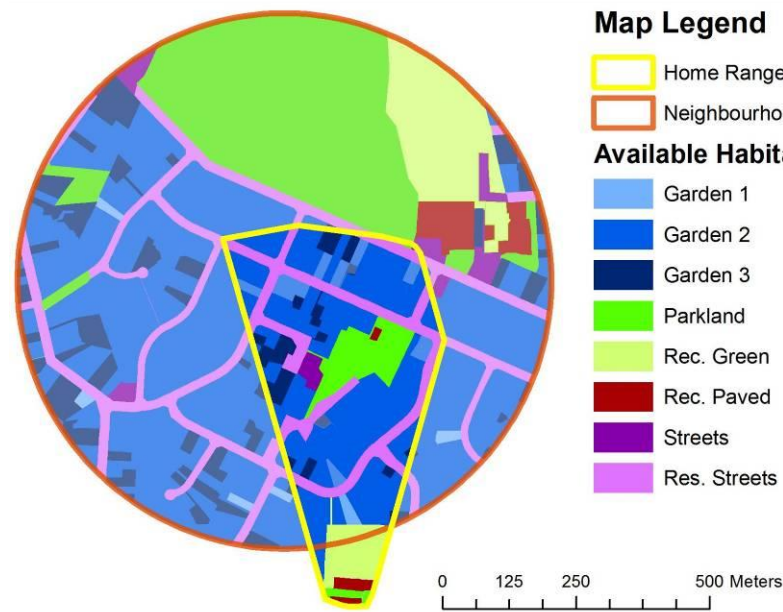
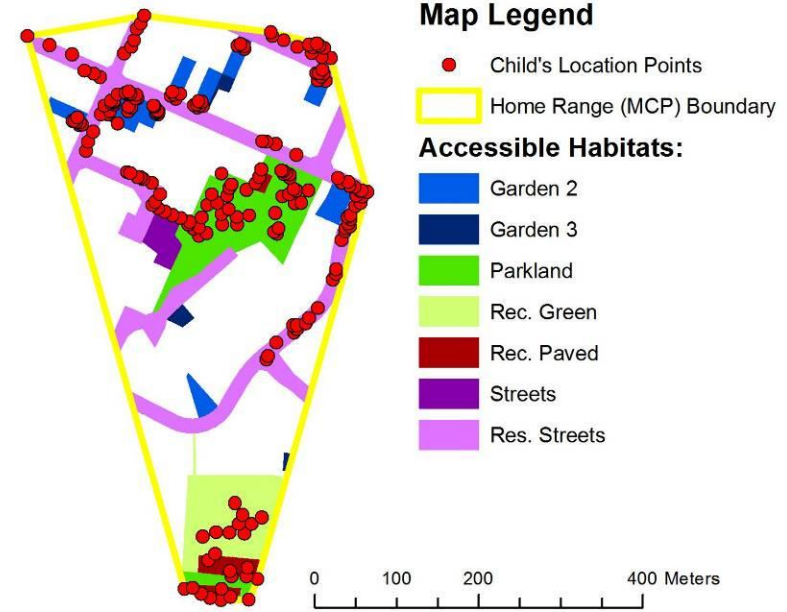


Figure 13. Habitat map of the central Auckland neighbourhood with based on 500 metre buffers/circles drawn around the children's homes



a)



b)

Figure 14. Example of a single child's (a) neighbourhood buffer and home range, with the habitats available within both, and (b) location points and accessible habitats within the home range. The location points were placed by the child using aerial imagery of their neighbourhood and indicate the spaces where they spend the most time outdoors. Home ranges were drawn around the outermost of these location points. Accessible habitats are those which are publicly accessible or others that the child has indicated they have access to. Gardens were categorised at three levels, with garden type 1 being the most biodiverse to garden type 3 the least.

The area of children's home ranges was highly variable, ranging from less than one hectare to over 200 hectares. The median home range size was 6.12 ha, however, since about half of the total home range area was identified by the children as being inaccessible, the actual average estimate of the area that children could use was 2.42 hectares. Boys tended to have larger total home ranges (7ha) than girls (4ha) and also travelled further from home (532 m c.f. 470 m respectively). This shows that, excluding occasional long trips, children spend most of their time in a very confined area. Home range size showed no relationship to ethnicity or level of deprivation. Instead it is likely that both children's preferences and parents' influence on home range selection itself determine the amount of biodiversity encountered in their home range.

Biodiversity in children's nearby neighbourhoods (i.e. the area contained within the 500 m radius circular buffer) was similar between cities. The most accessible form of green space was parkland, with 100% of children having access to a park within 500 m of their home. The majority of children also had access to woodland, vacant land and recreational green habitats at this scale. While we found that the total biodiversity within children's neighbourhoods was affected by deprivation level, but this result was not due to differing availability of public green spaces. Instead it appeared to be linked to more well-off families maintaining more biodiverse gardens.

## **F. Are children biophilic?**

Biophilia is defined as an innate affinity for nature. Support for this theory has grown as people have been shown to prefer greener and more natural landscapes over more urban and built landscapes. We tested whether children were biophilic by determining whether they spent more time in biodiverse areas than in other areas. When we asked the children to place dots on the aerial image of their neighbourhoods to show the places they went (termed "used points"), we asked them to distribute them in proportion to the amount of time they spent in these different places. We could then estimate how much biodiversity children would be exposed to when spending time in each of these habitats by applying our BioScores.

Across all children in the study, the most used habitat types were private gardens (43% of used locations) and residential streets (16%). Around 12% of time was spent on playing fields and less than 7% in woodland, vacant land or in natural habitats combined. There was little gender difference, with boys showing only slightly higher use of habitats outside their gardens than girls, who instead used gardens and residential streets most intensively.

To assess children's preference for habitats in relation to the relative availability of those habitats, we compared children's use of habitats with habitat availability at two different scales: (1) within their actual home range, and (2) within their potential home range. This potential home range was defined by determining the maximum distance the child travelled from their home unaccompanied by an adult, using this as the radius of a circle drawn around the home, and then removing any areas from within the circle that the child said they were not allowed to visit. The majority of children indicated they had some limits on where they could go from home. Figure 15 shows one child's neighbourhood buffer, actual home range, and potential home range, showing how restrictions on this child's movement have prevented access to areas of public green space available within their neighbourhood.

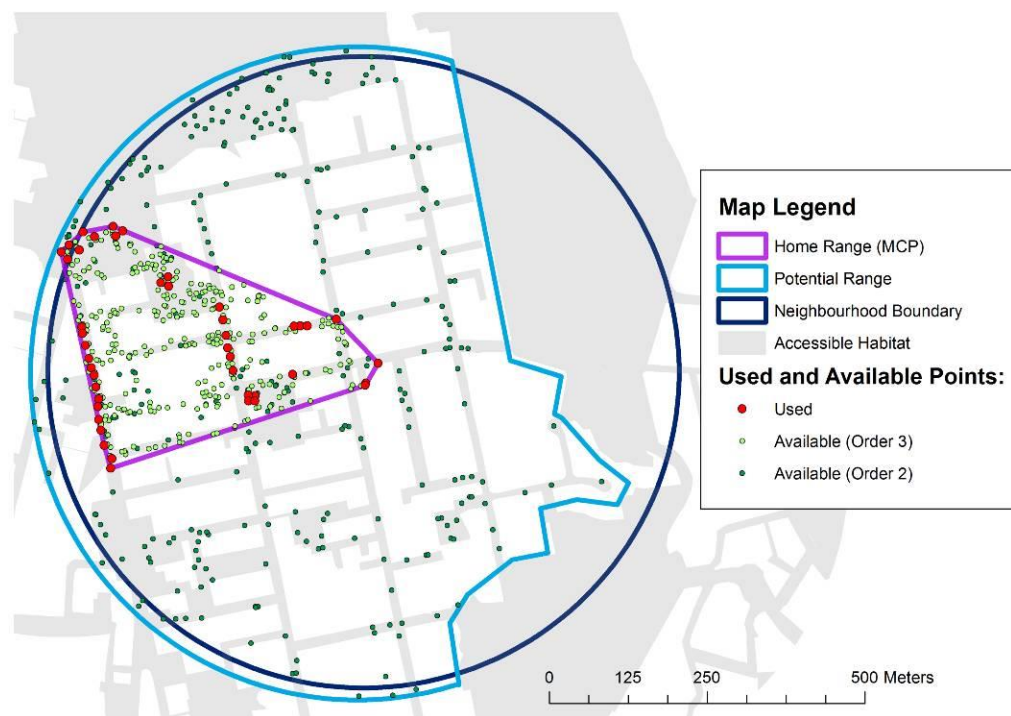


When use of different habitats was put in context with their availability, children did not behave as expected under the biophilia hypothesis. Instead, the strongest preference that children demonstrated was to be close to home, or to their own and friend's gardens. Many children visited biodiverse habitats much less than would be expected, given their availability. In particular, woodland, despite being the highest ranked habitat in terms of biodiversity, was often found to be the habitat least visited by children. Children showed strong preference for gardens above other habitat types and selection for sports grounds was positive within the potential home range but they are not heavily used compared to gardens.

Children from all three cities showed similar responses, although they did show more varied behaviour with respect to the less biodiverse habitats. Differences in both children's use and preference for different habitats appeared to be linked to varying availability between the two cities. Children at the schools we studied in Wellington generally had greater accessibility to woodland, non-residential streets and recreational paved habitats within their home range boundaries in comparison to those in Auckland. In contrast, children in the schools we studied in Auckland had greater accessibility to gardens, parkland and recreational green. One of the differences in selection between the cities was that children in Wellington spent more time in street habitats than children in Auckland or Dunedin. This may be due to the fact that streets in the Wellington neighbourhoods that we studied were commercial areas with shops which would be a more focal point for trips. Boys and girls also showed similar patterns in their preference for different habitat types, though girls tended to stay closer to home or in gardens, which corresponds with the smaller home ranges recorded for girls. Boys on the other hand demonstrated a greater preference for sports grounds at the larger scale.

Within their home ranges, children showed strong preference for gardens, but also for street and recreational habitats. Children's home ranges were not centred on the child's home; instead they protruded out in a specific direction from the child's home, often making the home one of the corners the home range polygon. This selection for gardens and recreational habitats suggests that it is the presence of these habitats that children extend their home ranges to include. These habitats may therefore be the most important for children to have access to within their home range.

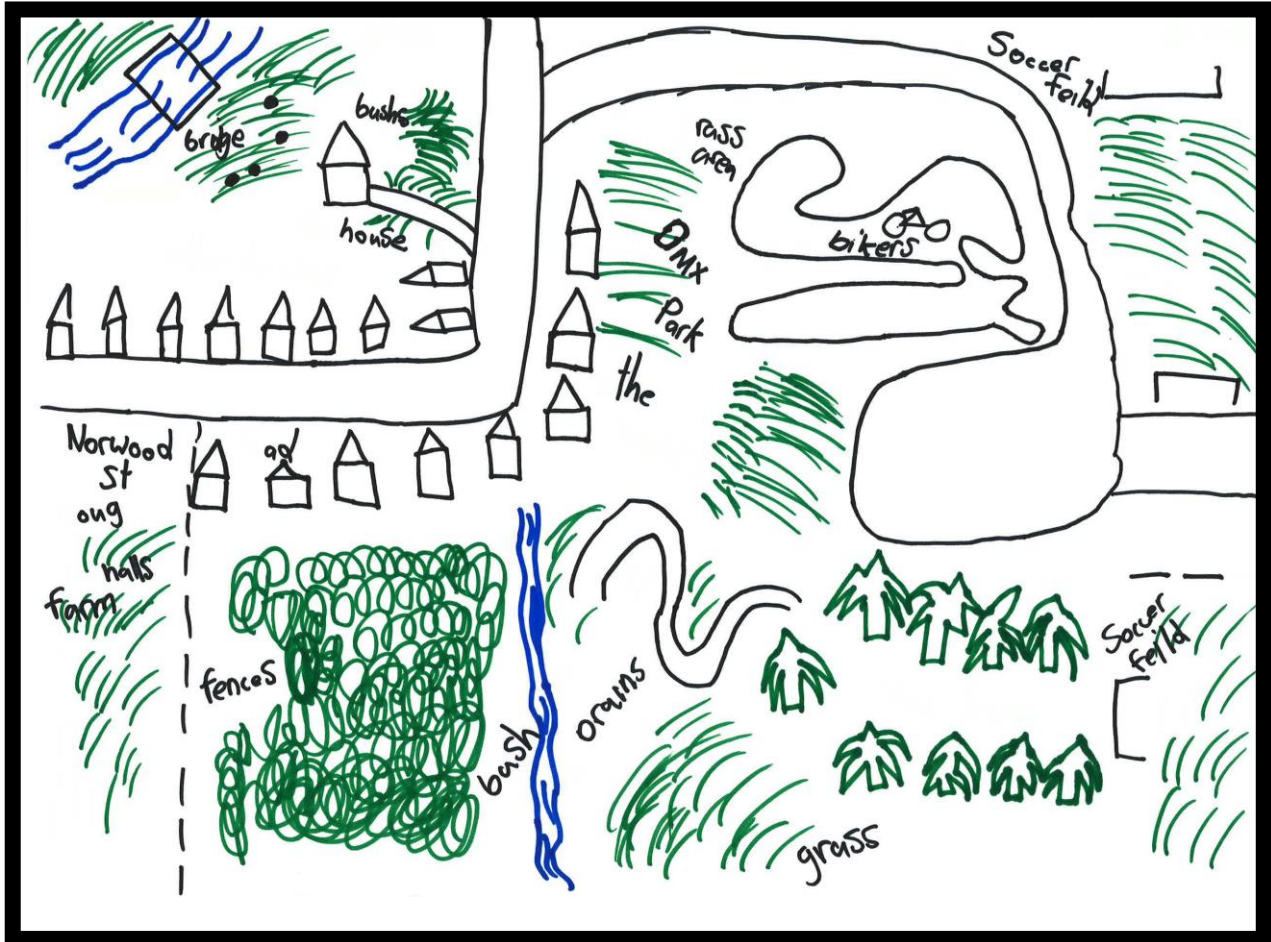
It is clear that children's home ranges are declining in size and this is reducing the amount of accessible biodiversity in their home range. For example only 73% of children used a park, though all had a park within their 500m neighbourhood buffer. Less than 50% had access to a sports field or a woodland within their home range. Gardens were the most preferred habitat type: they provide a valuable place where children can safely play and generally contain high levels of biodiversity. If children's home range sizes continue to shrink, gardens may be the main source of biodiversity which children interact with on a daily basis. However, while gardens can be biodiverse, they are often highly artificial and managed habitats, and do not support the same engaging play and connection to nature afforded by more natural sites.



**Figure 15.** Illustration of the scales of assessment used here to assess children’s habitat selection preferences. The child’s home range describes the area the child uses most frequently, calculated as a minimum convex polygon around the child’s used (red dot) locations. The Potential range, represents the area accessible to each child, based on the maximum distance travelled at home and altered to exclude the areas the child has identified as being inaccessible. In this example the Potential range has been amended to exclude woodland habitat on right edge of the buffer which the child was not allowed to visit alone. Within these two areas’ points were randomly drawn to characterise the available area, with one set being applied to the home range (light green) and the other to potential range (dark green). Also shown is the Neighbourhood Boundary, which is the 500m buffer placed around all children’s homes to compare biodiversity between nearby-neighbourhood.

## PART IV

### Conclusion





## The study

This report represents just one of the outputs from this study. In concluding, we point to some of the key findings that we trust will be of interest to the readers of this report, particularly those working in education, environmental organisations and those whose roles relate to design and management of the built environment.

We believe that the findings from this study do have relevance for wider New Zealand. Although our study focused on a small selection of neighbourhoods in Auckland, Wellington and Dunedin, these neighbourhoods contain the types of landscapes, habitats and biodiversity typically found in New Zealand cities. The availability of green space in the cities we examined was consistently high across the socio-economic gradient for the schools in our study.

### *Which spaces do children use?*

Our study explored children's relationship with nature and where and how this occurs – or does not occur, for children living in New Zealand cities. With reference to where: the areas children connect to nature are determined by two primary factors, available and accessible natural areas and parental licence. As demonstrated in Part IIID of this report, natural areas are largely present in the children's neighbourhoods and it is reasonable to state that New Zealand children generally have access to biodiverse urban environments. However, whether children can access these environments is largely dependent on societal and parental licence. No child in our study had the freedom to go wherever they wanted in their neighbourhood and most could only access specific areas and their associated habitat types, mainly gardens, streets, local parks, sports fields and school grounds. Rarely frequented natural areas included bush/forest, beaches, rivers/streams and more natural areas such as gullies, or overgrown vacant land. The notion that children seek and use wild 'untamed' and secluded natural places for play or for quiet times does not apply to the children in our study, who clearly experience the erosion of independent mobility that has been identified in studies in many parts of the developed world: Australia, USA, parts of Europe and in New Zealand. Few children had freedom to roam, even in their neighbourhood, and some children are not allowed outside their own gardens without an adult. The journey most children are likely to undertake independently or with friends is the journey to school. This means that few children in our study regularly or ever experienced the most biodiverse habitats in their neighbourhoods. This lack of experience means that children cannot necessarily connect with the most 'natural' places available locally.

Given the restrictions, both from parents and in light of restricted availability of accessible space (e.g. private land) for children in the study the importance of gardens is paramount as these provide children's main contact with nature. However, gardens are under threat from housing-infill development, changing housing styles with larger houses on smaller sites leaving less open vegetated space for play, and more families living in high density housing/apartments which have limited or no natural space. For children living in higher density housing or housing with limited private gardens or open space, the provision of easily accessible communal open space is imperative. The presence of parks, woodland, beaches or other spaces in the neighbourhood does not mean these will be used by children and does not replace open space immediately adjacent to the child's home.

Of the space that children use further away from home, sports fields are important as are local parks, however, many have limited natural features, and often contain just grass and trees. These areas present good opportunities for natural enhancement and planting programmes. The children in this study made limited use of the most biodiverse spaces, with their use often being possible only when accompanied by adults. We were surprised that many children in our study had no experience of using local bush, parks, beaches, or rivers even though these were within easy access of their homes. School trips to such neighbourhood sites could play an important role in making children and families aware of these sites and encouraging their use. Despite most of the schools having environmental initiatives these were not mentioned by children in talking about nature, except in relation to school camps which were strongly valued by all the children, who talked about them enthusiastically. For the children who do not visit more distant wild spaces such as forests, rivers, beaches with family these camps are particularly important.

### *Do children connect with nature?*

Children all value nature and show strong liking for being in nature and for natural experiences. Only one child did not like nature but even there the responses to nature were not all negative. Although some children described themselves as 'indoor children' they still appreciated nature and the outdoors. They liked outdoor activities such as watching birds, climbing trees or just being in the garden or on the deck. Outdoor activities, play and going to places such as beaches, sports fields and parks and being physically active outside were much more likely if the child had friends. A good friend network and friends living close by are essential for most children to experience being outdoors and being in nature.

We were interested to see whether the constraints children experienced in accessing natural spaces means they do not connect with nature. The findings in this regard were both positive and negative. Children clearly desire and make connections with nature, they generally observe and interact with the natural components in the areas available to them, that is birds, insects, animals, trees and plants. They appreciate their biotic but also their functional (climbable trees, fruit producing trees, grass area suitable for games) and their emotional (feeling of fresh air, sun, wind, places to be quiet, alone or talk to friends) values. While they may not be able to access the most natural spaces and their wildlife e.g. crabs on the beach or fantails in the bush; they do still seek out wildlife interactions but mostly through what is present in the space they can access. Thus, they experience insects on the deck, birds in the backyard, and have a 'forest' experience by using local groups of trees. Some children with very limited independence who were unable to go outside their gardens unaccompanied do make meaningful nature connections within their gardens and show detailed knowledge and emotional commitment to nature in them. Interactions with common and domestic species e.g. rabbits, chickens, dogs were very important and children usually did not distinguish between valuing native 'wild' species and common, exotic or even domestic species. They valued the interaction opportunities provided by all species. Children's resilience and ability to make the most of what at first sight appear to be limited 'natural' opportunities was noteworthy. This is not to say they do not need experience of wilder spaces and certainly the fact that there is limited accessing of wilder places in their neighbourhoods is worrying, but they are still making connections within the confines and limitations of their own life worlds.

*Enhancing nature connections*

There are two key players in this respect, parents and urban professionals including; urban designers, planners, engineers, educators, and recreation and conservation professionals. The behaviours of both groups, however, reflect wider societal attitudes around children and views of where children should be, when, with whom, and what activities are appropriate in their various life spaces. Some commonly expressed beliefs impacting on children are: that children's safety is compromised when they are free roaming in natural areas, streets are not safe places to play, children in 'challenging' environments such as beaches should be under adult supervision, responsible parents know where their children are at all times, children benefit from busy lives and participation in sporting and other activities and children should not be out after dark. While recognising the need to keep children safe wherever possible and the benefits of leading busy active lives, and the difficulties parents and professional face in balancing children's need for free play and providing safe environments there are, nonetheless, actions that can be undertaken to enhance children's innate desire to connect with and experience nature.

*Parents:* Parents can enhance children's connection to nature by supporting greater use of the neighbourhood by allowing children more unrestricted free time to explore their neighbourhood. Because children play outside more when they are with friends, friend networks should be encouraged and attending local schools has proved to be important in this respect<sup>12</sup>. Children engage in more enriching play when not under supervision. Parents have begun increasingly limiting which activities children can take part in when in natural environments. For instance, one UK survey reported half of the children were not allowed to climb a tree without adult supervision (Playday Survey, 2008). Children benefit from experiencing water, mud, long grass and different natural features, lawns, shrubs, gravel, streams, puddles, slopes, gullies and rocks. Outdoor play in different environments gives opportunities for children to physically interact with nature in natural and exploratory ways. Spending time outdoors increases children's nature interaction as well as enhancing other skills such as independence and physical abilities. Encouraging children to walk to school, instead of being driven, increases children's time spent outdoors after school. Nearly all the children in our study lived within walking distance of their school but many were driven to and from school. Family outings can include visits to local places. Some children talked about family outings to local places; lookout points, bush walks, beaches, the duck pond, community gardens, yet many children did not seem to have these experiences. More distant experiences such as, staying at the bach, kayaking, swimming, fishing are important and are enjoyed by many children but these need to be balanced with more local experiences and experiences that are less adult directed.

*Urban professionals:* Through their actions urban professionals can enhance or frustrate children's experiences of both the home and the wider environment. Safe environments encourage greater independent mobility and outdoor play. Most children in our study did, classify their neighbourhood as safe yet few had parental licence to freely access their neighbourhoods. Professionals need to better understand this conundrum and to address

---

<sup>12</sup>Freeman, C. 2010, Children's neighbourhoods, social centres to 'terra incognita' *Children's Geographies*, 8: 2. pp. 157 - 176

parental and societal concerns around children's safety and how to address these in ways that encourage greater outdoor play. Children generally had greater mobility where schools, shops, parks, sports fields were close to their homes. Location of services needs to be considered with reference to proximity to homes and safe access routes for pedestrians. Few children used bikes, and increasing cycling through enhanced and safer cycle ways should be encouraged. The child with the largest home range was a child in Dunedin who used a local cycle path. The cycle path at one Auckland park was well used but only went around the sports fields.

Preservation and enhancement of natural spaces should be prioritised, especially where these are experiencing development pressures. Natural and woodland habitats should be prioritised for conservation as they are especially valuable in supporting native biodiversity in the surrounding neighbourhood, and simultaneously providing engaging nature experiences for children. New wild areas can be established through the restoration of abandoned urban plots. These restorations should focus less on making sites aesthetically pleasing, which adults may consider to be more important, and instead allow spontaneous and unmanaged regeneration, supporting both biodiversity and children's play activities. Restoration of wild areas has been shown to improve community understanding and frequency of use of these areas.

Private gardens provide suitable areas for connection to nature, as they are safe, support play and can be structurally diverse and species-rich. However as cities grow, pressure on space is leading to greater infill of garden areas with built structures and impervious surfaces. Currently, as a response to the negative impacts from the past trend of urban sprawl, new city designs tend to follow a more compact city form. This often means the loss of gardens in favour of more dense housing and provision of public green space instead. However, if the quality and quantity of public green space provided is not high, and if children's mobility continues to be restricted, urban growth could further reduce children's connection to nature.

The more local the space the greater its importance. Children use the most accessible places yet some of these exhibit poor levels of biodiversity. Improving the biodiversity value of habitats children already spend time in could support their connection to nature. Naturalising local parks by providing shade trees, climbing trees, running water, rocks, long grass, can enhance the interest provided by spaces otherwise usually dominated by large swathes of unbroken grass. Large grass areas are valuable for sports and some running play but even these can be mixed with more informal planting on the periphery.

Another key area where improving biodiversity could be focused is school grounds. Schools are places where children spend a lot of time outdoors and where unstructured play predominates. Our children made good use of school grounds, including school fields for play outside school time where these were available for use. Greening of school grounds should prioritise native species, which tend to be rarer in urban environments. More biodiverse school yards have been shown to support more complex and enriching play, as well as improve children's knowledge of species and preference for more species-rich habitats and native species. If children gain an enhanced connection to nature within the relatively safe school environment, they may become more inclined to explore the biodiverse areas outside of school as well.



*Listen to children*

Children have a good understanding of the places they use, and the reasons why they use these spaces and not others. They understand and can talk effectively about family life and how this relates to their own neighbourhood lives and interactions with nature. In our study they had no difficulty identifying places using aerial photos through GIS software and showed great competence in providing data through unfamiliar technology. Talking to children is essential if urban designers and managers are to develop environments that meet their needs. In our experience, when given the opportunity children are very willing share their knowledge.

We end with the words of one of our children who would describe nature to an alien as follows. In her description she makes reference to biotic components of nature, considers how trees may feel as the land changes and refers to the changes people have made to nature over time:

*“Nature is where grass, trees, any living kind of species comes and hangs around on Earth, just sitting there, like a tree would just stand there saying “I’m a tree”, then people came and started making technology and that’s how we ended up here today.”*



## Useful Resources/Publications

- Angold, P.G., Sadler, J.P., Hill, M.O., Pullin, A., Rushton, S., Austin, K., Small, E., Wood, B., Wadsworth, R., Sanderson, R., Thompson, K. (2006) Biodiversity in urban habitat patches. *Science of the Total Environment* 360, 196–204.
- Charles, C. and Louv, R. (2009) *Children's Nature Deficit: What We Know – and Don't Know*, Children and Nature Network, <http://www.childrenandnature.org/>.
- Charles, C., Louv, R., Bodner, L., Guns, B. (2008) *Children and Nature 2008 A report on the movement to reconnect children to the natural world*, Children and Nature Network: Santa Fe, USA, [www.childrenandnature.org/](http://www.childrenandnature.org/)
- England Marketing, (2009) *Report to Natural England on childhood and nature: A survey on changing relationships with nature across generations*, [www.EnglandMarketing.co.uk](http://www.EnglandMarketing.co.uk).
- Freeman, C. and Tranter, P. (2011) *Children's Urban Environments: Changing worlds*, London: Earthscan.
- Freeman, C. The biogeography of urban environments. In: *Handbook of Biogeography*, Eds, A.C. Millington, M.A. Blumler and U. Shickhoff, Sage, London.
- Freeman, C., Mathieu, R., and van Heezik, Y. (2006) Enhancing understanding of urban biodiversity, *Parliamentary Commissioner for the Environment, Sustainability Review: Background Papers PCE*, PCE online: Wellington. <http://www.pce.govt.nz/projects/dunedin.pdf>.
- Gill, T. (2007) *No Fear: Growing up in a Risk-averse society*, Calouste Gulbenkian Foundation: London.
- Hahn, P. and Kellert, S.R. (2002) *Children and Nature: Psychological, Sociocultural, and Evolutionary*, MIT Press USA
- Higgins, H. and Freeman, C. (2013) Eds *Childhood: Growing up in Aotearoa, New Zealand*, Otago University Press, Dunedin, NZ.
- Louv, R. (2005) *Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder*. Algonquin: Chapel Hill.
- McKinney, M. (2002). Urbanization, Biodiversity, and Conservation, *BioScience*, 52, 883–890. doi:10.1641/0006-3568(2002)052[0883:UBAC]2.0.CO;2
- Miller, J.R. (2005) Biodiversity conservation and the extinction of experience. *Trends in Ecology & Evolution*, 20, 430–434. doi:10.1016/j.tree.2005.05.013
- Pyle, R.M. (2002) Eden in a vacant lot: Special places, species, and kids in the neighbourhood of life, *Children and Nature*, 305–327.

RSPB (2013) *Connecting with nature finding out how connected to nature the UK's children are*, [rspb.org.uk/connection](http://rspb.org.uk/connection) measure

Wilson, E.O. (1984) *Biophilia*. Harvard University Press, Cambridge.

**Web sites**

*Children and Nature Network* <http://www.childrenandnature.org/documents/C118/>

Enviroschools New Zealand <http://www.enviroschools.org.nz/>

Kiwi Conservation Club <http://www.forestandbird.org.nz>

National trust Natural England <http://www.nationaltrust.org.uk/what-we-do/big-issues/nature-and-outdoors/natural-childhood/>

Royal Society for Protection of Birds  
<http://www.rspb.org.uk/forprofessionals/policy/education/research/connection-to-nature.aspx>