Stockholm Resilience Centre
Research for Biosphere Stewardship and Innovation

Stockholm University

Master's Thesis, 60 ECTS

Social-ecological Resilience for Sustainable Development Master's programme. December 2015

Learning to connect

- A case study of a nature conservation project at school in Bromma, Sweden.

Sophie Belton

Supervisor: Dr. Stephan Barthel, *Stockholm Resilience Centre*

Co-supervisor: Matteo Giusti, *Stockholm Resilience Centre*

Stockholm Resilience Centre
Kräftriket 2B, Stockholm University, SE 106 91
info@stockholmresilience.su.se
www.stockholmresilience.su.se

A PARTNER WITH
The Beijer Institute of Ecological Economics
Kungl. Vetenskaps-Akademien
The Royal Swedish Academy of Sciences

FUNDED BY
MISTRA
The Swedish Foundation for Strategic Environmental Research

[What is the] extinction of a condor
to a child that has never seen a wren?

The Thunder Tree - Robert Michael Pyle

Abstract

Research shows that children's connection to nature (CN) influences their interest in protecting the natural world and practicing nature-friendly activities, driving a growing movement to (re)-connect children to nature. The aim of this paper is to contribute to this relatively new research field by exploring *how* children connect to nature through a case study of schoolchildren's involvement in a nature conservation project in Bromma, Sweden. The paper investigates whether 10-year-old children's participation in the project at school strengthens their affective CN and in which ways by incorporating Situativity theory into current theories related to nature connection. I employed the quantitative Connection to Nature Index tool to measure any changes in CN before and after participation in the conservation project (n=57). This method did not detect any significant changes in CN in contrast to the qualitative methods used. Drawing on interviews with children (n=25), as well as observations and survey results, I describe how hands-on engagement in this conservation project, and the meaningful 'in situ' learning that emerged from this experience, strengthened children's affective CN. I further identify five project features that were key in encouraging this connection: enjoyment, inclusion, responsibility, authenticity and duration. These findings have implications for our theoretical understanding of how children connect to nature, and the relationship between CN and pro-environmental behaviour. The paper also provides some insight for education practitioners regarding important characteristics to bear in mind whilst devising activities aimed at fostering nature connection in this age group.

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To Selma, for all the inspiration you have given me for this thesis.
Now come on, let's get outside!
Maman

Acknowledgments

Many, many thanks to my supervisors, Stephan Barthel and Matteo Giusti, for your great guidance and support throughout this project. This, alongside your flexibility and good humor has contributed to making this thesis a really enjoyable experience.

A big thank you also to all the schoolteachers and principals involved in this study who made me feel welcome in their classrooms and schoolyards. Thanks to all the children who participated in the study and who made my fieldwork extra engaging and fun. An extra big thank you to Elisabet Söderlund, the hero behind the Salamander Project: thank you for your warmth and your enthusiasm towards this study as well as for introducing me to the salamanders.

I also want to thank my family and friends for their support throughout this thesis. Particularly I thank you, Alba, for your interest and advice concerning the thesis and your delightful office companionship. And last, but far from least, I sincerely thank you Valle for your continual support and love. Merci!

Introduction

> *"The split with nature is at the heart of our environmental crisis."*
> (Jordan, 2009: 30)

Our current environmental problems, such as the rapid loss of biodiversity, are deeply connected to our personal relationship with nature as we live our lives more and more disconnected from the natural world (Folke et al., 2011; Liefländer et al., 2013). Today's children spend much less time outdoors, interacting directly with nature, than previous generations did due to many interacting and complex factors (Hofferth and Sandberg, 2001; Woolley et al., 2009; Bragg et al. 2011). In the UK, for example, less than 10% of today's children play in natural spaces compared to 40%, 35 years ago (Woolley et al., 2009).

The consequences of a childhood disconnected from nature are many, although this field of research is still in its relatively early stages. What is already well established are the numerous health, wellbeing and development benefits (physical and mental) of nature contact for children such as reduced stress, anxiety and depression (Wells and Evans, 2003; Russell et al., 2013; Chawla et al., 2014), increased concentration and cognitive functioning (Kaplan and Kaplan, 1989; Wells, 2000), and protection against obesity and other diseases or illnesses arising from sedentary lifestyles (Bar-Or and Baranowski, 1994; Hartig et al., 2014). The term 'nature deficit disorder', coined by author Richard Louv in his book *Last Child in the Woods* (2005), is now increasingly used to describe the numerous human costs of this distancing from nature.

One of the most serious of such costs is the effect that this is having on our children's understanding for - and interest in - protecting nature and, ultimately, how this influences their behaviour towards the environment. Scholars and practitioners from different fields now recognise that children who are not connected to nature are less likely to value and respect it, and, consequently, less likely to care for it as adults (Cheng and Monroe, 2010; Bragg et al., 2011; Gifford, 2014). This resonates with Sir David Attenborough's words: *"No one will protect what they don't care about, and no one will care about what they have never experienced*." (cited in Williams, 2013). Indeed, empirical evidence shows that nature contact helps children to develop

positive values and attitudes about nature (Davis et al., 2006, Wells and Lekies, 2006; Giusti et al., 2014) and many retrospective studies reveal the importance of time spent in nature during childhood as a key source of inspiration for environmentally-minded adults (Tanner, 1998; Chawla, 2006; Wells and Lekies, 2006; Pretty et al., 2009).

Connection to nature (CN) is therefore an important variable influencing a child's interest in, as well as understanding and concern for, nature. A growing number of people are voicing the same concern: where will future environmental stewards come from if our children do not develop a meaningful bond with the natural world?

(Re)-connecting with nature

> *"For everyone to value biodiversity, which is an essential underpinning for its conservation, the closest we can get is to feel nature and to love it"*
> (Samways, 2007:1995)

A growing branch of literature across the fields of Environmental psychology, Environmental education, and Conservation biology stress the importance of developing an emotional connection to nature above, or at least alongside, a cognitive one (Mayer and Frantz, 2004; Stokes, 2006; Moore, 2014). This implies that CN must arise by engaging people's emotions and feelings more than just acquiring ecological facts. Many scholars agree that experiencing nature first-hand (or even 'rescuing experience from extinction') is crucial to developing positive emotions and a sense of care towards nature (Kahn and Kellert, 2002; Miller, 2005; Stokes, 2006; Moore 2014). Providing hands-on environmental education to children is suggested to be a "unique opportunity to enhance children's affective attitudes toward nature and their interest in protecting nature" (Cheng and Monroe, 2010:45). In this thesis I explore the relationship between this kind of hands-on nature experience and children's affective CN.

Thesis aim

Through the case study of a school-based salamander conservation project in Stockholm, Sweden, I attempt to contribute to the research gap in this field, notably: understanding how children connect to nature as well as which features of a nature experience encourage a meaningful CN? An additional objective of the study is to explore the benefits of the conservation project from the perspective of a child's experience, as, until now, only the ecological benefits have been examined (Kiibus, 2011; Lundberg and Kiibus, 2014).

Research questions

- Does participating in the salamander conservation project at school increase a child's connection to nature?

- If so, which features of the project allowed the participating children to feel a closer connection to nature and how?

Theoretical background

People's connection to nature and related terminology

Interest in human-nature relationships is not a recent phenomenon. Aldo Leopold, in 1966, described his vision for a new 'land ethic' characterised by humans being 'members' of the natural environment not 'conquerors' over it. As citizens of a land community, he argued, humans should be obliged to preserve the natural world (Leopold, 1949). Later, in the 80's, Edward O. Wilson introduced the concept of Biophilia hypothesising that humans have an innate need (and predisposition) to connect to other living beings, described also as an "innately emotional affiliation of people to other living organisms"(Kellert and Wilson, 1993:31). Leopold's land ethic and Wilson's Biophilia hypothesis, amongst others, continue to inspire scholars across disciplines to conceptualise and understand human-nature relations.

In the relatively recent field of environmental psychology, several different ways in which to conceive of a person's connection to nature (CN) have emerged. Whereas some scholars see this relationship as an emotional connection with nature (Mayer and Frantz, 2004; Hinds and Sparks, 2008), others believe it to be characterised by the place nature has in one's self-concept (Clayton, 2003), or 'the extent to which an individual includes nature within his/her cognitive representation of self' (Schultz et al., 2004). There are, likewise, many different terms used to discuss the psychological bond between people and nature, such as: connection to/with nature, nature-connectedness, nature-relatedness or environmental identity. In this study I refer to this phenomenon as connection to nature (CN).

Recent studies comparing the different concepts of CN show that, despite the differences in theory, the various measures developed for each concept have 'excessive empirical overlap' making them all markers of a common construct getting at a 'single psychological phenomenon' (Brügger et al., 2011; Tam, 2013). Another similarity amongst the various environmental psychology perspectives on CN is that all point to the positive relationship between this (however we like to think of, or

measure it) and a person's environmental concern as well as their pro-environmental behaviour (Brügger et al., 2011).

Because psychology is concerned with people's attitudes and how these influence behaviour, several of the CN measures are a direct attempt to measure a person's attitude towards nature (Mayer and Frantz, 2004; Cheng and Monroe, 2010; Brügger et al., 2011). Previously, studies in this area had focused on people's cognitive attitude towards nature (how much we 'know' about nature or the environment and how this affects our behaviour towards it). Recently, however, there has been a marked shift to focus instead on people's affective attitudes towards nature (how emotionally attached we feel to nature) (Hinds and Sparks, 2008; Cheng and Monroe, 2010; Giusti et al., 2014). Indeed, studies in the fields of both anthropology and environmental psychology, as well as in environmental education show that an increase in environmental knowledge does not directly lead to an increase in environmental concern or behaviour (Hungerford and Volk, 1990; Stern, 2000; Pretty, 2002 cited in Kopnina, 2012; Ampuero et al. 2013). Instead, a growing number of studies demonstrate that emotions and affective attitudes (such as appreciating nature or developing empathy towards animals) play a crucial role in influencing one's environmental concern and behaviour (Pooley and O'Connor, 2000; Mayer and Frantz, 2004; Chawla 2007, Hinds and Sparks, 2008; Cheng and Monroe, 2010). Of course, there are many ways in which affective attitudes are formed and influenced such as, for example, social-cultural and family narratives and practices, education, urban spatial design or direct sensory experiences (Chawla, 1998; Colding and Barthel, 2013). Exactly how these aspects influence the emotional components of one's identity are not yet well established. However the role of nature in the process of developing an affective CN seems to be crucial (Chawla, 2006; Wells and Lekies, 2006; Cheng and Monroe, 2010). This study does not attempt to unwrap the complexity of influences on identity but rather aims to explore whether the Salamander Project (explained in detail in the next chapter) encourages an affective CN in children and, if so, how.

Children's connection to nature and research gaps

Only recently have scholars begun to research children's CN, both in trying to un-pack the meaning of a CN for children and in attempting to measure the strength and effects of this connection (Cheng and Monroe, 2010; Bragg et al., 2011; Ernst and Theimer, 2011).

After extensive literature review, pre-studies and testing, Cheng and Monroe (2010) developed a Connection to Nature Index (CNI) aimed specifically to measure an affective attitude towards nature in children aged 8-10. Their study suggests that children perceive a CN to consist of the following four elements: enjoyment in nature, empathy for creatures, sense of oneness and sense of responsibility (figure 1). These dimensions of a CN are echoed across the fast growing range of literature on the subject (Chawla, 1999; Clayton, 2003; Hinds and Sparks, 2008; Bragg et al., 2011). This study uses Cheng and Monroe's interpretation of a CN, as it is particularly suited to studying people-nature relations in children.

As this field is still in its early days there is a recognised need to understand how children develop a CN, how this changes over time, as well as how it influences their interest in environmental actions (Cheng and Monroe, 2010; Ernst and Theimer, 2011; Liefländer et al., 2013). The findings of Cheng and Monroe's research suggest that learning, understanding, and experiencing nature are all factors that can positively influence the development of a child's CN. However, few studies, for example, explore the question of when in childhood fostering a CN is most effective (Wells and Lekies, 2006; Ernst and Theimer, 2011; Liefländer et al., 2013). More knowledge in this area could help education practitioners (as well as parents) develop age-specific programmes and strategies with the purpose of fostering and strengthening a CN (Liefländer et al., 2013). Scholars and practitioners also agree that more research is needed in assessing how well different environmental education programmes (or nature-based activities) perform in fostering CN in children in order to determine what the specific aspects that encourage a CN are (Ernst and Theimer, 2011; Kossack and Bogner, 2012; Liefländer et al., 2013).

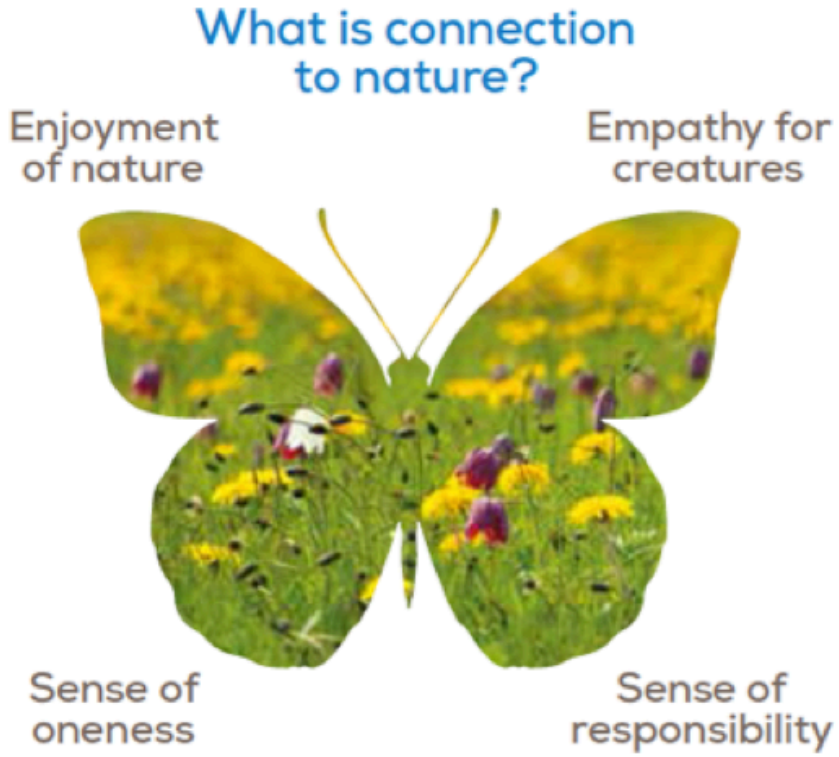

Figure 1: The four dimensions of a child's connection to nature. Taken from Bragg et al. (2011) originally adapted from Cheng and Monroe (2010).

Moreover, many studies have focused on the importance of children's free play in nature (particularly in the field of child development) but relatively few have looked at the benefits offered by guided/structured nature activities, such as those undertaken in this case study. The few studies that have been done in this area, have looked either at the mental health benefits (such as reduced stress) of guided nature activities (Chawla et al., 2014), or performed pre and post-activity CN tests to evaluate either the effectiveness of the activity or the effectiveness of the CN measure (Bragg et al., 2011; Liefländer et al., 2013). However, there remains, to my knowledge, a lack of research that explores the process of developing a CN and the role of context in the unfolding of this process: in other words how children learn to connect to nature. A different theoretical approach, Situativity theory (explained below), has the possibility to contribute to closing this research gap.

How can Situativity theory contribute to understanding connection to nature?

Several well-established theories and disciplines are nested under the umbrella framework of Situativity theory of which Situated Learning and Ecological psychology[1] are of relevance to this study (Durning and Artino, 2011). Instead of delving into these individual theories in detail, this section will focus on the main tenets of Situativity theory relevant to this study.

A radical break from traditional theories on knowledge and learning, Situativity theory provides "a new way of approaching knowledge and how experience and the environment impact knowledge, thinking and learning." (Durning and Artino, 2011:188). Indeed, this theory understands all learning, thinking and knowledge as inevitably situated in activity and, therefore, inseparable from experience (Brown et al., 1989; Barab and Roth, 2006). All learning and thinking occurs within a social, cultural and physical context. Knowledge emerges out of the context and the interactions amongst the equally important elements of the context: the participants, the culture and the physical setting (Barab and Roth, 2006; Durning and Artino, 2011).

Traditional theories of learning are commonly referred to as information processing theories. They view knowledge as something that is passed on from one person to another and stored in an individuals' head (their memory) to later be retrieved and applied when a fitting situation appears (Durning and Artino, 2011). There is, however, little evidence that people can actually re-apply the knowledge gained in one situation to another (Lave, 1988; Brown et al., 1989). In Situativity theory, on the other hand, 'conceptual' knowledge is not accumulated but, rather, knowing is the process that continuously co-creates an understanding between an individual and the particular context he/she is in (Brown et al., 1989; Durning and Artino, 2011). This constitutes therefore an important shift from viewing knowledge and learning as a

[1] The discipline of Ecological psychology is commonly called Environmental psychology. Although there is overlap between the two schools that both study how humans interact with their surrounding environment, there are also differences. Certain theories from Ecological psychology are considered part of Situativity theory, which is why I use the term here.

purely cognitive process to acknowledging that it is deeply embedded in emotional, social and cultural processes (Kopnina, 2012).

Situated Learning and meaning-making

There are many different ways to understand and define learning. This study takes the Situativity approach and understands learning to be about much more than the acquisition of facts. It views learning as, more importantly, the creation of personal meaning (meaning-making) and identity building (Lave and Wenger, 1991; Durning and Artino, 2011). In the context of education, this implies that learning should expand beyond academic achievement, to involve increasing possibilities for engagement in the world (Barab and Roth, 2006; Boyer and Roth, 2006).
This view is particularly reflected in the theory of Situated Learning (Barab and Roth, 2006) where emphasis is placed on the social nature of learning and how this shapes personal and community identity (Lave and Wenger, 1991; Durning and Artino, 2011). For some scholars, learning is theorised as a changing form of participation in a 'Community of Practice' by which a participant (learner) increases his/her membership (from a newcomer to an expert) by becoming increasingly independent and gaining responsibility (Wenger, 1998; Lave and Wenger, 1991). The learners' growing independence as well as his/her increasing responsibility in an activity, are argued to be crucial for meaningful learning to occur (Lave and Wenger, 1991; Durning and Artino, 2011).

The importance of authentic experiences for learning

Ecological psychology, nested under the theoretical framework of Situativity, highlights the importance of repetition in learning. A repeated experience (saving a salamander, for example) becomes embodied as a skill or understanding (Kyttä, 2002; Moore, 2014). It becomes deeply learnt. In order for this to occur it is essential for the experience to be first-hand (Reed, 1996; Kahn and Kellert, 2002; Chawla, 2007).

This, referred to as 'the necessity of experience' (Reed, 1996), is well explained by ecological psychologist Louise Chawla:

> *"Primary experience is (…) necessary because it occurs in the real world of full-bodied experiences, where people form personal relationships and place attachments, drawing motivation to protect the places and people they love and building alliances and competencies to do so."* (Chawla, 2007:153)

Furthermore, as the above quote implies, the more authentic an experience is, the better a learning opportunity it provides. It has been suggested that an authentic experience should be as close to real life as possible including such aspects as complexity, non-linearity and ill-defined boundaries (Boyer and Roth, 2006; Young, (1993) and Jonassen, (1997) cited in Durning and Artino, 2011). It is also suggested that, for an experience to be authentic, it should be framed by its culture by being meaningful to society and its practitioners (Brown et al., 1989). In this light, a typical school activity is not what we think of as an authentic experience (it usually doesn't resemble what practitioners in society do), reducing its meaningful learning possibilities (Brown et al., 1989; Boyer and Roth, 2006). However there is a growing effort to incorporate more authentic learning situations into schools as advocated by practitioners of Education for Sustainable Development and Experiential Education (Mehlmann et al., 2010; Hedefalk et al., 2014). As far as 'real life' situations go, scholars of Environmental education and Child development, point to nature experiences as being particularly rich in learning opportunities, especially for children (Chawla, 2007; RSPB, 2010; Moore, 2014). Another quote by Chawla illustrates this well:

> *"What children find in the natural world rewards their initiatives and encourages their continuing engagement, for nature is particularly rich in responsive affordances. It provides all the conditions for events that hold children's attention. Children see immediate, reinforcing effects of their actions, which simultaneously show them how the world works and their own capabilities.* (Chawla 2007: 153)

To summarise, Situativity theory understands learning as fundamentally situated in the context of the experience at hand. This theoretical framework claims that many elements, such as the authenticity of the setting and the learners' sense of responsibility, influence our capacity to learn and make meaning out of situations. In this light I believe that Situativity theory can contribute to advancing our understanding of the interdependences between CN and behaviour. This relationship is usually studied from a psychology perspective by focusing on how what we think and feel (our values, attitudes, emotions and feelings) determines our behaviour (Ajzen 1985; Stern, 2000). In other words standard psychology frames this relationship as being from the inner (values) to the outer (actions). Situativity theory, on the other hand, provides another lens through which to examine the relationship between CN and pro-environmental behaviour (PEB). Here, the very action of 'doing' allows one to make personal meaning of a situation, to shift from one place in ones' understanding to another. In this sense Situativity and, in particular, Situated Learning, allow us to explore whether our actions may influence our connection to nature.

This study explores the particular learning features present ('situated') in the Salamander Project and how they relate to nature connection.

Case study description

Olovslunds pond in Bromma is one of the most important breeding habitats of the greater Stockholm region for the two Swedish species of salamander[2], the common newt (*Lissotriton vulgaris*), and the great crested newt (*Triturus cristatus*)*. It is estimated that the Olovslund neighbourhood, nicknamed 'gardentown', including the pond, is home to 8,000-10,000 common newts and approximately 500 great crested newts (Kiibus, 2011). The pond, being shallow, relatively warm and free from predatory fish and crayfish provides an ideal habitat for these amphibians to reproduce. However, a concrete paddling pool located adjacent the pond traps a significant number of salamanders as they fall into it during their annual migration to spawn in the pond in spring. The salamanders, unable to escape the paddling pool that is free of water at that time of the year, dry out and die.

In 2007 the local authorities, realising how serious an issue this was, developed a pond management plan. This corresponded to a major effort, across the whole Stockholm region, to implement amphibian protection strategies (personal communication, 2014). Indeed, both salamander species are protected under national law (Landstyrelse, 2015) and the great crested newt is listed in both the Bern Convention and Annex IV of the EU Habitats Directive requiring a 'strict protection regime' by member states (Lundberg and Kiibus, 2014; European Commission, 2015). In 2008, under the Olovslund management plan, a low wall was built at one end of the pool in order to divert migrating salamanders away from it (figure 2). This solution was, however, not deemed sufficiently effective and, the same year, the local school was asked if they would be willing to help 'save' the salamanders (Kiibus, 2011; personal communications, 2014).

Since then, every year Olovslund schools' 4th grade (10 year old) students participate in the project during the breeding season (April and May). Every school day during the lunch break a group of 7- 8 children walk down to the park with the teacher in charge. There, in the dry paddling pool, they spilt into pairs and search through the

[2] Salamander is the common name for the order of Caudata, which includes newts and sirens

piles of leaves that have been created and maintained moist in order to appeal to the trapped salamanders. The children carefully search through the leaves with a stick and place any found salamanders in a bucket of water. They document salamander species and sex and from which leaf pile they were found on a daily record sheet. Before returning to school, the children count the total amount of salamanders found, release them into the pond and water the leaf piles so that these remain damp until the next group of children partake in the project, the following day. The student's daily reports are then communicated by the teacher to a local council biologist enabling the tracking of migration trends, the number of salamanders trapped and saved and monitoring the effectiveness of the management plan.

Figure 2: Olovslund Park with the pond on the right and the paddling pool to its left. The low, 23m long, wall is visible along the western side of the pool. The school is just a short walk away. (Source: Eniro)

Over the eight years that the project has been running 1019 great crested newts and 3148 common newts have been rescued by Olovslund School (Personal communication, 2015). This has allowed the Olovslund salamander population to remain stable in a time where urbanisation and habitat loss pose a threat to many urban amphibian species. Another measure of success from an ecological perspective is the successful re-introduction of the great crested newt into a nearby pond in 2009. Adult individuals were taken during mating season from Olovslund pond and transferred to Judarn pond in Bromma (Kiibus, 2011; Lundberg and Kiibus, 2014).

An identical operation took place this year (2015) to repopulate Kyrksjön pond, also in Bromma. This meant an extra task for the children: taking the ‘saved’ great crested newts back to school (not releasing this species into the pond), to be collected by a local council biologist. In order to do this, the school had to be given special permission by the county authorities (Landstyrelsen), as it is otherwise illegal to collect this species in Sweden.

Methodology

Structural approach and research design

This study uses a mixed-methods approach. I employ the quantitative Connection to Nature Index (CNI) scale to measure children's affective attitude at two points in time as well as a range of qualitative methods. The latter enable a much more in-depth understanding of the case study and answer the 'how' and 'why' lines of inquiry (Patton, 2002; Yin, 2009), that is to say, how do children experience the Salamander Project? and how do they connect to nature through this project?

In order to more robustly be able to determine any causality between a potential increase in children's CNI and their participation in the conservation project I chose to also perform the CNI measure with the 4th grade students of two other nearby schools (not engaged in any conservation or environment project). In this way I attempted to account for other factors that could influence changes in a child's CN (the change from winter to spring season for example). So, although this research is first and foremost a case study of the Salamander Project, in order to explore the first research question (does participation in the project increase a child's CN?) with quantitative methods, three schools were involved enabling a comparison. I refer to this as the CNI study.

CNI study and questionnaire

Participating schools and study area

The three schools that took part in the study are public schools, grade 1-6, following the same curriculum and located within five kilometres from one another in Bromma. This relatively small (26 km²) sub-division (statsdelområde) of the Stockholm municipality is located about 8km to the west of the city centre (figure 3). This predominantly middle-to-high income residential area has a population of approximately 70,000 people most of whom live in apartment buildings (Stockholm Stad, 2014). All public schools in the area were initially contacted by email, then

followed-up by phone-calls and, eventually, meetings with interested teachers/principals. Selecting schools from the same geographical area and following the same curriculum allowed for certain variables that have been suggested to influence children's CN to be accounted for (e.g. access/proximity to nature, socio-economic status of neighbourhood) (Liefländer et al., 2013; Giusti et al., 2014).

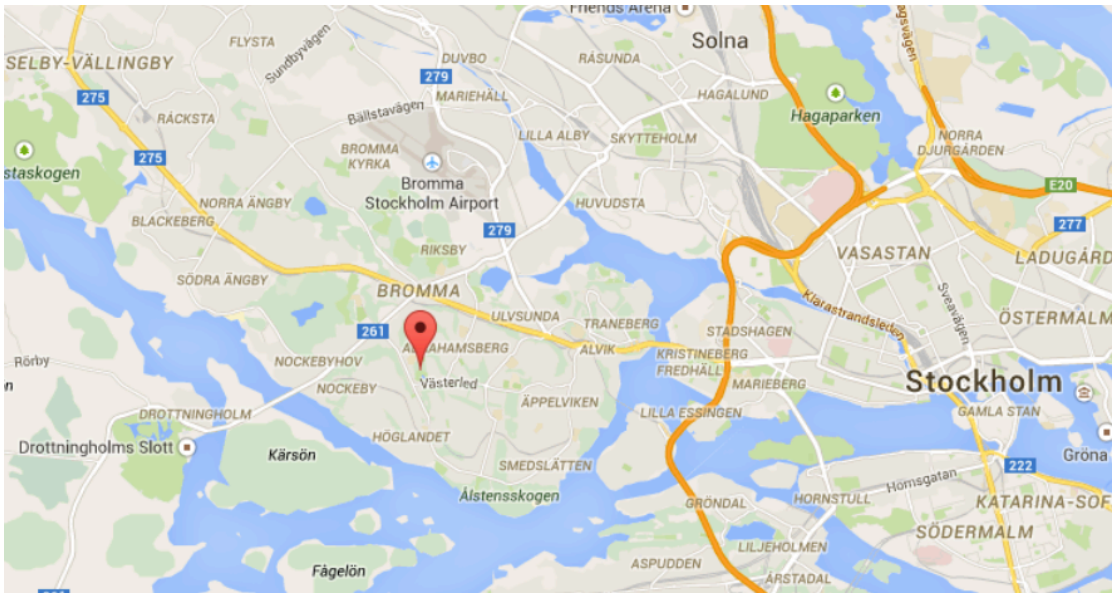

Figure 3: Bromma, a subdivision of the Stockholm municipality, is located approximately 8km to the west of the city centre. (Source: googlemaps)

CNI study fieldwork

Two sessions with each 4th grade class (in total 7 classes) were carried out. The first session took place in early February 2015, before the project had begun, and the second in late spring of the same year, after completion of the project. In both sessions students were asked to complete the CNI and a short questionnaire in Swedish.

The CNI (appendix A) is a well-established survey developed by Cheng and Monroe (2010) that aims to measure an affective attitude towards nature in children aged 8-10[3]. Participants respond on a 5-point likert scale ('strongly agree' to 'strongly disagree') to 16 statements such as 'being outdoors makes me happy' or 'collecting

[3] The UK's Royal Society for the Protection of Birds (RSPB) charity deems the CNI to be the most effective tool in measuring a child's connection to nature from ages 8-12 based on an extensive study (Bragg et al. 2013).

rocks and shells in fun'. Each statement reflects at least one of the four components of a CN as interpreted by the authors (figure 1). This particular method was chosen, after an extensive review of measures to assess children's CN, because of its track record of being well understood by children, its general user-friendliness, choice of subscales and because it was developed specifically to assess the emotional and not cognitive aspects of a CN. As this was (to my knowledge) the first time the CNI was performed in Sweden, it was first translated from English and reviewed by a Swedish primary school teacher before being used in the classroom. The main purpose of this method was to allow me to quantify the degree of change before and after the Salamander Project and to compare this to the non-participating schools.

Alongside the CNI was a short questionnaire comprised of open-ended questions such as "what does nature mean to you?" and "what is the best and worst thing about nature?" In the second session, the open-ended questions were different to those of the first acting more as follow-up questions (appendix B). The purpose of this was to gain a greater understanding of the meaning and value of nature for these children (expressed in their own words) and whether this, as well as the CNI results, varied significantly between schools or not.

Salamander Project case study (qualitative methods)

Field observations of the Salamander Project

Nine field observations of the conservation project took place spread out over a two-month period.
The first of these was of an initial information lesson given in the classroom by the teacher in charge of the project. Here the teacher explained to the class what the project was about, preparing them for their involvement.

Seven field observations involved meeting the group of children and the teacher at the school and walking with them to Olovslund park to observe them partake in the project (about 40 minutes per time). These observations were spread out over the duration of the project in order to capture differences across time and in differing conditions (such as weather, different group dynamics, presence and number of

salamanders). Different groups of children were observed at different points in time enabling me to note changes between children's 1st, 2nd and last participation (see appendix C for summary). The first of these on-site observations was a pure observation while the rest were participant observations allowing me to experience the hands-on work, mingle with the children and ask informal questions. This was helpful as it allowed the children to get to know me before being interviewed. Detailed notes were taken during and just after these observations in order to have a written record to refer back to.

Lastly I attended the Olovslund Salamander Evening in May as a participant observer. This is an annual event organised for the community by Stockholm biologists where information is given about the project and the state of the salamander population in the area, followed by a salamander count in the pond in which all can participate (adults and children).

The general aim of these observations was to witness the unfolding of the conservation project in its fullness and to follow the hands-on participation of the children in detail. These observations were also an important means to triangulate interview and booklet data (Patton, 2002) but also came to act as spring-pads for developing the interview guide.

Semi-structured interviews

In early June (2015), during the final days of both the project and the school year, 25 children who had participated in the project were interviewed. Selection criteria for the interviews was based on: 1) full parental consent to interview, record and use their child's quotes (see appendix D for ethical considerations of the study), 2) an even spread of students across the three classes so as to account for the possibility of a teacher's pedagogical influence on children's views about nature and the project, 4) equal gender representation (13 girls, 12 boys) and, 5) a variety in the number of times children had participated in the project (2,3,4 and 5 times). The purpose of this last criterion was to identify any changes in those that had become more familiar with

the project over time regarding their experience of the project, their learning and their CN (see appendix E for a table of interviewees).

The purpose of the interviews was to uncover the experience of participating in the project from the children's perspective. The focus was on how it felt to be part of the project, what changes (if any) they had experienced during the course of the project (changes in feelings towards salamanders and nature as well changes in oneself) and what they had learnt from it. The interviews were kept short (10 minutes) given the age of the children and were purposefully made to be informal so that the participants felt comfortable with the setting (one-on-one at school during school time). The interviews were in Swedish and were semi-structured following an interview guide (appendix F) at the same time as allowing for the conversation to follow its natural course and for new questions arise spontaneously (Kvale, 1996; Patton 2002).

Aside from children, the teacher responsible for the project was also interviewed. This teacher is key to the project having both established it in 2008 (in cooperation with the municipality) and in maintaining it running every spring. She supervises the children's participation everyday and is personally involved in the weekends. This interview allowed me to gain a greater understanding for the project, its background and developments as well as the teachers' view on its benefits to the children.

Salamander Project survey

Finally Olovslund students, during session 2 of the CNI study, completed a short survey with questions related directly to the project such as 'How many salamanders did you find in total?' and 'Pick 3 words that best describe the project for you' (appendix G). This enabled me a larger sample size (n=57), helpful when triangulating data from interviews (n=25). Table 1 below gives an overview of the different methods used, for what, and when.

Table 1: Overview of fieldwork 2015 (timeline and summary of data collected)

Schedule	**February**	**April-May**	**April**	**Early June**	**June**
Data collection technique + Sample size	**1st session - CNI study** in 3 schools (n=138): CNI (quantitative method) + Questionnaire (qualitative method)	**Field observations** (9) of the students participating in project, classroom lesson and Salamander Evening	**Interview** with teacher responsible for project	**2nd session - CNI study** in 3 schools (n= 146): Same methods as 1st session + Survey for Olovslund school children (n= 57)	**Semi-structured interviews** with Olovslund school children (n=25)
Data collected	CNI scores for each school (total score and 2 subscale scores) + Understanding for how children value nature. Similarities/differences between schools.	E.g. How does the project unfold? What does it consists of? How do children engage with it? How do they interact with salamanders/ classmates/teacher? What are they saying about the project?	Background information of project. Changes over time. Benefits to children.	CNI scores for each school (total score and 2 subscale scores) + Project-specific data: e.g. number of salamanders found by each student, number of participation times, particular memory of project	E.g. How do they experience the project? Have they changed with the project? What and how have they learnt from it? Do they feel closer to nature now?

Analysis

Total CNI scores from both sessions were calculated as well as scores for two of the four subscales (empathy for creatures and sense of responsibility). The 'empathy for creatures' subscale was chosen as it seemed particularly fitting given the nature of the project (involving animals) and the 'sense of responsibility' scale was chosen given its importance in Situativity literature as an enabler of meaningful learning. The data was then statistically analysed for any significant pre/post Salamander Project differences using t-tests[4].

[4] The statistical analysis was carried out by co–supervisor Matteo Giusti as part of his phd.

The questionnaire and survey data was first translated and then analysed looking for recurring themes with the help of the software programme NVivo (version 11) and the website Woodle.

Interviews with the Olovslund schoolchildren were transcribed and coded for emerging themes, using the software programme Dedoose (version 6.2.17). Relevant quotes were then translated into English. Additional grey and scientific literature, informal written and verbal conversations with the children's teachers, the local biologist and the teacher in charge of the project, as well as field observation notes, were all used to triangulate interview data.

Findings

CNI study and questionnaire results

CNI results from both sessions (session 1: n= 138, session 2: n= 146) show that children from all three schools feel similarly connected to nature. On a scale that ranges from -2 to +2 all schools, in both sessions, score on average between 1 and 1.28. This suggests that these children feel reasonably strongly connected to nature although UK's largest charity, RSPB, believe that a 1.5 CNI score is a realistic and achievable target for all children (Bragg et al., 2013).

The scores of the CNI's subscales 'empathy towards creatures' and 'sense of responsibility' are also similar across schools. It is only when looking at the 'empathy towards salamanders' score (a subscale I added) that there is a greater difference between schools. Not surprisingly Olovslund School scored highest (even prior to participation in the project) suggesting there is certain culture of awareness of the project embedded in the school.

The results show that there were no statistically significant ($p > .05$) differences in CNI scores (total and sub-scores) in any of the schools between February and May, as shown in Table 2 and Figure 4.

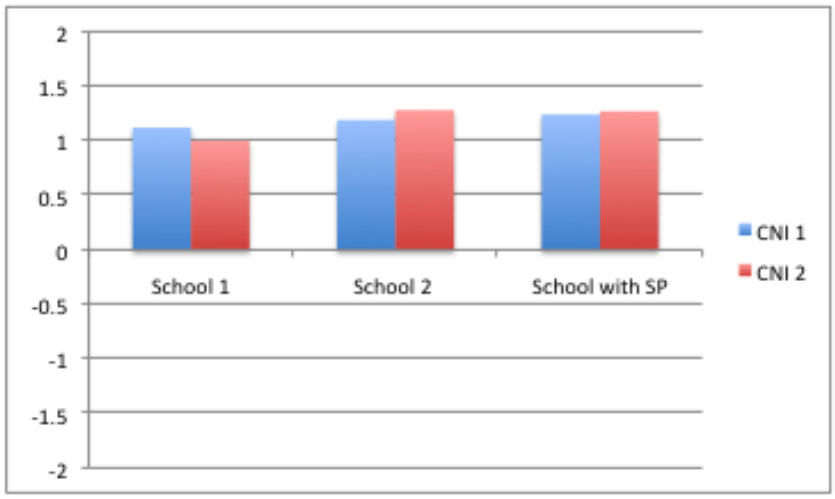

Figure 4: Average changes in CNI scores for all schools. In blue are the CNI scores from session 1 (February), in red the CNI scores from session 2 (May). The CNI scale is from -2 (complete disconnection to nature) to +2 (extremely connected to nature). Note: SP= Salamander Project.

Table 2: Changes in CNI and subscales scores over time and between schools. The CNI scale ranges from -2 to +2. Changes in CNI between the 2 sessions are calculated here as percentages with those in red representing a percentage decrease and those in green a percentage increase.

	School 1			**School 2**			**School with Salamander Project**		
	Session 1	Session 2	Change	Session 1	Session 2	Change	Session 1	Session 2	Change
CNI	1.12	1	- 3.85%	1.19	1.28	+ 2.82%	1.24	1.27	+ 0.92%
Empathy creatures	1.53	1.34	- 5.38%	1.51	1.50	- 0.28%	1.57	1.61	+ 1.12%
Sense responsibility	1.31	1.24	- 2.11%	1.28	1.42	+ 4.26%	1.29	1.32	+ 0.91%
Empathy salamanders	0.9	0.67	-7.93%	1.14	1.17	+0.95%	1.39	1.43	+ 1.17%

Analysis of the answers to the questionnaire also showed consistency across schools. There were no significantly different answers from school to school, or between the two sessions. The majority of children reported valuing nature highly both in their descriptions of what nature meant for them and also when ranking how important nature was for them (the three school averages ranged between 7.4 and 8.4 out of 10). All schools reported a sense of enjoyment associated with nature experiences and had similar views regarding the negative aspects of nature as well as similar examples of acting responsibly towards nature. The above findings suggest a similar CN baseline for the three schools (similar CNI scores and views on nature) as well as no significant changes in CNI over time.

The Salamander Project: learning to connect to nature

The above findings show only a very slight increase (less than 1%) in Olovslund school children's CNI scores between session 1 and 2 suggesting that their participation in the conservation project did not result in a strengthened CN. However, findings based on the qualitative methods used in this study paint another picture.

Indeed, interviews and survey results point to a self-observed change in children's feelings towards nature after project participation. This change was described as a positive one: an increased understanding, interest and/or care for nature. Answering questions about how they had changed with the project, 17 children talked about how they had learnt more and 16 expressed an increase in empathy towards salamanders ('feeling' and 'caring' more for them). They explained that they had developed a better understanding for salamanders, both in terms of facts about them (e.g. how to differentiate amongst species and sex) but also how to 'help' and 'care for' them.

> *"I have started to like them and I know now that you have to be careful with them. That you shouldn't harm them because they are also animals and they often live a hard life*." (Participant 20)

> *"I have more - okay respect is a big word but I have to use it because there isn't another one - respect for how they live because it's quite… I wouldn't survive if I were a salamander! … Now I see them in a different way. Before I thought they were like animals. Now it's like they are beings that, well, they need help, just like people can need help sometimes*." (Participant 1)

Furthermore, in the survey, 93% of children answered 'yes' to caring more about salamanders now than before the project. Of 57 respondents, two answered 'no' and two 'I don't know'. When talking about changes in how they felt toward salamanders and changes in themselves many children talked about going from not knowing or caring much about these amphibians to being closer to them, much more aware of them and thinking more about them: "We learnt to know them" (Participant 11).

"Umm, well now I care much more about them. Before, it was like 'yeah there is something called a salamander' that was like, here, in the back of my head. I didn't know much about them but now I know quite a lot and so more and more I want to go and save them and see them." (Participant 25)

"First I felt, well… how can I explain? 'Yeah it's exciting but they are…like…just salamanders'. But now I feel more like, they are alive, they exist. Before I didn't think 'I wonder where they are? (…) But now I wonder more 'are we going to find any today?'… I care more about them."
(Participant 15)

"Well, first I didn't know much – I had seen a salamander before (…) - but I didn't know so much about them. And now it feels like 'Oh, I want to have my own salamander'! They are so smooth and soft! (…) They are so nice!"
(Participant 19)

This increased 'connection' to salamanders (perhaps not in itself surprising) was mirrored by a strengthened CN in a broader sense. Indeed, children expressed thinking and caring more about other animals as well as nature as a whole after the project. When asked the question "Do you think you have changed with the project?" participants answered:

"I have learnt to take care of animals. I'm maybe thinking about doing something like that maybe…to fix things so that everything is good with nature. (…) Yes…I have become more nature-friendly."(Participant 6)

"Yes, well, I have much more of a sense for nature and salamanders."
(Participant 3)

"That's a hard question! No but… well I have started to think more about animals and nature. Actually a lot more than what I did before."(Participant 25)

"Well, it's like I'm less scared and I feel… more confident in nature." (Participant 23)

The above findings answer the first research question: engagement in the project has strengthened children's CN. Now we turn to the second research question: what emerged as the specific features of the project that allowed for a closer CN and how?

How the Salamander Project strengthens connection to nature

Five features of the project emerged as important in fostering a meaningful connection between children and nature. These features are: 1) children had fun; 2) they appreciated being included in something 'big'; 3) they enjoyed having responsibility; 4) the authentic nature of the project and, 5) the duration of the project. These features all contributed to creating a rich learning/meaning-making experience facilitating a child's connection to nature.

1. Children had fun

The project was considered a fun experience for the vast majority of children interviewed (all but one). Furthermore in the survey 'fun' was chosen by 66% of children as one of the three words that best described the project for them (figure 5). When asked about the best thing about the project many referred to the enjoyment they got out of it, the 'fun' in saving salamanders.

"The best thing is that we save them all and it's fun." (Participant 17)

"It feels fun and exciting." (Participant 14)

"There is a lot of joy in finding salamanders in the piles of leaves." (Participant 2)

The project was considered ‘fun’ for many reasons: it was exciting and different; it challenged certain children to get over their fears about salamanders; it was fun to help out and have responsibility; it was fun to be free from academic pressure and to be outside, move around, be with friends and ‘feel free’. These different descriptions of why the project was ‘fun’ suggest that this word has a multi-dimensional meaning for these children, encompassing many positive and complementary qualities[5]. This ‘fun’ feature is therefore tightly linked to the other four features described later in this section.

> Interviewer: *What is the best thing about the project for you?*
> Participant 21: *That we get to help out (…) we help the salamanders so that the municipality doesn’t have to do it so that’s good I think, and it’s really fun too.*
> Interviewer: *And why is it fun?*
> Participant 21: *Well, because we get to help out and (…) well we have never done this before!*

Although the project took place during lunch break (effectively meaning that children missed out on their usual break activities), 91% of survey respondents said that it didn’t feel like they had lost a break. Moreover 37% added, without being prompted, an extra voluntary comment such as ‘No way did it feel like I lost a break!’ or ‘It was at least a much fun as break!’ - a good indicator of the enjoyment they got from the project. Field observations and informal conversations with the students’ teachers confirmed the interview and survey results. Indeed the teachers saw that their students got a lot of joy out of the project and explained how they talked about it enthusiastically every day when they come back from the park.

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[5] It is also worth mentioning that two words in Swedish (‘rolig’ and ‘kul’) were repeatedly used in the interviews and surveys. Although often used side by side, they were considered interchangeable and, as such, were both translated to ‘fun’. Although help was sought from native Swedish speakers on this matter, it would be interesting to explore whether the two Swedish words are considered different from a child’s perspactive.

Figure 5: Words chosen by the children to best describe the salamander project (source Wordle)

2. *Being part of something 'big'*

This emerged as an important aspect of the project for the children. They appreciated being 'involved', 'part of' and given the opportunity to 'participate' in or be 'included' in a meaningful, relevant and real-world project.

> *"Well, it feels fun to be included [in the project] and help them."* (Participant 24)

> *"It made me happy. It was fun to be included in it."* (Participant 7)

> *"You feel like you have been, like, involved in something. That is nice."* (Participant 4)

Children enjoyed the contributing/helping aspect of the project not just in terms of helping salamanders but also in terms of having a role in the wider community by helping the municipality with its duty of protecting salamanders. Many children perceived the project as exciting, special and different and, in some cases, unique.

Participant 21: *I think it's really nice that - I have said this many times but - that we can help out (…). The teacher explained that we have to help out and that, like, only our school has permission to take the great crested newts and I think that that is pretty cool.*
Interviewer*: It is!*
Participant 21: *And we can talk about it later when we are big, to our children.*

"It's fun to feel that you have done something important. Something that is actually good for the environment, something that makes a difference."
(Participant 1)

Being part of a 'bigger' project (participating in an adult activity, beyond school) gave children a sense of importance and pride. Referring to the Salamander Evening, a student explains how it felt to be thanked in a speech by the event organisers:

Participant 22: *I felt happy that I got applause and that I had done a good job.*
Interviewer: *Did you feel proud?*
Participant 22: *Yes, very proud.*

3. Children had responsibility

Children enjoyed being given responsibility and being helpful (this is closely linked to them enjoying 'being part of something big'). The teachers also perceived that their students felt important doing this work and took it very seriously. This was confirmed by observations in the field of children being concentrated in the task, careful and thorough.

"Well it's nice because you feel like you have a kind of responsibility. That's fun."(Participant 4)

Children talked about how things changed over the course of the project and how they had an increasing amount of responsibility, as the teacher trusted them to do the job well. One student called this "freedom with responsibility" (Participant 25). This gained responsibility, trust and freedom allowed the children to get closer to the salamanders in their own time and manner and learn/experience/explore as well as gain competences in the tasks.

> *"Well it was nice that she [the teacher] didn't come and look over us, rather she thought we could do it and we could! We had to take responsibility but it was, like, fun to have it."* (Participant 9)

> Participant 23: *And she [the teacher] just let us be, like: 'now you can start!'*
> Interviewer: *And how did that feel?*
> Participant 23: *Umm… it felt really nice to have a bit of freedom. It was fun!*

4. Authenticity of the project

The fact that the project was a real conservation project was much appreciated by the children. The teacher in charge also insisted that this had particular meaning for their learning. Had it been set up as a normal 'school' project, she explained, they would have made sure to place salamanders in the paddling pool daily to be found by the students. Instead, being an authentic project, one never knew what one would find. While most days the children found some salamanders (the record find was 70 although the usual find was under 10), there were certainly days when no salamanders were found. On such days, the children reacted with maturity, understanding that this was the nature of such a project and even acknowledging the positive meaning of this:

> *"You felt a bit sad to not find one but at the same time happy that none had fallen into that trap."* (Participant 22)

The different conditions of each time participating in the project (e.g. number of salamanders found, weather or other events) expanded opportunities for reflection and

meaning-making. An example of this was when the children found a dead headless salamander. This allowed them to collectively think about what could have happened to it and, with the help of the teacher, brainstorm which animals prey on salamanders. Another example is of finding a juvenile salamander in the pool. This allowed the children to see for themselves how it is impossible to identify the sex of a juvenile and provided the teacher with a good opportunity to explain salamanders' lifecycle. These situations enabled the children to deepen their understanding of the complexity of the project (a characteristic of an authentic setting). A good example of this is when students were asked what their preferred solution to the paddling pool 'trap' would be. Their answers conveyed a clear understanding of the complexity of the issue:

> *"If they took away the pool it would be good for the salamanders but it would also be really bad for us who like splashing in it."* (Participant 6)

> *"Well, on the one hand it would be good to take it away so that no salamanders could fall in it at night but it is still pretty fun to play in the paddling pool during summer. On the one hand it would be good to remove it but on the other hand it's really fun for us to keep the project up, that we, Olovslund School, can save salamanders."* (Participant 9)

When children reflected on the differences between learning things by doing them, by being part of a real outdoors project, and learning things in the classroom, the vast majority voiced their preference for 'in situ' learning. Their answers suggest that, not only is learning in this way more 'fun', it is also easier to understand things by doing them 'for real':

> *"There is actually quite a big difference between doing it and learning about it. You learn a lot more by doing the thing."*(Participant 15)

> *"Well, there you get to learn for real, whereas in the classroom maybe someone explains about it and you do some exercises about it. In nature, then you can do it… I mean that you can understand more easily."* (Participant 18)

Participant 19: *Well, this is more that you learn how it is, like, for real. In the classroom it's more like you learn information about them (…). You don't get to see what they look like for real. So this is much more like reality.*
Interviewer: *Umm, and is there a way of learning that you prefer?*
Participant 19: *Yes, it's when you get to try for yourself. For example if you were to learn about a lion, you should see a lion and nearly inspect it yourself.*

Many children specifically talked about how they developed more of a 'feeling for' the project/salamanders by doing it compared to learning about it in the classroom. This suggests the importance of feelings/emotions to be engaged for meaningful learning and connection (to nature) to occur:

"Yes, yes, very different! You get to feel the feeling of being part of something, and saving" (Participant 20)

"You get a feeling for it when you do it yourself… more than if you just sit and write." (Participant 9)

"We get a completely different kind of education!" (Participant 25)

5. ***The time aspect***

The fact that the projects length was relatively long (two months) transpired to be an important factor in enabling learning and fostering CN. This time span enabled the children to get used to the project, familiar with the salamanders, and develop a routine out of it. Indeed, when asked about the differences between the first and last time in the project, 15 children (out of 25) described how they had changed in that time: they had gotten more used to the project, knew more about salamanders or felt more confident in the tasks. The repetition of actions enabled them to build competence and confidence:

"The first time it took a long time but then the two other times we just knew what to do and so we asked 'can we go and get them?' and we just went and did it."(Participant 14)

"The first time we didn't really know what to do and we were a bit unsure how to see if it was a girl or a boy (...). And then the last time, well, we were more used to it. We found them and helped them." (Participant 25)

The time aspect also allowed several children to get over their initial fear or unease about holding salamanders. Eight children experienced a change from being scared of, or nervous about salamanders or finding them 'creepy' to daring to hold them and not being scared/nervous:

Interviewer: *Do you think that you have you changed with the project?*
Participant 4: *Umm (...) before, I was a bit scared of salamanders. They were, like, a bit slimy. I didn't dare to hold one and now I can hold one without any problem.*
Interviewer: *And do you like to hold them now?*
Participant 4: *Yes, actually I do. (...) I have, like, stopped being scared of them.*

Participant 19: *The first time it was a bit scary. I'm a bit afraid of animals so I was a bit scared of it biting me, or how it would feel if it walked on my hand. It was a bit nerve-racking the first time.*
Interviewer: *And then how did it feel after that?*
Participant 19: *Then it felt quite normal to just go and do it. It was completely normal!*

The time that elapsed between each groups' turn in the project (on average children participated three times) also appeared important as the wait made it more exciting for the children. The teachers continued to talk about the project regularly after lunch

asking how it had gone and how many were found. Although they didn't participate in the project physically, it seems that their interest helped the project stay alive at school throughout its duration. The nine groups participating in the project also talked to one another about the daily 'find' throughout the spring and could see whether any the great crested newts were transported back to the school by their friends who had participated in the project that day.

Discussion

Discrepancy between CNI and qualitative results

An interesting finding is the discrepancy between the CNI and the qualitative methods results. The latter point to a strengthened CN after participation in the Salamander Project whereas the CNI results show no statistically measurable increase in CN. Furthermore, as we have seen, children's sense of responsibility proved to be important feature of the project. This, however, only translated in a very small increase in the CNI 'sense of responsibility' subscale.

One reason for these differences in qualitative and quantitative results could be that the CNI is a tool intended to measure an affective attitude (a trait measure) and attitudes take time to change. Perhaps the three and a half months between the two sessions was not enough time for a change in attitude to be detected. Although Cheng and Monroe (2010) themselves warn that the CNI may be unsuitable as a pre-and post- measure for an in-class activity or field trip, there is a lack of research exploring what an appropriate elapse of time for measuring changes with the CNI might be. Until this research gap is filled, it may be more appropriate to use the CNI for longitudinal studies.

Furthermore, it seems important to acknowledge here the many difficulties of 'measuring' a CN no matter what quantitative instrument is used (Brügger et al., 2010). Indeed, how can feelings and emotions be robustly 'measured' given their fundamental subjectivity? Attempting to measure this in children adds another layer of difficulty given different aged children's ability to describe their emotions (Aldwin, 2007 in Chawla, 2014). In light of the above, qualitative methods appear better suited, at this point in time, to gauge a child's CN and, more importantly, attempt to understand its development.

The importance of 'fun'

The importance of enjoyment for learning as well as for fostering a CN are well established in literature from the fields of both Education and nature connection/conservation (Chawla, 2007; Cheng and Monroe, 2010, Moore, 2014). The findings of this study support the literature and can act as a reminder for (environmental) educators and parents of the importance of having fun with regards to children's learning about, and experiencing of, nature. Children gave several reasons for why the project was so 'fun' of which the most common were: having responsibility, being included in something 'big' and the 'real' nature of the project. This 'fun' aspect is therefore tightly intertwined with these other features (discussed below). However, it is also important to acknowledge all the other reasons listed for why the project was 'fun' in order to understand the broad meaning of this concept for this age-group/this particular group of children. In this way meaningful learning opportunities can be adapted to what engages a child's evolving notion of 'fun'. More research in this area would be useful for educational practitioners aiming to encourage a CN in children through a child's sense of fun.

The importance of being included and having responsibility

Children's sense of responsibility and appreciation for being involved in a real conservation project emerged as key in expanding learning horizons and feeling closer to nature. Whereas 'empathy for creatures', 'enjoyment', and 'responsibility' (all of which were visible in the project) are acknowledged in the CNI as main components of a CN (Cheng and Monroe, 2010), what appears new here is how highly children valued being part of something 'big' or 'important'. This finding does, however, resonate well with literature on this particular age group wanting to feel useful and contribute to society (Moore, 2014). Viewed from a Situated Learning perspective, where learning is a changing form of participation in a community of practice, this finding is also supported (Lave and Wenger, 1991).
Indeed, as the children participate in this 'bigger-than-school' project and gain responsibility, they experience an increased feeling of membership in the project and

community surrounding the project. Feeling included, useful and responsible encouraged children to develop their competence in the tasks as well as build confidence. This finding backs studies that show how CN encourages confidence, and positive self-image (Louv, 2005; Ward Thompson et al., 2006; Chawla, 2014; Moore 2014). The learning-by-doing nature of the project, and the emotions and feelings that this triggered, resulted in a form of personal growth for many children. This was particularly apparent for those who overcame their initial fear of touching salamanders but also for the majority of children who felt that they had learnt/changed with the project. This finding is supported by Situativity theory, which understands learning as involving the "construction of identities" (Lave and Wenger, 1991:53).

Furthermore, competence is linked to self-efficacy, one's belief in one's ability to accomplish a specific task and the influence this belief has on the accomplishment of the task (Bandura, 1982 in Cheng and Monroe, 2010). Here, increased competence in the project and the gratification this gave the children is likely to have influenced their sense of being able to help the environment and their affective CN, both of which are consistent with the findings of Cheng and Monroe's study.

Having responsibility (being given a 'role') and feeling part of something 'big' proved to be important features of the project enabling meaningful learning (in the broad sense of the term) and a closer CN. Moreover the findings affirm that these two characteristics are well suited for this age group suggesting they be taken into account when planning activities aimed at fostering CN for 10 year-olds.

How authenticity stimulates learning and nature connection

Unlike a typical school learning activity the Salamander Project was a hands-on experience 'situated' in a rich 'real-world' context. The authenticity of the project enriched children's learning and understanding about nature and, thereby, encouraged a CN. These findings corroborate theory that states that authentic experiences result in better learning (Brown et al., 1989; Boyer and Roth, 2006; Durning and Artino, 2011).

Literature stipulates that, for an experience to be authentic, it should resemble real life as much as possible by, for example, being complex, having multiple solutions and including collaboration with members of society (Durning and Artino, 2011). Here I discuss three characteristics that illustrate how the conservation project provided an authentic learning setting: its complex nature, its required collaboration, and the variability of conditions.

The project was established as a socio-ecological solution to the issue of a protected species dying because of a socially valued paddling pool. A more effective solution (from a purely ecological perspective) may have been to remove the pool. However, authorities were unwilling to do this due to its high recreational and aesthetical value, resulting in the current solution and its reliance on Olovslund School's. This provided the children with a rich opportunity to reflect on the pros and cons of the solution to this **complex issue**. When considering this, some children even came up with their own alternative solutions demonstrating critical thinking. The fact that the 'issue' was located in their neighbourhood also seemed to stimulate reflection: the consequences of different solutions could directly affect them (e.g. removal of the pool). This endorses evidence that we are more willing to protect what has meaning for us (Louv, 2005; Bragg et al., 2011). Salamanders now have a particular meaning for the children engaged in the project and who express an increased interest in and/or concern for nature. This finding thereby supports the argument that nature-human experiences have the benefit of increasing those engaged to be interested in conservation elsewhere or at larger scales (Miller, 2005).

The project required **collaboration** amongst the children (working together) but also with 'practitioners in society' (notably the teacher and biologist but even, during the Salamander Evening, other members of the community). This collaboration broadened the children's learning as they engaged with different people, took on different roles (e.g. learner, expert) and worked together towards a common goal. This finding is supported by Environmental psychology that stresses the importance of goal-driven activity for learning (Chawla, 2006; Durning and Artino, 2011). Environmental psychologists understand this goal-directed activity as the manner in which people interact amongst themselves and with the environment, acknowledging

the importance of collective action and problem solving for meaningful learning (Brown et al., 1989; Boyer and Roth, 2006).

Furthermore, as literature suggests, the **variety of conditions** under which the project occurred (varying weather, group dynamics, number of salamanders etc.) was an important 'authentic' factor that engaged children's learning. Like in normal life, the different daily conditions allowed for a more extensive experience of the project from which children learnt (Chawla, 2014; Moore, 2014). Children were able to experience what scientific data gathering is truly like: different under different conditions. Moore and Young call the variation in environmental factors 'sufficient unpredictability' and understand this as important in maintaining a child's fascination and attention (Moore and Young, 1978 in Chawla, 2014). This is a good example of the unpredictable nature of the project upholding a child's excitement for, and interest in, nature.

The importance of project duration

Of course, in order for children to experience the project under a range of conditions, the relatively lengthy duration of the project was important. This time aspect appeared crucial in permitting children to develop an affiliation with, and understanding for the salamanders, and thereby a strengthened CN. Although there remains a knowledge gap regarding what a sufficient duration for a nature activity to foster a CN might be (Ernst and Theimer, 2011), this study shows that, for this project at least and based on the qualitative data only, eight weeks was sufficient. More studies would, however, be needed to establish this beyond this study.

The 'time' aspect also proved interesting for another reason. Although the project ran for two months, the actual amount of hands-on participation time was relatively short: on average 2.25 hours per child (3x45min sessions). What appears important therefore (in fostering CN) was the fact the project was spread out over such a long time. The weeks that passed in between participation times were not disconnected from the project. Instead as their friends participated in the project, interest and involvement was kept alive in the schoolyard and classrooms. The particular school culture and pride around this project (the school logo is a salamander) also appear to have

encouraged children's commitment and interest in the project. More research is needed in exploring the effects of culture but also 'by proxy' experience (alongside direct experience) in nurturing a connection to nature.

Exploring the relationship between connection to nature and behaviour

There is a growing amount of evidence confirming the link between one's CN and one's interest in, and concern for, nature as well as one's pro-environmental behaviour (PEB) (Mayer and Franz, 2004; Cheng and Monore, 2010). This study adds to this evidence by confirming the association between a child's CN and their interest in, and concern for, nature. It did not attempt to look at how CN affects a child's PEB. However an interesting finding emerged that contributes to our understanding of how this CN-PEB relationship works: PEB can strengthen a CN.

Current theory understands CN to influence PEB, that is, the more strongly one feels connected to nature the more likely one is to display environmental behaviour. As described in the theory section, the 'inner' (a person's affective CN) results in the 'outer' (a person's behaviour). The findings from this study, however, suggest that the opposite might be of equal importance (or, perhaps, more important): acting as stewards through the project (exhibiting PEB) seems to have led to a strengthened CN (stronger feelings and emotions towards nature) (figure 6). Through performing the environmentally friendly actions of the project (saving a protected species, and contributing to its repopulation elsewhere) and the learning that accompanied these actions, children developed a closer CN. They learnt to 'connect' by doing. This finding resonates well with Situated Learning theory that sees learning and doing as inseparable.

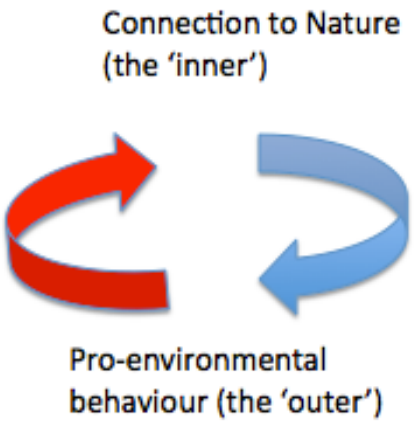

Figure 6: Exploring the backloop. Most often the relationship between CN and PEB is studied in psychology by exploring how our affective CN (the 'inner') influences our PEB (the 'outer'), represented here by the blue arrow. This study, however, with the help of Situativity theory, highlights the influence that PEB has on CN (the red arrow): acting as environmental stewards through the project strengthened children's affective CN.

In this light the study reveals an alternative relationship between CN and PEB, which could have important implications for environmental education but also for our theoretical understanding of our CN. Further research in this area is needed, however, to better understand the mechanisms of this relationship.

Conclusions

This study is situated within the greater context of the recognised need to (re)-connect today's children to nature (both in terms of their wellbeing as well as the planets') and contributes to our understanding of this relationship.

The findings of this study show that ongoing participation in a local species conservation project during school time strengthened children's affective CN. Through the project, children developed empathy and 'feeling' towards salamanders reflected by an increase in interest, understanding, and care for other animals and nature as a whole. The fact that these findings only emerged through qualitative analysis suggest that the quantitative CNI is not an adequate tool for detecting changes in CN over the particular timeframe of the project or that the increase in a child's CN was not sufficiently large to be grasped quantitatively.

This study sheds light on the manner in which children 'connected to nature': children learnt by doing through their first-hand experience of the project. Their learning was situated in a rich context becoming a: "more deeply integrated connection between observation and meaning" (Lawrence 2009:173). Furthermore this thesis identified some specific characteristics of the project that enabled a closer CN through meaningful learning. Notably, the project: gave children a sense of responsibility; allowed them to be part of (and feel included in) something 'big' and important; was a real-world project unfolding under authentic circumstances; and, last but not least, was a fun experience. These findings highlight the important contribution of Situativity theory (and in particular Situated Learning) to current theory concerning children's affective CN: the importance of contextual 'doing' for meaning-making. An additional finding from this study - and one that deserves further analysis and scrutiny - concerns our understanding of the relationship between CN and PEB. While it is widely accepted that our CN influences our behaviour towards nature, this study reveals that the opposite is also true. Indeed, through their actions (practicing biodiversity conservation), children's CN was strengthened. In other words, by doing children 'learnt' to connect to nature. By incorporating Situativity theory into the

realm of literature and theory on children's CN this study makes a theoretical contribution to our understanding of the relationship between CN and behaviour.

Further research would be needed in order to extrapolate these findings beyond this case study and to advance our understanding of the mechanisms of the PEB-CN relationship. However, there is, I believe, significant theoretical backing to assume that the current findings can already be of use to practitioners aiming to enhance children's connection to nature – for this age group.

Lastly, this study acts as a testimony for the social/human side of the project from a children's perspective. This is important seeing that the project's success has, until now, only been documented from a ecological perspective. Here, some of the social aspects of the project (which is set up as a social-ecological solution to the paddling-pool trap) are uncovered: benefits to the children with regards to their learning and CN. This project is therefore a good example of the multiple benefits of engaging schools in local conservation issues that, I hope, can inspire others concerned with 'growing' tomorrow's environmental stewards.

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Appendix A - CNI

Du, Naturen, och Hemma

Namn _____

Klass _____

Användernamn _____

Hur mycket håller du med om följande påståenden?
Kryssa en ruta

Påståenden	*Stämmer mycket bra*	*Stämmer*	*Håller varken med eller inte*	*Stämmer inte*	*Stämmer inte alls*
Jag tycker om att höra olika ljud i naturen	☐	☐	☐	☐	☐
Jag tycker om att se vilda blommor i naturen	☐	☐	☐	☐	☐
När jag är ledsen tycker jag om att vara ute och leka i naturen	☐	☐	☐	☐	☐
Jag känner mig lugn när jag är ute i naturen	☐	☐	☐	☐	☐
Jag tycker om att arbeta I trädgarden	☐	☐	☐	☐	☐
Att samla på saker från naturen är kul (t.ex. stenar, fjädrar)	☐	☐	☐	☐	☐
Jag känner mig ledsen när vilda djur blir skadade	☐	☐	☐	☐	☐
Jag tycker om att se vilda djur leva i en ren miljö	☐	☐	☐	☐	☐
Jag tycker om att röra vid djur och växter	☐	☐	☐	☐	☐
Jag tycker det är viktigt att ta hand om djur	☐	☐	☐	☐	☐
Människor är en del av naturen	☐	☐	☐	☐	☐
Människor kan inte leva utan växter och djur	☐	☐	☐	☐	☐
Att vara utomhus gör mig glad	☐	☐	☐	☐	☐
Mina handlingar kommer att påverka naturen	☐	☐	☐	☐	☐
Att plocka upp skräp från marken kan hjälpa miljön	☐	☐	☐	☐	☐
Folk har inte rätt att ändra på naturen	☐	☐	☐	☐	☐

1

CNI in Swedish (my translation of the original by Cheng and Monroe, 2010)

Appendix B – Nature questionnaire for all schools

Session 1:

1. What does nature mean to you?
2. What is the best thing about nature for you?
3. What is the worst thing about nature for you?
4. Can you give an example of when you did something good for nature?

Session 2:

1. Do you have pets at home?
2. On a scale of 1-10, how important is nature to you?
3. What does nature give you?
4. Could you see yourself working for a nature/environment protection organisation in the future?

Appendix C - Summary of field observations

Field Observation	Of what?	Date	Group	Which participation time?	How many Salamanders found?	My role
1	Salamander Project	13 April	4C, 1	1st time	70	Observer
2	Intro lesson	16 April	4B	NA	NA	Observer
3	Salamander Project	20 April	4C, 1	2nd time	1	Participant Observer
4	Salamander Project	22 April	4B, 2	1st time	1	Participant Observer
5	Salamander Project	24 April	4A	2nd time	2	Participant Observer
6	Salamander Project	29 April	4B, 2	2nd time	4	Participant Observer
7	Salamander Evening (community event)	8 May	NA	NA	1000 + (salamanders counted in pond)	Participant Observer
8	Salamander Project	13 May	4A, 1	4th time	9	Participant Observer
9	Salamander Project	25 May	4C, 3	3rd time	0	Participant Observer

Appendix D - Ethical considerations

Ethical implications of this study were carefully considered prior to fieldwork. Furthermore an ethical review of the research project was carried out by education staff of the Stockholm Resilience Centre as a requirement of its Master's programme. Although the topic is not deemed to be of a sensitive nature the study involved children and therefore followed specific guidelines relating to researching children (Graue and Walsh, 1998; The Research Ethics Guidebook, 2014; UNICEF guidelines for interviewing children, 2014).

Firstly, background police checks were provided to all schools involved once relevant teachers and/or principals had agreed to participate in the study. Secondly, an information letter and consent form was sent out to all 4th grade student's parents/caregivers. The letter explained what the study involved, the terms of student confidentiality and anonymity as well as how the data would be handled. Consent was asked for their child's participation in both: 1) the classroom sessions (where CNI and booklets were completed) and, 2) recorded interviews where quotes could be used. Fieldwork commenced only once consent forms were collected and involved only those students whose caregivers had given consent.

Participants were met at all times with respect and study methods were adapted to the specific age group and chosen so as to be fun and engaging activities in a familiar atmosphere (their school). Before being interviewed, students were explained that their participation was fully voluntary and that they didn't have to answers questions if they chose not to. They were encouraged to ask questions and were explained both prior to the classroom sessions and interviews that there were no 'right' or 'wrong' answers but that we were instead interested in their personal views and feelings.

Appendix E - Table of interviewees

Participant ID	Class	Date	Boy/girl	Participation times	Attended Salamander Evening
1	4a	03 June	G	4	N
2	4a	03 June	G	4	N
3	4a	03 June	G	4	Y
4	4a	03 June	G	4	N
5	4a	03 June	B	3	N
6	4a	04 June	B	4	N
7	4a	04 June	B	4	N
8	4a	04 June	B	4	N
9	4b	04 June	G	5	Y
10	4b	04 June	B	4	Y
11	4b	04 June	G	3	N
12	4b	04 June	B	4	N
13	4b	04 June	G	3	N
14	4b	04 June	B	3	Y
15	4b	04 June	G	3	N
16	4b	04 June	B	3	Y
17	4c	03 June	B	3	Y
18	4c	09 June	G	3	Y
19	4c	09 June	G	3	N
20	4c	09 June	B	2	N
21	4c	09 June	B	3	N
22	4c	09 June	G	3	Y
23	4c	09 June	G	3	N
24	4c	09 June	B	3	N
25	4c	09 June	G	3	Y
Total: 25			**12 boys 13 girls**	**Participation range 2-5 times (average 3)**	**9 /25**

Appendix F - Interview guide

1. What is the best thing about the Salamander Project for you?

2. Is there anything that you think is not good about the project?

3. Do you have a special memory or story from the salamander project you could tell me about?

4. Could you explain for me how it feels to 'work' with salamanders? (How does it feel to search for them/find one/hold one?)

5.How does it feel to be part of the project?

6. What was different between the first and the last time you participated in the project? (Did something feel different?)

7. Can you tell me about what you have learnt from the project?

8. Was it different to the way you learn things in the classroom? (How?)

9. In what way(s) have your feelings towards salamanders changed with the project? (if they have changed)

10. In what way(s) have your feelings towards your classmates changed with the project? (if they have changed)

11. Do you feel like you have changed a bit yourself? (In what way?)

12. If you could decide, would you rather that the municipality got rid of the paddling pool so that the salamanders wouldn't get stuck there anymore or would you prefer things to continue as they are now (with your school saving the salamanders every year and keeping the paddling pool)? What would be the best solution in your eyes? (Why?)

Extra questions that often came up:

Did you find any salamanders yourself? How many?

Had you ever seen a salamander before you started this project?

Do you feel like you know more about salamanders now than most other people? (How does that feel?)

Appendix G - Salamander Project survey

Write 3 words that best characterise the Salamander Project for you:

Did you find any salamanders yourself?

How many? (if you can remember!)

Were you at the Salamander Evening?

Did it feel like you had missed out on your lunch break when you participated in the project?

Do you feel that you care more about salamanders now than before the project?

Write down a particular memory you have from the project:
