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REVIEW AND SYNTHESIS

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Childhood nature connection and constructive hope: A review of research on connecting with nature and coping with environmental loss

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Abstract

1. Within a generation, children's lives have largely moved indoors, with the loss of free-ranging exploration of the nearby natural world, even as research indicates that direct experiences of nature in childhood contribute to care for nature across the life span.
2. In response, many conservation organizations advocate connecting children with nature, and there has been rising interest in measuring young people's connectedness with nature, understanding how it relates to their well-being and stewardship behaviour and creating programs to increase connection.
3. This article reviews the literature on these topics, covering both quantitative and qualitative studies. It notes that this research emphasizes positive experiences and emotions, even as global environmental changes and biodiversity loss accelerate.
4. Young people's emotions of worry, frustration and sadness as they learn about environmental degradation also express their understanding that they are connected to the biosphere. Therefore this review includes research on how young people cope with information about large-scale environmental problems, and it identifies practices to sustain hope.
5. The review concludes by suggesting how research on connection with nature and coping with environmental change can benefit from integration.

KEYWORDS

adolescent, biodiversity loss, child, climate change, environmental identity, hope, nature connection, proenvironmental behaviour, wellbeing

1 | INTRODUCTION

1.1 | Understanding nature connection in childhood

Opportunities for children to connect with nature are important for the preservation of the biosphere. This is a message of the report *Home to Us All: How Connecting with Nature Helps Us Care for Ourselves and the Earth* (Charles et al., 2018), prepared by the International Union for the Conservation of Nature, the Children and Nature Network and other partner organizations for the Convention on Biological Diversity in 2018. The report advocates an increased focus on connecting people with nature to inspire action for biodiversity conservation; and while it presents evidence for the importance of connecting with nature at all ages, it gives childhood

a leading place, based on its review of research that childhood experiences often motivate later conservation actions. In considering how to move social and ecological systems toward sustainability, Ives et al. (2018) propose that emotional connections with nature have the potential to leverage deep societal change toward respect and care for nature; and they recognize childhood as a time to begin building connection. Chan et al. (2016) make a similar argument that people often protect and restore the natural world for the sake of 'relational values': because feelings like connection with nature, attachment to a special place in nature or satisfaction found in caring for nature enhance the quality of people's lives.

When Ives et al. (2017) surveyed peer-reviewed articles on the human connection with nature published from 1984 through 2015, they found a steep increase from the year 2010 onward. They attributed this rise to surging evidence of health and well-being benefits when humans engage with nature (van den Bosch & Bird, 2018) as well as concern that humans need to feel connected with nature in order to commit to its protection. Other reviews by Restall and Conrad (2015), Tam (2013) and Zylstra, Esler, Knight, and Le Grange (2014) identify experiences that define nature connection, and how it is associated with other facets of life like happiness and support for environmental protection. These reviews primarily cover research with adults, with only a few references to young people below the age of 18 or none at all.

This review is the first to focus on nature connection in children and adolescents. As the first overview of this topic, it aims for breadth of coverage. It looks at childhood nature connection through the lens of both quantitative and qualitative methods, considers evidence that connection with nature matters for children's well-being as well as the future of conservation and synthesizes evaluations of programs to increase young people's connection with the living world. Consistent with the United Nations definition of childhood as the period from birth through age 17 (UNICEF, 1989), this paper refers to this span of years as 'childhood', populated by 'children' and 'young people'.

Interest in both adults' and children's connection with nature reflects concern that an 'extinction of experience' is underway (Pyle, 1978). Around the world, more and more people are living in urban areas, which are becoming more densely developed, eroding opportunities for people to experience nature and feel kinship with the larger community of life. According to Soga and Gaston (2016), this sets up feedback loops that are troubling for the future of conservation. They note that as people's experience of nature declines, their interest in nature is likely to diminish. This reduces motivation to seek out natural areas. As parents, people are likely to pass their disengagement from nature to their children, and over time this can become a generational shift, with the public understanding and valuing the natural world less and feeling less investment in its protection. Many of the publications that this paper reviews express these concerns.

With his book *Last Child in the Woods*, the journalist Richard Louv (2005) documented children's loss of freedom to roam their neighbourhoods and discover nearby nature, which happened within little more than a generation as children's lives become more managed and confined indoors. 'At the very moment that the bond is breaking between the young and the natural world', he observed, 'a growing body of research links our mental, physical and spiritual health to our association with nature' (p. 3). Concerns about declining access to nature and children's loss of freedom outdoors have spurred efforts to define and measure nature connection in childhood, identify key experiences that contribute to its development, evaluate interventions designed to increase connection and determine how nature connection relates to other aspects of young people's lives, such as well-being and care for the environment.

This paper argues that there are two parallel streams of research that investigate young people's feelings of connection with nature, each developing independently without reference to the other, and that a comprehensive effort to understand the meaning of nature connection in childhood requires their integration. One stream presents nature connection as a primarily positive experience. It follows the precedent set by quantitative measures of nature connection in adults, which ask adults to state, for example, how much they feel a sense of oneness and identification with nature, enjoy, respect, appreciate and love nature, feel responsibility for conserving nature and recognize interdependence between human welfare and the welfare of the natural world (Restall & Conrad, 2015; Tam, 2013; Zylstra et al., 2014). When researchers created quantitative tools to assess nature connection in children, they began by reviewing measures for adults and adapting them for children, with a similar emphasis on positive statements. Qualitative studies that observe children in natural areas, or ask children to draw, write and talk about their engagement with nature, confirm this view that connecting with nature primarily involves positive experiences.

Yet because the natural world is currently under levels of stress unparalleled in human history (Díaz et al., 2019; IPBES, 2019), children's encounters with nature include witnessing environmental degradation and destruction, and children hear about global threats like climate change and species loss. This paper argues that young people's fears and worries about environmental risks and losses also express a sense of connection with nature. Therefore it includes a second stream of research that examines this painful side of connection, and how adults can help young people navigate environmental loss. Support includes providing conditions for young people to form 'constructive hope': the capacity to face environmental threats and uncertainties, while finding positive meaning in taking action (Ojala, 2016) (see Figure 3 for a summary of ways to help young people with both positive and painful forms of connection).

1.2 | The structure of this paper

This review begins with an overview of quantitative, qualitative and mixed methods studies of childhood nature connection. It looks at how nature connection has been measured from the preschool years through adolescence, and it considers how the variables of age, gender, time in nature and family relationships relate to connection. It then turns to qualitative studies of children in nature, finding considerable overlap between indicators of nature connection in quantitative tools, how children engage with nature when they are observed

during free play and exploration and how they express their feelings for nature in narratives and interviews. Qualitative studies suggest how natural areas support positive experiences, and how children's ways of relating to nature change at the transition points from early childhood to middle childhood, and middle childhood to adolescence.

After considering nature connection through quantitative and qualitative approaches, this paper assembles evidence for the significance of this topic. Why is it important to understand and promote a sense of connection with nature in childhood? Evidence indicates that connecting with nature supports multiple areas of young people's healthy functioning and well-being. Children who express greater connection with nature are also more likely to report taking action to care for nature. Children's connection with nature increases with time spent in nature, and extended time in nature in childhood, many studies show, predicts active care for nature in adulthood.

After reviewing studies that present nature connection as a positive experience, this paper turns to evidence that many young people are struggling with feelings of loss as the natural world unravels. When they react with despair, research shows, they are unlikely to take action to address challenges (Ojala, 2016; Stevenson & Peterson, 2016). Therefore it is important to understand how some young people are able to acknowledge environmental risks and yet endeavour to protect the natural world, without fatalism that their efforts are futile. This section reviews studies that explore this question, as well as how adults can acknowledge young people's difficult feelings and support their hopefulness, well-being and desire to act.

After considering both positive and painful emotions associated with connection with nature, this paper proposes that each body of research can benefit from attention to the other. It turns to assessments of programs that seek to increase young people's connection with nature, and then compares them with practices to help young people cope with environmental threats and build hope. It suggests that programs may better prepare young people for lives of sustained environmental action if they integrate ideas from each side. The paper ends with a few observations to guide future research and practice.

1.3 | The review process

This review does not seek to be comprehensive, as the systematic investigation of young people's connection with nature began with qualitative studies in the 1970s, and between qualitative and quantitative studies, the literature on this topic has grown too large for any single paper to encompass. The goal is to cover peer-reviewed articles, books, book chapters and well-designed studies by environmental organizations that present key findings that advance understanding of child-nature connections. The review process followed three tracks.

1. This author participated in a 2-day Connection to Nature Workshop in October 2018, which brought researchers and environmental and educational practitioners together to evaluate 26 papers that measured relations with nature in children and adults, in preparation for the creation of an online *Practitioner Guide to Assessing Connection to Nature* (Salazar, Kunkle, & Monroe, 2020). People discussed advantages and limitations of selected tools that assessed connection and identity with the natural world, and recommended additional measurement instruments for consideration. This paper's section on quantitative measures of nature connection in children and adolescents grew from this process. To ensure that it includes more recent work and studies that investigate associations between nature connection and other facets of child development, a literature search was conducted for the period January 2000–May 2020, using the databases and search terms listed in Figure 1. As Ives et al. (2017) note, research on nature connection increased after the year 2000.
2. The overview of qualitative studies draws on this author's reading in the field of child-environment studies since the 1970s, as well as the search of databases. It features often cited publications that explore young people's encounters with nature through free play and exploration, including observational studies of children's engagement with nature and young people's expressions of their feelings in nature.

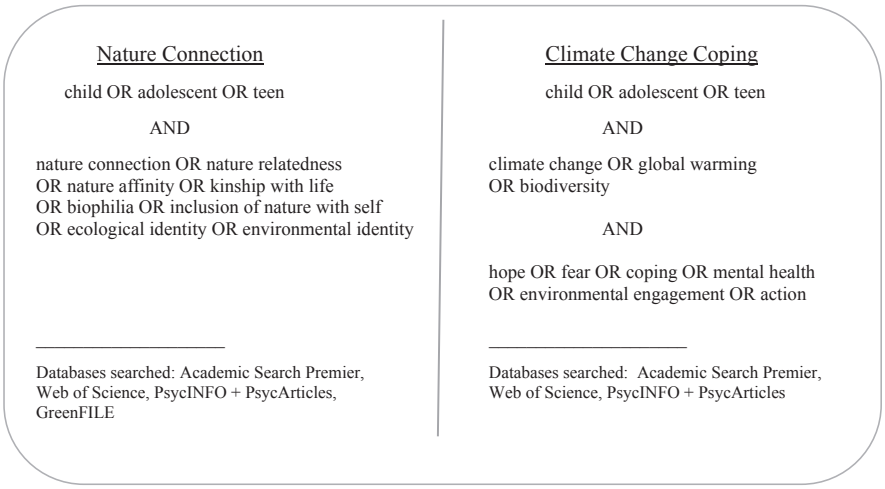

FIGURE 1 Search terms used in research databases

3. Since the 1990s, this author has been noticing reports of young people's environmental fears and worries. After 2010, as researchers developed tools to assess young people's reactions to threats like climate change and species loss, publications on this topic increased. To prepare this section, this author draws on years of following the work of individual researchers who examine this topic, as well as a literature search for relevant peer-reviewed articles, books and book chapters for the period January 2010–May 2020, as described in Figure 1.

As publications were collected for each section of this paper, their reference lists were scanned for additional studies.

2 | MEASURING NATURE CONNECTION IN CHILDHOOD

2.1 | Overview of measures

The review of tools during the Connection to Nature Workshop in 2018, followed by a literature search of relevant databases and scans of reference lists, yielded 10 measures of nature connection for children and adolescents that were tested for reliability and construct validity and published in peer-reviewed journals. Together, they cover ages 2 through 19. For summaries of these measures, see Table 1; Table S1–Expanded. Rather than discuss each measure individually, this section shares general observations and reflections about this collection as a whole. A few researchers, including Collado, Staats, and Corraliza (2013), Krettenauer (2017), Musitu-Ferrer, Esteban-Ibañez, Léon-Moreno, and García (2019) and Otto and Pensini (2017), have created other relevant tools for a specific sample or by adapting existing measures.

In developing quantitative assessments of nature connection for children, researchers commonly began by reviewing and adapting measures designed for adults. Therefore many characteristics of adult measures have been carried over into assessments with children. Just as there is no single consensus definition of nature connection in research with adults and a variety of terms have been used for this construct (Restall & Conrad, 2015; Tam, 2013; Zylstra et al., 2014), a variety of definitions and terms have been used in studies with children and adolescents. As Table 1 shows, four studies refer to nature connectedness or connection with nature (Cheng & Monroe, 2012; Ernst & Theimer, 2011; Richardson et al., 2019; Sobko et al., 2018), whereas others explore biophilia (Rice & Torquati, 2013), affinity with the biosphere (Giusti, Barthel, et al., 2014), eco-awareness (Elliot et al., 2014), environmental perceptions (Larson et al., 2011), implicit association with nature (Bruni & Schulz, 2010) and emotional affinity with nature (Müller et al., 2009). Table 1 shows that the dimensions of nature connection included in these 10 measures vary, but often overlap.

Like measures of nature connection in adults (Restall & Conrad, 2015; Tam, 2013; Zylstra et al., 2014), assessments of childhood nature connection are multidimensional. They include emotional attraction and affiliation with nature, cognitive understanding of human–nature interdependence and curiosity about natural phenomena, positive experiences in nature such as enjoyment and comfort and protective behaviours toward nature. Enjoyment in being in nature runs across most of the childhood measures (Cheng & Monroe, 2012; Elliot et al., 2014; Ernst & Theimer, 2011; Giusti, Barthel, et al., 2014; Müller et al., 2009; Rice & Torquati, 2013; Richardson et al., 2019; Sobko et al., 2018). Some studies treat awareness of human reliance on nature and nature's vulnerability to harm as a dimension of nature connection (Ernst & Theimer, 2011; Giusti, Barthel, et al., 2014; Larson et al., 2011); but general knowledge about nature and environmental issues is treated as a separate but related variable (Cheng & Monroe, 2012; Larson et al., 2011; Müller et al., 2009). Three studies treat empathy for nature as a dimension of connection (Cheng & Monroe, 2012; Giusti, Barthel, et al., 2014; Sobko et al., 2018).

Research with adults has generally separated measuring nature connection from asking people to identify their pro-environmental actions (Restall & Conrad, 2015; Tam, 2013; Zylstra et al., 2014). On the whole, tools to assess nature connection in children maintain this separation. Cheng and Monroe (2012) maintain this distinction by asking children about their sense of responsibility and efficacy to act (e.g. 'My actions will make the natural world different') and Larson et al. (2011) about intentions to act (e.g. 'I would help to clean up green areas in my neighborhood'), without asking about current actions. Elliot et al. (2014) divide nature relatedness and responsible environmental behaviour into separate subscales. Richardson et al. (2019), however, include one general behaviour ('I always treat nature with respect') in their 6-item scale, and Sobko et al. (2018) ask parents whether 'my child treats plants, animals, and insects with care' and 'enjoys recycling paper and bottles'.

Measurement items used to assess nature connection shift with age (Table 1). Studies with preschool children primarily consider enjoyment in nature, a desire to engage in nature-based activities, empathy and interest in nature. Questions about identification, oneness or kinship with nature begin with middle childhood and adolescence. These differences are consistent with young children's focus on embodied experiences (Beery, Chawla, & Levin, in press); whereas by middle childhood and adolescence, young people have developed a more stable self-identity that enables them to compare themselves with generalizations like 'nature' (Harter, 1999) and they can talk about their emotions with more self-awareness (Aldwin, 2007). Enjoyment in being in nature is the one thread that runs across measures for all ages. It includes appreciation for nature's sensory qualities and opportunities that nature affords for play, freedom, comfort and solace.

Methods to assess nature connection also change with age (Table S1–Expanded). To work with 5-year-olds who cannot read and comprehend items in a written survey, Elliot et al. (2014) and Giusti, Barthel, et al. (2014) used one-on-one interviews, asking children to choose among options as they landed on squares on a game board or made selections among pictures. With 2- through 5-year-olds, Rice and Torquati (2013) conducted interviews with puppets, and

TABLE 1 Measures of nature connection designed for children and adolescents

Study and instrument	Sample	Dimensions of nature connection
Sobko, Jia, and Brown (2018) Connectedness to nature index-parents of preschool children (20 item survey)	Study 1:31 parents of 2- to 4-year-olds in Hong Kong Study 2:299 parents of 2- to 5-year-olds in Hong Kong	• Enjoyment of nature • Empathy for nature • Responsibility toward nature • Awareness of nature
Rice and Torquati (2013) Biophilia interview (11-item interview using puppets)	2- to 5-year-olds in Nebraska & California, USA • 114 children in 10 early childhood programs	• Preference for playing outside • Enjoyment of sensory aspects of nature • Curiosity about nature • Desire to interact with nature
Elliot, Ten Eycke, Chan, and Müller (2014) Ecological awareness interview (10-item interview with board game) + weekly ethnographic documentation	5-year-olds in British Columbia, Canada • 21 in a nature kindergarten • 22 in a conventional kindergarten	• Nature relatedness (preference for playing outside and choosing nature activities) • Environmentally responsible behaviour
Giusti, Barthel, and Marcus (2014) Affinity with the biosphere interview (41-item interview with a series of games)	5-year-olds in Reggio Emilia preschools in Stockholm, Sweden • 11 with nature-rich routines at school • 16 with nature-deficit routines at school	• Emotional affinity • Cognitive affinity • Attitudinal affinity
Cheng and Monroe (2012) Connection to nature index (16-item survey)	9- to 10-year-olds in Florida public schools, USA • 372 students (26% of 1,432 students)	• Enjoyment of nature • Empathy for animals and plants • Sense of oneness • Sense of responsibility
Bruni and Schulz (2010) Flexitwins™/IAT nature computer game	10- to 12-year-olds in public school in California, USA • 30 students	• Implicit connectedness with nature
Larson, Green, and Castleberry (2011) Children's environmental perceptions scale (16-item survey)	6- to 13-year-olds in Georgia, USA • 177 in pre-test/146 in post-test • 66 in brief interviews	• Eco-affinity • Eco-awareness
Richardson et al. (2019) Nature connection index (6-item survey developed for ages 7–85+, using separate child and adult samples)	7- to 15-year-olds in the United Kingdom • 371 children	• Wanting to be in nature • Feeling happy in nature • Finding beauty in nature • Finding nature amazing • Feeling part of nature • Treating nature with respect
Ernst and Theimer (2011) Nature connectedness inventory (11-item survey)	8- to 17-year-olds in USA • 385 participants in seven environmental education programs	• Viewing oneself as egalitarian member of the broader natural community • Kinship with the natural community • Belonging to the natural world • One's welfare is related to welfare of the natural world • Enjoyment and comfort in nature
Müller, Kals, and Pansa (2009) Emotional affinity toward nature scale (11-item survey)	15- to 17-year-olds • 196 students in Germany • 207 students in Lithuania Divided between cities and rural villages	• Freedom in nature • Oneness with nature • Feeling calm and relaxed in nature • Solace in nature • Absorption in engagement with nature

Sobko et al. (2018) gathered parents' reports about their children. Researchers reported that playful approaches successfully held young children's attention. To use a written survey with children as young as 6, Larson et al. (2011) kept the language very simple, referring to 'plants' and 'animals' more often than 'nature' and avoiding difficult concepts like 'environment'. Otherwise, written surveys begin with children aged 7 and older who can read independently. For later childhood, researchers use adult scales or simplified measures of scales originally created for adults, like the Emotional Affinity toward Nature Scale adapted by Müller et al. (2009) or the Nature Connectedness Index of Richardson et al. (2019) that was designed for ages 7 through adulthood. In their comparison of three scales completed by 8- through 12-year-olds, Bragg, Wood, Barton, and Pretty (2013) concluded that measures created solely with adult samples should be reserved for ages 12 and older.

Tam (2013) noted that the collective dimension of nature connection is largely missing from quantitative measures for adults, in the sense of experiencing nature as a member of a social group. It is also absent from measures for children—surprisingly, considering that children spend most of their time engaging with the world in the presence of other people. People around them indicate what to notice in the environment, how to value it, how to

use it and how to respond to places and things (Chawla, 2007; in press). This omission may reflect researchers' tendency to review measures of nature connection for adults before developing tools for children, rather than beginning with qualitative observations of children in nature.

2.2 | Nature connection in context

The work by Sobko et al. (2018) raises important questions for the study of nature connection. Does the meaning of nature connection depend on context? To investigate nature connection in children in Hong Kong, a densely built urban environment, they began by sampling parents of 2- to 4-year-olds with the very young mean age of 2.2 years (Sobko, 2020). Because they doubted that children this young could answer questions competently, they gave parents a Cantonese translation of the Connection to Nature Index developed by Cheng and Monroe (2012) for 9- to 10-year-olds in Florida, asking them to report for their children. Parents who completed the survey marked almost half of the items as Not Applicable. In interviews afterwards, they explained that the survey often failed to reflect Hong Kong conditions. For example, a question about whether their child 'likes to go outside and enjoy nature' did not apply to a city where going outside meant stepping into heavily trafficked built streets. Questions about 'a sense of responsibility' for taking care of nature were impractical where government departments controlled parks and gardens; and the idea of a 'sense of oneness' was puzzling—perhaps because it requires quiet time in nature, which urban residents rarely find. The researchers began again, asking parents whether their children already possessed feelings for nature, and on this basis created a new index that included young children's enjoyment at seeing flowers, hearing birds, caring for domestic plants and animals and choosing books about plants and animals, as well as unhappiness at seeing animals hurt or plants and animals dying. This study highlights that the 'nature' in 'nature connection' means different things in different locations … but it also shows what parents notice when their young children engage with nature. When Barrable and Booth (2020a) used the same index with parents of nursery children in Scotland, they found it a good fit for this sample too, which suggests that it captures some common features of parents' perspectives.

Given concerns that diminished nature experiences can lead to diminished connection and care for nature as well as reduced well-being (Louv, 2005; Pyle, 1978; Soga & Gaston, 2016), studies need to provide information about the amount and kind of nature associated with high and low levels of connection. Six of the 10 studies covered in Table S1–Expanded compared outcomes associated with different degrees of nature: asking children about the level of nature near their home (Cheng & Monroe, 2012) or their preferences for out-of-school activities and nature experiences (Larson et al., 2011); comparing children in a nature kindergarten versus conventional kindergarten (Elliot et al., 2014) or teens in rural villages versus cities (Müller et al., 2009); and objectively measuring the level of nature available at school or during daily routines (Giusti, Barthel, et al., 2014; Rice & Torquati, 2013). Locations covered a continuum from an old growth forest and rocky beach in suburban British Columbia (Elliot et al., 2014), to rural–urban gradients in Germany, Lithuania, Florida and Georgia (Cheng & Monroe, 2012; Larson et al., 2011; Müller et al., 2009), to schoolyards in medium-density urban areas (Rice & Torquati, 2013), to urban Stockholm (Giusti, Barthel, et al., 2014). As the following section shows, in five out of these six cases, more access and time in nature were associated with higher levels of connection.

2.3 | Variables associated with nature connection

This section briefly summarizes quantitative studies that explore how levels of nature connection relate to access to green space, time in nature, age, gender and family relations. Children responded to questionnaires and interviews at school and in after-school programs, summer camps and nature centres. Some studies investigated variables that affect nature connection as the outcome of interest; but in many cases, researchers' focus was children's well-being or conservation behaviours, and they examined nature connection, among other variables, for its potential influence. Almost all of the studies covered here relied on multivariate analyses to explore how multiple variables affect outcomes, and each other. In addition to the variables reviewed here, control variables included school effects, parents' levels of education, parent income, nationality and rural versus urban residence. A number of studies used two or three different measures of nature connection to strengthen the validity of their conclusions.

2.3.1 | Access to nature and time in nature

Young people with more access and experience in nature express higher levels of connection (Barrable & Booth, 2020a; Cheng & Monroe, 2012; Collado et al., 2013; Dornhoff, Sothmann, Fiebelkorn, & Menzel, 2019; Elliot et al., 2014; Fränkel, Sellmann-Risse, & Basten, 2019; Giusti, Barthel, et al., 2014; Larson, Bowers, & Stephens, 2017; Larson et al., 2019; Müller et al., 2009; Richardson, Sheffield, Harvey, & Petronzi, 2015; Sheldrake, Amos, & Reiss, 2019; Soga, Yamanoi, Tsuchiya, Koyanagi, & Kanai, 2018). Rice and Torquati (2013) did not find this association when they evaluated levels of nature in preschool yards, but concluded that their measure was limited because it failed to include elements of nature around schools and children's time in nature outside of school. Low childhood levels of nature connection, in contrast, relate to more time spent inside and more hours watching television, playing digital games and following social media (Bruni & Schultz, 2010; Larson et al., 2019; Michaelson, King, Janssen, Lawal, & Pickett, 2020). The legacy of childhood time in nature reaches into adulthood. Among adults, greater connection with nature is associated with more access and interaction with nature during childhood (Cleary, Fielding, Murray, & Roiko, 2018; Fretwell & Greig, 2019; Guiney & Oberhauser, 2009; Pensini, Horn, & Caltabiano, 2016; Rosa, Profice, & Collado, 2018; Tam, 2013; Windhorst & Williams, 2015; Wood & Smyth, 2020).

Age

In their assessment of biophilia, Rice and Torquati (2013) found that scores for their preschool sample of 2- to 5-year-olds increased with age. Aside from these increasing scores in very young children, a reverse pattern appears: scores for nature connection fall as young people move from early and middle childhood into adolescence. This pattern is evident in samples that, together, cover ages 7–21, coming from the United Kingdom (Hughes, Rogerson, Barton, & Bragg, 2019; Richardson et al., 2019), Germany (Liefländer, Fröhlich, Bogner, & Schultz, 2013), Canada (Crawford, Holder, & O'Connor, 2017; Krettenauer, 2017; Krettenauer, Wang, Jia, & Yao, 2019; Michaelson et al., 2020), the United States (Larson et al., 2017) and China (Krettenauer et al., 2019). In two large samples that included adults, Richardson et al. (2019) and Hughes et al. (2019) found that levels of connection were significantly highest among 7- to 9-year-olds and 7- to 12-year-olds, respectively, falling to their lowest level in the teen years, and then gradually rising in adulthood.

Gender

Research results related to gender differences in childhood nature connection are inconsistent. The majority of studies that consider gender find that females report significantly higher levels of connection than males (Bruni & Schulz, 2010; Crawford et al., 2017; Giusti, 2019; Hughes, Richardson, & Lumber, 2018; Hughes et al., 2019; Müller et al., 2009; Musitu-Ferrer, Esteban-Ibañez, et al., 2019; Richardson et al., 2015, 2019). Dornhoff et al. (2019) found greater nature relatedness among female high school students in Germany compared to males, but the reverse among high school students in Ecuador, which they believed reflected cultural differences between these countries. Ahmetoglu (2019), Bragg et al. (2013) and Musitu-Ferrer, León-Moreno, Callejas-Jerónimo, Esteban-Ibáñez, and Musitu-Ochoa (2019) found no gender differences in their Turkish, British and Spanish samples. Working with rural multi-ethnic 11-to 14-year-olds who came from predominantly low-income families in the United States, Larson et al. (2019) found higher levels of connection in males, who also reported spending more time outdoors than females.

Family relations

Research into the socialization of children's relationships with nature suggest that parents and other family members can encourage or discourage connecting with nature (Chawla, 2007; in press; D'Amore & Chawla, 2020). Children's levels of connection are higher when parents believe it is important for their children to experience nature outdoors (Ahmetoglu, 2019) and report greater nature connection themselves (Barrable & Booth, 2020a), when children report more pro-environmental values in their family (Cheng & Monroe, 2012), and when they talk with their parents about nature on a regular basis (Larson et al., 2011). Musitu-Ferrer, Léon-Moreno, et al. (2019) found that 12- to 16-year-olds in Spain who reported that their parents communicated acceptance for their children, versus exhibiting authoritarian or neglectful parenting styles, scored higher on both connectedness with nature and empathy for nature.

The preceding summaries raise questions. When young people spend time outdoors in nature, what happens that promotes their sense of connection? Is the relationship bidirectional, with a sense of connection motivating young people to spend more time in nature, while time outdoors deepens connection? Why do levels of connection change from early and middle childhood to adolescence? Why does gender often make a difference? Why do family relationships matter? These questions invite qualitative methods as well as experimental designs and multivariate analyses to develop potential explanations. In the following section, this paper turns to a review of qualitative studies to see what light it casts on these questions.

3 | DEVELOPING CONNECTIONS WITH NATURE: QUALITATIVE DESCRIPTIONS

Relationships with nature in childhood and youth have been explored qualitatively through an interdisciplinary literature that crosses poetry, fiction, autobiography, geography, anthropology, psychology, education, environmental design and the study of children's spirituality (Kahn & Kellert, 2002). Since the Romantic Era, childhood experiences of nature have been an important literary theme (Chawla, 1994, 2002). In the 1970s, geographers and environmental designers pioneered methods to investigate children's experiences of local landscapes, including natural areas (Hart, 1979; Lynch, 1977; Moore, 1980). These methods continue to be applied and creatively extended, including observations, interviews, child-led tours and engaging young people in drawing, mapping, photographing and writing about places that are important to them (for a guidebook of methods, see Derr, Chawla, & Mintzer, 2018).

This interdisciplinary literature contains many insights that are relevant to young people's connection with nature, but the term 'nature connection' rarely appears. As Ives et al. (2017) noted, nature connection, as a distinct topic, is a relatively new research interest. The study of children's place experience—including interactions with nature—is much older. Nevertheless, ethnographic descriptions, interviews and children's own narratives bring to life what dimensions of nature connection like enjoyment, care, curiosity, awareness of interdependency or a sense of oneness mean in actual places—and they may suggest ways of connecting with nature that quantitative measures miss. This section turns to this qualitative literature for insight into young people's developing connection with nature and environmental and social contexts that shape it. Based on this author's many years of reading and contributing to this literature and the keyword search outlined in Figure 1, it features publications that represent different facets of this literature and suggest answers to questions raised by quantitative studies.

3.1 | Nature connection in the early years

Glimpses into the earliest years are few. Carson's (1956) essay *The Sense of Wonder* begins with her account of taking her 20-month-old

nephew to a Maine beach on a stormy autumn night, where the big waves thundered 'and threw great handfuls of froth at us', and 'together we laughed for pure joy' (pp. 8–9). She advised all guardians of young children to look for opportunities to share nature's wonder and excitement as an emotional foundation for a lifetime of curiosity and connection with nature. Pelo (2018) drew upon journal entries to describe a developing 'ecological identity' in a toddler whom she accompanied on outings into urban and suburban Seattle during the child's second year, from her first to second birthday. The little girl often spent 20 min or more raptly observing details like a bee in a sunflower or patterns and colours in leaves, and repetitively practicing new discoveries like splashing rocks in a river. She often mimicked the animal movements she observed, and she soaked in names for natural objects. Humphreys and Blenkinsop (2018) shared episodes in a little boy's interactions with a wild river in British Columbia, between the ages of 1½ to about 2½, as his mother allowed him to encounter the river and its creatures on his own terms. In her guide to young children's development in nature, Wilson (2018) considers experiences like these—when adults respect a child's interests and feelings in nature—formative ways to foster an ecological identity.

Several studies explore nature connection in 3- to 5-year-olds. The study of 5-year-olds in a nature kindergarten in British Columbia by Elliot et al. (2014) illustrates the value of complementing quantitative measures with qualitative descriptions. At the same time as this study collected pre- and post-measures of nature relatedness and environmentally responsible behaviour over the course of a school year (Table 1), Elliot made ethnographic observations of student excursions to their 'classrooms' in an old growth forest and along a beach. Her descriptions showed the children's fascination with sensory details of plants, animals and other elements of the forest and beach, their empathy for living things and their deep engagement as they faced physical and emotional challenges that they could only overcome through earnest individual efforts or cooperation with classmates, such as climbing over a fallen log. Her observations showed the social context that teachers created, as they practiced safety measures with the children to establish a 'community of safety', promoted collaborative thinking and helpfulness and encouraged the children's close observation and empathy for living things. In another nature preschool, Kharod and Arreguín-Anderson (2018) documented a four-year-old girl's shift from biophobia to biophilia, given classmates who showed pleasure in puddles and curiosity about small creatures like spiders and caterpillars, supportive teachers and freedom to try out similar behaviours at her own pace.

Quantitative indicators of nature connection include many elements of qualitative descriptions: enjoyment, curiosity, interest, attraction to natural areas, sensory immersion, quiet refuge, empathy and care for other living things, a sense of kinship and oneness (see Table 1); but other strands in qualitative descriptions are missing. Quantitative measures omit mastery of the physical challenges that the uneven terrain of natural lands presents, emotions associated with risk and achievement, and the social contexts of safety, cooperation and respect for each other and the natural world. In her book *Children's Environmental Identity Development*, Green (2018) drew on extensive observations to argue that children need to feel safety in nature as a foundation for developing a positive sense of identity and connection with nature. Given this security, she claimed, they can confidently venture out and explore natural areas, alone and with others, building a sense of environmental competence. At the same time, they gain direct knowledge of nature.

Green (2018) used the term 'natural world socialization' for the social context of this process, when adults and peers encourage a positive connection with nature by keeping a child safe, while allowing independent exploration and appropriate risk taking, appreciating the child's accomplishments and discoveries and promoting care for the environment. Using the language of ecological psychology, Chawla (2007, in press) also argued that a positive relationship with nature forms when children are able to develop environmental competence and knowledge through free movement and creative agency in nature, with support from friends, family and other mentors. She noted, however, that some children discover nature independently, as a place of refuge from difficult family conditions (Chawla, 2014).

A sense of oneness with the natural world is missing from quantitative measures for young children, as it is considered an abstract term beyond their levels of self-awareness and self-expression. In later life, people sometimes access this feeling in memories that extend back to early childhood (Chawla, 1990; Hoffman, 1992; Robinson, 1983). The naturalist Scott Sampson (2015, p. 2), for example, opened his book *How to Raise a Wild Child* with one of his earliest memories, dating to the age of 4 or 5. His mother took him for a walk in the forest near their Vancouver home on a spring day when sunshine broke a long period of drizzling rains. Coming to a pond, he found it swarming with newly hatched tadpoles. He waded in, until water and tadpoles flooded his boots and he was standing at the pond's center with water above his waist. He recalled: 'The sense of wonder and the smile across my face grew in tandem as I picked up handful after handful of squirming tadpoles. Immersed in that miniature sea of pollywogs, I felt, perhaps for the first time in my life, a deep and ecstatic sense of oneness in nature.' His mother exemplified positive roles of adults who connect children with nature: providing access, such as the walk in the woods; sharing appreciation for nature; and allowing freedom to engage with nature autonomously.

3.2 | Connecting with nature in middle childhood and adolescence

Traditionally, young children were kept under caretakers' watchful eyes, only venturing beyond the house and yard in the company of adults or older siblings; but with increasing competence, children began to move independently through their neighbourhood, travelling to school alone or with friends and exploring farther afield for play or errands. This expanding range is evident in reviews of 20th century research on children's local territories, based on observations, mapping and interviews with children (Chawla, 1992; Hart, 1979; Moore & Young, 1978). The middle years of childhood from 6 through 11 were a period of expansive neighbourhood use and a time when local landscapes such as parks, woods, overgrown

lots and ditches and other natural features were favorite places. It was a period associated with children's seeking out wild and semi-wild places for quiet reverie alone or with close friends, physical challenge, constructing fort cultures and acting out adventure stories across the landscape (Goodenough, 2003; Hart, 1979; Moore, 1986; Sobel, 2002). As the opening of this paper observed, the study of children's connection with nature has been impelled partly by concern that these opportunities for adventure in nature have eroded.

In the teen years, young people seek recreation destinations to meet up with friends, such as downtown attractions, sports fields and places indoors and out that escape adults' view (Chawla, 1992). In a review of adolescents' environmental preferences drawn from urban, suburban and rural samples in the United States, Australia, Europe and Latin America, Kaplan and Kaplan (2002) suggested that the teen years may be a 'time out' from nature: not because teens do not appreciate nature, but because they are more strongly drawn to developed commercial and recreational attractions. Eames, Barker, and Scarff (2018) interviewed 13- to 15-year-olds in New Zealand who were leaders in Enviroschool projects when they were 9 and 10. Most of these young teens still held progressive environmental and social values, but they had new social identities to maintain. As one girl said, 'As I've gotten older, other things have become important as well, like boys and clothes.' Another noted that, 'Most teenagers nowadays all sit inside and they'll text and they'll go on the computer and stuff, and they won't be able to think about what's outside' (p. 200). These remarks are consistent with quantitative studies that show a drop in nature connection in adolescence.

For some adolescents, natural areas form valued places for adventure, refuge and resilience. Through focus groups (Schwab et al., 2020; Ward Thompson, Travlou, & Roe, 2006) and photo surveys of important places in their lives (Owens & McKinnon, 2009), teens in California and Scotland communicated that they valued local nature for three reasons. They sought out places for active recreation, risk, discovery and challenge in nature. They enjoyed good times with family and friends in parks and other green gathering places. And they found retreats in nature where they could escape day-to-day stresses, relax, 'unplug', and be alone or with close friends. Through photovoice, 'talking circles' and interviews, Indigenous youth in Canadian cities revealed that they found calm, hope and metaphors of resilience in urban nature (Hatala, Njeze, Morton, Pearl, & Bird-Naytowhow, 2020). When teens in Taiwan were interviewed about 'their most connected moments in nature', their most memorable teen experiences often involved deep sensory immersion in wild environments far from urban areas, where they experienced the thrill of achievement during challenging activities like hiking and stream-tracking, awe and excitement at nature's beauty and calm and relaxation (Tseng & Wang, 2020).

3.3 | Connecting to nature through work and play in different cultures

These accounts of important places in nature involve young people in urban and suburban landscapes or wild sites for recreation. For some rural children, nature is a place of work as well as recreation and restoration. This does not mean that work and pleasure necessarily exclude each other. In their ethnography of rural Rajasthani children in north India, Gold and Gujar (2007) observed that children resourcefully combined herding and collecting firewood with play, and they were proud of their environmental knowledge and competence. Inuit youth in Labrador found soothing connection with the land when they were hunting, fishing and cutting wood (MacDonald, Willox, Ford, Shiwak, & Wood, 2015). In their descriptions of children on farms and ranches in the American West, Nabhan and Trimble (1994) found that some knew the land intimately through a combination of work and free exploration and valued it deeply as home. Models of environmental values in children as well as adults often put utilization of nature at odds with its protection (e.g. Manoli, Johnson, & Dunlap, 2007); but farming, herding, hunting and foraging families who want to maintain productive lands need to balance utilization with conservation and teach both values to their children.

When Bang, Medin, and Atran (2007) interviewed children and adults from the Menominee First Nation in Wisconsin as well as European-American families about their outdoor practices, Menominee families described hunter-gatherer traditions that put nature in the foreground: forest walks, berry picking, fishing, hunting, trapping, collecting wild rice, harvesting medicinal plants. European-American families talked about sports like baseball, soccer, dirt biking, snowmobiling and boating, that moved through green spaces as a background. Menominee parents were much more likely to use terms like Mother Earth and say that they wanted their children to understand they are part of nature. During walking and harvesting the land, Menominee families taught their children to observe closely and notice interdependencies among species (Bang, Marin, Medin, & Washinawatok, 2015).

Indigenous families commonly view the land as an extended community where humans are only one of many members. In video-recorded walks with Native American families in the upper Midwest of the United States, Marin and Bang (2018) recorded how parents cultivate this relational way of perceiving nature during outdoor activities with their children. In European cultures, in contrast, young children's tendency to attribute life, agency, intentionality and personhood to plants, animals and natural elements like wind and water may be discounted as childish anthropomorphism, and it fades with age (Gebhard, Nevers, & Billmann-Mahecha, 2003).

3.4 | Mixed methods studies

Mixed methods have the advantage that qualitative perspectives can show what nature connection looks like and feels like, features of the natural world that afford different activities and emotions and the role of friends, family and other companions; whereas quantitative methods can determine experiences associated with high and low levels of connection (see e.g., Elliot et al., 2014; Giusti, 2019; Sheldrake et al., 2019). When Giusti, Svane, Raymond, and Beery (2014) interviewed 26 practitioners who connect children with nature about

experiences that exemplify connection, they heard many responses that have already been covered in this review, including attraction to nature, enjoyment of active play, quiet refuge, learning through all the senses, curiosity, interest, empathy, kinship and oneness. In addition, people included telling stories about nature experiences, feeling empowered to take action for nature and feeling comfortable outdoors in elements like dirt, rain and sun. The researchers then surveyed 275 outdoor educators and advocates for connecting children with nature and presented them with this larger list. Almost all survey respondents considered this extended list comprehensive. In light of studies with rural and indigenous families, it is notable that the list omits children's participation in family tasks in nature.

Mixed method results support the importance of time in nature and families who appreciate nature together. When Larson et al. (2011) interviewed 66 children after they completed the Children's Environmental Perceptions Scale, they found that those who scored higher on eco-affinity and eco-awareness also talked about enjoying direct interactions with nature. Windhorst and Williams (2015) used a survey of 308 Canadian undergraduates to establish that nature connectedness in early adulthood was related to having many positive nature experiences in childhood, and then interviewed 12 students with high and low measures of connection. Students with high levels of connection, more than other students, described growing up near, and in, expansive natural areas, with families that prioritized nature experiences.

4 | WHY DOES CONNECTING WITH NATURE MATTER FOR CHILDREN AND NATURE CONSERVATION?

4.1 | Positive outcomes for child and youth development

A large and steadily growing body of research shows that access to nature benefits young people in multiple areas of their lives. Reviews of this literature show that when children have nature around their homes, schools and neighbourhoods, it promotes their physical and mental health and cognitive performance (Chawla, 2015; in press; Kuo, Barnes, & Jordan, 2019; McCormick, 2017; Norwood et al., 2019; Tillman, Tobin, Avison, & Gilliland, 2018; Vanaken & Kanckaerts, 2018). A number of studies indicate that a sense of connection with nature has similar benefits. These results are consistent with the claim of Nussbaum (2011), a philosopher who extended the idea of *eudaimonia* originated by Aristotle, which states that people flourish when they find opportunities to express all of their positive capabilities. Nussbaum proposed that affiliation with nature—being able to live with concern for, and in relation to, animals, plants and the world of nature—has an essential value in itself, as well as supporting healthy development in other dimensions of life.

The studies reported here and in the following section on 'Nature Connection and Conservation' used multivariate analyses to consider relations among variables and build explanatory models. Because children usually fill out questionnaires at school, several studies controlled for school or classroom effects, given their potential impact on children's well-being and conservation practices (Harvey et al., 2020; Hughes et al., 2018; Piccininni, Michaelson, Janssen, & Pickett, 2018; Roczen, Kaiser, Bogner, & Wilson, 2014). Where age, gender or time in nature influenced levels of nature connection in these studies, these results have already been reported in the section on 'Variables Associated with Nature Connection'. This section focuses on relations between nature connection, health and well-being.

After Sobko et al. (2018) designed their Connectedness to Nature Index for Parents of Preschool Children, they asked parents to fill out this index along with the Strengths and Difficulties Questionnaire, a widely used measure of young children's social and emotional health. They found significant positive correlations between prosocial behaviour and all four factors of the Connectedness to Nature Index—enjoyment of nature, empathy for nature, responsibility toward nature and awareness of nature. Conversely, these factors were negatively correlated with hyperactivity/inattention, peer problems and emotional problems. Enjoyment of nature and awareness of nature were negatively related to conduct problems.

Larson et al. (2017) explored relationships between nature connection and positive youth development in middle school students in South Carolina. The 11-to 14-year-olds were racially and ethnically diverse, and more than three-quarters attended schools that served economically disadvantaged communities. Higher measures of nature connection were positively associated with five areas of positive youth development: higher self-reported measures of competence, connection with other people, confidence, caring behaviours and character in the sense of taking responsibility and living by positive principles and values. Greater connection with nature also predicted that youth were more likely to believe in a hopeful future.

Among 9- to 12-year-olds in Mexico (Berrera-Hernández, Sotelo-Castillo, Echeverría-Castro, & Tapia-Fonllem, 2020), 10-to 11-year-olds in England (Richardson et al., 2015) and 11- to 12-year-olds in Australia (Whitten et al., 2018), children who expressed more connection to nature also reported a greater sense of well-being. The English children reported better overall health as well. Seven- to 11-year-olds in England who visited nature reserves for activities that ranged from a day to more than 6 weeks simultaneously reported increased nature connection, health and well-being (Sheldrake et al., 2019). When 8- to 11-year-olds in England engaged in year-long activities to improve and monitor biodiversity on their school grounds, those who moved from low to significantly higher scores for nature connection also reported significant gains in well-being (Harvey et al., 2020).

In Singapore, Leong, Fischer, and McClure (2014) found that 13- to 17-year-olds who expressed greater connection with nature had significantly higher scores for self-perceived general health, mental well-being, and positive affect. They also showed significantly more holistic and creative thinking, even after controlling for their sense of well-being. The researchers suggested that nature connection involves openness to experience and awareness of ecosystem

interdependencies, and proposed that these frames of mind encourage innovative thinking. In Canada, adolescents who expressed greater connection with nature also reported fewer psychological complaints such as depression, irritability, feeling nervous and difficulty getting to sleep (Piccininni et al., 2018).

These studies are consistent with research with adults that has found higher levels of nature connection associated with greater subjective well-being, positive emotions and relief from stress (Capaldi, Dopko, & Zelenski, 2014; Cervinka, Röderer, & Hefler, 2011; Dean et al., 2018; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). They are also consistent with a meta-analysis by Pritchard, Richardson, Sheffield, and McEwan (2020) and a large survey by Martin et al. (2020) that showed that nature connection is associated with eudaimonic well-being in terms of personal growth, autonomy, vitality and living meaningfully. Future research needs to identify the lines of influence here. Does nature connection support positive development? Are children who function better more likely to connect with nature? Do nature connection and positive development reinforce each other? What are the pathways of influence? Bakir-Demir, Berument, and Sahin-Acar (2019) demonstrated that children who have more greenery around their homes *and* who express connectedness with nature exhibit better emotional and cognitive self-regulation, which supports positive development. Chawla (in press) gathers evidence that engaging with nature promotes children's agency, stress regulation and cooperative social relations. These are promising suggestions, but more research is needed to explain how connecting with nature benefits young people.

4.2 | Nature connection and conservation

Children and adolescents with higher measures of nature connection show greater environmental knowledge (Cheng & Monroe, 2012; Otto & Pensini, 2017), and greater willingness to commit to conserving nature (Giusti, 2019; Müller et al., 2009; Zhang, Goodale, & Chen, 2014). They report more pro-nature behaviours like putting out food for birds and joining a nature club (Hughes et al., 2018; Richardson et al., 2015), more routine conservation behaviours like energy saving and recycling and more environmental citizenship behaviours like environmental volunteering and talking with others about the importance of environmental protection (Berrera-Hernández et al., 2020; Collado et al., 2013; Hughes et al., 2018; Krettenauer, 2017; Krettenauer et al., 2019; Otto & Pensini, 2017; Roczen et al., 2014). These results are consistent with studies with adults, which show that adults with higher levels of nature connection are more likely to engage in pro-environmental behaviours (see meta-analyses by Mackay & Schmitt, 2019 and Whitburn, Linklater, & Abrahamse, 2019, review by Tam, 2013, and recent papers by Martin et al., 2020 and Richardson et al., 2019). Mackay and Schmitt (2019) noted significant associations between nature connection and conservation behaviours in both correlational studies and experiments that demonstrated that increasing connectedness with nature makes people more likely to protect the environment.

The preceding section of this paper on 'Access to Nature and Time in Nature' associated more childhood time in nature with greater connection with nature in both childhood and adulthood. This section shows that greater connection, in turn, positively relates to more environmentally caring and conserving behaviours. These results resonate with research on 'significant life experiences' associated with pro-environmental values and behaviours (for reviews, see Chawla & Derr, 2012; D'Amore & Chawla, 2020; Wells & Lekies, 2012). Through surveys, written narratives and interviews, this research investigates the life paths of people who take action for the environment. The most frequent finding is that people with a record of pro-environmental behaviour also report regularly engaging with nature in childhood and adolescence (Chawla & Derr, 2012; D'Amore & Chawla, 2020; Wells & Lekies, 2012). This link is supported by a longitudinal study of young people in rural upstate New York, which found that participants who spent more time playing outdoors at age 6 reported more pro-environmental behaviours at age 18 (Evans, Otto, & Kaiser, 2018). Whether we look through the lens of quantitative assessments of nature connection, significant life experiences or longitudinal research, we find that childhood time in nature is positively associated with active care for nature.

These results raise the question: What do children do when they are out in nature that increases both connection and care? This paper's review of qualitative studies suggests experiences that encourage connection: multisensory immersion in nature play and exploration; caretakers who provide a sense of security and promote interest, attention, empathy and respect for living things and the land; a sense of competence outdoors; a sense of oneness; opportunities to enjoy nature with family and friends; and refuge from stress. Similar experiences surface in research into significant life experiences that contribute to actively caring for nature; but other formative experiences are issue- and action-oriented: learning about environmental issues, witnessing the loss of a wild place and learning skills and strategies to protect nature (Chawla & Derr, 2012; D'Amore & Chawla, 2020). In the sections that follow, these experiences associated with connecting with nature and developing care for nature will come together in a search for ways to help young people feel kinship with nature at the same time as they navigate feeling part of a world at risk.

Before moving forward, Figure 2 provides a synthesis of material covered up to this point. Drawing on both quantitative and qualitative research, it summarizes experiences that increase or diminish nature connection, and shows that childhood experiences can influence adulthood. It itemizes benefits of connecting with nature for young people's development, as well as benefits for conservation, as young people with greater connection demonstrate greater environmental knowledge and commitment to protect the natural world.

5 | CONNECTING TO NATURE IN AN AGE OF GLOBAL ENVIRONMENTAL CHANGE

Up to this point, this review has associated nature connection with positive experiences like free play and exploration and positive

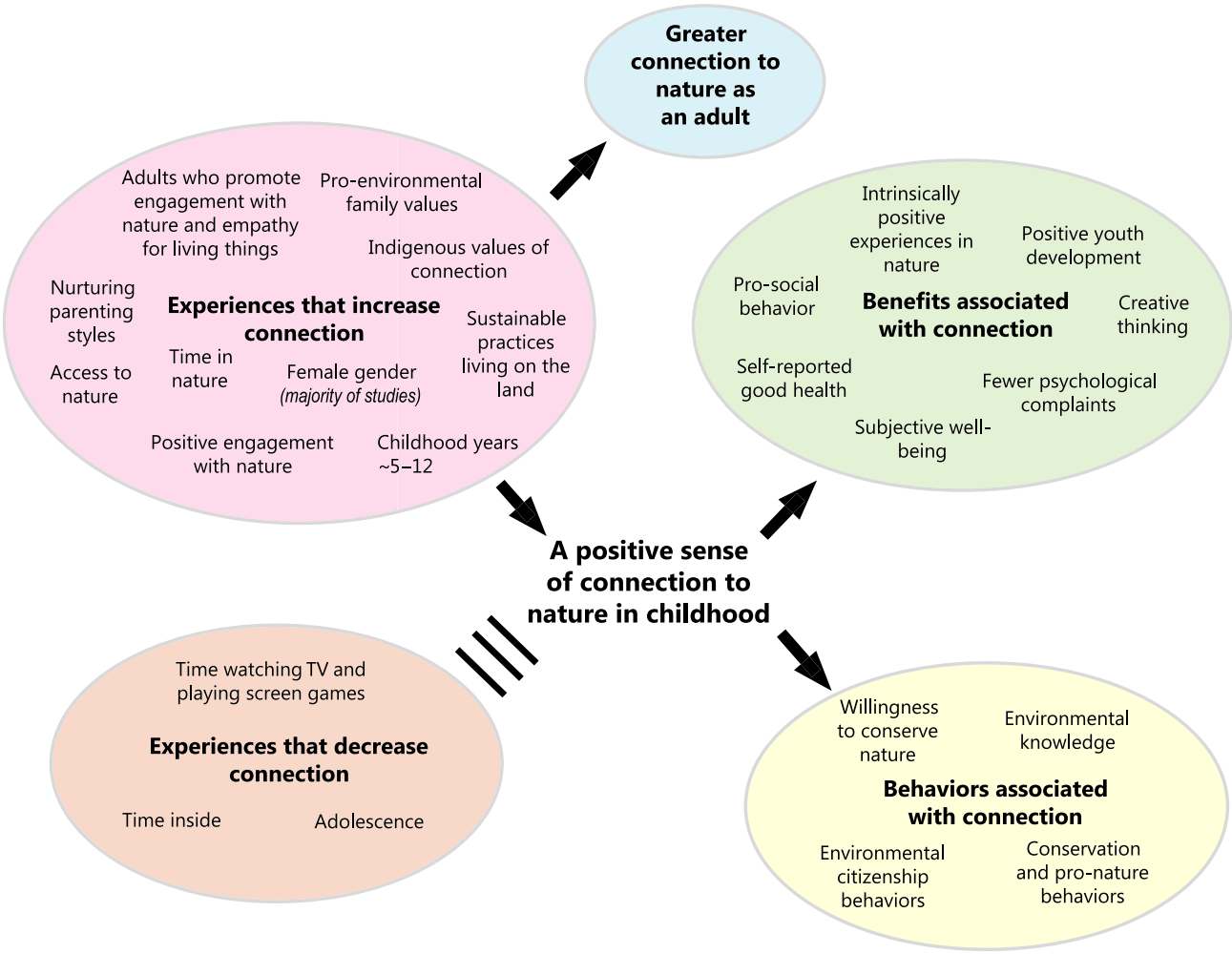

FIGURE 2 Contributions to nature connection in childhood and associated benefits and behaviours

emotions like enjoyment, interest, comfort, calm and kinship with all living things. Yet as processes of global environmental change accelerate, there is a dark side to feeling kin to creatures that are disappearing. To loving wild places that are lost. To feeling connected to a world whose life systems are unravelling. This difficult side surfaced in the interviews with Taiwanese adolescents about moments when they felt deeply connected to nature (Tseng & Wang, 2019). Although most of their accounts were positive, some teens voiced anger and sadness when they witnessed natural areas damaged or destroyed by humans. In Brazil, teens who expressed greater connection with nature also showed greater awareness of local climate change consequences (Barros & Pinheiro, 2020).

5.1 | Coping with environmental fears

Since the 1990s, surveys and interviews that ask young people about their hopes and fears for the future reveal high levels of alarm about environmental changes (Barraza, 1999; Hicks & Holden, 2007; Hutchinson, 1997; Ojala, 2016; Strife, 2012). Some young people deny that climate change is happening or de-emphasize the seriousness of environmental problems; but many voice concern (Lawson et al., 2019; Ojala, 2012a). More often than worry about consequences for themselves, children express concern about impacts on animals (Jonsson, Sarri, & Alerby, 2012; Ojala, 2016; Wilson & Snell, 2010). Although this research primarily involves young people in elementary school through high school, even children as young as 5 worry about 'the Earth getting too hot' (Davis, 2010). In research with adults, painful feelings like these have been termed 'ecological grief' (Cunsolo & Ellis, 2018), and when distress is due to degradation of one's own home landscape, 'solastagia' (Galway, Beery, Jones-Casey, & Tasala, 2019).

Research on environmental fears has not been assimilated into research on nature connection in either adults or children. Yet worry and fear are arguably expressions of connection. Children who voice these emotions acknowledge their interdependence with the natural world, recognize the shared vulnerability of people and nature, and feel empathy for other living things: all experiences included in assessments of nature connection (Table 1). This paper argues that a comprehensive view of connectedness with nature needs to encompass this full range of emotions. Environmental educators recommend that activities with young children should emphasize learning to love nature and

feel comfort, interest and enjoyment in nature, leaving disturbing information about environmental problems for later years (Sobel, 1996; Wilson, 2018). Yet in media-soaked societies, as environments rapidly change, it is impossible to control everything that children see and hear. Therefore it is important to understand how young people cope with disturbing environmental information, and how to help them integrate positive and negative experiences.

Worry, sadness, frustration and anger about the environment are difficult emotions to carry. Working with middle school and high school students in Sweden, Ojala (2016) investigated how young people cope with feelings about climate change, biodiversity loss and other complex environmental issues—problems that cannot be solved by individual action alone. She explored how different forms of coping affect young people's willingness to acknowledge threatening information and take action to protect the environment, how their responses affect their emotional well-being and how other people can help them cope in ways that are healthy for themselves and proactive for the environment. She builds on the work of Lazarus and Folkman (1984) and Folkman (2008) in health psychology, who identified three ways of coping with difficult emotions: emotion-focused, which seeks to escape painful feelings; problem-focused, which addresses problems that cause these feelings; and meaning-focused, which finds positive value in confronting problems.

Ojala (2012a) found emotion-focused coping common among young people who say they are highly worried about climate change. Most often, they tried to manage this emotion through distraction—deliberately thinking about something else, doing something else or avoiding disturbing information. An alternative was to seek support from others like family members or friends; but Ojala (2012a, 2016) found that this was uncommon, perhaps because young people in Sweden consider it 'uncool' to reveal their worries. A small group focused on feelings of hopelessness and helplessness, which she saw as a form of avoidance, because in this case they could conclude that action was pointless. Some young people deny that climate change and its consequences exist or believe that it will only affect future generations or distant places (Lawson et al., 2019; Ojala, 2012a, 2012b). All of these strategies are negatively associated with environmental action (Ojala, 2012b, 2012c, 2013).

Young people who report problem-focused strategies express a sense of environmental efficacy and take action for the environment, but many also express low subjective well-being (Ojala, 2012b, 2013). Studies in Sweden (Ojala, 2016) and the United States (Stevenson & Peterson, 2016) found that young people almost always report individualized actions in the private sphere, such as household energy conservation, rather than collective engagement. Ojala (2016) noted that an association between individual environmental action and low subjective well-being among young people who worry about environmental change is consistent with general research on coping in childhood and adolescence, which shows that when a problem is more than a young person can solve alone, individual strategies can lead to feelings of futility and reduce well-being (Clarke, 2006).

A third form of coping is meaning-focused, and it is especially important when a problem cannot be solved quickly but requires active engagement over a long period of time (Folkman, 2008). It involves positive reappraisal, or reframing a problem to find positive meaning in the struggle to address it. For example, Ojala (2012a, 2013) found that some young people reasoned that climate change is a great problem, but societies know more about it now and people with influence are taking it seriously, like scientists, politicians and environmental activists. When young people use a high degree of meaning-focused coping, they are more likely to express positive feelings and life satisfaction (Ojala, 2012b, 2012c, 2013). Ojala (2016, p. 14) calls this ability to face environmental risks and uncertainty, believe one's own actions and the actions of others can make a difference and find positive meaning in action, 'constructive hope'.

These three forms of coping can be observed in a different culture, in Inuit youth aged 15–25 who are already witnessing environmental changes that are disrupting their communities' traditional way of life (MacDonald et al., 2015). In interviews, they said that staying busy took their mind off these troubles (emotion-focused coping); but unlike young Swedes, they often found solace in getting out on the land, connecting with their culture and community and seeking support from family and friends. They learned to adapt when and how they did land-based activities (problem-focused coping), and they prided themselves that adaptability to change is part of Inuit culture (meaning-focused coping).

5.2 | Cultivating hope

The study of environmental coping strategies has inspired other researchers to explore the role of hope in young people. Li and Monroe (2017) created a measure of climate change hope for adolescents, based on the psychology of hope developed by Snyder (2000), who defines a positive sense of hope as a force for action. According to Snyder, hope requires a vision of a possible future, along with awareness of pathways to reach the goal and belief in agency to achieve it. Monroe and Oxarart (2015) integrated this theory into a curriculum for high school students in the United States who studied how regional forests respond to climate change. The curriculum included activities for students to learn 'things I can do' and 'things we can do', as well as activities that demonstrated that 'others care' and 'others are doing things'—in this case scientists and landowners sharing practices to sequester carbon and promote forest resilience. Students also studied ecosystem connections that support forest resilience, and learned how decisions that people make today have the potential for positive impacts tomorrow. With this curriculum that featured possibilities, pathways and agency, as students' knowledge increased, their hope increased (Li & Monroe, 2019; Li, Monroe, & Ritchie, 2018).

Li and Monroe (2019) found that when young people feel concern about environmental problems and believe that they and others can address problems effectively, they are more likely to

feel hope. Both hope and concern motivate action, whereas despair and feelings of helplessness are negatively related to action (Ojala, 2012b, 2013; Stevenson, Peterson, & Bondell, 2019; Stevenson & Peterson, 2016). In reflecting on her own work and the work of others, Ojala (2017) observed that young people's responses to global environmental problems are socially embedded and social trust is vital. Young people notice how others react to these problems, and how others respond to their emotions. Ojala (2017) noted that even though the young people in her samples were much more likely to report individual rather than collective actions to address problems, they felt encouraged when they believed that others could do similar small things and together they could make a difference. In this sense, social trust gave meaning to individual actions.

Collective projects often include direct experiences of social support. Trott (2019) followed 10- to 12-year-olds in a 15-week program to study climate change and plan and implement actions at a family and community level. In focus groups, they repeatedly expressed the value of this social dimension. As a girl noted, after her team gave a speech about local impacts of climate change to their city council and got permission to move ahead with a tree planting campaign, they felt that 'you can actually do something instead of ignore the stuff around us' (p. 53).

Reflections by researchers, environmental activists and educators produce converging lists of practices to help young people cope with difficult environmental emotions and conceive hope (Brown, 2016; Chawla, 2020; Hicks, 2014; Monroe, Plate, Oxarart, Bowers, & Chaves, 2017; Ojala, 2017; Sobel, 2008; Trott, 2020; Winograd, 2016). A first step is discussions that allow young people to share their feelings without judgement. Adolescents are more likely to express constructive hope regarding climate change when they expect their teachers to respect their emotions and offer support, rather than being dismissive and making fun of their feelings (Ojala, 2015). They are more likely to show both problem-focused and meaning-focused coping when parents and friends respond in solution-oriented and supportive ways, rather than being dismissive or voices of doom-and-gloom (Ojala & Bengtsson, 2018). In Labrador too, Inuit youth valued family, friends and community members who listened sympathetically to their concerns and ideas and supported them in finding new ways to get out on the land as the environment changed (MacDonald et al., 2015). Other key steps are making information personally relevant by relating it to local issues, connecting young people with scientists and activists who can share their work and stories, supporting them in projects to care for nature in their schools and communities and engaging them through experiential, inquiry-based and arts-based methods (see review by Chawla, 2020). For a summary of recommended practices, see Table 2.

6 | INTEGRATING RESEARCH ON NATURE CONNECTION AND COPING WITH ENVIRONMENTAL CHANGE

This paper argues that distress as the natural world degrades is a dimension of connection. Working with adults in Australia, Dean et al. (2018) also suggested that future research needs to explore this complexity. They found that when relatedness with nature was measured through enjoyment and comfort in nature, it was associated with good health; but when it was measured through self-identification with nature and interest in conserving nature, it was associated with

TABLE 2 Strategies to help young people cope with environmental change

Strategy	Application of the strategy in practice
• Combine the science of environmental change with information about how to make a difference	Young people need to understand physical and social causes of environmental changes in order to identify effective solutions. It is equally important for them to know what they can do to address problems, what others are doing, and how decisions made today have the potential for positive impacts tomorrow
• Create a receptive space where young people can share emotions	Let young people know that they can safely share their feelings about the environment. Take time to listen receptively. Be supportive and solutions oriented
• Encourage the positive reappraisal of problems	Help young people find meaning in addressing environmental challenges and see positive possibilities in the changes societies need to make to preserve the natural world
• Engage in visioning	With a focus on local areas, engage young people in visioning futures they would like to see unfold and identifying realistic steps to move in the desired direction
• Provide young people with opportunities to experience agency	Enable young people to investigate environmental problems that concern them, determine personally meaningful actions to address the problems, and implement practical ideas that they can accomplish individually or in partnership with others
• Foster social trust	Bring young people together with others who are working to protect and restore the natural world, enabling them to see that they are not alone but allied with others who are working on nature's behalf
• Show that voluntary simplicity can be a fulfilling way of life	Introduce young people to examples of individuals and groups who find happiness in community, creativity, service and nature, instead of the accumulation of more and more material things
• Connect young people with nature	Give young people time to become comfortable and competent in nature and feel kinship with other living things

Note: Adapted from Chawla (2020).

depression, anxiety and stress. They speculated that people were reacting to environmental degradation, including recent local floods. If some experiences that define connection with nature make people vulnerable to distress, then the idea of nature connection becomes more accurately developed, theoretically, by recognizing that it includes both positive and painful facets. With a focus on young people, this section suggests that there are also practical reasons to integrate research on nature connection and coping with environmental loss.

Studies of children's connection with nature and environmental coping have the shared aims of supporting young people's well-being and their agency to protect the natural world. As the opening of this paper noted, interest in children's connection with nature has been spurred by concern that children are losing opportunities for free-ranging encounters with nature, with negative consequences for their health as well as their motivation to protect the environment. Research into how children cope with difficult environmental information, on its side, reveals that some children respond with levels of worry that diminish their well-being; and when young people fall into despair and helplessness, it cripples their capacity to act. Bringing together research and practice related to both positive connection with nature and concern may create a stronger framework for fostering children's well-being and environmental agency.

The preceding section showed that researchers and practitioners in education and environmental protection have been exploring ways to support young people socially and emotionally as they face environmental change, by building their sense of agency, enabling them to see that they are not alone in taking action to address challenges and encouraging hope (Table 2). This section looks at evaluations of programs designed to increase children's connection with nature. A following section then asks the questions: How do strategies to promote nature connection compare with strategies to support constructive coping with environmental change? What can these two bodies of research contribute to each other? Together, what are their implications for research and practice?

6.1 | Increasing connectedness with nature

When Britto dos Santos and Gould (2018) and Barrable and Booth (2020b) reviewed evaluations of environmental education interventions to increase young people's connection with nature, they found encouraging evidence that this is a practical goal. Based on evaluation research published since 2008 in peer-reviewed journals and environmental organization reports, this section covers 16 papers included in these previous reviews along with 11 additional papers, which reinforce this conclusion. Most evaluations of program outcomes use quantitative pre- and post-assessments, but some gather qualitative reflection through interviews, focus groups, journaling and open-ended narratives. Programs that successfully increase feelings of connection with nature tend to share common features.

Four quantitative studies that looked at the effect of age found better program outcomes with younger participants. Comparing younger children in the age range from 7 to 10 versus 11 to 18, Braun and Dierkes (2017), Ernst and Theimer (2011) and Liefländer et al. (2013) found larger gains in nature connection in the younger groups. When Crawford et al. (2017) evaluated the effect of nature tours on 9-to 14-year-olds, younger children had higher nature connection scores both entering and leaving activities. In the study by Liefländer et al. (2013), only 9-to 10-year-olds maintained significant gains in a 4-week follow-up assessment, compared to 11-to 13-year-olds. This paper previously cited studies that found a greater sense of nature connection in school-age children compared to adolescents (Hughes et al., 2019; Larson et al., 2017; Richardson et al., 2019). These evaluations of program interventions suggest that younger children may also be more receptive to initiatives designed to cultivate connection.

Most programs that produce significant quantitative gains in nature connection last several days. In different studies, extended time meant 3–5days of immersion in residential field sites (Braun & Dierkes, 2017; Hinds & O'Malley, 2019; Liefländer et al., 2013; Mullenbach, Andrejewski, & Mowen, 2019; Stern, Powell, & Ardoin, 2008; Talebpour, Busk, Heimlich, & Ardoin, 2020), 4 days to 2 weeks enrolled in nature-based camps or wilderness expeditions (Barton, Bragg, Pretty, Roberts, & Wood, 2016; Collado et al., 2013; Ernst & Theimer, 2011; San Jose & Nelson, 2017), 4 weeks of nature play and learning in a preschool (Yilmaz, Çig, & Yilmaz-Bolat, 2020), repeated field trips to natural areas (Ernst & Theimer, 2011) and school curricula that last several weeks and include hands-on nature experiences (Cho & Lee, 2018; Harvey et al., 2020; Sheldrake et al., 2019). But even programs that involved only a day of classroom lessons about forests combined with activities in a forest (Kossack & Bogner, 2012), a few hours of forest exploration (Dopko, Capaldi, & Zelenski, 2019; Schneider & Schaal, 2018) or trips to natural areas or a natural history museum (Bruni, Ballew, Winter, & Omoto, 2018; Crawford et al., 2017; Sheldrake et al., 2019) resulted in immediate significant gains in nature connection scores.

After a 2-hr tour of local heathlands in Flanders, only students with low pre-scores expressed a greater sense of inclusion with nature (Boeve-de Pauw, Van Hoof, & Petegem, 2019). This result is consistent with assessments by Braun and Dierkes (2017), Bruni et al. (2018), Harvey et al. (2020) and Schneider and Schaal (2017), who found that students with low initial scores made the greatest gains in nature connection. Programs to teach about climate change (Sellmann & Bogner, 2013) or surfing skills (Hignett, White, Pahl, Jenkin, & Le Froy, 2018) failed to increase teens' sense of inclusion with nature.

Nine of these 24 quantitative and mixed methods studies include a follow-up assessment to determine whether young people retain their immediate gains in connectedness with nature after a program ends. Retention tests show that significant gains last 3–8 weeks; but when Stern et al. (2008) conducted a 3-month follow-up after residential programs in a national park, students' original gains in nature connection were lost. This result indicates the importance of long-term follow-up, and suggests that children may need repeated nature-based experiences to maintain connection.

Bruni, Winter, Schultz, Omoto, and Tabanico (2017) concluded that children are most likely to express connection with nature when

they are encouraged to focus on nature in their own way, at their own pace. They compared three activities that, together, involved 6-to 16-year- olds. One involved an online hike through a national forest. A second sent children on an adult-led mountain hike to find metal plaques of plant and animal species and collect rubbings. A third invited children to spend time in a place of their choice outdoors in nature or in a zoo or aquarium and express their experiences through any artistic medium. Only the free choice activity resulted in significant gains in nature connection, compared to activities that directed participants to focus on metal plaques or a digital screen.

Three studies used qualitative measures to understand experiences associated with nature connection, including observation, interviews and focus groups. In an evaluation of three US Fish and Wildlife programs, Theimer and Ernst (2012) found that students in a field-based middle school adjacent to prairie wetlands expressed relatedness with nature most consistently. In this program, they participated in daily natural history activities, outdoor pursuits like hiking and snowshoeing, long distance expeditions through the natural areas of the site, quiet contemplation and observation in nature and service learning like water sampling, duck banding and prairie restoration.

Barthel, Belton, Raymond, and Giusti (2018) conducted a longitudinal evaluation of a school program that involved 10-year-olds in Stockholm in protecting salamanders during their spring migration from a local woodland to a pond near school where they laid their eggs. Students studied salamanders, searched for salamanders who needed assistance to reach the pond and recorded numbers and species for a national monitoring program. Some described pivotal moments when they overcame fear and discomfort at touching salamanders, and most said that their understanding and empathy for these creatures increased, along with feeling more friendly to nature. Two years after participation, students still expressed these emotions, along with a sense of importance, pride and responsibility at participating in an adult conservation program.

Participants in three nature-based programs in Colorado evaluated by Colvin Williams and Chawla (2016) echoed these findings. They vividly recalled hands-on experiences outdoors, overcame fears of snakes and insects and developed growing respect for nature. They felt empowered as they learned responsible roles like bird banding, water quality monitoring and caring for wolves at a wolf refuge. They talked about the inspiring commitment to nature demonstrated by program staff, as well as pride and excitement at being part of a network of people who worked together across distances to study and protect the natural world.

Two mixed methods studies highlighted two factors that can affect program outcomes: group identity and weather. In another facet of the salamander program evaluation, Giusti (2019) compared results from the qualitative interviews with quantitative measures of nature connection, and found no significant change in scores before and after participation. In pretests, students in the program school expressed significantly greater empathy for salamanders than students at two control schools, even before beginning the program. The salamander program was a proud part of the school's identity, and just belonging to this school appeared to increase students' identification with salamanders. When Talebpour et al. (2020) evaluated three residential field trips in a wilderness area of California using both pre/post nature connection surveys and student journals, they found that journal entries about the weather helped explain score results. Nature connection scores fell for classes that visited the area during cold torrential rain, rose moderately during a period of mixed rain, sun and wind and rose highest during warm sunny weather.

Successful practices described in the quantitative and qualitative evaluations are summarized in Table 3. As a whole, these studies indicate that it is possible to design experiences that increase a sense of connection with nature. The importance of time in nature, hands-on experiences, natural history and service learning emerge in most studies. Qualitative evaluations also reveal feelings of pride and solidarity from working with others to protect natural habitats and wildlife: a social dimension that is missing from the quantitative measures.

TABLE 3 Program practices associated with gains in young people's connection with nature

- Provide time for direct engagement with nature and immersion in natural areas
- Focus on experiences that define nature connection:
  - Affiliation, a sense of belonging, a sense of oneness
  - Enjoyment
  - Comfort and confidence in nature
  - Curiosity, interest, exploration
  - Challenge and achievement
  - Understanding human interdependence with nature
  - Empathy and concern for other living things
  - Caring for wildlife and natural habitats
- Give young people time to encounter nature at their own pace, following their own interests
- Let them know that there are many ways to be a 'nature person', including play and recreation in nature, working the land sustainably, gardening, studying natural history, caring for animals, making art in nature
- Make young people partners in collective efforts to study and protect the natural world
- Ground experiences in the local culture and ecology
- Share examples of people's enthusiasm and care for nature
- Make sure young people see others who look like them engaged with nature
- Enable young people to record their observations and experiences through writing, scientific record keeping and the arts
- Start young, but provide access to nature for all ages
- Aim for extended engagement, but even short-term experiences in nature can lead to gains in nature connection
- Allow young people to overcome fears in nature or fears of particular species through gradual interactions at their level of comfort

Notes: Based on Barthel et al. (2018), Barton et al. (2016), Braun and Dierkes (2017), Bruni et al. (2017, 2018), Cho and Lee (2018), Collado et al. (2013), Colvin Williams, and Chawla (2015), Dopko et al. (2019), Ernst and Theimer (2011), Kossack and Bogner (2012), Liefländer et al. (2013), Sheldrake et al. (2019), Stern et al. (2008), Theimer and Ernst (2012) and Yilmaz et al. (2020).

6.2 | Building connection and hope

When Table 2 on helping young people cope with environmental change and build hope is compared with Table 3 on increasing young people's connection with nature, where do effective practices overlap? Are there practices only listed for one purpose that might be useful for the other? This section compares these tables to suggest how programs for young people might simultaneously support connection with nature, action for nature, hope and well-being. In the process, it identifies questions for further research.

Several practices appear in both tables: providing young people with time outdoors in natural areas, enabling them to feel comfortable and competent in nature, the study of ecology and natural science, activities that enable young people to see that they can make a positive difference for the environment and examples of other people who are making a difference. Up to this point, these practices have been recommended for one purpose or the other: to increase connection with nature, or to support healthy coping with environmental change and hope. The fact that they form a common core, recommended for both purposes, invites research to determine whether these practices can simultaneously help young people connect with nature and develop constructive responses to environmental threats. For success, are all of these program elements needed, in combination or cumulatively over time? Or are some most formative? (See Figure 3 for a summary of experiences associated with both connecting with nature and coping with environmental change, as well as experiences primarily aligned with one outcome or the other).

Table 2 on healthy coping includes a number of recommendations that are missing from Table 3 on promoting connection. It notes that the study of ecology and natural history needs to be combined with learning how to protect the natural world. It highlights the importance of social trust, of believing that one is not alone in taking action for nature because individual actions are amplified by the contributions of other people. It also emphasizes providing time for young people to share their emotions about environmental change and helping them find positive meaning in facing challenges. It points to the importance of developing concrete, achievable visions of a desirable future and finding value in voluntary simplicity. Some young people in programs to increase connection with nature may struggle with fears about environmental changes, and as change accelerates, their numbers are likely to grow. Without taking time to listen, people who implement these programs will never know if young people carry these burdens. As Brown (2016) notes, silence about environmental issues communicates implicit messages. It can convey fatalism about a problem, or indifference. By including these practices, programs to connect young people with nature may support constructive coping.

Providing young people with time in nature appears in both tables, but only Table 3 identifies specific experiences associated with feelings of connection: comfort, confidence, enjoyment, exploration, challenge, achievement, freedom to follow interests at one's own pace, overcoming fears outdoors and empathy and care for other living things. When programs want to build young people's bond with nature, they need to provide conditions for these experiences.

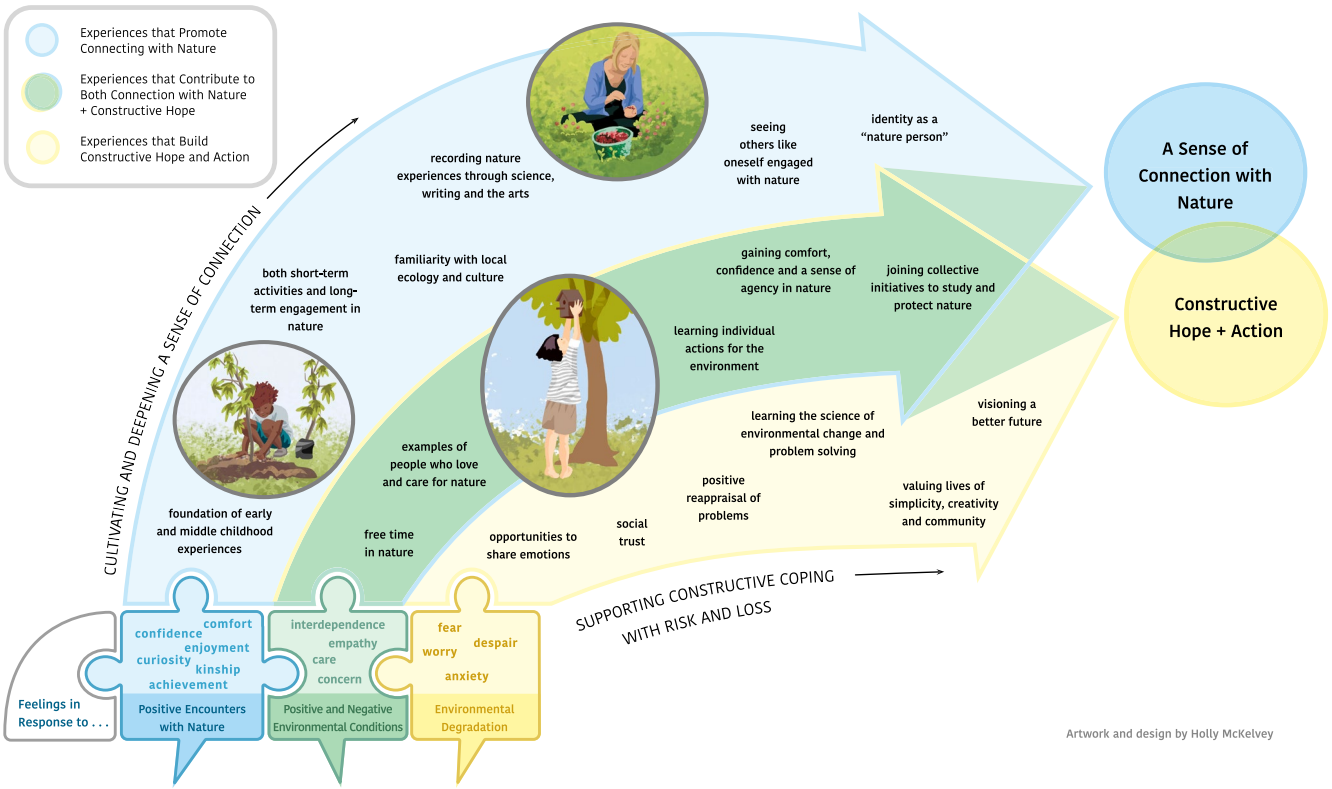

FIGURE 3 Practices that help young people connect with nature and cope constructively with environmental change

Table 3 also includes collective activities to study nature, care for wildlife and restore and protect natural habitats, and the importance of seeing role models who look like oneself.

Research on environmental coping and behaviour shows that most young people report individual actions to address environmental problems, such as conserving energy and resources (Ojala, 2012a; Stevenson & Peterson, 2016). More research is needed to understand what happens when young people have opportunities to engage in collective action. As one of the 10-to 12-year-olds who developed climate action projects for their community said, 'I don't know, there's something about it …. Getting together, creating projects, knowing each other, working together', (Trott, 2019, p. 53). What opportunities enable young people to feel empowered rather than discouraged by the challenges they face? How does virtual organizing compare with coming together in person? Does working in alliance with nature's own powers of growth and resilience during gardening, tree planting and ecological restoration add distinctive dimensions of meaning? Table 3 also notes the importance of programs for very young children. Environmental educators emphasize positive experiences in nature for young children (Sobel, 1996; Wilson, 2018); but when young children notice upsetting environmental changes, are they better prepared to express hope if they participate with others in protecting and regenerating the natural world?

This paper's title can be revisited as a question. Can connecting with nature in childhood form a foundation for constructive hope, in the sense that it prepares children for lives of action to care for the natural world even in the face of environmental threats? As this paper has noted, adults and children who express higher levels of connection with nature are more likely to report taking action for the environment. But research has not yet tested whether this relationship between connection and action holds even when young people feel acutely threatened by environmental losses. When young people fear climate change and biodiversity loss, research shows, what matters is social trust—feeling others' support and knowing that other people are also acting to protect the natural world—and the capacity to find meaning in addressing challenges. Can connection with nature, commitment to action, and hope develop together? What experiences are necessary for this to happen? This section has proposed practices that may achieve this purpose; but there may be other approaches, waiting to be discovered through careful listening to young people and those who work beside them to engage with the challenges and possibilities of a changing planet. These are open questions that invite both qualitative and quantitative research.

7 | CONCLUDING OBSERVATIONS ON RESEARCH AND PRACTICE

7.1 | Developing theory-based explanatory models

In addition to the questions above, this review has raised other questions. When children are out in nature, what are the formative experiences that contribute to their sense of connection with the natural world? What are formative experiences in families? Why do levels of connection decrease in adolescence? Why does gender often make a difference? What are the developmental pathways that link child health and well-being to connecting with nature? What experiences simultaneously build connection and care for nature? By looking at qualitative as well as quantitative research, along with programs and practices that are intended to build connection and help young people cope constructively with a world at risk, this paper has suggested where some answers may be found. Future research needs to link children's relations with the natural world to theory grounded in basic processes of child development, and weave back and forth between qualitative and quantitative methods.

There are promising steps in this direction. For example, after creating the Connection to Nature Index, Cheng and Monroe (2012) conducted two path analyses to explain initial survey results: one showing factors that predict children's interest in participating in nature-based activities, which have been associated with health and well-being; and one showing factors that predict children's interest in environmentally friendly practices. Roczen et al. (2014) also built a model to explain young people's pro-environmental behaviour, which is similar in key respects. In both models, connection to nature makes a strong contribution to pro-environmental practices, along with knowledge about the environment. In addition, Cheng and Monroe's model includes access to nature, experiences in nature, a sense of self-efficacy and family values toward nature. All of these factors are evident in descriptions of basic developmental processes when children engage with nature (Chawla, in press).

In seeking to explain why electronic screen use is associated with declining connection to nature in adolescence, Michaelson et al. (2020) provide an example of how to move systematically between qualitative and quantitative approaches. They began with background literature and qualitative methods to form their hypothesis, conducted a survey with a nationally representative sample to test their ideas and then returned to the qualitative material to interpret survey findings. Similar coordinated work that connects research on children's relations with nature with developmental theory, using quantitative, qualitative and experimental methods, will advance the search for causal explanations.

The research covered in this paper suggests that connecting with nature and acting to protect nature can be mutually reinforcing. Children and adults with higher measures of nature connection report more pro-environmental behaviours of many kinds … while programs that successfully increase connection with nature often involve nature conservation activities. Future research needs to look more closely at pathways between connection and action, as well as relations between knowledge about nature and empathy for other living things. This effort will be helped by a limited definition of nature connection that keeps this construct distinct from knowledge, empathy and pro-environmental practices. As Table 1 shows, all childhood measures of nature connection do this for knowledge of facts about nature, which is not included in any assessment tool's definition of connection. All but two measures (Richardson et al., 2019; Sobko et al., 2018) do this for environmental behaviours. All but three measures (Cheng & Monroe, 2012;

Giusti, Svane, et al., 2014; Sobko et al., 2018) exclude empathy for nature from connection. Ethnographic accounts show that when children are outdoors in nature, they are simultaneously connecting with nature and learning about the natural world; and when people around them encourage empathy and care for plants, animals and their habitats, children exhibit these emotions and behaviours (Elliot et al., 2014; Green, 2018; Humphreys & Blenkinsop, 2018; Pelo, 2018). In the unity of children's lived experience in nature, connection, knowledge, empathy and responsible action may co-develop. Nevertheless, by defining and measuring these constructs separately, it becomes possible to explore relationships between them.

7.2 | Contexts of connection

As this paper has noted, what the 'nature' in nature connection means depends on where children live. In the studies reviewed here, it has meant everything from a city bird or pet, to fragments of nature in dense urban districts, to wilder areas in forest schools, nature centres and large parks. In all of the studies covered, it means nature in or near inhabited areas. Kahn and Weiss (2017) recommend experiences of 'big nature' in the sense of untamed landscapes that people can trek through for weeks, but studies of nature connection have been located in neighbourhoods, schools and nature programs, where most children are found. How deep wilderness experiences affect young people's connection with nature deserves a review of its own, which will need to find accounts of children who have this rare experience. Kahn and Weiss note, however, that 'big nature' can be relative, and for a child in a city, it can mean a squirrel or a jump in a fountain.

What the quantitative and qualitative research covered here makes clear is the importance of direct experience as a foundation for connection, wherever children find nature. This conclusion suggests that every practice to increase children's access to nature is important, from naturalizing private yards and multifamily housing sites, to mosaics of parks and gardens, to greening the grounds of schools and child care centers, to making nature centers, camping and field trips to natural areas available for all children. Finding ways to bring nature to children, even in densely populated and low resourced parts of the world, appears essential to foster connection. Doing this can simultaneously create networks of green spaces for biodiversity and offer many opportunities for children to become involved in nature protection and restoration.

As it moves forward, research on nature connection needs to extend beyond populations in Western cultures. A few studies covered here originate in Asia, Latin America and indigenous communities, but only a few. Most population growth is happening in Asia, Africa and Latin America, and these continents are where most of the world's children live (United Nations, 2018). They also contain hotspots for biodiversity protection (Myers, Mittermeier, Mittermeier, da Fonseca, & Kent, 2000). Research on young people's connection with nature, action for nature and constructive hope needs to include diverse countries and cultures. The protection of the natural world requires committed work by people of all cultures, in agricultural and remote regions as well as cities and suburbs. Therefore it is critical to understand cultures of connection in all contexts, beginning with their development in childhood.

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CONFLICT OF INTEREST

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This article is not based on new data.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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