Practitioner Guide to Assessing Connection to Nature

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(See Appendix C for more details.)

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Julie Whitburn

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Translation:

The tools in this Guide were developed and validated in English. If you plan to use these tools in another language, we recommend that you contact the tool author to find out if a translated version exists. If not, we recommend you translate and back-translate the tool, and check with the author that the back-translated version is still accurate.

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Introduction

Photo: Gabby Salazar

Our goal in creating this guide is to provide practitioners, organizations, researchers, and others with a "one-stop shop" for measuring nature connections. The guide is for those interested in assessing and enhancing the connections their audiences have to nature; we use the term "audience" to refer broadly to your participants or to any group you are trying to assess. The guide can help you choose an appropriate tool (for example, a survey or activity) for your needs, whether you work with young children, teenagers, or adults (see the Decision Tree on p. 14). The guide also includes 11 tools and approaches that you can use to assess connection to nature. Since the way we think about nature and the types of relationships we develop with nature can be culturally determined, we also summarize where the tool has been used and report its validity with different audiences. For more information about how this guide was developed, see p. 58.

What is connection to nature and why is it important?

We define connection to nature as the way people identify with predominantly natural landscapes and the relationships they form with the elements in those environments.[1] This guide focuses on assessing the relationship people have with nature, which tends to have an emotional component. Connection to nature often encompasses affective attitudes about nature in general, but usually does not include attitudes about specific issues such as climate change or components of the landscape, nor does it include knowledge or beliefs about the environment.

People understand, appreciate, and engage with nature in many ways and for many reasons. Some rely on the natural world for sustenance, others for their livelihood. For many people around the world, cultural traditions and history are deeply rooted in nature. Biologist E. O. Wilson and others propose that a connection to nature is, in part, an expression of a deeply ingrained element of human evolution.[2] Even in urban environments, people reinforce this relationship with nature by planting flower boxes, resting in the shade of trees, and tossing food scraps to pigeons. Research reveals that connecting to nature supports human health and well-being, inspires creativity, and fosters environmental stewardship values that can lead to a commitment to keep nature and natural systems healthy.[3,4]

[1] Restall, B., & Conrad, E. (2015). A literature review of connectedness to nature and its potential for environmental management. *Journal of Environmental Management,* 159, 264-278.
[2] Wilson, E. O. (1984). *Biophilia.* Harvard University Press.
[3] Kellert, S. (2012). *Building for life: Designing and understanding the human-nature connection.* Washington DC: Island Press.
[4] Chawla, L., & Derr, V. (2012). The development of conservation behaviors in childhood and youth. In S. Clayton (Ed.), *The Oxford handbook of environmental and conservation psychology* (pp. 527-555). New York: Oxford University Press.

Engaging with nature can greatly benefit children's well-being, and can help them develop critical and creative thinking skills.[5] Immersing both children and adults in nature for play, recreation, or contemplation can reduce stress, improve brain development, promote healing, facilitate the development of social and emotional skills, improve attention, and promote greater civic engagement.[6,7,8]

Today, many communities and organizations are trying to increase opportunities for people to engage with nature. Some organizations create educational programming, while others advocate for new urban green spaces. Certainly, no single way exists to connect most effectively with the natural world. From outdoor free-play and active exercise to school field trips and community gardening, our opportunities to connect with nature are many and varied.

Notwithstanding the breadth and variety of opportunities and intentions, those who wish to assess connection to nature need reliable tools and strategies to measure this complex concept. Therefore, we've developed this guide for practitioners, organizations, and researchers interested in exploring or measuring connection to nature with their respective audiences and in their particular settings.


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Why would you want to assess connection to nature?

In our hectic, digital, and urbanized world, many people feel we are losing our connections to nature.[9] To counter this trend, municipalities, schools, camps, nature centers, agencies, and other organizations around the world are working to bridge the disconnect between people and nature. Whether their goal is to increase visitation to public lands, build city parks, encourage environmental behaviors, improve health and well-being, sell outdoor recreational gear, or build environmental literacy in schools, many groups are interested in understanding and assessing their audiences' relationships with and feelings toward nature. Some groups might be interested in knowing if and how their programs enhance connections to nature, while others might want to understand how specific populations feel about nature. For example, an environmental educator might want to document differences in a child's relationship with nature before and after participating in a summer camp, while a fishing association might want to provide those members who already have a strong connection to nature with a new opportunity to enjoy the outdoors. By measuring your audience's connection to nature, you can design appropriate strategies, improve existing programs, understand what is working and why, or even uncover more knowledge about the valuable and impactful ways that nature affects us.


Photo: Chen Mizrach, unsplash.com

How can you assess connection to nature?

Researchers and evaluators have developed numerous tools to measure connections to nature, including surveys, observational strategies, and interview guides. Not all measure the same things and not all come from the same philosophical perspective. Some of the tools and approaches included in this guide are designed to measure longstanding, deeply rooted cultural or individual values. Such values are unlikely to change after a specific event, experience, or short program, but they can be documented at one point in time and thus have important implications for understanding your audience and developing new strategies for connecting them with nature. Other tools in this guide can measure characteristics that a specific experience or program could impact in the short term. This guide is designed to help you know which tools are appropriate under which conditions, and to help you identify strategies to measure the specific elements that interest you. It also explains how some tools can be adapted for a particular purpose or context (for example, adapting vocabulary to make it age appropriate, or changing the ecosystem reference) as well as how to analyze the data you collect.

[5] Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature,* 30(4), 433-452.
[6] Hartig, T., Mitchell, R., de Vries, S., & Frumkin, H. (2014). Nature and health. Annual Review of Public Health, 35, 207-228.
[7] Kuo, M. (2015). How might contact with nature promote human health? Promising mechanisms and a possible central pathway. *Frontiers in Psychology,* 6, Article 1093.
[8] Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology,* 10, Article 305.
[9] United Nations Department of Economics and Social Affairs. (May 2018). Accessed February 2018. Available at: https://www.un.org/development/desa/en/key-issues/statistics.html.

How to use this guide

Pages 9 and 10 introduce factors to consider before embarking on a new assessment of connection to nature. On pages 11–13, you will find two glossaries of important terms that describe assessment strategies and data collection and analysis. The **Decision Tree** on page 14 will help you identify which tools or approaches might be best for your audience. Following the Decision Tree, you will find descriptions of the 11 tools we recommend along with copies of the tools themselves (pages 16–53). Once you've found a tool that works for you, ***Conducting your assessment*** on page 54 and the ***Evaluation resources*** on page 56 can help you use it effectively. Finally, if you want to learn more about how this guide was created, or about related research and evaluation, go to pages 57 and 58.

Photo: Tomáš Malík, pexels.com

Factors that may affect your choice of connection to nature tools

We have created the Decision Tree to help you select a tool or approach to assessing connection to nature that is right for your audience. It may be useful to review these guiding questions before using the Decision Tree. The questions are divided into two sections, those relevant to both audience assessments (a one-time measurement of a population) and program evaluation, and those relevant only to program evaluation.

For audience assessments and program evaluations

- **What is the age of your audience?** All of the tools in this guide were developed for, and tested with, specific age groups. Many of these tools require reading skills, and some require respondents to think about their emotions and attitudes—so age and/or developmental ability, as well as attention span, are important considerations. Each tool in this guide indicates the ages for which it is best suited.
- **Should you use one of the tools in this guide instead of making up your own?** Developing valid and reliable tools is a time-consuming process. The tools in this guide have been created, tested, reviewed, considered, and reconsidered, and are thus likely to measure what they say they are measuring. Your findings will be easier to claim and to justify if you use a published tool such as those included here.
- **How many respondents do you need for a connection to nature assessment?** You do not need to survey everyone who participates in your program to understand whether it influences your participants' connection to nature. Similarly, if you are interested in assessing connection to nature among the population of a city, you do not need everyone to respond. Statisticians have developed sampling methods that can help you understand how many people you need to survey (and how to select those individuals) so you can make more valid conclusions about the population.[10] Approaches that collect qualitative data, such as drawings or journal entries, rarely involve large sample sizes. You'll want to think purposefully and strategically about selecting a sample. For example, sampling a class of gifted students and an after-school Boys Club group could provide information from a range of participants and their experiences. Do they all experience an increase in their connection to nature? For internal program evaluations, you may have the capacity to assess only a few classrooms or field-trip groups. That's okay! You can still gain important insights from these assessments. But, for a study you intend to publish, we recommend contacting a professional evaluator or a researcher to help you with your sampling design.

For program evaluations only

When using these tools for program evaluation, the purpose is usually to report a change in participants' connection to nature as result of their experience. You will need to use the tool twice, before and after the program. Whether you can detect a change will depend on several things, including the purpose, design, and intensity of your program, and the characteristics of your audience. The following questions will help you think through whether your program is likely to influence a person's connection to nature or whether you should instead measure other outcomes, such as environmental literacy or changes in participants' knowledge.

- **Is the purpose of your program or experience a good fit for assessing connection to nature**? Understanding what a program or experience is intended to do can help you determine whether or not you should measure connection to nature. For example, if your program is focused on teaching soil science, it might be more appropriate to measure environmental knowledge than connection to nature (see Appendix B for a list of tools that measure outcomes other than connection to nature). Similarly, service-learning programs can build skills and self-efficacy, but will not necessarily influence a person's connection to nature. When thinking about whether to assess connection to nature, consider whether your program is designed to encourage people to reflect on and strengthen their relationship with nature and to express their feelings about nature.

[10] Fowler, F. J. (1993). *Survey research methods* (2nd edition). Sage Publications.

- **Does the intensity of your program matter when choosing a tool to assess connection to nature?** In this guide, we define ***intensity*** as a combination of engagement and time (where time can be either duration or frequency). Intensity is a useful way of thinking about the potential impact of a program or activity on a participant's connection to nature. In general, participation in a higher intensity program is more likely to result in a measurable change in a person's connection to nature than participation in a lower intensity program. For example, a short walk in a park would be a lower intensity activity than a guided hike that actively engages the audience in noticing sights, smells, and sounds in nature and then reflecting on the experience. A weekly after-school program with a curriculum and leader might be a medium intensity activity. A three-week residential outdoor learning experience, on the other hand, might be considered high intensity. Longer, more immersive experiences are more likely to build deeper connections to nature, if they are designed to accomplish this objective.

  If you are selecting a tool to conduct an assessment of a program or activity, the degree to which an individual is impacted by your program will likely affect your choice. When determining the intensity of the program or experience you're evaluating, take time to consider these questions: How engaging is the experience for your audience (for example, visiting the ocean for the first time versus going for a routine run in a local park)? How rich is the experience (for instance, camping overnight under the stars or visiting a local park for an afternoon)? How much time do people spend participating in your program or activity (a one-hour field trip versus an ongoing after-school program)? Does the program or experience offer participants a chance to build a connection over time (such as returning to the same place to watch a bird nest)?[11] After thinking through these questions, you can use the Decision Tree on p. 14 to find the right assessment tool.

- **Can you expect to see a change**? Different audiences will have different baseline levels of connection to nature. You may be more likely to see a change if your audience starts out with a low connection to nature. For example, you may be more likely to detect a significant change if you take youth from an urban environment on their first visit to a wilderness area as opposed to taking a scout group on their seventh camping trip. For people who already feel a strong bond with nature, a program might need to be high intensity or very engaging in order to yield a measurable increase in nature connection. However, over time, repeated experiences might also deepen connection to nature, or strengthen a feeling of stewardship for a particular place. Personality traits and values, including an individual's feelings of connection to nature, are less likely to change quickly.[12,13] But even short programs or experiences can have a high impact on an individual; for example, walking by a zoo exhibit at the moment a lion roars might have a stunning influence. In general, information-based factors, like environmental literacy, are more likely to change over the course of a short program or experience (see Appendix B on page 60 for a list of tools that can be used for this type of assessment).

- **How do you know if you're changing people's connection to nature in a way that lasts?** If you're interested in understanding whether your program or activity is deepening or affecting the relationship people have with nature, you will need to measure their connection both before they have the experience (pretest), and soon after the experience is completed (posttest), and compare the two scores. You can use the same posttest tool to collect data from your participants several months, or even years, after the experience to determine whether they believe any change in connection to nature due to the program has persisted. (Keep in mind that you'll need to collect participants' contact information so you can mail or email the posttest to them at a later date. Alternatively, you can ask the same questions by phone or videoconference.)

  If you're using a reliable data collection tool such as the ones included in this guide, you can be fairly certain that data you collect immediately following the program are reflecting changes directly tied to participants' experience. But long-term outcomes can be less directly attributed to your program or activity, as a myriad of experiences in the intervening months or years can impact how a participant responds to your questions. However, collecting data from your participants over time can still help you understand any patterns or trends in their connection to nature. These data can also help you demonstrate the impact of your program or make improvements to it. Interviews with participants can also help you understand how well participants remember the experience, and whether they feel it impacted their connection to nature over time.

[11] Wheaton, M., Kannan, A., Selby, S. & Ardoin, N. M. (2018). The concept of dosage in environmental and wilderness education (Environmental Literacy Brief, Volume 4). Stanford, CA: Social Ecology Lab, Stanford University.

[12] Liefländer, A. K., Fröhlich, G., Bogner, F. X., & Schultz, P. W. (2013). Promoting connectedness with nature through environmental education. *Environmental Education Research*, 19(3), 370-384.

[13] Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, 17(5), 577-598.

Glossary of terms related to assessment

Items are grouped together to become a **tool** or **survey** instrument that measures one or more **constructs** that help us understand (in this case) connection to nature.

It will be easier to describe these assessment strategies if we first clarify the vocabulary we are using. Here are some commonly used terms and concepts about connection to nature and measurement tools.

- **Item:** An item is a type of question or statement you can use as part of a survey or interview to understand your respondents' reactions or feelings. Each item measures a particular idea. In many of the tools in this guide, possible responses are presented on a five- or seven-point continuum. These scaled items may ask respondents to use numbers ranging from 1 to 5 to rate their responses to questions such as how much they enjoyed their experience. In this example, a rating of 1 would indicate they did not enjoy the experience and a rating of 5 would indicate they loved every minute. Scaled items may be rising (e.g., 1 to 5) or balanced (e.g., -2 to +2). A "yes" or "no" question is essentially a simple two-point scaled item.

- **Tool:** A tool, sometimes referred to as an instrument, is anything you use to collect information about your audience's connection to nature. For example, you might have respondents fill out a questionnaire before and/or after a program or experience. If you're conducting interviews with audience members, you might use an interview guide to direct your discussion; or if you're observing your audience, you might use an observation checklist to make sure you're looking for everything you hoped to capture. You could even use games, photos, journaling, or other strategies—and these are all tools, or instruments, for gathering information.

- **Survey:** A survey, sometimes called a questionnaire, is a tool that respondents complete either on paper, on a computer, or orally. It could include any of the scales in this guide, as well as other questions you'd like ask.

- **Scale:** A scale (also called a summative scale) uses a series of scaled items to measure an underlying concept, such as a person's feelings about nature. If people respond consistently to a series of items about the same concept, you have a better idea of how they really feel about that concept. For example, you could ask them to react to the following three statements by selecting a number from 1 to 5, with 1 indicating that they strongly disagree with the statement and 5 indicating that they strongly agree: "Being outdoors makes me happy," "I feel joyful when spending time in nature," and "When I'm sad, I try to spend time in nature to feel better." You could then average their responses to create a summative scale score. The average score is a better reflection of how they feel about nature than their response to any individual item. Many of the tools in this guide are summative scales, which have been carefully tested by researchers to ensure that all of the statements in each scale are measuring the same underlying concept.

- **Reverse-scoring:** Some scales include both positively worded statements and negatively worded statements. For example, a connection to nature scale might include a negatively worded item such as "I do not like spending time in nature." In this case, a higher number on the scale would actually indicate a lower connection to nature. For many years, researchers recommended including a mix of positively worded and negatively worded statements in order to make sure respondents were paying attention to the questions. Today, there is more debate about whether to include reverse-scored items in scales because they can be confusing to respondents.[14] Nevertheless, we have included some scales with reverse-scored items in this guide. Details on how to handle these items are in the "Analyzing Your Data" section of each tool summary.

- **Constructs:** Psychological factors, such as a person's connection to nature, cannot be measured as simply as physical phenomena, such as height. They are multidimensional variables and, in this guide, we refer to them as constructs. One way these constructs can be measured is with a set of items (questions or statements). Some constructs are relatively simple (such as those designed to measure political orientation) and can be measured using only one or two questions, while other constructs are more complex (such as those designed to measure empathy or environmental identity) and may require many items to fully assess an individual's reaction.

[14]Swain, S.D., Weathers, D., & Niedrich, R. W. (2008), Assessing three sources of misresponse to reversed Likert items, *Journal of Marketing Research*, 45(1), 116-131.

Tools in this guide measure different constructs related to *connection to nature*, including *emotional affinity toward nature*, which refers to a person's feeling toward nature, and *inclusion of nature in self,* which refers to how someone perceives the distinction between self and nature.[15] Another concept is *connectedness with nature,* which refers to the extent to which people feel they are a part of the natural world.[16] All of these concepts are related, but they measure different aspects of our relationships with nature, along with our personalities.

A note about gender:
These tools were developed with gender measured using two options. If your population is likely to recognize categories other than boy and girl or male and female, it would be appropriate to add them to your tool.

[15] Tam, K. P. (2013). Concepts and measures related to connection to nature: Similarities and differences. *Journal of Environmental Psychology*, 34, 64-78.
[16] Ibid.

Photo: Shutterstock.com

Glossary of terms related to data collection and analysis

- **Quantitative versus qualitative data:** Quantitative data refers to numerical data (such as age) or data that can be put into distinct categories (such as "agree" or "disagree"). Quantitative data are typically collected through closed-ended questions that require individuals to select from provided answers (e.g., a multiple-choice question or scale) or observations. Qualitative data refers to thematic or descriptive data that are captured through interviews, drawings, observations, photographs, or journal entries. Qualitative data are typically collected by asking participants to provide their thoughts or feelings in response to open-ended prompts.

- **Coding:** Coding is one method of synthesizing responses to better understand qualitative data and to convey this data to others. Coding is used to categorize and organize text, images, quotes, or other information in order to identify common themes, reveal trends and patterns, and find relationships between them. For an example of how this method can be implemented with one of the tools in this guide, see "Summarizing and Analyzing Responses" in the description of Journaling (p. 41).

- **Intensity:** In this guide, we define program intensity as a combination of engagement and time, with time referring to either duration or frequency (i.e., repeated experiences). Intensity is a useful way of thinking about the potential impact of a program or activity on a participant's connection to nature (see p. 10 for more details).

- **Reliability:** A tool is considered reliable if it measures the same thing and produces the same result each time it is used. A yardstick, for example, should be sturdy enough to reliably measure distance. You wouldn't want it to be made out of elastic, or you could get a different answer every time. Tools that measure factors such as attitudes, knowledge, and behavior can be challenging to develop and administer, but they still need to be just as reliable as tools that measure easier to obtain quantitative data such as age or height. One way to test the reliability of qualitative tools is to give them to two groups of people who should score similarly (such as groups of third grade teachers from two schools in the same school district) and see if the responses are consistent within the group. Another test of reliability is to measure a tool's internal consistency. Internal consistency refers to the level of agreement between items on a scale and is often measured by the degree of correlation between respondents' answers across the different items. Internal consistency is often reported using Cronbach's alpha (α), expressed as a number between 0 and 1. Higher numbers indicate higher internal consistency and researchers generally agree that alpha should be at least 0.7 for a tool to be considered to reliably measure that construct.

- **Validity:** A tool is considered valid if it truly measures what it is intended to measure. For example, a weight scale might be reliable if it consistently reads the same weight no matter how many times an individual steps on it, but if the scale isn't properly calibrated, then the weight it's reporting will not be valid.

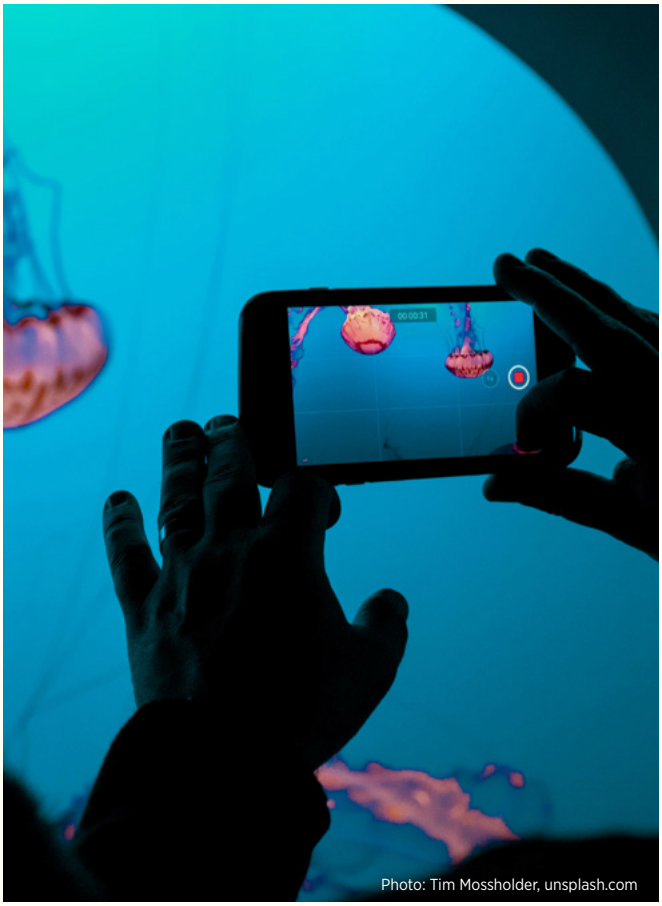
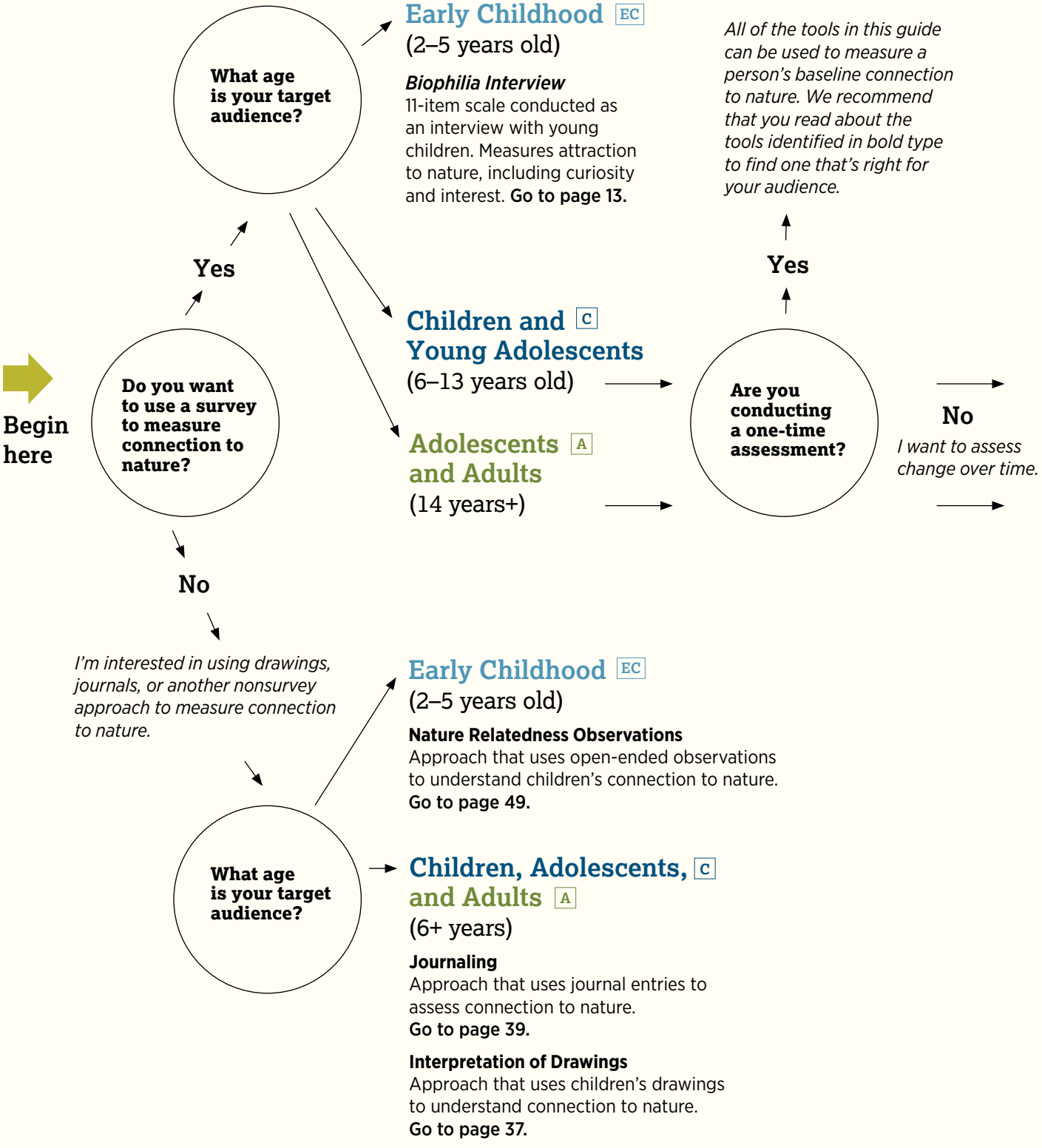


Photo: Tim Mossholder, unsplash.com

Decision Tree: Finding the right tool

Quick Tip:

You may want to use a survey if there are a lot of individuals in your program, if you need to report numerical data, or if you have limited time to administer or analyze responses. Other approaches, like journals and photos, can provide rich detail and insights, but will likely involve fewer respondents.



Low intensity
(Example: a one-day field trip or a short nature program)

Your program may be very useful and impactful, but a short exposure is unlikely to influence connection to nature in a way that can be measured with these tools. Try measuring knowledge or attitudes. **(See Appendix B.)**

Medium intensity
(Example: a weeklong day camp or an ongoing after-school program)

Children's Environmental Perceptions Scale (6–13 years)
16-item scale that measures appreciation for nature and concern about nature. **Go to page 20.**

Inclusion of Nature in Self Scale (7+ years)
1-item pictorial scale that measures how an individual thinks about their relationship with nature. **Go to page 34.**

High intensity
(Example: an immersive 10-day backpacking trip or a yearlong after-school program)

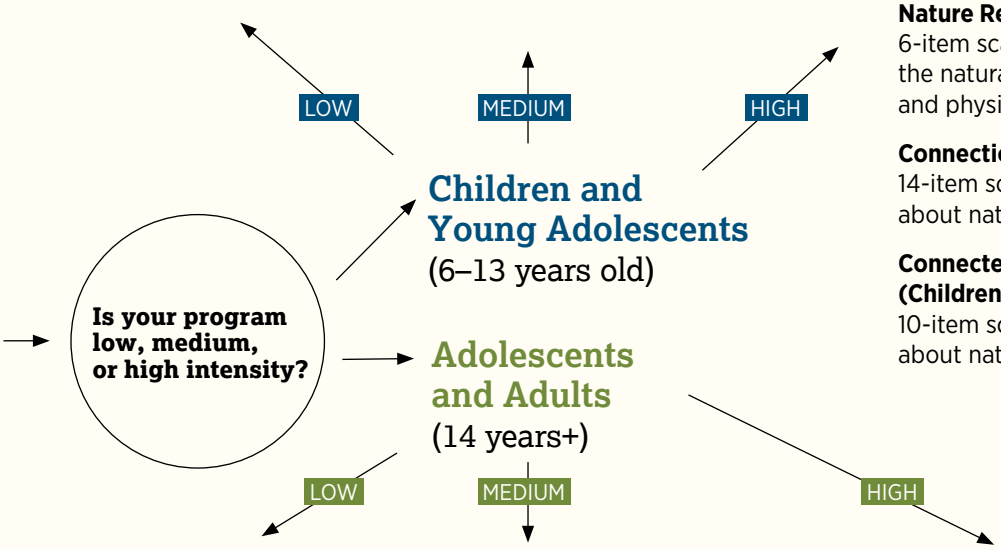
Children's Environmental Perceptions Scale (6–13 years)
16-item scale that measures appreciation for nature and concern about nature. **Go to page 20.**

Inclusion of Nature in Self Scale (7+ years)
1-item pictorial scale that measures how an individual thinks about their relationship with nature. **Go to page 34.**

Nature Relatedness Scale
6-item scale that measures how people relate to the natural world through their beliefs, attitudes, and physical connections. **Go to page 46.**

Connection to Nature Index (8–10 years)
14-item scale that measures a child's feelings about nature connection. **Go to page 27.**

Connectedness to Nature Scale (Children's Version) (10+ years)
10-item scale that measures a child's feelings about nature connection. **Go to page 23.**



Low intensity
(Example: a one-day field trip or a short workshop)

Your program may be very useful and impactful, but a short exposure is unlikely to influence connection to nature in a way that can be measured with these tools. Try measuring knowledge or attitudes.
(See Appendix B.)

Medium intensity
(Example: a weeklong nature retreat or an ongoing after-school program)

Inclusion of Nature in Self Scale
1-item pictorial scale that measures how an individual thinks about their relationship with nature. **Go to page 34.**

Love and Care for Nature Scale
10-item scale that measures emotional connection to nature. **Go to page 43.**

High intensity
(Example: an immersive 10-day backpacking trip or a yearlong training program)

Inclusion of Nature in Self Scale
1-item pictorial scale that measures how an individual thinks about their relationship with nature. **Go to page 34.**

Love and Care for Nature Scale
10-item scale that measures emotional connection to nature. **Go to page 43.**

Environmental Identity Scale
11-item scale that measures how an individual's connection to nature relates to their personal identity. **Go to page 30.**

Nature Relatedness Scale
21-item scale that measures how people relate to the natural world through their beliefs, attitudes, and physical connections (there is also a shorter, 6-item version). **Go to page 46.**

Connectedness to Nature Scale
14-item scale that measures feelings about nature connection. **Go to page 23.**

Tools to measure connection to nature

Dozens of different tools and approaches have been developed to assess connection to nature and related constructs. In the development of this guide, we reviewed the available tools and selected those that have appeared in the literature and have been tested for reliability and validity. We also selected tools that are straightforward and that produce data that can be analyzed with commonly available software. We paid close attention to tools that specifically assess connection to nature rather than related ideas, such as interest or concern. Each of the selected tools includes background information and a copy of the tool itself.

If you do not find a tool to fit your needs, you may want to explore Appendix A, which lists additional connection to nature assessment tools, or Appendix B, which lists tools that measure environmental attitudes and literacy rather than connection to nature.

Photo: Zach Lezniewicz, unsplash.com

Tool #1

Biophilia Interview

Developed by Camilla Rice and Julia Torquati

Photo: Jennifer Murray, Pexels.com

What This Tool Measures

This tool is based on E. O. Wilson's biophilia hypothesis, which suggests that humans posses an innate attraction to nature, interest in, and curiosity about nature (Wilson, 1984). Wilson's theory is widely cited as one of the most influential formulations of nature connection. Dimensions of nature connection captured by the biophilia interview are consistent with other tools that measure nature connection in children and adults: interest in spending time in nature and in being outdoors versus indoors (in study contexts where the outdoors includes elements of nature); interest in learning about wild animals and other living things; comfort in being in nature and in being close to nature; and sensory enjoyment in nature.

Tool Format

The tool is an 11-item interview with puppets, administered to children aged 3 to 5, one child at a time. The two smiley-faced puppets are identical and gender neutral, but the gender of the child in the questions changes to match the child being interviewed ("this boy" or "this girl"). Children are asked questions about which puppet they are most like, for example: "This boy (puppet) likes to watch birds and this boy (the other puppet) doesn't like to watch birds." Then they are asked, "Which one is more like you?" The child picks the puppet that resembles his or her interest. Non-biophilic responses receive a score of 0 and biophilic responses receive a score of 1, for a maximum score of 11.

How This Tool Has Been Used

Initial research was done with children who ranged from 34 to 69 months, with an average age of 56 months (Rice & Torquati, 2013). They attended early childhood programs along an urban-rural gradient in California and Nebraska. The 114 participants were Caucasian (54%), Hispanic (22%), Asian/Pacific Islander (8%), Multi-ethnic (8%), African American (7%), and Native American (1%). As of this writing, research using a revised version of the interview is being conducted with three- to five-year-old children in Nebraska.

Variations and Modifications

When Simge Yilmaz investigated biophilia in 105 five-year-olds in Turkish preschools, she asked children to choose between colorful drawings, created by an artist, instead of puppets (Yilmaz, 2017). For example, for the item, *This boy likes to splash in puddles/This boy doesn't like to splash in puddles*, a male respondent was asked to choose between a picture of a boy happily jumping in a puddle and a boy jumping in a puddle but looking unhappy. Female respondents were shown otherwise identical drawings depicting a girl.

Tips for Using This Tool

It is important to consider the appropriateness of this tool for your audience before using it. For example, children in urban areas may not be familiar with some of the activities in the items, such as digging for worms or splashing in puddles. The interview takes approximately ten minutes. Researchers who have used this tool report that children enjoy participating and sometimes ask to "play" again.

One flexible characteristic of this tool is the fact that children don't need to respond verbally; if they feel shy or hesitant to engage verbally, they can just point to the puppet of their choice. The researchers recommend using a warm-up question, such as, *This girl likes ice cream/This girl doesn't like ice cream.*

This tool was designed to obtain a snapshot of a child's attraction to nature. We do not recommend using it to evaluate changes after a short program because a biophilia score is unlikely to change quickly. It is also important to note that some of the statement pairs in the tool are not opposites. For example, *This boy likes to look at the stars and moon at night* is not the opposite of *This boy would rather play indoors at night* in the same way that the following statements are opposites: *This boy likes to watch birds/This boy doesn't like to watch birds.* However, each of the interview statements is thought to be an appropriate measure of connection to nature for this age group.

Analyzing Your Data

Recording the Data

1) We recommend entering your interview data into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 11 columns for the 11 statements and a row for each participant. Assign each child's interview responses a record number, and enter each individual's responses (0 for non-biophilic responses and 1 for biophilic responses) across the corresponding row.

Calculating Biophilia Scores

1) Add the numbers across each row to create an overall score for each respondent; the maximum score for each individual is 11. Scores of 0–5 indicate a low level of biophilia, a score of 6 indicates neither low nor high biophilia, and scores of 7–11 indicate a high level of biophilia.
2) You can also average the scores from all individuals for an overall group score; this number will also be between 0–11. You could then compare an individual's score to the group average. (At the 10 preschools where this tool was initially tested, average school scores ranged from 6.2–9.4, indicating that most children tended to be biophilic. This is consistent with Wilson's concept of biophilia as an innate human tendency that needs to be encouraged for its full expression.)

Additional Analytic Options

To further analyze your data, you could compare the averages for different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the biophilia scores of males and females.

Photo: Leah Villejo, unsplash.com

Reliability and Validity

Experts in child development/early childhood education, landscape architecture, and environmental education assessed this tool's validity. When the interview was piloted with a group of 15 children who were asked to elaborate on their responses, it demonstrated good validity in the sense that children could describe an experience as an example (e.g., choosing "This boy likes to dig for worms," and then stating "I dig for worms with my friend, Billy").

In a test of internal consistency, Cronbach's alpha was .63 for the initial version of the interview. The revised interview was retested with a separate sample of 57 preschool children, with a new Cronbach's alpha of .69. The authors of the tool noted that children who answered the interview twice gave the same responses. However, a formal test-retest for reliability has not been conducted.

In current research with a sample of 68 preschool-aged children (4 to 5 years) who participated in the biophilia interview along with an interview that assesses social and environmental moral reasoning, a moderate correlation between biophilia and empathy for nature was found ($r = .237$; $p = .051$).

References:

Rice, C. S., & Torquati, J. C. (2013). Assessing connections between young children's affinity for nature and their experiences in natural outdoor settings in preschool. *Children, Youth and Environments,* 23(2), 78-102.

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

Yilmaz, S. (2017). Investigation of five-year-old preschool children's biophilia and children's and their mothers' outdoor setting preferences. Ph.D. thesis submitted to Middle East Technical University, Ankara, Turkey.

Tool #1: **Children's Biophilia Interview**

> *Instructions: This tool should be administered to one child at a time. You can use two identical and gender neutral puppets and change the gender of the child in the questions to match the child being interviewed ("this boy" or "this girl"). For each question below, ask children which of the puppets they are most like. For example: "This boy (puppet) likes to watch birds and this boy (the other puppet) doesn't like to watch birds. Which one is more like you?" Record which puppet the child selects.*

Biophilic Item	**Non-Biophilic Item**
This boy* likes to play outside.	This boy likes to play inside.
This boy likes to dig for worms.	This boy doesn't like to dig for worms.
This boy likes to splash in puddles.	This boy doesn't like to splash in puddles.
This boy likes to watch birds.	This boy doesn't like to watch birds.
This boy likes to catch bugs and look at them.	This boy doesn't like to catch bugs and look at them.
This boy likes to watch animals like squirrels and rabbits.	This boy doesn't like to watch animals like squirrels and rabbits.
This boy likes to play in creeks and lakes.	This boy doesn't like to play in creeks and lakes.
This boy likes to play with sticks, leaves, and pine cones.	This boy doesn't like to play with sticks, leaves, and pine cones.
This boy likes to listen to birds singing.	This boy doesn't like to listen to birds singing.
This boy likes to look at the stars and moon at night.	This boy would rather play indoors at night.
This boy likes to learn about wild animals.	This boy isn't interested in wild animals.

***Note to evaluator:** Substitute "this girl" when the respondent is a girl.

Source: Rice, C. S., & Torquati, J. C. (2013). Assessing connections between young children's affinity for nature and their experiences in natural outdoor settings in preschool. *Children, Youth and Environments*, 23(2), 78-102.

This tool was developed and validated in English.

Tool #2

Children's Environmental Perceptions Scale

Developed by Lincoln Larson, Gary Green, and Steven Castleberry

What This Tool Measures

The Children's Environmental Perceptions Scale (CEPS) was designed to measure younger children's perceptions of nature (Larson, Green, & Castleberry, 2011). Specifically, the tool measures a child's personal interest in nature (eco-affinity) and a child's attitudes toward and concern about environmental issues (eco-awareness). The CEPS was tested and validated with African American, Hispanic, and non-Hispanic White children to ensure that it can measure perceptions of nature among diverse audiences.

Tool Format

The CEPS consists of 16 agree/disagree statements. Children respond on a five-point scale, where 1 = strongly disagree and 5 = strongly agree, but instead of numbers, each response option is marked by one or two "thumbs up" or "thumbs down" symbols. (This facilitates interpretation for younger children, but keep in mind that in some cultures, these hand signals can be offensive.) The intermediate option, "not sure," is shown as two open hands representing the number 3.

How This Tool Has Been Used

The tool was designed for use with children and was tested with a diverse group of 6- to 13-year-olds at environmental education summer camps and after-school programs. Nearly 90% of the 152 participants were between 8 and 11 years old; 51% were African American, 45% were non-Hispanic White and 3% were Hispanic. Results were analyzed by splitting respondents into two subgroups: non-Hispanic White children and Hispanic and African American children. Although testing included slightly younger and older children, the authors recommend using it for youth ages 7 to 12.

Variations and Modifications

This tool has proven to be useful across a range of settings. Additional questions and items can be added to CEPS to evaluate other aspects of environmental literacy, including environmental knowledge (with respect to specific topics) and pro-environmental behavior.

Tips for Using This Tool

The authors recommend reading each statement aloud while children respond on paper copies of the questionnaire by circling the symbol that best reflects their feelings. In the original study, the authors read each question aloud twice. They recommend giving children 20–30 seconds to respond to each item. Following these guidelines, approximately 15 minutes are needed for children to complete the CEPS. The tool was used as a pretest and posttest evaluation tool for a one-week environmental education program (Larson, Castleberry, & Green, 2010). On average, children who attended the environmental education program scored higher in both eco-affinity and eco-awareness than children in the control group, who did not attend an environmental education program.

Analyzing Your Data

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 16 columns for the 16 statements and a row for each participant. Assign each child's interview responses a record number and enter each individual's responses across the corresponding row. Using a 1–5 point scale, enter the equivalent value (1 for two thumbs down to 5 for two thumbs up) for each response. Enter a dot if the response was skipped.
2) After you enter your data, we recommend that you take time to clean it up. Cleaning data is necessary because participants do not always respond carefully to surveys. For example, some participants may leave responses blank and others may circle the same answer for every question. We recommend reviewing your data and excluding individuals' responses if approximately 25% or more of their responses are blank, or if their answers display a strong visual pattern, like a zigzag.

Calculating CEPS Scores

1) Create an average CEPS score for each individual by adding all their responses and dividing by the number of questions answered. Do not include skipped questions for which you entered a dot. The average will be between 1 and 5. CEPS scores of 1–2 indicate a lower connection to nature, a score of 3 indicates neither a low nor a high connection, and scores of 4–5 indicate a higher level of connection to nature. Scores can be calculated for the scale as a whole, or for the separate sub-dimensions of CEPS: eco-affinity and eco-awareness.
2) You can also average the scores from all individuals for an overall group score (this number will also be between 1 and 5). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the pre-program average score to the post-program average score using a t-test in Microsoft Excel.

Reliability and Validity

The tool was piloted and revised twice to improve the scale's reliability and validity. The final tool was found to have high internal consistency (Cronbach's alpha = 0.75) for all subgroups in a pretest; the alpha increased to 0.80 for all subgroups in a posttest (Larson, Green, & Castleberry, 2011).

References:

Larson, L. R., Castleberry, S. B., & Green, G. T. (2010). Effects of an environmental education program on the environmental orientations of children from different gender, age, and ethnic groups. *Journal of Park & Recreation Administration*, 28(3).

Larson, L. R., Green, G. T., & Castleberry, S. B. (2011). Construction and validation of an instrument to measure environmental orientations in a diverse group of children. *Environment and Behavior*, 43(1), 72-89.

Tool #2: **Children's Environmental Perceptions Scale**

My name is _____

I am _____ years old. I am a: ☐ Boy ☐ Girl

> *Instructions: We want to know what you think about some things. There are no right or wrong answers. Just be honest about the way you feel. After I read each sentence, you will see five choices: Strongly Disagree (two thumbs down), Disagree (one thumb down), Not Sure (question mark), Agree (one thumb up) and Strongly Agree (two thumbs up). Circle the one that best describes how you feel about each statement.*
>
> *Let's try an example.*

Example Statement:

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. Ice cream tastes great.	👎👎	👎	?	👍	👍👍

> *Are there any questions? I'll read one sentence at a time and you decide how you feel about each one. Raise your hand if you need help.*

Tool #2: **Children's Environmental Perceptions Scale**

1. I like to learn about plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
2. Plants and animals are important to people.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
3. I like to read about plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
4. Plants and animals are easily harmed or hurt by people.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
5. I am interested in learning new ways to help protect plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
6. People need plants to live.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
7. My life would change if there were no trees.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
8. I would give some of my own money to help save wild plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
9. I would spend time after school working to fix problems in nature.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
10. We need to take better care of plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
11. I like to spend time in places that have plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
12. It makes me sad to see homes built where plants and animals used to be.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
13. I like to learn about nature.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
14. I would help to clean up green areas in my neighborhood.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
15. Nature is easily harmed or hurt by people.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
16. My life would change if there were no plants and animals.	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

Thanks for your help!

Source: Larson, L. R., Green, G. T., & Castleberry, S. B. (2011). Construction and validation of an instrument to measure environmental orientations in a diverse group of children. *Environment and Behavior*, 43(1), 72-89.

This tool was developed and validated in English.

Tool #3

Connectedness to Nature Scale

Developed by F. Stephan Mayer and Cynthia M. Frantz

Photo: Gabby Salazar

What This Tool Measures

The Connectedness to Nature Scale (CNS) measures an individual's emotional and experiential response to nature (Mayer & Frantz, 2004). Specifically, the tool measures the extent to which an individual feels a sense of community, equality, kinship, embeddedness, and belongingness to nature. The CNS can also be used to predict whether or not a person is likely to engage in behaviors that support the environment.

Tool Format

The CNS for adults consists of 14 statements to which people respond on a five-point scale, in which 1 = strongly disagree and 5 = strongly agree. There is also a simplified version of the scale, with 10 statements on a seven-point agreement scale, for use with children and low-literacy adults. Both the 14-statement version for adults and the 10-statement version for children are included here.

How This Tool Has Been Used

The 14-statement CNS was designed for use with adults. It was first tested in the United States with undergraduate psychology students and subsequently with a broad range of others between the ages of 18 and 68 (Mayer & Frantz, 2004). It has also been used in France, where a French language version of the tool was tested with adults (Navarro, Olivos, & Fleury-Bahi, 2017). After recognizing that some of the statements in the original CNS scale might be too complex for children and for adults with low literacy skills, the authors revised the scale through a series of focus groups. The revised scale was tested with middle school students as young as 10 years old, with college students, and with a diverse sample of low-income adults, and was found to be a valid measure of connection to nature in all of these groups.

Variations and Modifications

A study in Australia adapted the CNS to assess the relationships between farmers' pro-environmental behavior, attachment to place, and connectedness to nature (Gosling & Williams, 2010). After pretesting the scales with eight farmers, several items were revised or deleted to make the questions more relevant. The final scale included eight items. The study found that the farmers' behavior of protecting native plants was influenced to some degree by their connectedness to nature.

Tips for Using This Tool

This tool can be used to collect baseline data or a snapshot of a person's connection to nature at a certain point in time. Practitioners who are implementing long-term programs or multiple interventions may be able to use it in a pretest/posttest to detect changes over time. However, according to the author, the concepts that the CNS measures are relatively stable over time, so it may be difficult to detect change if a program is short or low intensity.

Photo: Forest Simon, unsplash.com

Analyzing Your Data

These scoring instructions are for the 14-item scale.

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 14 columns for the 14 statements and a row for each participant. Assign each survey a record number and enter each individual's responses (ranging from 1 to 5) across the corresponding row, noting the need to reverse-score some of the statements (see Step 2). Enter a dot if the response was skipped.
2) Statements 4, 12, and 14 of the CNS scale are reverse-scored, so that a high score means a lower connection to nature. To be able to sum these scores with the other statements (where a high score means a greater connection to nature), you must reverse the score. For example, if a person answered 1 to a reverse-scored statement, you would record a 5 in your Excel spreadsheet. If they answered 2 on the survey, you would assign a 4. An answer of 3 stays the same. An answer of 4 receives a 2, and an answer of 5 receives a 1.
3) After you enter your data, we recommend that you take time to clean it up. Cleaning data is necessary because participants do not always respond carefully to surveys. For example, some participants may leave responses blank and others may circle the same answer for every question. We recommend reviewing your data and excluding individuals' responses if approximately 25% or more of their responses are blank, or if their answers display a strong visual pattern, like a zigzag.

Calculating CNS Scores

1) Create an average CNS score for each individual by adding the scores you recorded and dividing by the number of questions answered. Do not include skipped questions for which you entered a dot. The average will be between 1 and 5. CNS scores of 1–2 indicate a lower connection to nature, a score of 3 indicates neither a low nor a high connection, and scores of 4–5 indicate a higher level of connection to nature.
2) You can also average the scores from all individuals for an overall group score (this number will also be between 1 and 5). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the averages for different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the CNS scores of males and females.

Reliability and Validity

The CNS is believed to be valid because results positively correlate with related measures that assess environmental attitudes and connection to nature. The tool has high internal consistency (Cronbach's alpha = 0.84) and high test-retest reliability (Mayer & Frantz, 2004).

References:

Gosling, E., & Williams, K. J. (2010). Connectedness to nature, place attachment and conservation behaviour: Testing connectedness theory among farmers. *Journal of Environmental Psychology*, 30(3), 298-304.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology,* 24 (4), 503-15.

Navarro, O., Olivos, P., & Fleury-Bahi, G. (2017). "Connectedness to Nature Scale": Validity and reliability in the French context. *Frontiers in Psychology*, 8, 2180.

Tool #3: **Connectedness to Nature Scale (Adult Version)**

> *On the line before each of the following statements, use the scale below to indicate how you generally feel about each one. Be as honest as you can. There are no right or wrong answers.*

1	2	3	4	5
Strongly disagree		**Neither agree nor disagree**		**Strongly agree**

_____ 1. I often feel a sense of oneness with the natural world around me.

_____ 2. I think of the natural world as a community to which I belong.

_____ 3. I recognize and appreciate the intelligence of other living organisms.

_____ 4. I often feel disconnected from nature.*

_____ 5. When I think of my life, I imagine myself to be part of a larger cyclical process of living.

_____ 6. I often feel a kinship with animals and plants.

_____ 7. I feel as though I belong to the Earth as equally as it belongs to me.

_____ 8. I have a deep understanding of how my actions affect the natural world.

_____ 9. I often feel part of the web of life.

_____ 10. I feel that all inhabitants of Earth, human, and nonhuman, share a common "life force."

_____ 11. Like a tree can be part of a forest, I feel embedded within the broader natural world.

_____ 12. When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.*

_____ 13. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.

_____ 14. My personal welfare is independent of the welfare of the natural world.*

***Note to evaluator:** Items marked with an asterisk are reverse-scored items.

Source: Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503-515.

This tool was developed and validated in English.

Tool #3: **Connectedness to Nature Scale (Children's Version)**

	1	2	3	4	5	6	7
	Strongly disagree			**Neither agree nor disagree**			**Strongly agree**
I often feel a strong connection to nature.	1	2	3	4	5	6	7
I think of nature as a family that I belong in.	1	2	3	4	5	6	7
I see myself as a part of the greater circle of life.	1	2	3	4	5	6	7
Humans are more important than plants and animals.*	1	2	3	4	5	6	7
I feel related to animals and plants.	1	2	3	4	5	6	7
I feel I belong to the Earth and that the Earth belongs to me.	1	2	3	4	5	6	7
I feel that all living things in this world are connected, and I am a part of that.	1	2	3	4	5	6	7
There is something that every living thing shares.	1	2	3	4	5	6	7
Like the tree in the forest, I feel I belong to nature.	1	2	3	4	5	6	7
I don't feel part of nature.*	1	2	3	4	5	6	7

***Note to evaluator:** Items marked with an asterisk are reverse-scored items.

Source: Revised by F. Stephan Mayer and Cynthia M. Frantz from Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503-515.

This tool was developed and validated in English.

Tool #4

Connection to Nature Index

Developed by Judith Chen-Hsuan Cheng, Martha C. Monroe, and Julie Whitburn

What This Tool Measures

The Connection to Nature Index (CNI) was designed to measure children's feelings about the natural world (Cheng & Monroe, 2012). It is based on previous research regarding children's environmental attitudes and builds on the Connectedness to Nature Scale (see p. 23). In 2019, Cheng and Whitburn revised the CNI to make it a better measure of children's affective attitudes toward nature. The revised CNI, which is included below, measures three concepts: 1) enjoyment of nature, 2) empathy for creatures, and 3) sense of oneness with nature. The tool can also be used to predict children's interest in participating in nature-based activities and in performing environmentally friendly behaviors. With the original version, Cheng and Monroe (2012) found that youth who had previous experience and knowledge of nature, who had a home near nature, and who had families that valued nature were more likely to have a higher connection to nature as measured by the CNI.

Tool Format

The revised CNI consists of 14 statements to which children respond on a five-point scale, in which 1 = Do not like at all and 5 = Like very much.

How This Tool Has Been Used

The tool was originally designed for children and was tested with 9- to 10-year-olds (fourth graders) in a diverse urban setting in Florida, USA (Cheng & Monroe, 2012). It has also been used by the United Kingdom's Royal Society for the Protection of Birds (RSPB) and by the New Zealand Department of Conservation to obtain baseline data about their audiences. The revised CNI, featured here, was tested with third to fifth graders in Taiwan. Cheng and Monroe (2012) recommend using the CNI with children ages 8 to 10, while the RSPB found the original CNI to be useful with children ages 8 to 12 (Bragg et al., 2013).

Variations and Modifications

The CNI was revised to address three issues with the original CNI. First, the original questions in the CNI tended to lead participants to answer in a positive way. For example, asking participants to rate their agreement on the question, "I like to hear different sounds in nature" could suggest that liking nature is a social norm and encourage agreement. To solve this problem, Cheng and Whitburn modified the items by having a single question at the beginning of the survey, "How much do you like to see or do the following things?" Second, the original CNI included questions about both affective attitudes and behavior. In the revised tool, all questions focus on affective attitudes toward nature. Third, the number of items measuring each concept was unequal; in the revised tool, each concept has an equal number of items.

Tips for Using This Tool

The CNI was designed to obtain a snapshot of how children feel about nature in the moment. It may be used to measure change in certain contexts, but according to the authors, the concepts it measures are unlikely to change quickly. Ernst and Theimer (2011) used the CNI as a pretest/posttest evaluation tool for seven US Fish and Wildlife Service programs that differed in duration, format, location, and age level. They found that participation in the programs did not lead to a significant increase in children's CNI scores, and suggest that this might be due to a "ceiling effect."

Analyzing Your Data

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 14 columns for the 14 statements and a row for each participant. Assign each child's survey a record number, and enter each individual's responses across the corresponding row. Using a 1–5 point scale, enter the equivalent value (1 for do not like at all to 5 for like very much). Enter a dot if the response was skipped.
2) After you enter your data, we recommend that you take time to clean it up. Cleaning data is necessary because participants do not always respond carefully to surveys. For example, some participants may leave responses blank and others may circle the same answer for every question. We recommend reviewing your data and excluding individuals' responses if approximately 25% or more of their responses are blank, or if their answers display a strong visual pattern, like a zigzag.

Calculating CNI Scores

1) Create an average CNI score for each individual by adding all of their responses and dividing by the number of questions answered. Do not include skipped questions for which you entered a dot. The average will be between 1 and 5. CNI scores of 1–2 indicate a lower connection to nature; a score of 3 indicates neither a low nor a high connection; and scores of 4–5 indicate a higher level of connection to nature.
2) You can also average the scores from all individuals for an overall group score (this number will also be between 1 and 5). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the average scores of different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the CNI scores of males and females.

Reliability and Validity

The revised CNI was found to have a Cronbach's alpha of 0.92, which is similar to the internal consistency of the original CNI (Cronbach's alpha = 0.87) (Cheng & Monroe, 2012). The original CNI is believed to be valid because the results correlate to other relevant factors, such as experience in nature, home setting, and family values. The revised CNI was tested against four measures of pro-environmental behavior and was found to correlate positively.

References:

Bragg, R., Wood, C., Barton, J., & Pretty, J. (2013). Measuring connection to nature in children aged 8-12: A robust methodology for the RSPB. *University of Essex*.

Cheng, J. C., & Monroe, M. C. (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, 44, 31-49.

Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, 17(5), 577-598.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503-515.

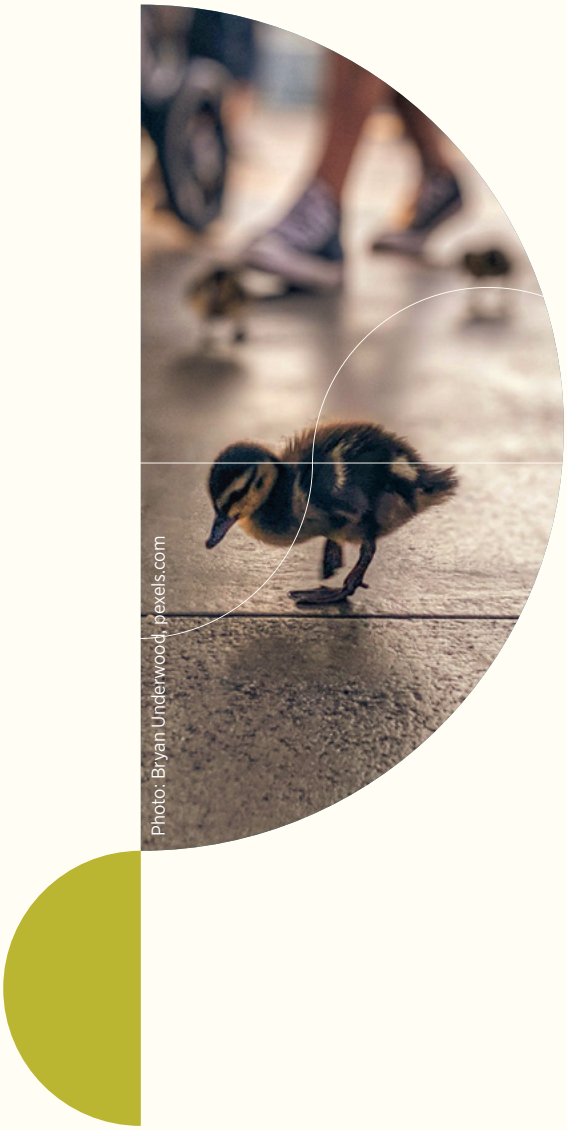


Photo: Bryan Underwood, pexels.com

Tool #4: **Revised Connection to Nature Index**

> *How much do you like to see or do the following things? Please mark one circle for each line.*

Experiences	**Do not like at all** ○				**Like very much** ○
See plants and flowers in nature	○	○	○	○	○
See wild animals living in a clean environment	○	○	○	○	○
Take care of animals and plants	○	○	○	○	○
Touch animals and plants	○	○	○	○	○
Love and care for nature	○	○	○	○	○
Go outside and enjoy nature	○	○	○	○	○
Learn more about nature	○	○	○	○	○
Collect rocks/shells/leaves in nature	○	○	○	○	○
Hear different sounds when I am in nature	○	○	○	○	○
Grow vegetables and plants	○	○	○	○	○
Be in the outdoors	○	○	○	○	○
Live with plants and animals	○	○	○	○	○
Consider myself as part of nature	○	○	○	○	○
Feel comfortable and peaceful in nature	○	○	○	○	○

Source: Revised by Judith Chen-Hsuan Cheng and Julie Whitburn from Cheng, J.C. & Monroe, M. C., (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, 44., and used with permission.

This tool was developed and validated in English.

Tool #5

Environmental Identity Scale

Developed by Susan Clayton


Photo: Gabby Salazar

What This Tool Measures

The Environmental Identity (EID) Scale was designed to measure an individual's environmental identity—that is, a person's sense of connection to and interdependence with the natural world. This identity can be influenced by an individual's previous experience, emotional attachment to nature, and personal perception of being similar to or different from nature (Clayton, 2003). Much like a national or ethnic identity, people's environmental identity can form an important part of their self-concept and can influence their behavior. Recently, Clayton and colleagues revised the EID Scale to include broader conceptions of nature and to make it relevant to a wider range of people, including those with lower literacy levels. The original and revised versions of the EID Scale, both included below, measure: 1) self-identification (based on the extent and importance of an individual's interaction with nature), 2) ideology (based on support for environmentally friendly lifestyle choices), and 3) positive emotions toward the environment (based on enjoyment obtained in nature).

Tool Format

The original EID Scale consists of 11 statements to which people respond on a seven-point scale, with 1 being "not at all true of me," and 7 being "completely true of me." The revised EID consists of 14 statements and uses the same seven-point scale.

How This Tool Has Been Used

The EID Scale was developed for adults and was originally tested with college students in American universities (Clayton, 2003). Clayton, Fraser, and Burgess (2011) tested zoo visitors in Ohio to examine whether zoo exhibits influenced environmental identity scores. That test showed that scores on the EID Scale were unrelated to exhibit experiences, but were related to whether or not an individual was a zoo member. This suggests that environmental identities are not likely to change with a single program or visit. The EID Scale has also been used at a university in France (Prévot, Clayton & Mathevet, 2018) to assess whether an individual's score on the EID Scale is influenced by their course of study. Translated versions of the original scale have also been successfully used in China, Russia, Finland, Turkey, and Hungary. The revised EID Scale has been tested and validated cross-culturally with six different audiences (Taiwanese undergraduate students; Peruvian adults; Russian adults; crowd-sourced American adults; American adults at zoos, aquariums, and National Wildlife Refuges; and American high school students in Chicago, Illinois). Participants in five of these groups were also asked about the likelihood that they would engage in pro-environmental behaviors, such as conserving water or energy, participating in community environmental events, or voting for environmental policy. Higher scores on the EID Scale correlated positively with pro-environmental behaviors.

Variations and Modifications

Two versions of the original scale exist: a 24-statement tool and an 11-statement tool. The 11-statement version, featured below, functions just as reliably as the longer version (see Clayton, 2003). The revised 14-item scale, also below, has been updated and tested to be more relevant for urban audiences and more accessible to individuals with low literacy levels.

When deciding which version of the EID scale to use with your group, we recommend reading over each version and thinking about the following questions:

- Is my audience likely to have spent a lot of time in wilderness areas, or has their experience of nature primarily been in urban settings?
- How old is my audience?
- Is my audience likely to have low literacy levels or to lack formal education?

If you know your audience, you may be able to quickly tell which version of the scale is likely to resonate more. In general, we recommend the revised version of the scale for teenagers, highly urban audiences, or if your audience has low literacy levels. If it is important for you to link your new data to published papers, you may want to use the original 11-question version.

Tips for Using This Tool

The EID Scale was designed to obtain a snapshot of an individual's environmental identity. The author does not recommend using this tool to evaluate changes after a short program because a person's identity is unlikely to change quickly. It could be used to describe the environmental orientation of specific groups, or to compare different groups. Respondents' scores on the EID Scale can also be used to predict whether or not they are likely to engage in behaviors that support the environment, such as recycling or conserving energy in their home. Higher scores on the scale correlate positively with pro-environmental behaviors.

Analyzing Your Data

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 11 columns for the 11 statements (or 14 if using the revised version) and a row for each participant. Assign each survey a record number, and enter each individual's responses (ranging from 1 to 7) across the corresponding row. Enter a dot if the response was skipped.
2) After you enter your data, we recommend that you take time to clean it up. Cleaning data is necessary because participants do not always respond carefully to surveys. For example, some participants may leave responses blank and others may circle the same answer for every question. We recommend reviewing your data and excluding individuals' responses if approximately 25% or more of their responses are blank, or if their answers display a strong visual pattern, like a zigzag.

Calculating EID Scores

1) Create an average score for each individual by adding all of their responses and dividing by the number of questions answered. Do not include skipped questions for which you entered a dot. The average will be between 1 and 7. EID scores of 1–3 indicate a lower environmental identity, a score of 4 indicates neither a low nor a high environmental identity, and scores of 5–7 indicate a higher level of environmental identity.
2) You can also average the scores from all individuals for an overall group score (this number will also be between 1 and 7). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the averages for different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the environmental identity scores of men and women.

Reliability and Validity

The revised EID has high reliability (Cronbach's Alpha of ≥ 0.82), which is similar to the reliability of the original 24- and 11-statement versions of the scale (Cronbach's Alpha of ≥ 0.90) (Clayton, 2003). All versions of the tool have been validated across different contexts and cultures. The EID is believed to be valid because EID scores correlate with other relevant factors, such as past experience in nature, pro-environmental attitudes, and the likelihood to engage in pro-environmental behaviors.

References:

Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S. Clayton, & S. Opotow (Eds.), Identity and the natural environment: The psychological significance of nature (pp. 45-65). Cambridge: MIT Press.

Clayton, S., Fraser, J., & Burgess, C. (2011). The role of zoos in fostering environmental identity. *Ecopsychology*, 3, 87-96.

Prévot, A.-C., Clayton, S., & Mathevet, R. (2018). The relationship of childhood upbringing and university degree program to environmental identity: Experience in nature matters. *Environmental Education Research*, 24, 263-279.

Tool #5: **Original Environmental Identity (EID) Scale**

> *Please indicate the extent to which each of the following statements describes you by using the appropriate number from the scale below.*

1	2	3	4	5	6	7
Not at all true of me			**Neither true or untrue**			**Completely true of me**

_____ 1. I spend a lot of time in natural settings (woods, mountains, deserts, lakes, ocean).

_____ 2. I think of myself as a part of nature, not separate from it.

_____ 3. If I had enough time or money, I would certainly devote some of it to working to protect the environment.

_____ 4. When I am upset or stressed, I can feel better by spending some time outdoors "communing with nature."

_____ 5. I feel that I have a lot in common with other species.

_____ 6. Behaving responsibly toward the earth—living a sustainable lifestyle—is part of my moral code.

_____ 7. Learning about the natural world should be an important part of every child's upbringing.

_____ 8. I would rather live in a small room or house with a nice view than a bigger room or house with a view of other buildings.

_____ 9. I would feel that an important part of my life was missing if I was not able to get out and enjoy nature from time to time.

_____ 10. I have never seen a work of art that is as beautiful as a work of nature, like a sunset or a mountain range.

_____ 11. I feel that I receive spiritual sustenance from experiences with nature.

Source: Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S. Clayton, & S. Opotow (Eds.), Identity and the natural environment: *The psychological significance of nature* (pp. 45-65). Cambridge: MIT Press.

This tool was developed and validated in English.

Tool #5: **Revised Environmental Identity (EID) Scale**

> *Please indicate the extent to which each of the following statements describes you by using the appropriate number from the scale below.*

1	2	3	4	5	6	7
Not at all true of me			**Neither true or untrue**			**Completely true of me**

_____ 1. I like to spend time outdoors in natural settings (such as woods, local parks, lake or beach, or a leafy yard or garden)

_____ 2. I think of myself as a part of nature, not separate from it.

_____ 3. If I had enough resources, such as time or money, I would spend some of them to protect the natural environment.

_____ 4. When I am upset or stressed, I can feel better by spending some time outdoors surrounded by nature.

_____ 5. I feel that I have a lot in common with wild animals.

_____ 6. Behaving responsibly toward nature—living a sustainable lifestyle—is important to who I am.*

_____ 7. Learning about the natural world should be part of everyone's upbringing.

_____ 8. If I could choose, I would prefer to live where I can have a view of the natural environment, such as trees or fields.

_____ 9. An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.

_____ 10. I think elements of the natural world are more beautiful than any work of art.*

_____ 11. I feel refreshed when I spend time in nature.

_____ 12. I consider myself a steward of our natural resources.*

_____ 13. I feel comfortable out in nature.

_____ 14. I enjoy encountering elements of nature, like trees or grass, even when I am in a city setting.

***Notes to evaluator:**
In Statement 6, could replace "sustainable" with "environmentally friendly."
In Statement 10, could replace "elements" with "some parts."
In Statement 12, could replace "a steward" with "someone who takes care of."

If it is important for you to link your new data to published papers, you may want to use the original version of the EID Scale above.

Source: Revised by the Environmental Identity Revision Team (see p. 3) from Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S. Clayton, & S. Opotow (Eds.), Identity and the natural environment: *The psychological significance of nature* (pp. 45-65). Cambridge: MIT Press.

This tool was developed and validated in English.

Tool #6

Inclusion of Nature in Self

Developed by P. Wesley Schultz

Photo: Nandhu Kumar, Pexels.com

What This Tool Measures

The Inclusion of Nature in Self (INS) Scale assesses connectedness to nature by measuring the extent to which individuals include nature within their views of themselves (Schultz, 2002). It is a modification of a tool used to assess how people perceive closeness in personal relationships (Aron, Aron, & Smollan, 1992).

Tool Format

The tool is one pictorial question with seven pairs of circles. The circles are labeled "Self" and "Nature," and overlap to varying degrees (similar to Venn diagrams). Participants select the pair of circles that best describes their relationship with nature in response to the question "How interconnected are you with nature?" The circles are scored on a one- to seven-point scale from complete separation (1) to complete overlap (7).

How This Tool Has Been Used

This tool has been widely used with children as young as age 7 and with adults of diverse backgrounds and nationalities. For example, the INS has been used as a program assessment tool with 10- to 13-year-old children in India; with undergraduate students in the United States; and with low income, Latinx farmworker families. Larson et al. (2018) used the INS to explore relationships between self-reported outdoor time, screen time, and connection to nature among a diverse group of sixth- to eighth-grade students in rural South Carolina. They analyzed their results by gender and by race and found that connection to nature was highest among boys, non-Hispanic White students, and sixth graders. For other studies using the INS, see Bruni, Fraser, & Schultz (2008); Schultz et al. (2004); Schultz & Tabanico (2007); Bruni & Schultz (2010); Liefländer et al. (2013).

Variations and Modifications

Larson et al. (2018) condensed the INS from a series of seven sets of circles to five sets and still found the tool to be effective. Martin and Czellar (2016) developed the Extended Inclusion of Nature in Self (EINS) by adding three additional questions to the INS that also measure how individuals think about their relationship with nature.

Tips for Using This Tool

This tool has been used to gather baseline information and to evaluate programs. For example, Liefländer et al. (2013) used the tool to explore whether participation in a four-day environmental education program led to changes in 9- to 13-year-old German students' connectedness with nature. Students answered the INS question during a pretest, an immediate posttest, and a posttest four weeks after the program. Results showed a short-term increase in connectedness across the entire age range using the INS, although only 9- to 10-year-olds sustained the increase four weeks later. Richardson et al. (2016) used the INS to determine that participation in the 30 Days Wild Campaign (a campaign that encouraged people "to do something wild everyday") led to increased connectedness to nature.

Analyzing Your Data

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with a single column for the question and a row for each participant. Assign each survey a record number, and enter each individual's response (ranging from 1 to 7) in the corresponding row. Enter a dot if the response was skipped.

Calculating INS Scores

1) An individual's INS score is simply the number they picked (ranging from 1 to 7).
2) You can also average the scores from all individuals for an overall group score (this number will also be between 1 to 7). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the pre-program average score to the post-program average score using a t-test in Microsoft Excel. You could also compare the averages for different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the INS scores of males and females.

Reliability and Validity

The INS is thought to be valid because it correlates positively with scores on other scales that measure environmental attitudes and behavior, including the New Ecological Paradigm Scale (Schultz, 2002). However, internal reliability for INS cannot be determined because it is a single-item test.

References:

Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, 63(4), 596-612.

Bruni, C., & Schultz, P. W. (2010). Implicit beliefs about self and nature: Evidence from an IAT game. *Journal of Environmental Psychology*, 30, 95-102.

Bruni, C. M., Fraser, J., & Schultz, P. W. (2008). The value of zoo experiences for connecting people with nature. *Visitor Studies*, 11(2), 139-150.

Larson, L. R., Szczytko, R., Bowers, E. P., Stephens, L. E., Stevenson, K. T., & Floyd, M. F. (2018). Outdoor time, screen time, and connection to nature: Troubling trends among rural youth? *Environment and Behavior*, 51(8), 966-991.

Liefländer, A. K., Fröhlich, G., Bogner, F. X., & Schultz, P. W. (2013). Promoting connectedness with nature through environmental education. *Environmental Education Research*, 19(3), 370-384.

Martin, C., & Czellar, S. (2016). The extended inclusion of nature in self scale. *Journal of Environmental Psychology*, 4, 181-194.

Richardson, M., Cormack, A., McRobert, L., & Underhill, R. (2016). 30 days wild: Development and evaluation of a large-scale nature engagement campaign to improve well-being. *PloS One*, 11(2), e0149777.

Schultz, P. W., & Tabanico, J. (2007). Self, identity, and the natural environment. *Journal of Applied Social Psychology*, 37, 1219-1247.

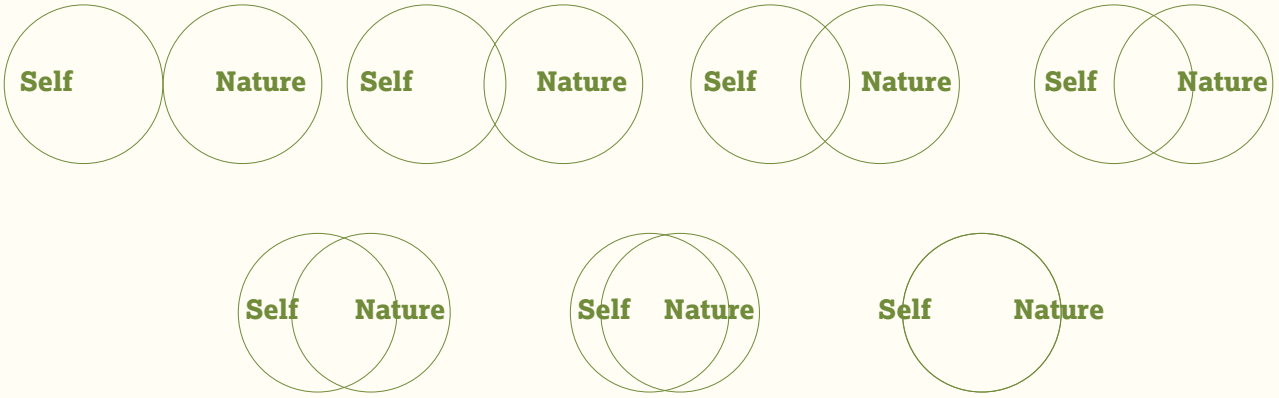
Schultz, P. W., Shriver, C., Tabanico, J., & Khazian, A. (2004). Implicit connections with nature. *Journal of Environmental Psychology*, 24, 31-42.

Schultz, P. W. (2002). Inclusion with nature: The psychology of human-nature relations. In Schmuck, P., Schultz, W. P., & Milfont, T. L. (Ed.) *Psychology of Sustainable Development*. Boston: Kluwer Academic.

Photo: Pixaby.com

Tool #6: **Inclusion of Nature in Self Scale**

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



Source: Schultz, P. W. (2002). Inclusion with nature: The psychology of human-nature relations. In Schmuck, P., Schultz, W. P., & Milfont, T. L. (Ed.) *Psychology of Sustainable Development*. Boston: Kluwer Academic.

This tool was developed and validated in English.

Tool #7

Interpretation of Drawings

Summarized by Joe Heimlich, Chris Parsons, and Gabby Salazar

Photo: Shutterstock.com

What We Learn from This Approach

Psychologists, educators, teachers, and researchers often use children's drawings to gain insight into their thoughts and feelings (Farokhi & Hashemi, 2011). Environmental educators have used drawings to understand more about children's relationships with nature (Kalvaitis & Monhardt, 2012), their attitudes toward wildlife (Smith, Meehan, & Castori, 2003), and their perceptions of different ecosystems (Bowker, 2007). By analyzing and interpreting children's drawings, it may be possible to understand more about their connection to nature, as well as their interests, knowledge, and experiences of nature.

What This Approach Looks Like

This approach usually entails asking children to draw a picture using a standardized prompt and then giving them a set amount of time to draw. For example, in one study, Kalvaitis and Monhardt (2012) asked 6- to 11-year-old children to "draw a picture of yourself in nature doing something," and then to "write about your picture and your relationship with nature." They then analyzed both the drawings and the written responses to understand how children conceptualized their relationships and interactions with nature.

One of the advantages of this approach is that it can easily be integrated into many programs. You could use a single drawing as a baseline assessment, or you could use drawings at the beginning and end of a program to evaluate the influence of the program on your participants' perceptions of nature. Because it is easier to measure changes between drawings than to interpret meaning in a single drawing, it may be more useful to use drawings as a pre- and post-assessment. You could then score the drawings using a rubric or you could use the drawings as a prompt in an interview. For example, you could ask participants to discuss the different elements in their drawings to help them express their feelings about nature. Unlike most of the tools in this guide, there is not a single, standardized approach for assessing children's drawings of nature. Instead, the guidelines we present here are a summary of best practices from a number of studies that have adapted this approach for different age groups and contexts. While this approach has most commonly been used with children, it could also be used with adults.

How This Approach Has Been Used

The prompt for drawings is important because different prompts will elicit different drawings and answer different questions. For example, Profice (2018) instructed groups of 6- to 14-year-old children to "draw a picture of nature and of nature around you." If, instead, you asked students to draw their favorite place in nature, you might get very different responses. Also, keep in mind that children typically draw what they are familiar with.

This approach can be useful for program participants of all ages, and particularly those who struggle with communicating through writing or for whom English is not their primary language. Children's drawings have also been used to evaluate changes in learning with environmental education programs (Bowker, 2007).

Tips for Using This Approach

It is important to ask children to label or explain the elements of their drawings. Accurate scoring and interpretation requires this step. If you do not have time to talk to the children individually about their drawings, you could ask them to write a sentence or two describing them. Because some children may be self-conscious about their artistic abilities, it can be helpful to remind children that there are no right or wrong ways to depict something and that they will not be judged on how well they draw. If you are using this approach both before and after a program, be sure to give participants the same amount of time to do their drawings pre- and post-program so the comparisons are more equitable.

Summarizing and Analyzing Responses

Before you start interpreting drawings, determine what you are actually trying to measure so that you can develop appropriate criteria for scoring the drawings. Do you want to understand how children feel about nature? Or do you want to understand more about their interactions with nature? Once this is clear, you can build a rubric around these questions by determining related factors to look for and then coding the drawings and descriptions according to their appearances and content. The detailed instructions for coding in the discussion of journaling on page 41 can assist with developing an appropriate rubric and quantifying the results for analysis.

A number of studies have explored children's attitudes toward nature and their relationships with nature through drawings (Kalvaitis & Monhardt, 2012; Flowers et al., 2015; Profice, 2018). Because these studies were developed for research, the scoring rubrics were not developed with practitioners in mind. If you want to create your own rubric, you could code for how frequently the following factors are represented in a drawing: humans, living elements (plants, trees, animals), nonliving elements (sun, wind, mountains), setting (urban areas or a natural area with no human artifacts). You could also code for emotion conveyed in the drawing or the tone of the text that the child uses to describe the drawing (e.g., are they using positive words or negative words; see Journaling on pg. 41 for coding instructions). Finally, you could code for the interactions between people and nature in the drawings. What are people are doing in the drawing (playing in a natural area or doing chores at home) and how are they interacting with nature (walking, hiking, sleeping, planting)? Depending on the prompt you used, you could also code for the relationship between people and nature in the drawing. For example, if you had prompted the children to draw a picture of themselves in nature, does their drawing show them as being distant from nature (e.g., interacting only with people) or being connected to and part of nature (e.g., resting under a tree or holding hands with an animal)?

Photo: Shutterstock.com

Trustworthiness and Credibility

Keep in mind that children's drawings can be difficult to interpret, and that people may interpret drawings differently. To increase the reliability of this approach, you can test the standardized scoring rubric you've developed for your study with multiple scorers. Rubrics can help an evaluator focus on specific aspects of a drawing. To increase the reliability of your rubric, give two or three adults the same set of ten drawings. Ask them to analyze each drawing using the rubric. Next, discuss each drawing as a group and look for discrepancies in your scoring. This process can help you refine the scoring rubric and ensure that all scorers are looking for the same elements in the drawings. Even with a rubric, you can misinterpret what children intend their drawing to mean. We recommend asking children about why they drew what they drew in a one-on-one interview before you begin scoring the drawings. If this is not possible, ask participants to label parts of their drawings or write a paragraph on the back of their drawing describing what they drew.

References:

Bowker, R. (2007). Children's perceptions and learning about tropical rainforests: An analysis of their drawings. *Environmental Education Research*, 13(1), 75-96.

Farokhi, M., & Hashemi, M. (2011). The analysis of children's drawings: Social, emotional, physical, and psychological aspects. *Procedia-Social and Behavioral Sciences*, 30, 2219-2224.

Flowers, A. A., Carroll, J. P., Green, G. T., & Larson, L. R. (2015). Using art to assess environmental education outcomes. *Environmental Education Research*, 21(6), 846-864.

Kalvaitis, D., & Monhardt, R. M. (2012). The architecture of children's relationships with nature: A phenomenographic investigation seen through drawings and written narratives of elementary students. *Environmental Education Research*, 18(2), 209-227.

Profice, C. (2018). Nature as a living presence: Drawings by Tupinambá and New York Children. *PloS one*, 13(10), e0203870.

Smith, M. H., Meehan, C. L., & Castori, P. (2003). Children's drawings: An alternative assessment strategy. In *Proceedings of the North American Association for Environmental Educators' 2003 Annual Conference*.

Tool #8

Journaling

Summarized by Anna Lee and Nicole Ardoin

Photo: Shutterstock.com

What We Learn from This Approach

This approach uses journal entries to reveal how participants think about and relate to nature. Data from journal entries can be used to measure feelings and thoughts related to connection to nature, as well as other constructs such as interest in nature, salience of an experience, mental models, social emotional learning, and more. This approach can also offer insight into how students construct and understand their relationship to nature.

What This Approach Looks Like

This summary is drawn from the experiences of educators who integrated a daily journaling activity into a one-week nature education program. Each day they asked the student participants to respond to two prompts: (1) *Write about something that catches your eye*, and (2) *Write about how you feel in this place*. At the end of the week, the team photographed the journals of willing participants before returning the journals to them. Researchers then transcribed the journal entries with word processing software and analyzed the text to look for themes and patterns (see instructions below).

How This Approach Has Been Used

This approach was tested with 18 participants in a summer day camp at a farm and wilderness area in California. It was retested with 40 participants during a weeklong school trip for California middle school students at Yosemite National Park. All participants were between the ages of 11 and 15.

Tips for Using This Approach

Journaling as an assessment tool has some distinct advantages over more formalized, structured approaches as it can be relatively easily embedded into existing curricula. Moreover, it provides insight into nuanced thoughts and feelings that may not be easily captured in surveys or even in formal interviews or observations. Because the prompts can be quite broad, and because journaling may take place at any point during a program, journaling is a good way to capture a range of participant experiences.

Some of these benefits are also challenges: Variation in the contexts where the journal entries are created means that any single entry must be considered a snapshot in time, rather than a representation of the participants' full experiences in the program. Further, many factors can impact the consistency and quality of journal responses, so it can be difficult to compare one response to another. These factors may include, but are not limited to, physical conditions (such as comfortable seating, protection from the elements, privacy of the writing space), incentives to finish (e.g., "You may play a game after you finish your journal entry."), framing of the task (e.g., as an assignment versus an opportunity for personal reflection), timing of the task (e.g., in relation to meals or to other activities), and cues from others regarding what is interesting or special, among other aspects.

Logistical considerations that impact legibility are important to keep in mind when using this approach, such as providing surfaces on which to write, pens versus pencils depending on field conditions, and the ability to keep journals out of rain and creeks.

This tool can be made more powerful by integrating journaling exercises into longer-term classroom practices, both before and after participating in a program, camp, or other nature-based experience. Journal entries collected before an experience would be particularly useful for linguistic analyses (e.g., interpreting whether and how participants' word choices or descriptions of nature change after a program), but it would also be informative to compare how the content, feelings, or emotions vary between the indoor classroom and outdoor settings, as well as in various types of nature-rich settings. Post-experience journaling could point to longer-term outcomes associated with programs and provide insights into any lasting effects they may have had.

Keep in mind that the process of journaling can influence a participant's experience in a program; reflection through journaling may change how participants process experiences and assign them significance (Schweingruber, Shouse, & Michaels, 2008).


Photo: Shutterstock.com

Variations and Modifications

Several strategies can be used to prompt participants to share their thoughts and feelings. Ardoin et al. (2014) used digital photography in combination with reflective journaling to measure interest in surroundings and activities during an environmental education program. Some participants were given digital cameras and were asked to take photographs throughout the day, and to accompany those photographs with notes in their journals that documented what interested them throughout the day. Other participants participated only in the journaling activities; they were asked to write about their experiences in their journals. At the end of the day, the researchers asked participants who received cameras to select their "top five" photos and to write captions describing each photo. The team reviewed the captioned photos and the journal entries, looking for patterns in content and language that might suggest positive or negative connections to nature, engagement, and past experiences. While this approach was originally used to understand what sparks interest during an environmental education program, different prompts could be used to assess connection to nature.


Photo: Gabby Salazar

Summarizing and Analyzing Responses

There are multiple ways to analyze journal entries and summarize responses. In this example, the researchers used qualitative content coding to analyze the journal entries. Coding is a systematic way of looking for themes and patterns within texts. For example, using qualitative content coding, you can understand how many students had emotional responses to an outdoor experience and whether those experiences were positive or negative.

Qualitative content coding

Coding is a process of categorizing text, images, and quotes to identify common themes. You can use qualitative content coding to look for themes of interest in the journal entries, including evidence of affective responses to nature, as well as constructs such as social emotional learning competencies, and how participants describe what caught their eye. Here are step-by-step instructions for qualitative content coding.

1) List Related Themes

Develop a list of themes that are related to your specific evaluation goals. These are the themes you will be coding for (or highlighting) as you review the journal entries. For example, if you are interested in your participants' connection to nature, you could highlight any time a journal entry includes an emotional response to nature and assign a code to these instances so you can count how frequently they occur. Because emotion can be either positive or negative, it is helpful to have a second code to summarize what type of emotion is conveyed. Here is a list of potential themes you could look for in the journal entries:

- Content (landscapes, non-human animals, people)
- Affect (words related to emotions, use of strong adjectives)
- Intent (statements about "when I get home" or "when I come back")
- "Shoulds" (statements about how humans should feel or act with respect to nature)
- Connections or comparisons to home or school
- References to specific parts of the experience in a program (e.g., a particular hike or game)
- Statements that convey participants' assumptions about nature (e.g., "This forest is a safe place.")
- Adjectives that describe nature (Do participants focus on scale, beauty, danger, peacefulness?)
- References to social aspects of the experience (interactions with friends, leaders, parents)
- Nouns that describe nature (Are these nouns active subjects, as in "The wind blows my hair around" or passive objects, as in "We watered the plants to make them grow"?)
- Use of metaphors, analogies, and personification (in making sense of the natural world, do participants compare nature entities to human-related concepts or to other things in nature?)


Photo: unsplash.com

2) Code the Themes

Using your list of themes, and a copy of a few of the journal entries, try coding a small sample of the entries by using different-colored highlighters to mark words that represent the themes you have identified. Provide a copy of the same journal entries, along with your list of the themes to a colleague, and ask the colleague to code the same sample. After you've both finished coding, get together and discuss each entry and the themes you found. You can discuss any differences in the way you coded the journal entries and further define what you mean by different themes. This is a good way to make sure that nothing is missed and that the coding system you have created is standardized and replicable.

3) Summarize Your Results

After you have practiced coding a sample and established a coding system, complete the coding process on all of the journal entries. Then summarize your results by recording the number of times each theme occurred. For example, you could count the number of participants who mentioned a positive experience in nature ("five participants wrote that they liked hearing birds sing"), or the number of participants who wrote about an intent to change behavior ("seven participants wrote about their plans to spend more time outside in the future"). You could also count the number of times a particular program experience was mentioned ("nine participants wrote about the time we went swimming in the creek"). Such an assessment can help you understand what parts of an experience resonated with participants. When you summarize these themes in a report, it may be helpful to include specific quotes from participants that are representative of each theme.

Trustworthiness and Credibility

To use journaling as an evaluative tool, consistency in implementation is key. Evaluators must strike a balance between smooth, flexible integration of journaling into the existing curriculum and consistency in both the prompts used and how they are delivered.

Standardization of codes, especially among multi-researcher teams, will also ensure consistency and quality of analysis.

References:

Ardoin, N. M., DiGiano, M., Bundy, J., Chang, S., Holthuis, N., & O'Connor, K. (2014). Using digital photography and journaling in evaluation of field-based environmental education programs. *Studies in Educational Evaluation*, 41, 68-76.

Schweingruber, H. A., Shouse, A. W., Michaels, S., & National Research Council. (2007). Ready, set, science! *Putting research to work in K–8 science classrooms.* National Academies Press.

Photo: Christian Joudrey, unsplash.com

Tool #9

Love and Care for Nature Scale

Developed by Helen Perkins

What This Tool Measures

This tool measures an individual's emotional relationship with nature, which includes their love for nature and their deep feelings of care for nature. More specifically, items included in the Love and Care for Nature (LCN) Scale measure feelings of awe, wonder, and interest in nature; feelings of love, emotional closeness, and interconnectedness with nature; and feelings of care, responsibility, and commitment to protect nature.

Tool Format

The LCN comes in three versions consisting of 5, 10, or 15 statements to which people respond on a seven-point disagree/agree scale where 1 = strongly disagree and 7 = strongly agree.

How This Tool Has Been Used

This tool was developed for use with adults and the original tool was tested with ecotourists at two sites in Australia (Perkins, 2010). Since that time, the author has used the scale for research across a range of contexts such as tourism and leisure research, pro-environmental consumption and behavior, consumer purchasing behavior, and the psychological benefits of feeding backyard wildlife. The scale has been tested with a number of different audiences, including university students, members of the general population, consumers, backyard feeder special interest groups, mainstream tourists, and ecotourists.

Variations and Modifications

This scale has been used to measure emotional connection to nature in many contexts, including nature-based occupational therapy, nature-based family therapy, and similar interventions. The 15-item, 10-item, and 5-item versions of the scale function equally well. The 10-item and 5-item versions are included in this guide, and the full 15-item version can be found in Perkins' published work (2010).

Tips for Using This Tool

The LCN was designed to obtain a snapshot of an individual's emotional connection to nature. We do not recommend using this tool to evaluate changes after a single low intensity program because a person's emotional connection to nature is unlikely to change quickly.

Photo: Shutterstock.com

Analyzing Your Data

These scoring instructions are for the 10-item scale.

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 10 columns for the 10 statements and a row for each participant. Assign each survey a record number and enter each individual's responses (ranging from 1 to 7) across the corresponding row. Enter a dot if the response was skipped.
2) After you enter your data, we recommend that you take time to clean it up. Cleaning data is necessary because participants do not always respond carefully to surveys. For example, some participants may leave responses blank and others may circle the same answer for every question. We recommend reviewing your data and excluding individuals' responses if approximately 25% or more of their responses are blank.

Calculating LCN Scores

1) Create an average LCN score for each individual by adding all of their responses and dividing by the number of questions answered. Do not include skipped questions for which you entered a dot. The average will be between 1 and 7. LCN scores of 1–3 indicate lower levels of caring and emotional connection to nature, a score of 4 indicates neither a low nor a high level of caring and emotional connection to nature, and scores of 5–7 indicate higher levels of caring and emotional connection to nature.
2) You can also average the scores from all individuals for an overall group score (this number will also be between 1–7). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the averages for different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the LCN scores of males and females.

Reliability and Validity

The 15-item, 10-item, and 5-item versions of the scale all demonstrate high internal consistency and reliability (Cronbach's alpha of ≥ 0.93). The validity of the scale was tested through multiple processes, including an assessment by a panel of experts and an assessment of the degree to which LCN scores correlate with similar constructs. The scale was found to be a valid measure of a person's emotional relationship with nature (Perkins, 2010). In addition, a sample of ecotourists was shown to have a higher average LCN score than a sample of the general population, as expected. LCN scores may also be used to predict the likelihood that a person holds pro-environmental attitudes or engages in pro-environmental behaviors. A high score on this scale makes it more likely that someone will be willing to take some effort or make some sacrifice to adopt an environmental behavior than a high score on environmental attitudes in general. Even though this tool is similar to the Connectedness to Nature Scale (see p. 23) and the Inclusion of Nature in Self Scale (see p. 34), it measures different concepts (Perkins, 2010).

References:

Perkins, H. E. (2010). Measuring love and care for nature. *Journal of Environmental Psychology*, 30(4), 455-463.

Photo: Ricardo Esquivel, Pexels.com

Tool #9: **Love and Care for Nature Scale (LCN)**

> *On the line before each of the following statements, use the scale below to indicate how you generally feel about each one. Be as honest as you can. There are no right or wrong answers.*

1	2	3	4	5	6	7
Strongly disagree			**Neither agree nor disagree**			**Strongly agree**

_____ 1. I feel a deep love for nature.*

_____ 2. Protecting the well-being of nature for its own sake is important to me.*

_____ 3. I often feel a sense of awe and wonder when I am in nature.*

_____ 4. I often feel a strong sense of care toward the natural environment.*

_____ 5. I often feel emotionally close to nature.*

_____ 6. I enjoy learning about nature.

_____ 7. I feel that closeness to nature is important for my well-being.

_____ 8. I feel content and somehow at home in nature.

_____ 9. I feel a personal sense of interconnectedness with the rest of nature.

_____ 10. I need to have as much of the natural environment around me as possible.

***Note to evaluator:** This is the 10-statement version of the LCN; the items marked with an asterisk (*) make up the 5-statement version of the scale.

Source: Perkins, Helen E. (2010). Measuring love and care for nature. *Journal of Environmental Psychology,* 30(4), 455-463.

This tool was developed and validated in English.

Tool #10

Nature Relatedness Scale

Developed by Elizabeth K. Nisbet, John M. Zelenski, and Steven A. Murphy

Photo: Shutterstock.com

What This Tool Measures

The Nature Relatedness (NR) Scale measures a person's emotional, cognitive, and physical connection to nature (Nisbet, Zelenski, & Murphy, 2009). The NR scale measures the overall construct, but three subscales or dimensions can also be calculated: Self (emotional), Perspective (cognitive), and Experience (physical). NR-Self reflects an internal, personal identity and connection to nature. NR-Perspective measures an individual's external worldview about nature and how that relates to that person's behavior. NR-Experience describes an individual's familiarity with nature and that person's desire for and comfort with being outdoors.

Tool Format

The NR scale consists of 21 statements to which people respond on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The scale includes reverse-scored items. Scores can be calculated to provide an overall score, as well as scores on each of the three dimensions. There is also a short-form (unidimensional) version of the scale, called the NR-6, which includes six statements (Nisbet & Zelenski, 2013).

How This Tool Has Been Used

The longer version of the tool was initially tested with undergraduate psychology students and used with adults in the community, the federal government, and the private sector (Nisbet et al., 2009; Nisbet & Zelenski, 2013). The NR scale has been used in a variety of countries and cultural contexts including Australia, Canada, Ecuador, Finland, Germany, the United Kingdom, and the United States, and has also been translated into Arabic, Chinese, Czech, French, Korean, Hungarian, Polish, and Turkish.

The Royal Society for the Protection of Birds adapted the shortened scale for use with 8- to 12-year-old children in the United Kingdom (Bragg et al., 2013). The shortened scale has also been used in Tokyo, Japan to assess whether a person's level of connection to nature can help explain the psychological and social well-being experienced by people who participate in urban gardening (Soga et al., 2017).

Variations and Modifications

Nisbet and Zelenski (2013) developed and tested a shorter version of the NR scale. The NR-6 contains six items that perform very similarly to the 21-item scale. The NR-6 is comprised of items representing two of the three factors from the original scale (Self and Experience), but is intended to assess the overall construct, rather than dimensions. The NR-6 scale is reliable, stable over time, and correlates with other environmental attitude scales and well-being indicators similarly to the full 21-item scale. The short form is appropriate when time or space is limited, but the 21-item scale provides a more nuanced and robust assessment of the nature relatedness construct.

Tips for Using This Tool

This tool can be used to collect baseline data or a snapshot of a person's connection to nature at a particular point in time. Practitioners who are implementing long-term programs or multiple interventions may use it as a pretest/posttest to detect changes in NR. Because the NR is relatively stable over time (e.g., it measures traits rather than more temporary states), it would be difficult to detect change after a short or low-intensity program.

Analyzing Your Data

These scoring instructions are for the 21-item scale.

Recording the Data

1) We recommend entering survey responses into a spreadsheet using a program such as Microsoft Excel. Create a spreadsheet with 21 columns for the 21 statements and a row for each participant. Assign each survey a record number, and enter each individual's responses (ranging from 1 to 5) across the corresponding row, noting that some statements are reverse-scored and need to be adjusted as explained in step 2. Enter a dot if the response was skipped.
2) Some of the statements in the NR scale are reverse-scored: a high score means a lower connection to nature. To be able to calculate these scores with the other statements (where a high score reflects a greater connection to nature) you must reverse the score. For example, if a person answered 1 on a reverse-scored statement, you would assign them a 5 in your Excel spreadsheet, or if they answered 2 on the survey, you would assign a 4. A score of 3 stays the same. If they answer 4, you would assign a 2, and if they respond 5, you would assign a 1. Statements 2, 3, 10, 11, 13, 14, 15, and 18 are all reverse-scored and need to be adjusted in this manner.
3) After you enter your data, we recommend that you take time to clean it up. Cleaning data is necessary because participants do not always respond carefully to surveys. For example, some participants may leave responses blank and others may circle the same answer for every question. We recommend reviewing your data and excluding individuals' responses if approximately 25% or more of their responses are blank, or if their answers display a strong visual pattern, like a zigzag.

Calculating NR Scores

1) Create an average (mean) NR score for each individual by adding all of their responses and dividing by the number of questions answered. Do not include skipped questions for which you entered a dot. The average will be between 1 and 5. NR scores of 1–2 indicate a lower connection to nature, a score of 3 indicates neither a low nor a high connection, and scores of 4–5 indicate a higher level of connection to nature.
2) You can also average the scores from all individuals to obtain an overall group score (this number will also be between 1 and 5). You could then compare an individual's score to the group average.

Additional Analytic Options

To further analyze your data, you could compare the averages for different groups or subgroups using a t-test in Microsoft Excel. For example, you could compare the NR scores of males and females.

Reliability and Validity

The NR scale is said to be valid because it correlates with the other scales measuring environmental attitudes and predicts behaviors consistent with the constructs, such as time spent in nature. The scale also has high internal consistency (Cronbach's alpha = 0.87) and has been found to be stable over time (Nisbet et al., 2009).

References:

Bragg, R., Wood, C., Barton, J., & Pretty, J. (2013). Measuring connection to nature in children aged 8-12: A robust methodology for the RSPB. *University of Essex*.

Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. *Frontiers in Psychology*, 4.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*. 41(5), 715-740.

Soga, M., Cox, D., Yamaura, Y., Gaston, K., Kurisu, K., & Hanaki, K. (2017). Health benefits of urban allotment gardening: Improved physical and psychological well-being and social integration. *International Journal of Environmental Research and Public Health*, 14(1), 71.

Photo: Martha C. Monroe

Tool #10: **Nature Relatedness Scale**

> *For each of the following statements, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think you should feel, or how "most people" feel.*

1	2	3	4	5
Strongly Disagree	**Disagree a Little**	**Neither Agree nor Disagree**	**Agree a Little**	**Strongly Agree**

_____ 1. I enjoy being outdoors, even in unpleasant weather.

_____ 2. Some species are just meant to die out or become extinct.

_____ 3. Humans have the right to use natural resources any way we want.

_____ 4. My ideal vacation spot would be a remote, wilderness area.*

_____ 5. I always think about how my actions affect the environment.*

_____ 6. I enjoy digging in the earth and getting dirt on my hands.

_____ 7. My connection to nature and the environment is a part of my spirituality.*

_____ 8. I am very aware of environmental issues.

_____ 9. I take notice of wildlife wherever I am.*

_____ 10. I don't often go out in nature.

_____ 11. Nothing I do will change problems in other places on the planet.

_____ 12. I am not separate from nature, but a part of nature.

_____ 13. The thought of being deep in the woods, away from civilization, is frightening.

_____ 14. My feelings about nature do not affect how I live my life.

_____ 15. Animals, birds, and plants should have fewer rights than humans.

_____ 16. Even in the middle of the city, I notice nature around me.

_____ 17. My relationship to nature is an important part of who I am.*

_____ 18. Conservation is unnecessary because nature is strong enough to recover from any human impact.

_____ 19. The state of non-human species is an indicator of the future for humans.

_____ 20. I think a lot about the suffering of animals.

_____ 21. I feel very connected to all living things and the earth.*

*__Notes to evaluator:__ The statements marked with asterisks make up the short-form version of the NR scale (NR-6). No items are reverse-scored in the short-form version.
In the long version, statements 2, 3, 10, 11, 13, 14, 15, and 18 are reverse-scored.

Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. Frontiers in Psychology: *Personality Science and Social Psychology*, 4, 1-11

Nisbet, E. K. L., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*, 41, 715-740.

This tool was developed and validated in English.

Tool #11

Nature Relatedness Observations

Developed by Enid Elliot

Photo: Shutterstock.com

What We Learn from This Approach

Observation is one approach to collecting information about how children express their feelings in nature that may offer a surprising view of children's experiences in a natural setting. Open-ended observation encourages you to pay close attention, to be curious about what you see, and to deepen and clarify your understanding of how children connect with the natural world.

How do children in your programs show their feelings for nature and demonstrate their connection with the natural world? How do the activities they engage in and their social relationships encourage a sense of connection with aspects of the world, whether that is water, trees, insects, soil, or other components of the natural world? How does their relationship with nature change over time? These are program-specific questions that observations can answer.

What This Approach Looks Like

As an assessment technique, observation can range from unstructured and spontaneous to a highly structured format with checklists for tallying predetermined behaviors. The approach presented here involves ethnographic observations (Curtis & Carter, 2013). It uses note-taking as children engage with nature, supplemented by photography, video recording, conversations with students and teachers, and focus groups with parents.

How This Approach Has Been Used

This observation approach was developed to document the first nature kindergarten in British Columbia, opened by the Sooke School District on southern Vancouver Island, Canada (Elliot & Krusekopf, 2017; Elliot, Ten Eycke, Chan, & Mueller, 2014). In addition to preparing children in traditional kindergarten skills such as reading readiness and social-emotional development, the nature kindergarten has a variety of goals, including aboriginal awareness, physical activities in natural spaces, and promoting children's awareness of their relationship to their place and the biota found there, also referred to as nature relatedness. Narratives of the children's environmentally responsible behavior and relationship with, as one child said, "our forest," emerged through anecdotes of their connection to land and place. Observations were made one morning per week with three different kindergarten classes over the course of three school years. Each class had 22 five- and six-year-old students and two teachers. The observer arrived before the children in order to have time to talk with the teachers before observing the students until lunchtime. The children went outside each morning into the forest of fir, cedar, and oak adjacent to their school or to a nearby beach. Conducting observations over the school year made it possible to see how students' behavior reflected rhythms of the natural world.

The school was built within the traditional territory of the Coast Salish First Nations, and its curriculum includes learning about First Nations' culture and relationships with the land. Although the observation procedure described here was designed for this place, it can be applied wherever children are given opportunities to interact with the natural world around them.

Variations and Modifications

There is another approach, called Learning Stories, that integrates this observational method into ongoing teacher practices, assessment, and professional development to document children's interests and strengths and to build bridges to families (Carr & Lee, 2019). The Learning Stories approach was originally created in New Zealand to make early education more inclusive of Maori children and their culture.

Tips for Using This Approach

The frequency and duration of observations can be adjusted, depending on time and resources available. Even if you cannot do weekly observations, try to go into the field often enough to develop comfortable familiarity with the children, and they with you. In places with distinct seasons, it is advisable to observe in all seasons, and to make observations over time in order to see if children's ways of relating with nature change. Your relationships with the children, the teachers, and the place will enrich your understanding of the children's experiences.

Before starting your observations, determine the underlying question or questions that you would like your observations to address. For example, at the Sooke nature kindergarten, the observer had these underlying questions: "What do these interactions indicate about the children's relationships with the natural environment?" "What do these interactions indicate—intellectually, physically, emotionally and spiritually—about the children's relationships with the life they find outdoors?" "Do the children see themselves as part of a web of relationships, and if so, how?"

The following principles, used to guide the Sooke nature-kindergarten observer, can serve as a reference when implementing an observation assessment.

- ***Be open-minded and give yourself time***
  Each observer brings his or her own history to a setting, and so does each child. Your own memories of being a young child in nature may emerge, and you can use your remembered feelings and sensations to enrich your experience with the children around you. Do not, however, assume that they are experiencing nature exactly as you did, or that they are all experiencing the same activities in nature in the same way. Observing children and glimpsing their own perspectives takes time, continuity, and being present to the actions, conversations, and concerns of individuals and their group. Even young children are capable of deep thoughts and reasons for decisions. Be open to whatever they share. Be aware of your expectations and be prepared to be surprised.

- ***Build relationships***
  Be present with the children. Listen to their conversations, engage with their interests, and maintain an open curiosity about what is happening. Let teachers and parents also see that you are there to learn. As people build relationships of trust with you, they will be more likely to share their thinking and experiences.

- ***Be aware of adults' influence***
  Children look to adults to help them make sense of their world, and an adult's approach and personal narrative of the value of nature can influence children's views. Notice whether teachers or parents talk about elements of nature as resources for consumption or if they see the world as a web of relationships of which people are a part. What ideas, actions, and stories do teachers and other adults share with the children? What behaviors in nature do they model? Do they place value on certain aspects of nature? Do they listen respectfully and convey that children's questions and theories about their discoveries in nature are worth investigation? Notice how children respond.

- ***Notice children's relationships***
  Notice the relationships with nature that children encourage in each other. How do children act within their world outside the classroom? What behaviors do they teach and model for each other? How do they inform each other about what they are learning in nature?

- ***Power of place***
  The place that children encounter is an agent in their developing relationship with nature. Notice: How does it reach out and teach about itself? What opportunities does it afford for sensation and action? What does it invite children to experience and do?

This Approach In Action

Taking Notes and Writing Them Up

- Take notes when you are with the children. As soon as possible after each observation session, reflect on the session and write up what you saw and thought. Your write-up will be a record of what stood out to you each day—interactions, impressions, sensations, reflections, questions, conversations you had, and conversations you overheard.
- Your notes will remind you of the flow of the day, but it's not possible to capture everything. You may need to reconstruct a more detailed narrative, including interactions and discussions that you had with children or educators that didn't lend themselves to note-taking.
- Some people talk into a recorder rather than writing notes. Others feel this is intrusive. Aim to be immersed in the experience, making notes as moments allow.

Using Photography

- Photographs are a good way to capture some of what children are doing and learning in nature. If you get permission (see "Ethics of Sharing," below), you can also share the photos with fellow researchers and others. At the end of each day, label your photographs, add explanatory notes, and catalogue them with your written record for that day.

Using Recording Devices

- Some people record conversations in the field using either audio or video equipment. This can be intrusive compared with taking notes, but if you do it frequently, children may begin to ignore it.
- Like photographs, video clips are a good way to document and reflect on what you saw, and a good way to share examples of children's experiences with nature with others.

Ethics of Sharing

- If you are planning to take photos or use audio or video equipment, be sure to let the children know in advance. Also let them know that they are free to tell you not to photograph them, or make video or audio recordings of them. Make sure both the children and their parents are comfortable with you sharing their ideas, stories, and images with others. Check if your school requires signed forms for parents' consent and children's assent (see p. 56).

Summarizing and Analyzing Responses

As your records of each day accumulate, they will give you a sense of how the children's relationships with nature change over time and across the seasons. Go back over your notes to see what evidence you have for impressions and reflections that seem important to you—but also look for repeating threads that may not have seemed important at the time, but now indicate a pattern. For example, did a site that you visited several times evoke a particular response from the children each time? Why might that be?

Look again through any photos you took and, just as you did with your notes, look for patterns. You may find that the subjects change over time. For example, you may have taken general photos of the group in the beginning, but as you became more familiar with the children and the daily process, perhaps you started to focus on particular aspects of children's experiences in nature. The photos may also show that these experiences changed as the children became more familiar and comfortable with routines and places. How do your written records help you understand what you see in the photos, and how do the photos reveal elements of the children's connection with nature that were missing from your notes?

Rewatching the videos you took and sharing them with teachers and other practitioners can help you understand how deeply children can engage with nature and how many different forms their connections to nature can take. Video clips can help you see peripheral activities in addition to the main action that was your focus. What do the behaviors of different children in a scene tell you about their different ways of engaging with nature, and how people in the scene may be influencing each other?

Collecting and analyzing observation material should be an iterative process. Periodically take time to go back over your records. Rereading your records may raise questions and send you out to do more focused observations when you are curious about something specific.

As you go back over your notes, and any photos, audio recordings, and video clips, you can begin to construct a research narrative that weaves in stories of your immersion in nature with the children, stories collected from the children, and stories from the educators. Together, these perspectives paint a picture of children's developing connection to nature.

Photo: Kelly Sikkema, unsplash.com

Supplemental Material

Informal conversations with teachers and parents, along with group interviews with parents, can fill in gaps in your narrative or provide insights into children's actions and statements.

Conversations with Teachers

As you are conducting observations, talk with the teachers about what you are noticing and elicit their thoughts about the children's developing connections to nature. The teachers know the children well, and they may be able to share related stories about the children's engagements and struggles in nature that can help you better understand your observations.

Conversations and Focus Groups with Parents

If you see parents during the school day, try to talk with them to gain other perspectives on your observations. Parents can give you insights into what is going on with their children, and can fill you in on the children's experiences with nature outside of school.

To gather parents' observations more systematically, parents of children in the Sooke School District nature kindergarten were invited to participate in focus groups of 12 to 15 parents at a time. Parents were asked general questions about their goals for their children and experiences with the nature kindergarten. (For guidelines on conducting focus groups, see Krueger & Casey, 2014.) The open-ended character of the questions encouraged parents to share their own observations about their children's developing connection to nature.

The following questions were asked during the Sooke nature-kindergarten focus groups:

1. Why did you choose the nature kindergarten?
2. Has it met your expectations?
3. Have there been any surprises?
4. Have there been any challenges?
5. What has been the effect on your children, would you say?
6. Any effects for your family?
7. What advice might you give to incoming parents?
8. Do you have any concerns about the transition to next year?

A questionnaire can be used a few weeks, or months, after the focus group to collect any additional thoughts from parents.

Listening to Children

Asking young children in the nature kindergarten direct questions about their relationship with nature is less useful than building familiarity and trust and listening to the stories, questions, and ideas that they instinctively share. Often, children try to answer adults' direct questions in the "right" way. They realize that adults have an agenda and usually want to do what adults want.

Trustworthiness and Credibility

In informal ethnographic observations, no two people will take notes and photographs and make video recordings in exactly the same way. In your report, you should explain the history and expectations that you brought to your work, and how your observations confirmed what you expected or surprised you. On occasion, it is helpful to bring other researchers to a project and compare their observations and reactions with your own. They may direct you to aspects of children's experience that you were missing or undervaluing. Regularly talking with teachers and parents can provide the background you need to help you interpret what you see.

This approach is less about whether the observations and analyses are "valid" in an absolute sense than about whether the narratives share some of the children's experiences and understandings. By gathering records of children engaged in natural settings, you can deepen other people's understanding of a program and expand thinking about what children experience and learn in that program.

Photo: Diana Akhmetfanov, unsplash.com

References:

Carr, M., & Lee, W. (2019). *Learning Stories in Practice.* Thousand Oaks, CA: Sage Publications.

Curtis, D., & Carter, M. (2013). *The Art of Awareness: How Observation Can Transform Your Teaching*, 2nd edition. St. Paul, MN: Redleaf Press.

Elliot, E., & Krusekopf, F. (2017). Thinking outside the four walls of the classroom: A Canadian nature kindergarten. *International Journal of Early Childhood*, 49(3): 375-389.

Elliot, E., Ten Eycke, K., Chan, S., & Mueller, U. (2014). Taking kindergartners outdoors: Documenting their explorations and assessing the impact on their ecological awareness. *Children, Youth and Environments*, 24(2), 102-122.

Krueger, R. A. & Casey, M. A. (2014). *Focus Groups: A Practical Guide for Applied Research. Thousand Oaks*, CA: Sage Publications.

Conducting Your Assessment

The following information answers some of the common concerns and questions practitioners express about using connection to nature assessment tools.

- **When and how often should I assess my audience's connection to nature?**
  This depends on what evaluation questions you are trying to answer. Are you trying to get a baseline understanding of your typical audience's connection to nature? Then you only need to collect information once, and you can do so whenever it is convenient. Are you hoping to understand whether a program or experience increases participants' connection to nature? In this case, you will need to measure their connection to nature both before the experience (pretest) and after (posttest) the experience, and then compare the two scores. Try to implement the pretest before participants arrive at the natural area; studies have shown that a "novelty" effect exists when people are initially exposed to a new environment, which could increase their excitement and artificially increase their scores. The posttest should be implemented at least one week after the experience if you want to know what participants have retained. Are you interested in understanding how different components of your program or activity affect your participants' connection to nature? Then you might want to make strategic observations at critical points throughout the program. Think about what questions you hope to answer through your nature connection assessments and any barriers you might face collecting your data.

- **When do I introduce the tool I've selected to my audience?**
  How you gather data from your audience depends on who your audience is and when and where you hope to collect information. For example, if you are interested in how your fifth-grade students are feeling before and after they go on a long hike in the woods, you could try using journaling to collect their reactions. Approaches like journaling can also be used as an embedded assessment, which is an assessment that is carried out as part of a class or activity rather than, for instance, more formal pretests and posttests. Or, are you interested in visitors' reactions to a multi-day trip in a national park? You might use an exit survey to find out more about their reactions. If you want pre-experience data, you could ask a teacher to distribute a survey in class before a school program, or you could email participants a link in advance. Keep in mind that some tools have specific guidance for using them. For example, a survey for young children might work best if it's read aloud as children provide answers.

- **Can I modify tools to meet my needs?**
  Some modifications are okay—and even necessary—for adapting a tool to different contexts. For example, you can change the landscape features that are referenced in a tool to make them locally relevant (e.g., "I enjoy being in the forest." can be changed to "I enjoy being near the ocean."). Some words or phrases can be edited to suit your audience, as long as you are careful to not change the meaning of the question or statement. You'll want to be careful that any modifications you make do not alter what the tool is measuring. Consider this statement from the Nature Relatedness Scale[17] as an example: "The thought of being deep in the woods, away from civilization, is frightening." You could change the word "civilization" to "people" to be more age or culturally appropriate. But avoid removing, replacing, or significantly altering questions. If you're unsure about any modifications, it is best to work with a researcher to recheck the reliability and validity of the tool before using it.

  — **Translation:** Keep in mind that if you decide to translate a tool into a different language, you may accidentally change the underlying meaning of some of the statements so the tool is no longer measuring the same construct. We recommend contacting the author of the tool to see if a translated version already exists. If not, we recommend you translate and back-translate the tool, and check with the author that the back-translated version is still accurate.

- **Is my tool culturally appropriate?**
  Our views of nature vary widely because they are influenced by how and where we grew up, our culture and traditions, the experiences that shaped who we are, and how we view the world. If you ask a group of people, "What's the first thing you think of when I say the word nature?" you're likely to hear a range of responses. Some might mention the flowers in their

grandma's window boxes that they watched grow each summer as a child. Others might talk about a forested wilderness they hiked through last year. Others still might reference a park where they walk their dog every day. It is important that tools for assessing connection to nature take such differences into account, so your assessments provide an accurate measure of connection to nature. Only then our can results help inform our thinking about how to improve nature connections in a range of settings and with a range of experiences. We recommend including someone on your team who can help you understand how your audience views nature and who can help you develop culturally relevant measures. (For example, will the language be familiar? Will the experiences described have meaning for your audience? How might your audience's culture and traditions influence their responses to the questions included in the tool?) We also recommend reviewing multiple tools in this guide to find the one that is most appropriate for your audience.

— **Urban applications:** Many of the tools in this guide have been developed with a particular definition of nature in mind. They may refer to wilderness, forests, and wildlife, all of which are typically found far away from the cities where most people live. For people who live in urban areas, "nature" may mean the tree outside the window or the squirrels in the schoolyard. To measure nature connection in urban audiences, it may be necessary to change the words we use to describe nature. As part of the development of this guide, a study was conducted to revise the Environmental Identity Scale (p. 30) so that it is better suited to measuring nature connection among urban audiences. If you are working with urban audiences, we recommend that you think carefully about which tool to use and whether the language it uses reflect how people experience nature in cities. Further research in this area is needed as people increasingly spend time in suburban and urban settings.[18]

[17] Nisbet, Zelenski, & Murphy (2009), see p. 46.

[18] DeStefano, S., & DeGraaf, R. M. (2003). Exploring the ecology of suburban wildlife. *Frontiers in Ecology and the Environment,* 1(2), 95-101.

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Evaluation resources

Does your program build or improve connections to nature? Do your participants' feelings about nature change due to your program? Are some program activities more effective than others at connecting people to nature? If you are interested in answering these types of questions, you may want to conduct a program evaluation. Evaluations can help you improve your programs and can also help you understand their short- and long-term impacts.

While many of the tools featured in this guide can be used as part of a program evaluation, the guide is not intended to be a comprehensive guide to evaluation. Fortunately, there are many other resources that detail program evaluation techniques. These resources can help you determine factors such as the appropriate number of respondents, how to select participants, and how to report your findings. The following resources are a good place to start for additional information and guidance on designing and conducting a program evaluation:

- **eeLEARN Research and Evaluation Online Learning Module**

  This module, created by NAAEE, guides you through the evaluation process and highlights case studies that illustrate evaluation in action.
  naaee.org/eepro/learning/eelearn/research-evaluation

- **Evaluating Your Environmental Education Programs: A Workbook for Practitioners (2014)**

  This workbook, written by Julie A. Ernst, Martha C. Monroe, and Bora Simmons, helps you plan and implement an evaluation. It is available for purchase through the NAAEE website.
  naaee.org/eepro/publication/evaluating-your-environmental-education

- **NAAEE (North American Association for Environmental Education) eePRO**

  eePRO is NAAEE's online hub for environmental education resources. You can search for resources related to evaluation.
  naaee.org/eepro

Ethics and evaluation

When using the tools in this guide to measure your audience's connection to nature or to conduct a program evaluation, you are collecting information from people. Ethical evaluation practices are designed to protect the rights of study participants both during the project and into the future. You do not need any formal approval to conduct an internal program evaluation or a pilot test, but we still recommend that you consider the ethical concerns discussed below before collecting data to ensure that you are respecting your participants' rights and their privacy. You will also want to make sure you clearly state your intentions to the participants.

It's critical that participants voluntarily give their informed consent to be part of your study. (Be aware that universities follow a specific protocol—see below.) Participants need to know what data you are collecting, why you are collecting it, and how you will use it. If you are working with children under 18 years of age, their parents or guardians should have this information. Another important concern is how you will protect the confidentiality of your participants. If the data will be kept confidential and used only to improve your program, make that clear to your participants before beginning, verbally or, preferably, in writing. If you intend to share your results outside of your organization, you should explain what you are collecting, why, and that you will be consolidating data and reporting at the group level, or anonymously if individual responses are reported.

If you are based at a university, you will need to contact your university's Institutional Review Board (IRB) for approval of your evaluation and to ensure that you are following the correct steps to protect your participants. If you are part of an informal learning institution, and are not connected with a university, check out the Informal Learning website[19] for resources on ethics and evaluation. For more information on human subjects research, visit the Office for Human Research Protections website[20] or take a course on protecting human research participants[21] for IRB approval.

[19] https://www.informalscience.org
[20] https://www.hhs.gov/ohrp
[21] https://phrptraining.com

Future research on connection to nature

While the development of this guide has helped us gain a comprehensive understanding of the high quality and accessible tools and strategies that exist for assessing connection to nature, it has also helped us identify additional questions that should be answered by researchers in this field. We've documented our initial efforts to fill some of these gaps in this guide by pursuing the answers to a number of research questions (see p. 58).

There is still room, however, to serve a greater range of audiences, improve existing tools, and design new approaches. For example, many existing tools for measuring connection to nature consider a specific context, which has historically been people visiting a natural area on a field trip, exploring a park, or in an outdoor education program. However, ongoing research continues to reveal that connecting people to nature in more urban settings is also valuable, and municipalities, schools, government agencies, and other entities and organizations are increasingly seeking to understand how they can improve this connection in those they serve. This pattern points to the need for tools that can serve a broader range of audiences (disabled, multicultural, non-United States-based, etc.) and different settings (urban to rural). The experiences people have with nature affect their relationships with nature. For example, hunters and fishers may not score high on the Love and Care for Nature Scale simply because they use different language to communicate their deep connection to nature. Additional tools to collect qualitative data (relying less on formal surveys or questionnaires) could result in new strategies that better serve a range of audiences.

What it means to experience nature is also evolving. Researchers are studying new ways for people to connect with nature "vicariously" through videos, virtual reality experiences, and interactive exhibits, and we're learning more about the benefits of bringing nature indoors by, for example, building "living walls" of plants or aquaria inside classrooms and businesses or designing rooms that offer abundant natural light and views to the outdoors. Understanding if and how these strategies help to build or maintain nature connections offers a compelling pathway for future research that can inform how we bring nature to the unlikeliest of places and how we develop cities and towns that better meet our need to connect with nature.

In a similar vein, questions arise about the types of settings that can foster a connection to nature. How much nature is "enough"? How is the concept of "connecting with nature" or the definition of nature different among urban populations? Can one tool work in all geographic areas? Moving forward in this work, it will be important to consider the ways in which connecting with nature varies from one place to another, from one way of knowing to another, and from one experience to another.

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How we developed this guide

This guide was developed through the collaborative efforts of a team of researchers, practitioners, and a committed funder. In 2018, the Pisces Foundation provided support for this project, which was designed to do the following.

- Identify environmental educators' needs for measuring connection to nature
- Collect and organize relevant research on measurement tools
- Convene researchers and practitioners to review tools and pursue research questions designed to make existing tools more useful and rigorous
- Share the resulting conclusions and collection of tools with researchers and practitioners

Martha Monroe (University of Florida), Nicole Ardoin (Stanford University), Cathy Jordan (Children & Nature Network, C&NN), and Judy Braus (North American Association for Environmental Education, NAAEE) provided leadership for this effort. Students from the University of Florida and Stanford University conducted a literature review and field scan to find researchers who are developing or improving tools that measure connection to nature.[23, 24, 25, 26] A search of the literature identified 23 commonly used tools, and the team added three tools that represent lesser-used techniques for measuring connection to nature (e.g., puppet show, board game, and photography). The team then identified experts working on connection to nature assessment tools and invited them to join a learning network to reflect on different approaches to understanding and measuring connection to nature. At the same time, students and faculty at Stanford developed a survey and analyzed data from C&NN's and NAAEE's networks to better understand what practitioners and researchers use and need for measuring connection to nature.

In October 2018, 23 of the identified researchers and practitioners met before NAAEE's Annual Research Symposium and Conference in Spokane, Washington, USA to participate in a two-day workshop. The attendees worked in groups to review, critique, and compare tools that assess connection to nature; identify ways to make tools more useful to a greater range of audiences and needs; and suggest topics for future research.

As a result of these group efforts, small research teams worked on the following projects in subsequent months:

- Revising the Environmental Identity Scale (see p. 30) to meet the needs of urban and cross-cultural populations and testing it in different national and international settings.
- Modifying the Connection to Nature Index (see p. 27) for different ecosystems and for use with other cultural groups.
- Developing and testing new qualitative tools for assessing connection to nature (see p. 39).
- Conducting a review of tools used to assess connection to nature in early childhood.
- Testing the correlations between the Inclusion of Nature in Self Scale, the New Environmental Paradigm Scale, and the Two Major Environmental Values Scale.

This guide synthesizes the results of our collective efforts to systematically analyze the connection to nature literature, collect and prioritize tools that assess connection to nature and serve a range of practitioners, convene researchers and practitioners for feedback and guidance, and pursue research questions designed to modify and improve tools for measuring connection to nature. We hope it has given you new insights, new tools and strategies, and new information to help you understand or improve how your audiences connect with nature. While implementing any kind of assessment or evaluation can be daunting, we hope that understanding your audience's relationship with nature, and considering the varied implications of making and improving those connections, will be an exciting and rewarding experience.

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Appendix A: Additional Connection to Nature Tools for Researchers

Many tools have been developed to assess connection to nature, but only a handful of them are featured in this guide. This curated list of references is for readers who want to dig deeper. Please keep in mind that this list contains only some of the additional tools that exist. It is also important to note that some of the following tools are more complicated to administer and analyze than many others, and may be of more interest to researchers than to practitioners.

Affinity with the Biosphere Interview
Giusti, M., Barthel, S., & Lars, M. (2014). Nature routines and affinity with the biosphere: A case study of preschool children in Stockholm. *Children, Youth and Environments*, 24(3), 16-42.

Allo-Inclusive Identity Scale
Leary, M. R., Tipsord, J. M., & Tate, E. B. (2008). Allo-inclusive identity: Incorporating the social and natural worlds into one's sense of self. In: H. Wayment & J. Bauer (Eds.), *Transcending Self-Interest: Psychological Explorations of the Quiet Ego* (137-147). Washington, DC: American Psychological Association.

Connectivity with Nature Scale
Dutcher, D. D., Finley, J. C., Luloff, A. E., & Johnson, J. B. (2007). Connectivity with nature as a measure of environmental values. *Environment and Behavior*, 39(4), 474-493.

Ecological Awareness Interview
Elliot, E., Ten Eycke, K., Chan, S., & Mueller, U. (2014). Taking kindergartners outdoors: Documenting their explorations and assessing the impact on their ecological awareness. *Children, Youth and Environments*, 24(2), 102-122.

Ecological Identity Scale
Walton, T. N., & Jones, R. E. (2018). Ecological identity: the development and assessment of a measurement scale. *Environment and Behavior*. 50(6), 657-689.

Ecospirituality
Suganthi, L. (2019). Ecospirituality: A scale to measure an individual's reverential respect for the environment. *Ecopsychology*, 11(2), 110-122.

Emotional Affinity Toward Nature
Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behavior*, 31(2), 178-202.

Implicit Association Test
Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology*, 24(1), 31-42.

Nature Connectedness Inventory
Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, 17(5), 577-575.

Nature Connection Index
Richardson, M., Hunt, A., Hinds, J., Bragg, R., Fido, D., Petronzi, D., Barbett, L., Clitherow, T., & White, M. (2019). A measure of nature connectedness for children and adults: Validation, performance, and insights. *Sustainability*, 11, 3250.


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Appendix B: Tools for Measuring Environmental Attitudes and Literacy

After reading this guide, you may realize that you are actually interested in measuring environmental literacy or attitudes, rather than connection to nature. Or you might want to measure your audience's environmental attitudes in addition to their connection to nature. An entire guide could be written on each of these topics! Below we've listed a few examples of tools that may help you measure environmental knowledge, environmental attitudes, and other outcomes with your target audience.

Environmental Attitudes

Children's Environmental Attitude and Knowledge Scale

Leeming, F. C., Dwyer, W. O., & Bracken, B. A. (1995). Children's environmental attitude and knowledge scale: Construction and validation. *The Journal of Environmental Education*, 26(3), 22-31.

Ecocentric and Anthropocentric Attitudes Towards the Environment

Thompson, S. C. G., & Barton, M. A. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology*, 14(2), 149-157.

New Ecological Paradigm Scale

Version for Adults: Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of Social Issues*, 56(3), 425-442.

Version for Children: Manoli, C. C., Johnson, B., & Dunlap, R. E. (2007). Assessing children's environmental worldviews: Modifying and validating the New Ecological Paradigm Scale for use with children. *The Journal of Environmental Education*, 38(4), 3-13.

Two Major Environmental Values Scale (2-MEV)

Bogner, F. X., Johnson, B., Buxner, S., & Felix, L. (2015). The 2-MEV model: Constancy of adolescent environmental values within an 8-year time frame. *International Journal of Science Educatio*n, 37(12), 1938-1952.

Environmental Education Program Outcomes

Environmental Education 21 (EE21)

Powell, R. B., Stern, M. J., Frensley, B. T., & Moore, D. (2019). Identifying and developing crosscutting environmental education outcomes for adolescents in the twenty-first century (EE21). *Environmental Education Research*, 1-19. Link to tool: https://frec.vt.edu/people/Stern/stern_docs.html

DEVISE Tools (Developing, Validating, and Implementing Situated Evaluation Instruments):

Cornell Lab of Ornithology Evaluation Research. Link to tools: http://www.birds.cornell.edu/citscitoolkit/evaluation/instruments

Environmental Literacy

Kentucky Environmental Literacy Plan

Kentucky Environmental Education Council. 2013. Kentucky Environmental Literacy Plan. Link to background and tools: https://keec.ky.gov/publications/Pages/default.aspx

National Environmental Literacy Project

McBeth, W., & Volk, T. L. (2009). The national environmental literacy project: A baseline study of middle grade students in the United States. *The Journal of Environmental Education*, 41(1), 55-67.

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Practitioner Guide to Assessing Connection to Nature

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