

HOW CAN PLACE ATTACHMENT IMPROVE SCIENTIFIC LITERACY?

DR BEN HAYWOOD AND
PROFESSOR JULIA PARRISH

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At **Furman University** in the US, **Dr Ben Haywood** and **Professor Julia Parrish** from the **University of Washington** are studying how citizen science programmes impact the relationships participants have with the places and ecology they study which might, in turn, increase scientific literacy. They are investigating whether our emotional attachments to the places around us can be harnessed in citizen science programmes to improve how well we understand our world.



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Fields of research

STEM Education, Conservation,
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Critical Thinking and People-Place
Relationships in Citizen Science

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TALK LIKE AN ...

ENVIRONMENTAL SCIENTIST

Citizen science — voluntary participation by members of the public in authentic scientific projects and programmes, often in an informal, hands-on way

Civic scientific literacy — an individual's ability to understand and use science to advance the common good and engage in public scientific discussion and decision-making

Meaning-making — the process where people interpret relationships, situations and self-image in light of their own knowledge and experience

Place attachment — a meaningful bond between a person and a specific place that may involve emotions, knowledge and beliefs, and behaviours

Sense of place — the particular characteristics of a place that make it what it is

Critical thinking — careful thinking that involves analysis of available information and arguments to form a sound judgement

Whether it is the place we grew up in, a frequented restaurant, or a local building where we

participate in a favourite hobby, most of us have specific places we feel attached to. This feeling of place attachment is being studied by Dr Ben Haywood at Furman University in South Carolina, as he asks the question of whether place attachment can affect how well we engage with and understand science and the environment. Ben is working with Dr Julia Parrish, a professor at the University of Washington, who is also the Executive Director of the Coastal Observation and Seabird Survey Team (COAST), an environmental, hands-on citizen science programme. Together, Ben and Julia are collaborating to research whether COAST

participant place attachment shapes understanding of the local environment and specific critical thinking skills.

"In COAST, we have seen time and time again the deep care that programme participants maintain for the places they study," says Julia. "At the same time, participants gain knowledge about science, scientific processes and the natural components they study. We wondered whether there was a link between connections to place and the learning that occurs there."

Why is citizen science important?

While formal science education – the science we study in school or college – provides important scientific skills and knowledge, a lot



Velevella velevella, pictured here, is a floating hydrozoan and a member of the cnidaria family (jellyfish and sea fans). Observations by COASST participants allowed programme leaders to analyse and publish on the occurrence of mass Velevella velevella beachings in 2021. (© Steve Morey)

of learning occurs outside of formal settings. Citizen science allows people to choose what project appeals to them, and engage in ways suited to them.

“Research in social psychology suggests that individual identity and life experience can influence whether or not science is perceived as relevant and influences the degree to which science is used in decision-making processes,” explains Ben. This means we learn and understand science best through a highly personalised lens – the sum of our lived experiences. “Historically, formal education has focused on science content in a universal, remote and de-contextualised form. On its own, this has failed to foster the kind of civic scientific literacy necessary in the 21st century,” says Ben.

Hands-on, out-of-doors, environmental citizen science, where participants have the chance to visit their data collection site repeatedly, can offer unique opportunities for learning and personal connection. “These projects allow for extended participation where people can refine their skills, integrate their observations across time, and develop a deeper understanding of the phenomena or place,” explains Julia.

How are Ben and Julia working on this?

COASST is a 23-year-old citizen science project, recruiting coastal residents in the Pacific Northwest and Alaska to participate in marine ecology and conservation research on the beach. To assess patterns of seabird mortality due to natural and human-induced events across both time and space, COASST participants collect data in three different areas: beached birds, marine debris and evidence of human use of the beach environment. “For this project, we focused specifically on the COASST beached bird module,” says Julia. “Most participants come to the programme with little-to-no bird identification experience and live within 20 km of their data collection beach.”

Ben and Julia used two social science research methods to gather data. Firstly, they surveyed nearly 300 participants about place attachment

and programme participation. Secondly, they interviewed 30 participants about critical scientific thinking and programme engagement.

What do the results show?

After analysing the research, Ben and Julia found that there are a certain set of place attachment catalysts that appear across diverse sample types within the COASST programme. These catalysts help explain why individuals feel attached to the places they monitor in the programme. “The six catalysts are self-identity, science affinity, natural/environmental bonding, science community bonding, family and friend bonding, and social rootedness,” says Ben.

For example, the self-identity category means that, for some individuals, the attachment they feel to their COASST beach relates to their sense that that place makes up part of who they are – their perception of self. Natural/environmental bonding means individuals feel connected due to the nature or environment in that place (such as the plants and animals found there), and social-rootedness means individuals feel attached because the place is part of their history or ancestry.

“This helps us understand how the power and significance of a place might be leveraged in a more personalised and targeted way through place-based citizen science programmes,” explains Ben. “The results show us how citizen science might help people harness the connection they have to a place and use that for positive action,” says Ben.

How has participating in citizen science affected people?

Ben and Julia found that COASST participants improve their identification accuracy over time – a result of repeated and consistent identification practice and engagement with COASST staff who train and provide opportunities to learn. “Participants experience deep learning about a specific place through repeated interactions, observations of the place, and processing of hands-on information with feedback from project staff,” says Ben. “We believe that the knowledge

participants gain about scientific processes or the ecology of that place is not limited to that one context. Instead, we suggest that such understanding goes beyond that one place. Accordingly, we hypothesise that the deep relationships and interactions between participants and specific places observed through the COASST programme have broader impacts on the ability of those participants to think critically and with a scientific lens.”

Ben and Julia’s results also show that engaging in the COASST programme influences participants’ sense of environmental responsibility and can increase their desire to engage in science-based processes to understand and monitor places of importance. “This can also lead to specific behavioural outcomes (like engaging in more citizen science) and means there seems to be a relationship between place attachment, science affinity, and a sense of stewardship and care,” explains Ben.

How can citizen science programmes be the best they can be?

Instead of just being the backdrop from which data are collected, strengthening or capitalising on the relationships between people and the places where they might engage in citizen science can play a central role in increasing interest in public research participation.

How exactly can programmes do this? “Firstly, research programmes can develop opportunities for local residents to collect repeated, frequent observations of a place or environmental phenomena,” says Ben. “Secondly, they should include tasks that require participants to ask questions and make sense of the data collected from a place, instead of just collecting data and submitting it. This might include making connections between the information collected and the lives and livelihoods of those that use the places under study. Thirdly, programmes should have a structure that supports peer interaction and engagement, so that participants share their knowledge of place with others and can compare and contrast experiences to make broader inferences.”

ABOUT ENVIRONMENTAL GEOGRAPHY

Environmental geographers study the relationships between organisms and the environment. Ben explains more.

“Given the growing separation between people and nature in our modern world, there is great need for geographers to find ways to reconnect people with the environment and educate them about how

their actions impact our ecological home.

“My research is rewarding because I get to ask questions about ecosystems, the creatures in them and the people and cultures that rely on and interact with them. I am able to learn about things that are fascinating to me and also find ways to better care for the things and places that I study.

“The opportunities are so diverse that it’s hard to think of a pressing challenge that isn’t open to geographical examination! For example, geographers look at how our coastlines will respond to sea-level rise, how political borders influence the products we buy in the grocery store, and how conservationists can manage conflict.”

Pathway from school to environmental geography

- Ben recommends studying an undergraduate degree in Earth and environmental science, biology, chemistry or mathematics. “However, environmental geography is a very interdisciplinary field, and those who want to work within it need training in social science as well – including psychology, sociology, political science and communications,” says Ben.
- If you are more interested in social science, consider studying this as an undergraduate degree and environmental geography as a postgraduate degree.
- The American Association for Geographers has an interactive map on college geography courses in the Americas: www.aag.org/guide-to-geography-programs-opportunities

Explore careers in environmental geography

- Environmental Science provides information on careers in environmental science, sustainability and geography. It also explains what being a geographer is like and has a list of various college programmes that will help you become a geographer: www.environmentalscience.org
- Because environmental geography is such a diverse area of study, the pay can vary widely. According to Glassdoor, the average salary of an environmental geographer in the US is \$61,164 per year. See the full range of salaries here: www.glassdoor.com/Salaries/environmental-geographer-salary-SRCH_KO0,24.htm

How did Ben become an environmental geographer?

“I spent much of my time outdoors as a child. I loved observing and learning about the animals and natural systems around me and was especially interested in birds. I became fascinated with farming and growing food. I also became interested in travel as a way to see new places and ecosystems, and developed a love of writing and forms of creative expression.

“I used to watch TV shows about nature and animals and read books about conservation, veterinary medicine and science fiction. Several passionate math and science teachers encouraged me to learn more about the world through observation, experimentation and curiosity.

“My career pathway has been anything but direct. My undergraduate degree focused on communications and marketing, and I thought I would be an environmental journalist. I spent years volunteering with environmental and educational non-profit organisations and realised that being able to understand environmental policies and systems of governance was critical

for protecting natural resources. I completed a master’s degree in public administration and environmental policy and pursued my doctorate in environmental geography. I’m glad to have this interdisciplinary pathway into STEM. My diverse education allows me to look at the scientific challenges we face today from different perspectives.

“Some of my most impactful experiences emerged from the volunteering I did as an educational guide at my local zoo, an assistant in a bird banding field station in college, and as an environmental education intern. Each of those experiences opened doors for me and shaped my next steps.

“The work I’ve done to inspire care for birds is perhaps my proudest work so far. Whether it’s through the courses I teach, the research I conduct or the writing I do to highlight the significance of our feathered friends, it gives me great meaning to be able to engage in this work.

Ben’s top tips

1. Try a lot of experiences and learn about as many different things as possible – this will help you identify what you are most passionate about. Doing something you love will lead you to your greatest success.
2. Spend time observing the natural world around you and recording your observations.
3. Foster skills at communicating and interacting with people, especially in negotiating multiple interests at once.
4. Always take advantage of opportunities to learn new things.
5. Start small and be persistent – small actions eventually add up to big results.

ABOUT MARINE ECOLOGY

Marine ecology is the study of how organisms in salt water habitats, from the deep sea to the open ocean to coastal beaches, survive and thrive in their environment. Marine conservation acknowledges the negative influence humans have on ocean systems and seeks to work cooperatively with non-science organisations to find lasting solutions.

“How will marine species deal with warmer or more acidic water?” asks Julia. “Will coastal development and the associated disturbance and pollution force some species to abandon nesting, feeding habitats, or migratory routes? What can we do about this? The chance to be a part of the solution, instead of just part of the problem, is the most rewarding thing.”

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HOW WILL MARINE SPECIES DEAL WITH WARMER OR MORE ACIDIC WATER?
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Being a marine ecologist might allow you to work in some fantastic places. “I’ve been tremendously privileged over my career to work on remote seabird colonies and on research vessels in some wild, beautiful places that most people will never see,” says Julia.

Photo caption: The Kalaloch area of Olympic National Park in Washington offers a sample of the variety of wild and rugged coastal habitat protected by the park. Beach 4 (pictured here) is one of several beaches monitored by COASST participants in the area. (© Brian Burgess)

Explore careers in marine ecology

- The MarineBio Conservation Society is a great resource for learning more about ocean life and marine science. It also has a page specifically on marine ecology: www.marinebio.org/conservation/marine-ecology

Pathway from school to marine ecology

- Some universities offer degrees in marine ecology, but studying a degree in ecology, marine biology, environmental science, geology, chemistry or oceanography is also an option.
- Julia advises, “It’s important to be able to translate phenomena into numbers to enable analysis, so take statistics and data science courses.”
- Julia also encourages students to learn about science history and ethics. “We’re taught that science is a truth, but that’s as subjective as any other statement. What is studied, how it’s studied and how we understand the world is as much about who is in charge as anything else. It’s critical to go into science with open eyes to that bias if we hope to create an equitable and truly creative space.”

How did Julia become a marine ecologist?

“I had a chance to spend an undergraduate semester at the Duke Marine Lab. It was slightly scary as it meant leaving my university and friends and going somewhere new, but it was a great experience. It opened up graduate school as an opportunity for me, and I never looked back.”

“I’m proudest of COASST. It’s an internationally acclaimed citizen science programme producing great science that is published in scientific literature and highly cited by other marine scientists and conservationists, simultaneously digging deep into why people join, what makes them stay, and how they understand themselves to be a part of the science team.”

Julia’s top tips

1. Get out there. Observe. Get wet and muddy. Pick up slimy things. Ask questions!
2. Don’t try to leap directly into saving the world. Take the time to understand the world and how it works. Otherwise, you may end up saving the wrong parts or missing what’s important.
3. Everyone will have unique choices and opportunities. Don’t be afraid to take advantage of them and go outside of your comfort zone.



Carcass identification is often a group activity that relies on collective experience and feedback for accuracy. Here, three COASST participants on a beach on the shores of Mendocino National Forest (CA) work together to examine a beach cast bird. (© Julia Parrish)

ENVIRONMENTAL SCIENCE

WITH DR BEN HAYWOOD AND PROFESSOR JULIA PARRISH

Talking points

KNOWLEDGE & COMPREHENSION

1. What is place attachment?
2. What is citizen science, and why is it important?
3. What is civic scientific literacy?
4. How long has COASST been running, and what is its purpose?
5. Why are citizen science projects like COASST important?

Application

6. What would you find interesting about being involved with COASST or another citizen science programme focused on marine ecology? What do you think you could learn from the experience?

Analysis

7. What are the benefits of citizen science? How are these benefits connected to place attachment based on Ben and Julia's research? How is citizen science different from formal science education or research?

Evaluation

8. "Formal education alone has failed to foster the kind of civic scientific literacy necessary in the 21st century." To what extent do you agree with Ben's comment? In what way have your own experiences of science – both in and out of school – impacted your ability to "understand and use science to advance the common good and engage in public scientific discussion and decision-making?"
9. According to Ben and Julia's research, there are several elements that can cause participants in citizen science to feel attached to a place including self-identity, science affinity, environmental bonding, and family and friend bonding. Which of these reasons do you relate to the most? Why else do you feel connected to places that are important to you?

CREATIVITY

10. What type of citizen science programme would you create? What issue would you focus on, and why? Where would your programme be located?

Activities

1. The importance of place

Ben says, "I have a strong attachment to the small patch of woods behind my childhood home. The trees, rocks and animals there spurred my interest in the natural world. I also had so many adventures on the coastline of North Carolina growing up. Even today, when I visit those places, I have a rich flood of memories that make me feel connected to and responsible for protecting that area. When I feel sand or smell salty air, it takes me right back to that place."

Think of an outdoor place that means something to you. Draw an image of this area, and ask yourself:

- What do I like to do in this place?
- Does this place have a certain smell?
- What can I hear when I am there?
- Do I go there alone or with other people?
- Have I always felt connected to this place or did my attachment grow over time?
- How do I feel when I spend time there?
- How would I feel if I could no longer visit?

Now, do some research on this area:

- Which ecological cycles take place there?
- Do plants and animals depend on it? In what ways?
- What are the human social and cultural uses of this place?
- How could a citizen science project help you and others better understand, monitor or care for this place?

2. Get involved!

You could:

- Organise a trash clean-up/beach clean with friends
- Count the birds you see in your local area
- Talk to teachers about opportunities to conduct research in your local environment
- Find a citizen science project to join:
scistarter.org/finder is a great place to find projects all over the world

www.citizenscience.gov/catalog/# has hundreds of projects you might join in the US.

www.nps.gov/subjects/citizenscience/be-a-citizen-scientist.htm has a list of projects in national parks in the US.

Ben also recommends joining a science or nature club at your public library or school: "The more you engage, the more people you will meet, and the more opportunities you will have to learn and grow."

More resources

- A BioBlitz is a species inventory that involves observing and documenting living things in a certain area. National Geographic has a video on how to organise your own BioBlitz: education.nationalgeographic.org/resource/do-it-yourself-bioblitz
- Explore citizen science programmes across the US: www.citizenscience.gov/toolkit/case-study



COASST participants record detailed notes about the bird carcasses they find using a kit of instruments that include custom record sheets, tools for measuring and a camera to take photos for verification. (© Steve Weileman)



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© Martin Renner



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Photo montage

Top row: left: Giants Graveyard, an area in Olympic National Park, is one of the many beaches surveyed by COASST participants for beach cast birds and marine debris.

Middle row: left: Julia takes a break from bird watching on a ferry before hopping into a small plane to fly out to Kayak Island (AK) for a three-day marine debris sampling adventure.

Centre: Ben records information about a common yellowthroat as a part of a long-term avian conservation monitoring project.

Right: Julia demonstrates how to analyse the shape and size of an unidentified bird wing with two COASST participants during an on-site programme training in Homer, Alaska.

Bottom: Julia pauses for a break while conducting a multi-day survey on Kayak Island (AK). Because many coastal surveys involve travelling to remote and isolated places, it never hurts to bring along companions like the canine friend in the photo.

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