

Science Career Cards: Water Theme

From the Natural Inquirer: <https://naturalinquirer.org/collector-cards>

To use with the Earth Around Us Water Tent Follow-up Activity:
Make a Career Connection.



Welcome to the *Natural Inquirer* Scientist & Engineer Cards!

These cards are a product of FIND Outdoors and highlight Forest Service scientists and engineers who conduct research across the Nation and the world.

Who is FIND Outdoors?

Formerly the Cradle of Forestry in America Interpretive Association, FIND Outdoors is a re-imagined 501(c)3 nonprofit organization based in Pisgah Forest, North Carolina. We are the Southeast's leader in providing access to public lands, environmental education, recreation, and front country camping experiences. We maintain and operate 21 recreation, education, and camping facilities across western NC, northern GA, and beyond — serving approximately 800,000 visitors each year with over 150 recreational and environmental education programs, special events and tours.

Our story is rooted in education about the **forest**.
Our passion is to help people become **inspired**.
Our goal is to help people connect with **nature**.
Our drive is to help people learn through **discovery**.

We help people... FIND Outdoors
We are... FIND Outdoors
goFINDoutdoors.org

What is the Forest Service?

The mission of the Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. There are 154 national forests and 20 grasslands in 44 States, Puerto Rico, and the Virgin Islands. National forests and grasslands make up 8.5 percent of the total land area in the Nation. Approximately 550 scientists work for the U.S. Forest Service in many different research topics.

For more information, visit <http://www.fs.fed.us>.





Meet the Scientist!



<http://www.naturalinquirer.org>



Dr. Adams is a trained professional. The frog she is holding was not harmed and was released back in to the wild. Never approach or handle wildlife.

An aquatic ecologist studies interactions in aquatic ecosystems and an astacologist studies crayfish. I often focus on interactions involving fish and crayfish.

Dr. Susie Adams
Aquatic Ecologist/Astacologist
Ph.D., University of Montana
USDA Forest Service scientist

Important Scientist Characteristics

Research requires many abilities. Doing research is often logical, precise, and repetitive, but a surprising amount of creativity goes into figuring out the most interesting questions to ask and the best ways to get the answers. Curiosity is critical to loving my work. Good writing skills are essential to everything!

Example of a simple research question I have tried to answer:

How do small reservoirs on headwater streams affect crayfish communities downstream?

Technology or equipment used in research:

We use backpacks and boat electrofishers. These tools send electricity into the water causing fish to experience galvanotaxis, in which their muscles tighten and cause them to swim toward the electricity. The fish are stunned, and we collect them in dipnets. We study them, allow them to recover, and release them.

Most Exciting Discovery

In the Clark Fork River, Montana, biologists thought there was one species of sculpin, a small bottom-dwelling fish. My colleagues and I discovered there were really two species, and both are undescribed (meaning they are unnamed). The two species differ in behavior and where they live in the streams.

When did you know you wanted to be a scientist?

When I was 5 or 6, my mom started a Ranger Rick Nature Club for the neighborhood kids. I think that's when I decided to become a biologist. My challenge later was figuring out exactly what kind of job I wanted and how long I was willing to go to college.

<http://srs.fs.usda.gov/staff/768>



Meet the Scientist!



A herpetologist studies reptiles and amphibians. I assess how reptile and amphibian populations respond to forest management and land use changes.

Dr. Tim Baldwin

Herpetologist

Ph.D., Alabama A&M University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

I use careful observation, extensive record keeping, and my statistical background in my research. Amphibian and reptile communities are exciting to me. It is important that I take notes, photographs, and keep track of the information that is compiled for each captured individual.

Example of a simple research question I have tried to answer:

How does forest management influence amphibians' abilities to reproduce in ephemeral, or temporary, pools of water?

Technology or equipment used in research:

I use snake hooks. A snake hook helps me immobilize a snake so that I can measure and weigh the individual. Once the animal is processed, I return the organism to the environment. Snake hooks can also be used to lift logs or other cover objects that herpetofauna use for refuge.

Most Exciting Discovery

I found that eastern spadefoot tadpoles (*Scaphiopus holbrookii*) will often aggregate and consume other larval amphibians, including individuals that may be too large for one tadpole to eat. This collective feeding resembles a feeding frenzy.

When did you know you wanted to be a scientist?

I have wanted to work with animals since I was 4 years old. In college, I worked as an intern on several wildlife studies, and these experiences gave me the opportunity to decide that I wanted to pursue a career in herpetology.

<http://www.naturalinquirer.org>



Meet the Scientist!



<http://www.naturalinquirer.org>



Dr. Barnett is holding a hellbender which is the largest salamander found within the United States.

An aquatic ecologist studies the interactions between aquatic animals and their environment and an astacologist studies crayfish. I focus on how the changes humans make in aquatic ecosystems and their surrounding watersheds impact aquatic animals, especially crayfish.

Dr. Zanethia Barnett Aquatic Ecologist

Ph.D., University of Mississippi
USDA Forest Service scientist

Important Scientist Characteristics:

I have to think creatively when trying to answer a scientific question. My ability to think outside the box and pay attention to details enables me to fully understand how small changes affect the environment.

Example of a simple research question I have tried to answer:

How do dams and man made lakes impact gene flow of stream crayfish above and below dams? Gene flow is the movement and mating of individuals from one population to another. When crayfish mate with crayfish from another population they pass on genetic material that is important to the survival of the populations.

Technology or equipment used in research:

We use small, oval PIT tags to monitor crayfish movement. PIT tags are inserted into the hard, outer shell of a crayfish. The tags link to antennae used to track crayfish movement throughout their environment.

Most Exciting Project or Discovery

In Alabama streams, crayfish were not able to move past dams to mate with crayfish on the other side of dams. This fragmented or separated crayfish populations above and below dams. Because the crayfish were separated by dams, they could no longer pass on their genetic information which is important to the survival of crayfish populations. Now we must find ways to connect crayfish above and below dams to prevent the reduction and loss of crayfish populations.

When did you know you wanted to be a scientist?

I have always loved the outdoors and spent a lot of time fishing, hunting, and exploring aquatic environments growing up. However, I did not realize I wanted to become a scientist until my second semester of college after taking an animal science course. I was an agricultural economics major and realized I enjoyed my science classes and field experiences more than economics.

<https://www.srs.fs.usda.gov/staff/952>



Meet the Engineer!



A construction engineer is responsible for making sure that all of the world's infrastructures (e.g. the roads you drive on, the buildings that you go to school in, the systems that supply the water you drink) are built safely and correctly.

Leslie J. Boak
Construction Engineer
B.S., Oregon State University
USDA Forest Service engineer



<http://www.naturalinquirer.org>

Important Engineer Characteristics

The number one job of any engineer is to be a problem solver. Good critical thinking is the most important trait of a construction engineer. You need to think on your feet in response to the differences between what the plans say and what fits on the ground.

Example of a simple question I have tried to answer:

How can we build a better road crossing to limit impacts to wildlife? The natural world sometimes conflicts with the human-made world. We need to be flexible enough to make changes to the plans so they match up with what is on the ground.

Technology or equipment used in my work:

Plans and specifications are the most important things I have on a job. Plans are the pictures that I use to build a project. Specifications tell me what the materials and requirements are to construct the project.

Most Exciting Work

One of my favorite projects was replacing an undersized culvert with an aquatic species culvert. Culverts are pipes that help something, such as a stream, pass under a road. We went back to check the project after it was finished and we saw salmon swimming up the stream!

When did you know you wanted to be an engineer?

I have always liked building and creating things. My grandpa gave me a hammer, nails, and scraps of wood to build with when I was just a little girl. It is fun to make something useful out of a big pile of random stuff. Construction engineering seemed like the perfect fit for me.

<http://www.fs.fed.us/eng/>



Meet the Scientist!



As a biological scientist, I study environmental processes related to how human and forest management activities will impact water and air quality.

Johnny Boggs
Biological Scientist
M.S., Alabama A&M University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

Curiosity and creativity are big parts of research and discovery. Formal training in math and science is also necessary to answer complex ecological questions. These talents and skills complement each other and keep exploration fun and interesting with the goal of producing sustainable environmental conditions for future generations to enjoy.

Example of a simple research question I have tried to answer:

Forestry Best Management Practices (BMPs) are designed to prevent water pollution during tree harvest operations. A key research question that I am trying to answer is, how effective are forestry BMPs at keeping streams and rivers clean and healthy?

Technology or equipment used in research:

I use Sapflow Sensors and Sigma Samplers to collect large volumes of tree water use and streamflow data. I then use data analysis and statistical software to process these data and address a series of research questions related to forest water use and water pollution.

Most Exciting Discovery

I discovered the effects of soils on the amount and health of water in some of North Carolina's forested areas. Since water runs underground to streams and water supply reservoirs, well-planned forest management helps reduce the amount of pollution in local water supplies. Land managers will use my discovery to improve water quality for human use.

When did you know you wanted to be a scientist?

I was always curious about nature and how all aspects of it worked as an interconnected system. I started thinking about forestry or environmental science as a career after I took an environmental science class in high school.

<http://www.forestthreats.org/>



Meet the Scientist!



A geographic information system (GIS) is a computer system that can capture, store, analyze, manage, and display geographic data. A GIS professional uses the computer system to perform spatial analyses on geographic data to answer scientific questions and present the results in maps.

Erika Cohen

Physical Scientist

Ph.D., University of Mississippi
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

My ability to be detail-oriented and enjoy a challenge contribute most to my research. My work is like putting together a puzzle. The data layers are my puzzle pieces, and I have to figure how to put them together to answer the scientific question.

Example of a simple research question I have tried to answer:

I work with the Water Supply Stress Index (WaSSI) model. This model looks at the effects of climate change, land use change, and water use change on water supply across the United States. One question I have asked is, will climate or land use changes have the most impact on water supply?

Technology or equipment used in research:

I use computer mapping software called ArcGIS and a computer programming language called Python in my research. I use Python to automate tasks too complex to do by hand. I use ArcGIS for spatial analysis. Spatial analysis takes different kinds of information, each connected to a location on a map, and combines it. The result is like a map sandwich, with each location on the map having layers of information.

Most Exciting Discovery

Using the WaSSI model we have determined that on a regional scale future climate could have a greater impact on water stress than land use changes, however on a local scale land use changes have a great impact on water stress.

When did you know you wanted to be a scientist?

I knew in the 7th grade that I wanted to become a scientist. My initial goal was becoming a seismologist, which required majoring in geology. My focus changed from seismology to GIS during my sophomore year of college. I loved that GIS could be applied to any discipline.

<http://www.forestthreats.org/research/tools/WaSSI/>



Meet the Scientist!



A wetlands ecologist studies land-based ecosystems that often flood or pond with water, such as swamps and marshes. My specialty is wetland plant communities.

Dr. Diane De Steven

Wetlands Ecologist

Ph.D., University of Michigan
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

It's essential to be curious and interested in solving problems. I pay attention to detail and make careful observations so that my conclusions are based on logic and evidence. Good writing is important. I also enjoy working in the field, even if it's wet and muddy!

Example of a simple research question I have tried to answer:

How do different patterns of flooding affect which plant communities occur in wetlands, and how can we use that knowledge to manage or restore wetlands? One finding is that length of the flooding period affects whether a wetland is forested or herbaceous.

Technology or equipment used in research:

I use basic field equipment such as measuring tapes, compasses, and water-level gauges. In the lab, I need a stereomicroscope for identifying plant species. A computer is essential for analyzing data, making maps, and studying wetland landscapes in a geographic information system (GIS).

Most Exciting Discovery

It's hard to choose! In one study, I analyzed a large number of wetlands that were restored by a federal conservation program (Wetlands Reserve Program). I was excited to find that some unusual and creative projects were helping to conserve and restore important floodplain forests in the southeast U.S.

When did you know you wanted to be a scientist?

As a child I was fascinated by nature, even if it was just learning about the insects and plants in my backyard. In high school and college, I found that I could study biology in-depth and pursue a career doing field research on natural systems.

<http://www.srs.fs.usda.gov/staff/730>



Meet the Scientist!



An ecologist studies interactions between living things and their environment. As an ecologist, I often focus on streams, rivers, and riparian ecosystems

Katelyn Driscoll

Ecologist
M.S., University of Montana
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

Curiosity about how different parts of an ecosystem fit together motivates my work. I enjoy spending time outdoors, and making careful observations of how streams and rivers interact with their floodplains. I'm enthusiastic about ecology, and I love to read, think, and write about ecosystems.

Example of a simple research question I have tried to answer:

How does the timing and size of a flood affect habitats in a river and on the floodplain? What types of patterns exist in the development of river and floodplain habitats during a flood? A floodplain is the low-lying area near a river which is subject to flooding.

Technology or equipment used in research:

I use cameras mounted on a small airplane to take pictures of a river and its floodplain. I use a computer program that identifies different aquatic and floodplain features like pools, springs, or cottonwood trees. I use geographic information systems (GIS) to measure and map the river habitats.

Most Exciting Discovery

One summer I worked on a project that collected data on the condition of backcountry streams in the northwest U.S. I got to work in beautiful creeks and hike and camp in stunning mountains.

When did you know you wanted to be a scientist?

I always loved exploring and being outdoors. When I was a kid, my family often went on "creek walks." We would walk down a stream and look at the plants, rocks, birds, amphibians, and bugs. I learned I could do this for a living in college during my first ecology course.

<https://www.fs.fed.us/research/people/profilephp?alias=katelyndriscoll>



Meet the Scientist!



<http://www.naturalinquirer.org>



Aquatic ecologists study how forests and other environmental factors influence the plants, animals, and ecological processes in aquatic ecosystems. This knowledge helps resource managers better manage land and aquatic habitats so they provide clean water for people and wildlife.

Dr. Sue Eggert Aquatic Ecologist

Ph.D., University of Georgia
USDA Forest Service scientist

Important Scientist Characteristics:

Along with curiosity and a passion for understanding nature, an aquatic scientist should be detail-oriented, be able to think outside the box, and be persistent in the face of obstacles.

Example of a simple research question I have tried to answer:

Water quality and quantity has become a critical issue globally. My research addresses the questions: How does land management and global change affect the functioning of rivers, lakes, and ponds? What management practices work best to protect water quality and quantity?

Technology or equipment used in research:

We use several samplers, including Surber, Hess, and core, to collect invertebrates, like insects, from a known area of a stream bottom. The invertebrates are identified and counted in the laboratory before entering the data into a computer. This process helps us understand the response of stream invertebrates to local and global disturbances, like pollution or climate change.

Most Exciting Project or Discovery

Small streams are tightly linked to forests and the larger river network through the inputs of leaves and wood from trees on river banks. Unexpectedly, I found that the slimy, biofilm layer on submerged wood in aquatic ecosystems can be an important food source for some invertebrates.

When did you know you wanted to be a scientist?

As a kid, I spent a lot of time in streams and lakes catching aquatic animals and identifying them with books borrowed from the library and a homemade microscope. I learned much about aquatic animal identification, behavior, and life history which led to a career in science.

<https://www.nrs.fs.fed.us/people/seggert>



Meet the Scientist!



An ichthyologist studies fishes. The word ichthyologist comes from the Greek words “ikhthus” which means fish and “logos” which means study.

Dr. Becky Flitcroft

Ichthyologist

Ph.D., Oregon State University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

I'm very curious. I like to observe what happens in nature. It is important to be organized, take good notes, and think logically. I am good at writing and math, which have been important skills. I have also learned to be a storyteller, which helps people understand my research.

Example of a simple research question I have tried to answer:

Why do juvenile salmon live where they do?

Technology or equipment used in research:

Rivers are my laboratory. To watch fish in the wild, we get into the river. We use snorkels, drysuits, waders, nets, buckets, and electroshockers. We use scales to weigh fishes, measuring tapes for measuring fish length, computers to analyze fish data, thermometers to measure the temperature of the water, and Global Positioning System (GPS) units and maps to know our location.

Most Exciting Discovery

Salmon use different habitats at different parts of their life. Young salmon can't swim well, so they need sheltered pools. Adult salmon swim well, and lay their eggs where water moves quickly. We find more young salmon where pools and fast water habitat are close together. We find fewer young salmon where pools and fast water are farther apart.

When did you know you wanted to be a scientist? I knew I wanted to be a scientist after I finished my undergraduate degree in college. I found that I loved working outdoors, and I became fascinated by salmon and how they use their habitats. I had a lot of questions about how fish chose to live in the habitats where we found them.

<http://www.fs.fed.us/pnw/lwm/aem/people/flitcroft.html>



Meet the Scientist!



<http://www.naturalinquirer.org>



A social scientist in the USDA Forest Service studies what people think and do in relation to natural resources and the environment.

Dr. Kristin Floress Social Scientist

Ph.D., Purdue University
USDA Forest Service scientist

Important Scientist Characteristics:

My best skill is my willingness to fail and try again. A lot of what we do in science doesn't work out on the first, second, or even tenth try. A good scientist isn't scared to be wrong, and they work on a problem until they get it right!

Example of a simple research question I have tried to answer:

One big environmental issue is water pollution. People have an important role in keeping pollutants, like fertilizers and pesticides that are often used on lawns, out of streams, rivers, and lakes. One question I try to answer is: What alternatives to fertilizer and pesticides do people like when it comes to taking care of their lawns?

Technology or equipment used in research:

Important technologies when you are a scientist include specialized programs used to analyze data. Data can be numbers, words, pictures...almost anything! We use computer programs to take a lot of individual observations and make sense of them through statistics and other methods.

Most Exciting Project or Discovery

My most exciting project was working with a colleague at the United Nations Food and Agriculture Organization in Rome to understand why farmers in Africa use Climate Smart Agriculture practices.

When did you know you wanted to be a scientist?

When I was in my senior year of college, I changed my major to general studies so I could take forestry classes, and then went on for my master's degree. Then I followed an opportunity to get my Ph.D., even though I hadn't planned on it.

<https://www.nrs.fs.fed.us/people/kfloress>



Meet the Scientist!



A hydrogeologist is a person who studies the ways that groundwater (hydro) moves through the soil and rock of the earth (geology). Hydrogeologists evaluate the quantity, quality, reliability, and sustainability of groundwater.

Joe Gurrieri Hydrogeologist

M.S., University of Connecticut
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics:

A hydrogeologist must have scientific knowledge across a range of disciplines, the ability to visualize geology and conceptualize groundwater flow in three dimensions, and the skill of drawing conclusions from incomplete information.

Example of a simple research question I have

tried to answer: How fast does groundwater move through the ground, and what flow path does it take on its journey? I have been asked to answer this question many times for different reasons including tracking the movement of pollutants and determining groundwater connections to surface water.

Technology or equipment used in research:

My hiking boots are the most important piece of equipment. A geoscientist needs to spend time in the field to be able to understand how natural systems operate. Wells are also important. Wells are used to sample groundwater quality and measure the depth to the water table.

Most Exciting Discovery

Large mines are my favorite projects to work on. Mining huge holes and tunnels in the ground can severely reduce or pollute groundwater in aquifers. Analyzing the effects of mining on groundwater dependent ecosystems like springs, streams, lakes, and wetlands is very challenging and rewarding.

When did you know you wanted to be a scientist?

When I was a young boy, I watched TV shows about scientists doing all kinds of exciting things like going to exotic places, climbing mountains, and scuba diving. I remember saying to myself, "I want to be a scientist when I grow up."

<https://www.fs.fed.us/geology/groundwater.php>



Meet the Scientist!



As an aquatic ecologist, I study animals that live in rivers and lakes and how they interact with each other and their habitats.

Dr. Wendell Haag

Aquatic Ecologist

Ph.D., University of Mississippi
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

I think curiosity, critical thinking, and creativity are my most important skills. You've got to be curious to be a scientist, but critical thinking is also important so you don't automatically believe everything you read. Creativity helps you see things in different ways and makes your work more interesting to other people.

Example of a simple research question I have tried to answer:

How does mussel reproduction work, and how is it affected by various changes that people have made to aquatic habitats? For example, I've done experiments to see how fertilization of mussel eggs and survival of baby mussels is affected by water pollution.

Technology or equipment used in research:

I use a device called a hookah rig to dive for mussels. It has an air compressor mounted on an inner tube and a hose with a regulator that I breathe from. This works better than scuba diving because I don't have to lug heavy air tanks. We also use microscopes and equipment to measure water quality.

Most Exciting Discovery

My most exciting discovery was learning just how different mussel species are from each other. People used to think mussels were pretty boring and that all mussels lived the same way. It turns out that some species live only 5 years but others live over 100 years. They also do all kinds of cool things we didn't know about.

When did you know you wanted to be a scientist?

I knew I wanted to be a biologist by the time I was about 14.

<http://www.srs.fs.usda.gov/staff/260>



Meet the Scientist!



As a fisheries biologist, I study fish and how different features of their habitat affect their distributions and populations. Once we have learned enough about a fish species, we create resources that make it easier for people to protect them.

Dr. Dan Isaak Fisheries Biologist

Ph.D., University of Wyoming
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

The ability to work cooperatively with other people as part of a team, being good at math, public speaking, writing, and graphic design are all important skills in my career.

Example of a simple research question I have tried to answer:

How will climate change affect cold-water fish like trout, salmon, and char in the Rocky Mountains?

Technology or equipment used in research:

We use small digital sensors to record water temperatures in rivers and streams. Each sensor records the water temperature every hour. We put hundreds of sensors out across the Rocky Mountains so we can understand how climate change may affect fish habitat.

Most Exciting Discovery

I discovered that steep, cold mountain streams will act as climate refugia to preserve trout populations during this century. Climate refugia are places which will have good habitat for an animal, even after the climate changes.

When did you know you wanted to be a scientist?

During my freshman year in college, I learned you could have a career in fisheries. That meant I could muck around in streams and rivers while chasing fish, like I had done growing up.

<http://www.fs.fed.us/rm/boise/AWAE/projects/ClimateShield.html>



Meet the Scientist!



As a hydrologist,
I study water in streams,
soils, and plants.

Dr. Adelaide (Di) Johnson
Hydrologist

Ph.D., Portland State University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

A combination of being curious and wanting to share nature stories keeps me motivated to learn the tools needed to investigate water in our world.

Example of a simple research question I have tried to answer: How does water that is in a well respond to different forest cutting treatments? We found that even small forest cutting treatments can significantly increase soil saturation.

Technology or equipment used in research: I have used piezometers to measure water pressure in soils and used pressure bombs to measure the amount of water pressure in plants.

Most Exciting Discovery

Landform shape controls not only hydrology, but also controls site temperature. Getting into the details of these micro sites not only helps you predict what plant species might grow in a particular location, but it also helps you understand the effects of climate change.

When did you know you wanted to be a scientist? After college I worked with a community planning agency. I was very excited to learn that, as part of my work, I could study the effects of urban development on stream systems. For me, this meant I could be paid to learn new skills, be curious, and play outside!

<http://www.naturalinquirer.org>



Meet the Scientist!



As an ecologist, I seek to understand how different parts of an ecosystem, such as plants, rocks, water, and human uses, interact and change. My research strives to help people take care of their environment, especially after damaging events.

Dr. Jonathan Long

Ecologist
Ph.D., Northern Arizona University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

For my work, it is important to integrate diverse sources of information to understand how systems work and what causes them to fail. So having an insatiable curiosity and broad education is important to start. You can develop more specialized skills to recognize the building blocks of ecosystems and how they fit together.

Example of a simple research question I have tried to answer:

What ingredients are needed to restore wetlands damaged by wildfires? To answer this question, I set up long-term studies at streams that were damaged and treated. I also studied geologic maps and old photos and interviewed elders to gain an even longer-term perspective.

Technology or equipment used in research:

I used repeated surveys of stream channels using self-leveling laser devices, measurements of plants, and photographs taken at the same place over time. The measurements quantify physical and biological changes, while the photographs provide an integrated view.

Most Exciting Discovery

Working with Native Americans to restore important springs that had been damaged by overgrazing and floods, I learned that we could return many of those places to a lush, vibrant condition. I have discovered new populations of rare plants and fishes while exploring these special places.

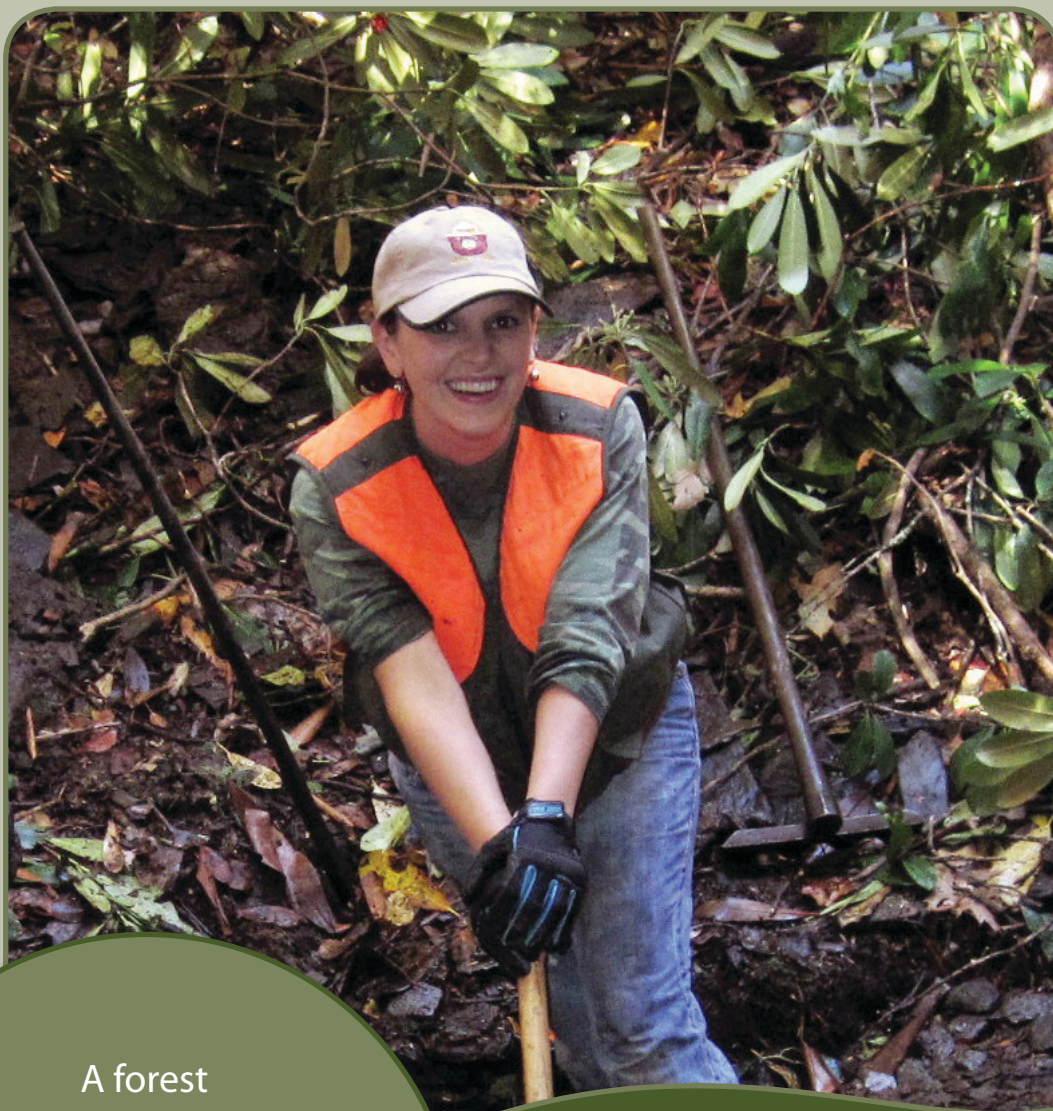
When did you know you wanted to be a scientist?

Early in my career, I saw the opportunity for ecological restoration to resolve conflicts that had resulted from past mismanagement and injustice. I decided to study ecological restoration for my doctoral degree so I could gain a deeper understanding of how to help people bring their treasured natural places back to health.

<https://www.fs.fed.us/psw/people/profile.php?alias=jwlong>



Meet the Scientist!



A forest hydrologist studies the water cycle. Where does water go after it falls as a raindrop? We study how it travels through a forest, into the soil, and eventually to a stream.

Stephanie Laseter

Hydrologist

M.S., University of Georgia
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

- ★ A love for being outdoors
- ★ Attention to detail
- ★ Problem solving skills

Example of a simple research question I have tried to answer:

I work at a Research Station where rainfall and temperature data has been collected for nearly 80 years! This lengthy record helps us answer questions about climate change. We are working to understand how a changing climate might affect forests and streams.

Technology or equipment used in research:

We use rain gages to measure how much precipitation falls on the forest. A weir is an instrument designed to accurately measure the volume of water in a stream. Combined, they allow us to measure a stream's response to changes in climate or forest structure.

Most Exciting Discovery

We are discovering that our rainfall patterns are changing over time. In the area where I live and work, we are now experiencing drier summers, wetter autumns, and more frequent droughts. We are continuing to investigate what effect this may have on streamflow and forest health in the future.

When did you know you wanted to be a scientist?

Since I was a kid, I loved being outside. I loved learning about plants and animals, playing in streams and looking under rocks to discover what might live there. In sixth grade I participated in a science fair and was hooked!

<http://www.srs.fs.usda.gov/coweeta>



Meet the Scientist!



Hydrologists study how water moves around the world, whether as streamflow, groundwater, precipitation, or transpiration. Water is important to all life.

Dr. Charles Luce

Hydrologist

Ph.D., Utah State University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

I enjoy math, which is important for many types of scientists. Math is short, simple, and meaningful, which makes it a bit like poetry to me. When we express our ideas about nature mathematically, it is easier to see what we understand and find testable questions.

Example of a simple research question I have tried to answer:

How do we measure how sensitive a stream is to changes in climate? Streams are warming with the climate, which is important to fish and other wildlife. Some streams are more sensitive to changes in climate than others. I studied over 200 streams in Oregon and Washington. I learned that cold streams are less sensitive to warming than warm streams.

Technology or equipment used in research:

I use large tipping buckets to measure runoff and sediment coming from forest roads. A tipping bucket is like a teeter-totter made of two triangular-shaped "buckets." When tilted to one side, water flows into the upturned bucket until it collects enough water to make the teeter-totter tip. When it tips, the water spills out, and the other bucket begins to collect water.

Most Exciting Discovery

I noticed that river runoff was declining across the Northwestern U.S. Our team figured out that precipitation was declining. The decline was only occurring in the mountains. The reason was that winter winds across the region were slowing down. The lack of winter winds reduced the lifting of clouds over mountains, which also reduced the amount of precipitation. Declining precipitation is important to forests and streams across the region and helps explain increased drought.

When did you know you wanted to be a scientist? I was hooked on science after doing two fun science projects in 6th grade. The creative, problem-solving aspect of science is what grabbed my attention and still does today.

<http://www.fs.fed.us/research/people/profile.php?alias=cluce>



Meet the Scientist!



Dr. Lugo is pictured second from the left during field research with volunteers and staff.

I am a tropical ecologist, and I study forests, wetlands, and cities in the tropics.

Dr. Ariel Lugo

Ecologist

Ph.D., The University of North Carolina at Chapel Hill

USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

- ★ Discipline and desire to understand how nature works.
- ★ Systematic and comprehensive in your approach to issues.
- ★ Relentless in the analysis of data and writing articles in scientific journals.

Example of a simple research question I have tried to answer:

Why do mangrove trees that live in seawater along dry coastlines decline in size from the ocean to the land?

Technology or equipment used in research:

I use electronic equipment in the field and the laboratory, but my favorite equipment includes my flip video for recording ecological systems, my Global Positioning System (GPS) unit for keeping track of where I go in the world, and my Mac computer where I keep my videos and maps, analyze data, and write scientific articles.

Most Exciting Discovery

I was very excited by the realization that native and introduced species are mixing and self-organizing to form new communities, called novel ecosystems. These novel communities function normally and could represent the ecosystems of the future in response to the activities of people.

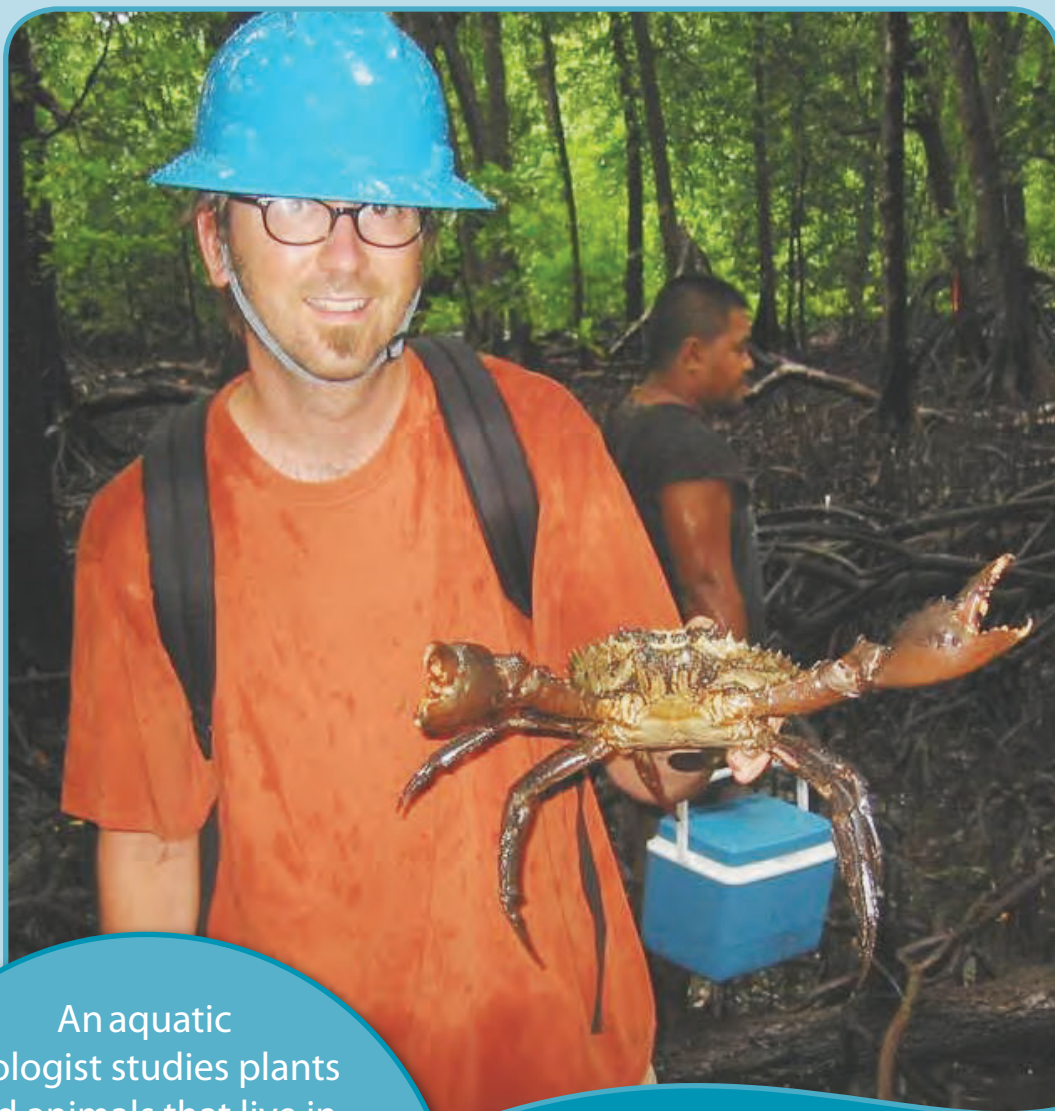
When did you know you wanted to be a scientist?

I wanted to study science since sixth grade when I learned about fossils. My desire to be a scientist developed after I graduated from college and spent a summer working with real scientists in the rain forest. Experiments in the rain forest were fun and I could learn a lot.

<http://www.sanjuanultra.org>



Meet the Scientist!



An aquatic ecologist studies plants and animals that live in streams, lakes, and wetlands. We try to understand the roles these organisms play in aquatic ecosystems and how stressors such as land use change, climate change, and exotic species influence those roles.

Dr. Rich MacKenzie

Aquatic Ecologist

Ph.D., University of Wisconsin-Milwaukee
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

Working in remote locations around the world, as well as sampling fish and invertebrates from challenging environments (mangroves, streams that frequently flood), requires creative ideas to design or modify equipment that can effectively and accurately sample fish and invertebrates.

Example of a simple research question I have tried to answer:

Pacific island streams and wetlands support native fish, birds, and invertebrates found nowhere else in the world. I have been studying how the invasion of these ecosystems by nonnative tilapia and poeciliid fish affects the food resources that are also used by native fish and birds.

Technology or equipment used in research:

Masks, snorkels and specialized nets are used to sample fish, shrimp, and crabs from streams and wetlands. Seines are long nets stretched between two poles that are then dragged through the water. Throw nets are large circular nets that are thrown in to the water.

Most Exciting Discovery

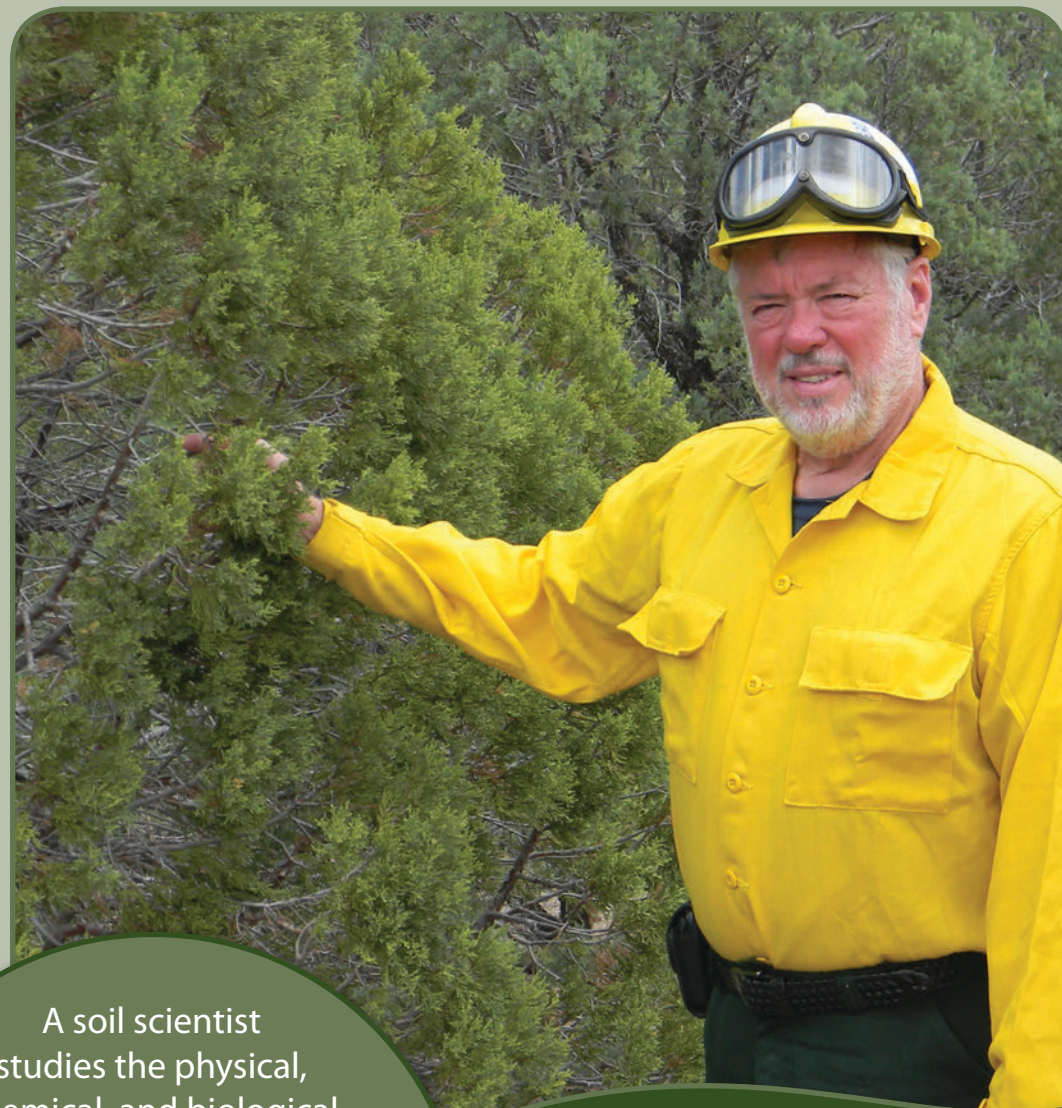
I have discovered two new species of shrimp and several new species of insects from streams and wetlands on the islands of Yap and Pohnpei in the Federated States of Micronesia.

When did you know you wanted to be a scientist?

I have been sampling fish and invertebrates from muddy environments since I was 5. A summer internship in college revealed that this could be a career. I designed a project that sampled streams for mayfly larvae and then videotaped them in special chambers to document how they responded to pollution.



Meet the Scientist!



A soil scientist studies the physical, chemical, and biological aspects of soils, how they are classified, how they function, and how water moves into and through them. A hydrologist studies all the aspects of the quantity and quality of water cycle from precipitation to streamflow to groundwater.

Dr. Dan Neary
Soil Scientist/Hydrologist
Ph.D., Michigan State University
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

- ★ Creativity
- ★ Careful observation and logic
- ★ Inherent curiosity about nature and the physical environment

Example of a simple research question I have tried to answer:

What are the impacts of wildfires and prescribed fires on soil erosion and water resources?

Technology or equipment used in research:

Automatic weather stations are used to measure the climate. They measure the amount and timing of rainfall, air temperature, relative humidity (i.e., percentage of moisture in the air), or the percentage of moisture in the air, wind speed and direction, and evaporation. Data can be collected at short intervals (1-5 minutes) and are stored for 3-4 months or can be sent by radio signal to a remote computer.

Most Exciting Discovery

It is all exciting. I wouldn't know where to start. Maybe, the scale and magnitude of soil erosion and flooding after the Schultz Wildfire of 2010—it was enormous! Another exciting thing is the opportunity to work all over the world.

When did you know you wanted to be a scientist?

As a child, I was fascinated by rocks and forests. I collected rocks and would often play in forests. We made forts and villages in forests and would pile up rocks to make swimming holes in small streams.

<https://www.fs.fed.us/rmrs/people/dneary>



Meet the Scientist!



A quantitative ecologist uses mathematical skills and ideas to better understand forests, rivers, oceans, fish, wildlife, climate, and more.

Dr. E. Ashley Steel

Quantitative Ecologist

Ph.D., University of Washington—Seattle
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics:

I enjoy making connections between ideas from different scientific disciplines. Statistical ideas about variability can help us explore fluctuating water temperatures. Models for managing salmon have many similarities to models for predicting forest growth. Seeking out fun, exciting collaborators and learning to work together is essential for finding these fascinating links between ideas.

Example of a simple research question I have tried to answer:

How do natural water temperature patterns in rivers influence the development of salmon eggs?

Technology or equipment used in research:

I use R, free statistical software for graphing, analyzing, and understanding data. I also use water temperature loggers. These are small gadgets about the size of a thick quarter that I cable into a river. They record the water temperature every hour for a year and then I go back and download the data.

Most Exciting Discovery

We found that when water temperature fluctuated in strange ways or with natural patterns, it influenced the timing of salmon eggs developing into young fish. Our discovery suggests that dams, climate change, and other human actions affecting water temperature patterns could have big, and possibly unexpected, impacts on salmon populations.

When did you know you wanted to be a scientist? In college, I conducted research on human health. I loved figuring out how to collect quality data and learn from it. I also loved rivers. I knew I wanted to be a scientist when I discovered that I could use data to study rivers too.

<http://www.fs.fed.us/pnw/lwm/aem/people/steel.html>



Meet the Scientist!



Hydrologists study the water cycle. Studying the water cycle means tracking water movement from the raindrops falling from the sky to the ground, going into the soils, flowing through the rivers, and eventually moving to the ocean.

Dr. Ge Sun
Hydrologist
Ph.D., University of Florida
USDA Forest Service scientist



<http://www.naturalinquirer.org>

Important Scientist Characteristics

Doing science requires a lot of patience and dedication. You do not have to be the smartest to do science, but you do need passion for what you are doing. Critical thinking is essential since our understanding of nature is evolving and what is known even in a textbook may not be the truth.

Example of a simple research question I have tried to answer:

How much water does one tree or a forest use in one day or a year?

Technology or equipment used in research:

We used a computer simulation model to simulate the water cycles and predict how climate change will affect future streamflow.

Most Exciting Discovery

I found that removing trees changed water flow in a watershed. I can use mathematical formulas and computers to calculate the change and predict the future.

When did you know you wanted to be a scientist?

In high school, I began to love mathematics and chemistry. I wanted to be a scientist because science is fun.