

FIELD INVESTIGATION GUIDE: WHEN RAIN FALLS



INVESTIGATE HOW WATER MOVES ACROSS THE LANDSCAPE—
AND HOW SIMPLE CHOICES HELP KEEP IT CLEAN

Why does one
field soak up rain
while another
turns into muddy
runoff?



INVESTIGATING QUESTION



BIG IDEA

- Healthy soil acts like a sponge.
- When rain falls on healthy soil filled with roots and living organisms, much of the water soaks into the ground.
- When soil is compacted, bare, or disturbed, more water runs across the surface, carrying valuable soil & nutrients with it.
- Healthy soil protects both farms and our lakes, rivers, and streams.

Same rain.

Different soil
management.

What happens
next?



QUICK FACTS:



Investigation Time | Reset Time

• 10–15 MINUTES

• 5 MINUTES



Audience

GRADES 3–ADULT
SCHOOL GROUPS/FAMILIES
COMMUNITY EVENTS
PROFESSIONAL DEVELOPMENT

Group Size

4–8 PARTICIPANTS
LARGER GROUPS SHOULD
ROTATE THROUGH ADDITIONAL
INVESTIGATIONS.

PARTICIPANTS WILL:



Learning Goals

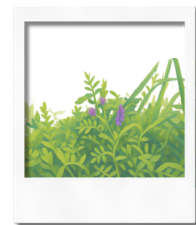
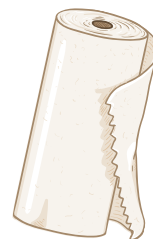
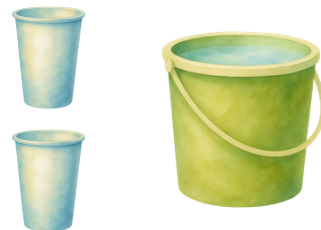
- Compare infiltration in different land management systems.
- Observe runoff and erosion.
- Discover how living roots improve soil health.
- Recognize the connection between soil health and water quality.
- Understand why conservation practices reduce flooding and erosion.

rainfall simulator

EQUIPMENT CHECKLIST



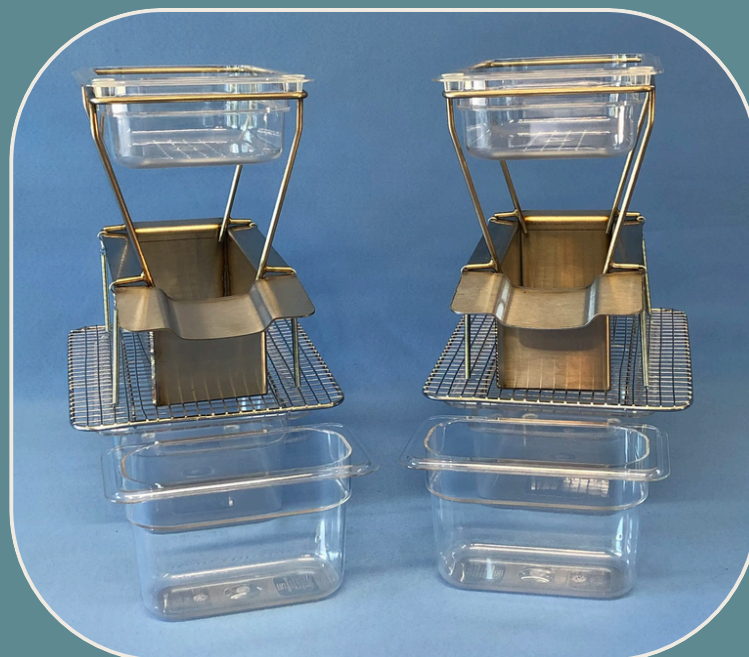
- ☐ Rainfall simulator tray
- ☐ Metal Risers
- ☐ Perennial Cover soil tray
- ☐ Conventional soil tray
- ☐ Cups and extra water bucket
- ☐ Collection containers
- ☐ Paper towels
- ☐ Brooke QR sign
- ☐ Laminated comparison photos



QUICK SETUP

Estimated Time: 5 minutes

1. Place rainfall simulator on stable table.
2. Verify soil trays are secure.
3. Position runoff containers.
4. Prefill water cups
5. Place towels nearby.
6. Display Brooke QR sign.
7. Test water flow.



You're ready to investigate.

<https://rainfallsimulator.com/wp-content/uploads/2019/08/Rainfall-Simulator-Instructor-Guide-1.pdf>

rainfall simulator

HOSTING GUIDE



OPENING CONVERSATION

"If the same amount of rain falls on two fields... why doesn't the same thing happen?"

Let visitors make predictions.

Avoid telling them which tray is which.



DURING THE ACTIVITY

Invite visitors to:

Observe both soil trays.

Predict what will happen.

Watch rainfall begin.

Compare runoff.

Compare infiltration.

Compare water clarity.

Discuss what they noticed.



QUESTIONS TO ASK

Which tray absorbed more water?

Which tray produced muddy runoff?

Where did more water go?

Why do you think that happened?

How might this affect nearby streams?

What could farmers—or homeowners—do differently?

BROOKE'S NOTES:



Have you ever
wondered
where a raindrop
goes after
it lands?



Ask
Brooke!
SCAN TO
LISTEN

BROOKE'S NOTES

"Rain doesn't just fall.

It begins a journey.

Some rain soaks into the soil where plants can use it later.

Some races across the land, carrying tiny pieces of soil along the way.

Healthy soil slows that journey.

Let's investigate what happens when the exact same rain falls on two very different landscapes."

LOOKING CLOSER

The next time it rains...

Can you find...

- Water soaking into a garden?
- Muddy water flowing into a storm drain?
- A grassed waterway?
- Water pooling in a parking lot?
- Earthworms after a rain?

Healthy soil leaves clues everywhere.



RESEST CHECKLIST



Empty runoff containers

- ☒ Drain rainfall infiltration and runoff collection bins
- ☒ Wipe table
- ☒ Return towels
- ☒ Swap soil trays every 1.5 hours or as needed
- ☒ Dry table
- ☒ Refill water if needed
- ☒ Straighten signage



TROUBLE SHOOTING



WATER NOT FLOWING EVENLY

Check rainfall holes.
Remove debris.
Verify tank has a slight slope.



RUNOFF CONTAINERS OVERFLOWING

Reduce rainfall amount.
Empty collection cups



PARTICIPANTS FINISH QUICKLY

Repeat using different rainfall amounts.
Discuss local examples.
Compare photographs of real fields after storms.

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These materials were developed with support from:



rainfall simulator

FIELD INVESTIGATION: WHEN RAIN FALLS

Date: _____

Host: _____

Location: _____

Approximate Attendance: _____

Questions visitors asked:

What worked especially well?

Ideas for improving this investigation

Supplies needing replacement

**LESSONS
LEARNED**



FIELD INVESTIGATION: WHEN RAIN FALLS

Date: _____

Host: _____

Location: _____

Approximate Attendance: _____

Questions visitors asked:

What worked especially well?

Ideas for improving this investigation

Supplies needing replacement

**LESSONS
LEARNED**



FIELD INVESTIGATION GUIDE



Will it Soak in?

INVESTIGATE HOW WATER MOVES ACROSS THE LANDSCAPE—
AND HOW SIMPLE CHOICES HELP KEEP IT CLEAN

How quickly can healthy soil absorb water?



INVESTIGATING QUESTION



BIG IDEA

- Healthy soil is full of tiny spaces created by roots, earthworms, and living organisms. These pore spaces allow rainwater to soak into the ground, reducing runoff, flooding, and erosion while storing water for plants.
- Not all soils absorb water at the same rate.
- The way we care for the land changes how the soil responds when it rains.

Have you ever wondered where a raindrop goes after it lands?



QUICK FACTS:



Investigation Time | Reset Time

• 10–15 MINUTES

• 3–5 MINUTES



Audience

GRADES 4–ADULT
FAMILIES
COMMUNITY EVENTS
PROFESSIONAL DEVELOPMENT

Group Size

UP TO 20 WHEN
WORKING IN PAIRS



Learning Goals

PARTICIPANTS WILL:

- Measure how quickly water infiltrates into soil.
- Compare infiltration between different locations or management practices.
- Discover how soil structure affects water movement.
- Understand why healthy soil reduces runoff and erosion.
- Connect infiltration to plant health, groundwater, and water quality.

Infiltration kit

EQUIPMENT CHECKLIST



- ☐ 10 Soil Infiltration Kits include:
- ☐ Single infiltration ring
- ☐ Mallet
- ☐ Plastic wrap
- ☐ Stopwatch or Timer
- ☐ Wood driving block
- ☐ Water & Cup
- ☐ Printed instruction sheet
- ☐ Towels
- ☐ Brooke QR sign



QUICK SETUP

Estimated Time: 5 minutes

1. Select an undisturbed soil surface.
2. Place the wooden block over the infiltration ring.
3. Drive the ring approximately 2 inches into the soil.
4. Place plastic wrap over the soil surface inside the ring.
5. Pour the measured amount of water onto the plastic wrap.
6. Carefully remove the plastic wrap without disturbing the soil.
7. Start the timer and observe.
8. If possible, try the infiltration experiment on different soil types or land management.

HOSTING GUIDE



OPENING CONVERSATION

When it rains, where does the water go?

After a few responses, ask:

How could we actually measure that?

Explain that scientists use infiltration tests to understand how well soil absorbs water.

DURING THE ACTIVITY



Invite visitors to:

Observe the soil surface.

Predict how quickly the water will soak in.

Discuss what might influence the results.

Measure infiltration time.

Compare observations with other locations or soil conditions.

Discuss why the results matter.

Imagine this wasn't one cup of water. Imagine it was two inches of rain falling across an entire field.

QUESTIONS TO ASK



What did you notice first?

Did the water disappear faster or slower than you expected?

What might have created spaces for the water to move through?

How would this soil behave during a heavy rainstorm?

How might roots, worms, or soil organisms change these results?

What would happen if this soil became compacted?



BROOKE'S NOTES:



How quickly can healthy soil absorb water?

BROOKE'S NOTES

"At first glance, soil looks solid. But healthy soil is actually filled with tiny spaces created by roots, fungi, earthworms, and countless other living organisms. These spaces act like tiny highways for water. Every time it rains, healthy soil quietly stores water underground instead of letting it rush across the surface. Let's see how this soil responds."

Ask Brooke!
SCAN TO LISTEN



LOOKING CLOSER

The next time it rains...

Notice:

- Does water soak into your lawn or run toward the street?
- Where do puddles form?
- Are there places where soil stays soft?
- Can you find earthworm holes?
- Do fields with living plants absorb water differently than bare soil?

Healthy soil leaves clues everywhere.

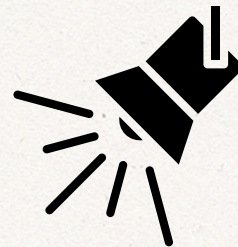


BROOKE'S FIELD NOTES:



Practice Spotlight

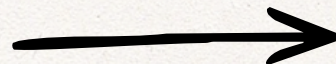
REAL WORLD SPOTLIGHT



Many farmers throughout our state are improving infiltration by planting cover crops, reducing tillage, and keeping living roots in the soil throughout more of the year. These practices help rain soak into the ground, reducing erosion while storing water for crops during dry periods.



LET'S LOOK CLOSER!





Practice Spotlight

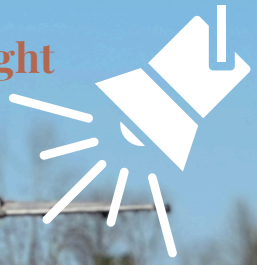


COVER CROPS

HAVE YOU EVER NOTICED GREEN FIELDS AFTER CORN OR SOYBEAN HARVEST? THOSE ARE OFTEN COVER CROPS—PLANTS GROWN TO PROTECT AND IMPROVE THE SOIL BETWEEN CASH CROPS. THEIR LIVING ROOTS HELP FEED SOIL ORGANISMS, HOLD THE SOIL IN PLACE, REDUCE EROSION, AND CREATE PATHWAYS FOR RAINWATER TO SOAK INTO THE GROUND INSTEAD OF RUNNING OFF.



Look Closer... Can you spot living plants growing after the cash crop has been harvested?



NO-TILL

IN A NO-TILL FIELD, FARMERS PLANT NEW CROPS WITH VERY LITTLE DISTURBANCE TO THE SOIL. LEAVING THE SOIL MOSTLY UNDISTURBED HELPS PROTECT EARTHWORM TUNNELS, FUNGAL NETWORKS, AND SOIL AGGREGATES. OVER TIME, THOSE UNDERGROUND PATHWAYS HELP WATER MOVE DEEPER INTO THE SOIL WHILE REDUCING EROSION.



Look Closer...How much crop residue is still covering the soil?



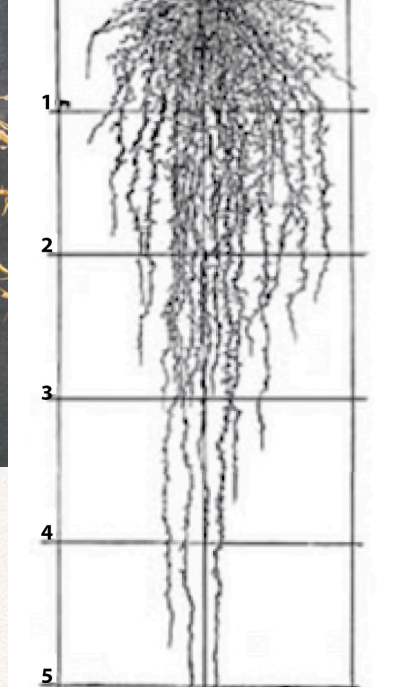
REDUCED TILLAGE

SOMETIMES FARMERS STILL WORK THE SOIL, BUT MUCH LESS THAN IN THE PAST. THAT'S CALLED REDUCED TILLAGE.

BY DISTURBING THE SOIL LESS OFTEN, MORE PLANT RESIDUE STAYS ON THE SURFACE, SOIL STRUCTURE HAS A CHANCE TO RECOVER, AND THE UNDERGROUND COMMUNITY CONTINUES BUILDING HEALTHY AGGREGATES AND PORE SPACES.



Look Closer... Can you see areas where last year's residue is helping protect the soil?



CROP ROTATION



Practice Spotlight

GROWING THE SAME CROP EVERY YEAR ISN'T THE ONLY OPTION. MANY FARMERS ROTATE CROPS LIKE CORN, SOYBEANS, SMALL GRAINS, AND ALFALFA. WHEN A COVER CROP IS GROWN TOO, THERE'S A LIVING ROOT THROUGHOUT THE ENTIRE YEAR! DIFFERENT PLANTS GROW DIFFERENT ROOT SYSTEMS AND SUPPORT DIFFERENT SOIL ORGANISMS. THAT DIVERSITY HELPS BUILD HEALTHIER SOIL OVER TIME AND CAN IMPROVE HOW WATER MOVES THROUGH THE GROUND.



Look Closer... How might different root systems change what happens beneath the surface?

RESEST CHECKLIST



- ☐ Remove infiltration ring.
- ☐ Clean ring.
- ☐ Dry wooden block.
- ☐ Return plastic wrap.
- ☐ Return timer.
- ☐ Restock supplies.



TROUBLE SHOOTING



WATER RUNS UNDERNEATH THE RING
Drive the ring slightly deeper into the soil.



RING DIFFICULT TO INSERT.
Avoid rocky or heavily compacted areas.
Use the wooden block to protect the ring.



WATER INFILTRATES ALMOST INSTANTLY
Discuss why healthy soil absorbs water rapidly.
Discuss how different soil types impact infiltration rates (Sandy Soil for example infiltrates quickly)
Compare results with another location



WATER INFILTRATES VERY SLOWLY
Discuss soil compaction
Discuss Soil type impacts on infiltration (High clay content slows infiltration)
Ask what practices might improve infiltration over time

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Infiltration kit

FIELD INVESTIGATION GUIDE



What Holds Soil Together?

INVESTIGATE SOIL AGGREGATES.

What happens when healthy soil and conventionally tilled soil get wet?



INVESTIGATING QUESTION

- Healthy soil isn't just loose dirt. It's made up of tiny particles that are naturally glued together into stable clumps called aggregates.
- These aggregates help soil resist erosion, improve water infiltration, and support healthy plants.



BIG IDEA

What holds soil together?



QUICK FACTS:



Investigation Time | Reset Time

• 10–15 MINUTES

• 3–5 MINUTES



Audience

GRADES 4–ADULT
FAMILIES
COMMUNITY EVENTS
PROFESSIONAL DEVELOPMENT

Group Size

UP TO 20 WHEN
WORKING IN PAIRS

PARTICIPANTS WILL:



Learning Goals

- Observe how different soils react when submerged in water.
- Understand what soil aggregates are.
- Discover the connection between soil biology and aggregate stability.
- Connect aggregate stability to erosion, infiltration, and water quality.

Slake Test

EQUIPMENT CHECKLIST



- ❑ 20 slake tubes
- ❑ 10 aggregate samples from healthy soil
- ❑ 10 aggregate samples from conventionally tilled soil
- ❑ Water container
- ❑ Observation sheets
- ❑ Timer
- ❑ Magnifying lenses



QUICK SETUP

Estimated time: 5 minutes

1. Fill each slake tube with clean water to the appropriate level.
2. Pair the tubes and label them Sample A and Sample B.
3. Select similarly sized, air-dried soil aggregates from each management system.
4. Gently place one aggregate on the support platform in each tube.
5. Keep the soil samples above the water until participants have observed them and made predictions.
6. Place paired tubes at each group station.
7. Set out timers, observation sheets, magnifying lenses, and towels.
8. Display the Brooke QR sign.

You're ready to investigate.

Slake Test

HOSTING GUIDE



OPENING CONVERSATION

Hold up two identical-looking clumps. Ask:

"Which one do you think will stay together?" Most people honestly don't know.

Then ask: "What do you think is holding soil together?"

You'll hear:

- roots rocks
- clay moisture

Very few people say: "Soil biology." Now they're ready.

DURING THE ACTIVITY



Each group receives:

Sample 1 (Healthy soil)

Sample 2 (Conventional soil)

Do not specify which sample is healthy or conventional.

Ask them to: Look closely. Describe: color, texture, smell size

Predict: Which one will survive underwater?

Then...

Submerge both simultaneously.

Don't say anything.

Just let them watch.

QUESTIONS TO ASK



Encourage observations: Use "I notice..." instead of "It is..."

Examples: (tiny particles floating away, bubble, cloudy water, soil remaining intact, cracks forming, pieces breaking off)

What did you observe?

What do you think caused that?

"What surprised you?"

What questions do you still have?

BROOKE'S NOTES



BROOKE'S NOTES:



Have you ever wondered what holds soil together when it rains?

At first glance, these two soil clumps may have looked almost the same. But once they were placed in water, the difference became easier to see.

Healthy soil is made of tiny particles joined together into clumps called aggregates. Living roots feed bacteria, fungi, and other soil organisms. As those organisms grow and work, they produce natural glues that help hold the soil together. Fine roots and fungal threads also help bind the particles into stronger clumps.

Stable aggregates protect the tiny pore spaces inside the soil. Those spaces allow air and water to move through the ground and give plant roots room to grow.

When soil aggregates break apart easily, the loose particles can clog pore spaces, form a crust at the surface, or be carried away by runoff.

What we are seeing in these tubes is more than a clump of soil staying together. We are seeing evidence of how the soil has been built—and how it may respond when real rain falls on a field.

LOOKING CLOSER

The next time you see exposed soil, look closely.

Can you find:

- Soil that forms small, rounded crumbs?
- Soil that looks powdery or crusted?
- Roots growing through soil clumps?
- Earthworm holes or pieces of plant residue?
- Muddy water leaving a garden, field, or construction site?
- Soil beneath living plants compared with nearby bare soil?

Living roots feed soil life. Soil life builds aggregates. Aggregates protect pore spaces. Pore spaces help water soak in.



FIELD INVESTIGATION



OBSERVATION SHEET

WHAT HOLDS SOIL TOGETHER?

Slake Test

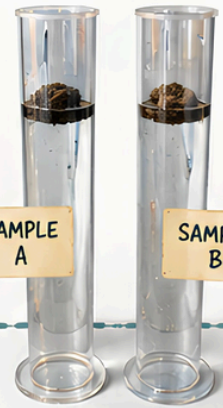
Name(s): _____

Date: _____

Location: _____

SAMPLE A

SAMPLE B



BEFORE THE INVESTIGATION



LOOK CLOSELY

Without touching the samples, what do you notice?

	Sample A	Sample B
Color		
Shape		
Size		
Texture		



MAKE A PREDICTION

Which sample will stay together longer in water?

☐ Sample A ☐ Sample B ☐ They will behave the same.

Why do you think that?



DURING THE INVESTIGATION

Watch carefully. Use your senses like a scientist.

SAMPLE A

- ☐ Tiny particles begin floating away
- ☐ Water becomes cloudy
- ☐ Air bubbles appear
- ☐ Cracks begin forming
- ☐ Pieces break off
- ☐ Soil stays mostly together
- ☐ Other: _____

SAMPLE B

- ☐ Tiny particles begin floating away
- ☐ Water becomes cloudy
- ☐ Air bubbles appear
- ☐ Cracks begin forming
- ☐ Pieces break off
- ☐ Soil stays mostly together
- ☐ Other: _____



TIP: The changes might be slow at first. Keep watching for a few minutes!



COMPARE THE SAMPLES

Which sample stayed together longer?

☐ A ☐ B ☐ About the same

Which sample made the water cloudier?

☐ A ☐ B ☐ About the same

Which sample lost more soil?

☐ A ☐ B ☐ About the same



THINK LIKE A SCIENTIST

Why do you think the two samples behaved differently?

What do you think was helping hold one sample together?



☐ Roots



☐ Earthworms



☐ Fungi



☐ Tiny soil organisms



☐ Plant residue



☐ Something else: _____



THE REVEAL!

Now your host will tell you which sample came from:

- ☐ Soil managed for soil health (living roots, cover crops, reduced tillage)
- ☐ Conventionally tilled soil

Did the results surprise you?



Yes



A little



No

Why?



BROOKE'S CHALLENGE

The next time you're outside... Can you find:



☐ Bare soil



☐ Living plants growing



☐ Earthworm holes



☐ Crop residue covering the soil



☐ Muddy runoff after a rain



☐ Soil that looks crumbly, not powdery



"Healthy soil leaves clues. Look for soil that is covered, rooted, alive, and able to stay together when water arrives."
—Brooke

EVIDENCE → EXPLANATION

What did you OBSERVE?



What do you think CAUSED that?



What questions do you still have?



Great Scientists Ask Great Questions!

RESEST CHECKLIST



- ☐ Discard used soil aggregates.
- ☐ Empty water from slake tubes.
- ☐ Rinse tubes with clean water.
- ☐ Remove any remaining soil particles from the support platforms.
- ☐ Refill tubes with clean water (if preparing for the next group).
- ☐ Set out fresh Sample A and Sample B aggregates.
- ☐ Restock observation sheets.
- ☐ Return magnifying lenses.
- ☐ Wipe table and surrounding area.
- ☐ Straighten Brooke QR sign.

BOTH SAMPLES FALL APART QUICKLY

Possible causes:

- Soil aggregates were collected while too wet.
- Aggregates were broken during collection.
- Samples were not naturally formed aggregates.
- Both samples came from similar management systems.

Discussion Opportunity

"Soil structure develops over time. Different soils and management histories can influence aggregate stability."

BOTH SAMPLES REMAIN INTACT

Possible causes:

- Aggregates are exceptionally stable.
- Soil contains higher clay content.
- Samples are too large to show differences quickly.

Discussion Opportunity

"Let's keep watching. Some aggregates break down more slowly than others."

PARTICIPANTS DON'T NOTICE A DIFFERENCE:

Ask participants to look more closely.

Can they see:

- Water becoming cloudy?
- Tiny particles falling?
- Small cracks forming?
- Air bubbles escaping?
- Differences in water clarity?

Encourage them to compare both tubes side by side.

PARTICIPANTS FINISH EARLY:

Invite them to:

- Compare magnified soil aggregates.
- Guess which sample came from healthier soil.
- Discuss what practices might build stronger aggregates.
- Compare photographs of fields using different management systems.



TROUBLE SHOOTING

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Slake Test