

Adaptable Roots May Hold a Key to Tree Survival

The Wired Word for the Week of December 4, 2022

In the News

Recent studies by researchers at the University of Nottingham are examining how plant roots use "hydro-signaling" to sense the presence of water so they can maximize their absorption rate of moisture. When water is less available, roots slow the development or branching of new roots until they detect moisture again. The ability of roots to change their shape according to local conditions helps plants "optimize foraging" for water and thus survive the stress of drier periods.

Co-leaders of the research, Dr. Poonam Mehra and Professor Malcolm Bennett, assert that the discovery of hydro-signaling will prove essential to the development of strategies to deal with periods of extended drought.

"Our plant research is vitally important for understanding how we can futureproof crops and find ways to ensure successful crop yields even in the most challenging climates," Bennett said. "We are already experiencing a hotter climate and designing plants that can still access water in these conditions is vital"

Some scientists think that the tips of plant roots are like the brains of plants. "Roots sense the environment," said Ying Fan Reinfelder, a professor of Environmental, Earth and Planetary Sciences at Rutgers University-New Brunswick. "They sense the water, where there are more nutrients, and they go for these resources."

In her studies, published in 2017, Reinfelder found a strong connection between root depth and water content in the soil. Whether a plant can adapt to more arid conditions will largely depend on the health and length of its roots, she indicated.

For more than four centuries, Shajarat-al-Hayat, or "the tree of life," has survived alone, without a nearby source of water for miles in the middle of the desert in Bahrain. Temperatures in the area can reach 114°F in the summer and average yearly rainfall is less than 3 inches. The secret of the tree's survival, scientists say, is the tree's extremely long tap root.

A Shepherd's tree (*Boscia albitrunca*), native to the Kalahari Desert, has the deepest documented roots at more than 230 feet deep.

However, "most of a tree's roots, even of those species that have a so-called taproot, are within the top 18 inches of soil. That's typically where the richest organic matter and the most water is," explained forestry writer Joe Rankin. "And a tree can have hundreds of miles of roots, some as thin as a human hair."

In [a related study](#) at the Universities of Birmingham, in the UK, and Bergen, in Norway, scientists learned that increased carbon dioxide in the atmosphere causes trees to produce more and longer roots. That research extended to Australia and into the Amazon. In each location, the team introduced extra CO2 to simulate levels that are expected to be typical around the world by 2050.

"We need to invest in understanding the below-ground half of the ecosystem," Reinfelder said. "It's dark. It's opaque, but it holds the key to many questions, and the scientific community needs to shed some light there."

More on this story can be found at these links:

[Research Reveals Plant Roots Change Shape and Branch Out for Water. *phys.org*](#)

[Deep Roots in Plants Driven by Soil Hydrology. *Rutgers.edu*](#)

[The Dirt on Roots. *Northern Woodlands*](#)

[Plants Use Acoustic Vibes to Find a Drink. *Quartz*](#)

[Trees Talk to Each Other. 'Mother Tree' Ecologist Hears Lessons for People, Too. *NPR*](#)

The Big Questions

1. How can we develop spiritual roots that are capable of drawing on the water of life we need to survive and thrive? What are some methods that we can use to determine in which direction to go in order to better access Jesus' water of life?
2. Some plants need to go through a dry time in order to bloom. When, if ever, have you gone through a "dry" time that has forced your spiritual "roots" to go deeper in your thirst for God? In periods of spiritual dryness, how can we adapt so we don't lose contact with the water of life?
3. What "fertilizers" help your spiritual roots grow strong and healthy? What "weed killers" seem like they will protect, but actually make it harder for your faith to grow?
4. If you envision yourself as a tree with a deep taproot, what scriptures provide the spiritual waters you need to survive? Were these verses near the surface or did you have to delve deep? Describe the circumstances if you choose.
5. Plants become root-bound when they outgrow their container and aren't repotted in a larger one. The roots grow around and around which halts growth. Is it possible to become spiritually "root-bound"? If so, what happens to cause this, and how can we "repot" ourselves to allow our roots to find sustenance?

Confronting the News With Scripture and Hope

Here are some Bible verses to guide your discussion:

Jeremiah 17:7-8

*Blessed are those who trust in the LORD,
whose trust is the LORD.*

*They shall be like a tree planted by water,
sending out its roots by the stream.
It shall not fear when heat comes,
and its leaves shall stay green;
in the year of drought it is not anxious,
and it does not cease to bear fruit.*
(For context, read [Jeremiah 17:5-8](#).)

This passage contrasts with the preceding two verses, in which God curses those who place their trust in "mere mortals" and expect human strength to sustain them in tough times. Those who trust in the Lord, on the other hand, are blessed, because they are like a tree planted by streaming water that sustains its roots and transmits nourishment to keep its leaves evergreen and produce fruit in abundance.

Other passages that describe the righteous in similar terms include [Psalm 1:1-3](#), where spiritual blessing comes to those who delight in God's law, not in the advice of the wicked, and [Psalm 92:12-15](#), which says those who are planted in the house of the Lord flourish "like a cedar in Lebanon."

As Proverbs 12:3, 12 says, "No one finds security by wickedness, but the root of the righteous will never be moved. ... the root of the righteous bears fruit."

Jeremiah depicts a tree that seems capable of feeling fear and anxiety. But those feelings are allayed because it is planted in the right place, where its roots have access to life-giving water, even in times of drought.

Questions: What might make it difficult at times for people to trust in the Lord? What can help people overcome barriers to faith in God?

Matthew 13:5-6. 20-21

[Jesus said,] Other seeds fell on rocky ground, where they did not have much soil, and they sprang up quickly, since they had no depth of soil. But when the sun rose, they were scorched, and since they had no root, they withered away. ... As for what was sown on rocky ground, this is the one who hears the word and immediately receives it with joy, yet such a person has no root but endures only for a while, and when trouble or persecution arises on account of the word, that person immediately falls away. (For context, read [Matthew 13:1-8, 18-23](#).)

Acts 17:11

These Jews were more receptive than those in Thessalonica, for they welcomed the message very eagerly and examined the scriptures every day to see whether these things were so. (For context, read [Acts 17:10-12](#).)

In the Parable of the Sower (aka The Four Soils), Jesus identified lack of roots and depth as factors that contribute to spiritual crop failure. In contrast, when the seed of Christ's word falls in the receptive heart, the listener bears abundant spiritual fruit (Matthew 13:23).

The Jews at the synagogue in Berea fit the description of soil that is receptive to the seed of Christ's word. They eagerly welcomed Paul's message about Jesus, but they did more than respond with a flash of emotional enthusiasm. They also diligently studied the scriptures daily, to determine whether Paul's message about Jesus matched what was written in biblical text. They were sending their roots down deep into the scriptures, which resulted in a strong faith (Acts 17:12).

Question: What metaphorical "rocks" may need to be removed from a person's life so the seed of God's word has space to sprout long, healthy roots?

Colossians 2:5-8

... I rejoice to see your orderly conduct and the firmness of your faith in Christ. As you therefore have received Christ Jesus the Lord, continue to walk in him, rooted and built up in him and established in the faith, just as you were taught, abounding in thanksgiving. Watch out that no one takes you captive through philosophy and empty deceit, according to human tradition, according to the elemental principles of the world, and not according to Christ. (For context, read [Colossians 2:5-15](#).)

In this passage, Paul mixes several metaphors, as he often does, to convey the concept that God wants us to develop a strong faith in Christ that can withstand falsehoods and worldly philosophies that are counter to the life and teachings of Christ. He commends the Colossians for the firmness of their faith, and encourages them to continue living that way.

Questions: What do the following metaphors add to your understanding about how to develop a firm faith in Christ?

- Receiving Christ Jesus the Lord
- Continuing to walk in Christ
- Being rooted in Christ
- Being built up in Christ
- Being established in the faith, just as you were taught

What do you need to do to be sure no one takes you captive to a deceitful philosophy or human tradition that is not according to Christ's life and teachings?

Isaiah 53:1-3

Who has believed what we have heard?

And to whom has the arm of the LORD been revealed?

For he grew up before him like a young plant

and like a root out of dry ground;

he had no form or majesty that we should look at him,

nothing in his appearance that we should desire him.

He was despised and rejected by others;

a man of suffering and acquainted with infirmity,

and as one from whom others hide their faces

he was despised, and we held him of no account. (For context, read [Isaiah 53:1-9](#).)

Who has ever pulled a root out of the ground and exclaimed, "Isn't that beautiful?" And then rushed to find a fancy vase to display the root on a festive banquet table for a royal wedding?

Absurd, you say? Your reaction isn't far off from the kind of reaction to the suffering servant Isaiah describes in these verses, which suggest that people would have a hard time believing that "the arm of the Lord" was active in this person.

First-century followers of Jesus interpreted Isaiah 53 as a depiction of their Master ([Acts 8:30-35](#)). But from his birth throughout his adult ministry, many people didn't find him or his teaching attractive. Herod tried to kill him when he was just a toddler ([Matthew 2:16-20](#)).

One of his first disciples thought it highly unlikely that Jesus' hometown could produce a personage of any worth, let alone the Messiah. Nathanael said, "Can anything good come out of Nazareth?" ([John 1:45-46](#)) People in Jesus' own hometown hated his message so much that they wanted to hurl him off a cliff ([Luke 4:16-29](#))!

Many of Jesus' own disciples found his teaching too difficult, and turned back from following him ([John 6:60-66](#)).

John wrote: "He was in the world, and the world came into being through him, yet the world did not know him. He came to what was his own, and his own people did not accept him" ([John 1:10-11](#)).

Jesus identified himself as the root and the descendant of David ([Revelation 22:16](#)).

Questions: When, if ever, have you been disinclined to accept Jesus' teachings? Which of his teachings do you find most challenging?

What persuades you to follow Jesus, in spite of what you may dislike about some of his teachings?

How could Jesus be both the root and the descendant of his own ancestor, David?

Why do you think God "hid" himself in the Incarnation (in Mary's womb and in the Christ child), in the Crucifixion, and in the tomb? How is this hiddenness like what is hidden in a root under the ground?

For Further Discussion

1. What principles do the following quotes express?

- A tree with strong roots laughs at storms. Malay proverb
- When the root is deep, there is no reason to fear the wind. African proverb

- Deep roots are not reached by the frost. Author J.R.R. Tolkien
- Roots anchor a tree, of course, allowing it to stand up to much of what nature can throw at it. Joe Rankin, a forestry writer
- A tree with strong roots can withstand the most violent storm, but the tree can't grow roots just as the storm appears on the horizon. Dalai Lama XIV

2. In *Champak Magazine* is found the story, [Root and Branches](#), about a huge Banyan tree on the side of a road leading to a village. Its root and branches had an ongoing argument over which part of the tree was most important. The branches contended that they and the leaves were more important because they provided shade to tired travelers, while no one even noticed the root. The root replied that the branches wouldn't survive without its support.

"That's true," the branches answered, " but we take in the air and sunlight we need to survive."

"And I absorb the water that keeps you alive," the root retorted.

A squirrel sitting on the tree who was listening to this exchange spoke up, "Why are you arguing? Each of you should just do your work without worrying who is the greatest, and the tree will then grow strong and beneficial to the world."

Philosopher Matshona Dhliwayo wrote: "A tree's beauty lies in its branches, but its strength lies in its roots."

How does this story relate to Jesus' teaching about greatness and service ([Matthew 20:25-28](#))?

How does it relate to Paul's teaching about the church as a body with many members, all with different gifts ([1 Corinthians 12:4-7, 14-26](#))?

3. How is it possible that fragile roots are able to anchor and nourish plants and trees, some as great as sequoias and redwoods? How might that aspect of life in the natural world illustrate some truth about the power and usefulness of even the seemingly lowest and weakest human?

4. When it comes to understanding what happens underground, [master arborist, Gilbert A. Smith writes](#): "We need to sort of change our perception of 'survival of the fittest.' You see plants, fungus, bacteria, and soil insects have been around for an immensely long time. They have learned how to play together, nicely. ... bacteria along with the fungi, secrete enzymes that digest stuff, they gobble it up, die and release water soluble, plant available minerals. In turn, these essential minerals are absorbed through the *mycorrhizae* [from Latin, meaning 'fungus roots'] and transported into the plant roots!"

What lessons could we learn from the way roots, fungus, bacteria and soil insects interact that might benefit humanity as a whole and our churches in particular?

5. How have your familial roots provided you with stability and sustenance, and in what ways do you wish they might have been different?

6. If you grew up in one religious tradition but now are part of another one, what was lacking in the roots or branches of the first one that you found in the one you're in now?

7. The root cap exudes lubricants, which eases the passage of the root through the soil. What are some spiritual lubricants God provides which we can use to find the water of life and spiritual nutrients we need?

8. Discuss this, from author and educator Stephen Covey: "You can't have the fruits without the roots."

Responding to the News

Brainstorm ways you can strengthen your rootedness in Christ. Choose one way you'll work to do that this week.

Prayer suggested by [Psalm 63:1](#); [2 Peter 3:17-18](#); [1 Corinthians 15:58](#); [2 Corinthians 1:21-22](#); [Hebrews 13:8-9](#); [2 Thessalonians 2:16-17](#); [Ephesians 3:14-19](#)

O God, we thirst for you, as dry tree roots thirst for water in hot, dusty soil. Help us to send spiritual roots down deep into the grace and knowledge of the One who is the same yesterday and today and forever, our Lord and Savior Jesus Christ, who is able to give us stability when the earth shakes and the storms of life swirl about us. Rooted and grounded in your love, and strengthened and comforted by your grace and your Spirit who gives us hope, may we be steadfast and immovable in the work Christ gives us to do, until he comes again. Amen.