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Theme : Mangrove - the Mysterious and Rich Forest

Mangrove – the Forest That Grows in the Sea

"Forests that grow in the sea? You're kidding! Forests grow on the land. Fish swim in the sea." Surprisingly, however, such forests exist on this planet: they are called mangroves.

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Until recently, if someone had told me that there are forests that grow in the sea, I would have thought, "You' re kidding! Forests grow on the land. Fish swim in the sea." Surprisingly, however, such forests exist on this planet: they are called mangroves. Does that name sound familiar to you? And even if it does, you may still find it surprising. **How is it possible for a forest to grow in the sea?** To find out more, I asked Dr. Tomomi Inoue to reveal the mysteries of the mangrove world.

Mangrove tree roots

Photo 1: Bamboo shoot like roots (Pneumatophore), Pohnpei, Micronesia

Photo 2: Bending knee like roots (Knee root), Viet Nam

Mystery of Mangrove

Mangrove forests grow in tidal estuaries in the tropics and subtropics.

To survive in the sea, they have to endure salt, regular flooding and tidal currents. ***How do they survive and grow in these conditions?*** This mystery has deeply fascinated Dr. Inoue and motivated her research. I agree; I had never previously seen trees growing in the tidal zone. So, then, how do mangrove trees grow there? ***The key is in their unique roots.***

Gifted Roots

As shown in the Tarzan movies, tropical forests often grow with intertwined tree roots. So do mangrove trees. Some of their roots grow up into the air, where they become tangled with each other. Dr. Inoue explains that this provides support for the trees' "body" in the soft soil. Different species have their own unique roots, like bamboo shoots, with bent knees (photos 1, 2, 3). ***I can see that each does its best to stand firm in the unstable soil.***

If you look at these roots in cross-section under a microscope, you can see a straw-like structure that provides an air path: mangroves breathe through their roots. But that' s not all. The roots are also doing an essential job deep under the ground. Dr. Inoue found that they recruit specific types of bacteria that live in the mud. From those bacteria, the trees receive nitrogen, but much of the process is still mysterious.***With their curious shapes, the roots work hard not just up***

in the air, but also deep in the soil.
Furthermore, she continues, mangrove trees work 24 hours a day to prevent salt intake from the sea water. Some roots filter out the salts, others excrete it. This is amazing and must require a lot of energy. Mangrove roots are thus gifted. They work hard to keep the trees upright in the soft soil and moving water, breathe air above the water, and keep shunting salt out, which is energy-intensive work. ***We can liken this to a circus performer juggling and playing a pantomime, all while balancing on a ball.***

Living in Harmony with Rich Mangrove Forests

Living and growing vigorously in adverse environments, mangrove forests support many living creatures (photos 6-12 on page 4). Humans are no exception, benefitting richly from mangrove forests. For many types of living things, mangrove forests provide nursery grounds and habitat. For humans, ***they provide fish stocks, firewood (photos 4 and 5), medicines, and protection against coastal erosion.*** Yet despite all these benefits, it is a painful fact that they continue to disappear in the pursuit of land development for housing, plantations, shrimp ponds, mining, and war. But there is a ray of hope: ***by protecting coastal regions from recent devastating tsunamis,*** they gave the world a deeper appreciation of their role, promoting conservation activities such as reafforestation. I deeply hope humankind can come to live in harmony with mangroves.

Future Research on Mangroves

Mangrove trees rely on their unique roots to thrive in sea water. Just focusing on their roots is fascinating enough.

Photo 3: Mangrove trees standing in the sea water. Kiribati

But they are still shrouded in mystery. Dr. Inoue says nearly a hundred species of mangrove trees are known, and each has its own functions and mechanisms yet to discover. This arouses my curiosity even more.
Dr. Inoue hopes to develop her research to be able to ***listen to the "voices" of mangroves,*** and relay their message to people to foster better relations between mangroves and other living things, particularly humans, which all depend on mangroves. I cannot take my eyes away from the mangroves.

Photos 4 and 5: Mangrove trees are quality firewood. It provides a strong and long-lasting fire. Local residents have been used the mangrove firewood for cooking.

Ecosystem in Mangrove Forests

A wide range of living creatures are living in mangrove forests. These photos are just a few example.

6 : Lumnitzera littorea, Kiribati
7 : Sonneratia alba, Iriomote Japan
8 : Proboscis monkeys, Malaysia
9 : Sea snake, Fiji
10 : Monitor lizard, Malaysia
11 : Fiddler crab, Fiji
12 : Mud skipper, Viet Nam

TropicalCoastalEcosystemsPortal

The website provides information on tropical coastal ecosystems: world distribution maps, plant species lists and ecosystem functions.
The information would contribute to a deepened understanding of tropical coastal ecosystems.

URL:http://www.nies.go.jp/TroCEP/index.html

TropicalCoastal EcosystemsPortal

Related Papers

1) Inoue T., Shimono A., Akajji Y., Baba S., Takenaka A., Chan H. T. (2020) Mangrove-diazotroph relationships at the root, tree and forest scales: diazotrophic communities creates high soil nitrogenase activities in Rhizophora stylosa rhizospheres. Annals of Botany, 125(1), 131-144.
2) Inoue T., Khozu A., Shimono A. (2019) Tracking the route of atmospheric nitrogen to diazotrophs colonizing buried mangrove roots. Tree Physiology, 39(11), 1896-1906.
3) Inoue T. (2018) Carbon Sequestration in Mangroves Kuwae T. and Hori M. eds Blue carbon in Shallow Coastal Ecosystems: Carbon Dynamics, Policy, and Implementation, Springer, pp.373

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