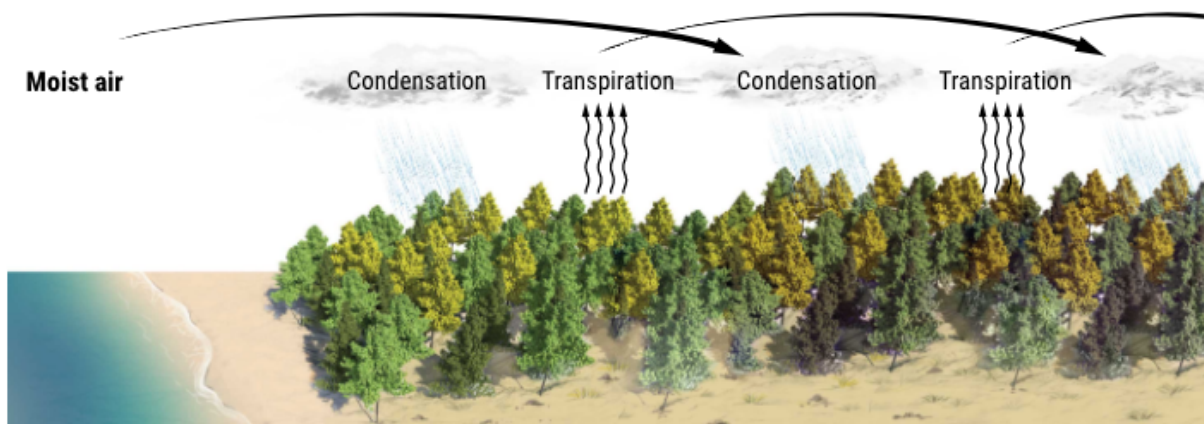
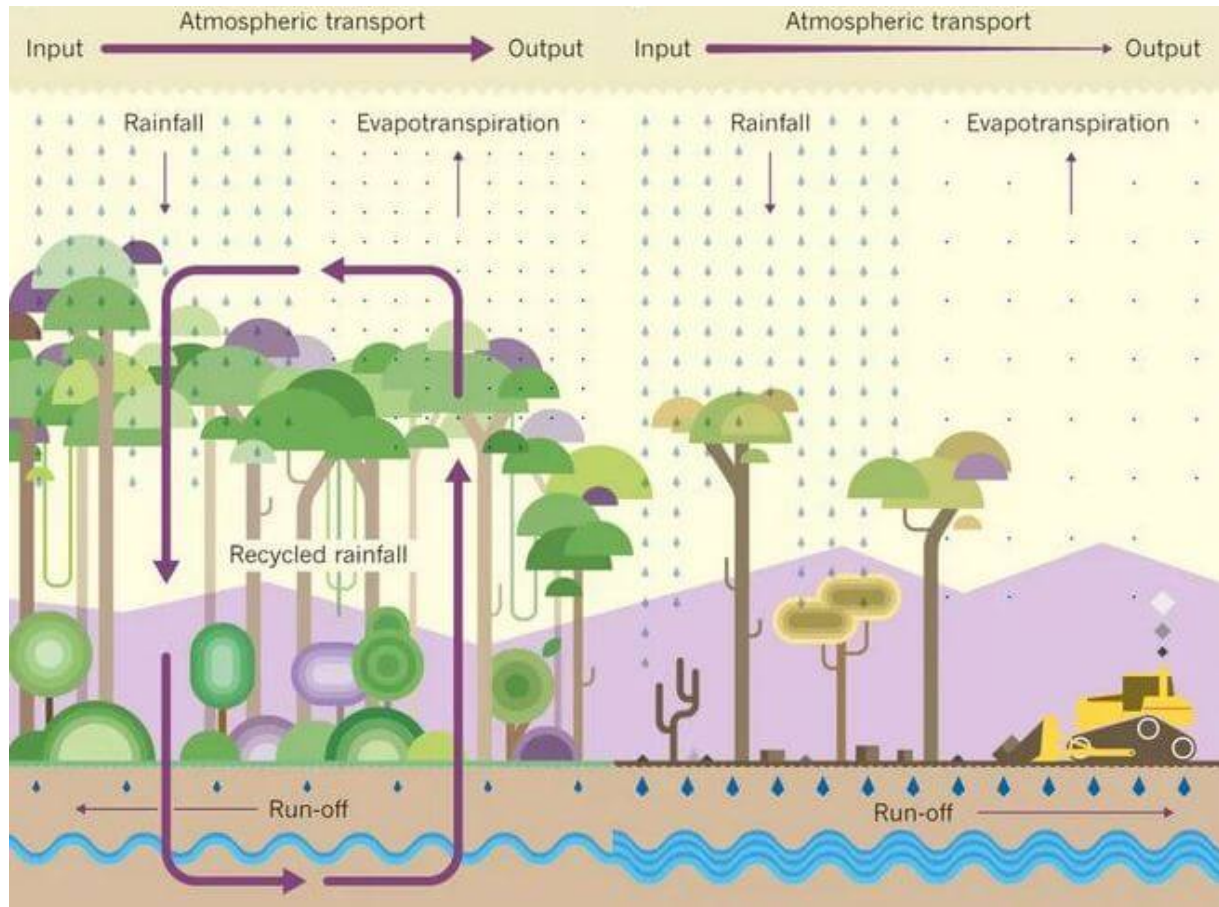


Trees are the Life Support System of the Planet

Trees seed 2/3 of the rain on the planet. All water droplets in a cloud need a rain seed to form around. Trees make the very best cloud seeds. Trees, through transpiration, release tiny atomized aerosol VOC particles. Because the rain seeds trees make are so fine, they allow the clouds to get five times thicker before they turn into rain, doing a better job of cooling the planet. Over the ocean tiny organisms in the sea spray seed the clouds that form over the ocean. When there is thick forest cover on the coast, the trees there will make new clouds that rain further inland. This is the rain chain that carries rain into the interior of a continent, with each forest sending the rain on to the next forest. If an area is deforested it breaks the rain chain. Without forests rain can't reach the interior of a continent, and it becomes arid.



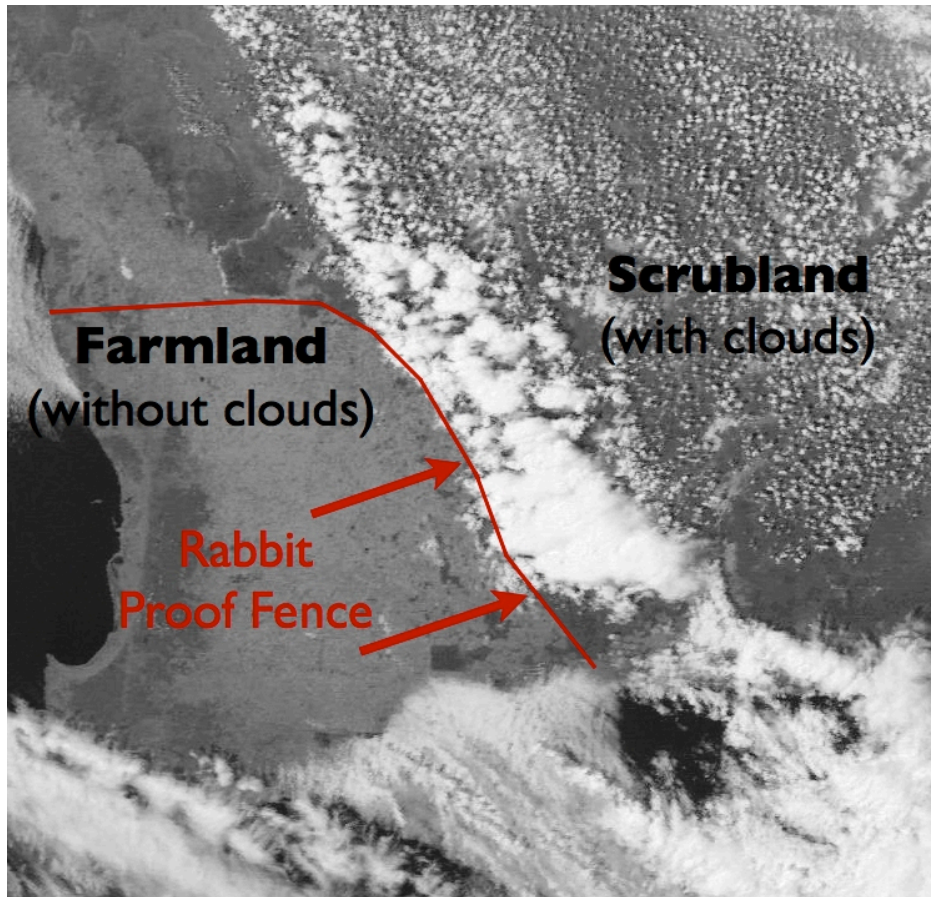
A graphic of how the biotic pump functions, *Source: [N. Desai/Science](#)*



The effects of Deforestation on Rainfall, Source: [L. Araújo/Nature](#)

All plants seed the rain. The mist rising from a forest, or a meadow, just as the morning sun first hits the land, or just after a rain, sends new moisture into the clouds. I've started photographing the mist as it rises. It lasts only for a short period, as the sun dries the leaves. Trees provide a multi-tiered structure of leaves to seed the rain. I recently saw an article, "Trees make Rain – there is science now to prove it!"¹ An aerial photograph showed a piece of land in Australia. There was scrubland next to agricultural land. A rabbit-proof fence has been installed between them. There was no transpiration coming from the agricultural land, but over the scrubland there was more transpiration. Below both pieces of land was a forest where there was much more transpiration. Scientists who were studying this land documented that before the rabbit-proof fence was erected, there was more rainfall on the agricultural land.

¹ "Trees make Rain – there is science now to prove it!" Learning From Nature, <https://www.learningfromnature.com.au/drought-proof-increasing-rainfall/>. Accessed 9-28-22.



Cloud cover either side of the Rabbit-Proof Fence (©Earth Observing Laboratory).
<https://www.learningfromnature.com.au/drought-proof-increasing-rainfall/>

Another article, Rivers in the Sky (Yale 360),² reports growing evidence that trees create vast rivers in the sky, huge flows of moisture that deliver rain around the globe. These atmospheric rivers contain more water than all the rivers on earth. However, globally, we are cutting 15 billion trees per year. This is reducing rainfall globally. Drought is becoming an increasing problem.

Seeding rain is not all that trees do. Trees feed the aquifers. When it rains, trees gather water through their surface roots, and store it underground for later use, like camels. During dry times trees draw water up from below, providing moisture for themselves and the biota around them. When an area is deforested, a clay layer forms on the surface of the soil. When it rains the clay layer swells, actually inhibiting rain from going back the ground, and the water runs off. Trees and forests makes the difference between a living aquifer and a fossilized aquifer.

² Pearce, Fred. "Rivers in the Sky: How Deforestation Is Affecting Global Water Cycles." Yale Environmental 360, 24 Jul. 2018, <https://e360.yale.edu/features/how-deforestation-affecting-global-water-cycles-climate-change>. Accessed 9-28-2022.

The Critical Role of Mature Forests to Reversing Climate Change:

Trees absorb 30% of the 9.4 gigatons of carbon humans create each year.³ Half of this is done by the 1% biggest diameter trees in every forest around the world. Trees, depending on their species, roughly double how much carbon they sequester every 50 years, so it is exponential. For example, a white pine will sequester a half ton of carbon in the first 50 years; from 50 to 100 years, 1 ton; from 100 to 150 years, 2 tons, from 150 to 200 years, 4 tons and so on.⁴ The tallest tree in New England, The Jake Swamp Pine, is in Mohawk State Forest, in Charlemont, MA. It is 165 years old; and 175 feet tall. It is storing 7 tons of carbon. At a certain point trees reach their maximum height, but they can continue to thicken for hundreds of years. A 100-year-old tree lays on as much carbon in a year, as a sapling takes 25 years to add. It is not until a tree reaches 70 to 100 years, that it starts stepping into its accelerated capacity to sequester carbon. Meanwhile, the ideal size for a saw log is 14" and no bigger - a 70 to 100-year-old tree. 70 to 100-year-old trees are still young trees, with hundreds of years more growth in them. It would be as if we decided to kill every person when they reached the age of 19 to 25. Forests are losing their mother trees, who hold the genetic memory going far back in time for how to overcome diseases, and pests, and make strong trees.

Swamp forests sequester 4x as much carbon as other forests.⁵ In mature old growth forests, 60% of the carbon is stored in the forest duff layer, which is quite deep. When a forest is logged, the forest floor bakes, releasing all the carbon stored in the forest duff layer back into the atmosphere. It will take 50 -100 years for the forest duff layer to recover. Each time a forest is cut, the forest duff layer becomes shallower. Some deforested areas never recover, and are still deserts thousands of years later.⁶

Trees purify the water. They purify the air. They take carbon from the air, and put it back in the ground where it belongs. Trees cool the planet, and not just by creating shade, but also through transpiration.⁷ "The water that a single tree transpires daily has a cooling effect equivalent to two air conditioners for a day." When many big old street trees were cut down in Worcester in 2014, summer electrical usage went up 40%, due to increased need for air conditioning.

The Boreal Forest

³ Moomaw, William R., Susan Masino, and Edward K. Faison. "Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves the Greatest Good." *Front. For. Glob. Change*, 11 June 2019, <https://doi.org/10.3389/ffgc.2019.00027>. Accessed 9-28-2022.

⁴ Leverett, Robert T., Susan A. Masino, and William R. Moomaw. "Older Eastern White Pine Trees and Stands Accumulate Carbon for Many Decades and Maximize Cumulative Carbon." *Frontiers in Forests and Global Change*, 13 May 2021, <https://doi.org/10.3389/ffgc.2021.620450>. Accessed 9-28-2022.

⁵ McLeish, Todd. "Swamped With Carbon." *Northern Woodlands*, 10 Jul. 2019, <https://www.northernwoodlands.org/discoveries/swamped-with-carbon>. Accessed 9-28-2022.

⁶ Cassella, Carly. "Ancient Maya Landscape Never Recovered From Deforestation Thousands of Years Ago," *Science Alert*, 22 Aug 2018, <https://www.sciencealert.com/the-ancient-landscape-of-the-maya-never-recovered-from-deforestation-thousands-of-years-ago-scientists-warn>. Accessed 9-28-2022.

⁷ *Ibid.* Pearce. *Rivers in the Sky*.

The Boreal Forest is mission-critical for our climate survival.⁸ Canada has announced plans to cut 50% of the Canadian Boreal Forest,⁹ a suicidal and irrevocable act. Domestic toilet paper, especially the soft cushy kind like Charmin, is made from 30,000-year-old Boreal Forest virgin timber. The Boreal forest is mission critical to climate survival. 28 million acres of the Boreal Forest have been cut down since 1996, an area the size of Pennsylvania.¹⁰ Major toilet paper brands have refused to switch to sustainable materials.¹¹ Americans are a major contributor. We are 4% of the world's population. We are using 20% of the world's tissue paper.¹²

Trees heal us. When we walk in the forest, the minute we see green, all the cortisol drops out of our body. When trees sense our presence, they emit aerosols to calm us down, and then they go to work on our immune system. A 15-minute walk in a pine forest boosts our immune system for a month.¹³

When a forest along a coast is cut down, the marine ecology by that coast begins to die. Marine life needs iron, but it needs a very specific kind, provided by fulvic acid, which is abundant in the fallen leaves in the forest.:

“Mother trees have an effect on the oceans as well, as Katsuhiko Matsunaga and his team in Japan had confirmed. The leaves, when they fall in the autumn, contain a very large, complex acid called fulvic acid. When the leaves decompose, the fulvic acid dissolves into the moisture of the soil, enabling the acid to pick up iron. This process is called chelation. The heavy, iron-containing fulvic acid is now ready to travel, leaving the home ground of the mother tree and heading for the ocean. In the ocean it drops the iron. Hungry algae, like phytoplankton, eat it, then grow and divide; they need iron to activate a body-building enzyme called nitrogenase. This set of relationships is the feeding

⁸ Mitchell, Alanna. “The Boreal Forest: Our Secret Weapon to Fight Climate Change.” Canadian Wildlife Federation, 24 Sept 2019, <https://blog.cwf-fcf.org/index.php/en/the-boreal-forest-our-secret-weapon-to-fight-climate-change/>. Accessed 9-29-22.

⁹ Beresford-Kroeger, Diana. “To Speak for the Trees: My Life's Journey from Ancient Celtic Wisdom to a Healing Vision of the Forest.” Timber Press, 2021

¹⁰ NRDC. “Major Toilet Paper Makers Are Wiping Out the Climate-Critical Boreal Forest.” CleanTechnica, 13 Sept 2022, <https://cleantechnica.com/2022/09/13/major-toilet-paper-makers-are-wiping-out-the-climate-critical-boreal-forest/>. Accessed 9-29-22.

¹¹ Wolfson, Sam. “Major brands’ refusal to use sustainable materials is having a devastating impact on forests and climate, new report says.” The Guardian News, 1 Mar 2019, <https://www.theguardian.com/world/2019/mar/01/canada-boreal-forest-toilet-paper-us-climate-change-impact-report>. Accessed 9-29-22.

¹² Miller, Kevin. “Tree Free Toilet Paper: Why You Should Use It.” Reelpaper, 23 Nov 2020, <https://reelpaper.com/blogs/reel-talk/tree-free-toilet-paper>. Accessed 9-29-22.

¹³ McKay, Jeffrey. “Call of the Forest: The Forgotten Wisdom of Trees.” 2016, <https://calloftheforest.ca/>. Accessed 9-28-22.

foundation of the ocean This is what feeds the fish and keeps the mammals of the sea, like the whale and the otter healthy.”¹⁴

These are just some of the extraordinary things trees do for us. We're only now just beginning to understand the complexity of just how much our lives and all life depends on trees to survive and thrive. Most models of how water works on the planet show the cycle beginning with the rain falling on the land, then flowing down into brooks, lakes, rivers, and finally to the sea. How does water get back up into the sky? There is growing evidence that the global water system is a living system driven predominantly by mature forests around the world, who are linked to each other by the atmospheric rivers they create.¹⁵

I mentioned above that we are cutting 15 billion trees a year. The earth has 3.04 trillion trees. "The total number of trees has decreased by about 46 percent since the beginning of human civilization."¹⁶ Of those 15 billion trees, a third are cut for paper. Only 30% of paper is recycled.¹⁷ I've started saying to myself, "It's not paper, it's rain." In the United States, we've cut 95 to 98% of the forests that were here when we first arrived as settlers.

¹⁴ Beresford-Kroeger, Diana. "To Speak for the Trees: My Life's Journey from Ancient Celtic Wisdom to a Healing Vision of the Forest." Timber Press, 2021

¹⁵ Pearce, Fred. "A controversial Russian theory claims forests don't just make rain—they make wind." The Biotic Pump, 18 Jun 2020, <https://www.thebioticpump.com/post/a-controversial-russian-theory-claims-forests-don-t-just-make-rain-they-make-wind>. Accessed 9-29-22.

¹⁶ Peng, Lucinda. "Trillions of Trees: Yale study finds three trillion trees on Earth." Yale Scientific, 3 Feb 2016, <https://www.yalescientific.org/2016/02/11815/>.

¹⁷ Rabin, Emily. "The Paper Chase." Green Biz, 1 Aug 2004, <https://www.greenbiz.com/article/paper-chase>. Accessed 9-29-22.