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Forest climate: Why atmospheric water matters

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At the 2018 High-Level Political Forum (HLPF) on Sustainable Development on July 10, a report was released during a session titled "Forests and Water on a Changing Planet: Scientific Insights for Building Sustainable and Resilient Societies", hosted by the Permanent Mission of Austria to the United Nations and cohosted by the International Union of Forestry Research organizations (IUFRO).

The report "Forest and water on a changing planet: Vulnerability, adaptation and governance opportunities" reviewed a thousand recent publications and involved 50 authors working in 20 countries, including Indonesia. Among its conclusions is a major game-changer for policy: re-anchor the forest-climate discussion in water, rather than carbon. Meeting the water-SDG requires dealing with climate change, meeting the climate change SDG requires dealing with water. Forests and trees connect these issues, across the scales.

Every tree provides shade, reduces wind speed, uses water, increases humidity and cools it surrounding air. That's well known and may be the basis of the popularity of tree planting as sign of commitment to deal with global climate change. But the 'micro-climate' effects just mentioned have so far not been recognized in internationally agreed climate policy. The UNFCCC climate convention, and its Paris Agreement, focus on carbon-dioxide (CO_2) and other greenhouse gasses, not on the most potent greenhouse gas of all: water vapour. Historically there were good reasons for this choice: water vapour is coming and going, on average staying in the atmosphere for 8 days, rather than the 5 – 15 years for CO_2 and methane (CH_4), 100 years for nitrous oxide and even longer for other greenhouse gasses. For getting long-term global climate change under control, the emissions of other greenhouse gasses took priority. The

energy transition needed to wean humankind off its fossil fuel dependence took main stage, justifiably so.

As forests and soils, especially peat soils, store large amounts of carbon, forest conversion and human-induced fire became known as an additional source of CO_2 emissions, and efforts to reduce such emissions became part of the climate action portfolio. In doing so, however, 'avoided carbon emissions' became the main metric by which forests and trees were valued for their contributions to climate and climate change. The initial promise of REDD+ that this value had a financial equivalent that could make standing forests worth more than the benefits obtained by cutting them, failed to materialize, however. 'Throwing out the baby with the bathwater' might mean that disappointment with carbon finance means losing interest in forests and trees as key elements of climate. The new report suggests that it is the water that is more important than the carbon baby…

The report describes a pendulum swinging in public understanding starting from a 'paradise lost' perception that deforestation is the reason of all water-related issues (floods, droughts, erosion) and tree planting the universal solution. Twenty years ago, the evidence that not only Eucalypts but any fast-growing tree uses more water than other vegetation replaced the 'paradise lost' view by one based on competition. It was understood that tree planting might dry up, rather than replenish streams and rivers. Carbon-focussed tree planting in dry areas became seen as a risk, and water-challenged countries such as South Africa put a water-tax on tree plantations. Cutting forests has created more opportunities for irrigation-based agriculture. This 'Blue Revolution', however, dealt with only part of the hydrological cycle: 'losses to the atmosphere. A cycle doesn't match the concept of 'loss', however. The question is where, how and when the atmospheric moisture returns as rainfall.

Satellite imagery, remote sensing and global water balance calculations and models have in the past two decades led to a reconsideration of how much of rainfall over land is derived from evapotranspiration over land, and how much comes from the oceans. Globally the answer is now half-half, but in coastal areas oceans dominate and inland the terrestrial recycling, with further nuance brought by the position relative to global atmospheric circulation systems, such as monsoons.

If trees and forests return more water to the atmosphere than most other vegetation, and recycled moisture

is a major component of rainfall, it is a logical conclusion that changes in tree cover can affect rainfall 'downwind'. Rather than being a side-effect or co-benefit, the new hydrological synthesis suggests that this may well be a major reason for conserving and enhancing global tree cover, whether inside or outside forests. Even if downwind tree cover modifies precipitation by only 10%, it can be significant for crops and livelihoods, if it comes at otherwise critical times.

The pendulum did not swing back all the way to the 'paradise lost' perception, however, as the new 'hydrological cycling' concept includes all the 'Blue revolution' insights – but it emphasizes scale and location. Scale, because the atmospheric moisture recycling depends on wind speed and may involve relations at thousands of km, often beyond the watershed. Location, because in the new understanding it matters where, not only how much, a tree injects water vapour to the atmosphere. The recycling over the Amazon basin is well studied, but atmospheric moisture links over Africa, connecting East Africa, Congo basin and Nile basin likely affect more people. Recent evidence that rainfall recycling is important for Borneo can be understood from the low wind speed over the island, making recycling more local than elsewhere on the globe.

The bottom line of these new perspective on the forest-climate relationship is that global and landscape scale climate issues are actually closely linked to the local, microclimatic effects of trees. The prospect is thus to have global climate policies that take land cover influences on rainfall seriously, and that also directly connect with local priorities and understanding. Wouldn't that be so much easier than having to explain the abstract concept of Carbon stocks and the politically charged concept of a common but differentiated responsibility to controlling climate change? Indeed, there is good reason to 're-anchor' the forest-climate debate in atmospheric water. The 'Sustainable Development Goals' offer us an opportunity to connect the pieces of the puzzle and challenge the existing boxes that constrain thinking.

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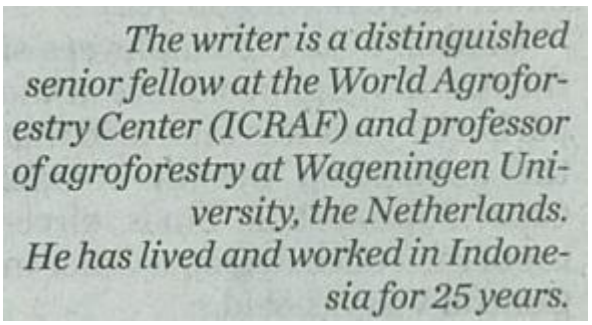
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