NATURE CREATIVE COMMONS

Nature Creative Commons

Old Forests are the Carbon Champions

Understanding Forest Carbon

PRESENTED BY:

Hummingbird Collective

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Part I :
The Carbon Understory

Is it really better for the climate to replace old-growth forests with young replanted trees?

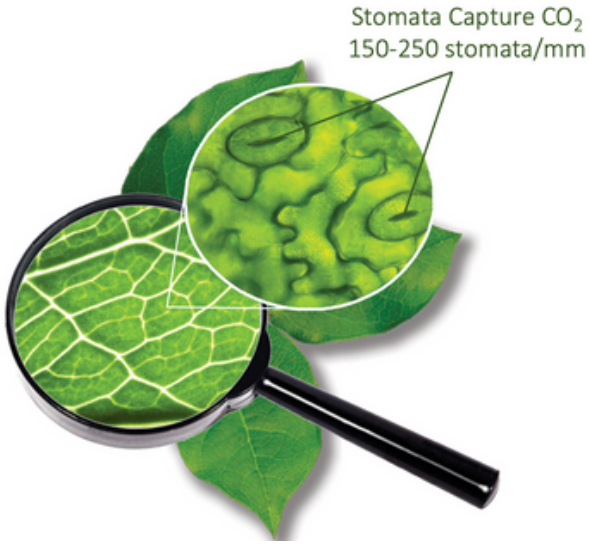
It is often said that young trees are better at mitigating climate change based on the idea that they absorb carbon at a faster rate.

This is not true.

The real story begins with understanding carbon uptake (sequestration), carbon flux and carbon storage.

Carbon Uptake

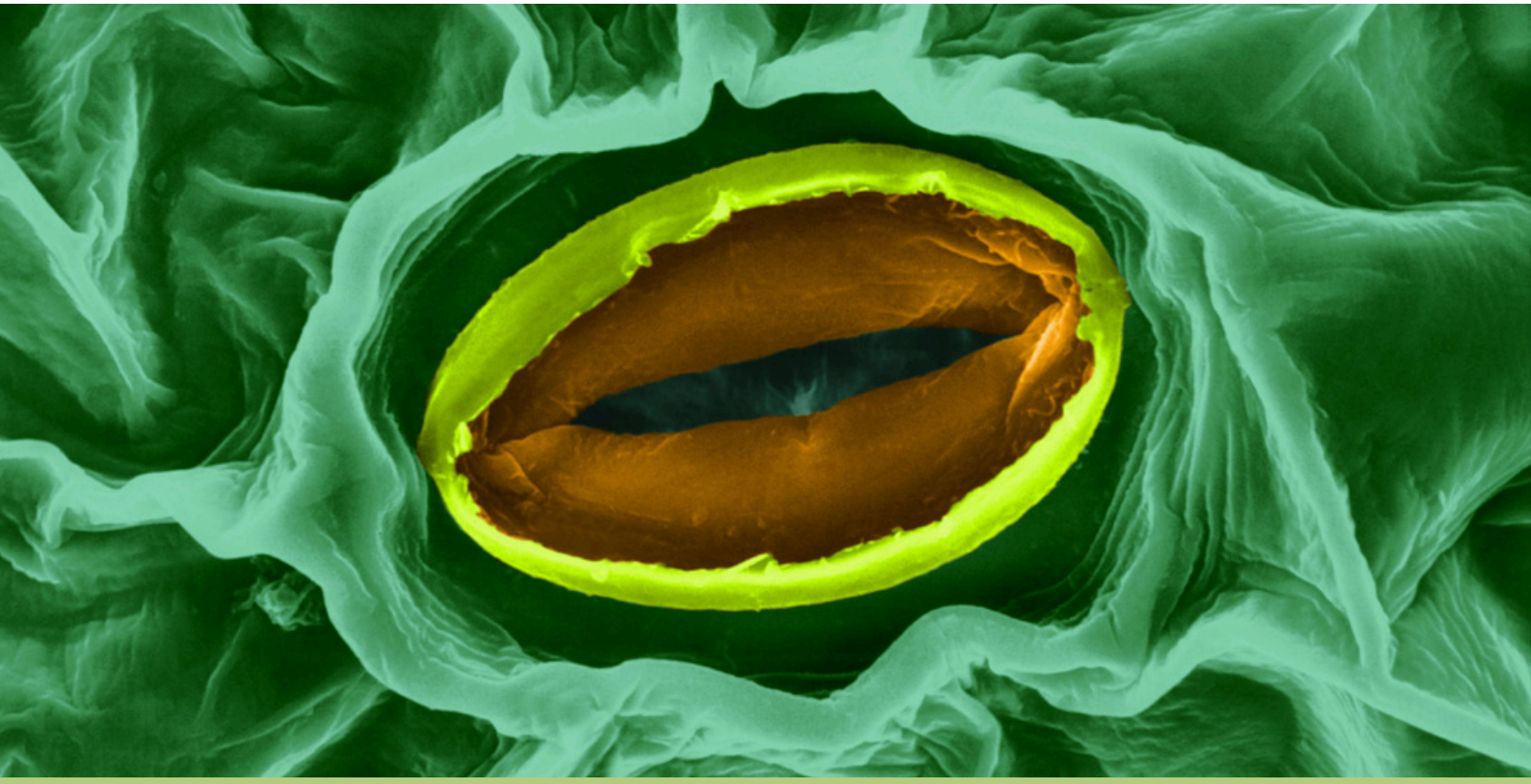
It all begins with plants and their stomata. Stomata are tiny openings in the epidermis of a plant that facilitate the exchange of carbon dioxide and oxygen.

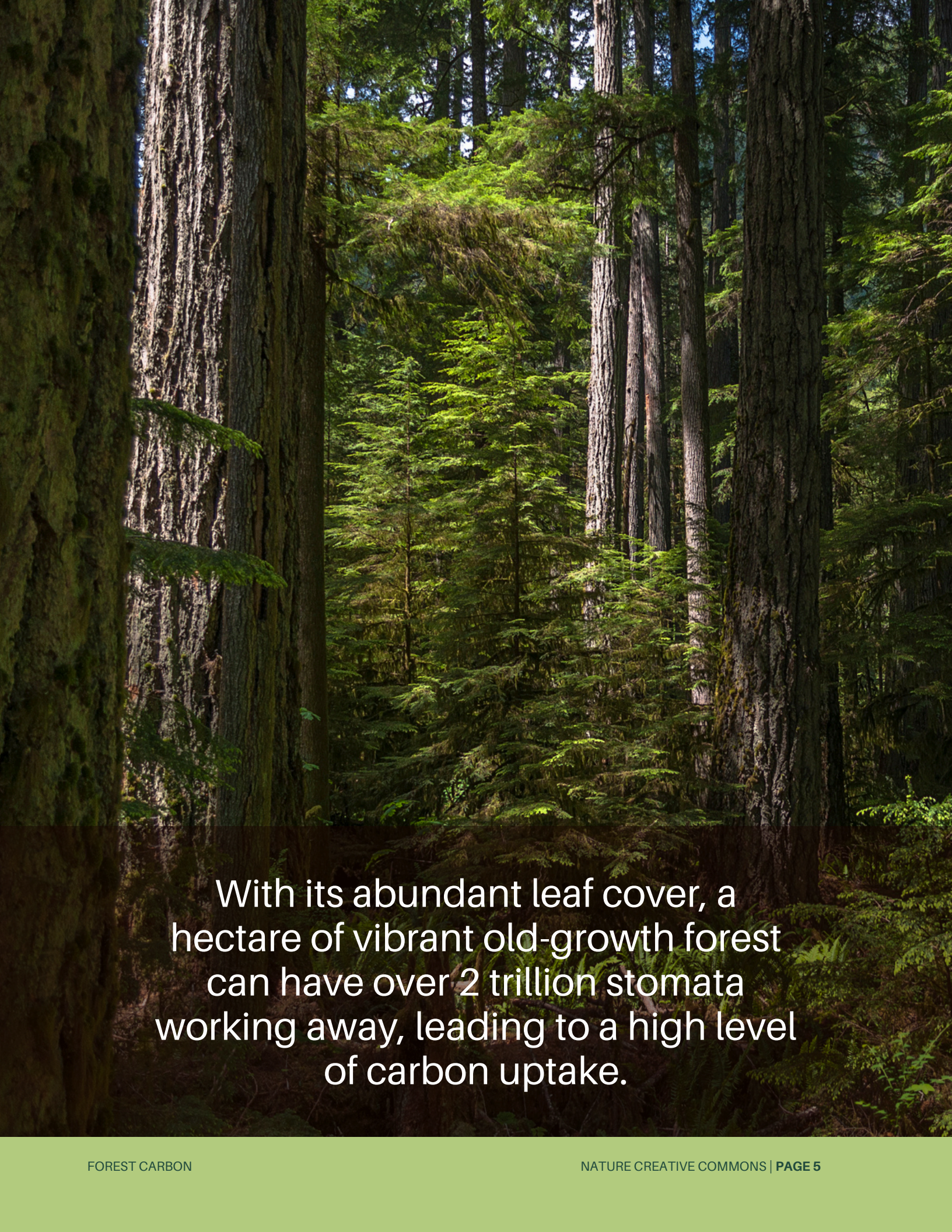


The more leaf cover in a forest, the more stomata. The more stomata, the more carbon dioxide taken in.

The net storage of carbon over a given amount of time is known as sequestration.

DENNIS KUNKEL MICROSCOPY/SCIENCE PHOTO LIBRARY



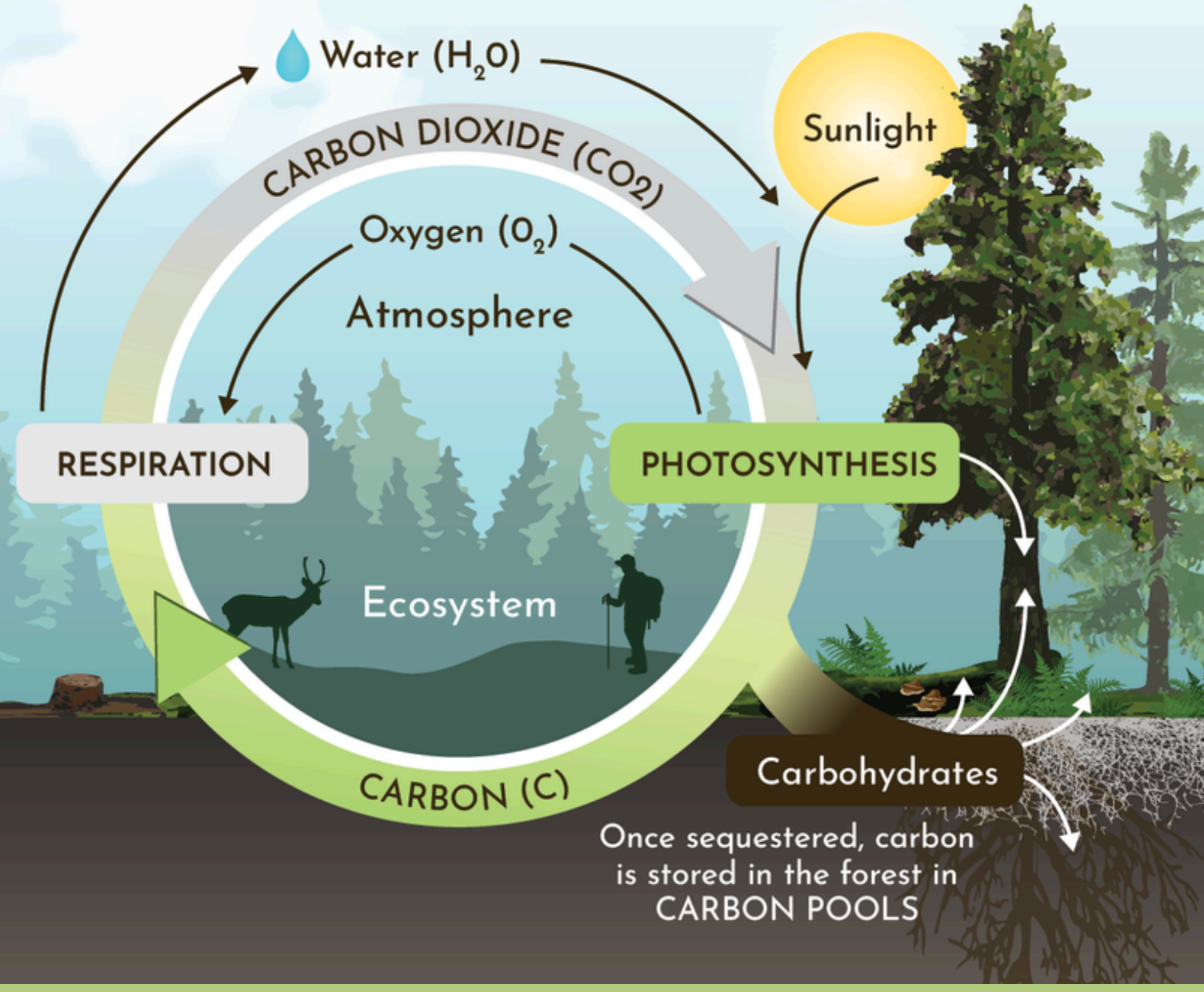


With its abundant leaf cover, a hectare of vibrant old-growth forest can have over 2 trillion stomata working away, leading to a high level of carbon uptake.

Carbon Flux

Forest carbon flux is the flow of carbon exchanged between the atmosphere and forest ecosystems.

Carbon flux is typically expressed as an annual rate. Example Carbon Flux is ~1 tonne/hectare/year net uptake



Carbon Flux

Although carbon uptake is maintained at high levels in most old-growth stands, it is usually balanced by mortality and decomposition.

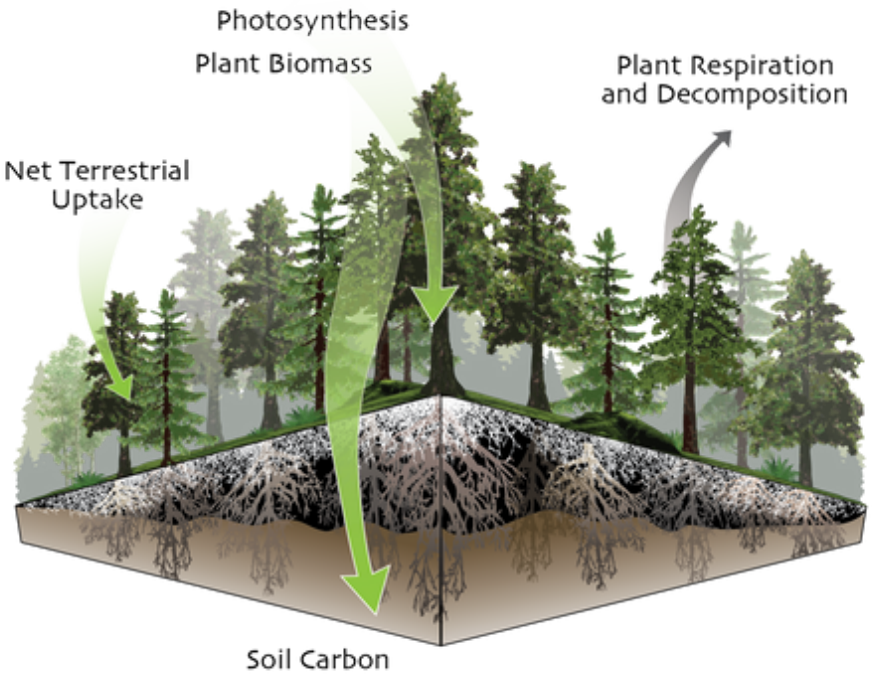
However, old forests can continuously operate as carbon-rich banks because in addition to the living tree carbon, over time they accumulate large amounts of carbon in litter, the soil, and woody debris (snags, down logs) which accumulates more rapidly than it decomposes.

An old forest is a dynamic ecosystem rich with other carbon-sequestering and recycling species – shrubs, plants, mosses, fungi, lichen, and soil organisms.

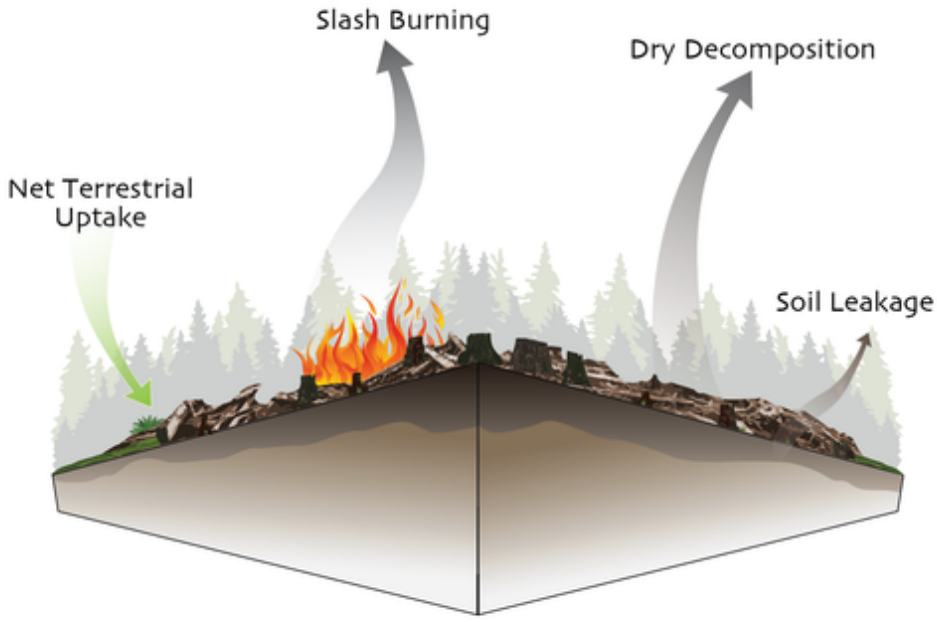
The traditional hypothesis that old-growth forests are carbon neutral is under debate as recent studies show evidence of net carbon sequestration of approximately 0.5 tonne / hectare / year*

* Flux Tower data in the Wind River Experimental Forest in Washington State that is a stand of 500-year-old Douglas Fir/Hemlock

An old-growth forest is a **CARBON SINK** as it sequesters more carbon than it emits.

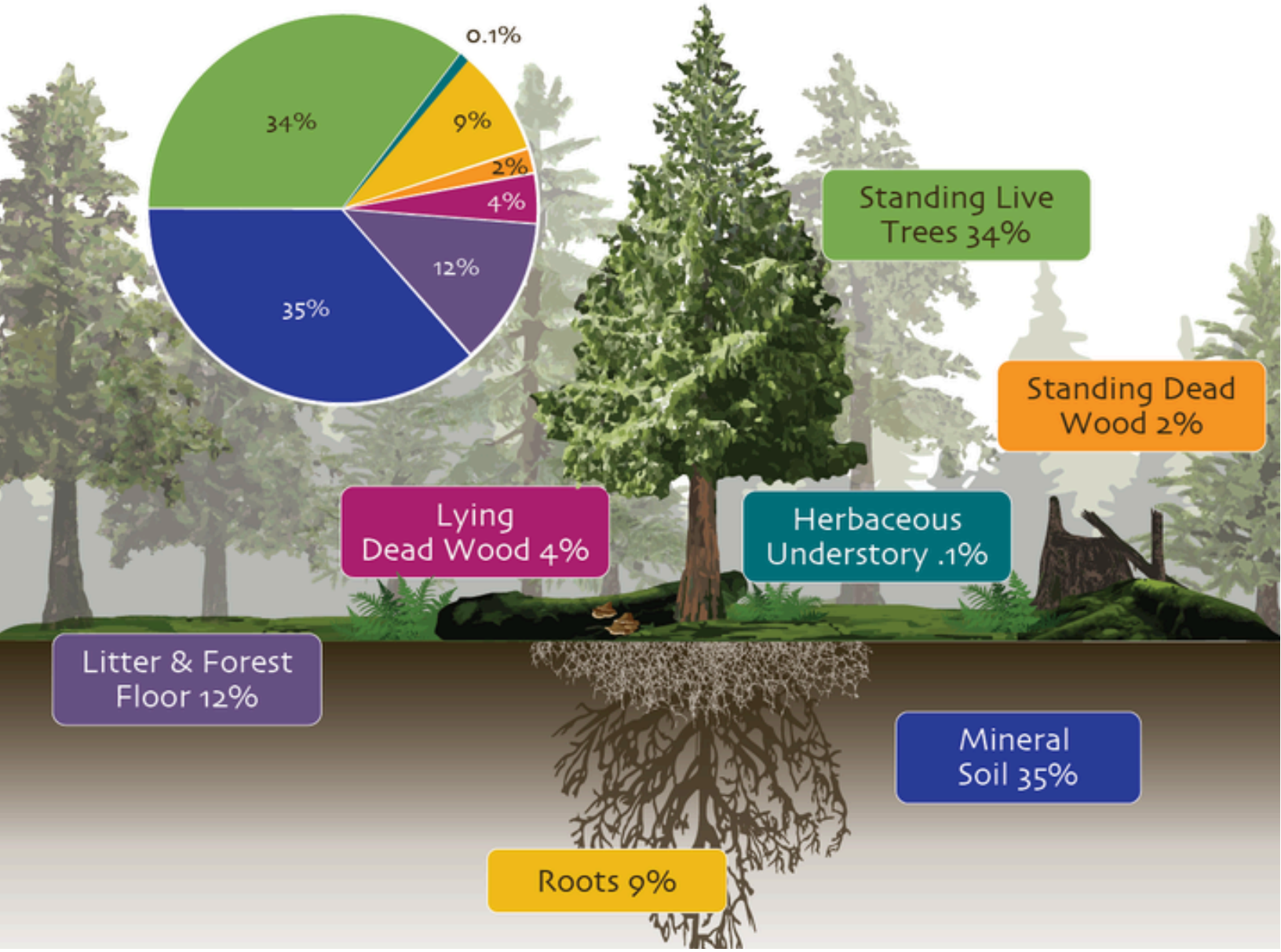


A clearcut is a **CARBON SOURCE** as it releases more carbon than it takes in.



Carbon Storage

Carbon storage refers to the total amount of carbon stored in a forest ecosystem at any one time. Carbon is stored in areas of the forest called forest carbon pools (all 7 areas in this diagram).



Roach, W. J., Simard S., Defrenne, C. E., Pickles, B. J., Lavkulich, L.M. & Ryan, T. L. (2021) Tree diversity, site index and carbon storage decrease with aridity in Douglas-fir forests in western Canada. Front. For. Glob. Change, 23 June 2021. Sec Forest Management Vol. 4, 2021


Over 1,000 tonnes of carbon can be stored in one hectare of old-growth temperate forest.

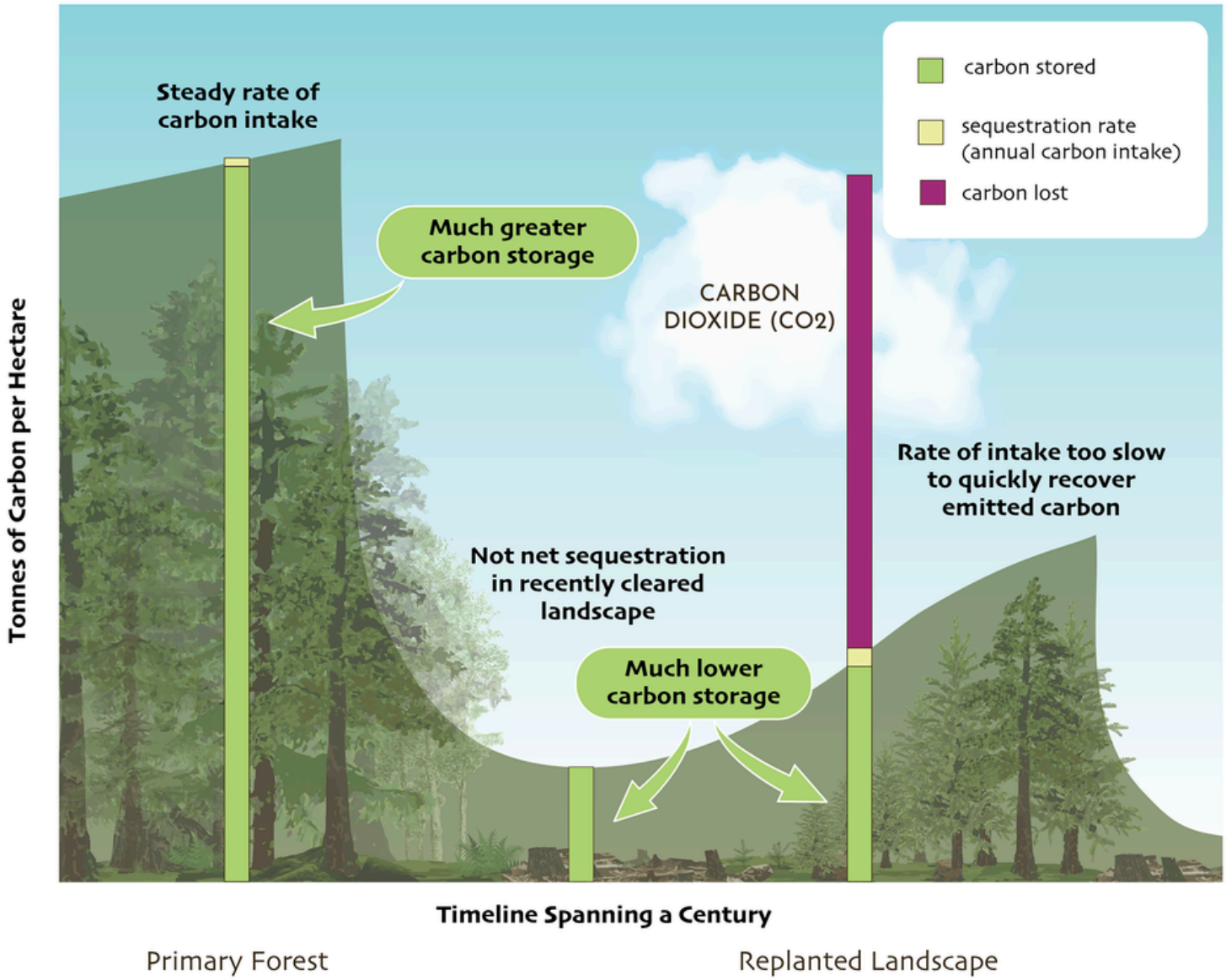
Carbon Storage

The carbon storage (1,000 tonnes/hectare) is three orders of magnitude higher than the annual amount of carbon sequestered (~1 tonne/hectare).

The claim that a young replanted forest sequesters carbon at a faster rate than an old-growth forest is **still a diversion** from the real issue – the loss of the vastly greater stores of carbon in old-growth forests.

Carbon Storage and Uptake

Old-growth forests store a much larger amount of carbon than replanted landscapes, where harvesting has caused considerable emissions.

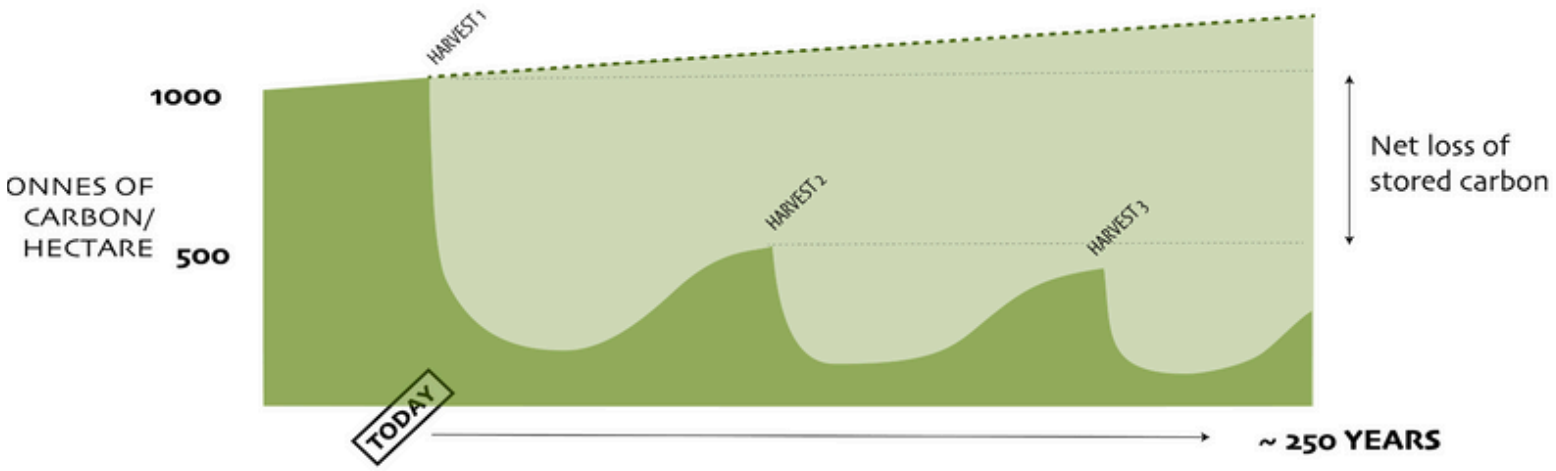


In fact, BC's old-growth coastal forests store huge amounts of carbon (up to 1,300 tonnes per hectare) which is more than in tropical or boreal areas.

Intensively harvested landscapes will not recapture this carbon for hundreds if not thousands of years and will certainly not meet the Emission Reduction Deadline needed to prevent the worst climate damages.

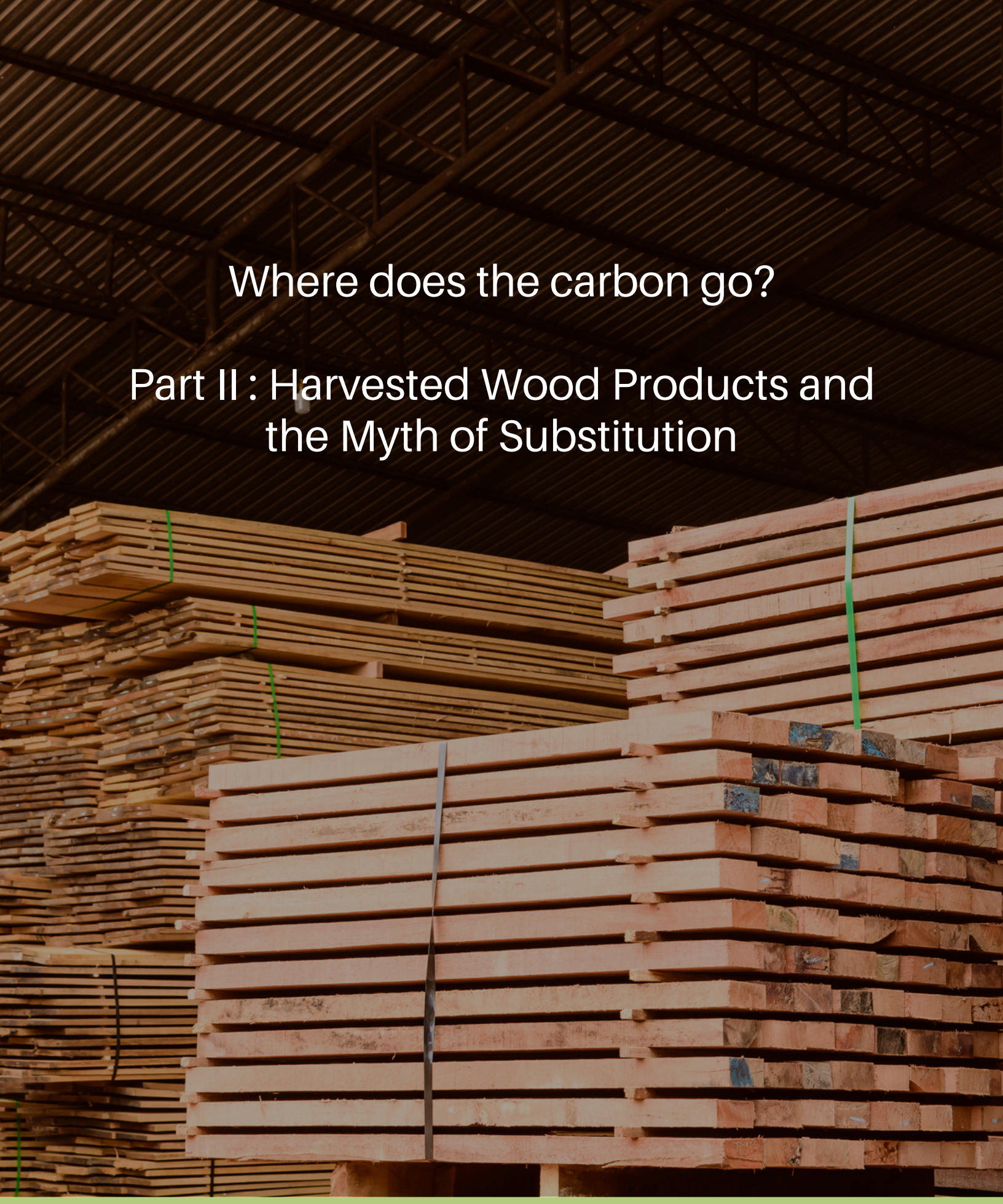
Carbon Loss Over Time

In fact, replanted forests will never recover this carbon under the repeated harvest rotations of current industrial forest practices.



Where does the carbon go?

Part II : Harvested Wood Products and the Myth of Substitution



The Forest Products Association of Canada says Harvested Wood Products are an effective way to store carbon from the forests.

This is not true.

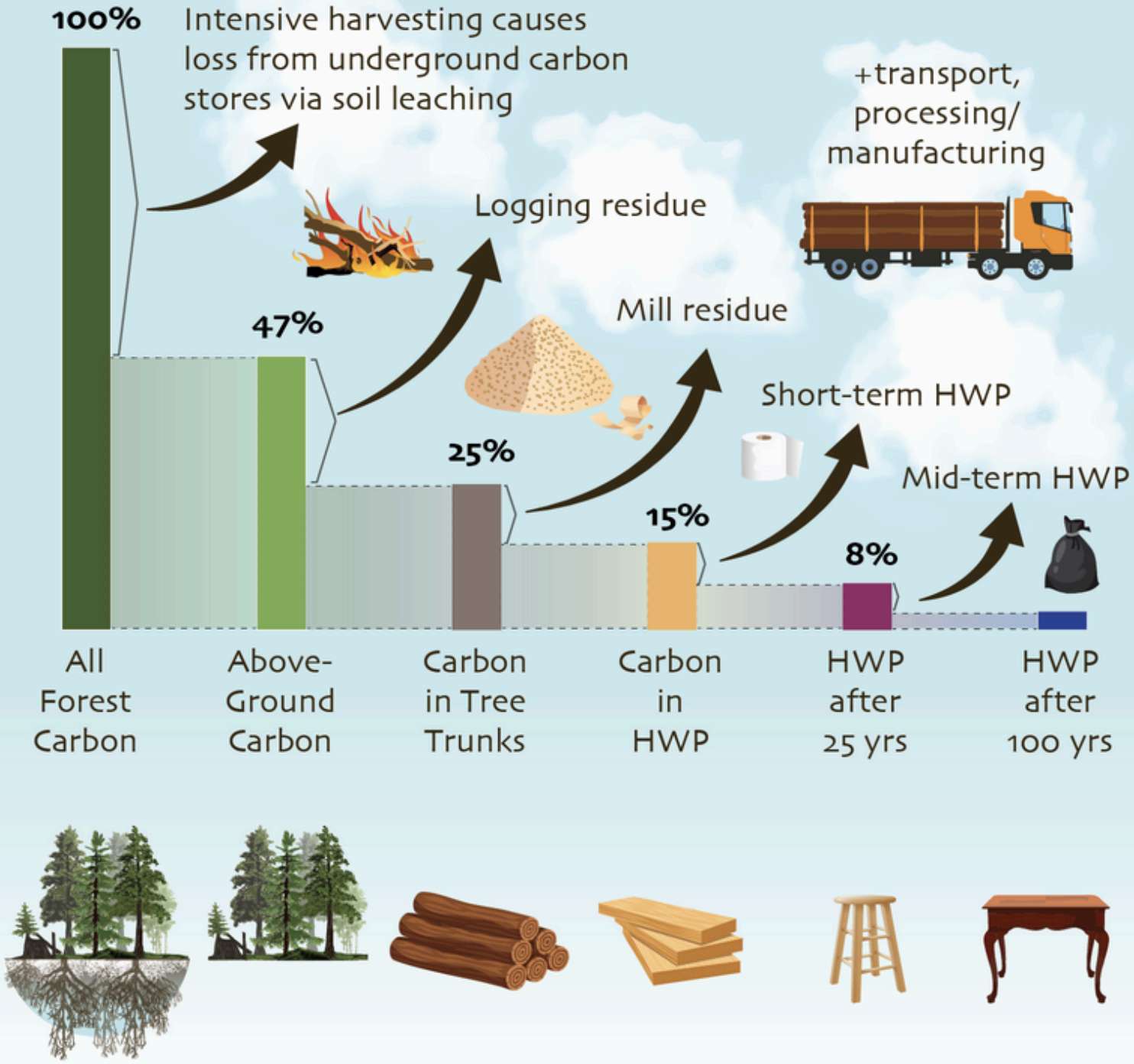
Gordon River Clearcut, photo courtesy of Ancient Forest Alliance

Harvested Wood Products

Harvested Wood Products (HWP) are claimed to be an effective way of storing carbon from forests long-term and thereby mitigating C02 emissions. However, the amount of carbon retained in Harvested Wood Products (HWP) long-term is often highly overestimated.

Carbon in intensely harvested landscapes is emitted into the atmosphere and lost during harvest, transport, processing and manufacturing.

Photo source: Katrine Kaarsemaker / Flickr



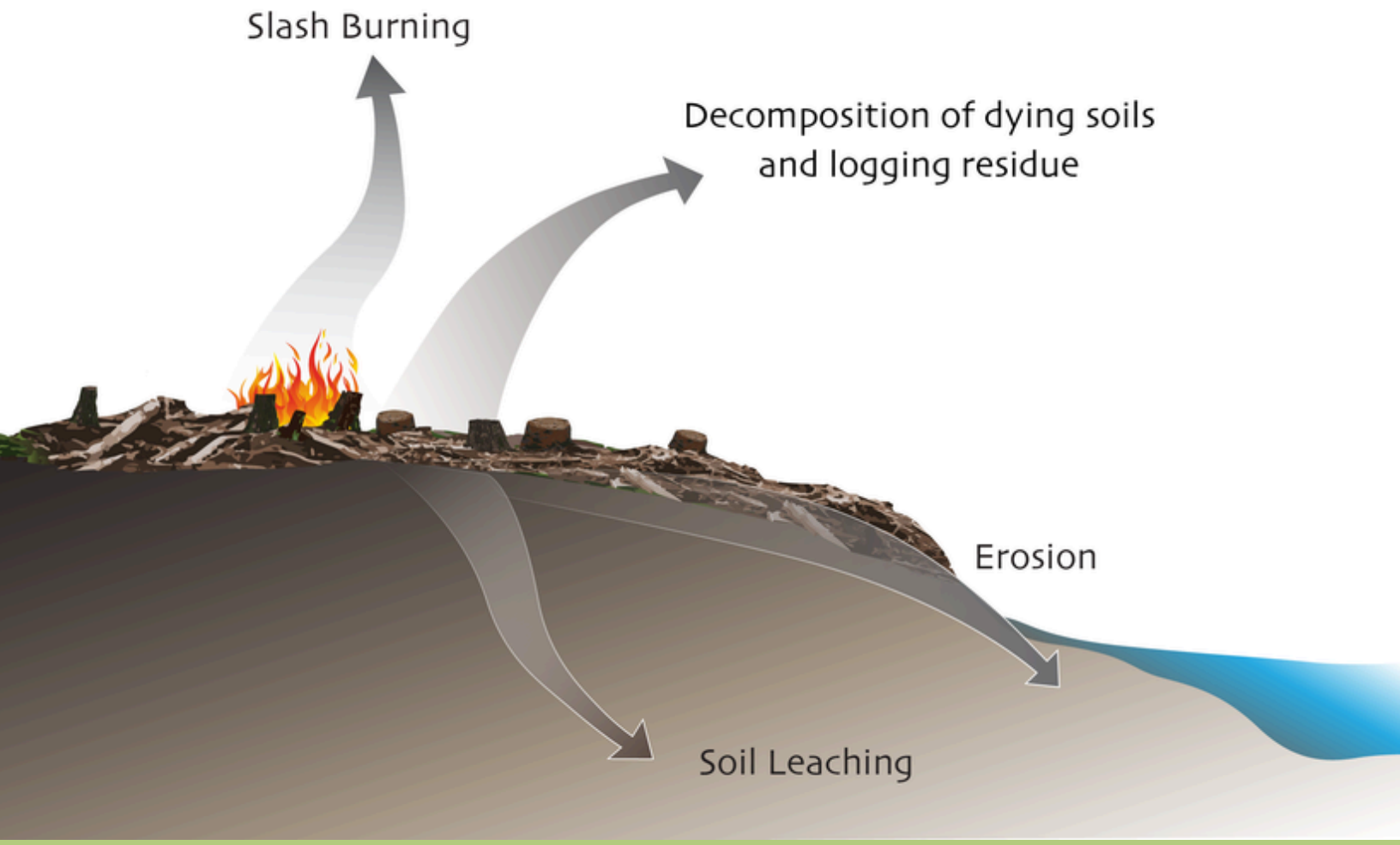
Carbon Loss from Above Ground Pools

Harvested wood products and substitution
Smith, James E.; Heath, Linda S.; Skog, Kenneth E.; Birdsey, Richard A. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p.

Dymond, C. C. (2012). Forest carbon in North America: annual storage and emissions from British Columbia's harvest, 1965–2065. Carbon balance and management, 7(1), 1-20.

Carbon Loss from Soil

Intensive harvesting also causes loss of carbon from the forest floor and soil via various processes.



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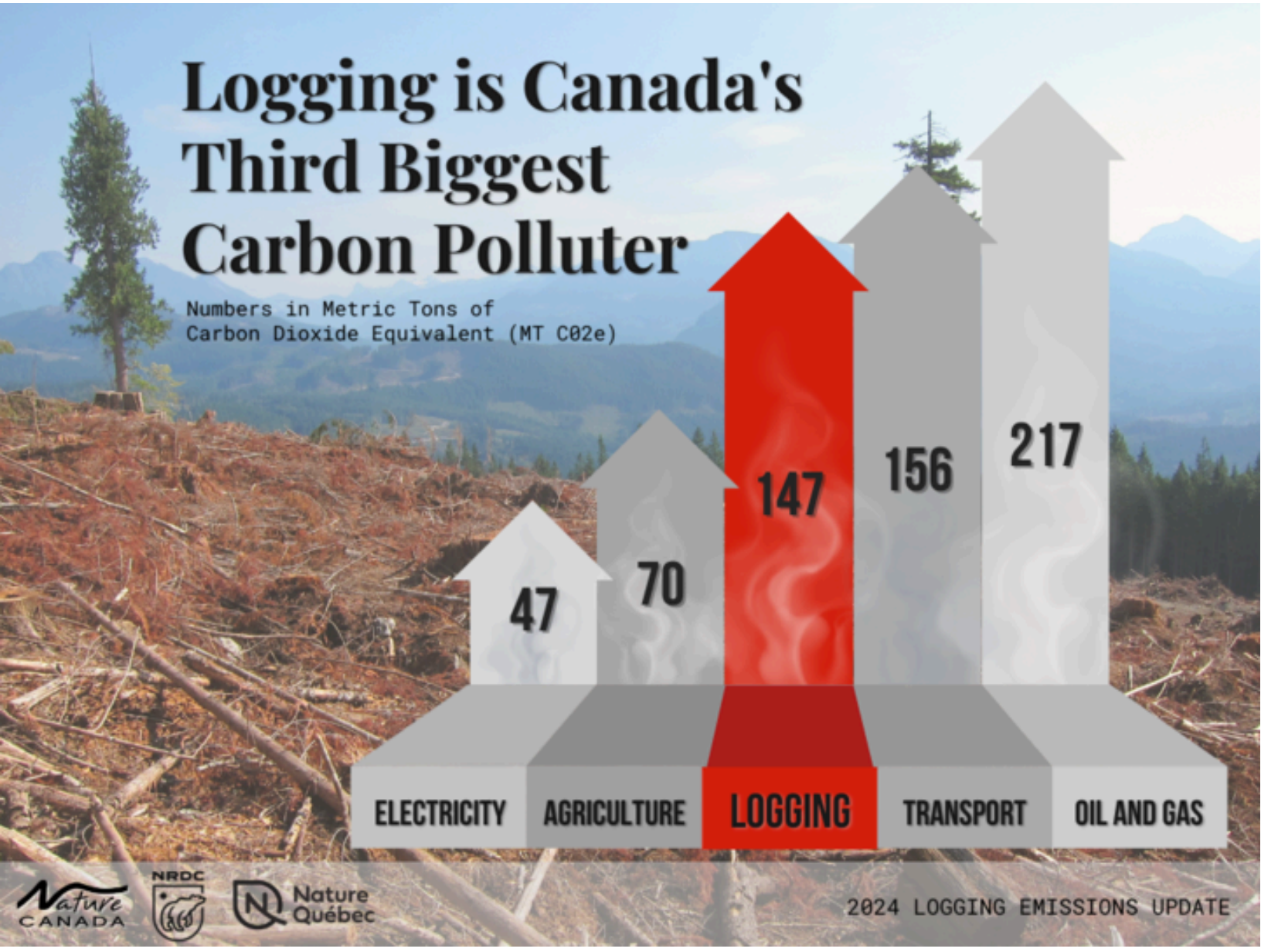
Carbon – The Big Picture



Carbon in healthy intact forest ecosystems is drawn down into soils, where it can be stored for hundreds of years.

Forest carbon is best preserved through practices that maintain the health and ecological integrity of forest ecosystems.

Logging old-growth forests is **not** a climate solution.

Nahmint Valley photo courtesy of Ancient Forest Alliance

The industrial logging sector impacts the climate in two ways – it creates huge emissions and reduces natural carbon sinks.

Preserving the ecological health and structural integrity of forest landscapes (particularly old-growth and mature forests) helps to safeguard high existing levels of carbon AND forests' capacity to act as carbon sinks.

Resources

For a Complete List of Resources, please visit the Nature Creative Commons – Forest Carbon

The Hummingbird Collective

Hannah Carpendale is a PhD student exploring creative avenues for critical data literacies surrounding biodiversity loss and climate change through her research at SFU's School for Interactive Arts and Technology. Through an approach based in storytelling and connection to ecological place, she is exploring strategies for co-designing public resources fostering a deeper understanding and engagement around forest carbon stewardship, with the broad purpose of facilitating community organizing, public advocacy and decision-making at the intersection of forest and climate policy.

Emily Clark is a PhD student studying the historical ecology of Salish Sea (Garry) oak meadow ecosystems. Her research combines archival materials, Indigenous knowledge systems, and field-based techniques to map the pre-contact extent of oak meadows, evaluate trajectories of change over time, and support traditional stewardship practices. Emily worked as a consultant ecologist/spatial analyst in British Columbia and as a historical ecologist in California. Her MSc research at McGill University evaluated the long-term trends of ecosystem service provisioning in Canada. Emily is also a painter and focuses primarily on ecological subjects and botanical illustration.

Dr. Robin June Hood has a PhD in global education with 35 years as an international development consultant, educator, and filmmaker. Robin has focused her work on supporting endangered peoples and landscapes, and creating strategies for educational renewal. She has developed hundreds of programs and courses including a UNICEF publication, Growing Strong. Robin was the lead curriculum designer for the innovative indigenous youth program, Guiding Spirit and was a research associate on the "Coasts under Stress Research Alliance" with Dr. Nancy Turner. Robin worked in Latin America supporting Mayan efforts to strengthen indigenous knowledge traditions, and secure cultural survival. She was on the Rainforest Solutions team that crafted the landmark Great Bear Rainforest Agreement.

Sachia Kron is a creative marketer who specializes in developing visual communication and branding strategies for organizations. With a BSc in Environmental Science and continuing studies in Graphic Design, she has worked as a freelancer for over a decade and has been a founding member of three environmental and health tech startups. Sachia currently supports not-for-profit organizations that focus on the transition from extractive to regenerative models of forest stewardship.

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Dr. Allen Larocque is a forest ecologist and systems thinker. He has worked on plankton, social spiders, and how biodiversity shapes ecosystem stability. He is a soil specialist and his PhD work was studying how salmon change forest soil; and in particular how salmon nutrients flow through fungi, plants, and bacteria to fertilize recipient forest trees. He also works as a consultant for various BC First Nations on imagining what 'regenerative forestry' should look like, learning best practices in how to do it, and seeing how it could be used to heal the land.

Liljana Mead Martin is an interdisciplinary artist working at the intersections of visual arts and ecological research. Her work aims to support ecological awareness and conscious actions through impactful art, design and communications. Liljana works as a Science Communicator with Conservation Decisions Lab, and contextualizes current research for students and scientists through writing, web development, collaborative media, photo, video and sound. Martin holds an MFA from Emily Carr University of Art + Design '16, and BFA from the Nova Scotia College of Art & Design '10.

Dr. Briony Penn has been working on biodiversity, climate and forest carbon literacy with rural communities, First Nations, policy makers, and urban audiences for over 30 years. She is an adjunct professor in environmental studies, journalist, author, illustrator, graphic recorder, broadcaster and workshop host. With her work in forest carbon projects, Briony is interested in communicating various financial pathways to a regenerative economy for rural communities who are looking to get out of industrial dependencies.

Anneke Rosch uses comics to convey information in a short space with characters & humour; the longer format styles allow for more development of nuanced and complex ideas. She illustrates in a variety of styles with a preference for drawing in ink. Anneke is responsible for creating visual representations of data & conceptual illustrations with a strong dedication to accuracy when portraying data. With the ability to summarize and condense information in forest-related issues and terminology, she focuses on concise communications over long-form.