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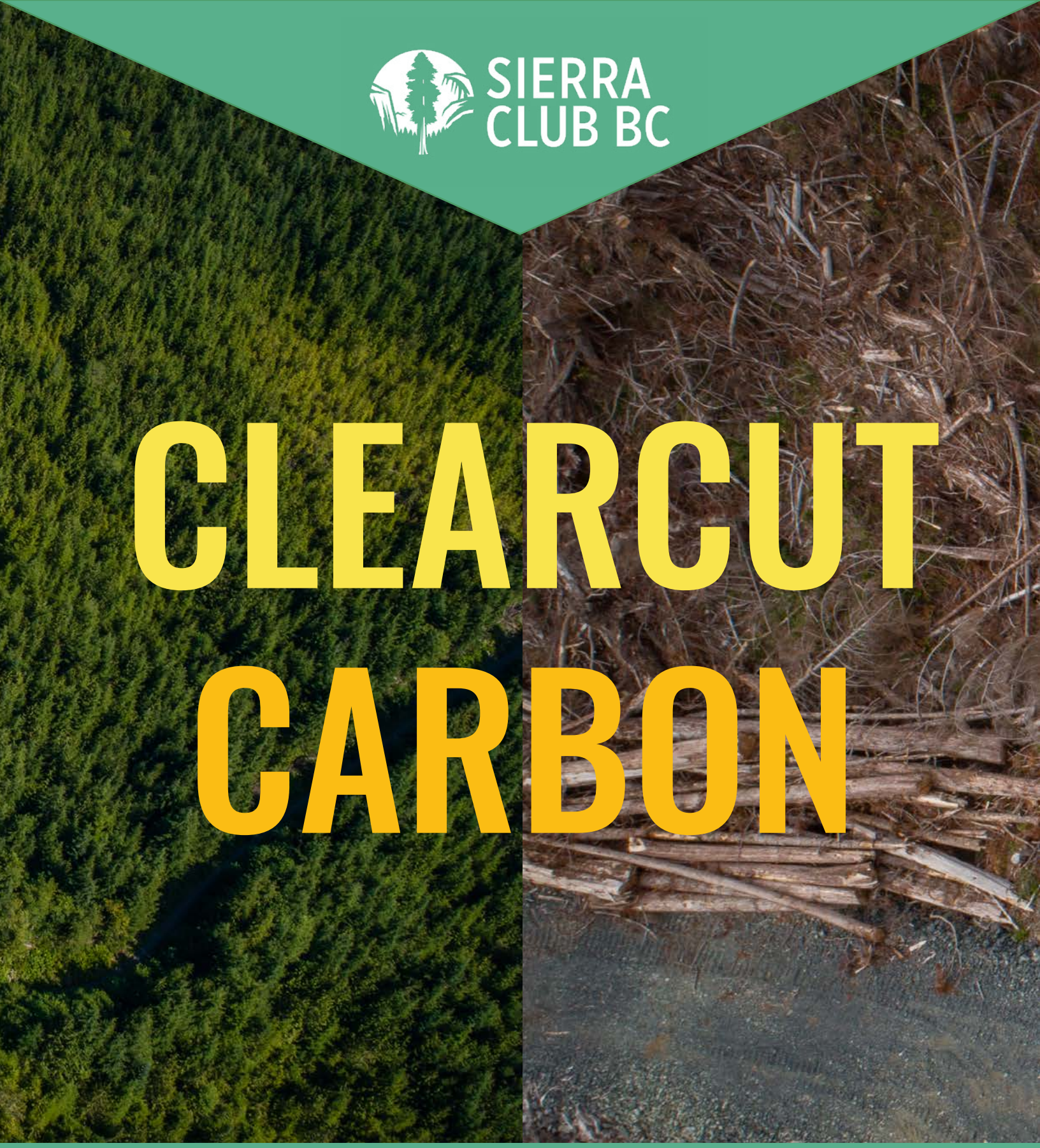

CLEARCUT CARBON

A Sierra Club BC report on the future of forests in British Columbia

December 2019

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Cover photos: Old-growth and clearcut stands on Vancouver Island (Photos by Sierra Club BC/Wilderness Committee/Stand.Earth).

EXECUTIVE SUMMARY

Our planet is in the midst of a climate crisis, and the latest science calls for reducing global emissions by half within the next decade to avoid catastrophic climate change. Most of the world's intact forests, particularly primary (unlogged) forests, help slow climate change by taking carbon out of the atmosphere and storing it in living and dead trees and soil. However, according to provincial data, as a result of destructive logging and climate impacts like beetle outbreaks, forests in B.C. have released more carbon than they absorb for over a decade.

Forest clearcutting is a major contributor to carbon emissions and loss of carbon capture in the Pacific Northwest of North America. Clearcutting causes a rapid and large loss of carbon from decomposing organic matter and soils, particularly when old-growth forests are logged. Additionally, it takes 13 years or more before the replanted young forest begins to absorb more carbon than is still being released from the area cut. For at least 13 years, these areas are "sequestration dead zones": clearcut lands that emit more carbon than they absorb.

For this report, Sierra Club BC reviewed B.C. government data to identify the total area of old-growth and second-growth forest logged across the province over 13 years (2005-2017), and to estimate the carbon emissions and the loss of carbon capture caused by this logging.

The analysis shows a total area of about 3.6 million hectares of "sequestration dead zones," an area larger than the size of Vancouver Island. This includes over 1.9 million hectares of old-growth forest and close to 1.7 million hectares of second-growth that were cut. The "sequestration dead zones" make up 9.1% of the total area of relatively productive provincial forests.

A burnt clearcut on Vancouver Island. Slash-burning or fire in clearcut areas speeds up the release of carbon from wood waste left behind, instead of leaving more trees standing to continue to grow and sequester carbon (Photo by TJ Watt/Ancient Forest Alliance).

The latest provincial data show annual emissions from logging as 42 million tonnes of carbon dioxide. Temperate forests capture about 2 tonnes of carbon per hectare per year. This analysis suggests that in B.C., in addition to emissions from logging, clearcutting also prevented trees from removing at least 26.5 million tonnes of carbon dioxide per year from the atmosphere. This amount of carbon capture that cannot occur because the forest has been logged is known as foregone carbon sequestration.

For comparison, B.C.'s officially reported emissions (primarily from burning fossil fuels, not counting forest emissions) were about 65 million tonnes of carbon dioxide in 2017. Considering the 42 million tonnes of carbon dioxide emissions caused annually by logging and the 26.5 million tonnes of foregone capture of carbon dioxide per year together, their combined impact on our climate exceeds the impact of B.C.'s officially counted emissions. This means reforming forestry to avoid emissions from logging and loss of carbon capture is as important for provincial climate action as phasing out fossil fuels.

Overall, B.C.'s growing forest emissions from destructive logging, wildfires and beetle outbreaks are now three times greater than official provincial emissions. Yet these forest emissions are largely ignored because they are not counted as part of B.C.'s official emissions in provincial greenhouse gas inventories.

Old-growth forests in B.C. can store over 1,000 tonnes of carbon per hectare, one of the highest rates on earth. These old-growth forests are like a carbon bank, accumulating carbon in soil, trees and organic matter over millennia. The carbon loss from logging old-growth is much greater than from logging second-growth.

We can defend communities and future generations by increasing protection of carbon-rich old-growth and intact forests, improving forest management by transitioning to selective logging and allowing trees to grow older. A rapid shift towards increased forest conservation and improved management would not only reduce emissions from forests but also allow for increased carbon capture. These steps would also help defend communities from worsening climate change impacts like droughts and flooding.

This report includes a number of recommendations for forest conservation and reform of the provincial forestry sector to support a stable climate and healthy communities.

Photo by TJ Watt/Ancient Forest Alliance.

BACKGROUND: THE ROLE OF FORESTS IN TACKLING THE CLIMATE CRISIS

Our home planet is in the midst of a climate and ecological emergency. In early November 2019, 11,000 scientists warned of "untold suffering" unless there are "major transformations in the ways our global society functions and interacts with natural ecosystems."[1] There is overwhelming evidence that our collective actions to reduce carbon pollution in the next decade will decide whether humans can slow down global heating before impacts become completely unmanageable and further climate disruption becomes unstoppable.

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) warned that humanity has until 2030 to reduce global greenhouse gas emissions by about half, followed by net zero emissions by mid century, to have a fighting chance of limiting global heating to 1.5 degrees Celsius by 2100.[2] Severe climate impacts like drought, flooding, hurricanes, wildfires and sea level rise are already creating devastating impacts for people in B.C. and around the world. There is now overwhelming evidence that any further delay of the necessary transformations will result in increasingly catastrophic climate change and ecosystem degradation on a global scale.

One crucial factor in this unprecedented moment is the fate of the world's forests.

Globally, forests are slowing climate change by absorbing about a quarter of the greenhouse gas emissions caused by humans. In fact, forests store such enormous amounts of carbon that we cannot stabilize the climate without protecting and restoring them. However, protecting forests is only possible if we also quickly phase out fossil fuels, before higher temperatures push the world's forests beyond what they can adapt to.

Simply put, we cannot safeguard a stable climate without protecting and restoring intact forests, and we cannot sustain forests without stabilizing the climate. These actions must be taken together.

The good news is that a rapid shift towards increased forest conservation and improved management would not only reduce carbon emissions from forests, but also allow more carbon to be sequestered, removing it from the atmosphere.

New analysis from The Nature Conservancy and others[3] estimates that stopping deforestation, restoring forests and improving forestry practices could cost-effectively remove 7 billion metric tons of carbon dioxide annually (for comparison, global annual emissions were 37 billion tonnes in 2018). Research shows that no other nation can contribute more to this goal than Canada—home to more than a tenth of the world's trees, it is the country with the highest ratio of trees to people in the world.[4] The biggest and oldest trees in Canada are found in B.C., as are forests with some of the highest carbon storage per hectare globally.[5]

B.C. clearly has an outsized role to play in tackling the climate crisis because of the forests that grow here. The good news is that the Province has taken some steps to reduce its officially counted greenhouse gas emissions through its CleanBC program. However, provincial emissions reduction targets are not based on the best

[1] https://academic.oup.com/bioscience/advance-article/doi/10.1093/biosci/biz088/5610806
[2] https://www.ipcc.ch/sr15/
[3] https://www.pnas.org/content/114/44/11645
[4] There are nearly 9,000 trees for every Canadian. https://www.washingtonpost.com/news/energy-environment/wp/2015/09/02/scientists-discover-that-the-world-contains-dramatically-more-trees-than-previously-thought/
[5] Wilson et al. (2008), Mitigating and Adapting to Climate Change Through the Conservation of Nature https://ltabc.ca/publications-a-research/mitigating-and-adapting-to-climate-change-through-the-conservation-of-nature/

current science, making them too weak. Worse, the B.C. government's fossil fuel subsidies of $830 million per year[6] provide support to new fossil fuel projects that would make it impossible to meet even the current weak targets.[7]

Another grave concern is that B.C. does not have a coherent forest climate action plan to reduce its massive and growing forest carbon emissions, which are not even counted in its official annual emissions. This is despite the fact that B.C.'s forests are now releasing more carbon per year than all other provincial sectors combined, due to destructive clearcut logging and climate impacts like pine beetle outbreaks and wildfires.[8]

This report includes a high level estimate of the damage to the climate caused by clearcutting vast areas of B.C.'s forests. It shows the scope of the harm that will be caused if the Province fails to change course in forest stewardship in the coming decade—a decade crucial for securing a livable climate for our future. And it outlines the steps we must take to reform forest stewardship for a stable climate and healthy communities.

More in-depth analysis is needed to accurately model and inform conservation, improved forest management and land use planning scenarios for all regions of B.C. in a changing climate.

There are few trees in North America that grow with greater vigor than Sitka Spruce (photo taken in the Lower Seymour Conservation Area near Vancouver). The Queets Spruce on the Olympic Peninsula in Washington State, the world's largest known Spruce, shows particular strong evidence of vitality. This tree is estimated to be 350 to 450 years old and about 75 metres tall. The prevailing industry view is that old-growth forests are unproductive and should be replaced with young forest. The Queets Spruce is a dramatic example of how misguided this view is. According to one study, this tree is adding 40 to 50 cubic feet of wood every year, a productivity rate equivalent to a quarter acre (0.1 hectare) of the surrounding forest (Photo by Jens Wieting).[9]

[6] International Institute for Sustainable Development 2019 fossil fuel subsidies report, Locked In and Losing Out https://www.iisd.org/library/locked-in-losing-out

[7] https://thenarwhal.ca/b-c-s-climate-action-must-address-three-elephants-in-the-room/

[8] For more details and recommendations on how to address the missing data needed to inform local and regional forest management, see Sierra Club BC's 2019 forest carbon emissions report, *Hidden, Ignored and Growing*: https://sierraclub.bc.ca/wp-content/uploads/SCBC-Forest-Emissions-Report-Jan-19.pdf

[9] Van Pelt, Forest Giants of the Pacific Coast, University of Washington Press 2001

B.C.'S "SEQUESTRATION DEAD ZONES"

Forests are natural carbon sinks. They sequester carbon, pulling it from the atmosphere. If the forest remains intact, it can store more and more carbon over time, particularly in certain types of forests like temperate old-growth rainforests with little natural disturbance like fire.

The impact of a clearcut on the carbon stored in a forest is like a business hit by bankruptcy. The business experiences big, immediate financial losses (losing all money in the bank to pay debt) plus the loss of the profits the business would have made, if it had continued to exist. When a forest is clearcut, large amounts of carbon are released into the atmosphere by decomposing organic matter and exposed soils. The forest also loses its potential to capture carbon for many years, until young trees reach a certain size. During this time, they are "carbon sequestration dead zones": clearcut lands that emit more carbon than they absorb.[10]

Research shows that clearcutting forests in the Pacific Northwest creates "sequestration dead zones" that emit more carbon than they absorb for 13 years.[11] This is the typical time span in the Pacific Northwest required for young trees to reach a size where their ability to sequester carbon matches the ongoing high carbon losses that result after clearcut logging.

Other reports found that it takes even longer before Canadian forests become a net carbon sink after clearcutting. A 2008 report concluded that forests less than 20 years old generally show low levels of carbon capture or a net carbon release due to decomposition.[12]

Based on a review of several science papers, a Natural Resources Defense Council boreal forest report concluded that it takes up to three decades following a clearcut before the regrowing forest can capture more carbon than is being lost during that time.

For this report, Sierra Club BC reviewed various government data sources (see Appendix). Using the conservative estimate of 13 years for "sequestration dead zones", this report outlines:

- the total area of old-growth and second-growth forests clearcut logged across B.C. and turned into "sequestration dead zones" during this period
- the amount of carbon emissions caused by this form of forest degradation
- an estimate of the amount of carbon these forests would have captured, if left standing

EXTENT OF B.C.'S "SEQUESTRATION DEAD ZONES"

Sierra Club BC has found that 3.6 million hectares—a combined area larger than the size of Vancouver Island—was clearcut and turned into "sequestration dead zones" in B.C. over 13 years. Based on an analysis of government data (included in the Appendix), our map shows all forests logged in B.C. between 2005-2017.

This included 410,000 hectares in the coastal region (of which 221,000 hectares was old-growth forest) and close to 3.2 million hectares in the Interior (of which close to 1.7 million hectares was old-growth forest).

[10] https://sustainable-economy.org/wp-content/uploads/2017/12/Oregon-Forest-Carbon-Policy-Technical-Brief-1.pdf
[11] http://www.cof.orst.edu/cof/fs/turner/pdfs/turner_env_man_2004.pdf
[12] Wilson et al 2008, *Mitigating and Adapting to Climate Change Through the Conservation of Nature* https://ltabc.ca/publications-a-research/mitigating-and-adapting-to-climate-change-through-the-conservation-of-nature/
[13] NRDC 2017 white paper, *Accounting for Carbon Dioxide Emissions from Clearcut Logging in the Canadian Boreal Forest* https://www.nrdc.org/sites/default/files/accounting-emissions-clearcut-canadian-boreal-wp.pdf

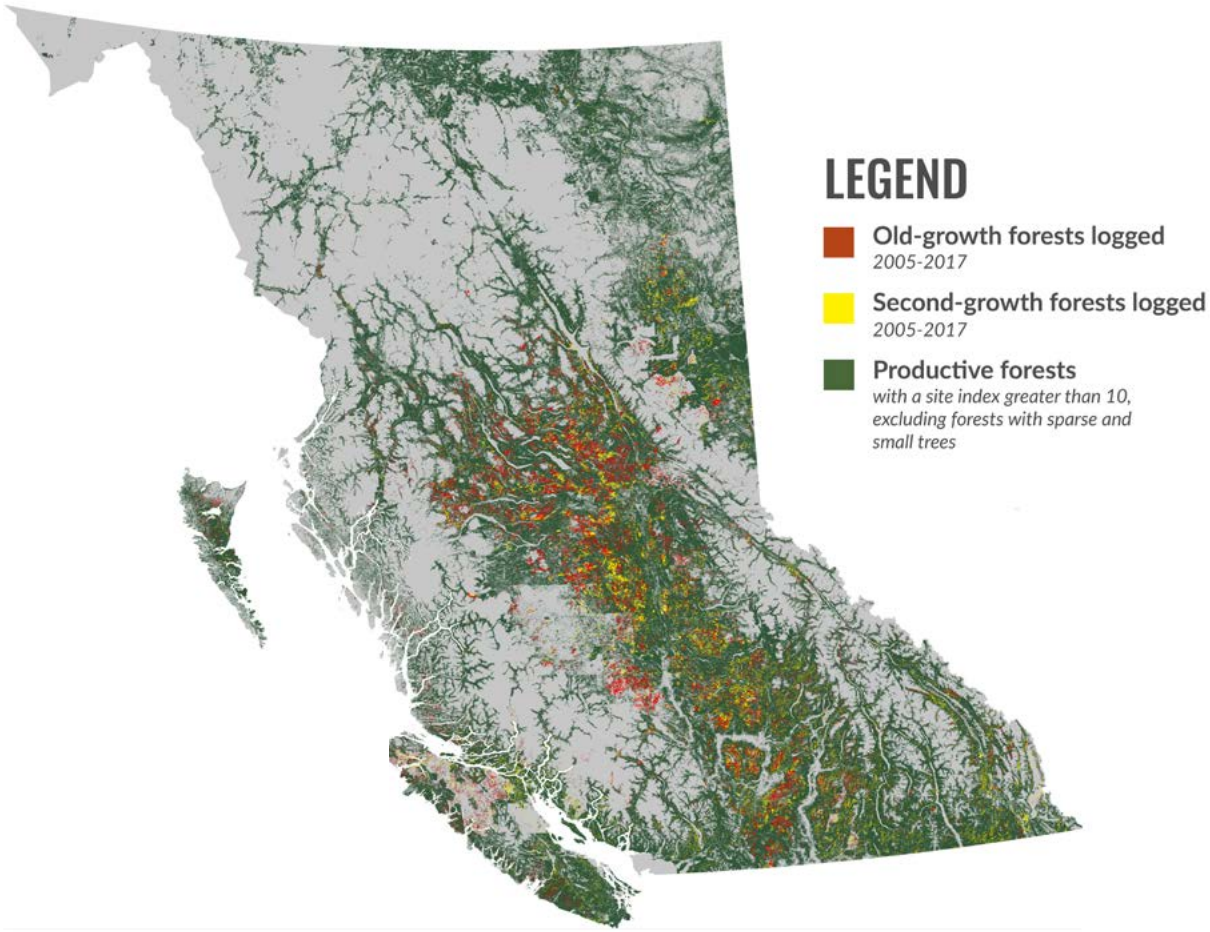


Figure 1: *"Carbon sequestration dead zones" in B.C. Areas shown in red (logged old-growth) and yellow (logged second-growth) were clearcut between 2005 and 2017. The forests shown in green show relatively productive forests of B.C. (with small gaps in data), excluding marginal stands with very sparse and small trees (and limited potential for carbon storage and capture). The forests shown in green include many second-growth areas that were logged before 2005 and some of them remain "sequestration dead zones"—for example, stands permanently lost to logging roads. For full data and references, see the Appendix.*

The total area of old-growth cut was just over 1.9 million hectares and the total area of second-growth cut was close to 1.7 million hectares. Relatively stable logging rates for old-growth and second-growth forests over the 13-year period (see Appendix for annual data) suggest that in any given year, a similar-sized total area was logged (some very recently cut, others in early stages of recovery). The data shows no visible transition trend away from old-growth logging towards second-growth logging.

The combined "sequestration dead zones" of B.C. represent 9.1% of the 39.5 million hectares of forested land in BC that is relatively productive (with a site index[14] >10); this is excluding marginal sites, primarily at higher elevations, with sparse and small trees and limited potential for carbon storage and capture. For comparison, the total area of provincial forest lands is 55 million hectares.[15]

ANNUAL EMISSIONS FROM CLEARCUT LOGGING

Provincial greenhouse gas emissions reports contain only superficial information about the scope of B.C.'s massive carbon pollution from forests. However, they do show the enormous amount of emissions caused by logging. A 2015

[14] https://en.wikipedia.org/wiki/Site_index
[15] https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/reporting/envreportbc/archived-reports/sof_2010.pdf

Sierra Club BC review of government data showed that average annual emissions from logging between 2003 and 2012 were nearly 50 million tonnes.[16] This amount was equivalent to about three quarters of B.C.'s officially reported annual emissions.

In recent years, the province moved to a new way of including forest carbon emissions in provincial reports. Logging emissions are now reported at about 42 million tonnes per year.[17] However none of these logging-related emissions are included in the officially reported amount for BC's emissions.

FOREGONE CARBON CAPTURE

B.C.'s destructive forestry practices are causing huge amounts of carbon losses that are far beyond what newly planted trees can capture from the atmosphere. In addition, we are not benefitting from the carbon sequestration that would have occurred in these clearcut forests if the old-growth forest been set aside from clearcutting or if the second-growth trees had been left to grow older. This amount of carbon the forest could have captured if not clearcut is the foregone carbon capture.

A study looking at tropical forests showed that only accounting for carbon losses from destroying forests will cause the full impact of the loss of intact forest on the climate to be underestimated.[18] The authors found that the real carbon storage benefit of protecting tropical forests increased by more than 600% when foregone carbon capture and indirect damages to forests that remain standing are taken into account. They also warned that a comparable analysis for regions outside the tropics is urgently required, given that approximately a half to two-thirds of carbon removals on Earth's intact ecosystems occur outside the tropics.

Temperate forests accumulate more carbon over time than tropical forests. Temperate old-growth forests continue to capture carbon at an average rate of about 2 tonnes of carbon per year.[19] Rapidly growing second-growth forests—of interest for logging—have the highest potential annual carbon uptake.[20] Forests in the range of 70 to 125 years are the ones that are going to add the most carbon in the coming decades.[21]

This means that logging of temperate forests results in at least 2 tonnes less carbon sequestered per hectare per year—compared to leaving the trees standing—for at least 13 years, based on the typical average for these ecosystems.

This is a very conservative approach because the forests clearcut by industry are not average forests. Industry generally targets forest areas with above-average size and volume per hectare because they are more profitable than forests with smaller trees and volume. The stands being clearcut in B.C. likely have above-average rates of carbon sequestration, so the foregone carbon capture as a result of logging is likely even greater. It is also likely much higher because a significant amount of logged areas in B.C. (hundreds of thousands of hectares) are considered NSR (Not Satisfactorily Restocked)—and take longer than average for trees to grow back.[22] One report showed that across a large study area in Ontario, treeless patches and "logging scars" caused by logging roads and other work sites account for 10-24% of the area of forests that should have grown back after logging. As a result of industrial logging practices and road

[16] https://sierraclub.bc.ca/wp-content/uploads/2015/08/Forest-Emissions-Detailed-Backgrounder_June22.pdf
[17] Emissions related to logging are now reported as 'Emissions from Decomposition of Harvested Wood Products,' despite the fact that the majority of these emissions are caused by destructive logging practices that leave behind vast amounts of wood waste instead of leaving more trees standing to continue to capture carbon.
[18] Degradation and forgone removals increase the carbon impact of intact forest loss by 626%. https://advances.sciencemag.org/content/5/10/eaax2546
[19] Wilson et al. 2008, *Mitigating and Adapting to Climate Change Through the Conservation of Nature*
[20] According to the FAO, the typical carbon sequestration rate after reforestation in tonnes of carbon per hectare per year is 0.8-2.4 tonnes in boreal forests and 0.7-7.5 tonnes in temperate regions. Most of B.C.'s forests are temperate forests. http://www.fao.org/3/y0900e/y0900e06.htm
[21] https://e360.yale.edu/features/why-keeping-mature-forests-intact-is-key-to-the-climate-fight
[22] https://wfca.ca/wp-content/uploads/2015/02/Feb-3-NSR-FPB-Backgrounder-Marvin-Eng.pdf

building, the area of replanted forest is not equal to the area of forest that originally covered the same space.[23]

Using this conservative high-level approach, Sierra Club BC estimates that every hectare clearcut in B.C. over 13 years (3.6 million hectares) is resulting in foregone carbon capture of at least 2 tonnes of carbon (more than 7 tonnes of carbon dioxide[24]) per hectare per year. This suggests that in B.C., clearcut logging is preventing forests from removing at least 26.5 million tonnes of carbon dioxide per year from the atmosphere (7.34 tonnes of carbon dioxide X 3.61 million hectares).

For comparison, B.C.'s officially reported annual emissions (primarily from burning fossil fuels, not counting forest emissions) were about 65 million tonnes of carbon dioxide in 2017. Considering the 42 million tonnes of carbon dioxide emissions caused annually by logging and the 26.5 million tonnes of foregone capture of carbon dioxide per year together, their combined impact on our climate exceeds B.C.'s officially counted emissions from burning fossil fuels. This means reforming forestry to avoid emissions from logging and loss of carbon capture is as important for provincial climate action as phasing out fossil fuels.

It is clear that industrial clearcut logging is disrupting forest carbon storage for more than a decade; a practice we cannot afford in the midst of a climate crisis when we urgently need to be keeping carbon out of the atmosphere.

Clearcuts on the west coast of Vancouver Island (Klanawa Valley). One study comparing the original carbon storage of one hectare of coastal old-growth rainforest with the carbon storage of one hectare of a 60 year old stand found a carbon loss of 305 tonnes (after considering that a certain amount remains stored in wood products).[25]

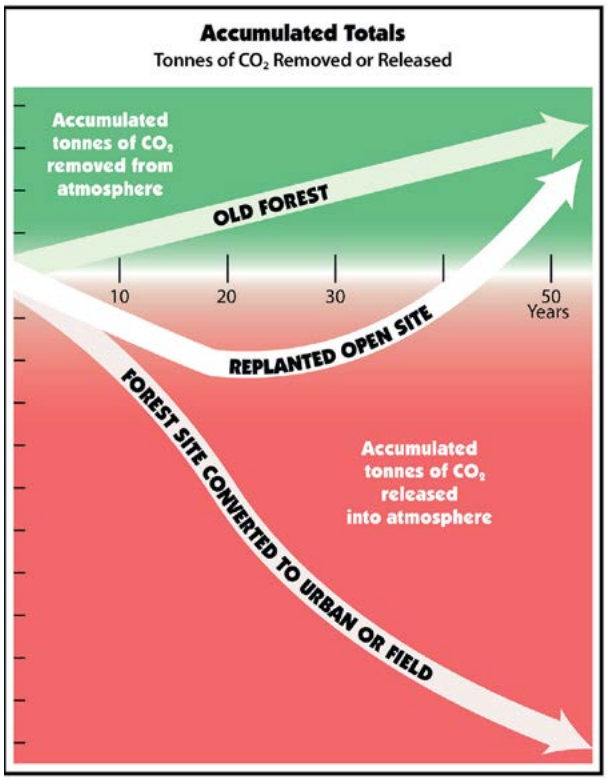
The average annual old-growth logging rate along the BC coast during the 13 year period analyzed for this report is 17,000 hectares. Using the finding mentioned above would translate to an annual loss of carbon of more than 5 million tonnes (or close to 19 million tonnes of carbon dioxide) from logging of coastal old-growth alone, a loss that is never recovered because the second-growth forests are cut again in short rotation. More research is needed to inform conservation initiatives before it is too late to protect carbon rich, endangered old-growth forests (Photo by TJ Watt/Ancient Forest Alliance).

[23] https://wildlandsleague.org/news/loggingscars/
[24] 1 tonne of carbon translates to 3.67 tonnes of carbon dioxide
[25] Harmon ME, Ferrell WK, Franklin JF. 1990. Effects on carbon storage of conversion of old-growth forests to young forests. https://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/ThreatsForestHealth/Climate/CI-Harmon_Ferrell_Franklin_1990.pdf

OLD-GROWTH FORESTS ARE THE BEST CARBON BANK

Not every hectare logged contributes the same amount to B.C.'s carbon emissions from logging. The initial carbon loss from cutting down old-growth forest is much greater compared to renewed logging of second-growth forests. The loss of carbon as a result of clearcutting also varies depending on the ecosystem and how much carbon has been accumulated over time.

Many forest ecosystems in B.C.'s Interior have a higher level of natural disturbance from impacts like fire and insects (now increasingly worsened by climate change).[26] In contrast, B.C.'s old-growth coastal and inland temperate rainforests have lower levels of natural disturbance and trees that grow much older. They can store over 1,000 tonnes of carbon per hectare, one of the highest rates on earth.



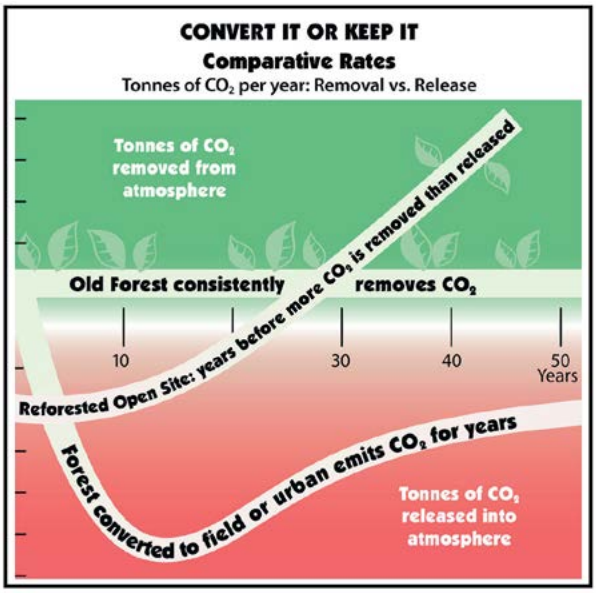


Figure 2[27]: *(Top)* ***Changes of total amount of carbon stored per hectare for old-growth compared to young forest over decades.*** *An old-growth forest that is clearcut and replaced by young forest will release hundreds of tonnes of carbon per hectare over several decades. An equivalent area of replanted forest will not have any positive effect on carbon storage for decades. "Like the proverbial turtle, the slow and steady carbon removal benefits of a conserved old forest end up ahead even of a replanted stand in the short and medium term."[28]*

(Bottom) ***Rate of carbon capture per hectare for old-growth compared to young forest per year.*** *A clearcut loses carbon for more than a decade before young trees catch up and begin capturing a similar amount of carbon as the original stand. In contrast, old-growth and older forests continue to sequester steady amounts of carbon per year.*

[26] https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/climate-risk-summary.pdf
[27] Concept Richard J. Hebda, graphic Patricia Walker
[28] Wilson et al. 2008, *Mitigating and Adapting to Climate Change Through the Conservation of Nature*, p. 12-13. https://ltabc.ca/publications-a-research/mitigating-and-adapting-to-climate-change-through-the-conservation-of-nature/

These old-growth forests are like a carbon bank, accumulating carbon in soil, trees, and organic matter over millennia.[29] Old-growth forests with exceptionally high carbon storage per hectare can only be found on a small percentage of the forested land base, particularly in valley bottom forest ecosystems. A 2018 study showed that the largest 1% of the world's trees store 50% of forest carbon globally.[30] Unfortunately, these highly productive stands have historically been the most targeted for logging. Therefore, they are now the most endangered ecosystems, reduced to a fraction of their former extent, with insufficient protection.

Research increasingly shows that, contrary to industry claims, old trees store more carbon than young trees.[31] One study found that old trees store more carbon in proportion to their size, and that almost 70% of the carbon stored in a tree is accumulated in the second half of its life.[32] It makes no sense to cut down carbon-storing older trees at a time when scientists are desperately trying to invent carbon-capture technology.

Clearcuts on Edinburgh Mountain (Photo by Kat Zimmer/Sierra Club BC).

[29] https://sierraclub.bc.ca/7-myths-about-forests-carbon-and-climate-change/
[30] Lutz et al. 2018, "Global importance of large-diameter trees." https://onlinelibrary.wiley.com/doi/abs/10.1111/geb.12747
[31] https://www.nature.com/articles/nature07276
[32] https://www.cbc.ca/news/canada/how-old-trees-help-climate-1.4252888

UNCOUNTED FOREST CARBON EMISSIONS: THE BLIND SPOT WE CAN'T AFFORD

British Columbia's forests are now releasing more planet warming carbon dioxide per year than all other provincial sectors combined. Yet these forest emissions are largely ignored because they are not counted as part of B.C.'s official emissions in provincial greenhouse gas inventories.[33]

The amount of carbon pollution from B.C.'s forests that is caused by direct human actions like clearcutting and slash burning is already staggering. However, the full extent of carbon emissions from provincial forests is even greater when considering the full picture, including worsening climate impacts like fires and the loss of trees caused by the Mountain Pine Beetle outbreak.

According to data released by the B.C. government in September 2019,[34] uncounted net forest emissions are now 3 times greater than B.C.'s official emissions. However, this substantive loss of carbon was not mentioned in the Province's media release about the new carbon pollution data. This is despite the fact that these emissions—shown at the bottom of the provincial data[35]—had grown by more than 650% between 2016 and 2017 (from close to 31 million tonnes to nearly 203 million tonnes).

Both the 2017 and 2018 wildfires each burned more than 1.2 million hectares of the province, 8 times more than the 10-year average.[36] Because wildfire emissions have skyrocketed, B.C.'s overall forest emissions have skyrocketed to about 203 million tonnes (42 million from logging, 4 million from slash burning and 177 million from wildfires, minus 20 million tonnes that were sequestered).[35]

Forest carbon emissions resulting from climate impacts like forest fires[37] and insect outbreaks are difficult to control. This makes it even more important to fully understand and address the impact of practices like clearcutting and slash burning that are under our control.

However, forest strategies currently discussed by government and industry primarily focus on increasing fibre utilization, promoting wood products, and planting and fertilizing trees. These approaches don't address the urgency to achieve immediate emissions reductions by phasing out clearcutting of old-growth forests and the massive amounts of wood waste left behind, allowing forests to grow older, and leaving more trees standing to sequester carbon.

What little remains of B.C.'s intact and unprotected inland rainforest is at risk of being clearcut like in this landscape close to Prince George (Photo by Dominick DellaSala).

[33] Sierra Club BC 2019 forest carbon emissions report, *Hidden, Ignored and Growing* https://sierraclub.bc.ca/wp-content/uploads/SCBC-Forest-Emissions-Report-Jan-19.pdf
[34] https://news.gov.bc.ca/releases/2019ENV0097-001737
[35] https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory
[36] https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-statistics/wildfire-averages
[37] Some researchers suggest that emissions from wildfires in North America are often overestimated, e.g. https://www.sciencedaily.com/releases/2010/01/100127121532.htm

RESILIENT FORESTS FOR SAFE, RESILIENT COMMUNITIES

A changing climate requires new policy responses. Forestry practices that cause significant carbon emissions need to be phased out. Forest management for community and ecological resiliency also requires protecting and restoring forests as a defense from worsening climate impacts and as the basis for a diverse economy and high quality of life in B.C. communities.

Forests are the last line of defence for many communities amid worsening climate impacts like droughts and floods. As the climate shifts into uncharted territory, only intact forests can buffer the impacts—not clearcuts and young tree plantations. Intact forests are also essential for clean air and water, species habitat and long term forestry jobs. Carbon-rich old-growth forests remain the most resilient. Forest management decision makers must recognize that protecting and restoring resilient forests will both slow climate change and help defend the safety of communities.

In some forest landscapes, cautious intervention like thinning to build resiliency and controlled burns will be necessary. Clearcutting forests on short cycles is not a climate solution in any forest type in B.C., as this forest management practice releases carbon emissions. Our urgent task is to store carbon, not release it, and natural intact forests do this best.

The IPCC concluded that, without unprecedented action, the world will heat by about 1.5 degrees Celsius by 2040. Global heating of just one degree is already causing longer and more extreme flooding and droughts.

These trends will only stop once the world economy has completely decarbonized. However, impacts to B.C. communities can be significantly slowed by protecting intact natural forests, particularly large landscapes, to moderate local climates.

An ancient forest stand near Port Renfrew known as Eden Grove (Photo by TJ Watt/Ancient Forest Alliance).

CONCLUSION

As our climate is changing rapidly, B.C.'s forestry policies and practices must reflect the changing forest ecosystems we live and work in. Safeguarding our natural life support systems and the ability of forests to store and capture carbon will require leadership, funding and innovation.

Forest management must be guided by the overarching goal of restoring ecologically intact, resilient forests that can capture carbon and protect communities from devastating climate impacts.

Specifically, the need to massively reduce global carbon emissions in the next decade requires that we prioritize actions that have immediate benefits. While tree planting initiatives have potential long-term benefits for the climate, these benefits will not be significantly realized for decades. In contrast, protecting old-growth forests, ending slash burning and allowing second-growth forests to grow older would have immediate benefits for the climate.

Second-growth forests can be harvested selectively in a way that allows timber production and increases the amount of carbon stored at the same time by constantly improving growth conditions for standing trees.[38]

It is not too late to save and restore some of the remaining relatively intact forest landscapes in the province, their cultural values, and their benefits for clean water, pure air and a stable climate. But the decision to transition to truly sustainable forest management cannot wait. Creating more jobs with less damage per cubic metre of wood and truly climate-friendly wood products deserves full provincial support.

In the midst of a climate crisis, we can no longer afford to clearcut forests for timber. The good news is that a reimagined forestry model is a core component in a low carbon economy, if we act quickly to slow climate change with the help of our best ally: forests.

More than 500 kilometres from B.C.'s coast, rare inland temperate rainforests with similarly high carbon storage per hectare as coastal rainforests can be found. These rainforests exist in moist valley bottoms stretching from the Cariboo Mountains east of Prince George to the Rocky Mountains. Other inland temperate rainforests only exist in Russia's far east and southern Siberia (Photo by Taylor Roades).

[38] B.C. forester Merv Wilkinson harvested 2 million board feet of lumber from his Wildwood parcel on Vancouver Island over a 70 year period of selective logging, with 1.3 million board feet of standing timber at the beginning and 1.6 million board feet still standing at the end of this period. http://vancouverislandbigtrees.blogspot.com/2011/09/vancouver-islands-forest-defender-merv.htm

RECOMMENDATIONS FOR FOREST STEWARDSHIP

Based on these findings, Sierra Club BC makes the following recommendations for forest stewardship to support a stable climate and healthy communities:

1. Overhaul B.C.'s legislation and regulations governing forestry and make them consistent with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).

2. Partner with the federal government[39] to support First Nations who are seeking new Indigenous protected area designations for their territories, many of which include carbon-rich old-growth forests such as those found in Clayoquot Sound.[40] The federal government has reserved $1.3 billion to support these conservation aspirations and deliver on international conservation commitments that neither Canada nor B.C. has met thus far.[41] B.C. is considered the ecologically richest part of Canada and therefore has a disproportionately large responsibility to contribute to Canada's target of conserving 17% of its land base and the goal of protecting 25% by 2025 included in the throne speech. The Province should commit to matching funding contributions that are, at minimum, proportional to its geographic area (close to 10% of Canada's geographic area).

3. Amend the Forest and Range Practices Act (FRPA) to reflect a paradigm shift from a timber-based approach to an ecosystem-based approach, to restore the ability of forests to store and capture carbon, safeguard the life support systems provided by forests and give more species and ecosystems a chance to adapt to the changing climate by increasing protection.[42] Prioritize amendments that will result in immediate carbon emissions reductions such as minimum protection for old-growth ecosystems, an end to slash burning and an end to the spraying of deciduous stands with glyphosate.

4. Provide additional transition assistance to forestry dependent communities and workers affected by climate change impacts and mill closures to support their efforts to restore ecologically intact forest landscapes, safeguard future forestry opportunities and create a diverse economy. Support community well-being and a diverse economy—including long-term forestry jobs—by shifting subsidies away from the fossil fuel industry and towards supporting ecosystem-based management and conservation finance solutions.

Old-growth forests on Nootka Island (Photo by Sierra Club BC/Wilderness Committee/Stand.Earth).

[39] In the case of the Great Bear Rainforest Agreements, provincial and federal governments contributed $30 million each to conservation financing mechanisms, matching private donors to a total of $120 million made available for funding First Nations' economic opportunities and management of protected areas https://coastfunds.ca/
[40] https://thenarwhal.ca/biodiversity-crisis-feds-announce-175-million-new-conservation-projects/
[41] https://thenarwhal.ca/canada-commits-historic-1-3-billion-create-new-protected-areas
[42] https://sierraclub.bc.ca/wp-content/uploads/FRPA-Joint-ENGO-Submission.pdf

5. Implement all recommendations related to forestry laws from the Professional Reliance Review Report, strengthening regulation and reversing the trend of outsourcing oversight to corporations.[43]

6. Apply a "climate impact test" for existing logging plans to address the imminent danger of climate impacts worsened through destructive logging. Where needed, adjust or cancel logging plans to address these risks.

7. Restore and expand government capacity for forest stewardship, monitoring and enforcement at the provincial, regional and local level. Increased oversight is urgently needed since destructive logging practices will cause greater harm in landscapes hit by increasingly extreme weather events worsened by climate change.

8. Restore and expand government capacity to update ecosystem mapping, update inventories and undertake research, especially related to climate adaptation and climate change impacts such as fire and insects.

9. Adjust the provincial Annual Allowable Cut to a realistic, sustainable level that takes into account past overharvesting and climate impacts, the need for increased conservation and risks from worsening climate impacts.

10. Develop a detailed provincial report on forest carbon emissions to inform governments and decision makers at all levels. Develop forest climate action plans with timelines for keeping more carbon stored in forests through old-growth protection, ending slash burning and spraying, and reducing clearcuts in size and number (eventually phasing them out).

11. Amend regulation and create incentives to support improved forest management and value-added businesses that create a higher number of jobs per cubic metre and reduce damage and wood waste. Phase out raw log exports. Promote selected harvesting of second-growth forests in a way that allows to increase the amount of carbon stored in forests by constantly improving growth conditions for standing trees.

12. Increase funding for modernized regional land use plans with science-based conservation targets for all types of old-growth using the Ecosystem-Based Management model applied in the Great Bear Rainforest,[44] combined with support for First Nations' governance, land use planning and a rapid transition to improved management of second-growth forests and a diverse economy.

Old-growth forests on Nootka Island (Photo by Sierra Club BC/Wilderness Committee/Stand.Earth).

[43] https://engage.gov.bc.ca/app/uploads/sites/272/2018/06/Professional_Reliance_Review_Final_Report.pdf

[44] The 2017 NDP platform stated, "In partnership with First Nations and communities, we will modernize land-use planning to effectively and sustainably manage BC's ecosystems, rivers, lakes, watersheds, forests and old growth, while accounting for cumulative effects. We will take an evidence-based scientific approach and use the ecosystem-based management of the Great Bear Rainforest as a model." https://action.bcndp.ca/page/-/bcndp/docs/BC-NDP-Platform-2017.pdf

APPENDIX: ANNUAL DATA AND DATA SOURCES

Year	Coastal Old-Growth	Coastal Second-Growth	Interior Old-Growth	Interior Second-Growth	Total
2005	23,300	10,709	159,592	111,280	304,882
2006	22,841	10,094	156,739	126,677	316,350
2007	22,799	8,539	124,427	123,583	279,348
2008	13,535	6,546	118,008	106,576	244,665
2009	11,360	10,217	97,963	86,916	206,456
2010	17,995	14,944	128,706	130,789	292,434
2011	14,470	16,249	130,268	120,428	281,416
2012	15,416	16,149	131,825	111,298	274,689
2013	16,452	16,825	142,855	107,611	283,743
2014	16,074	15,910	119,376	112,075	263,435
2015	17,044	21,277	130,835	126,248	295,405
2016	17,221	19,406	123,633	118,446	278,706
2017	12,594	21,984	132,496	108,687	275,761
Total	**221,102**	**188,849**	**1,696,724**	**1,490,615**	**3,597,291**

Table 1: B.C.'s "sequestration dead zone" forests with hectares clearcut between 2005–2017. The total area logged was 409,952 hectares in the coastal region and 3,187,339 hectares in the Interior region (Figure 3). The total area logged included 1,917,827 hectares of old-growth and 1,679,464 hectares of second-growth.

Figures include all forests older than 140 years (Age class 8 and 9) and, in the Interior, also lodgepole pine forests older than 120 years.

Figure 3: A locator map showing Coastal and Interior Forests (B.C. government).

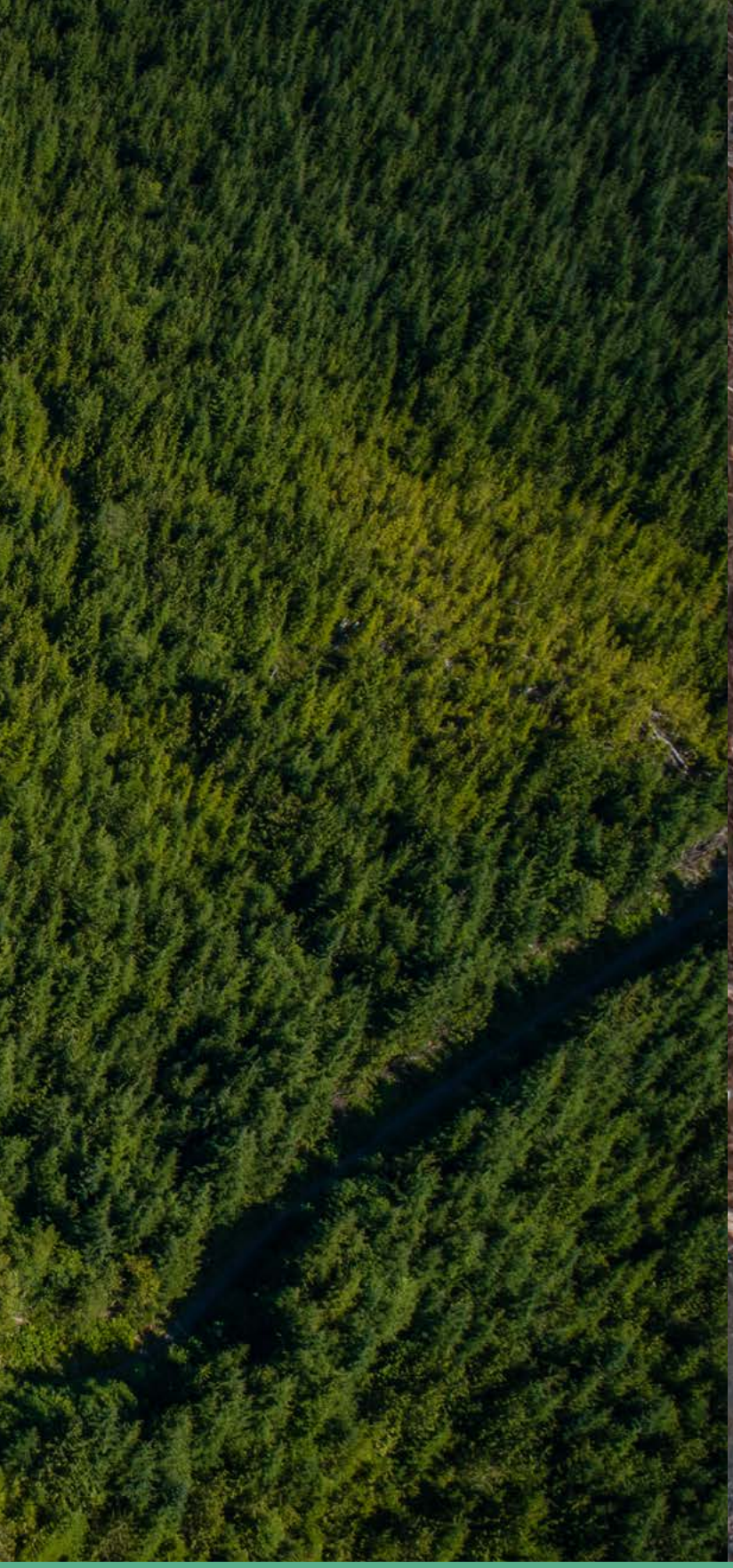
Provincial data sources used for "sequestration dead zones" map and analysis

Harvest data from Vegetation Resources Inventories (VRI) and Consolidated Cutblocks
https://catalogue.data.gov.bc.ca/dataset/harvested-areas-of-bc-consolidated-cutblocks-

Previous stand age from 2003 VRI, 1990's forest cover, Baseline Thematic Mapping (BTM) and RESULTS
https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/silviculture/silviculture-reporting-results

Productive forest area from VRI (site index >10).

Productive forest area from VRI where site index >= 10. Where Age Class and Height Class exist without site index or stand age values, the ratio of Age Class/Height Class < 3.4 was used. Several Tree Farm Licenses (TFLs) along with areas of private forest and a few protected areas are missing from the VRI data and not shown.



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