# Satellite images show link between wood pellet demand and increased hardwood forest harvesting.

SOUTHERN ENVIRONMENTAL LAW CENTER

A new satellite image analysis, conducted by researchers at Clark University, shows a strong link between wood pellet demand from Enviva's mills in North Carolina and Virginia and hardwood forest harvesting in the area. Specifically, the analysis concludes that the area's ecologically valuable hardwood forests have been harvested at a higher rate since Enviva's pellet mills started operating and consuming primarily hardwoods and that nearly half of this wood is going to Enviva's Ahoskie, Northampton, and Southampton mills, likely contributing to overall declines in carbon stocks in the area's hardwood forests. Additionally, this analysis found—in direct contradiction to repeated industry claims—that from 2001-2016 forest harvesting in Enviva's sourcing area exceeds growth, resulting in a net loss of forested area. Moreover, in the time period after Enviva's three mills started operating (2011-2016), the area's hardwood forests experienced a net loss. Taken together, this analysis (as well as years of photographic evidence) contradicts or otherwise highlights the misleading nature of many of the industry's main arguments. Instead of enhancing forest carbon and decreasing emissions, policies that subsidize large-scale burning of forest biomass undermine global efforts at addressing climate change. Now, at a time when urgent climate action is needed, governments must move away from forest biomass and invest instead in genuine climate solutions.

## Introduction

We are in the midst of a global climate and biodiversity crisis, with scientists warning that we must take critical action now if we hope to minimize some of the worst impacts, such as extreme heat, drought, catastrophic flood, and unprecedented species extinction.[1] Protecting intact forests is of utmost importance to addressing this dual threat, and yet the biomass industry is using trees harvested from the Southeast's natural forests to manufacture wood pellets for use as fuel in power stations. These pellets are overwhelmingly shipped overseas to be burned for electricity as an alternative to coal. However, just like burning fossil fuels, burning forest biomass increases carbon dioxide pollution in the atmosphere, and this increase can persist for several decades or more—far outside of relevant timeframes for climate action.

Wood pellets are made mostly from living trees,[2] which are taken to pellet mills, ground into chips, dried, and formed into pellets. Enviva, the world's largest wood pellet manufacturer, currently operates nine pellet mills throughout the southeast—three of which source wood from forests primarily within the coastal plain area of northeast North Carolina ("NC") and southeast Virginia ("VA").

A new report by researchers at Clark University,[i] commissioned by the Southern Environmental Law Center ("SELC"), takes a closer look at the impacts of wood pellet harvesting on the forests around three of Enviva's wood pellet mills—which are located in Ahoskie, NC; Northampton, NC; and Southampton, VA (the "three-mill area"). Researchers analyzed satellite images of forests in the sourcing areas of these mills to evaluate forest loss (i.e., harvesting or clearing) over time and by forest type.


The report concludes that:

- **Hardwood forest harvesting increased in the three-mill area after Enviva's pellet mills started operating, returning to and then exceeding pre-2008-2010 recession harvest levels.**
- **From 2011-2016, hardwood forest harvests exceeded growth, resulting in a net loss of hardwood forest cover in the area around Enviva's pellet mills.**
- **From 2016-2018, Enviva's three mills consumed nearly half of all wood from hardwood forest clearings in the three-mill sourcing area.**
- **Sourcing for Enviva's mills is likely contributing to overall declines in carbon stocks in hardwood forests in the three-mill area.**

When discussing impacts to forests, the industry typically prefers to focus on national or regional trends in forest growth, rather than localized impacts in the sourcing area associated with specific pellet mills. This analysis exposes how such an approach skews conclusions about the industry's impacts on forests and therefore masks its footprint. While Enviva tries to downplay the impact of the pellet industry by stating that wood pellets account for less than 3% of total wood harvesting in the southeast,[3] this analysis shows that when evaluating the actual forests being harvested for biomass, the impact is much larger: Enviva consumed close to half of all wood from hardwood harvesting in the sourcing area around its three pellet mills. Moreover, Enviva often proclaims the climate benefits of its practices by relying in part on the fact that forest growth in the southeast exceeds harvests.[4] Once again this analysis shows this to be misleading—in fact, harvests exceed growth in the actual sourcing area of Enviva's pellet mills.

At a time when we must urgently act to stabilize our climate and protect nature, we must invest in genuinely low-carbon energy sources and protect our natural forests as vital carbon sinks. The results of this analysis add to a large body of research showing that the forest biomass industry is not a climate solution and threatens both goals by driving additional harvesting of natural forests. This further calls into question policies in the European Union and United Kingdom that continue to support and heavily subsidize burning of forest biomass in power stations. It should also give pause to any country, including the United States, that is considering including largescale burning of forest biomass in its energy plans.

## Background

Over the last decade, wood pellet manufacturing in the southeast U.S. has exploded—increasing fivefold from 2012 levels. Most of these pellets are being produced for export overseas, primarily to Europe, where they are burned for energy production under the guise of being clean and climate beneficial. In reality, an established body of scientific research shows that burning forest biomass for electricity increases carbon pollution in the atmosphere for decades or more, exacerbating climate change.[5] In particular, the use of whole hardwood trees taken from clearcut forests has been shown to be the most carbon-intensive form of biomass, increasing

[i] The full report is available at https://selc.link/3Bm7bKf.

carbon pollution for nearly a century.[6] Biomass sourced in this way routinely enters energy supply chains in the U.K. and other top biomass-importing countries in Europe.[7]

Despite the detrimental effects of the industry on the climate, the woody biomass industry is supported by billions of dollars annually in E.U. and U.K. subsidies that are aimed at addressing climate change. Biomass energy producers are able to receive these subsidies if they can demonstrate on paper that the wood pellets they are burning meet specified "sustainability criteria." However, these criteria do not address lifecycle carbon emissions and most importantly fail to account for the $CO_2$ emissions from burning the pellets.[8] As a result, the industry receives massive subsidies despite increasing carbon in the atmosphere.[9]

## Enviva Pellets

Enviva, a primary supplier to Drax's U.K. power plant,[10] has been operating pellet mills in the Southeast U.S. for over ten years. Its flagship facility in Ahoskie, NC began manufacturing wood pellets in 2011, and was followed shortly thereafter by Enviva's Northampton, NC (early 2013) and Southampton, VA (late 2013) mills. As originally constructed, these three pellet mills had a combined production capacity of 1.4 million metric tons per year, but now have an annual production capacity of over 1.9 million metric tons after receiving permits authorizing expansions at two mills. In 2016, Enviva started operating its Sampson, NC mill and then a mill in Hamlet, NC in 2019.

Since 2013, multiple independent, on-the-ground investigations have uncovered destructive sourcing practices used to supply wood to Enviva's NC and VA mills.[11] These investigations found that Enviva's mills routinely source whole trees and other large-diameter wood (rather than claimed "residues" or "wastes"), and that many of these trees are taken from clearcuts of ecologically valuable and highly biodiverse natural upland and lowland hardwood forests, including bottomland hardwood and other wetland forests. These forests, located in the North American Coastal Plain global biodiversity hotspot, are some of North America's most valuable ecosystems; they provide key habitat to many at-risk species, including migratory songbirds, purify the air and improve water quality, and store large amounts of carbon.

Despite this and other evidence, Enviva continues to argue that its practices are not harmful to forests or the climate. The company even suggests that demand for wood pellets is actually benefiting forests by providing a market to keep and grow forests. Specifically, Enviva has repeatedly argued that it is not "driving harvests"[12] and that "forest inventories have increased" since Enviva began operating.[13] However, evidence on the ground suggests that these claims may be untrue in certain sourcing areas. To date, however, there has not been a large-scale quantitative measurement of the impacts of wood pellet demand on the pattern and rate of forest clearings by forest type and whether forest harvesting has increased in pellet mill sourcing areas. Researchers at Clark University undertook to answer these questions through an analysis of satellite images, the results of which were compiled into a final report: *Forest Clearing Rates in the Sourcing Region for Enviva Pellet Mills in Virginia and North Carolina, U.S.A.*

## Satellite Image Analysis

*Methodology:* The report utilized best-available satellite data to map the harvesting of forests in the sourcing region for Enviva's three pellet mills in northeastern NC and southeastern VA. First, Clark University researchers analyzed harvesting over key time periods to detect whether harvesting has increased concurrent with mill operations.[ii] Given that these three mills heavily rely on hardwood tree species,[iii] this analysis looked at harvesting rates by forest types to see if impacts of the pellet mills' operations are more strongly associated with certain types of forests in the area. To test the relationship between its findings and pellet mill *(continue on page 5)*

[ii] Clark University researchers used satellite data from Global Forest Watch and the National Land Cover Dataset. The analysis excluded forest disturbance and forest clearing events that are not likely to be related to market-driven biomass supply for wood products (e.g., developed areas, wildfires, and protected/non-harvestable land). For more information about the methodology, please see the full report.

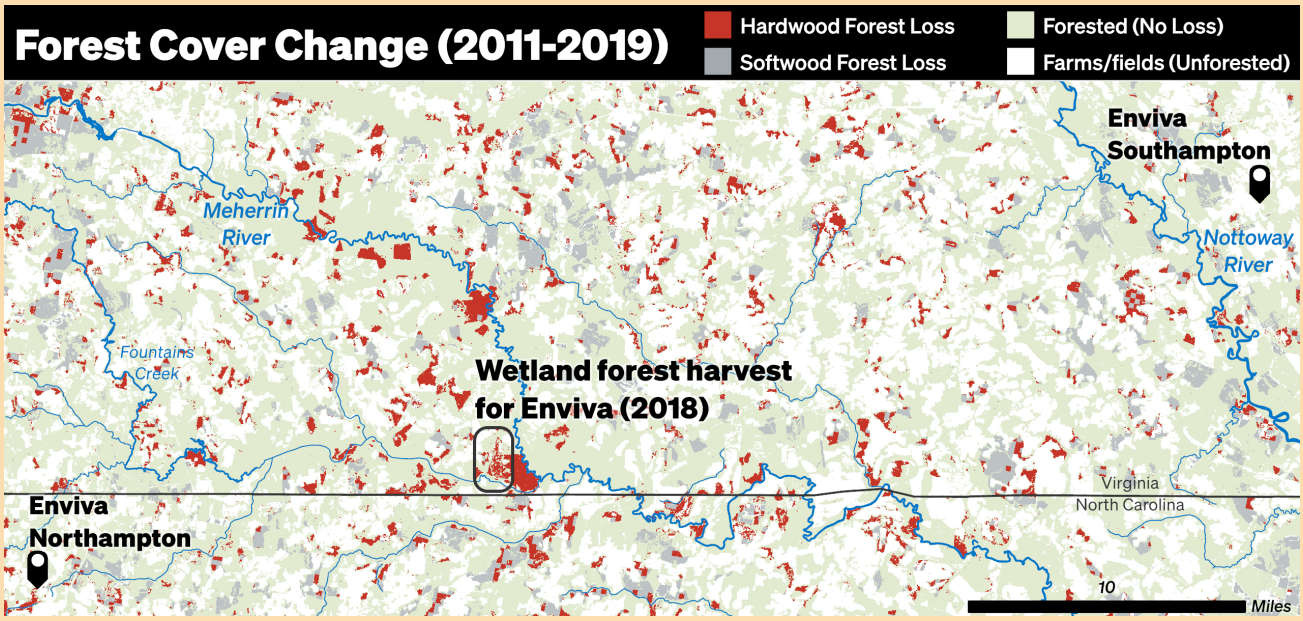
[iii] The most recent Enviva-reported data shows the following hardwood percentages at these mills: Southampton (91%), Northampton (72%), and Ahoskie (63%). This information comes from Enviva's Supply Base Reports submitted to the Sustainable Biomass Program in 2020.

## Satellite Images Confirm Investigation into Enviva's Use of Valuable Wetland Forests

In 2018, the U.K.'s Channel 4 "Dispatches" program conducted an independent investigation into Enviva's sourcing practices in NC and VA. This investigation identified an active clearcut of a mature wetland forest located less than half a mile from the Meherrin River in VA. Logging trucks carrying whole hardwood trees and other large-diameter wood were traced from this clearcut and documented entering Enviva's Southampton, VA pellet mill.*




Data from the satellite analysis confirmed that prior to the 2018 harvest this area was a forested wetland, comprised primarily of oak/gum/cypress tree species. Moreover, as shown below, this harvest site is located in an area along the NC and VA border that has experienced significant loss of hardwood forest cover from 2011-2019, according to the satellite image analysis.




* Anthony Barnett, *Dispatches: The True Cost of Green Energy*, Channel 4 (aired Apr. 16, 2018), https://ecostorm.tv/2018/04/16/the-real-cost-of-green-energy-dispatches/; *see also* note 7.

demand, the researchers utilized a time-series analysis—looking at both a pre-pellet mill and pre-recession time period (2004-2008) and a post-pellet mill period (2013-2018).[iv] Second, as part of a separate analysis, the researchers analyzed annual harvesting and growth rates from 2001 to 2016 in order to assess the potential net forest loss in the area over time. Finally, as part of both of these analyses, the researchers also looked at forest cover data around Enviva's Sampson, NC mill (the "Sampson area"), which commenced operations in the southeastern portion of the state in 2016.

*Hardwood Harvesting & Pellet Demand:* The analysis found an increase in forest harvesting in both the three-mill sourcing area and the Sampson area after Enviva's respective pellet mills started operating, showing a clear connection between demand for wood for the pellet mills and forest harvesting.

The rate of harvesting[v] of the area's hardwood (i.e., deciduous) forests were the most telling results of this analysis. Enviva's own self reporting demonstrates that its Ahoskie, Northampton, and Southampton mills rely predominately on hardwoods, and the satellite imagery analysis confirmed that the rate of hardwood forest harvesting increased in the area around these mills after Enviva's pellet mills started operating.

As shown in the table below, although hardwood harvesting in the area was relatively high around 2004-2008, harvesting dropped during the recession and subsequent closure of the Franklin, VA hardwood pulp mill. This analysis shows that with Enviva's demand for wood, not only did the hardwood forest harvesting rate in the area return to pre-recession levels but it ultimately exceeded those levels by 2016 and through 2018. The report's authors thus concluded that, "[I]t is very likely that the initiation of the pellet mill operations contributed to elevated rates of deciduous forest clearing in the [three]-mill region beginning in the 2010s, and in the [Sampson] region beginning in 2016."[14]

**Annual Hardwood Forest Harvesting Rates Over Time**

| | Forest Area in 2000 [ac] | 2004-2008 (Pre-Recession & Pre-Pellet) [ac/yr] | [%/yr] | 2009-2012 (Recession) [ac/yr] | [%/yr] | 2013-2018 (Post-Pellet) [ac/yr] | [%/yr] |
|---|---|---|---|---|---|---|---|
| **Three-Mill** | 2,624,986 | 40,587 | 1.5% | 30,075 | 1.1% | 42,994 | 1.6% |
| **Sampson** | 1,324,895 | 17,381 | 1.3% | 16,316 | 1.2% | 22,185 | 1.7% |

Forest area in 2000 and the average annual rate of gross hardwood forest harvesting in select time periods for the three-mill and Sampson regions.

This same pattern held true in the Sampson sourcing area, reflecting the impacts on hardwood forests from Enviva's Sampson mill coming online in 2016. From 2004 to 2015, hardwood harvesting in this region ranged from 1.2% to 1.5% per year, but harvesting increased to 1.9% per year from 2016 to 2018 after Sampson started operating.

These findings, and the direct relationship between the increased harvesting levels and demand from Enviva's pellet mills, are further supported by the U.S. Forest Service's Timber Products Output ("TPO") data.[15] As shown in Figure 1, harvesting for bioenergy/fuelwood in the three-mill area increased from just over 500,000 green tons in 2011 to 4.8 million green tons in 2019.[16] Similarly, harvesting for bioenergy/fuelwood in the Sampson region increased from 155,000 green tons in 2011 to 1.8 million green tons in 2019, with a marked increase after the Sampson mill started operating.[vi]

[iv] Although this first analysis was focused on forest loss in the three-mill area, as noted, researchers at Clark University wanted to be able to also assess the impact of the Sampson mill's more recent activity. To do so, they separated the post-pellet time period into two ranges, with 2013-2015 representing the time immediately after the three mills started operating and 2016-2018 representing the time after all of the mills, including Sampson, were online.
[v] The forest harvesting rate is calculated by dividing the area of forest cleared in a given year by the area of forest in 2000, the baseline for the analysis.
[vi] Review of the TPO data was separate from the analysis conducted by Clark University researchers.

## U.S. Forest Service Data Reveals Enviva's Reliance on Sawtimber Trees—Not Low Value or Waste Materials

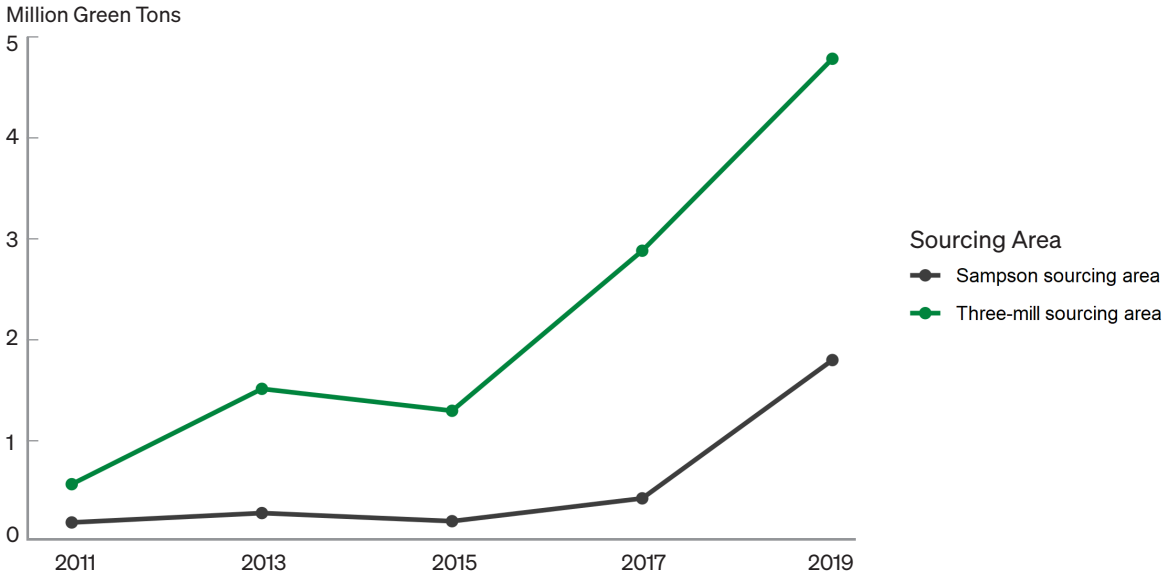
As part of the U.S. Forest Service's Forest Inventory and Analysis ("FIA") program, the Service compiles the TPO dataset. SELC's geospatial analysts reviewed the TPO data from 2001 to 2019 for the counties in NC and VA that fall within the three-mill and Sampson sourcing areas identified by researchers at Clark University. To assess the impact of Enviva's pellet mills, this analysis focused on the TPO removal or harvest category called "bioenergy/fuelwood," which includes all harvesting to manufacture wood pellets as well as other fuelwood uses such as industrial boiler fuels at mills. Based on Enviva's self-reported data regarding its feedstock use at the relevant pellet mills, wood pellet production appears to be the single largest use of wood harvested as "bioenergy/fuelwood."

Review of this TPO data reinforces the findings of the satellite image analysis and further underscores what on-the-ground investigations have shown for years—Enviva's pellet mills in northeastern NC and southeastern VA rely heavily on larger-diameter hardwood trees—and directly contradicts Enviva's repeated claims that its pellet mills use wastes, residues, and low-value roundwood.

FIGURE 1

**Forest Harvesting for Bioenergy/Fuelwood**

Wood pellet sourcing areas, 2011-2019




Moreover, a closer look at hardwood harvesting for bioenergy/fuelwood in the three-mill sourcing area shows that the overwhelming majority (approx. 84%) of hardwood material comes from larger diameter whole trees that could otherwise be used for sawtimber.* Given the share of this material going to Enviva's Ahoskie, Northampton, and Southampton mills, this data slams the door firmly shut on Enviva's claims that its pellet mills rely predominately on wastes, residues, and low-value roundwood that has no other use.

The U.S. Forest Service categorizes the hardwood material harvested as either "non-growing stock," which includes tops, limbs, stumps, and crooked or rotten "cull" trees (what Enviva refers to as "low value") or "growing stock," which is the main bole of the tree. The growing stock is then divided into two categories depending on the size of the tree, with the larger diameter trees categorized as "sawtimber growing stock" and the smaller diameter trees categorized as "poletimber growing stock." As shown in Figure 2, only a small fraction

* The Service defines sawtimber trees as live trees with a diameter outside bark (d.o.b.) of at least 11 inches for hardwood and 9 inches diameter at breast height (d.b.h.) for softwood. These are larger than poletimber trees. U.S. Forest Service, *Forest Inventory & Analysis Glossary*, https://www.nrs.fs.fed.us/fia/data-tools/state-reports/glossary/.

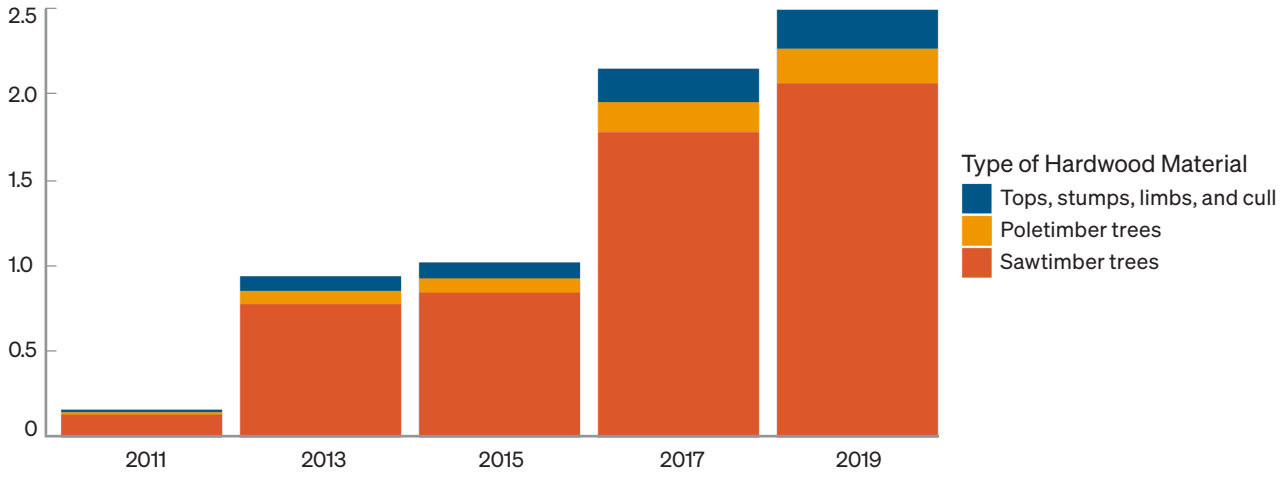
of the hardwood material harvested for bioenergy/fuelwood comes from the non-growing stock category. Instead, this material is almost exclusively from trees classified as sawtimber.

FIGURE 2

**Type of Hardwood Material Harvested for Bioenergy/Fuelwood**

Three-mill sourcing area, 2011-2019

Million Green Tons




## Net Forest Loss

The first part of the satellite analysis, discussed above, looked at the gross rates of forest clearings to assess whether and to what extent demand for wood for Enviva's pellet mills has impacted forest harvesting rates in the region. Separately, the Clark University researchers also assessed the average net value of forested area within the three-mill region through 2016.[vii] This distinct analysis compared annual rates of forest harvesting with gains to determine whether the area's forests have experienced a net loss over time.

The analysis found that from 2001-2016, the amount of forests being harvested exceeded any new growth in the three-mill region, resulting in a net loss of forested area. Specifically, the forested area decreased annually by 4,467 acres during this time period (for a loss of 1.18%), with losses concentrated in the area's deciduous, mixed, and woody wetland forests. Similarly, a net loss of forested area was also shown in the Sampson sourcing area over this same time period. Moreover, in the years following Enviva's operation of the Ahoskie, Northampton, and Southampton mills (from 2011-2016), hardwood forests in the area around the mills also experienced a net loss. In that six-year period, the area's deciduous, mixed, and woody wetland forests decreased by almost 28,000 acres (4,638 acres/year).[viii] Loss to the area's natural hardwood forests is particularly concerning—biodiversity at the landscape scale, in form of diverse forest types, provides important ecosystem services, including habitat for a rich variety of wildlife, resistance against pests and climate stressors, water and nutrient cycling, and beyond.

Based on these findings, and in direct contrast to Enviva's repeated assertions, the report's authors conclude that, "pellet mill operations do not appear to have induced an increase in forestland area within the [three-mill] region, and in fact deciduous forestland saw a sizeable and steady decline."[17]

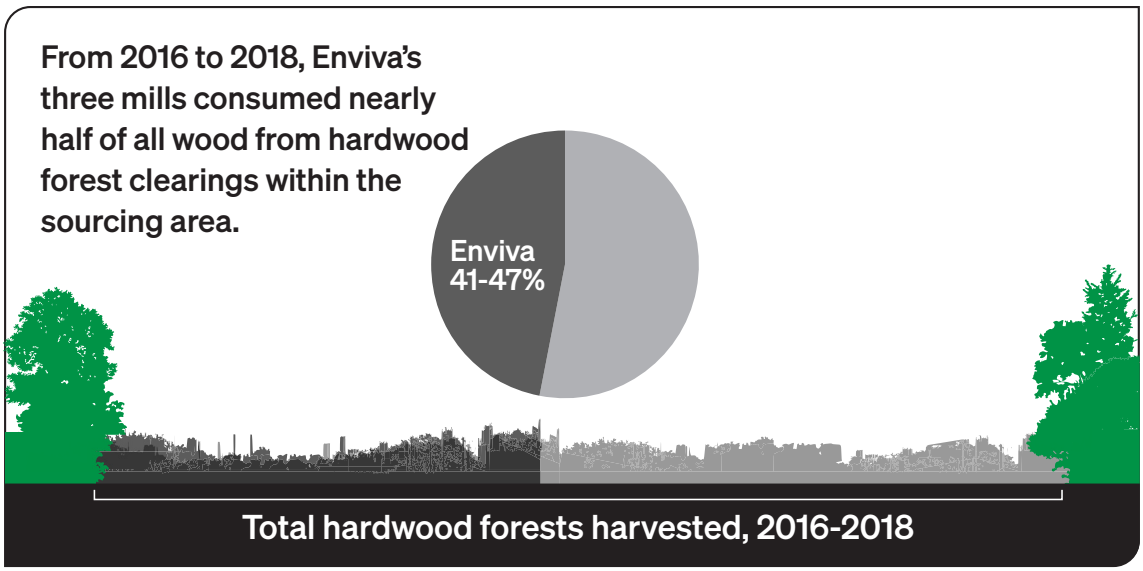
[vii] Satellite images related to forest gains were only available through 2016.

[viii] A small net gain in the area's softwood forests during this time resulted in a minimal overall increase in forested area in the area from 2011-2016 (approx. 0.14%), although as noted above the area's hardwood forests experienced a net loss.

## Enviva's Consumption

In addition to analyzing the amount of hardwood forest harvesting occurring in the three-mill region, the report was also able to conclude that from 2016 to 2018 Enviva's Ahoskie, Northampton, and Southampton mills consumed between 41% and 47% of all woody materials from hardwood forest harvesting within the three-mill area.

This conclusion is based on Enviva's own self-reported data regarding the sourcing practices of these three mills, including the amount of materials consumed by these mills during the relevant time period (between 2.33 and 2.66 million green tonnes per year), the percentage of this material that came directly from the forests (87%), and the percentage of this material that came from hardwood species (78%).[18] Using all of this data, the report's authors estimate that approximately 68% of Enviva's feedstock would have come to the mills directly from recent hardwood harvests in the area. Comparing that to the results of the satellite analysis, they conclude that, "pellet mill operations consume a correspondingly large fraction of the total deciduous forest clearing within the [three-mill] region."[19]




## Forest Carbon Stocks

Finally, although a detailed assessment of forest carbon stocks was not a part of this analysis, with the information obtained during the study regarding forest harvesting rates, declining hardwood forest cover, and the percentage of hardwood harvesting going to Enviva, the report's authors were able to conclude that, "it is likely that Enviva sourcing is contributing to overall declining carbon stocks in deciduous forests in the [three]-mill area."[20] This conclusion is further supported by recent research by the Woodwell Climate Research Center and Chatham House, which countered industry claims that biomass demand incentivizes landowners to keep or even expand their forests, stating:

*"These claims are based on economic theory and are not consistent with the empirical evidence, which suggests the opposite. Demand for wood for energy leads to a reduction in the forest carbon stored because the total area and volume harvested increases to meet this demand."*[21]

Enviva itself has acknowledged that in situations such as these, the use of wood pellet biomass is not beneficial to the climate: "If growth and sequestration are not keeping up with harvest, then we agree that the emissions from biomass combustion should not be treated as climate friendly."[22]

## Conclusion

While Enviva and others in the industry like to point out that wood pellet harvesting only accounts for a small percentage of overall harvesting in the Southeast, such a region-wide approach masks the impacts this industry is having on our natural forests. When researchers zoomed in to examine the forests directly harvested for these pellet mills, as in the satellite image analysis, the results show a strong link between the operation of Enviva's Northampton, Ahoskie, and Southampton mills and increased rates of hardwood forest harvesting in the area. The analysis also found that "a correspondingly large fraction" (41-47%) of all hardwood material being cleared in the area was being consumed by Enviva for use in pellet manufacturing and that over time the area's forests, including its ecologically valuable hardwood forests, have experienced a net loss in forest cover.

Urgent climate action is needed now. This must include a drastic reduction in emissions, as well as significant increases in forest carbon sinks. Indeed, all the pathways identified by the IPCC to address the climate crisis in its 2018 special report on keeping global warming below 1.5°C involve both. The forest biomass industry sets back efforts on both sides of this equation, increasing carbon dioxide in the atmosphere as pellets are burned in power stations to produce electricity and contributing to overall declining carbon stocks in the forests supplying trees for the production of wood pellets. To address the climate emergency, subsidies for the large-scale use of forest-biomass for energy must be ended and countries like the U.S. must avoid putting in place similar policies or incentives for this false solution, favoring instead genuine solutions like wind, solar, and battery storage.

## Endnotes

[1] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2021: The Physical Science Basis Summary for Policymakers* (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf; IPCC & Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), *Biodiversity and Climate Change Workshop Report* (2021), https://ipbes.net/sites/default/files/2021-06/20210609_workshop_report_embargo_3pm_CEST_10_june_0.pdf.

[2] *See* Enviva, *Track & Trace*, https://www.envivabiomass.com/sustainability/responsible-sourcing/track-trace/ (last visited Feb. 18, 2022) (reporting approximately 75% of material coming directly from forests); Drax, *Annual Report and Accounts 2020* at 54 (2021), https://www.drax.com/wp-content/uploads/2021/03/Drax_AR2020.pdf (reporting over 60% US-derived pellets from whole trees).

[3] Enviva Partners, LP, *Business Overview Presentation* at Slide 19 (June 14, 2021), https://s28.q4cdn.com/898203682/files/doc_presentation/2021/06/EVA-Investor-Presentation-June-14-2021-FINAL.pdf.

[4] *See, e.g.*, Holly Taylor, *Enviva Official Addresses Concerns from CNN Article*, Roanoke-Chowan News Herald (Aug. 17, 2021), https://www.roanoke-chowannewsherald.com/2021/08/17/enviva-official-addresses-concerns-from-cnn-article/ ("During the last 20 years, even after accounting for all the forest uses by the forest products industry, forest growth has exceeded removals by nearly 50 percent.").

[5] *See, e.g.*, Thomas Buchholz et al., *When Biomass Electricity Demand Prompts Thinnings in Southern US Pine Plantations: A Forest Sector Greenhouse Gas Emissions Case Study*, Front. For. Glob. Change (2021), https://doi.org/10.3389/ffgc.2021.642569; John D. Sterman et al., *Does Replacing Coal with Wood Lower CO2 Emissions? Dynamic Lifecycle Analysis of Wood Bioenergy*, 13 Envtl. Res. Letters (2018), http://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta; Duncan Brack, *Woody Biomass for Power and Heat: Impacts on the Global Climate* (2017), https://www.chathamhouse.org/publication/woody-biomass-power-and-heat-impacts-global-climate.

[6] Spatial Informatics Group, *Carbon Emission Estimates for Drax Biomass Powerplants in the UK Sourcing from Enviva Pellet Mills in U.S. Southeast Hardwoods using the BEAC Model* (2015), https://www.southernenvironment.org/wp-content/uploads/legacy/news-feed/SIG_BEAC_calculations_SE_hardwoods_2015-05-27.pdf?cachebuster:11.

[7] *See, e.g.*, Alex Thomson, *Fears Biomass Green Revolution Could be Fuelling Habitat Loss*, Channel 4 (July 5, 2021), https://www.channel4.com/news/fears-biomass-green-revolution-could-be-fuelling-habitat-loss; Dogwood Alliance, NRDC, Southern Environmental Law Center, *Global Markets for Biomass Energy are Devasting U.S Forests* (2019), https://www.southernenvironment.org/wp-content/uploads/2021/11/2019-Updated-Investigation-Booklet_Wood-Pellets-in-SE-US.pdf (hereinafter, "Biomass Investigation Booklet").

[8] Duncan Brack, Richard Birdsey, & Wayne Walker, *Greenhouse Gas Emissions from Burning US-Sourced Woody Biomass in the EU and UK* (Oct. 2021), https://www.chathamhouse.org/2021/10/greenhouse-gas-emissions-burning-us-sourced-woody-biomass-eu-and-uk.

[9] *Id.*

[10] *See* Enviva Business Overview, *supra* note 3, at Slide 23.

[11] *See, e.g.,* Biomass Investigation Booklet, *supra* note 7.

[12] *See, e.g.,* Johanna F. Still, *Environmentalists Condemn Wilmington Wood Pellet Exporter Whose Mission is to Reduce CO2 Emissions*, Port City Daily (Oct. 20, 2021), https://portcitydaily.com/deep-dives/2021/10/20/environmentalists-condemn-wilmington-wood-pellet-exporter-whose-mission-is-to-reduce-co2-emissions/ (Enviva's Director of Sustainability: "We don't drive the harvest."); Enviva, *White Paper – Seeing the Forest: Sustainable Wood Bioenergy in the Southeast United States* at 21 (May 2020), https://www.envivabiomass.com/wp-content/uploads/white-paper-seeing-the-forest.pdf.

[13] Enviva, *Sustainable Forestry*, https://www.envivabiomass.com/sustainability/forests/ (last visited Feb. 18, 2022) ("In areas where we operate, we can show that forest inventory has increased after we arrive.").

[14] Christopher A. Williams, *Forest Clearing Rates in the Sourcing Region for Enviva Pellet Mills in Virginia and North Carolina, U.S.A.* at 10 (Dec. 2021), https://selc.link/3Bm7bKf.

[15] U.S. Forest Service, *Timber Products Output* (2001-2019), data downloaded from https://usfs-public.app.box.com/s/y4ziirdb9v7zardus0cuajh7ziy9b2id.

[16] *See* N.C. Dep't of Envtl. Quality, *North Carolina GHG Inventory* at 72 (2022), https://deq.nc.gov/media/27070/download?attachment (noting that from 2011 to 2018, "although total roundwood production has increased by about a third during during this period, roundwood production for bioenergy/fuelwood has increased by more than a factor of five").

[17] Williams, *supra* note 14, at 25.

[18] Sustainable Biomass Program, *Supply Base Report: Enviva Pellets Southampton, LLC, Fourth Surveillance Audit* (2019), available at https://sbp-cert.org/certificate-holders/#4435; Sustainable Biomass Program, *Supply Base Report: Enviva Pellets Northampton, LLC, Fourth Surveillance Audit* (2019), available at https://sbp-cert.org/certificate-holders/#4310; Sustainable Biomass Program, *Supply Base Report: Enviva Pellets Ahoskie, LLC, Fourth Surveillance Audit* (2019), available at https://sbp-cert.org/certificate-holders/#4347.

[19] Williams, *supra* note 14, at 25.

[20] *Id.*

[21] Brack et al., *supra* note 8, at 16.

[22] Enviva White Paper, *supra* note 12, at 15.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**For more information, contact**

**Heather Hillaker**
Staff Attorney
Southern Environmenal Law Center
919-967-1450
hhillaker@selcnc.org