Contrary to Popular Thinking,

Going Paperless Does Not "Save" Trees

A white paper produced on behalf of Two Sides North America, Inc.

by Dovetail Partners, Inc.

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February 8, 2016

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Contents

Executive Summary

The concept of avoiding use of paper in order to save trees may seem logical and has been adopted by many. The reality, however, is that avoiding use of paper may well result in significant loss of forest land in North America.

North American forests are a global resource, providing critical, renewable raw materials for a variety of societal needs. Large areas of these forests, including those in the southern region, are managed by millions of individual landowners, many of whom rely on their forests for periodic income. Absent a market for wood from pulp and paper manufacturers, significant numbers of landowners will turn to different markets or perhaps reduce investments in tree planting. Should markets for wood simply dry up, then there is a very real likelihood of land conversion to other uses such as urban development or agriculture.

The risk of forest loss in the absence of wood markets is reflected in trends for the world as a whole which show that regions with the highest levels of industrial timber harvest and forest products output also tend to be the regions with the lowest rates of deforestation. The reality is that the greatest incentive for continued investment and retention of our nation's forests is a stable market for paper and other wood products.

It is important to understand that forest resources are used for many different products in addition to paper. For example, in the U.S. South, forest landowners have embraced the emergence of a growing bioenergy industry that produces fuel pellets from wood. The new bioenergy industry is currently consuming a quantity of wood equivalent to about 16% of that going into pulp and paper production, up from 0% in 2008. In New Brunswick, Canada there has been a major decline in paper production and use of pulpwood for papermaking due to mill closures over the past decade. However, harvesting rates on Crown Land have remained the same or increased due to the acceptance by sawmills of smaller diameter logs which would have typically gone into pulp, and the emergence of new markets for sulfite pulp used in making textiles and for pulpwood-sized logs used to manufacture energy pellets.

Even in the face of generally declining paper consumption, harvesting of trees for forest products is stable or increasing in key paper producing regions.

Serious rethinking of the "save paper – save trees" movement is needed.

Contrary to Popular Thinking, Going Paperless Does Not "Save" Trees

You've seen the slogans – "Save paper - save trees". Intuitively it is so simple. Use less paper and the number of trees will be far greater than today. But is this really the case? Would using less paper really save trees?

The answer might surprise you.

Herein we report on a case study of the Southern region of the United States where the majority of the nation's paper production occurs. As it happens, there has been a marked decline over the last several decades in paper consumption and production in the U.S., a development that has significantly impacted the paper industry of the South. It is a situation that allows testing of the notion that using less wood, whether in the form of paper or other forest products, would result in

more trees or more extensive forests. We examined recent trends in U.S. paper consumption, and statistics regarding paper manufacturing, timber harvesting, tree planting, forest area, and number of trees in the South. Sources of wood for papermaking were also investigated as were threats to forests of the region.

A Snapshot of Forests and the Forest Industry in the Southern Region of the U.S.

The southern region of the U.S. encompasses 13 states – Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. This is the dominant forest products producing region in the United States, generating more than 55 percent of U.S. timber harvests by volume. According to the World Resources Institute, the South's forests produce more wood products than any nation, except the United States itself. With just 2 percent of global forest cover, the forests of the U.S. South region produce 25 percent of the world's pulpwood for paper and 18 percent of its industrial timber.[1]

Specifically regarding pulp and paper, more than 75% of the U.S. pulpwood harvest occurs in the South. Just five states - Georgia, Alabama, Mississippi, Louisiana, and South Carolina – produce over 50% of the nation's pulpwood. Four of the southern states also are among the top five sources of sawmill residues that are used in papermaking. Given the dominance in production of wood raw materials used in papermaking, it is not surprising that more than 60% of the nation's pulp and paper mills are located in the South.[2]

Regarding forests of the southern region from which wood for commercial use is obtained, several characteristics are particularly noteworthy:

- Individuals and families, private investment groups, and the forest industry own 87% of forestland in the South. The majority of wood harvested in the South is obtained from privately owned forestland which provides 96% of the annual wood harvest in that region.[3] Slightly over one-half of the wood harvested in the South (52%) is used to manufacture pulp, paper, and paperboard. In other words, pulpwood represents a substantial market for southern forest landowners.
- Annual removals of wood in the U.S. as a whole are less than half of annual net growth.[4] In other words, each year forests of the United States grow more than twice as much wood as is harvested or otherwise removed. Annual removals amount to about 1.3% of total growing stock volume. In forests of the southern region, the ratio of growth to removals as reported in the most recent survey (2011) was 1.7:1, again indicating net growth far in excess of removals.
- The volume of growing stock in southern forests has doubled since 1952, despite large-scale ongoing annual harvesting and a 40+ percent increase in annual removals since the early

[1] World Resources Institute (2009)
[2] Piva et al. (2014)
[3] Oswalt et al. (2014)
[4] Net annual growth is defined as the measure of the increase in volume of a tree or trees within a forest after deductions in volume occasioned by decay, damage, or tree death resulting from fire, wind throw, insect infestation, or other vector.

1950s.[5] Over the same time frame the forested area has remained relatively constant, with forest cover today about 2.6% greater in the southern region than in 1952.

Despite the southern region's dominance in the U.S. forest sector and a number of positive trends, all is not well for the forest landowners and forest and mill workers in that part of the country. A significant decline in domestic consumption of paper has occurred in the U.S. in general over the past two decades, with paper production in 2013 down 15% from 2007 and 20% from 1995.[6] In addition, dominance of the U.S. in supplying export markets, which had grown steadily through near the end of the 20th century, has faltered in the face of competition from other countries, including China, Brazil, Sweden, and Finland.[7] Printing and writing papers have been most affected by these changes, with a 70% drop in mill capacity in North America as a whole.[8] The decline is attributable to a number of factors, including shifting preferences toward electronic communication, reduced paper demand stemming from the 2007-2009 economic downturn, and rising competition from Asian paper manufacturers. The effect on the southern paper industry has been mill closures and loss of pulp production capacity since the mid-1990s, accompanied by a decrease in the quantity of wood used in making paper and paperboard. Between 2000 and 2011, for instance, the region lost 17 pulp mills and six percent of pulp manufacturing capacity, with impacts felt region-wide.[9] Additional closures have occurred since that time, reducing production capacity within the region another 4-5%.[10] As a consequence of these developments, wood use in the region's pulp mills declined about 8% from 1998-2011.

Recent trends in the southern paper industry, though catastrophic to a number of forest and mill workers and communities, would appear to be good news for those seeking to save trees. Or is it?

Forest Landowner Objectives and Behavior

Surveys and studies of non-industrial private forest (NIPF) owners (also often referred to as family forest owners) across the United States have found that they are primarily interested in such amenities as esthetics and privacy that their forests provide. However, although timber production is not a primary objective of most such owners, timber harvesting is a common activity; landowners respond to price signals as well as public policies and various incentives and disincentives to producing wood.[11] Based on analysis of a number of such studies, public policy was most commonly identified as a driver of landowner behavior, followed by forest conditions, owner characteristics, and wood prices/markets, though differences in the importance of various factors were found to be small. [12]

[5] Oswalt et al. (2014); USDA-Forest Service 1982
[6] MAPI (2014)
[7] Wear et al. (2013)
[8] Montague (2015)
[9] Brandeis and Guo (2015)
[10] Alabama Forestry Commission (2013)
[11] Butler (2008)
[12] Beach et al. (2005)

A survey of southern non-industrial private forest landowners found that:

- Owners primarily interested in timber production controlled over one-third of forestland in the region.[13]
- Those who indicated that they would never harvest timber from their land controlled only 12 percent of the total private timberland acreage.[14]

A number of other studies have revealed that a large majority of landowners are willing to periodically harvest, with decisions dependent upon expected financial return among other considerations.[15] In fact, Young and colleagues found that expected income was the most important factor influencing NIPF landowners' decisions in supplying woody biomass. Given the importance of financial considerations in land management for a significant portion of forest land owners, the economics of alternative land uses are constantly in play.

Throughout the southern region, forest land is under constant pressure from agricultural interests – often in the form of current owners who own both farm and forest land. McCraw Energy recently reported instances of forest conversion to agriculture driven by high commodity prices, observing that ". . . there is no such thing as marginal farmland. Marginal farmland in the South is called timberland."[16] There is also considerable and mounting interest in forest conversion to urban development or for subdivision to vacation homes. In fact, the U.S. Forest Service has forecast forest losses of 11-23 million acres (7 to 13 percent of forest area) in the southern region by 2060, with almost all of this due to urbanization trends.[17] The extent of expected forest loss is highly dependent upon population and economic growth, but also on timber prices.

"In general, the data show that the global regions with the highest levels of industrial timber harvest and forest products output are also the regions with the lowest rates of deforestation."

- *Ince (2010)*

The greatest losses are projected in an environment of high economic growth and low timber prices. Conversely, increasing timber prices (i.e. strong timber markets) and low economic growth lead to the lowest extent of forest loss. Other assessments of drivers of forest retention have similarly found that increased wood demand can slow the loss of forest or even lead to expansion of forest area.[18] These findings are consistent with those of Ince[19] who observed that "in general, the data show that the global regions with the highest levels of industrial timber harvest and forest products output are also the regions with the lowest rates of deforestation."

[13] Wicker (2002)
[14] Wicker (2002)
[15] Young et al. (2013); Joshi et al. (2013); Aguilar et al. (2014)
[16] McCraw (2014)
[17] Wear (2013)
[18] Miner et al. (2014)
[19] Ince (2010)

Production of Pulpwood in the Southern Region

> Fiber used in papermaking in the United States comes from:
>
> - Recycling
> - Roundwood (mostly from thinning of forest stands managed primarily for sawtimber).
> - Sawmill residues

About 39% of the fiber used in papermaking in the United States is obtained through recycling. The rest comes from wood that is typically obtained through 1) thinning of forest stands being grown to larger diameters (sawtimber) to provide raw material for production of lumber and plywood, 2) patch clearcutting of smaller diameter trees managed specifically for pulp production, and/or 3) collection of chips and sawdust produced as by-products in the production of lumber. When trees are harvested to provide pulp they are thereafter collectively referred to as roundwood; chips and sawdust are described as mill residues. In 2011, softwood roundwood (pine) accounted for 60% of the raw material used in southern region pulp production, hardwood roundwood for 20%, and mill residues for the remaining 20%. In a typical year, most of the roundwood is obtained from thinning of stands as in #1 above. High pulpwood prices can lead to a greater proportion of wood obtained through dedicated pulpwood harvests as described in #2 above.

Thinning in southern pine stands being managed for multiple products including sawtimber typically occurs at 8-10 year intervals until 20-30 years of age. Each removal, beginning with the second thinning treatment, results in an increasing proportion of wood used in producing lumber and other long-lived products. The sawtimber harvest occurs at 30-40 years of age or about a decade following the final thinning. This harvest is typically followed by replanting or direct seeding.

The value of sawlogs is four to five times greater than that of pulpwood such that income from intermediate thinnings constitutes an important, but relatively minor portion of overall harvest income from a complete harvest cycle. Consequently, during periods of low pulpwood demand, such as during an economic downturn, landowners will often thin sawtimber stands despite the lack of markets. Continued thinning is necessary to ensure the growth and development of the higher valued sawlogs. This was experienced in the late 1990s when a glut of pulpwood in the southern region led to a lack of markets for some landowners.[20]

Dissecting the Effect of Reduced Paper Consumption on Southern Forests

Understanding how reduced markets for paper can impact forests requires analysis that considers all of the major influences on forest sustainability. In this case, the fact that 96% of the wood used to make paper comes from private lands is a hugely significant factor. Another important consideration is that much of the wood supply to paper mills comes from thinning of forests where the focus is sawtimber production, or flows to paper manufacturers as a by-product of lumber manufacturing facilities.

[20] McCraw (2014)

The convergence of many factors over the past 7-8 years complicates analysis of the impact on forests of reduced paper use. Nonetheless, examination of what has happened is informative.

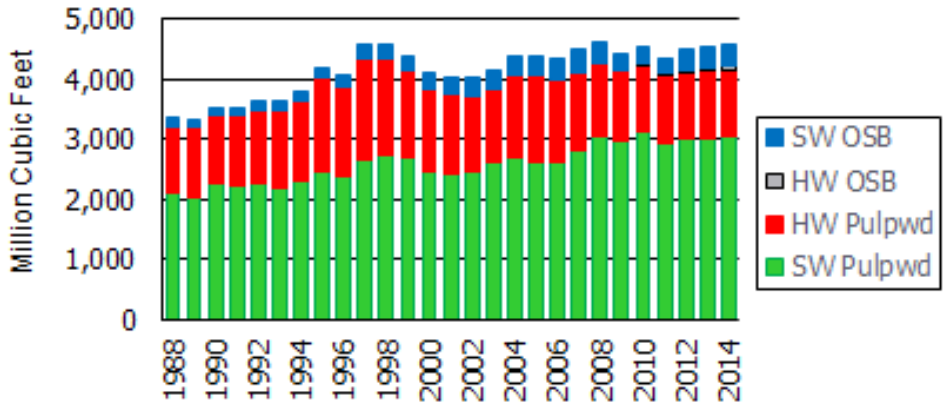
The decline in U.S. paper consumption began in the late 1990s. Early on, there were direct impacts on southern forests, with about a 1/3rd drop in pulpwood harvests from 1997 to 2002. Soon thereafter, however, the use of sawmill chips as a source of pulpwood began to decline due to a combination of factors including high hardwood chip prices and low pulpwood prices which drove paper manufacturers back toward roundwood as a preferred raw material source.

Since the late 1990s:

- Paper consumption in the U.S. South, and the U.S. overall, declined.
- Homebuilding activity declined sharply, reducing demand for lumber.
- Reduced lumber production resulted in lower production of chips and sawdust commonly used in making pulp for papermaking.
- Harvest of trees for pulpwood production increased.
- The decline in forest products production contributed to reduced tree planting activity, and in some cases, conversion of forest land to non-forest uses.
- Forest landowners have begun to embrace new markets for wood, including bioenergy.

In late 2005, presaging the deep economic recession that would follow, homebuilding activity in the U.S. began to decline. In succeeding years, home construction would fall to less than 30% of early 21st century levels. The effect on the softwood lumber industry was catastrophic. As lumber production dropped by more than half over a period of just 4 years, production of chips and sawdust dropped sharply as well, further reducing use of residues in papermaking. And, paper production fell to a lesser extent than building products, in part because of increased exports made possible by a weak US dollar. As a result, even in the face of generally declining paper consumption, harvesting of trees for production of pulp increased (Figure 1).

Southern Pulpwood Harvest, 1988-2014



Sources of data: Carter and Wear (2007); Georgia Center for Forest Business (2012); Pye (2013); Kinney (2014); Bentley and Cooper (2015).

In addition, because demand for sawlogs fell in step with the decline in lumber production, sawtimber-sized trees were left to grow until markets rebounded. That, in turn, led to a decline in trees planted, accentuating a decline in tree planting in the region dating back to the early 1990s.

In the meantime, forest landowners have embraced the emergence of a growing bioenergy industry that produces fuel pellets from wood. The new industry is producing fuel pellets largely to serve an export market that is seeking lower carbon production of energy supplies. The new bioenergy industry is currently consuming a quantity of wood equivalent to about 16% of that going into pulp and paper production, up from 0% in 2008.[21]

The experience in the southern U.S. is not unique. For instance, in Northern New Brunswick, Canada there has been a major decline in paper production and use of pulpwood for papermaking due to the closure of three large mills over the past decade. However, harvesting rates on Crown Land have remained the same or increased due to several factors:

- Sawmills are accepting lower diameter logs which would have typically gone into pulp.
- Trees are now going into other markets such as sulfite pulp for textiles. Most of this pulp is shipped to India. Two of the mills in Northern NB are now under partial or full ownership by Indian companies.
- Pulpwood sized logs are being used to manufacture oriented strandboard (OSB) and pellets for energy, with an increase in volumes forecasted for the pellet market.

In Minnesota, the closure of several paper and oriented strandboard mills has led to divestiture of large blocks of forest land long held by the Potlatch Corporation. Soon thereafter, several thousand of these acres were cleared and converted to intensive agriculture, including potato production.[22]

Bottom Line

Forests are global resources that provide renewable raw materials for a variety of societal needs. Wood is a low-carbon, versatile, abundant, recyclable material, grown in North American forests that continue to expand in both area coverage and volume. Large areas of these forests, including those in the southern region of the U.S., are managed by millions of individual landowners many of whom rely on their forests for periodic income. Without a market for wood from paper manufacturers, significant numbers of landowners will turn to different markets or reduce investments in tree planting. Should markets for wood simply dry up, then there is a very real likelihood of land conversion to other uses such as urban development or agriculture.

The notion of saving paper to save trees is fundamentally flawed. Counterintuitively, continued use of paper and other wood products may be an essential factor in maintaining a forested landscape for future generations.

[21] Kinney (2014)
[22] Marcotti, (2013)

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