UBC Social Ecological Economic Development Studies (SEEDS) Student Report

An Investigation into Wheat Paper

Allister MacLean

Jae Yeong Bae

Ting Hin Wan

University of British Columbia

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Allister MacLean
Jae Yeong Bae
Ting Hin Wan

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ABSTRACT

UBC consumes nearly 50 million sheets of copy papers every year. While 30% recycled paper was used until today, Royal printers has proposed to supply seemingly more environment friendly wheat paper to UBC. In this report, environmental, economic, and social aspects of wheat paper and 30% recycled paper have been compared.

The Carbon Footprint is one of the most important reasons why wheat paper is more sustainable than 30% recycled paper. The total carbon footprint of wheat production is actually lower than the wood production if carbon storage is taken into account. Cutting down trees would decrease the level of carbon storage and increase the rate of global warming.

Economically, after analyzing the cost to the manufacturer, it is confirmed that they are making enough profit so that the price would not be raised afterwards. Also, buying from a developing country would support the global economy.

Socially, switching to wheat paper will improve UBC's reputation as a world leader in sustainability and pave the way for eventual canadian production of this product. It will also introduce a potentially world changing technology to a continent which knows nothing about it.

Considering the triple bottom line, switching the supplier to wheat paper would benefit the global environment, economy, and society.

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GLOSSARY

by-product - A product made during the manufacture of something else

carbon storage - The long-term storage of CO2 in the forests, soils, ocean, or underground in depleted oil and gas reservoirs, coal seams and saline aquifers.

minimum wage - The lowest wage permitted by law or by a special agreement.

oxygenation - The process of providing or combining or treating with oxygen; "the oxygenation of the blood".

organochlorines - Any of a large group of pesticides and other synthetic organic compounds with chlorinated aromatic molecules

photosynthesis - The process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using.

tariff - A tax or duty to be paid on a particular class of imports or exports

1.0 Introduction

Every year, UBC recycles tons of waste paper. We, as students, generate a lot of paper waste everyday. Especially after final exams, most students recycle pile of notes. Switching to wheat paper would save many trees from being cut down. This report will investigate whether wheat paper is actually more sustainable than recycled paper. Firstly the environmental effect of wheat production and the manufacturing process will be investigated. Problems like carbon footprint, energy used, waste generated and the life-cycle of wheat paper will be considered. Secondly, economic issues will be considered like manufacturing cost, purchasing cost and the total cost. Finally the social issues will be investigated such as labour conditions throughout production and the UBC sustainability policy.

2.0 Environmental Analysis

2.1 Carbon Storage

All living organisms on earth store a specific amount of carbon within their bodies. For example, plants absorb carbon dioxide and release oxygen, while retaining the excess carbon during photosynthesis (J. Fix, S. Tynan, 2011). The carbon will remain trapped unless the plant is cut down or burned. Due to this reason carbon storage plays an important role in preventing global warming. As trees are cut down for the papermaking process, the carbon that is stored inside these trees will be released, which will increase the speed of global warming (J. Fix, S. Tynan, 2011). Therefore, why should we cut down trees to make paper when we can use the ample supply of wheat straw instead?

2.1.1 Wheat

More than 24 million tons of wheat are grown and harvested every year in Canada leaving behind tons of wheat straw as a byproduct (J. Fix, S. Tynan, 2011). Since wheat straw is the main ingredient in wheat paper, no extra carbon will be released which means the carbon storage level stays the same. Therefore, it is more sustainable to make paper with wheat than wood.

2.1.2 Wood

Tons of trees are cut down by the papermaking industry to make paper each year. Although we do replant many trees, figure 1 below shows that undisturbed forests actually store significantly more carbon than harvested forests (J. Fix, S. Tynan, 2011). Clearly, harvesting forests for wood pulp to make paper reduces the carbon storage level, which is bad for the environment.

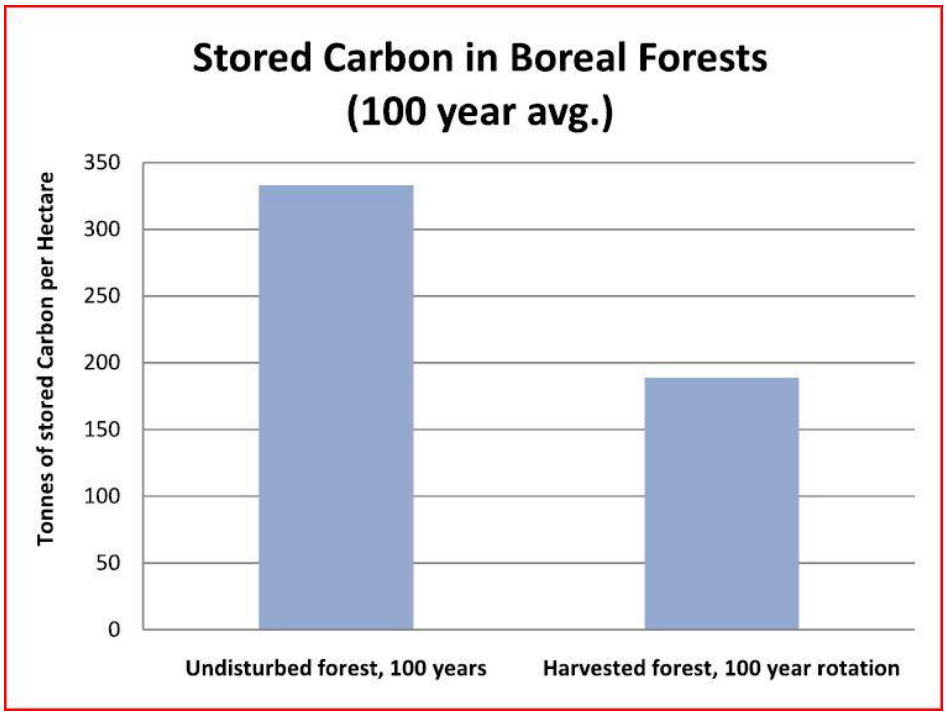

Figure 1: Stored Carbon in Forests

(J.Fix, S. Tynan (Summer 2011). Carbon Footprint Analysis for Wood & Agricultural Residue Sources of Pulp.)

2.2 Carbon Footprint

Carbon footprint refers to the total set of greenhouse gas emissions caused by an organization, event, product or person (Wikipedia, 2012). During the process of wheat and wood production large amount of carbon dioxide will be produced and released to the atmosphere. In the table below, the carbon footprint of the production of different types of wheat straw and wood are compared.

2.2.1 Wheat

In the table below, there are four categories of wheat straw. They are conventional, organic, grain-based rotation and integrated rotation (J. Fix, S. Tynan, 2011). Each type wheat straw has a different carbon footprint. Within the four of them conventional wheat straw has the highest carbon footprint while the organic wheat straw has the lowest carbon footprint. By looking at the table, we can see that wheat production actually has a higher carbon footprint level than wood production. However, if we take into account the potential carbon storage loss from wood production, we can see that the total carbon footprint of wheat production is actually a lot lower than the wood production.

2.2.2 Wood

By looking at the same table below, we can see that wood production actually has a smaller carbon footprint that wheat production. However, we have to take into account the potential carbon storage loss from cutting down the trees. Trees can hold much more carbon than wheat plants. When this is taken into account, wood production has a higher carbon footprint than wheat production.

	Production (kg CO_2/tonne pulp)	Processing (kg CO_2/tonne pulp)	Carbon Footprint from Energy Inputs (kg CO_2/tonne pulp)	Potential Carbon Storage Loss from Land Use Conversion (kg CO_2/tonne pulp)
Spruce (Canada)	89	N/A*	89	~1,000**
Aspen (Canada)	76	N/A*	76	~1,000**
Wheat Straw: Conventional (i.e. non-organic)	368	N/A*	368	0
Wheat Straw: Organic	125	N/A*	125	0
Wheat Straw: Grain-Based Rotation	278	N/A*	278	0
Wheat Straw: Integrated Rotation	207	N/A*	207	0

Figure 2: Total Carbon Footprint

(J.Fix, S. Tynan (Summer 2011). Carbon Footprint Analysis for Wood & Agricultural Residue Sources of Pulp.)

2.3 Energy and Materials Used

During the process of manufacturing paper, large volumes of energy are used in the logging chipping, bleaching and pulping processes (J. Fix, S. Tynan, 2011). Reducing the energy consumption of these processes will reduce the output of greenhouse gases.

2.3.1 Wheat

New technologies have been invented by the paper industry. Companies like Royal Social Print use a wheat based bio-fuel to boil self collected and recycled water by burning wheat straw (Royal Social Print Wheat Paper, 2012). The boiled water is used to clean the paper during the process but also generates steam to turn the turbines and generate 80% of the plant's required power (Royal Social Print Wheat Paper, 2012). The materials used to make wheat paper are 95% wheat straw and 5% wood fibers. The wood fiber is used to ensure the structural integrity of the paper (P. Goldspink (personal communication, January 20 2012)).

2.4 Waste Water

Large amounts of water is used during the papermaking process. The wastewater contains chemicals and toxins such as sulfur dioxide, sodium silicates, sodium carbonate etc. Therefore, if the wastewater is not treated properly, it can pollute farms, runoffs and freshwater resources. Clearly, pollution by waste water will affect and damage the environment.

2.4.1 Wheat

Companies like Royal Social Print and Natures Paper use advanced technologies such as sodium salt and oxygenation process to whiten the pulp. The oxygenation process is environmentally friendly because the wastewater has very low toxic chemical concentration so it can be reused many times to lower the water consumption of the manufacturing process (Royal Social Print Wheat Paper, 2012).

2.4.2 Wood

In general, the papermaking industry uses large volumes of chlorine compounds to whiten the pulp during the bleaching process (The Secret Life Series, 2012). This process generates large volumes of bleaching solutions that need to be treated with extreme care. These chlorine compounds can create harmful byproducts called “organochlorines” that could cause cancer in living organisms (The Secret Life Series, 2012). Without a good waste water treatment system, the wastewater cannot be reused and will have to be gently filtered and then release back to the environment.

2.5 Life-cycle

The life-cycle of wheat paper is actually similar to the life-cycle of 30% post-consumer waste paper. Wheat paper can be treated like any other paper products during the recycling process. Wheat paper can be recycled with other paper products to repulp

and become recycled paper once again (P. Goldspink (personal communication, January 20 2012)). Usually, high quality paper can be repulped up to ten times while poor quality paper can be recycled three to four times. Therefore, wheat paper can definitely replace our daily recycled paper.

3.0 Economic Analysis

Economics also play a very important role. Royal Printers has proposed to UBC that they would be able to supply wheat paper at exactly the same price that we pay for the 30% recycled paper. Therefore both options cost the same to UBC. However, as a leading member of global economy, we must also consider the Indian economy as well as the Canadian economy. In this section, we will 1) analyze the cost to the manufacturer to verify that they will be able to maintain the price without raising it in the future, and 2) Compare the local and global economy that we can influence by making the decision.

3.1 Price of Wheat Paper vs Cost at manufacturers' hand.

According to to the statistics from 2011, UBC has consumed 47.6 million sheets of copy paper and spent $1,057,639 on it. If we consider 12 percent HST, this sums out to approximately 944,321 dollars received by the paper suppliers (Eq.1). The exact numbers are unknown, so for simplicity, we will assume the price is 1 million dollars per 50 million sheets, or 5000 dollars per 1 ton of paper (Eq.2 and Eq.3). In this section, the paper will be measured by weight instead of sheets, as size of the paper may vary.

$$\frac{\$1{,}057{,}639}{1.12} = \$\,944{,}321 \qquad \text{(Eq.1)}$$

$$50{,}000{,}000\,sheets \times \frac{20\,lbs}{5000\,sheets}\frac{1t}{1000lbs} = 200t \qquad \text{(Eq. 2)}$$

$$\frac{\$50{,}000{,}000}{200t} = \$5000\ /\ t \qquad \text{(Eq. 3)}$$

According to Hapag-Lloyd, a global shipping company, importing goods from India to canada incur an ocean tariff of 80 percent. Following this standard, this leaves 1,000 dollars per ton at the manufacturer's hands for all local manufacturing expenses, such as labour and utilities. 1000 dollars/ton may seem too low at a glance, but considering that Indian minimum wage is approx. $2 CAD, we learn that these expenses are much cheaper in India.

Unfortunately, no further information was available. We had no way of collecting information such as how many people it takes how long to make a ton of paper. Therefore we are forced to make an assumption at this point. considering the low prices in India, 1000 dollars per ton may not be a lot, but it should be enough to pay the labourers and for utilities.

3.2 Local Economy vs Global Economy

As discussed in previous section, UBC spends over one million dollars each year to on purchase copy paper used on campus. Even though the price UBC will pay shall remain the same, we can still investigate and make a better choice for the economy.

The 30% recycled paper is manufactured locally in British Columbia, and the Wheat paper is manufactured away in India and shipped to Canada. To support the local economy, we should support the local manufacturer by purchasing the 30% recycled paper without doubt. However, we need to think more in depth and think beyond our national borders.

The local minimum wage in British Columbia is currently $9.50 CAD, while the minimum wage in India, a developing country, is approximately $2 CAD. The minimum wage rises with a strong economy, and is an accurate indicator of wealth and prices of daily necessities. Simply put, bread is much cheaper in India. If we purchase from India,

we would be able to feed about 5 to 10 times more people than we would in Canada, including Indian labourers, freight workers, and local dealers.

Continuing to purchase 30% recycled paper will strengthen the Canadian economy, while changing the supplier to Indian manufactured wheat paper will strengthen both the Indian economy and the global economy.

4.0 Social Analysis

4.1 UBC Sustainability Policy

UBC is recognized as a world leader in sustainability technologies. The UBC Supplier code of conduct states that UBC suppliers should help to build a sustainable environment and assist UBC towards campus sustainability (UBC Supply Management, 2008). One excellent example of this is the current packaging and paper requirements. The policy states that UBC supplies must be packaged in a way that reduces the amount of material used or be made of a minimum 30 % post consumer recycled material (UBC Supply Management, 2008). The paper UBC currently uses is 30% recycled. Wheat paper, on the other hand is 95% wheat straw, a waste produced by harvesting wheat plants. While it is not post consumer material, it is a waste product that is produced every time a farmer grows the most common staple crop of the western world. this exceeds the UBC sustainability expectation by 65%!

Another factor to consider is that wheat paper is practically an unknown technology in Canada. Though it has been produced in india for years, wheat paper has only been used in Canada once. Canadian Geographic magazine ran a story on wheat paper in 2008, creating an entire issue out of wheat paper (Boychuck, R, 2008). Aside from this, there is no mention of wheat paper at all in any canadian journals or sources. This is probably because canada has such an active forestry industry. Wood fiber is plentiful and inexpensive available as a byproduct from the sawmills. However, wheat straw is just as plentiful if not more so. Canada produces approximately 25 million tons of wheat each year, and each wheat plant comes with a straw portion as well as the edible part(Friesen, J, 2008). Canada's prairies produce enough wheat straw to print newspapers for the entirety of north america (Friesen, J, 2008)! By introducing this technology to Canada, UBC will become the first university in north america to use this

technology. This would make the university a continental sustainability leader in this new technology.

4.2 Population Support

One of the largest problems with adopting this new technology is the fact that it is produced in India instead of Canada. The 30% recycled paper currently in use by UBC is produced right here in british columbia. The current producer of UBC's paper employs canadian workers, providing our citizens with many jobs in the pulp mills. If UBC were to switch suppliers, we would instead be supporting a foreign country's workforce. Ethically this would not be a sound choice.

The obvious best case solution would be to use the wheat paper, but produce it in Canada. Our country has an enormous supply of the needed raw materials, and it is possible to convert a wood fiber pulp mill into a wheat fiber paper factory. Unfortunately such a modification would cost in excess of four million dollars (Boychuck, R, 2008). As there is no current market for the paper no company would invest in the conversion.

While these reasons would seem to discourage the adoption of wheat paper, in the long run other factors come into play. The primary reason wheat paper is not used in north america is that it is unknown. Adopting this technology for use at ubc would open the western world's eyes to its existence. If a well known university is using the paper, suddenly it becomes viable to sell in local stores. This creates increased demand for the product. In the short term this will only boost the sales of the Indian paper company, but once demand spreads enough eventual canadian production of wheat paper becomes possible.

5.0 Conclusion and Recommendation

5.1 Environmental

From the environmental perspective, UBC should switch to wheat paper as our primary paper source. Whenever trees are cut down, decomposed or burnt, the carbon stored inside them will be released and increase the effects of global warming. By using wheat paper, we are decreasing the amount of trees that will be cut down and keeping the carbon storage level constant. If we compare the carbon footprint and storage of wood

production and wheat straw production, we can easily see that the carbon footprint for wheat straw production is much lower than wood production if we take into account the carbon storage of the trees. Also, the wheat paper companies such as Royal Print are using advanced technology like the wheat based bio-fuel to boil water by burning wheat straw. The wastewater from these processes has very low or no amount of toxic chemicals so it can be reused many times. Last but not least, the life-cycle of wheat paper is similar to regular recycled paper. Wheat paper can be recycled the same way as other paper products. Clearly, using wheat paper can reduce the amount of trees being cut down and minimize the amount of carbon footprint to the atmosphere. Therefore, UBC should consider using wheat paper as our main paper source.

5.2 Economic

From the economic perspective, the price to UBC would be the same either way. However, for the global economy, switching to wheat paper would be a better choice than staying with 30% recycled paper. By doing so, we would be able to help strengthen the global economy by helping a developing country.

5.3 Social

From the social perspective, switching to wheat paper would reinforce UBC's commitment to sustainability. The new supplier will move us closer to full campus sustainability. Furthermore switching to wheat paper will introduce this new technology to north america. UBC will reinforce its image as a global leader in sustainability and our use of the paper will pave the way for eventual canadian production. UBC should switch to wheat paper as our primary paper supply.

REFERENCES

J.Fix, S. Tynan (Summer 2011). Carbon Footprint Analysis for Wood & Agricultural Residue Sources of Pulp.
<http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/sag13757/$FILE/Final_Report_CFA.pdf>

"Paper." The Secret Life Series. Feb 15, 2012.
<http://www.secret-life.org/paper/>

Carbon Footprint. In Wikipedia. Retrieved March 26, 2012, Retrieved from
<http://en.wikipedia.org/wiki/Carbon_footprint>

Royal Social Print Wheat Paper (2012). SWP Wheatpaper [PDF]. Retrieved from
<https://www.elearning.ubc.ca>

"Ocean Tariff Rates and Surcharges. " Hapag-Lloyd. Retrieved March 26, 2012. Retrieved from
<http://www.hapag-lloyd.com/en/tariffs/ocean_tariff.html>

"Minimum Wages India. " Paycheck. Retrieved March 26, 2012. Retrieved from
<http://www.paycheck.in/main/salary/officialminimumwages>

"Minimum Wage Factsheet. " Government of B.C., Ministry of Labour. Retrieved March 26, 2012. Retrieved from
<http://www.labour.gov.bc.ca/esb/facshts/min-wage.htm>

Boychuk, R. (2008, Introducing the wheat sheet. Canadian Geographic, 128(3), 11-11. Retrieved from
<http://ezproxy.library.ubc.ca/login?url=http://search.proquest.com/docview/216050299?accountid=14656>

Friesen, J. (2008, May 22). Glossy magazine wakes up on wheat sheets. The Globe and Mail, pp. A.5-A.5. Retrieved from
<http://ezproxy.library.ubc.ca/login?url=http://search.proquest.com/docview/382735997?accountid=14656>

UBC Supply Management (2008) Supplier Code of Conduct. Retrieved from
<http://www.supplymanagement.ubc.ca/sites/supplymanagement.ubc.ca/files/uploads/documents/Supplier%20Code%20of%20Conduct.pdf>

(Friesen, J, 2008) (Boychuck, R, 2008) (UBC Supply Management, 2008)