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## THE CARBON FOOTPRINT OF EDUCATION A CASE STUDY ON INDIRECT CO<sub>2</sub> EMISSIONS FROM PAPER CONSUMPTION

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**Abstract:** *LPU Batangas undertook a carbon footprint project to estimate the university's direct and indirect emissions of CO<sub>2</sub> for academic year 2012-2013. This report contains the university's carbon footprint from paper consumption. Five sources of paper consumption were identified. These were the supply office, classrooms, library, student publication office, and the university bookstore. Data were collected from these sources and from official university records. Random samples of various paper products were weighed. A survey was made about the average weight of test questionnaires used during major examinations per student. The total weight of paper used by LPU Batangas for SY 2012 – 2013 was approximately 59.3 metric tons of paper. Using the EPA emission factor for office paper (virgin paper) this is equivalent to 65.23 MT CO<sub>2</sub>. The largest contributor of indirect CO<sub>2</sub> emissions among paper products were books sold to students through the university bookstore.*

**Keywords:** *Carbon Footprint, Paper Consumption, Global Warming, Education, Environment.*

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## **INTRODUCTION**

Carbon footprint pertains to two concepts. It is a method of accounting for total carbon dioxide ( $CO_2$ ) and greenhouse gas emissions or it is the quantity of direct or indirect greenhouse gas emissions a person or an organization produces. As a greenhouse gas,  $CO_2$  traps heat in the earth's atmosphere causing global temperature to rise with the long term effect of initiating climate change.

Paper is a source of indirect  $CO_2$  emissions. Trees are the primary raw materials to manufacture paper and since trees sequester  $CO_2$ , consumption of paper leaves a carbon footprint. Lewis, for example, in his 40 year study of African forests estimated that a hectare of intact African forest trapped 0.6 ton of  $CO_2$  a year (Lewis, 2009). Therefore, each hectare of African forest harvested to meet the demands of paper consumption will potentially leave at least a ton of  $CO_2$  in the atmosphere.

A ton of virgin office paper requires 24 trees (Thompson, 1992). This is based on calculations done by Tom Soder who studied the soft and hardwood mix required to produce a ton of printing and writing paper using kraft chemical pulping process. Worldwide it is estimated that a person consumes 48 kg of paper a year (International Institute for Environment and Development, 1996). This translates to 278.8 million tons of paper consumed annually which is supplied by 6.7 billion trees.

It is urgent for universities to manage paper consumption as paper has been traditionally tied to reading, writing and communication. The issue of managing paper consumption in universities, however, is sensitive for educational and economic reasons. A spacious library housing thousands of collection, for example, is the centrepiece of good universities. Furthermore, schools profit from sales of paper products. In a hypothetical university with a student population of 10,000, if all students were to be required to buy at least six books from the university bookstore as required manuals or textbooks for their courses, the university stands to earn 4.5 million pesos a semester. This is, assuming each book costs 250 pesos, and the university sets a profit margin of 30% of gross sales.

The necessity for universities to look into its carbon footprint requires LPU Batangas (LPU B) to implement a paper consumption audit. Its objectives: a) to trace sources of paper, b)



measure the weight of paper consumed in one school year, and c) develop an accounting model to track paper consumption.

This research publishes the result of LPU B paper consumption for SY 2012 – 2013.

## **METHODOLOGY**

The university's consumption of paper was grouped into five sources: a) library, b) supply office, c) classrooms, d) student publication and e) university bookstore. The quantities of paper products classed under each source were obtained from official university documents and records. But the amount of paper used to produce questionnaires for major examinations, and the quantity and weight of thesis manuscript produced for the school year were estimated through a survey conducted in various colleges of the university. A random sample of paper products from each source was obtained and weighed using electronic weighing scales. The instruments used to obtain weight were Otyx electronic weighing scale and Adventure analytic balance.

This research classified all paper products as virgin paper, and used the emission factor of 1.1 set by the Environmental Protection Agency of US in 2006 (Environmental Protection Agency US, 2006).

### *Library*

Library acquisitions were classed into three groups: a) periodicals, b) newspapers, and c) books. Magazines, journals and local tabloids were placed under periodicals. The three major broadsheets the Philippine Daily Inquirer, Philippine Star, and Manila bulletin were classed under newspapers. Textbooks, references, and the rest were classed under books.

### *Supply Office*

Paper products were classed into six groups: a) office paper, b) log books, c) envelopes, d) letter envelopes, e) grade sheets, f) folders. Classed under papers were leaves of papers whose surface areas are comparable to an 8×11 inches coupon bond.

### *Classrooms*

Students finish at least four major examinations in one semester. A random sample of examination questionnaires were collected for four major examinations and their average weights were obtained. The total number of classes were obtained from each college for SY 2012-2013. Copies of thesis submitted by each college to the library were also tallied and weighed. The total weight of paper used for examinations and thesis for each college is



$$P = c\bar{x}Q + qM$$

where  $c$  is the number of classes opened for two semesters,  $\bar{x}$  is the average class size,  $Q$  is average combined weight of questionnaires for four examinations,  $q$  the number of thesis submitted to the library, and  $M$  the average weight of thesis. This study set  $\bar{x} = 35$  students, a value supplied by the university registrar.

#### *Phoenix Publications*

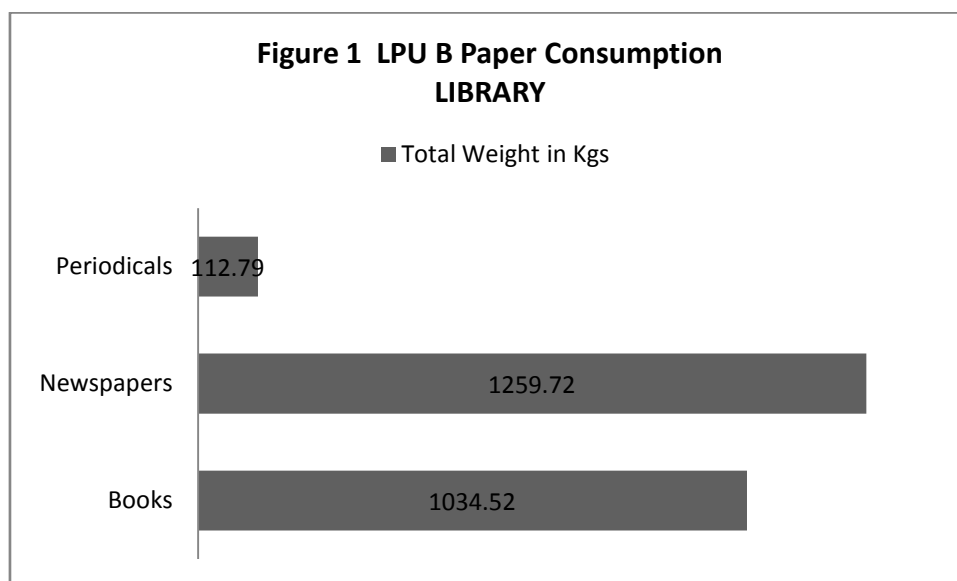
Phoenix is the official student publication arm of LPU Batangas. It publishes five titles: Phoenix Magazine, Folio, Phoenix Tabloid, Phoenix Broadsheet, and Phoenix Newsletter.

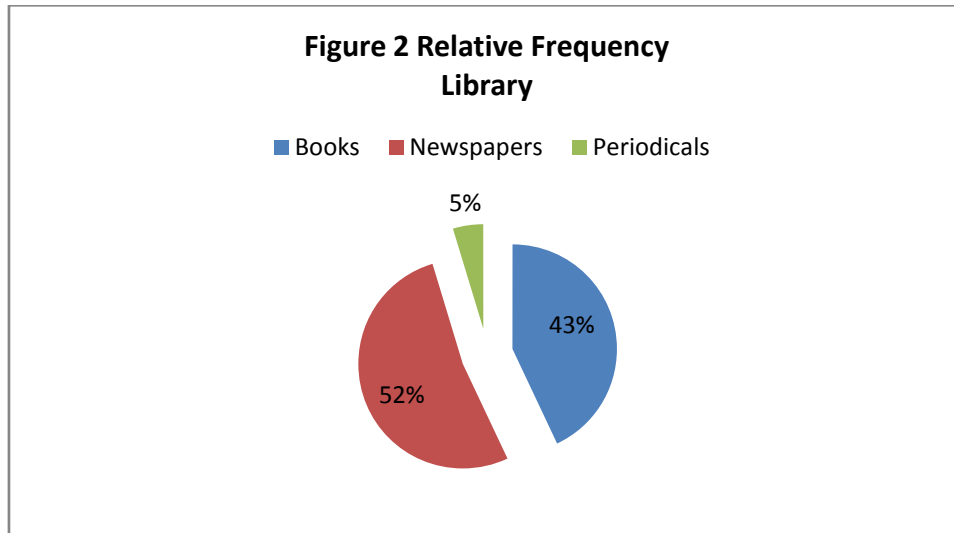
#### *University Bookstore*

Paper products sold in the bookstore were classified into three: a) office paper, b) test booklets and c) books. A test booklet contains six leaves and is approximately 10.47 grams. They are distributed to students for major examinations. All required manuals, work texts, and textbooks are classed under books.

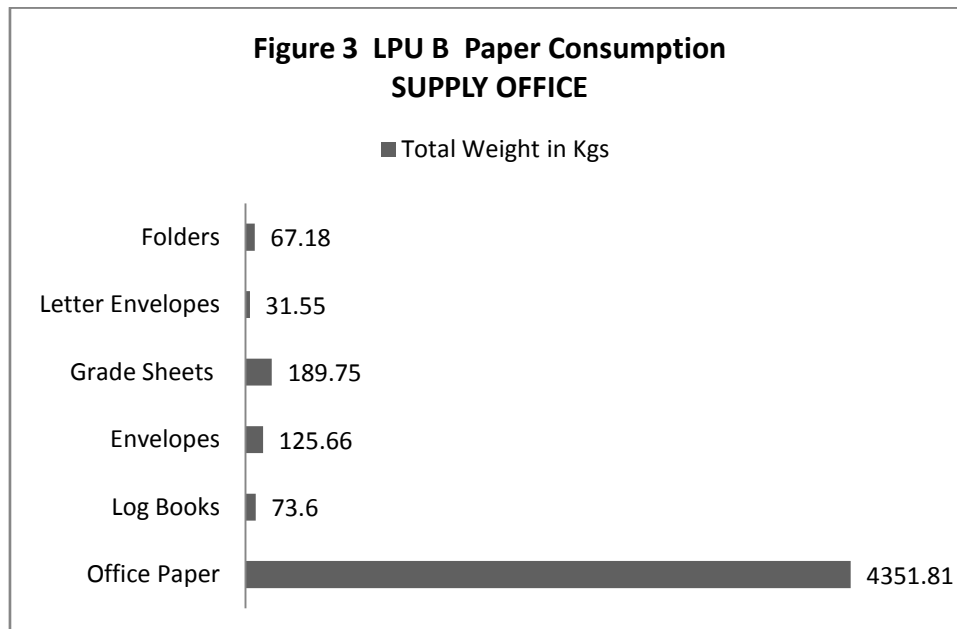
## RESULTS

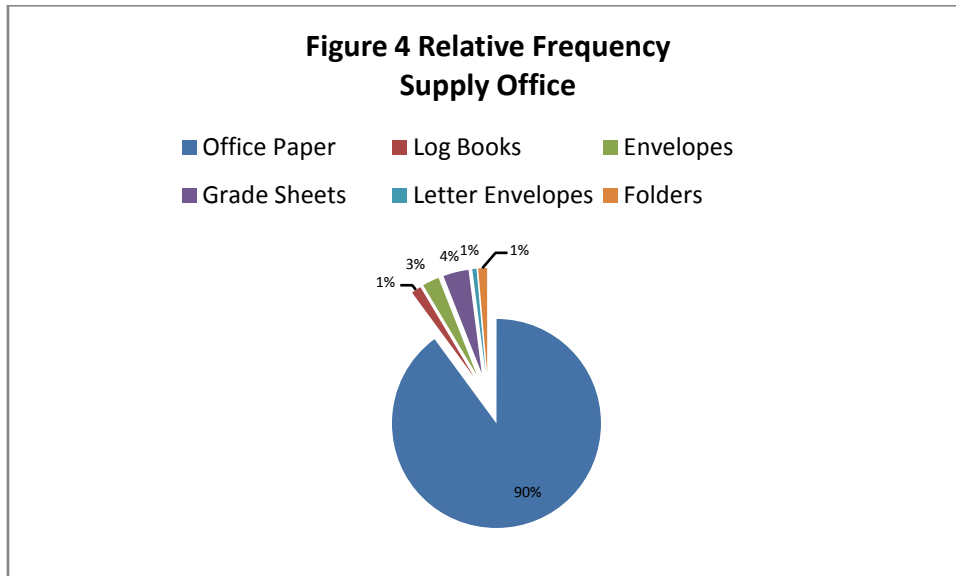
Figures 1 to 10 show the breakdown of paper consumption for each source. Figures 11 and 12 show the relative consumption of each source in relation to total consumption of the university.



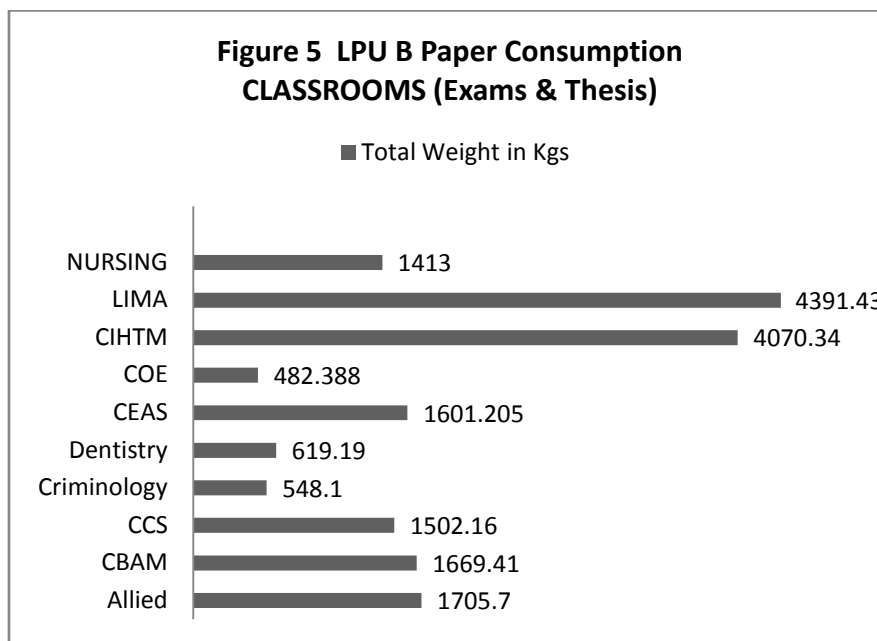


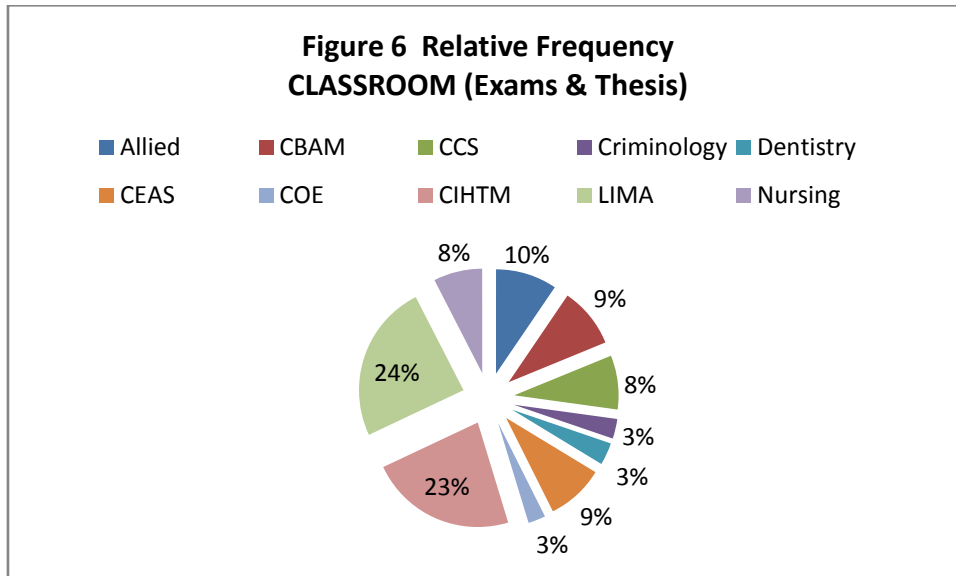
It is a point of interest to note total weight of newspapers accounts for more than half of all paper acquired by the university library. The university subscribes to three national broadsheets these are The Philippine Star, The Philippine Daily Inquirer, and The Manila Bulletin.





This research was undertaken not only to put measure to the amount of paper the university consumed in SY 2012 – 2013. But corollary to this investigation is the necessity to develop an auditing model to track paper consumption. It is a demanding task to weigh all paper products that enter a university. But the results show an audit model that will look into the acquisition of the supply office can simply focus on office paper. Office paper as defined in this model is any paper product whose leaves are comparable to an 8×11 inch-coupon bond. This includes the usual coupon bonds, mimeographing papers, book papers, but also graphing papers, notebooks, and the like.

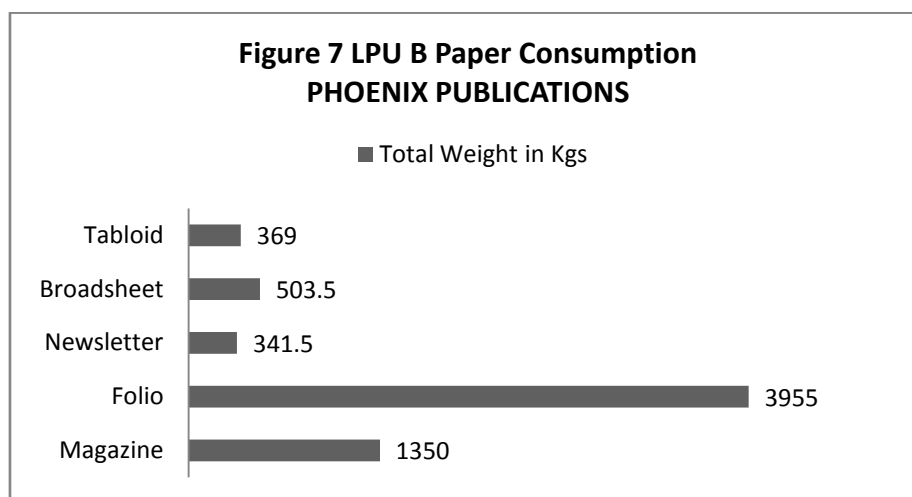


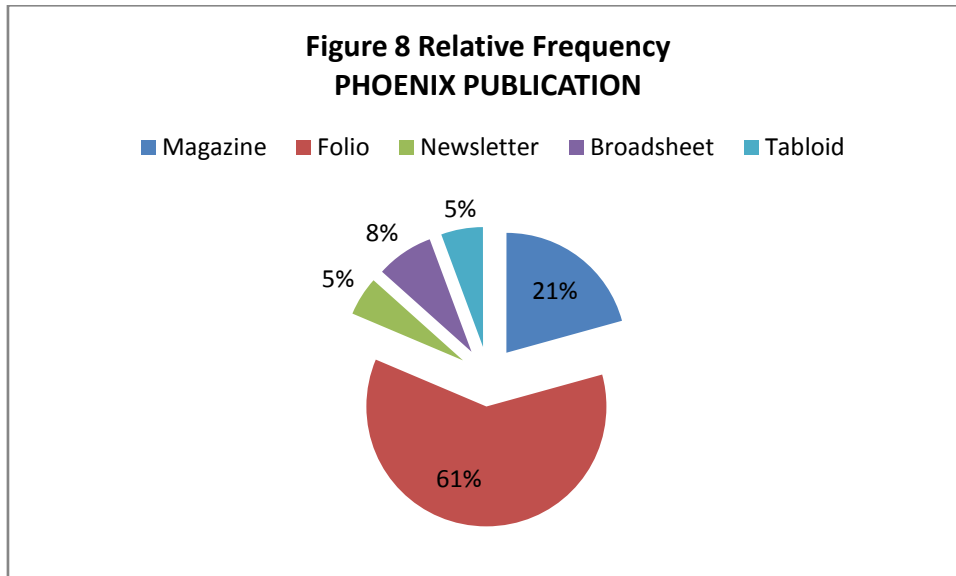


Students take at least four major exams in a semester. Other universities give only two to three. LPU's niche in the education system is on professional education and the policy to drill students on examinations has to do in part with the necessity to prepare students to pass professional board exams.

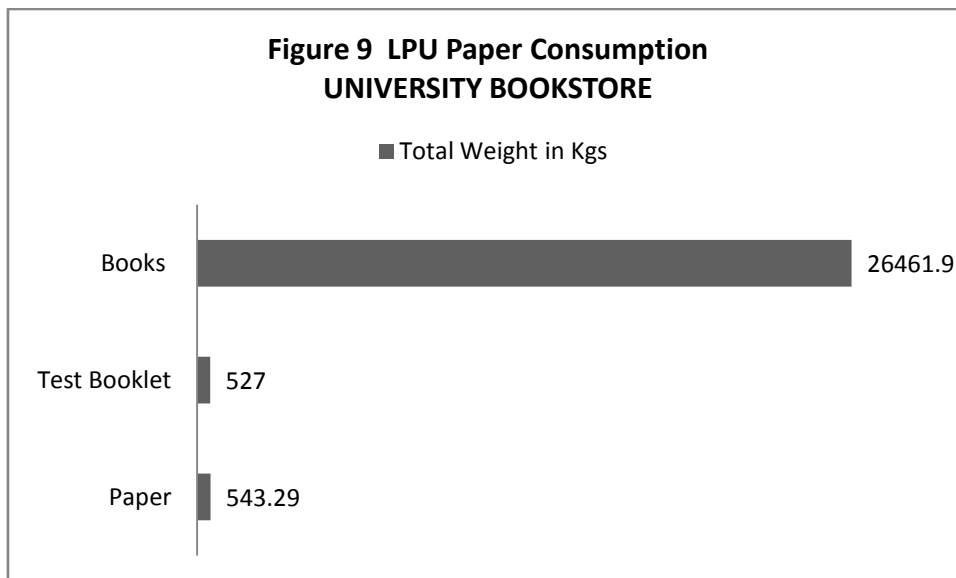
LIMA and CIHTM accounted for the largest consumption of paper for examinations and thesis as these two are the largest colleges of LPU in terms of student enrolment. LIMA, for example, has a separate and spacious campus for itself at Cuta, Batangas City. It is a point of interest to highlight LIMA's consumption of paper for major examinations is just as large as all office papers supplied to various offices and departments for one school year.

For future auditing projects, this research shows production of thesis carries little weight on consumption. For this reason thesis can be dropped from paper audit.

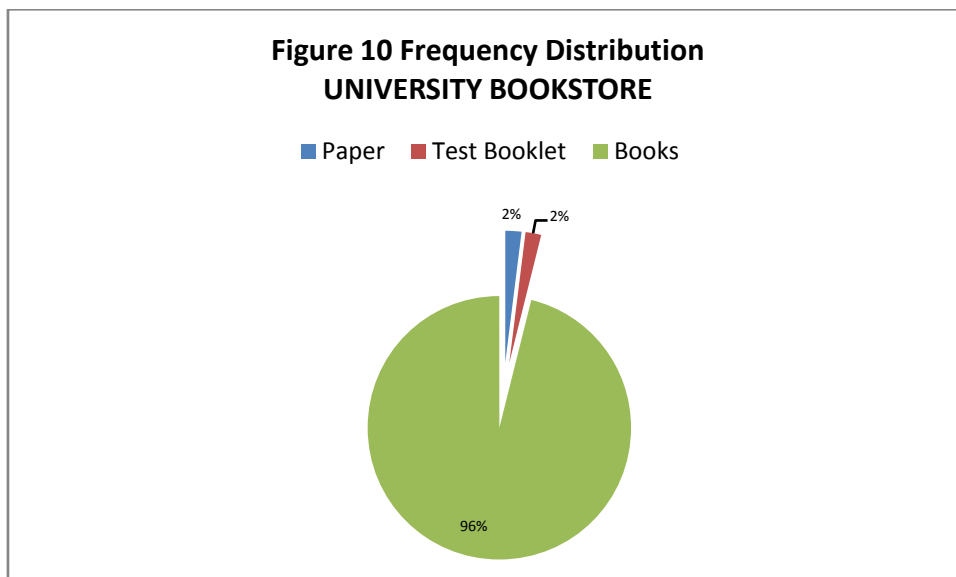




FOLIO is a literary showpiece for students. It publishes short stories, poems, and commentaries. It is published in book form. It must be pointed out the total weight of paper devoted to FOLIO was only a little less than the weight of all office papers acquired by the supply office.

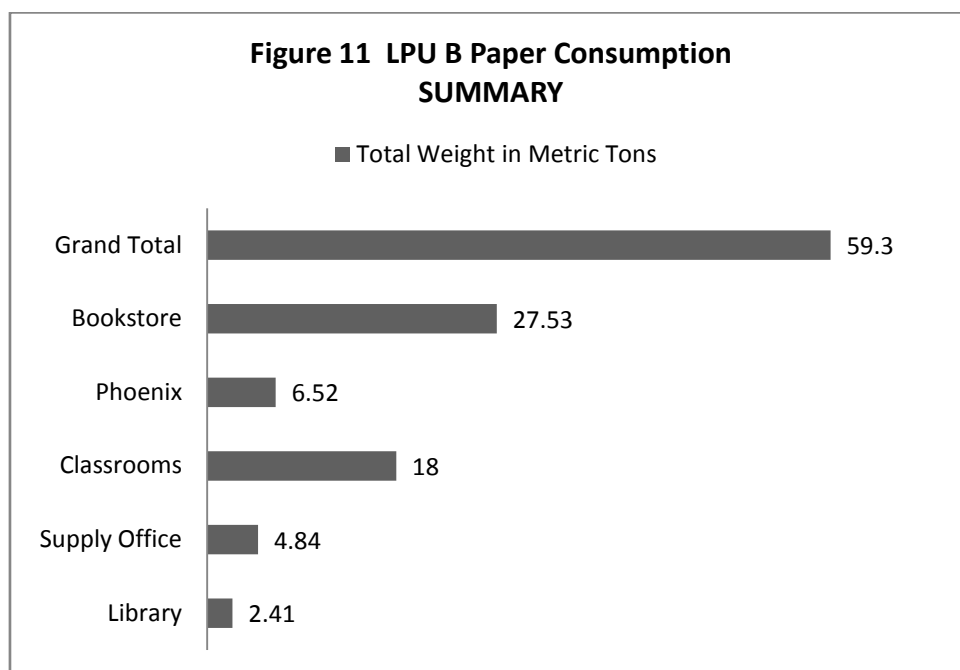


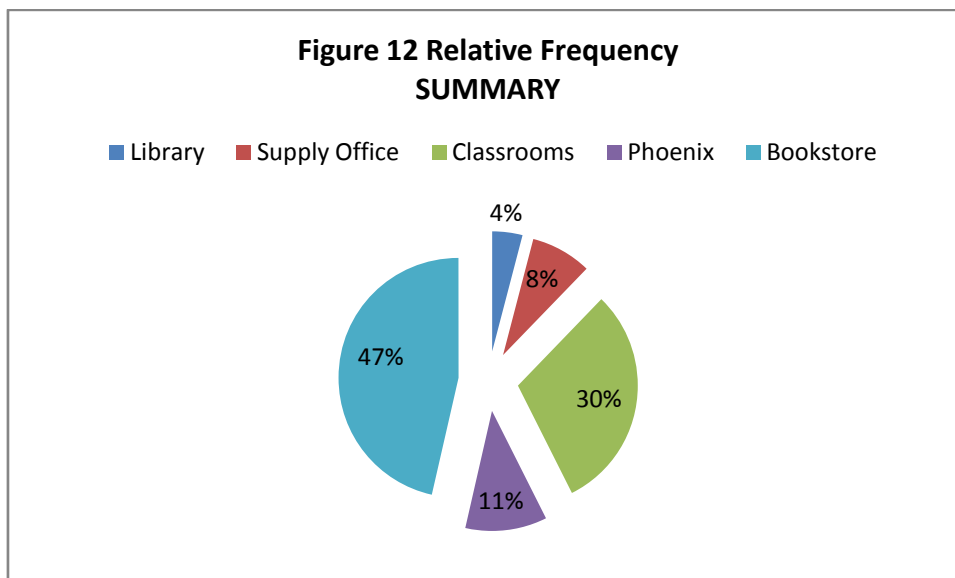




Books sold in the university bookstore accounted for the largest item for paper consumption. The volume of books sold to students was nearly half the total weight of paper consumed by the university in one school year. It is part of university policy to require students to buy manuals and textbooks, and there are many of them for nearly all the courses.

The amount of merchandize that enters and leaves the bookstore can overwhelm a paper auditor. But this research shows as far as paper consumption is concerned an audit model can simply focus on books and drop all other office and school supplies.





LPU B consumed 59.3 metric tons of paper for SY 2013 – 2014. Nearly half of that came from sales of required textbooks and manuals to students. One-third came from major examinations, and around ten percent each from the library and the student publication. One ton of paper is equivalent to roughly 24 trees. Therefore, 59.3 metric tons is equivalent to 1400 trees. If these trees were to be planted at five-meter intervals it will cover 3.55 hectares. The main campus of LPU B is only 2.2 hectares. This means this forest is 1.6 times the land area of LPU B. Furthermore using EPA CO<sub>2</sub> emission factor for virgin paper the equivalent CO<sub>2</sub> emissions of paper consumption for SY 2012 – 2013 is 65.23 MT CO<sub>2</sub>.

**Figure 13 Satellite Map Lyceum of the Philippines University Batangas**



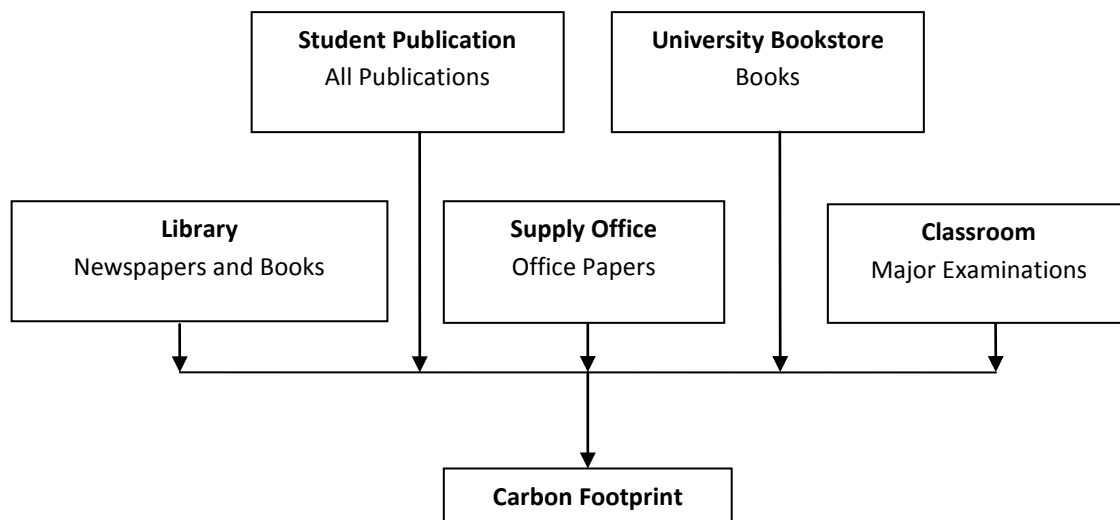
The amount of paper consumed by LPU Batangas for SY 2012-13 is roughly equivalent to 1,400 trees. If planted at five-meter intervals this will cover 3.55 ha which is 1.6 times the land area of the main campus.



This paper chooses to forgo with recommendations because crafting a policy to manage paper consumption and as a consequence reduce carbon footprint carry complex issues. Financial issues for one attend any policy to reduce paper consumption because LPUB receives revenues from sales of books. Feasibility is another issue. What can replace paper? What are the financial and environmental costs of this replacement? This paper will instead propose a simple model to carry out paper audit in universities.

As it turns out paper audit does not require a meticulous examination of all instances of paper consumption. There are papers that stand out in paper consumption. Books sold to students from the university bookstore is one. Office papers acquired by the supply office is another. Thesis, quizzes and reports which are often part of course requirements can be dropped from paper audit. It is major examinations which carry a large carbon footprint. For the library it is newspapers and books, and for student publication whose operations and acquisitions are simpler, an audit can include all publications.

Figure 14 Model for University Paper Audit



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