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How does the University of Northern Iowa's recycling program compare to the recycling programs of its peer institutions?

Anna J. Schrad
University of Northern Iowa

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Running Head: HOW DOES THE UNIVERSITY OF NORTHERN IOWA'S RECYCLING

HOW DOES THE UNIVERSITY OF NORTHERN IOWA'S RECYCLING PROGRAM
COMPARE TO THE RECYCLING PROGRAMS OF ITS PEER INSTITUTIONS?

A Thesis
Submitted
in Partial Fulfillment
of the Requirements for the Designation of
University Honors

Anna J. Schrad
University of Northern Iowa
May 2010

Running Head: HOW DOES THE UNIVERSITY OF NORTHERN IOWA'S RECYCLING

This Study by: Anna J. Schrad

Entitled: How Does the University of Northern Iowa's Recycling Program Compare to its Peer Institutions' Recycling Programs?

has been approved as meeting the thesis or project requirement for the Designation of University Honors

Date

Dr. Catherine Zeman, Honors Thesis/Project Advisor

Date

Jessica Moon, Director, University Honors Program

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Abstract

In recent years, the concept of sustainability has become mainstream and has begun to be incorporated into the decisions that businesses, organizations, and institutions make. With over 12,000 students, the University of Northern Iowa (UNI) has great potential to generate large quantities of recyclables (Kaplan & von Kolnitz, 2004). By expanding its recycling program, UNI can increase its appeal to prospective students while gaining economic benefits in addition to protecting the environment. Waste managers at 8 of UNI's peer institutions (Appendix B) were interviewed to determine how UNI's recycling and waste diversion efforts compared to similar schools for a variety of measurements. Based on a rubric of waste diversion efforts and investments, UNI ranked lowest compared to its eight peer institutions. Waste diversion efforts that UNI already participated in included separating landscape clippings for mulch, providing special pick-up of used items during move-out week, and informing campus members about recycling options through a recycling webpage. All of these efforts were also commonly practiced or available at the peer institutions surveyed. Efforts that exist at other campuses but not at UNI included an organic compost program, the presence of a full-time recycling coordinator, recycling orientation for new students, faculty, and staff, the opportunity to recycle across campus, and event recycling. The percent of solid waste recycled and the percent diverted could not be used for analysis since tracking of recycled, reused, and composted materials varied from school to school. This demonstrates the need for recycling tracking standards and the difficulty in collecting quantitative measurements for recycling and waste diversion efforts.

Keywords: recycling, university, campus, college, University of Northern Iowa, benchmarking, peer institutions

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How Does the University of Northern Iowa's Recycling Program Compare to the Recycling Programs of its Peer Institutions?

Introduction

When the topic of recycling is mentioned to University of Northern Iowa (UNI) students, many complaints, confusions, or suggestions about the program, or lack of a program, arise. "After eating in Maucker Union, I want to recycle my plastic food container but have nowhere to, so I throw it away." "They just stopped recycling [in Campbell Hall]. Something about nobody would collect the bags for the truck to pick up. I didn't know they needed volunteers." These statements point out the lack of information and understanding of the university's recycling efforts along with the challenges faced by UNI students who would like to recycle. Is UNI's recycling program as weak as the above comments seem to indicate?

To be fair, opportunities to recycle on campus exist. Various recycling containers are found throughout campus, many of which have been added in the past three years. Receptacles for discarded printing paper are found in each of the seventeen Student Computer Centers; the variety of materials collected for recycling in Maucker Union has increased; 10 receptacles for plastic bottles are now located outside buildings throughout campus; and one dormitory hall contains a personal recycling bin in each resident's room. So where does the University's recycling program, or lack thereof, stand in comparison to the recycling programs of universities across the nation? Until now, no one knew. This research effort answered these questions by conducting a broad survey of UNI and eight of its peer institutions' recycling programs (Appendix B). From the data, a comparison matrix and suggested changes in UNI's recycling program were provided.

Purpose

The goal of my thesis project was to develop fair and applicable benchmarking standards for UNI's recycling program. Benchmarking standards were developed based on the responses of UNI's peer institutions to a questionnaire also developed for the study. The UNI Administration can use the comparison study to objectively evaluate the effectiveness of its current recycling program efforts and to set realistic goals for excellence in the area of campus recycling services. The final recommendation includes the economic and environmental benefits of recycling along with the potential that a recycling program will make UNI marketable to prospective students.

Reasons for UNI to increase its recycling efforts and percent of diverted solid waste go beyond the current "green" fad and landfill space saved by recycling. Recycling allows the university to save money from decreased disposal fees, reduces the demand on natural resources, lowers pollution and energy costs by decreasing embodied energy costs and off-setting carbon emissions, introduces participants to sustainable thinking, and makes the school appealing to potential students (Hershkowitz, 1998; EPA, 2009a; Princeton Review, 2009).

Research Questions to Be Answered

Pre-evaluation.

1. What schools should UNI be compared to when setting standards for its recycling program?
2. What is a fair and accurate way to evaluate UNI's recycling program and that of its peer institutions?

Developing and implementing recommendations from recycling evaluation.

3. What common challenges are faced by university recycling programs?
4. What are the environmental benefits of recycling?

5. What funds and/or incentives are available in Iowa to support university recycling programs?

Literature Review

Challenges Faced by University Recycling Programs and Their Solutions

Campus recycling programs can be more successful by making waste managers aware of common challenges faced by programs at comparable institutions and by knowing how the problems were mitigated. Common problems include the following: lack of support from custodians or facilities management assistant heads (Lounsbury, 2001); discontinuation of a program once volunteers or interested students graduate; contamination of recycling bins; and a lack of participation from campus members (Cole, 2007; Kaplan & von Kolnitz, 2004). Solutions to the above problems include sign prompts, which inform recyclers about the purpose of each recycling bin (for example, "Glass Only" and "Wait! Can You Recycle That?" with a list of recyclable materials below (Cole, 2007, p. 83)), containers for recycling located next to garbage bins, a consistent and recognizable logo for recycling, and informational recycling resources such as a website and/or phone number to contact the recycling coordinator. A key solution to these problems provided by both Cole (2007) and Kaplan and von Kolnitz (2004) includes hiring a full-time coordinator who can be responsible for implementing the solutions to the problems.

Full-time recycling coordinator.

Hiring a full-time recycling coordinator through the administration increases the longevity, cohesiveness, and success of a recycling program. Chief custodians or other university staff who inherit the responsibility of managing their school's or building's recycling program on top of their previous job requirements often see the added work of recycling as a burden (Kaplan & von Kolnitz, 2004; Lounsbury, 2001). On the other hand, recycling managers who obtain their

role through “status accretion” (hired specifically to operate campus recycling) are enthusiastic about their job and value recycling more than “role accretion” managers (Lounsbury, 2001). Status accretion managers see the broad range of benefits from recycling activities, including both the environmental and the economic. They are more passionate because they see how recycling “contribute[s] to the well-being of life on the planet” (Lounsbury, 2001, Status Creation Versus Role Accretion section, para. 7). Full-time recycling coordinators can guarantee the implementation of professional-looking sign prompts that inform campus members about what to recycle and how to properly recycle.

Education and convenience.

A number of studies have been conducted relating sign prompts and convenience of recycling to the amount of recycling collected. Katzer and Mishima found that prompts informing student recyclers about the number of pounds of paper collected from their college campus mail room the previous day, increased paper recycling 76% above baseline (as cited in Cole, 2007). After the prompt was removed, paper recycling decreased to 43.3% above baseline. A similar study by Austin, Hatfield, Grindle, & Bailey was conducted in 1993 involving location of recycling containers in addition to sign prompts and their effect on recycling in two academic buildings (Cole, 2007). Building A placed its recycling bins by the trash, while Building B placed its recycling bins four meters away from the trash bins. As part of the study, prompts were added above each bin in both building. The study found an increase in recycling in both buildings after the addition of prompts. However, Building A had a greater increase in recycling than Building B due to the convenient location of recycling bins. Baseline recycling for each building was 51% and increased to 60% for Building B and 84% for Building A during the study.

The use of sign prompts and location of recycling bins next to trash containers are prime examples of providing education and making recycling convenient.

Rider Recycling Revolution: A UNI pilot study.

Making recycling convenient and providing education are reoccurring recommendations for making any recycling program successful. The "Recycling on Campus and in the Community" sub-committee of the UNI Energy Conservation Committee is currently conducting a pilot study involving the effects of convenience and education on dormitory recycling called the Rider Recycling Revolution (RRR) (Lorenzen, personal communication and written documents, 2009). The project and study began in the spring of 2009 with the collection and weighing of recycling in Rider and Noehren Halls. In the fall of 2009, each room in Rider Hall was provided with a recycling bin along with an educational session about recycling in their dorm by their Resident Assistant. Noehren Hall did not receive any recycling bins nor did they receive more recycling education than the year before (P. Wilson, personal communication, October 21, 2009).

According to Wilson's data, the average amount of recyclables collected over an eight week period after the recycling bins were distributed in Rider Hall increased by 387% from the eight week average during the 2009 spring semester. Noehren Hall was the control dormitory, and its eight week average of recycling collected decreased between the spring and fall semesters. The preliminary results of the Rider Recycling Revolution illustrate UNI students' desire to recycle, but it also illustrates that they are more willing to do so when it is convenient, and when they are informed enough to know how to recycle properly. The sub-committee has figured out how to make recycling convenient and provide residents with recycling education, but they have not figured out how to pay for the initial costs of the program.

Finances.

One obstacle faced by the sub-committee's effort to support the Rider Recycling Revolution or any campus recycling effort that does not have the administration's support is initial cost. The sub-committee's goal is not to make money but to provide an example of how recycling in the residence halls can be successful. If the RRR is successful, it hopes to expand the recycling program to all the dormitories with the administration's support. The sub-committee does not reap the economic benefits of its recycling efforts. The campus budget for waste management gains the economic benefits of recycling through decreased disposal fees. The Recycling Reuse Technology Transfer Center (RRTTC) at UNI is willing to help absorb the cost of the pilot study because it believes the environmental benefits of recycling outweigh the initial financial cost of implementing a recycling program (C. Zeman, personal communication, October 9, 2009).

There is one concept which considers the environmental and social benefits, in addition to the economic benefits, of an organization's or business' activities when measuring its success. It is called the triple bottom line (TBL), and it was coined by John Elkington, a founder of the business consultancy SustainAbility, in 1994 (Elkington, 2010). It can also be described as a formula that incorporates the 3 P's: people, planet, and profits. The TBL is a measurement of sustainability. The United Nations' World Commission on Environment and Development defined sustainability in 1987 as "[meeting] present needs without compromising the ability of future generations to meet their needs." Now that we have entered the Age of Accountability, practicing sustainability and being able to show evidence of sustainable practices through measures such as the TBL is more important than ever before (Savitz & Weber, 2006, p.xiv). As Costanza et. al (1997) pointed out "The economies of the Earth would grind to a halt without the

services of ecological life support systems..." Therefore, it is crucial that the actions that we take today have the least impact on the natural environment for the sake of future generations.

Funding.

A variety of opportunities exist to help fund recycling programs, ranging from government grants to donations from private businesses. The Iowa Department of Natural Resources (IA DNR) offers the Solid Waste Alternatives Program (SWAP) four times a year. SWAP provides forgivable loans, zero interest loans, and 3% interest loans to projects that reduce solid waste generation and the amount of waste landfilled (IA DNR, 2010). The following list contains example projects that the Iowa DNR website lists for SWAP funding:

1. recycling, collection, processing, or hauling equipment (including installation)
2. planning and implementation of education forums, workshops, etc.
3. salaries directly related to implementation and operation of the project (IA DNR, 2010)

Businesses that provide donations related to recycling include the Coca-Cola Company and Anheuser-Busch. The Coca-Cola Company's Keep America Beautiful Bin Grant Program provides recycling bins for beverage containers to schools, parks, and other public facilities (National Recycling Association, n.d.). Anheuser-Busch's grant has a broader application. The company provides funds to qualifying organizations for any project that is related to protecting or enhancing the environment (Anheuser-Busch, 2007). Awards have been given to projects to promote aluminum can recycling, purchase recycling bins for parks, and to fund a river cleanup (Keep America Beautiful, 2008). The company reviews project proposals on a continuous basis; there is no deadline for submitting proposals. More information about applying for the grant can be found at <http://www.anheuser-busch.com/community/grantGuidelines.html>.

Campus specific program.

The problems and solutions listed above are general to any campus recycling program. Specific decisions such as how to collect recyclables (mixed or separated), which materials to collect from each building, and whether or not to contract with an outside recycling company will vary from university to university based on its size, layout, and trash disposal system (Environmental Protection Agency (EPA),1999). This study provides broad recommendations to UNI for implementing a campus wide recycling program and expanding its diversion efforts. Specific implementation and logistics will require extended research. A further look at the Rider Recycling Revolution's successes and challenges later into its implementation can act as a good starting point by providing guidelines for developing a cohesive recycling program in all nine of its campus dormitories.

Whether or not a campus sorts or comingles its recycling depends on the local recycling broker's operations equipment and will vary from school to school. For the purpose of this study, comingled recycling meant any form of mixed recycling. Comingled recycling can occur at various levels from comingled plastic or comingled paper, which collects various forms of plastic or paper in one bin (i.e. plastics 1-7 together or white paper with colored paper) to comingled recycling which combines all recyclable materials into one container. Based upon the websites of UNI's peer institutions' recycling programs, some schools use comingled recycling because their city has the technology to sort the materials and it is more convenient for campus members than on-site sorting. However, the Cedar Falls Transfer Station does not have the technology to sort the materials. Therefore, it is to the university's benefit to have recycling participants separate their recycling on site. As Kaplan and von Kolnitz pointed out "The better job the team does in preparing non-contaminated clean recyclables for market, the more

recycling markets will work to accommodate maximum revenues” (Kaplan & von Kolnitz, 2004, p. 23).

Benefits

Economic benefits.

Establishing a campus wide recycling program is an investment that returns economic benefits to the campus. The economic benefits include income from selling recyclables and reduced disposal fees (Kaplan & von Kolnitz, 2004; Hershkowitz, 1998). The more waste diverted due to recycling efforts, the greater the savings in disposal fees and profits from selling recyclables (Kaplan & von Kolnitz, 2004; EPA, 1999). An example of the potential avoided costs from a recycling program can be found in Cole’s doctoral dissertation (2007). During move-out week at Antioch University, the campus had to rent an additional seven 20-yard dumpsters which were emptied a total of eleven times, adding \$3,945.45 to the university’s disposal fees for that week. Much of the 38,120 pounds of goods thrown away were reusable (Cole, 2007, p. 136). Large campuses (10,000 students or more) are appealing to recycling brokers since they have great potential to generate large quantities of recyclables (Kaplan & von Kolnitz, 2004).

The market value for recyclables fluctuates and varies throughout the year and from region to region. As Kaplan and von Kolnitz (2004) recommend, the Cedar Falls local recycling broker, City Carton, was contacted to obtain the local market values for recycling. Kaplan and von Klonitz (2004) suggest taking this step to avoid collecting recycled materials that will ultimately become waste. However, lack of recycling revenue from a material should not prevent its collection since the benefits of recycling extend beyond economics; recycling also benefits the environment in many ways.

Environmental benefits.*Natural resources.*

In addition to returning economic benefits to the campus, recycling also returns environmental benefits to the planet by reducing the demand on natural resources and the amount of pollutants and greenhouse gases produced (Hershkowitz, 1998; Trisolini, 2009). The financial savings from recycling do not take into account these environmental benefits and the resulting health and future security benefits from reduced pollutants and greenhouse gases. These are all externalized costs in our current market (Lounsbury, 2001). Externalities as defined by bussinessdictionary.com (2009) are “activities and conditions whose benefits and costs are not reflected in the market price of goods and services.” Producing new goods from recycled materials in place of virgin materials reduces the demand for raw materials such as timber, crude petroleum, and ores which are processed to make products commonly found in campus waste streams such as paper, plastic, glass, and various metals (Hershkowitz, 1998 and Trisolini, 2009).

Greenhouse gases.

According to an extensive study by the Environmental Protection Agency (EPA) on Solid Waste Management and Greenhouse Gases, processing recycled materials takes less energy than processing raw materials (2009). Since the majority of the United States' energy comes from burning fossil fuels, processing recycled materials also reduces the of amount pollutants emitted during the manufacturing process (Hershkowitz, 1998). Greenhouse gases are a pollutant of concern to the EPA because of the increased level of the gases in the atmosphere. In April of 2009, the EPA announced that “greenhouse gases in the atmosphere threaten the public health and welfare of current and future generations” (EPA, 2009b). Recycling is able to lower greenhouse gas emissions in three ways: by reducing emissions during manufacturing, increasing

forest carbon storage, and reducing landfill methane emissions (EPA, 2009a). Recycled materials with the greatest ability to avoid greenhouse gas emissions include aluminum, mixed paper, corrugated cardboard, and magazines, all of which are commonly found on campuses (EPA, 2009a).

Appeal to prospective students.

An additional benefit of recycling for colleges, including UNI, is that it adds to the University's overall sustainability efforts and resulting image, increasing the school's marketability to prospective students. According to the Princeton Review 2009 "College Hopes and Worries Survey" (2009), 66% of 15,722 responses from students (81%) and parents (19%) from across the United States stated that a college's "commitment to environmental issues (from academic offerings to practices concerning energy use, recycling, etc.)" would influence their decision to apply to or attend a school.

Methods

The first step in carrying out the research project was to determine which universities to evaluate to create a fair example of what can be accomplished and expected from UNI's recycling program. Comparing UNI's recycling efforts to San Francisco State University who diverted 76% of its waste in 2006 (Steele, 2009) with a student population over 30,000 (San Francisco State University, 2009) or to Georgia Tech who won the National Recycling Coalition's award for Outstanding College or University Program (National Recycling Coalition, 2008) and whose student population exceeds 19,000 (Georgia Institute of Technology, 2009), would not be a fair comparison. In order to develop fair benchmarking standards a list of 10 peer institutions from the UNI Office of Institutional Research website was used as comparison schools (University of Northern Iowa, 2009).

Developing Questionnaire

A list of questions was created to obtain an accurate and comparable assessment of each campus's recycling efforts and their effectiveness. The questionnaire was based on performance indicators and common questions listed under the waste portion of Sustainability Assessments (Appendix C). Such indicators and assessments were obtained from the Campus Consortium for Environmental Excellence's *Draft List of Environmental Indicators* (n.d), the Campus Sustainability Assessment Project's *Proposed Snapshot CSA Indicators* (2003), and the recommended questions to answer when starting a recycling program provided by the *Recycling and Beyond: A College Campus Primer* (Kaplan & von Kolnitz, 2004).

The College and University Recycling Council's (CURC) Campus Refuse Profile Workbook was also used for the study. The workbook was developed by the CURC's measurements and standards committee. It was provided to each school and intended for the schools to accurately compare and analyze their progress towards waste abatement (Lounsbury, 2001). The Microsoft Excel workbook included a sheet for collecting benchmarking data for recyclables, a sheet for calculating volume to weight conversions, and a sheet containing definitions for each material. The figures for the conversions were obtained from the U.S. Environmental Protection Agency. Conversions for single stream recycling (containers, paper, and cardboard) were added from the RecycleMania Steering Committee's estimates (n.d.). The volume to weight conversion sheet from the CURC's Campus Refuse Profile Workbook was provided to each school through electronic mail along with the questionnaire prior to the phone interview.

The study intended to measure the success of a recycling program based on the percent of solid waste diverted through recycling. However, inconsistencies among the schools concerning

how and to what extent solid waste, recycling, reuse, and composting efforts were tracked prevented a fair comparison between the schools. Therefore, a rubric consisting of recycling efforts and investments that each school could make was designed for fair comparison. Efforts and investments that were taken into account included whether or not the campus had a full-time recycling coordinator paid through the administration, each building had the opportunity to recycle, or a website was available containing information about how and where to recycle on campus. Other measurements of success included whether or not special pick-up was provided during move-out week, and the level of consistency for recycling opportunities across campus.

A beta test of the questionnaire was conducted prior to its implementation. Five staff members involved in recycling management at either the University of Iowa or Iowa State University reviewed the questionnaire and provided feedback to increase its clarity and effectiveness. Some of the suggestions that were implemented included asking “What is the Institution receiving for each collected item?” instead of “What is the market value of each collected item?” This change was made since many campuses receive a *portion* of the market value for their recycled materials from their recycling contractor. Additional questions were added to determine if students were involved in running the recycling program, and to determine the most successful and efficient aspects of each university's recycling program (see questions 26, 29, and 30 of Appendix C).

Phone Interviews

Each school's recycling and/or waste management center was contacted by phone between December 2009 and March 2010. A table listing each of the peer institutions and their recycling contact's name, title, email address, and phone number was created to help in the process. The website is also listed as a further resource (Appendix B). The study participant

listed for each school was first contacted by phone. At this time he/she was introduced to the thesis project and asked if he/she would be able and willing to participate in a phone survey, evaluating his/her school's recycling program for the thesis project (Appendix D). If he/she was willing to participate, a date and time for the phone interview was scheduled and a pdf version of the questionnaire along with the volumes-to-tons conversion Excel sheet was emailed. Emailing the questionnaire prior to the phone interview allowed participants to look over and collect any necessary data ahead of time. Answers to the questionnaire were typed below the corresponding question in the Word document by the researcher during the phone interview.

By conducting telephone interviews, answers to any questions that the interviewees had concerning the questionnaire were provided. The phone interviews also prevented ambiguity in regard to open ended questions. Follow up questions were conducted by email or through telephone calls, depending on each participant's preference.

Derived Data

The questionnaire contained questions concerning the number of full-time equivalent (FTE) students, the number of FTE faculty and staff, and amount of solid waste generated in tons per year that corresponded with the year the number of FTE students, faculty, and staff numbers of the same year to prevent false per capita solid waste generation numbers. Each of the schools was also asked the total cost of disposal per ton for solid waste. This value was then multiplied by the amount of solid waste generated (tons) per year to obtain the annual total solid waste costs at each school.

Further calculations were made if a school was not able to provide data in the requested format or if format variations occurred between the schools' answers. For example, Central Michigan provided solid waste numbers for 263 days. The school's 263 day solid waste number

was prorated for 365 days to obtain its annual solid waste generation. Fresno State was not able to provide its solid waste disposal fee by ton, but the school did provide its total cost for 2008. This value was divided by its total solid waste generation (tons) for the same year to determine its solid waste per ton fee. Finally, some schools provided percentages while others provided dollar amounts in response to the question concerning increased disposal fees over the past five years. If percentages were provided, the percentages were multiplied by the school's total solid waste cost to obtain consistent format for analysis.

Analysis

After each school completed the questionnaire, jmp7 Statistical Discovery Software from SAS Institute was used to enter the data into a database to analyze and compare the data. This was done by first examining the frequency distributions and descriptive statistics derived from the raw data. This information was then evaluated to determine if a derivative matrix, which provides a rank analysis of the institutions relative recycling participation and program development, could be used. The derivative matrix included a number of measures of success including, but not limited to, the overall percent of waste diverted through campus recycling.

Results and Discussion

Snapshot of Participants

Eight of UNI's 10 peer institutions (80% response, Appendix B) participated in the study in addition to UNI, totaling nine participants. The size of the campuses ranged from 11,500 to 36,000 full-time equivalent (FTE) students with a mean of 18,986 and standard deviation of 7,227. The number of FTE Faculty and Staff ranged from 1,370-6,000 with a mean of 2,989 and standard deviation of 1,330. Six of the nine universities provided solid waste and recycling data

for their entire campus (Table 1 & 2). Three of the universities' annual solid waste generation data only represented a portion of their campus (noted by asterisks).

School	FTE Students	FTE Faculty & Staff	S.W. Generation (tons/yr.)
Fresno State	19,381	2,200	4,196
Central Michigan	20,246	2,600	2,125^
Illinois State University	18,868	3,281	2,466
Northern Arizona University	16,000	3,400	1,811*
Ohio University	21,000	3,500	4,500
University of Minnesota Duluth	11,500	1,370	700*
University of North Carolina Greensboro	15,779	2,546	1,479
University of North Texas	36,000	6,000	411*
University of Northern Iowa	12,105	2,000	1,543

FTE: Full-time equivalent

* Missing measurements from portions of campus. See 2nd paragraph below for details.

^ Prorated based on 263 days worth of solid waste generation beginning in September 2008

Diversion Efforts

All of the interviewed schools had a recycling program on campus. Recycling of materials such as paper, cardboard, plastic, and glass was one of many efforts that a campus could take to prevent waste from entering the landfill. Waste diversion includes any effort that prevents waste from entering the landfill. As a means to measure the success of each school's recycling program, the percent of materials removed from the waste stream for recycling was obtained from each school (Table 2). The percent recycled included the amount of waste that was collected as part of the campus recycling program (i.e. paper, cardboard, plastic, tin, glass, etc.), while the total percent diverted reflected the campus's entire efforts to reduce the amount of

waste being landfilled. Diversion efforts among the schools included reuse of materials, food compost, and grounds compost (i.e. grass clippings, leaves, branches, and dead trees).

Tracking of recycling and diversion efforts varied between schools, making comparisons between schools difficult. Northern Arizona University and the University of Minnesota Duluth's solid waste and recycling numbers did not include their dining centers. The University of North Texas' data did not include the Student Union, residence halls, or all of its dumpsters, resulting in artificially lower solid waste generation totals and a higher percent of solid waste recycled and percent diverted than the other schools.

School	S.W. Generation (tons/capita/yr.)	% Recycled	Total % Diverted
Fresno State	0.19	20	61
Central Michigan	0.09	24.18 [^]	24.18
Illinois State University	0.11	26	41
Northern Arizona University	0.09*	41* [^]	41*
Ohio University	0.18	27.5	30
University of Minnesota Duluth	0.05*	53* [^]	53*
University of North Carolina Greensboro	0.08	35 [^]	35
University of North Texas	0.01*	49.9*	not available
University of Northern Iowa	0.11	20	---

* Missing measurements from portions of campus. See paragraph above for details.

[^] Includes reuse, grounds composting, and/or food compost. See paragraph below for details.

--- Not available. The university does not track the yard waste that is separated.

Bolded formatting was applied to the lowest per capita solid waste generation and the highest percent recycled and the highest percent diverted values for schools which had data for the entire campus and that did not contain added materials.

The schools did not track their recycled materials and other waste diversion efforts in precisely the same manner. For instance, Central Michigan and the University of North Carolina Greensboro's percent recycled calculations included reuse and grounds composting; Northern Arizona's percent recycled calculations included its grounds composting. While the University

of Minnesota Duluth's percent recycled calculations did not include its residence halls, it did include the amount of food compost, cooking fats, and grounds compost that was diverted from the landfill.

Operations

Full-time recycling coordinator.

Four schools, not including UNI, have a full-time recycling coordinator. An additional school, Fresno State, had a full-time recycling coordinator prior to the study, but due to a resignation and hiring freeze, the position was vacant at the time of the study and did not count towards the number of schools with a full-time recycling coordinator. Two of the schools with a full-time recycling coordinator deviated from the majority by placing their recycling manager under a separate campus entity other than Facilities or Campus Management. These non-traditional organizational placements of the recycling coordinators included Administrative Services (Fresno State) and the Office of Waste Reduction and Recycling (the University of North Carolina at Greensboro). See page 30, heading Bivariate Analysis for the relationship between the percent of solid waste recycled at a school and the presence of a full-time recycling coordinator.

Involvement from campus members.

Table 3 <i>Campus Involvement in Operations, Paid Positions</i> (n = 9)			
	Involved	Not Involved	UNI's Response
Custodians	2 I, 1 E, 5 B	1	Interior
Students	7	2	Not Involved

I = interior collection, E = exterior collection, B = both interior & exterior collection

Involvement from custodians and student employees in a recycling program can make the program more efficient and successful. Recycling can be collected in conjunction with trash by

custodians who would otherwise be responsible for the materials if they were thrown away (Kaplan & von Kolnitz, 2004). If custodians feel burdened by the responsibility, student employees can be hired. Student employees are a low-cost resource for recycling collection (Kaplan & von Kolnitz, 2004). Custodians at eight of the nine universities were involved in the collection process. Depending on a school's contract with their recycling broker, some custodians were responsible for gathering recycling from various locations within buildings while others also took part in collecting the recycling from outside each building. Student employees are a common and low-cost resource for recycling collection and other related duties. All of the schools, except UNI and Northern Arizona University, hired students to help run the recycling program. Student roles ranged from outreach to collection. In some cases, the students collected the recycling from within each building and placed the recycling in large containers for pick-up. At other times, student employees were in charge of collecting specific materials such as cardboard or plastics. Two schools assigned their student employees to pick-up specialized recycling (i.e. electronics), and one of those schools hired seven part time students to help with move-out week, theatre tear downs, homecoming and sporting events in addition to specialized recycling pick-up.

Extent of the recycling program.

Table 4 <i>Materials Collected for Recycling</i> (n = 9)		
Material	# of Schools with yes response	UNI's Response
Office Paper	9	Yes
Newspaper	9	Yes
Magazines	9	Yes
Cardboard	9	Yes
Aluminum	9	Yes
Tin	8	Yes
Batteries	8	Yes
Scrap Metal	8	Yes
Plastics	8 (#1 - #7) 1 (#1 & #2)	Yes (#1 - #7)
Glass	7	Yes
Fluorescent Lights	7	Yes
Ink Cartridges	7	Yes
Books	6	No
Steel	6, 1 missing	No
Concrete	4	No

Note. The materials that made of the largest percent of the recycling by weight at the participating schools were paper, cardboard, plastics, and glass in rank order.

While UNI does offer recycling for 12 of the 15 materials listed, including all of the most commonly recycled materials among its peer institutions, most of the recycling occurs in limited locations (Table 4). UNI has only one dependable location to recycle glass, tin, aluminum, plastics, newspaper, and magazines besides the residence halls. It is a drop off site which is located off campus. In addition, recycling among the nine residence halls varies from hall to hall and year to year. Limited recycling availability and frequent changes in the recycling program

among dormitories reduces the convenience of the program and creates confusion, ultimately reducing participation in recycling. Five of the nine schools had a consolidated recycling program where each of the buildings on campus had the option to recycle the same materials.

Special recycling efforts.

Efforts to divert waste at each school go beyond collecting recyclables from campus buildings. All of the nine schools collected landscape clippings and mulched the landscape clippings to some extent. Each of the schools also had an electronic waste recycling program, had a refuse program for used materials to be traded or sold, and tried to reduce their hazardous waste through recycling measures. Other recycling measures that varied from school to school included separating organic waste from eating facilities, providing special pick-up of used items during move-out week, and offering recycling at campus events (Table 5).

Table 5 <i>Special Recycling Efforts</i> (n = 9)		
School	# of Schools with yes response	UNI's Response
Compost organic waste from dining centers (Pre-consumer, Post-consumer or Both (B))	4 (3 Pre, 1 B)	No
Move-out week (Fall (F), Spring (S), or Both (B))	8 (4 B, 4 S)	Yes (S)
Event Recycling	8	No

Organic waste.

UNI was one of five schools that did not have a system established for separating organic waste from general waste at campus dining centers and/or eating facilities. Three of the four schools which did separate their organic waste only composted *pre-consumer* organic waste. Pre-consumer organic waste is food scraps that are created during the food preparation process

before the food is made available to dining center users. Post-consumer organic waste includes the leftover food that has been touched by consumers. One school, Illinois State University, collected and composted both its pre and post-consumer organic waste from two of its three dining centers. In one year, the university was able to divert 52 tons of organic waste, saving \$2,652 in disposal fees (\$51/ton). The University of Minnesota Duluth was able to collect 61.8 tons of pre-consumer organic waste in one year, totaling \$8,837.40 in avoided costs (\$143/ton).

Move-out week.

UNI kept up to par with its peer institutions by providing special pick-up of used items during move-out week. Only one of the schools did not offer this service. Four of the schools, including UNI, collaborated with outside organizations such as Goodwill, the Salvation Army, Big Brothers and Big Sisters, and other second-hand stores in their area to collect used furnishings and clothing. The University of North Carolina Greensboro used the program as an opportunity to make money by selling the abandoned items directly to the campus community. Ohio University and the University of Minnesota Duluth not only collected used items from students living on campus, but also from students living off campus. Students at the University of Minnesota call to schedule a pick-up time and covers are provided to protect donated furniture from the elements until it is picked up. Central Michigan's collection is limited to paper and plastic; however, the recycling containers are placed beside solid waste dumpsters at the end of both the fall and spring semesters.

Event recycling.

One recycling effort in which UNI significantly lagged behind its peer institutions was event recycling. All of the peer institutions that participated in the questionnaire offered recycling at their campus events. The extent of the recycling offered by each school at campus

events ranged from recycling plastic bottles and vendor cardboard at football games to collecting an assortment of materials such as plastics, aluminum, glass, steel, paper, and cardboard at events that take place in the school's arena or dome (i.e. Special Olympics). A majority of the schools fell into the latter description. Northern Arizona also provided designated recycling containers *outside* during homecoming and parents' weekend. Ohio University prided itself in its aggressive approach to event recycling. Their efforts included breaking down and recycling homecoming floats; collecting beverage containers, pizza boxes, and event programs; requiring their concession vendors to recycle cardboard packaging; and composting at tailgating events. The school has been able to recover 50-80% of solid waste from basketball and football games.

Education and convenience.

Event recycling and move-out week are examples of steps that some campuses have taken to make recycling convenient for potential recyclers. Convenience is highly correlated to increased recycling as the Rider Recycling Revolution pilot study at UNI has demonstrated. Informing students, faculty, and staff about what, where, and how to recycle also leads to increased participation and waste diversion (Cole, 2007). The Director of Operations at Central Michigan could not emphasize enough the importance of outreach. Websites dedicated to the school's recycling program and orientations for new students, faculty, and staff about the campus' recycling program are two ways to keep campus members informed.

Websites.

All nine of the study participants had a website or page which provided information about what materials the campus recycled, where recycling drop-off sites were located, and whom to contact for questions. Beyond those three pieces of information, the sites varied greatly in the

extent of their content (i.e. recycling statistics, frequently asked questions, pictures of recycling bins, etc.). Each school's website is listed in Appendix B.

Recycling Orientation.

Concerning orientation, four of the nine schools had employees who oriented new students and/or faculty & staff to the recycling options available on campus. They included Central Michigan, Ohio University, the University of Minnesota Duluth, and the University of North Carolina at Greensboro. Ohio University used a similar approach as the Rider Recycling Revolution by having the residence life staff inform students about recycling in the dorms during orientation. Orientation for new staff was not provided at Ohio University. The University of Minnesota Duluth provided handouts about recycling on campus in the orientation packets for faculty and students. The other two schools did not elaborate on their orientation process.

Relation to success and efficiency of a recycling program.

In response to the questions *what are the most **successful** methods of your recycling collection program?* and *what is the most **efficient** aspect of your recycling collection?* many of the schools provided answers that were related to education and convenience. Responses to the most successful methods of a program included outreach activities such as orientation (3), recycling receptacles located at each desk/work station (2), consistent containers across campus with visual and textual guides (2), easily identifiable recycling bins (i.e. a 5 foot soda bottle for plastic recycling, a green outdoor recycling bin for mixed recycling) (2), recycling bins located both inside and outside at public events (1), and recycling greenwaste (1).

Few responses to the most efficient aspect of a school's recycling program related to education and convenience. They included collecting recycling at the same time as trash (3), single sort/comingled recycling bins (2), participation from the custodians (1), cardboard

dumping containers outside buildings with a large cardboard turn out (1), having student recycling employees work at campus events (1), recycling greenwaste (1), and the plastic recycling program because the only work involved is changing out the bags (1).

Finances

	S.W. Cost/ton	S.W. Cost/yr.^	Increased S.W. Fees/ton (Yes/No)	Increased S.W. Fees over 5 yrs.
Fresno State	\$26.71	\$112,085.84	No	\$0.00
Central Michigan	\$97.10	\$206,337.50	No	\$0.00
Illinois State University	\$51.00	\$125,766.00	Yes	\$15,720.75
Northern Arizona University	\$49.50	\$89,644.50*	No	\$0.00
Ohio University	\$64.40	\$289,800.00	Yes	\$35,000.00
University of Minnesota Duluth	\$143.00	\$100,072.83*	Yes	\$15,011.00
University of North Carolina Greensboro	\$46.00	\$68,034.00	Yes	\$221,000.00
University of North Texas	\$79.72	\$32,725.06*	Yes	---
University of Northern Iowa	\$40.66	\$62,034.00	No	\$0.00

^ derived calculation. Obtained by multiplying annual solid waste generation (tons) by solid waste disposal fee/ton.

* Missing annual solid waste generation from portions of campus, resulting in lower annual costs.

--- Could not provide an amount or percent but has observed increase in disposal fee over the past 5 years.

Table 7 <i>Savings from Recycling and Program Funds</i> (n = 9)				
	Rebate (Yes/No)	Offset Costs	Funding	Grants (Yes/No), Name
Fresno State	Yes, on disposal fees	\$26,315.43	Centrally	No
Central Michigan	No, but recycling fee is \$18.34 less than solid waste fee	\$38,972.50	Energy and Utility Money	No
Illinois State University	Yes, recycling revenue	\$12,576.60	General Revenue line item under Facilities	Yes, DCEO Illinois Recycle Grant
Northern Arizona University	Yes, exchange tipping fees for recycling revenue	\$0.00	State Account	Yes, AZ Dept. of Environmental Quality
Ohio University	Yes, combination of revenue and reduced disposal fees	\$382,500.00	50-50 between academic and auxiliary side of campus	Yes, Coca-Cola grant and State grant
University of Minnesota Duluth	No, the pick-up fees outweigh the commodity value	\$0.00	Centrally	No
University of North Carolina Greensboro	Yes, recycling revenue	\$243,000.00	State Operating Funds	No
University of North Texas	Yes, recycling revenue	\$88,500.00	State Funds	Yes, Anheuser-Busch bins for plastic bottles
University of Northern Iowa	Yes, recycling revenue	\$29,841.00	Department of Residence and Facility Services	No

Illinois State University's recycling program offsets about 10% of the cost for its campus waste. According to the Recycling Coordinator, the recycling program does not offset itself due to operating costs and low market values for recyclables. However, the university's investment in a recycling coordinator and a consolidated recycling program across campus reflects the school's values and sustainability efforts. Illinois State University does save money by collecting and mulching approximately 200 tons of wood material each year, avoiding landfill and

mulching fees of over \$10,000 and \$29,000 respectfully. Another example of the environmentally conscious is Northern Arizona. The school does not see any offset costs from the recycling program, yet it continues to offer a recycling program which allows the school to avoid paying a tipping fee in exchange for the recycling revenue.

Central Michigan takes active steps to make its recycling program successful and cost effective. The school makes the most of its recycling program by optimizing the pick-up schedule. Recycling staff closely monitored each of the outdoor recycling containers that are picked up by an outside contractor to determine the pick-up schedule. They only want recycling containers collected when they are full to make the most of their recycling pick-up fee. Since the solid waste disposal fee is a fixed price, the school would not see an increase in solid waste costs by dumping all of their recycling into it. However, since the recycling fee is \$78.76/ton, and the solid waste fee is \$97.10/ton at the current solid waste generation rate, the university saves \$18.34/ton by recycling.

Funding

Grants.

In addition to the universities supporting their recycling programs through recycling revenue, avoided solid waste disposal fees, and/or reduced tipping fees for recycling, four of the nine schools received grants to help fund portions of their recycling program. The grants came from the Illinois Department of Commerce & Economic Activity, the Arizona Department of Environmental Quality for outreach and education, Coca-Cola for recycling bins, the state of Ohio to start a composting facility (\$350,000), and Anheuser-Busch to purchase large plastic bottle recycling containers.

Cedar Falls recycling market.

Since the market value for recyclables varies from region to region and month to month, average market values over the past five years were obtained from City Carton, a local recycling broker in Cedar Falls. City Carton's market values are determined by the Official Board Market out of Chicago which changes every month. Bill McKinley, assistant director of campus services and manager of refuse and recycling at UNI, was contacted to determine what percent of the market value UNI receives for each material (Table 8). These values were then combined with the total amount of recycling collected in one semester from Rider Hall (after the implementation of the Rider Recycling Revolution) to estimate the amount of revenue that could be generated if the Rider Recycling Revolution was expanded to all nine dormitories on the UNI campus (Table 9). Based on the current (March 2010) revenue that UNI receives from City Carton and the recycling rate in Rider Hall, UNI would accumulate approximately \$202 per year from recycling revenue (Table 9). While the income from recycling is minimal compared to the university's annual solid waste costs, it "is the only solid waste management strategy that offers the potential to generate revenue" (Hershkowitz, 1998).

Material	5 year average	Annual Variation	UNI Revenue[^]
Mixed Paper (cardboard, office, newspaper)	\$45/ton		\$0
Newspaper	\$60/ton		\$20/ton
Commingled Plastic	\$150/ton*		\$0
Tin	\$175/ton*		\$0
Cardboard (OCC)	\$80/ton	\$20/ton-\$165/ton	\$15/ton
Glass	\$30-\$35/ton (a money loser)		\$0
SOP (sorted office paper)	\$105/ton		\$50/ton
SWL(sorted white ledger), purely white paper only)	\$170/ton		

Based on Official Board Market (OBM) out of Chicago, changes every month

* Not based on OBM. Estimates from Chet.

[^] UNI Revenue obtained from Bill McKinley on March 24, 2010

Material	Total (lbs)/ semester	Total (tons)/ semester	Potential for 9 Residence Halls/yr. (tons)	UNI Potential Revenue/yr.	Avoided Cost	Total
Cardboard	962	0.481	8.66	\$130	\$352	\$482
Paper	160	0.080	1.44	\$72	\$59	\$131
Plastic	544	0.272	4.90	\$0	\$199	\$199
Tin	5	0.0025	0.045	\$0	\$2	\$2
Total				\$202	\$612	\$814

Rider Resident Population = 400

Average Residence Hall Population = 464

Avoided Cost = \$40.66/ton for landfill disposal fee

At the time of the study, UNI was not receiving revenue for the recycled materials from the Rider Recycling Revolution since the materials were being taken to the recycling substation located off campus and operated by City Carton. However, money was saved by avoiding the disposal fee associated with dumping solid waste at the county landfill (avoided costs).

According to Bill McKinley, cardboard collected from Rider, Noehren, Hagemann, and Shull

could be merged at the Redeker Center where the cardboard is collected for revenue. The same could be done for the towers (Bender and Dancer) but at the Towers Dining Center instead of the Redeker Center. It could not be easily done for Campbell, Lawther, Bartlett, or ROTH, the university's apartment complex. Further discussion with City Carton would have to occur to determine if a contract/program/process could be set up which would allow revenue to be generated from the recycling collected from the residence halls. It is important to keep in mind the concept of the Triple Bottom Line when looking at the estimated revenue of any recycling program.

Bivariate Analysis

Bivariate analysis ($n=6$) was performed for the six schools with campus wide data (see Table 1) to look for correlations between percent of solid waste recycled or the extra percent diverted and various variables such as offset costs, landfill restrictions, solid waste disposal fees, the presence or absence of a full-time recycling coordinator, and whether or not recycling locations were offered across campus or in limited locations. Northern Arizona, the University of Minnesota Duluth, and the University of North Texas were eliminated from the bivariate analysis since their data did not represent their entire campus's waste. Some general trends were observed, but only one analysis showed a statistically significant difference between the variable and the percent of solid waste recycled. Schools that had a full-time recycling coordinator paid through the administration had statistically significant higher percentages of recycling (mean percent recycled = 29.50%) than schools that did not have a full-time recycling coordinator (mean percent recycled = 21.29%). A lack of statistically significant results from the bivariate analysis was caused by a combination of a small sample size and inconsistencies between waste

management data collection (i.e. tracking the amount of recycling collected separately from the amount of the amount of landscape clippings collected, if at all).

Comparison Rubric

The success of a school's recycling was initially going to be determined by the percent of solid waste recycled and/or the percent of solid waste diverted. However, variations among the schools concerning how and what waste management data they track (see Table 2) made this measure incomparable. Therefore, for fair comparison, it made sense to design a rubric consisting of recycling efforts and investments that each school could make but that not all of the schools incorporated (see Table 10). All of the schools had a recycling website, separated landscape clippings from solid waste, and offered a refuse program for used materials, so those items were not incorporated into the rubric. Below is the rubric that was used to evaluate each school's recycling program.

	Fresno	C. MI	IL	N.AZ	OH	Duluth	N.C.	N.TX	UNI
FT Recycling Coordinator	1	0	2	0	2	0	2	2	0
Campus Wide	0	2	2	2	2	0	2	0	0
Outreach/Education	0	2	0	2	1	1	2	0	0
Student Involvement (paid)	1	2	2	0	2	2	2	2	1*
Event Recycling	2	1	2	2	2	1	2	1	0
Move-out Week	2	1	0	2	2	2	2	2	2
Organic Compost	1	0	2	0**	1	1	0**	0	0
Total	7	8	10	8	12	7	12	7	3

FT = full-time

* UNI's recycling representative answered no to question 26 of the questionnaire (Appendix C); however, 2 students have been hired by the RRTTC to collect recycling for the RRR (p.5)

** collects used oil from dining centers to make biodiesel

0: the opportunity, event, or position was not available at the school.

1: a variation or reduced version of the opportunity, event, or position is available at the school.

2: the opportunity, event, or position exists on campus.

Description of each category and its score.**1. FT Recycling Coordinator**

This category represents whether or not the school had a full-time recycling coordinator hired through the administration. The Fresno State received a 1 for this category because the position was established and filled; however the employee resigned and a hiring freeze prevented a replacement from taking over.

2. Campus Wide

The score for this category was based on the school's response to the following question:

Does each building on campus have the option to recycle the same materials? (For example if paper, plastic, cardboard, and glass are recycled in the residence halls, do the academic buildings recycle the same materials or only paper and cardboard?)

If the school answered yes, it was given a 2; if the school answered no, it was given a 0.

3. Outreach/Education

This category did not include whether or not a school had a website about its recycling program since all of the schools did have a recycling website, or a webpage at the least.

A school received a 1 if it answered yes to the following question:

Does your recycling program have employees who orient new students or faculty and staff to the recycling options available on campus?

A 2 was given to Central Michigan because it advertised its recycling program through announcements at sporting events. Northern Arizona received a 2 because it provided tours of its Materials Recovery Facility (MRF) to students. The University of North Carolina at Greensboro also offers field trips to its landfill and recycling facility in addition to presentations about the schools recycling program.

4. **Student Involvement (paid)**

Student involvement from volunteers and student groups was not assessed in the questionnaire. Schools with a score of 2 had more than one student employee involved in running the recycling program. Fresno received a 1 because it only had one student recycling employee. A 1 was given to UNI because its student employees were not permanent positions paid through facilities. Two students were hired to collect recycling for the Rider Recycling Revolution pilot project. If a school did not hire any student recycling employees it received a 0.

5. **Event Recycling**

Schools that did not offer recycling at campus events received a 0. If the school offered limited recycling at campus events (i.e. only beverage containers or strictly plastics bottles and vendor cardboard), then it received a 1. If the school offered recycling of many materials and/or at homecoming and parents' weekend in addition to events inside the school's athletic center, the school received a 2.

6. **Move-out Week**

Move out week symbolizes the presence or absence of a special pick-up program for used items during move-out week. All of the schools that had a move-out week program received a 2 except Central Michigan because its move-out week collection only included recycling materials such as paper and plastic, not used items such as furniture. However, an extra effort to collect these recyclables was made by placing rolling recycling containers next to dumpsters.

7. **Organic Compost**

Schools that composted their organic food scraps (i.e. carrot peels) from food/meal preparation (pre-consumer organic waste) received a 1 while schools that also composted organic waste from eating facilities after the food had been offered to the consumer (post-consumer organic waste) received a 2.

Used cooking oil & biodiesel.

Northern Arizona did not have an organic compost program, but it did take steps to reduce the amount of waste landfilled from its dining centers by turning its used cooking oil into biodiesel to power the school's shuttle buses. North Carolina at Greensboro also recycles its used cooking oil by taking it to Piedmont Biofuels, where it is converted to biodiesel.

School rankings and top performers.

After totaling each school's scores for waste diversion investments and efforts, UNI received the lowest score, a 3, with the next lowest score a school received being a 7. The schools with the top three scores: Ohio University (12 points), the University of North Carolina at Greensboro (12 points), and Illinois State University (10 points) all had a full-time recycling coordinator paid through the administration. As Lounsbury's study in 2001 found, recycling managers that are hired specifically to operate campus recycling, referred to as "status accretion" managers, are not only enthusiastic about their job, but they also have the time to strengthen and expand their school's recycling program compared to "role accretion" managers. The status accretion recycling coordinators at the top three schools implemented a campus-wide recycling program, hired two or more student employees to help with the recycling program, and offered recycling at campus events. None of these efforts or investments was practiced at UNI. Two of

the three top schools also provided some level of orientation/outreach, collection of reusable items during move-out week, and organic composting.

Conclusion

Comparing the success of each school's recycling program by the percent of solid waste recycled or diverted was not possible due to variations among what each school tracks concerning its waste management. This lack of comparable data to measure the success of a campus' recycling program exemplifies the need for a standardized method for tracking solid waste diversion efforts.

While the percent of recycling and waste diverted by each school could not be compared, each school's effort to capture recycling could be determined by the number of opportunities that the school offered to divert solid waste (i.e. move-out week, event recycling, organic waste from eating facilities) and the effort that the institution put into educating its campus community about the campus recycling program. UNI has already made an effort to reduce the amount of waste it sends to the landfill by collecting landscape clippings for mulch, initiating Panther Pick-up to collect used items at the end of the spring semester, and by providing recycling bins to each dorm room in Rider Hall in conjunction with recycling education. However, these efforts do not make UNI stand out among its peer institutions; similar efforts are already taking place at all eight of the peer institutions that took part in the study.

UNI can improve its rank among its peer institutions, in addition to increasing the percent of solid waste recycled, by taking the following steps. They include: (a) expanding the Rider Recycling Revolution to all nine dormitories on campus, (b) providing opportunities to recycle at campus events such as homecoming, parents' weekend, and competitions that take place in the McLeod Center and the UNI Dome, and (c) hiring a full-time recycling coordinator, who can

improve the success of each of these efforts, through the administration. This person can work together with facilities, the RRTTC, and the department of residence to determine the logistics of each of the added efforts and to create a cohesive, campus-wide recycling program that uses consistent sign prompts. He or she can also encourage campus members to recycle by sharing the success of everyone's efforts and by organizing a recycling orientation program or packet for new students, faculty and staff. Many of the peer institutions have also hired students to keep the recycling program running. Student duties commonly include collecting materials from within each building for pick-up and informing campus members about how to recycle on campus. Ben Kunka, the Recycling Operations Supervisor at North Carolina University at Greensboro, captured the responsibilities of any campus recycling program when he stated, "[A campus recycling program] is a service to the university. [The] goal is to make it user friendly and labor intensive...a stewardship mindset. An institution of higher learning has a special responsibility to train students and faculty."

UNI can not only increase its rank among its peer institutions but can also become a leader in waste management and sustainability by implementing an organic compost program for food scraps from dining facilities. Three of UNI's peer institutions currently compost their school's organic waste to some extent, but only Illinois State University composts both its pre and post consumer organic waste. UNI can look to Illinois State University for guidance about establishing and operating an organic compost program. Other helpful references for expanding, implementing, and monitoring a campus recycling program include *RecycleMania*, *WasteWise* *Re-TRAC*, and *Recycling and Beyond: A College Campus Primer* by Kaplan & von Kolnitz (2004). For more information about each of these resources see Appendix A.

UNI can also look to its peer institutions when trying to determine how to fund the initial and long-term costs of a campus-wide recycling program. Successful university recycling programs at UNI's peer institutions have funded their recycling program by making it a priority in their solid waste management budget, by applying for grants, and by making the collection process efficient. It is important to keep in mind the concept of the Triple Bottom Line, which incorporates the environmental and social benefits in addition to the economic benefits.

This study is not meant to give the impression that recycling is the only approach to waste management and sustainability. Source reduction is key to decrease the amount of waste generated, whether it is recyclable or not. Source reduction includes steps such as a reduced packaging policy for suppliers, double sided printing in computer labs, and the replacement of disposable items with reusable items. By reducing the amount of waste generated on campus and by diverting this waste for reuse and recycling, the university will not only increase its marketability in a society that is becoming more environmentally conscious, but it will also result in lower solid waste fees from avoided costs and reduced greenhouse gas emissions and pollutants.

While UNI does offer some opportunities to recycle on campus, education about how and where to recycle, accessibility to recycling, and cohesiveness among building recycling can all be improved greatly. The results of the study demonstrate the room for growth within UNI's recycling program to the UNI Administration and encourage the administration to increase recycling efforts on campus. As Lounsbury (2001) stated in the discussion and conclusion of his paper, "Larger schools, for instance, may look to each other for cues about how to respond to similar institutional pressures" (2001). The research also showed the administration the

economical and environmental benefits of recycling and how it fits into the concept of sustainability, a topic and initiative that has become mainstream.

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Appendix

A. **Recommended Resources**

Recycle Mania

RecycleMania is a 10 week long recycling and solid waste reduction competition among over 500 colleges and universities from the United States and Canada. It was started by the College & University Recycling Coalition (CURC) which is part of the National Recycling Coalition. Participating schools report their recycling and solid waste numbers each week, and awards are given to the competing schools with the most recyclables collected per capita, the largest amount of total recyclables collected, the least amount of solid waste generated per capita, and the most recycling collected for four materials: paper, corrugated cardboard, bottles and cans, and organic food waste. Currently, UNI could only participate as a benchmarking member and not a competitor. This is because the university's main recycling location of multiple materials is a recycling substation located at the edge of campus which is utilized by community members from off campus, and RecycleMania competitors can only include "trash and recycling generated by the school...Outside sources such as public drop-off materials are not permitted" (RecycleMania, 2010). However, as a benchmarking participant, UNI can gain valuable information concerning its waste prevention and recycling performance compared to a number of secondary education schools across the country. The competition and its promotional tools (i.e. posters, e-cards, and web banners) can also be used to encourage students to reduce and recycle. More information about the competition can be found at RecycleMania's website: <http://www.recyclemania.org>

WasteWise Re-TRAC

WasteWise Re-TRAC is an online resource offered by the Environmental Protection Agency. The program allows members to manage and report their waste generation and reduction activities on a daily, weekly, monthly, quarterly, or yearly basis, depending on the school's tracking methods. In addition to tracking, organizing, analyzing, and reporting all waste-related activities, including such efforts as composting and buying recycled-content products, the program also quantifies the environmental benefits of those efforts (i.e. greenhouse gas emission reductions). Benefits of the program consist of the following: the account can be accessed by members anywhere at anytime online; reports can be generated whenever they are needed versus only at the end of the year; and waste related data can be separated by facilities and kept secure. The program also provides tools for sharing the benefits of waste reduction efforts with custodians, students, and faculty as a means to encourage participation.

Recycling And Beyond: A College Campus Primer

Kaplan and von Kolnitz's (2004) college campus primer for recycling is a great resource for any university looking to establish or expand a campus recycling program. The primer was used to develop the questionnaire that UNI and its peer institutions answered for the study. The primer covers every aspect of a recycling program from a campus evaluation, to development of a recycling program, to its implementation.

B. UNI and its Peer Institutions' Recycling Contacts

School	Contact	E-mail	Phone
1. Fresno State, California	Lisa Kao , Administrator of Environmental Health and Safety	lisak@csufresno.edu	559.278.6910
http://www.csufresno.edu/Recycling/index.shtml			
2. Central Michigan	Jay Kahn , Director of Facilities Operations	Kahnlja@cmich.edu	989.774.6553
http://www.fmgmt.cmich.edu/recycling/index.asp			
3. Illinois State University	Ted Ratajski , Recycling Coordinator	thrataj@ilstu.edu	309.261.7594
http://www.greenteam.ilstu.edu/initiatives/recycling.shtml			
4. Northern Arizona University	Robert Chavez Director: Capital Assets, Department of Safety and Environmental Services (SES)	Robert.Chavez@nau.edu	928.523.6434
http://recycling.nau.edu/index.html			
5. Ohio University	Ed Newman , Recycling and Refuse Manager	newmane@ohio.edu	740.593.0231
http://www.facilities.ohiou.edu/recycle/index.html			
6. University of Minnesota Duluth	Doug Greenwood , Principal Building and Grounds Supervisor	dgreenwo@d.umn.edu	218.726.7468
http://www.d.umn.edu/fm/recycle/index.htm			
7. University of North Carolina at Greensboro	Ben Kunka , Recycling Operations Supervisor	bakunka@uncg.edu	336.256.0433
http://www.uncg.edu/rcy/			
8. University of North Texas	Doug Turnage , Recycling Services Coordinator	turnaged@unt.edu	940-369-8516
http://www.facilities.unt.edu/depts/recycling			
9. University of Northern Iowa	Bill McKinley , Assistant Manager of Transportation Services/Refuse and Recycling	william.mckinley@uni.edu	319-273-6109
http://www.vpaf.uni.edu/fs/services/recycle.shtml			

C. Operator of Recycling and Waste Questionnaire

I. Campus Information

Date Completed:

1. Name of Institution:
2. Number of full-time equivalent (FTE) students for the year that corresponds with your most recent waste management data:
3. Number of FTE faculty and staff for the year that corresponds with your most recent waste management data:

II. Incentives

4. Is your state a Bottle Bill State (does it require a bottle deposit on beverage containers)?
5. Are you required by your jurisdiction to recycle?
6. Does your garbage disposal site accept all types of garbage or are there restrictions?

III. Waste Management Information

7. How much solid waste is generated on campus (in tons per capita per year during 2007-2008 or 2008-2009 school year)?
8. Is your data obtained from
 - a. actual weights
 - b. estimated weights
 - c. actual volumes converted
 - d. estimated volumes converted
9. Who is in charge of solid waste disposal for your campus (title of position and place within the administration)?
10. Is the waste collected internally or contracted out?
11. Is all of the campus under the same contract (for example is the waste generated by the academic buildings separated and disposed of in the same way as the residence halls)?
12. Is your waste disposal fee charged by weight, volume, or a fixed fee?
13. What is the total cost of disposal per ton for solid waste?
14. How much have your costs for solid waste disposal increased in the past five years?
15. Does the campus have a current recycling program?

If you answered **yes** to question 15, please **answer questions 16-36**

If you answered **no** to question 15, please **skip to question 37**

IV. Basic Recycling Information

A. Management

16. Who manages the recycling on your campus (what facility, department, or group is it under?)
17. Does your college have a full-time recycling coordinator paid through the administration?
18. How many years has the campus's recycling program been in operation?

B. Collection

19. What materials are collected for recycling?
20. Are your recyclables comingled or sorted at the drop off sites on campus?

If the recyclables are sorted:

 - a. How are the materials sorted? (For example: white paper, colored paper, newspaper or all under mixed paper; plastics sorted by number or mixed)
21. What is the **percent removed** from the waste stream as a **combined total**
22. What is the **percent removed** from the waste stream **per category** (e.g. plastics, paper, cardboard, glass)?
23. Does each building on campus have the option to recycle the same materials? (For example if paper, plastic, cardboard, and glass are recycled in the residence halls, do the academic buildings recycle the same materials or only paper and cardboard?)
24. Who collects the recycling *within* each building? (For example, custodians or specialized recycling staff)

25. Who collects the recycling *from* each building on campus? (For example, building services, a separate recycling facility through campus, or an outside contractor)
26. Are students involved in running the recycling program?
27. Where does your campus recycling go after it is collected
28. How often are recyclables collected (once a week, twice a week)?
29. What are the most *successful* methods of your recycling collection program? (For example, the use of a specific, identifiable collection container)
30. What is the most *efficient* aspect of your recycling collection? (For example, increase cardboard bailer size)

Recycling Finances

31. What is the Institution receiving for each collected item (e.g. \$140/ton for white paper)?
32. How much of the **cost** from campus waste is offset by recycling?
33. How is your recycling program funded?
34. Has your recycling program received any grants to get started or continue running?

Education/Outreach

35. Does your college have a website dedicated to the school's recycling program listing the materials recycled on campus, how the recycling program operates, locations to recycle on campus, statistics from recycling, and a contact for any questions?
36. Does your recycling program have employees who orient new students or faculty and staff to the recycling options available on campus?

V. No Basic Recycling (Answer only if you answered "no" to question 15)

37. Are there plans to implement a recycling program at any level?
38. Has your campus attempted to start a recycling program at any level?

VI. Other Recycling

A. Compostables

39. Are landscape clippings mixed or separated from general waste?
 - a. If landscape clippings are separated, how much is collected in tons/year?
 - b. If landscape clippings are separated, are they used for mulch?
40. Is organic waste from eating facilities/dining centers separated from general waste?
 - a. If a program is in place, how many tons per year are managed?
41. What percent of solid waste generated on campus is diverted by **recycling, reuse, and composting**?

B. Other

42. Have you tried to reduce your hazardous waste through recycling measures (For example, recycle batteries or motor oil)? If yes explain:
43. Does your campus have an electronic waste recycling program? If yes explain:
44. Does your campus have a refuse program for used materials to be traded or sold? If yes explain:
45. Does your campus provide special pick-up of used items during move-out week? If yes explain:
46. Does your campus provide event recycling (For example, sporting events, concerts, outdoor public events)? If yes explain:

VII. Reduce

47. What programs exist on campus to promote source reduction and reuse in order to decrease the quantity of waste generated?

D. Introduction to Phone Call about Contact Person

Hi, my name is Anna Schrad. I am a senior at the University of Northern Iowa. I am working on my thesis project: *How Does the University of Northern Iowa's Recycling Program Compare to its Peer Institutions' Recycling Programs?* To obtain fair and applicable benchmarking standards for the University, I am examining recycling programs from 10 of UNI's comparable schools through phone interviews with recycling managers.

1. Could you tell me who I can contact for your school's phone interview concerning waste management and the recycling program?
 - a. Name:
 - b. Phone:
 - c. Email:
2. At a scheduled time, would you be willing to participate in a 30 minute phone survey evaluating _____ (Name of School's) _____ recycling program to be used for my thesis project?
 - a. If so, what day(s) and time work best for you?
 - b. Date and time of phone interview:

Introduction to Electronic Mail Delivery

Thank you for agreeing to participate in the questionnaire for my senior thesis project: *How Does the University of Northern Iowa's Recycling Program Compare to its Peer Institutions' Recycling Programs?* I have attached a pdf format of the questionnaire I will be giving you during your phone interview scheduled for _____ (date and time) _____. Please familiarize yourself with it and prepare any calculations/data prior to the scheduled phone interview (for example, most recent data for tons of waste collected in one year and tons of recyclables recovered in one year). Your preparation will help the phone interview run smoothly and efficiently.

I have also attached a Microsoft Excel Sheet to help you easily convert volumes of recycled materials to tons of recycled materials. Conversions are available for newspaper, office paper, mixed paper, various forms of cardboard, glass, aluminum, steel cans, plastic containers, and compostables.

Please let me know if you have any questions or concerns about the questionnaire prior to your scheduled phone interview time. Minor questions can be answered/addressed during the interview.

I greatly appreciate your willingness to participate in my thesis project.

Thank you for your time and knowledge.

Sincerely,

Anna Schrad

annajo12@uni.edu

Introduction to Phone Survey

Hi, my name is Anna Schrad. I am calling to conduct the recycling and waste management questionnaire for my senior thesis project at the University of Northern Iowa. The survey should take about 30 minutes. Have you had a chance to look over the questionnaire and prepare your data?

We will first begin with some background information about your university.