

2014

# The Impact of Innovation: New Frontiers in Undergraduate Research (Full Issue)

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(2014) "The Impact of Innovation: New Frontiers in Undergraduate Research (Full Issue)," *PSU McNair Scholars Online Journal*: Vol. 8: Iss. 1, Article 6.  
<https://doi.org/10.15760/mcnair.2014.2>

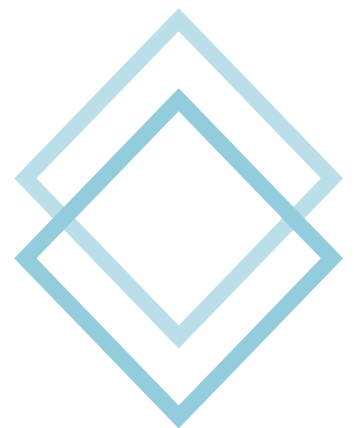
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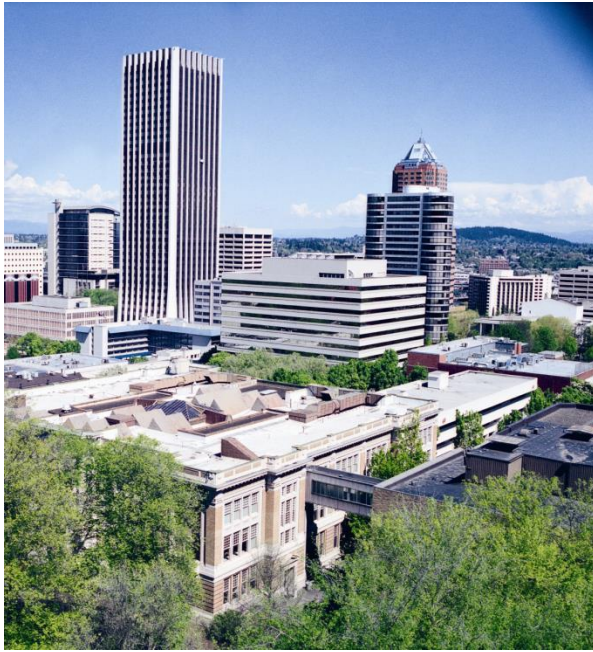


The Impact of Innovation:  
New Frontiers in  
Undergraduate Research

2014 Ronald E. McNair  
Scholars Journal

Portland State University





The Ronald E. McNair Scholars Program at Portland State University (PSU) works with motivated and talented undergraduates who want to pursue PhDs. It introduces juniors and seniors who are first-generation and low-income, and/or members of under-represented groups to academic research and to effective strategies for getting into and graduating from PhD programs.

The McNair Scholars Program has academic-year activities and a full-time summer research internship. Scholars take academic and skills-building seminars and workshops during the year, and each scholar works closely with a faculty mentor on original research in the summer. Scholars present their research findings at the McNair Summer Symposium and at other conferences, and are encouraged to publish their papers in the McNair Journal and other scholarly publications.

The Ronald E. McNair Post-baccalaureate Achievement Program was established in 1986 by the U.S. Department of Education and named in honor of Challenger Space Shuttle astronaut Dr. Ronald E. McNair. The program, which is in its seventh year on campus, is funded by a \$1,155,000 grant from the U.S. Department of Education and PSU institutional cost-share funds.

The McNair Scholars Program's student-centered approach relies heavily on faculty and university commitment. Activities and opportunities provided by the program focus on building a positive academic community for the scholars while they are undergraduates at PSU.

## Ronald E. McNair



Ronald Erwin McNair was born October 21, 1950 in Lake City, South Carolina. While in junior high school, Dr. McNair was inspired to work hard and persevere in his studies by his family and by a teacher who recognized his scientific potential and believed in him. Dr. McNair graduated as valedictorian from Carver High School in 1967. In 1971, he graduated magna cum laude and received a Bachelor of Science degree in Physics from North Carolina A&T State University (Greensboro). Dr. McNair then enrolled in the prestigious Massachusetts Institute of Technology. In 1976, at the age of 26, he earned his Ph.D. in laser physics. His dissertation was titled, "Energy Absorption and Vibrational Heating in Molecules Following Intense Laser Excitation." Dr. McNair was presented an honorary doctorate of Laws from North Carolina A&T State University in 1978, an honorary doctorate of Science from Morris College in 1980, and an honorary doctorate of science from the University of South Carolina in 1984.

While working as a staff physicist with Hughes Research Laboratory, Dr. McNair soon became a recognized expert in laser physics. His many distinctions include being a Presidential Scholar (1971-74), a Ford Foundation Fellow (1971-74), a National Fellowship Fund Fellow (1974-75), and a NATO Fellow (1975). He was also a sixth degree black belt in karate and an accomplished saxophonist. Because of his many accomplishments, he was selected by NASA for the space shuttle program in 1978. His first space shuttle mission launched successfully from Kennedy Space Center on February 3, 1984. Dr. Ronald E. McNair was the second African American to fly in space. Two years later he was selected to serve as mission specialist aboard the ill-fated U.S. Challenger space shuttle. He was killed instantly when the Challenger exploded one minute, thirteen seconds after it was launched. Dr. McNair was posthumously awarded the Congressional Space Medal of Honor. After his death in the Challenger Space Shuttle accident on January 28, 1986, members of Congress provided funding for the Ronald E. McNair Post-Baccalaureate Achievement Program. Their goal was to encourage low-income and first-generation college students, and students from historically underrepresented ethnic groups to expand their educational opportunities by enrolling in a Ph.D. program and ultimately pursue an academic career. This program is dedicated to the high standards of achievement inspired by Dr. McNair's life.

Source: [mcnairscholars.com](http://mcnairscholars.com)

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**First Generation Minority Students: Understanding the Influential Factors  
that Contributed to their Preparation and Decision to Pursue Higher  
Education**

by

**Alexis Shawnee Palacios Cabrera**

**Faculty Mentor:**

**Dr. Karen Haley**

Cabrera, Alexis S. P. (2014) "First Generation Minority Students: Understanding the Influential Factors that Contributed to their Preparation and Decision to Pursue Higher Education" *Portland State University McNair Scholars Research Online Journal*: Vol. 8

## FIRST GENERATION MINORITY STUDENTS

### **Abstract**

The purpose of this research was to explore and understand the experiences of first generation minority students at Portland State University. First generation students are students whose parents have not earned a four-year degree or the equivalence of a bachelor's degree in the United States. By looking at factors that contributed to college decision making process, such as family, peers, high school educators, and high school mentor programs, we can better understand how these factors influence students' experiences. A qualitative analysis was used to assess the responses from 42 students collected through an online survey. This study looked at how these factors influenced students' preparation and decision to pursue higher education. In addition to analyzing specific factors, some motivational themes that emerged from the data included family expectations, financial stability, and personal/career goals. The findings of this study indicate that if parents, students, and school educators are involved then the student develops higher college aspirations and transitions successfully into college. One overall theme in this study emphasizes the importance of tackling students as early as middle school age.

*Keywords:* first-generation, minority

## Introduction

Why is an education beyond high school necessary in the United States? With the many economic changes that continue to occur, it is becoming essential in our society to obtain a college education. Recent trends in the U.S. show an increase in the number of minority students graduating high school, "by the year 2020, minority students will account for forty-five percent of the nation's public high school graduates, up from thirty-eight percent in 2009" (Hoover, 2013, p. 16). With the expected increase in minority students graduating, it is important to identify what key factors play a role in the preparation and decision making process to attend college for these students. In order to gain a better understanding we must explore factors such as family, peers, high school educators, and high school mentor programs and how they affect their transition into higher education. One of the biggest problems in higher education is the achievement gaps that exist between students of diverse ethnic backgrounds (Kern, 2010; Pitre & Pitre, 2009; Herdon & Hurt, 2004).

More research needs to be conducted on how we can assist students of diverse ethnic backgrounds in providing better access to higher education and how we can increase goal attainment and graduation rates for underrepresented minority students. For this project I chose to work with first generation minority students at Portland State University. A qualitative analysis was used to assess the responses from 42 students collected through an online survey. Responses from each student were assessed using open-coding & small coding (the examination and breaking down of collected data). The data were then grouped into major themes and categories to represent the experiences of this student population. The question I tried to answer was "How did family, peers, high school educators, and high school mentor programs influence students' decisions and preparation to attend higher education?" The purpose of this study was to gain insight and understanding on the experiences of these students.

## Literature

Because of achievement gaps and small amount of research exploring the preparation and decision making process of these students I looked at three different areas of literature: first generation minority students, mentoring programs, and Alexander Astin's I-E-O Model. The paper focuses on exploring these three areas and how they are important considerations in the preparation and decision making process of these students while pursuing higher education.

## First Generation Minority Students

The population that I have chosen for my study is first generation minority students. First generation students are students whose parents have not earned a four-year degree or the equivalence of a bachelor's degree in the United States. First-generation students are "from families with low incomes or from middle- or higher-income families without a college-going tradition" (First Generation Students, para. 2), and are "more likely to be ethnic minority students who speak a language other than English" (Bui, 2002, p. 4). Research conducted by Susan Choy of the Department of Education explains that, "most high school students formalize their education plans between 8<sup>th</sup> and 10<sup>th</sup> grade, suggesting that interventions to influence students educational aspirations are most likely to succeed" in pursuing a college education (Choy, 2000, p.4). This suggests that the "development of college aspirations during the middle school grades has the greatest impact on actual college attendance" (C. Pitre & E. Pitre, 2009, p. 99). One of the overall

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factors that became apparent is the need to tackle students as early as middle school in their preparation for higher education. I focused on three different components that played a role in the preparation and decision making processes of these students, socioeconomic status (SES), family expectations, and culture.

**Socioeconomic Status (SES).** Studies have found that, "first generation college students may be less equipped for college due to poor academic preparation from high school and lower critical thinking scores prior to college" (Dennis, Phinney, & Chuateco, 2005, p. 223). In addition the socioeconomic status of parents is correlated to the achievement of their children. For example, "children whose parents are better educated, make more money, have high status jobs tend to attain higher levels of education than do other children" (Schmid, 2001, p. 73). Students whose parents did not attend college and who come from "low-income families, experience financial barriers are one of and actually delay entry into college" (Wells & Lynch, 2012, p. 672). Because of the financial barriers that low-socioeconomic status families face, the ability for these families to contribute to educational (tuition) cost are limited and these students are more likely than "higher socioeconomic students to attend under-resourced high schools and receive inadequate college counseling and less likely to attain a degree or receive benefits associated with completion" (Wells & Lynch, 2012, p. 673). As a result of limited funding and inadequate counsel, low-socioeconomic status students, especially students from diverse ethnic backgrounds, are less likely to attain higher education and are at a higher risk of not "transitioning to college, completing high school, expecting a college degree, and acquiring college qualifications" (Wells & Lynch, 2012, p. 674).

**Family and cultural expectations.** Family members are "amongst the most common and important proximal processes for adolescents and young adults and play an important role in academic outcomes" (Dennis et al., 2005, p. 224). However, it is important to assess the different types of expectations that families have. For example, the family expectations for first-generation students (non-traditional) vary from traditional students. For traditional students, "college is what one does after the completion of high school and was simply the next, logical, expected and desired stage in the passage toward personal and occupational achievement" (Terenzini et al., 1994, p. 62). First generation students do not necessarily have that same expectation because for them going to college was not part of their family's expectations and traditions. In some aspects, "those who were the first in their immediate family to attend college are breaking, not continuing, family tradition" (Terenzini et al., 1994, p.63). Even though families of first generation students of diverse ethnic backgrounds, "lack the first-hand knowledge of the college experience and university system," this does not mean that they are not important influential factors (Dennis et al., 2005, p.233). Despite the lack of first-hand college experience and the university system, families can "instill in their children the expectation of attending college and can provide encouragement and emotional support" (Dennis et al., 2005, p. 224).

Some of the reasons why students pursue higher education are influenced by their cultural beliefs and values. The cultural identity of a student can have either a positive or negative effect. Some students may bring a "sense of who they are, where they are from, and seem to retain this different, but non-oppositional social identity" while other students may "develop a new sense of social or collective identity that is in opposition to the new social identity of the dominant group" (Schmid, 2001, p. 76). In other words some students learn to embrace their culture and apply it to their everyday lives while others may adopt a new cultural identity in order to become part of the dominant group.

Another way of looking at the impact of culture is through collectivistic and individualistic perspectives in which both perspectives can be related to attaining a college education. People with a collectivistic approach are "motivated to achieve in order to meet the demands and expectations of others, particularly family members" (Dennis et al., 2005, p. 226). People with an

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individualistic approach are “more likely to be motivated for personal reasons like the desire to attain a rewarding career” (Dennis et al., 2005 p. 224). The significance of this cultural aspect is how it affects the outcome of student success. In this case success is that they made it to college. Overall, family and culture play a crucial role for the “maintenance of psychological well-being, adjustment, and transition in college for ethnic minority students” (Dennis et al., 2005, p. 226).

### **Mentoring Programs**

Mentoring is defined as “significant career assistance that is given by more experienced person (s) to less experienced one (s) during a time of transition” (Haring, 1999, p. 9). Mentors can offer support, counseling, coaching, and encouragement to these students. For schools and institutions who work closely with students, the mentor-mentee programs give students the opportunity to work with professionals, receive academic support, and engage in hands-on experiences to increase success (Talbert, 2012, p.23). They can also help students with their transitions in education which means having the ability to progress from one level (e.g., from high school to college). The transition for minority students may consist of “moving from an educational setting in which they are a small percentage of the institutions population and their culture is poorly understood or accepted” (Haring, 1999, p.10). When taking this transition into account, having the support of mentors or advisors can have a great effect on these students in that it can help them “find their way in a new environment gives them the ability to recognize their existence in the field of education” (Talbert, 2012, p. 24).

One of the biggest changes that we are seeing is the increase in high school enrollment and completion rates of students from diverse ethnic backgrounds. It is projected that by the year “2050, about half (approximately 49.4%) of the U.S. population will be composed of individuals from diverse ethnic backgrounds” (C. Pitre & E. Pitre, 2009, p.99). The TRIO educational opportunity program for instance, has been successful in “increasing both higher education attendance rates and educational attainment of students from low income, first generation college, and underrepresented ethnic minority backgrounds” (C. Pitre & E. Pitre, 2009, p.96). However, there is still a lack of programs available compared to the number of ethnic minority students, resulting in the need for more established programs such as TRIO, Upward Bound, and the Educational Talent Search.

### **I-E-O Model**

The I-E-O Model serves as the theoretical framework for this study. Alexander Astin’s Input-Environment-Outcome (IEO) Model was used to look at internal and external involvement of these first generation minority students. This theory helped identify the areas and programs that could be improved to increase the educational degree attainment amongst first generation minority students.

**Description.** Alexander Astin discusses three key issues that are involved in a prospective college student’s decision: “(1) whether or not to go, (2) where to go, and (3) how to go” (Astin, 1993, p. 1). In order to adequately observe how these sources impacted the experience of these students, I am using Astin’s Input-Environment-Outcome (I-E-O) Model as a theoretical framework. “Inputs” refers to the “characteristics of the student at the time of initial entry to the institution” (Astin, 1993, p. 6). Some examples of inputs can be demographics, family influence, and financial status, and what inspired them to go to college. “Environments” refers to the “various programs, policies, faculty, peers, and educational experiences to which the student is exposed” (Astin, 1993, pp. 6-7). The last aspect of Astin’s model is “outcome,” which refers to the “student’s characteristics after exposure to the environment” (Astin, 1993, p. 7). Outputs can be based on academic, social, and economic outcomes. For example, grade point

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average (GPA), what students do after college (types of jobs), and community service are all outcomes.

**Relevance to my study.** For my research I mainly used the “input” portion of Astin’s model. Because I am looking at the resources that students receive prior to entering college, taking into account these students demographics, background, and previous experiences is important. This model also helped identify what student success means. For this study student success can be defined as the students making the decision to go to college and actually getting there.

### Methodology

Because of the importance of understanding each of these students and their relative experiences in the preparation and decision making to pursue higher education, a qualitative, survey research design was used. Data were gathered from 42 students from the Diversity and Multicultural Student Services (DMSS) at Portland State University. All the students varied in ethnic backgrounds, grade level, and ages. The methods of this study describe the design, participants (first-generation minority students), procedure, data analysis, and limitations.

### Design

In this study, a survey was used to determine how factors such as family, peers, high school educators, and high school mentor programs influenced students’ preparation and decision making process to attend college. The survey was developed using Qualtrics, an online survey program available to students, faculty, and staff of Portland State University. A total of 17 questions including demographic (ethnicity, age, and grade level), yes or no, and open ended questions were used to determine what resources were available to these students prior to entering college (See Appendix A). Students were not required to answer any questions that did not pertain to their experience and even though they were free to skip any questions, it was helpful to the results of the study if all questions were answered to the best of their knowledge. This study includes, but is not limited to just their high school experience. It is important to also consider those students who may not have pursued higher education directly following high school completion, but chose to return after years away from schooling.

### Participants

Participants for this study were all students from Portland State University. Participants were predominantly juniors and seniors, ranging between the ages of 19-53 years old. The recruitment process included approval from the Institution Review Board and the Diversity and Multicultural Student Services at Portland State University. Some of the programs under DMSS include: Diversity Enrichment Scholars, Presidential Equal Access Scholars, TRIO students, Student Leaders and Organizations, and the Multicultural Center. Once the approval was received, the DMSS Advisors and Coordinators forwarded the research project email and survey link to the students on their DMSS list serve. However, for this study the number of students on the DMSS list serve is unknown. I received a total of 43 responses that provided enough relevant information to be used in this study; however of the 43 participants, 42 identified as first generation students while 1 student did not. First generation in this study is defined as students whose parents have not earned a four-year degree or the equivalence of a bachelor’s degree in the United States. I also sought out participants who came from diverse ethnic backgrounds including: African Americans, Hispanics, Asian/ Pacific Islanders, Native American, Caucasians, and Multi-Racial individuals. Participants were able to equally access the survey from any computer as long as there was access to the internet. If students had any difficulty accessing a computer from home, they had the



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option to access it through any computer lab, personal computers, and electronic devices at Portland State University (through available Wi-Fi and computer labs).

Table. 1

### *Ethnicity*

<b>Ethnicity</b>	<b># of students in each ethnic group</b>	<b>% of students in each ethnic group</b>
Caucasian/ White	5	11.9%
Hispanic/ Latino	12	28.6%
African American/ Black	3	7.1%
Native American/ American Indian	0	0%
Asian/ Pacific Islander	10	23.8%
Other	3	7.1%
<b>Mixed Race</b>		
Hispanic/ Asian/ Pacific Islander	1	2.4%
Asian/ Pacific Islander/ Middle Eastern	1	2.4%
White/ Black	3	7.1%
Hispanic/ Black	1	2.4%
White/ Native American	2	4.8%
Hispanic/ Native American	1	2.4%
<b>Total:</b>		<b>100.0%</b>

Table. 2

### *Grade Level*

<b>Grade Level</b>	<b># of students in each level</b>	<b>% of students in each level</b>
Freshman	2	5%
Sophomore	4	10%

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Junior	13	30%
Senior	23	55%
<b>Total</b>	<b>42</b>	<b>100%</b>

Table. 3

### Age

<b>Age Range</b>	<b># of students in each age group</b>	<b>% of students in each age group</b>
18-22	24	57%
23-27	8	19%
28-32	3	7%
33-37	2	5%
38-42	2	5%
43-47	1	2%
48 and above	2	5%
<b>Total:</b>	<b>42</b>	<b>100%</b>

## Procedure

The data collection process consisted of three main phases. First, email notifications regarding the research project were sent out to students under the Diversity and Multicultural Student Services Department (DMSS). Each student was provided sufficient information regarding the purpose, potential risk and benefits, incentive, and confidentiality of the study. Participation in this study was entirely voluntary and students had the option to decline participation. The identity of all the participants and their responses were kept confidential and the survey did not ask the participants for any personal identifiers. Second, each student consented to provide information on their personal experiences prior to college. The survey included demographic questions, yes/no questions, and reflective questions. The demographic questions included ethnicity, age, and grade level. The yes/no questions asked if students received support from family, peers, high school educators, and high school mentor programs. If students answered no they could skip to the next question and if they answered yes, there was a follow up question asking how they received support. Third, students filled out the survey to the best of their abilities. Once the survey was closed, I downloaded a copy of the data from the online Qualtrics program into my personal computer, which was password protected to ensure the confidentiality of each participant.

## Data Analysis

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Upon the completion of the survey, the results (student responses) were imported into a Microsoft Excel file. The Excel program allowed me to "easily format and rearrange data to gain new insight, perform complex analysis, compare them and select the options that tells your story best" (Excel, n.d.). Once I imported the data into Excel, I began reading, organizing and sifting through the data. All incomplete data was then eliminated from the excel file. Any incomplete responses were eliminated from the study because they did not provide enough relevant information to be used. I used a system of color coding in order to differentiate and separate each question and response. I went through the data question by question first using open coding (the examination and breaking down of collected data) in order to "take the data and label those categories with a term, or short phrase, mostly based in the actual language of the participant" (Creswell, 2003, p.192). Next, I used the open codes to "generate smaller themes or codes" (Cresswell, 2003, p. 193). Each question had three to four themes associated with the overall responses of the students. After looking at all the themes, I determined that motivation and support became the two overall factors that influence these students preparation and decision making process to attend college. Coding the responses in this manner allowed me to think about what each student said and the meaning (interpretation) behind each response. As I analyzed the data in Microsoft Excel, I also began transferring and explaining the themes and meanings in a Microsoft Word document. I transferred over the themes as well as quotes from each major question in order to describe and strengthen the overall findings and explained what each theme meant and how it supported the data.

### **Limitations**

This study had several limitations. The first limitation was my connection as a researcher to this study. Because I identify as a first generation minority student, I found that I was able to relate to some of the experiences of these students. At times it was difficult to separate my own experiences and preconceptions from theirs. In order to neutralize my connection to the participants, I had to keep an open mind and not let my personal experiences influence the outcome of the results. The second limitation was related to the participants of this study. The students invited only included students from the Diversity and Multicultural Student Services of Portland State University. Thus, the participants were not fully representative of the larger first-generation/ minority student population. Third, because participants were invited by advisors and coordinators of the Diversity and Multicultural Student Services, the participants in this study are more likely than other first-generation minority students to have been successful in pursuing higher education. Fourth, the methodological approach used (qualitative analysis) gave us a wide range of responses, depending on each person's own individual experiences, making the data more complex.

### **Results**

The results section indicates the themes that emerged from these students' responses and provides an insight into the different experiences that these students went through. This section was organized based on how the survey was organized and includes the following: Initial College Motivators, Educational Support and Guidance, High School Mentor Programs, Family Support and Guidance, Peer Support and Guidance, and Other Support and Guidance. It provides both meaning and interpretation and assesses how family, peers, high school educators, and high school mentor programs influence these students decision to pursue higher education. The section also illustrates some of these students' experiences by including the actual words (responses) of these students.

#### **Initial College Motivators**

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The table below is a breakdown of the responses students gave when asked when they first thought about college. Students had the option from choosing between elementary, middle school, high school, and other. This section also explains why these students decided to go to college.

Table. 4

When did you first think about college?

Grade Level/ Other	# of Student Responses	% of student Responses
Elementary	8	19%
Middle School	10	24%
High School	19	45%
Other	5	12%
<b>Total:</b>	<b>42</b>	<b>100%</b>

A total of 42 students answered the question about when they first thought about college and of the 42, 8 students answered to first thinking about college in elementary, 10 in middle school, 19 in high school, and 5 students provided different answers from the rest of the group. The majority of these students thought about pursuing college in their middle and high school years. After looking at the 5 other responses one student described their experience, "I was a High school dropout. I was studying for GED and impressed myself as to how much I had retained from school and what I had learned unconventionally" while two other students both said they decided to pursue college after "working full-time when there were 19."

Next, students were asked why they wanted to go college. The reasons that students provided include family expectation, hope for a better future for themselves and their families, chance to experience learning and independence, and to pursue their dream jobs. For many attending college was a stepping stone for themselves and their families, they were in a sense role models for others. The overall themes that emerged from these students' responses were **family, future financial stability, and personal/ career goals.**

For these first generation students, family became a driving force and reason for their pursuit of higher education. To them college was an opportunity that many of their parents did not have the privilege of pursuing, because survival was achieved by working. Parents, siblings, aunts, and uncles all became a source of encouragement for these students; these family members put an emphasis on education and believed in the students' ability to improve their lives. Other reasons why these students went to college include bringing honor to their family and to be the first in their families to get a college education. One student said, "I wanted to go into college so I could make my parents proud," and because "my parents always encouraged me to seek opportunities that would provide a better life for myself."

The next theme that emerged was the importance of attending college for financial stability. Pursuing higher education for these students became essential because they wanted to be able to help their families financially in the future. One student provided a great example:

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I first wanted to go to college because I thought it would be the way out of poverty. I thought it would be the way I could finally make enough money to help my family out; help them live comfortably for once. I didn't want to struggle in the ways my parents did.

Getting educated can enable these students to explore and engage in opportunities that many of their parents were unable to.

The final theme that emerged from this question was pursuing higher education for personal and career goals. These students saw college as an "opportunity to do something with my life," as a way to "gain understanding of others perceptions," and a "way to achieve my dream job." College was an opportunity to gain knowledge, skills, and tools necessary to pursue future careers and also because students today have more opportunities and options when pursuing a college degree and field of study.

After reading and categorizing the responses, I found that there were several students who had different reasons from the overall group. For them pursuing an education was an outlet or way to keep busy by doing something productive and beneficial, one student said, "I was getting bored at home so I thought that I would try to earn an AA at PCC then I decided I would go for a B.A.," and another student said it "was the right thing to do after high school."

### **Educational Support and Guidance**

Educational support and guidance in this study refers to what type of educators helped them in high school (teachers, counselors, advisors, etc.) and how these educators helped these students. Students were asked to freely explain their experiences and share how they received support. After analyzing the data, 3 types of support became very influential in these students decisions to pursue higher education.

When students were asked if they received support from high school educators, a total of 40 responded. Of the 40 responses, 30 students answered yes, 7 answered no, and 3 left it blank. For these students preparing for college was difficult because they did not have parents who had the first-hand experience to guide. College was a new experience for them, their families, and friends. Therefore, students depended on their counselors, advisors, teachers, mentors, and even principals for advice, resources, and access to higher education. The themes that emerged from these students experiences are **college preparation activities, student engagement, and moral support.**

College preparation activities are events or actions that facilitated these first generation minority students to prepare for college. College preparation activities can include: college prep courses and exams, internships, college applications, and financial aid. For these students taking academic courses like writing helped them with their admissions and scholarship applications or participating in workshops helped them connect with other resources. One student describes their experience with Trio and Upward Bound advisors, "they helped me prepare for standardized test, helped me fill out scholarship forms/applications and looked at college catalogs."

Student engagement also became a great source for these students, whether they were involved in high school or college prep programs, participated in campus visits, or made the effort to seek help from their school educators. They took the initiative to seek help and accept help. One student identified several of these factors by explaining that:

The advisors at my school had computers set up in order for students to do research on schools, if we had any questions they would be there to help us. The avid programs were

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set up at my school in order for students to start prepping for college courses and to learn better techniques in taking notes and studying.

From their engagement they along with their school educators were able to find resources, skills, tips and tools to access higher education.

Lastly, high school educators also provided students with moral support. They encouraged, motivated, and supported their students with their college aspirations. Some educators made the effort work closely with these students and spent extra time in ensuring that these students would have the opportunity to go to college. One student in particular gave a great description of the type of moral support she received:

I found a support network in my high school that consisted of my counselor, teacher, and staff who started talking to me about going to college, and not just talking but signing me up to visit colleges or to go and get involved with things. One teacher in particular helped me out immensely by talking with me and my family about how to get into college and what to do. She helped me with scholarships, connected me to services and so much more.

This is just one example of the dedication and work that these high school educators invested in their students.

Most of the students received many of the same support and assistance from advisors, counselors, some teachers, and high school programs; however, some students' experiences were not as effective as others. One student shared their experience of losing their support system: "I lost my mentors, advisers, friends and community...the support was lost." This students experience navigating the educational system seemed to be done through independence and not so much through support and guidance. However, even though there were some challenges, some students were able to overcome these obstacles in order to move forward—they successfully made it to college.

### High School Mentor Programs

The next part of the survey was to evaluate if students were involved in any mentor programs and how they received support from these programs. After looking at the data, I found that majority of the students in this study were not involved in mentor programs nor received any form of support; however, there was enough data from the students who did receive support to explain the pros of being involved in high school mentor programs.

A total of 42 students answered whether or not they received support from high school mentor programs, and of the 42, 12 answered yes, and 28 answered no, and 2 left it blank. Based on the responses offered there is a recognizable gap between the number of students who were and were not involved in high school mentor programs. Students received the most assistance from school programs including: **financial aid, academics, and college engagement activities.**

As first generation students, one of the most difficult challenges is being able to pay for a college education because these students generally came from low-income families. For that reason, their high school mentor programs assisted these students in applying for Federal Financial Aid, scholarships, and grants. One student was involved in a program titled, the "Scholarship Mom" program, and she described her experience as:

A program in which mothers of the kids of my high school would volunteer their time to a select few students, most of which were first generation students, to find and apply to

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scholarships to their colleges. This of course helped me to see that there was additional funding that I had no idea about.

Students also received help in the area of academics. Advisors in the mentor programs helped students prepare for college exams like the Standardized Assessment Test (SAT): "I did SAT prep courses and was introduced to technical colleges and schools that I didn't even know existed, like OIT in Klamath Falls." Advisors also shared their own experiences and knowledge with the students in order to provide them with some insight in the college experience.

Lastly, the mentor programs offered students the opportunity to engage in college engagement activities. These activities included campus visits, tours, and workshops. A student described her experience with a mentor program: "My first two years in high school the mentor program helped me prepare immensely and left a big impact on my young mind." For this particular student, exposure to the college helped her successfully transition into college.

Out of all the responses provided, only one student expressed difficulties that affected their overall experience of the high school mentor program. This student described their experience: "It was not a good program. I was paired up with one mentor who never made time to meet with me. It did not prepare me for college at all." For this particular student, his experience did not prepare him for college like he hoped it would. However, he was the only student who expressed a negative experience with a program.

### Family Support and Guidance

For these first generation minority students', family became a very important reason why they went to college. For many of these students their family's expectations, culture, and livelihood became driving forces in their decision to attend college. Therefore, when the students were asked to indicate if they received support from their families, 30 of them answered yes, 10 answered no, and 2 left it blank. The majority of these students did receive some form and support and it is explained in the section below.

There is no doubt that families play an important role in the lives of these first generation minority students. Their families understood the importance of seeking an education and tried to support their children in the best way they could. Parents and families provided students with motivation and encouragement which influenced the way they viewed education.

Families instilled values, morals and set the foundation for these students, therefore it is important to recognize the connection between the student and their family. In this study families are important because they provided **moral, emotional, and financial support** to these students. For these students, the transition to college "involves adaptation to a new set of academic and social systems" (Terenzini et al., 1994, p.63).

The encouragement students received is evidence of the type of moral support they got from their families. Their families encouraged them to pursue education, their dream jobs, and to build a better future for themselves. Families instilled a sense of hope and determination, "pushing the vision and opportunity" for these students. For all these students their parents did not have the opportunity to go to college, therefore, their parents really encouraged these students to pursue higher education. One student wrote, "Knowing and experiencing what poverty is my parents encouraged us to go to school." These parents wanted their students to live better, more prosperous lives and they understood that getting an education was one way to achieve that goal.

Emotional support was another big support system for these students. Families stayed by these students to ensure that they were ready and prepared for college. Parents understood what

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survival meant, and they knew that these students needed them to be there for them, and in some ways it became a learning experience for the families and the students. One student noted her families' emotional support:

Emotional support was huge! My parents went to every meeting, every informational session, and every award ceremony. They knew that they could not support me fiscally but were able to help me by offering me rides to anything, or making me a cup of coffee on late nights anything they could to be there for me. They talked me through every anxiety and problem they could. Also, they tried to inform themselves and understand the college process."

When one thinks of financial support from our families we often think of them paying for tuition, and yes that may be part of it, but these students discussed other ways that they received financial support from family. For these students, financial help was not all about paying for their tuition, to them it was being able to live at home while they went to school without having to move out and pay rent elsewhere. For one student financial support from their family was "letting us live with them; let us have plenty of time to do homework: / did not force us to work or pay for bills/food." For this student having their family support enabled them to pursue a college education.

### Peer Support and Guidance

Because these students are first in their families to go to college, relying on peers as a support system became apparent in their success and transition into college. For these students peer support and guidance was a huge part of their transition to college. Peers provided **social, academic, and emotional support** system for these students.

Peers provided tips and resources for access to college, scholarships, and in some cases went through the application process together. By having friends who are going through the same or similar experience it makes it easier to connect and network with one another. In this way peers then served as a social system for one another, most especially having friends who also were working towards transitioning into college. They worked together to navigate the college process and with that they formed their very own social support system. One student discussed her experience with her peers:

My peers were a huge part of my support. Applying to college was a new process to all of us because none of us had parents that went to college. They supported me by doing research in the colleges we) had planned to apply to, attend college information nights with me, and we all visited colleges to get to know the college more.

Peers also provide academic support towards one another. Whether it was through helping each other study, encouraging each other to apply for college, or getting involved in college preparation activities. They explored career options together and discussed their plans. They shared tips, advice, and directions towards applying for schools, financial aid, and scholarships. For one student they described their peer experience as being "able to network and find out about classes, professors, programs and jobs."

The last theme that emerged from peer support was emotional support. Peers of these students believed in their friend's capabilities, and saw potential in them. Their peers encouraged these students to pursue college. As one student said, "They supported me by cheering me on and motivating me to apply for college." The belief that peers had in these students influenced their decision and preparation to attend college.

### Other Support, Guidance and Comments



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At the end of the study, students were asked if they had any other sources of support, guidance, and or comments to add. The students gave a variety of answers, some of which included the previous sources (family, peers, high school educators, and high school mentor programs). Other students shared part of their stories in how they made it to college, and what they experienced to get to college.

These students discussed how family members like aunts, uncles, and siblings influenced them based on their personal experiences in higher education. Others went through life experiences where they struggled in the job market, and through those struggles they were encouraged to go back to school. One student talked about how they pursued higher education because "I was motivated as a single father to lead by example," while another student said, "it was a self-desire." Because all of these students are non-traditional students they faced difficulties in accessing and going through the process of transitioning into college, for some it was a journey on their own. Another student talked about how much they appreciated the support that they received:

I am in college now because some incredible people cared enough to take the time and cared enough to get me into college. I stayed in college because the tools that these people gave me I was able to develop and use long after my high school time had ended.

Because all of these students are non-traditional students they faced difficulties in accessing and going through the process of transitioning into college, for some it was a journey on their own. Some students had to independently pursue their education because they did not have much support or help. One student explained their experience:

To be honest, not really. The jobs I had blatantly discouraged me from limiting my availability to work by going to school. This made it much more difficult to pursue an education on my own. I was on my own as a teenager, so it was always out of reach financially.

This student may have been independent and out of reach financially, but they managed to find other ways to get to college.

## Discussion

The results of this study indicate that there is great potential in increasing the number of first generation minority students in higher education. The participants in this study can all be classified as successful students in that they are all in college. By having family involvement, support from educators, and encouragement from others these students showed their ability to succeed in college.

First-generation students are identified as students whose "parents had not attended college; reducing the likelihood of going to college, and increasing the risk of dropping out of high school" (Choy, Laura, Nunez, & Chen, 2000). However, data now indicates that "more and more students whose parents have not attended college are pursuing higher education" (Bui, 2002, p.3). Based on the results of this study, motivation and support became the two overall themes that influence these first generation minority students in their preparation and decision making to pursue higher education. Because first generation students have a harder time transitioning from high school to college, receiving motivational support in the form of encouragement from family, peers, and educators became a guiding source in their ability to attend college. For these students it was the fact that others believed in their potential that helped prompt them to go to college. Those who provided moral support helped inspire and influence these students to make something of their lives. It showed them that they could be anything or anyone they wanted to be, just as one student described that they wanted to go to college "to achieve my dream job of being a television

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show presenter/reporter.” This means that the encouragement they received influenced the development of future career aspirations.

For their families, going to college grew into an expectation even though college was outside of their tradition. Even though these students’ parents never earned their Bachelor’s degrees, their parents made the time and effort to stay alongside their child and go through the college process with them. Parents also instilled in their children the importance of going to college to build a better future for themselves and their family. In return going to college was seen as a great accomplishment for their families, peers, and community. To the students it meant being able to provide for themselves and their families future security, making them proud, and bringing honor to them. To their peers motivating each other became a learning and driving experience.

Though the literature indicates that these students are “less equipped for college due to poor academic preparation,” the results of this study show that these students were capable of preparing themselves academically. For example, peers learned to work together by taking college prep course, filling out college applications, and even engaging in campus visits and workshops. They built a networking system, shared tips and advice, and helped one another access resources to help with the college transition. For their high school educators and high school mentor programs, having their students go to college meant that they did their job, that they had an impact on the lives and goals of their students. The fact that their students made it to college became a reward, a sense of achievement and success in their roles as educators.

Besides receiving motivation, these students also received various forms of support. The forms include, moral, emotional, financial, social, and academic support. Through these support systems, these students were able to make that transition into college successfully. Indeed, these students may have not attended the best schools or had the best programs to prepare them college, however, they still successfully made it to college. The only difference is that these students did not have parents with a college education. Though the literature indicates that students whose parents are educated and come from higher income families tend to attain higher levels of education, the students in this study indicate otherwise. With that said, it just meant that they needed to work harder to access the necessary resources to help prepare them. In fact, students showed much gratitude for the support they got and gave great examples of the types of assistance they received. For example, these students knew that their parents may have not been able to afford the cost of tuition; however, that did not prevent them from seeking an education. In retrospect, families did whatever they could to provide some kind of assistance to these students, whether it was continuing to put a roof over their heads or food on the table, they did it. This is evidence that the Socioeconomic Status of parents is not always correlated to the achievement of their children. Family members also attended campus visits and tours, meetings, and workshops. By attending these activities, families “increased the odds of students enrolling in college, than for those whose parents had little or no discussion with them” (Choy S. et. al, 2000). This showed the families commitment to ensure that these students would have a better future.

Peers came together in helping one another research colleges and institutions. They helped each other fill out and look for financial aid, scholarships, and grants. Peers networked with one another by recommending professionals who could assist with the college preparation process. Finally, friends understood the importance of an education and also showed support by believing in each other’s career aspirations and goals.

High school educators and programs offered services that allowed students to participate in college prep classes, advising, and college engagement activities. These educators were able to share their personal experiences of the expectations, environments, and adjustment processes of college. When educators become involved in developing college aspirations with these students as early as middle school they help increase the likelihood that these students will pursue higher education.

### Implications

Based on the results of this study, there is significant evidence indicating that if first generation minority students are supported and encouraged by their families, peers, high school educators, and high school mentor programs, the likelihood of transitioning from high school to college is increased. After looking at the experiences of these students it is evident that these students have as much potential to attend college as do other students as long as they have the personal motivation and support to do so. So the question is what can we do in order to better prepare and increase access for these first generation minority students in their pursuit of higher education? I think this may be your research question!!

We need to promote the importance of college engagement activities and recruitment of first generation students from diverse ethnic backgrounds. When students are actively engaged in activities that will expose them to the expectations, information, and knowledge of the college experience students are better prepared for their transition. By giving them an insight to what higher education can offer, students can better determine what school, major, or career they would like to pursue.

Participating in campus visits, workshops, preparatory, and recruitment programs, students will be better prepared for the college transition. Through college engagement activities students and their peers can begin networking and connecting with important campus resources including admissions, financial aid, and academic advising. Through such activities students can begin the research processes for schools, scholarships, and academic programs; they can "receive their first introduction to the attitudinal and behavioral norms of a new academic and social setting" (Terenzini et al., 1994).

We also need to emphasize the importance of family involvement for first generation minority students. The evidence "strongly indicates that parents/spouses play a key role in the support of new students adjusting to a new environment" (Terenzini et al., 1994). Though the parents of these students do not have a 4-year degree or the equivalence of a Bachelor's degree in the U.S., they were able to support their children beyond expectation. Parents may not have had the first-hand college experience but they still provided encouragement, moral, emotional, social, and financial support to these students.

The data suggest that family members provided the most encouragement for these students to pursue high education. Therefore we need to conduct more research on the relationships of students, most especially first generation minority students. Just as it is necessary for students to familiarize themselves with resources to access college, it is also vital that families also familiarize themselves with those same resources so that they too can encourage these students to utilize these resources.

### Conclusion

The preparation and decision to go to college is one that entails research, access to resources, support, and most of all the motivation. For this reason, it is important to understand who, what, why, and how these 42 first generation minority students have successfully pursued higher education. Based on this study, I have found that family, peers, high school educators and mentor programs all influenced these students' decisions to go to college. Today, students from diverse ethnic backgrounds are still less likely to attend institutions of postsecondary education and with the expected increase of "high school enrollment and completion rates of high school students from ethnic minority backgrounds" (C. Pitre & E. Pitre, 2009, p.99). Thus, it is important that we continue doing research on these student population groups. For example, increasing and

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expanding educational/ developmental mentor programs like TRIO, Upward Bound, and Student Support Services in order to accommodate the growing ethnic minority populations.

### Appendix A: Survey Questionnaire

**Directions: Please answer each question as completely as possible.**

#### Demographic information

1. Are you a first generation student? (Neither parent has earned a four year degree (Bachelor's Degree) in the U.S.).

Yes

No

2. Ethnicity origin (or Race): Please specify all that apply.

- Caucasian
- Hispanic or Latino
- Black or African American
- Native American or American Indian
- Asian/ Pacific Islander
- Other (please specify)

3. What is your age?

4. What is your grade level? (please specify)

- Freshmen
- Sophomore
- Junior
- Senior

5. When did you first think about going to college (i.e., elementary school, middle school, high school, after graduation)?

#### Initial College Motivators

6. What was it that first made you think about college (i.e., person, event, program)? Explain the situation; you may include more than one example.

7. Why did you first want to go to college?

#### Educational Support and Guidance

8. Did your school educators (i.e., teachers, counselors, advisors) support you in going to college?

Yes

No

9. If yes, how did your school educators support you in preparing for college? Be specific.

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10. Were you involved in any mentor programs?

Yes                      No

11. If yes, how did the mentor program help you in preparing to go to college?

### **Family Support and Guidance**

12. Did your family support you in preparing you for college?

Yes                      No

13. If yes, how did your family support you in preparing for college?

### **Peer Support and Guidance**

14. Did your peers support you in preparing for college?

Yes                      No

15. If yes, how did your peers support you in preparing for college?

### **Other Support and Guidance**

16. Explain any other sources of support and guidance as you prepared for college.

17. Any other comments that you want to add to explain your journey to college.

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## **Open-access Crystallography database administration: Preparation and upload of 400 structures**

By: Justin Shuck

Faculty Mentor: Dr. Peter Moeck

Shuck, Justin. (2014) "Open-access Crystallography base administration: Preparation and upload of 400 structures" *Portland State University McNair Scholars Online Journal*: Vol. 8

## Abstract

Since 2004, Portland State's Nano-Crystallography Group has provided crystallographic resources including five interactive open-access databases (educational subset of the Crystallographic Open Database (COD), Crystal Morphology Database, Nano-Crystallography Database and Wiki Crystallography Database) as well as a mirror to the whole COD, which is the world's largest open-access crystallography database (with currently over 235 thousand data entries of inorganic, organic, and metal-organic compounds as well as minerals). Before information can be stored inside of databases they must be put in Crystallographic Information Framework files (CIFs), the framework established by the International Union of Crystallography, and the worldwide standard for representing crystallographic information. Recent findings and crystallographic publications will provide a CIF file with the work, however the older publications need their data to be manually entered as a CIF before they can be accessed by the public. Thus, this particular project focuses on generating and uploading an additional four hundred known structures that can be openly accessed through the website hosted by the Nano-Crystallography Group at Portland State University.

## Introduction

This particular project focuses on making significant contributions to the open-access crystallography databases by adding more than four hundred data entries of known structures to be accessible for academic purposes. These data structures are derived from *Structure of Materials: An Introduction to Crystallography, Diffraction, and Symmetry* (De Graef, McHenry 2007). The data entries will be entered into the educational subset of the COD and then later submitted to the COD.

Other important aspects to the project are maintenance and improvements to Portland State's open access-crystallography database infrastructures and adding content to a range of associated websites. The need to further populate the databases and to continue providing valuable resources to the crystallography community is warranted by foreign and domestic website activity and logistic support.

## Background Information

The Crystallographic Open Database (COD) [1] project began in early March of the year 2003. The primary goal of this project was to create a single depository to hold information pertaining to all known small molecules and small to medium sized unit cell crystal structures. Using technology as the driving force, this project aimed to promote crystallography, the science concerned with the structure and properties of matter at the atomic and molecular level, in hopes of worldwide collaboration and growth of scientific knowledge [2]. Using an 'open-access' methodology for the database, the COD offers its information of currently over 235,000 entries for free [3].

The COD stores each individual data entry as a Crystallographic Information File (CIF). The CIF framework was created by the International Union of Crystallography (IUCr) [4] and provides a uniform method of representing and transporting crystallographic information. Each CIF can be searched, accessed and downloaded directly through its primary site and database mirrors. The COD primarily collects data that has been published in the peer-reviewed scientific press; however they also collect data from established crystallographic laboratories. More recent data acquisitions will come in CIF format, while the data from older publications must be manually entered as a CIF before the data can be deposited in the COD. Web software has been created to help create CIFs and encourages researchers to publish their crystallographic data by offering built-in database depositing features.

In July 2004, Dr. Peter Moeck of Portland State University began his "Open-Access Crystallography" project [5]. The goals of the project are to provide free crystallographic resources



to the academic community through the means of interactive databases and useful links to other crystallographic sites. The sites have been maintained by the Nano-Crystallography Group, a set of students mentored by Dr. Moeck and composed of both graduate and undergraduate students. Currently the Nano-Crystallography group maintains two websites, as well as contributes to the web development of other crystallographic websites and resources.

The first site hosts the five interactive databases, information of the Nano-Crystallography Group members and acknowledgments to the contributors of the project. These databases include a mirror to the COD, an educational subset to the COD, a crystal morphology database, Wiki Crystallography database and the Nano-Crystallography database (Figure 1).



**Figure 1:** The five interactive databases that can be openly accessed through the website maintained by the Nano-Crystallography group.

The other site maintained by the Nano-Crystallography group is an informative resource portal (Figure 2). Information of other open-access crystallography projects, tools and articles can be found here, as well as the links to their respective sites.



**Figure 2:** The Open Access Crystallography resources portal, hosted by Portland States Nano Crystallography group, has links to useful crystallographic resources.

## Gathering Data

The process of documenting information of a known structure begins with obtaining information of a specific structure. The data of these structures can come from research or from already published work (in this particular project the data were collected from *Structure of Materials: An Introduction to Crystallography, Diffraction, and Symmetry* (De Graef, McHenry 2007))[6]. Although the CIF framework is fixed, the information that is found inside a CIF can vary based on the compound being documented. However, for the documented CIF to be practical there are particular fields that have to be contained. These fields include chemical equations, chemical name, unit cell constants (unit cell length  $a$ ,  $b$  and  $c$  and unit cell angles), unit cell volume, space group number and symmetry equivalent positions as fractional coordinates xyz (Figure 3).

```

_chemical_name_structure_type    Cu
_chemical_name_common           Bismuth Trifluoride
_chemical_formula_sum            'BiF3'

_cell_length_a                   5.865
_cell_length_b                   5.865
_cell_length_c                   5.865
_cell_angle_alpha                90.000
_cell_angle_beta                 90.000
_cell_angle_gamma                90.000
_cell_volume                     201.746

_symmetry_space_group_name_H-M   'F m -3 m'
_symmetry_Int_Tables_number      225
_symmetry_cell_setting           cubic

```

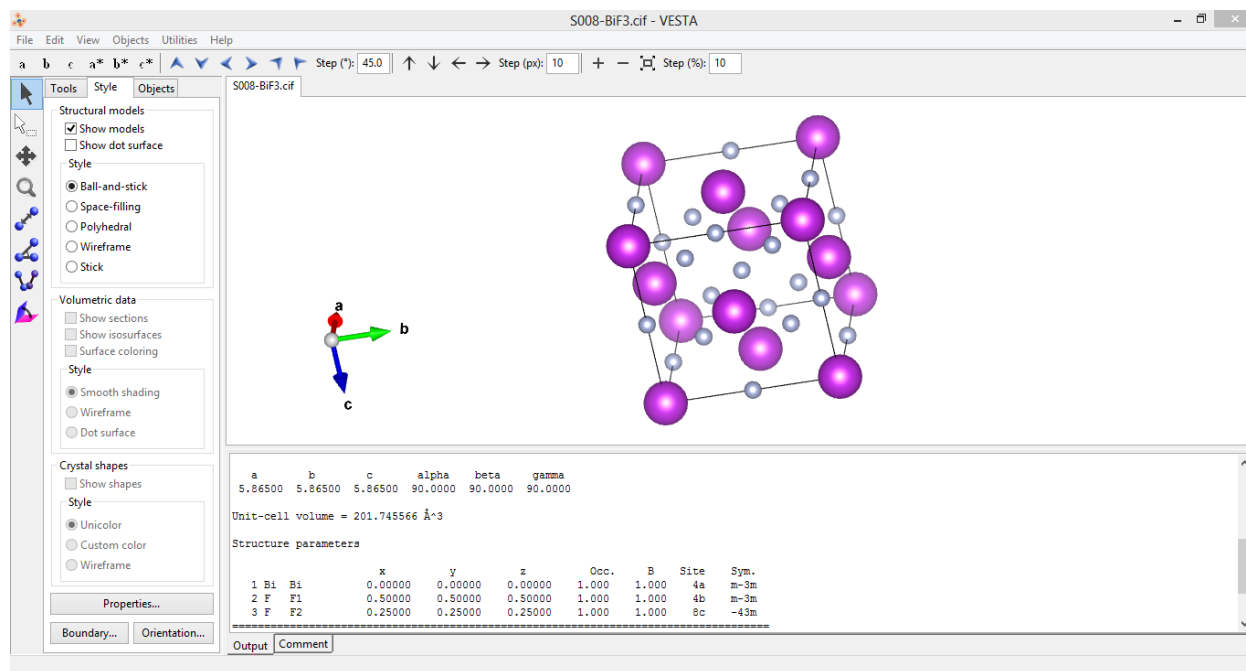
**Figure 3:** Some of the information contained in the CIF documentation of Bismuth Trifluoride ( $\text{BiF}_3$ ).

The IUCr provides many valuable resources of what can be included in a CIF. They also provide information on the way it should be stored within the CIF framework and a brief explanation of each particular field. Referring to these documents and using a text editor geared towards editing CIFs, such as enCIFer, is one way to properly document a known structure in a CIF.

## Verifying Information

EnCIFer is an academic software program developed by Cambridge Crystallographic Data Centre (CCDC) that is available for no charge to the scientific community [7]. The program allows the user to create new CIFs and perform various operations on the file. Some features of enCIFer include syntax coloration/verification (Figure 3), a link to verify entries in the CIF format and a basic structure visualization tool.

After the information is stored as a CIF, the program Visualization for Electronic and Structural Analysis (VESTA) was used to visualize the structure described [8]. The program offers a three dimensional view of the structure and multiple tools that can be used to get a better understanding of the structure (Figure 4).



**Figure 4:** Structure visualization of Bismuth Trifluoride through the program VESTA.

## Open-Access Crystallography Deposition

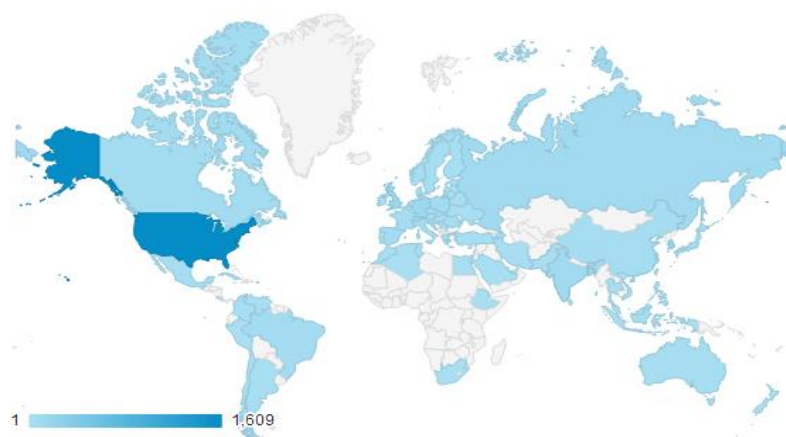
Through the Portland State University Open-Access Crystallography project, known crystallographic structures can be submitted to the different databases that they have developed and maintained. In this particular project the files will be added to the educational subset of the COD. Once they have been uploaded any one can access the files, through our website, for no charge.

Users that register to the website also have the ability to deposit their data to the database of their choice, after a database administrator reviews the work submitted.

## Analysis

The conclusion of this project does not end with the depositing of the created CIFs from the *Structure of Materials: An Introduction to Crystallography, Diffraction, and Symmetry* (De Graef, McHenry 2007). There will always be more known structures to document and deposit for open-access use. As such, there will also be a need to document structures for the other databases. Further populating these open-access databases have just as much importance as promoting the usage of them.

The site that hosts the five interactive databases has seen steady activity over the lifetime of this project. Although the website receives many visits in the United States, it is important to note that our website not only receives international visitors, but that they account for a little under half of our total website activity (Figure 5).

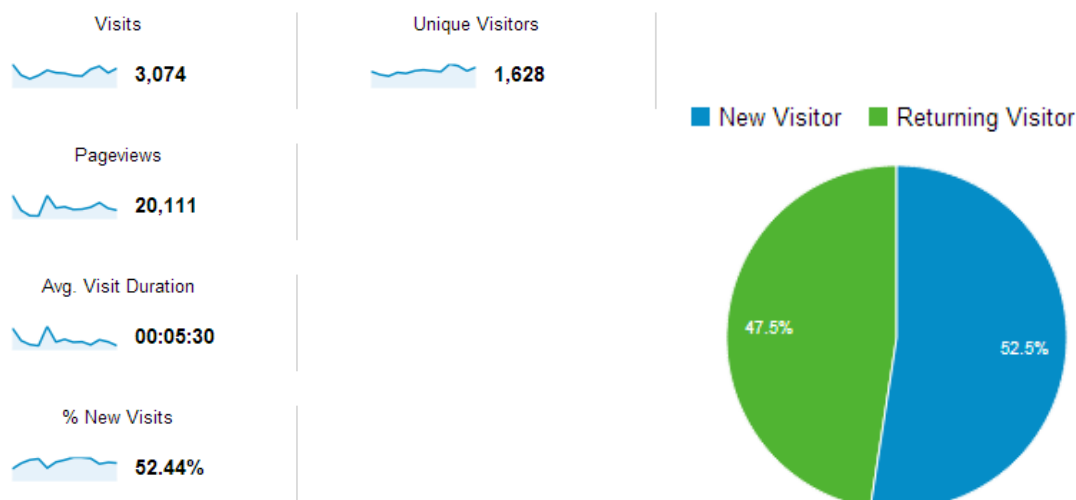


**Figure 5a:** A Map of website activity for the Open-access Crystallography Project (Duration: July 30th 2012 - July 30th 2013).

Country / Territory		Visits	Visits
		3,074	3,074
		% of Total: 100.00% (3,074)	% of Total: 100.00% (3,074)
1.	United States	1,609	52.34%
2.	South Korea	189	6.15%
3.	United Kingdom	150	4.88%
4.	Germany	128	4.16%
5.	India	90	2.93%
6.	Russia	77	2.50%
7.	Poland	74	2.41%
8.	Canada	64	2.08%
9.	Brazil	51	1.66%
10.	Spain	46	1.50%

**Figure 5b:** A map and table of the website activity where the five interactive databases are hosted (Time duration: July 30th 2012 - July 30th 2013).

In the one year span, the open-access databases amassed over three thousand visits with over fifty percent of them accessing our website for the first time (Figure 6). This shows that not only are we able to attract new people to access our crystallographic resources, but we are also retaining those who have used our site before.



**Figure 6:** A breakdown of website activity, specifically exploring the number of visitors and returning visitors (Time duration: July 30th 2012 - July 30th 2013).

### Future Work:

The Open-Access Crystallography project will continue to work on providing crystallographic materials to the academic community. These contributions will come in the form of new databases, adding new content to the current databases and maintain the web portal with links to crystallographic materials.

As a crystallography research team, we aim to contribute meaningful work to the academic community. This begins with the development with the first ever open-access Bi-crystallography database. Other work includes developing a program that can add additional meaningful information to the CIFs currently in our database. This will be followed by papers, presentations and conference contributions to help promote and advocate our databases.

### Acknowledgments

Special thanks to my mentor Dr. Peter Moeck, Ryan Lerud and Galen Gledhill for the invaluable advice and mentoring, the Portland State McNair staff for the opportunity and those who have contributed to this opportunity.

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<http://www.ccdc.cam.ac.uk/Solutions/FreeSoftware/Pages/EnCIFer.aspx>
- [8] Visualization for Electron and Structural Analysis (VESTA)  
<http://jp-minerals.org/vesta/en/>

**Historical vegetation of three salmon-bearing watersheds in the interior  
Columbia River basin**

By Tyanna Smith

Mentor: Seth White

Smith, Tyanna. (2014) "Historical vegetation of three salmon-bearing watersheds in the interior Columbia River Basin" Portland State University McNair Scholars Online Journal, Vol. 8, 2014

## **Abstract**

Land use practices can be a contributing factor to environmental degradation and have been the focus of many ecological studies. One aspect that is less addressed is land use history and the effects that past practices, such as logging and grazing, can have on the current landscape. This paper describes research and the synthesis of material on the environmental history and watershed characteristics for three watersheds located within spawning and rearing areas for Chinook salmon in the Grande Ronde River Basin in Northeast Oregon: upper Grande Ronde River, Catherine Creek, and Minam River. The Grande Ronde Basin is critical spawning and rearing habitat for salmonids listed under the Endangered Species Act. The primary historical data sources for reconstructing 19th century stream and riparian conditions are the General Land Office township survey notes from 1863 - 1901. Data about the habitat conditions of the landscape were extracted from notes of each township survey source regarding vegetation, stream crossings, and other features found on the landscape in tabular and spatial forms. Data were organized to describe common stream and riparian conditions for the historical time period using a geographic information system. Watershed basin, Chinook salmon life history, ecoregion and surveyor were analyzed using multivariate techniques to determine which parameters were strongly connected to historical vegetation. Ecoregion had the strongest correlation with plant communities. For future research, these historical data could be compared to current habitat survey data, such as the Oregon Department of Fish & Wildlife's Aquatic Habitat Inventories, to evaluate the degree of change over time of stream and riparian conditions.

## **Introduction**

Land use practices, past and current, in watersheds can have negative impacts on the structure and proper function of water bodies (Maloney et al., 2008; Harding, Benfield, Bolstad, Helfman, & Jones, 1998). Humans have influenced the environment on a landscape scale and have disrupted the geomorphic and riparian processes that maintain streams and rivers and their biota. This can result in stream habitat that is degraded and less heterogeneous (Allan, 2004). Agriculture is the main land use activity by humans that covers the largest fraction of land area, or watershed catchment areas, in many developed watersheds (Allan, 2004). Urban areas usually make up a small percentage of total catchment areas, but often have a large influence on the associated rivers and streams. Other types of land use that negatively affect streams are forestry, mining and recreation (Allan, 2004), which are predominant within the study area.

The negative impacts from land use come in various forms. Agriculture is present in the project area and has many different effects on watersheds. Effects that can harm salmon habitat include soil erosion, sediment transport and deposition downstream, on-site pollution from overuse and secondary effects of fertilizers and pesticides, off-site pollution of adjacent areas, deforestation, desertification, degradation of aquifers, salinization, accumulation of toxic metals and organic compounds, and loss of biodiversity (Botkin & Keller, 2009). An overload of nutrients can lead to algal growth, deposition, and decomposition by bacteria which consume a majority of the dissolved oxygen in the stream (Murdoch, Cheo, & O'laughlin, 2001). Deforestation caused by agriculture, forestry, or long-term grazing can increase soil erosion and delivery of sediment into the stream channels, expose impermeable lower soil layers, and reduce the amount of canopy cover over the streams. In general, an overload of sediment into streams can result in channels being less sinuous, broader and shallower (Charlton, 2008).



Another important impact within our project area is cattle grazing. Cattle, grazing in the riparian zones of streams, trample the banks and consume high amounts of vegetation, destabilizing the bank and resulting in erosion. At high grazing densities, cattle can consume the vegetation faster than it can grow, which results in the loss of some plant species and a dominance of less beneficial species (Botkin & Keller, 2009). Overgrazing of riparian areas can result in destruction of fish habitat by removing overhanging vegetation, which fish use for cover and by sloughing stream banks (White & Rahel, 2008).

These land use types have negative effects on the environment and have been well studied. However, there has been comparatively less research on historical agricultural practices and other types of historic land use and how this may still be affecting the environment or determining its current state. Recently there have been articles published on the environmental history of an area from the recognition that it plays a large role in its evolution. Historical land use has been shown to be a major contributor to current environmental composition from local to landscape scales. It has also been shown to affect forests by controlling the modern vegetation patterns by decreasing species diversity and homogenizing soils (Foster et al., 2003), as well as reducing the amount of woody debris located in riparian areas of streams and rivers, which negatively impacts the entire stream or river food web (Clarke & Bryce, 1997; Foster et al., 2003).

Riparian vegetation plays a major role in understanding environmental history of a watershed. This vegetation has an important impact on water temperature and the amount of suspended solids entering the stream from bank stabilization. The loss of canopy cover can result in an increase in stream temperature, which can reduce the dissolved oxygen levels (Murdoch et al., 2001). The absence of riparian vegetation can destabilize stream banks and increase soil erosion entering the stream which will increase the amount of suspended solids and decrease dissolved oxygen levels (Clarke & Bryce, 1997; Murdoch et al., 2001). Sparse riparian vegetation can also lead to a decrease of large woody debris (LWD). Stream complexity is increased by LWD as water flows around and through it and creates areas in the water with different depths, velocities, substrate types, and amount of cover. Woody debris increases the amount of depth of pools large enough for salmon to use as cover and creates more diverse physical habitat. It may also create pockets of cool water which would aid survival of salmonid species (Quinn, 2005).

Classifying the landscape by ecoregion where Chinook salmon (*Oncorhynchus tshawytscha*) currently spawn and rear can provide an ecological basis to establish boundaries that assist in identifying stream potential for supporting freshwater species distribution, unlike applying administrative boundaries that merely define states and counties. Classifying watersheds within ecoregions can help in describing the expected conditions and riparian vegetative characteristics of the watersheds and help make predictions of how watersheds in similar ecoregions will respond to certain types of land use and/or degradation (Clarke & Bryce, 1997).

The objective of this research was to describe patterns of historical vegetation of the mainstems of the Upper Grande Ronde River, Catherine Creek, and the Minam River and their corresponding ecoregions in the locations where Chinook salmon currently spawn and rear using information from the Government Land Office (GLO) township surveys (1863 – 1901). The larger project objective is to classify the historical landscape of this area in order to conduct further research to be able to make comparisons with current vegetation and analyze how land use has altered the environment since the GLO surveys were conducted. Questions analyzed for this research paper are:

1. How were historical plant communities distributed in the watershed area?

2. Which watershed scale factors (life use area, watershed basin, or ecoregion) best explain variation in historical vegetation patterns?
3. Are individual plant taxa indicative of these watershed scale factors?

## Methods

### Study Area

The study area is located in Northeast Oregon in the Grande Ronde Basin and includes the upper Grande Ronde River, Catherine Creek and the Minam River (Figure 1). The Upper Grande Ronde River, Minam River, and Catherine Creek have drainage areas of 1,896 km<sup>2</sup>, 1,051 km<sup>2</sup>, and 618 km<sup>2</sup> respectively. The headwater topography consists of rugged mountains and a low gradient valley between the Blue and Wallowa Mountains for the Upper Grande Ronde River and Catherine Creek. The majority of these watersheds' surface geology consists of Columbia River Basalt rocks, granitic intrusive rocks and older volcanic rocks. These watersheds have a climate of cold, moist winters and warm, dry summers. In the valleys, the average annual precipitation is 36 cm (14 in) with 152 cm (60 in) in the mountains and consisting mainly of winter snow fall (McCullough, White, Justice, Lessard, & Hill, 2013).

Very recent vegetation descriptions of the study area include low elevation regions which consist of grasslands with Idaho fescue-bluebunch wheatgrass (*Festuca idahoensis-Agropyron spicatum*) and bluebunch wheatgrass-Sandberg's bluegrass (*Agropyron spicatum-Poa sandbergii*). The higher elevations consist of shrub/scrub plants and coniferous forests, with species such as Ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), subalpine fir (*Abies lasiocarpa*), and mountain hemlock (*Tsuga mertensiana*). The majority of vegetation in the riparian zone are black cottonwood (*Populus trichocarpa*), mountain alder (*Alnus incana*), willow (*Salix spp.*), black hawthorn (*Crataegus douglasii*), and mountain maple (*Acer glabrum*) (McCullough et al., 2013).

This area has been influenced by humans since before the European settlers. Early travelers noted that Native Americans used fire as a land management technique and grazed horses (Robbins & Wolf, 1994). Many explorers and fur traders came to this area for beavers and commodity purposes which also altered the land. The Grande Ronde River has undergone much larger changes since the very early European settlement. A study conducted in 1990 retrieved stream surveys from 1941 and found that there has been a 60% loss in pool habitat and an increase in concentrations of fine sediments in Chinook salmon spawning areas since the surveys (Wissmar et al., 1994). A more recent study demonstrated that pool frequencies have increased or remained the same in 96% of minimally disturbed streams but have decreased in 52% of streams managed for the extraction of natural resources (McIntosh et al., 2000). Surveys from the Wallowa-Whitman National Forest claim that more than 70% of stream miles do not meet current Forest Plan standards for sediment, shading, temperature and adequate LWD. These factors indicate that there has been severe degradation of the stream and riparian habitat throughout the Grande Ronde Basin (Wissmar et al., 1994).

### Spring Chinook Salmon in Study Area

The three watersheds contain populations of spring Chinook salmon, which were listed as threatened in 1992 under the Endangered Species Act. Decreases in these populations can be attributed in large part to degradation of their habitat. Anthropogenic disturbances in this area consist of timber harvest, cattle grazing, levee and road construction, and stream diversions for irrigation. Limiting factors for Chinook salmon habitat quality include stream temperature, stream flow, fine sediment, habitat diversity, and large pools (McCullough et al., 2013).

Chinook salmon are the largest of the Pacific salmon species and have populations that migrate upstream in the spring, summer and fall. The Grande Ronde basin currently has spring and fall Chinook populations. They spawn in areas with large gravel and cold waters in the mainstem of the Grande Ronde River and its major tributaries. In order for Chinook salmon to successfully spawn and produce offspring, there are certain habitat requirements that need to be met. Two of the most important requirements for development of salmon are cold water temperatures and high dissolved oxygen levels (Quinn, 2005). Water temperature has shown to be lacking and limiting salmon production in varying degrees in the study area (McCullough et al., 2013). Riparian vegetation is important for the survival of fish in the summer months by providing shade but also in the winter months where it moderates the loss of heat from the stream and prevents ice forming (Clarke & Bryce, 1997).

### *Government Land Office Surveys*

The GLO surveys conducted in the mid to late 19<sup>th</sup> century were originally intended to provide information to prospective settlers regarding timber harvest, agriculture and animal grazing. During the GLO survey, a surveyor walked each 1 mile section line in which the township was broken up into 36 sections of 1 square mile. Surveyors also walked to boundaries of all townships. Distance at the time of the surveys was measured in chains and chain links, where 80 chains equals one mile. Most surveyors recorded when vegetation, streams/rivers/wetlands, human structures, trails/roads, or other noteworthy features or landscape objects were located on the one mile line representing a section border. Upon completing a township, the surveyor usually noted a general description of the township.

Methodologies for extracting information from GLO surveys were adapted and revised from McAllister (2008). GLO survey notebooks were viewed online at the Bureau of Land Management website (<http://www.blm.gov/or/landrecords/survey/>) and used as a primary data source to spatially locate on a map the vegetation types, landscape characteristics, and human features described in the handwritten notes. ESRIs geographic information system (GIS) ArcMap 10 was used to map the data extracted from surveys.

A point was plotted in GIS for each feature at the location along the township section line (Figure 2) and the information about the feature was recorded in a GIS attribute table. A general description was written about each section line's vegetation and soil quality. Data recorded in the GIS attribute table which originated from the surveys consist of date surveyed, surveyor, stream crossing names, width and depth, soil type, human structures, and a number of vegetative species. Data created from the surveys include an accuracy rating of exact feature location versus point placement, animals, and Native American uses. Township summaries were recorded in a separate document along with an image of the original data (Figure 3) and hand drawn maps (Figure 4).

### *Data Analysis*

In order to select the points for analysis of the research questions, township and section lines were selected that crossed the GIS line features representing current spawning and rearing of Chinook salmon along the mainstem of the Grande Ronde River, Catherine Creek and Minam River. Each section line was given its own unique identifying code. The transect data, which were representative of the section lines, were then entered into tabular form to classify by their vegetation summary category which fell mutually according to Chinook salmon spawning or rearing areas. Transects were also attributed by level IV ecoregion. Nonmetric multidimensional scaling (NMS) was used to describe multivariate patterns of upland versus riparian plants across the project area. Upland and riparian plants were categorized using the Natural Resources Conservation Service riparian plant identification field guide (NRCS, 2008). A multiple response permutation procedure (MRPP) was used to test for categorical (salmon life history use, basin, ecoregion) differences in plant community taxa. Indicator species analysis (ISA) was used to test whether particular taxa were good indicators of categorical descriptors such as life stage use, basin and ecoregion. Only the taxa with an occurrence of 5% or greater were included in the analysis (Table 1). Two ecoregions were excluded from MRPP and ISA analyses due to containing only one transect (Table 2). Because GLO surveyors had varying ability to identify vegetation taxa, we also tested for the effect of surveyor on the recorded plant community structure.

## Results

### *Question 1: Distribution of plant community types*

Throughout the study area, upland versus riparian plants displayed a difference in key taxa describing the community composition, as demonstrated by their NMS scores (Table 3). Riparian plants had higher positive NMS values and upland plants had lower negative values (Figure 5). This helps to display the differences in areas of growth and development of each plant taxa. The plant taxon with the highest NMS score was cottonwood (1.192) and was the most representative of a riparian taxon, while pine (-0.612) had the lowest NMS score representing upland plants.

### *Question 2: Watershed-scale factors affecting plant communities*

Ecoregion, basin, life history and surveyor all were significantly representative of historical plant taxa distribution. Of the environmental factors, ecoregion revealed the strongest relationship to historic plant spatial distribution (*A-statistic* = 0.255), followed by basin (*A-statistic* = 0.108) and Chinook salmon use (*A-statistic* = 0.019, Table 4). Surveyor was also strongly correlated with the highest NMS score representing the vegetative distribution (*A-statistic* = 0.484). An ordination plot revealed that the ecoregions Wallows/Seven Devils Mts and Mesic Forest had similar species composition, while the Maritime Influenced Zone represented more upland plants and the Blue Mt Basin was more reflective of riparian plant species (Figure 6).

### *Question 3: Plant taxa indicators*

The ISA phi scores show that individual plant taxa were statistically indicative of certain ecoregions ( $p = 0.05$ ) (Table 5). Species with statistically significant relationships with the Maritime Ecoregion were grass ( $\phi = 0.409$ ), pine ( $\phi = 0.457$ ) and tamarack ( $\phi = 0.230$ ). Species with statistically significant relationships with the Blue Mt Basin were cottonwood ( $\phi = 0.587$ ) and willows ( $\phi = 0.470$ ), while balm ( $\phi = 0.378$ ) was indicative of the Wallows/Seven Devils Mts (Figure 7). The Mesic forest zone was included

in the analysis but did not have any statistically significant indicator taxa. Fir, spruce and alder were not statistically indicative of any of the ecoregions analyzed.

## Discussion

GLO survey data for key plant taxa revealed a significant difference when data were stratified by position on the landscape (e.g., riparian vs. upland). A study conducted by Pabst and Spies (1998) demonstrated the composition of vegetation as representing a complex environmental gradient from the streamside to the lower hillslopes with the vegetative patterns being related to specific landforms and topography. This helps to explain expected plant taxa composition and distribution with emphasis on their location. The differences in the NMS scores between the community types show that the GLO surveys exhibited consistency regardless of observer which matches what we know about major vegetative transitions from riparian to upland areas (Pabst & Spies, 1998).

Spawning versus rearing areas were analyzed only in the Upper Grande Ronde River and Catherine Creek because data in the rearing areas of the Minam River were not retrievable on the BLM site. This factor may be important to explain why the smallest A-statistic is in the life history and not any of the other parameters analyzed. Though surveyor had the strongest statistical significance, there needs to be more data exploration in order to conclude its legitimacy. Therefore, ecoregion is interpreted to display the closest connection to vegetation distribution due to its lack of potential biases. This result is supported by McAllister (2008) study who also found that some plant taxa are highly ecoregion specific and others are not. This helps to verify the use of ecoregions when displaying plant characteristics and distribution. Not including the surveyor data, basin has the second highest connection to vegetation type. The Maritime Influenced Zone ecoregion contains only transects in the upper Grande Ronde River. The Wallowas/Seven Devils Mts contains part of the Minam River and Catherine Creek while the Blue Mt Basin contains the Minam River and the upper Grande Ronde River. Since each ecoregion contains only one or two of the study basins boundaries within it, basin in conjunction with ecoregion can be used as a second predictor of the plant communities present.

Analyzing plant distribution from various factors can show how it can be predicted by landscape attributes, such as ecoregion and basin. A study conducted by Kooch, Jalilvand, Bahmanyar, & Pormajidian (2008) identified indicator species to show differential distributions between plant groups and to help distinguish between different plant groups which validated how certain species can be indicative of a plant type or location. Clarke & Bryce (1997) describe the Maritime Influenced Zone as receiving some of the most precipitation within the Blue Mountains. The higher relative precipitation across the Maritime Influenced Zone causes xeric (e.g., characterized by Ponderosa pine and bunchgrass) upland habitats to be found at lower elevations than in other ecoregions of the Blue Mountains. Pine was indicative of the maritime influenced zone in our ISA results. Willow was an indicator species for the Blue Mt Basin ecoregion which has a dynamic relationship with its floodplain and is heavily grazed by cattle and elk. Balm, which is believed to be the evergreen shrub *Ceanothus velutinus*, has common names mountain balm and snowbrush and was indicative of the Wallowas/Seven Devils Mountains. Clarke & Bryce (1997) described the native vegetation of this ecoregion to include pines, firs, and various types of evergreen and deciduous shrubs (i.e., Mountain big sagebrush (*Artemisia tridentata* vaseyana) mallow ninebark (*Physocarpus malvaceus*), and western serviceberry (*Amelanchier alnifolia*)).

This study showed the significance of ecoregions influencing the distribution of upland and riparian vegetation. Chinook salmon habitat conditions are being monitored in three study watersheds within the Grande Ronde basin (the upper Grande Ronde River, Catherine Creek, and the Minam River) (McCullough et al., 2013). Riparian vegetation restoration to potential natural conditions is essential to the full recovery of the listed spring Chinook salmon populations in these watersheds. Identifying historical indicator plant communities within the riparian zones of various local ecoregions from historical surveys could be a means to identify reference conditions for restoration goals of Chinook salmon spawning and rearing areas which have been affected by anthropogenic land use practices. Monitoring the current landscape for the indicator plant species distribution and abundance, which are assumed to be the representative plant communities of historical ecoregions, could be a gage on how much change has occurred and how much effort will be needed for restoration.

A source of error in the data could be surveyor bias. Methodologies and protocols used to survey the land were different for regions and time periods in which the surveys were conducted. "Bearing" trees (i.e., trees used to sight compass bearings from points on the section lines) were recorded only if they had a diameter greater than 2.95 in (7.5 cm) and the level of completeness in data entry varied from surveyor to surveyor (Collins & Montgomery, 2001). Some surveyors presumably had more knowledge about vegetation than others and some may have had more familiarity with Eastern U.S. plants and not of Western plants. Therefore, plants may have been misidentified due to surveyor lack of knowledge of plant species of the Pacific Northwest. Surveyors were also looking at the landscape for potential resource extraction and were biased in describing plants that could be harvested for timber or were indicators of rich soil for farming. Settlements and roads were recorded in the GLO surveys indicating that there has been some land use activity in this area before the surveys were conducted, meaning that some areas may have already had their vegetation altered and did not represent the true historical vegetation. Since we have not collected all the data yet for the study area, another source of error is variation in sample sizes and the exclusion of the Minam River basin in the rearing data. Excluding the Minam River basin in the rearing analysis does not provide a complete analysis of the study area and may be biasing the results due to potential differences in vegetation among basins.

This preliminary analysis showed that the ecoregion may be the best predictor of vegetation communities and that some plant species may be indicators for an ecoregion. The historical data can be used as a tool to determine reference conditions for comparison of past and current vegetation located within a site and help predict which plant communities are to be expected at the site location. Further analysis of the different types of data noted in GLO surveyor notes could include surveyor biases, changes in stream complexity and sinuosity, changes in abundance and distribution of historical vegetation, and identifying the leading land use practices which led to changes in environmental conditions.

## **Acknowledgements**

I thank the Portland State University Ronald E. McNair scholars program and staff, Dr. Toeutu Fa'aleava, Dr. Jolina Kwong-Caputo, Jennifer Robe, and Kristy Schepker for providing funding and support to conduct this research. I also thank the Columbia River Inter-Tribal Fish Commission staff in particular Dr. Seth White, Denise Kelsey, and Dr. Dale McCullough for providing me the opportunity to conduct research. Multivariate data analyses were conducted by Dr. Seth White.

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## Figures

### Grande Ronde Basin Study Areas

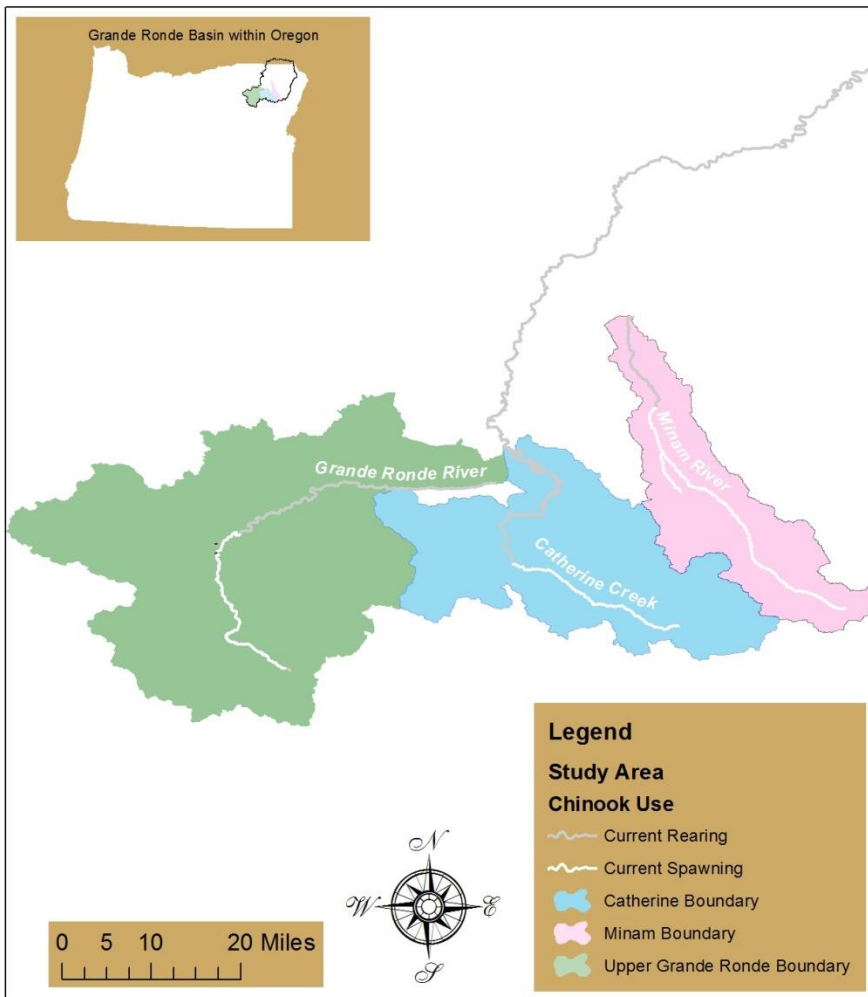


Figure 1: Study areas located in the Grande Ronde Basin which includes the mainstems of the Upper Grande Ronde River, Catherine Creek, and the Minam River.

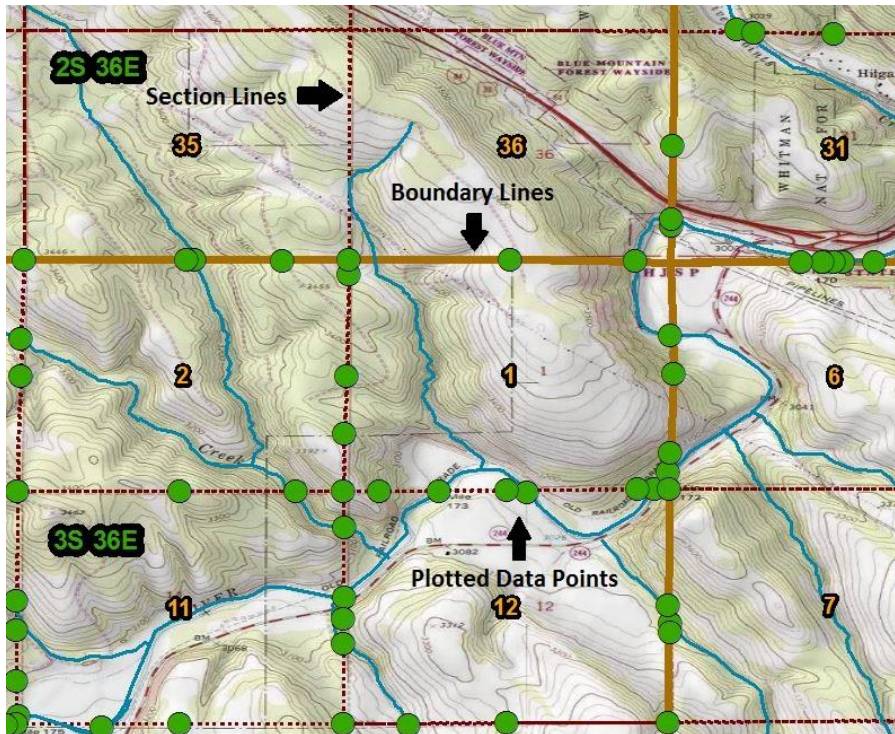


Figure 2: Use of Geographic Information System to plot data points (colored in green) retrieved from Government Land Office Township surveys in the Grande Ronde Basin.

*General Description*  
 The land in this township is high and mountainous, heavily timbered with pine, fir and tamarack, timber of fair quality, and some undergrowth of fir, tamarack and pine.  
 The soil is generally 2<sup>nd</sup> rate, except along Starkey and McCoy creeks, where there is some good bottom land, and several claims have been taken on in Sec. 35 and one in Sec. 3.  
 The township is well watered by Starkey and McCoy creeks and many small springs and brooks.

Figure 3: Example of hand written Government Land Office township summary survey document circa 1882 for the Grande Ronde River basin.

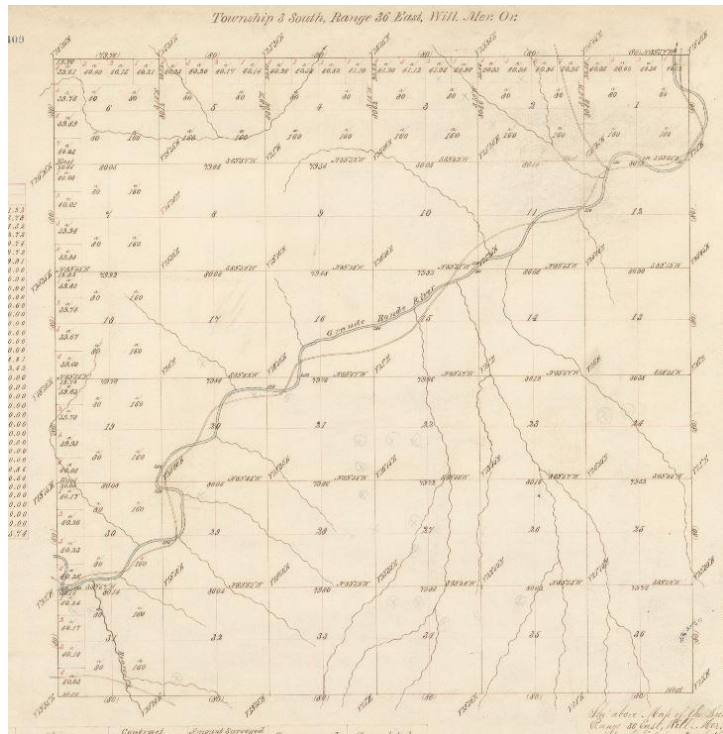


Figure 4: Example of hand drawn map based off of Government Land Office township surveys circa 1874 upon completion of township survey in the Grande Ronde Basin.



# NMS Transect Scores

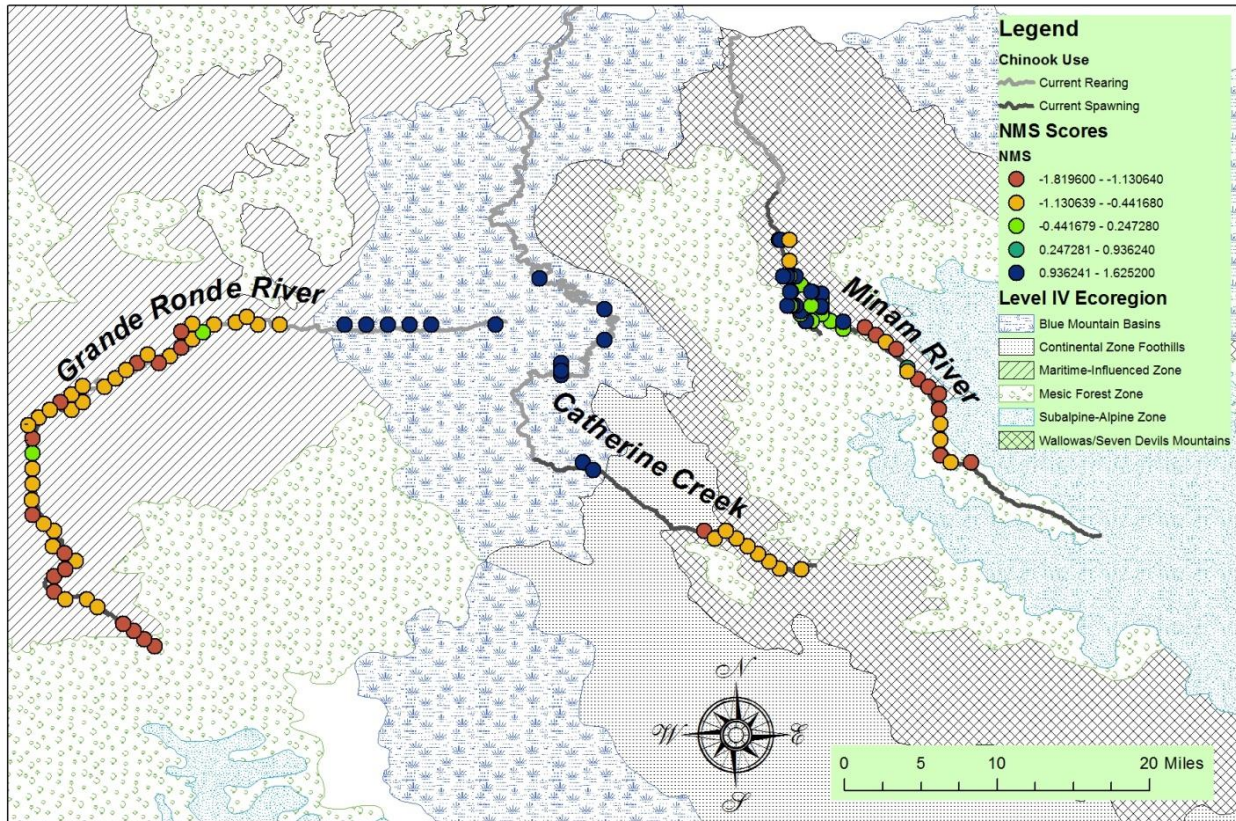


Figure 5: Upland versus riparian vegetation in the Grande Ronde River basin with riparian plants consisting of the higher positive NMS scores and upland plants having a lower negative NMS score.

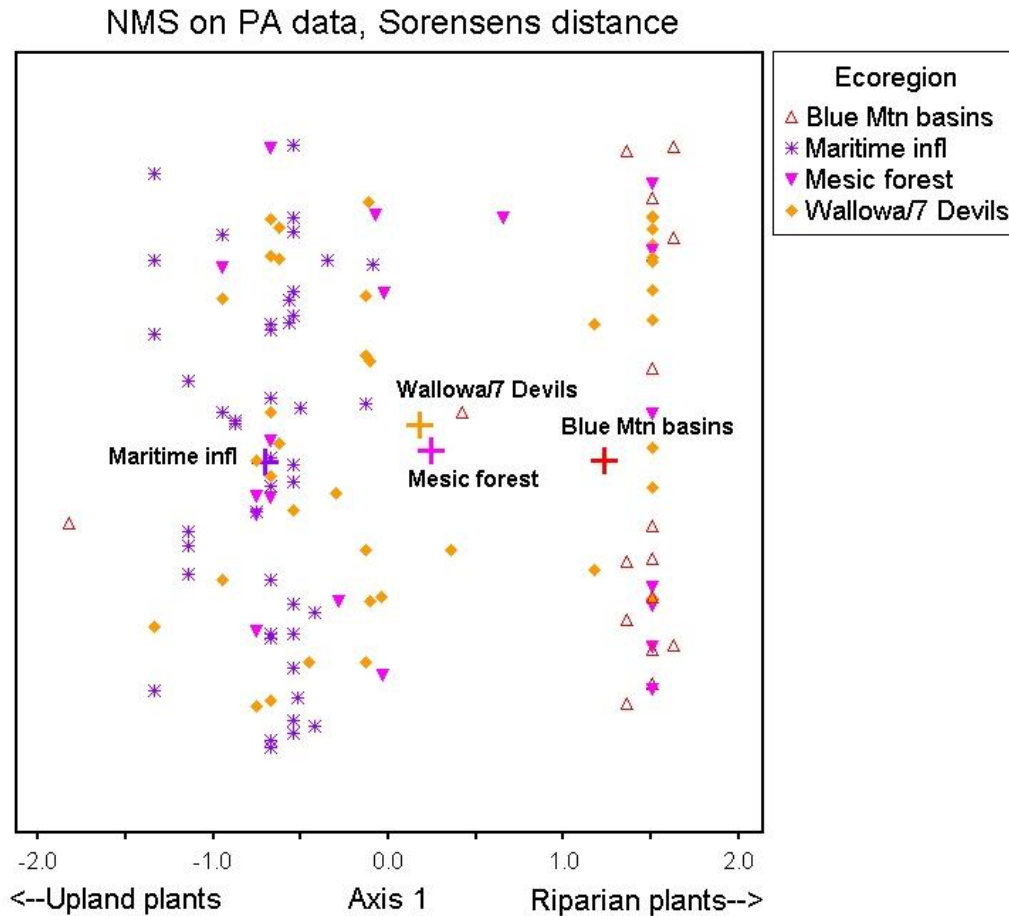


Figure 6: Nonmetric Multidimensional Scaling ordination plot of upland versus riparian plants located within each ecoregion present.

## Tables

Table 1: All plant taxa present in study area. Species with asterisk (\*) had a presence of 5% or greater and were used in analysis.

Taxa	
Alder*	Hemlock
Balm*	Maple
Birch	Mt Mahogany
Cottonwood*	Mt Laurel
Crabapple	Pine*
Fir*	Rose
Grass*	Spruce*
Willow*	Tamarack*

Table 2: Ecoregions within study area. Ecoregions with asterisk (\*) had locations on more than one transect.

<b>Ecoregions</b>	
Blue Mt Basin*	Continental Zone Foothills
Mesic Forest Zone*	Wallowas/Seven Devils Mts*
Maritime Influenced Zone*	Subalpine/Alpine Zone

Table 3: Nonmetric Multidimensional Scaling values for presence/absence of each species.

<b>Taxa</b>	<b>NMS Value</b>
Cottonwood	1.192
Willow	1.017
Alder	0.212
Spruce	-0.103
Balm	-0.220
Grass	-0.478
Fir	-0.498
Tamarack	-0.521
Pine	-0.612

Table 4: Multi-Response Permutation Procedures against riparian vegetation data using Sorensen (Bray-Curtis) distance measures and rank transformed distance matrix.

<b>Category</b>	<b>Number of Groups</b>	<b>A- Statistic</b>	<b>P-value</b>
Chinook Use	2	0.019	0.021
Basin	3	0.108	4.70E-07
Ecoregion	4	0.255	< 1.0E-08
Surveyor	11	0.484	< 1.0E-08

Table 5: Indicator values for taxa type versus ecoregion.

<b>Ecoregion</b>	<b>Taxa</b>	<b>Phi Scores</b>	<b>P-value</b>
Blue Mt Basin	Willow	0.378	0.0014
	Cottonwood	0.587	0.0002
Maritime Influenced Zone	Grass	0.409	0.0004
	Pine	0.457	0.0002
	Tamarack	0.230	0.0310

Wallowas/Seven Devils Mts	Balm	0.470	0.0004
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**Go Before You Go: How Public Toilets Impact Public Transit Usage**

by  
**Kate M Washington**

**Faculty Mentor:**  
**Dr. James G. Strathman**

Washington, Kate M. (2014) "Go Before You Go: How Public Toilets Impact Public Transit Usage" *Portland State University McNair Scholars Online Journal*: Vol. 8



## **Abstract**

The emphasis on sustainable solutions in Portland, Oregon includes developing multi-modal transportation methods. Using public transit means giving up a certain amount of control over one's schedule and taking on a great deal of uncertainty when it comes to personal hygiene. Buses, the MAX, and the Streetcar – the cornerstones of public transit in Portland – are not equipped with toilets and rarely are their stations, while most shops and restaurants reserve toilets for patrons only. As a result, many people may bypass public transit in favor of cars, which afford travelers greater autonomy and flexibility. Theories of New Urbanism endorse urban lifestyles, where all a person's needs are within a "twenty-minute neighborhood." The reality is that many people commute to work or school outside that radius. As sustainability focuses on public transit, it must also consider the needs of the public for hygiene and dignity. Using data from an online survey of Portlanders and applying New Urbanism's lens, this article examines the relationship between public toilet availability and public transit usage. Understanding this correlation may enable communities, planners, and administrators to create sound strategies that may increase ridership and align with sustainability goals.

Keywords: public toilet, public restroom, public bathroom, New Urbanism, toilet availability, Portland, public transit, walkability

## **INTRODUCTION**

The United States, while perfectly willing to provide rest stops along highways, seems to be opposed to public toilets in urban settings. Parks, yes. Thoroughfares, no. Much of this hesitation revolves around budgets. Even cities that built public services along with public transit have closed many toilets due to budget cuts. Public toilets must be maintained or they simply become social problems and bio-hazards. Some of this hesitation is cultural. Rural communities had long dealt with public excretion and few communities expanded beyond a twenty-minute walk, so there was less need there for public toilets. However, as the Industrial Revolution crowded people into cities, innovations in water and sewer made the difference between healthy workers and the spread of disease. There was a time, in the late 1800s and early 1900s, that public utilities were among the popular measurements of a successful city.

Today, Americans primarily live in suburbs and drive cars instead of living in cities and walking or using buses, light rail, and streetcars. Americans are very individualistic, expecting people to provide for their own health and security. This includes bowels. However, since the extended recession, urban living has become increasingly attractive and residential growth in city cores is increasing. Theories of urbanism endorse "twenty-minute neighborhoods," much like communities of yore, where all a person's needs are within walking distance. Today, those needs include non-automobile transportation to take people to destinations beyond their twenty-minute radius.

Public transit is more sustainable than individual car ownership and cities spend millions of dollars implementing multi-modal transportation strategies. Using public transit, however, means giving up a certain amount of control over one's schedule and surrendering oneself to the public transit system, for good or ill. As if that weren't daunting enough, it also means taking on a great deal of uncertainty when it comes to personal hygiene. Unlike in a car, one cannot simply return home or pull over at a gas station to use a toilet. Buses, light rails, and streetcars are not equipped with toilets, nor are their stations. Disembarking from a bus to find a toilet open to the public means 1) a walk to the nearest toilet and 2) another wait for the next bus. As a result, many people bypass public transit in favor of cars, which afford travelers greater autonomy and flexibility.

## **LITERATURE**

This article proceeds as follows. First, it briefly discusses the history of public toilet policy from ancient times to the present, then it summarizes the theories of New Urbanism that emphasize walkability and "twenty-minute neighborhoods" and examines toilets as the missing link in the success of

walkable neighborhoods. Next, it briefly describes the methodology and results of the research and finally, draws conclusions and makes recommendations for possible solutions.

## **A History of Public Toilet Policy**

There was a time when the provision of public toilets was a thing taken for granted, not a matter of social policy or urban planning. The history of toilets dates back to the first bowel movement, the first urination. The first trough dug outside an encampment, the first bucket of “night soil” dumped on a garden. In ancient Rome and England, public latrines were the norm – except for wealthy people. The Romans even had a goddess of the sewers, Cloacina. In Medieval London, public latrines were centrally located near main bridges, overhanging rivers. They were such a normal and popular part of people’s lives that one particular 84-seater, Whittington’s Longhouse, was named after the Mayor of London, Dick Whittington. Queen Mathilda even sponsored a latrine (Greed, 2003, p. 33). At this time in history, chamber pots were regularly emptied out an upper story window or the “nightsoil man” collected their contents daily to create fertilizer. Human waste was a valuable industry and commodity for agriculture even up until post World War II (Greed, 2003, p. 36).

Modern concepts of hygiene and public toilets evolved out of the problems of the Industrial Revolution. During and after the Industrial Revolution, cities swelled and poorly built homes around factories and mills were crammed with workers and their families. Thousands of people, densely packed into dirty and dangerous tenements was a recipe for outbreaks of communicable diseases. In 1854, after Dr. John Snow linked one contaminated pump in London to a major cholera outbreak, the state began to invest in public works to alleviate public stench and disease. In fact, one might say the roots of planning are firmly in the sewers (Greed, 2003, p. 38).

Sanitation policy of the early 20<sup>th</sup> century firmly established our modern system of water-based sewers and flush toilets. The installation of sewers and the building of public works were a matter of civic pride to Victorian Londoners. No expense was spared. Great systems of pumps, pipes and palatial toilets were funded in style. Despite a global prevalence of collecting and composting waste disposal methods, as front gardens disappeared and the distance between the city and the country increased (reducing the need and feasibility of waste collection, earth closets and night soil buckets), water-based sewerage systems developed. The invention of flush toilets in 1870 firmly linked water and toilets in the Western world, establishing baseline sanitation standards and principles.

A second contribution of the Industrial Revolution was the transportation revolution. Cheap mass transit such as trains, trollies and horse-drawn streetcars, generated demand for public facilities (Greed, 2003, p. 47). As distinct districts evolved (a product of evolving land use policy), people lived further from where they worked, therefore, they were away from their toilets for longer amounts of time. In addition, women joined the workforce, commuting alongside men and increasing the need for public facilities, including toilets. Modern patterns of home life, work space and the commute that links them became established much as our preference for flush toilets: by policies dating back to the late 19<sup>th</sup> century.

### **Public Toilet Policy and Portland**

Today, public toilet availability varies worldwide. While many Western countries are closing public facilities, Asian countries are emphasizing them. In preparation for the 2008 Olympics, Beijing committed to having a public toilet every eight-minute walk. In Japan, where cleanliness and order are paramount, toilet facilities and their maintenance are a valued occupation. Australia, which boasts nearly 17,000 public toilets, has created a nation-wide registry, accessible online, in order to “improve independence and quality of life” for all people, but especially for those who deal with incontinence (“National Public Toilet Map - About,” 2013). The City of Melbourne created a 2008-2013 Public Toilet Plan, which replaced and updated their 2002 Toilet Management Plan, that aims to “maintain a network of safe, accessible, clean and environmentally sustainable public toilets” and “improve the quality of the public toilet stock, ensuring toilets are placed at locations that best meet community needs (City of Melbourne, 2008).” In America, the U.S. Department of Labor, through the U.S. Occupational Safety and Health Administration (OSHA), requires employers provide toilets for employees, citing the adverse health effects that can result from not being able to use a toilet regularly. The U.S. Department of Health and Human Services, which is responsible for protecting the health of the public as well as employees, would be the United States’ primary tool for creating a national public toilet policy, but to date it has taken no stance on the matter. Therefore, the issue of public toilet availability in America (as in most other countries) falls to cities.

The City of Portland, home to the highly acclaimed Portland Loo – a freestanding public toilet – and renowned for its progressive planning policies, struggles to provide adequate public toilets for its residents, transit users, employees and tourists. The Portland conversation about public toilets dates back to 1915 when Prohibition shut down saloons and created an increased need for more “comfort stations” around the city (Ahmann et al., 2006, p. 12). Today, at least six major plans address the need for public toilets even as the City closes public toilet facilities, citing budget, health,

and safety concerns. Several cities in both the United States and Canada express interest in purchasing Portland Loos even as the City is being sued for maintaining its seven Loos. Clean & Safe, an independent organization of businesses founded in order to maintain an orderly downtown, charges the City an estimated \$12,000 to \$14,000 annually to clean human waste off sidewalks even as residents and business owners cite the homeless as a reason to *not* install more public toilets (S. Adler, personal communication, May 17, 2013).

*Going Public!*, a 2006 report by Relief Works for the Office of Mayor Tom Potter, focused primarily on public toilet availability in the Central City. Relief Works mapped twenty three toilets that were available to the public at the time and emphasized the need for public toilets particularly as a human dignity issue. They argue that since toilet usage is an issue that crosscuts every social classification we know, because everybody must excrete, provision should be a priority where human activity is sufficiently high. These areas of high activity include recreation corridors, parks and plazas, social service clusters, nightlife clusters, and major transit junctions. The report recommends that "restrooms should be available within four blocks, or no more than 1,000 feet, from major transit junctions (Ahmann et al., 2006, p. 39)." Volunteers at Public Hygiene Lets Us Stay Human (PHLUSH) go even further, recommending that TriMet, the local transit authority, install facilities at major transit hubs such as the Gresham Transit Center (Hottman, 2013). TriMet opposes this suggestion, claiming they are in the business of moving people from one place to another and nothing more (Y. Park, personal communication, May 1, 2013).

Perhaps Portland's greatest contribution to public toilet availability is the Portland Loo, affectionately called the Loo. Former Commissioner Randy Leonard organized a Loo Squad in 2006 and the first Loo was unveiled in 2008. Since then, the Loo has been patented, Portland has installed seven Loos throughout downtown and sold three to other cities in North America with interest from many more. Several features make the Loo's "defense-first" design enduring: no running water inside (and no sink), no mirror, bars at the top and bottom, a graffiti-proof coating, and heavy-gauge stainless steel (Metcalf, 2012). The design is solar powered and ADA accessible, large enough for wheelchairs, strollers and bikes. The first Loo cost \$140,000, but they are now closer to \$60,000 per unit. The controversial cost is maintenance, which runs about \$12,000 per unit per year. In 2011, the City of Portland was sued for "improper utility spending," which included the \$617,588 maintenance and marketing of the Loos (Mesh, 2013). The City responded by moving Loo ownership and maintenance from the Water Bureau's budget to the Bureau of Environmental Services' budget. Today, the City is trying to boost its sales of Loos in order to fund the maintenance of existing Loos in its downtown, but according to a recent Willamette

Weekly article, it would need to sell at least four units a year – eight if you include payroll and benefits for staff assigned to the project (Mesh, 2013).

Unfortunately, public toilets are not a common part of the urban landscape today. The primary argument for closing public facilities centers around the budget for their upkeep, but the underlying social reason is the fear of unsavory behavior, such as sex and drug use, in these public spaces. Not only do policymakers wish to control public behavior, but there are also concerns about safety in areas around public toilets.

## **A Summary of Urbanism**

In the 1990s, responding to the effects of urban sprawl, the Congress for New Urbanism wrote the *Charter of the New Urbanism*, which is influenced by planning principles that were prominent before the rise of the automobile. Their goals include restoring urban centers, reconfiguring sprawling suburbs, conserving environmental assets, and preserving the built legacy (Leccese, McCormick, & Congress for the New Urbanism, 2000, p. 2). Peter Calthorpe (2010), a New Urbanist, argues that the planet has an urban future (p. 3). For the first time in history, over half the global population lives in cities and as climate change progresses, urban living is key to addressing the environmental, social and economic problems we face. Calthorpe (2010) defines urbanism broadly

“..by qualities, not quantities; by intensity, not density; by connectivity, not just location. Urbanism is always made from places that are mixed in uses, walkable, human scaled, and diverse in population; that balance cars with transit; that reinforce local history; that are adaptable; and that support a rich public life (p. 3).”

According to Jane Jacobs, the key components of urbanism are diverse population and a range of activities; a rich array of public spaces and institutions; and human scale in its buildings, streets and neighborhoods. Calthorpe (2010) adds to that list conservation and regionalism and argues that “urbanism is our single most potent weapon against climate change, rising energy costs, and environmental degradation (p. 17).”

Transportation is at the center of the energy crisis facing the United States, therefore Americans must change their travel habits, abandoning automobiles. The most important community-scale system dependent on urbanism is transit, which is linked to density. The keys to a viable transit system are density, walkability and mixed use. A strong transit system supports and extends the pedestrian environment and the quality of the interface from walking to transit is central to displacing car trips. If a city is determined to increase transit ridership, it must improve the pedestrian experience. This means improving access by creating safer pedestrian zones

and more pedestrian-friendly design, which includes providing facilities that people need when they must be away from home longer.

The overall key to a successful neighborhood or district is walkability. In *Walkable City*, Speck argues that every transit trip begins and ends with a walk, therefore, good transit relies entirely on walkability (Speck, 2012, p. 140). According to G.B. Arrington, another New Urbanist, Europeans use public transit nearly as often as Americans do (which is not very often), they just walk more than Americans do (Leccese et al., 2000, p. 59). Regions that are more walkable are also more livable, drivable and bicycle and pedestrian friendly – they also serve transit better. Most of a person's daily travel consists of short trips, therefore, the goal for any community should be rewarding short trips and pedestrians. Withholding public services does not create a very rewarding experience for pedestrians, cyclists and commuters. In *The New Transit Town*, Dittmar and Ohland also emphasize the importance of building for pedestrians and identify a transit-oriented development's livability goals as location efficiency, rich mix of choices, value capture, and place making. The criteria for measuring livability include access to services and recreation, mobility choice, environmental quality, commute times and, last but not least, health and safety (Dittmar & Ohland, 2004, p. 22). Pedestrian health and safety includes the ability to use a bathroom regularly.

### **Toilets, the Missing Link**

In England, professors Clara Greed, Julianne Hanson and Jo-Anne Bichard have dedicated several years to the study of public toilet availability and accessibility, concluding that public toilets are the missing link to increasing transit ridership (Bichard, Hanson, & Greed, 2013, p. 21). In a chapter of her soon to be published dissertation, Bichard (2013) uses two metaphors to discuss this argument. One is the "bladder leash," which constrains how long people can be away from home (and, therefore, how far they can *get* from home via their various modes of transportation) before they need to use a toilet (p. 21). This varies depending on gender, age, medical history, and whether or not a person is traveling with children. The second metaphor is the "transportation chain," which is the link of trips any commuter takes in order to get from one place to another (Bichard et al., 2013, p. 21). For most transit users, the first link is a walk from home to the transit station. From there, the chain can include bus, streetcar, rail, bicycle, automobile, and more walking before a day's commute is complete. The current approach to transit is very linear, reflecting a "one size fits all" model that does not take into account the flexibility of many people's lives (Bichard et al., 2013, p. 21).

The 2003 London Transport Users Committee's report 'London for the Continent' directly identifies the availability of public toilets as essential to the transportation chain (Bichard et al., 2013, p. 22). In 2008, the British Department of Communities and Local Government published a strategic guide to *Improving Public Access to Better Quality Toilet Facilities* that identifies four key policy priorities in which the provision of public toilets play an important role. The fourth policy is "Sustainable Toilet Transport – encouraging people out of cars and onto public transport or cycling and walking will not be successful if people cannot find toilet facilities within the wider built environment (Bichard et al., 2013, p. 24). If a chain is only as strong as its weakest link, public toilets are, not only the weakest link, but in many American cities, the missing link to increasing transit ridership.

## **RESEARCH QUESTION**

This paper examines how public toilet provision relates to transit usage in Portland, Oregon. It assesses perceived availability and acceptability of facilities and finds no relationship between public toilet provision and transit usage. Indeed, the variable that seems to most strongly influence transit usage is household/family size.

## **METHODOLOGY**

The data for this research were collected via an anonymous online survey, hosted by Qualtrics, which was distributed to Portlanders through the Office of Neighborhood Involvement (ONI) and the neighborhood association network. ONI oversees Portland's ninety five neighborhood associations, giving them support and resources and fostering a certain level of autonomy for neighborhoods. As it appears that a survey tool does not yet exist for measuring the connection between public toilets and public transit, this project involved creating a unique survey tool. The resulting Portland State University 2013 Public Toilets and Transportation Survey was designed similarly to a community needs assessment, asking people to rate certain items or indicate their level of agreement with others.

Participants included any Portlanders who received the survey link and chose to participate in the survey. The sampling frame was the initial ONI neighborhood association board member email list, which is available to the public via the ONI website, and everyone who is subscribed to the mailing lists, blogs, Facebook pages, Twitter accounts and other social media that neighborhood associations use. Though this is not a systematic way of collecting data, this form of convenience sampling reached about 400 people. The use of the neighborhood association network may bias the survey toward people who are already civically inclined, but the network also had the potential to reach a wider socioeconomic variety of Portlanders. Further, through social media, the link to the online survey could reach well



beyond the neighborhood network, being forwarded and shared by anyone who wishes.

In reality, the survey was taken by 398 people, 369 of whom actually completed the survey. Results are predominantly from three neighborhoods, Cully, Pearl District and Overlook. Kenton, Northwest District and Sullivan's Gulch were the next most responsive neighborhoods. The survey was emailed initially to 371 email addresses registered with ONI. The survey link was then shared on neighborhood association Facebook pages, in electronic newsletters, on membership forums, forwarded to a mothers' group and even mentioned in *The Oregonian*.

## **RESULTS**

The results of the 2013 Portland State University Public Toilets and Transportation Survey do not support the hypothesis that having more public toilets would encourage more public transit usage. The number of responses was higher than expected, but still not representative of Portland in general. While the initial mailing reached people from nearly every neighborhood association in the city, only a handful of recipients shared the survey link on a broader scale. Every neighborhood contributed at least one or two responses, but few contributed more than five. The three most responsive neighborhoods were the Pearl District (72), Cully (39), and Overlook (28). Kenton (16), Northwest District (15), Sullivan's Gulch (13) were the next most responsive.

## **Demographics**

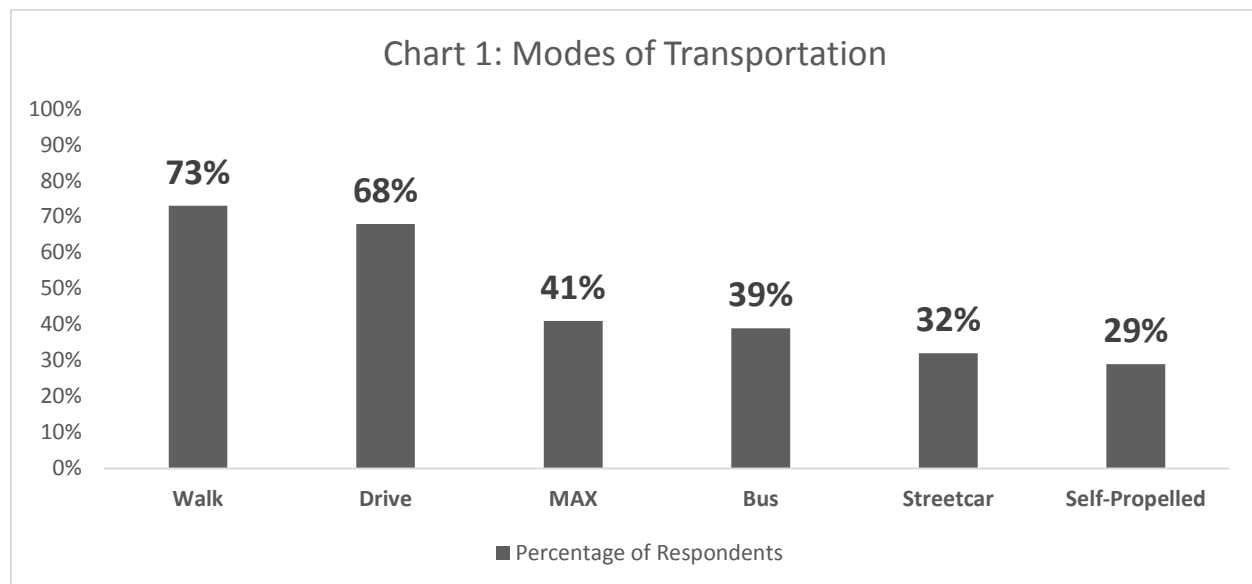
The demographics of the respondents are, similarly, not representative of Portland in general. Demographically, the respondents were predominantly female (67%), aged 60-71 years (34%), and very well educated with 85% earning a 4-year degree or higher. Of those, 39% have a 4-year degree and 46% have a graduate degree. The median annual income of the responses was \$65,000 and 26% reported earning over \$100,000 annually. In comparison, the City of Portland is 50% female with only 10% of the population aged 65 years or older and 42% earning a 4-year degree or higher. The median annual income for Portland is about \$52,000 ("Portland (city) QuickFacts from the US Census Bureau," 2013).

Another measure of affluence, car ownership, is only slightly more representative of Portland. Of the 369 respondents, 16% did not have cars. In Portland, 12% of households do not own cars. Most respondents (50%) owned one car and a quarter (26%) owned two cars. In Portland, the median number of cars per household is two, 38% of Portlanders own one car and 34% own two cars ("Portland, OR Number of Vehicles Per Household - CLRSearch," 2013).

Most Portland households consist of at least two people. The average for Portland is 2.27 people per household ("Portland (city) QuickFacts from the US Census Bureau," 2013). Of the respondents, 28% live alone and 60% have two to three people in their households and 12% have four or more people. These households are predominantly childless with 84% reporting no children in the home, 14% reporting one or two children.

## Commuting Habits

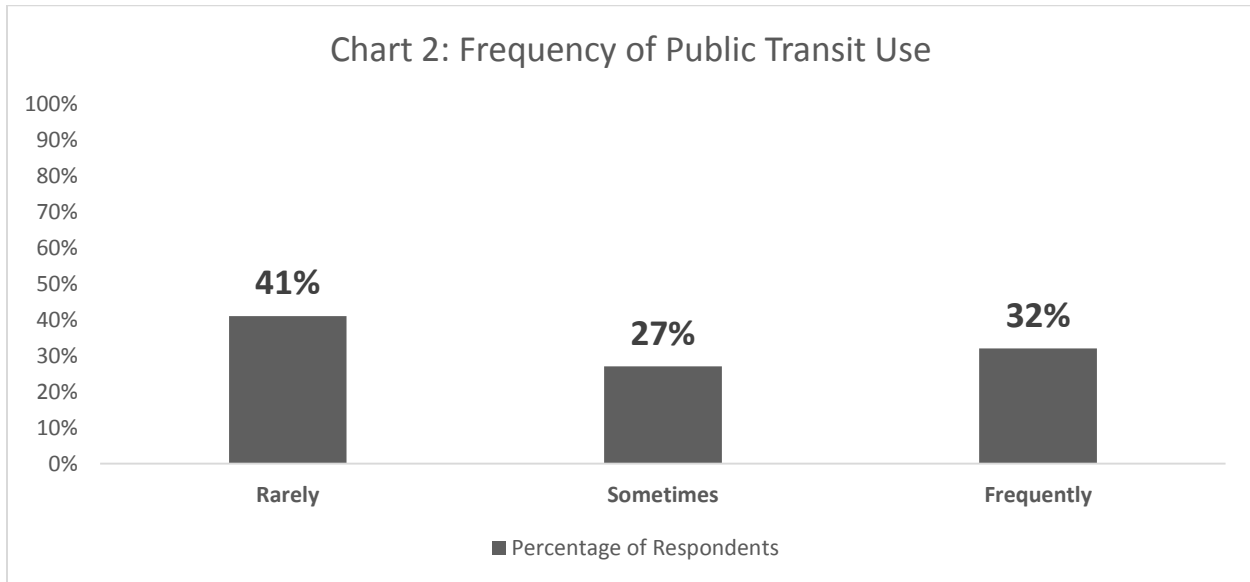
When asked about their commuting habits, most respondents indicated they walk (73%) and drive (68%). A relatively large percentage of respondents indicated using a variety of public transit methods with 39% of respondents using the bus, 32% using the Streetcar and 41% using the MAX. In comparison, according to the American Community Survey, 12% of Portlanders use public transit. That number indicates people who use public transit *instead of* driving or walking and this survey allowed respondents to indicate public transit *in addition to* driving or walking, however the comparison is valuable to understand that this sample is skewed toward public transit users. A slightly lower percentage of respondents (29%) get around via bicycle. Surprisingly, several respondents chose the "other" category and wrote in car sharing strategies such as ZipCar, Car2Go, and Getaround, indicating that they somehow do not see car sharing as driving.



Source: 2013 Portland State University Public Toilets and Transportation Survey  
N = 369

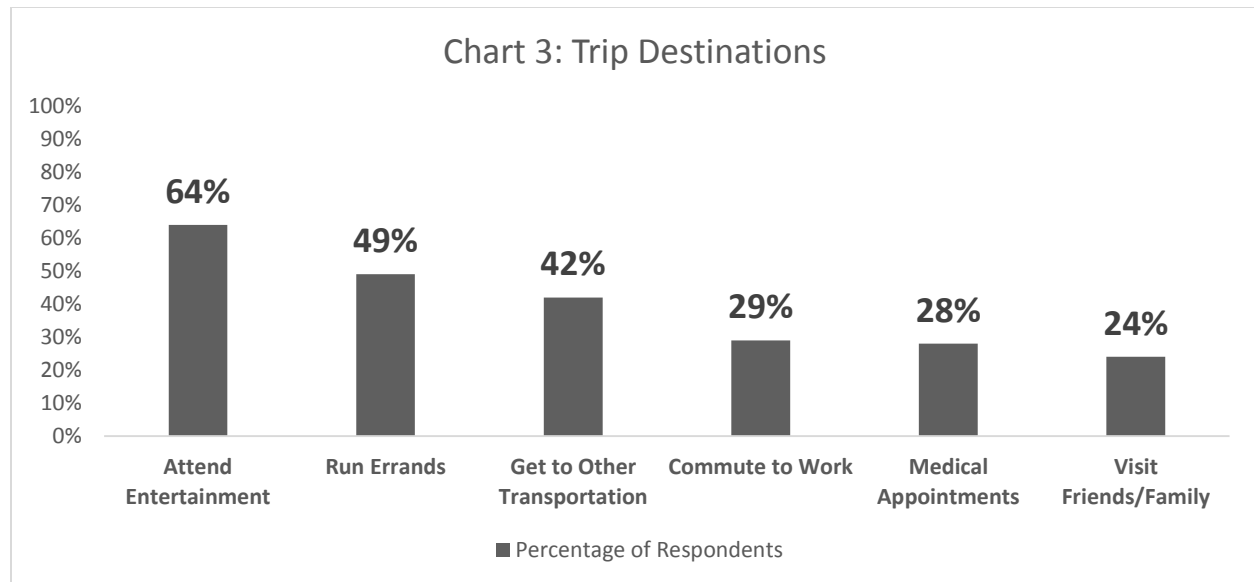
Though many survey respondents indicated using a variety of public transit methods, they use these methods infrequently, indicating possibly a failure to comprehend the word "usually" in the question or a broad interpretation of the word. A quarter (25%) of respondents, the largest

group, use public transit less than once a month, however, when grouped into three categories of rarely, sometimes, and frequently, 41% use public transit rarely (less than monthly), 27% use it sometimes (almost weekly), and 32% use it frequently (almost daily).



Source: 2013 Portland State University Public Toilets and Transportation Survey  
N = 369

The survey also asked the purpose or trip destinations of public transit use. Most respondents use public transit to attend entertainment (64%) or run errands (49%). They also use public transit to get to other transportation such as the airport or train station (42%). Some use public transit to commute to work (29%), get to medical appointments (28%), and visit friends and/or family (24%). Very few respondents use public transit to commute to school (5%) or take children to school (2%). A surprising 15% selected the "other" category, of which many wrote in "to get downtown" with no indication of what they did there. Several also wrote "jury duty" and "volunteer opportunities" as public transit destinations. When asked how far they commute to school or work, most respondents (38%) indicated they do not commute, perhaps reflecting the results' bias in the direction of older, retired people. Non-commuters aside, 28% commute one to five miles and 19% commute six to ten miles.

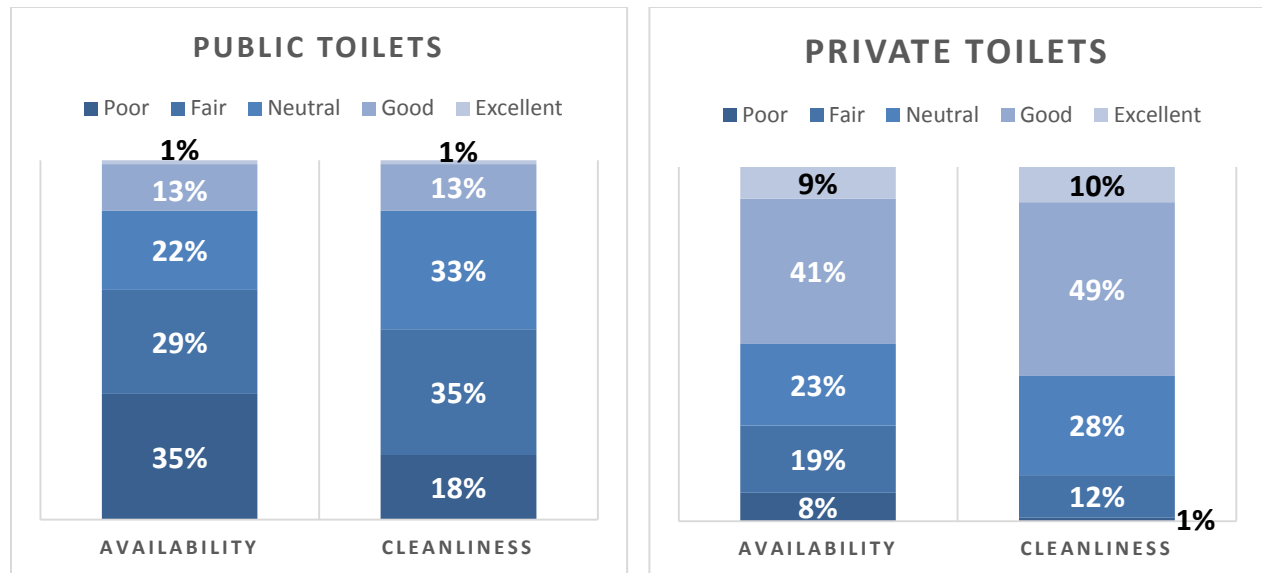


Source: 2013 Portland State University Public Toilets and Transportation Survey  
N = 369

## Attitudes

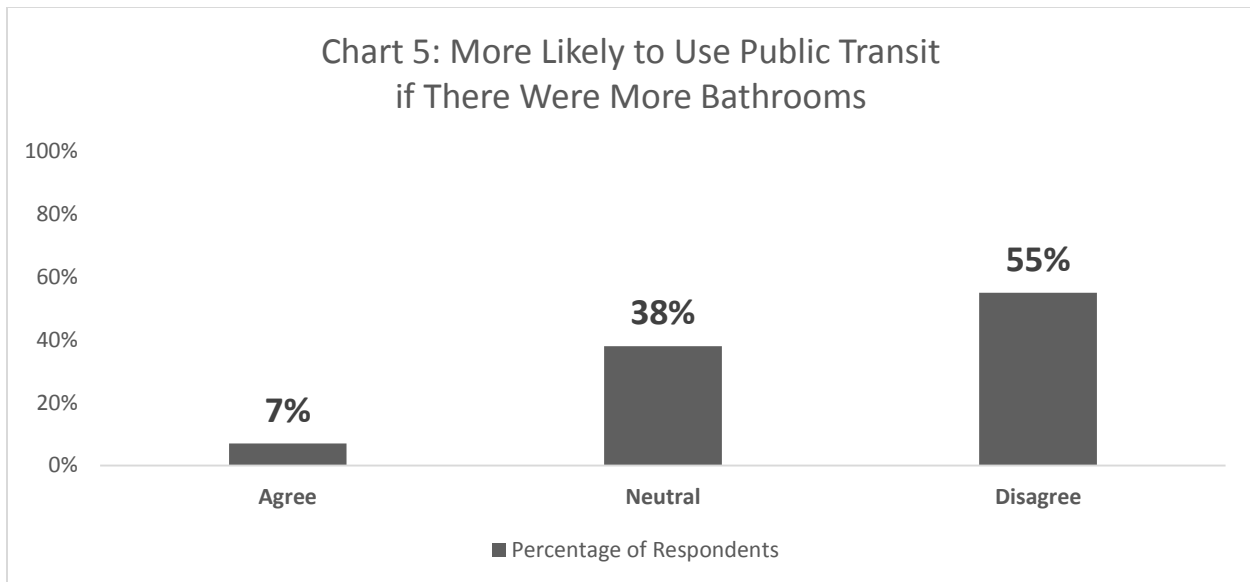
When asked to rate the availability and cleanliness and public and private toilets in Portland, respondents seemed satisfied with private toilets, but not public toilets. For the purpose of this survey, a public toilet was defined as one provided by the city and a private toilet was defined as one found in private businesses. Forty one percent rated the availability of private toilets as good and 49% rate their cleanliness as good. However, 35% rated the availability of public toilets as poor (a close 29% rated availability as fair) and 35% rated their cleanliness as fair. Most are comfortable using public toilets (44%) and most have no hygienic reservations about public toilets (45%). Overall, survey respondents believe that public toilet availability is an important issue for both people and transit providers (66%). A smaller quarter (26%) believe it is an important issue for people, but *not* for transit providers.

## CHART 4: ATTITUDES REGARDING PUBLIC AND PRIVATE TOILETS



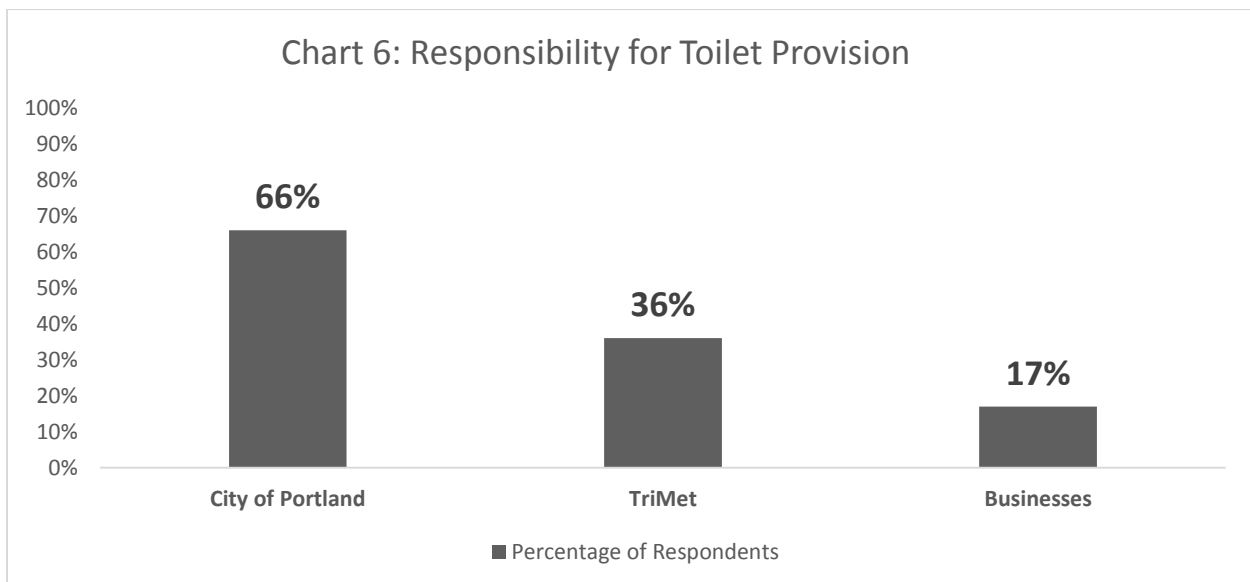
Source: 2013 Portland State University Public Toilets and Transportation Survey  
N = 369

Finally, the survey gets to the heart of the question, asking three questions designed to measure whether better toilet availability would increase transit usage. Combining the three questions into an index reveals that about half of the respondents (55%) do not feel that having more public toilets would encourage them to use public transit more often. A large portion (38%) remained neutral on the matter and only 7% feel they would use public transit more often. This does not support the literature's hypothesis that more public toilets would increase public transportation usage; however, it bears repeating that this small sample is overwhelmingly affluent and retired and may simply have less need for public transit than a younger, working population.



Source: 2013 Portland State University Public Toilets and Transportation Survey  
N = 369

Having established that most respondents do not feel they would use public transit more often, but that most also believe public toilet availability is an important issue for both people and transit providers, the analysis moves next to who should provide these important toilets that may not necessarily increase ridership. Given the options of TriMet, the City of Portland, and private businesses, most respondents (66%) felt that the City should provide public toilets, 36% felt that TriMet should, and only 17% felt that private businesses were responsible.



Source: 2013 Portland State University Public Toilets and Transportation Survey  
N = 369

This brings us to the question of who is more likely to feel they would use public transit more often. In a series of crosstabs evaluating the relationship between certain independent variables and the combined three questions, few variables approached significance (measured here at .10). Income drew near, but only household size, number of children, and age were soundly significant – and even then, .10 is more inclusive of variability than the general standard of .05. People living in households of two or three people are more likely to agree that they would use public transit more often. As household size increases, however, they are less likely to agree. People with zero children are more likely to agree that they would use public transit more often, however, as the number of children increases, they are less likely to agree. These two results may indicate a belief that using transit with multiple children is more difficult than alone or with one child and perhaps no amount of toilet provision can make up for moving around on public transit with a stroller and/or child in hand. Finally, people who are 54 to 65 years old are more likely to agree they would use public transit more often, supporting the “bladder leash” hypothesis that older people are more likely to want and need more public toilets.

## **DISCUSSION**

Given the neighborhood and demographic biases of the data, it is difficult to draw any conclusions with confidence. The data were rather skewed toward affluent, retired people and, therefore, not representative of Portland in general. As a result, the survey results can only be applied to the respondents and not more broadly. Further research might be more representative with systematic sampling of Portlanders or sampling that focuses on socioeconomic groups that are more likely to use public transit and whether public toilets would encourage more use. Another research strategy may be to only survey people who live within a certain distance of major transit lines, examining whether public toilets might incent them to use nearby transit more often.

Several interesting questions arise from the results. When asked to indicate how they usually get around, why did so many recipients select public transit though they use it so infrequently? Is this a different understanding of the word “usually”? Why were certain neighborhoods more responsive than others? One of the most striking questions to arise is why are car sharing strategies not considered driving? Is there a component of ownership that defines driving? And finally, given the resistance to providing public services for homeless people, how do people’s attitudes toward the homeless impact their attitudes toward public toilet provision?

Ultimately, this report concludes that public toilet availability is best presented as an economic issue, rather than a human dignity issue. Improving the pedestrian experience in the central city and neighborhood centers encourages pedestrians to stay longer, spending more money and activating public spaces more often throughout the day and night, which is good for business. One important way to improve the pedestrian experience is by providing accessible toilets that are safe and clean. According to urbanist theories of transit-oriented development, if the City of Portland committed to providing public toilets, the improved pedestrian environment would contribute toward increased transit usage. It seems that while toilets are an important link in the transportation chain, the goal should be walkability, not transit usage.

According to the survey results, the respondents feel the City is responsible for providing public toilets; however, the current trend is toward cutting city budgets, not increasing them. In addition, given the recent lawsuit for mismanagement, it seems unlikely the City will be expanding the Loo's budget any time soon. Private businesses are the least preferred option for toilet provision, yet an expansive infrastructure of toilets already exists within those businesses. Currently, many private toilets are reserved for paying customers; however, this creates a serious accessibility issue. Not everyone can afford a cup of coffee every time they need to use a toilet.

One creative option for public toilet provision is to create a public-private partnership between the City and businesses, contracting to make their toilets available to the public. Two cities in England already reimburse private businesses for opening their toilets to the public. Participation is voluntary and these businesses agree to certain standards of maintenance and are allowed to charge for use (Ahmann et al., 2006, p. 46). Amsterdam simplifies the process by requiring that all restaurants and pubs provide free public access to their toilets. In Portland, resistance would likely center around fear of the homeless using these newly available toilets; however, if enough businesses participated, the use would be spread across thousands of toilets, not the current handful.

A more unique solution to public toilet availability in Portland is to employ the food cart model. In many cities around the world, public toilets are privately maintained, whether inside a business or adjacent to a kiosk. Portland could break new ground by privately licensing public toilets in the same way it licenses food carts. Owners would purchase permits for one or several portable toilets, which come in a variety of styles and sizes, then wheel their unit or bank of units to the permitted location (perhaps a parking space). They would agree to maintain their toilets to a certain standard, be subject to inspection, and could charge whatever they like for use, but would be required to provide an attendant on site. Owners would determine their



own hours of operation, giving a variety of coverage throughout the day and night and, by their very design, the portable toilets could be removed at the end of a shift or moved around the city to accommodate parades, transit, events, festivals, and street closures. Portland's indie spirit is, perhaps, the ideal incubator for such a revolutionary solution.

## **CONCLUSION**

Although the unfortunately biased data of this survey do not support the relationship between public toilet availability and public transit usage, the literature strongly indicates that increased public toilet availability is part of the equation for improving non-automobile transportation. Any city determined to strengthen its central city and neighborhood centers should address public toilet availability as a way of improving the pedestrian environment, which, according to urbanist and transit-oriented theories, will increase not only the amount of time pedestrians spend out of their homes and, presumably, the amount of money they spend while away from home, but also transit usage in areas where walkability is a priority. Public toilet availability need not be solely the responsibility of one entity. In fact, variety always creates a stronger network that can survive more crises and provide greater flexibility. Therefore, any city exploring the issue of public toilet provision should integrate various solutions in its strategy. Not only is public toilet availability a human dignity issue and an indicator of civilization, it is a sound economic tactic.

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## Index

### **Survey Welcome Page**

#### **Portland State University 2013 Public Toilets and Transportation Survey**

Thank you for taking the time to participate in the 2013 Portland Public Toilets and Transportation Survey. This survey is part of a Portland State University research project. Information gathered via this survey will be used to analyze possible connections between public toilet provision and public transportation usage.

Please be assured that the information you share will be anonymous, meaning no one will be able to identify you. The survey asks 20 short questions and will take about 5 minutes to complete. You may not skip any questions, however, you are free to stop at any time.

**For the purposes of this survey, public toilets are defined as those provided in parks, at transit stations and on sidewalks, such as the Portland Loo. Private toilets are those provided by local businesses and restaurants. A personal toilet, would be one inside someone's home.**

**Note:** This survey is a Portland State University project and not affiliated with the Pearl District Neighborhood Association. The researcher is a member of her neighborhood association and initially distributed this survey via the Office of Neighborhood Involvement email list.

Before you start the survey, please confirm:

I am over the age of 18 and voluntarily participating in this survey. By participating, I acknowledge that I have read and understand the above paragraph.

Yes

No

### **Survey**

Usually, I get around via (select all that apply) (multiple choice)

Walking

Self-propelled vehicles (bicycle, skateboard, scooter, etc.)

Driving (includes carpooling)

Bus

Portland Streetcar

MAX

Taxi

Medical scooter/wheelchair

Other (text box)

How often do you use public transportation? (multiple choice)

Never

Less than once a month

Monthly

2-3 times a month

4-5 times a month

Weekly

2-3 times a week

4-5 times a week

Daily

For which of the following do you use public transportation? (select all that apply)

Commute to work

Commute to school

Errands

Visit friends and/or family

Attend entertainment

Medical appointments

Take child(ren) to school

Get to other transportation (airport, train station, carpool, etc.)

Other (text box)

How far do you commute to work or school? (multiple choice)

less than 1 mile

1-5 miles

6-10 miles

11-15 miles

16-20 miles

more than 20 miles

I do not commute to work or school

	Poor	Fair	Neutral	Adequate	Excellent
How would you rate the availability of public toilets in Portland? (at parks, transit stations, etc.)	1	2	3	4	5
How would you rate the cleanliness of public toilets in	1	2	3	4	5

Portland? (at parks, transit stations, etc.)					
How would you rate the availability of private toilets in Portland? (in businesses, restaurants, etc.)	1	2	3	4	5
How would you rate the cleanliness of private toilets in Portland? (in businesses, restaurants, etc.)	1	2	3	4	5

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
It is the responsibility of TriMet to provide toilets at stations.	1	2	3	4	5
If there were more public toilets, I would use public transportation more often.	1	2	3	4	5
It is the responsibility of the city of Portland to provide public toilets for use throughout the city.	1	2	3	4	5
Businesses, shops and restaurants should provide toilets for the city.	1	2	3	4	5
I have chosen not to use public transportation based on the availability of toilets along my route.	1	2	3	4	5
I would be more likely to take public transportation if there were more public toilets available.	1	2	3	4	5
I prefer not to use public toilets for hygienic reasons.	1	2	3	4	5
Having public toilets available would NOT affect my commute.	1	2	3	4	5
I feel uncomfortable using public toilets.	1	2	3	4	5

**The last part asks a few questions about your background**

Which neighborhood do you live in? (drop down list)

Alameda  
Arbor Lodge  
Ardenwald-Johnson Creek  
Argay  
Arlington Heights  
Arnold Creek  
Ashcreek  
Beaumont-Wilshire  
Boise  
Brentwood-Darlington  
Bridgeton  
Bridlemile (includes Glencullen)  
Brooklyn  
Buckman  
Cathedral Park  
Centennial  
Collins View  
Concordia  
Creston-Kenilworth  
Crestwood  
Cully  
East Columbia  
Eastmoreland  
Eliot  
Far Southwest  
Forest Park  
Foster-Powell  
Glenfair  
Goose Hollow  
Grant Park  
Hayden Island  
Hayhurst (includes Vermont Hills)  
Hazelwood  
Healy Heights  
Hillsdale  
Hillside  
Hollywood  
Homestead  
Hosford-Abernethy (includes Ladd's Addition)  
Humboldt

Irvington  
Kenton  
Kerns  
King  
Laurelhurst  
Lents  
Linnton  
Lloyd District (includes the Rose Quarter)  
Madison South  
Maplewood  
Markham  
Marshall Park  
Mill Park  
Montavilla  
Mt. Scott-Arleta  
Mt. Tabor  
Multnomah (includes Multnomah Village)  
North Tabor  
Northwest District (includes Uptown, Nob Hill, Alphabet Historic District)  
Northwest Heights  
Northwest Industrial  
Old Town Chinatown  
Overlook  
Parkrose  
Parkrose Heights  
Pearl District  
Piedmont  
Pleasant Valley  
Portland Downtown  
Portsmouth  
Powellhurst-Gilbert  
Reed (included Lambert Gardens)  
Richmond  
Rose City Park  
Roseway  
Russell  
Sabin  
Sellwood-Moreland  
South Burlingame  
South Portland (includes Corbett, Fulton, Lair Hill, Terwilliger, and the  
Johns Landing and South Waterfront developments)  
South Tabor  
Southwest Hills, Portland, Oregon  
St. Johns

Sullivan's Gulch  
Sumner  
Sunderland (includes the Dignity Village homeless encampment)  
Sunnyside  
Sylvan-Highlands  
University Park  
Vernon  
West Portland Park (includes Capitol Hill)  
Wilkes  
Woodland Park  
Woodlawn  
Woodstock  
Don't know

What is your gender? (multiple choice)

Male

Female

Other

What is your age? (drop down list)

18-23

24-29

30-35

36-41

42-47

48-53

54-59

60-65

66-71

72-77

78 or older

Do you have any disabilities? (multiple choice)

Yes

No

How many people live in your household? (multiple choice)

I am the only person in my household

2-3

4-6

7-9

10 or more people



How many children (under 18) live in your household? (multiple choice)

There are no children in my household

1

2

3

4

5

6 or more

How far did you go in school? (drop down list)

Less than high school

Some high school

High school diploma/GED

Some college/technical school

Junior college degree (AA, AS)

College graduate (BA, BS)

Master's degree

Doctoral degree (Ph.d., MD, JD, etc.)

Please indicate your household income BEFORE taxes. (drop down list)

Under \$10,000 yearly

\$10,000 to \$19,999 yearly

\$20,000 to \$29,999 yearly

\$30,000 to \$39,999 yearly

\$40,000 to \$49,999 yearly

\$50,000 to \$59,999 yearly

\$60,000 to \$69,999 yearly

\$70,000 to \$79,999 yearly

\$80,000 to \$89,999 yearly

\$90,000 to \$99,999 yearly

more than \$100,000 yearly

## End of Survey Message

Thank you for taking the time to participate in this survey. Your input makes this entire research project a richer experience. Please remember to forward this survey to your friends, family, colleagues, classmates and neighbors who live in Portland. The more responses, the better!

Sincerely -

Kate Washington

[wkate@pdx.edu](mailto:wkate@pdx.edu)

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