Mapping Health Effects of Vancouver's Built Environment

Written By:
Wes Harman
Emilie Hewko
Sandy Leung
Cheryl Yip

Final Report March 2014

WESC
WELLNESS
ENVIROMENTAL
SOCIAL
CONSULTANCY

Table of Contents

Acknowledgements

We are very thankful to everyone who has supported us on this project. Our team would like to express a special thanks and gratitude to our professor, Dr. Nadine Schuurman, for guidance and knowledge throughout the semester. We would also like to thank our teaching assistant Michael Martin for his support and assistance in completing this project.

We would like to acknowledge Dr. Scott Lear and CoHeaRT, for this project would not have existed without their research and inspiration. Again, we would like to thank Dr. Scott Lear, his team, and Blake Walker for providing us with the data that was needed to produce a successful project.

To group 1 in our Geography 455 class for their analysis data and the rest of our Geography 455 class for support.

Finally, to the future users of our project. We hope this will be a tool that will help influence and produce healthier lifestyle decisions.

Preface

The Wellness Environmental Social Consultancy (WESC) consists of four Simon Fraser University undergraduate students. WESC supports the public interests healthy lifestyle choices to improve cardiovascular health by providing a user-friendly interactive map that will show built environments within the Vancouver Region.

WESC's projects ensure practicality and viability with the following deliverables:

1. An interactive map with geo-coded attributes to represent real world built environment
2. An interactive mapping tool for users to customize and display geographical features
3. A framework easy to update, expand and manage by the client

What follows is the final report for "Mapping Health Effects of Vancouver's Built Environment" project.

For more information on WESC, please visit our website at:

http://www.sfu.ca/geog/geog455_1141/BuiltEnvironment/

Executive Summary

The Wellness Environmental Social Consultancy (WESC), Simon Fraser University, Burnaby B.C., has been working alongside our client, *Heart and Stroke Foundation Chair of Cardiovascular Prevention*, to develop a web-based mapping service that can inform users in decision-making to have a healthier lifestyle. The main goal is to replicate Vancouver neighborhoods that could influence cardiovascular health, such as availability of greenspaces, community recreation centres, fast food restaurants, and grocery store locations.

We have developed an interactive website and map that users can customize by selecting different layers and attributes gathered from the build environment data. This website is easy to update and maintain, whereby the client in future will be able to expand the map locations to other municipalities when the data becomes available.

Our interactive web map is useful to families of patients with cardiovascular disease, government officials in policy or urban planning, health practitioners, schools, or anyone seeking information on how services and environmental factors in their locale can affect their health.

Abstract

The Wellness Environmental Social Consultancy (WESC) has worked along with the Community Health and Research Team (CoHeaRT) to develop a website for an audience interested in cardiovascular health. The audience can examine the relationships between Vancouver's built environment and a healthy lifestyle. Using Web 2.0 creates an online health community. A visually appealing and user-friendly design allows visitors to be engaged with the information provided by the website. The general public can interact with health practitioners and vice versa to gain knowledge about health trends in Vancouver. The geoserver built by WESC will allow the client to update information when new data is collected. The website will help users in the decision-making process to build more active lifestyles and foster healthier communities.

Introduction

Client Profile

Dr. Scott Lear is a Simon Fraser University professor in the Faculty of Health Sciences and Department of Biomedical Physiology and Kinesiology, the Pfizer/Heart and Stroke Foundation Chair in Cardiovascular Prevention Research at St. Paul's Hospital. He is also the principal investigator of the Community Health Research Team that studies population health in relation to environmental factors. Dr. Lear's research includes studying the relationship of healthy lifestyles and the 'built environment' that can later on influence risk of cardiovascular disease.

Dr. Lear envisioned a digital health mapping tool that would be available to anyone in Metro Vancouver with internet access. Having a digital online presence will allow our client to communicate with patients at home, easily organize data and make quick updates or notifications for users to see.

Project Objectives

WESC has created a website framework that will be easy to manage and update by our client. The main focus of our project is to provide a visual tool for patients and visitors interested in cardiovascular health with relation to their surrounding environment. Our map includes geocoded attributes to represent real world features on top of interactive virtual layers that the visitor can choose to display and customize according to their needs.

Literature Review: Theoretical, Technical, and Geographical

Theoretical

Neogeography

The world's geographic informational data has been undergoing astonishing changes in recent years. Web 2.0 is the central premise involving both cartographic mapping and the World Wide Web (Crampton, 2008). The terms 'The Geographic World Wide Web' or 'GeoWeb' allows open sources to share and retrieve geographic information by the public (Haklay, Singleton, & Parker, 2008). Cartography is now involved with 'Spatial Media', which *Jeremy W. Crampton* states are "…activities based around and dependent on mapping," (Crampton, 2008). GeoWeb maps and location-based services create meaningful geographies with virtual data to allow end users to visualize the data for simple amateur-user understanding (Crampton, 2008). To *Andrew J. Turner*, the definition of neogeography is a 'new geography', which is a socially networked mapping platform made by any user on their own terms by combining the elements of existing toolsets to help shape context and convey understanding through the knowledge of place (Turner, 2006).

For this project, we will be able to use this new geographic innovation to include public interaction with those interested in the project created by the Community Health and Research Team. This project will gain additional data through users and provide data regarding the “study of population health and its associated environmental determinants,” (Community Health Research Team, 2013).

Data in Web 2.0 also includes creating ‘map mashups’. This allows a type of programming to no longer require raw datasets, where an overlay of various sources of data can be overlaid and used to create a new user-interface (Hudson-Smith, Batty, Crooks, & Milton , 2009). The project showcases a collaboration of multitudes of people working together on a common project known as ‘crowd-sourcing’. In a sense, participation creates a virtual community that builds and sustains relationships through the overall interaction (Fernando, 2010). The participants contributions in the project are only a collective portion of the total outcome, that are found widely distributed, where for some may not be aware that they are participating as a collective whole (Crampton, 2008). The project we propose will also help benefit all users through analyzing the visuals representations provided.

Web 2.0 Design

In this current technological era, the use of the web has become a primary source for information. Web 2.0 focuses on moving websites away from isolated information to sources of organized content with developed links of information (Liu, Liu, Bao, Ju, & Wang, 2010). The collection of web-based technologies share a user focus approach by designing functionality that will allow users to actively participate in content creation, and edit with open collaboration between community members(Liu, Liu, Bao, Ju, & Wang, 2010);(Bower, Hedberg, & Kuswara, 2010);(Ozek, 2011)(Cocciolo, 2010);(Divine, Schumacher, & Stal-Le Cardinal, 2011). The web 2.0 design places trust on users to control their own data through participation, should presents itself as playful, and should give off an expectation that the software will get better as more people use it(Cocciolo, 2010).

The learning design process is a framework created by Matt Bower, John G. Hedberg and Andreas Kuswara. The framework allows for a successful, functional webpage that focus on four topics: an objective, selecting a type of content in terms of knowledge to be represented, a type of pedagogy to apply, and preferred modalities of representation(Bower, Hedberg, & Kuswara, 2010).

The following table shows the different types of knowledge dimensions and cognitive processes that are considered when designing Web 2.0. While creating our project, three dimensions of knowledge were used to create an appealing product to our targeted audience. CoHeaRT has provided us data along with our research on health and built environments to place factual content on the website. The interactive map allows the end users to use conceptual knowledge to interpret the data based on their epistemology. Overall, our project focused on the knowledge and awareness of both the back and end users. The levels of cognitive processes were applied throughout the project.

Considered When Creating Online Content and Tasks	
Knowledge Dimension	Definition
Factual Knowledge	Pieces of information justified by affirmations (Bower, Hedberg, & Kuswara, 2010)
Conceptual Knowledge	Interrelated representations of more complex knowledge forms that is learned by thoughtful, reflective learning (Bower, Hedberg, & Kuswara, 2010)
Procedural Knowledge	Skills to perform processes, to execute algorithms and to know the criteria for their appropriate application (Bower, Hedberg, & Kuswara, 2010)
Metacognitive Knowledge	Knowledge and awareness of one's own cognition as well as that of other people (Bower, Hedberg, & Kuswara, 2010)
Levels of Cognitive Processes	Definition
Remembering	Recognizing, listening, describing, identifying, retrieving, naming, locating, finding (Bower, Hedberg, & Kuswara, 2010)
Understanding	Interpreting, summarizing, interring, paraphrasing, classifying, comparing, explaining, exemplifying (Bower, Hedberg, & Kuswara, 2010)
Applying	Implementing, carrying out, using, executing (Bower, Hedberg, & Kuswara, 2010)
Analyzing	Comparing, organizing, deconstructing, attributing, outlining, finding, structuring, integrating (Bower, Hedberg, & Kuswara, 2010)
Evaluating	Checking, hypothesizing, critiquing, experimenting, judging, testing, detecting, monitoring (Bower, Hedberg, & Kuswara, 2010)
Creating	Designing, constructing, planning, producing, inventing, devising, making (Bower, Hedberg, & Kuswara, 2010)

Table 1 List of Knowledge Dimensions and Levels of Cognitive Process Considered in Web 2.0 Design

Online pedagogies represent different roles in learning. Each pedagogy caters to a target audience, which is listed in (Table 2). Our project focuses on a con-constructive pedagogy that allows the community of researchers and the general public interested in Vancouver's built environment to interpret the given data and provide feedback to develop a product that will help promote healthier lifestyle choices.

Types of Pedagogies	
	Definition
Transmissive	Delivery approach – a stream of information broadcast to audience (Bower, Hedberg, & Kuswara, 2010)
Dialogic	Audience given opportunity to define concept boundaries and negotiate meaning(Bower, Hedberg, & Kuswara, 2010)
Constructionist	Learning occurs by developing a product(Bower, Hedberg, & Kuswara, 2010)
Con-constructive	Audience learns while creating together (mix of Dialogic and Constructionist pedagogies)(Bower, Hedberg, & Kuswara, 2010)

Table 2 Types of Pedagogies to Represent in Web 2.0

Designing web 2.0 will have preferred modalities of representation, including text, image, audio, and or video, that depends on the knowledge type represented(Bower, Hedberg, & Kuswara, 2010). These representations are a set of tools to provide distance collaborative interaction between members of the community(Divine, Schumacher, & Stal-Le Cardinal, 2011). In 2011, over 17 web tools exist that were provided for free or almost free on the Internet to create a well designed website, seen in (Table 3). The success of web 2.0 emphasizes interaction, collaboration, and communication between the target audience and project developers.

Definitions of 17 Main Web 2.0 Tools	
Tools	**Definitions**
Chat	Instant written conversation area where a real-time dialog appears line by line (Divine, Schumacher, & Stal-Le Cardinal, 2011)
Forum	Area opened by a moderator suggesting specific topics and invites members to post messages and comment(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Web Conferencing	Live meeting combining voice and onscreen presentation by a speaker(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Blog	Personal website where the owner posts messages and invites people to comment(Divine, Schumacher, & Stal-Le Cardinal,

	2011)
Wiki	Website which pages can be created and modified by visitors(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Posting	Ability given to visitors to upload documents in website area(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Sharing	Ability given to a group of individuals to modify a unique document (Divine, Schumacher, & Stal-Le Cardinal, 2011)
Commenting	Ability given to website visitors to add a written remark below a document, video, photograph, product description, etc.(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Rating	Evaluation by web visitors of content in a website(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Polling	Surveying with online questionnaires(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Podcast and Video Casting	Ability on specific viral-based website to post rich media documents, tag them, comment them and send their link to groups(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Social Networking site	A site where community members post in a personal area about themselves. The area is completed by comments of authorized visitors as indirect conversation(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Tagging	Ability to add and share favourite keywords linked to a document, photo, video, etc.(Divine, Schumacher, & Stal-Le Cardinal, 2011)
RSS	Ability to retrieve a message when specific tagged pages or documents are new(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Mobile Messaging	Ability to send short messages to groups on their mobile devices to receive feedback(Divine, Schumacher, & Stal-Le Cardinal, 2011)
Remote Control	Ability to use the PC of a person remotely(Divine, Schumacher, & Stal-Le Cardinal, 2011)
LMS	Tracking learner's online activities (Divine, Schumacher, & Stal-Le Cardinal, 2011)

Table 3 Definitions of 17 Main Web 2.0 Tools

In order from most important to least important studies have shown that these qualities within a website are what made websites appealing and functional to various audiences(Palaigeorgiou, Triantafyllakos, & Tsinakos, 2010);(Cocciolo, 2010);(Ozek, 2011):

- Content and Presentation
- Communication Between Community and Developer
- New Services – i.e. Emails, SMS, RSS
- Video Presentation
- Participation
- Networking

Web 2.0 design was an important aspect that was thoroughly considered when producing our final product.

User Friendly

Designing a user-friendly website requires a site plan to address the objective of the project. The best user-friendly website allows potential end users to participate in designing the interface by leveraging their specific knowledge as part of the overall process(Hager, Kibler, & Zack, 1999) and(Richards, 2006).

Before starting the project, it is important to set a goal that will outline when the final product should be complete. No design is perfect, and it is up to the designer to know when good is good enough.

Key things to consider when designing are the types of browsers, colour schemes, and resolution, and audience feedback. Choosing the browser is an important step to consider. If an application that capitalized on advanced features of one browser, it renders the usability from those viewing on a different browser. Our project focuses on creating the balance between various types of web browsers. Browsers and computer types are also considered when customizing colours for links, text, and background. Different colour palettes (8 bit), (16 bit), and (24 bit), on different types of computers may not match between machines(Hager, Kibler, & Zack, 1999). Common colour schemes are considered when creating our project. Resolution is another factor to consider when creating a user-friendly website. To create a balance between audiences with low and high resolution, designers choose a middle resolution 800 x 600(Hager, Kibler, & Zack, 1999). Audience feedback is important because the goal is for the audience and not from the expertise. Knowing what the people want and applying it will increase its user friendliness.

Involving the users during the development stage of websites will allow for better user participation. This allows for communication between the users and developers of the project. Designers consider task-analysis before starting the design work. This is where designers determine what users want in an application and how they will to achieve it(Hager, Kibler, & Zack, 1999). Designers then look at historical designs from competitors to see how others have approached the problem previously and learn from the mistakes and/or benefits.(Hager, Kibler, & Zack, 1999) Our project has performed research on user-friendly websites that function well by looking at all the benefits offered. Designers then ask for feedback from users after providing a walkthrough scenario of the project(Hager, Kibler, & Zack, 1999) and (Laituri, Zimmerman, Graham, Stapel, & Crall, 2010). Once developers have a stable code, users are asked to interact and test the effectiveness of the website(Hager, Kibler, & Zack, 1999). After completion, a beta version is sent for testing to select users before allowing the final product to be broadcast to the public(Hager, Kibler, & Zack, 1999).

The general rule is to dedicate the primary spot on your navigation to the directed audience. The website's secondary function is to educate the public on the services that separate this project from others. The language should be comprehendible so anybody in the public can understand. Specific keywords in the text will help raise search engine listings to attract new audiences(Richards, 2006). Our project has considered these functions to appeal to our audience while attracting new audiences.

Visuals

Visualization allows a viewing or large amounts of data simultaneously, while observing patterns and observations(Goecks, Eberhard, Too, The Galaxy Team, Nekrutenko, & Taylor, 2013). To capture and understand the data, incorporating good aesthetics serves as an important role in shaping users attitudes.

Historically, aesthetic values appeared as ideas about beauty. (Lavie & Tractinsky, 2003). Experiencing visual pleasure is subjective(Lavie & Tractinsky, 2003) and (Wu & Hu, 2013). Objects considered beautiful are adapted to cognitive faculties of various individuals by stimulating and sustaining them(Lavie & Tractinsky, 2003).

In human-computer interaction the purpose for aesthetics are for marketing purposes, effective interaction design, and emphasizing efficiency(Lavie & Tractinsky, 2003). The basic approach to web design includes 'artistic ideal' and 'engineering ideal'. 'Artistic ideal' allows designers to express their artistic skills while the 'engineering ideal' provides solutions to the users(Lavie & Tractinsky, 2003). The main goal for our web project is to make it easy for our audience to perform useful tasks. Creating a unique and interesting interface increases the user's arousal, which effectively sustains the user's interest on the webpage. Table 4 provides a list of primary variables that have left a good overall impression of visual attractiveness on various websites. We have incorporated all five variables to provide the best experience for the client's audience.

Primary Variables For Creating Visual Attractiveness on Websites	
	Definition
Classic Aesthetics	Well organized, clean, clear, and symmetrical
Expressive Aesthetics	Creative design, fascinating design, use of special effects, original design, sophisticated design
Usability	Convenient use, easy orientation, easy to use, easy to navigate clear design
Pleasure Interaction	Feel joyful, feel pleasure, feel gratified
Service Quality	Can count on site, site contains no mistakes, site provides reliable information

Table 4 A List of Primary Variables That Are Visually Attractive on Websites

The visualization framework helps manage data flow between web browsers and web servers by providing methods to obtain large data quickly, conduct visual analysis and share the publications for the client(Goecks, Eberhard, Too, The Galaxy Team, Nekrutenko, & Taylor, 2013). Data collected and shared to the public does not need to be downloaded on websites. It is easily comprehendible for the client to take the information they need, extending the user's experience. In this technological era, visualization is the new mechanism for in taking information. Rather than reading long reports, our cognitive minds have been reconfigured to review datasets in a different way(Wu & Hu, 2013). This project uses current technology to share information to the targeted audience by using visually appealing and interactive methods.

Background on Health and BE and Geography

It is well established that physical activity can lower the risk of health complications such as heart disease, diabetes and cancer (Hankey et al., 2012). Multiple studies have shown conditions of a surrounding Built Environment is associated with individual physical health, which can lead to economic and social costs and benefits (Gasevic et al., 2011); (Oliver et al., 2011); (Hankey et al., 2012) (Sallis, Saelens & Frank, 2009).

The Built Environment "refers to the human-made or modified characteristics of the physical environment" (Gasevic et al., 2011) that include components such as "offices, houses, hospitals, malls" (Younger, 2008). The overall health of the population can be influenced by BE factors such as walkability of a neighborhood, physical conditions of the area, residential density, access to green space (Oliver et al., 2011); (Bird, 2012) transportation and community services (Younger, 2008). Interaction with these BE features can affect individual physical activity behavior, environmental perceptions (Gasevic et al., 2011) and risk perceptions. Oliver et al., 2011 finds that "…the built environment can influence physical activity though the strength of the relationship depends on the type of physical activity considered (pg. 8).

Several studies look at walkability to determine the positive and negative outcomes of residents' relationship with their built environment (Oliver et al., 2011);(Hankey et al., 2012); (Sallis, et al., 2009). For example, these areas also allow for cycling as a mode of travel, which is considered healthier than automobile travelling. Walkability not only encourages for more physical activeness it also reduces the greenhouse gas emissions and air pollution created by automobiles.
According to Sallis, et al., (2009), walkable neighborhoods are ideally areas where non-residential destinations are close to residences that include well-connected streets. Neighborhoods that have more opportunities for social interaction – like walkable neighbourhoods - can alleviate isolation and health factors that can lead to depression (Sallis, et al., 2009). It is suggested that walkable communities are beneficial to residents' overall health when considering both physical and mental health.

Residents in areas of high walkability produced higher rates of physical activity (Hankey et al., 2012); (Sallis, et al., 2009) and lower overweight/obesity (Sallis et al., 2009). Lower income adults saw poor health factors such as "less favourable weight status, physical [quality of life], neighborhood satisfaction and social cohesion…"(6). When comparing lower and higher income groups, Sallis et al. (2009) found both groups benefited from high walkability; although lower income neighborhoods had weaker association with walkability, and might not "experience benefits of living in a walkable neighborhood"(6). Sallis et al. (2009) attributes this to perceived danger and crime among residents.

Neighborhoods that have high walkability but low perceptions of safety can lead to lowered experiences of walking. Bird (2012) finds poor neighborhood conditions such as lack of maintenance, graffiti, littering and fear of crime can discourage people from pursuing physical interaction within their immediate geography and lead to "sedentary, isolated lives" (p.5)

The studies suggest that neighborhood development and governing policies should include health professionals in the decision-making process, to guide issues of physical and mental health related to the environment. More sustainable planning that would encourage walkability, public transportation use, and social connectivity would greatly benefit residents in mental and physical health (Younger et al., 2008); (Bird, 2012).

Data Source

The data that was used for this project was compiled from multiple sources. Table 5 provides a list of all the data that was used and its source.

Data	Source
Primary Data	
Participant data (BMI, Waistline size)	CoHeaRT
Secondary Data	
Greenspace	District of North Vancouver City of Vancouver GeoBC (Province of British Columbia)
Road Network	GeoBC (Province of British Columbia)
Water Network	GeoBC (Province of British Columbia)
Postal Codes	Statistics Canada
Canada/USA boundary	ESRI

Table 5 List of the data used and its sources

Methodology

Data

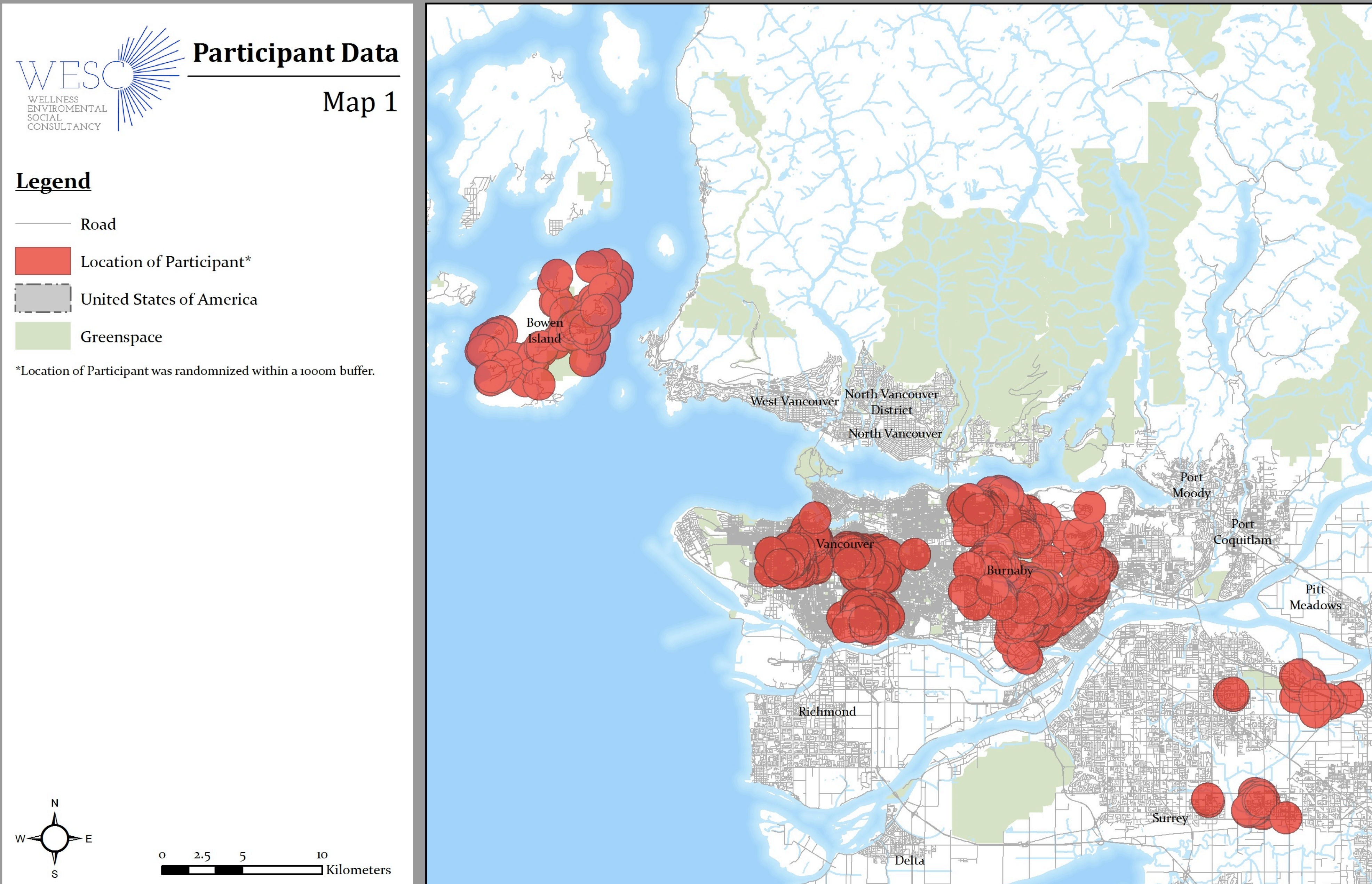
This section will describe how the data was prepared before it was uploaded to the website. After downloading and receiving all the necessary data that was mentioned in Table 5, it was important to determine the extent of the study area. The study area was determined by first examining the participant data. Once a suitable study area was determined, all the secondary data was then clipped to that extent.

The next step was to ArcGIS's tool *select by attribute*, to determine which forward sortation areas (FSA) intersect with the participant data. FSA are areas based on the first three characters of a postal code(Statistics Canada, 2008). This enabled the data to be more manageable(ESRI, 2013). After this, the average BMI and waistline size was determined by taking the average of the participant data in each postal code area. The data was then displayed and provided in this report (maps 2 and 3).

Due to some limitations from the data and website, which will be discussed in the *Limitations* section, our group wanted to process the participant data in such a way that protected the participants' identity, but still allowed our group to upload it to our map on the website. In order to hide the participants' location, the first step was to put a 1000m buffer around the point. Then by using ArcGIS's *create random point* tool, a random point was placed somewhere within the previously created buffer(ESRI, 2013). The last step was to create another 1000m buffer around the random point. This processes provides masks the location of the original data, while still providing a general location.

Participant Data

Map 1



Disclaimer: This map is for informational purposes only. This map is a living document and is intended to refined over time. The data sed to produce this map originates from many sources, are presented without prejudice, and are based only on information available from March 2014.
Projection: UTM, NAD83, Zone 10;
Scale: 1:325,000;
Data Sources: District of North Vancouver, City of Vancouver, GeoBC, ESRI, Ministry of Natural Resources, CoHeART.

Average Body Mass Index

Map 2

Legend

- Road
- United States of America
- Greenspace

Body Mass Index (BMI)

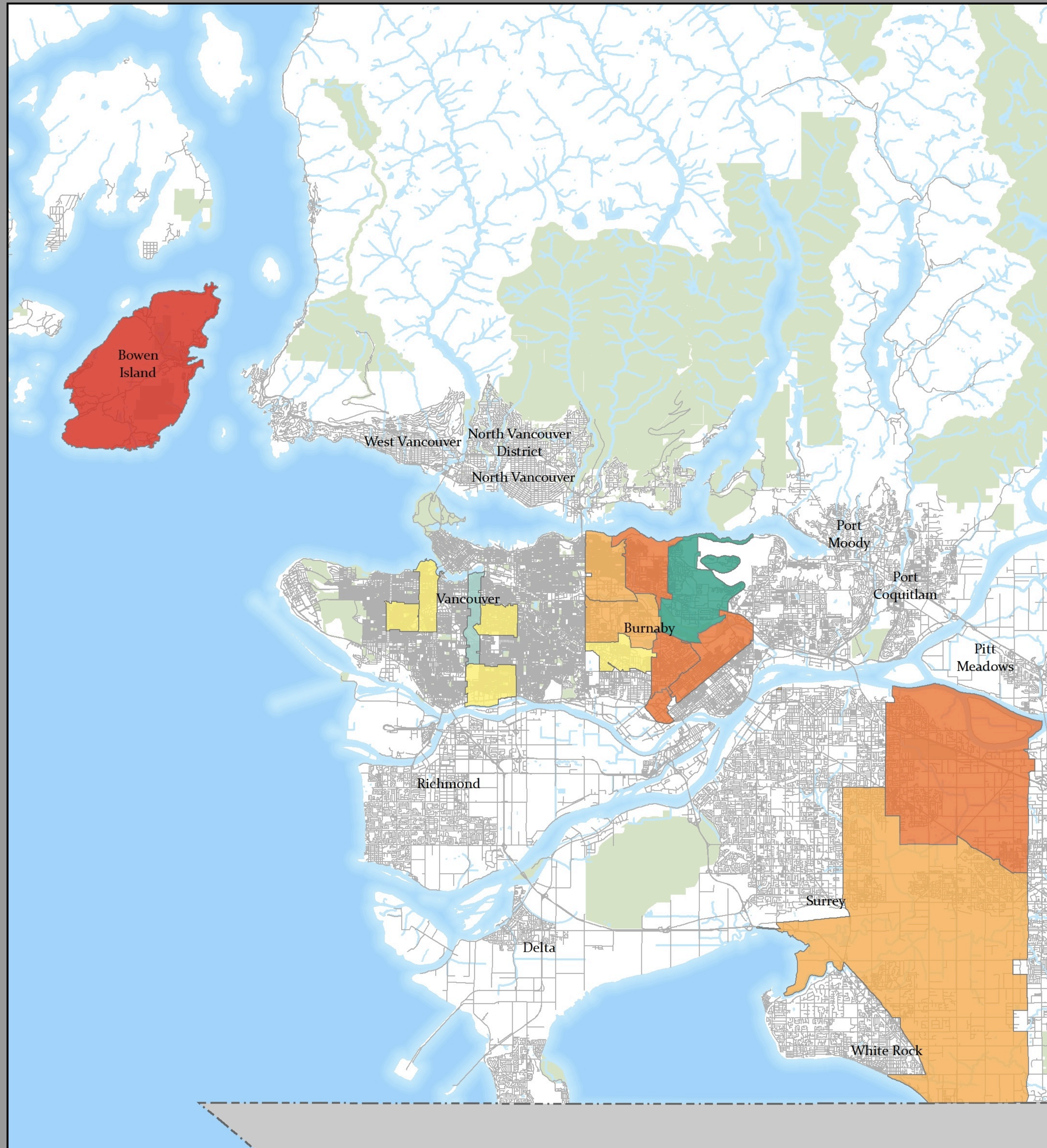
- 24.0 - 24.5
- 24.6 - 25.0
- 25.1 - 25.5
- 25.6 - 26.0
- 26.1 - 26.5
- 26.6 - 27.0
- 27.1 - 27.5

*Calculated by taking the average BMI value within each Forward Sortation Area (first three characters in a postal code).

N W E S

0 2.5 5 10 Kilometers

Disclaimer: This map is for informational purposes only. This map is a living document and is intended to refined over time. The data sed to produce this map originates from many sources, are presented without prejudice, and are based only on information available from March 2014.
Projection: UTM, NAD83, Zone 10;
Scale: 1:325,000;
Data Sources: District of North Vancouver, City of Vancouver, GeoBC, ESRI, Ministry of Natural Resources, CoHeART.



Average Waistline Size

Map 3

WESC
WELLNESS ENVIROMENTAL SOCIAL CONSULTANCY

Legend

Road

United States of America

Greenspace

Average Waistline Size (cm)

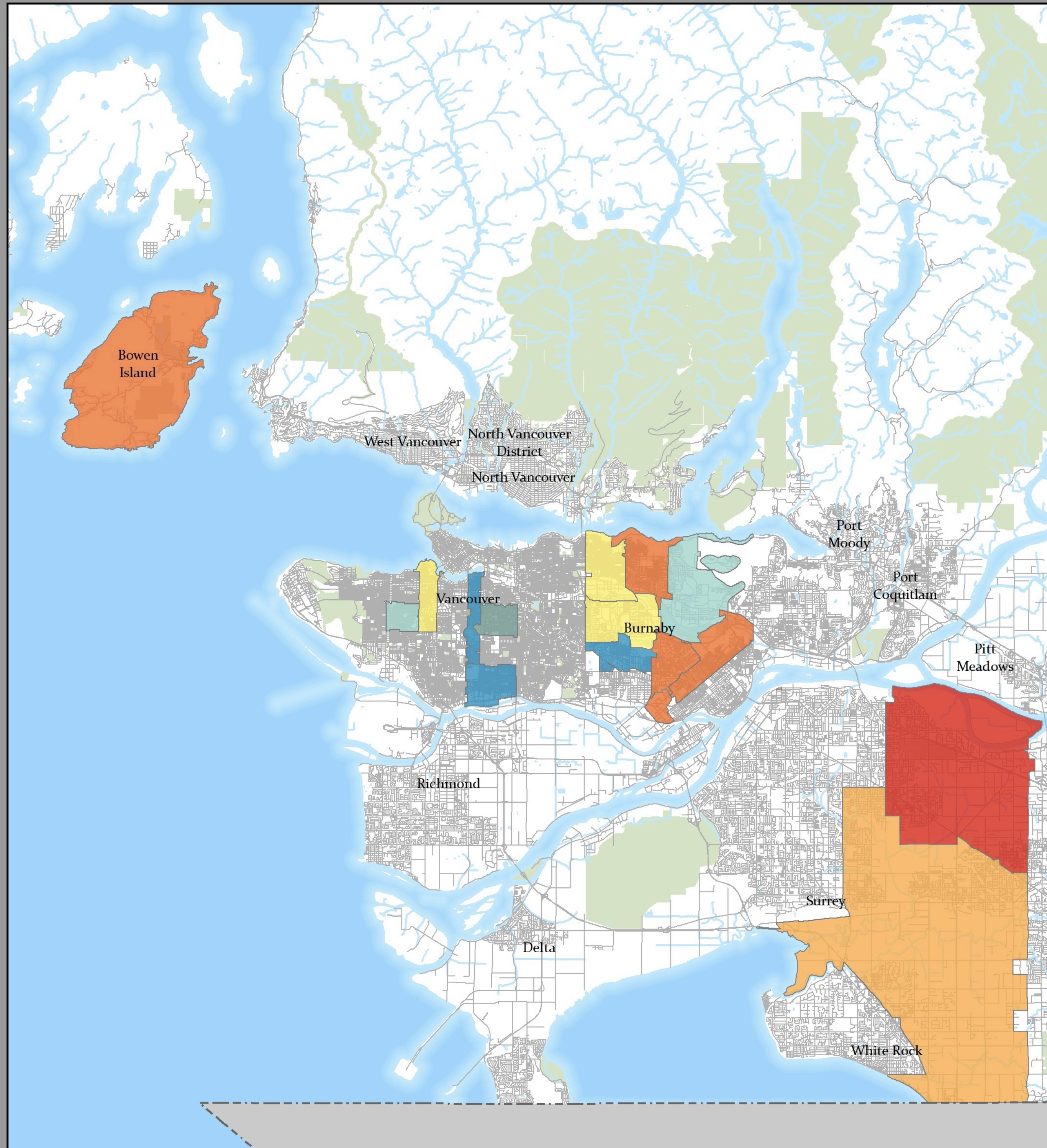
- 81.0 - 82.0
- 82.1 - 83.0
- 83.1 - 84.0
- 84.1 - 85.0
- 85.1 - 86.0
- 86.1 - 87.0
- 87.1 - 88.0

*Calculated by taking the average waistline size value within each ForwardSortation Area (first three characters in a postal code).

N W E S

0 2.5 5 10 Kilometers

Disclaimer: This map is for informational purposes only. This map is a living document and is intended to refined over time. The data sed to produce this map originates from many sources, are presented without prejudice, and are based only on information available from March 2014.
Projection: UTM, NAD83, Zone 10;
Scale: 1:325,000;
Data Sources: District of North Vancouver, City of Vancouver, GeoBC, ESRI, Ministry of Natural Resources, CoHeART.



Website

Implementation of Frameworks

The implementation of the web interface includes three defining technologies that allow us to implement and use a mapping product that can be easily included in any website. This web interface is called a Web Mapping Service, also known casually as a WMS. The defining ability of a WMS is allowing the user to save and serve spatially correlated data in a range of formats including both PostgreSQL data tables as well as ESRI shapefiles. We then utilize a web framework known as OpenLayers to include a javascript library that allows for dynamic implementation of a typical web mapping container. While this could be implemented in an easier fashion with the use of paid for tools such as ESRI ArcServer, or by using Googles API, this particular implementation was chosen to both reduce cost to the client, and to ensure we have not inadvertently given information to any outside companies.

Java Servlet Container and Server: Tomcat 7.0.1

What is a servlet container?

A java servlet is considered to be a java application that is often connected to a web server (Java Servlet, 2014). A Java servlet container, of which Tomcat 7.0.1 is just one, is used to contain and direct the requests made by each individual java servlet. Due to the use of OpenLayers as our display medium, Tomcat 7.0.1 becomes an extremely useful tool in the implementation of our Web Mapping Service.

Why is a servlet container useful to us?

The use of a servlet container allows the web server to create and configure an active java servlet once called upon by the web server. Upon receiving an HTTP request, the web server will forward the request to the java servlet container, the container will then load, initialize, and process the request in a dynamic fashion and respond to the client with this newly instantiated servlet package (What is a Servlet Container, 2014). This process can be seen more clearly in figure 1.

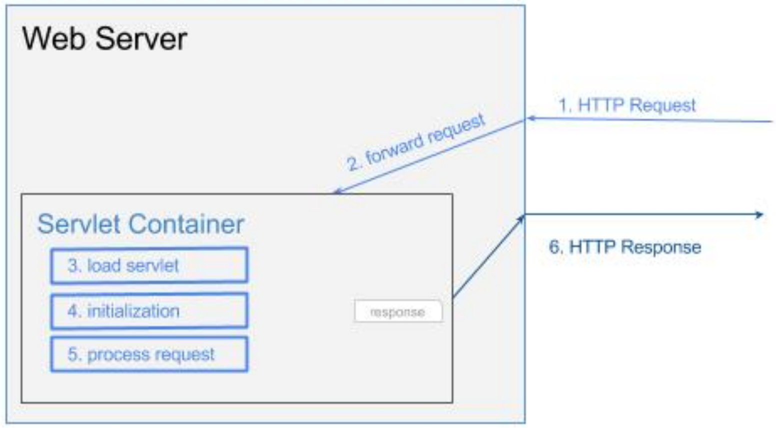


Figure 1. Workflow of a HTTP request

This implementation of a java servlet is required to ensure that our mapping service is a dynamic and changing entity and not just a statically served single image. This implementation allows for better user interaction with the chosen content and allows for greater access to the stored information.

Why we chose Tomcat 7.0.1

Tomcat 7.0.1 was chosen for this particular project, as it is a well-known open source implementation of a java servlet container that has been extensively tested, and ensured to be a stable version of this product.

GeoServer

Web Mapping Service: Geoserver 2.4.5

What is a Web Mapping Service?

A Web Mapping Service is a OpenGIS specification that standardizes the way in which web applications request maps (OpenGeoSpatial.org, 2014). Because this is an OpenGIS standard a lot of work has been previously done, and may be used by the client to implement any future developments as requested. The WMS allows us to create a single server location that can then serve multiple web applications. This means that our mapping framework can be used and implemented in as many websites as the client wishes. This is a useful tool in allowing for greater access to this information, while still retaining all the necessary data specifications required by the project. Advanced Web Mapping Services can also be to do some amounts of geospatial analysis. Due to their standardization, many mapping services include similar functions and abilities.

Why is a WMS useful to us?

The WMS is useful in our situation as it is a way to quickly and easily serve up data that can be stored in many different formats, including PostGIS, Shapefile, ArcSDE, DB2 and Oracle (Geoserver Features, 2014). This also allows us to retain control over our own data as we have all the data stored on our native server, if we need to remove data, or add data it is a simple process that only requires access to our own server. This data can also be used in many instances, and can be served up to as many web applications as is required by the client. One drawback to this method of implementation is the focus on OpenGIS abilities; this means that anyone that obtains the IP address of our server can serve our data for their own web applications. While this can be considered a problem, this user will not be allowed to add, alter, delete, or obtain any of the spatial data files due to password protection on the WMS itself.

Why we chose Geoserver?

We have chosen to use the geoserver implementation, as it is a well-defined application that is more powerful then solely being a Web Mapping Service. The inclusion of a simple web interface that allows for administrative GUI interaction is a large part of our reasons for implementing the WMS using Geoserver 2.4.5

OpenLayers™

Javascript Display Container: OpenLayers

Javascript library implementation

In order to view all the spatial data and information we have included in our Web Mapping Service, we need a tool to display the information that retains all the required spatial and attribute data. To implement this display we use something called a Javascript Library. The particular library we have chosen to use is called OpenLayers. A Javascript library is a set of pre-defined code that allows the developer to implement advanced and complex interaction, with minimal extraneous and duplicate coding. This vastly cuts down on implementation time, while retaining efficient code that is easily maintained and altered.

Utilization in this project

The utilization of OpenLayers library has enabled a wide range of efficient implementations such as navigation, zoom, and draw style manipulations. OpenLayers allows the developer to change and implement the layers, select which layers we wish to show or hide, overlay transparency and allow for significantly increased interaction then would have otherwise been possible. Due to the applications nature, the implementation of OpenLayers allows us to easily include this mapping and viewing functionality to any existing website, all that is required is a division container tag and the inclusion of the OpenLayers library and the attending javascript code.

Administration of the Geoserver Data Store

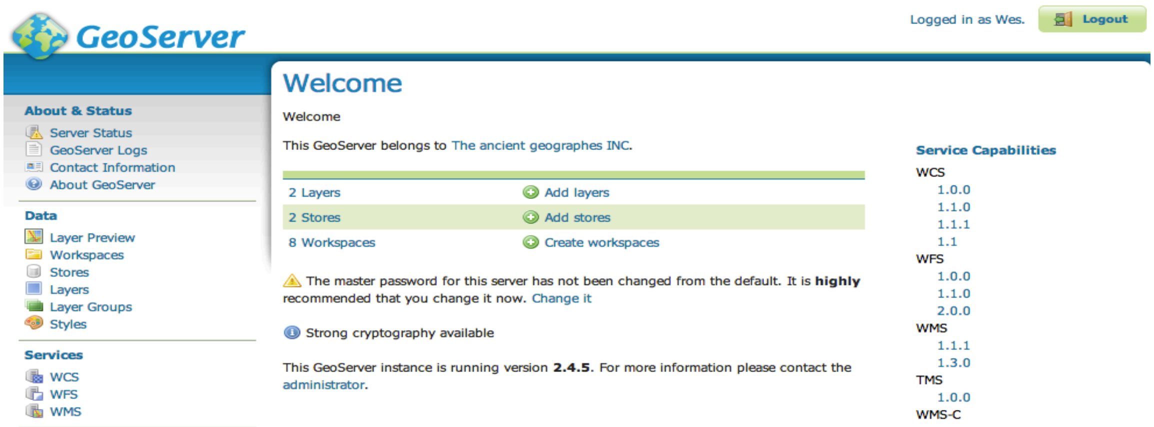
Logging in to your Geoserver implementation:

Logging in to your geoserver is as simple as visiting a regular webpage through your preferred browser, as most development has been done using Google Chrome, this is the suggested browser to use. The URL to visit is as follows:

http://142.58.127.116:8080/geoserver/web/

Geoserver will then require a Username and Password in order to log into the system and allow for any administrative processes to occur. Currently the only User with all allowed privileges is

Username: Wes
Password: wes



Upon Login, you can view all stores, layers and workspaces available to you.

Adding Data to your Geoserver

In order to add data to your Geoserver a few steps are required, you must have the data on your home drive, have an active Internet connection, know the server information, and have access to the terminal.

Step 1. Assuming the folder you wish to transfer to the server is on your machine in the Desktop engage terminal and type the following statement

scp -r ~/Desktop/*YourFolderName* geog455@142.58.127.116**:/home/geog455/Desktop**

Replace ***YourFolderName*** with the actual name of your folder, this will then ask for a password, the password is GEOSERVER in all capital letters. Once the folder has finished transferring to the server you will need to then log into the server itself using a function called ssh, to do this simply input the following command in terminal

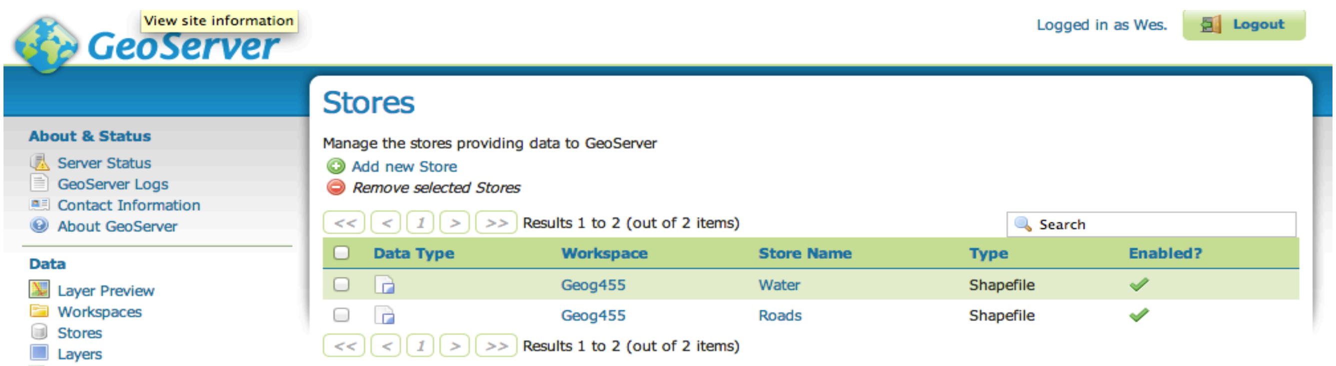
ssh geog455@142.58.127.116

Again the server will ask you for the password: **GEOSERVER** is the correct password again. Now that you have successfully logged into the server you will want to move the file from the Desktop to the appropriate geoserver data folder, to do this the last command is as follows

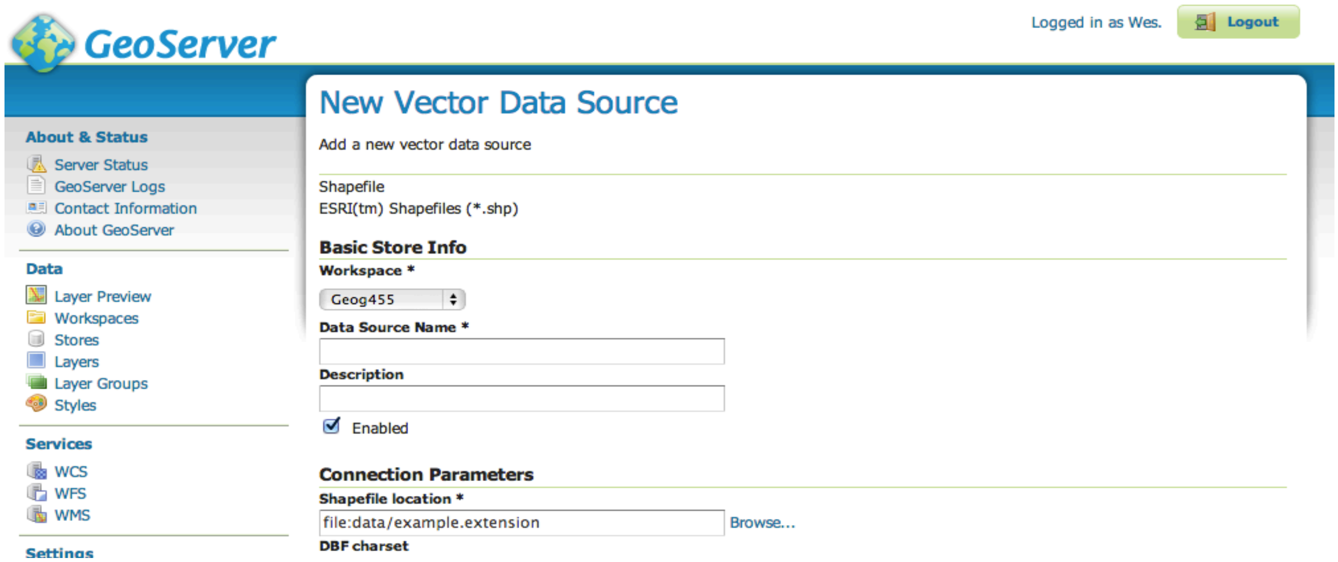
sudo mv ~/Desktop/*YourFolderName* /var/lib/tomcat7/webapps/geoserver/data/data/

This then moves your data into the correct folder so that geoserver can see and serve the data correctly.

Step 2. Log into the geoserver as stated in section 1 of this manual. Select Stores, from the left hand menu.



Clicking "Add new Store" as above, options are given as to the type of data we wish to add, this will likely be an ESRI shapefile, so select this file type to



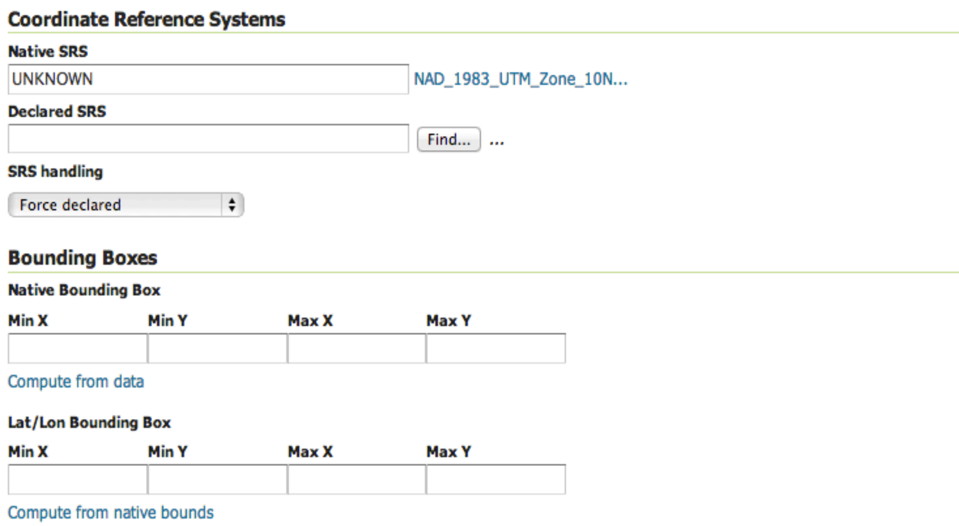
create a new data store. The next screen will ask you for a source name, and the file destination.

Input an appropriate name for the data; use only english characters and no spaces. Select the **Browse...** button to select the shapefile that you have just moved to Geoservers data folder and select **save** at the bottom of the page. On the right hand side of the next page we need to select **Publish**, this will allow us to use the newly linked data in our web applications.

This brings us to the final step in adding data to the Geoserver. This page asks for a name, and title, both of which should be the same as the "Data Source

Name" you created above. This name will be used to call on each layer when implementing the OpenLayers application.

As you scroll down the page most selections can be left as their default values, however, three selections must be set in order to correctly publish your new data store.



The Declared SRS, is the projection that will be used to define your data, there are many built in projections, to select one simply hit find, and select the projection you wish to use.

The Bounding Boxes, the easiest way to do this is to simply select "Compute from Data" for both boxes, however you must ensure the Declared SRS is selected before you select these options.

Once all of this is completed simply select **Save** at the bottom of the page and your new data is successfully stored in the Geoserver and can be accessed by your web implementation.

Quick Reference Guide:

IP: 142.58.127.116
Username: geog455
Password: GEOSERVER

scp -r ~/Desktop/*YourFolderName*
geog455@142.58.127.116:**/home/geog455/Desktop**
-Transfers files from your computer to the server
ssh geog455@142.58.127.116
– Logs you into the server to allow moving files
sudo mv ~/Desktop/*YourFolderName*
/var/lib/tomcat7/webapps/geoserver/data/data/
- moves files to the correct storage folder for geoserver to access

Geoserver Username: Wes
Geoserver Password: wes

Limitations

Throughout this project our group came across several limitations. One of our main goals that we were unable to complete was to provide a webmap that portrayed all the locations of restaurants, grocery stores and recreational centres. Our original plan was to download this information from Google Maps, unfortunately, that is not allowed. It is possible for a user to upload data, but not download it.

Another limitation in our webmap is that we could only upload shapeflles. This type of file is very easy to use in ArcMap (the software used to perform all the data management), but shapefiles can't store any symbology information. One way to work around this was to provide the analyzed data in paper format in the report.

The last limitation that we came across was if this type of website can actually be secure. Web 2.0 provides a new way to gather data and interact online, but there is no way to verify if the users are contributing false information.

Discussion

Our interactive web map will be useful to patients of cardiovascular disease, health practitioners, government officials in policy or urban planning, students and anyone seeking information on how services and environmental factors can affect their health. We have built a simple website framework that will be expansion-friendly for administration and user-friendly for visitors. The intent of our website is to allow users to see how their built environments positively or negatively affect their health such as locating where areas need better resources and how proposed development areas could be designed to improve its surroundings. The webmap would also provide a visual guide by displaying the available health services, where services are inadequate, where leisure centres, greenspaces, grocery stories and healthier food venues are located.

Conclusion

It is important to include the conditions of a locale in policy and development projects because the built environment can affect health, perception of safety and accessibility to services. With more sustainable planning and infrastructure, residents can easily enjoy the benefits of physical activity in their daily lives by accessing services close to them via greenspaces and walkable communities.

We believe our project allows our client to further expand the site depending on future needs. The site can be improved with more features such as allowing users to contribute more by sharing information about their locality, communicating with health practitioners and other users, and giving feedback about the website. Allowing users to save their own maps and add their own geotags could also improve this webmap. We hope that we have provided a simple website to help users in the decision-making process, to build more active lifestyles and foster healthier communities.

References

A direct assessment of "obesogenic" built environments: Challenges and recommendations2011*Journal of Environmental and Public Health* 161574-8

Assessing the influence of the built environment on physical activity for utility and recreation in suburban metro Vancouver2011*BMC Public Health 11*1959

Bower, M., Hedberg, J. G., & Kuswara, A. (2010). A framework for Web 2.0 learning design. *Eudcational Media International* , 177-198.

City of Vancouver. (2013, September 19). *Open Catalogue*. Retrieved March 1, 2014, from vancouver.ca: http://vancouver.ca/your-government/open-data-catalogue.aspx

Cocciolo, A. (2010). Can Web 2.0 Enhance Community Participation in an Institutional Repository? The Case of PocketKnowledge at Teachers College, Columbia University. *The Journal of Acadaemic Librarianship* , 304-312.

Community Health Research Team. (n.d.). *Home*. Retrieved Feb 14, 2014, from CoHeaRT: http://www.coheart.ca/

Crampton, W. J. (2008). Cartography: maps 2.0. *Progess in Human Geography* , 91-100.

District of North Vancouver. (2014). *Data*. Retrieved March 1, 2014, from DNV: http://geoweb.dnv.org/data/

Divine, M., Schumacher, M., & Stal-Le Cardinal, J. (2011). Learning virtual teams: how to design a set of Web 2.0 tools? *International Journal of Technology Management* , 297-308.

ESRI2013*Features*

Fernando, I. (2010). Community creation by means of a social media paradigm. *The Learning Organization* , 500-515.

GeoServer2014*Welcome*

Goecks, J., Eberhard, C., Too, T., The Galaxy Team, Nekrutenko, A., & Taylor, J. (2013). Web-based visual analysis for high-thoughput genomics. *Biomed Central* , 1-11.

Hager, D., Kibler, C., & Zack, L. (1999). The Basics of User Friendly Web Design. *Association for Quality & Participation* , 58-61.

Haklay, M., Singleton, A., & Parker, C. (2008). Web Mapping 2.0: The Neogeography of the GeoWeb. *Geography Compass* , 2011-2039.

Health impacts of the built environment: Within-urban variability in physical inactivity, air pollution, and ischemic heart disease mortality2011*Environmental Health Perspectives* 247-253

Hudson-Smith, A., Batty, M., Crooks, A., & Milton , R. (2009). Mapping for the Masses: Accessing Web 2.0 through crowdsourcing. 524-538.

Laituri, G. N., Zimmerman, D., Graham, J., Stapel, L., & Crall, A. (2010). User-friendly web mapping: lessons from a citizen science website. *International Journal of Geographical Information Science* , 1851-1869.

Lavie, T., & Tractinsky, N. (2003). Assessing dimensions of perceived visual aesthetics of web sites. *International journal of Human-Computer Studies* , 269-298.

Liu, X., Liu, H., Bao, Z., Ju, B., & Wang, Z. (2010). A web-based self-testing system with some features of Web 2.0: design and primary implementation. *Computers & Education* , 265-275.
Neighbourhood built environment and income: Examinin multiple health outcomes.1982*Social Science & Medicine 68*71285-1293
Open Geospatial Consortium2014*Glossary of Terms - W*
Ozek, Y. H. (2011). Implementing Web 2.0 Design Patterns in an Instiutional Repository May Increase Community Participation. 75-76.
Palaigeorgiou, G., Triantafyllakos, G., & Tsinakos, A. (2010). What if undergraduate students designed their own web learning environment? explorsing students' web 2.0 mentality through participatory. *Journal of Computer Assisted Learning* , 146-159.
Program Creek2014*Java*
Province of British Columbia. (2014). *Welcome to GeoBC*. Retrieved March 1, 2014, from geobc.gov: http://geobc.gov.bc.ca
Richards, D. (2006). Designing a User-Friendly Web site. *Journal of Califorina Dental Association* , 781-783.
Statistics Canada. (2008, December 19). *Forward Sortation Areas*. Retrieved March 21, 2014, from statcan: http://www12.statcan.gc.ca/census-recensement/2006/ref/notes/FSA-RTR-eng.cfm
The Apache Software Foundation2014*Home*
The built environemtn, climate change, and health: Opportunities for co-benefits2008*American Journal of Preventive Medicine 35*5517
The built environment and health2012*Perspectives in Public Health 132*3106
Turner, A. J. (2006). *Introduction to neogeography.* Sebastopol, CA : O'Reilly Media INC.
Wikipedia*Java Servlet*
Wu, O., & Hu, W. (2013). Measuring the Visual Complexities of Web Pages. *ACM Transactions on the Web* , 1-34.