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An Inventory and Assessment of Street Amenities and Vacant Lots in Downtown Lewiston, Maine: Defining Potential to Create a Healthier Neighborhood

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1. Executive Summary

Street amenities are publicly available resources, physical or biological, that have an aesthetic, functional, and/or ecological value (i.e. street trees, benches, traffic calming measures and community gardens). Healthy Neighborhoods (HN) is an organization working to improve the quality of life for residents of downtown Lewiston, Maine, USA through community engagement in increasing the number of street amenities and improving the local housing stock. With their work, HN hopes to encourage more people to get outside, improving health outcomes, and to foster greater cross-cultural community building and an enhanced sense of place. These goals of HN create a value system of which they plan to create a model corridor (a street of one or two blocks in length that demonstrates the values of HN) as a stimulus for increased equitable revitalization of this area with street amenities, improvements to housing, and development of vacant lots.

This project created an ArcGIS inventory of the street amenities that exist in a section of downtown Lewiston as outlined by HN. From this inventory, a scoring index was created as a tool to compare streets by their amenities and other factors. A brief assessment of vacant lots was conducted to evaluate the potential for future development by HN. A promotional brochure for HN that included maps was created. After creation of the ArcGIS maps, it was found that trees greatly outnumbered the other various amenities that were collected and assessed. A significant variation in sidewalk smoothness was discovered, with vacant lots more commonly found in places where the sidewalk was bumpy, unleveled, or had multiple flaws. Community gardens and open access green spaces have a non-uniform distribution within the neighborhood and the amount of each was limited. High amenity density by block was found where the sidewalk was smoother, although there were outliers. The highest model corridor block score was a 2.7 (with a maximum of 4 for a score) with the lowest score being a 0.4, which shows that no block is perfect in its current condition. The distribution of the composite scores was rather uniform, but it was noted that blocks with similar scores have different amenities and characteristics. The index demonstrates that there are multiple paths to obtaining a higher model corridor score. Vacant lots were assessed for potential development and the top three lots for future development, based on population density, distance from open access green space, and unit price per acre were: 111 Pine Street, 114 Bartlett Street, and 94 Howe Street.

Lewiston has immense potential for development and community engagement in this field, and this study has outlined visually where resources can be most effectively used. For future projects, it is suggested that Healthy Neighborhoods continues with their plan of engaging the neighborhood in their work (possibly using the brochure created), complete a more thorough evaluation of vacant lots and analyze more innovative possibilities for redevelopment, and to consider the impact of adding small commercial space into the neighborhood.

2. List of Tables and Figures

3. Introduction:

Where a person lives is a significant determinant of their health; it is a predictor of many negative health outcomes in the United States (U.S.)[1]. Neighborhoods are homes to many social determinants of health, such as social cohesion, access to good foods and services, and are homes to equitable forms of exercise for all of its residents [2-4]. There is a vast disparity in the indirect health services that a neighborhood can offer its residents between different regions, states, and especially different neighborhoods within the same city[3]. Using these determinants to measure a community's health status and focusing on these determinants is often a low-cost and effective intervention to improve the health outcomes of the residents (Figure 1).

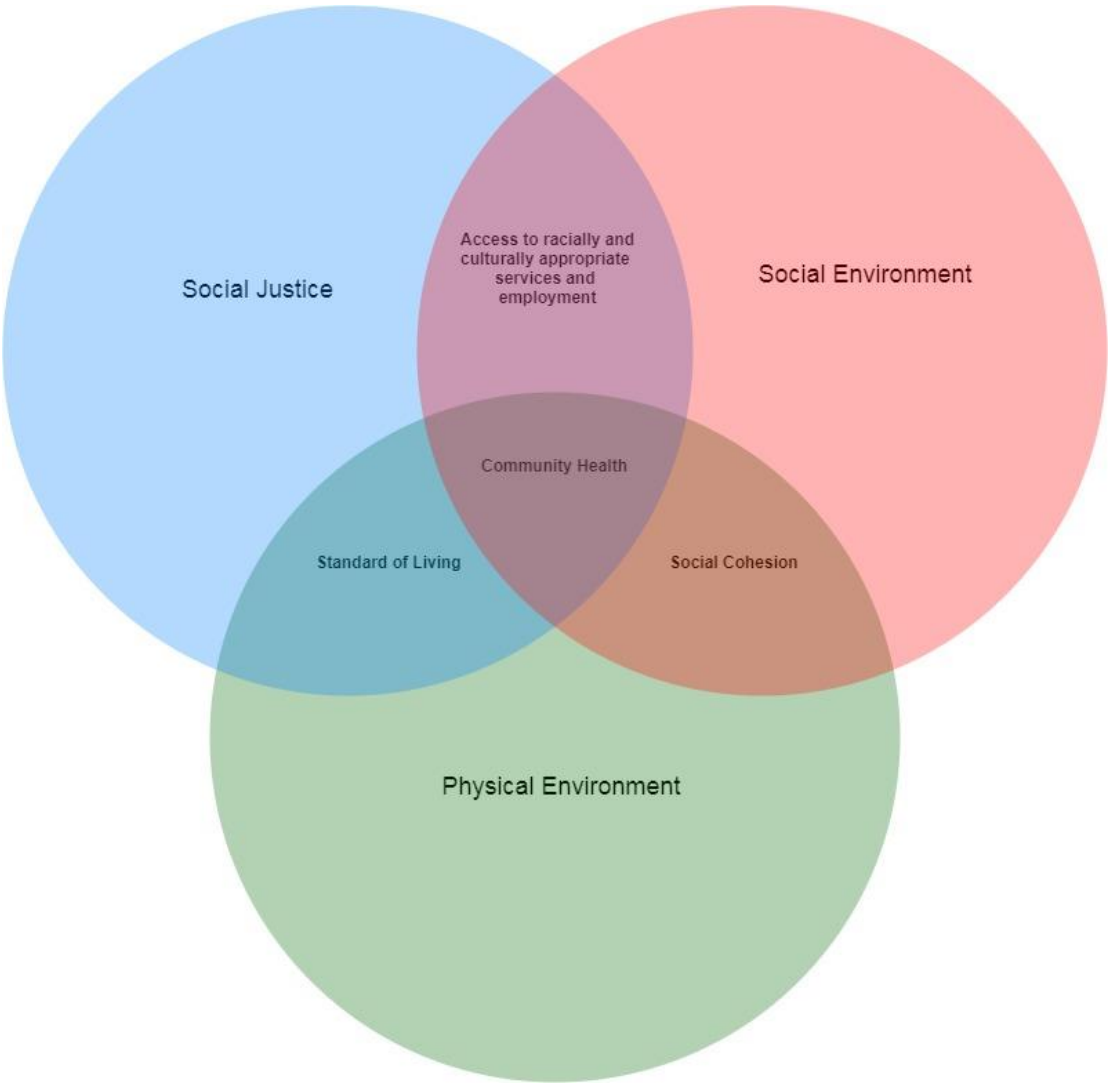

Figure 1: A conceptual diagram of the connection between determinants of health and outcomes. Adapted from Anderson et al[1].

A neighborhood-based approach to addressing these determinants would focus on interventions within homes and interventions outside of the home. To address determinants that occur outside of the home (e.g. the access to walk or ride a bike to work/school safely), an amenity-based approach can be taken. Street amenities are features of the built environment that provide a functional, aesthetic and/or ecological service to the neighborhood and have public access and benefits. This approach addresses issues concerning mobility, accessibility and safety of the built environment and how the residents perceive and interact with their neighborhood[4].

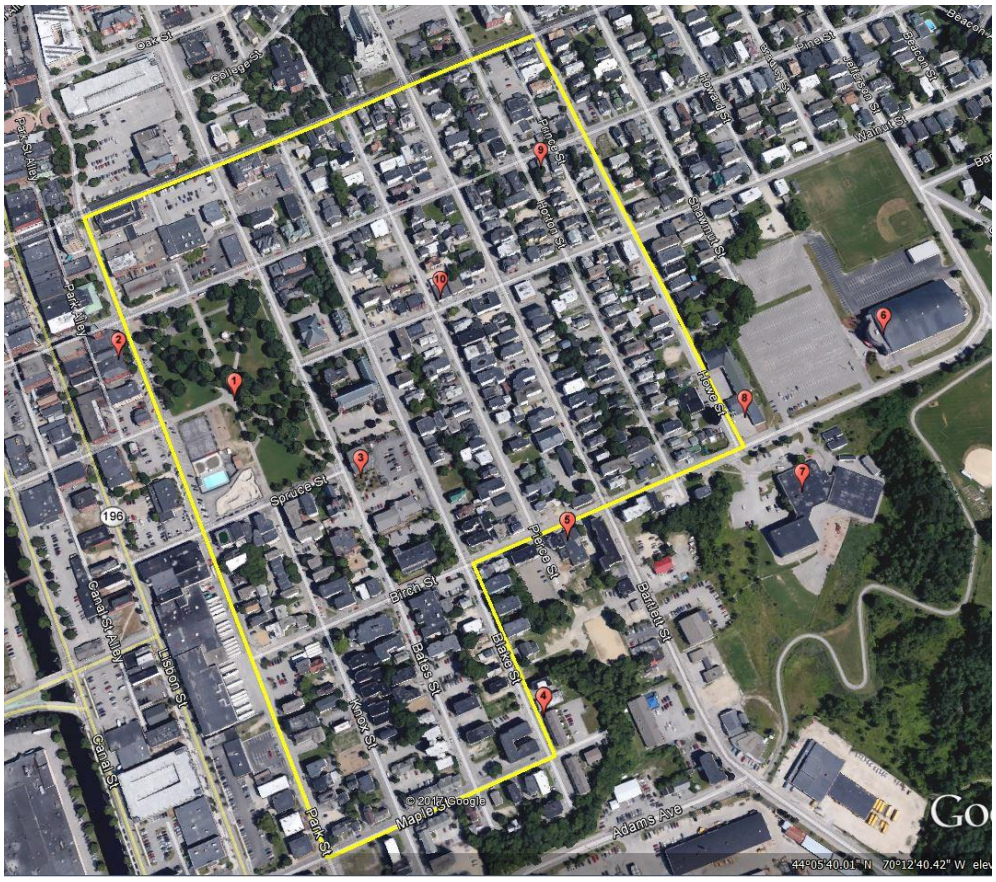

Figure 2: A map of the neighborhood that was studied, which is called the Tree Street Neighborhood and is highlighted in yellow. A list of significant places in or near the neighborhood are marked on the map by red numbered labels. 1= Kennedy Park. 2=Lewiston City Hall. 3=Community Concepts. 4=Dees Market. 5=The Root Cellar. 6=Androscoggin Bank Colisee. 7=Governor James B Longley Elementary School. 8=Tree Street Youth. 9.=Webb's Market. 10=Poirier's Market. This image was appropriated from Google Earth and adapted by the authors.

Healthy Neighborhoods is an organization whose mission is to improve the health status of the Tree Street neighborhood in Lewiston, Maine (Figure 2). They are comprised of several local organizations that focus on improving the living conditions of residents inside and outside of their homes so that Lewiston is a place in which people choose to live, work, play and invest [5].

However, an assessment of the amenities and vacant lots that exist in this area has not yet been created; this assessment will direct future work in improving this neighborhood. After the assessment is completed, Healthy Neighborhoods will first create a model corridor to demonstrate the benefits of a Healthy Neighborhood and encourage outward growth into other streets within the neighborhood.

A model corridor is a one or two block section of a street that demonstrates Healthy Neighborhoods' principles of creating a neighborhood that encourages people to be outside when they are not in their homes. Considering only within a residential neighborhood, a model corridor is green and fosters a sense of community and place for its residents. A model corridor has the amenities that can represent the values and attributes of a Healthy Neighborhood (Figure 3) and an amenity-based approach is the most appropriate to creating one.

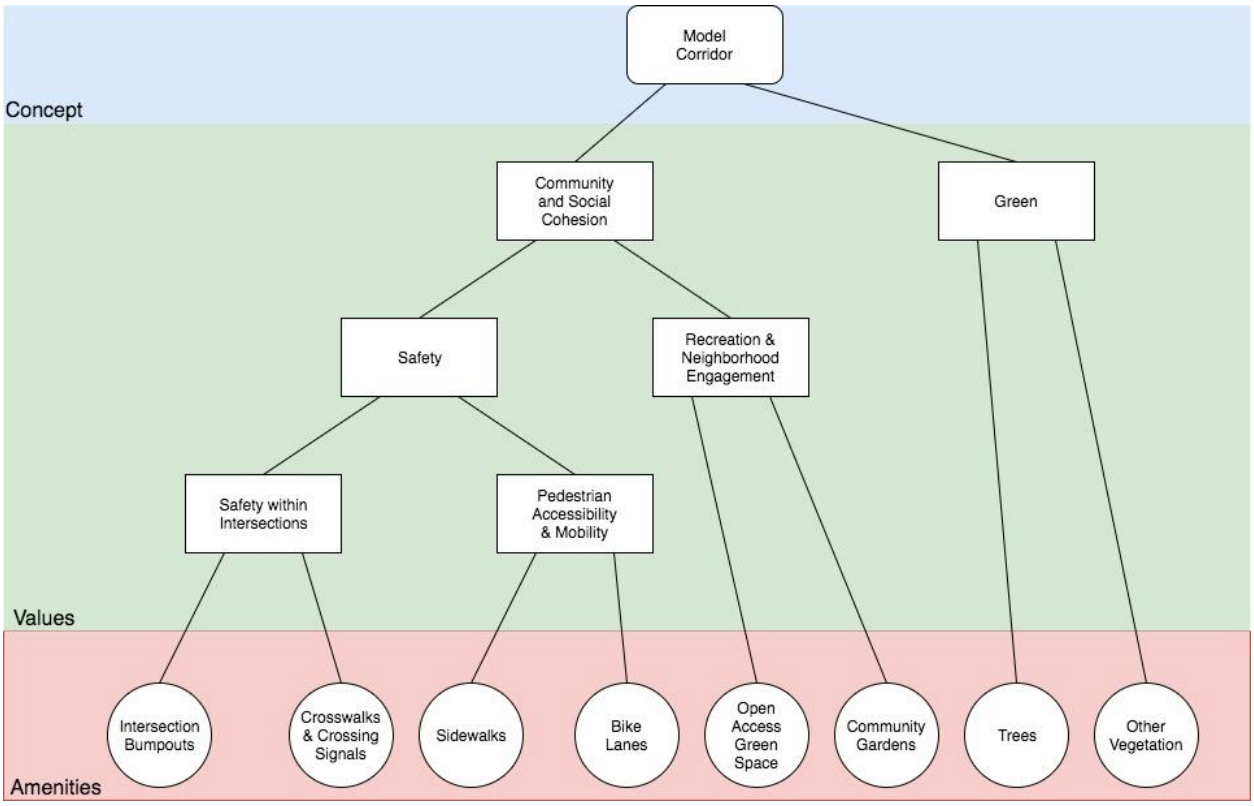

Figure 3: Tree chart of a model corridor and the values it represents, and the amenities that contribute to said values.

The work of this project with Healthy Neighborhoods was to complete an inventory and assessment of the existing amenities and vacant lots with a spatial component using geographical information systems (GIS) maps with the purpose of assisting in the identification of a model corridor in the future with the input of the neighborhood's residents. Our contribution to obtaining community input included a focus group on street amenities and their effects on

residents' lives and a promotional flyer about Healthy Neighborhoods and the impact of amenities to obtain more community input in future projects.

4. Methods:

4.1 Field Methods

After some research on street amenities, including what they are and what their benefits are, it was determined that the amenities to be inventoried were street trees, vacant lots, sidewalks, intersection bumpouts (i.e. the part of the sidewalk that extends into the road so that the pedestrian has a better viewing angle before crossing and that cars are encouraged to drive more slowly), crossing signals, benches, open access green spaces, community gardens and bike lanes. This included a strategy developed by the Los Angeles Land Trust to assess vacant lots for potential renovation into public green spaces and community gardens, as well as criteria from the University of Maryland to quantify sidewalk accessibility [6-7]. The City of Lewiston's GIS system was also used to see where vacant lots were [8]. This method collection was aimed at collecting both spatial and qualitative data that could be useful to both community members and organizations. Sidewalks were evaluated on a five-point scale, with a rating of 1 representing a sidewalk without cracks or bumps that could impede pedestrians, wheelchairs, or strollers. A rating of 5 signifies a sidewalk that is significantly cracked or has bumpy pavement that presents obstacles to passersbys. In all scales used for field data collection, 1 represents the highest quality, while the greatest number in the rating scale represents the potential for improvement. A waypoint of each amenity was taken using a geographic positioning system (GPS). Specific methods for analyzing each street amenity can be found in the Appendix D.

Data about the amenities that were assessed were collected between October 11, 2017 to November 8, 2017. Additionally, unsolicited feedback was collected from residents of the neighborhood who may have had questions about the research being conducted. These quotes from the residents were recorded as well. During and after data collection, data was entered into an Excel data sheet with the specifics of what information and how it was entered into the data sheet being explained in section 4.3 and appendix D.

4.2 Focus Group

Focus group questions were thought of after careful evaluation of scholarly sources and from discussions with Shanna Cox of Healthy Neighborhoods. It was decided that the questions needed to be concentrated on how residents evaluate the qualities of all amenities that were assessed, what they believe to be important and not important to the community, and what current assets and potential exist for the neighborhood. Examples of the questions created to ask the focus group can be found in appendix D. A slideshow presentation was created to accompany the questions that would be asked at the focus group. This visual presentation included pictures of the neighborhood and maps that had been created at that point in the process to show to the

community. The focus group was conducted at The Root Cellar located at 89 Birch Street, Lewiston, ME on November 9, 2017.

4.3 Model Corridor and Scoring Method

To consider the importance of certain qualities in a model corridor, a scoring method that evaluated and weighed certain qualities of a block differently, was created. From this the following equation was developed:

$$A_i = \frac{I_i}{\max(I)} + \frac{P_i}{\max(P)} + \frac{R_i}{\max(R)} + \frac{T_i}{\max(T)}$$

Where A is the model corridor score, *I* represents the block's two terminal intersections, *P* denotes pedestrian mobility of the block, *R* indicates recreation and social cohesion of the block, and *T* exhibits the number of trees on the block. Each of these subcategories is then divided by the maximize score that was attained by one of the blocks in the survey area. The components of *I, P, R,* and *T* were broken down and weighed accordingly. More information can be found in Appendix D.

4.4 ArcGIS Mapping

Using the data collected from the field and the GPS waypoints (as described in section 4.1 and Appendix D), a number of ArcGIS layers and subsequent maps were created to help visualize the data that was collected. First, all of the descriptive data and GPS waypoints that were collected were archived into Excel spreadsheets which were formatted and stored. All of the data points were then merged together into a single layer and the appropriate Excel spreadsheet that represented the amenity data was joined to this layer. Each amenity was then symbolized appropriately based on what the amenity represented was.

Layers were then created for sidewalk smoothness ratings, amenity density by block, model corridor score by block, census tracts for the area based on US Census data, and a 500 foot buffer distance around parks [9]. Model corridor scores were obtained by using the model corridor score formula in section 4.2 and appendix D. Parcel data was used to help generate vacant lot, open access green space, and community garden parcels and their polygons. The proper Excel spreadsheets were joined to these layers based on the methods. All layers were symbolized accordingly. With some layers, instead of joining Excel spreadsheets to them, the appropriate columns were just added to the layers attribute table and the numbers matched to the correct data. Labels to some layers were applied when necessary. See appendix D for more information on formatting details.

4.5 Flyer

An informational flyer was created for Healthy Neighborhoods to use with the purpose of getting their message out to the neighborhood about their principles and to also begin to create neighborhood ownership and engagement in Healthy Neighborhoods' work. The flyer was complemented with maps that were created.

4.6 Other Vacant Lot Data

Besides the data generated for vacant lots in section 4.3 and appendix D, data was collected from the City of Lewiston's GIS database about the current assessed value, in U.S. dollars and the area of the lot in acres. This was then made into a unit price in which the assessed value was divided by the lot area (U.S. dollars/acre). This data, along with the data from section 4.3 that was generated, were used to create a list of the top ten vacant lots for each category and then the three vacant lots that have the highest developmental potential based on these categories when they were combined together.

After finding the tract population, a number scale was made so that each block within the tract was assigned a number based on which tract it resided in. These numbers were assigned based on high to low, with highest number being assigned to vacant lots in blocks that were in the census tract with the highest population density; the next highest number was given to the next highest population density tract and so on for the amount of census tracts for the neighborhood. The highest number was given priority for development. If a lot resided outside of the open access green space buffer, as generated in section 4.3 and appendix D, then that lot was assigned a 1 in that category and lots inside the buffer were given a 0; lots that received a 1 were given priority. Priority based on unit price used the numbers 1 through however many vacant lots there were, with lowest unit price receiving a 1, the next lowest a 2, and so on. The lowest unit prices were given priority.

5. Results and Discussion:

5.1 Mapping with ArcGIS

After data collection, the number of recorded amenities was computed and organized by type. Trees were the most abundant amenity, with 457 trees recorded in the study area, almost 7 times more than the amount of benches found, the next most abundant amenity (Figures 4 and 5). Benches, however, were 2.7 times more common than trash cans (Figure 4). Other amenities studied, such as bump-outs, vacant lots, and community gardens, were less numerous than the benches.

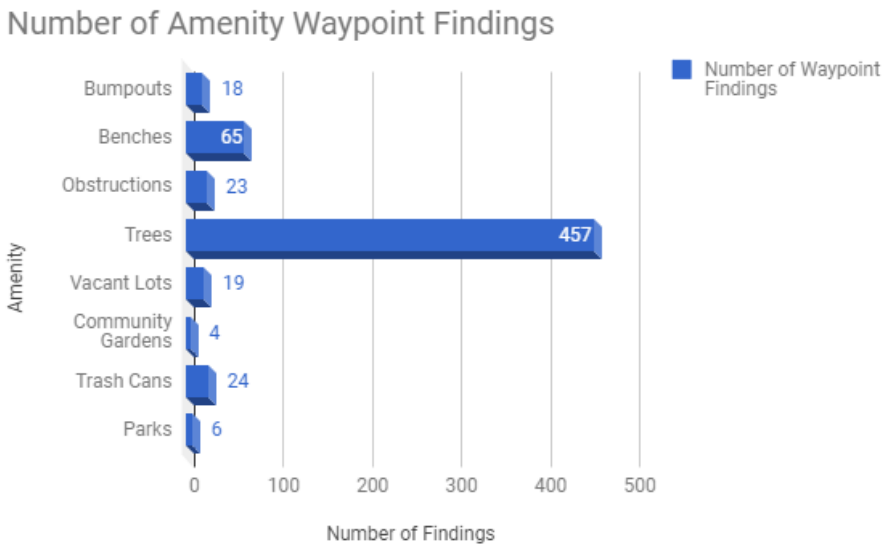

Figure 4. Graph of the number of amenity waypoints collected by type.

Using ArcGIS, a variety of maps were created to display the physical location of these amenities. Open access green space was decided to be the term representative of parks because not all parks are open to the public. Also, it should be noted that the parcels which are labeled as "Open Access Green Spaces," doesn't mean that the parcel is a whole entire open access green space; rather, part of the parcel or, in the cases of Kennedy and Paradis Parks, the whole entire parcel is the park. While these maps show the placement of these various amenities they do not show how the amenities interact or co-benefit one another.

The amenity concentration number is also inside of the yellow dots to show the exact amount of amenities that were by the block. While an 18.5 meter buffer was created on both sides of all of the streets to capture the amenities on each street, it should be noted that this catches all amenities that provide benefits to people along the streets; these buffers do not capture amenities that may be inside all of the parks, especially Kennedy and Paradis parks (Figure 11). High amenity concentrations are generally associated with the lowest numbers for sidewalk smoothness. For example, on Horton Street from Birch Street to Walnut Street, which has the highest concentration of amenities by block, also has a sidewalk smoothness ranking of 1 on both sides of the street. This is also true throughout Walnut Street, Ash Street, Park Street from Ash Street to Pine Street, Knox Street from Birch Street to Maple Street, and all blocks of Bates Street from Ash Street to Birch Street. There is an exception to this in a few places such as Birch Street from Bates Street to Blake Street, Blake Street from Walnut Street to Birch Street, and Bartlett Street from Walnut Street to Birch Street (Figure 11).

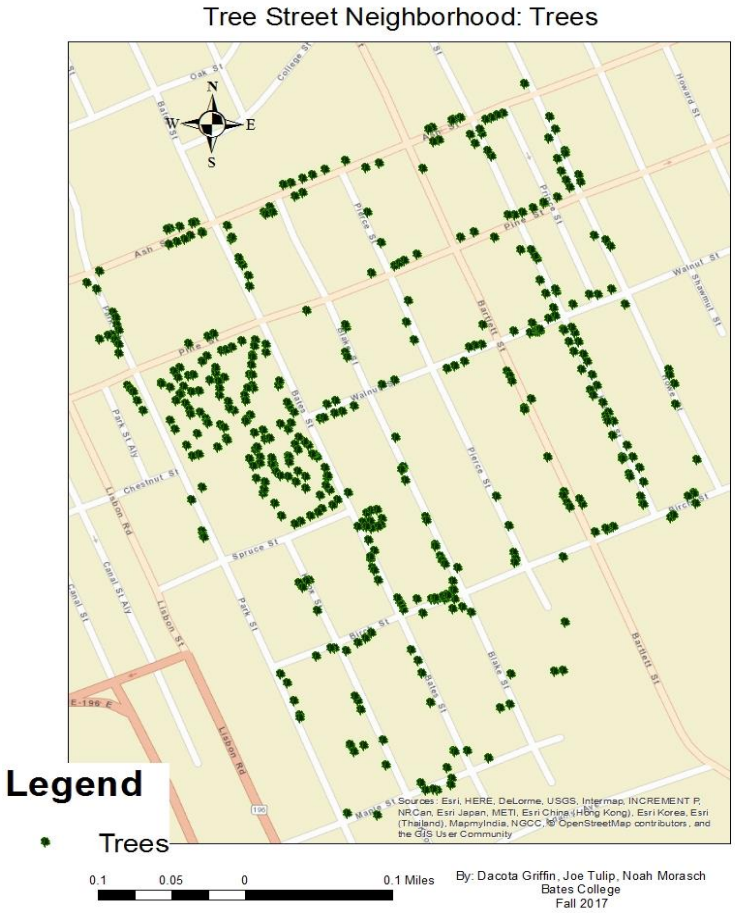

Figure 5: Map of tree waypoints collected, created with ArcGIS, from the Tree Street Neighborhood.

There are less amenities on streets where there are more vacant lots (Figure 11). This can be seen on Howe Street from Pine Street to Walnut Street, where there are five total amenities and two vacant lots, Bartlett Street from Pine Street to Walnut Street (one total amenity and three vacant lots), Bates Street from Birch Street to Maple Street (eight total amenities and three vacant lots), and Pierce Street from Walnut Street to Birch Street (twelve amenities and two vacant lots). The two exceptions to this are Horton Street from Birch Street to Walnut Street (40 amenities and two vacant lots) and Blake Street from Walnut Street to Birch Street (26 amenities and four vacant lots). While these Blake Street and Horton Street blocks may be an exception to this, the vacant lots correspond with sidewalk that have high sidewalk smoothness numbers. In general, vacant lots have high sidewalk smoothness ratings (at least a three or better) associated with the sidewalk that runs along the entry point or area to the vacant lot (Figure 11). This is true of every vacant lot except the two vacant lots on Horton Street from Walnut Street to Birch Street, the one on Bates Street from Ash Street to Pine Street, two of the three lots on Bartlett Street from Walnut Street to Pine Street, and the vacant lots along Walnut Street and the one

vacant lot on Pine Street from Blake Street to Pierce Street. Lastly, there are just four community gardens in the Tree Street Neighborhood and they are randomly scattered for the most part (Figure 11). Conversely, they are in areas with amenity concentrations below fourteen total amenities.

5.2 Focus Group

The focus group was attended by 8 people. 6 lived within the outlined neighborhood, and 3 were Lewiston High School students. Sidewalks were the general focus of the session, and participants noted the benefits of being able to get around easily, such as the environmental benefits of not creating emissions, the health benefits, and how it can facilitate "fun activities for people and/or families." We noticed that, for sidewalks with large visual deformities, that the focus group tended to rate the sidewalks more highly (Figure 6). However, there was more deviance between the criteria set and the focus group's beliefs on Park Street and Horton Street, as they saw the cracks less impeding on Park Street and that the trees on Horton Street would hinder the passage of pedestrians on the sidewalk.

There was also concern around planting esplanade trees, as they could potentially block drivers' line of sight until they are mature. This criticism, however, was met with several positive comments about adding street trees, such as "the more green, the better," "[Trees] break up the monotony," and "[Trees] improve one's disposition." Bumpouts also received mixed feedback, as some participants who do not own cars were concerned about the ability for larger vehicles (trucks and snow plows) to fit down the street while other participants who owned cars noted that it "forced them as drivers to pay more attention." The participants also saw the most important reuse of vacant lots to be pocket parks, with resources with which children can play.

Something that had not yet been considered until the focus group was the drastic effects that winter has on mobility in this neighborhood. The high school students described their half mile walk to and from school each day that involves walking over snow banks and walking on the street. When this was brought up, two of the other participants immediately chimed in that "[The city does] nothing about sidewalks." They noted that there are inconsistencies in clearing sidewalks in the neighborhood, and that cars are heavily prioritized in snow removal in a neighborhood where the majority of people do not own cars. Participants also noted a lack of activities for adults in the winter; participants with cars admitted to walking around Walmart or the Auburn Mall to get some exercise.

The participants also noted how there was a lack of this information concerning winter in our promotional brochure, and the authors added activities after the focus group. They liked how the maps were integrated into the brochure and how they were able to see where all of the trees in the neighborhood are located. They were quite excited about Healthy Neighborhoods' work, especially once they had a brochure to broaden the scope of the organization from just sidewalks and street amenities.

Figure 6: Comparisons between our evaluation of sidewalks and that of the focus group without having the criteria outlined to them. For the picture on the left (Birch Street between Howe and Horton), the authors evaluated it at a 5 and the focus group average was a 4.6. For the sidewalk on the right (Birch Street between Knox and Bates), the authors evaluated it as a 5 and the focus group average was a 3.8.

Figure 7: Comparison between our sidewalk smoothness evaluations and the focus group's. On the left (Park Street between Birch and Maple), we evaluated the sidewalk as a 4 and the focus group (on average) evaluated it as a 2.1. On the right (Horton Street between Walnut and Birch), the focus group evaluated it as a 2.8 (average) and we evaluated it as a 1.

5.3 Model Corridor Score and Map

Looking at this data from the perspective of the model corridor score that is reflective in the model corridor map (Figure 12), a variety of things can be interpreted. After normalizing all values so that they would fall within a 0-4 range, the highest score across the blocks is a 2.7 which appears in the block of Horton Street from Walnut Street to Birch Street and in the block of Pine Street from Park Street to Bates Street. Only 8 out of 58 blocks (when you combine the similar scores of blocks that were: Pine Street from Park Street to Bates Street, Walnut Street from Horton Street to Howe Street, Pine Street from Horton Street to Howe Street, and Ash Street from Horton Street to Howe Street.) in the neighborhood had model corridor scores of a 2 or above (Figure 12). Meanwhile, 11 out of 58 blocks received a score of 1 or lower, which shows that not a large majority of blocks were in the lowest scores. Overall, the majority of blocks were in the mid-range section based on the scores that were obtained by the formula, but the majority were in the lower half of the scoring method based on projected scores. The two blocks (Horton Street from Birch Street to Walnut Street and Pine Street from Park Street to Bates Street) with highest model corridor score of 2.7 varied in how they got that score. Both, the Horton Street block and Pine Street block have similar intersection scores (18 and 17, respectively), but their pedestrian mobility scores (40 and 29, respectively), recreation and social cohesion scores (0 and 9, respectively), and their tree scores (19 and 5.5, respectively) varied considerably from one another. The pedestrian mobility scores varied because the Pine Street block had an obstruction and higher smoothness rating, while it also had a lot of benches that boosted its recreation and social cohesion score that the Horton Street block didn't have. But the Horton Street block had a lot of trees, more than any other block, that really helped to boost its score. Many of the other high scoring blocks varied a lot, but typically had lower scores for their tree scores (usually 5.5 or less) and recreation and social cohesion scores (all others had a score of 0 to 1). Blocks with very low model corridor scores, usually had low intersection, pedestrian mobility, and tree scores. Low pedestrian mobility scores were mainly due to the fact that these blocks had high sidewalk smoothness ratings.

It can be seen from this data, that there is high variance in the ways which blocks receive the model corridor score. Usually, low amenity density leads toward low model corridor scores, since the individual scores that make up the overall model corridor score each have some aspect that involves the amenities (Appendix D). High ratings in sidewalk smoothness lead to low scores as well, because they contributed towards there being less ramps apparent on those sidewalks as well. Furthermore, obstructions could really reduce the pedestrian mobility score of the block. Recreation and social cohesion scores did not vary by that much, but being in the proximity of an open access green spaces could affect the density of amenities that are typically associated with open access green spaces in the block though. Tree scores vary from 0-19. The fact that the City of Lewiston chooses where to plant trees could greatly alter this score, because if they plant a high number of trees in one block, such as Horton Street from Walnut Street to

Birch Street, then the tree score increases. Tree scores could also be more variable because of the trees that were counted in the buffer created along the roads that were used to count the amenities for blocks. This buffer could have captured some trees that were more open access green space trees than they were street trees. That being said, those trees that may be more open access green space trees than street trees still provide shade to pedestrians traversing the sidewalks. It should also be noted that model corridor block scores may have been different if blocks were considered in a different manor. For the sake of this project, a block was considered to be both sides of one street and ended once this street intercepted another street at either end of it. Some people consider blocks to be a rectangle encapsulating the area between two parallel streets and the streets that they intercept at either end of them. The definition of a block could definitely alter these model corridor scores. The authors choice of what a block is was chosen because people in the Tree Street Neighborhood typically interact with their neighbors that are across or beside them on the same street, not their backyard neighbors.

With regards to the intersection score, crosswalk signals had very little effect on the overall score, as only 2 could exist for each block. On the contrary, if a street was a priority plowing street and was lacking of crosswalks, this score and overall score were greatly impacted because the safety of pedestrians could be at risk here because missing crosswalks could greatly increase accidents because of the assumed business of the street; the street was assumed to be busy if it was priority because that means it was one of the first streets to be plowed in the winter which indicates that it is heavily trafficked by cars.

5.4: Considerations for Vacant Lots

The one type of amenity that was not considered as a factor in the model corridor block score is vacant lots. Vacant lots were not put in as part of the score because they represent potential and opportunity for development in the neighborhood rather than an existing amenity. Instead, various factors were considered when evaluating what a vacant lot might become and which vacant lots would benefit the community most from development into a new open access green space, community garden, or something else. When looking at vacant lots in the Tree Street Neighborhood, this project assessed the population density of the block (people/square mile), the distance a vacant lot is from an open access green space, and the unit price or assessed value divided by the lot area (U.S. dollars/acres). U.S. Census tract population densities were chosen because the description of what was defined as a block for this project wasn't the same as the U.S. Census defined as a block [9]. The block sizes were highly variable and the population within those blocks could include several blocks. Also the measurement for population density as "people/square mile" was chosen because it was the only density measurement available for the neighborhood. When thinking about creating more open access green spaces or expanding community gardens in the neighborhood, it is also important to consider the size of a lot. Bigger lots are obviously more realistic to develop these types of spaces, but they are usually more expensive to purchase.

Tract 20300 though had double the vacant lot size than either of the other two tracts and the lots within this tract were assigned a 3, while lots in census tract 20100 and 20400 were given a 2 and 1, respectively. Lots that were outside of the open access green space buffer of 500 feet and these lots were given a 1 (Figure 13). As can be seen from this data, vacant lots on Bartlett Street and beyond going northeast in tract 20300 were given priority in these two categories (Figure 13). With the addition of best unit price, the three vacant lots that should be placed as priority for having the best development potential are: 111 Pine Street, 114 Bartlett Street and 94 Howe Street. These are in no particular order and all are just as worthy candidates for development. These vacant lots have high potential for development as new open access green spaces, but could also be used as community gardens and for other developmental projects that would benefit the neighborhood.

6. Next Steps:

1. **Create more community engagement in Healthy Neighborhoods' work:**
   Healthy Neighborhoods is looking forward to including the neighborhood's residents and their valued opinions. Healthy Neighborhoods intends to create minor edits to the brochure created and use it to continue to convey their message to neighborhood residents. Ideas for engaging the community may be to have a large meeting with a question and answer section to hear people's responses about ideas of development within the community and a neighborhood door-to-door survey

2. **Create a more comprehensive assessment of vacant lots in the neighborhood:**
   The authors were unable to give vacant lots and their potential the complete attention that they need. Some suggestions the authors have for this assessment is that density is measured as dwelling units per net acre. There are also more innovative and unique ideas than pocket parks and community gardens that may benefit Lewiston in a more effective and equitable manner.

3. **A consideration for the inclusion of more retail or other commercial space within the neighborhood:**
   Except for a few neighborhood markets, non-profits, and a bank, there are no other commercially zoned areas within the neighborhood (except LePage bakery, which is just at the edge of the neighborhood on Park Street). A study can be done to study the impact of several different options - the authors do not want to assume what they might be, having not studied this concept - on the neighborhood and suggest implementation plans if need be.

4. **Further consideration of the impact of the neighborhood on children:**
   Lewiston is a city of families, and the authors were reminded about this several times

during the focus group. Therefore, the authors suggest that Healthy Neighborhoods include specific focus on neighborhood interventions that benefit children directly and that all methods to improve their safety and health are considered and/or implemented.

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8. Appendix

A. Maps

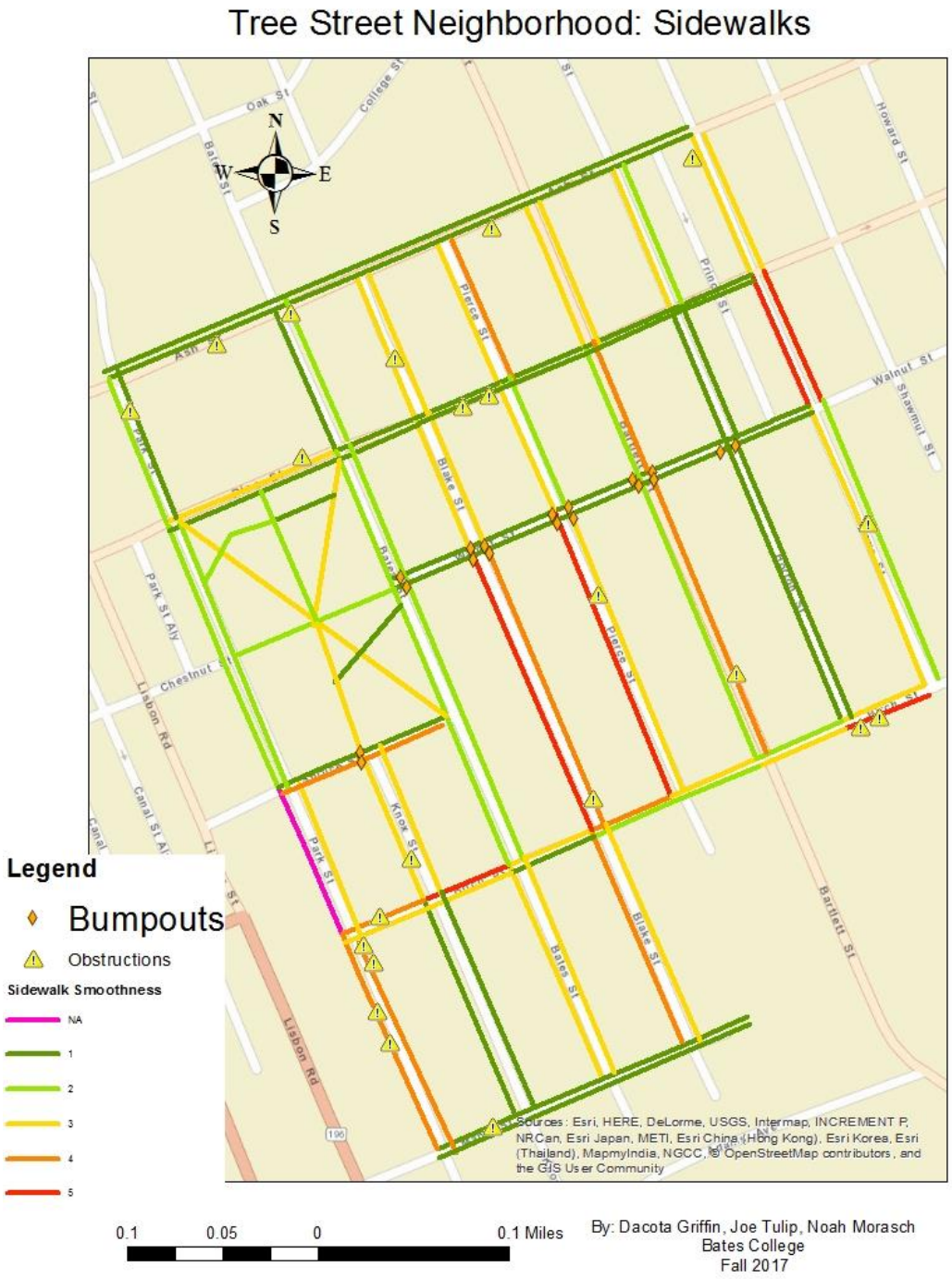

Figure 8: Map of sidewalk smoothness for each sidewalk in the Tree Street Neighborhood, which are displayed on the 1-5 scale rating. Yellow triangle signs with an exclamation point in the middle are representative of obstructions on the sidewalk and their waypoint location. Orange diamonds are the waypoint location of bumpouts.

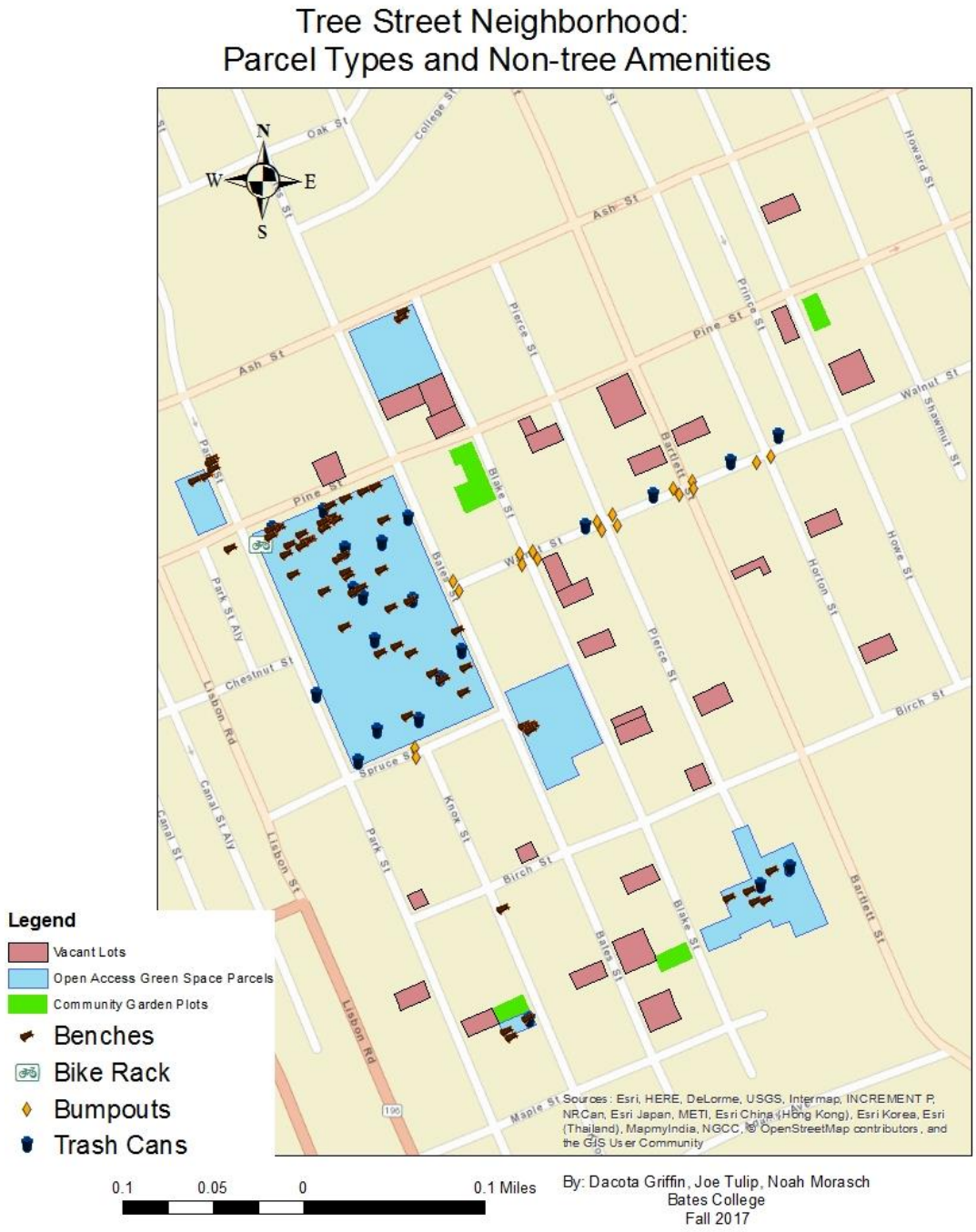

Figure 9: Map of the different parcel types and other amenities that were surveyed and found in the Tree Street Neighborhood. Benches are represented as red outlined benches, bike racks as a green bike surrounded by a sign, bumpouts are orange diamonds, and trash cans can be identified by blue trash cans. Parcel types are as follows: green lots are community gardens, coral lots are vacant lots, and blue lots are open access green space parcels. Community gardens are randomly scattered and these other amenities shown here are typically located within open access green spaces.

Figure 10: Map of the various parcel types whose location was collected. It can be seen that there are numerous vacant lots and a very limited amount of community gardens and open access green spaces.

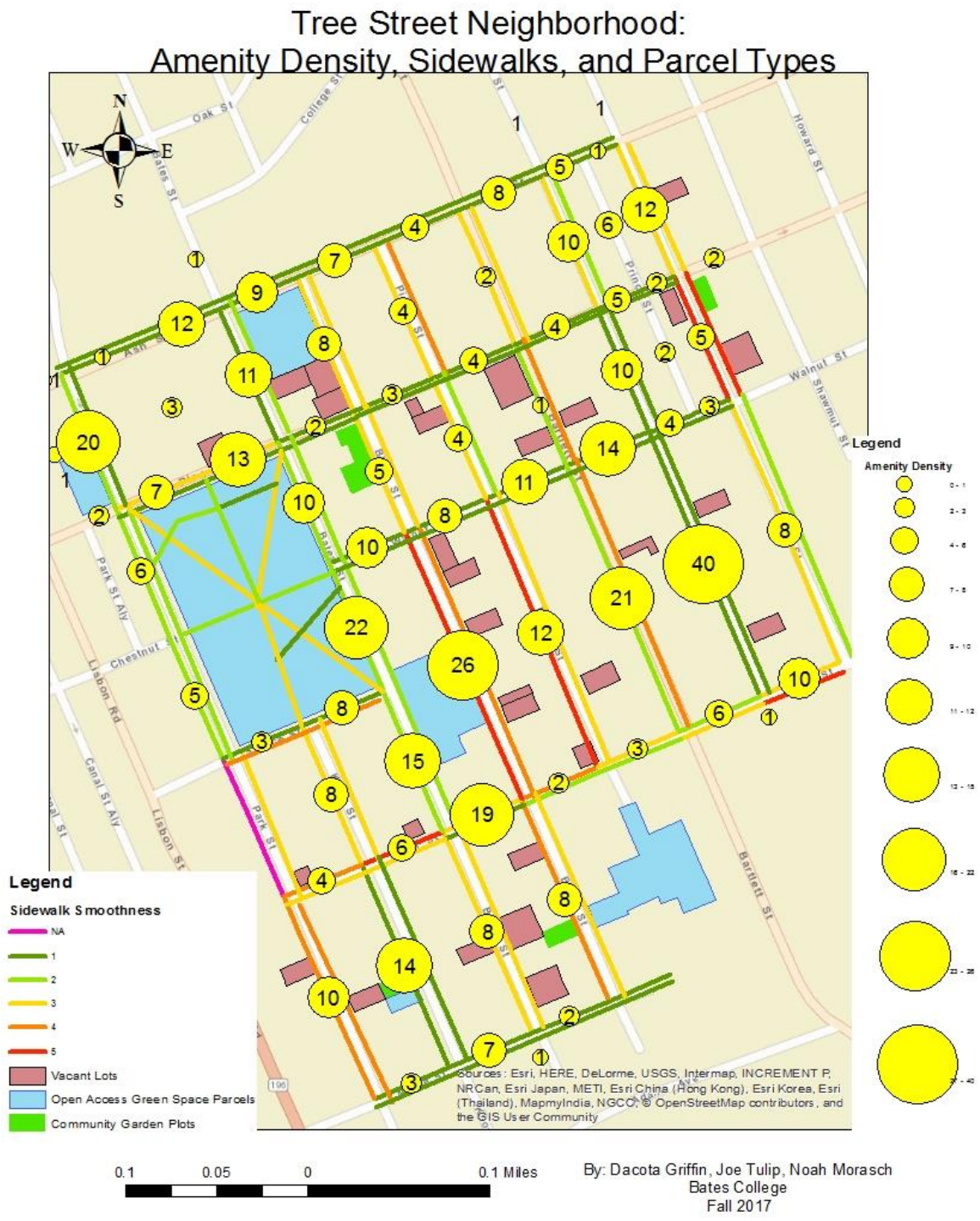

Figure 11: The amenity concentration of the neighborhood by block, where yellow circles indicating amenities density located in that block; the number of amenities in that block are labeled inside the yellow circle. Sidewalk smoothness is also noted along with the different parcel types. It can be seen that low sidewalk smoothness rankings (1 or 2) typically correspond with higher amenity density ratings and with less vacant lots.

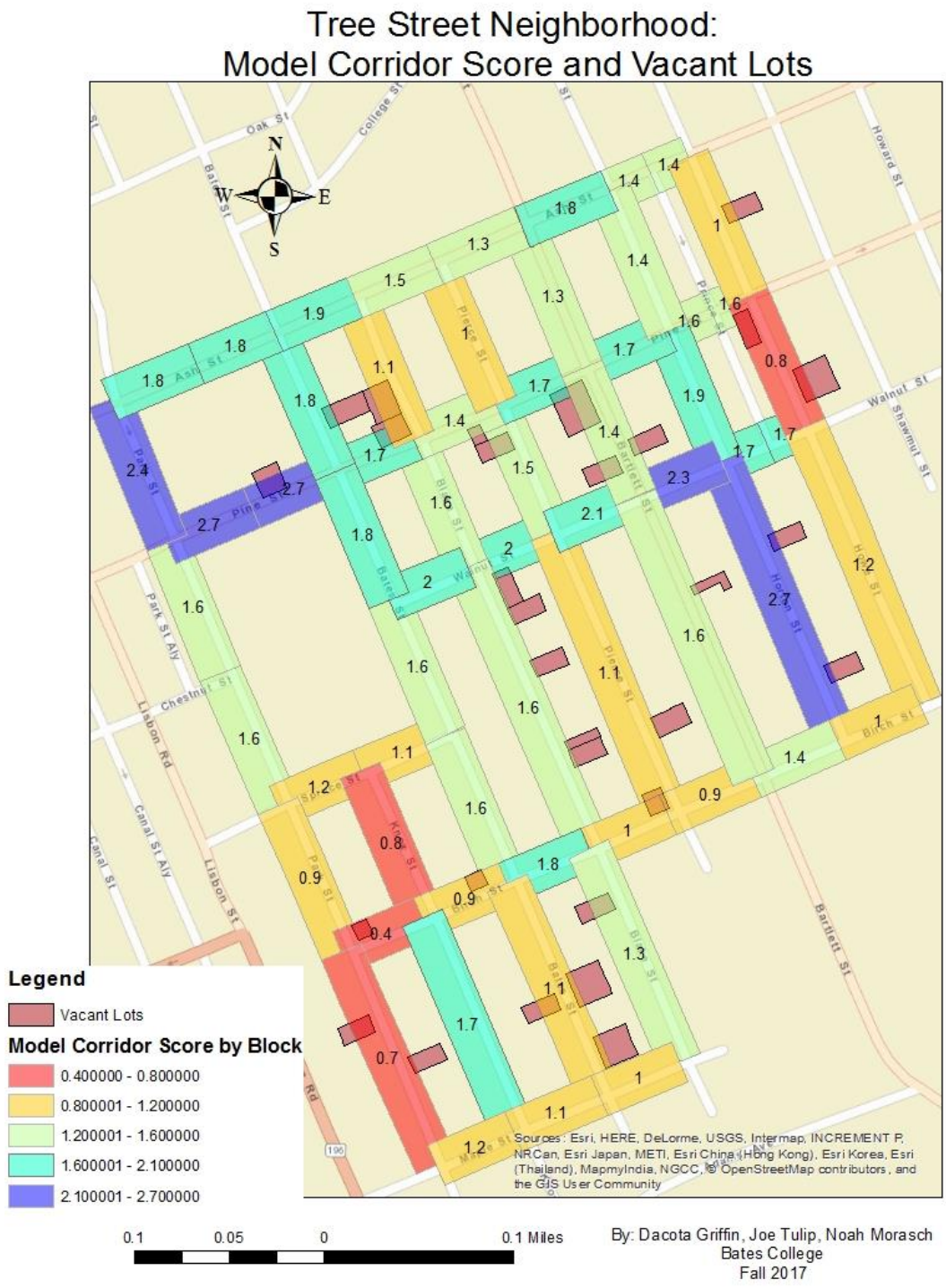

Figure 12: Map of each model corridor score, calculated using the model corridor scoring system, for each block; the score is labeled on the block. The color scale indicates a range of scores that fall within that color. No model corridor had a perfect score, but none received a zero either. This suggests that there is room for improvement on every block and the vacant lots are part of that development.

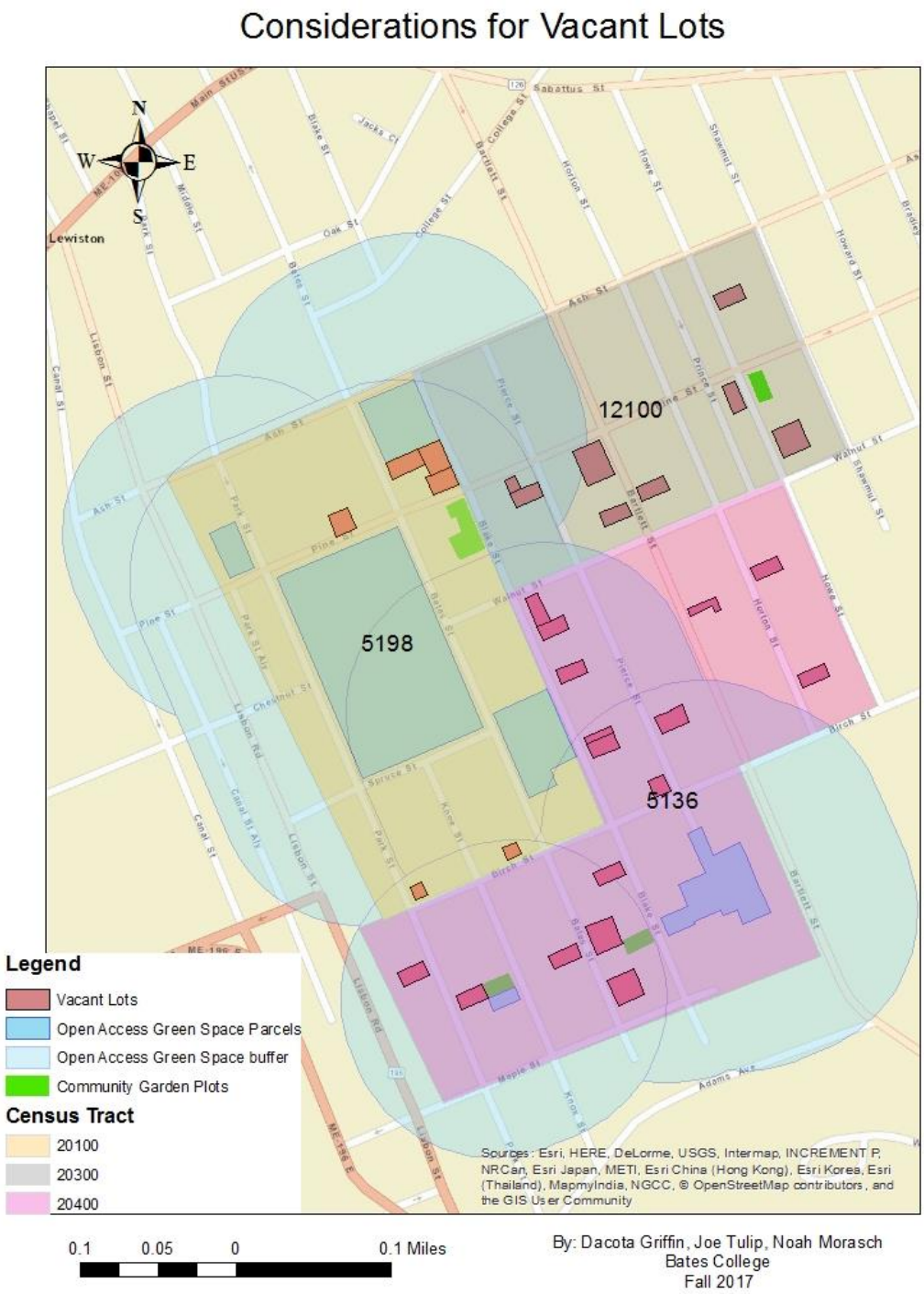

Figure 13. Map that shows all the different parcel types. The census tract numbers, as stated by the U.S. Census, that lie within the Tree Street Neighborhood are outlined and their population density (people/square mile) are labeled as numbers in the middle of the tract. 500 foot buffers around open access green spaces (the blue polygons) were designed as a tool to referring which lots would make sense to be another open access green space.

B. Flyer

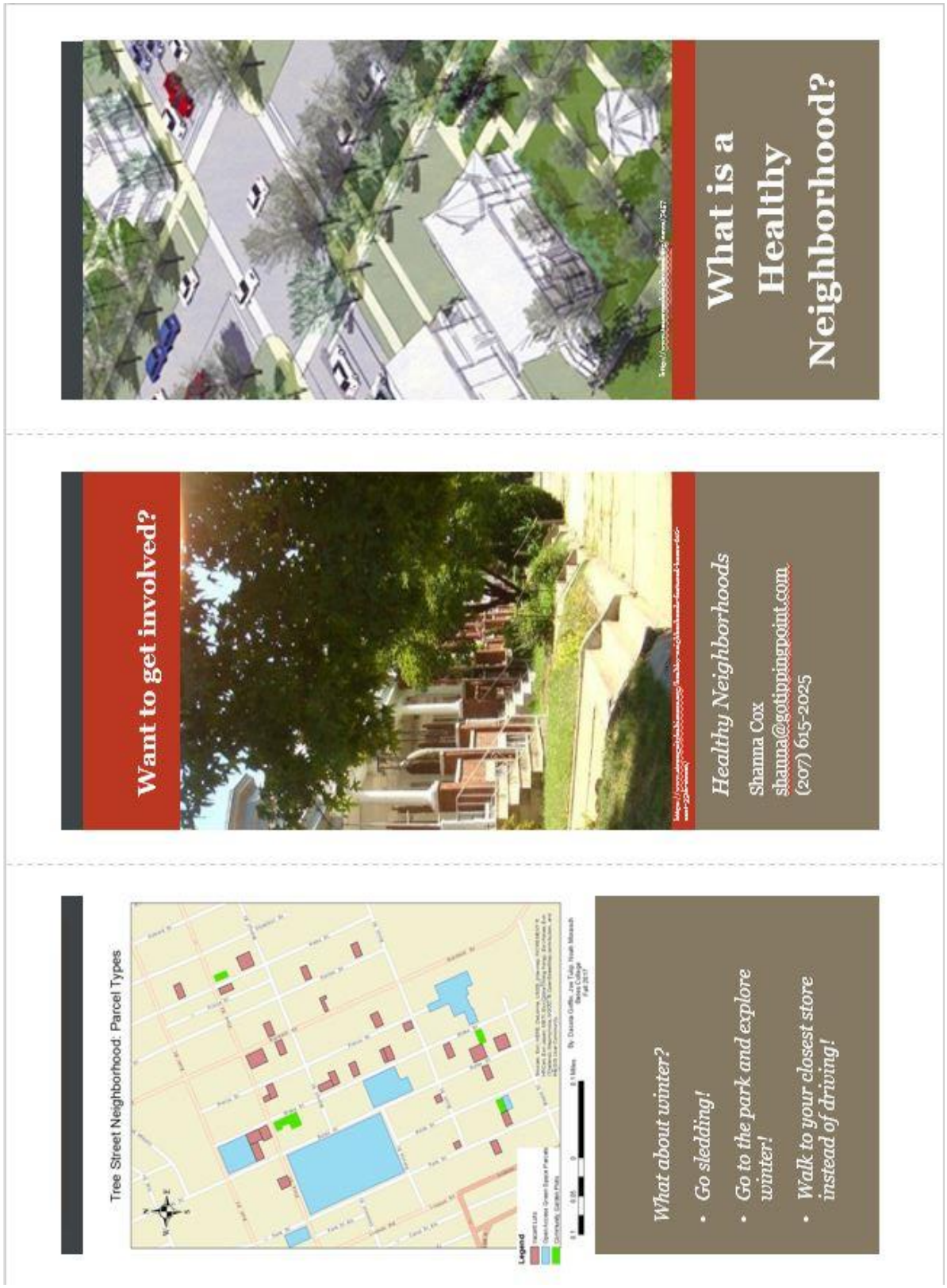
What is a Healthy Neighborhood?
Want to get involved?
Healthy Neighborhoods
Shanna Cox
shanna@gotippingpoint.com
(207) 615-2025
Tree Street Neighborhood: Parcel Types
What about winter?
Go sledding!
Go to the park and explore winter!
Walk to your closest store instead of driving!

Figure 14. Promotional brochure for Healthy Neighborhoods to use to foster community engagement in Lewiston. Developed with stock photos or cited photos and maps that were created from this project.

C. Annotated bibliography of useful sources

a. **Project Canopy**[10]

Project Canopy is a joint program from the Maine Forest Service and the USDA that is tasked to strengthen the canopies of towns and cities within Maine by offering grants. They offer a $8,000 grant for the planting and maintenance of trees to "increase the health and livability of communities through sound tree planting and maintenance" and a $10,000 grant that adds an educational component to increase community awareness concerning the benefits of trees. This might be a useful funding source to get some trees planted; however it seems like they have not yet renewed the program for 2018.

b. **Complete Streets Policy of Lewiston, Maine**[11]

Lewiston has a complete streets policy, which creates a framework to encourage design for multimodal transit and place pedestrians, bicyclists, wheelchair users at the same level as those who use motorized vehicles to get around. There are, however, exceptions to the policy that hinder its universal implementation. These include not taking advantage of "ordinary maintenance paving projects" to create improvements, widening pavement where costs are drastically increased, and areas where the development of sidewalks is not deemed as appropriate for development. It was enacted in July of 2017, and has yet to be demonstrated in public works projects within Lewiston.

c. Lewiston Treebate program[12]

This is a program that Lewiston has started recently (and even advertises on the front door of city hall during the 2017 election season) to credit the property owner for 50% (to a $100 maximum) of the cost of planting a new tree towards their stormwater fee. Trees they suggest planting are maples, yellowwoods, ginkgo, oaks, elms, and zone 4 or better rated fruit trees. Other specifications include that it must be deciduous, non-invasive, and have at least 1.5" in caliper circumference (which is measured 6" above the soil surface). Residents must be approved before planting the trees.

d. **Neighborhood Effects on Health**[3]

This is a review article that focuses on the empirical approaches to addressing neighborhood health issues. Diez Roux notes that an approach that considers all of the necessary contexts and has a multilevel analysis of socioeconomic status, race and gender is more indicative of the neighborhood and can direct more effective neighborhood-based interventions. There is also variance in how to draw the line between the neighborhood and the individual and how neighborhood based studies can often lead to individual based solutions due to this lack of clarity. This is important to note in this work - as people tend to think of a model

corridor as something that the city and Healthy Neighborhoods will work on, but includes significant engagement from residents.

e. **How Neighborhoods Affect Health, Well-being, and Young People's Futures**[4]
This is a very comprehensive review of the effects of a neighborhood on social cohesion and environmental hazards and their effects on the health of residents, especially concerning behavioral health issues and crime (which are issues that Lewiston and communities like it face). It does note a lack of data on the effect of stronger social networks as there has not yet been a quintessential form of socialization across socioeconomic barriers. This will be an essential for Lewiston, as there are many barriers that affect social cohesion among the neighborhood and Healthy Neighborhoods will need to consider as they manipulate the built environment to create more chance interactions among neighbors.

f. **Ecosystem Services of Urban Amenities**[13]
In addition to providing social support and improving health outcomes of residents, adding green spaces and amenities like street trees contribute to ecological benefits for both the environment and residents. These benefits are air filtering, micro-climatic regulation, noise reduction, rainwater drainage, and sewer treatment. Street trees and open access green spaces are able to provide all of these services except for sewer treatment, which only wetlands have the limited capacity to do. Issues like air pollution, climate change, and increased population growth are probable in Lewiston's future, and Healthy Neighborhoods has the opportunity to take a preventative approach to future environmental issues that will have impacts across the world.

g. **Urban Amenities and Sense of Place**[14]
This dissertation is a study that integrates placed based representations to draft a survey for residents of Knoxville, Tennessee and created conceptualizations of how the natural elements (such as street trees and open access green spaces) contribute to symbolic representations of "nature" and "forests"; they are positively correlated with place attachment and satisfaction. The author focused most on trees, and received responses that trees contribute to the spirituality of a place, create a source of pride for residents, have a calming effect, and create a healthier (and wealthier) place. The methods that this dissertation used may be helpful in asking residents about their perceived benefits (or disadvantages) of adding street amenities like trees.

D. Detailed Methods

Phase I: Collecting Data with a GPS and Descriptive Details of Street Amenities

To create an inventory of natural amenities throughout the survey area, an exhaustive survey of the area was creating using GPS systems to generate waypoints for each amenity. Site descriptions were created based on the guidelines set up below for each amenity to construct a map assessing the quality of each amenity and its location.

Part I: Trees and other Vegetation

GPS waypoints were collected from every tree planted alongside the sidewalks, as well as the trees that extend onto public areas. Trees away from the sidewalk were also recorded if shade from their canopies extended over the sidewalk. In addition to GPS data about the location of the trees, additional data was collected on species, as well as if it was a tree located along the esplanade or if it was protected by a grating.

Part II: Vacant Lots

Vacant lots were marked with a GPS waypoint to note their location. The area of the lot, its proximity to other green spaces, its assessed value, and the population density around the lot were evaluated to determine their potential for development.

Part III: Sidewalks:

Streets were noted if they had sidewalks and if sidewalks exist on both sides of the street. Emphasis was placed on the accessibility of the sidewalks for handicapped people. A sidewalk can be considered handicapped accessible if it has an on ramp to it from the street and if a wheelchair is able to move around freely on it. Obstructions in the sidewalk, such as telephone poles or other unmovable objects, were also noted. Also inventoried were esplanades, a strip of green (grass and trees usually) that exists between the curb and the sidewalk, and intersection bumpouts, a traffic calming measure that gives pedestrians a better viewing angle while crossing the street and encourages vehicles to drive more slowly.

Rankings for Sidewalks Smoothness: Sidewalk Smoothness was evaluated using the following 1-5 scale, with 1 being the best quality and 5 being the worst:

- 1= No flaws or very few
- 2= A few cracks here and there with maybe one or two bumps
- 3= Numerous cracks and/or bumps.
- 4= Lots of bumps and/or pavement is cracking/missing in spots. Minor holes may be apparent.
- 5= Tons of bumps and/or pavement is missing in numerous areas. Holes are visible.

Part IV: Benches

GPS coordinates were taken of publicly accessible benches. Descriptions considering the placement (facing into the green space or towards the street) and quality of the bench were recorded. Quality of the bench was assessed using the following 1-3 scale, with 1 being the best and 3 being the worst:

- 1= Perfect; a few imperfections or minor flaws, but fully functional.
- 2= Some functionality of the bench may be gone. Still could be used but not to the level it once had.
- 3= Bench is unusable. May be falling apart or rotting

Part V: Open Access Green Space

Open access green spaces were inventoried somewhat differently than the rest of the amenities, since an open access green space includes various amenities within it. The type of amenity, such as benches, and the number were recorded in addition to taking the waypoints. The handicapped accessibility of the open access green space was noted in addition to the presence of other features (bike racks, fences, etc.).

Part VI: Community Gardens

Locations of community gardens were inventoried using GPS units and later adapted to be the entire parcel using the City of Lewiston GIS parcel layer. The owner of the garden was also noted.

Part VII: Bike Lanes:

Location and length of bike lanes (in blocks) were recorded.

Phase II: Creating comprehensive maps and a scoring system for amenities and vacant lots

Components of the amenity score index

1. Intersections:
   $I=2(\#\,crosswalks)+(\#\,bumpouts)+((\#\,visual\ crossing\ sig-\#\,audible\ crossing\ sig)-priority)$
   a. Maximum # of crosswalks is 8
   b. Maximum # of bumpouts is 8
   c. Maximum # of crossing signals (both) is 2
   d. Priority is determined by snow plow routes; and is 1 for if a priority street is involved and 0 if not
   e. Range of I is 0-10
2. Pedestrian mobility:
   $P=(6-mean\ sidewalk\ smoothness)(\#\,ramps\ -2(\#obstructions))+2(bike\ lane)$
   a. Mean sidewalk smoothness is on a scale of 1-5
   b. Max # of ramps is 8
   c. # of obstructions is unlimited
   d. If bike lane (at least 1) is present, then value is 1. 0 if not present.
3. Recreation and Social Cohesion:
   $R=(\#community\ garden+\#open\ access\ green\ space+\#benches)$
   a. No maximum for any value
4. Trees: $T=\frac{1}{2}(\#\,trees)$

5. Composite equation: $A_i=\frac{I_i}{\max(I)}+\frac{P_i}{\max(P)}+\frac{R_i}{\max(R)}+\frac{T_i}{\max(T)}$
    a. Normalizes all variables so the range of the composite score is 0-4.

Phase III: Creating Maps of Natural Amenities with GIS & Archiving the Files

GPS data was transferred from the GPS device to a computer and then stored on a shared network device. The ArcGIS program was used to construct the maps. Specifically, ArcMap 10.5 was used in the map process. The shared network folder where the GPS information was stored was connected via the "Connect to Folder" icon under the "Catalog" section. Once connected, the GPS points were added to the map using the "Add Data" icon and navigating to where the GPS points were stored on the computer. The "World Street Basemap" was also added using the "Add Data" icon and clicking on the arrow to the side to navigate to Basemap and then the map.

After the general map was created, a Microsoft Excel database sheet was created to enter each amenity into for the different GPS units that were used to collect the location of the amenities. In order to organize the data, column names were created. These categories were: GPS, Waypoint, ident, Species, Simp_Species, PG, Esplanade, Comm_Garden, Bench, Bench_Qual, Sidewalk_Obs, Vacant_Lot, Trash_Can, Bike_Rack, Bumpout and Park. The following is a list of what each category name stands and its definition for the Excel sheets. Additionally, the way in which each information was entered for each category is listed:

- GPS: which GPS the waypoints are being taken from.
- Waypoint: The geographic location of the amenity.
- ident: The same as "Waypoint" except it was created in order to join the Excel data to the waypoints, so the type of amenity could be differentiated.
- Species: The species of the tree that was found. Tree species were listed as whatever was found, such as Maple, Birch, Ash, etc.
- Simp_Species: A generalization of the tree type. For this category, either "Deciduous" or "Evergreen" was entered.
- PG: A note made if the tree had a protective grate around it to protect the base of the tree. If present, "PG" was labeled in the correct amenity cell.
- Esplanade: A note made if the tree existed on an esplanade or that area of ground that exists between the sidewalk and the roadway. If present, "E" was noted in the column to mark its presence.
- Comm_Garden: Represents if the amenity waypoint was community garden. If present, the owner of the community garden was noted (for this project, "Lots to Gardens" was noted).
- Bench: If a bench was presented for this waypoint, the label "Bench" was entered in the correct cell.
- Bench_Qual: If a bench was present, the quality of the bench was also noted on the 1-3 scale rating, with quality number of the bench being entered into the cell.

- Sidewalk_Obs: This category stands for sidewalk obstruction, which is a structure that impedes or hinders wheelchairs from continuing along a sidewalk. If found, the type of obstruction was noted such as “Pole,” “Hole,” etc.
- Vacant_Lot: If a vacant lot, a parcel that is not occupied, was found, then “VACANT LOT” was noted in the correct cell.
- Trash_Can: If a trash can was found, the word “Trash Can” was entered to the appropriate waypoint number.
- Bike_Rack: If a bike rack, the structure which bikes can reside on to stay upright and be locked to, was found, then the word “Bike Rack” was entered.
- Bumpout: If a bumpout, the portion of a sidewalk curb that extends out into the roadway in order to slow down traffic, was found, then the word “Bumpout” was entered.
- Park: This category is representative of an open access green space. If found, the word “Park” was entered for the waypoint associated with it.

The waypoint and ident categories mark the GPS number location of each amenity or disamenity with the number being the same for both for each amenity entered. The ident category was created in order to join the Excel table to the GPS waypoints on ArcGIS, so that each amenity or disamenity could be identified by what it actually is. This Excel data sheet was then saved as .csv (Comma delimited) so that it could be joined to the GPS waypoints. It was stored in the shared file.

After completion of the Excel data sheets, the sheets were then joined to the GPS device which they belong to. This was done by adding the data sheets to the ArcGIS map and then clicking on the “List by Source” icon, to make sure that the data sheets were visibly added to the map. From there, the GPS device which matched the data sheet was left-clicked on and then go to “Joins” and finally the “Join…” field was clicked on. To then match the data sheets to the GPS device in the box that appeared, the correct table was chosen for 2. and for 1. and 3. the “ident” field was chosen to integrate the data and the okay button was clicked on to finalize it. This step was done for as many GPS devices that were used.

The next step is to separate the different types of amenities. First, the GPS devices and their adjoined data sheets were merged together to form a single layer. This was done by going to “ArcToolbox” icon and then “Data Management Tools” then “General” then “Merge.” In “Merge,” click on “Inputs” and putting the GPS device layer there, then the “Outputs” field was matched to the correct shared folder where the geodatabase is located that the current GPS waypoints are stored.

From here, the symbology of the different waypoints can be chosen. By either double clicking on the new Merged data points layer or left clicking on it and then going to “Properties…” and then the “Symbology” tab. A symbol was chosen that matched the type of amenity or disamenity such as a bench for a bench. Each time the merged data needs to be added again as another data layer until all the amenities or disamenities were done and each layer

should be named its proper amenity; this can be done by going to "Properties…" then the General tab and renaming it.

The map for sidewalk smoothness was created by first adding the medotpub layer which shows the roads. From this, the "Editor Toolbar" icon was picked and then in the editor toolbar, the editor drop down menu was choose and then "Start Editing" and the medotpub layer was picked. Once chosen, the medotpub layer was selected again on the right side and then line was picked in the "Construction Tools" category. Lines were drawn next to each street so that each street block had two sidewalks, as the sidewalk smoothness was judged for both sides of the street. Using the Editor tool again, the attribute table was selected and the column called "Surface_Qual" was added. Each single block of a street was selected and the correct sidewalk smoothness rating was added to this street based on the 1-5 scale created. Once all of the sidewalk smoothness ratings had been added to the attribute table, the Properties section of the layer was selected and then Symbology. In Symbology, "Categories" then "Unique Values" was chosen. For the value field, Surface_Qual was selected and then all values were added. The color ramp selection was made that showed that 1 was the best and 5 the worst by picking a green to red scheme. Finally, all other values were given a pink color.

While waypoints were collected for vacant lots, community gardens, and open access green spaces, these do not display the spatial variability of these lots. Therefore, the PARCELS layer was added from the Lewiston database. Then the PARCELS layer was left-clicked on and under "Selection" was made the only selectable layer. The Editor tool was then turned on and the PARCELS layer selected for editing. The correct parcels were then chosen for either vacant lots, community gardens, or open access green spaces. Multiple parcels were picked by holding the control key on the keyboard and picking the parcels. The Lewiston parcel database was also consulted to make sure that all vacant lots had been identified in the Tree Street Neighborhood [8]. The vacant lots not originally listed in our findings were added to the vacant lot layer. These lot layers were finalized by left-clicking on PARCELS and then "Save as Layer File" into the correct shared folder.

From this, a map of amenity density by block was created. The measuring tool was first used to decide which amenities exist within the street side. It was decided on that an 18.5 m buffer on each side of the street would be appropriate. Using the "Buffer" tool, a flat buffer around each street with an 18.5 m buffer on both sides of the street was established. This buffer was named "Flat_Buffer_Zone_18_5m". A feature class was then created using the "Intersect" tool that included all of the merged amenities that fall within this buffer on the street and that eliminates all of those that don't exist within the buffer region, i.e. those in park interiors. This was named "intersect_merged_with_flat_buffer_dissolved_roads". Going to the attribute table of the new featured class, all the amenities for each street were added together using the "Summarize" function which creates a summary table. Finally, the summary table was joined to the feature class containing the buffer zone on each street. The feature class was then symbolized by the field showing the total number of amenities on each street by going to the "Symbology"

tab under the "Properties…" section and choosing "Quantities" then the "Graduated Symbols" option. Symbol sizes were made gradually bigger with increased amenity count. The number was also put into the symbol by going to the Labels tab in Properties and picking "Cnt_FID_fl" as the Label Field and checking off the box for labeling the features.

Another buffer was created to evaluate which vacant lots resided within 500 feet of an open access green space. This was done by once again using the "Buffer" tool. A 500 foot buffer was created around the whole entire outside of the open access green space. Vacant lots were then assessed as to whether or not they were within any of these open access green space buffers.

A map was then created to visually show the model corridor scores generated using the model corridor scoring formula. A separate Excel spreadsheet was created using the following column headings: Street, Block, OBJECTID, I_Score, P_Score, R_Score, T_Score, Comp_Score. The definition of these are as follows:

- Street: The name of the road.
- Block: The section of the street that exists from one street to another street. An example of this would be "Ash-Pine."
- OBJECTID: The number that corresponds with the OBJECTID from the attribute table of "sum_features_on_roads" layer with the street and block. This is used so that the two tables can be joined.
- I_Score: The intersection score from the model corridor score formula.
- P_Score: The pedestrian mobility score from the model corridor score formula.
- R_Score: Recreation and social cohesion score from the model corridor score formula.
- T_Score: The tree score from the model corridor score formula.
- Comp_Score: The total score that is assessed to a block based on the model corridor score formula.

This excel sheet was saved as a .csv (comma delimited) to the shared folder where it was then added to the ArcGIS map. The table was then joined to the "sum_features_on_roads" layer. Once joined, Properties were open then Symbology and under the "Quantities" section, "Graduated colors" was chosen and "Comp_Score" for the value field. This was then given a 50% transparency by going to the "Display" tab under Properties.

Census tract population densities were then collected from U.S. Census 2010 data for our neighborhood and they were then designed to correspond with the proper streets which are included in them [9]. To do this, a new feature class was created by right-clicking on the default database, then clicking "New," then "Feature Class." "Tract_Area" was written for the new layer, polygon was selected as the geometry type, GCS_North_American_1983 as the coordinates system and then the layer was allowed to run. Going to the edit tab in the "Features" group, create was chosen. The polygon feature template was selected in the Create Features pane in the construction tools section. The "dissolved_roads" layer was turned on. Polygons were created for each census tract area that covered the area surveyed by clicking on the map to design it and snapping the points to the roads. A total of three polygons were made to represent the three

different census tracts represented by the neighborhood. These features were saved. Two new columns were added to the attribute table and were titled “Census_Tract” where the census tract number was written in and “Pop_Density’ where the population density of the census tract was written in. In the Properties section under the Symbology tab, “Categories” was selected and then “Unique values,” where the “Census_Tract” was put into the value field and the different census tracts given different colors. Under the Labels tab, “Pop_Density” was chosen in the Label Field and then the box to turn the label on was checked off. The layer was given a 75% transparency under the Display tab in Properties.

Phase IV: Focus Groups with Healthy Neighborhoods’ Community Members

The authors met with 8 community members linked to the Root Cellar for a focus group about the importance of street amenities. The goals were to evaluate the author’s sidewalk assessment criteria, include a voice in the authors determination of what contributes to a safe, accessible residential block, and to gauge how the authors findings align with the interests and priorities of the community at large. The participants responses complemented our data as it gave a small-scale voice to our work in assessing the neighborhood by contributing their lived experience. They also evaluated a flyer the authors created exhibiting the benefits of a healthy neighborhood and gave suggestions to complete it.

Some sample questions from the focus group include:

1. What wheels do you find yourself using to get around Lewiston?
2. What is the impact of adding more trees along the sidewalk?
3. Where are some places within Lewiston where it is difficult to get around?
4. (Show a picture of intersection bumpouts) What impacts do you notice for both pedestrians and drivers in this picture? What’s the difference between that and what you’re used to?
5. (Show pictures of local vacant lots) What would you like to see done with these spaces?
6. (Show flyer) Are there portions of it that are unclear to you? What do you like about it? Is there anything that we should improve on?
7. (Show picture of local sidewalks) If you were to rate this sidewalk on a scale of 1-5 (1 being the best, 5 being the worst), how would you rate this sidewalk?