Navigating Urban Networks: A GIS Exploration of Walkability in Salem, Oregon

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SALEM

Niamh Houston
Report Author • GIScience, Geography

Nick Kohler, Ph.D.
Senior Instructor • GIScience, Geography

GEOG 482/582: GISCIENCE II | COLLEGE OF ARTS AND SCIENCES

UNIVERSITY OF OREGON
CITY OF Salem AT YOUR SERVICE
SCI Sustainable Cities Institute
SCYP Sustainable City Year Program

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Colin Mast, Department of Geography Graduate Employee

Courtney Knox Busch, Strategic Initiatives Manager

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Rochelle Regutti, GIS Analyst

Stephen Williams, Transportation Planner

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About SCI

The Sustainable Cities Institute (SCI) is an applied think tank focusing on sustainability and cities through applied research, teaching, and community partnerships. We work across disciplines that match the complexity of cities to address sustainability challenges, from regional planning to building design and from enhancing engagement of diverse communities to understanding the impacts on municipal budgets from disruptive technologies and many issues in between.

SCI focuses on sustainability-based research and teaching opportunities through two primary efforts:

1. Our Sustainable City Year Program (SCYP), a massively scaled university-community partnership program that matches the resources of the University with one Oregon community each year to help advance that community's sustainability goals; and

2. Our Urbanism Next Center, which focuses on how autonomous vehicles, e-commerce, and the sharing economy will impact the form and function of cities.

In all cases, we share our expertise and experiences with scholars, policymakers, community leaders, and project partners. We further extend our impact via an annual Expert-in-Residence Program, SCI China visiting scholars program, study abroad course on redesigning cities for people on bicycle, and through our co-leadership of the Educational Partnerships for Innovation in Communities Network (EPIC-N), which is transferring SCYP to universities and communities across the globe. Our work connects student passion, faculty experience, and community needs to produce innovative, tangible solutions for the creation of a sustainable society.

About SCYP

The Sustainable City Year Program (SCYP) is a yearlong partnership between SCI and a partner in Oregon, in which students and faculty in courses from across the university collaborate with a public entity on sustainability and livability projects. SCYP faculty and students work in collaboration with staff from the partner agency through a variety of studio projects and service- learning courses to provide students with real-world projects to investigate. Students bring energy, enthusiasm, and innovative approaches to difficult, persistent problems. SCYP's primary value derives from collaborations that result in on-the-ground impact and expanded conversations for a community ready to transition to a more sustainable and livable future.

About City of Salem

The City of Salem is Oregon's second largest city (179,605; 2022) and the State's capital. A diverse community, Salem has well-established neighborhoods, a family-friendly ambiance, and a small town feel, with easy access to the Willamette riverfront and nearby outdoor recreation, and a variety of cultural opportunities.

The City is known for having one of Oregon's healthiest historic downtowns, hosts an airport with passenger air service, and is centrally located in the heart of the Willamette Valley, 47 miles south of Portland and an hour from the Cascade Mountains to the east and the ocean beaches to the west.

State government is Salem's largest employer, followed by the Salem-Keizer School District and Salem Health. The City also serves as a hub for area farming communities and is a major agricultural food processing center. A plethora of higher education institutions are located in Salem, ranging from public Western Oregon University, private Willamette and Corban universities, and Chemeketa Community College.

Salem is in the midst of sustained, steady growth. As a "full-service" city, it provides residents with services such as police and fire protection, emergency services, sewage collection and treatment, and safe drinking water. Salem also provides planning and permitting to help manage

growth, as well as economic development to support job creation and downtown development. The City also provides 2,338 acres of parks, libraries and educational programs, housing and social services, public spaces, streetscaping, and public art.

Salem's vision is a safe, livable, and sustainable capital city, with a thriving economy and a vibrant community that is welcoming to all. The City's mission is to provide fiscally sustainable and quality services to enrich the lives of present and future residents, protect and enhance the quality of the environment and neighborhoods, and support the vitality of the economy. The City is in the midst of a variety of planning efforts that will shape its future, ranging from climate action planning and implementation, a transportation system plan update, as well as parks master planning.

This SCYP and City of Salem partnership is possible in part due to support from U.S. Senators Ron Wyden and Jeff Merkley, as well as former Congressman Peter DeFazio, who secured federal funding for SCYP through Congressionally Directed Spending. With additional funding from the city, the partnership will allow UO students and faculty to study and make recommendations on city-identified projects and issues.

Course Participants

Anneke Brouwer, Undergraduate
William Bucher, Undergraduate
Katherine DeHart,
Somersey Gammon, Undergraduate
Jacob Haffner, Undergraduate
Lyssa Hanson, Undergraduate
Payton Henry, Undergraduate
Alexa Hopper Barraza, Undergraduate
Niamh Houston, Undergraduate
Vivi Hurley, Undergraduate
Sylvie Johnson, Undergraduate
Julia Katahdin,
Julia Kotvis, Undergraduate
Libby Mackin,
Victoria Olajide, Graduate
Finn Olson, Undergraduate
Jay Port,
Juliette Setudeh Nejad, Undergraduate
Alaina Sharp,
Carmen Sharpe-Velazquez,
Nicolas Soundberg,
Josh Willson, Undergraduate

Course Description

GEOG 482/582: GISCIENCE II

This courses focused on spatial data collection, spatial data models, database design, data editing, geographic information system (GIS) project management, and advanced topics in geographic information science.

Executive Summary

The City of Salem, Oregon, has shown dedication to achieving sustainability goals and revitalizing its neighborhoods by conducting walkability and comprehensive corridors assessments. As part of the Sustainable City Year Program, students from the Geography Department at the University of Oregon participated in an Advanced Geographic Information Systems (GIS) class in collaboration with Salem to uncover and address the deficits in pedestrian pathways and to strategize enhancements to the city's walkable corridors.

By leveraging the city's geospatial data, the students crafted an array of network service area maps, density maps, and weighted overlay maps using ArcGIS technology. The analyses considered demographic distribution, the location of public amenities, urban zoning, and commuting behaviors to assess the feasibility of pedestrian navigation in Salem.

Students focused on three main variables: diversity, equity, and inclusion; pedestrian safety; and sidewalk accessibility. In examination of these focal points, the data not only captures the current state of Salem's pedestrian pathways but also aligns with broader community needs. The ensuing narrative will summarize our research into clear recommendations for improving walkability in Salem, providing an overview suitable for readers interested in actionable strategies.

Enacting these recommendations could substantially elevate Salem's walkability score, thereby fostering a more sustainable, community-focused urban environment that encourages walking and cycling, reduces carbon emissions, and eases roadway congestion. The essence of this report is not just to propose, but to ignite a shift towards a greener, pedestrian-first Salem.

Introduction

In the pursuit of urban sustainability, cities around the world have recognized the pivotal role that walkability can play in shaping resilient and environmentally conscious communities. Salem, Oregon, stands at the crossroads of this transformative journey, envisioning a future where the simple act of walking becomes a catalyst for positive change.

Walkability emerges as a cornerstone for achieving sustainability objectives, fostering a sense of community, improving public health, and minimizing environmental impact. This report explores the multifaceted benefits of enhanced walkability in Salem, highlighting how urban design strategy can align with the city's broader sustainability goals, preparing it for a more resilient future.

City officials in Salem have engaged students from the Advanced GIS class to scrutinize aspects of the city's infrastructure, focusing on identifying areas with existing deficiencies. These infrastructure gaps manifest as a lack of sidewalks and crosswalks, discontinuities between sidewalks, or sidewalks situated in areas unsuitable for pedestrian activity. The objective is to pinpoint gaps in the walking network. Students were tasked with identifying these areas and proposing recommendations that would enable Salem to develop more walkable neighborhoods through the lenses of pedestrian safety, diversity equity and inclusion and sidewalk accessibility.

In collaboration with Salem, the GIS class spatially analyzed the current network of sidewalks, streets, population hotspots, and points of interest to assess the overall walkability of the community. Leveraging GIS data provided by the City of Salem, students identified spatial correlations of poor walkability to highlight specific areas, neighborhoods, and points of interest where walking could serve as a viable and convenient mode of transportation.

This report details the findings from select individuals from the class, providing spatial recommendations for enhancing walkability in Salem and aligning with the city's commitment to creating sustainable and accessible urban spaces.

Background

Amidst its charming landscape, Salem confronts the challenge of evolving its urban infrastructure to meet the needs of a growing population while adhering to sustainability principles. Central to this transformation is the concept of walkability - a measure of how friendly an area is to walking.

In Salem, the importance of walkability extends beyond the presence of sidewalks and pedestrian paths; it encompasses the integration of these elements into a cohesive network that connects neighborhoods, facilitates safe and enjoyable walking experiences, and supports the city's environmental goals.

Historically, Salem's development mirrored many American cities, where urban planning heavily favored automobiles. This legacy is evident in the city's wide roads, sprawling suburbs, and areas with limited pedestrian infrastructure. However, there's a growing recognition that enhancing walkability can significantly impact residents' health, the environment, and the city's cultural vibrancy.

The city's commitment to walkability is a proactive step towards reshaping Salem's identity as a modern, inclusive, and environmentally conscious city. This report aims to illuminate the current state of walkability in Salem and chart a course for its enhancement.

Methods

The methodological framework required for this walkability assessment entailed a sequential process, designed to ensure the accuracy and relevance of findings in relation to Salem's pedestrian infrastructure. Here is the step-by-step breakdown of our GIS analytical approach used by all students to achieve different analyses:

1. DATA COLLECTION AND INTEGRATION

Geodatabase Compilation
Vector datasets (point line and polygon data) were extracted from Salem's geodatabase under variables including public facilities, amenities, infrastructure hazard reports, and topographical data alongside demographic and zoning patterns.

Enhancement of Data
Additional points of interest (POIs) such as educational institutions, parks, childcare centers, senior care facilities, grocery stores, and eateries were identified through targeted data queries and integrated into our analysis to capture a comprehensive urban fabric.

Ground Truth Verification
To validate our GIS predictions, we utilized Google Earth Pro and Google Maps, enabling a remote yet accurate cross-reference of on-the-ground conditions.

2. OVERLAY ANALYSIS USING ARCGIS PRO

Raster Data Layering
Through ArcGIS Pro's raster functions, we layered multiple data sets, each weighted according to its influence on walkability, to produce a unified surface that represents the walkability score across Salem.

Standardization and Comparison
This analysis allowed for the standardized assessment of diverse factors using reclassification, making it possible to draw comparisons and pinpoint areas in need of improvement.

3. CARTOGRAPHIC VISUALIZATION

Density Mapping
Kernel density tools were employed to create smoothed density maps that visually communicate the distribution and concentration of data, highlighting regions with potentially higher walkability, particularly in downtown Salem.

Interpolation for Population Analysis
The Inverse Distance Weighted (IDW) interpolation method was utilized to estimate population densities, focusing on residential hotspots and student housing areas, crucial for understanding pedestrian footfall.

4. SPATIAL ANALYSIS AND INTERPRETATION

Overlay Map Production
By assessing a variety of data variables, we generated overlay maps that offer visual insights into Salem's walkability, serving as a foundation for formulating specific recommendations for infrastructural enhancements.

Through this structured approach, we have produced a series of maps that not only depict current walkability levels but also expose the spatial relationships between urban features and pedestrian dynamics. This process provides a solid base for proposing targeted interventions to improve Salem's walkability.

Results

In this section, we delve into the findings of individual projects, categorized under three central themes: Diversity, Equity, and Inclusion, Sidewalk Accessibility, and Pedestrian Safety. Each project offers a unique lens through which we examine the multifaceted aspects of Salem's walkability. These analyses not only highlight the current state of pedestrian infrastructure in the city but also shed light on areas where targeted improvements can enhance the overall walking experience.

DIVERSITY EQUITY AND INCLUSION

Figure 1. shows a walkability analysis that visualizes a 15-minute walking service area from grocery stores. The orange surface areas depict neighborhoods where amenities are readily reachable on foot. The green layer beneath represents the top two levels of suitability as determined through proximity to parks, bus stops, and poor sidewalk density. Areas outside of either layer would be most suitable for future walkability infrastructure because these areas have less access to existing infrastructure. Areas of interest are the data gaps in South Salem, including the Southwest Neighborhood. By investing in these areas, Salem can ensure that more residents have safe and convenient access to essential services like grocery shopping, thereby improving the city's overall walkability and reducing the reliance on vehicular transport for such everyday needs.

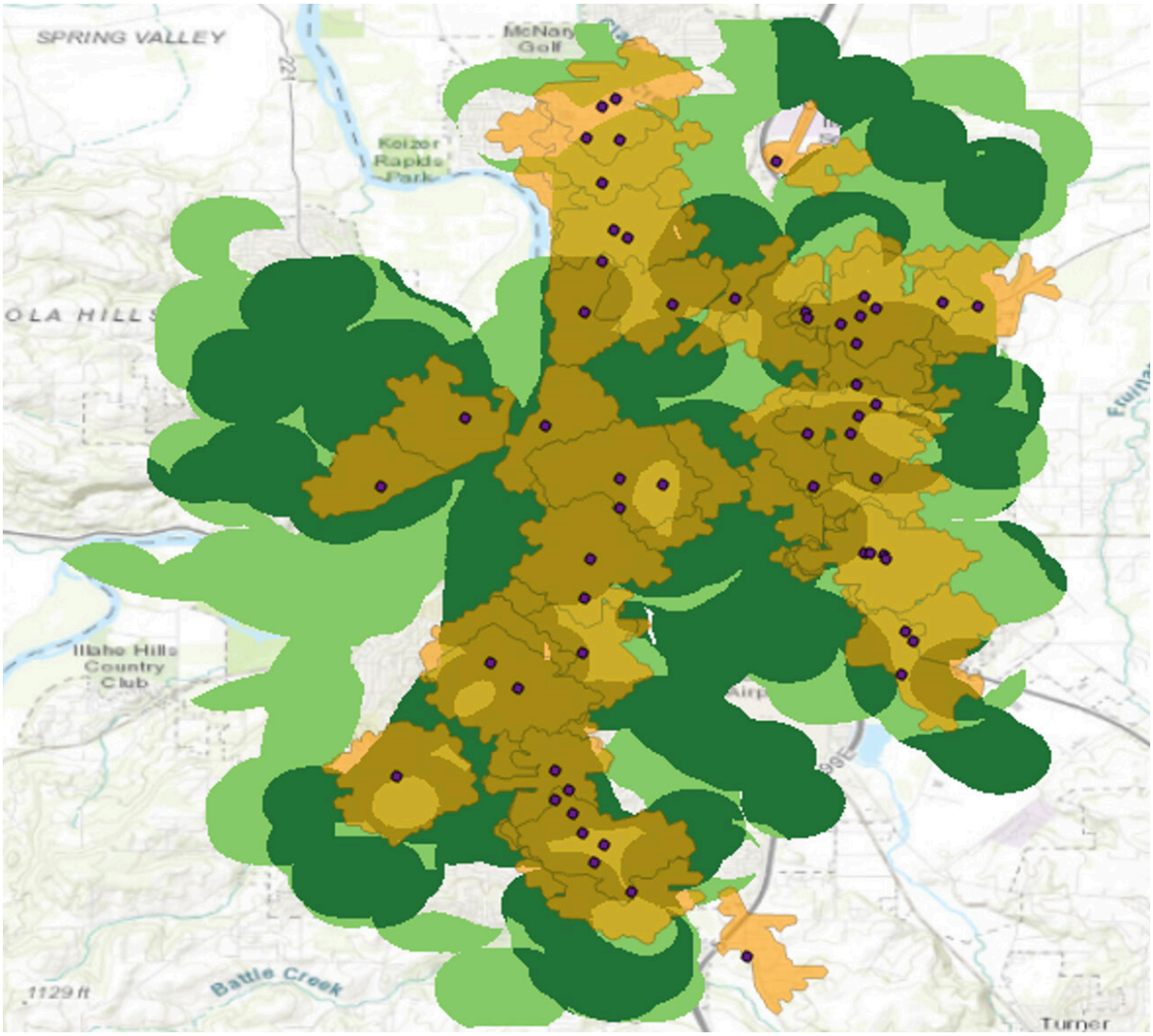

FIG. 1

Map analysis showing access to infrastructure

Source: Julia Kotvis

SIDEWALK ACCESSIBILITY

In the next map focusing on Salem's current infrastructure (figure 2.), the student has identified several areas that are suitable for walkability enhancements. Not previously highlighted by the author, the southwest region near the park and the southeast area leading towards the airport emerge as prime candidates for development. These areas as well as West Salem have a low density of crosswalks, as represented by the points. These regions, while currently underutilized in terms of pedestrian pathways, present valuable opportunities to expand Salem's walkable landscape.

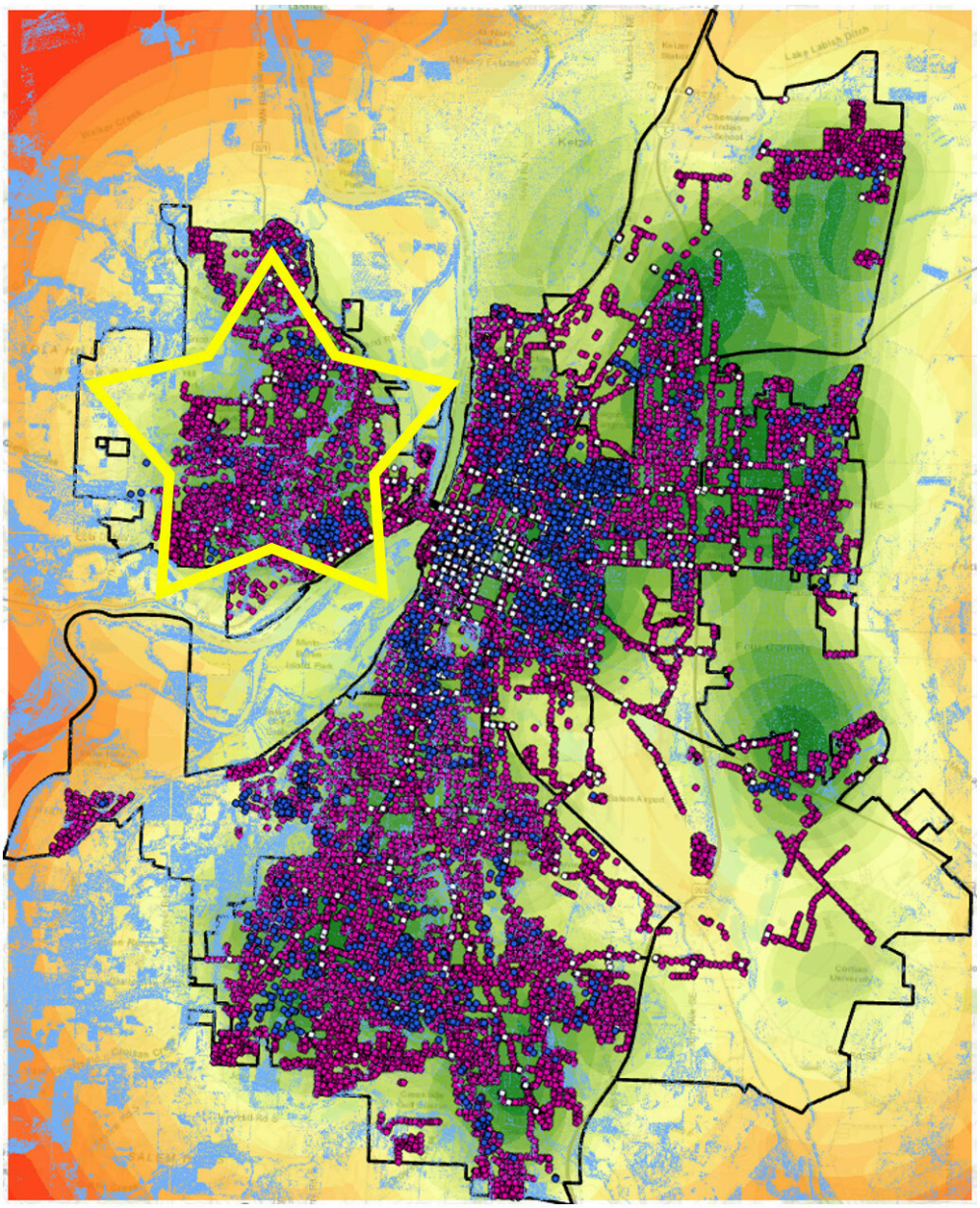

FIG. 2

Map showing density of walkable infrastructure

Source: Vivi Hurley

The maps below (Figure 3 and 4) provide a visual comparison of current versus potential walkability in Salem, employing change detection techniques to highlight areas most conducive to pedestrian infrastructure improvements. This analysis underscores regions within Salem where modifications could significantly enhance the city's walkability. By contrasting the existing state with an envisioned scenario where pedestrian pathways are optimized, the map delineates specific zones where interventions such as new sidewalks, safer crosswalks, and traffic-calming measures could transform the pedestrian experience.

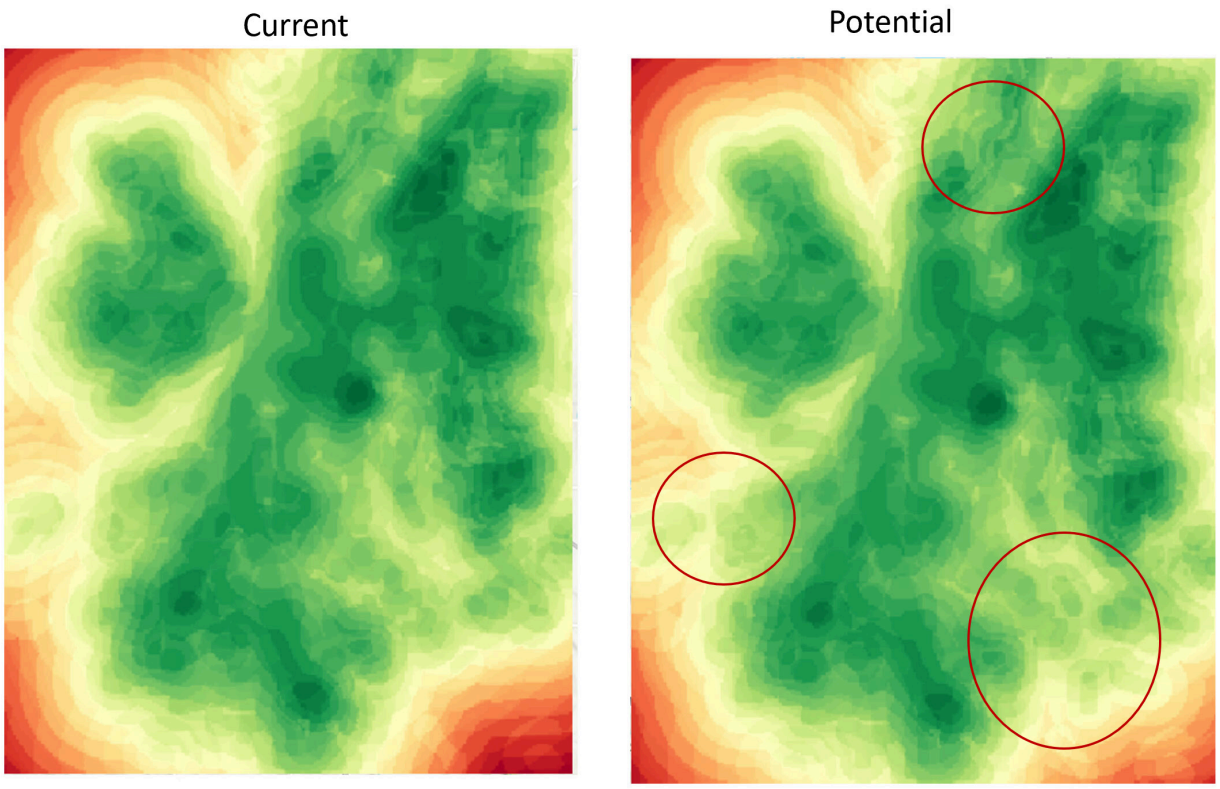

FIG. 3

Current and potential walkability in Salem

Source: Libby Mackin

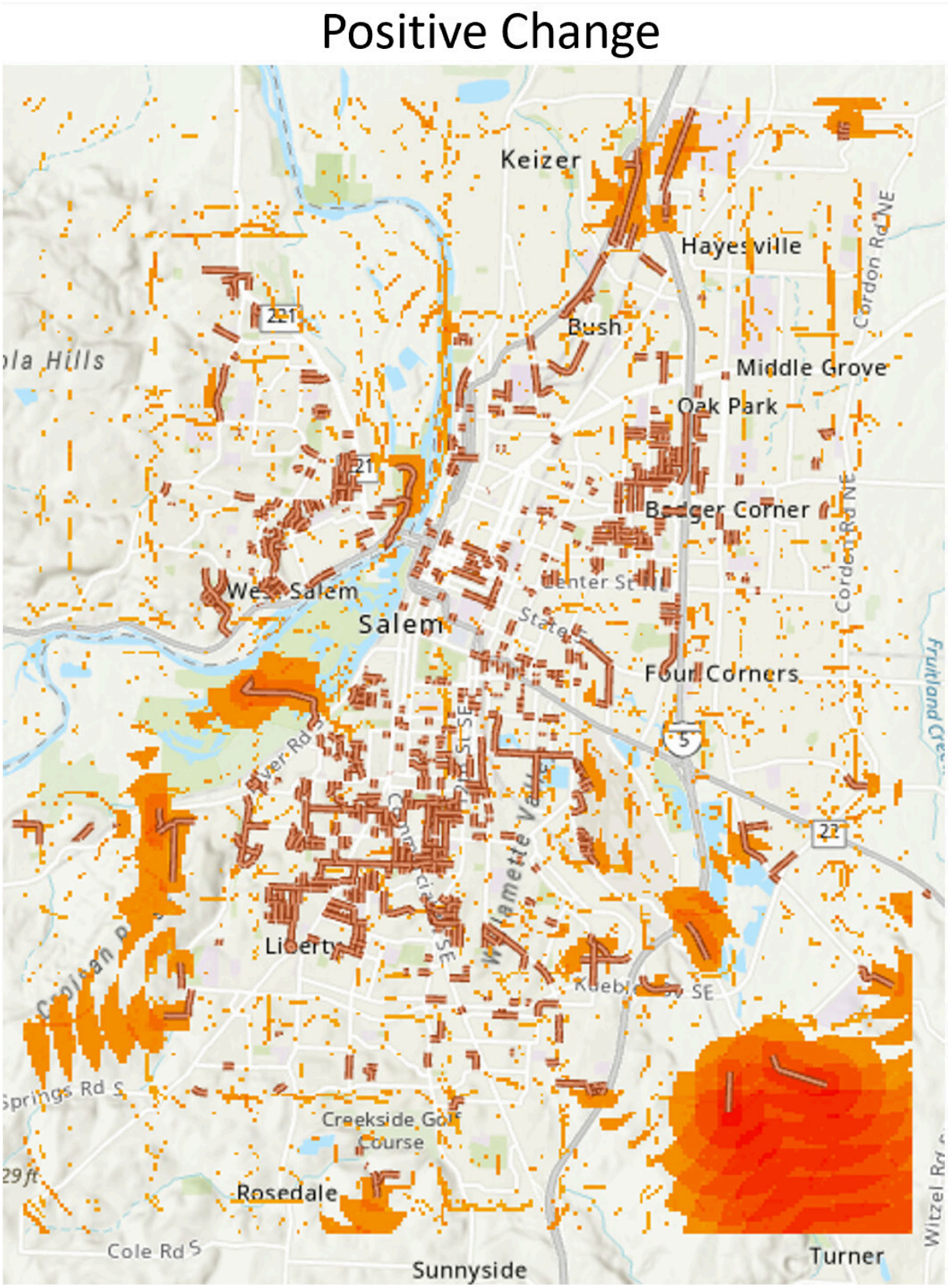

FIG. 4

Areas and road sections that would benefit most from walking infrastructure

Source: Libby Mackin

PEDESTRIAN SAFETY

As can be seen in the next graphic (figure 5), the safest, most walkable area of Salem is the downtown region. This area has slow speed limits, lots of crosswalks, and a high density of sidewalks, bike paths, and walking paths. The lowest values for walkability and pedestrian safety centralize around the major highways in Salem, like I5.

The following map (figure 6), is an inverse distance weighted interpolation of the population in Salem. It creates data values where there are none from sampled centroid census data polygons. As can be seen, there are four triangular population hubs: north Salem, west Salem, east Salem, and south Salem. As can be seen in the cross-validation point distribution, this model is the best-fit model for the data, containing relatively minimal predicted error.

Within Salem, the area identified with the most need for improving walkability is the west Salem neighborhood. This area has a relatively low walkability score contrasted with a high population.

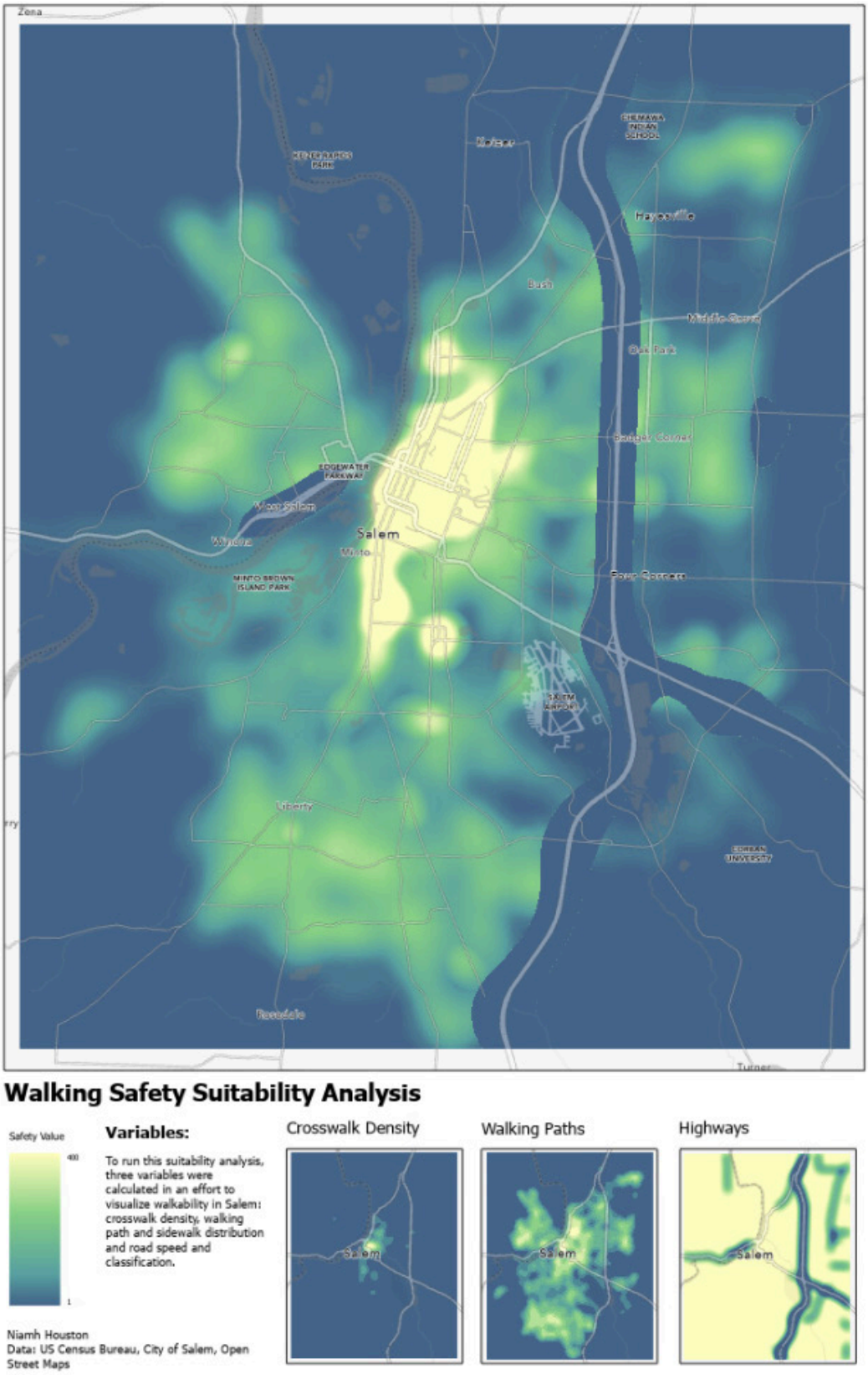

FIG. 5

Walking safety in Salem

Source: Niamh Houston

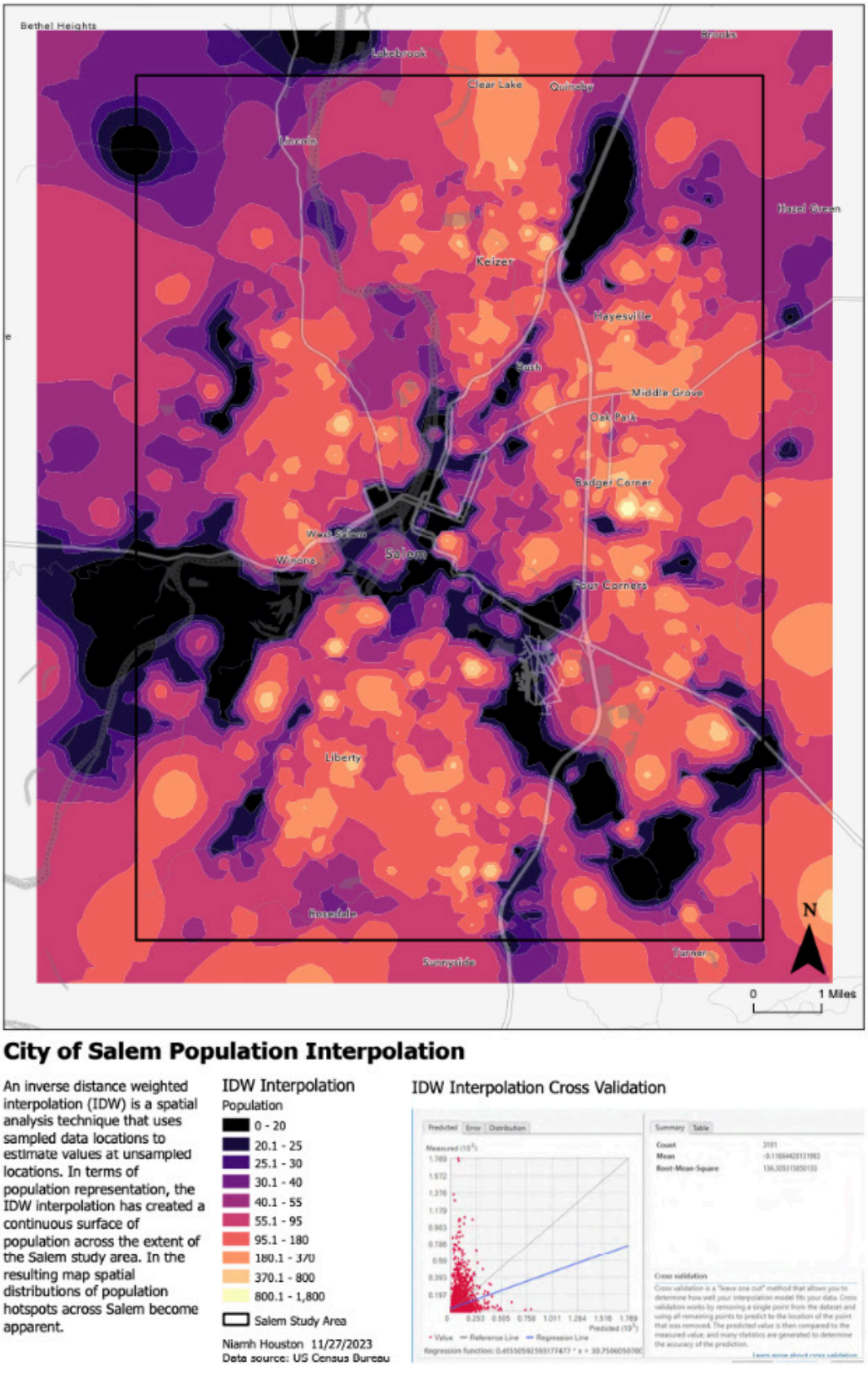

FIG. 6

Population density in Salem

Source: Niamh Houston

Discussion

Our GIS analysis, corroborated by a walk score of 42 from walkscore.com, suggests that Salem's car dependency stems from infrastructural deficiencies rather than preference. The downtown area, with its extensive network of sidewalks and crosswalks, stands as a beacon of walkability. Conversely, outlying districts exhibit disconnected pedestrian paths and streets that prioritize speed over safety.

To pivot Salem towards a future of foot-friendly travel, we propose a series of targeted interventions. The northeast corridor, particularly along Silverton Road NE, requires the addition of continuous sidewalks and secure pedestrian crossings to bridge the substantial gaps in the existing network. This will not only serve the daily foot traffic of residents but also enhance the safety of children commuting to nearby schools.

In West Salem, the Wallace Road NW stands out as a priority for pedestrian improvements. Here, the introduction of raised crosswalks and traffic calming measures such as road diets and median islands would significantly slow traffic, creating a safer environment conducive to walking. The Peter Courtney Minto Island Bridge connects the pathways between Minto-Brown Island Park and the bustling downtown core as an attractive route for both recreation and commuting, encouraging more residents to opt for walking over driving. Boosted infrastructure in this area, like a raised park pathway to ensure access during periods of park flooding, would also strengthen connectivity between the park and downtown, facilitating access to these vibrant community hubs and encouraging their use as social and recreational spaces.

Our findings call for a reimagination of land use, where mixed-use developments are championed to bring amenities and services within walking distance. Echoing the research of Leslie et al., Salem's path to increased walkability lies in diversifying land use to reduce vehicular reliance. This strategy should be complemented by a comprehensive review of traffic regulations, particularly in residential areas, to foster an environment where pedestrians are given priority.

Conclusion

The City of Salem is committed to revitalizing its community by fostering more pedestrian-friendly environments. To achieve this vision, the city has joined forces with the Sustainable City Year Program at the University of Oregon, enlisting the expertise of students enrolled in a Geographic Information Systems course. These students were tasked with conducting a comprehensive assessment of Salem's walkability and proposing enhancements to create a safe and convenient environment for pedestrians.

Specific areas poised for development have been identified, targeting not only the heart of Salem but also its extending limbs. For instance, the northeast corridor requires continuous sidewalks, and residential zones in the southwest neighborhood would benefit from traffic calming measures and secure pedestrian crossings. The aim is to create a seamless network that not only links Minto-Brown Island Park regardless of park flooding with the downtown area but also weaves together schools, parks, and residential areas with safe and accessible routes.

This report envisions a Salem where walking is a favorable option. By embracing the proposed transitions, Salem can redefine itself as a leader in sustainable urban development, setting a benchmark for cities nationwide to emulate.

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SCI Directors and Staff

Marc Schlossberg	SCI Co-Director, and Professor of Planning, Public Policy and Management, University of Oregon
Nico Larco	SCI Co-Director, and Professor of Architecture, University of Oregon
Megan Banks	SCYP Director, University of Oregon
Lindsey Hayward	SCYP Assistant Program Manager, University of Oregon
Zoe Taylor	Report Coordinator
Ian Dahl	Graphic Designers
Danielle Lewis	