# CITY OF POULSBO
# URBAN TREE CANOPY ASSESSMENT
# SUMMARY OF FINDINGS

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# TABLE OF CONTENTS

# Project Goals

- Enhance urban forest management, mitigate extreme heat effects, and support equitable decision-making while fostering professional growth for participating interns.

- Perform an Urban Tree Canopy Assessment to map and inventory vegetation.

- Enhance workforce development by engaging interns to complete project deliverables

- Use digitized dataset to analyze and develop a change analysis from 1994-2024

- Perform GIS data analysis on percentage of tree canopy by census track

# Overview

Western Washington University in collaboration with the City of Poulsbo has conducted an Urban Tree Canopy Assessment. This will provide valuable insight into the extent of tree canopy, identify areas with low or high tree coverage, and assess the overall health of the urban forest. The Urban Tree Canopy Assessment is designed to support the City of Poulsbo in understanding, maintaining, and expanding its urban forestry.

This assessment aims to empower the City of Poulsbo with data-driven insights to improve urban forestry, enhance resilience to climate change, and promote equitable green spaces for all residents. The project's multifaceted approach combines cutting-edge technology, collaborative teamwork, and actionable recommendations, ensuring a robust pathway toward a sustainable and healthy urban forest.

## Methods

Poulsbo City limits were mapped on a 10m x10m grid to allow for 100 randomized locations were then selected. Data loggers were tagged with a corresponding number in order to track location by GPS. Subsequently, temperature data loggers (iButtons) were placed at each of the 100 sites. The data loggers were set to record once every hour and placed on wooden stakes or nearby poles (if there was no ground that could be stacked). A brief description of the project was also attached to each stake. Each sensor location was assessed for canopy characterization via ground-truthing the sub-sampled plots for percent canopy cover, species composition, characterization of urban health through a vegetation inventory, (presence of buildings, ground cover including bare ground and asphalt, hazard trees, and the presence of at-risk forests under threat of invasive species). After the data loggers completed their cycle, the canopy cover was then compared to average daily temperatures and average afternoon temperatures. For the sake of this assessment, average afternoon temperatures were defined as 12:00pm-6:00pm. Temperature data was collected from August 2024 to December 2024. However, the data used for this study was from September 2024 to November 2024 as that is when all of the data loggers had continuous data.

Historical and current imagery of Poulsbo was georeferenced and digitized to analyze and develop a change analysis of canopy cover from 1994-2024. LiDAR was used to visualize variable structured forests and understand canopy height. Data visualizations were created using GIS for urban tree canopy, impervious surfaces, major roadways, heat zones, walking zones, and critical areas such as wetlands, riparian zones, estuaries, wetlands, and current census tract data.

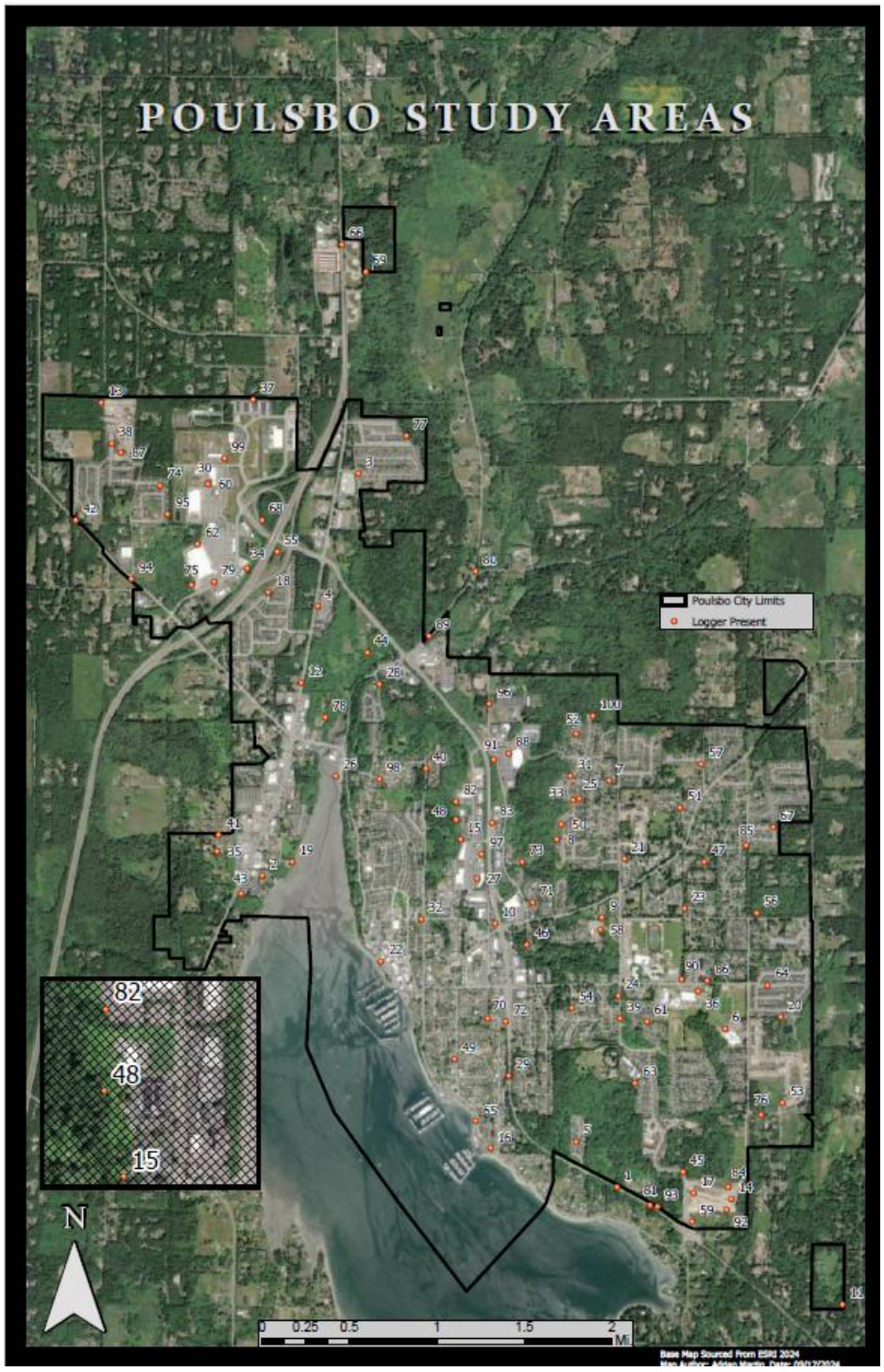


Figure 1: The above maps depict Poulsbo City limits and the location of all data loggers among their perspective study sites. The inset shows the 10mX10m grid that the Poulsbo City limits were mapped on.

# Observations

- Canopy cover has decreased over the last 30 years by roughly 30%.

- There is a correlation between canopy cover and temperature. As canopy cover increases temperature decreases.

- There is no significant temperature difference between census tracks.

- There is no significant difference between canopy cover by census tract.

- Census data indicates that all census tracts could benefit from heat mitigation efforts. However, tracts C, D, and E should take precedence.

# Results

## Temperature:

### Average Afternoon Temperature (12:00pm-6:00pm)

There was no significant difference between average afternoon temperatures by census tracts. All other temperature variables such as the presence of asphalt, percentage of grass, percentage of shrub layer, and percentage of bare ground showed no statistically significant difference as well. The slight variation in mean temperatures between the tracts (Tract A at 12.4°C, Tracts B and C at 12.2°C, Tract D at 13.0°C, and Tract E at 12.9°C) suggests a high degree of temperature uniformity during this period.

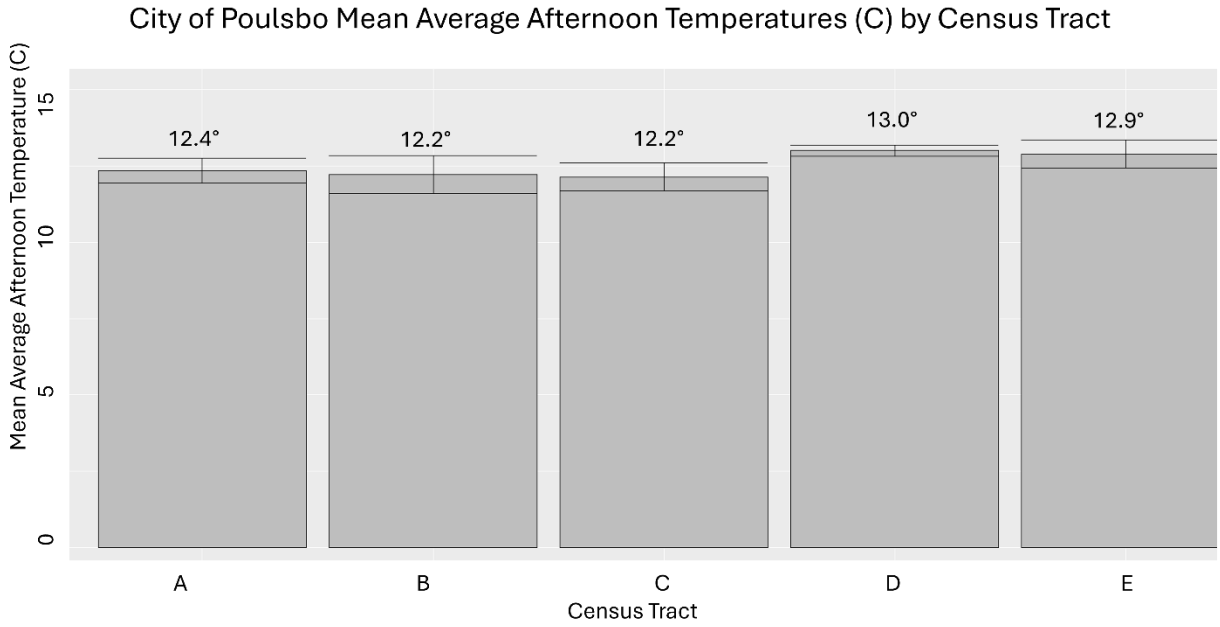


Figure 2: The above graph represents the mean average afternoon temperatures by census tract. Afternoon temperatures were relatively consistent ranging from 12.4(C)-13.0(C).

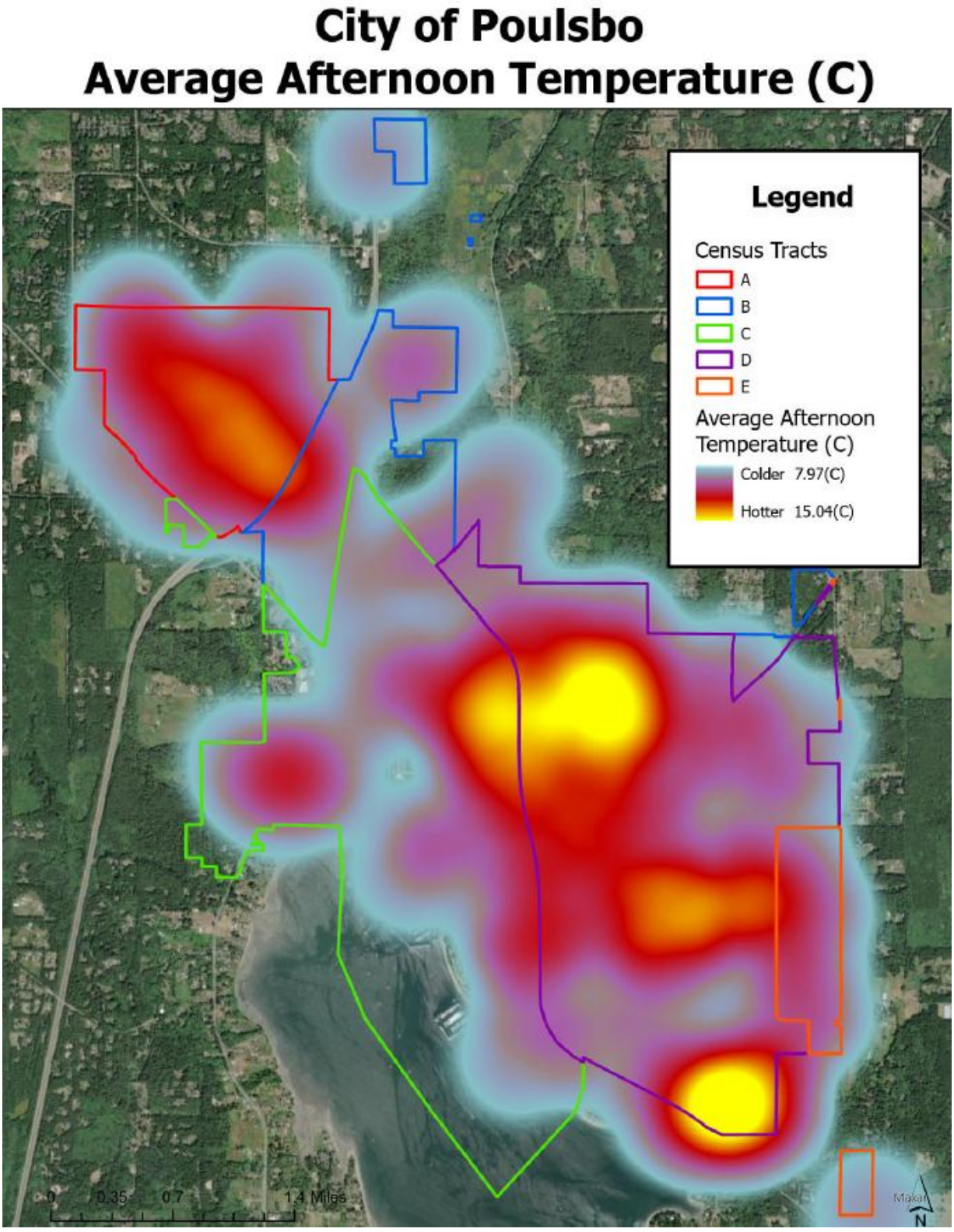


Figure 3: The above map illustrates the average afternoon temperatures (C) for this City of Poulsbo. Temperatures ranged from 7.97(C)-15.04(C) from September 2024 to November 2024.

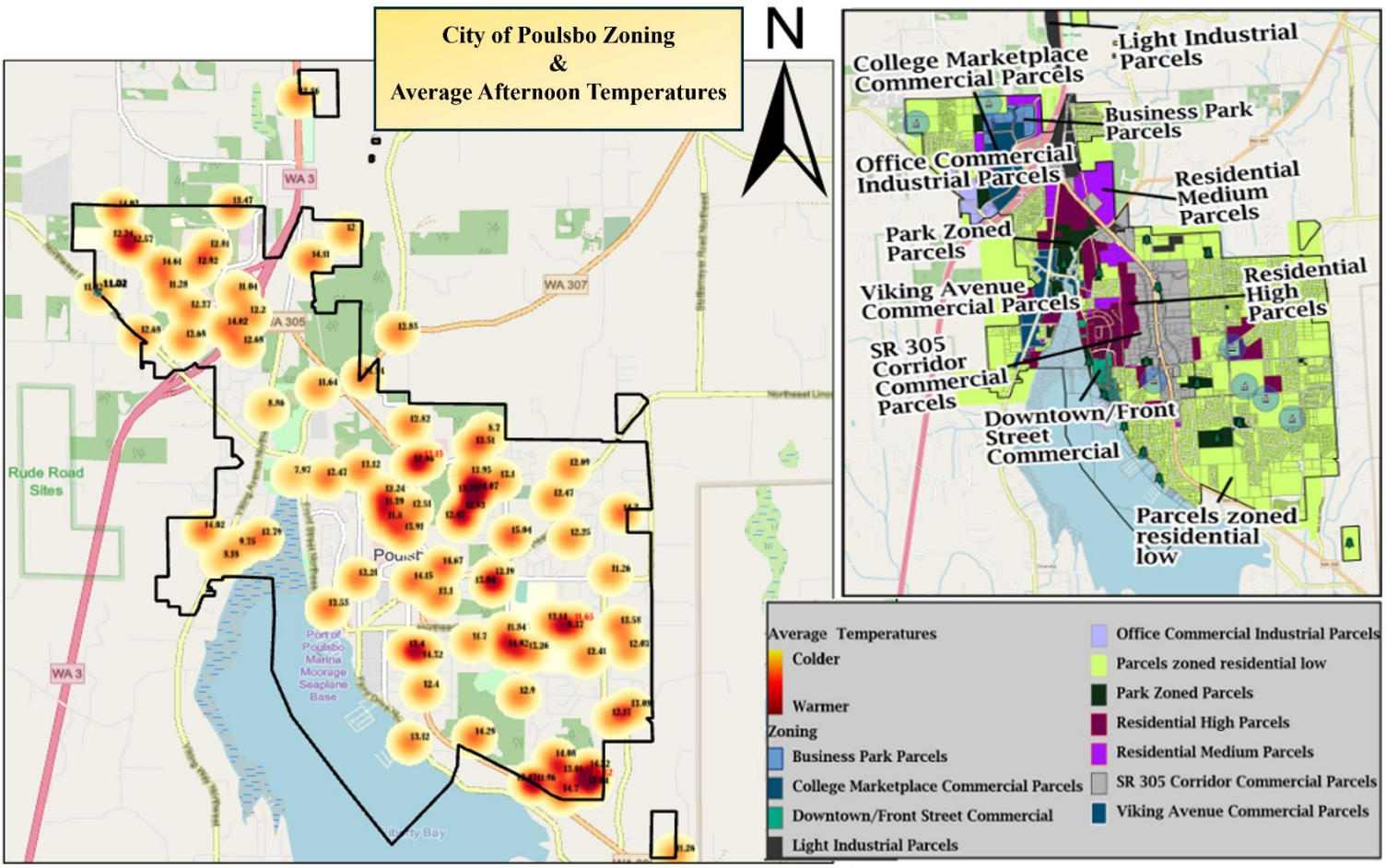


Figure 4: The above map illustrates average afternoon temperatures within Poulsbo as well as the zoning regulations. The temperatures ranged from 7.97°C to 15.94°C between September 2024 to November 2024.

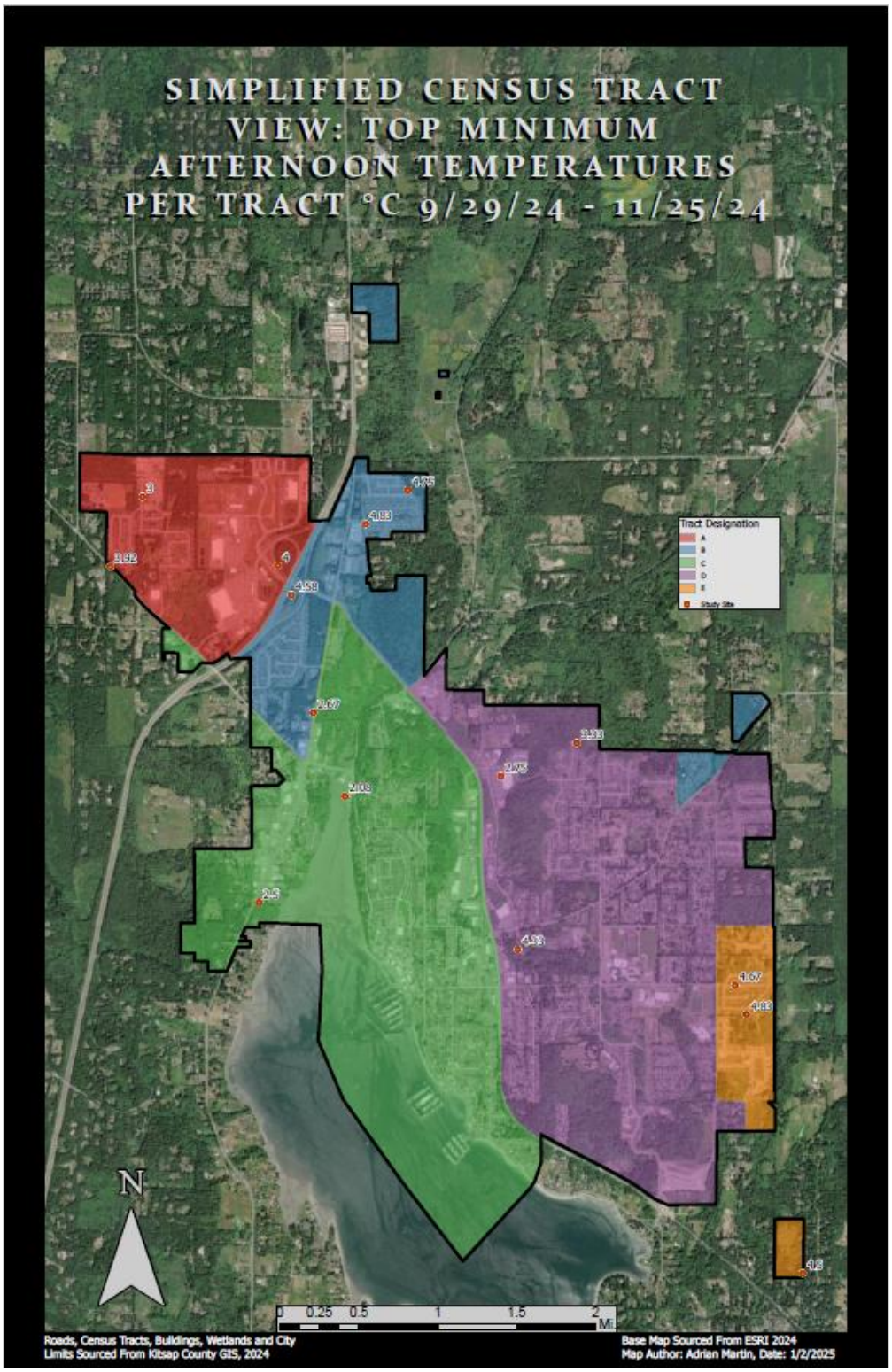


Figure 5: The above map illustrates the top three minimum afternoon temperatures in Celsius within each tract. Temperatures ranged from 3°C to 4.83°C respectively. Tract C seemed to have the lowest overall temperatures.

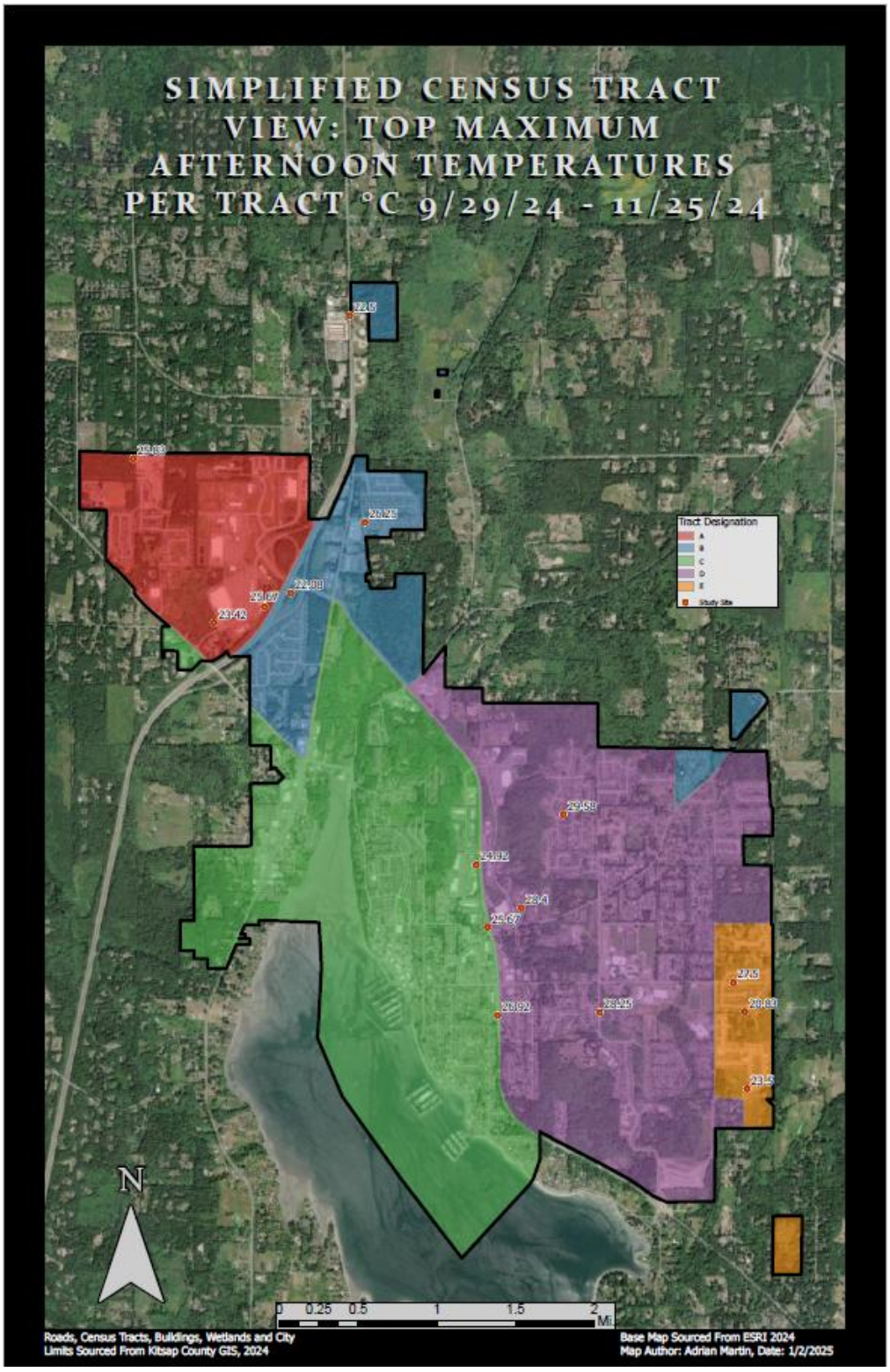


Figure 6: The above map illustrates the top three maximum afternoon temperatures in Celsius within each tract. Temperatures ranged from 22.5°C to 29.58°C. Tract D seemed to have the highest overall maximum temperatures.

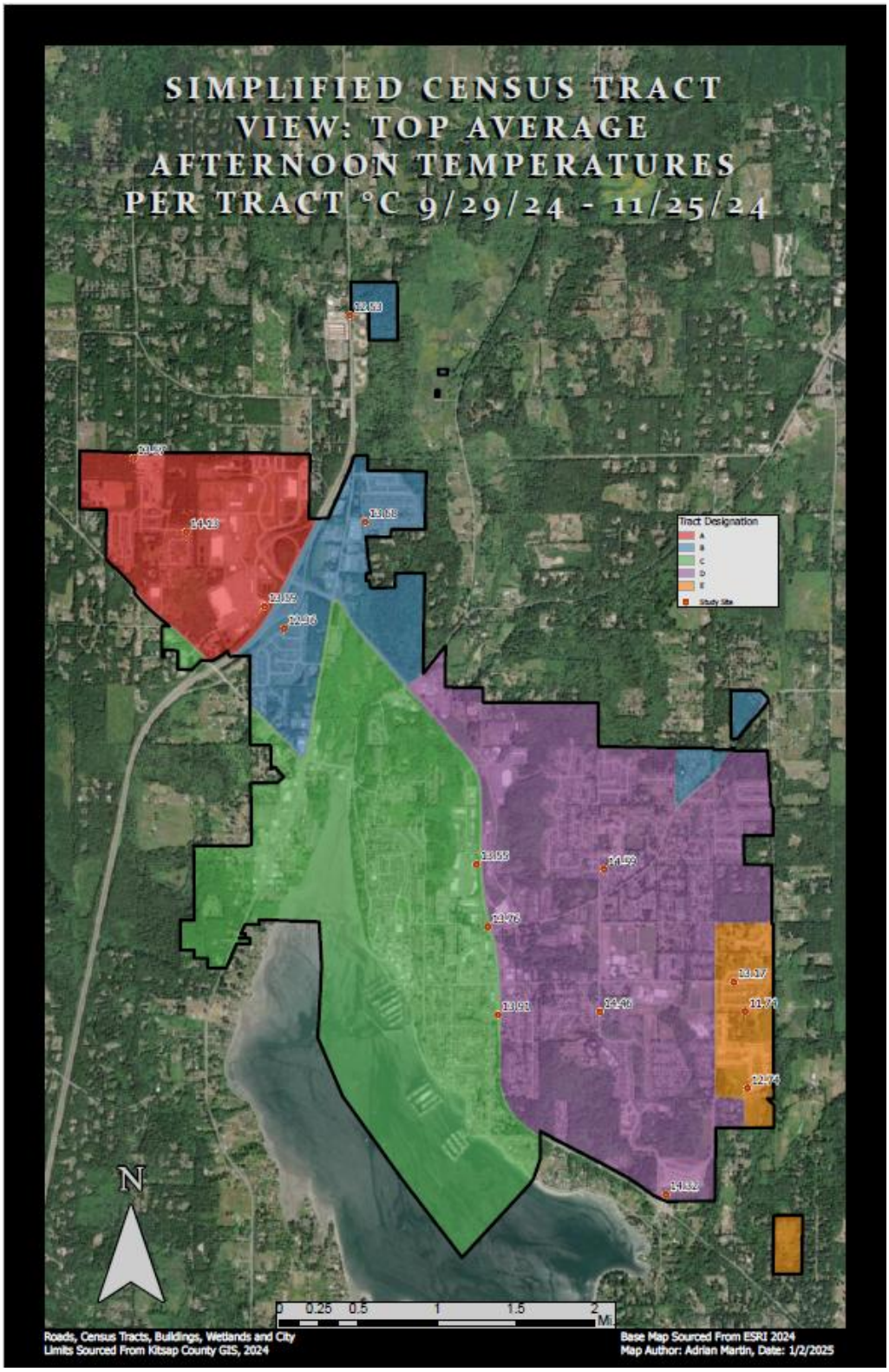


Figure 7: The above map illustrates the top three average afternoon temperatures in Celsius. Temperatures ranged from 11.8°C to 14.59°C. Tract D seems to have the highest mean temperatures among all the tracts.

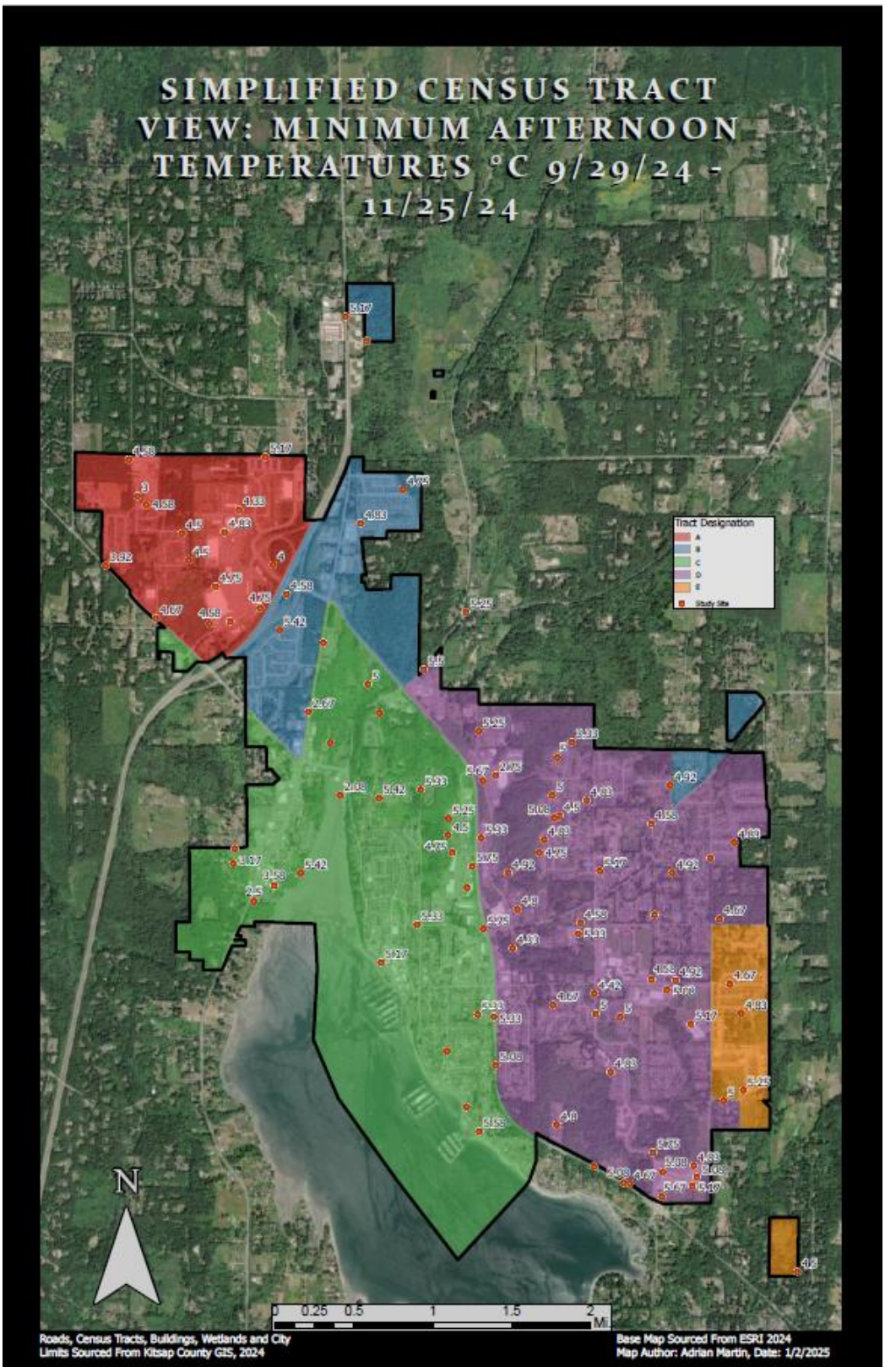


Figure 8: The above map illustrates the minimum afternoon temperatures in Celsius for all temperature sensor locations within each tract.

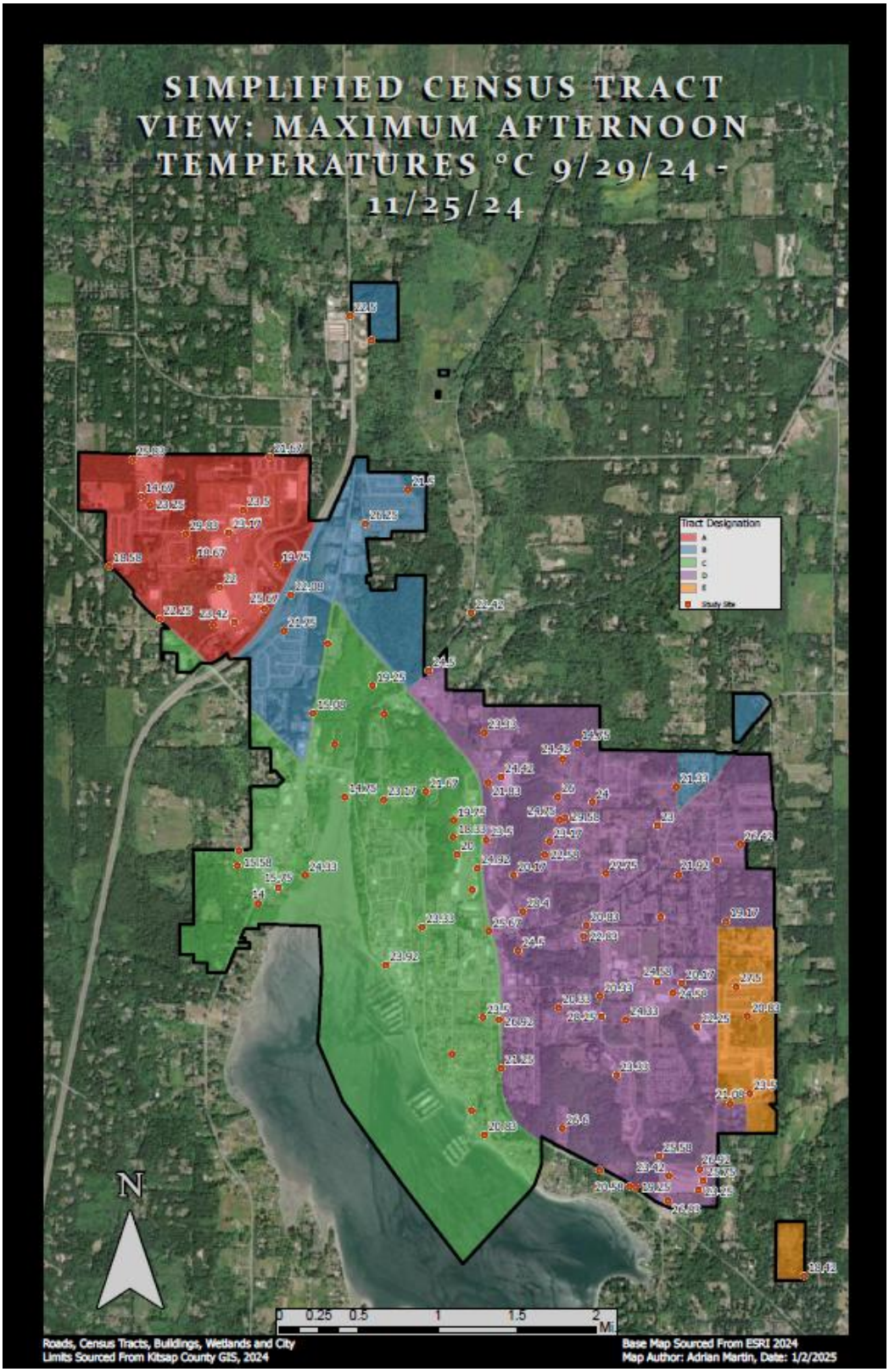


Figure 9: The above map illustrates the maximum afternoon temperatures in Celsius for all temperature sensor locations within each tract.

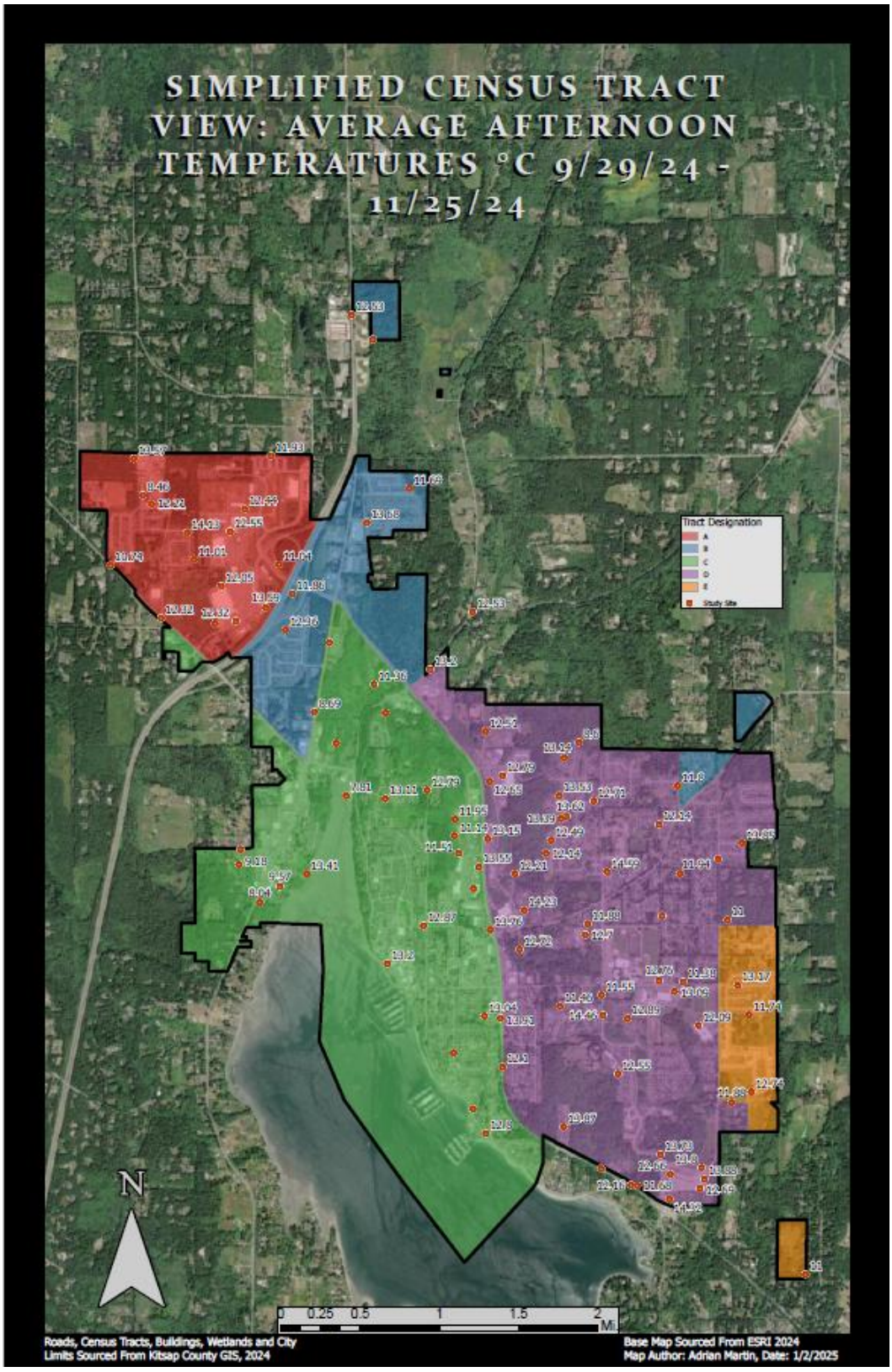


Figure 10: The above map illustrates the average afternoon temperatures in Celsius for all sensor locations

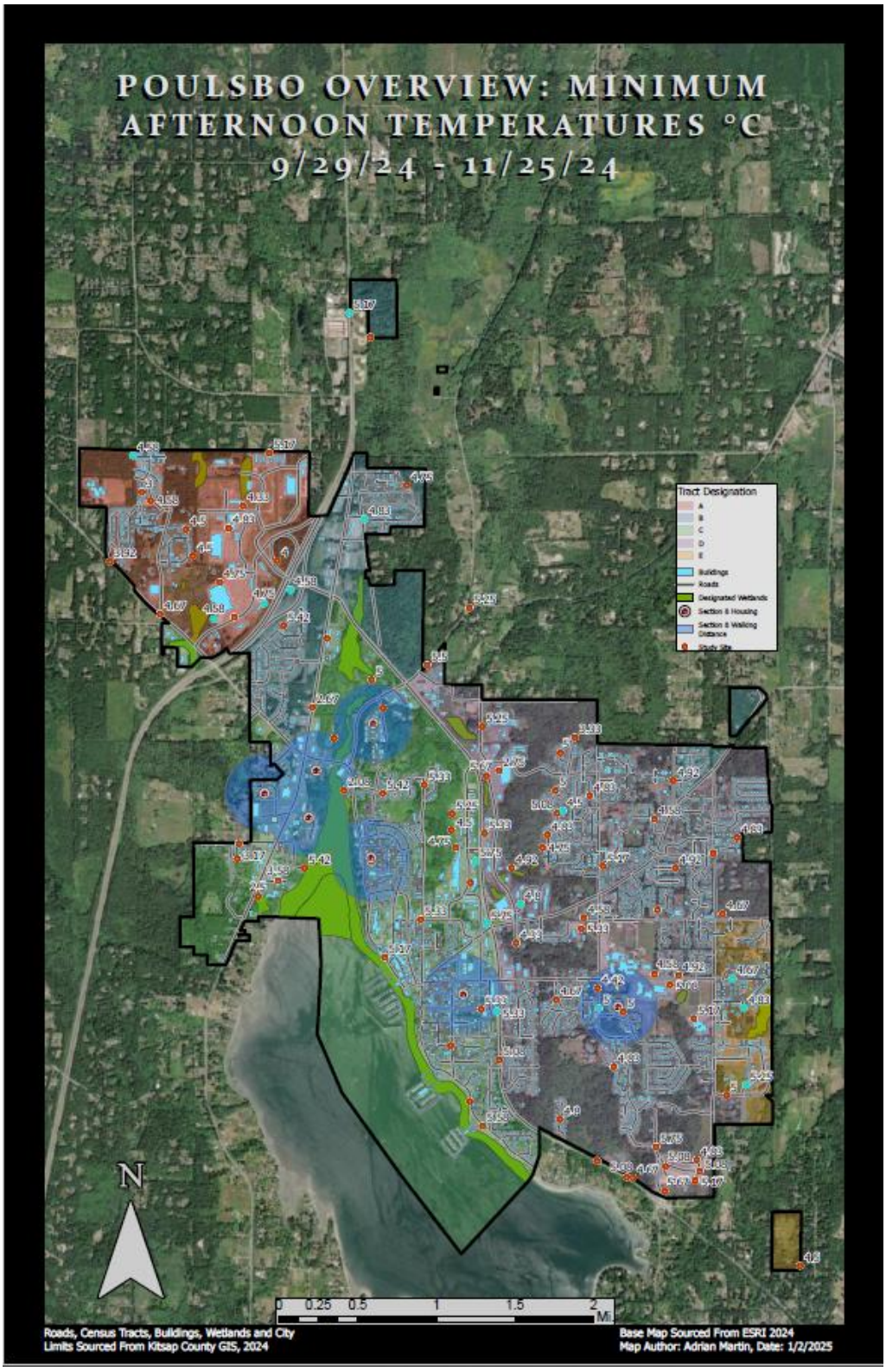


Figure 11: The above map illustrates the minimum afternoon temperatures in Celsius for each census tract within the city of Poulsbo. The map also depicts the location of low-income housing within the city as well as walking zones, buildings and wetlands.

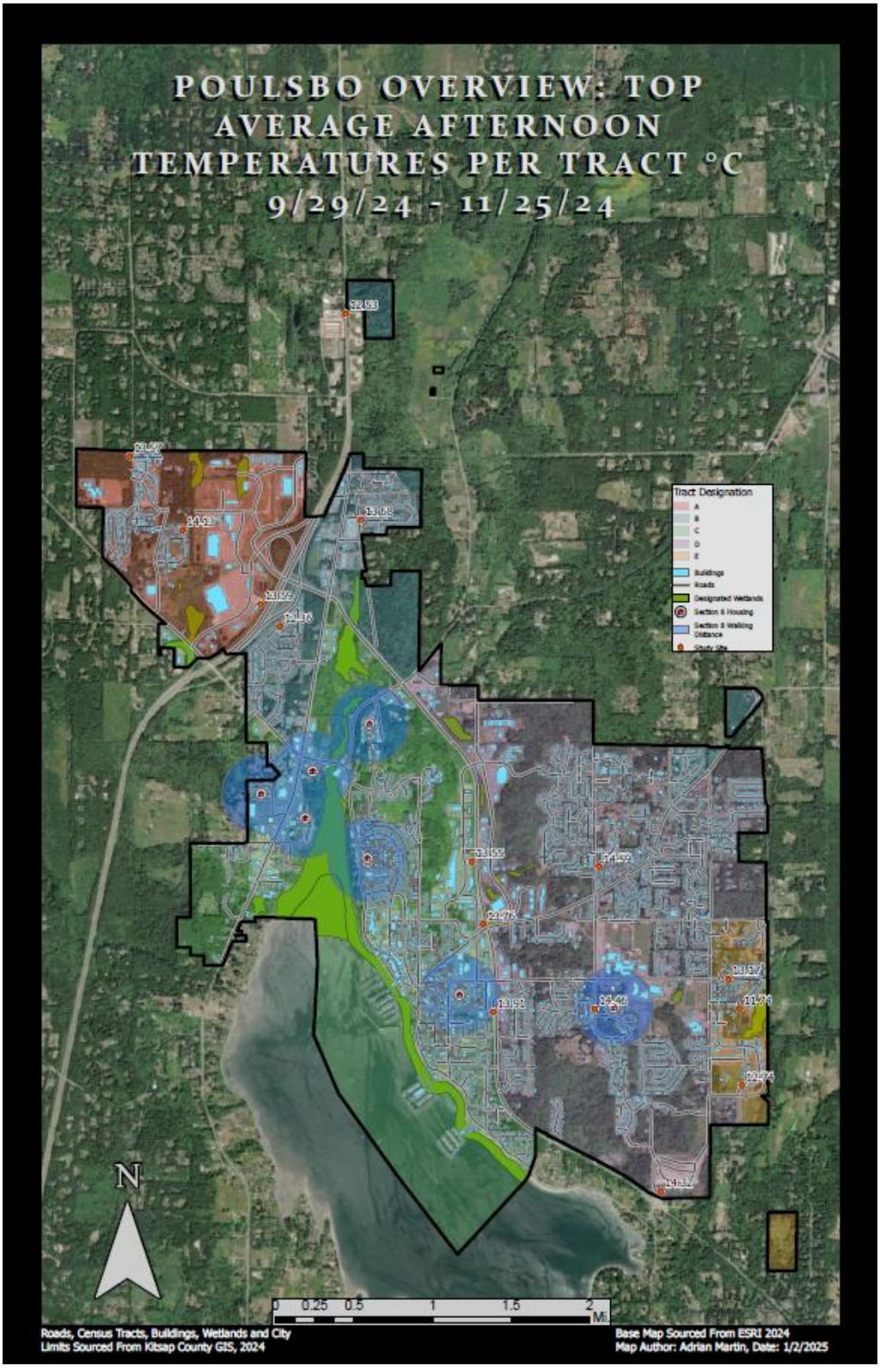


Figure 12: The above map illustrates the average afternoon temperatures in Celsius for each census tract within the city of Poulsbo. The map also depicts the location of low-income housing within the city as well as walking zones, buildings and wetlands.

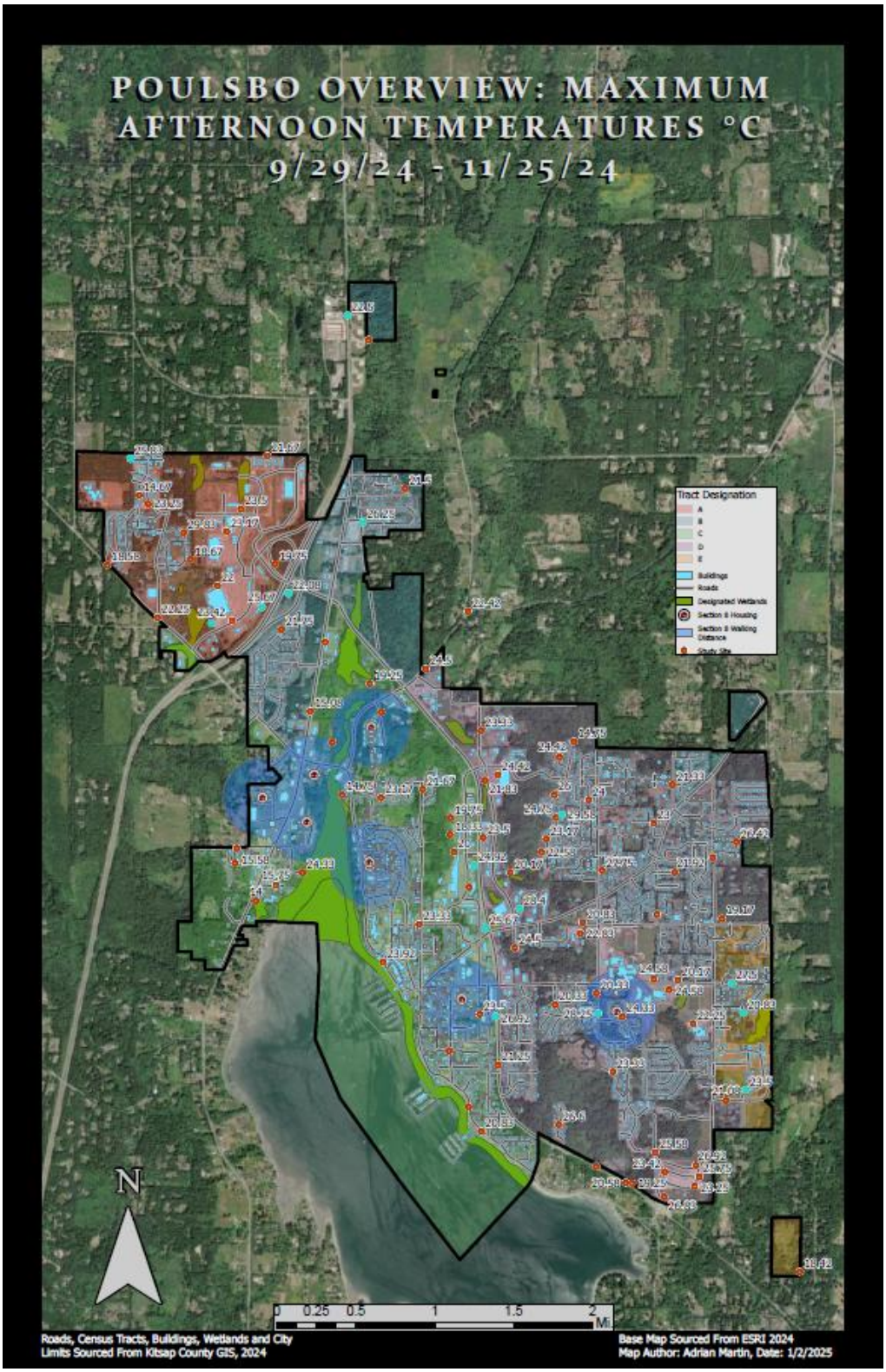


Figure 13: The above map illustrates the maximum afternoon temperatures in Celsius for each census tract within the city of Poulsbo. The map also depicts the location of low-income housing within the city, as well as walking zones, buildings and wetlands.

## Canopy Cover Over Time:

The overall trend from 1994 to 2024 shows a decline in the urban forest canopy. While there was a period of recovery between 2004 and 2014, the slight decrease in the last decade signals the need for ongoing and enhanced efforts to protect and expand urban forest cover.

1. **1994-2004:** There was a significant decrease in canopy cover from 51% to 33%, an 18-percentage point drop over 10 years. This could indicate a period of intense urban development, deforestation, or other factors that reduced the canopy.
2. **2004-2014:** During this period, the canopy cover increased from 33% to 38%, showing a 5-percentage point increase over 10 years. This suggests efforts to reforest or better manage the urban canopy were somewhat effective.
3. **2014-2024:** The percent canopy cover slightly decreased from 38% to 36%, a 2 percentage point drop over 10 years. While not as drastic as the 1994-2004 period, it does indicate a trend of canopy loss, possibly due to continued urban expansion or insufficient reforestation efforts.

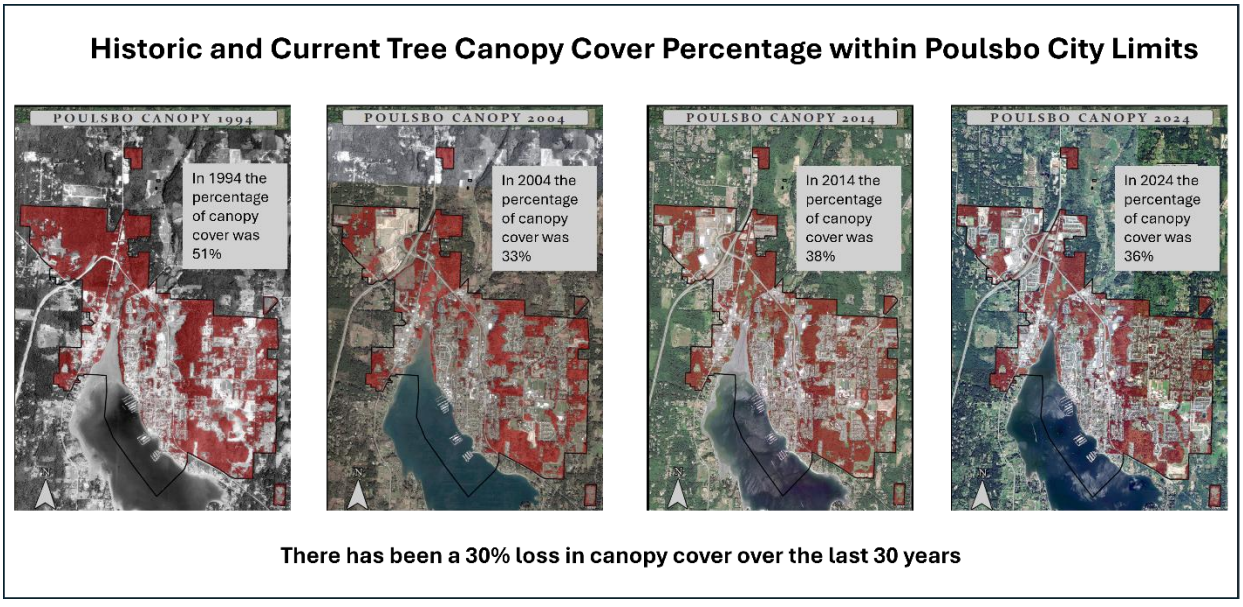


Figure 14: The above maps illustrate the percentage of canopy cover change over time from 1994-2024. Over 30 years there has been a decrease in canopy cover from 51% to 36%, decreasing overall canopy percent by 30%.

Table 1: The table below shows the percentage of canopy cover by year within Poulsbo City limits.

| Year | Canopy Cover (%) |
|---|---|
| 1994 | 51 |
| 2004 | 33 |
| 2014 | 38 |
| 2024 | 36 |

## Canopy Cover:

There was no significant difference in canopy cover by census tract. Tract A displayed approximately 34% canopy cover, offering moderate coverage with a balance of vegetation. Tract B stood out with the highest canopy cover at 57.6%, indicating a dense and thriving tree canopy. Tracts C and D followed with 37.8% and 35.5% canopy cover respectively, reflecting similar levels of greenery and vegetation density. Tract E exhibited the lowest canopy cover at 26.33%, suggesting a more open landscape with fewer trees.

Despite the overall consistency in canopy cover, significant differences emerged when analyzing the types of trees contributing to the canopy. There were significant differences in the percentage of canopy cover by deciduous trees among the study sites ($X^2 = 7.14$,df=1 p=0.008), percentage of canopy cover by conifers among the study sites ( $X^2 = 11.8$,df=1 p=0.001), and percentage of canopy cover by study sites that had both conifers and deciduous trees ($X^2 = 16.42$,df=1 $p<0.0001$).

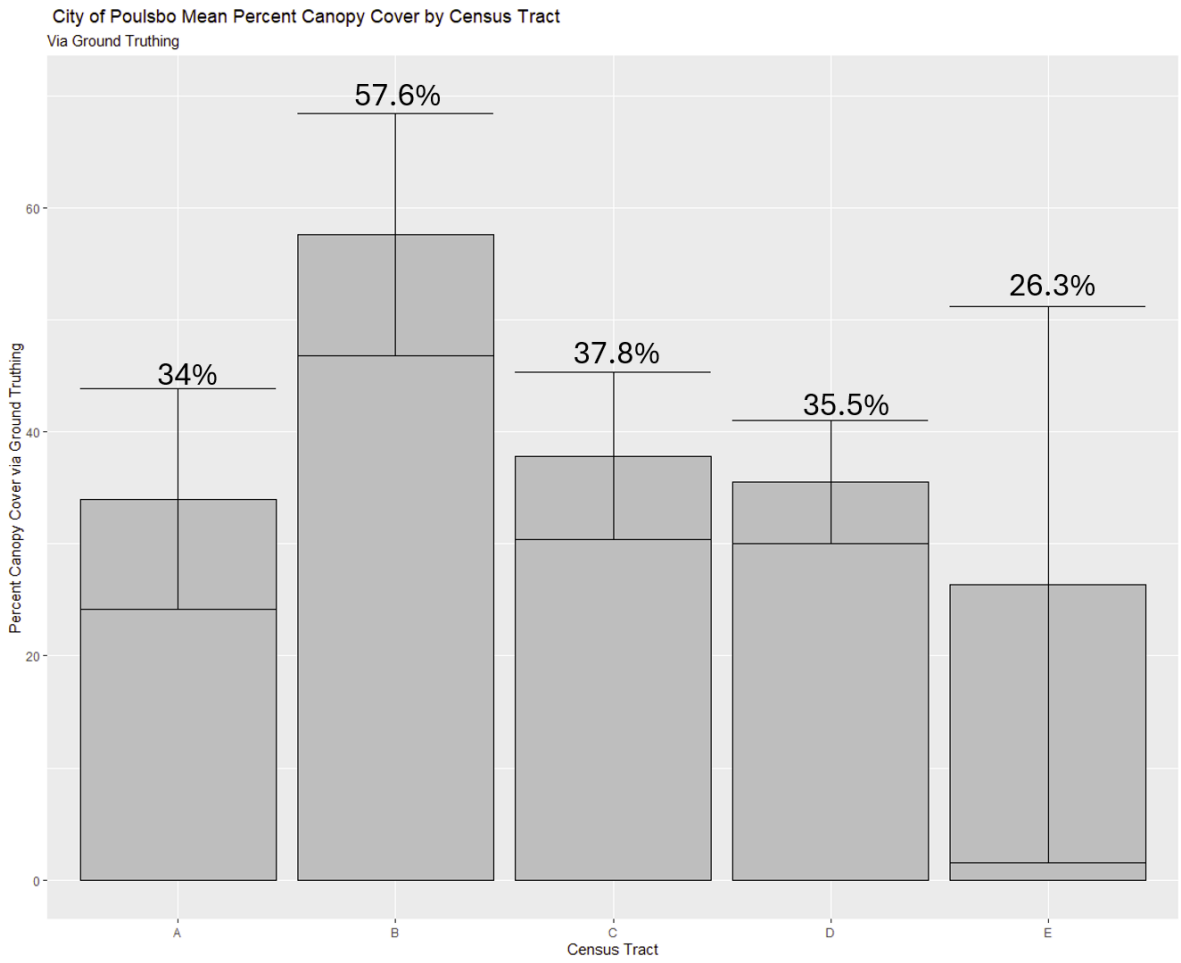


Figure 15: The above graph shows the mean percent canopy cover by census tract. There were no significant differences among the tracts regarding canopy cover. Ground -truthing shows that tract A has roughly 34% canopy cover, B 57.6% canopy cover, C 37.8% canopy cover, D 35.5% canopy cover, and E 26.33% canopy cover.

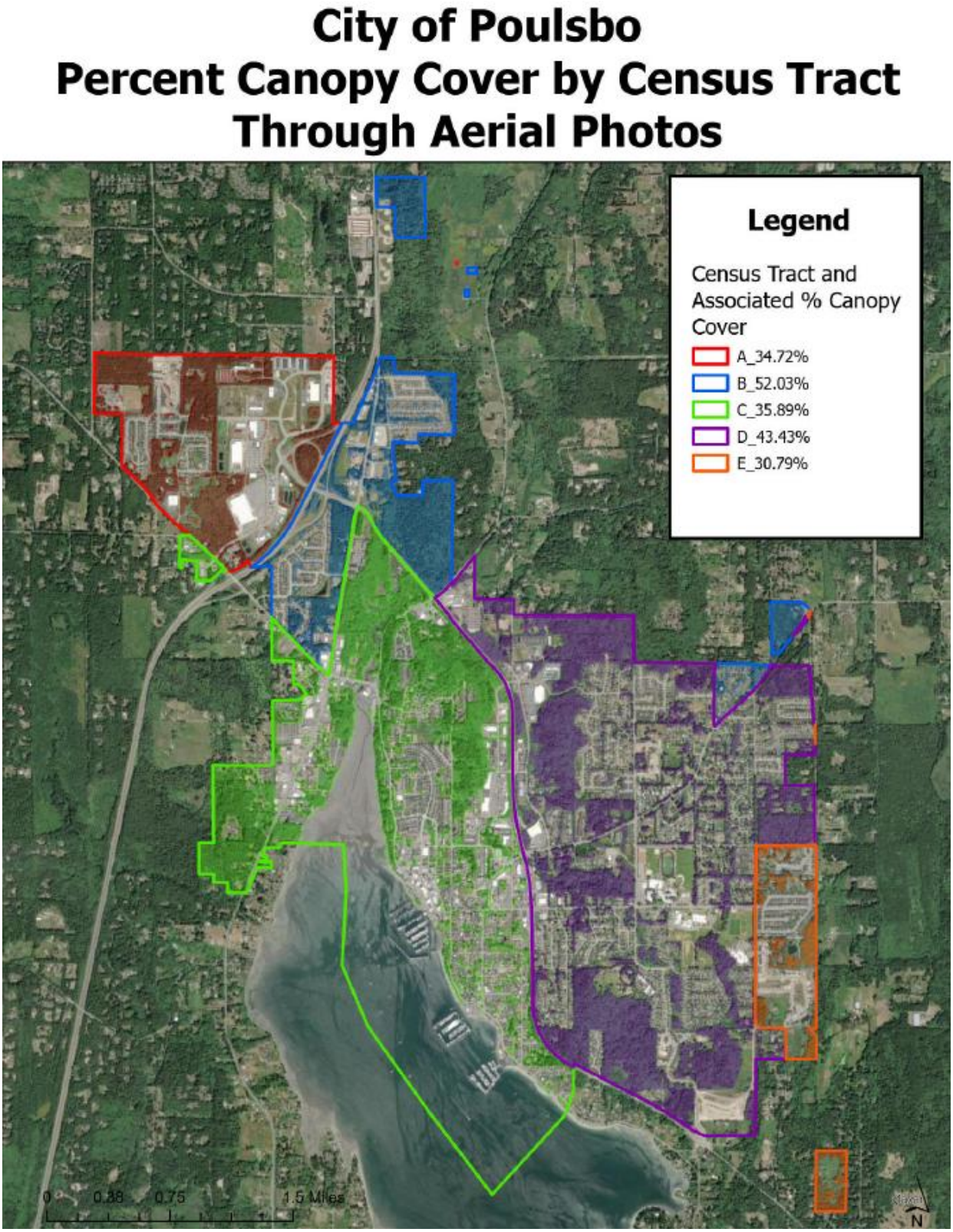


Figure 16: The above figure visualizes the percent canopy cover by census tract via aerial photos.

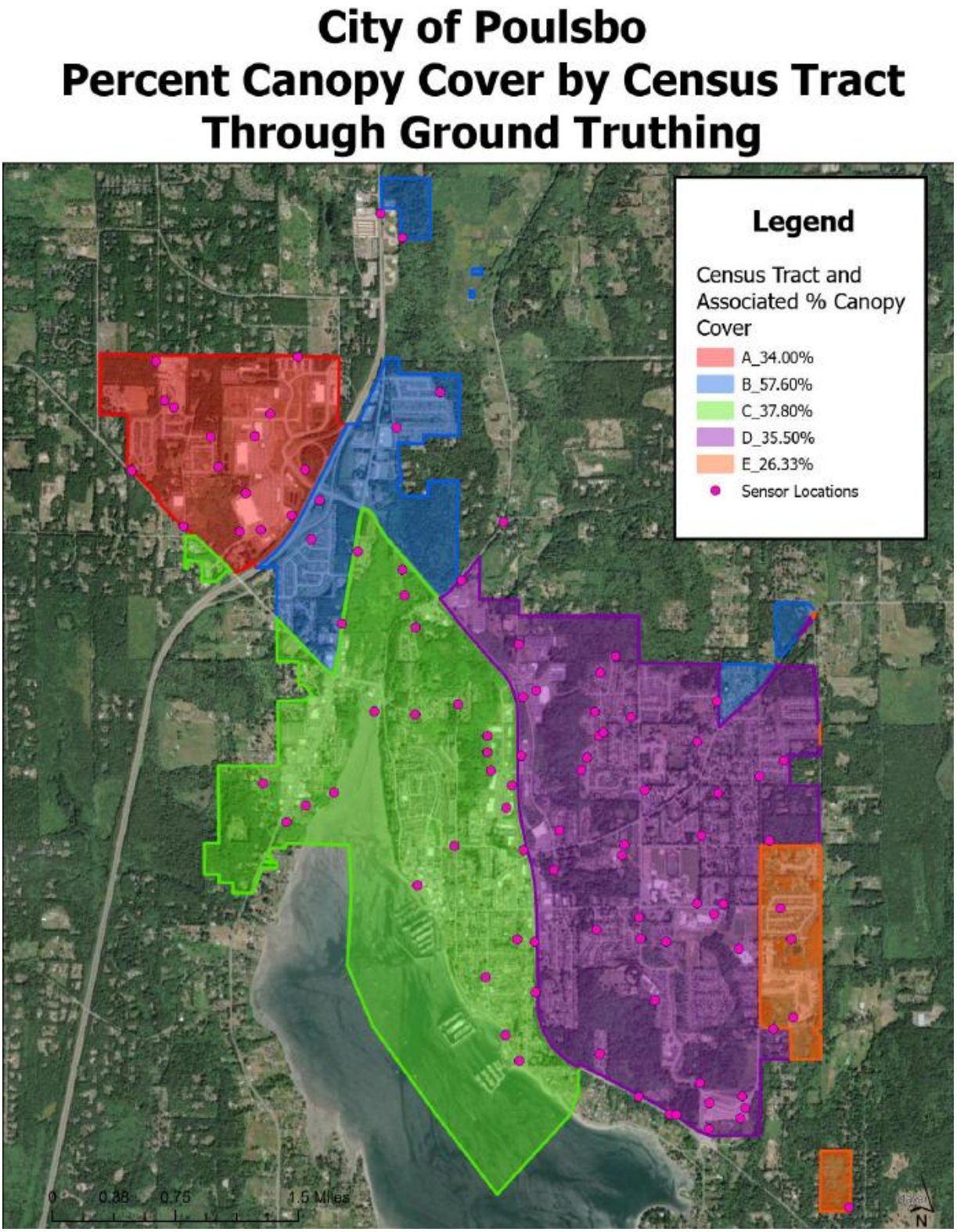


Figure 17: The above figure represents the percentage of canopy cover by census tract via ground truthing. Canopy cover was taken at each of the 100 sensor locations. The mean percentage of canopy was calculated per census tract.

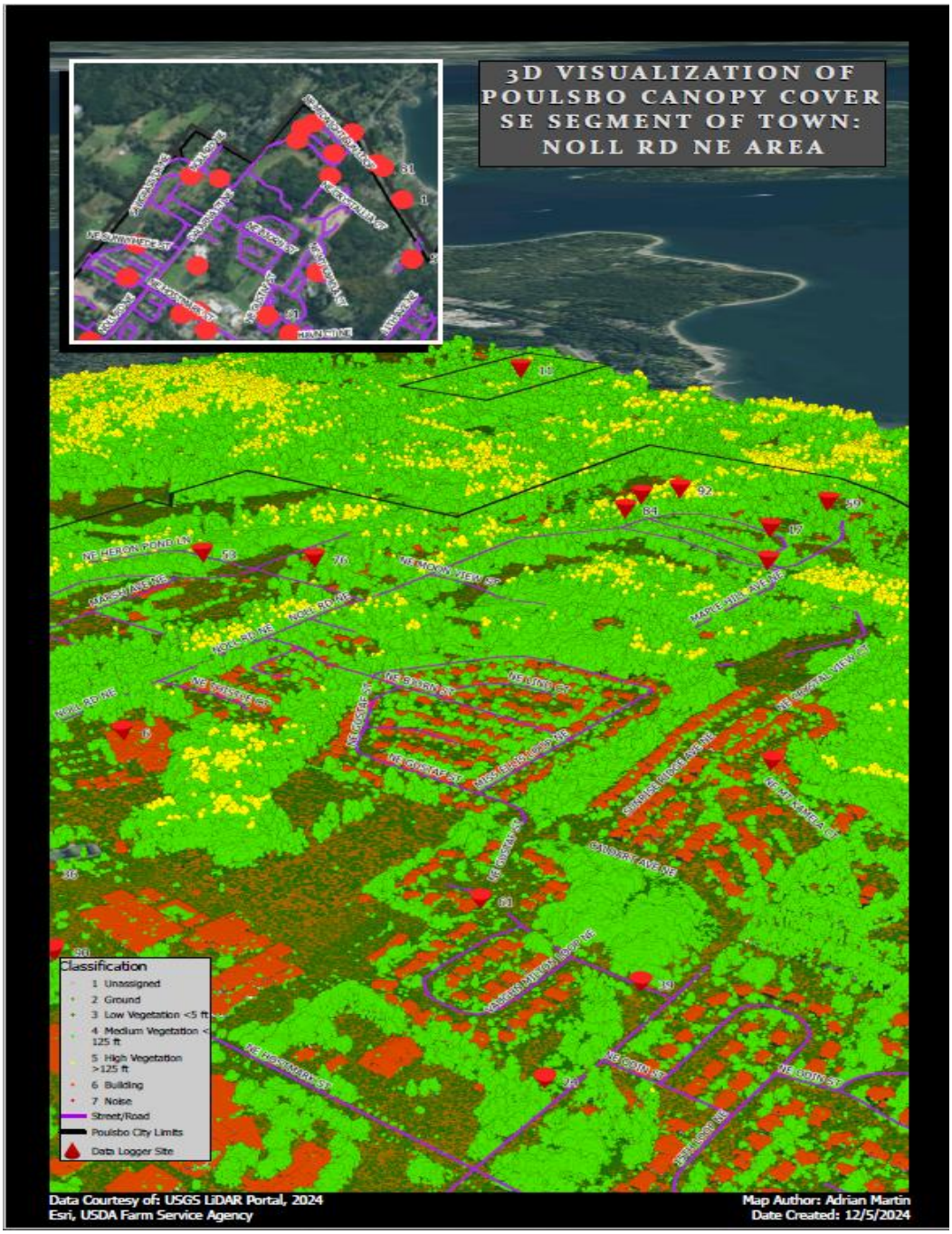


Figure 18: The above figure represents a 3D LiDAR visualization of the variable structured forests, canopy cover, and canopy height in Poulsbo's Southeast segment. Canopy height varied from <5ft to >125ft. The red indicates buildings while the bright green represents vegetation less than 125ft. The yellow represents vegetation above 125ft.


Figure 19: The above figure represents a 3D LiDAR visualization of the variable structured forests, canopy cover, and canopy height in Poulsbo's East Central segment. Canopy height varied from <5ft to >125ft. The red indicates buildings while the bright green represents vegetation less than 125ft. The yellow represents vegetation above 125ft.

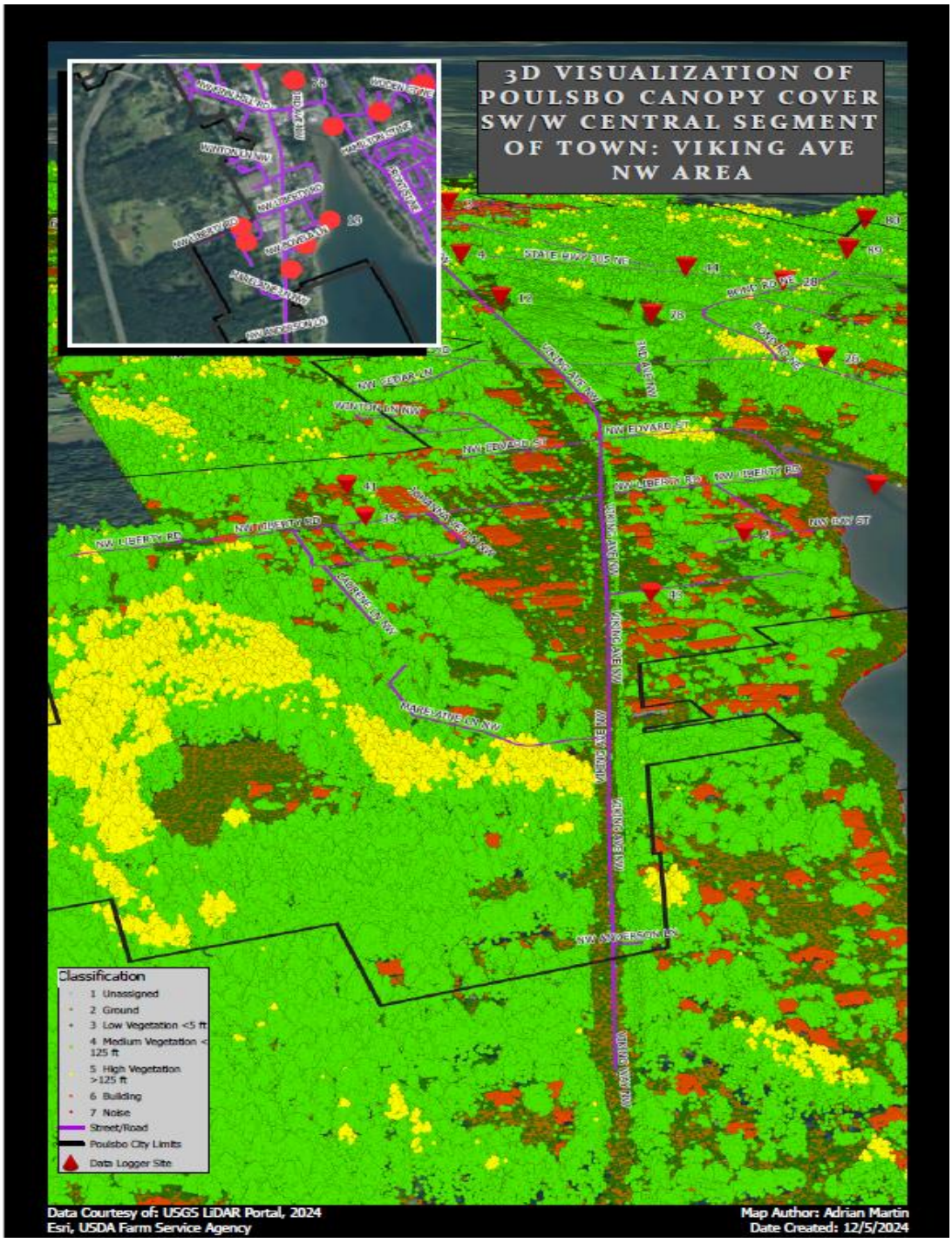


Figure 20: The above figure represents a 3D LiDAR visualization of the variable structured forests, canopy cover, and canopy height in Poulsbo's Southwest/West Central segment. Canopy height varied from <5ft to >125ft. The red indicates buildings while the bright green represents vegetation less than 125ft. The yellow represents vegetation above 125ft.

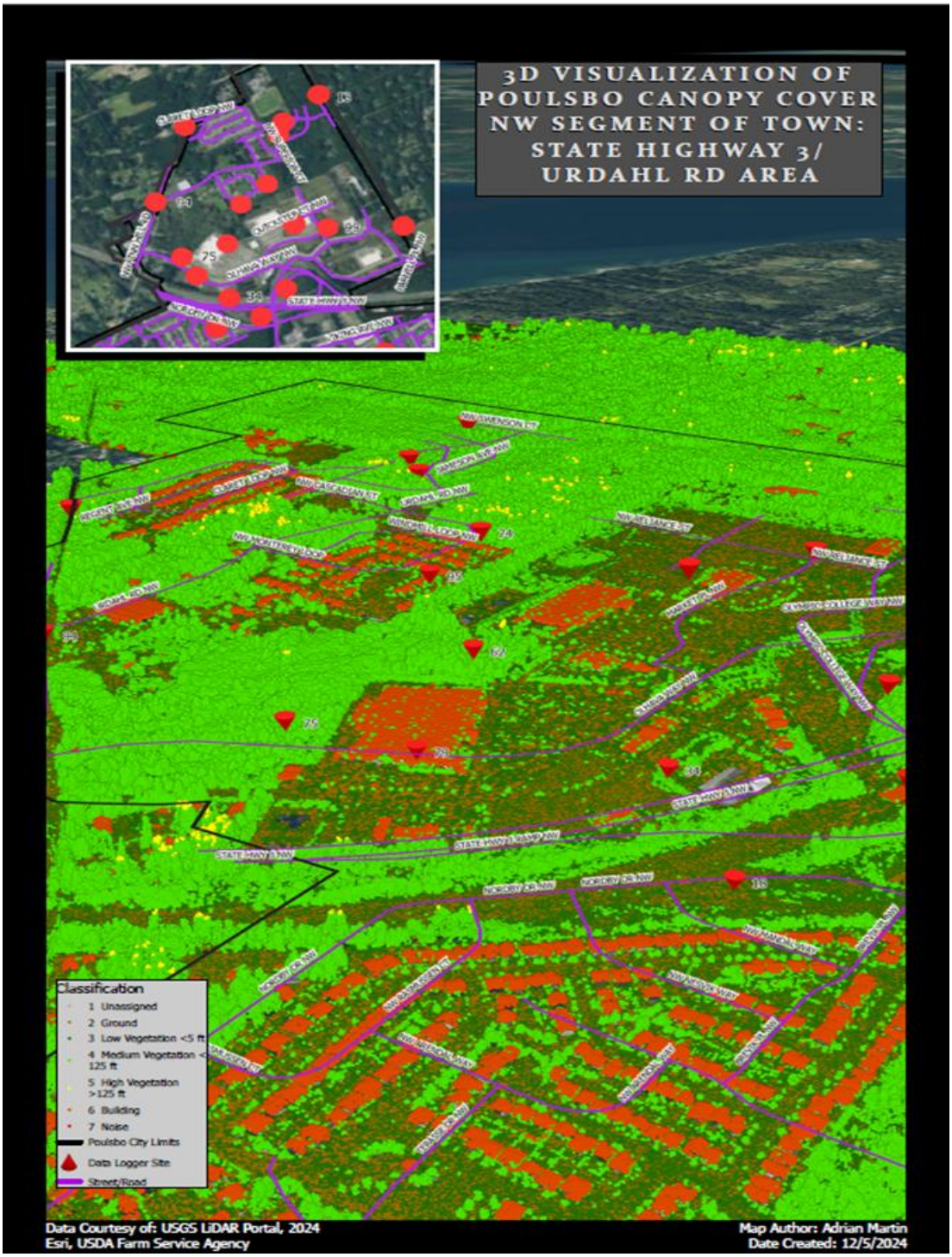


Figure 21: The above figure represents a 3D LiDAR visualization of the variable structured forests, canopy cover, and canopy height in Poulsbo's Northwest segment. Canopy height varied from <5ft to >125ft. The red indicates buildings while the bright green represents vegetation less than 125ft. The yellow represents vegetation above 125ft.


Figure 22: The above figure represents a 3D LiDAR visualization of the variable structured forests, canopy cover, and canopy height in Poulsbo's Northeast segment. Canopy height varied from <5ft to >125ft. The red indicates buildings while the bright green represents vegetation less than 125ft. The yellow represents vegetation above 125ft.

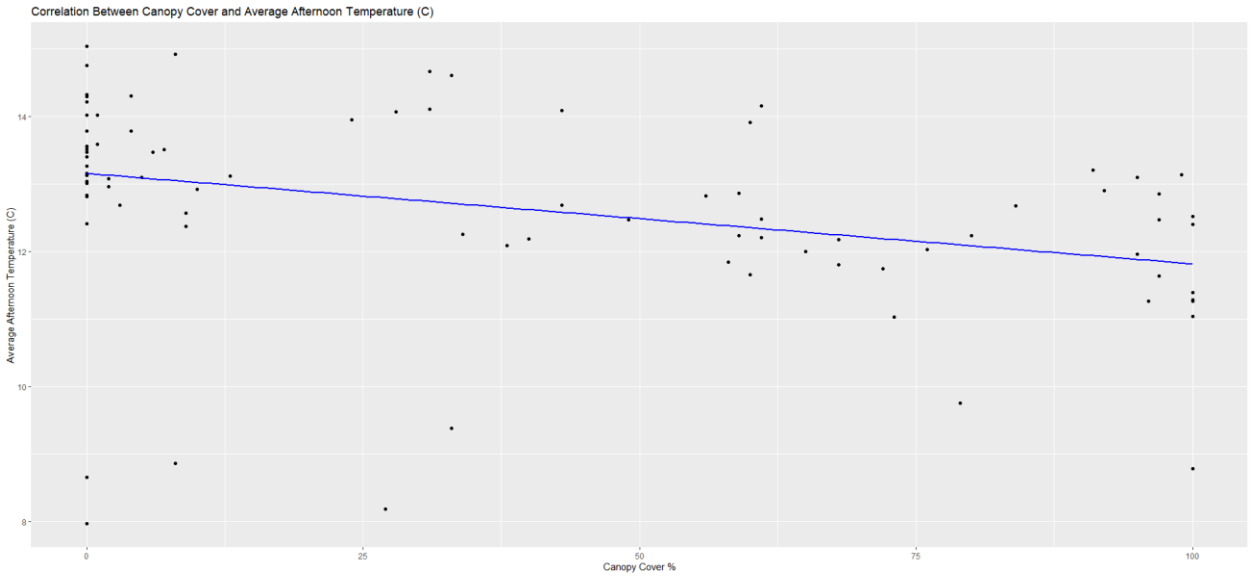


Figure 23: The above graph visualizes the correlation between percent canopy cover and average afternoon temperature within Poulsbo City limits. As the canopy cover increased the temperature decreased ($r=-0.1$, $p<0.0001$).

## Vegetation Survey:

An analysis of canopy cover across the census tracts revealed no statistically significant differences between shrubs, grass cover, bare ground or dirt, buildings, and asphalt by census tract. However, ground-truthing provided a clearer picture of the canopy/vegetation distribution. Tracts A and B have relatively higher tree and shrub coverage, which could indicate areas with significant forest or natural vegetation. The diversity of species suggests a mix of native plants (e.g., Douglas Fir, Western Hemlock) and invasive species (e.g., Himalayan Blackberry, English Ivy). This could contribute to ecological transitions or human impact. Tract C and D feature balanced vegetation, with notable grass, shrub, and tree coverage. Such balance might suggest semi-developed areas or urban spaces with green belts and landscaped vegetation. The presence of species like ornamental plants (e.g., Rhododendron, Azalea) mixed with native species indicates landscaping efforts or garden cultivation. In contrast, Tract E also shows a dominance of grass and minimal tree or shrub cover suggesting this tract may be more urbanized or primarily used as fields or parks. Among all the tracts, invasive species like Scotch Broom, English Ivy, and Himalayan Blackberry highlight human-mediated disruptions, which can outcompete native plants.

# City of Poulsbo Hazard Tree Locations

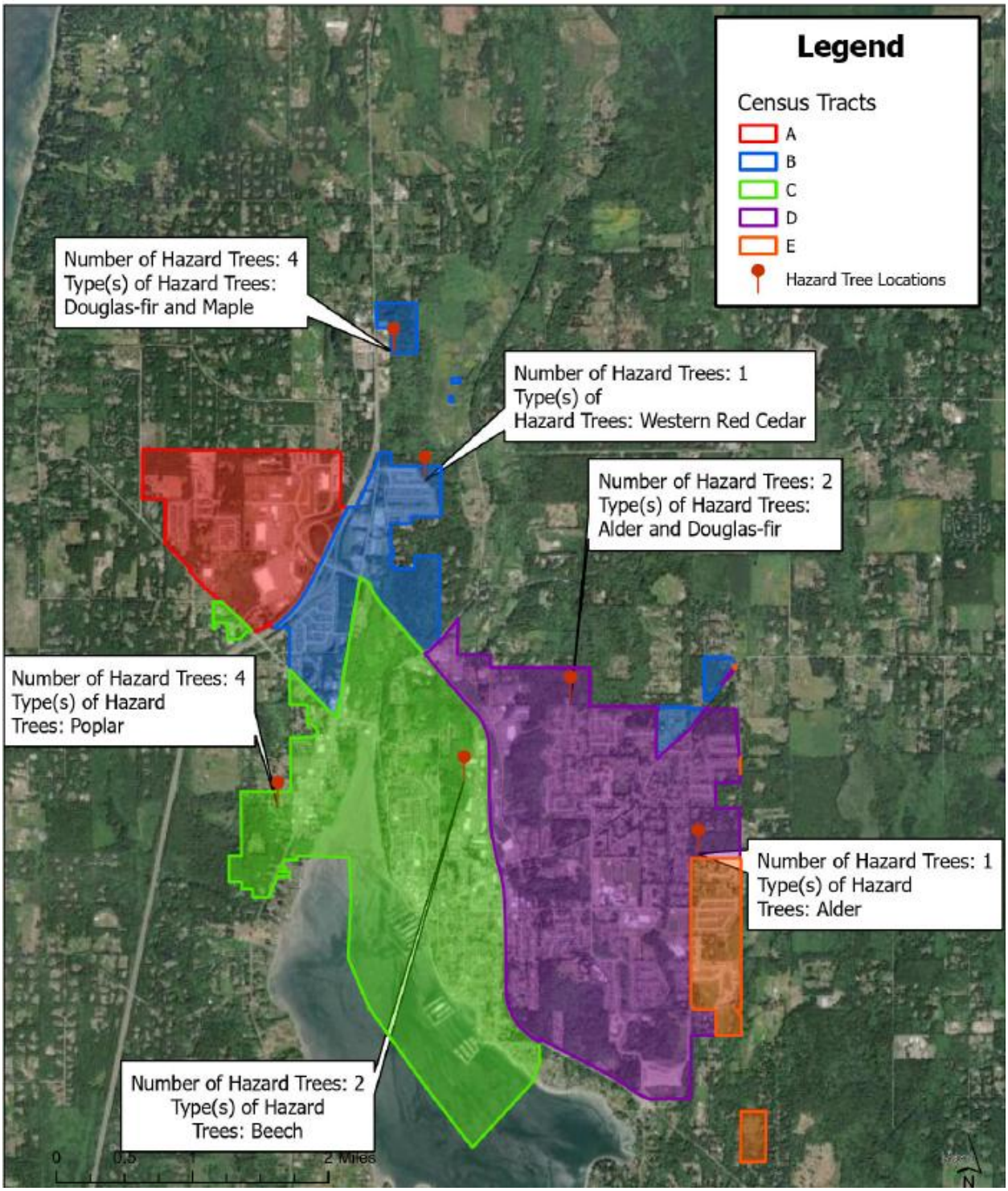


Figure 24: The above map represents areas within Poulsbo that have known hazard trees through ground-truthing.

# City of Poulsbo
# Areas with Invasive Species Encroachment

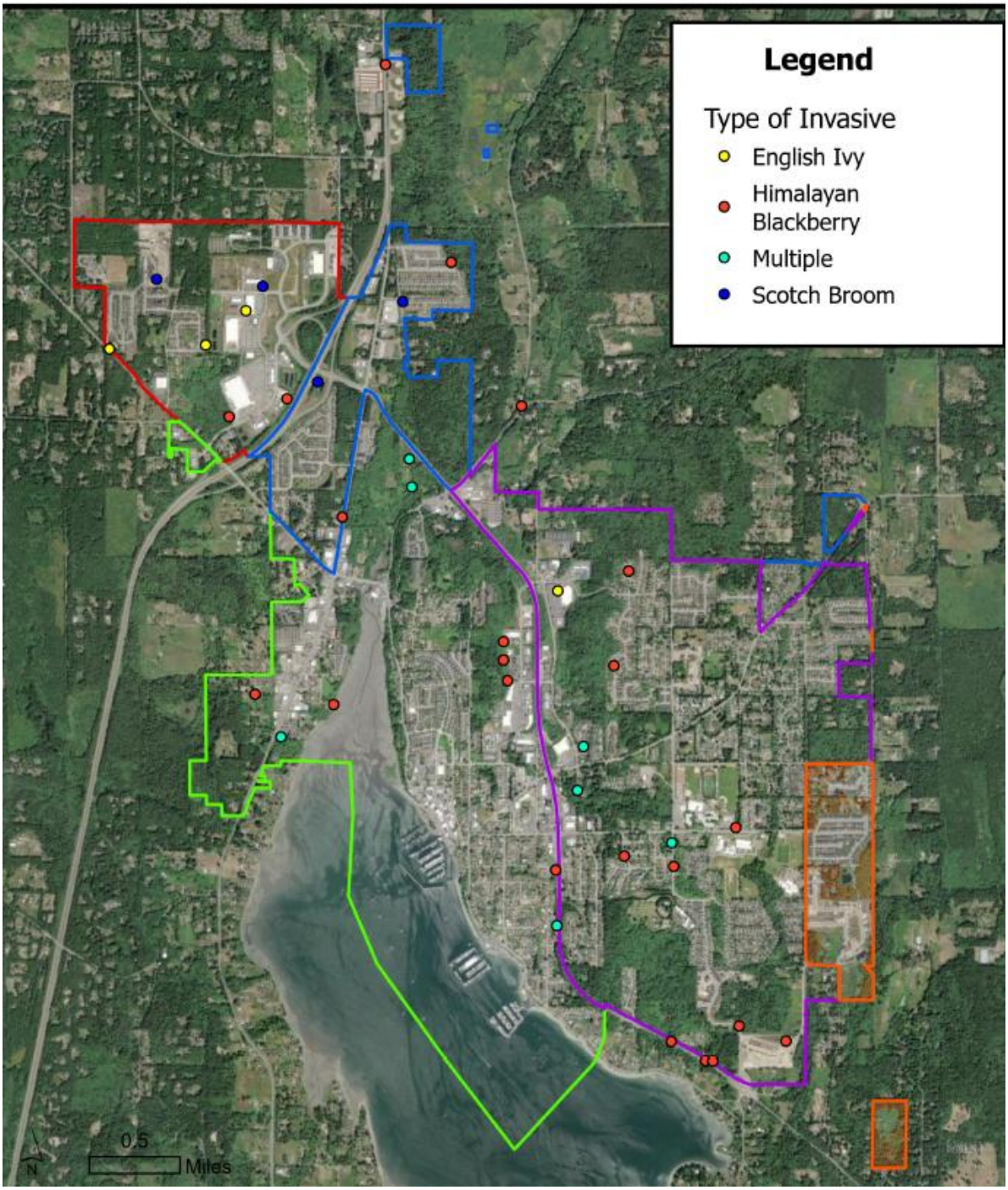


Figure 25: The above figure represents the areas within Poulsbo that have invasive species. The yellow indicates English ivy, red Himalayan blackberry, turquoise indicates multiple sources of invasives, and blue means Scotch broom. Only invasive species.

Table 2: The table below shows the average percentage of vegetation survey variables by census tract

| Study Site (Census Tract) | Tree Trunk cover(%) | Shrub/Bush Cover (%) | Grass Cover (%) | Bare Ground/Dirt (%) | Building (%) | Asphalt (%) |
|---|---|---|---|---|---|---|
| **A (90201)** | 3.67 | 20.20 | 16.13 | 19.60 | 1.00 | 40.13 |
| **B (90202)** | 6.22 | 34.44 | 23.89 | 15.56 | 1.11 | 28.11 |
| **C (90501)** | 3.92 | 24.04 | 23.08 | 16.24 | 1.20 | 33.00 |
| **D (90502)** | 2.34 | 19.70 | 23.79 | 20.94 | 1.38 | 34.36 |
| **E (940100)** | 0.33 | 1.67 | 53.33 | 1.67 | 0.00 | 41.67 |

Table 3: The table below lists the types of tree species found among all of the 100 study sites within Poulsbo.

| **Tree Types within Poulsbo Study Sites** | | |
|---|---|---|
| Alder | Ash | Beech |
| Cherry Plum | Cottonwood | Cotoneaster |
| Douglas fir | Fir | Ginko |
| Holly | Madrona | Malae |
| Maple | Paper Birch | Pine |
| Ponderosa Pine | Poplar | Red Maple |
| Redwood | Scots Pine | Western Red cedar |

Table 4: The table below lists the understory species found among all of the 100 study sites within Poulsbo City limits.

| Understory Species within Poulsbo Study Sites | | |
|---|---|---|
| Alfalfa | American sweet flag | Andromeda |
| Arrow bamboo | Asiatic jasmine | Asteroideae |
| Aucubas | Bald hip roses | Barberry |
| Bearberry cotoneaster | Bedstraw | Bird's-nest spruce |
| Bitter dock | Broomrape | Buckthorn |
| Burkwood osmanthus | Buttercup | California poppy |
| Carrot | Cats paw | Cheese wood |
| Cherry plum | Clover | Coastal blackberry |
| Common privet | Common self heal | Cotonaster |
| Crab apple sapling | Creeping thistle | Cypress hedge |
| Daisies | Dandelion | Daphne |
| Dogwood | Douglas fir | Dwarf Alberta spruce |
| Early figwort | E.huk. | Elder sapling |
| English holly | English ivy | Evergreen huckleberry |
| Foxglove | Geranium | Giant foxglove |
| Glandora | Glossy abelia | Grass sp. |
| Gum rock rose | Guelder-rose | Hairy cats paw |
| Hardy fuschia | Hazelnut | Himalayan blackberry |
| Holly | Honeysuckle | Honey suckle |
| Horsetail | Huckleberry | Hydrangea |

| Understory Species within Poulsbo Study Sites | | |
|---|---|---|
| Ice plant | Indian waltheria | Ipomoea |
| Iris | Japanese barberry | Japanese holly |
| Japanese maple | Japanese spirea | Juniper |
| Kinnikinnick | Lady fern | Lambs tongue |
| Lavender | Lemonade rose | Licorice fern |
| Lucanthemum | Lycan | Madrona sapling |
| Maleae | Manicured grass sp. | Manmade structure detritus |
| Maple sapling | Marigolds | Marsh jaumea |
| Moss sp. | Mountain pine | Mugo pine |
| Mushrooms | Mustard | Naked miterwort |
| Nettle | Nootka rose | Oak sapling |
| Oregon grape | Pacific blackberry | Pacific crab apple |
| Pacific dogwood | Petunias | Plantain |
| Poppy | Poplars | Ragwort |
| Red alder | Red alder saplings | Red claw |
| Reflex stone crop | Rhododendron | Rose |
| Rose of Sharon | Rosemary | Salal |
| Salmon berry | Scarlett pimpernel | Scotch broom |
| Sitka spruce | Slippery or American elm | Smoke bush |
| Smokebush | Smooth cat's ear | Snowberry |
| Sow thistle | Spurge | Spurge laurel |
| Spruce sapling | Stinky Robert | Strawberry |

| Understory Species within Poulsbo Study Sites | | |
|---|---|---|
| Sunflower | Sunrise winter creeper | Sword fern |
| Tansy | Tea plant | Three leaf goldthread |
| Trailing blackberry | Various small forb sp. | Venus comb |
| Viburnum | Vetch | Watercress |
| Western hemlock | Western red cedar | Western sword fern |
| Wild carrot | Willow sapling | Winter creeper |
| Yarrow | Yucca | Zinnia |

Table 5: The table below provides a list of plant species that were found among the 100 study sites within each census tract.

| Census Tract | Plants |
|---|---|
| **A (90201)** | Beach Rose, Cat's Paw, Cherry, Clover, Common Privet, Coastal Blackberry, Dandelion, Douglas Fir, Evergreen Huckleberry, Grass, Hairy Cat's Ear, Himalayan Blackberry, Huckleberry, Indian Waltheria, Japanese Maple, Kinnikinnick, Lady Fern, Lichen, Madrone, Moss, Mustard, Nootka Rose, Ocean Spray, Red Pine, Rhododendron, Salal, Scotch Broom, Snowberry, Spurge, Trailing Blackberry, Vetch, Western Hemlock, Western Red Cedar, Yarrow |
| **B (90202)** | Alder, Big Leaf Maple, Cherry Plum, Coastal Blackberry, Douglas Fir, Evergreen Huckleberry, Grass, Himalayan Blackberry, Kinnikinnick, Licorice Fern, Moss, Pacific Blackberry, Redwood, Salmonberry, Salal, Scotch Broom, Snowberry, Sword Fern, Tansy, Cat's Paw |
| **C (90501)** | Beech, Bitter Dock, Black Cottonwood, Cherry Plum, Clover, Cotoneaster, Crab Apple, Creeping Thistle, Cypress, Cypress Hedge, Dandelion, Daphne, Dogwood, Grass, Holly, Honeysuckle, Horsetail, Japanese Spirea, Madrone, Marsh Jaumea, Moss, Nootka Rose, Oregon Grape, Paper Birch, Plantain, Ponderosa Pine, Poplar, Rose of Sharon, Scots Pine, Shore Pine, Spurge Laurel, Viburnum, Watercress, Wild Carrot, Yarrow |
| **D (90502)** | Alder, Andromeda, Ash, Azalea, Barberry, Bedstraw, Beech, Clover, Cotoneaster, Dandelion, Douglas Fir, Evergreen Huckleberry, Ginkgo, Glossy Abelia, Grass, Hawthorn, Himalayan Blackberry, Hydrangea, Ice Plant, Lavender, Lemonade Rose, Madrone, Maleae, Maple, Moss, Nettle, Pacific Crab Apple, Poppy, Red Alder, Smokebush, Snowberry, Strawberry, Sunflower, Sword Fern, Winter Creeper, Yucca |
| **E (940100)** | Andromeda, Burkwood Osmanthus, Daisies, Dandelion, Geranium, Grass, Lavender, Madrone, Maple, Petunias, Pine, Plantain, Smoke Tree, Stonecrop, Sunrise Winter Creeper |

## Census Data

Census data indicates that within all of the census tracts the majority of the population is White Non-Hispanic, followed by Hispanic, Multiple Race Non-Hispanic, and Asian Non-Hispanic. Regarding income, Tract C and E have the highest population of households with income under $35,000. Conversely, Tract E also contains the highest population of households, making above $74,999 or more than $200,000. Tact C has the highest population of individuals with physical dependency, followed by Tract E, D, B, and A. Again, Tracts C and E have the highest population of people who are unemployed, followed by Tracts A, D, and B. Age for all census tracts is consistent in that it varies through all tracts.

The census data offers additional context to the findings from the Urban Tree Canopy Assessment and helps explain some of the variations in canopy cover and vegetation distribution across the different census tracts.

Tracts C and E, which have the highest population of households with income under $35,000, might face economic challenges that can impact urban forestry efforts. Lower-income neighborhoods often have fewer resources for tree planting and maintenance, which could contribute to the lower canopy cover observed in these tracts. Additionally, the higher unemployment rates in Tracts C and E might indicate limited community engagement and investment in urban greening initiatives, further affecting canopy cover.

Interestingly, Tract E also has a significant population of households making above $74,999 or more than $200,000, suggesting a mix of socio-economic conditions within this tract. This diversity might influence the distribution of green spaces, with wealthier areas potentially having better-maintained parks and landscaped gardens, while lower-income areas might have less green coverage. The presence of both higher-income and lower-income households in Tract E could create a complex landscape with varying levels of vegetation and canopy cover.

The higher population of individuals with physical dependency in Tract C and E could also play a role in shaping the urban forest. Areas with more individuals needing physical assistance might prioritize accessible and open spaces, which could lead to fewer trees and shrubs. This focus on accessibility might also explain the dominance of grass and minimal tree cover in Tract E.

The consistent age distribution across all tracts suggests that age-related factors might not significantly influence the variations in canopy cover and vegetation distribution. However, community engagement and support for urban forestry might still vary based on the specific needs and priorities of different age groups.

Overall, the census data highlights the importance of considering socio-economic and demographic factors when developing urban forestry management practices. By addressing the unique challenges and opportunities in each tract, Poulsbo can create targeted interventions that promote equitable green spaces, enhance environmental resilience, and improve quality of life for all residents. This holistic approach to urban forestry, informed by both environmental and social data, can ensure a more sustainable and inclusive urban forest for the community.

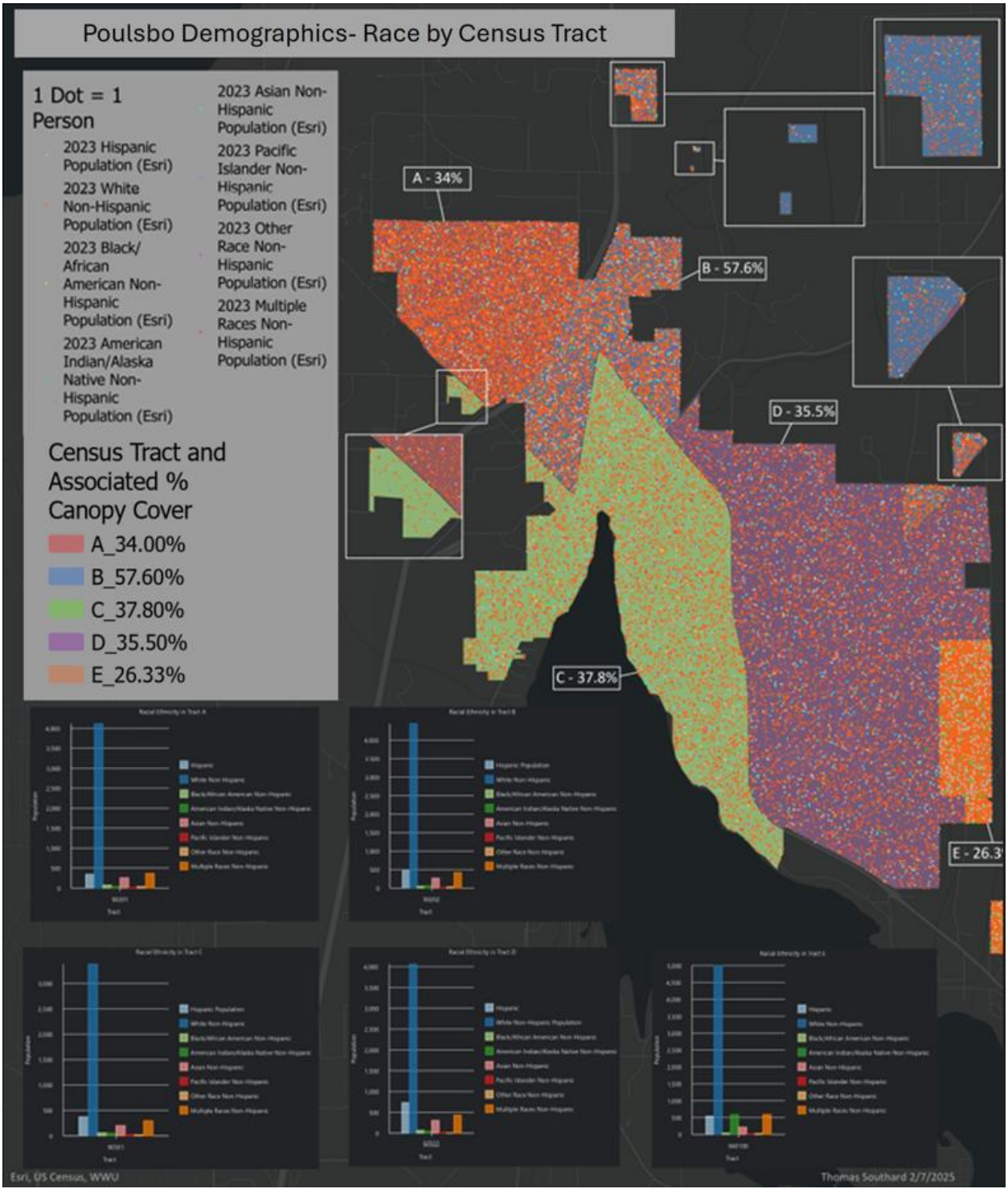


Figure 26: The above map depicts physical race by census tract within Poulsbo City limits. The associated percent canopy cover for each census tract is also shown.

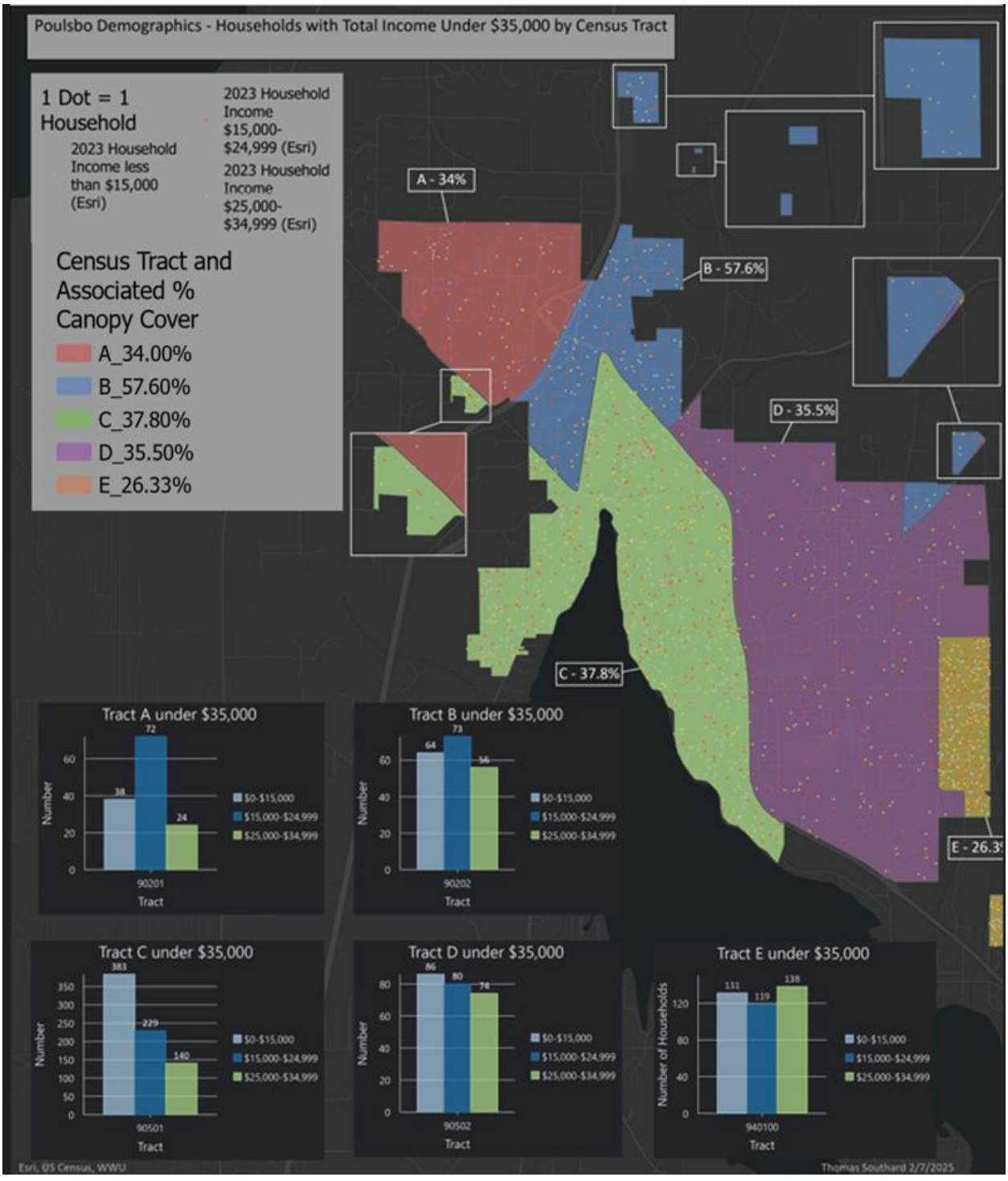


Figure 27: The above map depicts household income under $35,000 by census tract within Poulsbo City limits. The associated percent canopy cover for each census tract is also shown.

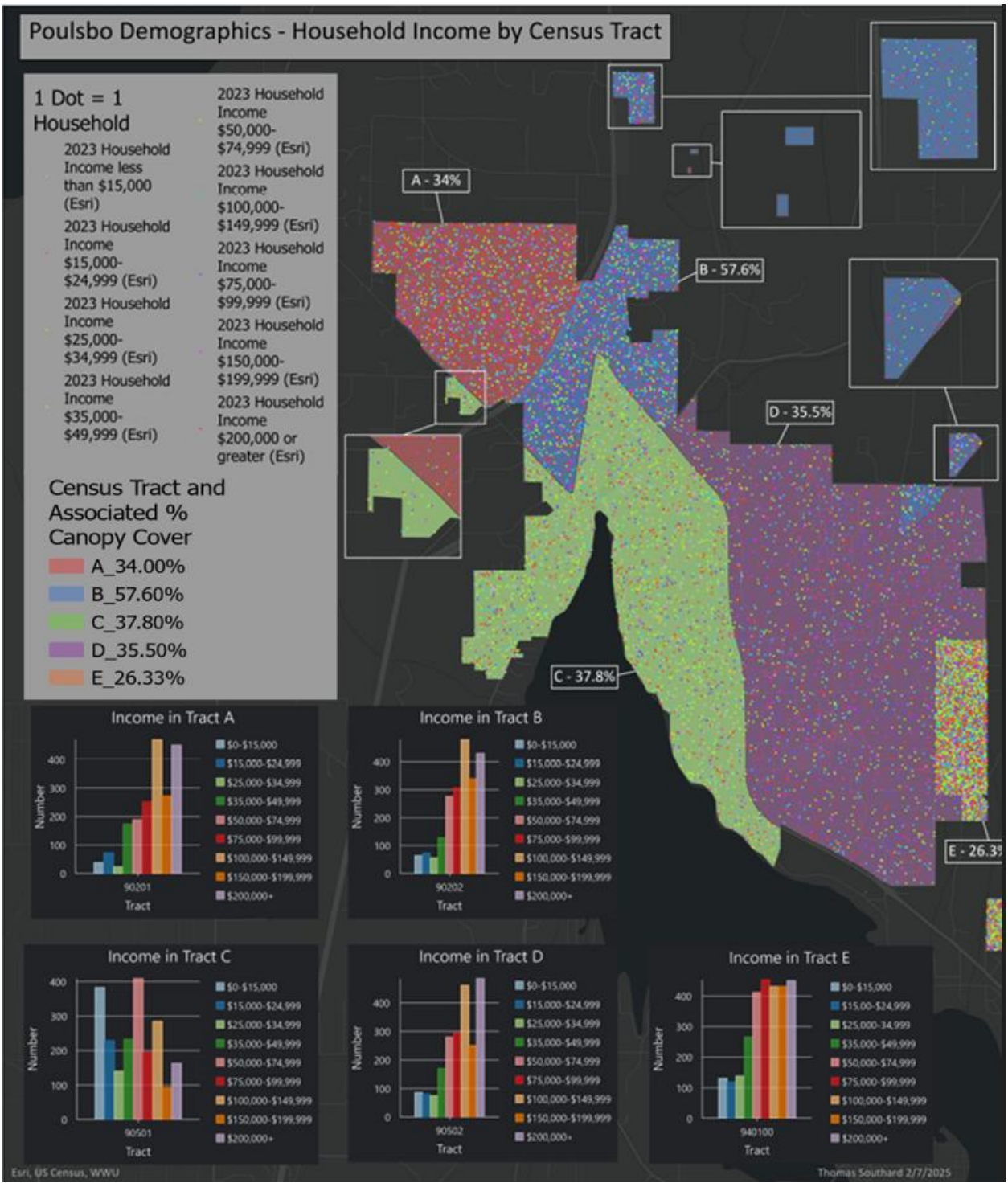


Figure 28: The above map depicts household income by census tract within Poulsbo City limits. The associated percent canopy cover for each census tract is also shown.

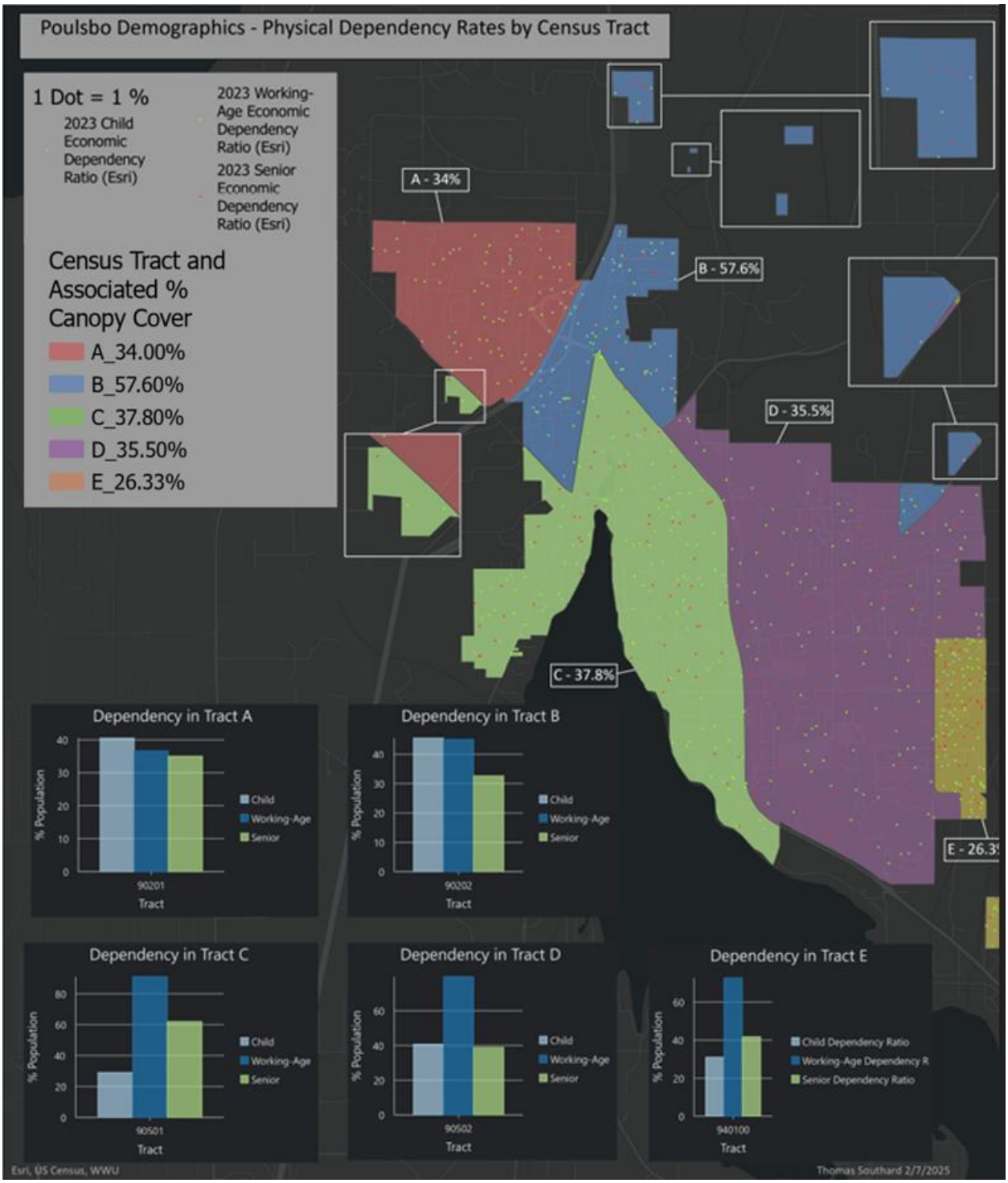


Figure 29: The above map depicts physical dependency by census tract within Poulsbo City limits. The associated percent canopy cover for each census tract is also shown.

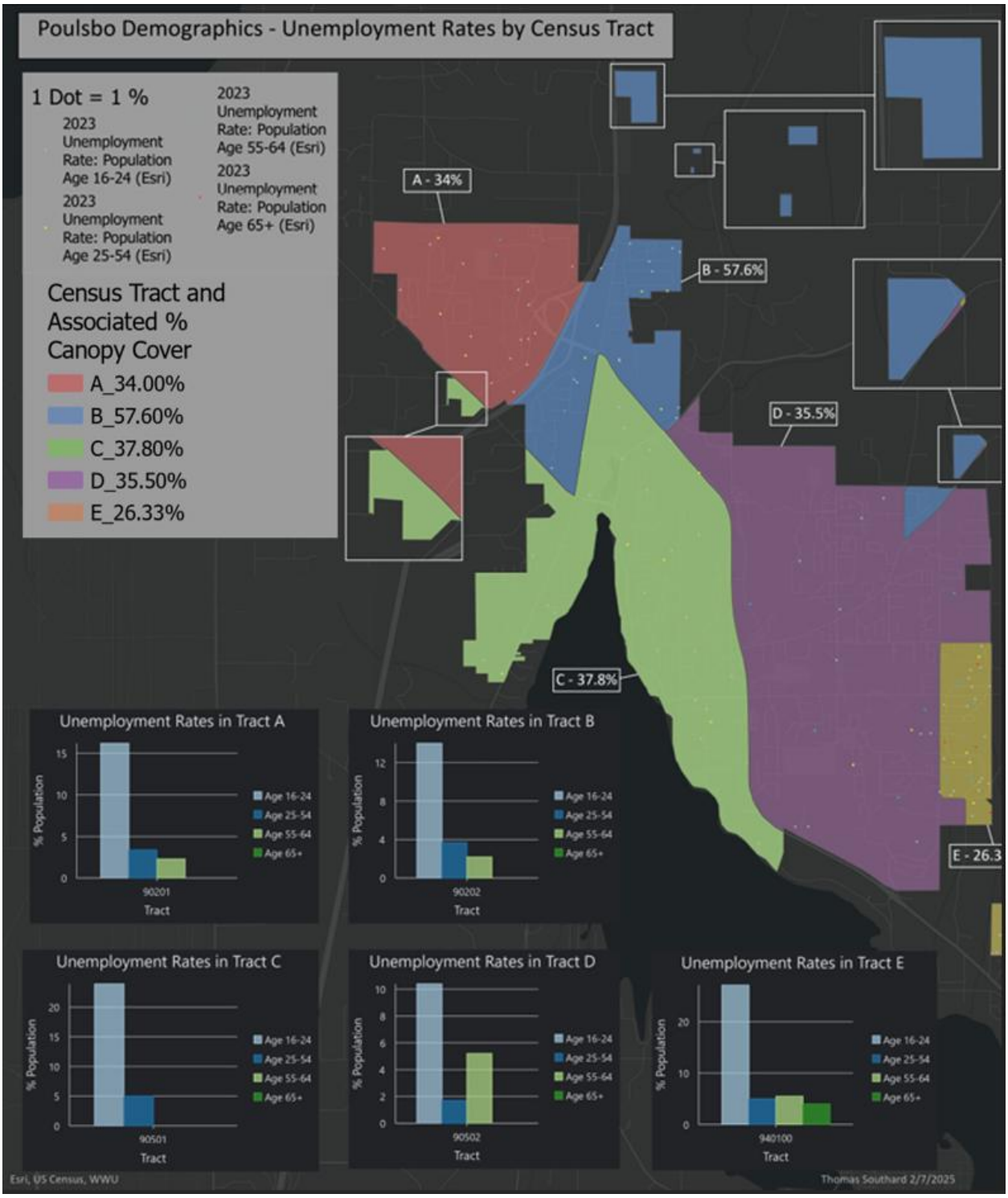


Figure 30: The above map depicts physical dependency by census tract within Poulsbo City limits. The associated percent canopy cover for each census tract is also shown.

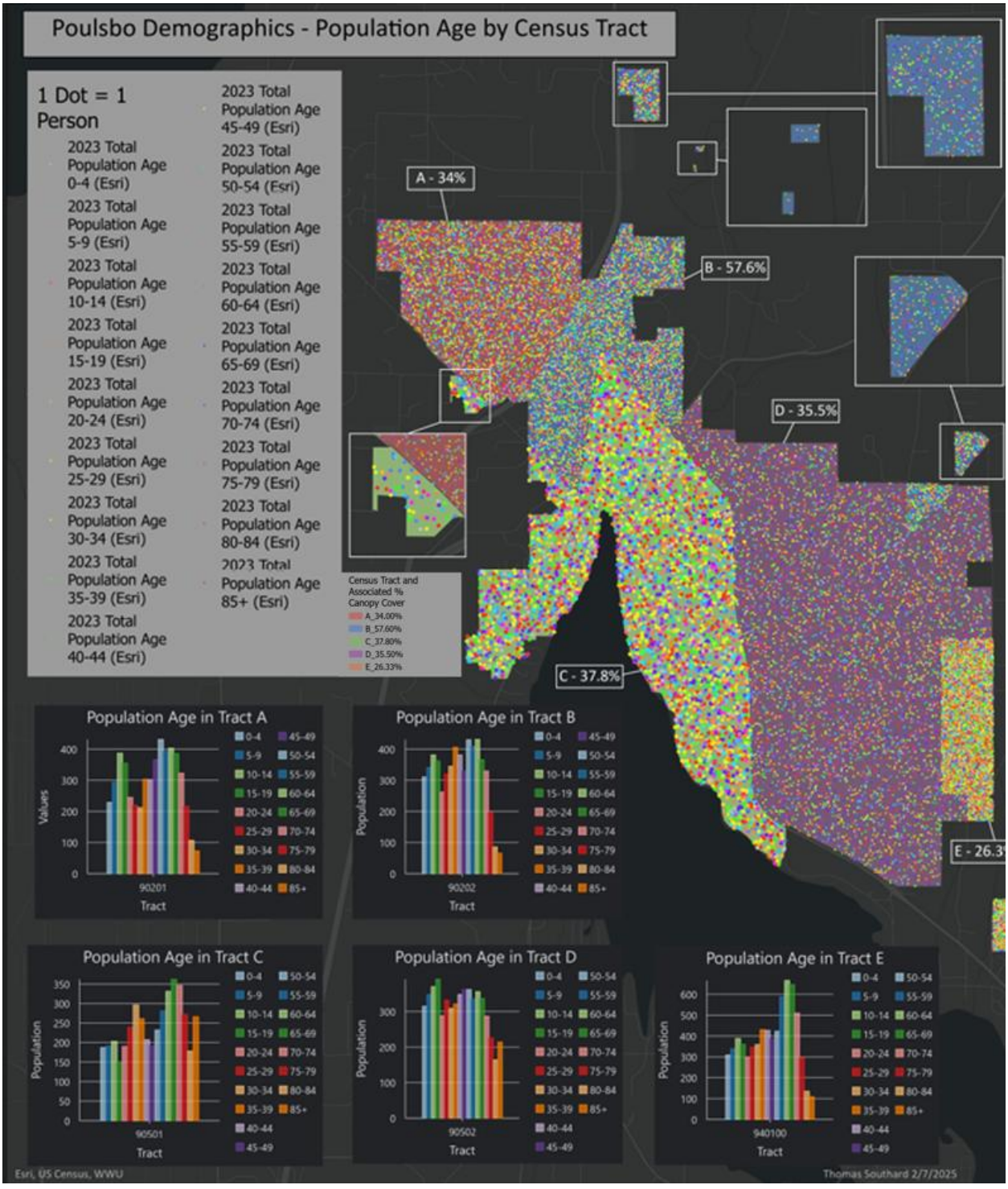


Figure 31: The above map depicts the age population by census tract within Poulsbo City limits. The associated percent canopy cover for each census tract is also shown.

# Solutions

To enhance urban greening efforts and tree canopy conservation, several innovative solutions and strategies have been proposed. These include creating "floating gardens" on top of carports in apartment building parking lots, introducing green parking spaces, and prioritizing tree planting along Highway 305 in Poulsbo and other public spaces with limited tree cover. Community-based tree planting programs should focus on native species that thrive in the local climate and soil conditions. Public engagement is crucial, with forums organized by the Tree Board to share results and highlight the importance of tree canopies. Educational campaigns can further raise awareness and encourage community participation in tree planting and care.

City policies should be revisited to improve tree retention in new developments and integrate mitigation strategies like green rooftops, permeable surfaces, heat-reducing paint colors, and tree canopy restoration for disturbed areas. Urban planning enhancements must prioritize tree conservation, implement protective ordinances, and promote green infrastructure. Conservation efforts also involve regular tree maintenance programs, including watering, pruning, pest control, and disease monitoring. In public spaces, priority areas for canopy expansion should be identified, and underground utilities could be considered to increase tree cover. Arborists' strategies, such as careful thinning and hazardous tree removal, can ensure healthy growth and public safety.

Addressing invasive species is vital; vegetation lists should be reviewed to identify areas for removal and new tree plantings. Conservation efforts should target priority areas to protect and enhance tree canopies, while urban greening solutions like green roofs and living walls can mitigate urban heat island effects. Financial incentives, such as tax credits or grants, could encourage property owners and businesses to contribute to these greening efforts. Partnerships with local governments, non-profits, and businesses can provide additional support for urban forestry projects.

Based on the analysis of collected data, it is strongly recommended to prioritize the restoration and replanting of areas impacted by invasive species and hazardous trees. Roadways with sparse or no vegetation have been identified as high-priority zones for tree planting, as they are particularly susceptible to elevated heat levels. Additionally, census data and findings from the vegetation survey emphasize that Tracts C, D, and E should be the primary focus for revegetation initiatives. To ensure long-term environmental health, conservation measures must also be implemented to address canopy loss and mitigate the effects of extreme heat in the future.

# City of Poulsbo Areas of Interest

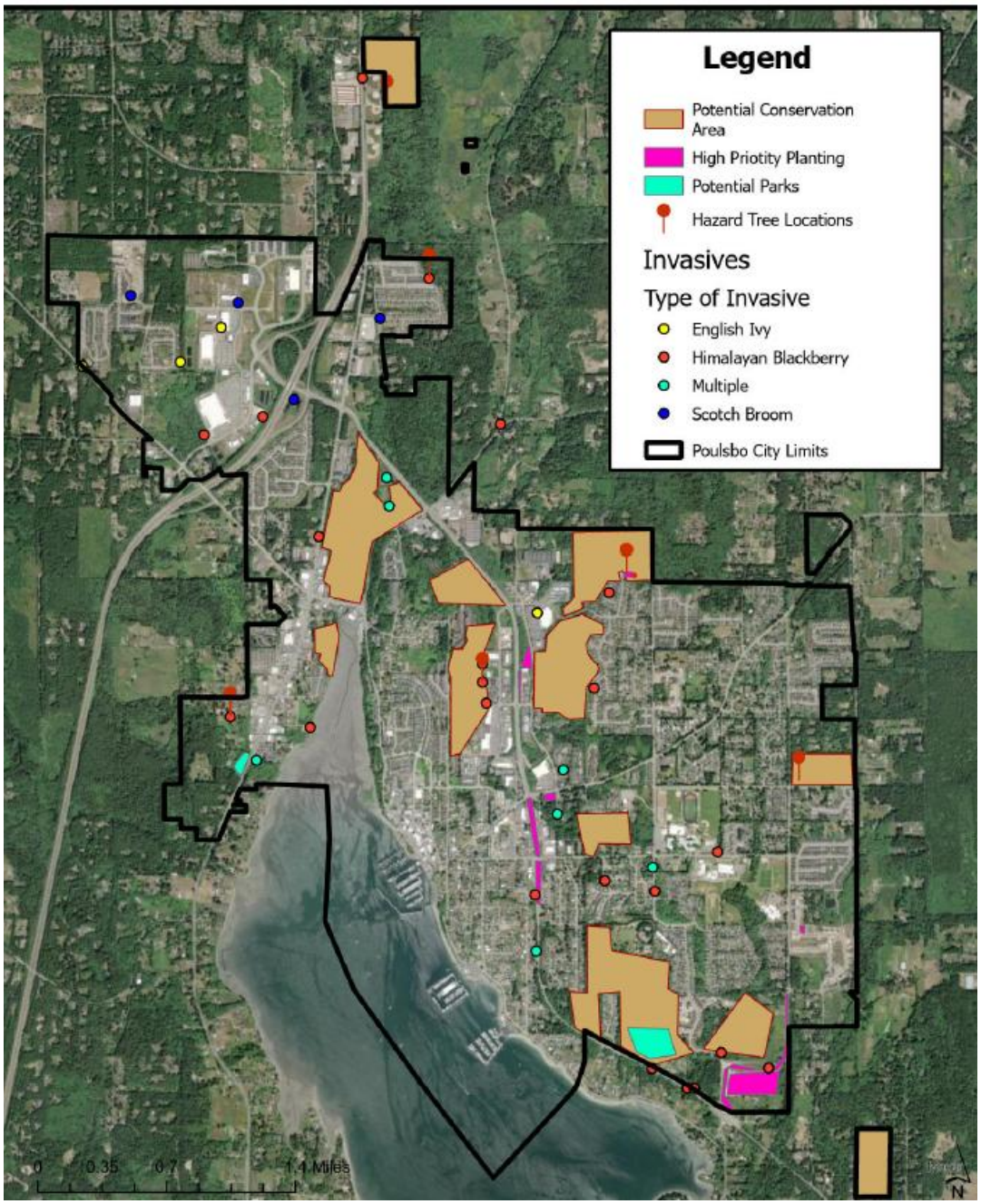


Figure 32: The above map indicates areas of interest regarding heat mitigation efforts for the City of Poulsbo. Areas in pink represent high priority planting to reduce heat islands. Light brown areas indicate potential conservation to aid in future heat mitigation efforts. Turquoise represents potential urban parks that could be added. The colored dots indicate areas of invasive species. Finally, the red pins indicate the hazard tree locations.

# Poulsbo Urban Tree Canopy Solutions

**1. Proposed Solutions and Strategies**

- **Floating Gardens**: Develop "floating gardens" atop carports in parking lots of apartment buildings to enhance greenery and utilize available space.
- **Green Parking Spaces**: Incorporate eco-friendly designs into parking spaces to promote sustainability.
- **Tree Planting Initiatives**:
    - Plant trees along Highway 305 in Poulsbo as well as roads and public spaces where tree cover is absent.
    - Launch community-based programs prioritizing native species to increase urban greenery.

**2. Public Engagement**

- **Forums for Community Awareness**:
    - Coordinate a public forum through the Tree Board to share results, insights, and the importance of tree canopies.
- **Educational Campaigns**: Raise awareness of urban forests' significance through outreach and community engagement activities.

**3. Policy Reviews and Improvements**

- **Revisiting City Policies**:
    - Evaluate and improve tree retention policies for new developments.
    - Incorporate mitigation strategies, such as green rooftops, permeable surfaces, and heat-reducing paint colors.
- **Urban Planning Enhancements**:
    - Mandate tree conservation in development projects and establish protective ordinances.
    - Encourage integration of green infrastructure in urban planning.

**4. Tree Canopy and Vegetation Management**

- **Conservation and Maintenance Programs**:

    - Regular maintenance, including watering, pruning, pest control, and disease monitoring, to ensure tree health.
    - Adopt arborists' strategies for canopy thinning and removal of hazardous trees when necessary.
- **Prioritizing Public Spaces**:
    - Identify priority areas in parks to increase tree canopy coverage.
    - Explore options like underground utilities to expand canopy cover.

**5. Addressing Invasive Species and Vegetation Planning**

- **Review and Remove**: Assess vegetation lists to prioritize invasive species removal and tree planting areas.
- **Conservation Strategies**: Determine areas for canopy conservation and develop long-term strategies.

**6. Urban Greening Solutions**

- **Green Roofs and Walls**: Promote their implementation to mitigate heat island effects.
- **Incentives and Grants**: Offer financial support to property owners and businesses contributing to greening projects.

**7. Partnerships and Collaborations**

- **Public-Private Partnerships**: Collaborate with local governments, non-profits, and businesses to support urban forestry projects effectively.

## Prioritization by Census Tract

Considering factors such as canopy cover, heat zones, socio-economic conditions, known hazard trees, and the presence of invasive species, The City of Poulsbo should reflect on the following:

**Tract A and B**

- **Priority Level:** Medium
- **Reasons:**
    - **Higher Canopy Cover:** Tracts A (34%) and B (57.6%) have relatively higher tree and shrub coverage, but ongoing maintenance and additional planting are essential to preserve and expand these green spaces.
    - **Balanced Vegetation:** Both tracts exhibit a mix of native and invasive species, requiring targeted removal of invasive plants to support native flora.

**Tract C**

- **Priority Level:** High
- **Reasons:**
    - **Moderate Canopy Cover:** At 37.8%, Tract C can benefit from increased tree planting to further enhance its green spaces.
    - **Low-Income Households:** The presence of a high number of households with income under $35,000 suggests a need for improving green spaces in economically disadvantaged areas.
    - **High Physical Dependency:** Planting trees can create inclusive and accessible green spaces, benefiting the community.
    - **Invasive Species:** Addressing invasive species will help maintain ecological balance.

**Tract D**

- **Priority Level:** High
- **Reasons:**

- **Moderate Canopy Cover:** With 35.5% canopy cover, Tract D has balanced vegetation but can benefit from additional tree planting to enhance urban greening efforts.
- **Extreme Heat Zones:** Hot Spot Analysis indicates that the majority of significant heat events are concentrated within Tract D
- **Invasive Species:** Addressing invasive species will help maintain ecological balance and support native plant growth.

**Tract E**

- **Priority Level:** High
- **Reasons:**
  - **Low Canopy Cover:** With the lowest canopy cover at 26.33%, Tract E requires immediate attention to enhance its green spaces.
  - **Socio-Economic Disparities:** This tract has both the highest population of households with income under $35,000 and a significant number of high-income households. Prioritizing tree planting can create equitable green spaces for all residents.
  - **Physical Dependency and Unemployment:** Higher populations of individuals with physical dependencies and unemployment rates necessitate creating accessible and beneficial green areas to improve quality of life.
  - **Invasive Species:** The presence of invasive species like Scotch Broom and English Ivy needs to be addressed to promote native plant growth and biodiversity.

**Areas with Known Hazard Trees**

- **Importance:** High
- **Reasons:**
  - **Safety:** Managing hazard trees is crucial for public safety, preventing potential damage to property and injury to residents.
  - **Urban Forest Health:** Replacing hazard trees with healthy, resilient species can improve the overall health and stability of the urban forest.

    - **Enhanced Canopy Cover:** Strategically planting in areas where hazard trees have been removed can quickly restore and enhance canopy cover.

**Removal of Invasive Species**

- **Importance:** High
- **Reasons:**
    - **Ecological Balance:** Removing invasive species is essential to allow native plants to thrive, supporting biodiversity and ecological health.
    - **Improved Tree Growth:** Invasive species can outcompete young trees and other vegetation, so their removal is crucial for successful reforestation efforts.
    - **Resilience:** A diverse mix of native species enhances the urban forest's resilience to pests, diseases, and environmental changes.

**Prioritizing Planting**

- **Focus Areas:** Tracts C, D, and E areas with known hazard trees, roadways with little to no tree plantings, and regions with significant invasive species presence.
- **Strategies:**
    - **Community Involvement:** Engaging the community in tree planting initiatives can foster stewardship and ensure sustained efforts.
    - **Targeted Interventions:** Implementing strategic planting plans that prioritize high-need areas and address specific local conditions will maximize impact.
    - **Ongoing Maintenance:** Ensuring regular maintenance and monitoring of newly planted trees and removal of invasive species to support long-term success.

By focusing efforts on these priority areas and addressing both socio-economic and environmental factors, Poulsbo can work towards creating a more equitable, resilient, and sustainable urban forest that benefits all residents.

# Appendix

## Impervious Surfaces within the Incorporated City Limits of Poulsbo

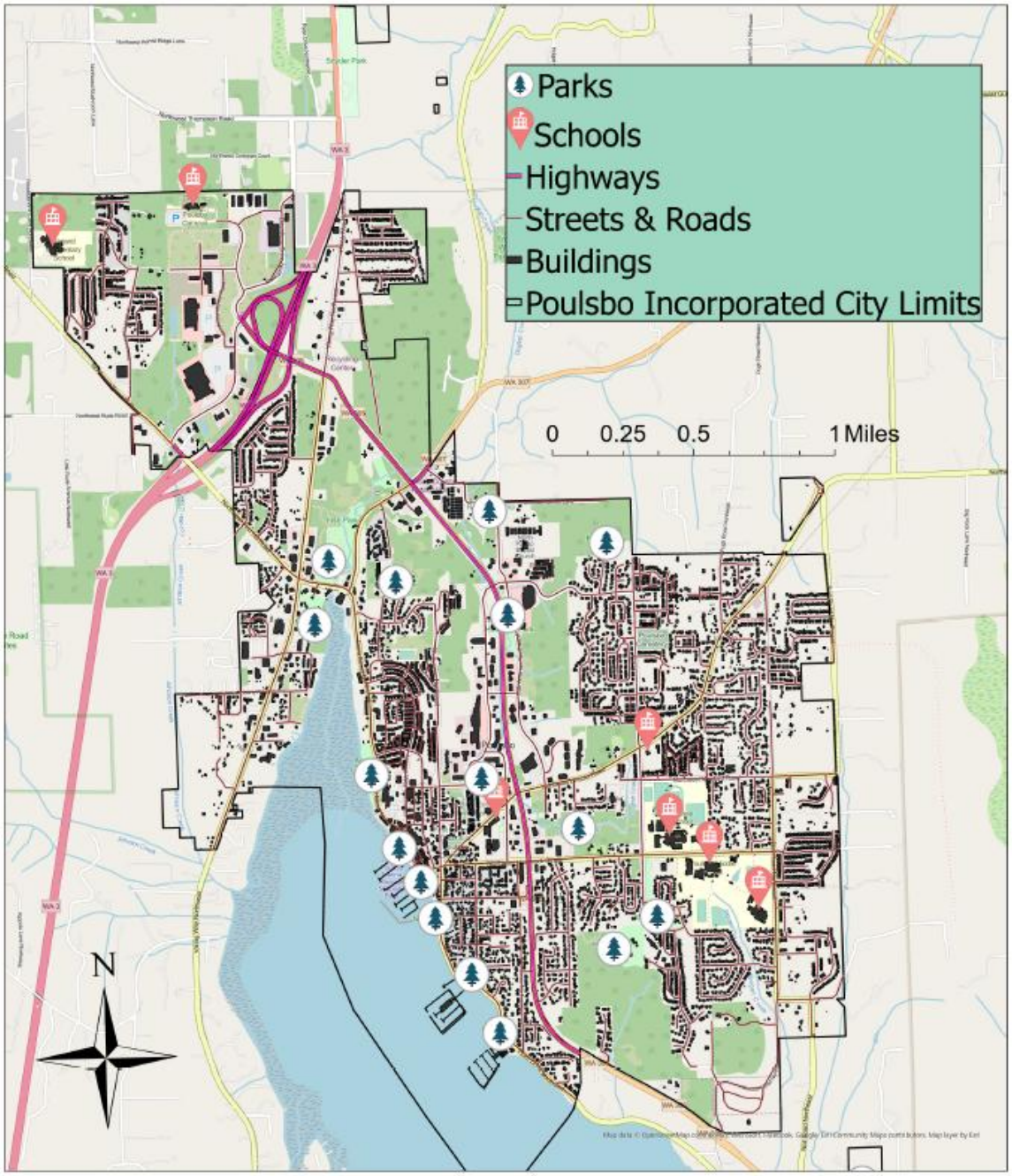


Figure 33: The above map illustrates school zones, impervious surfaces, buildings, and roads within The City of Poulsbo.

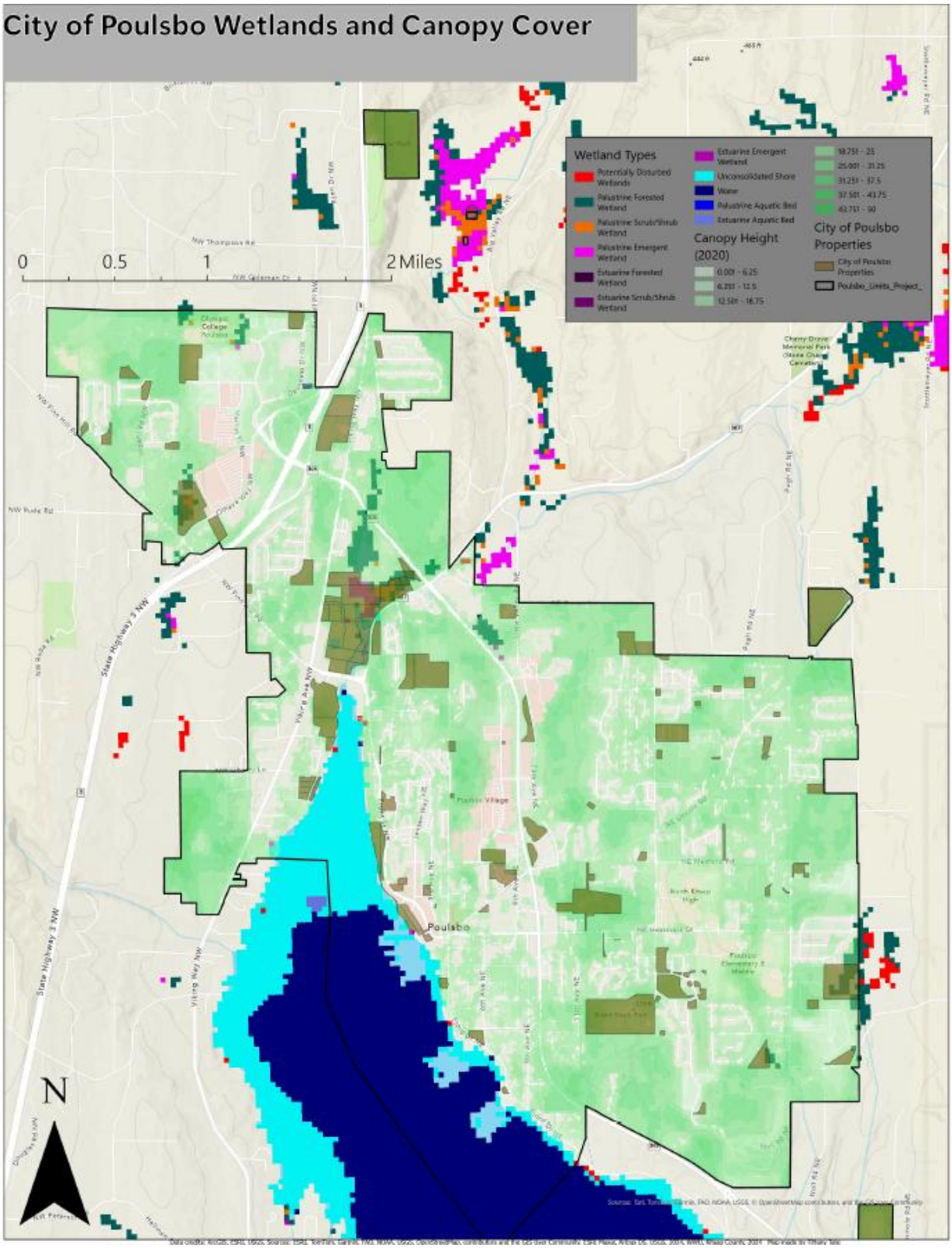


Figure 34: The above the various wetland types as well as relative canopy height (2020) within The City of Poulsbo.

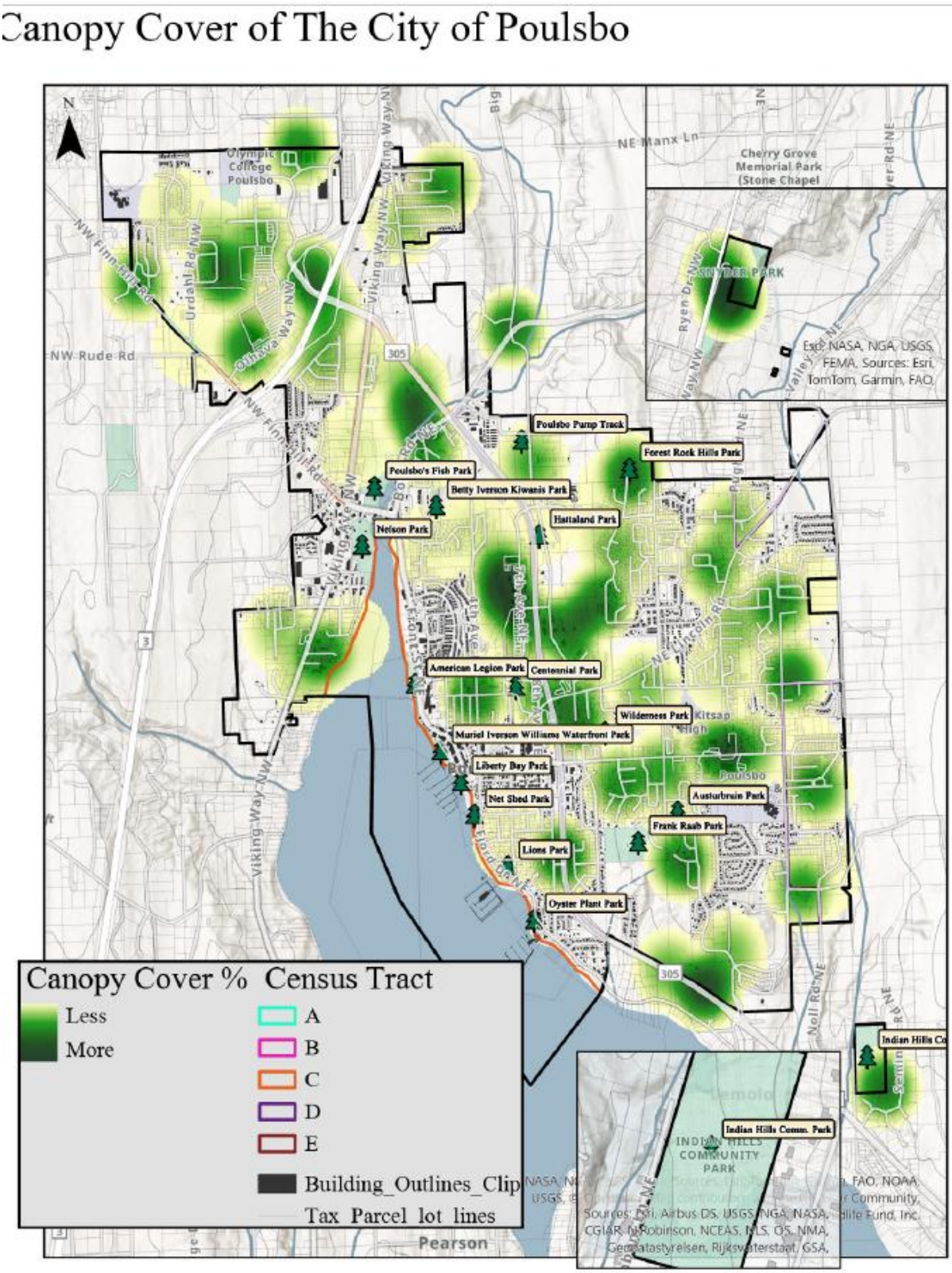


Figure 35: The above map illustrates canopy cover in the City of Poulsbo at each of the study site locations and within a relative distance of roughly feet.

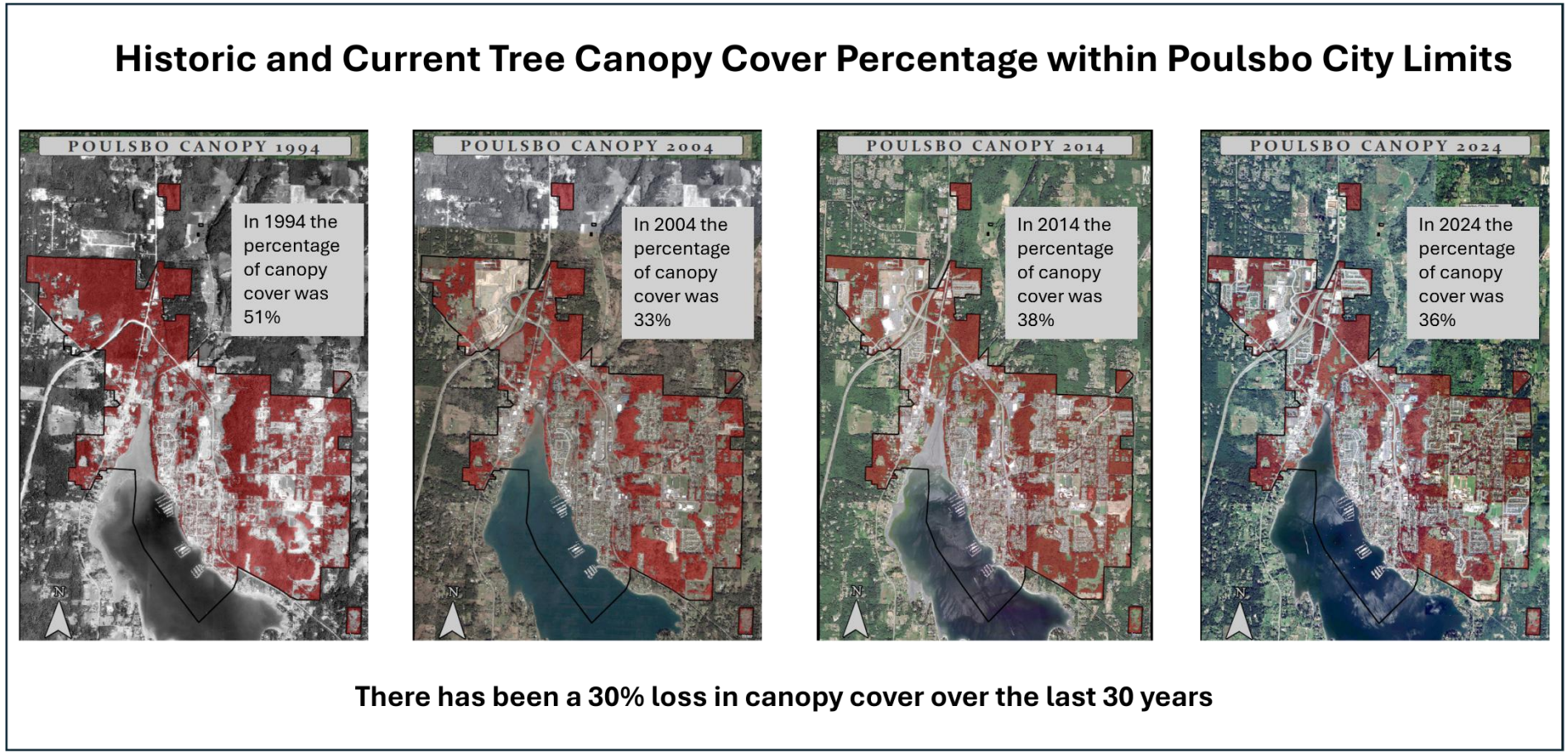


Figure 36: The above figure depicts canopy cover over the last 30 years within Poulsbo City limits. Canopy cover has decreased by roughly 30% in 30 years.36

City Arborist recommendations

The following are the recommendations for updating/editing the City of Poulsbo Master Public Tree Plan (MPTP adopted 2003). These recommendations reflect the data or information provided within canopy assessment. This assessment has been the catalyst along with support from City staff and tree board members to review the City's current policies, regulations and plans in an effort to limit tree canopy loss and increase it within City limits.

The council adopted 2003 Master Public Tree Plan was reviewed with the intent to provide recommended edits that reflect the canopy assessment findings and update the MPTP.

**Amend**

Vision Statement – Add language focused on maintaining and increasing the urban forest canopy.

1. Revisit Short- & Long-Term Goals & Policies – meet to discuss and determine urban forestry issues with the tree board members, citizens, council and department heads (focus on maintaining and increasing tree canopy).

Section 2. Public Tree Ordinance

1. Update Definitions (examples: Canopy, Risk Tree (not Hazard Tree), etc.
2. Revisit public tree ordinance sections to reflect updated Best Management Practices.
3. Amend and provide additional sections that focus on increasing canopy.

Section 3. Poulsbo Master Street Tree Design Plan

This section could have the title changed to focus on developing planting plans for parks, unopened Rights-Of-Way, facilities and other fee simple properties.

**Appendices**

C. Planting Guidelines

1. Add instructions for planting small seedlings (bare root, 1 gallon containers, plugs, etc..)
2. May need to specify unopened Rights-Of-Way, parks, open space ... not just street & park trees with caliper and height specifics (example; 2" cal. & 6' conifer).

I. Update the Public Tree Hazard Rating System

1. Integrate the International Society of Arboriculture Tree Risk Assessment Processes and Rating System.

L. City of Poulsbo Parks & Recreation Master Tree List

1. Update the list (it should be revisited every 3 years).

Poulsbo Tree Board observations and recommendations

Historic and Current Tree Canopy Cover Percentage within Poulsbo City Limits

- The largest decrease in canopy cover was between 1994 and 2004. It appears that development of the retail zone on Olhava Way resulted in a large decrease, along with residential development in the Northwest corner of the City.
  The increase between 2004 and 2014 appears to be due to a significant growth of trees in the far northwest corner, which may have been logged during the first 10 years and replanted, then grew by 2014 and has retreated again by 2024. This seems to indicate that planting after logging is a reliable means to replace tree canopy.

- Many residential neighborhoods have clusters of tree canopy which would play an important role in providing heat barriers and other benefits. Many do not have significant neighborhood tree canopy. There may be an opportunity to encourage neighborhood tree plantings with recommended species, and perhaps incentives.

- The largest decreases in tree canopy came from retail and residential development on private land.