

Urban Sustainability Forum 2007

**SAFE AND WALKABLE
COMMUNITIES
BY DESIGN**

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A PEDESTRIAN MASTER PLAN?

By all means!

MY PROPOSED TARGETS:

- ZERO pedestrian fatalities within Seattle
2020
- Designated pedestrian priority zones (PZs)



Structure of presentation

- General Questions:
 - Who walks?
 - What for?
 - Where in?
 - Where to?
 - How safe is walking?
- Personal and global contexts for walking
- What research tells us about walking



WALKING IN CONTEXT

PERSONAL-LEVEL MATTERS

- AGENTS OF DEATH FOR HUMANS
 - 1. Tobacco and drug use
- 2. Physical inactivity and co-morbidities
 - 3. Vehicular traffic



PERSONAL STATISTICS

United States

- Physical Inactivity
 - > 50% of adults not sufficiently physically active
 - 26% not active at all
- Overweight
 - Adult obesity rates have doubled 1980s-2000s; today 64% of adults are overweight
- Walking
 - A popular form of physical activity (uniquely accessible, affordable, and readily incorporated into one's daily routine)
 - Neighborhood streets as most popular places for physical activity



SETTINGS TARGETS

How much walking and where?

DAILY ACTIVITY		Steps per day	Distance covered in miles	Time distance in min.
Base		2112	1	20 min
Average sedentary person	Low	1000	0.47	9.4
	High—Health	3000	1.42	28.4
Walking for fitness		10,000	4.7	94
Walk around ONE 600 x 450 block			.40	8
Walk 10 blocks at 630 ft / block		2446	1.19	23.8
Walk 40 blocks at 630 ft / block		10,000	4.7	94



WALKING IN CONTEXT

GLOBAL MATTERS

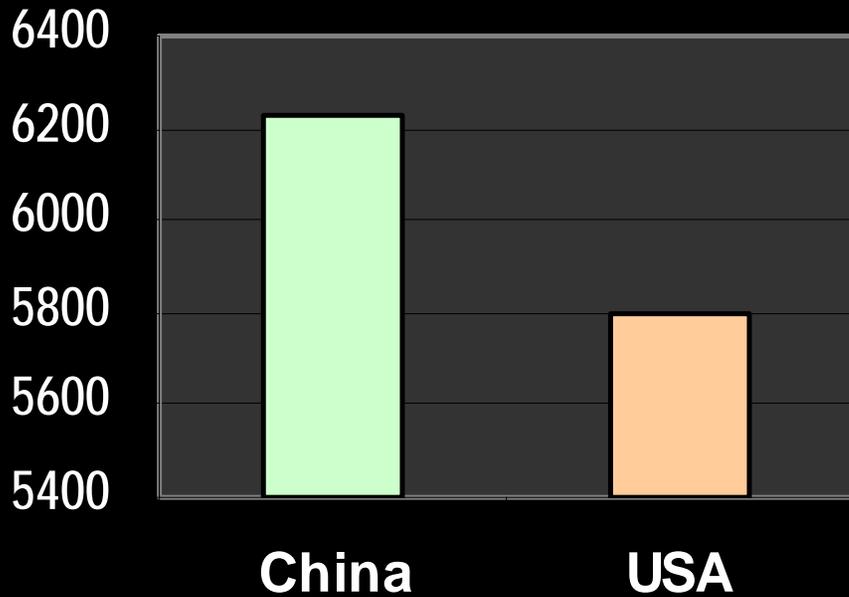
- Growth in human population
(native or invasive species?)
- Human concentration in cities
(80% of pop growth)
 - Global economic growth
- Resource consumption/depletion
 - Climate change



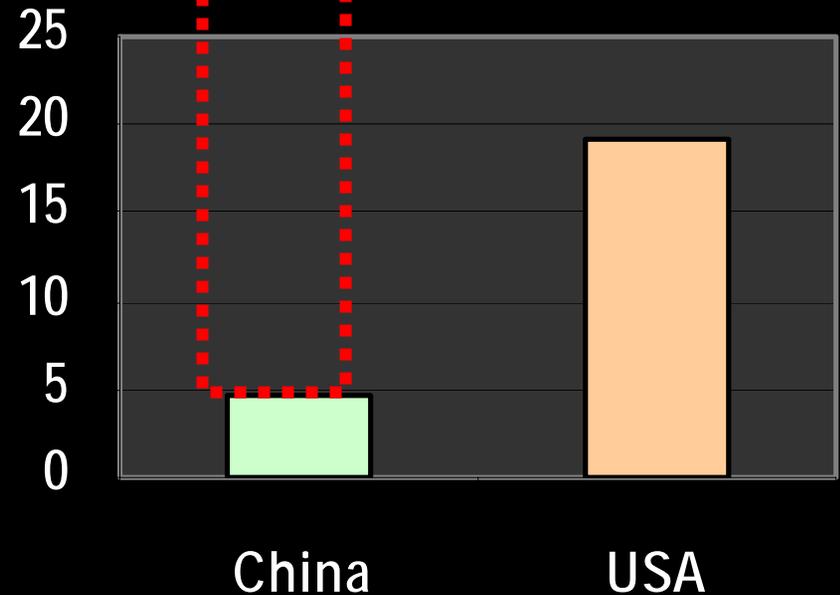
GLOBAL STATISTICS

Top producers of carbon dioxide emissions 2007

total (mi tons)



per capita (tons)



MORE WALKING

A simple and inexpensive answer [too simple and too inexpensive?]

- **Benefits:** More walking will help
 - To improve personal health (incl. mental health)
 - To reduce some of the resource consumption (and traffic congestion)
 - To mitigate climate change
- **Costs:** investments in
 - Shoes
 - Pedestrian infrastructure and safety
 - Transit



MORE WALKING

Consider current travel behavior Opportunities for more walking

- Travel: < 3% trips are walk trips
 - Work trips = 20% of all trips
- Latent demand for non-motorized (NPTS 1990)
 - 27% of auto trips < 1 mile (20 min. walk)
 - 40% of auto trips < 2 miles (40 min. walk)



WHO WALKS? WHAT IS WALKING?





Gorilla



hobbit-like species of
human 18,000 y indonesia

BIPEDALISM, The distinguishing feature of our species

Homo erectus
~ 2 mi to 300,000 y

Human brain size
no change since 200,000 y

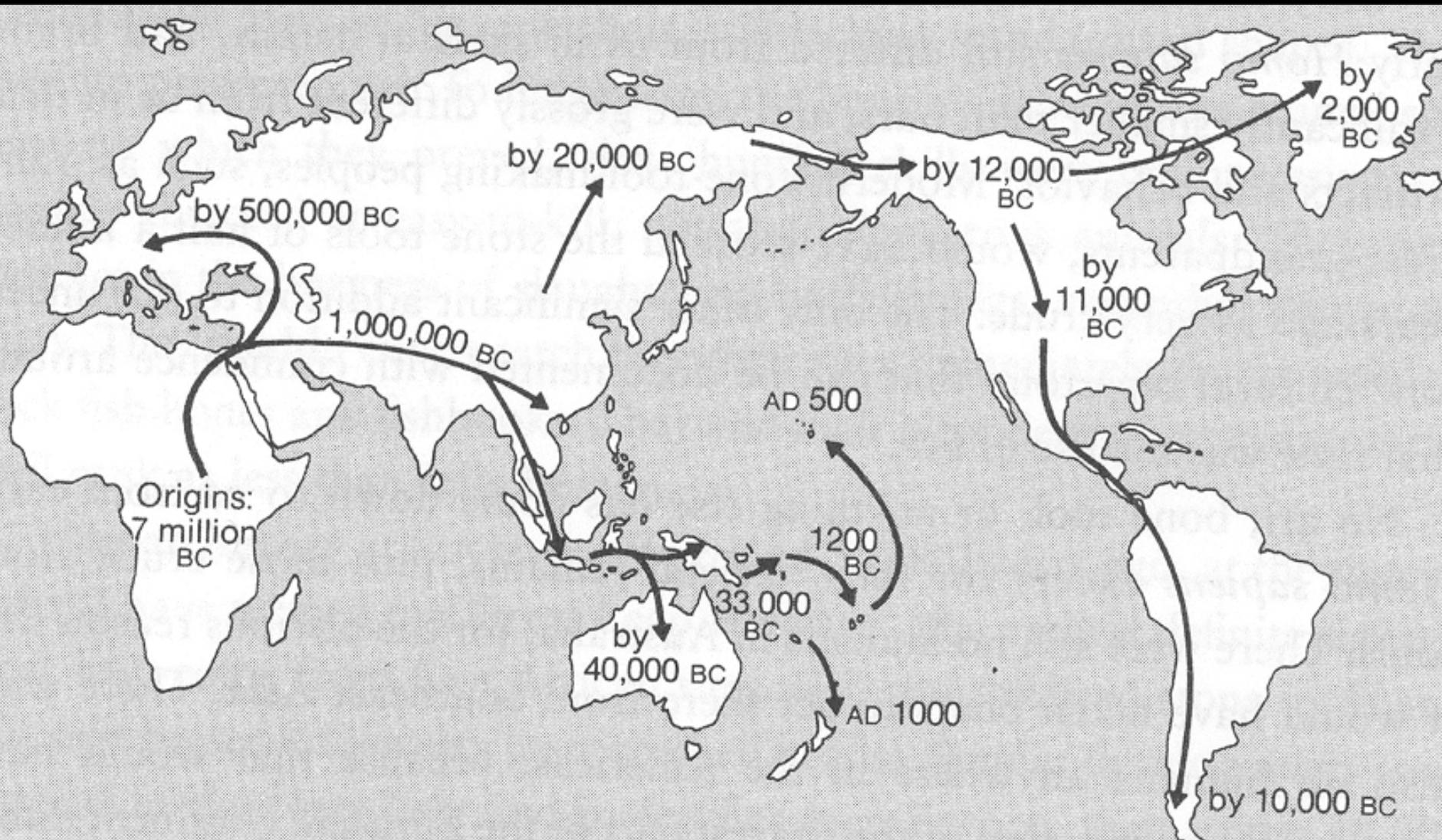


Gorilla



The spread of humans around the world

NON-MOTORIZED TRANSPORTATION AT THE GLOBAL SCALE



TODAY

People walk everywhere



TODAY

Transportation infrastructure





EXXON

EXXON

EXXON

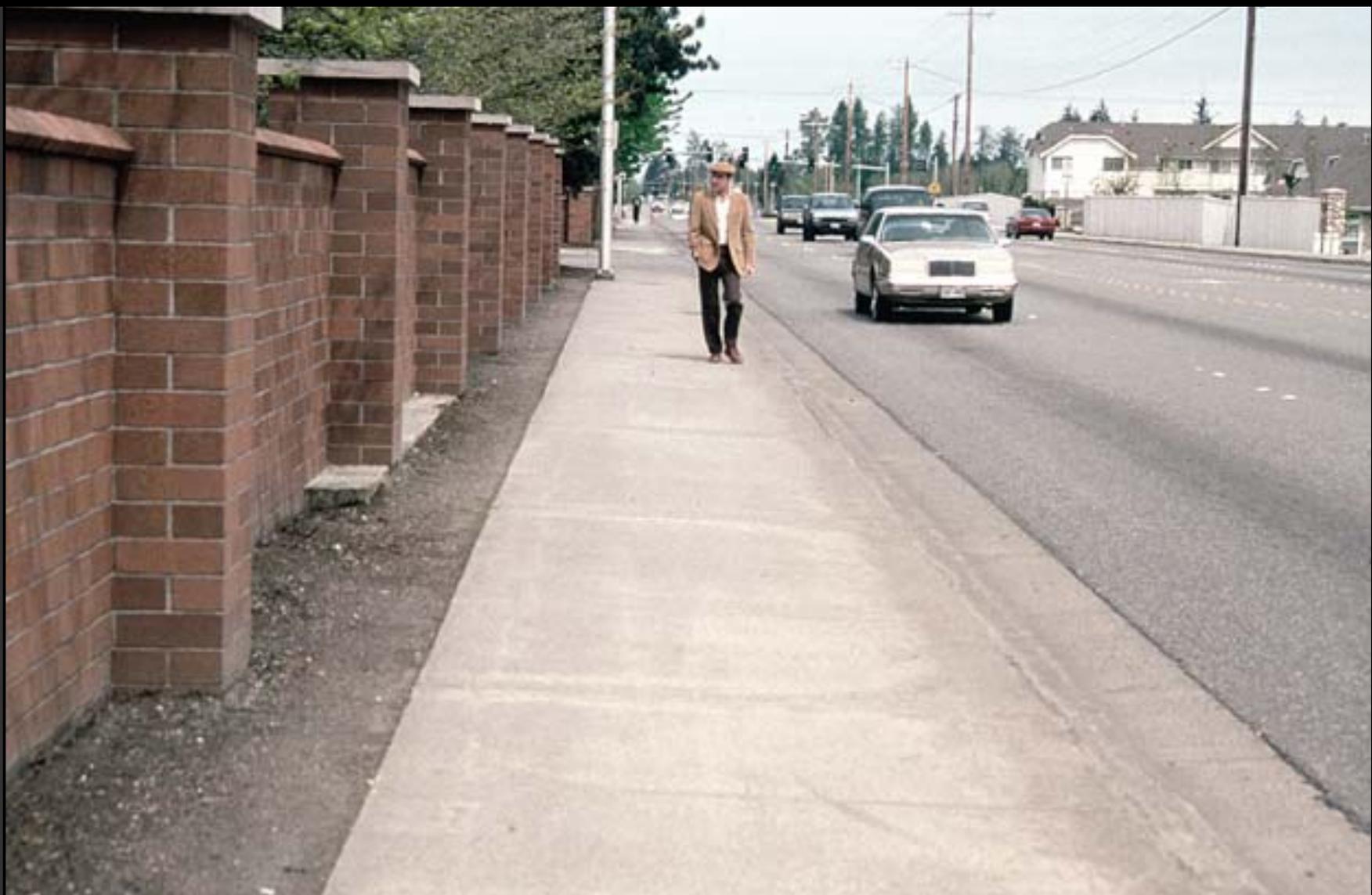
EXXON

EXXON
1.59
1.69
1.79

MARK C. PERRY D.D.S.
DENTISTRY







PARKING
0-20 MIN. \$7.50
20-40 MIN. \$10.00
40-60 MIN. \$12.50
1-2 HOURS \$15.00
2-3 HOURS \$17.50
3-10 HOURS \$19.00
EVENINGS (AFTER 5PM) \$19.00
ALL RATES INCLUDE TAX
PARKING MUST BE PAID IN ADVANCE
NO IN/OUT PRIVILEGES
MANAGED BY IPW
1518 11 AVENUE
SEATTLE WA 98101
206.468.8111

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SUN - MON





SEATTLE'S BEST COFFEE

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NO TURN ON RED

ONE WAY

1st



MODORE APTS.

UNIVERSITY WAY

UNIVERSITY WAY



Research at the Urban Form Lab University of Washington

Built environment

Transportation

Physical activity

Public Health

Nutrition

Design, planning, policy



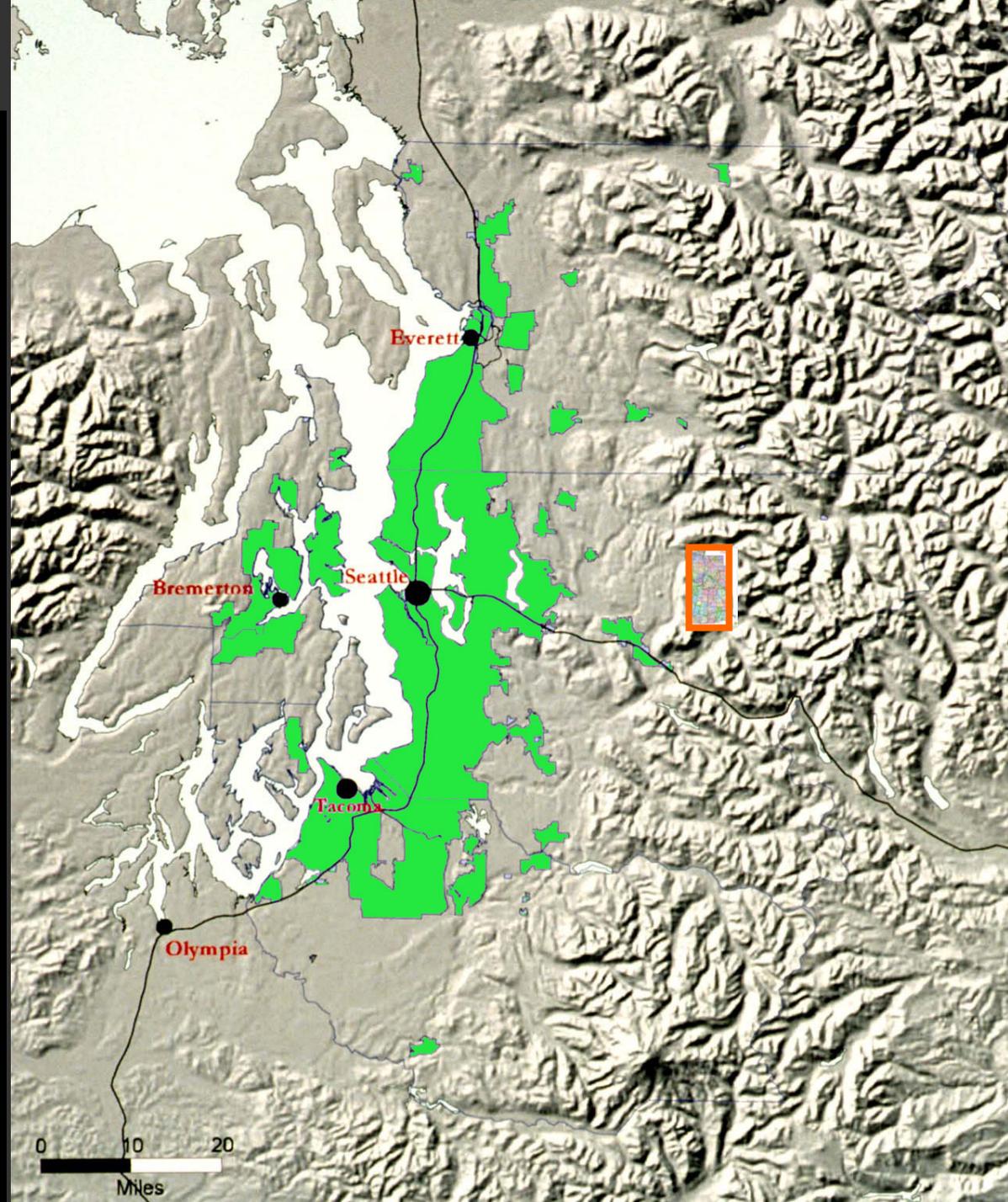
Physical/
Built
Environment

Puget Sound
Region

1,000 square miles
1,200,000 parcels

Urban Form Lab

moudon@u.washington.edu



DATA: Parcel-Level in Geographic Information Systems (GIS)



Cartographic/visual

PIN	ACRES	YRBUILT	APPRLAND	AI
0000800001	0.4672176241	1989	132300	
0000800006	0.7024793621	1969	198900	
0000800016	0.9223140481	1974	281200	
0000800019	0.9421487451	1966	266800	
0000800022	7.014990807		1069500	
0000800030	0.6198347211	1980	189000	

Quantitative/analytical
Control/Randomization



Walk and Bike Communities Project

WBC

Principal Investigators:

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Allen D. Cheadle, Ph.D.

Cheza Garvin, Ph.D.

Donna Johnson, Ph.D.

Thomas L. Schmid, Ph.D.

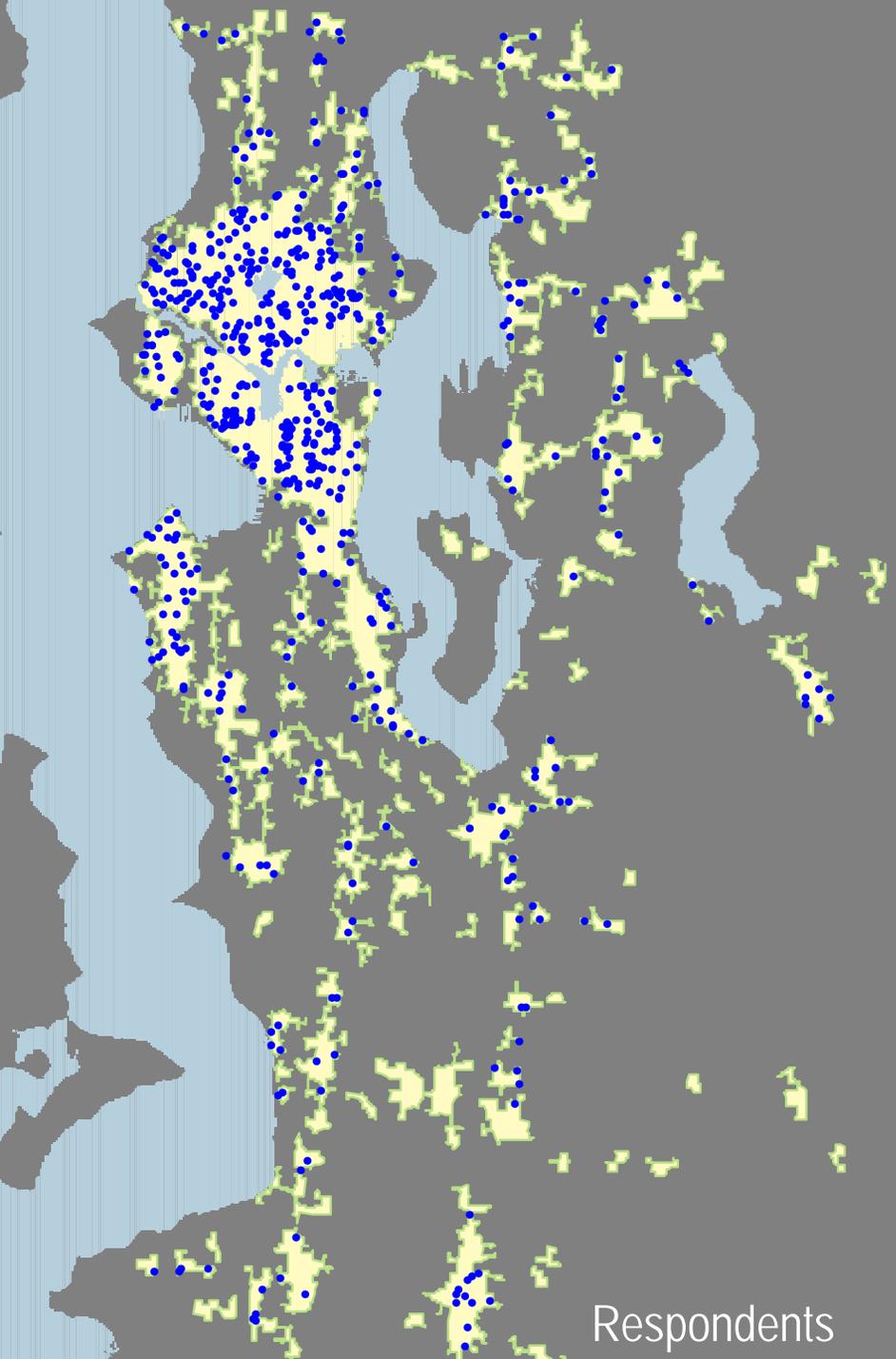
Robert D. Weathers, Ph.D.

Cooperative Agreement Number 1- U48/CCU209663 from the **Centers for Disease Control and Prevention through the University of Washington Health Promotion Research Center and the Urban Form Lab.**

Dr. Jean-Ives Courbois, statistical assistance

Mr. Phil Hurvitz, GIS support.





WBC

King Co Spatial Sample Frame

608 respondents

- 30 min survey
- 200 measures of environment (1 - 3 km from respondent's home)



WBC

Who walks in King County?

Distribution of survey respondents

- 14% non-walkers
- 48% moderate walkers <149 min/week
- 38% sufficient walkers > 150 min/week



WBC

Who walks MORE in King County?

❑ Demographics

Age, Education, Difficulty in walking, General health status

❑ Behavior

Vigorous activity, Transit use, Walking outside the residential neighborhood

❑ Attitude

Problems of traffic congestion and air pollution, Preference for walking and biking to solve congestion, Knowledge of physical activity***

❑ Perception

Social support for walking and biking in the neighborhood, Visual Quality***, Problems related to automobiles in neighborhood***

❑ Household

Income, Having a dog, Household location factors - Walkability considered?

*** Significantly different between Base and Final models



WBC—

WHERE DO SUFFICIENT WALKERS LIVE?

RESPONDENT HOME LOCATION [PARCEL]

◆ DENSITY OF HOUSEHOLD PARCEL [RES UNITS PER ACRE] >18.14
SIZE OF THE HOUSEHOLD BLOCK [ACRE] <7.70

AIRLINE DISTANCE [FEET]

◆ TO THE CLOSEST GROCERY STORES OR MARKETS <1545
TO THE CLOSEST EATING OR DRINKING PLACE <1090

1 KM NEIGHBORHOOD

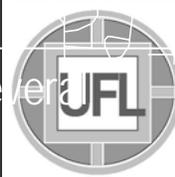
◆ GROCERY STORES OR MARKETS [COUNT] <3
EDUCATION LAND USES [COUNT] <5
◆ GROCERY + RESTAURANT + RETAIL NEIGHBORHOOD CENTERS [COUNT] >2
◆ RESIDENTIAL DENSITY [RES UNITS PER ACRE] <13.03
SIDEWALK LENGTH ALONG MAJOR STREETS >52,316

3 KM NEIGHBORHOOD

◆ SIZE OF CLOSEST OFFICE ONLY NEIGHBORHOOD CENTER >12.10
ROUTE DIRECTNESS BETWEEN AIRLINE AND NETWORK DISTANCE TO CLOSEST SCHOOL 73.86



◆ Consistently strong in several models



WBC

NOT SIGNIFICANTLY ASSOCIATED WITH MORE WALKING

- Convenience stores, fast food restaurants, big box retail
- Recreational land uses



WBC Distance

from home
to grocery
store



Mean

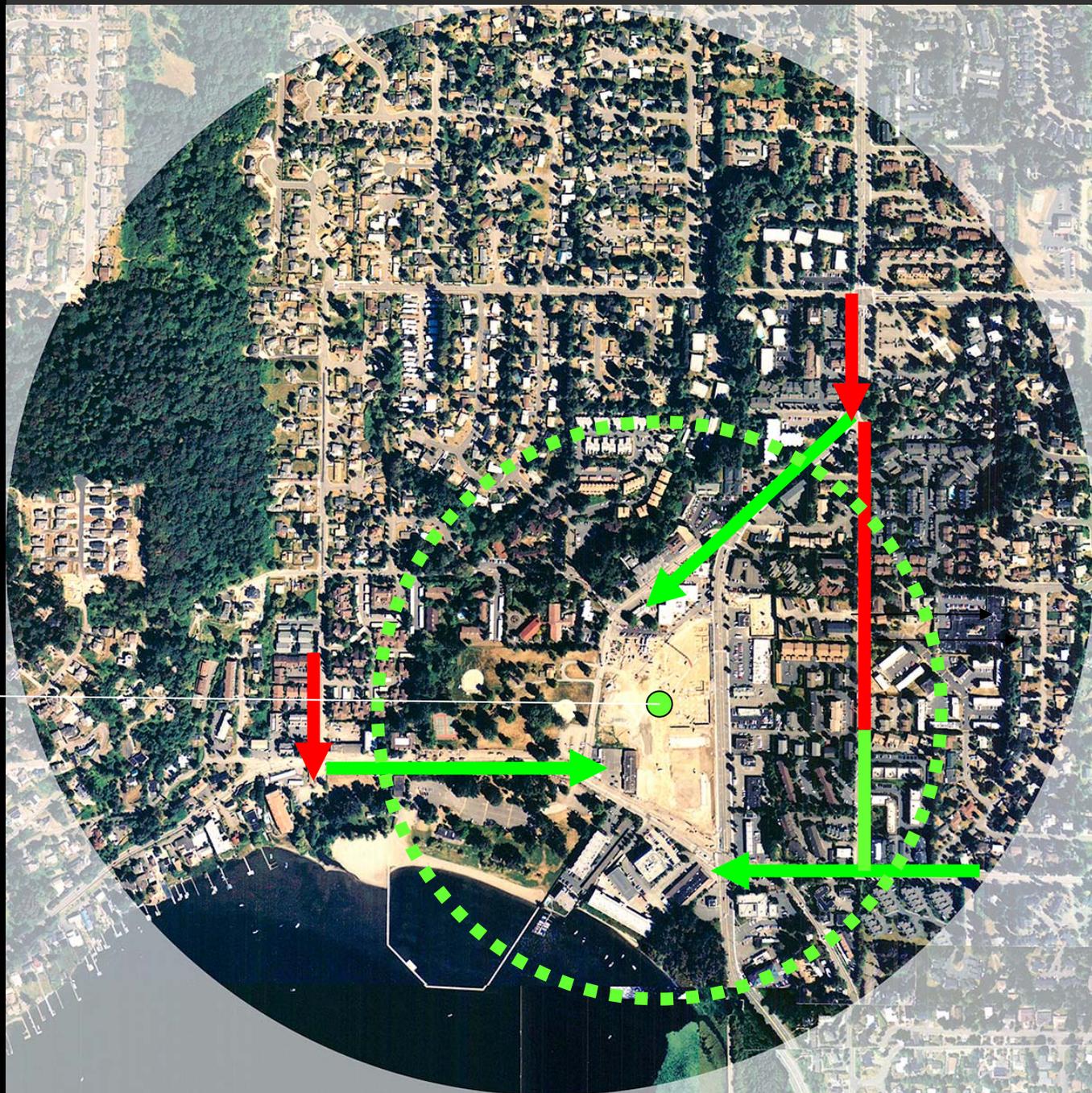
Sufficient Walker

0.27 miles

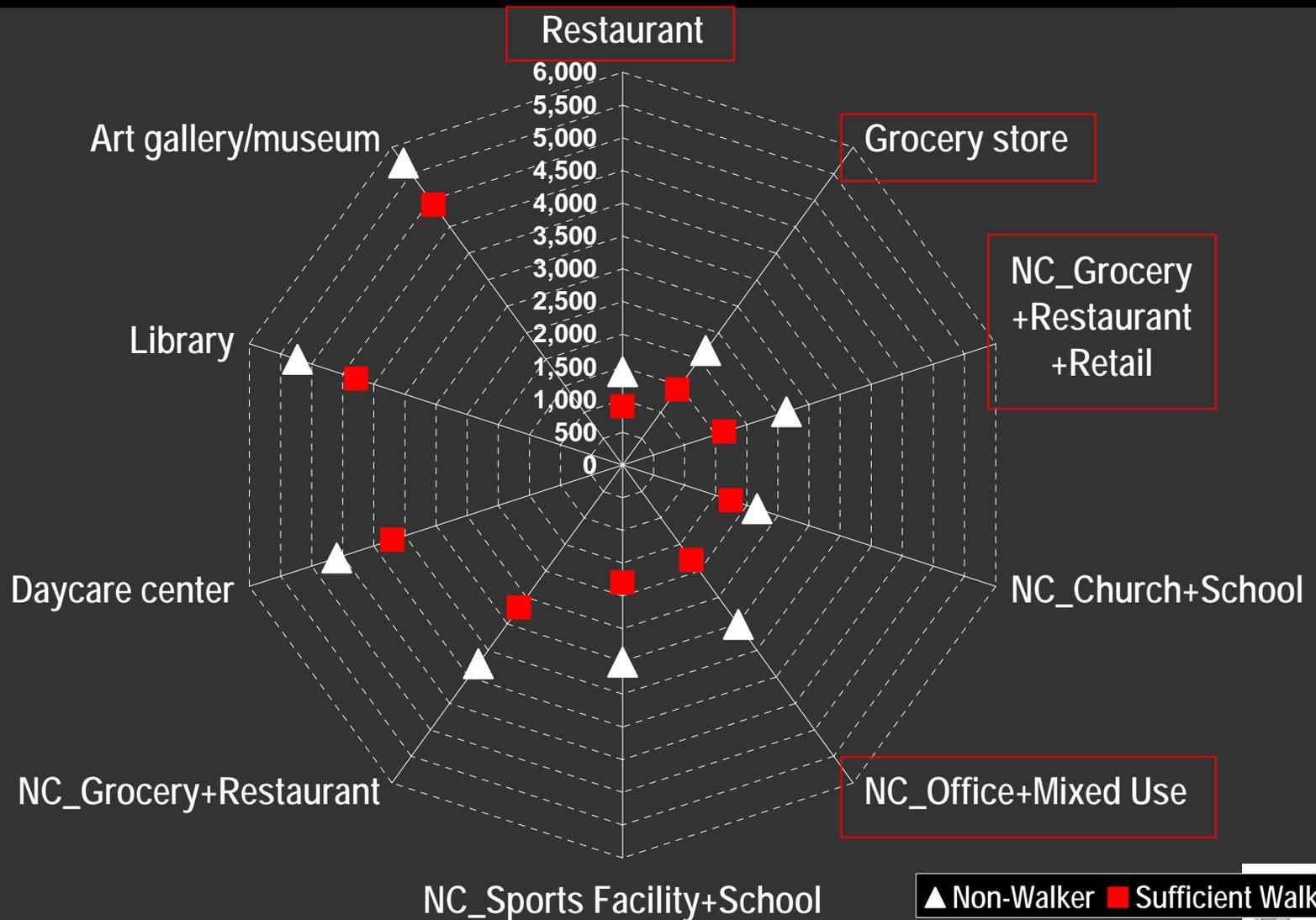


Non-Walker

0.41 miles

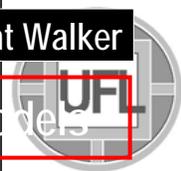


Distance to Closest [Non-Walker; Sufficient Walker]



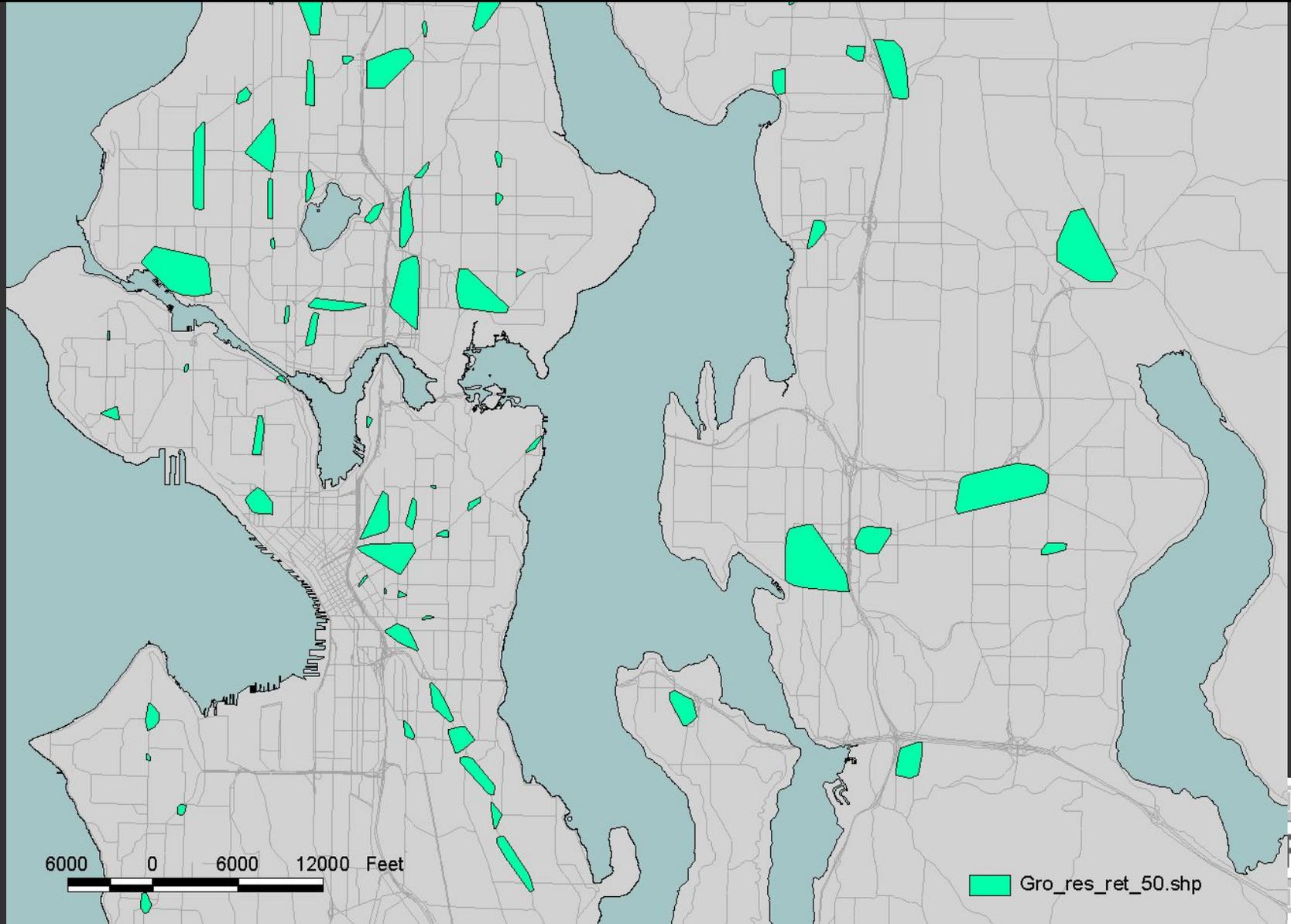
▲ Non-Walker ■ Sufficient Walker

Significant in the models



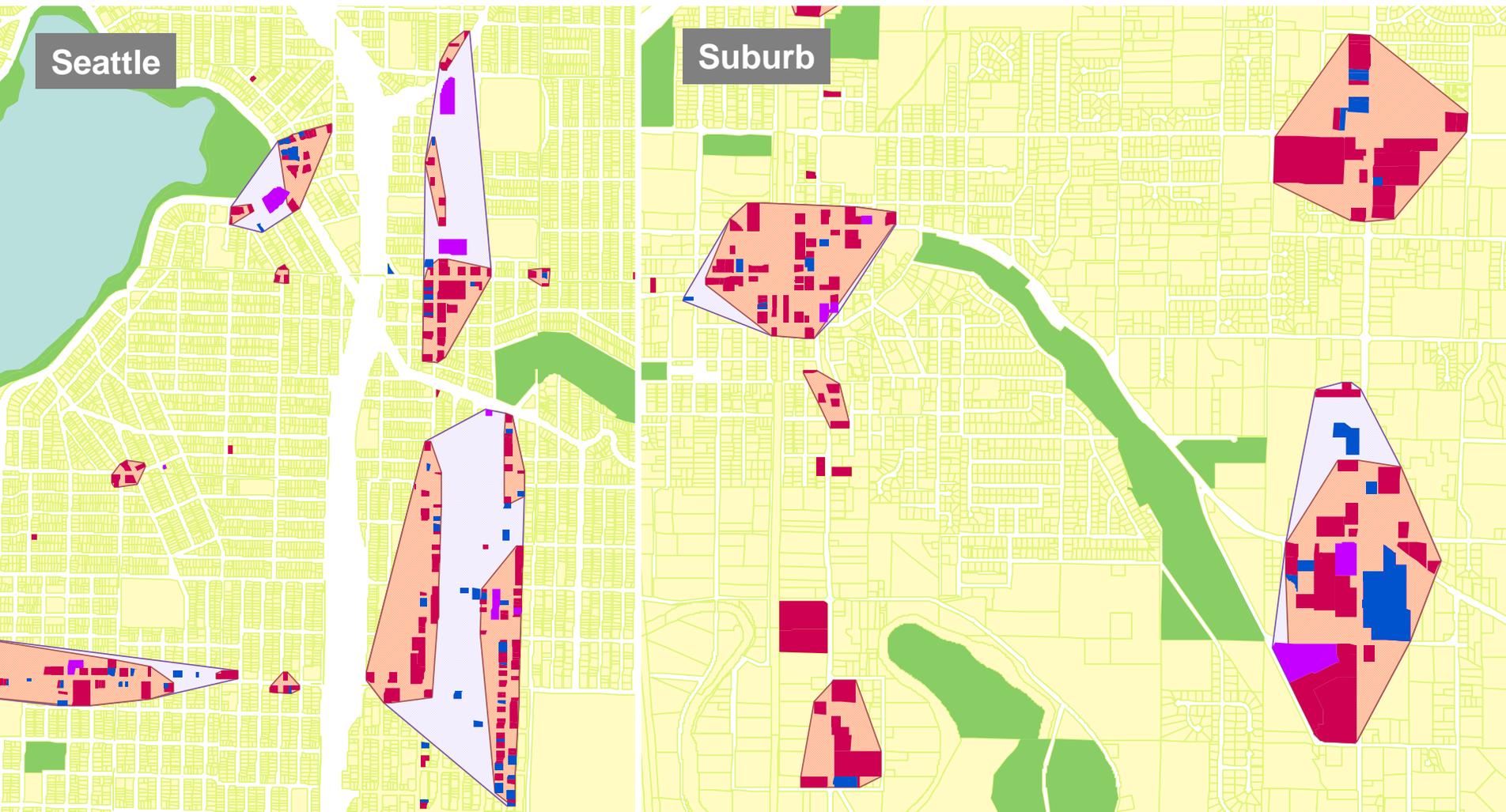
Environments that support walking

Presence of Grocery Store, Restaurant and Retail



Walking and living near food environments

- White: Retail only (3min)
- Red: Retail, Grocery and Restaurant (1 of each, 3min)

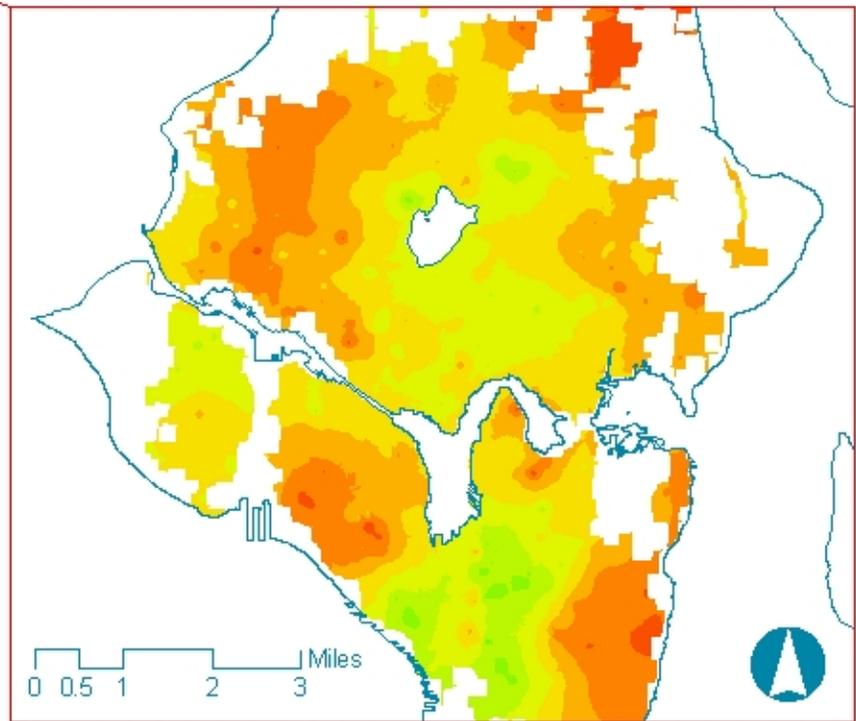
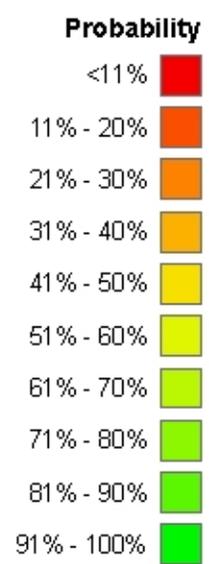
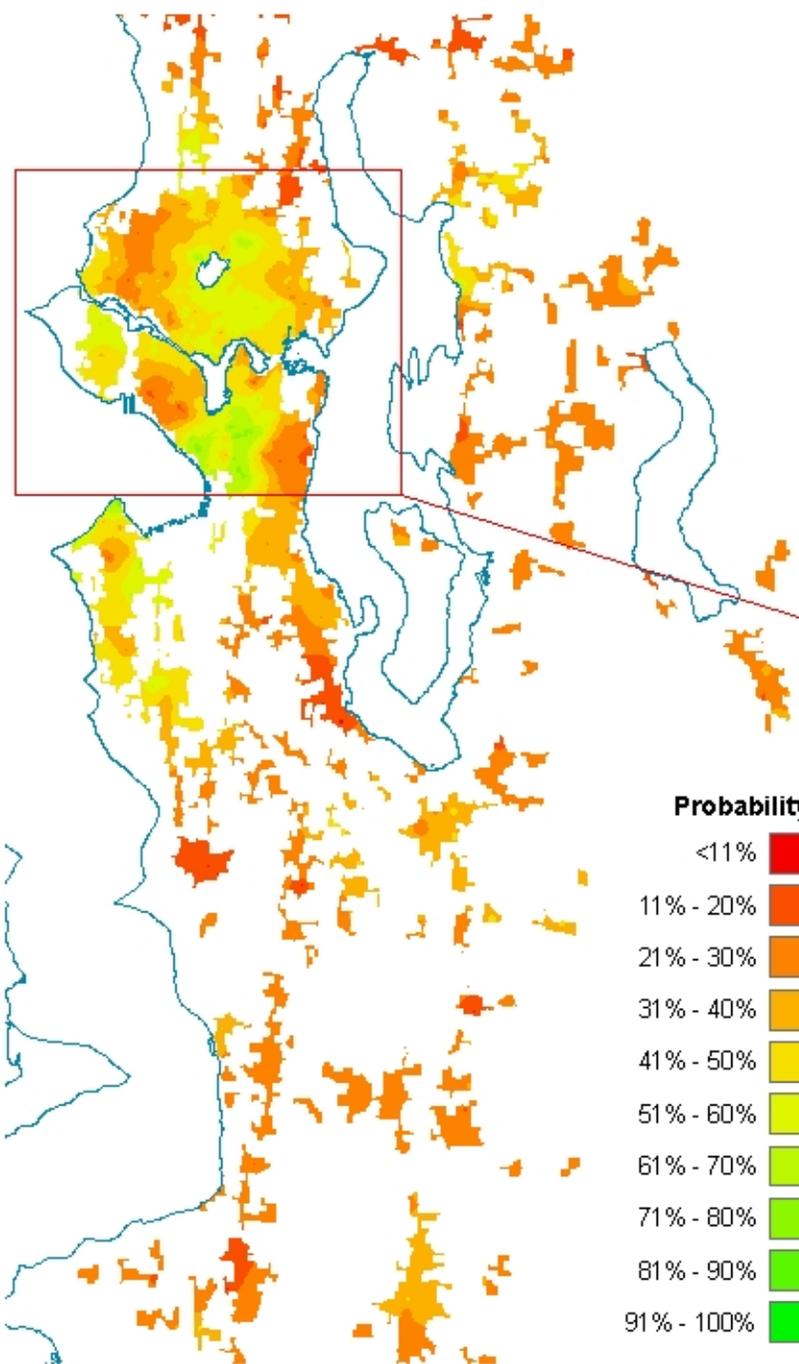


WBC TOOLS Surface Modeling

- Mapping probabilities of walking
- Testing effect of environmental interventions on probabilities of walking



WBC Surface modeling Likelihood of Sufficient Walking for Average Person

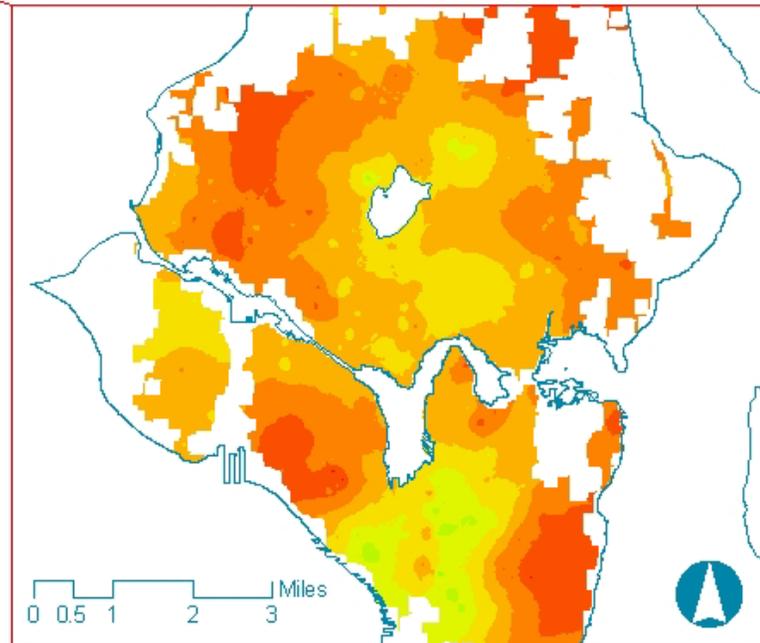
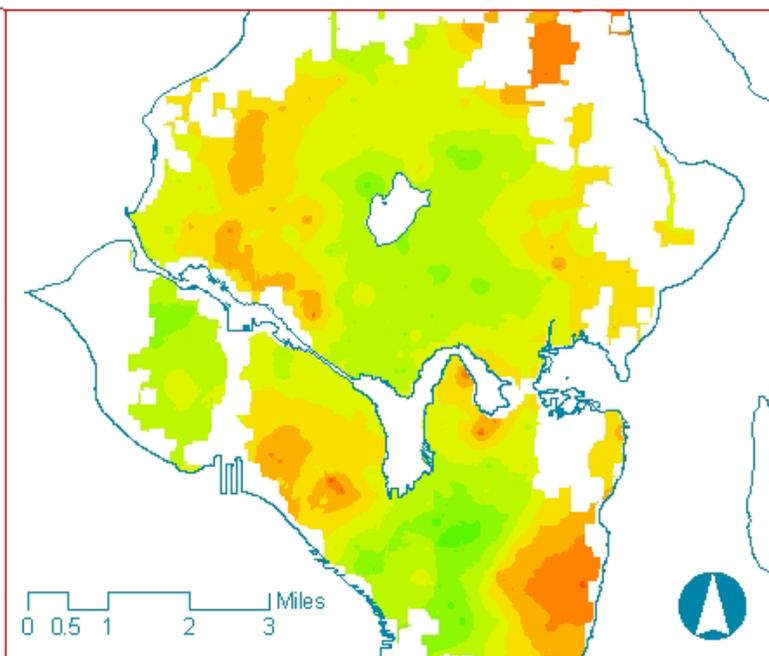


WBC Surface modeling

Likelihood of Sufficient Walking

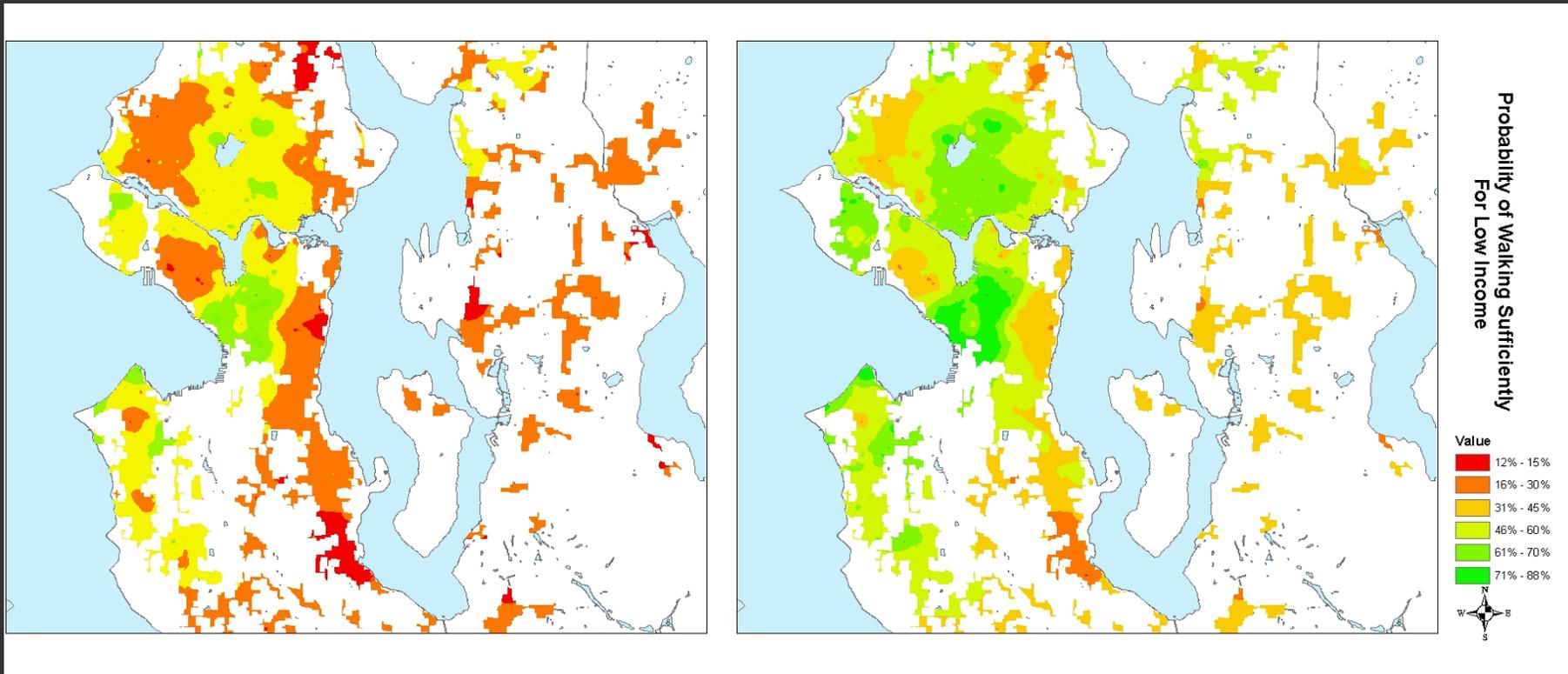
Older Adult >65

Younger Adults <35



Probability of Walking Sufficiently (>150 minute a week)

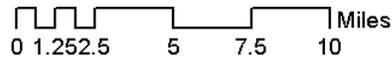
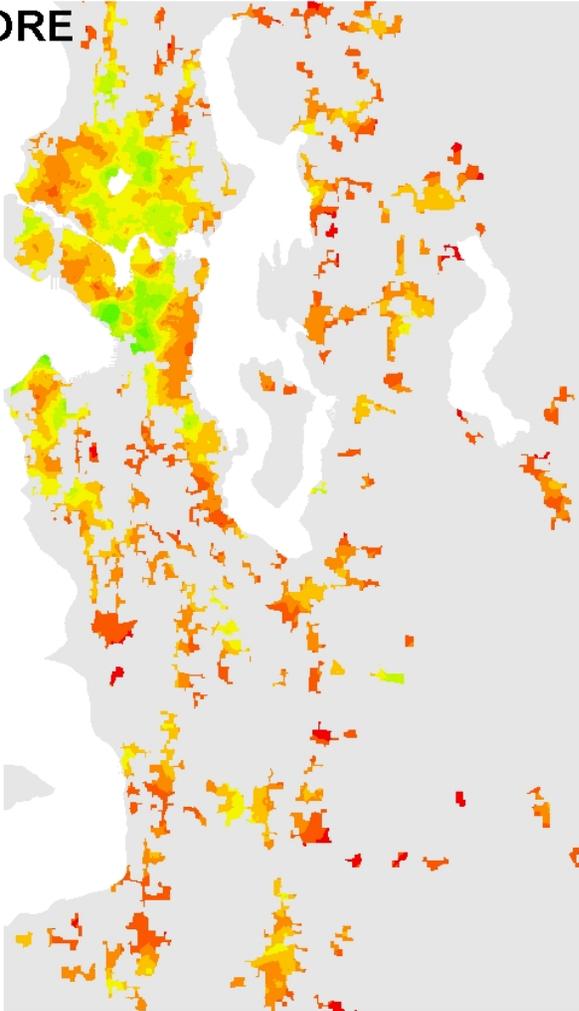
High / Low Reported Income
(>\$75,000 vs. <\$25,000)



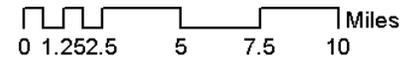
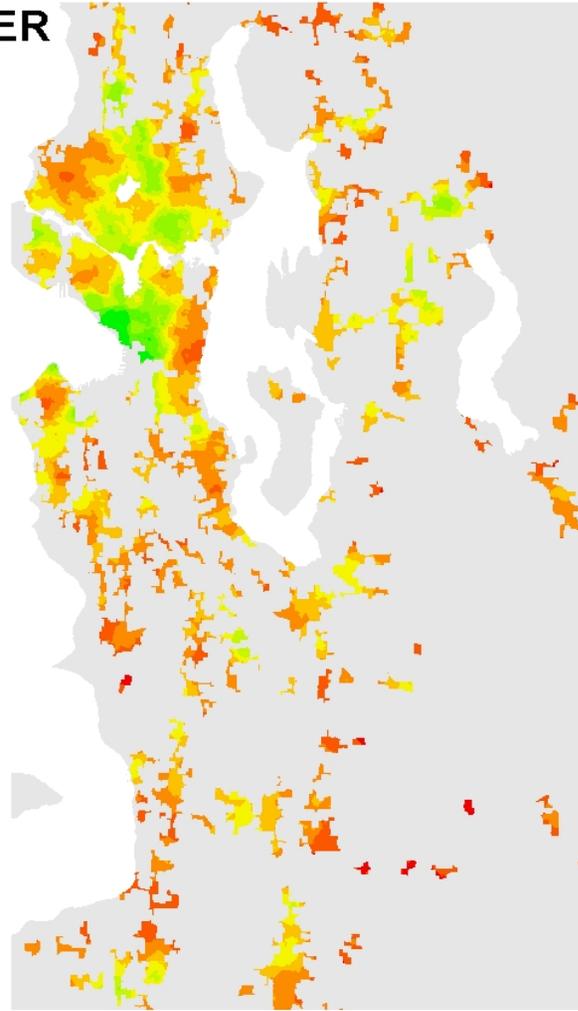
WBC Project GIS Intervention

Size of the Closest Office Complex (NC8) Changed to 5 Acres

BEFORE

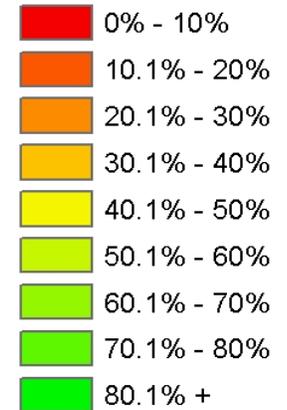


AFTER



Urban Form Lab
University of Washington
August 2004

Mean (acres)	Before	After
Size of NC8 (office)	12.07	5



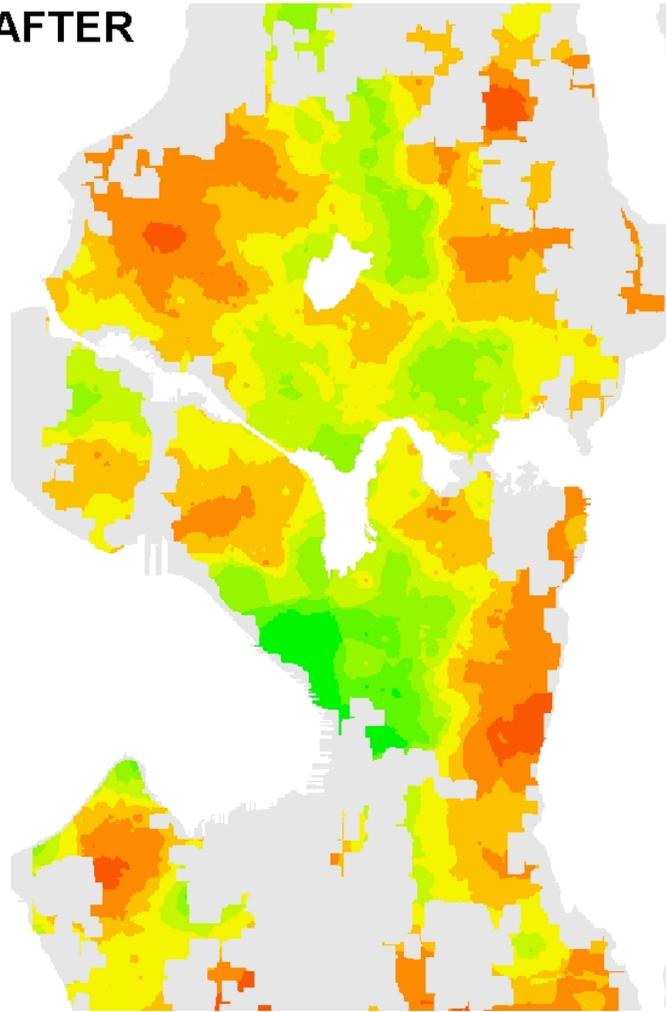
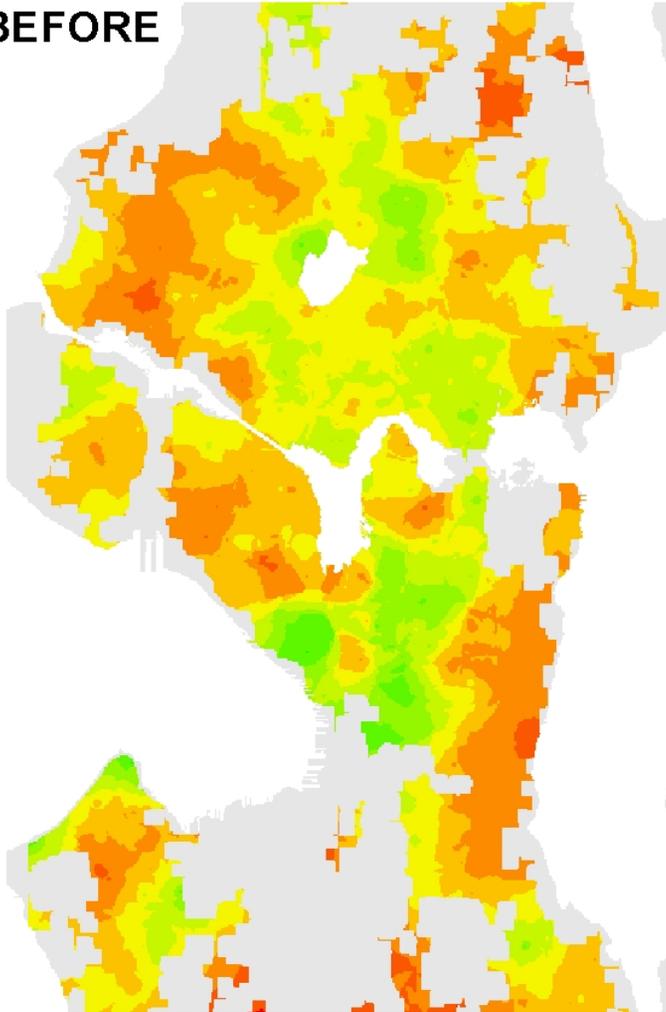
WBC Project GIS Intervention

Size of the Closest Office Complex (NC8) Changed to 5 Acres

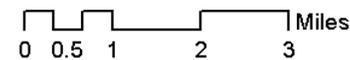
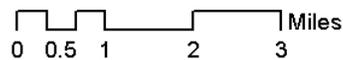
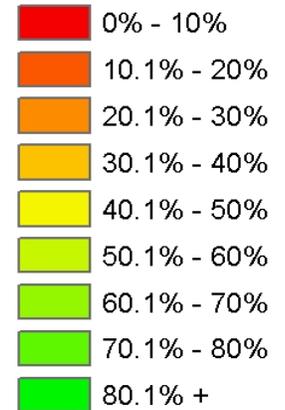
BEFORE

AFTER

Urban Form Lab
University of Washington
August 2004

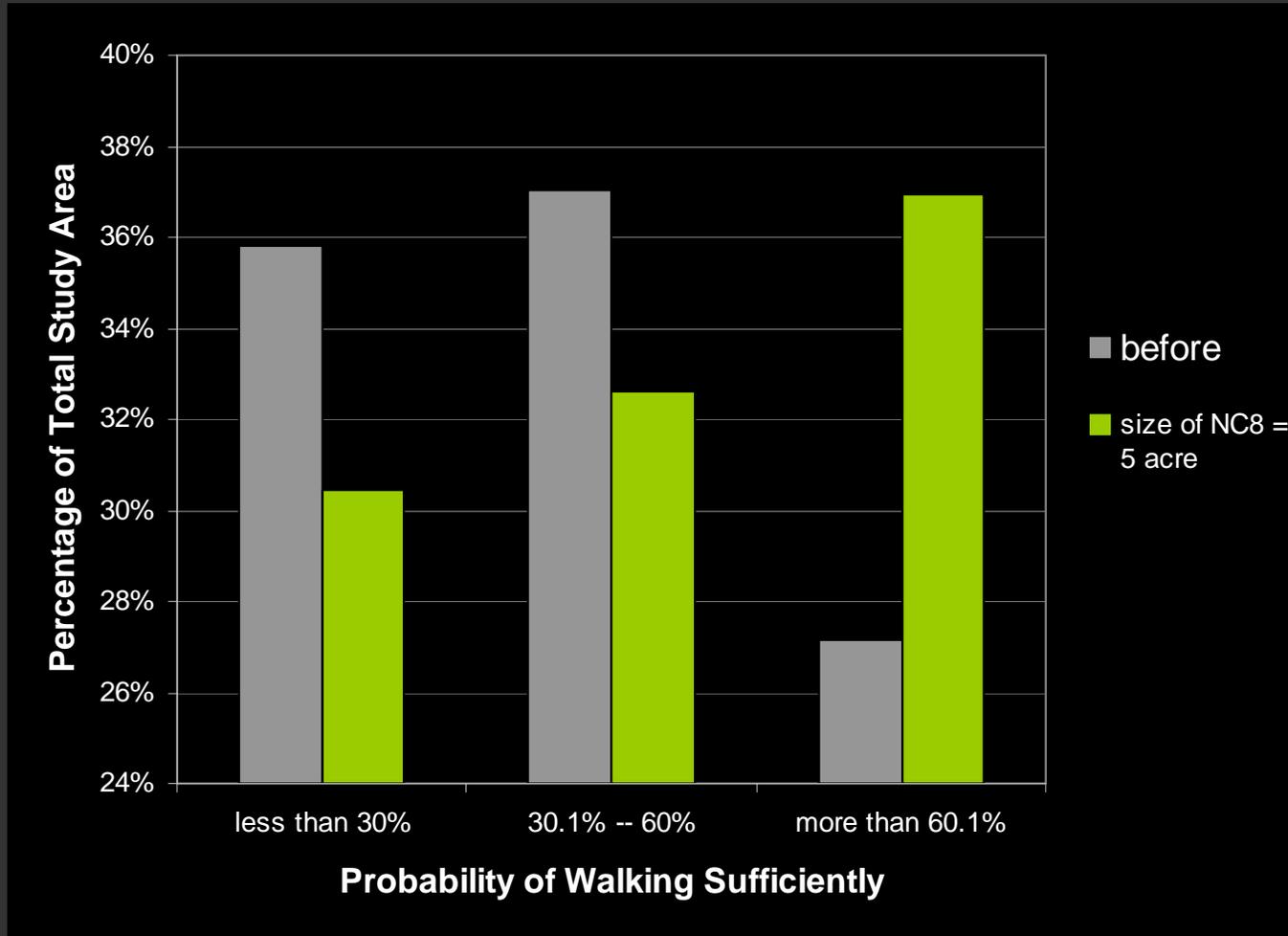


Mean (acres)	Before	After
Size of NC8 (office)	12.07	5



Intervention

Size of NC8 (office) \leq 5 Acres



Where people say they walk

Survey reports

ADDED EVIDENCE OF RELATIONSHIP BETWEEN FOOD AND WALKING

In a usual week:

- 46% to the grocery store,
- 23% to non-fast food restaurants,
 - 19% to drug stores.



Grocery Shopping

How can **3000** + **140** equal **10**?



Grocery

Shopping

How can **3000** + **140** equal **10**?



People Shopping on Foot



Grocery Shopping

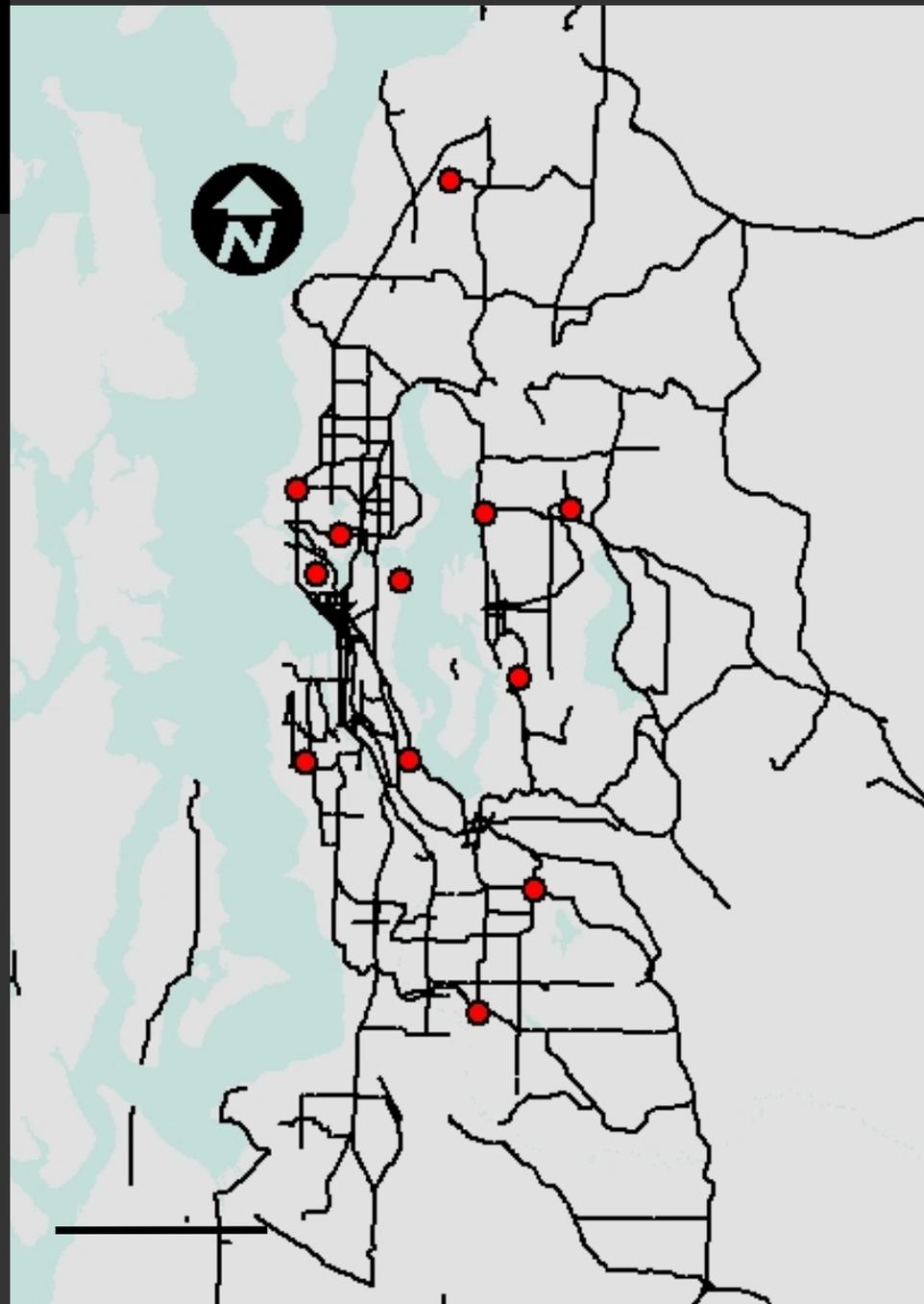
Sites

SITE

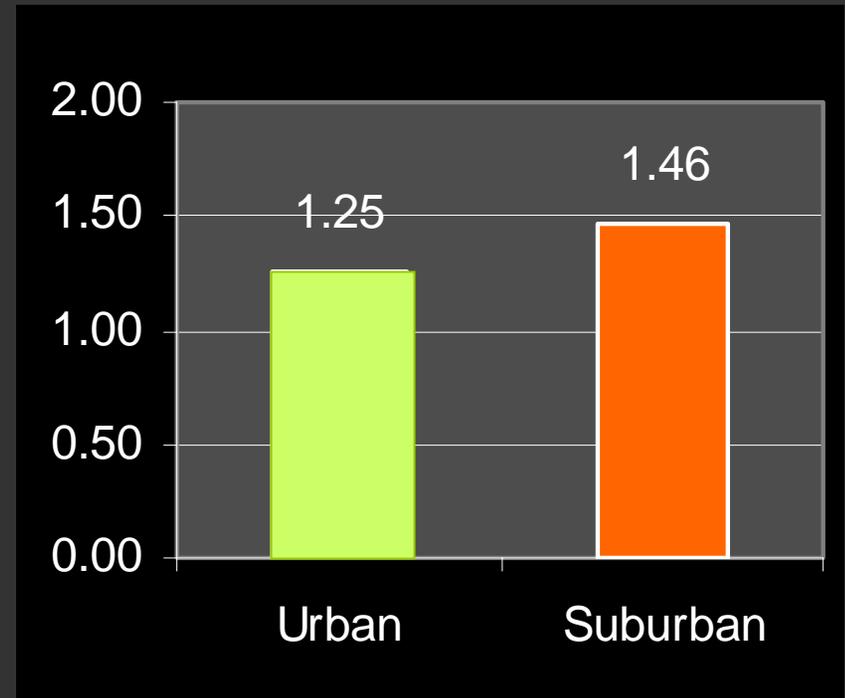
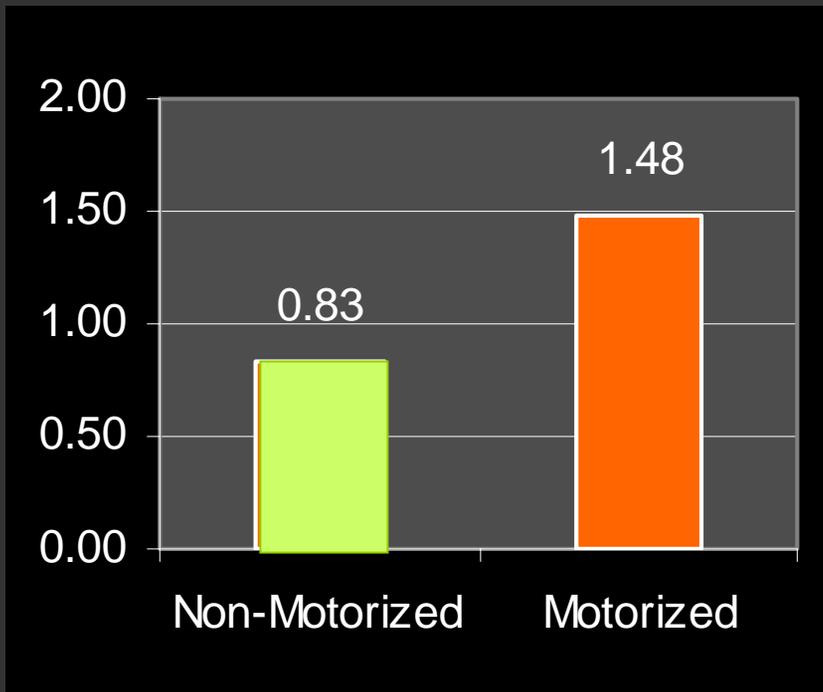
PERCENT
NON-MOT

PERCENT
MOT

	SITE	PERCENT NON-MOT	PERCENT MOT
URBAN	Madison Park	40	60
	Wallingford	34	66
	Queen Anne	27	73
	Ranier Beach	21	79
	Greenwood	18	82
	White Center	5	95
SUBURBAN	Kirkland	27	73
	Mariner	16	84
	Factoria	13	87
	Fairwood	9	91
	Redmond	8	92
	Kent	5	95
Urban		23	77
Suburban		13	87
Total N		456	2158
Grand Total N		2614	



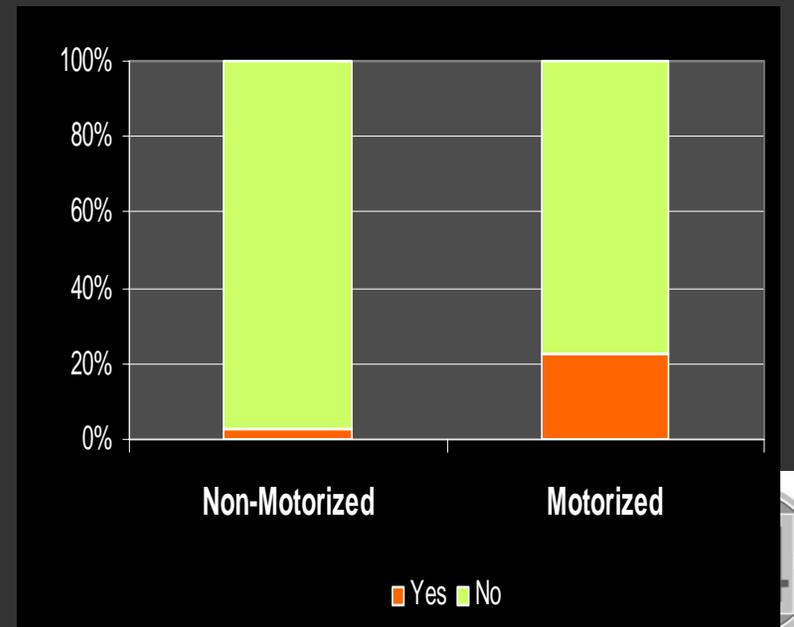
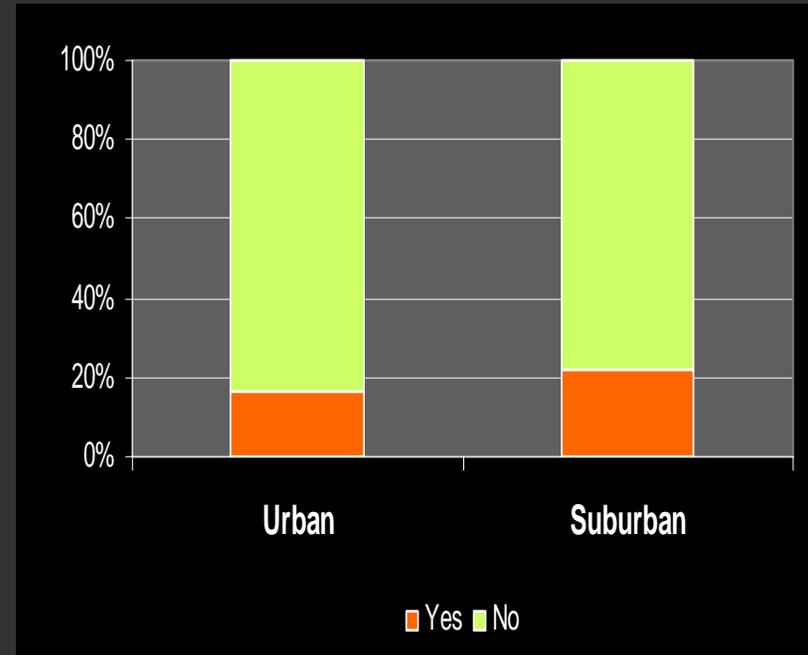
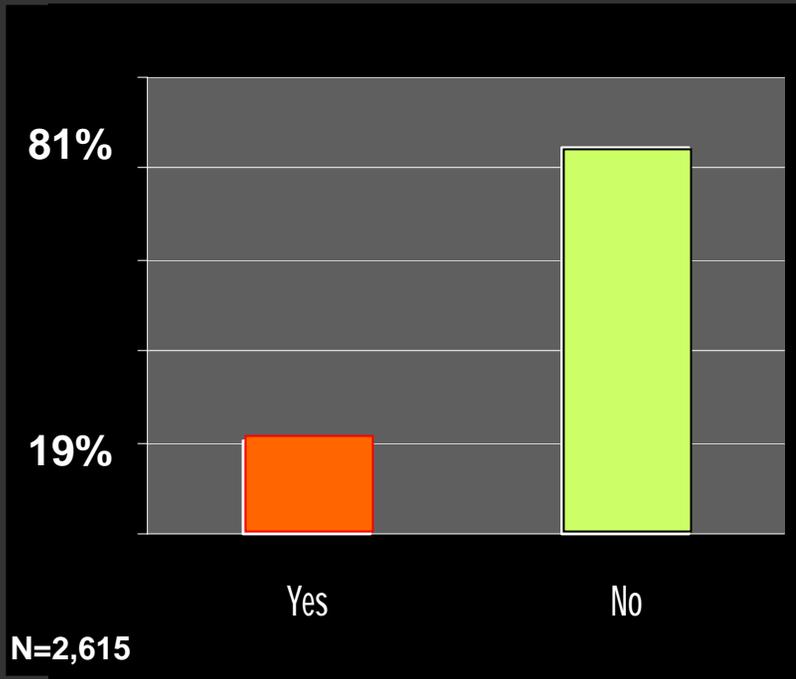
Grocery Bags per Person



MEAN=1.37
Std Dev =1.9
N=2614



Use of Grocery Carts



Is it safe to walk?

- Pedestrian motor-vehicle collisions or crashes
(NOT accidents)
 - Frequency of collision at location or along route/street
 - Severity of injury incurred including death

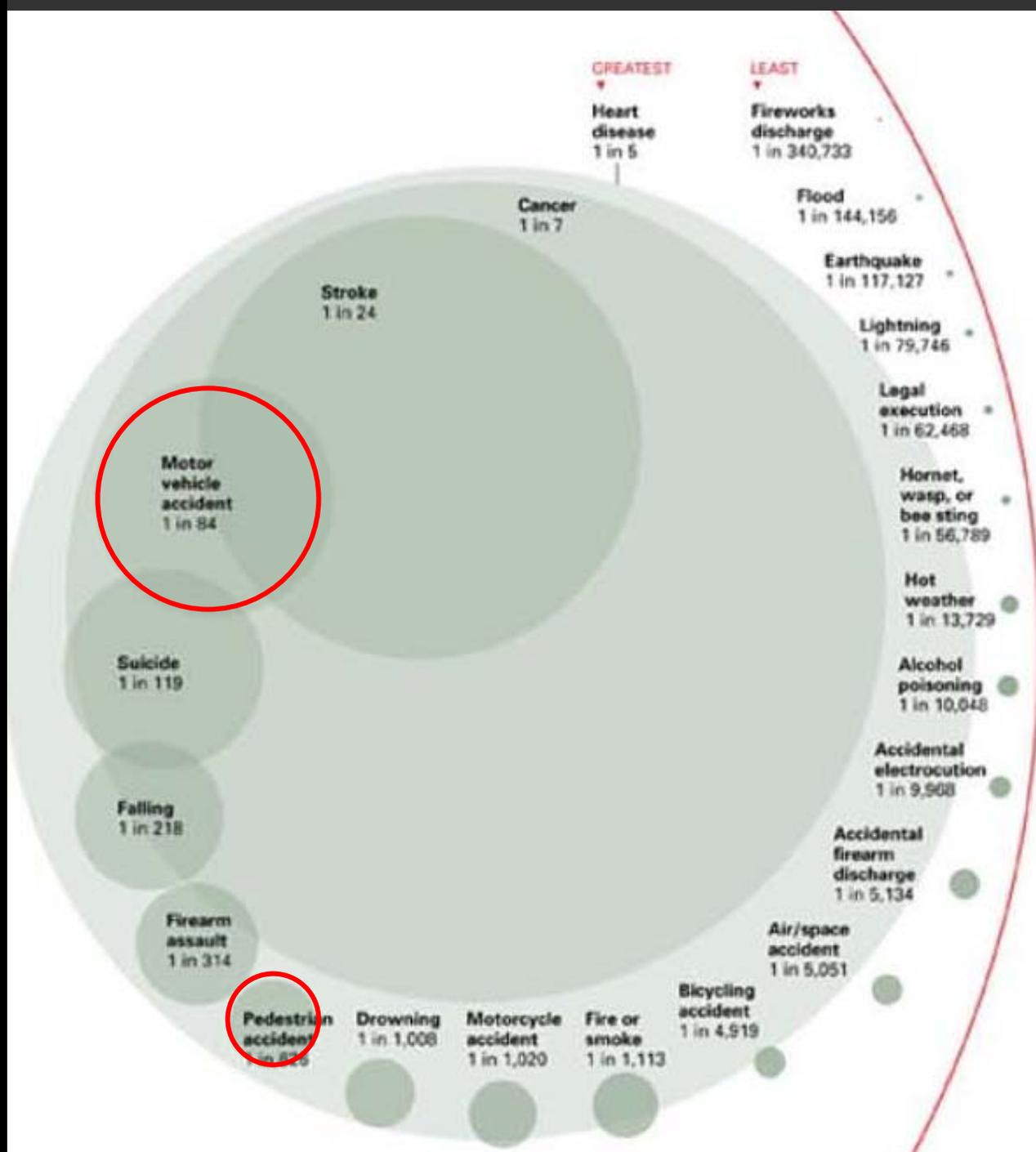


SAFER TO WALK THAN TO DRIVE

http://www.nsc.org/lrs/statinfo/dds_dying.jpg

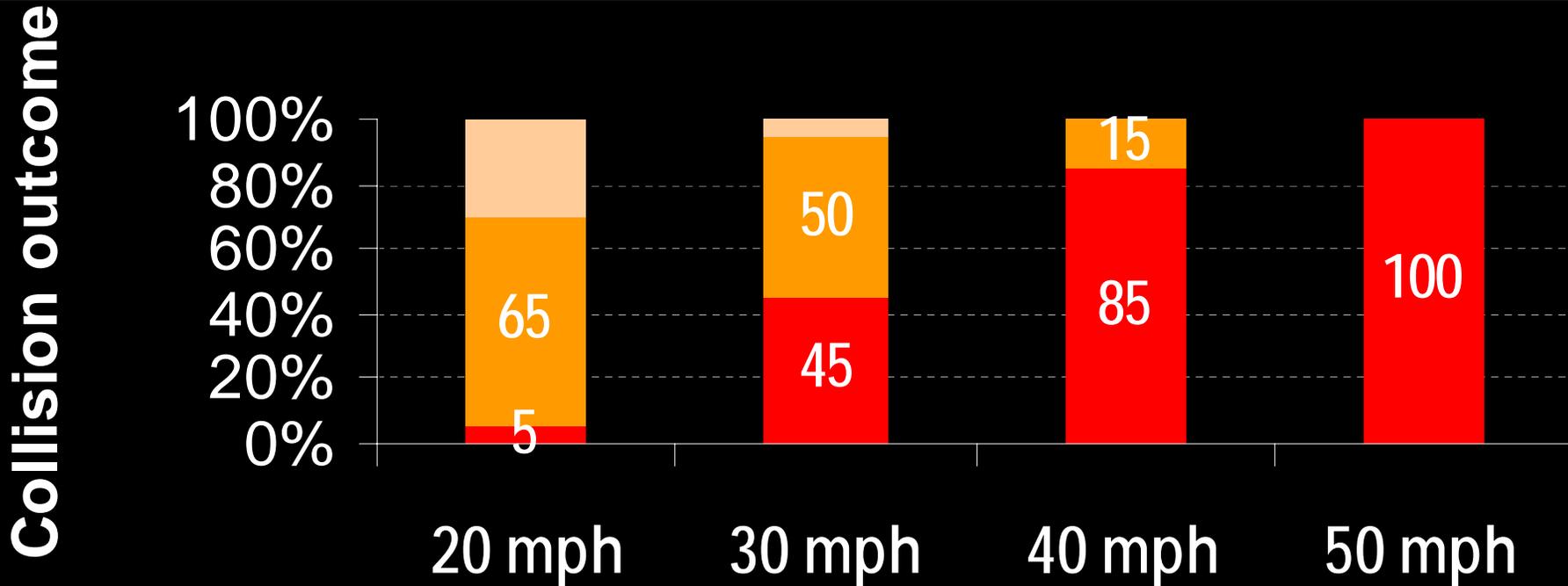
ODDS OF DYING

ANY CAUSE
(1 IN 1 FOR RED
LINE TO THE
RIGHT)



Deadly effects of impact speed

US Dept of Transportation, Leaf WA, Preusser DF 1999

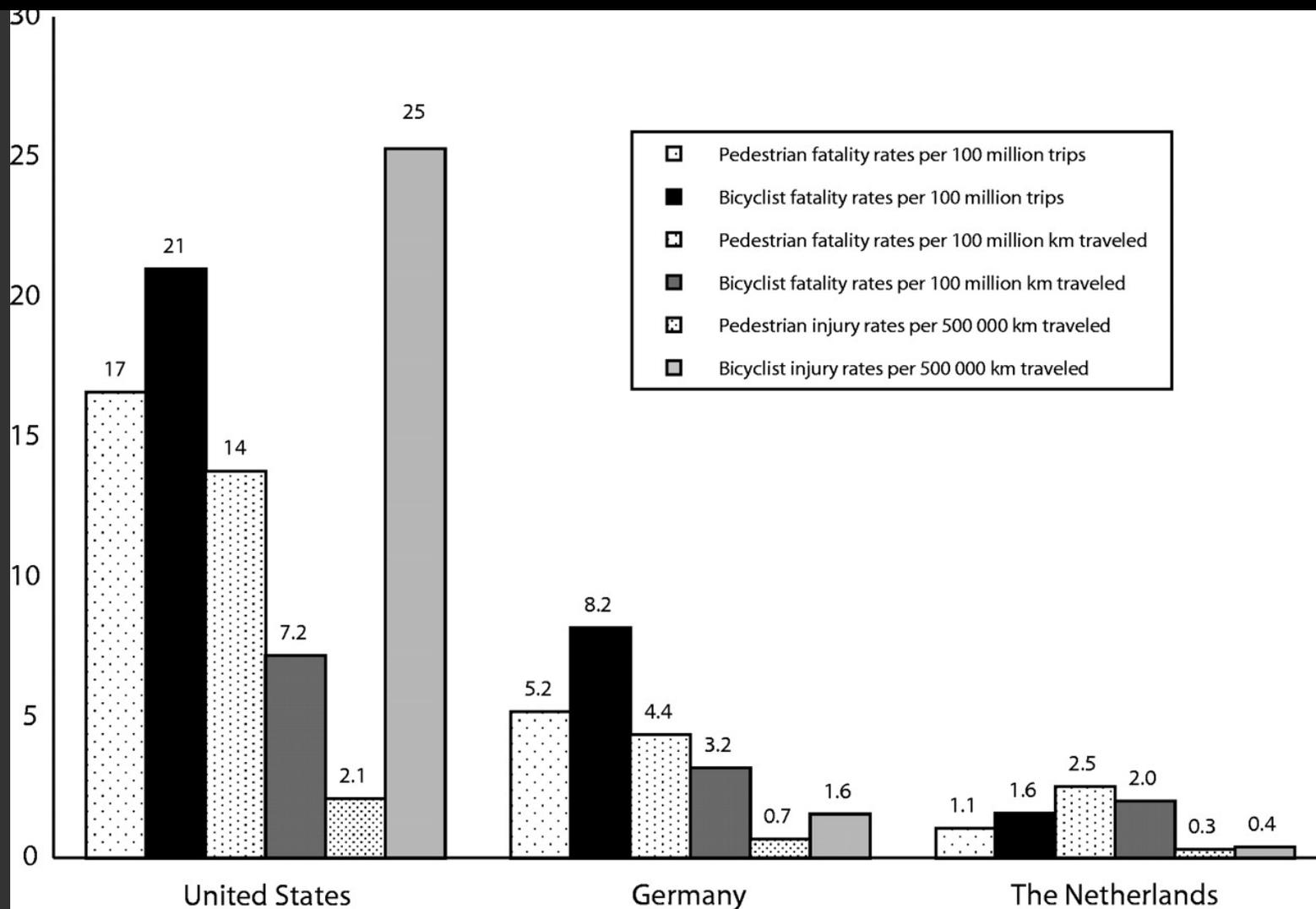


Fatality **Injury** **No injury**

Pedestrian and bicycling fatality and nonfatal injury rates United States, Germany, and The Netherlands, 2000

Pucher_Dijkstra_AJPH_2003

Note double German and Dutch figures based on police records. US figures based on CDC records



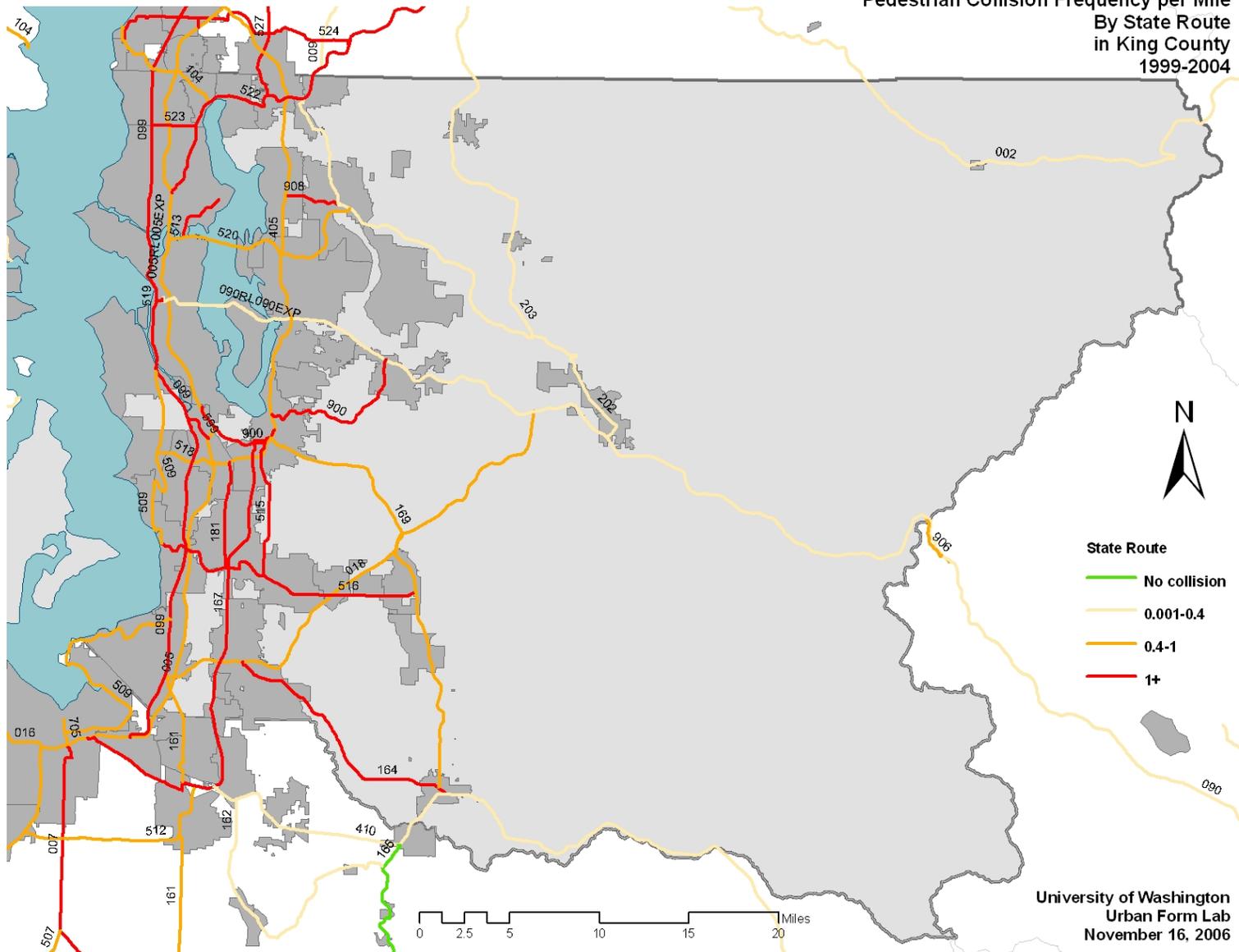
REDUCING FATALITIES

- The Netherlands and Germany reduced pedestrian death by 82% and 73% (1975-2001)
- By reducing (and enforcing) vehicular speed within cities, calming traffic in neighborhoods, and increasing fines related to traffic violations



Pedestrian Safety

Pedestrian Collision Frequency per Mile
By State Route
in King County
1999-2004



Risk of severe INJURY or DEATH on State Routes

Individual actions strongly and significantly associated higher risk of severe injury and death:

- the pedestrian crossing at an intersection without a signal (OR 3.89)
- the colliding vehicle moving straight ahead on the street (OR 2.226) (= higher speed)
- making a right turn (OR 0.285).



Risk of severe INJURY or DEATH on State Routes

No correlation between severity of injury and frequency of collision

Measures of environment

- Higher ADT lower risk of severe injury or death (OR 0.83)
- Higher home values higher risk of severe injury or death (OR 1.08) (within 0.5 km of the collision).



COLLISION FREQUENCY

Risk of a collision occurring on State Routes

- + **Intersections with or without signal** (OR 5 to 156)
- + **# lanes** 3-4 lanes (OR 3.71) to 4+ lanes (7.38) SR 99 OR 0.26
- + **# retail parcels** 0.5 km buffer (OR 3 to 13)
- - Being in Seattle OR 0.61

- Residential density
- Employment density
- Bus ridership and multiple collision sites

- NOT associated with higher risk: grocery stores, restaurants and drinking establishments, clusters of neighborhood food and retail services, elementary and middle schools, colleges



Conclusions

RESPECT/CELEBRATE BIPEDALISM

- **Walking and environment**
 - Importance of ROUTINE destinations near home
 - Importance of FOOD supply sources near home
- **More walking for transportation**
 - Walking DISTANCES are very short
 - Importance of people living NEAR each other
 - Importance of TRANSIT
- **Walking for health**
 - People should walk LONGER distances
- **Safe walking—where people walk:**
 - Reduce vehicular SPEEDS
 - SIGNALIZE intersections
 - PRIORITIZE pedestrian movement (PZ)
- **Tools**
 - Probabilities of walking and walkability score



END

