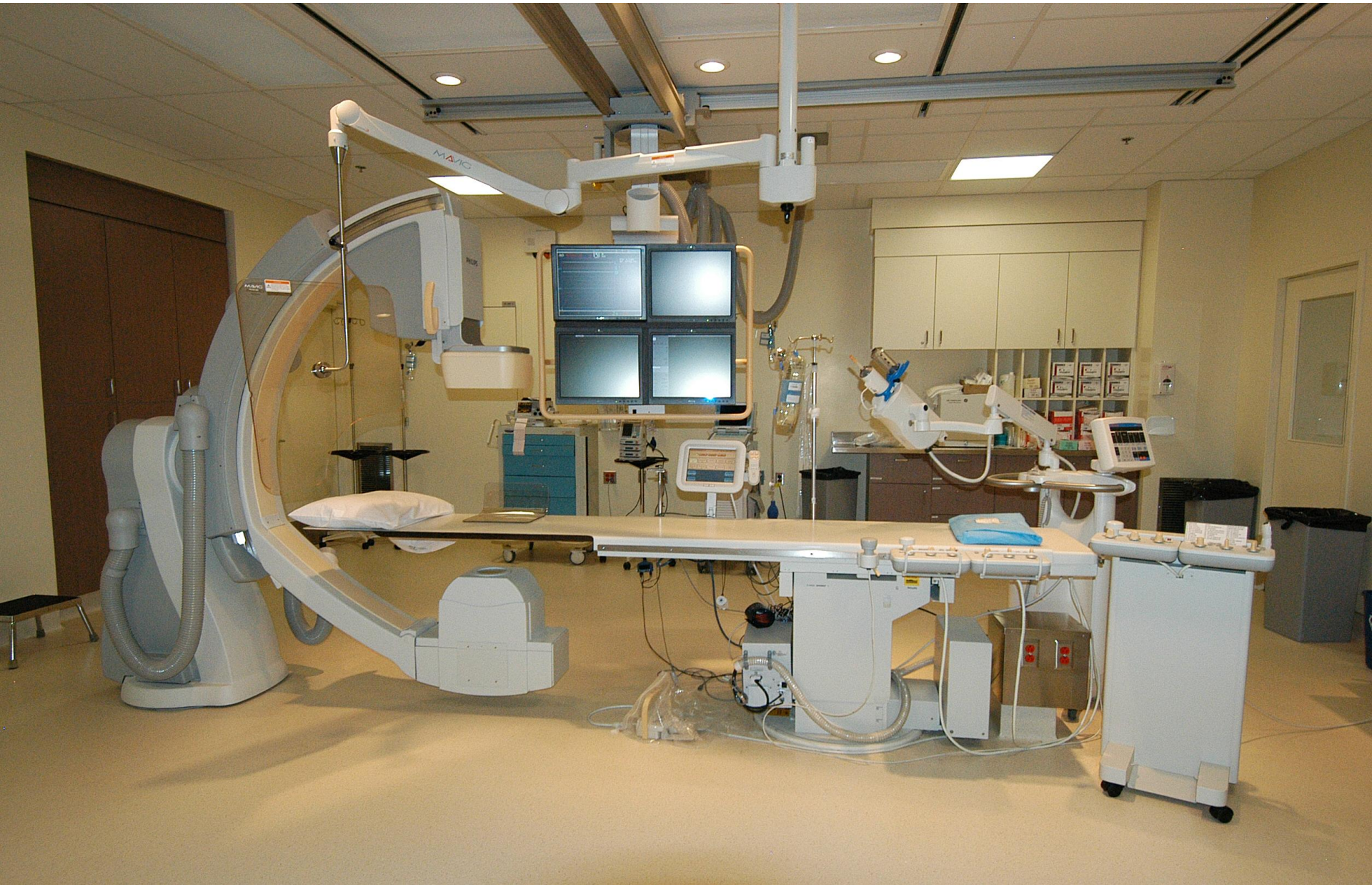
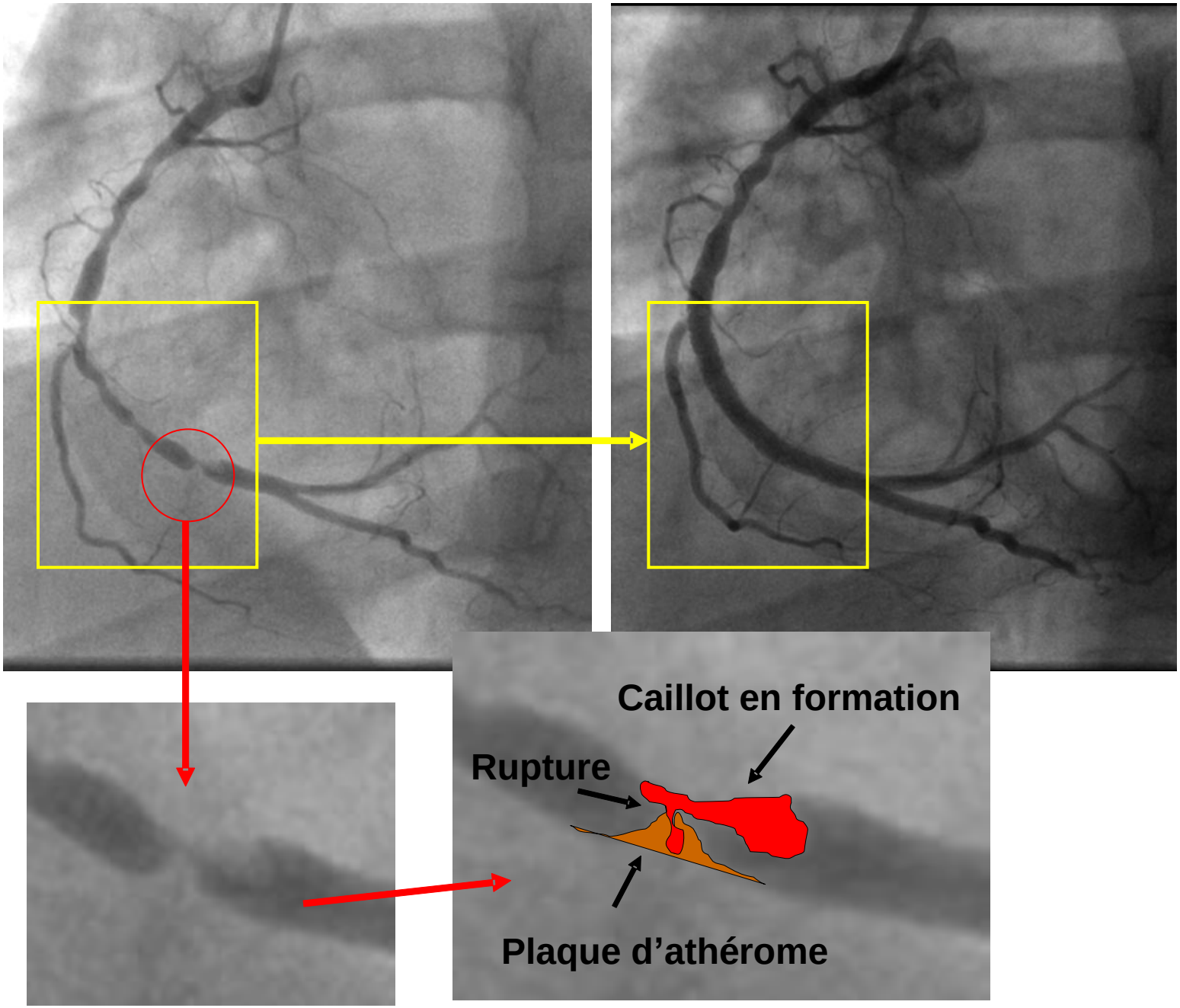
Environment and Heart Disease

Heart and the city

François Reeves MD FRCPC
Interventional Cardiologist
Associate Professor of Medicine
And Environnemental Health
Faculty of Medicine
Université de Montréal


MAVIC


Caillot en formation
Rupture
Plaque d’athérome

Dr François Reeves

PLANÈTE Cœur

SANTÉ CARDIAQUE ET ENVIRONNEMENT

Éditions du
CHU Sainte-Justine

ÉDITIONS
MULTIMONDES

A cardio-protective city

- Connects with nature
- Promotes active transport
- Eradicates food nano-agressors
- Eradicates airborne nano-agressors
- Eradicates fossil fuel

Why heart disease ?

- Framingham Heart Study 1948-2012

  National Heart and Blood Institute / Harvard Medical School

– Tobacco
– Heredity
– Diabetes
– High cholesterol
– High blood pressure
– Sedentarity
– Obesity
– Stress

Did Framingham say everything ?

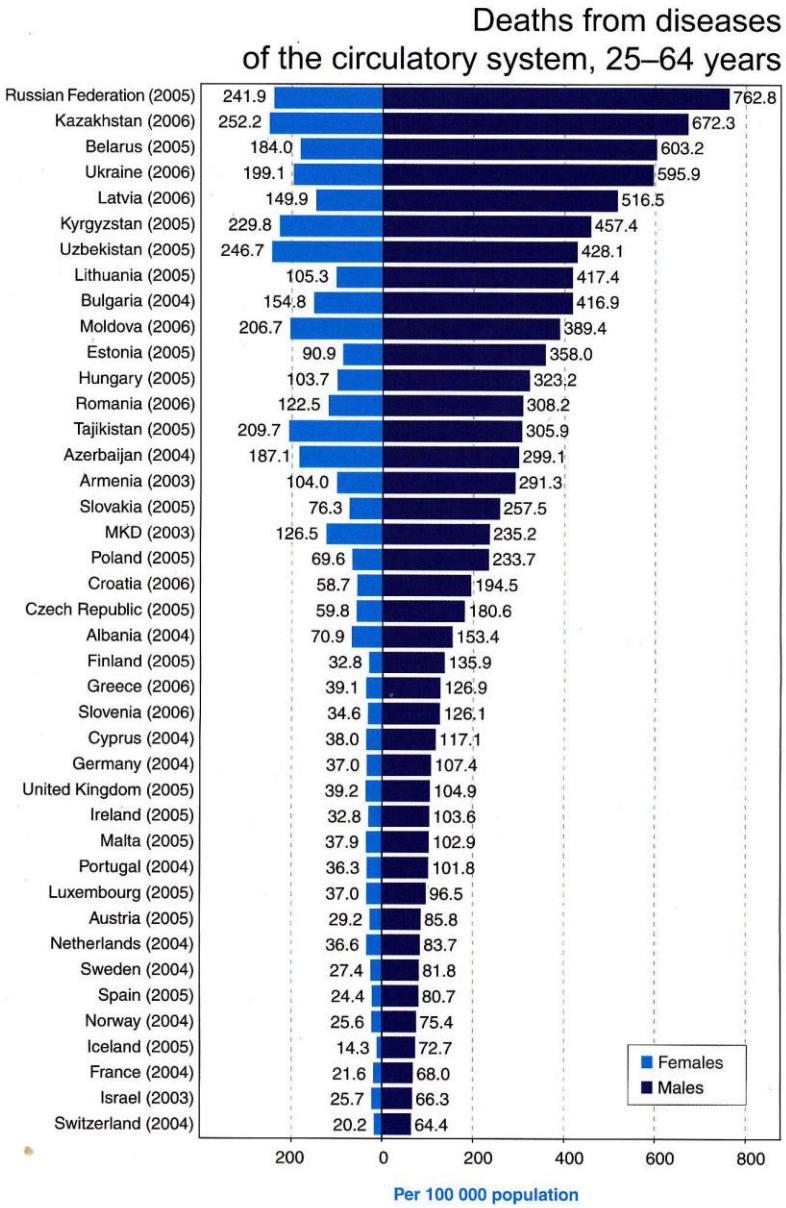
World Health Organization, 2008

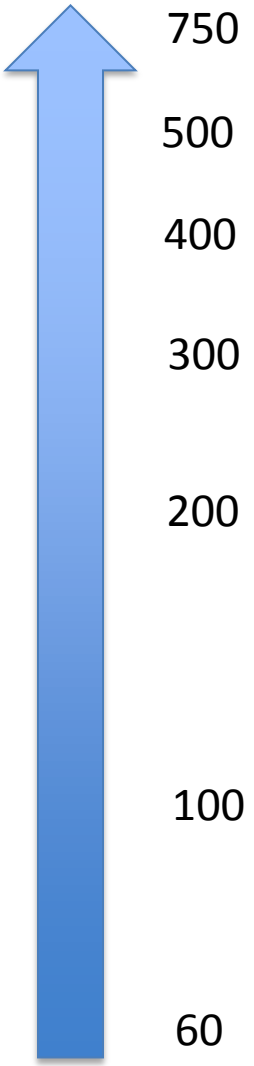
Russia

Poland

Austria

Switzerland





Coronary heart disease

FACTS

- Rare in animals
- Rare within humanity
  - before 1830
- Rare within humanity
  - living outside industrialized world

Coronary heart disease

FACTS

- Inducibled in animals
  - excellent medical bench test
- Dramatic increase of cardiac morbidity
  - following traditional industrial revolution

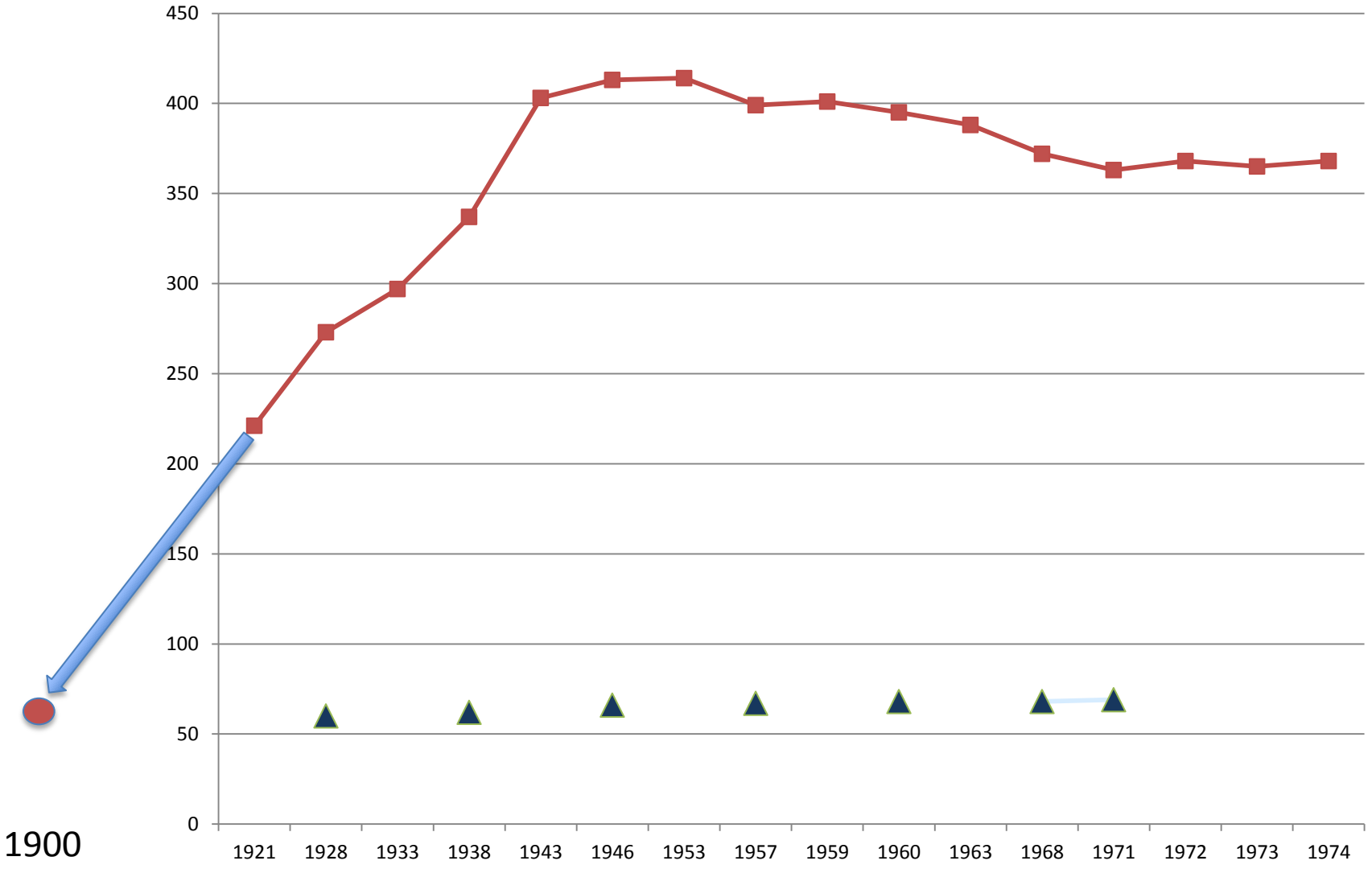
Why Heart Attacks ?

1948

The Framingham Heart Study

American epidemic

Rate of CV mortality / Canada 1920-1975

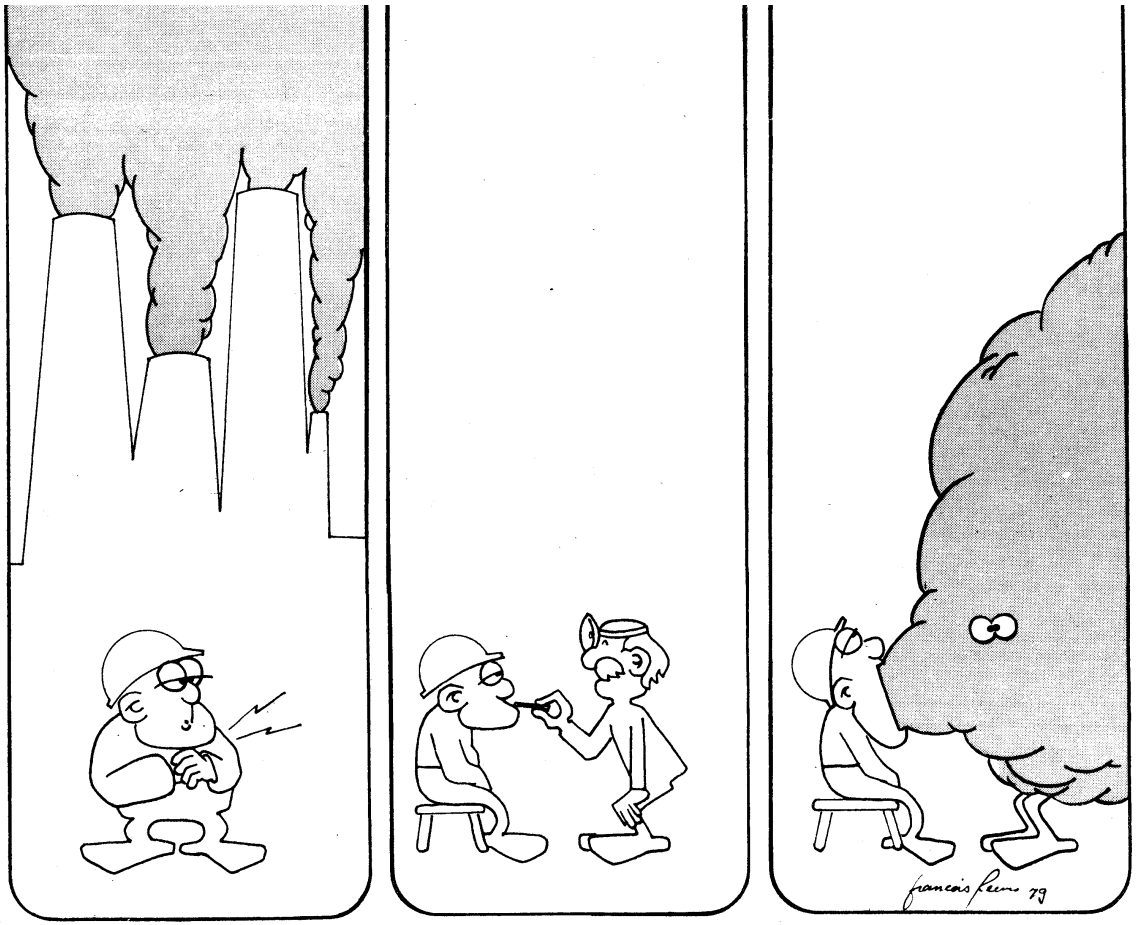


Inflammation and Infection Do Not Promote Arterial Aging and Cardiovascular Disease Risk Factors among Lean Horticulturalists.

Gurven M et al. *PLoS ONE* 4(8): e6590. doi : 10.1371/journal.pone.0006590, 2009.


PHILIPS

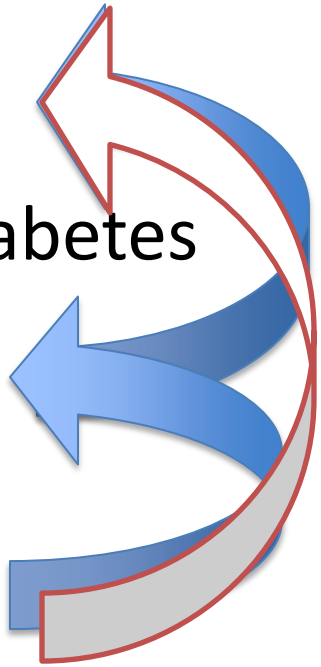
Cardiology is an environmental specialty



Why atherosclerosis ?

3 triads

- **What we are**
  - Cholesterol, hypertension, diabetes
- **What we do**
  - Sedentarity, obesity, tobacco
- **Where we are**
  - Environment, food, urbanism



Human trade with environment

• What we eat	• 1 kg
• What we drink	• 2 kgs
• What we breathe	• 20 kgs

A cardio-protective city

- Eradicates food nano-agressors
- Eradicates airborne nano-agressors
- Eradicates fossil fuel from the milieu
- Develops with renewable energies
  - Earth is geothermy
  - Wind is eolian
  - Water is hydrolic
  - Fire is solar
- Aims at a 25 % urban canopy.

United States

THE REVISES

The North Carolina family fights the effects of abundance with exercise

GRAINS AND OTHER STARCHY FOODS
$17.92

DAIRY
$14.51

MEAT, FISH AND EGGS
$54.92

FRUITS AND VEGETABLES
$41.07

CONDIMENTS
$12.51

SNACKS AND DESSERTS
$21.27

PREPARED FOOD
$24.27

FAST FOOD
$71.61

RESTAURANTS
$6.15

BEVERAGES
$77.75

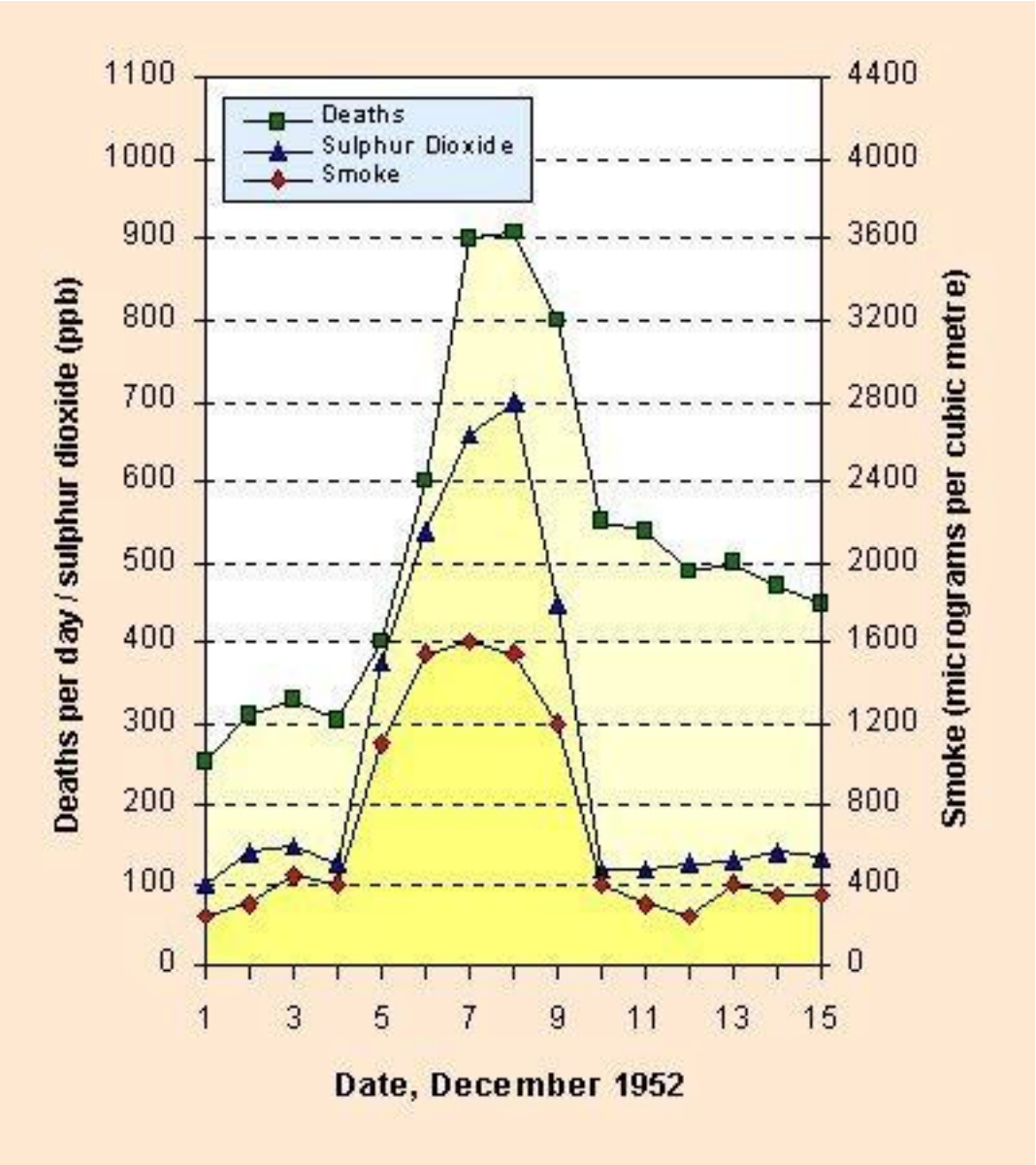
FOOD EXPENDITURE FOR THE WEEK
$341.98

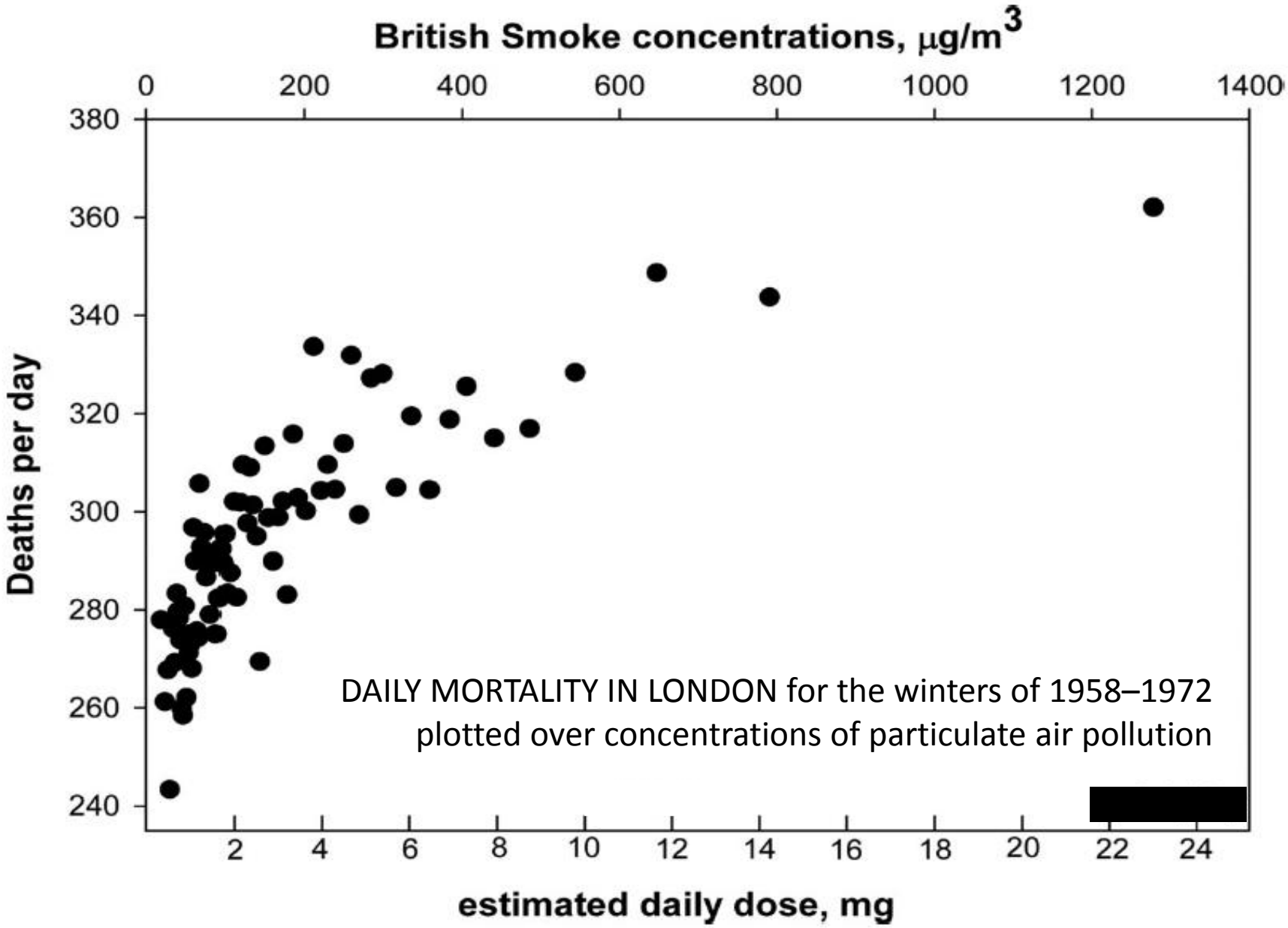
A cardio-protective city

- Eradicates food nano-agressors
- Eradicates airborne nano-agressors
- Eradicates fossil fuel from the milieu
- Develops with renewable energies
  - Earth is geothermy
  - Wind is eolian
  - Water is hydrolic
  - Fire is solar
- Aims at a 25 % urban canopy.

Great London Smog, December 1952

"Great London Smog » : 12 000 deaths in excess

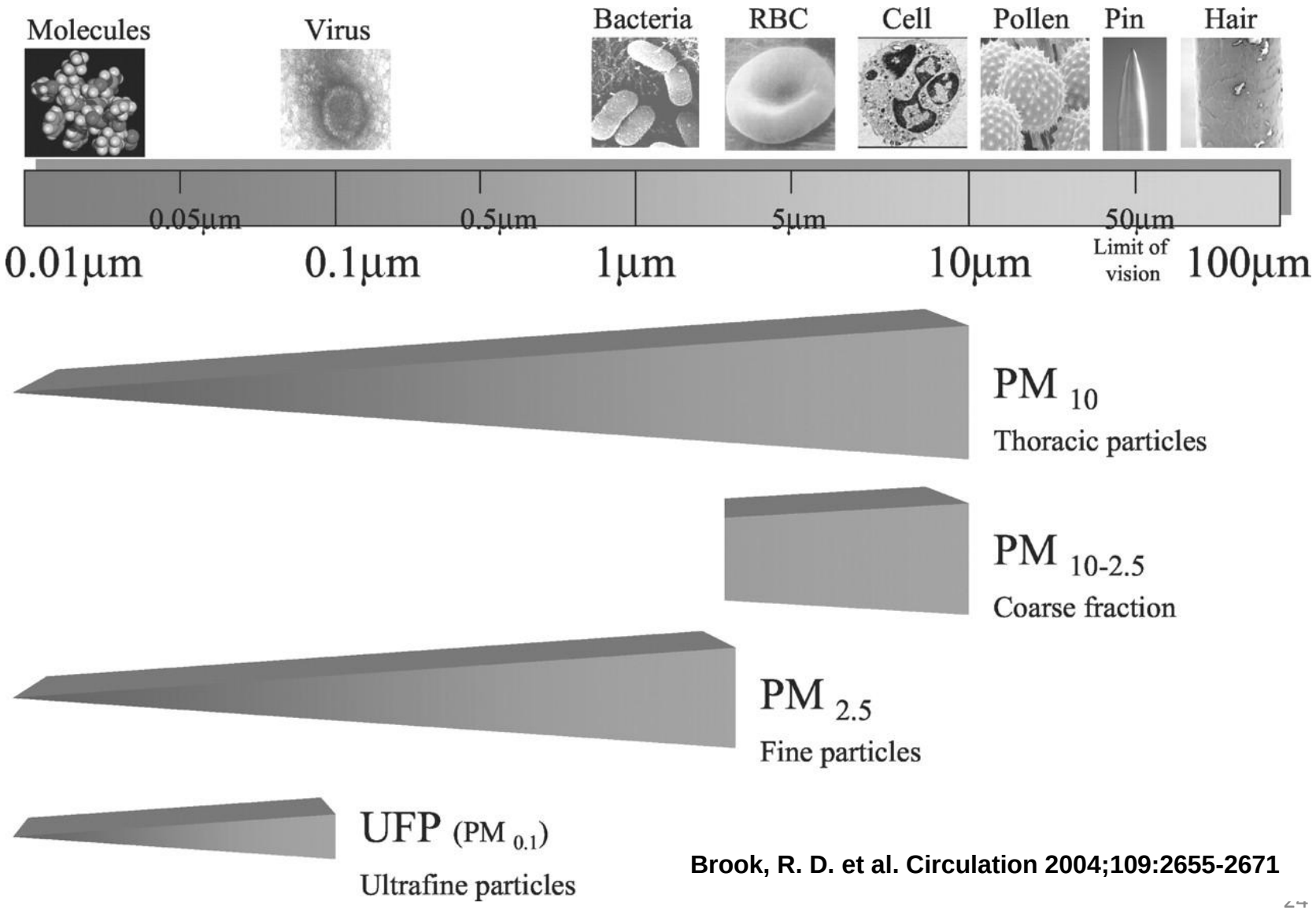




DAILY MORTALITY IN LONDON for the winters of 1958–1972
plotted over concentrations of particulate air pollution

Circulation September 15, 2009

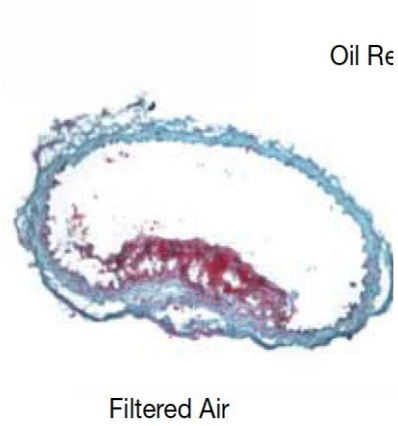
Fossil fuel : the Fine Particles



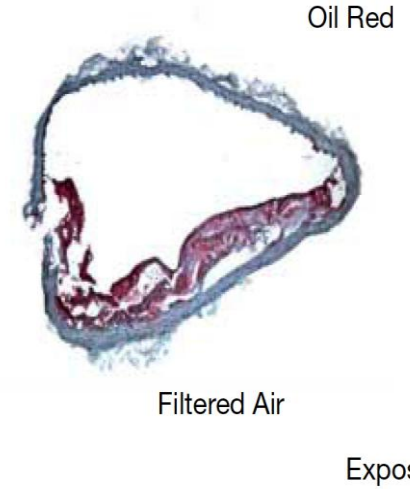
Brook, R. D. et al. Circulation 2004;109:2655-2671

Normal air

Normal Diet



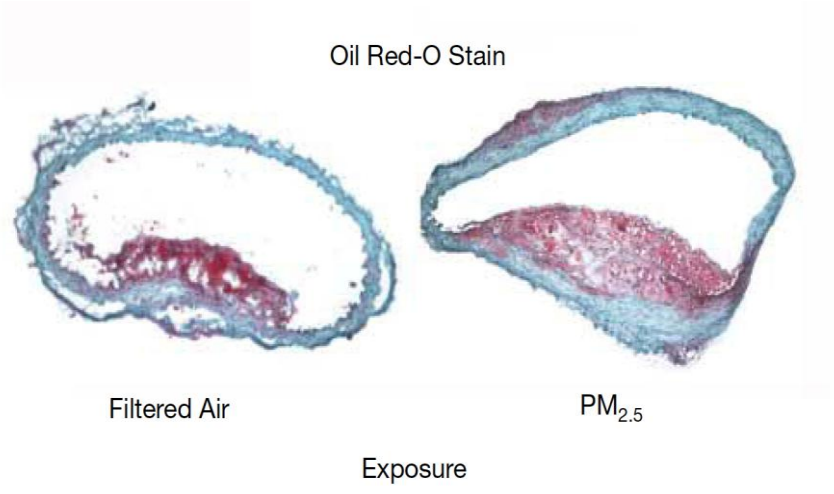
Fat Diet



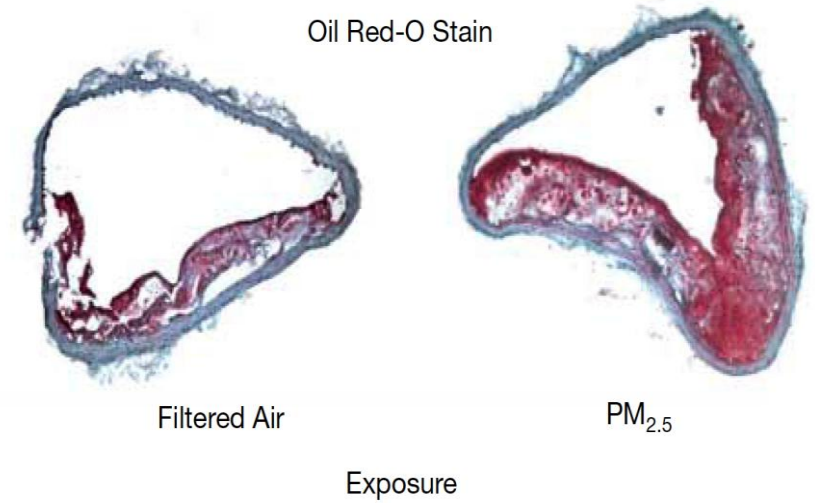
Long-term Air Pollution Exposure and Acceleration of Atherosclerosis and Vascular Inflammation in an Animal Model. JAMA 2005. 294: 3003-3010

Normal air Polluted air

Normal Diet



Fat Diet



Long-term Air Pollution Exposure and Acceleration of Atherosclerosis and Vascular Inflammation in an Animal Model. JAMA 2005. 294: 3003-3010

Residential Exposure to Traffic Is Associated With Coronary Atherosclerosis

B. Hoffmann, S. Moebus, S. Möhlenkamp, A. Stang
Schmermund, M. Memmesheimer, K. Mann, R. Erbe
Nixdorf Recall Study Investiga
Circulation 2007;116:489-496; originally publ

Ci
Cop

Exposure to Traffic and t

Annette Peters, Ph.D., Steph
Ines Trentinaglia, B.S., Allmut Hörmann, M.S., H. Erich Wichmann, M.D., Ph.D., and Hannelore Löwel, M.D.,
for the Cooperative Health Research in the Region of Augsburg Study Group

Long-Term Exposure to Traffic-Related Air Pollution and the Risk of Coronary Heart Disease Hospitalization and Mortality

Wen Qi Gan, Mieke Koehoorn, Hugh W. Davies, Paul A. Demers, Lillian Tamburic, and Michael Brauer

HEART

Effects of air pollution on the incidence of myocardial infarction

K Bhaskaran, S Hajat, A Haines, et al.

Heart 200
doi: 10.1

Associations of Fine and Ultrafine Particulate Air Pollution With Stroke Mortality in an Area of Low Air Pollution Levels

Jaana Kettunen, Timo Lanki, Pekka Tiittanen, Pasi P. Aalto, Tarja Koskentalo, Markku Kulmala, Veikko Salomaa and Juha Pekkanen

Stroke 2007;38;918-922; originally published online Feb 15, 2007;
DOI: 10.1161/01.STR.0000257999.49706.3b

Increased Particulate Air Pollution and
Annette Peters, Douglas W. Dockery, Ja
Circulation 200

ENVIRONMENTAL DISASTERS

1953 Sixty-eight dead and hundreds crippled by eating mercury-tainted fish in Minamata, Japan

1957 Nuclear explosion in Chelyabinsk, Russia, exposes 270,000 people to high doses of radiation

1978 Toxic wastes, including dioxin, discovered in Love Canal neigborhood, near Niagara Falls, N.Y.

1984 Gas leak at Union Carbide plant in Bhopal, India, kills 10,000 in worst industrial accident ever

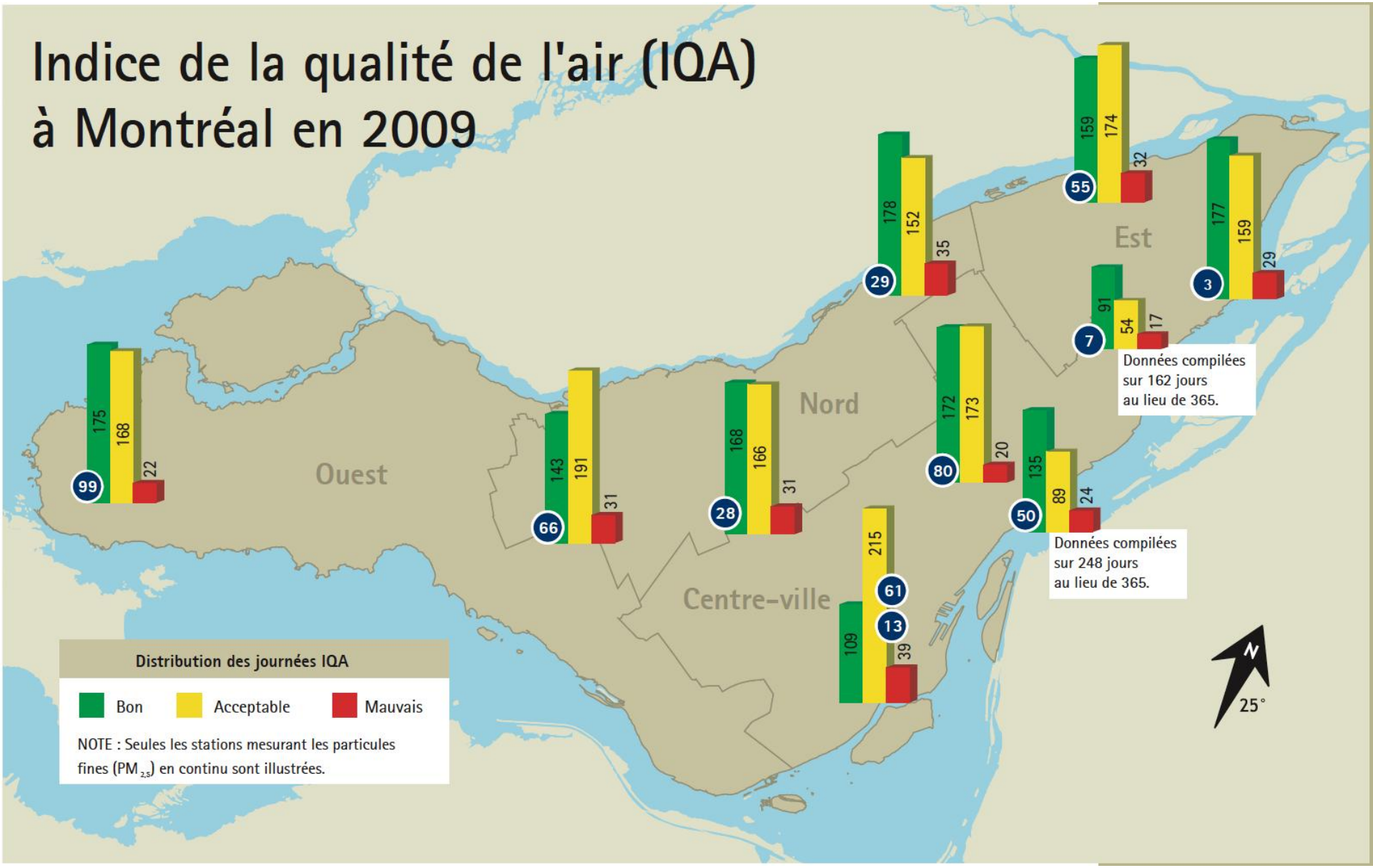
1986 Meltdown at Soviet nuclear power plant in Chernobyl releases radioactive materials

1989 *Exxon Valdez* runs aground off the coast of Alaska, spilling 11 million gallons of oil

Environmental Contribution to Canadian Cardiac Disease Burden

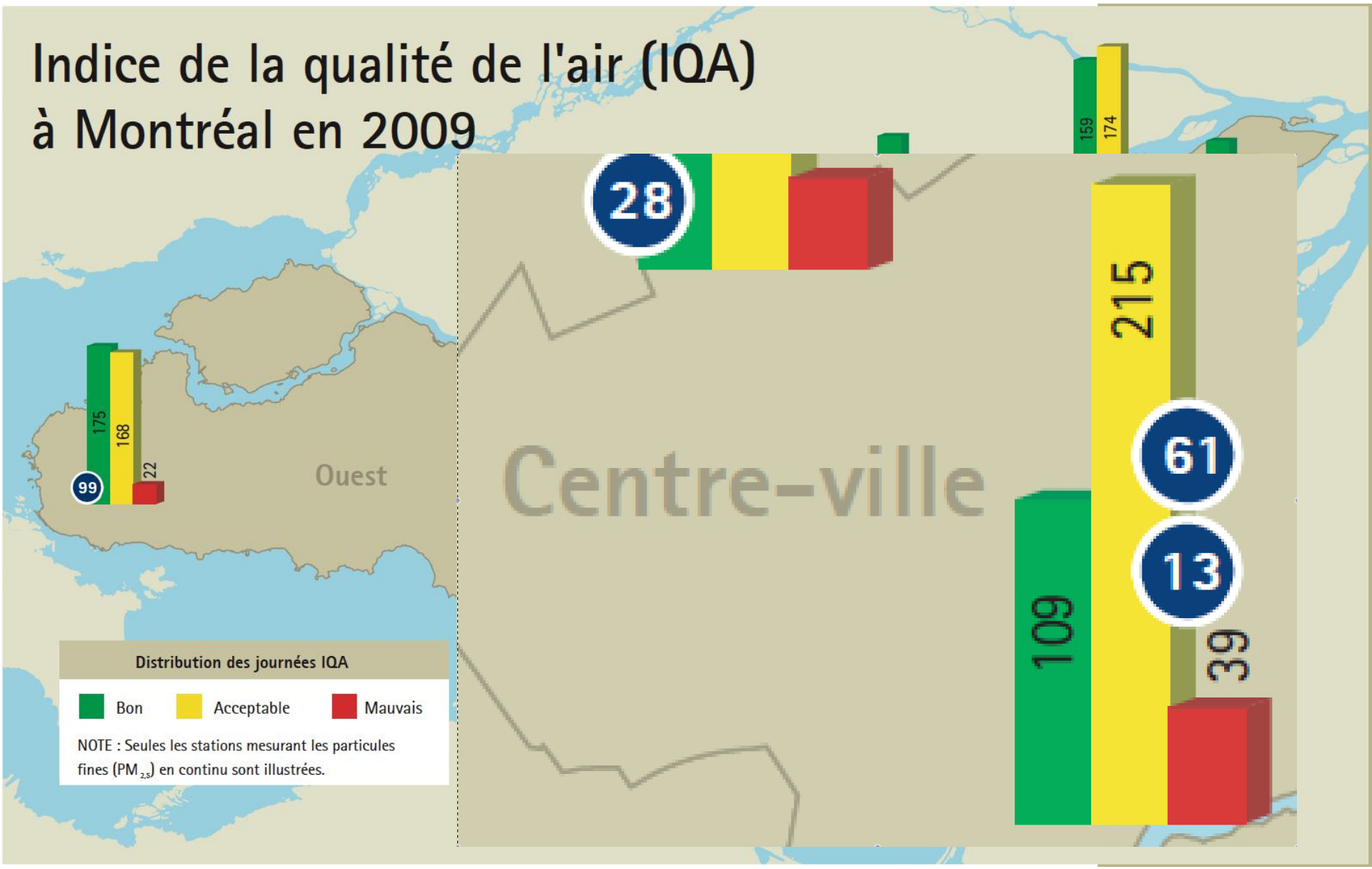
- 20,000 deaths (in excess)
- 5-11 000 cardiovascular deaths
- 33-67 000 cardiac hospitalizations
- 1,5 millions hosp days for heart disease
- 9,1 billions dollars

David R.Boyd, Stephen J. Genuis
Envir. Research, 2008, 106:240-249.

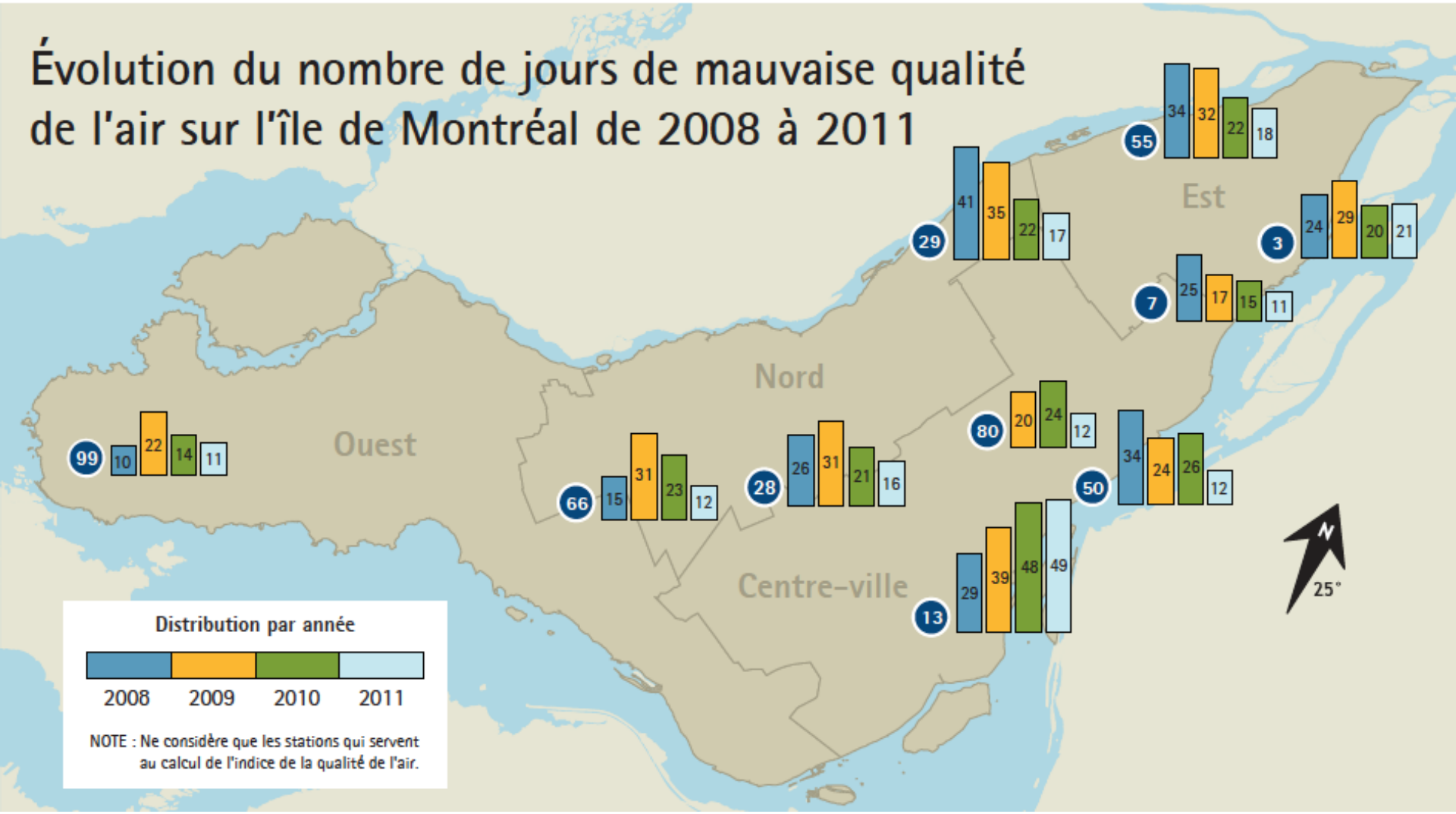


Source: RSQA, Ville de Montréal

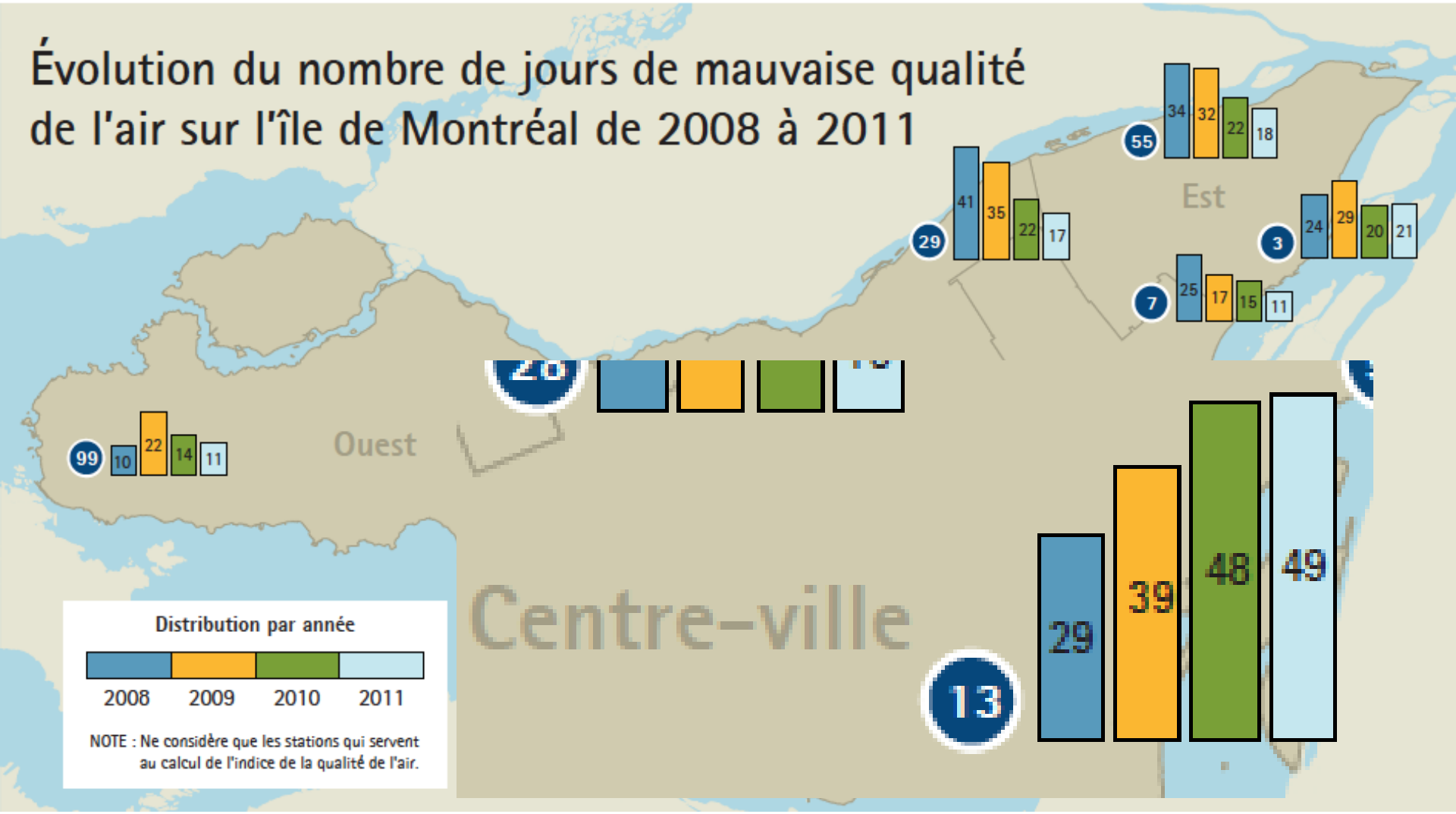
Indice de la qualité de l'air (IQA) à Montréal en 2009



Source: RSQA, Ville de Montréal



Source: RSQA, Ville de Montréal



Source: RSQA, Ville de Montréal

Ambient Air Pollution and the Risk of Acute Ischemic Stroke

Gregory A. Wellenius, ScD; Mary R. Burger, MD; Brent A. Coull, PhD; Joel Schwartz, PhD; Helen H. Suh, ScD; Petros Koutrakis, PhD; Gottfried Schlaug, MD, MPH; Diane R. Gold, MD, MPH; Murray A. Mittleman, MD, DrPH

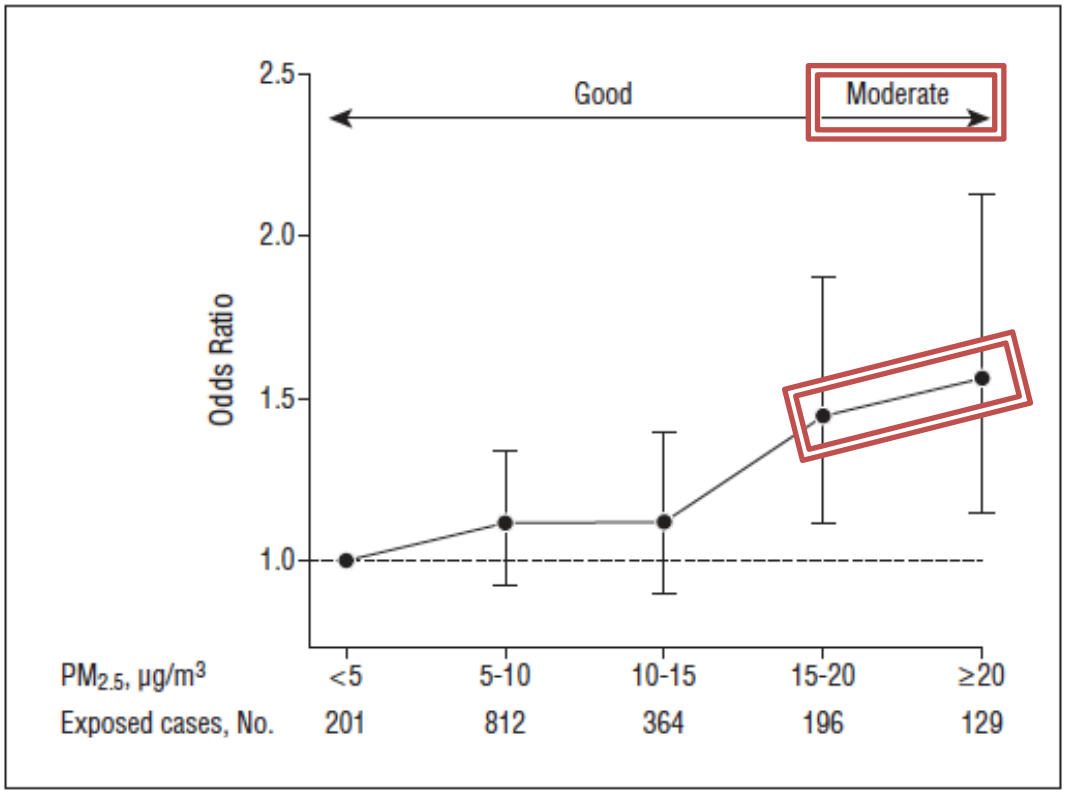
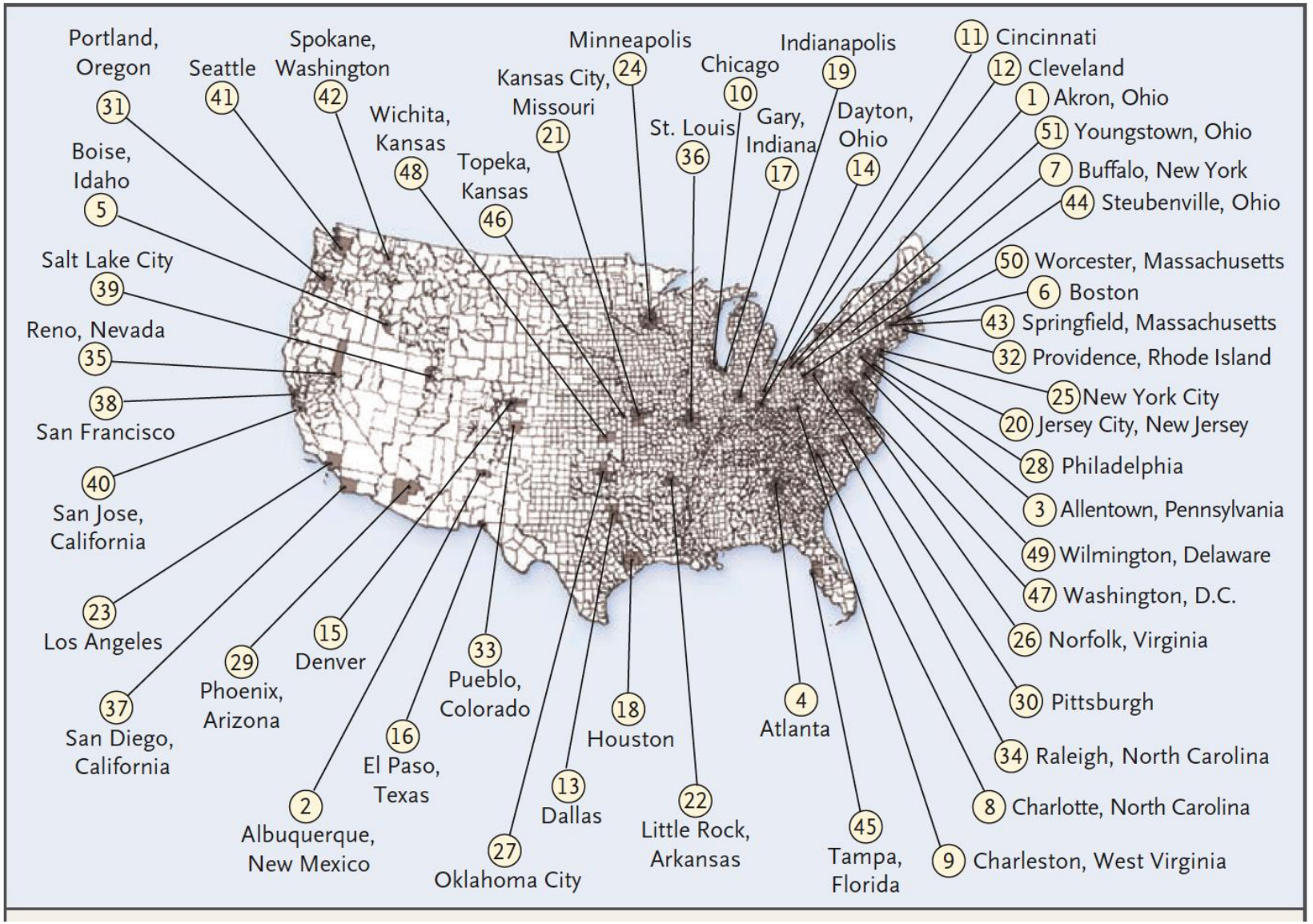


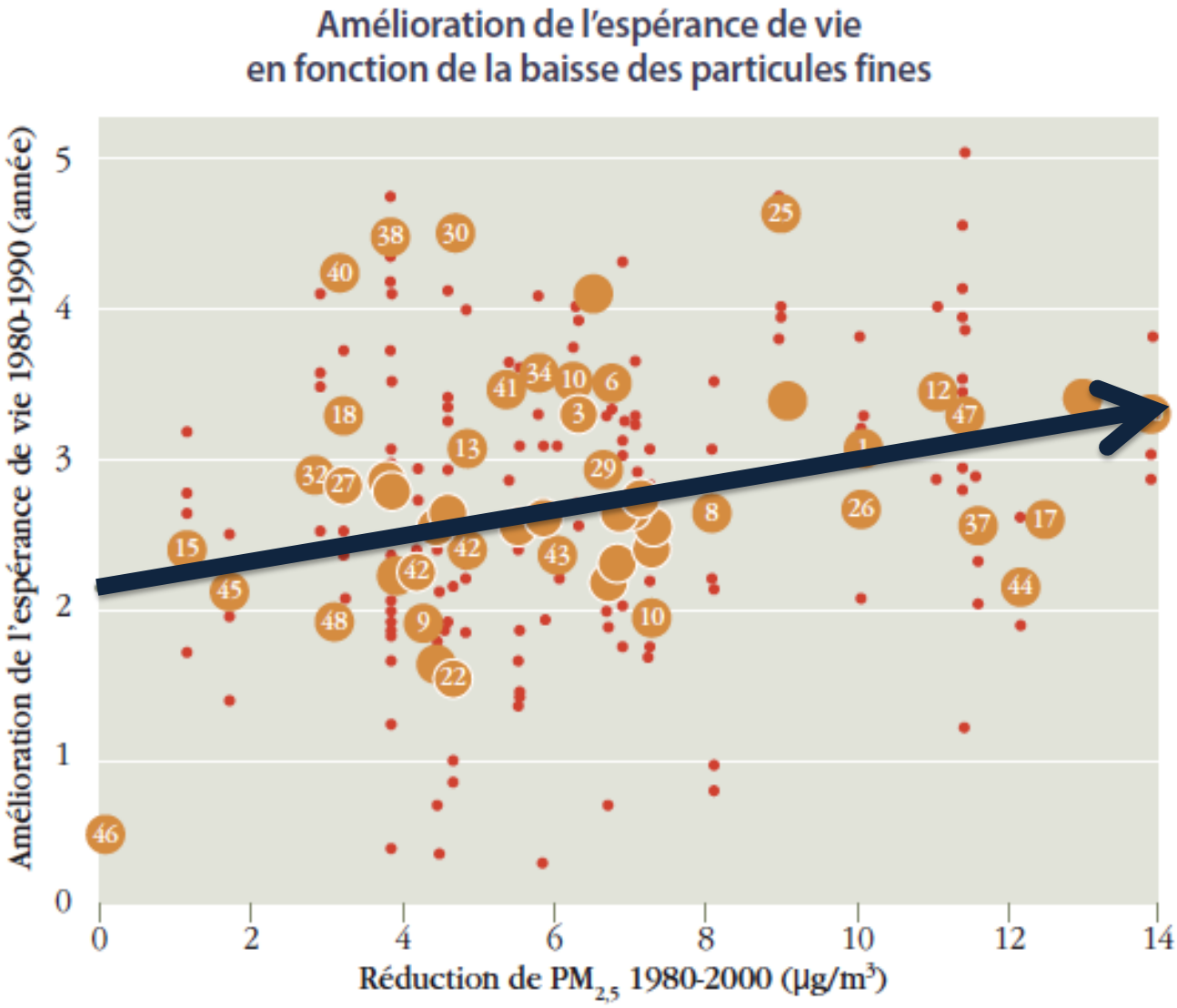
Figure 1. Odds ratio of ischemic stroke onset for US Environmental Protection Agency categories (*good* and *moderate*) of mean ambient fine particulate matter air pollution ($PM_{2.5}$) levels in the 24 hours preceding stroke onset. Error bars indicate 95% CIs.

A cardio-protective city

- Eradicate food nano-agressors
- Eradicate airborne nano-agressors
- Eradicate fossil fuel form the milieu
- Develop with renewable energies
  - Earth is geothermy
  - Wind is eolian
  - Water is hydrolic
  - Fire is solar
- Aim at a 25 % urban canopy.



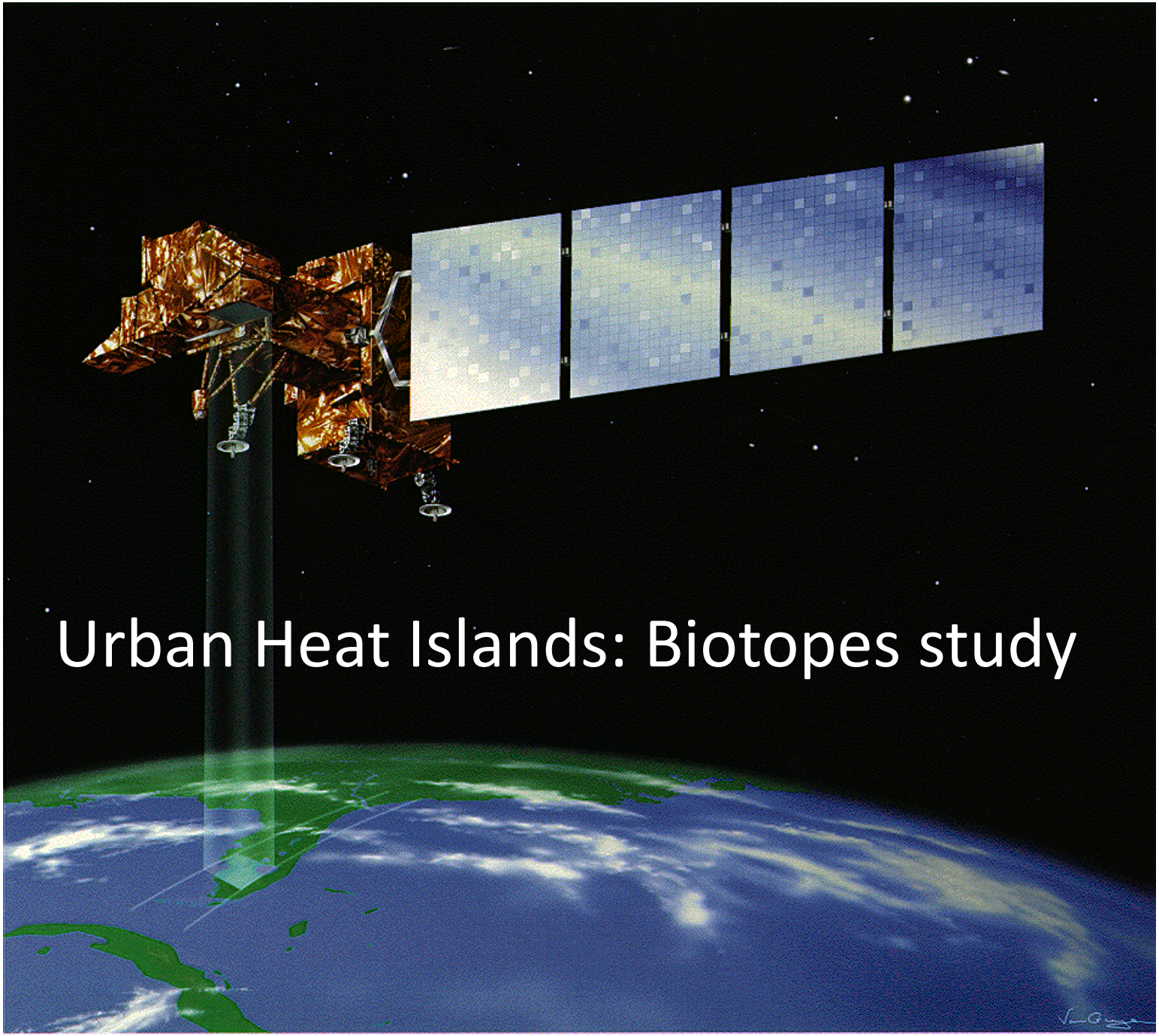
Fine-particulate air pollution and life expectancy in the United States .
C. Arden Pope III, Majid Ezzati et Douglas W. Dockery.
New England Journal of Medicine 2009 360 : 376-86.

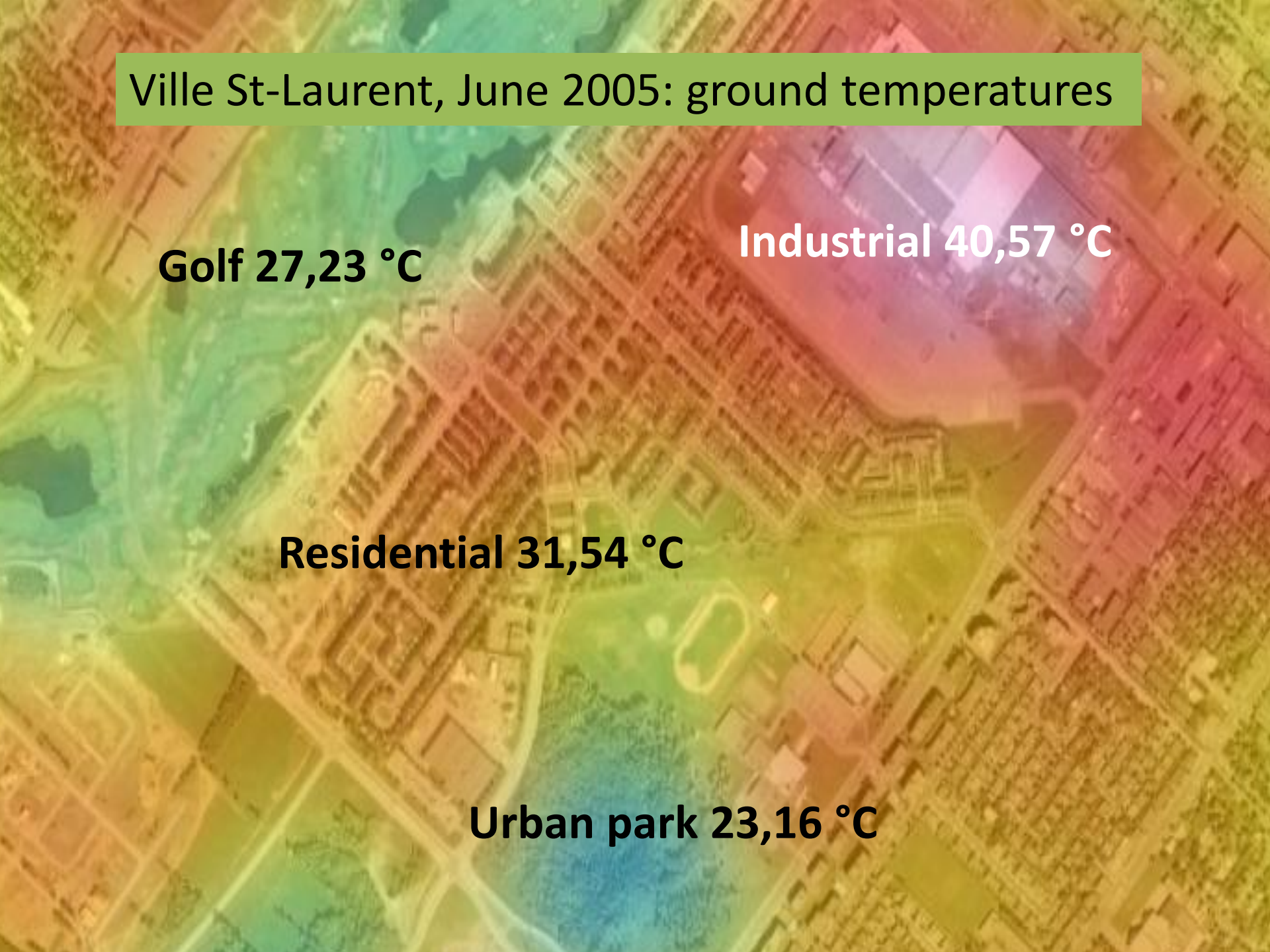


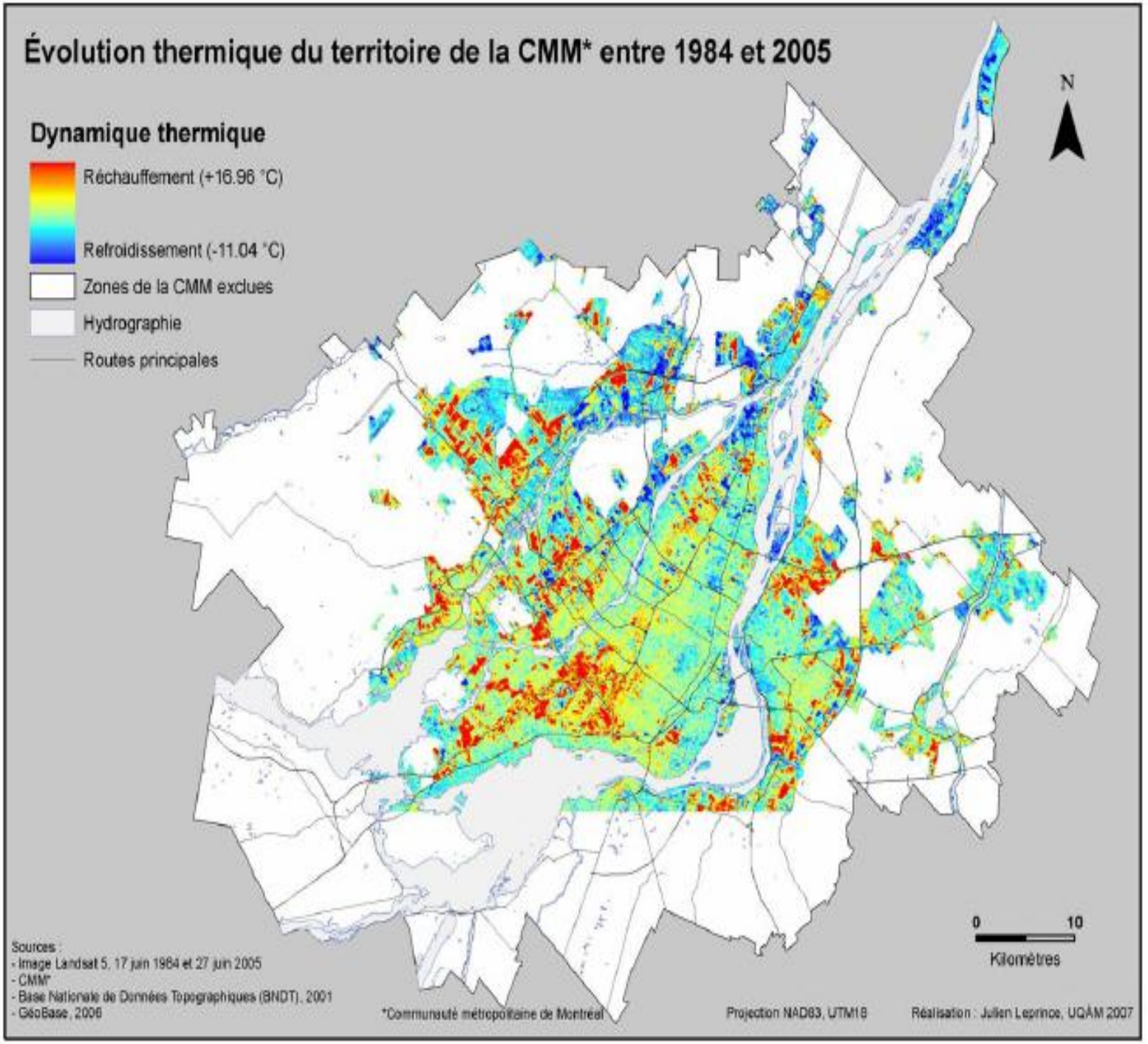
Fine-particulate air pollution and life expectancy in the United States .
C. Arden Pope III, Majid Ezzati et Douglas W. Dockery.
New England Journal of Medicine 2009 360 : 376-86.

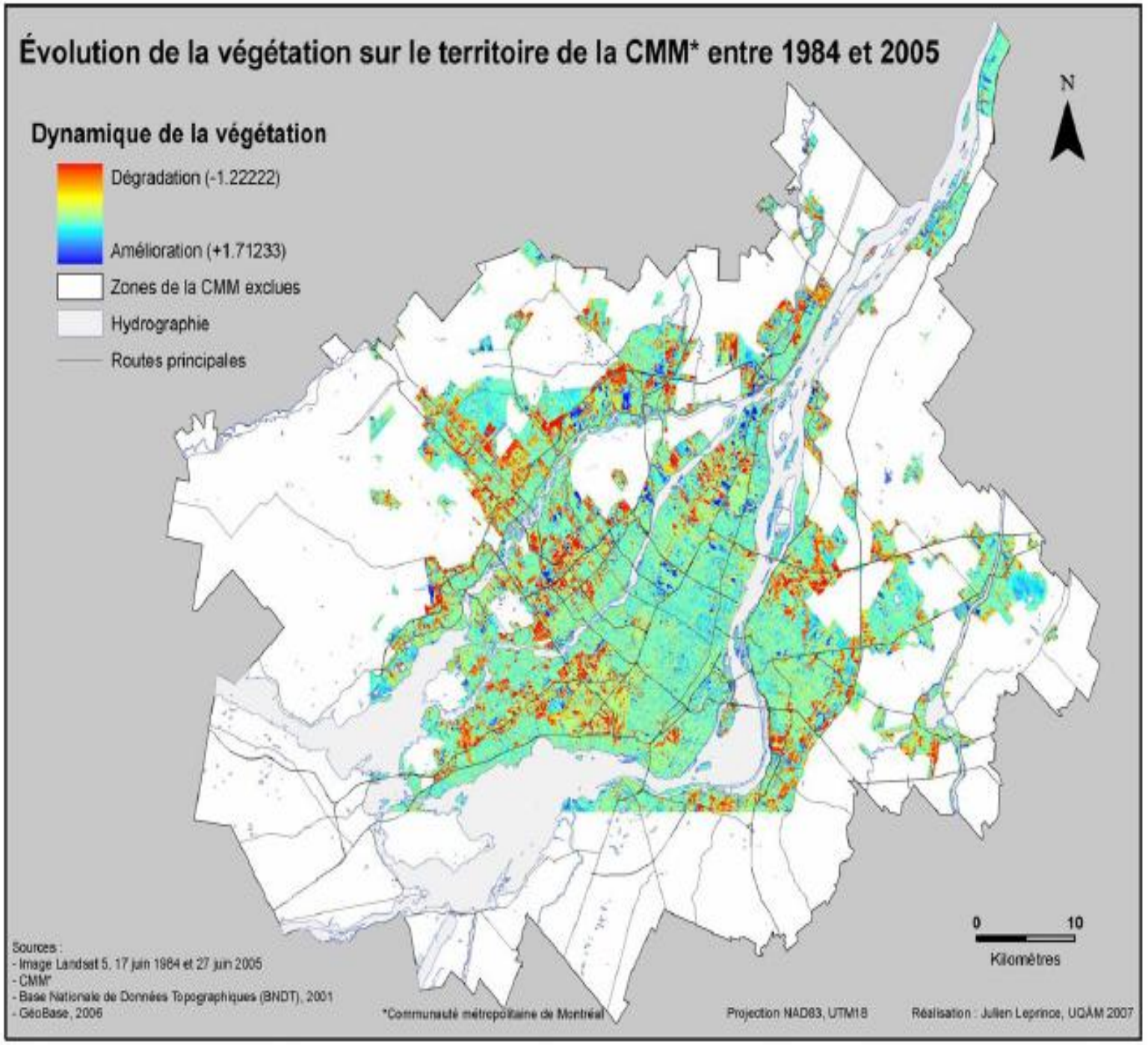
A cardio-protective city

- Eradicates food nano-agressors
- Eradicates airborne nano-agressors
- Eradicates fossil fuel form the milieu
- Develops with renewable energies
  - Earth is geothermy
  - Wind is eolian
  - Water is hydrolic
  - Fire is solar
- Aims at a 25 % urban canopy.

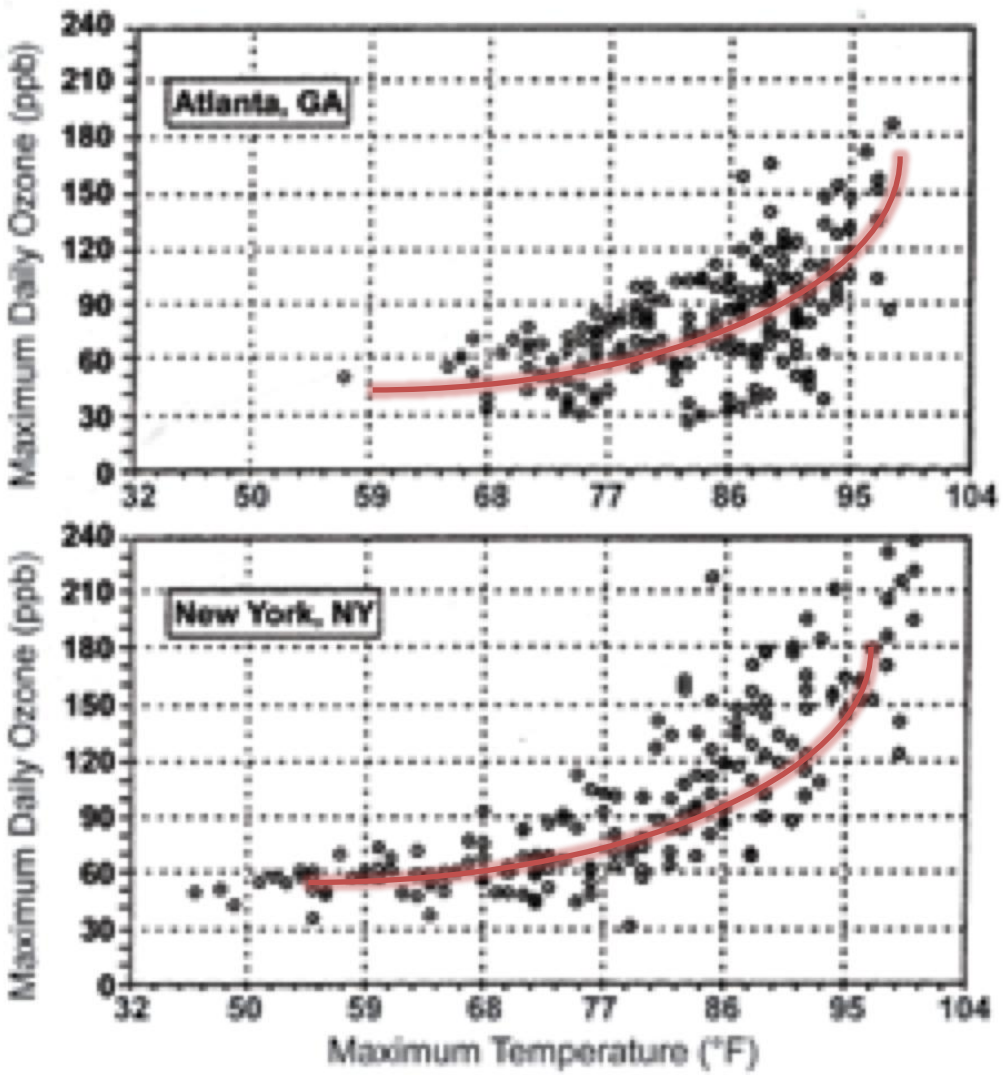

Urban Heat Islands: Biotopes study


Ville St-Laurent, June 2005: ground temperatures
Golf 27,23 °C
Industrial 40,57 °C
Residential 31,54 °C
Urban park 23,16 °C


Évolution thermique du territoire de la CMM* entre 1984 et 2005
Dynamique thermique
Réchauffement (+16.96 °C)
Refroidissement (-11.04 °C)
Zones de la CMM exclues
Hydrographie
Routes principales
N
0
10
Kilomètres
Sources :
- Image Landsat 5, 17 juin 1984 et 27 juin 2005
- CMM*
- Base Nationale de Données Topographiques (BNDT), 2001
- GéoBase, 2006
*Communauté métropolitaine de Montréal
Projection NAD83, UTM18
Réalisation : Julien Lesmoe, UQAM 2007


Évolution de la végétation sur le territoire de la CMM* entre 1984 et 2005
Dynamique de la végétation
Dégradation (-1.22222)
Amélioration (+1.71233)
Zones de la CMM exclues
Hydrographie
Routes principales
N
0
10
Kilomètres
Sources :
- Image Landsat 5, 17 juin 1984 et 27 juin 2005
- CMM*
- Base Nationale de Données Topographiques (BNDT), 2001
- GéoBase, 2006
*Communauté métropolitaine de Montréal
Projection NAD83, UTM18
Réalisation : Julien Leprince, UQÀM 2007

Warming increases pollutants toxicity



US Global Climate Change Program Research, 2009

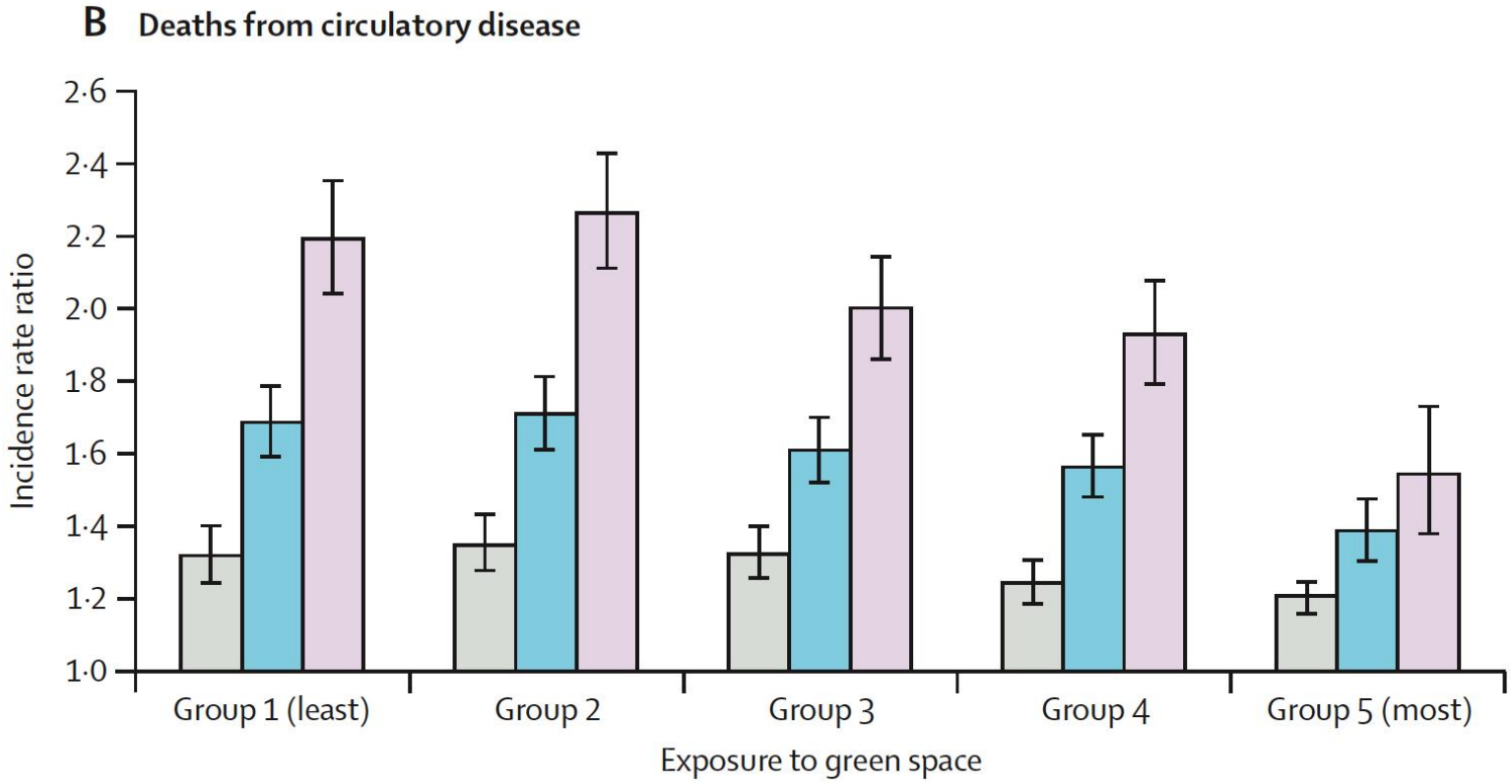
THE LANCET

Effect of exposure to natural environment on health inequalities: an observational population study

Richard Mitchell, Frank Popham

- ✓ 2001-2005
- ✓ 40 millions of non-retired british subjects
- ✓ 360 000 deaths records
- ✓ 4 quartiles according to income
- ✓ 5 quintiles according to green exposure

Lancet, Vol 372, 9650, 1655-1660, 8 Nov 2008,



Green exposure: Reduction by half (from 219 % to 154%) of the difference of deaths by circulatory disease between poors (lower quartile) and riches (higher quartile).

Effect of exposure to natural environment on health inequalities; an observational population study. R Mitchell, F Popham. Lancet, nov 2008

Shinrin-yoku

The term *Shinrin-yoku* (taking in the forest atmosphere or forest bathing) was coined by the Japanese Ministry of Agriculture, Forestry, and Fisheries in 1982. It can be defined as making contact with and taking in the atmosphere of the forest: a process intended to improve an individual's state of mental and physical relaxation [13]. *Shinrin-yoku* is considered to be the most widespread activity associated with forest and human health.

Environ Health Prev Med (2010) 15:18–26
DOI 10.1007/s12199-009-0086-9

SPECIAL FEATURE

The Trends on the Research of Forest Bathing in Japan, Korea and in the World

The physiological effects of *Shinrin-yoku* (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan

Bum Jin Park · Yuko Tsunetsugu · Tamami Kasetani · Takahide Kagawa · Yoshifumi Miyazaki

Received: 18 July 2008 / Accepted: 6 April 2009 / Published online: 2 May 2009

Table 1 Measured physiological parameters and subjective evaluation

Autonomic nervous activity	Pulse rate, systolic blood pressure, diastolic blood pressure
	Heart rate variability (HRV)
	HF component (parasympathetic nervous activity)
	LF/HF or LF/(LF + HF) (sympathetic nervous activity)
Endocrine system activity	Salivary cortisol concentration
Immune system activity	Salivary immunoglobulin A concentration

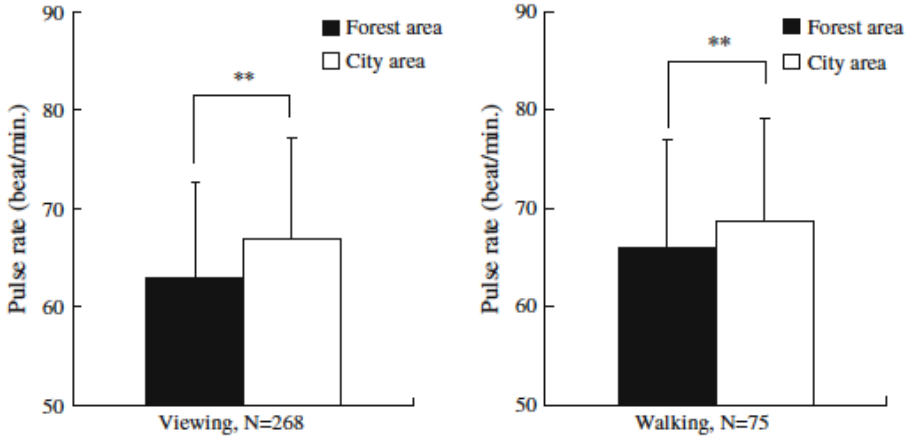


Fig. 3 Change in pulse rate after forest viewing and walking. Mean ± SD; ** $p < 0.01$; p value by t test

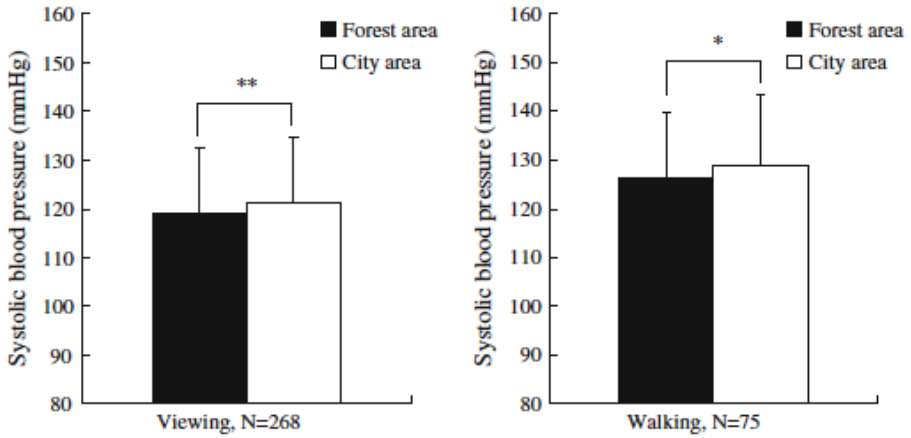


Fig. 4 Change in systolic blood pressure after forest viewing and walking. Mean ± SD; ** $p < 0.01$; * $p < 0.05$; p value by t test

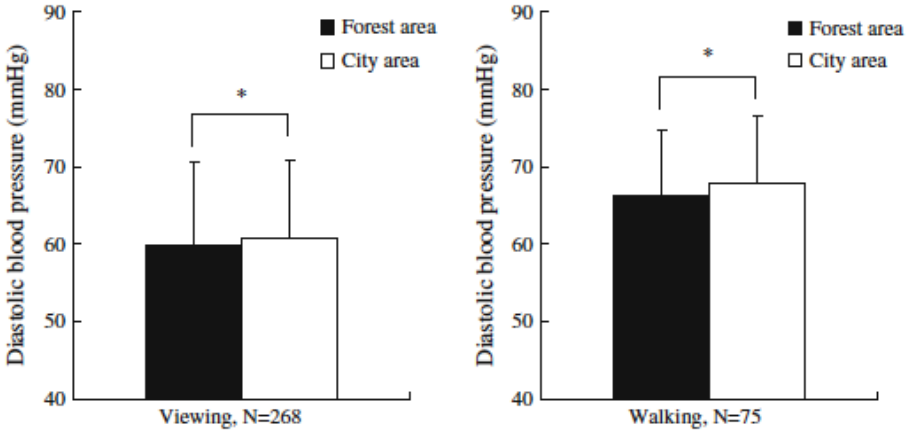


Fig. 5 Change in diastolic blood pressure after forest viewing and walking. Mean ± SD; * $p < 0.05$; p value by t test

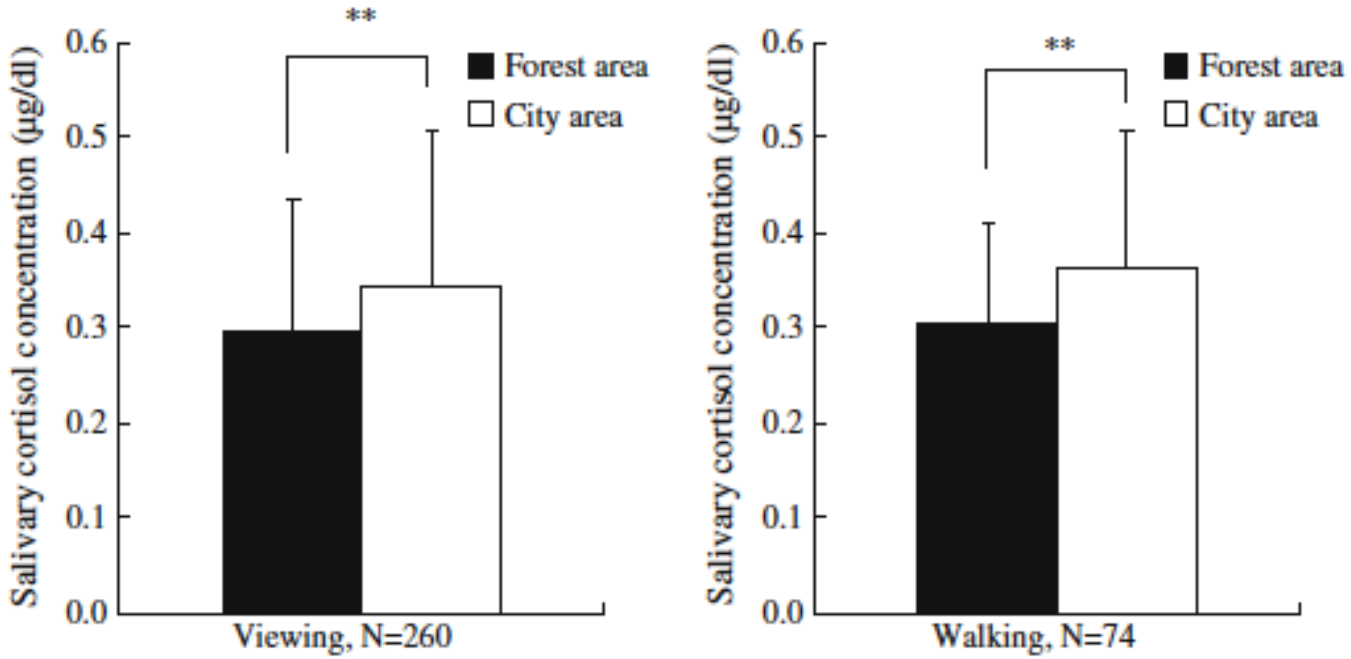


Fig. 2 Change in salivary cortisol concentration after forest viewing and walking. Mean ± standard deviation (SD); ** $p < 0.01$; p-value by t test

salicylate de méthyle

alcaloïdes

diterpénoïdes

Limonoïdes

saponine

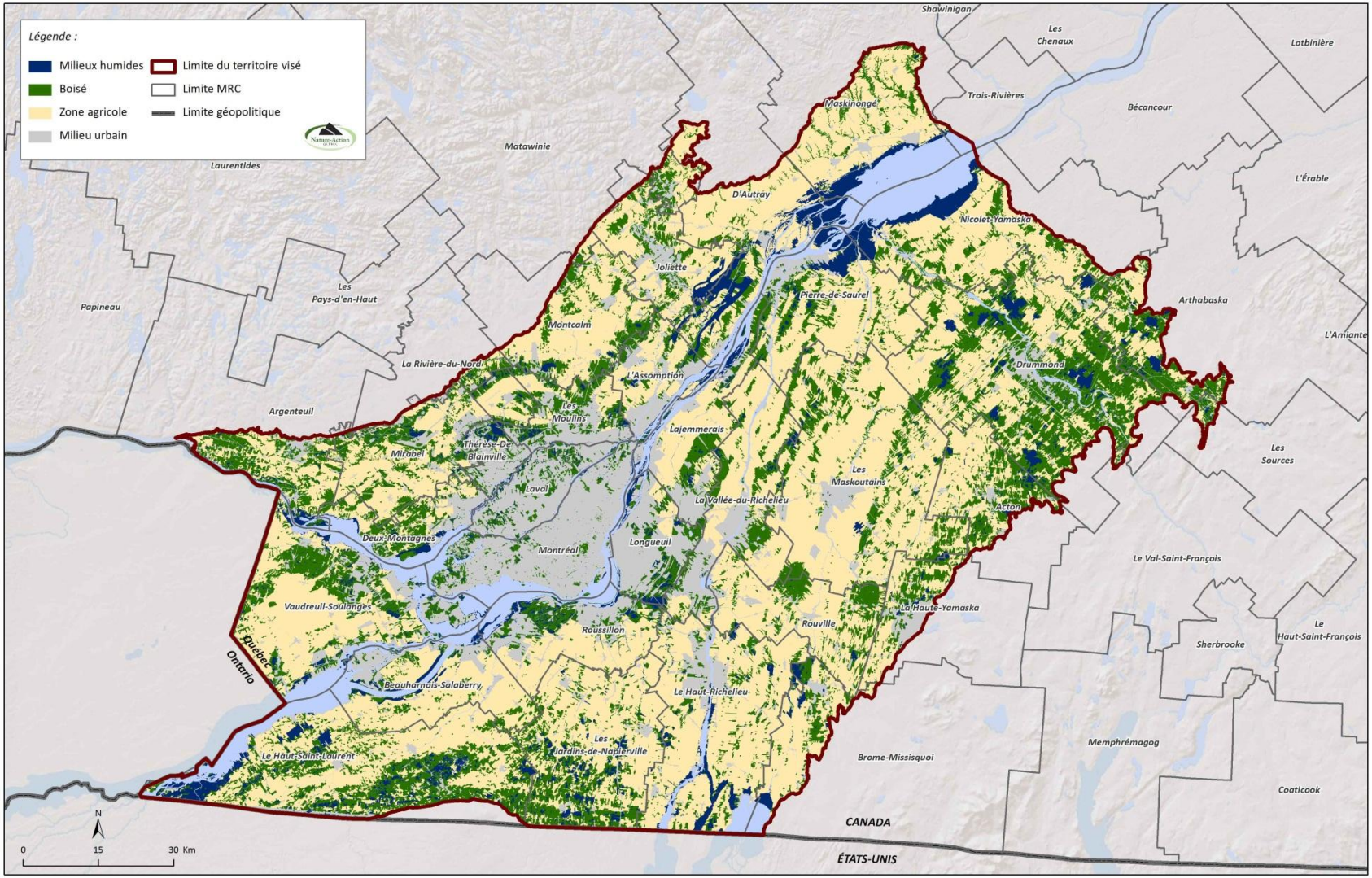
phénols

cucurbitacine

cardenolide

glucoside

La ceinture verte



If a City eliminates

- ✓ **Food nano-agressors**
  - ✓ Trans Fat
  - ✓ Excess of Salt
  - ✓ Fructose-Glucose
  - ✓ Phosphoric Acid
- ✓ **Air nano-agressors**
  - ✓ CO
  - ✓ SO2, NO2
  - ✓ FP, UFP
  - ✓ VOC

And promotes a green and active milieu

This City may expect a
25-75 % reduction of cardiac disease

"After all, CVD was not common in 1830, so why can't it now become uncommon by 2050? That is the challenge **we all** face."

Dr Salim Yusuf
Cardiologist and epidemiologist
McMaster University, Hamilton, Ontario

Que préférez-vous ?

Ville

Que préférez-vous ?

Industrie

Que préférez-vous ?

Rue

Que préférez-vous ?

École

Que préférez-vous ?

Loisir


LE PROJET

ÉCO-CAMPUS

HUBERT REEVES

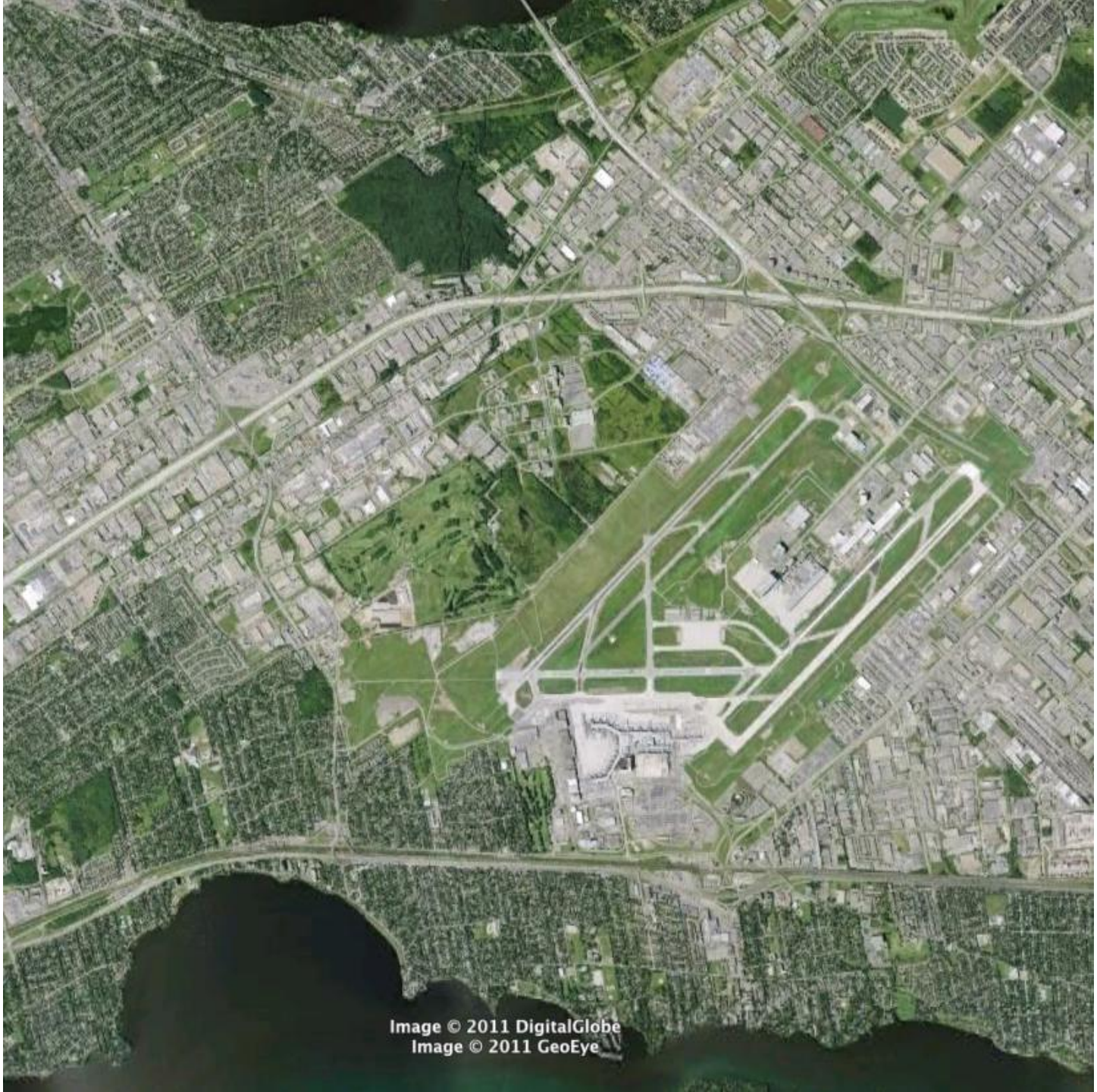


Image © 2011 DigitalGlobe
Image © 2011 GeoEye


Boulevard Alfred-Nobel
Rue Alexander-Fleming
Chemin Saint-François
Futur parc régional
des Sources
Aéroport internat
Pierre-Elliott-Truc
de Montréal

Écopsychologie : la psy se met au vert

Crise écologique | L'homme vit coupé de la nature, et tous les deux en souffrent. Soigner la planète pour se soigner soi (et vice versa), tel est l'objectif de l'écopsychologie, une nouvelle approche en plein essor outre-Atlantique et qui arrive en France. PAR SYLVAIN MICHELET

Université de Montréal

MÉDECINS FRANCOPHONES DU CANADA

Dr François Reeves

Planète Cœur

SANTÉ CARDIAQUE ET ENVIRONNEMENT

Éditions du CHU Sainte-Justine

ÉDITIONS MULTIMONDES