Green urbanism
The new face of Paris in the 21st century

Lucie Laurian
Urban & Regional Planning
The University of Iowa
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Population

- France: 65.4 million
- Paris 2.2 million
  - 12 million in urban area
Typical focus on urbanism in Paris
Haussmann
Presidential Big projects
New framework: environmental sustainability
An National Ecological New Deal?

- Grenelle 1 (2008): Environmental goals
- Grenelle 2 (July 2010): implementation gap
  - Carbon tax cancelled
  - Reduction in ag. pesticides abandoned
  - Distributed power production more difficult
• Plus side
  – National support for urban sustainability
  – Ecolabels launched
  – 2008 Exemplary Administration Plan
  – Building energy performance
  – 2008 Sustainable Cities Plan: green neighborhoods
Environmental sustainability in Paris
Paris history

• Roman in 52BC, Medieval city

• Capital since the 16\textsuperscript{th} cent.

• Major modernization in the 19\textsuperscript{th} cent.

• Last decade: toward a greener city
Leadership

• Socialist Mayor Delanoë since 2001
  – Socialist-green coalition

• Tensions between Paris & national government
  – Fronde, Revolution
  – No Mayor between 1871 and 1977 (Seine Prefect )
  – 1977- 1995: Chirac
Assets and Constraints

- 2.2 million residents, 10 million commuters
- Employment center, cultural amenities
- Land area: 41 mi$^2$ (4.5 X 6.2mi)
  - Density: 63,320/mi$^2$ (up to 100,000mi$^2$)
- 75% of residential buildings built before 1914
- Social inequalities
Dimensions of environmental sustainability

• Air and water quality

• Climate change, energy, GHG emissions
  – Adaptation
  – Energy and GHG emissions
    • Buildings
    • Transportation

• Green spaces and biodiversity
Water quality
Drinking water sources

Source: Eau de Paris www.eaudeparis.fr
Air pollution
Air pollution: PM10
Air pollution: benzene
Air pollution NO2

Moyennes annuelles de dioxyde d'azote (NO2) à Paris

2009

μg/m³

>=64
61
58
55
52
49
46
43
40
37
34
31
28
25
22
19
16
13
10
7
4
<1

Objectif de qualité
• Compliant with EU standard for SO2, CO, lead
• Non-compliant for NO2, ozone, roadside benzene

• Sources
  – #1 Transportation, #2: Heating, #3 Industry
  – Transportation:
    • 77% of CO
    • 52% of NO2
    • 36% of PM10
    • 28% of CO2 (heating: 45%)
Airparif Balloon

- Ambient
- Roadside

Source: Airparif
http://www.airparif.asso.fr/page.php?rubrique=actualites&article=ballon_inauguration
Climate plan (2007)

- Adaptation
- Energy efficiency
- Transportation
Adaptation to climate change

- Heat waves
- Flood risks
Heat waves

- Summer 2003: above 30°C for weeks
  - some days above 40°C (104 °F)

- CHALEX database
- Intergenerational solidarity

- Avoid reliance on AC
Flooding

1910 flood
Floodable areas

Source : Plan Boreux de la crue de 1910 (Rapport Picard)
Adaptation to flood risks

- **Water elevation (Austerlitz bridge)**
  - 3m: roads along the Seine close
  - 7m (1955, 1924): buildings, public services affected
  - 8m (1910, 1658): service provision compromised

- Flood information to all homeowners

- EDF must provide service on 2\textsuperscript{nd} floors & above during flood events (waterproof network)
DOCUMENT DE TRAVAIL juin 2003

- Zone d'inondation des voies publiques en 1910
- Zone d'inondation des caves en 1910
- Enveloppe de la zone d'alimentation électrique fragilisée, dans l'hypothèse d'une crue type 1910
  - absence de certains secours
  - risques de coupures brèves ou
  - dans certains cas de longue durée

Beyond adaptation
Planning to reduce climate change

• Energy and GHG emissions audit

• Focus on
  – Buildings
  – Energy use and production
  – Transportation

• Land use & transportation plans must be consistent with climate plan
GHG emissions (Carbon equivalent)
GHG emissions by sector

Bilan Carbone de Paris

~ 6 550 000
 tonnes équivalent carbone

1 750 000
BATIMENT

1 750 000
Transports des personnes

1 750 000
Transports des marchandises

1 300 000
Consommation et déchets

Source: Plan Climat de Paris 2007, p.5
Administration GHG emissions

**Bilan Carbone de l’administration parisienne**

- **69 000** tonnes équivalent carbone
- **253 200** tonnes équivalent CO₂

- **23 500**
  - Chauffage gaz, fioul, vapeur

- **11 500**
  - Electricité bâtiment éclairage public

- **2 200**
  - Climatisation

- **15 500**
  - Matériaux entrants

- **12 500**
  - TRANSPORTS

- **4 000**
  - Amortissement

- **-200**
  - Déchets

Source: Plan Climat de Paris 2007
Source of residential GHG emissions

Résidentiel : 900 000 t Eq. C

Gaz 51%
Electricité 26%
Vapeur 8%
Fuel Domestique 8%
Autres (charbons, bois, fuel lourd...)

Émissions du secteur résidentiel
Bilan carbone de Paris - 2004

Source: Plan Climat de Paris 2007
Tourism GHG emissions

Evaluation des visiteurs

~ 4 425 000 tonnes équivalent carbone

En voiture: 220 000
En autocar: 35 000
En avion: 4 050 000
Nourriture: 120 000

Source: Plan Climat de Paris 2007
Buildings
Buildings

• Nationally
  – 42% of energy consumption
  – 23% of Co2 emissions
  – 1/3 of greenhouse gas emissions

• In Paris:
  – 85% built before 1975
  – 48% before 1915
  – 25% before 1850
Age of buildings

Purple: before 1800
Blue: 1800-1890
Green: 1890-1922
Yellow-orange: 1930-1980
Red-brown: since 1980

Source: APUR Atelier Parisien d’Urbanisme  http://www.apur.org/
Thermography study

- Aerial study, March 2009
- All roofs, sample of facades

Source: APUR
Municipal buildings

• Energy diagnostic for 3000 public structures

• New constructions
  – Goal: 50kWh/m² (heating, cooling, hot water, lights)

• City manages 220,000 subsidized housing units
  – Current energy consumption: 270kWh/m²
  – Renovations goal: 80 kWh/m²
Municipal energy production

- District heating (CPCU)
  - Steam and hot water
  - 45% from incineration
  - Goal: 60% from biomas/ waste
    - Lower tax (5.5% vs 19.6%)
    - Plan to increase geothermal
Renewable energy

• Goal: increase by 30% by 2020
  – Biomass, incineration
  – More solar, geothermal, wind, hydro

• CPCU : 45% from incineration
• EDF electricity: 14% renewable

• Since 2008: assessment of
  – Geothermal potential
  – Wind turbines at Périph. interchanges
  – Low speed underwater turbines
Private buildings: energy efficiency

- 1.4 million units, 96,000 buildings

- Subsidies for insulation projects (grants)

- 1\textsuperscript{st} large scale insulation program
  – 13\textsuperscript{th} district, 1940-81 structures

- New energy-efficient developments eligible for higher density
Projects highlights: Innovations in 3 ZAC projects

- Rungis (13\textsuperscript{th}): 3.9ha, 300 units, services
  - high insulation, 4,000m2 PV panels, solar water heating, geothermal

- Clichy-Batignolles (17\textsuperscript{th}): 59ha, 3,500 units, services
  - Insulation, passive solar, geothermal, PV panels
  - Goal: energy use < 38KWh/m2

- Frequel-Fontarabie (20\textsuperscript{th}): rehab of insalubrious structures & new construction
  - Most ambitious, ECOQUARTIER prize
  - Goal: 65kW/m2 for rehab
  - 15kWh/m2 for new structures
Transportation

- Transit
- Walking/biking
Transportation plan

• **Goal:** reduce GHG emissions from transportation by 25% by 2013, 60% by 2020 (vs 2004)
Passenger transportation

• Support low-emissions vehicles
  – lower parking rates for small, electric cars
  – recharge stations

• More park-and-ride facilities

• Transit system
  – Extension
  – More connections
Paris transit system

• Bus
• Metro
• Tramways
• Boats
Bus

- 1662: horse-drawn carriage; 1828-1913: Omnibus

- Now
  - 64 lines in Paris, 200 in suburbs
  - 1 billion passengers / yr
  - 6 busiest lines serve 11-17 million passengers / yr
  - 4,580 buses
    - 537 articulated double buses
    - 62 electric midibuses in Montmartre
    - 103 minibuses (Traverses)
  - Noctilien (00:30 - 05:30am)

•
Bus
Mobilien
Metro

- Since 1900
- 14 lines
- 214 km (133 mi)
- 300 stations (62 transfer points)
- 2 minutes between stops
Other transit modes

• RER: suburban train
  – 5 lines, 257 stops, 587km of rails
  – connect with Metro, bus, train stops
  – 450 millions passengers / yr

• River shuttle Voguéo since 2008
  – 5 stops

• Tramway
  – Petite Ceinture: 16 million passengers / yr
Tramway

Source: Mairie de Paris
Regional transportation planning
Regional transportation plan (2008)

- 300km bus
- 120km tramway
- 105km tram-train
- 20km RER
- 13 multimodal nodes
- 80km metro (incl. 60km Arc Express)
  - > 61 projects, 24 underway
  - > €18 billion (€ 12 approved)
Sarkozy’s Grand Paris

• Announced in 2007
• International competition in 2008
  – “post Kyoto Paris”
• Framed as project of national interest
• €35 billion
La rocade du Grand Paris
(le projet de Christian Blanc, 130 km, 60 stations)

Schéma du futur métro (130 km)

CDG-Express

Infographie : Le Monde
Source : Le Monde
<table>
<thead>
<tr>
<th></th>
<th>Double Loop (Sarkozy)</th>
<th>Arc Express (Region)</th>
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</thead>
<tbody>
<tr>
<td>Length</td>
<td>130 km</td>
<td>60 km</td>
</tr>
<tr>
<td>Speed</td>
<td>60 km/h</td>
<td>40 km/h</td>
</tr>
<tr>
<td>Stations, location</td>
<td>40 stations every 4-5 km links business centers</td>
<td>40 stations every 1-1.5 km link residential areas</td>
</tr>
<tr>
<td>Peak</td>
<td>6,000 passengers</td>
<td>15,000 passengers</td>
</tr>
<tr>
<td>Cost</td>
<td>€21 billion</td>
<td>€5 billion</td>
</tr>
<tr>
<td>Delivery</td>
<td>by 2023</td>
<td>by 2017</td>
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</table>
Update

• May 2010: Sarkozy’s plan adopted by National Assembly & Senate
  – Both alternatives to be debated
  – National government can’t finance without regional support
Non-motorized transportation

- Walking
- Biking
Walking

Density

-> walkability

Source: the author
Time-sharing on Paris’ roads

- “Paris respire”
  - High-speed roads along the Seine closed to traffic every Sunday and holiday 9-5pm

- “Paris Plage”
Paris Plage 2009

Source: author
Quiet and green neighborhoods
(Quartiers tranquilles/ verts)

• Speed limit 30km/2
• Amenities
  – Wider sidewalks, elevated crossings, lights, plantings, favor residential parking over traffic

• 2008
  – 67 neighborhoods
  – 18% of Paris area
New “Zone de rencontre”

20km/h
Priority to pedestrians

Dutch model: Woonerf in Utrecht, source: Author
Giving public space back to people
République Place

• 280m X 120m

• Connects 7 traffic axes, 5 Métro lines, 4 bus lines

• Cars: 60% of total space
Source: BBC News one-minute world news. January 30 2008 Taxi drivers block the place to protest against a government plan to open the trade to more competition. news.bbc.co.uk/2/hi/in_pictures/7217540.stm
Winning team: Trevelo & Viger-Kohler

Completion planned in 2013

http://www.paris.fr/portail/pratique/Portal.lut?page_id=9025
Rendering

A mega-pedestrian zone?
Rendering
Biking in Paris

- Bike lanes
- Low-speed zones
- Velib’
Bike lanes

• Since 2001
  – 400km of bike lanes
  – 600km planned by 2013
  – 27km of bus lanes open to bikes

• Since summer 2010:
  2-way bike lanes on 1-way streets in 30km/h zones
  = 1000 streets in 65 neighborhoods
Red: bike lanes
Purple: bus lanes open to bikes
Pale green: Green neigh./ zones 30

Source: Paris a velo
http://www.parisavelo.net/new_carte_pistes_cyclables.pdf
Red: bike lanes
Purple: bus lanes open to bike
Pale green: Green areas/ zones 30
Dark grey: pedestrian
Red dots: Tramway construction

Source: Ville de Paris
Bike lanes

Source: author
Bike lanes

Source: author
Velib’

- Public bikes, since July 2007
  - 20,000 public bicycles
  - 1,450 docking stations
  - Cost: €1/ day, €5/week or €29/year
    - Covers first 30min, unlimited numbers of trips
    - > 30 min: €1 to €4 for each additional 30-min.

- 2008: 50,000 uses / day
Velib

Source: author
Velib stations in the center of Paris
Green spaces
Green spaces

• 448 public green spaces
  – two large woodlands
    • 995ha Bois de Vincennes
    • 846ha Bois de Boulogne
  – 16 parks
  – 137 gardens
  – 274 small parks
  – 14 cemeteries (Père Lachaise: 44 ha)

• % of green space
  – 6.4% without the woods
  – 23% with the woods
Green spaces
Luxembourg

Source: author
New parks and gardens
La Villette
Gainsbourg Garden over the Périf.
Greenery without green space
Green roofs/ walls

Bercy (1985)

Musee Quai Branly

BHV Hommes
Biodiversity

Photos: Ville de Paris
## Wild species in Paris

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of species in Paris</th>
<th>Number of <strong>nationally protected species</strong> in Paris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insects</td>
<td>1,038</td>
<td>1 (10 regionally protected)</td>
</tr>
<tr>
<td>Amphibians</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Reptiles</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Birds</td>
<td>166 (51 nesting, 17 occasionally)</td>
<td>119</td>
</tr>
<tr>
<td>Mammals</td>
<td>32</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td><strong>1,249</strong></td>
<td><strong>149</strong></td>
</tr>
</tbody>
</table>

*Ville de Paris 02/02/2010*

Ponds
Bees in Paris

• 300 beehives

Source: author
Municipal purchases
Local/ organic foods in municipal meals

• Schools, childcare centers, admin. restaurants
• Goals: 20% organic foods in 2010

• Childcare centers
  – beef, potatoes, spinach, carrots organic since 06

• K-12 schools
  – Managed by district City Halls
  – 20 million meals/ yr

• Best practice: 2nd district
  – Organic foods since 2001 (60% in 201)
  – 1 meal / week vegetarian