Geography IB Course IB2: Urban Environments

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Urban Environments - Case Studies

<u>Tasks:</u>



Referring to at least two city case studies, discuss the concepts of:

- Sustainable city management > Bogota, Vancouver, Curitiba: <u>http://www.coolgeography.co.uk/A-level/AQA/Year%2013/World%20Cities/Sustainability/Curitiba.htm</u> also cracks on the myth: <u>https://nextcity.org/daily/entry/cracks-in-the-curitiba-myth</u>
- The urban ecological footprint > Calgary, San Francisco: <u>https://www.footprintnetwork.org/2015/04/10/calgary/</u> <u>https://www.footprintnetwork.org/2011/08/15/san-francisco-looks-footprint-2/</u> <u>http://www.spur.org/news/2011-07-05/measuring-san-franciscos-ecological-footprint</u>

Evaluate one case study of each of the following:

- One socially sustainable housing management strategy
 > Singapore: <u>http://siteresources.worldbank.org/EXTSDNET/Resources/Presentation3.pdf</u>, <u>https://www.mindomo.com/mindmap/evaluate-a-socially-sustainable-housing-management-strategy-singapore-02b3f457ca064bee93821a2ec916bb3e</u>
 > Nairobi: <u>http://geographylaunchpad.weebly.com/sustainable-housing.html</u>
- One environmentally sustainable pollution management strategy

 Mexico (Hoy no circula): http://geo-mexico.com/?p=2343 (+Wiki)
 http://www.hoy-no-circula.com.mx/ (in Spanish)
 http://www.theguardian.com/world/2016/mar/30/mexico-city-air-pollution-orders-cars-off-road-one-day-a-week
 But also other cities follow Mexico and ban cars depending on the registration plate (even and odd numbers):
 http://www.citylab.com/cityfixer/2014/05/partially-banning-cars-for-a-day-in-paris-actually-worked/371086/

https://www.theguardian.com/world/2016/dec/29/madrid-bans-half-of-cars-from-roads-to-fight-air-pollution

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One strategy to control rapid city growth resulting from in-migration > China (Hukou):

http://geography.about.com/od/chinamaps/fl/Chinas-Hukou-System.htm http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,.contentMDK:21812803%7EpagePK:64165401%7EpiPK:64165026%7EtheSitePK:469382,00.html http://edition.cnn.com/2013/02/07/world/asia/china-lu-stout-great-migration/ https://www.theguardian.com/world/2014/jul/31/china-reform-hukou-migrant-workers https://www.theguardian.com/world/2015/dec/12/china-to-give-more-people-access-to-basic-public-services-in-urban-areas

Urban environmental problems

Brown Agenda - policy concentrated on environmental problem connected with rapid growth of the cities (e.g. Mexico City, Delhi, Karachi):

- Issues connected with limited availability of land, water and services
- Problems such as toxic, hazardous waste, pollution of water, air and soil, and industrial accidents (disasters)
- The problems of rapidly growing urban areas in the developing world are the focus of this agenda
- The environmental problems of **rapid**, **often uncontrolled and unplanned**, **urban growth** have a direct impact on human health
- The Brown Agenda recognises that the "environmental health" issues need to be urgently addressed in the world's growing megacities; these include high infant mortality, respiratory disease, illnesses from low quality water supplies

• Temperature is higher on average 2-4 C° in urban areas than in surrounding rural areas



URBAN HEAT ISLAND PROFILE



- Natural surfaces are often composed of vegetation and moisturetrapping soils. Therefore, they utilize a relatively large proportion of the absorbed radiation in the evapotranspiration process and release water vapor that contributes to cool the air in their vicinity.
- In contrast, built surfaces are composed of a high percentage of non-reflective and water-resistant construction materials. As consequence, they tend to absorb a significant proportion of the incident radiation, which is released as heat.
- The narrow arrangement of buildings along the city's streets form urban canyons that inhibit the escape of the reflected radiation from urban surface to space. This radiation is ultimately absorbed by the building walls thus enhancing the urban heat release.
- Additional factors are: scattered and emitted radiation from atmospheric pollutants to the urban area, the production of waste heat from air conditioning and refrigeration systems, as well from industrial processes and motorized vehicular traffic.
- Related link: <u>http://www.youtube.com/watch?v=lnBO4vX82Fs</u>

- UHII Urban Heat Island Intensity difference in temperature between urban and rural area
- UHII is influenced by:
 - Weather conditions
 - Topography and hydrology
 - Population size & density
 - Level of economic development
 - Types of buildings and street design
 - Land surface cover
 - Air pollution
 - Anthropogenic heating (coming from heating and cooling systems)

The impact of UHII:

- Human health (respiratory and heart diseases)
- Discomfort (quality of life) + heat stress (productivity loss)
- Spread of diseases (with regard to vector- and waterborne diseases in poor cities)
- Use of energy leading to energy waste
- Environmental and urban fabric degradation

- Urban heatwaves a growing problem due to increase size of the cities, growing urban population and climate change effects
- They catch urban societies unaware, unprepared; also with inappropriate infrastructure
- Leading to: discomfort, increase in energy use, higher mortality rates

• Europe 2003 (total death toll 30 000 - 70 000 people)





Figure 11.30 Midday temperatures, Paris, August 2003

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Figure 11.32 Mortality during the Paris heatwave of 2003

Related link:

• <u>https://www.theguardian.com/sustainable-business/2017/feb/21/urban-heat-islands-cooling-things-down-with-</u> trees-green-roads-and-fewer-cars

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Source: ochocianie.pl

URBAN TREES, COOLER CITIES

Pavement and concrete in cities absorb energy from the sun and then radiate that energy out, heating the air in cities more than in the surrounding countryside. Urban trees provide shade, preventing pavement and concrete from heating up, and also cool the air by transpiring water. Trees can cool neighborhoods by up to 4 degrees Fahrenheit.

Related link:

https://actreesnews.org/featured/urban-trees-can-save-lives-by-reducing-air-pollution-and-temperature/

URBAN TREES, BETTER AIR QUALITY

Trees in cities can remove up to a quarter of the particulate matter pollution in their immediate vicinity. And when planted between a source of pollution and an apartment building, school or hospital, urban trees can help protect human health.

Related link:

https://actreesnews.org/featured/urban-trees-can-save-lives-by-reducing-air-pollution-and-temperature/

Urban environmental problems - air pollution

- **SO₂ = Sulphur Dioxide**. From industry and vehicles; causes respiratory problems, e.g. severe coughing attacks
- SPM/PM = (Suspended) Particle Matter (e.g.: dust + microscopic particles of benzene produced by vehicles). Suspended particles cause haze over cities, but especially pulmonary illnesses including lung cancer
- **Pb = Lead.** From vehicles using leaded gasoline; causes anemia, kidney disease, hearing damage, and can cause death
- **CO = Carbon Monoxide.** From incomplete combustion and internal combustion engines burning fossil fuels; causes pulmonary and hearing problems, headache, fatigue, sleepiness, respiratory problems, can cause death
- NO₂ = Nitrous Dioxide. From vehicles; causes respiratory problems and bacterial infections
- **O**₃ = **Ozone**. From vehicles; causes irritated eyes, persistent headaches, may cause cancer

Urban environmental problems - air pollution

Main gases produced by vehicles:

- Sulphur dioxide
- Nitrous oxides
- Carbon monoxide
- + particulate matter (especially diesel engines)

Related links:

- http://www.bbc.com/news/science-environment-30381223
- <u>http://www.telegraph.co.uk/news/earth/environment/11280067/L</u> ondon-will-follow-Paris-and-ban-diesel-cars-campaigners-warn.html

Urban environmental problems - smog

- **Photochemical smog** term used to describe air pollution that is a result of the interaction of sunlight with certain chemicals in the atmosphere
- The word "smog" comes from the combination of the words "smoke" and "fog"
- One of the primary components of photochemical smog is ozone. Ground-level ozone is formed when vehicle emissions containing nitrogen oxides (primarily from vehicle exhaust) and volatile organic compounds (from paints, solvents, and fuel evaporation) interact in the presence of sunlight. Therefore, some of the sunniest cities are also some of the most polluted with smog (e.g. Los Angeles, Mexico City, Delhi)

Related links:

- <u>http://www.museumofthecity.org/project/urban-air-pollution-in-chinese-cities/</u>
- <u>https://www.theguardian.com/cities/2015/dec/02/where-world-most-polluted-city-air-pollution</u>

Mexico City

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Source: Museum of the City

Marriel of

Beijing

Delhi

Kraków

Related links:

- <u>http://wiadomosci.gazeta.pl/</u> <u>wiadomosci/7,114883,200724</u> <u>82,33-z-50-miast-ue-z-</u> <u>najgorszym-powietrzem-jest-</u> <u>w-polsce-na-pierwszym.html</u>
- <u>https://www.ft.com/content/</u> <u>6712dd66-c91d-11e6-8f29-</u> <u>9445cac8966f</u>

Urban environmental problems - air pollution responses

- **Trees and all sorts of green areas** within and outside of urban areas (parks, pocket parks within cities and green belts around cities)
- Limiting the usage of private cars driving restrictions and road space rationing (e.g. odd-even license plate policy); also cars that produce too much pollution are banned (or soon to be banned, e.g. Paris by 2020, selected German cities) in some countries
- Encouraging and improving public transport, as well as the usage of bicycles
- Electronic Road Pricing (ERP in Singapore) and other congestion fees systems

The city as a system

- Large cities are considered to be unsustainable because they consume large amounts of resources and produce vast amounts of waste
- The city can be analyzed as a system containing of inputs-processesoutputs - Rogers (1997) model of city systems

Urban ecological footprint

- The key concept: need to change the city's metabolism (the flow of energy and resources in the urban system)
- The ecological footprint the area required to sustain a population of any size and absorb its waste under prevailing technology (theoretical measurement)
- We need cities to satisfy human needs (utility, amenity, livability, security, comfort, urban services, health, opportunity, community, quality of life) and minimize the human impact on the environment (ecological footprint)

Related links:

- Intro: <u>https://www.footprintnetwork.org/our-work/cities/</u>
- The story of Calgary (Alberta, Canada): <u>http://www.footprintnetwork.org/en/index.php/GFN/page/calgary_case_study/</u>

Unsustainable Linear Urban Metabolism

Source: https://mrphillipsibgeog.wikispaces.com/4.+The+Sustainable+City

Towards urban sustainability

Unsustainable City

High level of inputs. Not satisfying our needs (e.g. congestion, poor air quality). Producing large amounts of waste and pollution.

Sustainable City

Reduced level of inputs. Satisfying our needs (good quality of life). Reduced levels of waste and pollution.

Sustainable Circular Urban Metabolism

Source: https://mrphillipsibgeog.wikispaces.com/4.+The+Sustainable+City

Figure 5.3: Comparison between individual city and national carbon footprints per capita

Source: Sovacool and Brown, 2010.

Metropolitan per capita carbon footprint (metric tons)

National average carbon footprint (metric tons)

Urban ecological footprint

• The design of a city's built environment, its land area and land use will affect its urban ecological footprint

Sustainable cities

- EU policy based on *Leipzig Charter on Sustainable European Cities* (May 25, 2007): http://ec.europa.eu/regional_policy/archive/themes/urban/leipzig_charter.pdf
- Sustainable city (eco-city) city designed to have minimal environmental impact (smallest possible ecological footprint and produce the least amount of pollution and waste)
- Sustainable city:
 - reducing pollution (including CO₂ emissions)
 - land use control (ideas of compact city and foot city)
 - integrated transport with special emphasis on public transport
 - recycling and waste management but also:

- inclusive economic and social policy leading to decrease of inequalities, improvement in quality of life and more participatory management / urban governance

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 Interesting and inspiring case study: Cities On Speed: Bogota Change (Bogotá Cambió) documentary from 2009 directed by Andreas Dalsgaard: <u>https://youtu.be/33-4NRpowF8</u>

Sustainable urban development - broad approach The steps needed to achieve "broad" sustainability: Improve economic security Meet social, cultural and health challenges Society and culture Minimize the use of non-renewable resources Use finite amount of renewable resources Preserve green space And work towards cities' compactness Environment Environment Sustainable impact • Economic, social, Economy city cultural and political sphere Environmental **Eco-city** impact 137

Sustainable urban development - Barcelona, Spain

- Superblock model changing the transportation grid (2013-2018) <u>Related links:</u>
- <u>https://www.youtube.com/watch?v=ZORzsubQA_M</u>
- <u>https://www.theguardian.com/cities/2016/may/17/superblocks-rescue-barcelona-spain-plan-give-streets-back-residents</u>

Sustainable urban development - Seoul, South Korea

- Cheong-Gye-Cheon River sustainable city project, but also urban renewal initiative
- A 10.9 km long, public recreation space in downtown Seoul constructed for 900 million USD (!) and opened in 2005 instead of the road (1940s) and elevated highway (1968) than were built along the original stream (the picture below is from 1904)

Sustainable urban development - Seoul, South Korea

Related links:

- <u>http://wwf.panda.org/?204454/Seoul</u>
- <u>http://inhabitat.com/how-the-cheonggyecheon-river-urban-design-restored-the-green-heart-of-seoul/</u> 140
- <u>https://landscapeiskingston.wordpress.com/2014/06/17/rivers-help-reduce-the-urban-heat-island-effect/</u>

Sustainable urban development - Seoul, South Korea

Sustainable urban development - Copenhagen, Denmark

 Bicycles as a major mode of transportation within the city: ~50% of daily trips

Related links:

- <u>https://www.theguardian.com/cities/2016/nov/30/cycling-revolution-bikes-outnumber-cars-first-time-copenhagen-denmark</u>
- <u>http://uk.phaidon.com/agenda/architecture/articles/2014/august/24/copenhagen-s-orange-bike-highway/</u>
- <u>http://denmark.dk/en/green-living/bicycle-culture/cycle-super-highway/</u>

Related issue: cities that plan to ban cars:

- https://www.weforum.org/agenda/2017/02/these-major-cities-are-starting-to-go-car-free
- <u>https://www.theguardian.com/cities/2015/dec/09/car-free-city-oslo-helsinki-copenhagen</u>

- Capital city of the Brazilian state of Parana, population 1.9 m (metro area: 3.4 m)
- Sustainable urban development policy introduced already in late 1960s - integrated transport and land-use
- On large scale started by the mayor Jamie Lerner (1971-74, 1979-83, 1989-93) promoting the idea of "urban acupuncture"

Related links:

- Curitiba Research and Urban Planning
 Institute: <u>http://ippuc.org.br</u>
- Jamie Lerner TED talk: <u>http://www.ted.com/talks/jaime_lerner_sings</u> <u>of_the_city?language=en#t-514549</u>

Map 3.1 Location of Curitiba

Source: Map Design Unit, General Services Department, World Bank.

 The city went through rapid growth from 1950s facing typical challenges of the cities of the global South

- 1965: Curitiba Research and Urban Planning Institute (por. Instituto de Pesquisa Planejamento Urbano de Curitiba)
- 1966: "Master Plan" was accepted that identified 5 major spatial growth/development axes

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The city bought floodplains (floods were one of the key challenges) and dedicated them to public parks which, due to financial deficit, were not managed with the usage of machinery (capital intensive), but originally they were "maintained" by sheep grazing

Figure 3.10 Barigüi Park, Curitiba

Source: IPPUC.

Note: This area was once flood prone and occupied by slum dwellers. It is now a converted 140-hectare park with a 40-hectare lake.

Figure 3.11 Former Slums in Flood-Prone Areas in Curitiba Source: IPPUC.

1970: 0.5 m² per capita

2000: 50 m² per capita

- Since 1960s the city's development was planned and implemented along the structural axes and their connection allowing to avoid the city center
- Dense network of local (non-transit) streets
- Gradually limiting the use of private cars in the city center
- Alongside the road infrastructure development the biking infrastructure is being developed (along the axes and interconnecting city parks)
- Rigid urban planning policy forcing to develop housing along the axes with different functions and density depending on the distance from the major transportation corridors
- City bought plots dedicated to affordable social housing nearby the communication axes (one of the major factors influencing real estate prices), so the (relatively) poor communities would not be forced to the edges of the city (the risk of informal settlements)

Figure 3.7 The Trinary Road System in Curitiba

Source: Author compilation (Hinako Maruyama) based on IPPUC (2009a), Hattori (2004), and pictures supplied by IPPUC. Note: km/h = kilometers per hour.

- BRT (Bus Rapid Transit) system was designed and developed together with the axes major bus terminal was located at the end of each axis; it was the first BRT system (1975 r.); it cost less than 5% of the potential metro system
- Now 60 % of people use public transport every day; no one has to walk more than 400 meters to the nearest bus stop

- Except for a "km fee" the city pays off 1% of a each bus's value monthly, and after 10 years the buses become city's property; consequently the BRT buses are replaced with the new ones on regular basis and the old buses are used by the city as a free public transport to/from parks and as mobile schools
- ¾ of city inhabitants chose to use pubic transportation (BRT daily ridership: 2.3 m) and fuel consumption per capita is 75% of the ¹⁴⁹ Brazilian cities average (despite higher levels of car ownership)

• BRT system - por. *Rede Integrada de Transporte*

• BRT system - por. *Rede Integrada de Transporte*

- Urban planning and policy based on transparency precise information on each available plot
- Investors have the right to buy extra two stories above the limit in the neighborhood - the payment can be in cash or by an exchange of a different plot (later on used by the city for social housing)
- Companies that want to locate within city are obligated to report the influence of their location on traffic, parking needs, public infrastructure and services
- Owners of the real estate located in the historic center have the right to exchange their property to a different one within a city

- Historic city center is a traffic-free zone and is strictly controlled by the city authorities (including the heritage and renovation bodies)
- The land-use plan (zoning plan) strictly defines functions to be maintained in this part of the city
- Selected streets were transformed into "shopping malls" and leisure areas; some are open 24/7

- Widespread waste segregation and waste recycling system that is being used by 70% of the inhabitants
- There is a dedicated system for collecting segregated waste from poor communities - the trash is being exchanged for bus tickets, food and school supplies for the children
- Employment opportunities for the elderly and unemployed (originally also illeterates) in waste disposal and management

Figure 3.13 Curitiba's Waste Program

Source: Photos courtesy of IPPUC. Note: The Garbage That Is Not Garbage Program (left) and The Green Exchange Program (right).

- Population: 600 thousand, metro area: 2.4 m
- Integrated spatial (zoning) and development policy since 1996 with regard to metro area (Metro Vancouver: <u>http://www.metrovancouver.org/about/Pages/default.aspx</u>)
- There are 10 sectorial programs (2002-2040)
- Protection of selected agricultural areas within MV (ang. Agricultural Land Reserve)
- Rigid urban planning policy:

- each city block should be host of mixed housing including affordable apartments

- easy access to schools and kindergartens

- specific urban design - buildings always open to streets with accessible ground floors, tall buildings surrounded with lower buildings facing streets

 All new buildings on rezoned sites in the city have to meet LEED Gold standard (<u>http://www.usgbc.org/articles/about-leed</u>)

- Sustainable Development Strategy 2009-2020-2050 (sic!)
- Action plan for 2020:
 - GhG emission reduction by 1/3
 - reduction of energy consumption in existing building (rising the energy efficiency) by 20%
 - reduction of the average distance travelled by cars by 20%

- Population: 600 thousand, metro area: 2.4 m
- Spatial (zoning) and development policy based on Urban Growth Boundaries (<u>http://www.oregonmetro.gov/urban-growth-boundary</u>)
- There is a separate agency managing the metro area it serves more than 1.5 million people; the agency's boundary encompasses Portland and 24 other cities; the agency authorities are being elected (not appointed); the agency is in charge of land-use planning, transportation, waste management and recycling, environment protection and green areas development
- The metro development plan selected goals:

- max distance to public transportation station or stop: 5 minutes be feet by 2040

- CO_2 emissions reduction by 40% until 2030 and by 80% until 2050

- spatial growth along transportation corridors

- Introduction of "Max" LRT (Light Rail Transit) service
- Discouraging the usage of private cars
- 1974-1978 removal of Harbor Drive (freeway removal) that was replaced by the public park - Tom McCall Waterfront Park

Sustainable cities - bonus from Australia 🙂

Sustainable cities - bonus from Cracow $\textcircled{\mbox{$\odot$}}$

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 > Nairobi: <u>http://geographylaunchpad.weebly.com/sustainable-housing.html</u>
- One environmentally sustainable pollution management strategy

 Mexico (Hoy no circula): http://geo-mexico.com/?p=2343 (+Wiki)
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Urban Environments - Additional examples

Topics and links:

 Portland, Seoul are not the only cities that transformed highways into city parks:

http://www.archdaily.com/800155/6-cities-that-have-transformed-their-highways-into-urban-parks

- Now Curitiba's innovations are in Beijing (but with the usage of new technologies) recycling plastic bottles exchanged for metro tickets: https://www.theguardian.com/environment/2012/jul/04/beijing-recycling-banks-subway-bottles
- Is urban farming an answer to ongoing demand for food in cities? <u>https://www.theguardian.com/sustainable-business/2014/jul/02/next-gen-urban-farms-10-innovative-projects-from-around-the-world</u> <u>https://www.theguardian.com/sustainable-business/food-blog/designing-cities-factory-urban-agriculture</u> <u>https://www.theguardian.com/global-development-professionals-network/2015/sep/18/urban-farmers-around-the-world-in-pictures</u>
- Will London be following Copenhagen? Norman Foster's plan of elevated "bike highways" above train tracks in London:

http://uk.phaidon.com/agenda/architecture/articles/2014/january/09/could-lord-fosters-skycycle-scheme-take-off/ https://tfl.gov.uk/modes/cycling/routes-and-maps/cycle-superhighways https://www.theguardian.com/uk-news/2015/feb/04/segregated-cycle-lanes-london-tfl https://www.theguardian.com/lifeandstyle/2016/aug/07/london-cycle-superhighways-heaven-or-hell

- Is Singapore the ultimate city of the future?: <u>https://www.theguardian.com/sustainable-business/sustainable-cities-innovative-urban-planning-singapore</u> <u>https://www.theguardian.com/world/2017/oct/24/singapore-no-more-cars-allowed-on-the-road-government-says</u>
- Most sustainable cities?:

https://www.theguardian.com/sustainable-business/gallery/2016/mar/20/hamburg-coffee-pod-ban-bogota-buses-sustainable-cities-in1p7dtures

Thank you for your attention Robert Łuczak robert@robertluczak.eu