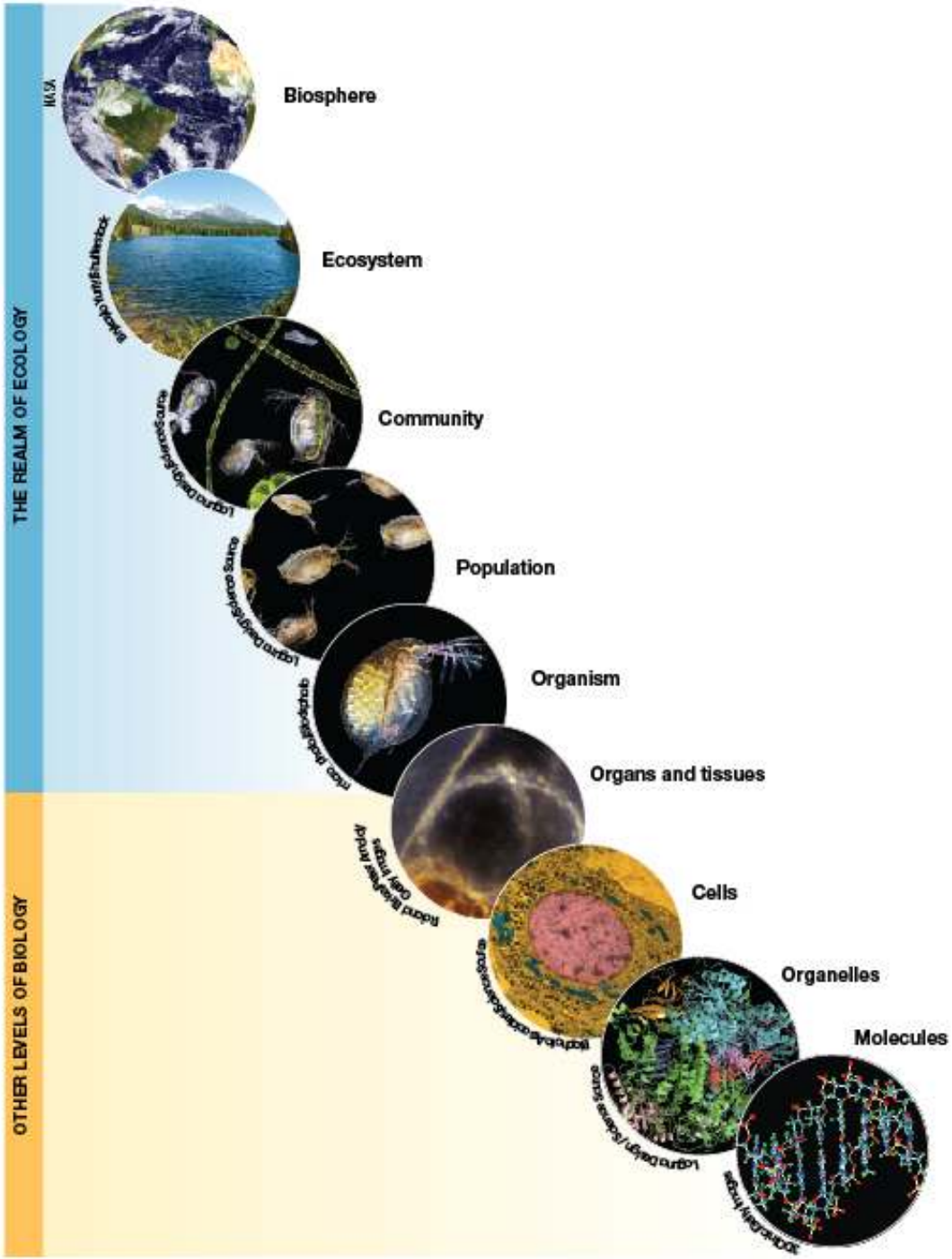
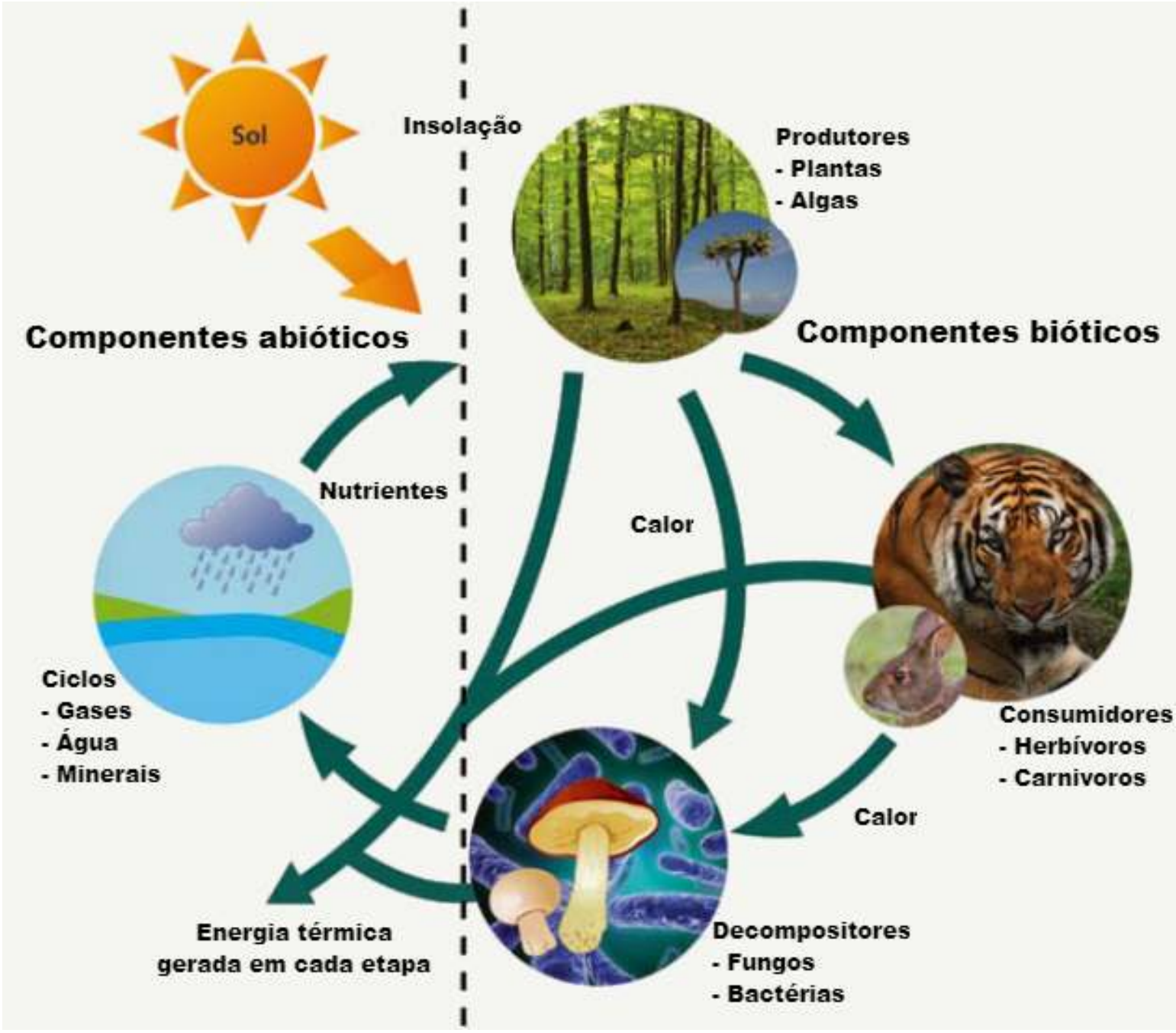
Ecologia Urbana

Aula 2 – Clima da cidade

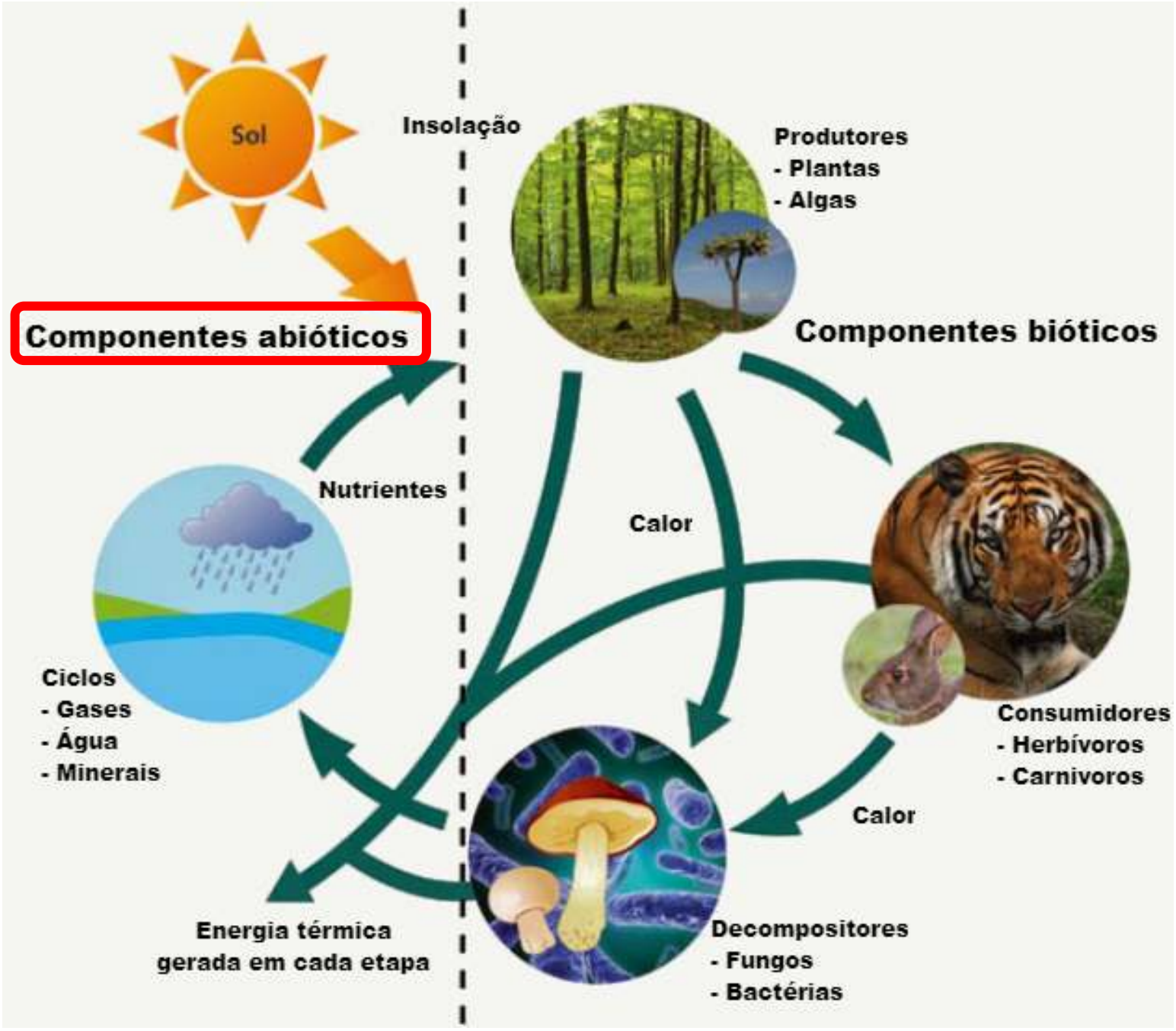
- Aula 2
- Clima de cidade -> Ilha de calor
  - Impacto sob a fisiologia dos organismos
  - Pode ter ajudado na adaptação de espécies tropicais em ambientes temperados
  - Tamanho do corpo de organismos



Begon et al. 2016



https://www.todamateria.com.br/fatores-bioticos-e-abioticos/



https://www.todamateria.com.br/fatores-bioticos-e-abioticos/

Impacto do processo de urbanização em fatores abióticos

Processos biofísicos associados com a construção de cidades são similares ao redor do mundo

Table 2.1 The primary biophysical processes of urbanization and the secondary biophysical processes that arise from these.

Primary Processes	Secondary Processes
1. Removal of existing vegetation	Habitat loss, fragmentation and isolation (arising from 1, 2, 4, 5)
2. Construction of buildings, roads, lights, drains and other urban infrastructure	Climatic changes (arising from 1, 2, 3, 4)
3. Replacement of permeable with impermeable surfaces	Altered noise regimes (arising from 1, 2, 3)
4. Reduction in the area of open space	Altered light regimes (arising from 2, 3)
5. Modification or destruction of aquatic habitats	Altered hydrological regimes (arising from 1, 2, 3, 4, 5)
6. Production of pollution and waste	Pollution of air, water and soil (arising from 1, 2, 3, 6)

Parris 2013

A vegetação de uma área é substituída por construções à medida que a densidade populacional aumenta

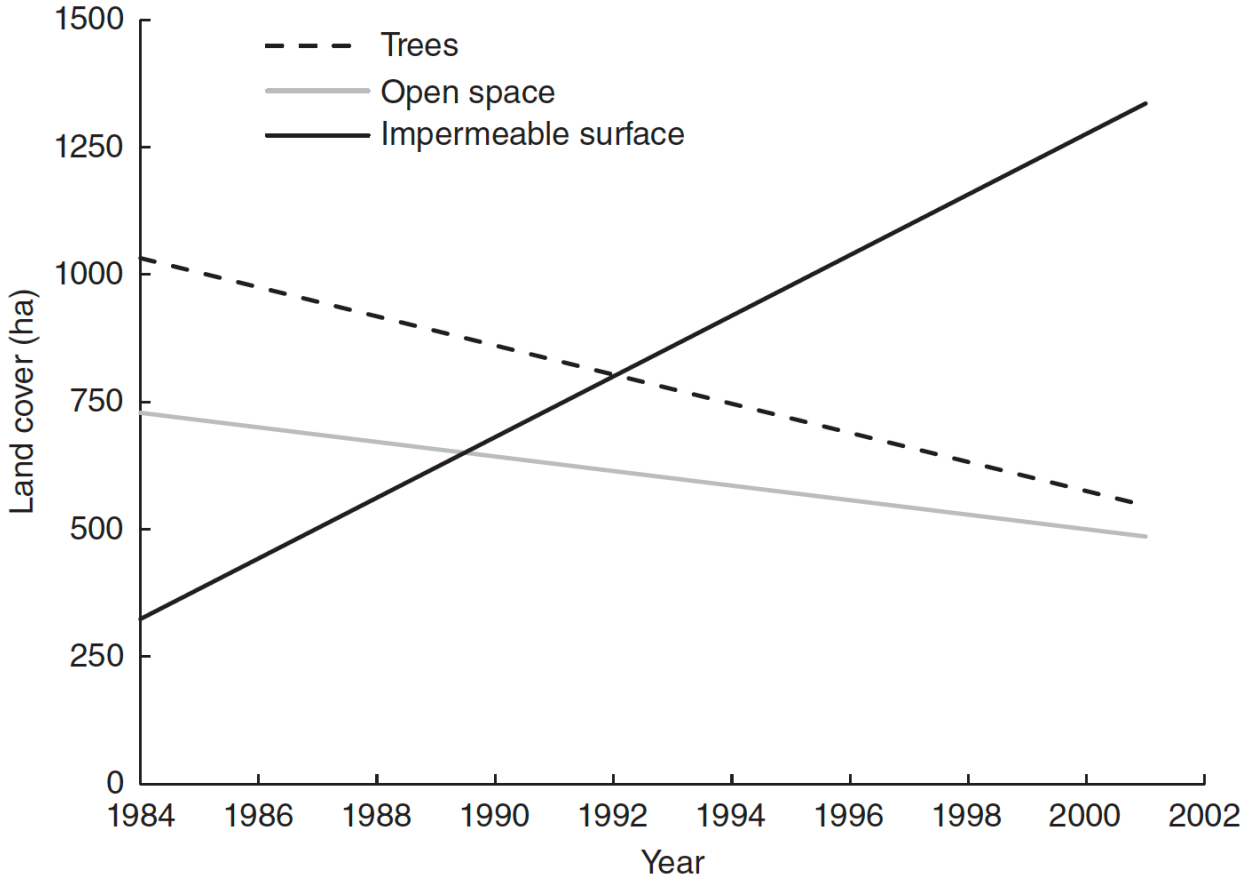


Figure 2.4 Land-cover change in Cornelius, North Carolina, USA resulting from urban expansion, 1984–2001. Impermeable-surface cover increases while the cover of trees and open space decreases. Data from American Forests (2003).

Parris 2013

Mas o padrão de remoção de vegetação varia dentro da cidade

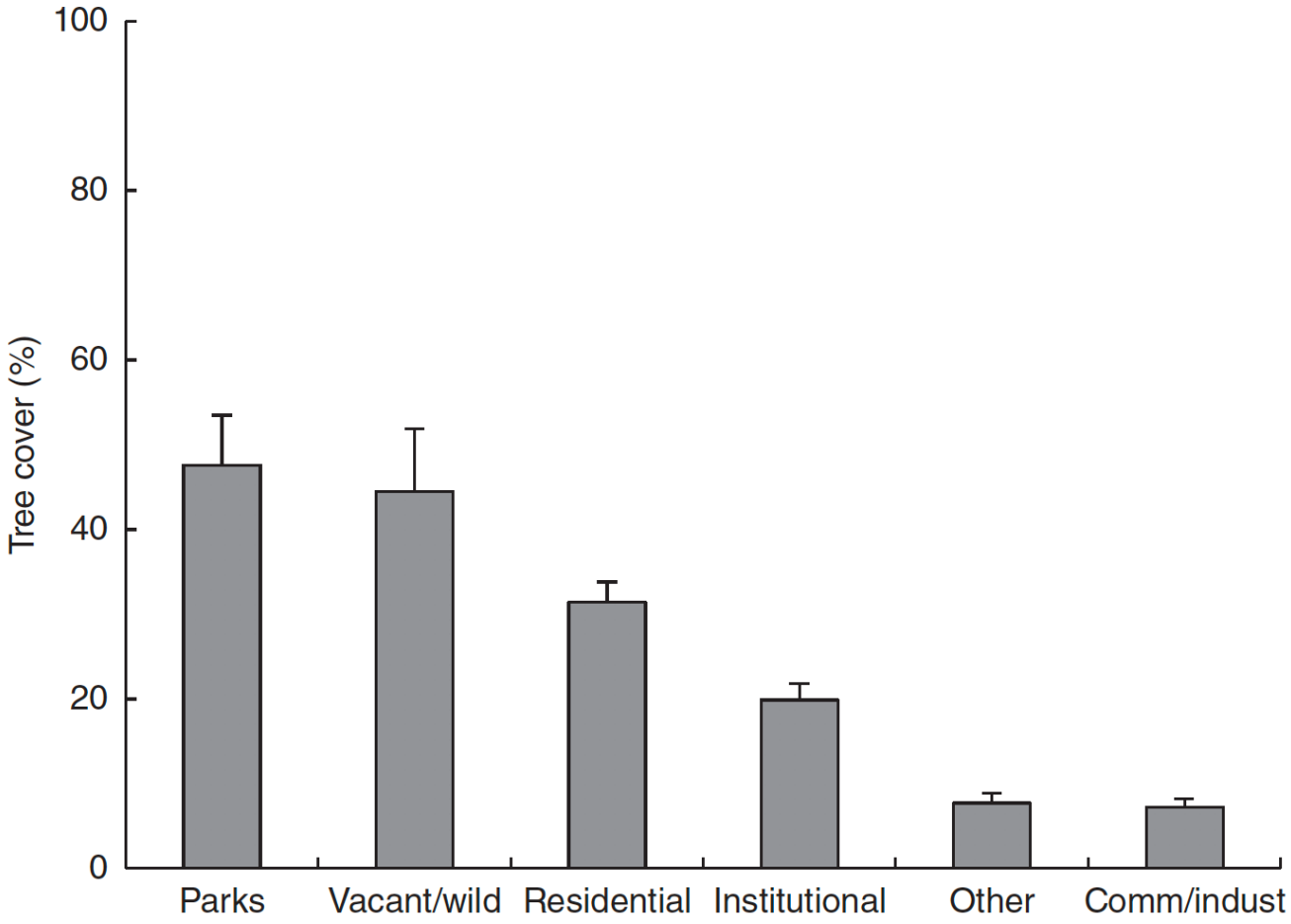


Figure 2.3 Tree cover (%) in different urban land-use types, averaged across 12 cities built in naturally forested areas in the USA. Vacant/wild = vacant lots or wild lands, institutional = institutional areas such as hospitals and schools, other = agricultural land, orchards, roads and airports; comm/indust = commercial and industrial land. The error bars represent standard errors. Data from Nowak et al. (1996).

Parris 2013

Áreas abertas não construídas

- Tamanho das áreas abertas expostas é um bom indicador de variáveis microclimáticas
  - Espaços verdes (e.g., parques)
- Relação espécie-área => maior área suporta mais espécies

$$S = c + z log(A) = log(cA^z),$$

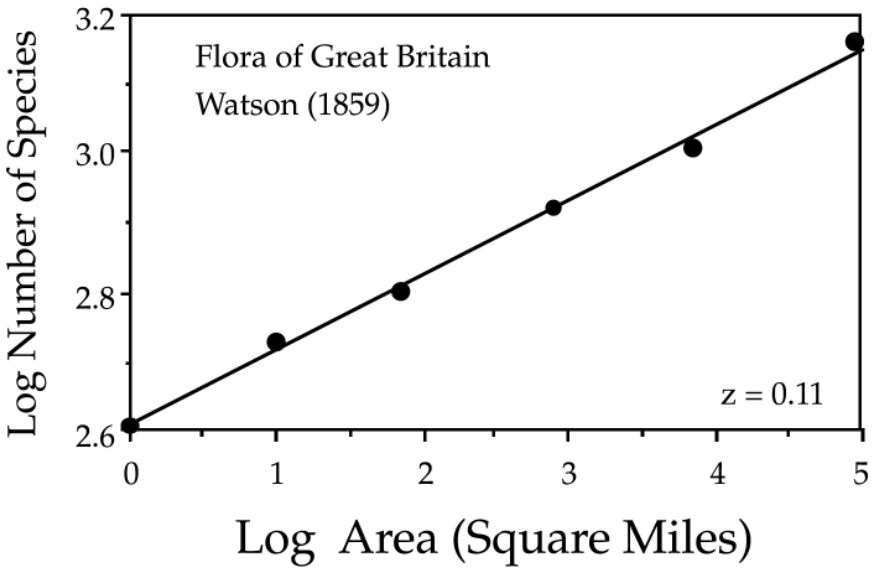


FIG. 6.1. Watson's species-area curve for vascular plants of Great Britain, accumulating species from a starting point in Surrey. After Williams (1964) and Rosenzweig (1995).

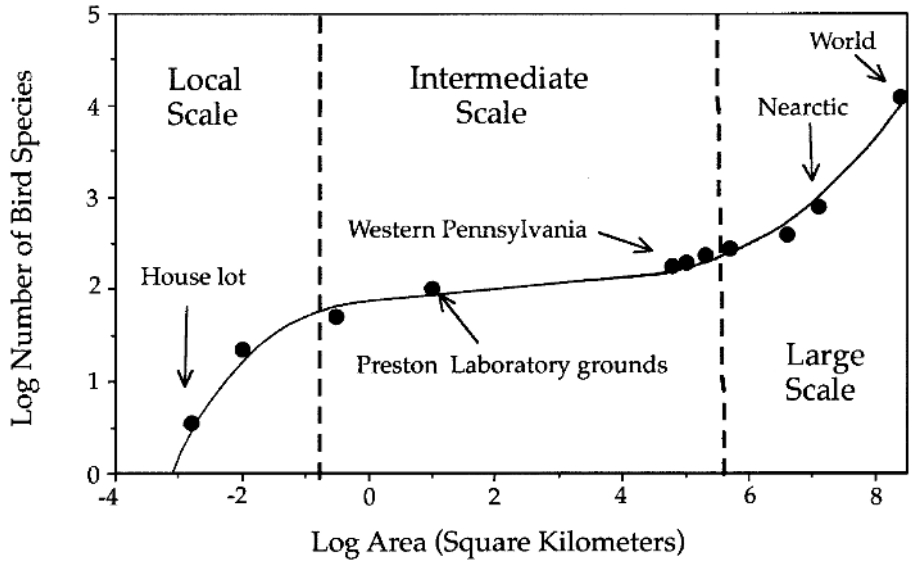


FIG. 6.2. Species-area curve for the world's avifauna, spanning spatial scales from less than one acre to the entire surface of the Earth. The *S*-shaped curve suggests that the sampling units change as area is increased, from individuals, to species ranges, and finally to different biogeographic realms at local, regional to subcontinental, and finally to intercontinental spatial scales. Data from Preston (1960).

Hubbell 2001

Áreas abertas não construídas

Tamanho das áreas abertas expostas é um bom indicador de variáveis microclimáticas

Espaços verdes (e.g., parques)

Relação espécie-área => maior área suporta mais espécies

Cidades geralmente tem espaços verdes pequenos	38 cidades tiveram < 4 Km^2	Isolamento e efeito de borda

Componentes do clima de uma cidade

- Todas essas modificações alteram o ambiente e clima da cidade
- Superfícies impermeáveis dificultam a drenagem e infiltração da água da chuva
  - ~ 0.34 % da superfície global
- Dificultam a dissipação da radiação solar e calor
  - Centros de cidades tendem a ser mais quentes
- Superfícies pavimentadas separam o solo do ar e água
  - interferem em ciclos biogeoquímicos
  - Penetração raízes de plantas
- Circulação do ar

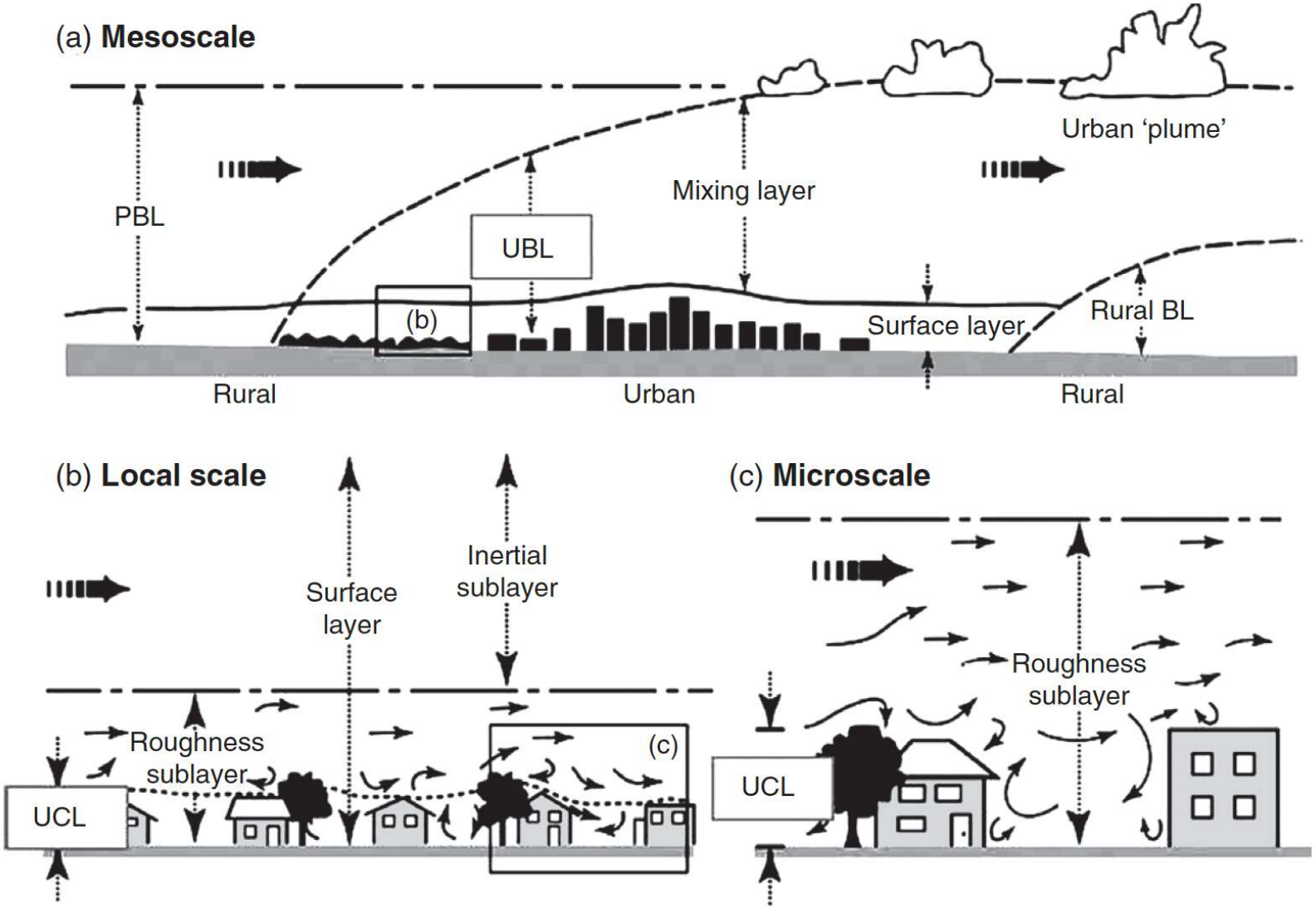
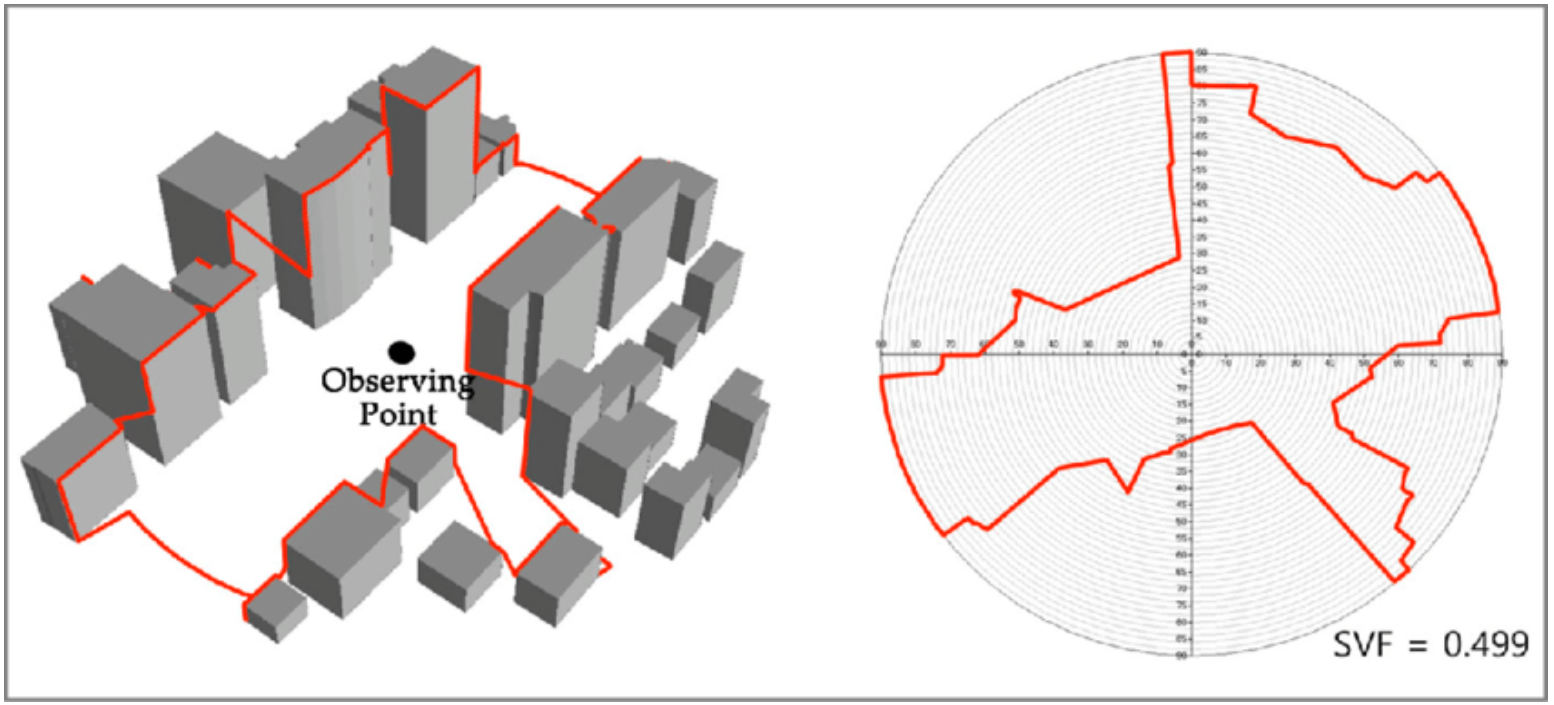


Figure 3.1 Urban environments at different spatial scales, with an emphasis on atmospheric components: (a) mesoscale; (b) local scale; (c) microscale. PBL, planetary boundary layer; UBL, urban boundary layer; UCL, urban canopy layer; BL, boundary layer. Reproduced with permission from Shepherd (2005), modified after Oke (1987).

Gaston

Sky View Factor



Medida que resume várias informações sobre morfologia urbana (Dossel urbano)

Útil para modelar e entender microclima, qualidade e fluxo do ar (vento) da cidade

Urban Climate 25 (2018) 120–134

Contents lists available at ScienceDirect

Urban Climate

journal homepage: www.elsevier.com/locate/uclim

Sky View Factor footprints for urban climate modeling

Ariane Middel[a,f,*], Jonas Lukasczyk[b], Ross Maciejewski[c], Matthias Demuzere[d], Matthias Roth[e]

Fig. 2. Fisheye photographs generated from Google Street View (top), detected horizon limitations (bottom), and respective Sky View Factors (bolded text) for four locations around the globe.

Usou fotos do Google Street view (> 16 milhões de localidades) para calcular SVF de várias cidades do Hemisfério Norte

World Urban Database

Home | Materials and Events | Level 0 data | Tools

The World Urban Database and Access Portal Tools project is a community-based project to gather a census of cities around the world. Come join us!

VIEW THE VIDEO

Create LCZ Training Areas

Follow the simple steps outlined here to create LCZ training

Classify your City

Follow the step-by-step instructions to create an LCZ

View LCZ maps

Access LCZ maps for different cities around the world using

World Urban Database

Home | Materials and Events | Level 0 data | Tools

The overall aims of WUDAPT are to:

- use the Local Climate Zone (LCZ) classification framework as the starting point for characterizing cities in a consistent manner
- use Geo-Wiki to sample land cover and land use types across LCZs (e.g. impervious surfaces (buildings, roads, other), pervious surfaces, grassland, etc.)
- develop tools (online and mobile-based) to obtain other parameters such as building materials, building dimensions, canopy widths, etc.
- provide open access to this dataset so that researchers around the world can use the data for many different types of applications, from climate and weather modeling to energy balance studies
- provide basic tools in the portal to allows researchers to aggregate the data to a user-specified reference grid (resolution and starting location) and compare cities around the world.

The World Urban Database and Access Portal Tools project is a community-based project to gather a census of cities around the world. Come join us!

VIEW THE VIDEO

Create LCZ Training Areas

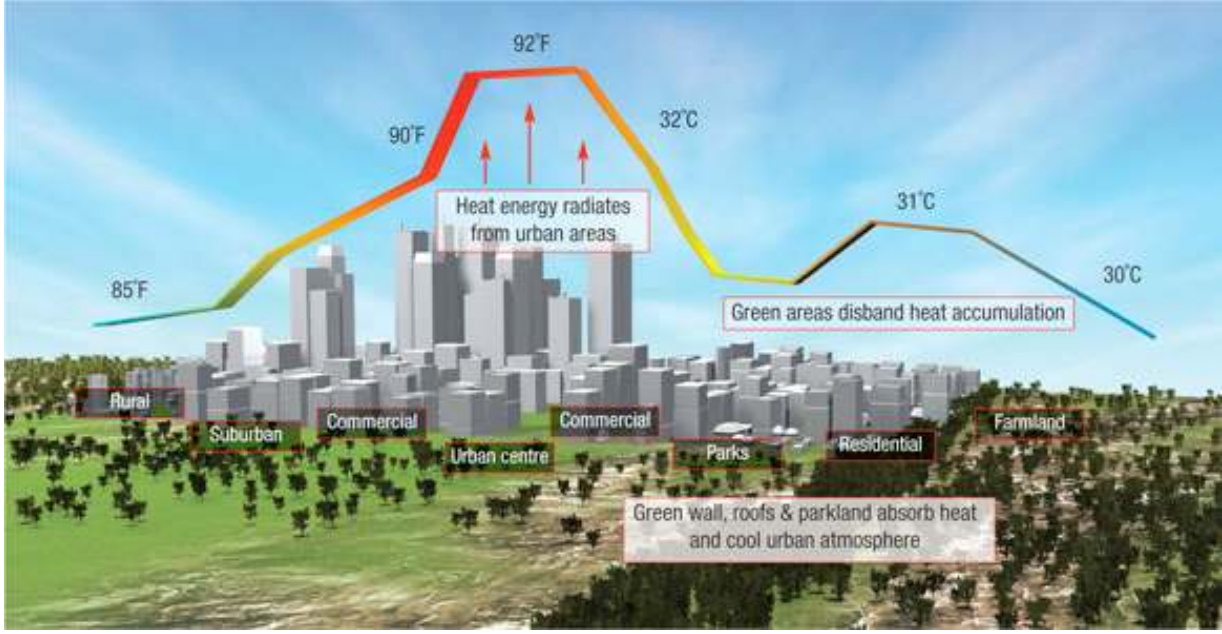
Follow the simple steps outlined here to create LCZ training

Classify your City

Follow the step-by-step instructions to create an LCZ

View LCZ maps

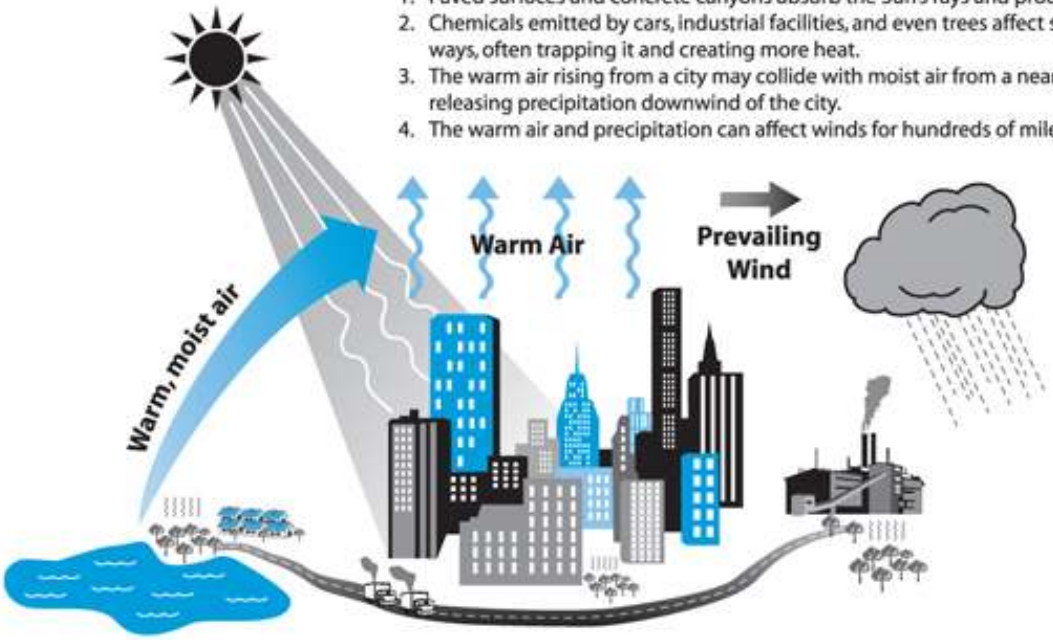
Access LCZ maps for different cities around the world using



Urban Heat Island Effect

Urban areas influence the atmosphere through a number of processes:

1. Paved surfaces and concrete canyons absorb the Sun's rays and produce heat.
2. Chemicals emitted by cars, industrial facilities, and even trees affect sunshine in different ways, often trapping it and creating more heat.
3. The warm air rising from a city may collide with moist air from a nearby body of water, releasing precipitation downwind of the city.
4. The warm air and precipitation can affect winds for hundreds of miles.



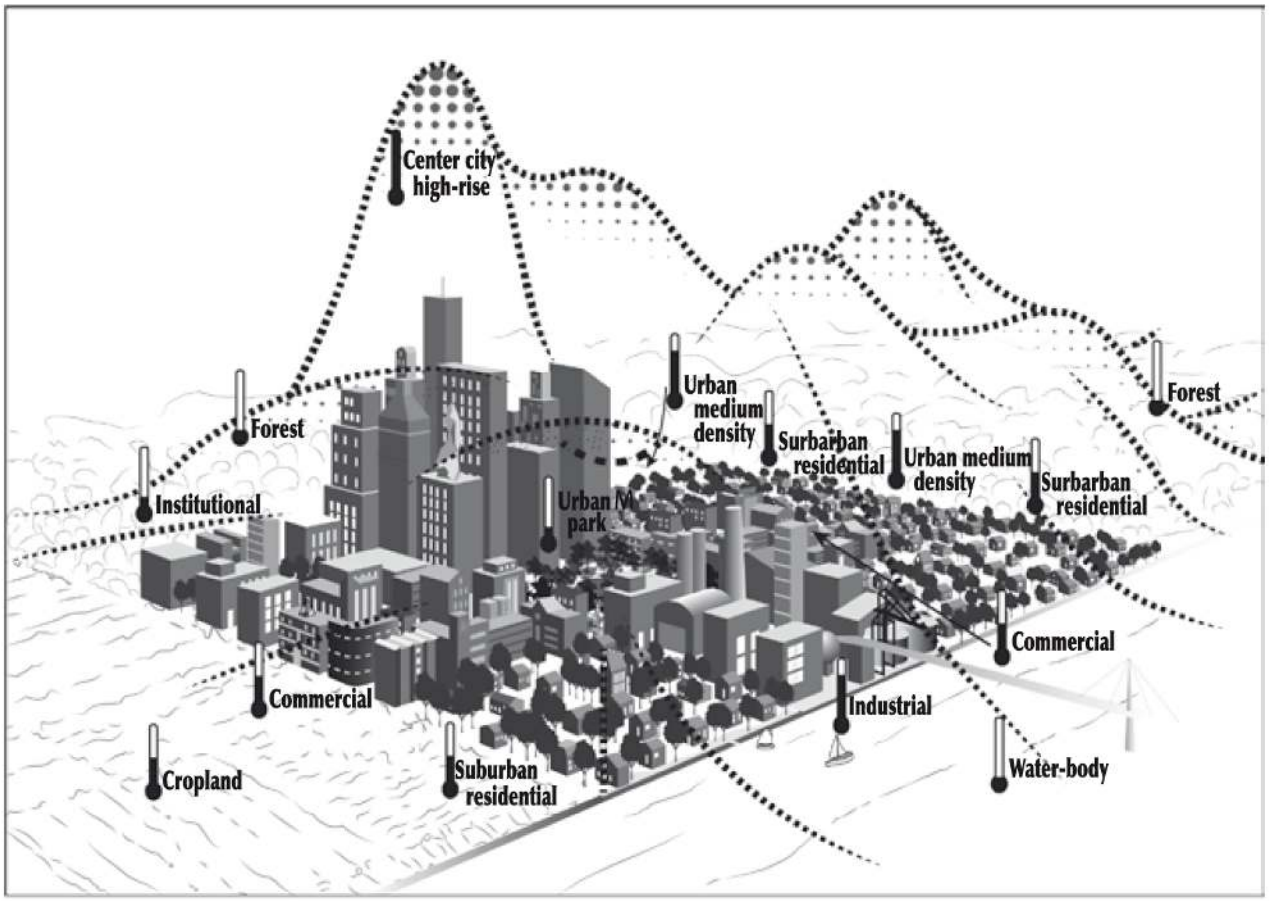
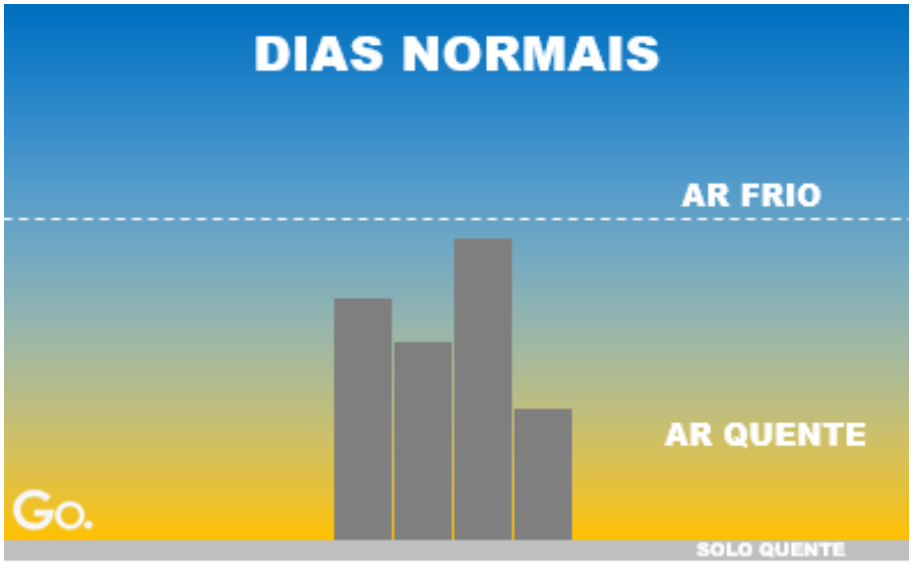
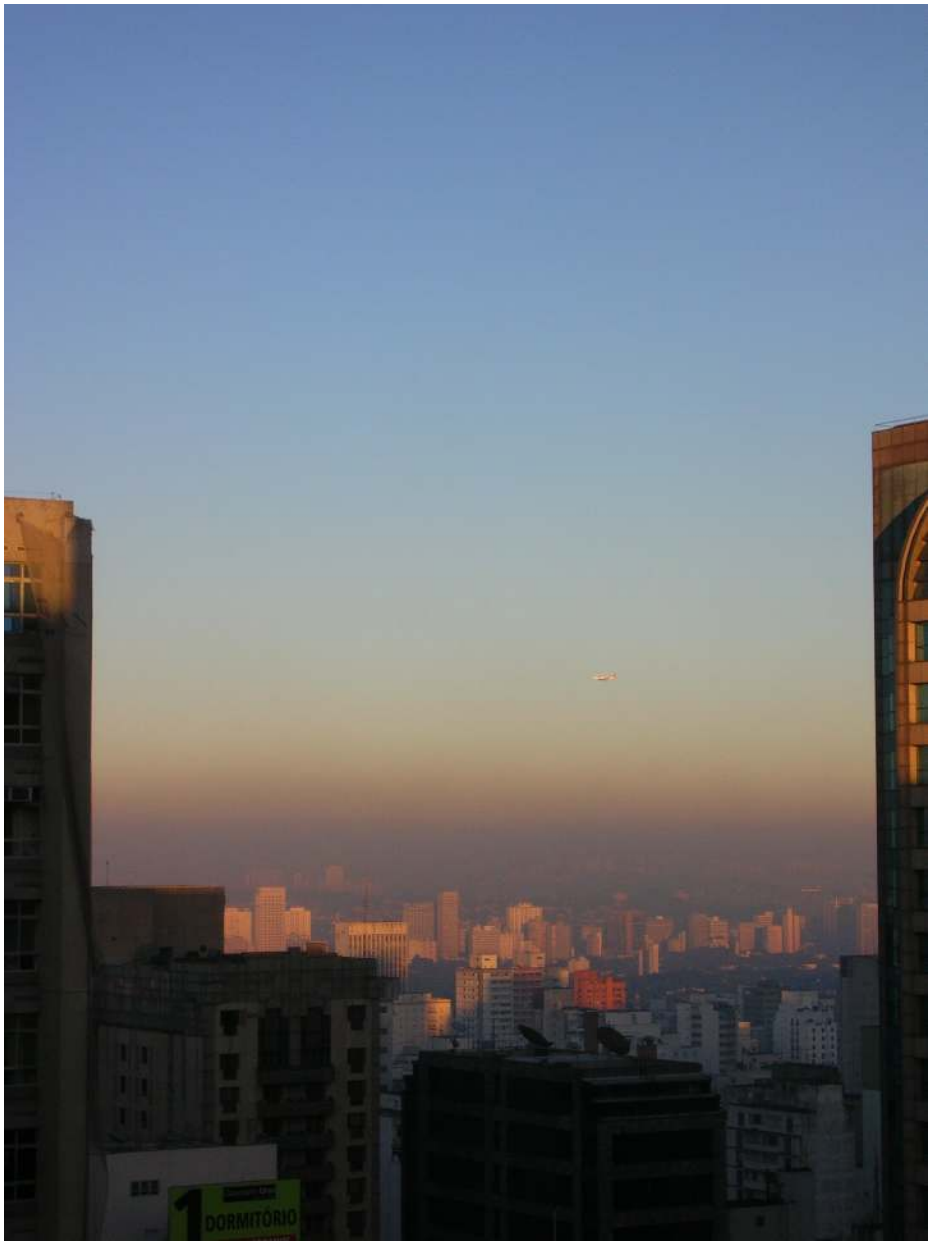


Figure 5.3. Dome of heat and pollutants over different land uses of city and surroundings. General heat and pollution levels indicated by "thermometers": very high; high; medium; low; very low. For each land use, estimates of roughness (*R*) (effective terrain or surface roughness), aspect ratio (*A*) [average height of the main roughness elements (buildings, trees) divided by their average spacing], and percent hard surface (*H*) (buildings, roads, etc.) are as follows (Alberti, 2008): center city high-rise ($R = 8$; $A > 2$; $H >$ 90%); medium density urban residential ($R = 7$; $A = 1.0$; $H = 80\%$); commercial ($R =$ 5; $A = 0.1$; $H = 85\%$); suburban residential ($R = 6$; $A = 0.4$; $H = 50\%$); industrial ($R = 5$; $A = 0.1$; $H = 85\%$); institutional ($R = 5$; $A =$ 0.3; $H < 50\%$); urban park ($R = 5$; $A > 0.5$; H < 50%); cropland ($R = 3$; $A > 0.05$; $H = 1\%$); forest ($R < 4$; $A > 0.05$; $H = 1\%$); water (R = 2; $A > 0.05$; $H = 0\%$). See Hough (2004), Marsh (2010).

Forman 2014





- Vegetação arbórea ajuda a manter níveis de humidade e diminuir a temperatura (sombra)
  - Radiação solar

Figure 5.4. A corridor of shade where transpiring trees cool street, sidewalk, and wall. Tree roots receive oxygen from the air and water runoff from the sidewalk. Guatemala City. R. Forman photo.

Forman 2014

Tipos de poluição

- Ar
  - Substâncias particuladas
- Luz (iluminação noturna)
  - Alteram ritmos circadianos de organismos
- Som
  - Níveis de ruídos -> podem interferir na comunicação de organismos que utilizam sons

Urban Ecosyst (2011) 14:415–427
DOI 10.1007/s11252-011-0158-7

Impacts of traffic noise on anuran and bird communities

Maria Isabel Herrera-Montes · T. Mitchell Aide

A riqueza e composição de aves , mas não de anfíbios foram afetadas pelo nível de ruído

Nível de ruído foi diferente entre locais perto e distantes de mata

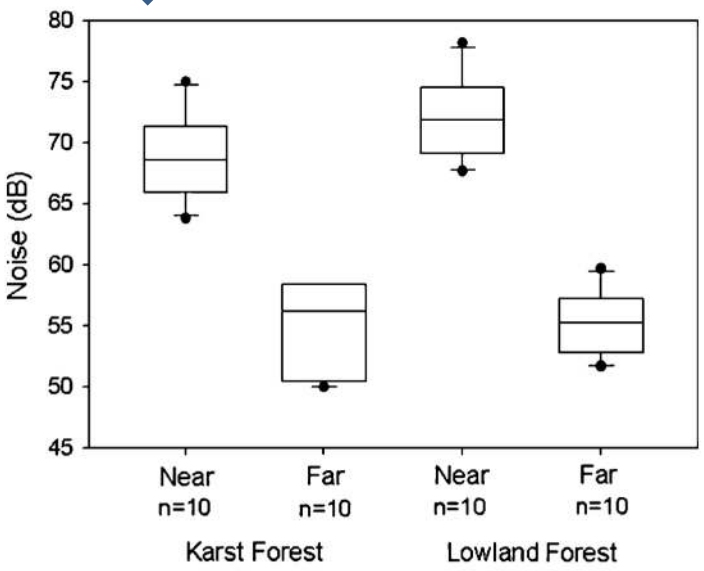
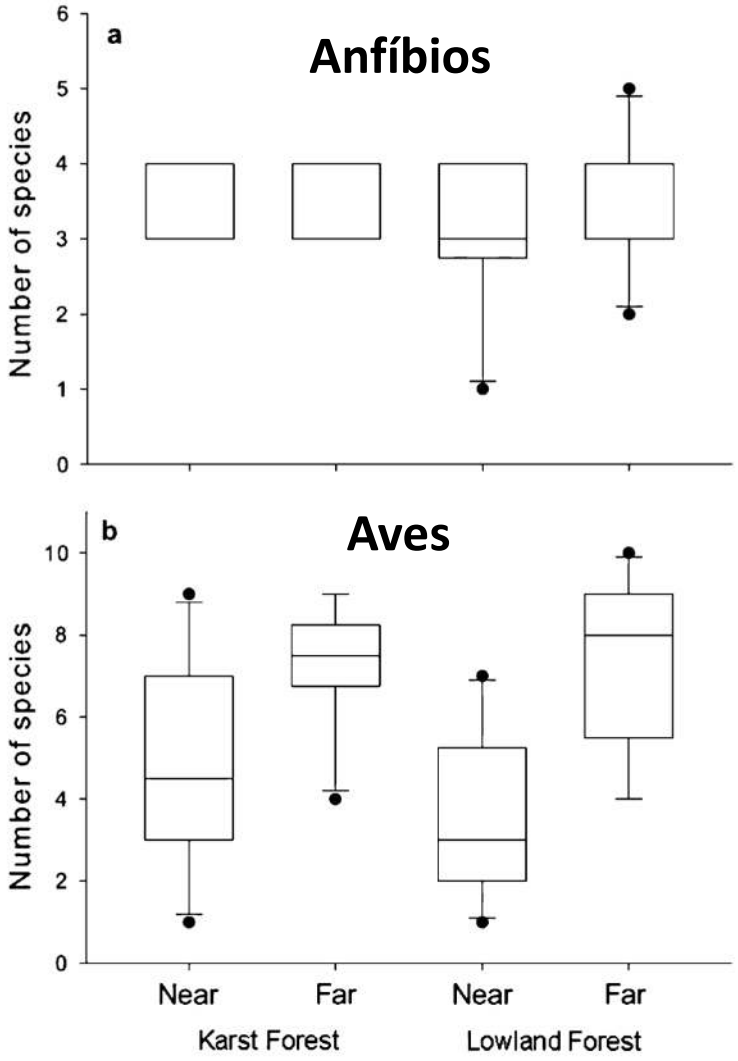
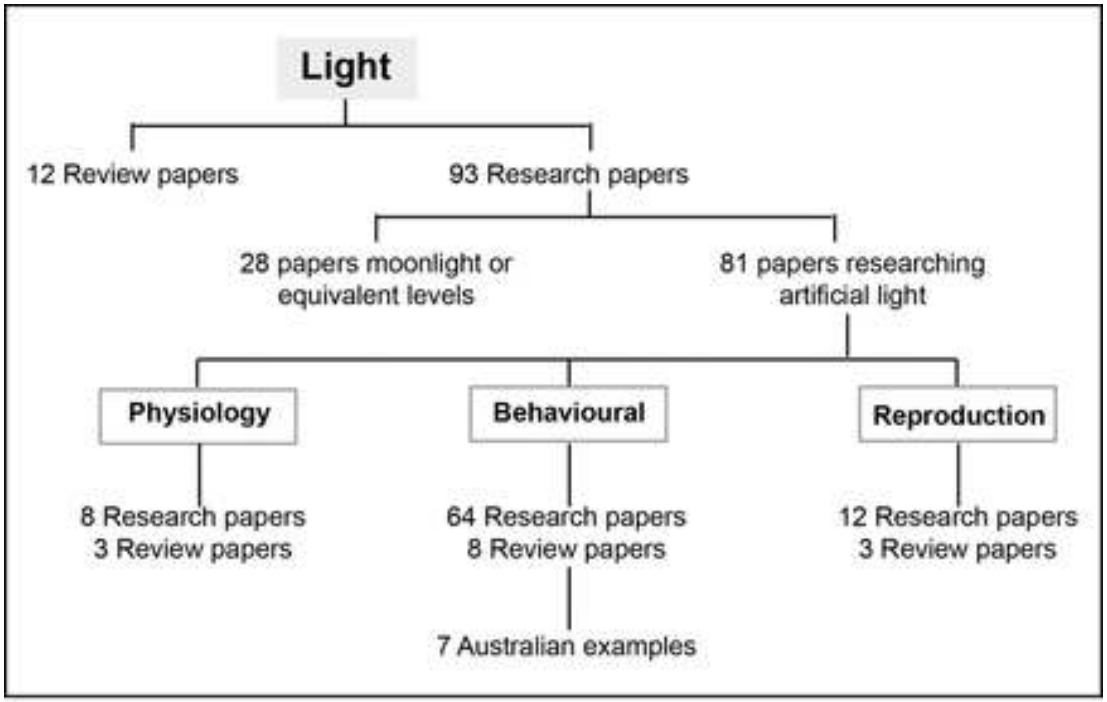
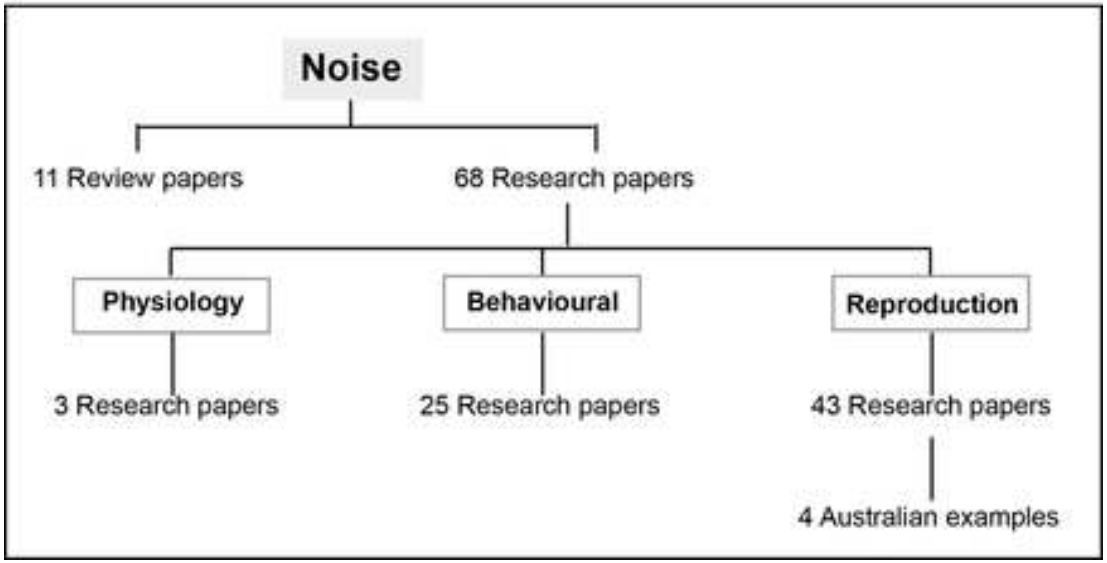


Fig. 3 Noise level (dB) near and far from the highway in karst forest and lowland forest in Puerto Rico. (Paired *t*-test, KF: T=8.05, $p<0.00$; LF: T=11.5, $p<0.00$). Box plots illustrate the median (*horizontal line within the box*), 25–75th percentiles (*the box*), 10–90th percentiles (*T-bar*) and the values greater than the 10–90th percentiles (*the points*)

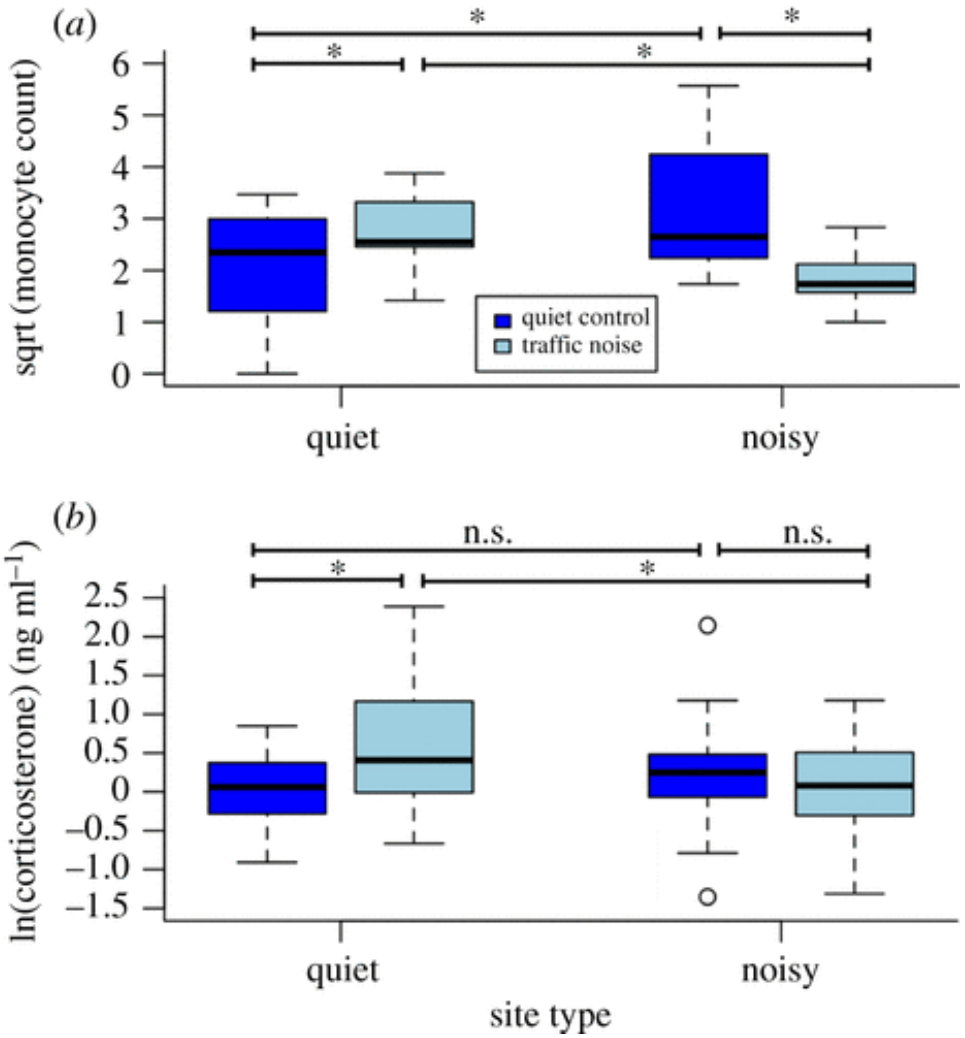


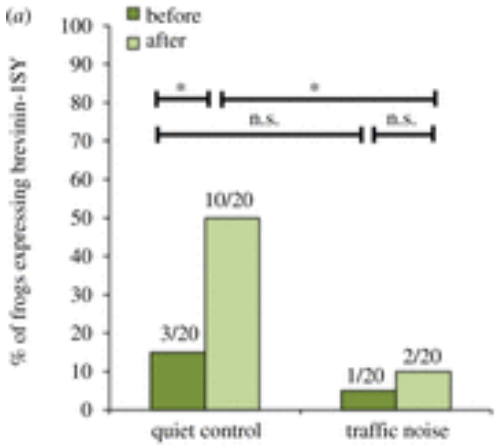


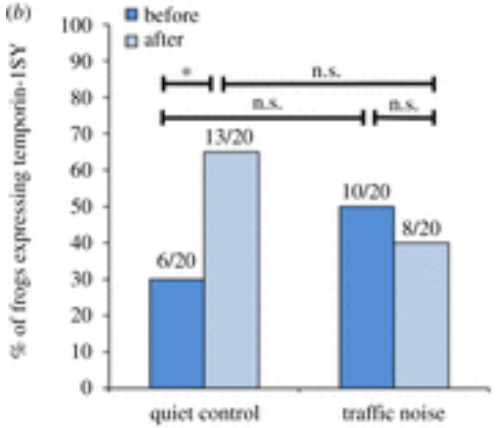


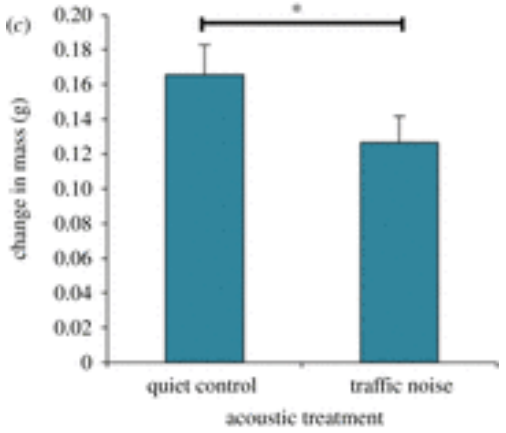
Ecological Management & Restoration, Volume: 15, Issue: 3, Pages: 204-214, First published: 18 September 2014, DOI: (10.1111/emr.12120)

Sapos exibiram mais sinais de estresse e comprometimento do sistema imune em locais com altos níveis de ruídos









Frogs adapt to physiologically costly anthropogenic noise, Volume: 285, Issue: 1891, DOI: (10.1098/rspb.2018.2194)

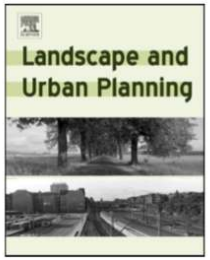
Como organismos (componente biótico) se adaptam para viver em cidades?

Landscape and Urban Planning 176 (2018) 22–29

Contents lists available at ScienceDirect

Landscape and Urban Planning

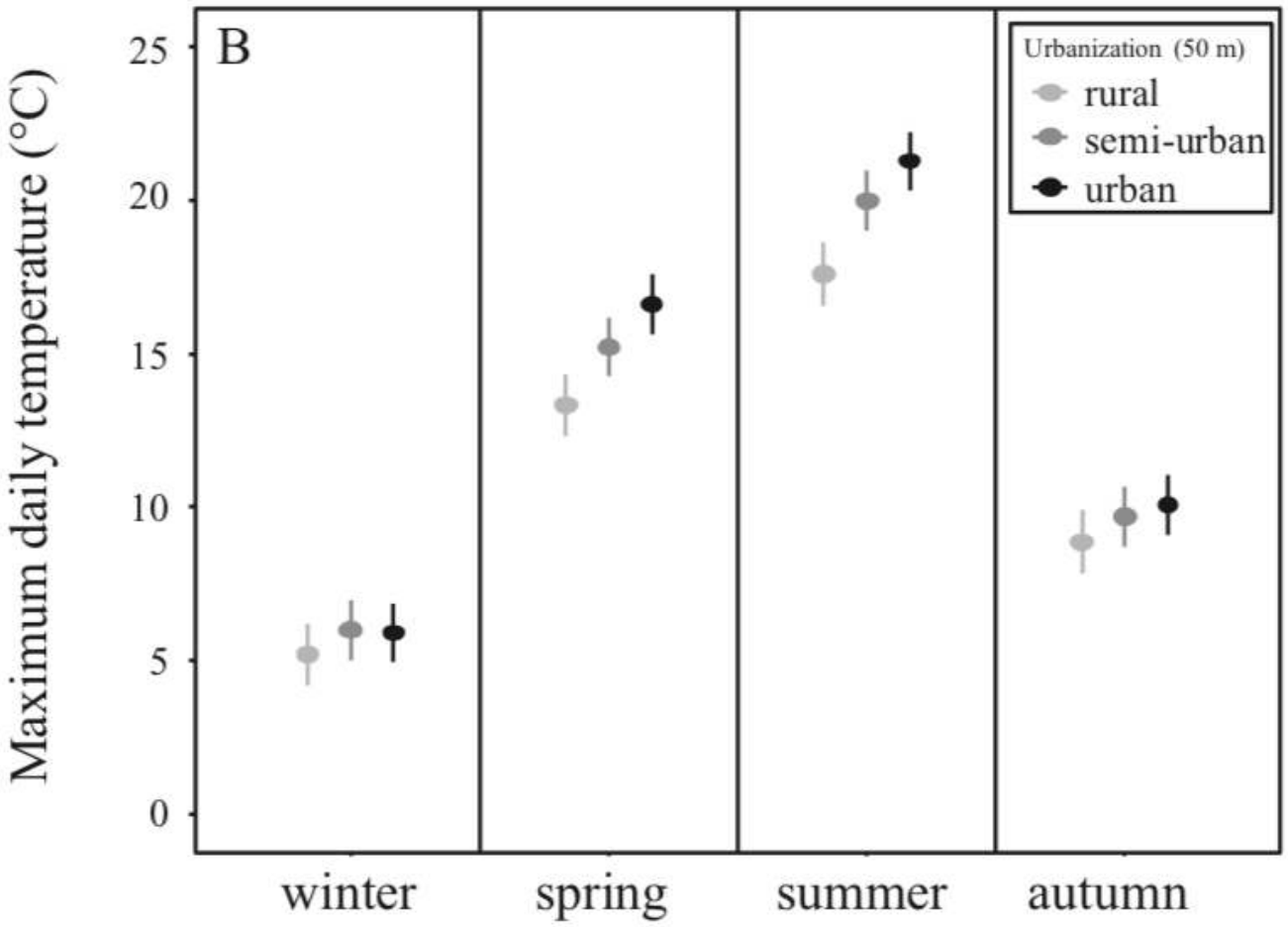
journal homepage: www.elsevier.com/locate/landurbplan



Research Paper

Urban hot-tubs: Local urbanization has profound effects on average and extreme temperatures in ponds

Kristien I. Brans*,[1], Jessie M.T. Engelen[1], Caroline Souffreau, Luc De Meester



Poças em áreas urbanas são mais quentes independente da estação do ano

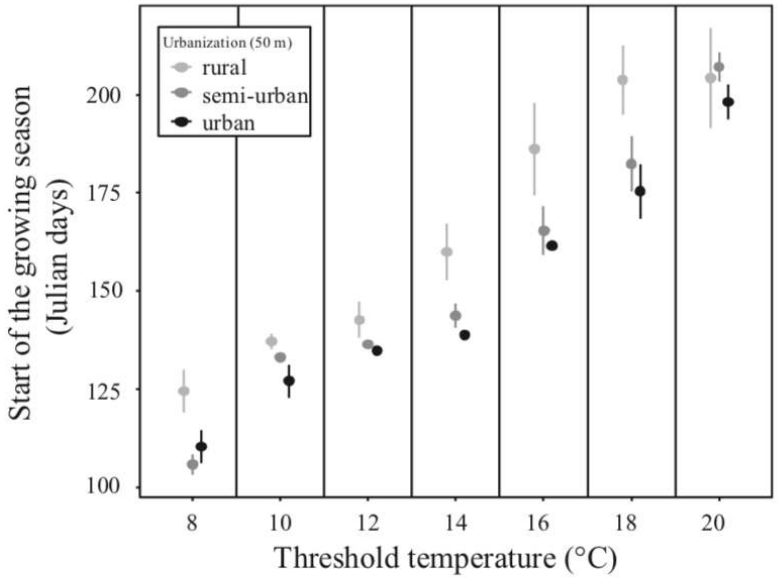
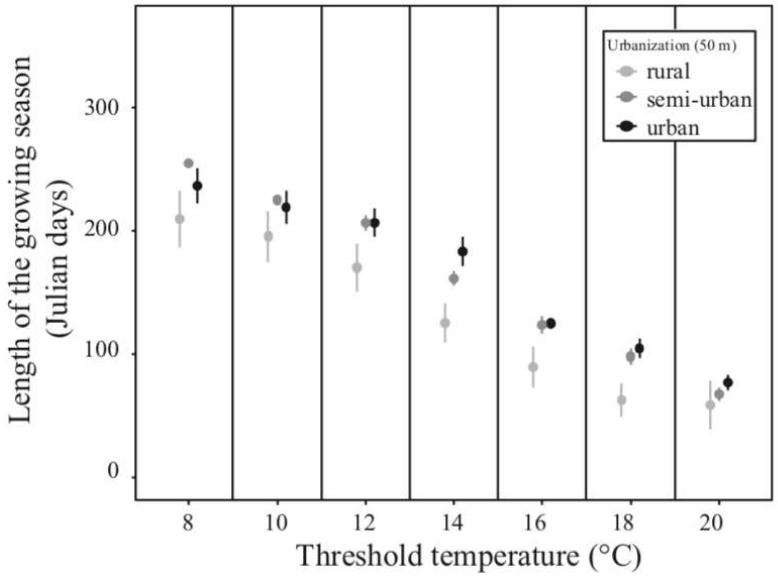


Fig. 5. Mean start of the estimated growing season (Julian day) ± 1 SE rural (light grey), semi-urban (grey), and urban (black) ponds. Urbanizati levels were assessed at a radius of 50 m around the pond. Day number is Juli day at which water temperature exceeded the threshold temperature. Thresh temperatures ranged from 8 °C to 20 °C.



Período reprodutivo das espécies aquáticas está ficando mais quente e mais curto

LETTER

https://doi.org/10.1038/s41586-018-0140-0

Body–size shifts in aquatic and terrestrial urban communities

Thomas Merckx[1]*, Caroline Souffreau[2], Aurélien Kaiser[1], Lisa F. Baardsen[3], Thierry Backeljau[3,4], Dries Bonte[5], Kristien I. Brans[2], Marie Cours[6], Maxime Dahirel[5,7], Nicolas Debortoli[8], Katrien De Wolf[4], Jessie M. T. Engelen[2], Diego Fontaneto[9], Andros T. Gianuca[2,10,11], Lynn Govaert[2], Frederik Hendrickx[4,5], Janet Higuti[12], Luc Lens[5], Koen Martens[6,13], Hans Matheve[5], Erik Matthysen[3], Elena Piano[4,14], Rose Sablon[4], Isa Schön[6,15], Karine Van Doninck[8], Luc De Meester[2,16] & Hans Van Dyck[1,16]

2018

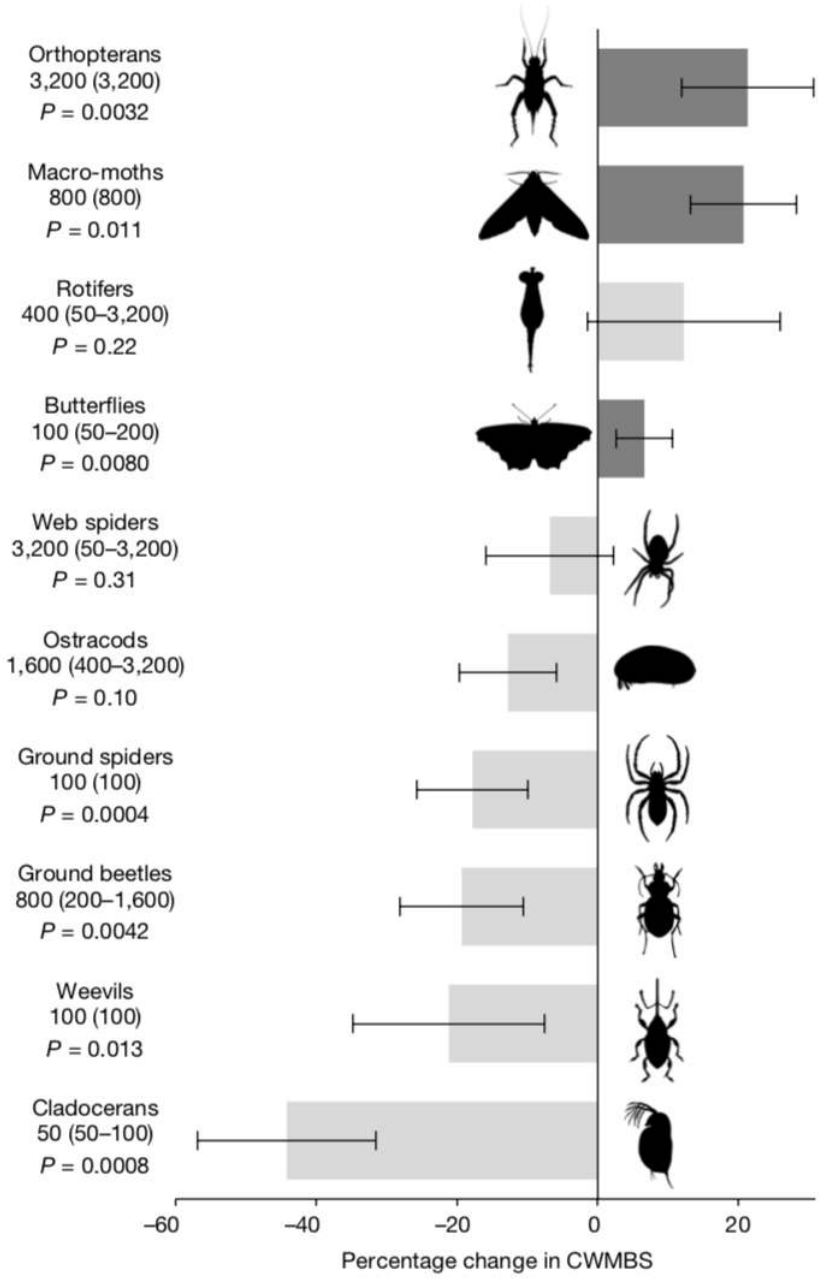
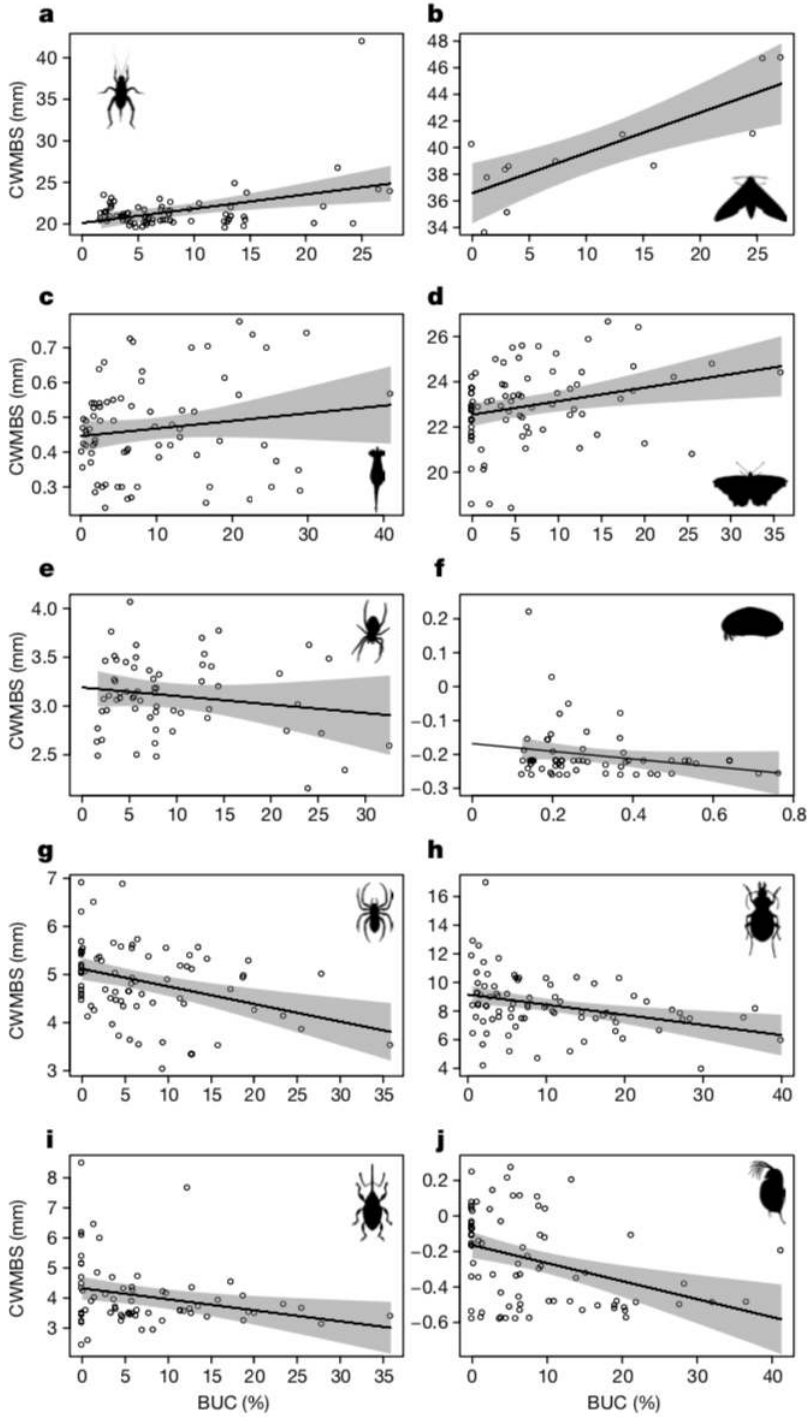


Fig. 3 | Taxon-specific percentage change in CWMBS for a 0–25% change in urbanization. Modelled extent of the mean percentage change in CWMBS for each taxon when comparing sites that differed by 25% BUC. CWMBS was analysed for each taxon ($n = 76, 12, 75, 80, 62, 60, 81,$



- O tamanho do corpo da maioria dos grupos de espécies está diminuindo em cidades

- Tamanho do corpo é uma característica fenotípica relacionada a vários aspectos da história de vida, regulação térmica, fisiologia