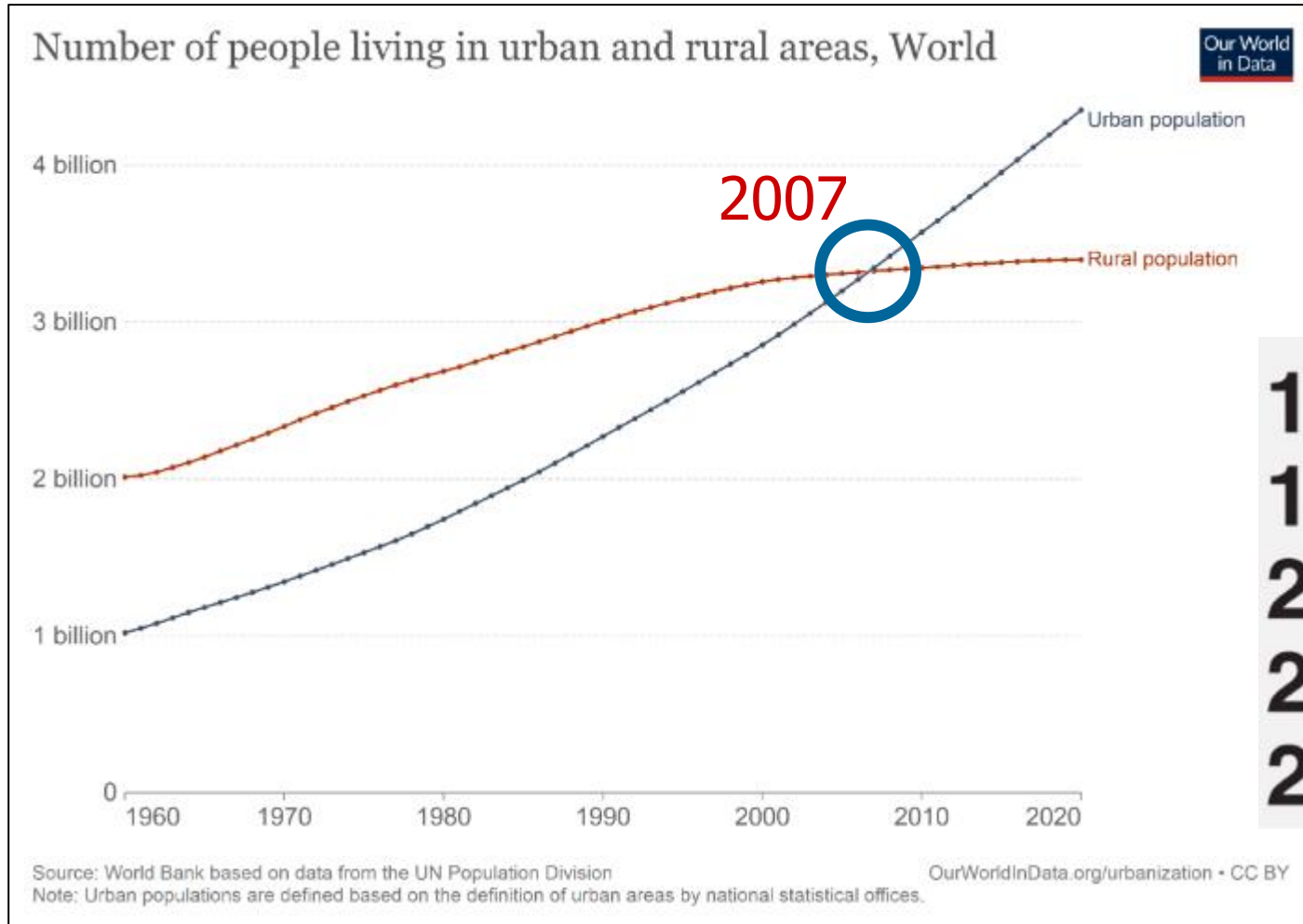


Green cities and vector-borne diseases: emerging concerns and opportunities

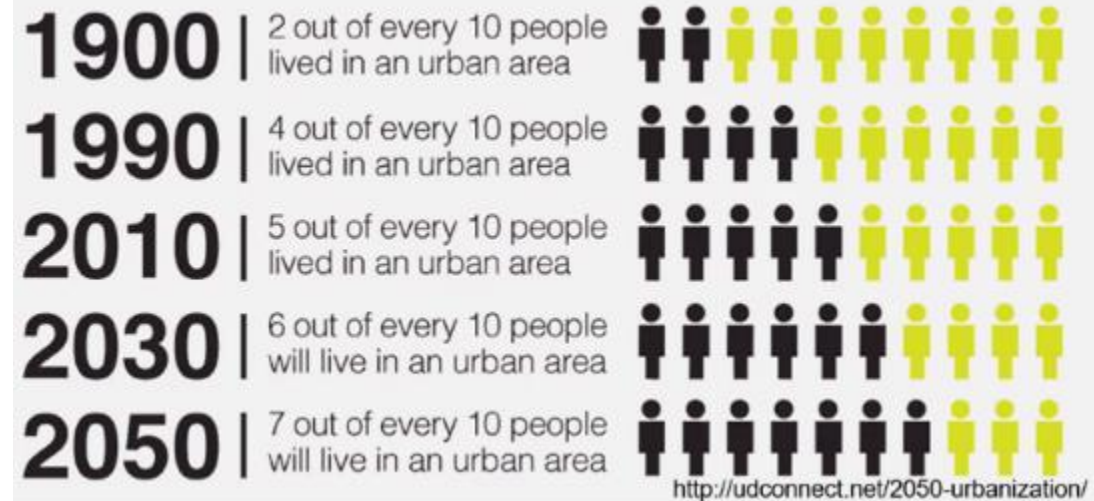
Florence FOURNET, French National Institute for Sustainable Research

No conflict of interest

An increasingly urban world ...



4.4 billion urban dwellers in 2022
75.3% in Europe
Expected to double by 2050



... At the root of biodiversity loss

- By 2030, 1.2 million km² more urban surfaces
- Urban area observed in 2000 is expected to triple
- Representing 110 + km² of urban area every day

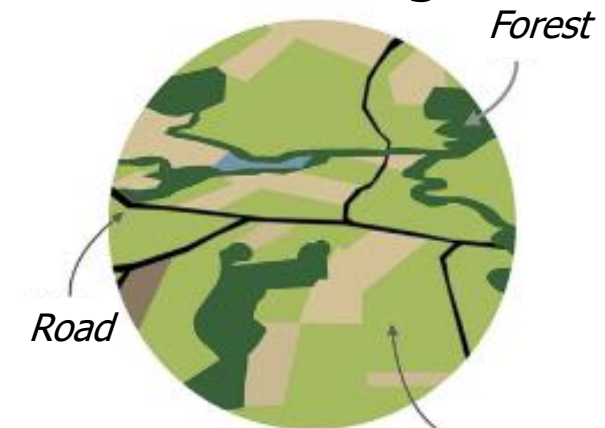
(Seto, Güneralp & Hutyra, 2012)

Habitat loss



City nibbling at the forest

Habitat fragmentation

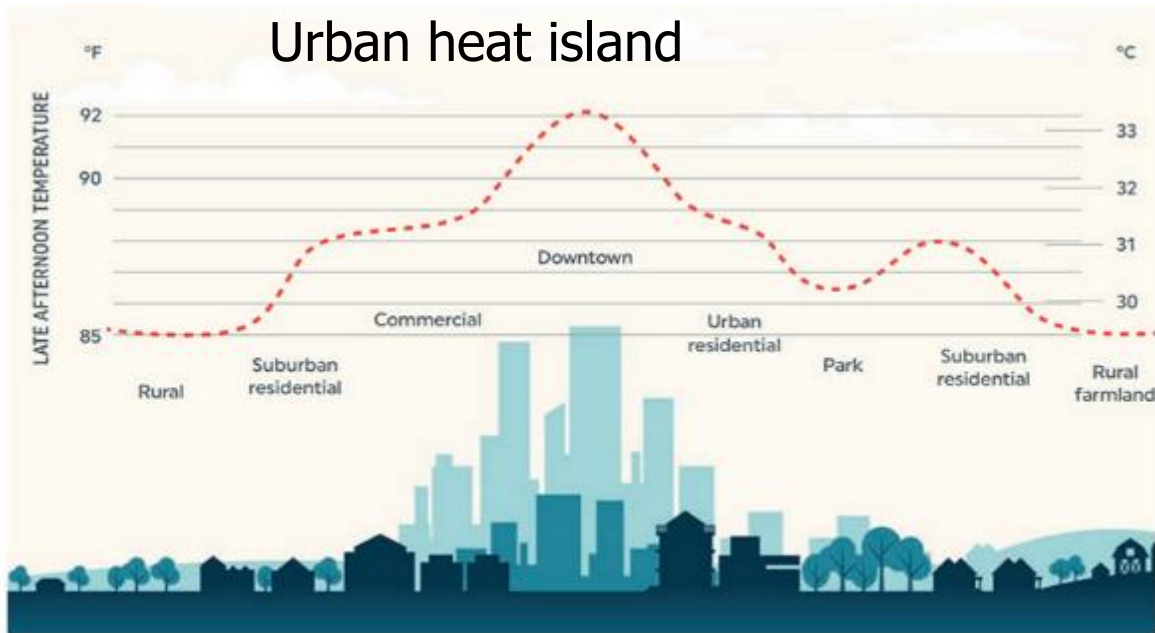


Cultivated area

<https://www.projetpangolin.com/comment-preserver-la-biodiversite/>

... Inequalities and health hazards

Urban heat island



The average air temperature in a city of a million or more inhabitants can be 1.8° to 5.4°C warmer on average, and as much as 22°C hotter at night, than in surrounding areas (*Heat Island Group, Lawrence Berkeley Lab, 2019*)

Air pollution



© Damien Glez

Inequalities



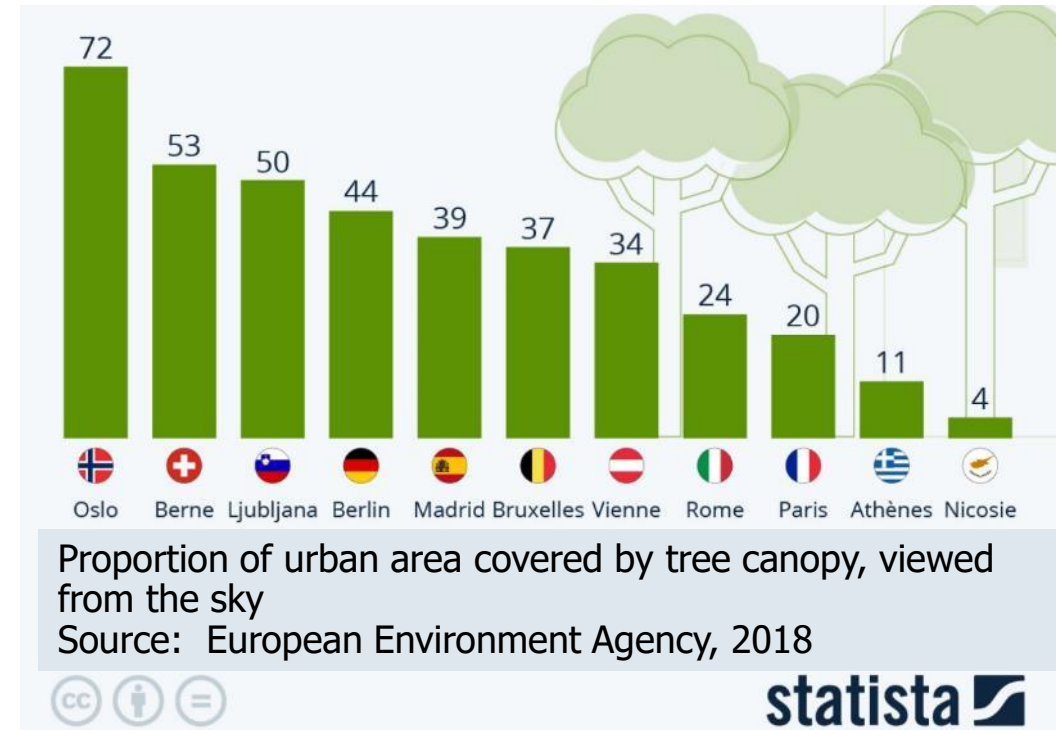
©Tuca Vieira

What about greening cities?

- Greening cities supports ecosystems and enhances their resilience meeting biodiversity, pollution and climate challenges
- Greening cities is a nature-based solution developed to cope with the UN sustainable development goals to “Make cities inclusive, safe, resilient and sustainable”



What about greening cities in Europe?



Nature-Based Solutions

- Definition

Actions to **protect, sustainably manage, and restore** natural or modified ecosystems, which address **societal challenges** effectively and adaptively, simultaneously providing **human well-being** and **biodiversity** benefits (*UN Environment Assembly in 2022*)



<https://www.lyon-gerland.com>



<https://www.couleursdavenir.fr>



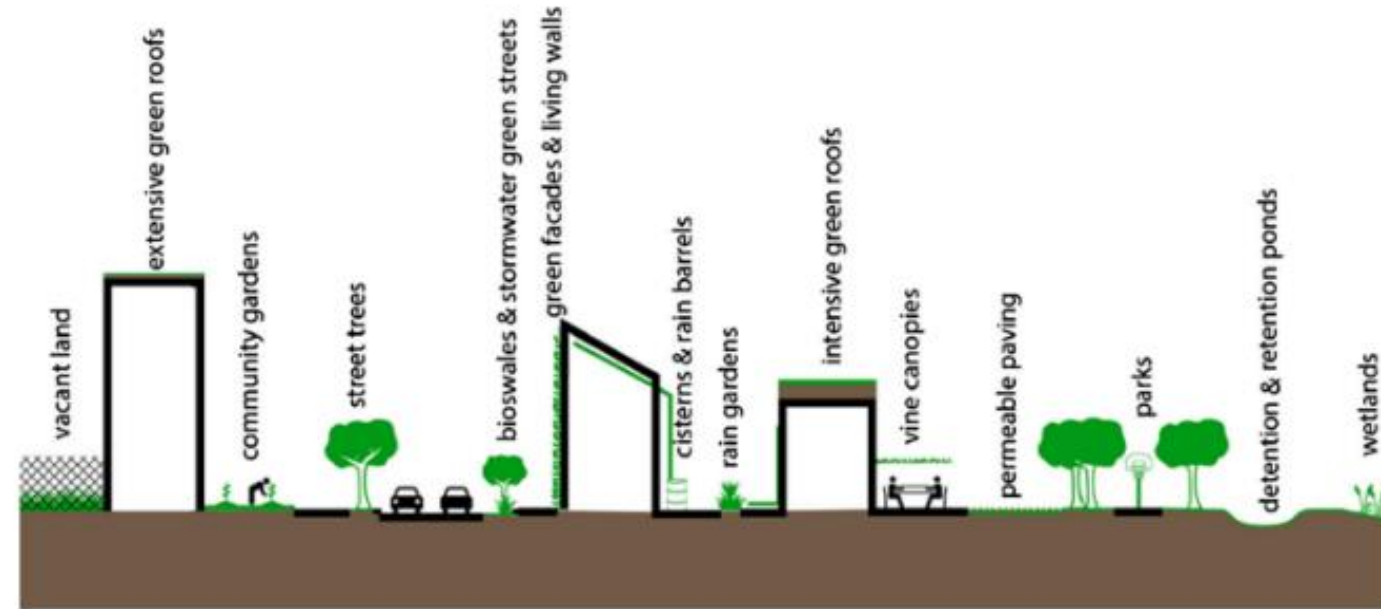
<https://www.soprema.fr/>



<https://experiencesdenature.com>

Nature-Based Solutions

- There are two types of NBS:
 - Existing areas that can be used to provide ecosystem services while also being maintained to protect and increase biodiversity
 - Areas that can be designed and constructed to support the ecosystem



Benefits for urban ecosystems

- Improve soil quality (*Schröder & Kiehl, 2020*)
- Enhance biodiversity (*e.g., community gardens: Young et al, 2020*)
- Reduce noise levels (*e.g., urban forests: Manning, 2008*)
- Reduce urban heat island effect (*e.g., forests; Moss et al, 2019*)
- Improve pollination (*Bennett & Lovell, 2019*)
- Capture air pollutants (*Pereira et al, 2021*)
- Contribute to food provisioning with urban gardens (*Lin & Egerer, 2020*)

Benefits for human health

- Greening policies ultimately contribute to human wellbeing by providing the above mentioned ES and other benefits on:
 - Mental health (*Gascon et al, 2015*)
 - Respiratory diseases (*Rojas-Rueda et al, 2019*)
 - Cardiovascular diseases (*Pereira et al, 2012*)

Numerous studies highlighted the challenges associated with comparing sites, methods, and the quantity and quality of green infrastructures

Potential harmful effects on public health

- Emissions of volatile organic compounds by urban trees may increase ozone formation (*Baro et al, 2014*)
- Air circulation restricted by tall roadside vegetation (*Vos et al, 2013*)
- Pollen emission by plants is among the ecosystem disservices having the greatest impact (*Carinanos et al, 2014*)
- Inequalities may increase because of unequal access to green infrastructures (*Mushangwe et al, 2021*)
- Interactions between humans and wildlife can be conflicting (*e.g. wild boar: Kotulski & König, 2008*)

What about arthropods borne-diseases?

- Arthropods with potential health risks (mosquitoes, sandflies, and ticks) are often overlooked
- Urban green spaces may facilitate the emergence and the spread of vector-borne pathogens to humans:
 - local increases in vector and/or reservoir diversity and abundance
 - boosting human exposure as more people engage in outdoor recreation
- Diseases can also concern animals and plants

Dengue and Mosquitoes in Tokyo



RESEARCH ARTICLE

Assessing dengue control in Tokyo, 2014

Baoyin Yuan^{1,2}, Hyojung Lee^{1,2}, Hiroshi Nishiura^{1,2*}

160 dengue cases

Aedes albopictus

Main focus: urban park Yoyogi

Highly frequented by people



Source: Wikipedia, 2023

Leishmaniasis and Sandflies in Madrid

SURVEILLANCE AND OUTBREAK REPORTS

Re-emergence of leishmaniasis in Spain: community outbreak in Madrid, Spain, 2009 to 2012

A Arce (araceli.arce@salud.madrid.org)¹, A Estirado¹, M Ordobas¹, S Sevilla¹, N García¹, L Moratilla¹, S de la Fuente², A M Martínezz, A M Pérez¹, E Aránguez², A Iriso², O Sevillano², J Bernal², F Vilas²

1. Division of Epidemiology, Health Promotion and Prevention Subdirectorate, Primary Care Directorate, Madrid, Spain
2. Division of Health Environmental, Ordination and Inspection Directorate, Health Department, Madrid, Spain



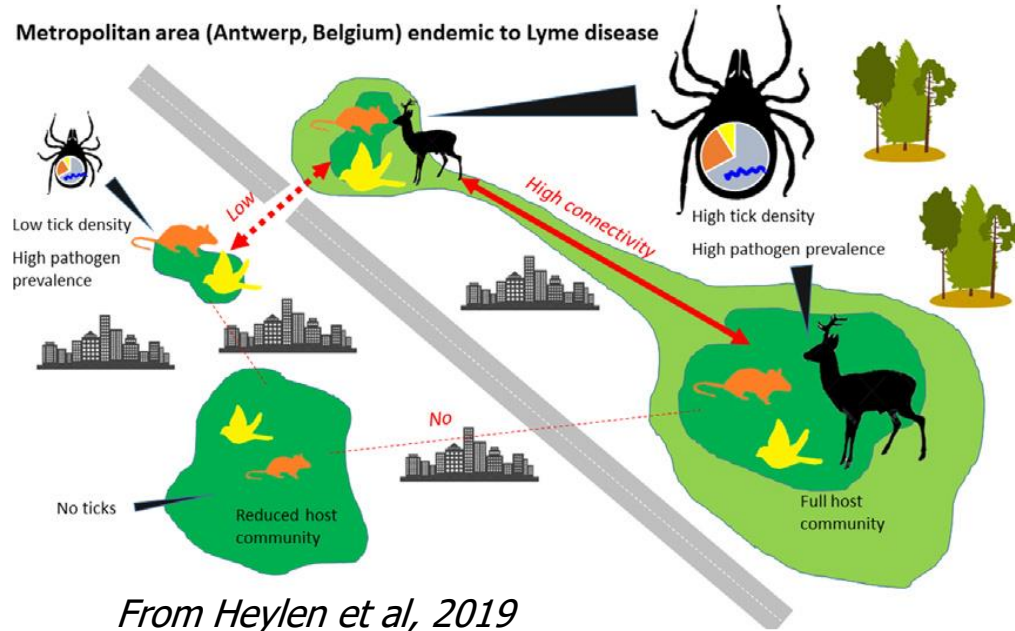
Source: Molina et al, 2012

446 cases of cutaneous and visceral leishmaniasis

Urban forest of Fuenlabrada

Introduction of a novel host (hare) and development of sandflies vectors

Ticks and Tick-borne diseases in cities



Received: 18 June 2020 | Revised: 18 August 2020 | Accepted: 25 August 2020

DOI: 10.1111/zph.12767

Zoonoses Public Health. 2020;67:822–838.

ORIGINAL ARTICLE

WILEY

Enhanced threat of tick-borne infections within cities? Assessing public health risks due to ticks in urban green spaces in Helsinki, Finland

Jani Jukka Sormunen¹ | Niko Kulha^{2,3} | Tero Klemola⁴ | Satu Mäkelä⁴ |
Ella-Maria Vesilahti⁴ | Eero Juhani Vesterinen^{1,5}



2020: **47 % of reporting in private gardens** between March and April on the French metropolitan area

Huang Long Bing and Psyllids in California

REVIEW ARTICLE

Biocontrol program targets Asian citrus psyllid in California's urban areas

Two parasitoids of the Asian citrus psyllid, from Pakistan, have been released in Southern California with promising results.

by Ivan Milosavljević, Kelsey Schall, Christina Hoddle, David Morgan and Mark Hoddle

<http://calag.ucanr.edu>



© A. Rival, Cirad

The top priority for the Californian citrus industry is to reduce the bacterium's rate of spread by reducing Asian citrus psyllid populations in urban areas where it is present.

What questions should we ask?

- What is the role of green infrastructures (GIs) in relation to arthropods?
- Do GIs increase vector abundance and diversity?
- Do GIs serve as a breeding site for mosquitoes? A resting place? A source of plant nectar?
- Do GIs promote contact between humans/animals/vectors, thereby enhancing infection risk?
- How do vectors, hosts, and pathogens circulate in the GI network?
- Does the heightened biodiversity of vectors and hosts dilute the transmission risk?
- Is the impact on arthropods the same whatever the GIs (forest, park, green wall, green roof, etc.)?

What do we need?

- Supporting data
- More comprehensive definition of green infrastructures (such as size, plant diversity, and surface extent)
- Development of consistent protocols for collecting entomological and environmental data (encompassing variables like temperature, relative humidity, and landscape metrics)
- Exploration of factors influencing Arthropod biodiversity and their role in pathogen emergence and transmission

What do we need?

- Definition of risk within diverse contexts (e.g., nuisance and disease)
- Designing robust indicators for assessing the risk of VBDs
- Implementation of long-term monitoring
- Collaboration with policy-makers, urban planners, health stakeholders, and civil society
- Use of citizen science (e.g. Mosquito Alert app)

Conclusion

- Greening cities is not an option
- The potential hazards of urban greening should not be a reason to shelve this urban planning concept
- The effects of urban greening on vector risks need to be explored further to prevent them
- Urban greening should be considered as an opportunity and a tool for sustainable risk management
- Raise awareness and involve the city's various stakeholders in identifying solutions to prevent vector-borne risks is essential
- Interdisciplinary and intersectoral approaches are needed, addressing the interconnections between human health, animal health and the socio-ecosystem



Thanks for your attention!



Vertical forest of Chengdu (China) Source: The Conversation

ESOVE 2024

The XXIIIrd European
Society for Vector Ecology
Conference



ONE HEALTH IN ACTION:
supporting and accelerating
the bridging of the vertebrate
and plant health communities



14-17th Oct. 2024
Montpellier, France

[https://www.alphavisa.com/
e-sove/2024/index.php](https://www.alphavisa.com/e-sove/2024/index.php)



Save the date!