**Introduction**

* What is the scope of the problem?
  + Improving the modeling of the walkable environment / service connecting area for urban green spaces (UGS) in European cities based on a proximity approach
  + Provide solutions for easy-to-handle / understandable indicators based on publicly available data and software
  + Develop an approach to combine high-resolution data with a comparative approach
* What do we know about the problem?
  + Living in proximity of urban green spaces (UGS) was found to have positive effects on mental health and physical activity as well as reduce mortality.
  + In the Sustainable Development Goal (SDG) 11, the United Nations have agreed to provide universal access to public green spaces by 2030.
  + Nonetheless, urban population is growing worldwide, leading to green space development.
  + Compact city paradox:
    - The more compact a city, the more people benefit from UGS, the higher the pressure on the ecological functions of the UGS
  + The accessibility of available green spaces is influenced by spatial as well as non-spatial factors
    - Accessibility of UGS vs availability of UGS (?)
    - Three perspectives have been used in past studies to tackle the problem:
    - Provision (area / person): Flow from green area to buildings (providing green space)
    - Pressure (person / area): Flow from residential buildings (population) to green spaces (pressure on / demand of green areas)
    - Proximity (min. or avg. distance): Space between supply and demand (proximity)
    - Approach from Wolff 2021: Coupling the perspectives via network characteristics
      * Modeling service connecting areas / the walkable environment to allow including the three perspective into one workflow.
      * Two promising indicators: Detour Index (DI) and Local Significance (LS).
  + Accessibility and availability of UGS in Europe have been analyzed and compared in multiple studies e.g.:
    - State of the art
      * Analysis for whole Europe:
        + Kabisch et al. 2016 green spaces Europe
        + JRC accessibility study
      * Analysis for single city:
        + Wolff 2021
        + Haase Kabisch Berlin paper
* What do we not know about the problem?
  + Research gaps (of previously mentioned studies):
    - Mostly using fixed distances
      * ‘To have or not to have access to green spaces’
    - Mostly using only one perspective
      * Not accounting for mutual dependencies of supply and demand
      * No focus on service connecting areas / walkable environment
      * A proximity perspective is necessary to account for barriers and network characteristics
    - Mostly using course resolution if on a larger scale
      * Fine resolution can reveal spatial patterns at a finer scale enabling targeted intervention
      * A finer resolution will also reduce the uncertainty that is introduced if e.g. a grid or a district aggregation is used
      * No comparable studies using e.g. a building-based approach on a European scale
  + Conclusion:
    - Knowledge about UGS is important for planning and decision making to remove uncertainties in UGS provision.
    - Detect mismatch between provision and demand
    - Need for a method that models service connecting areas to combine supply and demand aspects of green space accessibility / availability with a high spatial resolution that is comparable on a European scale
* What is the purpose of this paper?
  + Research questions

What does a modeling approach look like that estimates the walkability between green space supply and demand in cities?

How to incorporate publicly accessible data and open source software in order to allow i.) a reproduction over time (e.g. with more recent data), ii.) assessments in data-scare regions, and iii.) comparative approaches covering a larger sample of cities

* + - How can easy understandable and applicable indicators be used in order to support urban planning in detecting mismatches between demand and supply
  + Objective 1:
    - Create a homogeneous workflow for the modeling of service connecting areas / walkable environment (on a building level) across European cities using publicly available data and open source software:
      * Create Network characteristics for European cities:
        + Combine buffer distance and network distance (Detour index)
        + Combine population, GBS size network distance (Local significance)
  + Objective 2:
    - Find ways for effective comparisons and pattern detection both within cities  
      and between cities
    - Detect mismatch between provision and demand using the results of objective 1.
  + Objective 1: From concept to workflow (based on service-connecting area/proximity approach)

Objective 2: Combine data and software which are free, updatable, and comparable over Europe

Objective 3: Develop and apply indicators, display/interpret/compare them