DRR: Urban Roots - Summaries of Articles Found

DRR: Urban Roots

Literature review database - Google Sheets
Key Words
Quick Facts Sheet
Final Presentation

Developing a sustainability indicator set for measuring green infrastructure performance

Pakzad, P., & Osmond, P. (2016). Developing a Sustainability Indicator Set for Measuring Green Infrastructure Performance. Procedia - Social and Behavioral Sciences, 216, 68–79. https://doi.org/10.1016/j.sbspro.2015.12.009

- **Keywords used to find the article:**
  - Green infrastructure performance
- **2 - 3 sentence summary:**
  - This conference paper presents a conceptual framework to facilitate the development of an inclusive model for the sustainability assessment of green infrastructure. The purpose of this study is to critically examine the existing frameworks for urban sustainability indicators and to compare the existing green infrastructure conceptual models (Table 1).
- **Outcomes:**
  - Authors proposed a new framework to facilitate the process of selecting green infrastructure performance indicators to best reflect the comprehensive and integrated function of green infrastructure. The framework links green infrastructure performance with ecosystem services (Table 2), human health (Table 3), and ecosystem health. Table 4 presents the proposed green infrastructure performance indicator set, including references to empirical studies.
- **Description of the type of study:**
  - Authors reviewed existing models for assessing green infrastructure performance and evaluated these models via a range of selection criteria based on literature review and interviews with stakeholders.

It Is Not Easy Being Green: Recognizing Unintended Consequences of Green Stormwater Infrastructure

Taguchi, V., Weiss, P., Gulliver, J., Klein, M., Hozalski, R., Baker, L., Finlay, J., Keeler, B., & Nieber, J. (2020). It Is Not Easy Being Green: Recognizing Unintended Consequences of Green Stormwater Infrastructure. *Water*, *12*(2), 522. https://doi.org/10.3390/w12020522

- **Keywords used to find the article:**
  - Green infrastructure
- **2 - 3 sentence summary:**
  - This paper discussed the different types of green infrastructure and their benefits and drawbacks from using each. It additionally discussed the unintended consequences of using each of them.

- **Quick Facts:**
    - Urban trees provide stormwater benefits by intercepting rainfall and taking up water soaking into the soil around their roots which can stabilize soil and reduce erosion
    - Trees produce organic matter which can be picked up by runoff and transported into storm drains loading nutrients into storm water.
    - There is a strong spatial correlation between tree canopy and median household income as urban trees are seen as a commodity, in turn, planting trees can increase property value.
- **Description of the type of study:**
    - Overview and Gaps analysis of Green Infrastructure

People, Land and Sustainability: Community Gardens and the Social Dimension of Sustainable Development

Ferris, J., Norman, C., and Sempik, J. (2001). People, Land and Sustainability: Community Gardens and the Social Dimension of Sustainable Development. *Social Policy and Administration,* 35(5), 559-568. https://doi.org/10.1111/1467-9515.t01-1-00253.

- **Keywords used to find the article:**
    - Community gardens
- **2 - 3 sentence summary:**
    - The paper reviews community gardens in San Francisco and the positive roles community gardens can have towards environmental issues, food security, recreation, drugs and crime, and the education of the public. There are many types of community gardens with different purposes, but in general, the gardens can bring together the community and have many benefits.
- **Outcomes:**
    - One garden in a poor neighborhood with many ex-prisoners led to a 75% non-return to jail within three years; it offered twice the minimum wage and provided a self-esteem boost for ex-prisoners.
- **Quick Facts:**
    - In many American cities, white populations have vacated inner-city areas that have been environmentally damaged and now community gardens serve as one way to restore these areas.
- **Description of the type of study:**
    - Qualitative, seemed somewhat anecdotal

The Urban Forest and Ecosystem Services: Impacts on Urban Water, Heat, and Pollution Cycles at the Tree, Street, and City Scale

APA citation (with DOI): Livesley, S.J., McPherson, E.G., Calfapietra, C. (2016). The Urban Forest and Ecosystem Services: Impacts on Urban Water, Heat, and Pollution Cycles at the Tree, Street, and City Scale. *Journal of Environmental Quality,* 45 (1), 119-124. 10.2134/jeq2015.11.0567

- **Keywords used to find the article:**
  - Urban forest and heat island effect and heatwaves
- **2 - 3 sentence summary:**
  - This paper combined evidence from 14 studies across the globe to review the ecosystem services of urban forests. It reviewed the ability of trees to provide shade and evapotranspiration benefits and posited that urban trees are the most cost effective mitigation tool for the urban heat island. It also recognized the ability of trees to reduce runoff and to uptake pollutants and sequester carbon dioxide.
- **Outcomes:**
  - Urban forests are most effective in large sizes. Some trees emit BVOCs (Biological volatile organic compounds) that can be harmful to the atmosphere, so tree selection should consider these emissions along with water supply. Urban pollution can be prevented by establishing urban forests along waterways to intercept high-nutrient runoff or groundwater.
- **Quick Facts:**
  - A large area of forested trees will be more effective at reducing the heat island effect than many spread out trees.
- **Description of the type of study:**
  - Review article. Calls itself a “special section”

Garden Pollinators and the Potential for Ecosystem Service Flow to Urban and Peri-Urban Agriculture

Langellotto, G. A., Melathopoulos, A., Messer, I., Anderson, A., McClintock, N., & Costner, L. (2018). Garden Pollinators and the Potential for Ecosystem Service Flow to Urban and Peri-Urban Agriculture. *Sustainability*, *10*(6), 2047. https://doi.org/10.3390/su10062047

- **Keywords used to find the article:**
  - Urban gardens and pollination
- **2 - 3 sentence summary:**
  - Authors explored the possibility of pollination service flow between urban, residential gardens, and adjacent agriculture areas.
- **Outcomes:**
  - The results suggested that urban gardens might provide neighboring farms and food gardens with pollination services. Additionally, urban gardens could serve as a refuge for pollinators when forage or nest sites are scarce, or management practices are inhospitable (e.g. use of fertilizers). Authors found that when pollination-dependent crops (commercial-scale or residential-scale) are nearby,

30–50% of the garden bee community could provide pollination services to adjacent crops.

- **Quick Facts:**
    - Urban gardens could serve as a refuge for pollinators when forage or nest sites are scarce, or management practices are inhospitable (Langellotto et al., 2018).
    - 30–50% of the garden bee community in urban gardens might provide neighboring pollination-dependent farms and food gardens with pollination services (Langellotto et al., 2018).
- **Description of the type of study:**
    - Authors sampled bees from 24 gardens in the Portland, Oregon metropolitan area, and estimated the foraging distances in the context of commercial and residential-scale up to 1000 m from garden study sites. They collected bees on three separate occasions within each garden (June, July, and August 2017), using a combination of water pan traps and hand collecting.

Citizen science in schools: Engaging students in research on urban habitat for pollinators

Saunders, M. E., Roger, E., Geary, W. L., Meredith, F., Welbourne, D. J., Bako, A., Canavan, E., Herro, F., Herron, C., Hung, O., Kunstler, M., Lin, J., Ludlow, N., Paton, M., Salt, S., Simpson, T., Wang, A., Zimmerman, N., Drews, K. B., … Moles, A. T. (2018). Citizen science in schools: Engaging students in research on urban habitat for pollinators. Austral Ecology, 43(6), 635–642. https://doi.org/10.1111/aec.12608

- **Keywords used to find the article:**
    - Pollinator gardens and students
- **2 - 3 sentence summary:**
    - This study is one of a growing number of peer-reviewed scientific publications resulting from collaborations between scientists and school groups. This paper reports on a citizen science education program targeted at school-age children across eastern Australia. The program focused on building knowledge for both the scientific community and the participating school groups of diverse native insect pollinator taxa. The project used citizen science to involve school students in scientific research, addressed two research questions: (i) In which habitats were most insects caught? (ii) In which trap colors were most insects caught?
- **Outcomes:**
    - Habitat had a significant effect on the number of pollinator insects caught. The highest number of insects were caught in open grassy areas, and the fewest insects were caught in paved areas.
    - There was no difference in the number of individuals caught in each trap color. However, the color of a pan trap has previously been found to influence the number and types of insects attracted to the trap, with many studies showing color preferences for particular taxa.
- **Quick Facts:**

    - Projects that engage students with habitat for pollinator insects in urban environments can enhance scientific literacy by giving students first-hand experience in the scientific process (Saunders et al., 2018).
    - Habitat had a significant effect on the number of pollinator insects caught. The highest number of insects were caught in open grassy areas, and the fewest insects were caught in paved areas (Saunders et al., 2018).
    - Although the color of a pan trap has previously been found to influence the number and types of insects attracted to the trap, this study results yielded that there was no difference in the number of individuals caught in each trap color (Saunders et al., 2018).
- **Description of the type of study:**
    - The program used standardized methods deployed across multiple schools through scientist–school partnerships to engage students with a vital conservation problem: habitat for pollinator insects in urban environments. Four sites were chosen at or near each school to represent four general habitat types: one paved site with no vegetation (e.g. assembly ground or basketball court), one open grassy site, one garden site (e.g. a landscaped garden or kitchen garden), and one 'forest' area with tall trees. The collection method was standardized across all schools and sites deploying colored pan traps to collect insects.When citizen science education programs are implemented in a coordinated way across multiple schools, the data can be analyzed collectively to identify biogeographical patterns in the focal ecological interactions.

Effectiveness of Nature-Based Solutions in Mitigating Flood Hazard in a Mediterranean Peri-Urban Catchment:

Ferreira, C. S., Mourato, S., Kasanin-Grugin, M., Ferreira, A. J. D., Destouni, G., & Kalantari, Z. (2020). Effectiveness of nature-based solutions in mitigating flood hazard in a mediterranean peri-urban catchment. *MDPI.* https://doi.org/10.3390/w12102893

- **Keywords used to find the article:**
    - Flood mitigation nbs
- **2 - 3 sentence summary:**
    - Researchers wanted to see what the effects of Nature-Based Solutions (NBS) were on rural landscapes around cities, peri-urban areas. This study was conducted in the Mediterranean, where there is significant flooding and rainfall.
- **Outcomes:**
    - Through the study they found that the sites that were implemented showed a lower water height for almost all the different return periods, ranging from 10-100 years. Also found that the NBS approach can be useful and successful in mitigating floods but that there needs to be more research conducted as there are not many articles out there exploring this side of flood mitigation.
- **Quick Facts:**

    - NBS approach can be useful and successful in mitigating floods

Opportunities and threats for pollinator conservation in global towns and cities

Baldock, K. (2020). Opportunities and threats for pollinator conservation in global towns and cities. *Current Opinion in Insect Science,* 38, 63-71. https://doi.org/10.1016/j.cois.2020.01.006

- **Keywords used to find the article:**
    - Pollinator gardens
- **2 - 3 sentence summary:**
    - This article detailed the positive and negative effects on pollinator success of pesticides and pollution, climate change, and competition concerns in urban areas. In urbanized areas with high levels of impervious surfaces, increasing floral resources through floral plantings of native and pollen-rich non-native species, green infrastructure, and increased greenspace can contribute to an improved landscape for pollinators.
- **Outcomes:**
    - Promoting community pollinator habitat is an effective way to engage urban residents in citizen science projects, and citizen science projects were cited as one opportunity for protecting pollinators. One key aspect of pollinator protection is monitoring programs to assess changes over time. Additionally, a potential opportunity to help pollinators is through developing regional pollinator initiatives with public policy and developing policy for urban landscapers.
- **Description of the type of study:**
    - Overview article

Developing “community” in community gardens:

Firth, C., Maye, D., & Pearson, D. (2011). Developing “community” in community gardens. *EBSCOhost.* 10.1080/13549839.2011.586025

- **Keywords used to find the article:**
    - Community gardens
- **2 - 3 sentence summary:**
    - Community gardens help to bring people together to work on joint activity, build bonds within the community, help build links with institutions and authorities, and bridging social capital by bringing together people from all different backgrounds to cook, grow and eat food together.
- **Outcomes:**
    - Talk about the advantages of having a community garden and how it can go beyond just creating bonds within the community.

    - Talks about how it creates a green space for the community, allows people to learn different skills, have commonality with other community members, and teaches others lessons.
    - There is mention of the disadvantages of having a community garden and how not all the time does it work.
- **Description of the type of study:**
    - Qualitative research-based article that looks into the differences between place-based and interest based community gardens

A systems approach reveals urban pollinator hotspots and conservation opportunities

Baldock, K., Goddard, M.A., Hicks, D.M., Kunin, W.E., Mitschunas, N., Morse, H, Osgathorpe, L.M., Potts, S.G., Robertson, K.M., Scott, A.V., Staniczenko, P., Stone, G., Vaughan, I.P., Memmott, J. (2019). *Nature Ecology and Evolution,* 3(3), 363-373. https://doi.org/10.1038/s41559-018-0769-y

- **Keywords used to find the article:**
    - Pollinator gardens
- **2 - 3 sentence summary:**
    - In this article, researchers surveyed the abundance and richness of pollinators throughout four cities in the UK to find out how land uses contribute to pollinator abundance; they split up land use into allotment, garden, cemetery, nature reserve, park, other greenspace, verge (vegetation beside a road), pavement, and manmade surface.
- **Outcomes:**
    - Allotments, or community gardens focused on food production, had the greatest floral abundance and therefore the greatest bee richness. Modifying land use (such as converting a park to a community garden) or improving management practices (such as reducing grass mowing frequency) were both found to be ways to increase pollinator abundance in an urban environment. Generally, adding allotments, cemeteries, or nature reserves would improve community robustness; enhancing floral resources in current land uses would have similar effects.
- **Quick facts:**
    - Modifying land use to incorporate more green space increases pollinator abundance.
    - Both native and non-native flowers have been found to be important for pollinator foraging.
- **Description of the type of study:**
    - Data collection and model development

Assessing the effectiveness of green infrastructures on urban flooding reduction: A community scale study

Liu, W., Chen, W., & Peng, C. (2014). Assessing the effectiveness of green infrastructures on urban flooding reduction: A community scale study. *Ecological Modelling*, *291*, 6–14. https://doi.org/10.1016/j.ecolmodel.2014.07.012

- **Keywords used to find the article:**
    - Green Infrastructure urban flooding reduction
- **2 - 3 sentence summary:**
    - This article discussed a hydrologic modeling effort to show the effectiveness of different green infrastructures on reducing peak flow and runoff volume in urban settings. The green infrastructures simulated in the model included green spaces, concave green spaces, storage ponds, and porous pavements. The model showed the effectiveness in reducing flooding from stormwater runoff in urban settings.
- **Outcomes:**
    - The researchers concluded from their model simulations that a single green infrastructure structure would not be capable of reducing both runoff volume and peak flow of runoff effectively. To achieve maximum effectiveness in reducing peak discharge and runoff volume, an integrated green infrastructure system of multiple green infrastructure practices would need to be used.
- **Quick facts:**
    - For green spaces, the model results showed that reduction in urban stormwater runoff volume was relatively small with increased green space.
    - The researchers concluded that urban flooding can be reduced with considerable increases in urban green space but most communities are limited in their ability to expand green space.
    - The researchers concluded from their model simulations that a single green infrastructure structure would not be capable of reducing both runoff volume and peak flow of runoff effectively.
- **Description of the type of study:**
    - Hydrologic modeling study

Planting the living city: Best practices in planning green infrastructure - Results from major U.S. cities

Young, R. F. (2011). Planting the living city: Best practices in planning green infrastructure - Results from major U.S. cities. *Journal of the American Planning Association*, *77*(4), 368–381. https://doi.org/10.1080/01944363.2011.616996

- **Keywords used to find the article:**

    - Urban forests disaster resilience
- **2 - 3 sentence summary:**
    - This article focuses on 8 major cities and one metropolitan area in the United States and their urban reforestation efforts. The cities serve as benchmarks where the researchers interviewed them about the programs and their accompanying challenges, key considerations, and best management practices.
- **Outcomes:**
    - The study found that cities employed a wide variety of strategies to advance tree planting initiatives which ranged from highly institutionalized and data driven to more decentralized grassroots strategies. Tree planting initiatives lack traditional infrastructure funding and the paper described the strategies, community engagement, and creative development programs used to maintain funding and momentum. The paper also describes the use of corporate sponsorship to advance underfunded programs. In addition, contracting with grassroots and advocacy organizations to provide educational benefits and fieldwork to maintain momentum in underfunded programs can be a means to achieving their initiatives goals.. The most effective strategy in advancing urban forestry based green infrastructure was institutionalized, diverse funding structures and robust, agency level commitment to maintaining and expanding urban forests. One last outcome the paper found was that the initiatives benefitted from being launched early in an administration as some programs were found to lose funding after a mayor who launched it lost reelection.
- **Description of the type of study:**
    - Community Benchmarking Study
- **Reviewer comments (include your name):**
    - Phil-This article will help the urban roots project by detailing considerations and best management practices with a reforestation effort to ensure its success.

Conversion and recovery of Puerto Rican mangroves: 200 years of change

Martinuzzi, S., Gould, W. A., Lugo, A. E., Medina, E. (2009). Conversion and recovery of Puerto Rican mangroves: 200 years of change. Forest Ecology and Management, 257(1), 75-84. https://doi.org/10.1016/j.foreco.2008.08.037.

- **Keywords used to find the article:**
    - Mangroves Puerto Rico
- **2 - 3 sentence summary:**
    - This study evaluated the history of land use and development in Puerto Rico and its effects on mangroves (defined here as the ecosystem hosting mangrove forests). Puerto Rico's history of agricultural development, switch to industrialization, and institution of mangrove protections showed that forests can naturally recover from abandoned lands. Mangroves are compatible with

urbanization given there is hydrological stability and a lack of urban pollution, and that policies to protect mangroves are effective.

- **Outcomes:**
    - Between 1977 and 2002, mangrove cover increased by 12% due to an abandonment of agriculture and increases in conservation policy protection. Mangroves are able to survive in urban areas given social protection and favorable ecological conditions.
- **Quick facts:**
    - The world's mangrove forests have decreased in area by 35% since the 1980s (Valiela et al., 2001)
    - By 1948, most of the island of Puerto Rico was deforested for agricultural use, and only 6% of the original forest remained (Birdsey and Weaver, 1987).
- **Description of the type of study:**
    - Analysis of historical data
- **Reviewer comments (include your name):**
    - Annie - mostly focused on how mangroves can naturally recover given the space and how policy protection of mangroves is effective. Very briefly mentions that NGO planting can contribute to mangrove gain, but it's anecdotal in a table.

Attitudes toward Residential Trees and Awareness of Tree Services and Disservices in a Tropical City

Olivero-Lora, S., Meléndez-Ackerman, E., Santiago, L., Santiago-Bartolomei, R., & García-Montiel, D. (2020). Attitudes toward Residential Trees and Awareness of Tree Services and Disservices in a Tropical City. Sustainability, 12(1), 117. https://doi.org/10.3390/su12010117

- **Keywords used to find the article:**
    - Attitudes trees puerto rico
- **2 - 3 sentence summary:**
    - Authors present a case study that builds upon prior work on the social–ecological processes driving residential vegetation dynamics in the Río Piedras Watershed (RPWS) located in San Juan, Puerto Rico. The objectives were to evaluate: (1) how household demographics and watershed location (site) drive positive and negative attitudes toward urban trees located in two referenced green spaces (residential yards and neighborhoods); (2) whether awareness of ecosystem services and disservices differs according to the spatial proximity of the tree (home versus neighborhood); and (3) whether attitudes may drive yard management outcomes (tree abundance) within the Río Piedras Watershed.
- **Outcomes:**
    - Most residents self-reported positive attitudes toward trees in general and these appeared to be more frequent than self-reported negative attitudes. Respondents recognized more tree services (emphasizing shade, lower temperature, food, and ornamental/aesthetics) and fewer disservices (emphasizing maintenance hardship, property damage, and power line obstruction). Not all tree services and

disservices were equally recognized, and differences in the spatial context of trees and residents may contribute to the variation in residents' awareness of tree ecosystem services or disservices. Variation in positive attitudes partially explained the current variation in yard tree abundance, along with residents' age, housing tenure, yard size, and watershed location.

- **Quick Facts:**
    - Residents' attitudes toward trees and their related services and disservices have been found to differ according to the location of the tree relative to the resident's property or whether they are located on private or public property (Olivero-Lora et al., 2020).
    - Variation in residents' positive attitudes toward trees explained the current variation in yard tree abundance, along with residents' age, housing tenure, yard size, and watershed location (Olivero-Lora et al., 2020).
- **Description of the type of study:**
    - In 2011, 397 household surveys were conducted in six locations of the Río Piedras Watershed (San Juan, Puerto Rico) to evaluate residents' attitudes toward residential and neighborhood trees and their association with household socio-demographic factors, how awareness of services and disservices relate to the spatial proximity of trees (home versus neighborhood), and whether attitudes are associated with yard management (tree abundance).
- **Reviewer comments (include your name):**
    - Glorynel - Results have direct implications for urban forest planning and management in residential contexts.

Rainfall interception by six urban trees in San Juan, Puerto Rico

Nytch, C. J., Meléndez-Ackerman, E. J., Pérez, M.-E., & Ortiz-Zayas, J. R. (2019). Rainfall interception by six urban trees in San Juan, Puerto Rico. Urban Ecosystems, 22(1), 103–115. https://doi.org/10.1007/s11252-018-0768-4

- **Keywords used to find the article:**
    - Stormwater trees puerto rico
- **2 - 3 sentence summary:**
    - Rainfall interception by trees is an important part of the urban hydrological cycle. Understanding is limited about the role of urban trees and other vegetation in the interception process. This study quantified interception losses by six trees in the Caribbean coastal city of San Juan, Puerto Rico.
- **Outcomes:**
    - Results suggest that individual urban tree canopies function as spatiotemporally dynamic storage reservoirs whose interception capacity can vary as micro-meteorological conditions change. During relatively small and less intense storms, the canopies of the six trees examined influenced throughfall, the magnitudes of which varied by tree type and individual. However, interception capacity was severely limited during larger and more intense storms, regardless

of tree type. These factors, along with tree cover, soil hydrologic groups, infiltration, storage, and other variables must be taken into consideration when developing strategies for managing stormwater flows, particularly in geographic locations where climate change is anticipated to increase rainfall intensity.

- **Quick Facts:**
    - Urban tree canopies function as spatio-temporally dynamic storage reservoirs can vary as micro-meteorological conditions change (Nytch et al., 2019).
- **Description of the type of study:**
    - Six individual trees, three representing *Calophyllum antillanum Britt*, and three representing *Albizia procera* were selected within the North Botanical Garden of the University of Puerto Rico-Río Piedras (UPRRP) in San Juan. The species were chosen because of their occurrence as two of the ten most common trees across the city of San Juan. Rainfall was partitioned into throughfall for 13 storms to compare the results between tree types.

The bees of Greater Puerto Rico

Genaro, J. A., & Franz, N. M. (2008). *The bees of Greater Puerto Rico (Hymenoptera: Apoidea: Anthophila)*. 27.

- **Keywords used to find the article**:
    - Bees pollinator puerto rico
- **2 - 3 sentence summary**:
    - Genaro and Franz (2008) studied the bee fauna of the Puerto Rico area. This paper includes an annotated catalog and information about the origin and distributional patterns of bees.
- **Outcomes:**
    - Thirty-nine (39) species of bees occur in Puerto Rico and adjacent islands. This fauna is composed of four elements: exclusive Puerto Rican endemics (26.5%); Antillean endemics occurring on multiple islands (76.5%); continental species that have also colonized the Antilles (23.5%); and species introduced through human activity (12.8%). The bee fauna was both low in its diversity and showed the highest level of disharmony in relation to other faunas of the Greater Antilles.
- **Quick Facts:**
    - The bee fauna of Puerto Rico was found to have lower biodiversity in relation to the remaining Antillean islands (Genaro & Franz, 2008).
- **Description of the type of study:**
    - Authors reviewed previous relevant studies on the topic.

Urgent Biophilia: Human-Nature Interactions and Biological Attractions in Disaster Resilience

DRR: Urban Roots

Tidball, K., (2012). Urgent Biophilia: Human-Nature Interactions and Biological Attractions in Disaster Resilience. *Ecology and Society* 17(2): 5. http://dx.doi.org/10.5751/ES-04596-170205

- **Keywords used to find the article:**
    - Urban forests disaster resilience
- **2 - 3 sentence summary:**
    - In times of stress or disaster, individuals and communities turn to an affinity for living organisms (biophilia) and may instinctively turn to “greening” their communities. Green spaces have been shown to have positive emotional, psychological, and cognitive impacts on individuals and could be expanded to a community scale for societal benefit. Furthermore, combining the act of community “greening” in the context of a disaster could strengthen recovery and resilience of the community.
- **Outcomes:**
    - Community restoration of greenspaces may contribute to their resilience after a disaster and reflect and feed into their sources of capital (human, social, natural etc.).
- **Description of the type of study:**
    - “Based on a combination of literatures attempting a transformative theory”

The Work of Community Gardens: Reclaiming Place for Community in the City

Cumbers, A., Shaw, D., Crossan, J., & McMaster, R. (2017). The work of community gardens: Reclaiming place for community in the city. *Sage Journals,* 32(1). https://doi-org.lib-e2.lib.ttu.edu/10.1177/0950017017695042

- **Keywords used to find the article:**
    - Community Gardens
- **2 - 3 sentence summary:**
    - Research looked at community gardens in Glasgow. Much of the land had been in the government’s possession and was just wasting away and so they looked at how when the community gets these places back how it can empower a sense of community. They also found that these community gardens were a place to learn a lot of new or hoan existing skills, along with learning where your food comes from and having a deeper appreciation for your community as well as the food you grow.
- **Outcomes:**
    - Found that there was tension between the gardens because they were competing for funds that were already scarce.
    - It provided jobs for people in the middle to lower income bracket.
    - Enhanced people’s knowledge and everyday food skills.
    - Found that people working with the community garden were also reaching out to those around the area.

    - People were finding ways to involve everyone in different communities. Some who weren't able to participate were now able to help by giving them compost to grow the food and then to be given back to them after harvest.
    - It also brought people from all different backgrounds and were able to communicate and learn from those who have a different background from them.
- **Description of the type of study:**
    - Qualitative interviews

Constructing community gardens? Residents' attitude and behaviour towards edible landscapes in emerging urban communities of China:

He, B., & Zhu, J. (2018). Constructing community gardens? Residents' attitude and behaviour tears edible landscapes in emerging urban communities of China. *Urban Forestry & Urban Greening,* 34, 154-165. https://doi.org/10.1016/j.ufug.2018.06.015

- **Keywords used to find the article:**
    - Community Garden Attitude
- **2 - 3 sentence summary:**
    - This study looked at three different communities in China and the way they are doing community gardens. Most residents were taking back plots of land that had been abandoned as a way to reclaim the city and this caused some tension within the community. Also, some gardens had been planted in areas that were inaccessible making the gardens not community-focused and not worthwhile.
- **Outcomes:**
    - The communities were suffering from issues like informal community gardening
    - "The occurrence of informal community gardening was the result of a series of factors, including a lack of community management, neglected public infrastructure and residents' living needs in respect of personal sentiment, entertainment, ornament, food quality, and saving expenses amongst growers and non-growers."
    - The city officials need to first be made aware of the advantages to community gardening because it is an effective approach to social and cultural cohesion.
- **Description of the type of study:**
    - Qualitative interviews

Food for thought: The intersection of gardens, education, and community at edible schoolyard New Orleans

Fakharzadeh, S. (2015). Food for thought: The intersection of gardens, education, and community at edible schoolyard New Orleans. *JSTOR,* 25(3) 175-187. https://doi-org.lib-e2.lib.ttu.edu/10.7721/chilyoutenvi.25.3.0175

- **Keywords used to find the article:**
    - Community Gardens School
- **2 - 3 sentence summary:**
    - This study looked at how having an edible schoolyard provides a positive impact on children's capacity to learn, their social behaviors, and understanding of food systems. It also provided a place for students to embrace and learn more about their culture.
- **Outcomes:**
    - Students enjoyed working on the gardens and being able to see the product they have been working on
    - Make sure to have balance of routines/structures and freedom/curiosity
    - Ensure that it is also open to the community so they can learn/volunteer but also continue to get support from the community as a whole
    - Taught skills in cooking and provided environmental and culinary experiences for students
- **Description of the type of study:**
    - Ethnographic research through semi-structured interviews over the course of 10 weeks

Integrating Valuation Methods to Recognize Green Infrastructure's Multiple Benefits

Wise, S., Braden, J., Ghalayini, D., Grant, J., Kloss, C., MacMullan, E., Morse, S., Montalto, F., Nees, D., Nowak, D., Peck, S., Shaikh, S., & Yu, C. (2010). Integrating valuation methods to recognize green infrastructure's multiple benefits. *Low Impact Development 2010: Redefining Water in the City - Proceedings of the 2010 International Low Impact Development Conference*, 1123–1143. https://doi.org/10.1061/41099(367)98

- **Keywords used to find the article:**
    - Hydrologic Regulation: Flood control
- **2 - 3 sentence summary:**
    - This study reviews different types of green infrastructure, their uses, and their benefits. The study then breaks down the economics of their benefits and value of the green infrastructure. Examples include the value of the groundwater recharge created by green infrastructure, the value of reduced flood risk, etc.
    - Outcomes: The study details the economic value of the benefits that stem from green infrastructure. The benefits are listed in the study and include use and non-use values of the green infrastructure. One of the main benefits looked at is the societal benefit of urban reforestation with public parks used as a main example of their valuation
- **Quick facts:**
    - Property values for houses located within 1000 feet of a community garden increased by 9.4% in 5 years
    - Direct use values of public parks in Philadelphia were valued at approximately $100,000 per acre.

    - The groundwater recharge valuation is on average $86.42 per acre foot of recharge stemming from green infrastructure usage.
- **Description of the type of study:**
    - Economic Analysis of Green Infrastructure.

Plants in urban ecosystems

Manning, W. J. (2008). Plants in urban ecosystems: Essential role of urban forests in urban metabolism and succession toward sustainability. *International Journal of Sustainable Development and World Ecology*, *15*(4), 362–370. https://doi.org/10.3843/SusDev.15.4:12

- **Keywords used to find the article:**
    - Enhancing Attractiveness of Cities
- **2 - 3 sentence summary:**
    - This paper discusses the physical and societal benefits of urban trees. The physical benefits looked at included the urban heat island effect, its influence on the air environment, and sequestering CO2. The societal benefits included nose reduction, reducing crime, and increasing the physical and mental well being of residents.
- **Outcomes:**
    - The study details the benefits of urban trees as well as some potential considerations such as evaluating tree species. The paper concludes that urban forests and green roofs have clear benefits in improving air quality and the lives of residents.
- **Quick facts:**
    - Trees do emit BVOCs which in sufficient quantities can increase ozone production.
    - Urban trees can capture coarse, fine, and ultrafine grained particulates.
    - Urban Trees can reduce energy needed for cooling and the urban heat island effect
    - Description of the type of study: Physical and Societal Evaluation of Urban Trees.

The built environment and collective efficacy

Cohen, D. A., Inagami, S., & Finch, B. (2008). The built environment and collective efficacy. *Health and Place*, *14*(2), 198–208. https://doi.org/10.1016/j.healthplace.2007.06.001

- **Keywords used to find the article:**
    - Enhancing Attractiveness of Cities
- **2 - 3 sentence summary:**
    - This paper describes a statistical model used to assess the collective efficacy of a neighborhood based on physical traits characteristic of an area. The collective efficacy is the social cohesion among neighbors and willingness to intervene for

the common good. The physical features assessed included public parks, alcohol-outlets, fast food outlets, and elementary schools.

- **Outcomes:**
    - The study found that an increase in collective efficacy would lead to associated health improvements of an area such as a reduction in premature deaths, cardiovascular deaths, homicides, reduced probability of asthma and breathing problems,and malignant neoplasms. The study found that a two standard deviation increase in the number of parks per census tract would result in a marginal decrease in collective efficacy rating. This would lead to marginal reduction in health related issues of a community.
- **Quick facts:**
    - A two standard deviation in increase of the number of parks would result in a 0.14 unit decrease of collective efficacy rating. This effect in Chicago would translate to 21 fewer premature deaths, 17 fewer cardiovascular deaths, 31 fewer homicides, 3 fewer malignant neoplasms, and a 14% reduction in the probability of asthma/breathing problems. This would also lead to 0.08 fewer violent crimes, 0.16 fewer victimizations epr neighborhood, and 0.16 fewer homicides per neighborhood.
- **Description of the type of study:**
    - Statistical analysis of physical traits in a neighborhood and its effect on crime, health, and societal cohesion.

A Socio-Ecological Assessment of the Potential for Vegetable Gardens in Elementary Schools Across an Urban Tropical Watershed in Puerto Rico

Vila Ruiz, Cristina Pilar; Shear, Theodore H.; Warren, Sarah; Flores Mangual, Mario L.; and Melendez-Ackerman, Elvia J. (2018) "A Socio-Ecological Assessment of the Potential for Vegetable Gardens in Elementary Schools Across an Urban Tropical Watershed in Puerto Rico," Cities and the Environment (CATE): Vol. 11: Iss. 1, Article 2. Available at: https://digitalcommons.lmu.edu/cate/vol11/iss1/2

- **Keywords:**
    - Urban garden and academic performance and Puerto Rico
- **Summary:**
    - Authors evaluated 20 elementary schools and surveyed school principals in the Rio Piedras watershed of San Juan, Puerto Rico to identify both social and physical environment (soils) factors that are considered opportunities and constraints to establishing and sustaining a school garden.
- **Outcomes:**
    - School principals identified social factors that help in implementing and sustaining long-term vegetable gardens: engagement of stakeholders, sponsorship, gardening skills, and logistics, and curriculum integration.
- **Quick Facts:**

    - Some of the most commonly recommended vegetables to grow in Puerto Rico gardens are cantaloupe, cucumber, eggplant, onion, and tomato (Muñiz-Torres 1992, in Ruiz et al., 2018).
    - The number of schools with gardens in San Juan was much lower than the number of schools with people interested in establishing a garden (Ruiz et al., 2018).
    - The percentage of schools in the Rio Piedras watershed that discontinued gardening was high (55%) when compared with schools in Los Angeles (14%) and nationwide (10%) (Ruiz et al., 2018).
    - The main reasons for ending gardening programs in 20 elementary schools in Puerto Rico were: lack of funding, turnover of staff, and the burden on teachers (Ruiz et al., 2018).
    - A limiting factor unique to Puerto Rico compared to other U.S. school jurisdictions is the green iguana. With few predators and competitors, this invasive reptile has become a severe agricultural pest as its population has expanded considerably on the island (Ruiz et al., 2018).
- **Description of the type of study**:
    - Social component: Interviews were conducted in person with the principal of the school to identify factors that facilitated initiatives of vegetable gardening and agriculture programs in elementary schools (the questionnaire is provided in the supplemental files).
    - Physical environment component: Four samples of topsoil (0–15 cm depth) were pooled, and chemical analyses were performed at the Central Analytical Laboratory of the University of Puerto Rico-Mayaguez Rio Piedras Agricultural Experimental Station. Soil nutrient concentrations (as cumulative relative frequencies) were compared with the recommended nutrient range for five crops (cantaloupe, cucumber, eggplant, onion, tomato) for Puerto Rico developed by Muñiz-Torres (1992). These vegetables were selected based on their economic importance, ease of harvest, and adaptation to a tropical climate.

School Gardens Enhance Academic Performance and Dietary Outcomes in Children

Barrett, C., Yoder, A., & Schoeller, D. (2015). School Gardens Enhance Academic Performance and Dietary Outcomes in Children. *The Journal of School Health*, *85*, 508–518. https://doi.org/10.1111/josh.12278

- **Keywords:**
    - Urban garden and academic performance
- **Summary:**
    - This article focuses on school garden programs and their effects on students' academic and dietary outcomes**.** Authors searched for peer-review literature that documented school-day garden interventions with measures of dietary and/or academic outcomes. The authors stated that more studies with robust experimental designs and outcome measures are necessary to understand the

effects of experiential garden-based learning on children's academic and dietary outcomes.

- **Outcomes:**
    - Results indicated that these school-based garden interventions improved or maintained both fruit and vegetable consumption or mediators thereof and academic performance. Among 12 identified garden studies with dietary measures, all showed increases/improvements in predictors of fruit and vegetable consumption. Seven of these also included self-reported fruit and vegetable intake with 5 showing an increase and 2 showing no change. Four additional interventions that included a garden component measured academic outcomes; of these, 2 showed improvements in science achievement and 1 measured and showed improvements in math scores. Garden programs improved fruit and vegetable intake in 71% of studies measuring that outcome and improved or showed no difference in academic performance in all 5 studies comparing gardening to non gardening students. Moreover, academic test scores improved or showed no change, regardless of the academic area assessed.
- **Quick Facts:**
    - School-based garden interventions improved or maintained both fruit and vegetable consumption or mediators thereof and academic performance (Barrett et al., 2015).
    - Garden-based learning does not negatively impact academic performance or fruit and vegetable consumption and may favorably impact both (Barrett et al., 2015).
    - Garden programs improved fruit and vegetable intake in 71% of studies measuring that outcome (Barrett et al., 2015).
- **Description of the type of study:**
    - The initial idea was to conduct a Meta-analysis, but the interventions lacked similar designs and measures, and thus, a formal meta-analysis was not feasible. Because this is a small collection of studies, the findings should be considered preliminaries. The paper is organized around 2 guiding questions: (1) Do interventions with school gardens change dietary outcomes or their predictors? (2) Do interventions with school gardens impact academic outcomes?

Greenspace After a Disaster: The Need to Close the Gap With Recovery for Greater Resilience

Miller, S. (2020). Greenspace After a Disaster: The Need to Close the Gap With Recovery for Greater Resilience. *Journal of the American Planning Association*, 86(3), 339-348, DOI: 10.1080/01944363.2020.1730223

- **Keywords used to find the article:**
    - Urban forests disaster resilience
- **2 - 3 sentence summary:**

    - Green infrastructure is multifunctional and can provide ecological, recreational, human health, and stormwater management benefits. Hazard planning should, but often does not, recognize the ecosystem and human services of greenspaces and plans to restore them after a disaster. Planning out ecological recovery, such as planning for larger, more connected areas rather than fragmented areas, is important to maximize the ecological and recreational services of greenspaces.
- **Outcomes:**
    - Parks can play a role in re-establishing balance and a sense of normalcy after a disaster; children were seen using still-closed parks four months after Hurricane Maria in Puerto Rico, which demonstrates the need to reconnect to these spaces following the disaster. Green volunteers of greenspaces after disasters perceive their community as more resilient and contribute to community resilience on top of ecological resilience.
- **Description of the type of study:**
    - "Viewpoint," argument on why parks can help with disaster resilience

Community and the Crime Decline: The Causal Effect of Local Nonprofits on Violent Crime

Sharkey, P., Torrats-Espinosa, G., & Takyar, D. (2017). Community and the crime decline: The causal effect of local nonprofits on violent crime. *JSTOR,* 82(6) 1214-1240. http://lib-e2.lib.ttu.edu/login?url=https://www.jstor.org/stable/26426368

- **Keywords used to find the article:**
    - Community gardens crime rate
- **2 - 3 sentence summary:**
    - This study looked at the effects of local nonprofits in several different cities and what they did for the local crime rate between the 1990s-2010s. They found that there was a decrease in the crime rate when nonprofit or community organizations intervened. There was also a drop in children individually involved with a crime when they participated in these organizations.
- **Outcomes:**
    - There was a drop in the crime rate over a span of years.
- **Description of the type of study:**
    - Quantitative

Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach

Mayunga, J.S. (2007). Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach. Summer academy for social vulnerability and resilience building, July 1-16,

https://www.u-cursos.cl/usuario/3b514b53bcb4025aaf9a6781047e4a66/mi_blog/r/11._Joseph_S._Mayunga.pdf

- **Keywords used to find the article:**
  - Urban forests disaster resilience
- **2 - 3 sentence summary:**
  - This paper acknowledges the wide range of definitions for “community disaster resilience” and poses an overarching definition as “the capacity or ability of a community to anticipate, prepare for, respond to, and recover quickly from impacts of disaster.” It discusses disaster resilience in terms of the different types of capital (social, economic, physical, human, and natural). It proposes that an assessment of resilience should be a combination of the types of capital and weigh them in terms of importance to resilience.
- **Outcomes:**
  - The paper proposed that physical capital (roads, dams, etc.) is one of the most important capitals in a disaster along with human capital, which can include knowledge of people on hazards in their community and education in general.
- **Description of the type of study:**
  - Feels like an essay, *this article might have never actually been published - could only find a “draft paper”

Regulating Ecosystem Services and Green Infrastructure: assessment of Urban Heat Island effect mitigation in the municipality of Rome, Italy

Marando, F., Salvatori, E., Sebastiani, A., Fusaro, L., Manes, F. (2019). Regulating Ecosystem Services and Green Infrastructure: assessment of Urban Heat Island effect mitigation in the municipality of Rome, Italy. *Ecological Modelling,* 392 (July 2018), 92-102. https://doi.org/10.1016/j.ecolmodel.2018.11.011

- **Keywords used to find the article:**
  - Urban forest and heat island effect and heatwaves
- **2 - 3 sentence summary:**
  - This study analyzed the overall Urban Heat Island (UHI) effect and the reduction of the UHI effect by three different green land uses - peri-urban forests, urban forests, and street trees- in Rome, Italy. The UHI effect was observed in the summer but not in the winter in the study. The study showed the importance of Green Infrastructure (GI) for regulating temperature in urban areas.
- **Outcomes:**
  - In the study, the peri-urban forests were the most effective at reducing the temperature compared to their surroundings with a 2.5-3.1 ℃ reduction in the summer; urban forests had a 2.8-3.2 ℃ reduction but with more sensitivity to drought and heatwaves. Street trees showed a 1.3 ℃ reduction in temperature but with a much smaller area of influence.

- **Quick Facts:**
    - Greenspaces (gardens & forests) help to mitigate the effects of the Urban Heat Island effect.
    - Forests have a greater impact on reducing temperature than street trees do.
- **Description of the type of study:**
    - Quantitative

Ecophysiology of a mangrove forest in Jobos Bay, Puerto Rico

Lugo, A. E., Medina, E., Cuevas, E., Cintrón, G., Laboy Nieves, E. N., & Novelli, Y. S. (2007). Ecophysiology of a mangrove forest in Jobos Bay, Puerto Rico. *Caribbean Journal of Science*, *43*(2), 200–219. https://doi.org/10.18475/cjos.v43i2.a6

- **Keywords used to find the article:**
    - Buffered area and mangrove and Puerto Rico
- **2 - 3 sentence summary:**
    - This study focuses on the different ecophysiological properties of mangrove forests in Jabos Bay Puerto Rico. They compared the properties between red, white, and black mangroves. The properties looked at include gas exchange, leaf dimensions, litter production, leaf and litterfall chemistry, salinity gradient, nutrient flux to the forest floor, retranslocation rates, and nutrient use efficiency.
- **Outcomes:**
    - In the study, they found that under favorable conditions the mangroves in the study area can exert high rates of production and cycle nutrients fast. The black waters rich in organic matter and particulate matter indicate a slower turnover rate for the tides to flush the system. This hydrology was found to be critical for mangrove forests in maintaining their salinity and root environments.
- **Description of the type of study:**
    - Quantitative

How effective were mangroves as a defence against the recent tsunami?

Dahdouh-Guebas, F., Jayatissa, L. P., Di Nitto, D., Bosire, J. O., Lo Seen, D., & Koedam, N. (2005). How effective were mangroves as a defence against the recent tsunami? *Current Biology*, *15*(14), 1337–1338. https://doi.org/10.1016/j.cub.2005.07.025

- **Keywords used to find the article:**
    - Buffered area and mangrove and Puerto Rico
- **2 - 3 sentence summary:**
    - This study focuses on how mangroves provide protection against tropical natural disasters such as tsunamis and hurricanes. The paper details the scientific evidence that supports the buffering function of mangroves being socio-economic and ethno-biologic studies. The paper describes the results of a post-tsunami

study done in Sri Lanka and the results as they relate to mangrove's buffering ability.

- **Outcomes:**
    - The study found that mangroves do offer some protection from tropical natural disasters. The important lesson from the paper is that an area can appear to be superficially protected by mangroves, but can cryptically be destroyed and not offer the expected protection. The paper listed the 3 factors that can undermine mangrove's protection ability: complete clearance, insufficient regrowth following a clearing, and infusion of adult mangroves with excess of non-mangrove vegetation components. The study concluded that mangroves play an important role in storm protection but it all hinges on the health of the forest.
- **Description of the type of study:**
    - Qualitative overview with summarizing findings of a post-tsunami study.

Caribbean Mangroves Adjust to Rising Sea Level through Biotic Controls on Change in Soil Elevation

Mckee, K. L., Cahoon, D. R., & Feller, I. C. (2007). Caribbean mangroves adjust to rising sea level through biotic controls on change in soil elevation. Global Ecology and Biogeography, 16(5), 545–556. https://doi.org/10.1111/j.1466-8238.2007.00317.x

- **Keywords used to find the article:**
    - Urban forest and heat island effect and heatwaves
- **2 - 3 sentence summary:**
    - This paper discusses mangroves ability to cope with rising sea level in the face of climate change. The researchers used experimental plots in Belize and varied the nutrient (nitrate and phosphate) inputs in each plot. The researchers looked at changes in rates of mangrove root accumulation.
- **Outcomes:**
    - The study found that modern rates of change in elevation vary in both direction and magnitude within the same mangrove ecosystem, changes in elevation vary with natural gradients in productivity, and the input of nutrients can alter the direction and rate of change of surface elevation. The study additionally found that mangrove systems have to have vertical building rates equal to sea level rise rates, and found that mangroves can also move laterally in addition to vertically in response to sea-level rise.
- **Quick Facts:**
    - Mangrove forests are susceptible to nutrient overloading which can have effects on the structure and ecosystem of the forest
    - Mangrove forests must match the sea level rise rate predicted to be 3-5 mm/yr in most modeled scenarios
- **Description of the type of study:**
    - Review article. Botany Study on Mangrove Forest Experimental Plots

Stable isotopes indicate ecosystem restructuring following climate-driven mangrove dieback

Harada, Y., Fry, B., Lee, S. Y., Maher, D. T., Sippo, J. Z., & Connolly, R. M. (2020). Stable isotopes indicate ecosystem restructuring following climate-driven mangrove dieback. 1251–1263. https://doi.org/10.1002/lno.11387

- **Keywords used to find the article:**
  - Urban forest and heat island effect and heatwaves
- **2 - 3 sentence summary:**
  - This paper discusses how extreme climate-related events can cause the loss of mangrove forests and discusses the harm to the ecological community that can stem from this. The study uses the mangrove forests along 1000 km of coastline in Australia which suffered severe mangrove dieback during an extreme climate event. The study investigated the effects on the biologic community resulting from this dieback.
- **Outcomes:**
  - The study found that there was no significant difference in total infaunal biomass between impacted and unimpacted forests. The mangrove mortality rates drove changes in the epifaunal species composition with the impacted forests becoming more dominated by algae-feeder fauna and having lower population densities of leaf-feeders. The study did find that impacted forests still had abundant epifauna and infauna regardless of the mangrove loss. The study did find that mangrove dieback will impact the provision of key ecosystem services. These include food and habitat provision, carbon sequestration, and coastal protection. The study lastly found that changes in fish assemblage and decreases in fish abundance were observed with mangrove loss, with smaller schooling species most impacted.
- **Description of the type of study:**
  - Review article. Ecosystem study

Tree and forest effects on air quality and human health in the United States

Nowak, D.J., Hirabayashi, S., Bodine, A., Greenfield, E. (2014). Tree and forest effects on air quality and human health in the United States. *Environmental Pollution,* 193, 119-129. 10.1016/j.envpol.2014.05.028

- **Keywords used to find the article:**
  - Urban forest air quality respiratory conditions
- **2 - 3 sentence summary:**
  - This study created a model of the air pollution removal effects of trees in the United States. The removal benefits were in terms of human health and focused

on human mortality rates and adverse health effects, translating these into monetary values.

- **Outcomes:**
    - Air quality improvement from tree pollution removal was typically less than one percent, but was still impactful with a $6.8 billion value. Even though most of the trees were in rural areas, most of the value was from urban areas because they have concentrated human populations, so trees have a greater per capita impact on human health and thus more monetary value.
- **Quick Facts:**
    - Trees in the United States were estimated to remove 17.4 million tons of air pollution in 2010, accounting for $6.8 billion in human health value.
- **Description of the type of study:**
    - Model

Urban Forests and Their Ecosystem Services in Relation to Human Health

Nilsson, K., Sangster, M., Gallis, C., Hartig, T., Vries, S., Seeland, K., & Schipperijn, J. (2011). Forests, trees and human health. Forests, Trees and Human Health, 1–427. https://doi.org/10.1007/978-90-481-9806-1

- **Keywords used to find the article:**
    - Urban forest air quality respiratory conditions
- **2 - 3 sentence summary:**
    - Urban forests impact the hydrology, urban heat island, air quality, and biodiversity of cities. Areas with greenspace positively correlate with human health; whether from effects of wealth or the greenspace itself is unclear. Greenspaces can also act as social and community spaces.
- **Outcomes:**
    - Trees affect urban hydrology by intercepting precipitation, reducing peak runoff rates, and reducing raindrop impact, soil erosion and pollutant wash-off.
- **Quick Facts:**
    - In terms of hydrological impacts, the greatest influence on the ecological value of urban areas depends on green space area, especially trees.
- **Description of the type of study:**
    - Book chapter

The link between school environments and student academic performance

Kweon, B.-S., Ellis, C. D., Lee, J., & Jacobs, K. (2017). The link between school environments and student academic performance. Urban Forestry & Urban Greening, 23, 35–43. https://doi.org/10.1016/j.ufug.2017.02.002

DRR: Urban Roots

- **Keywords used to find the article:**
    - Urban garden and academic performance
- **2 - 3 sentence summary:**
    - This study looks into the link between greater amounts of trees on campuses and higher academic performance. The authors examined the relationship among green spaces, students' socio-economic factors, and their academic performance by using spatial measurements in geographic information systems (GIS).
- **Outcomes:**
    - Authors found that schools with more trees had a higher percentage of proficient or advanced scores in Mathematics and Reading standardized tests even after controlling for school size, student-teacher ratio, and free lunch enrollment. However, not all types of landscapes have the same beneficial properties. Large expanses of land, "featureless landscapes," including large areas of campus lawns and athletic fields have negative effects on academic performance.
- **Quick Facts:**
    - Schools with more trees had a higher percentage of proficient or advanced scores in Mathematics and Reading standardized tests even after controlling for school size, student-teacher ratio, and free lunch enrollment (Kweon et al., 2017).
    - Trees may also play an important role in creating supportive environments for children to study and learn (Kweon et al., 2017).
- **Description of the type of study:**
    - The research study included 219 District of Columbia (D.C.) public schools. School environment measurements (e.g., land cover), school demographic data (e.g., number of students, student-teacher ratio and free lunch enrollment), and school performance data (e.g., DC Comprehensive Student Assessment in Mathematics and Reading) were collected and georeferenced. GIS was used to integrate spatially dependent information regarding student and environmental factors with the land cover data.
    - The study determined the following school environmental factors as hypothesized predictors for student academic performance in mathematics and Reading respectively.
        - School Parcel – the area within the school boundary.
        - Trees per school parcel – the percentage of the school parcels made up of trees.
        - Grass and Shrubs per school parcel – the percentage of the school parcels made up of grass, shrubs, and groundcover.
        - Bare Soil per school parcel – the percentage of the school parcels made up of bare soils
        - Paved Surfaces per school parcel – the percentage of the area for roads/railroads, and other paved surfaces per school parcels.
        - Buildings per school parcel – the areas for buildings in school parcels.
    - The study accounted for the following factors as control variables in the statistical analyses.

- School Socioeconomic Status – the percentage of students eligible for the free lunch programs (not reduced-price meals).
- Enrollment – the number of students enrolled.
- Student/Teacher Ratio – the number of students per teacher
- Race/Ethnicity – percent of African American, Asian, Hispanic, and White students respectively

How to sustainably increase students' willingness to protect pollinators

Schönfelder, M. L., & Bogner, F. X. (2018). How to sustainably increase students' willingness to protect pollinators. *Environmental Education Research*, *24*(3), 461–473. https://doi.org/10.1080/13504622.2017.1283486

- **Keywords used to find the article:**
  - Pollinators and students
- **2 - 3 sentence summary:**
  - This study implemented two educational modules (using living animals and eLearning) aiming to increase individual willingness to protect honeybees as crucial pollinators. The analysis focused on three issues: First, the effects of our educational programs on students' perception of bees; second, differences between using living animals and eLearning on perception and situational emotions; third, the extent of the association between perception of bees and situational emotions due to participation.
- **Outcomes:**
  - Participating students' interest in bees changed significantly from the pre-intervention test to an immediately after-intervention test and a post-intervention test. Similarly, the perceived danger score changed over the three measurements. The post hoc tests revealed that the perceived danger decreased both over the short-term and the long-term. The willingness to protect bees also changed significantly between the test times. Comparison of the two intervention groups yielded a significant difference only in the short-term decrease of perceived danger: students who had contact with the living animals significantly decreased their perceived danger compared to the students who participated in the eLearning program. The two groups did not differ with respect to other aspects. When comparing the two subgroups with regard to their situational emotions, researchers found significant differences: the well-being of participants who had contact with living animals was significantly higher and boredom was significantly lower compared to the participants who used the online beehive. Concerning situational interest, the two subgroups did not differ significantly.
- **Quick Facts:**
  - Educational modules aiming to increase individual willingness to protect honeybees in intervention groups (living animals vs. eLearning) produced a

greater willingness to protect bees as pollinators. This effect remained for six to nine weeks after participation (Schönfelder & Bogner, 2018).

- **Description of the type of study:**
    - Authors monitored secondary school students' (N = 354) perception of bees with respect to interest, danger, and conservation as well as situational emotions (interest, well-being, boredom) during both interventions. The study consisted of a quasi-experimental design with pre-test, post-test, and retention tests. They applied paper-and-pencil tests one to two weeks before (T0), immediately after (T1), and six to nine weeks (depending on school holidays) after students had participated in the educational program (T2).

Safeguarding pollinators and their values to human well-being

Potts, S. G., Imperatriz-Fonseca, V., Ngo, H. T., Aizen, M. A., Biesmeijer, J. C., Breeze, T. D., Dicks, L. V., Garibaldi, L. A., Hill, R., Settele, J., & Vanbergen, A. J. (2016). Safeguarding pollinators and their values to human well-being. *Nature*, *540*(7632), 220–229. https://doi.org/10.1038/nature20588

- **Keywords used to find the article**:
    - Pollinators and human well-being
- **2 - 3 sentence summary:**
    - This study focuses on evaluating the available evidence about pollinators, their status, risks, anthropogenic drivers, and responses. Figure 5 summarizes the drivers, risks, and responses to pollinator decline.
- **Outcomes:**
    - Declines in bee diversity over the last century have been recorded in highly industrialized regions of the world, particularly northwestern Europe and eastern North America (Potts et al., 2016).
    - Pollinators are also shifting ranges to more temperate latitudes or higher altitudes, following climate change, but often seem unable to track temperature shifts completely (Potts et al., 2016).
    - The most widespread managed pollinator is the western honeybee (A. mellifera) and globally the number of hives has increased by 45% during the last five decades, despite a temporary drop during the 1990s. National trends vary widely among countries (Fig. 3); for example, there were recent declines in the United States and Germany but large increases in China, Argentina, and Spain during the same period (Potts et al., 2016).
    - The production of crops that depend directly on pollinators constitutes a global food volume of 5–8% but global agriculture is now twice as dependent on pollinators compared to five decades ago (Potts et al., 2016).
    - A loss of pollinators may have negative impacts on the reproduction of wild plants, as more than 90% of tropical flowering plant species and about 78% of

temperate-zone species rely, at least in part, on animal pollination (Potts et al., 2016).
    - Pollinators and pollination services are threatened by land-use changes involving the destruction, fragmentation, and degradation of semi-natural habitats or the conversion of diversified farming systems into conventional intensive agriculture (that is, large, homogeneous fields with high agrochemical inputs and intensive tillage, grazing, or mowing (Potts et al., 2016).
- **Quick Facts:**
    - This paper is full of facts because it evaluates empirical evidence generated until May 2015. The results are a summary of the actual facts.
- **Description of the type of study:**
    - This study is a review robustly underpinned by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services Pollinators, Pollination, and Food Production assessment, whose 77 international experts critically evaluated the available global evidence about the diverse values of pollinators, their status and trends, risks from environmental pressures and consequent management and policy response options, and highlight key knowledge gaps until May 2015.

Definitions:

Include term, definition and source (as a link to where it is above). Please try to alphabetize.

- Adaptive cycle: Urgent Biophilia
    - Tool for viewing the processes in ecological systems but can be expanded to view all systems
    - www.resalliance.org/adaptive-cycle
- Allotments
    - Urban food-growing areas. Commonly known as community gardens
    - A systems approach reveals urban pollinator hotspots and conservation opportunities
- Austere
    - Severe or strict in manner, attitude, or appearance
    - Of living conditions or a way of life, having no comforts or luxuries; harsh or ascetic
    - Having an extremely plain and simple style or appearance; unadorned
- Biophilia: Urgent Biophilia
    - Innate and learned affinity of life or living systems
    - Humans' innate relationship with nature
- Civic ecology: Urgent Biophilia
    - "study of feedbacks and other interactions among 4 components of a SES"

    - 1) community-based environmental stewardship
    - 2) education and learning situated in these practices
    - 3) people and institutions
    - 4) ecosystem services by the people, stewardship, and educational practices
- Community disaster resilience:
    - Understanding and Applying the Concept of Community Disaster Resilience: A capital-based approach
    - “the capacity or ability of a community to anticipate, prepare for, respond to, and recover quickly from impacts of disaster”
- Derelict
    - In a very poor condition as a result of disuse and neglect
- Green infrastructure:
    - Greenspace After a Disaster: The Need to Close the Gap With Recovery for Greater Resilience
    - “Interconnected network of greenspace that conserves natural ecosys- tem values and function and provides associated bene- fits to human populations” (Benedict & McMahon, 2002, pp. 5–6)
- Greening : Urgent biophilia
    - “an active and integrated approach to the appreciation, stewardship, and management of living elements of social-ecological systems”
- Greenspaces:
    - Vegetated lands protected from development
    - Greenspace After a Disaster: The Need to Close the Gap With Recovery for Greater Resilience
    - Quantitative plant–pollinator networks
    - Describe the relative frequency of observed interactions
    - A systems approach reveals urban pollinator hotspots and conservation opportunities
- Robustness
    - “measures community's vulnerability to cascading secondary extinctions following an initial loss of species”
    - A systems approach reveals urban pollinator hotspots and conservation opportunities
- SES: Urgent Biophilia
    - Social-ecological systems
- Soil sealing:
    - Regulating Ecosystem Services and Green Infrastructure: assessment of Urban Heat Island effect mitigation in the municipality of Rome, Italy
    - Conversion of agricultural fields and green spaces into artificial surfaces
- Urban and Peri-urban forests:
    - Regulating Ecosystem Services and Green Infrastructure: assessment of Urban Heat Island effect mitigation in the municipality of Rome, Italy
    - Woodlands located inside the city core and in its immediate surroundings (peri-urban - located immediately adjacent to an urban area)

DRR: Urban Roots

- WSUD - water sensitive urban design
    - “Ways of thinking about retaining, retarding, and using stormwater within the urban landscape” (wikipedia)
    - The Urban Forest and Ecosystem Services: Impacts on Urban Water, Heat, and Pollution Cycles at the Tree, Street, and City Scale