QUANTIFYING THE IMPACT:
How Urban Planning Shapes Public Health Through Nature Exposure

By Owen Wiseman

SUMMARY

As a healthcare provider, I witness firsthand how urban planning acts as a social determinant of health. Green space access, walkability, and environmental conditions influence chronic disease, mental health, and overall well-being. Yet, quantifying these impacts remains the missing piece in policy and planning decisions. Emerging tools provide a data-driven approach to measuring nature exposure and its health benefits. This article explores how urban planning and healthcare sectors can collaborate using spatial data and tech to design healthier cities, reduce healthcare costs, and promote equitable access to nature.

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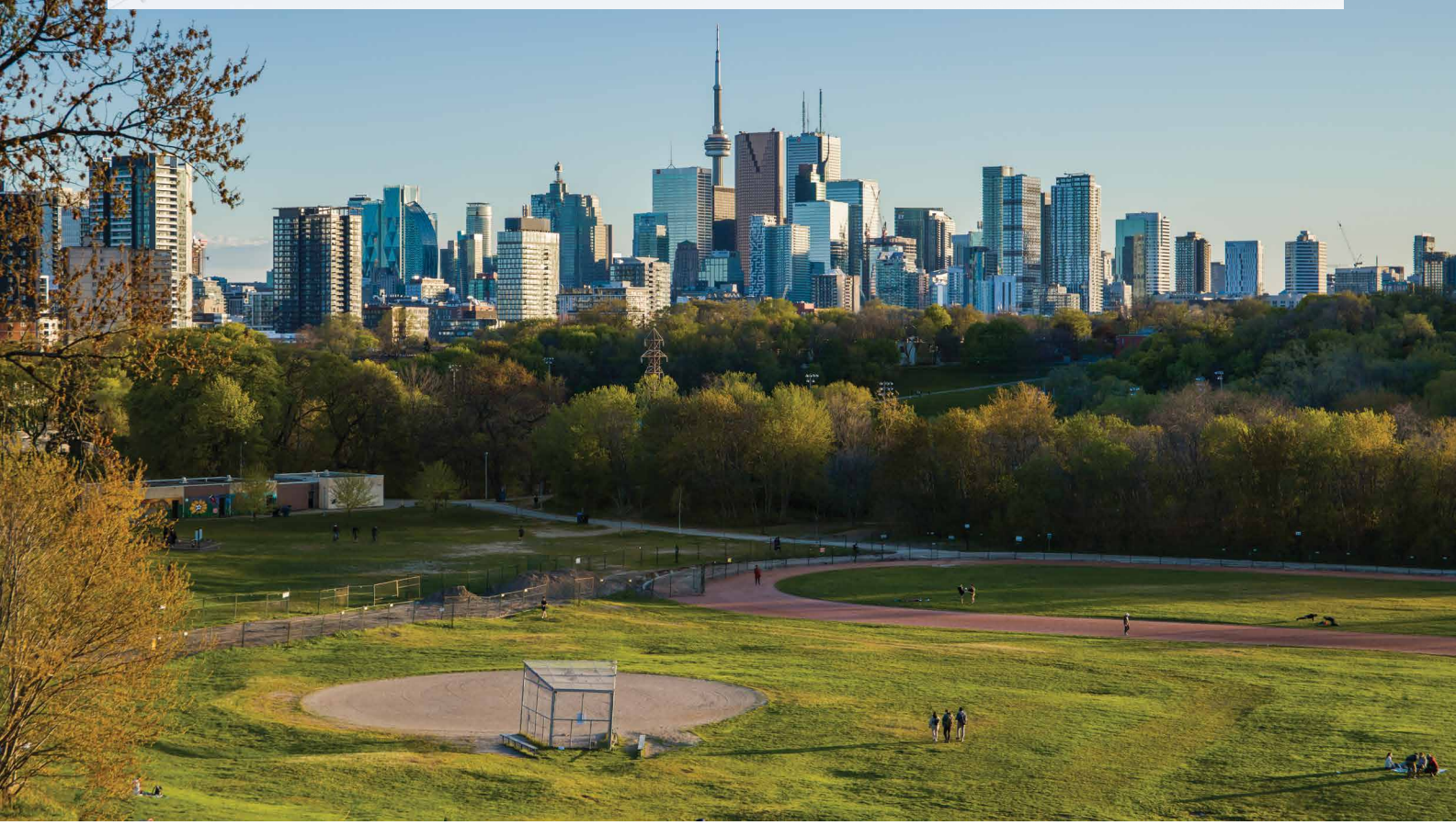
En tant que prestataire de soins de santé, je suis le témoin direct de la façon dont l'urbanisme agit comme un déterminant social de la santé. L'accès aux espaces verts, la possibilité de se promener et les conditions environnementales influencent les maladies chroniques, la santé mentale et le bien-être général. Pourtant, la quantification de ces impacts reste la pièce manquante dans les décisions politiques et de planification. De nouveaux outils offrent une approche fondée sur les données pour mesurer l'exposition à la nature et ses effets bénéfiques sur la santé. Cet article explore la manière dont les secteurs de l'urbanisme et de la santé peuvent collaborer en utilisant des données spatiales et des technologies pour concevoir des villes plus saines, réduire les coûts de santé et promouvoir un accès équitable à la nature.



Urban planning is a crucial, but often overlooked social determinant of health, one that fundamentally shapes every aspect of our shared human experience.

As a healthcare provider, I observe how the built environment contributes to chronic illness, stress, and high blood pressure. The way we design our cities – from walkability to green spaces – has measurable effects on mental health, cardiovascular function, and overall longevity. While the health benefits of walkability are well-known in urban planning (e.g., Walk Score), what remains underutilized is the ability to quantify nature's direct health impact into planning and policy decisions.

Advancements in spatial analytics and wearable health tracking technologies have made this possible. Tools like NatureScore™ and NatureDose™, assess a person's exposure to nature and correlate it with health outcomes[1] By leveraging data-driven approaches, planners and decision makers can move beyond intuition and begin designing cities that actively promote public health.

This article explores the intersection of urban planning, technology and health, and how quantifying nature-based planning can reduce healthcare costs, improve quality of life, and drive equitable development.

The Urban-Nature Divide: How Cities Shape Health

The Shift Towards Urbanization

Over 80 per cent of Canadians now live in urban environments, with a growing portion residing in high-density metropolitan areas.[2] While city life brings economic opportunities and access to a broader range of services, it also creates environments that limit access to nature.

Urbanization is linked to an increased prevalence of non-communicable illnesses such as cardiovascular disease, cancer, and diabetes.[3] Urban heat islands which are exacerbated by dense infrastructure and minimal green space worsens respiratory conditions, especially among vulnerable populations. Yet research shows that neighbourhoods with walkable design and nearby green spaces see higher physical activity and better overall well-being.[3] In contrast, sprawling, car-centric developments with little greenery are strongly linked to preventable diseases, air pollution, and sedentary behaviours.[4]

Green Spaces and Their Impact on Our Health

Over the years, we've also come to understand that nature exposure has measurable physiological and psychological benefits, with green spaces shown to:

- Lower blood pressure and heart rate variability, helping to reduce overall cardiovascular risk.[5]
- Improve mental health and reduce stress hormones (i.e., cortisol).[6]
- Enhance cognitive function, particularly in our youngest residents, by increasing attention and memory retention.[7]
- Reduce air pollution and heat stress, mitigating respiratory issues.[8]
- Promote social cohesion by providing safe communal gathering spaces, particularly in densely populated areas.[9,10]

Despite the mountain of evidence, city planning departments have largely failed to integrate nature-based solutions into their public health policy, though that is changing.

The Quantification of Nature: Measuring What Matters

Historically, public health assessments have lacked tools to measure nature exposure's direct impact on well-being. Within my own clinical practice, I often rely on questionnaires like the Nature Relatedness Scale (NR-6) or the Connectedness to Nature Scale. However, emerging technologies now make it possible for me to assess nature access and integrate that into treatment plans.

Introducing NatureScore™ and NatureDose™

NatureQuant™ has developed two pioneering tools to quantify exposure to nature:

- **NatureScore™:** A geospatial tool that assigns a numerical value to locations up to 10m^2 granularity using a proprietary algorithm based on 30+ data sets. These sets include census data, air quality, noise pollution, biodiversity, and the normalized difference vegetation index (NDVI).
- **NatureDose™:** A mobile app that uses geolocation data to track an individual's time spent in nature and correlate it with health outcomes. The app differentiates between time spent in natural environments (dark green) and calculated NatureDose™ exposure (light green), aiming to encourage a minimum threshold of time in health-promoting spaces.

A study published in the *American Journal of Health Promotion* found that people with a higher NatureScore™ had lower rates of stress-related conditions including high blood pressure and anxiety.[1]

Importantly, you can use NatureScore™ to forecast the health return on nature-based planning. For example, modeling shows that planting 100 trees in a single census tract, and increasing the NatureScore™ by 20 points can result in:

- A 1.7-year gain in average life expectancy
- Up to 11.9 fewer deaths from CVD per 100K people
- A 7 per cent reduction in $PM_{2.5}$

This moves the conversation beyond whether green infrastructure works, to how well it works and for whom.

Biodiversity-Sensitive Urban Design (BSUD)

BSUD emphasizes the need for integrating biodiversity into master plans and advocates for policies that not only preserve existing green spaces but also restoring native ecosystems.[11] In areas classified as *Nature Utopias* (NatureScore™ of 80-100), research shows significant psychological benefits, in part due to richer biodiversity.[12] Using this technology, planners can collect evidence that 'utopias' are demonstrably healthier to guide funding decisions and planning proposals.

Equity in Green Space Access: Who Benefits and Who Doesn't?

Shocking no one, green space is not equitably distributed.

Figure 1.

Numerous studies have shown that lower-income and marginalized communities have lower NatureScores™, fewer parks, and significantly more exposure to environmental hazards like pollution and noise.[13] During the COVID-19 pandemic, residents living within 1km of green spaces were more likely to engage with nature and experience its benefits, while those father away faced meaningful barriers and obstacles.[14]

Addressing Environmental Justice in Urban Planning

To combat these trends and create equitable urban environments, cities must:

- **Identify and address green deserts:** Nature quantification technology can help map nature-deficient areas and guide investments in new parks and green infrastructure (i.e., green roofs, permeable pavement, bioswales).
- **Expand access:** Bus routes and bike lanes could be expanded to ensure neighbourhoods without parks have safe, affordable access to larger regional green spaces. Some cities have even implemented shuttle systems to bring residents to nearby provincial parks.
- **Implement zoning policies that require greenery:** Zoning bylaws could require minimum NatureScore™ improvements (e.g., 10-point increase over baseline) as part of approvals for new developments or major renovations.
- **Develop targeted interventions for marginalized populations:** Low NatureScore™ areas could be prioritized for heat-mitigating investments such as permeable surfaces or expanded tree canopy to combat urban heat islands.

Case Study: Toronto's Ravine Strategy

Toronto's planning department has turned its attention to its over 11,000 hectares of ravines that connect Ontario's most urbanized region with biodiversity corridors. The irreplaceable value is well recognized, but there has been no comprehensive analysis of their health and economic contributions.

That's now changing. By leveraging tools like NatureScore™, planners can establish a baseline measure of environmental quality across neighbourhoods adjacent to the ravines. Over time, this baseline allows for

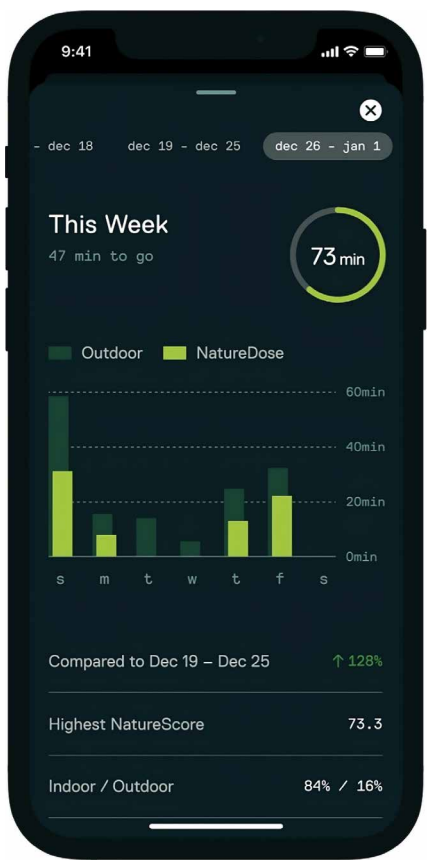


Figure 2.

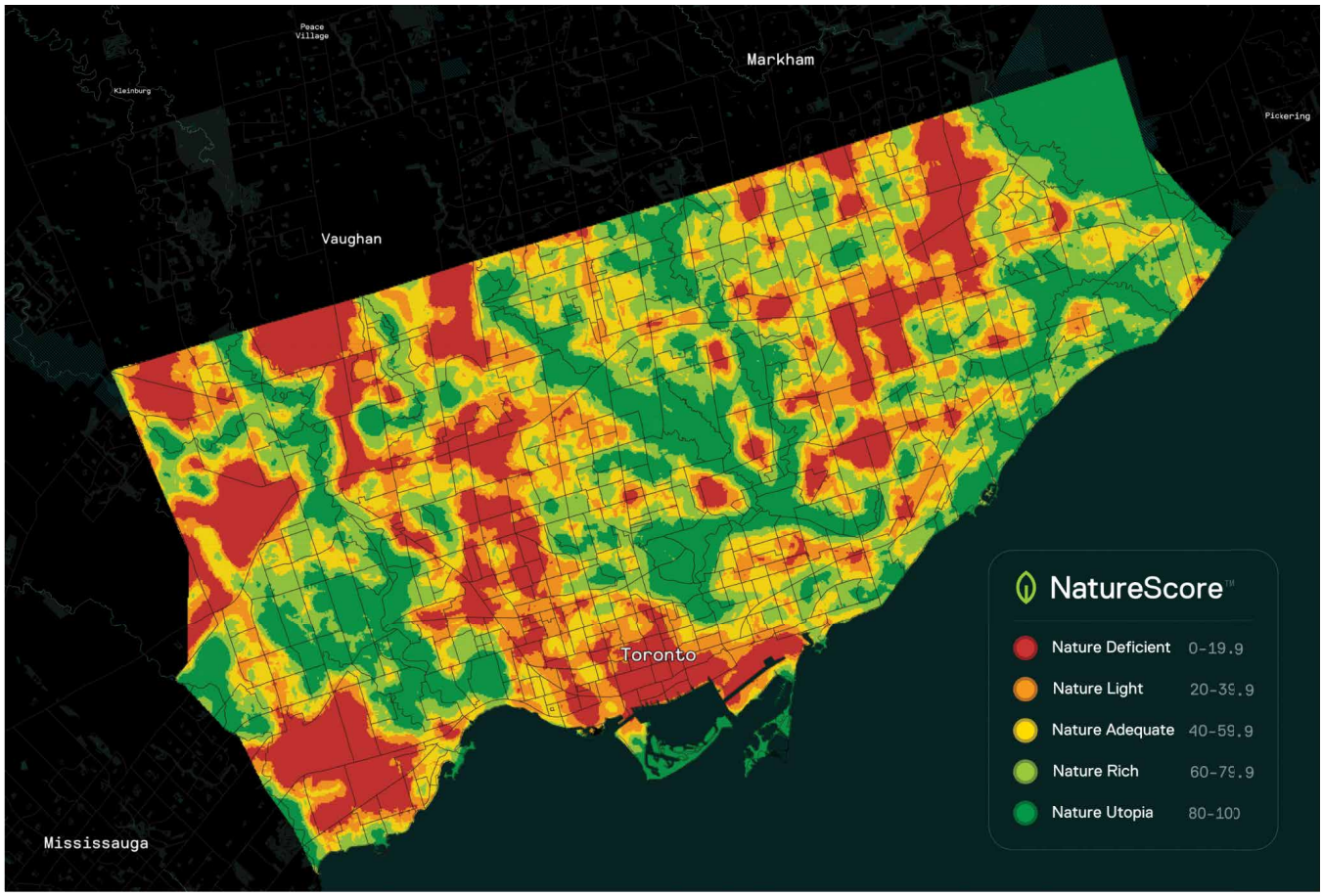


Figure 3. A spatial distribution map of NatureScore across Toronto, Ontario, highlighting neighbourhood-level variation in access and exposure to nature. The colour gradient represents the five tiers noted in the legend.

annual tracking of improvements, linking these to quantifiable health and climate resilience outcomes.

For example, research from 2010 showed Toronto's urban forest was responsible for $28 million annually in ecological services including recreation, flood control, and support for wildlife. As the ravines are restored, planners will have the metrics to show how each dollar spent yields measurable gains.

Looking to the Future of Nature-Inclusive Planning

Urban planning is public health planning. As climate change accelerates and cities densify, ensuring equitable access to nature will be key in preventing disease and enhancing resilience. By embracing new technologies like NatureScore™ and NatureDose™, cities can better transition towards evidence-based, human-centred planning.

Here are some statistics and key findings that may be relevant to your work and planning, especially as you champion nature-inclusive urban policy!

Mental Health

- Those living with 10 per cent more greenery had a 3.7 per cent and 6.9 per cent lower risk of depression and anxiety, respectively, while even a 0.1-unit increase in NDVI was associated with a 6.9 per cent lower risk of depression compared to those in nature-light environments[16]

Green Space & Healthcare Costs

- A study analyzing 5 million people in Northern California found that higher residential greenery was associated with significantly less direct healthcare costs.[17]
- Increasing canopy cover from 10 to 30 per cent results in annual healthcare savings of AU$19.3 million per 100,000 people.[18]

Urban Cooling (Heat Mitigation)

- Increasing tree canopy can significantly reduce exposure to extreme heat, with full coverage lowering local temperatures by up to 1.0°C and reducing the risk of dangerously high temperatures by fivefold![19]

As urban planners, you are uniquely positioned to close the gap between what we know about nature and health. I see the impacts of your decisions in the blood pressure of a single parent walking their kid to school through a treeless neighbourhood, or in the respiratory flares of a senior living in a heat island with no canopy coverage.

This is public health, and it's in your hands.

I see the impacts of your decisions in the blood pressure of a single parent walking their kid to school through a treeless neighbourhood, or in the respiratory flares of a senior living in a heat island with no canopy coverage.

Endnotes

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