

# Density and sustainability: A radical perspective



It's time to challenge the wisdom of exaggerated height and density in urban structures, writes **Jason F. McLennan**.



We have all seen the futuristic, sci-fi depictions of what our cities of tomorrow are supposedly going to look like. These Blade Runner-esque wastelands are as depressing as they are ridiculous and they are certainly not the kinds of places where we want our children and grandchildren to live.

They present a foregone conclusion that our cities will end up as megalopolises filled with skyscrapers that stretch for miles – taking New York, Tokyo, Singapore and Hong Kong to an absurd level of density and height. Unfortunately, many in the green building community seem captivated by so-called Eco-high-rises and green skyscrapers and assume that the sky-high buildings portrayed in books and movies are not only coming, but are best for us from a sustainability standpoint. There is a belief that more density and height is always better.”

I disagree.

As global populations rise and resources diminish, I propose an alternative way of thinking about the greening of our city structures. I believe that there is, like so many things in life, a “sweet-spot” between density and height as well as culture and the environment. Contrary to popular thinking, I believe that there is a point at which the sustainability benefits of density and building height diminish – then actually reverse!

## Cities of the future

The cities of the future should be more than ecologically benign; they must also be socially just and culturally rich. As today's designers, urban planners, politicians and architects, we have a responsibility to seek urban form that achieves the highest possible level of cultural, social, aesthetic and environmental goals. Solutions that achieve one or two at the expense of the others are, in the long-term, failures. Such is the story of most of today's cities. Unfortunately, the same can be said for the current planning and visions of the city of the future that revolve around excessive height and density.

## Putting Density in its Vertical Place

We've known for some time that the lower the urban density, the greater the environmental burdens and the more dramatic the societal impact. There are countless scholarly articles about the ills of suburban sprawl and low-density development. Since the 1990s, the negative reality of how we transformed our cities from World War II onward has finally sunk in.

When people are spread out, public transportation systems lose their effectiveness, private vehicle use rises, pollution increases and the citizens' interconnectedness and cultural connections suffer. We have paved over farmland and forestland for strip malls and lollypop subdivisions. I have no debate with these realizations. The suburban model is broken and destructive. When presented against our litmus test of ecologically benign, socially just and culturally rich communities, they fail miserably.

I do take issue, however, with the disparagement of all low-density communities, including small rural towns that traditionally had a purpose as the breadbasket of our nation. As bedroom communities, they are disastrous, but as centers of rich agricultural life, they are essential. There is nothing wrong with living on an acre or more if you are raising chickens and growing a large percentage of your vegetables!

With that said, let's leave the well-worn path of low density out of this discussion and focus on a current sacred cow: the assumption that density and building height is always good and the more there is of it, the better. The question we should ask ourselves is simple.

What building heights and urban densities result in the maximum benefits to culture, society and the environment?

I believe the answer might surprise a few people.

## The Nature of Limits and Finding the Sweet Spot

In the natural world, it is commonly understood that there are limits to the density of any one species on a given area of land. These limits are never hard and fast rules, but are based on the carrying capacity of the land that varies through time and location. Too many of any one animal in any one place results in less than ideal conditions for the whole. There are limits, but we believe our cleverness removes these rules on our behalf. We build how we like because we think we can and the results of this attitude are becoming painfully clear.

So, let's skip right to the punch line.

I believe that there should be limits to the density of our cities and to the heights of the buildings in which the majority of humanity lives. I believe that there is a “sweet spot” or optimal range that results in the kind of urbanity that best meets our test and should guide our long-term vision of the cities of tomorrow.

I believe that this sweet spot tends to be in the four-to-eight-story height range at densities between 30 and 100 dwelling units/acre for reasons that I’ll outline shortly. Depending on circumstances, this range could be extended downward to two-to-three stories and upwards to twelve-to-fourteen (with corresponding adjustments to density). But the sweet spot is between four and eight.

The remainder of this article presents a series of arguments that explain my rationale. Each argument alone is not enough, but I believe that in concert they make a compelling case for my theory. As you will see, a built environment within the “sweet spot” of height (assuming an urban fabric and most decidedly not isolated buildings in the landscape) results in the best mix of energy efficiency while retaining a fundamental human-to-nature connection.

Within my proposed range, the best results are achieved: enough density to allow for car-free living in a city that is resilient and walkable, while keeping us close enough to the ground to maintain our relationship with the Earth and with one another. In this regard, density may be looked at from a spatial as well as a vertical perspective.

## **Making the Case**

Capping the height and density of our communities will yield advantages on global, societal and personal levels. When the following individual arguments are considered together, they demonstrate the overwhelming strength of the idea. This combination of factors can usher in a better quality of life for and in our cities.

### **Argument One – Living Buildings; Energy and Water Independence**

The Living Building Challenge™ focuses on buildings that are energy- and water-independent. For single structure projects pursuing the Challenge, the program requires your building to generate all of its own energy on-site with renewable resources on a net annual basis, and to capture all water for use in the building through rainwater catchment, then treat it onsite for reuse. This is a radical departure from resource wasteful regional systems.

That said, we recognize in the Living Building Challenge that the ideal scale for energy generation or water treatment and capture may not always be at the building level. The program has a system called “Scale Jumping” that allows for neighborhood/district scale systems as well.

At this scale, buildings can share “resources” in a similar way that a forest shares resources without sizeable system losses and obscene levels of infrastructure. A decentralized system for energy and water is, in the long term, more economic, safer from a national security standpoint, and allows for more innovation due to the scale of solutions available.

This is interesting: when you look technically at what it takes to produce net-zero energy and water buildings based on available solar energy, wind or rainfall, you end up with a maximum range between two and six stories in height on a fully built-out urban site depending upon climate and building type.

Building anything taller would require more surface area than exists to generate enough energy or capture enough water with the resources available. That height/density range can be extended based on a more district/neighborhood level approach. If we believe in a future of carbon-neutral cities with decentralized neighborhood and building scale systems, then our sweet spot is activated.

### **Argument Two – Density and Transportation Effectiveness**

In an ideal and truly sustainable city, people should be able to walk or bike for any of their daily needs, and the city’s density would support renewably-powered public transportation systems to take people further afield when necessary. A truly walkable, pedestrian-oriented community is the most democratic and socially just, allowing people of all ages access to the services they require, whether they can drive or not. At the densities suggested in our “sweet-spot,” this idea is reached perfectly without the need for super-scaled, mass-people-moving systems that end up using even more energy.

### **Argument Three – Security and Passive Survivability**

In this discussion, it is important to consider the concept of passive survivability: how a building’s inhabitants will fare when its power, heating and water systems fail. As the climate continues to change and weather patterns become less predictable, the possibility of system disruptions increase. Additionally, as we transition from a fossil fuel economy, supplies will inevitably decrease and potentially make our communities more vulnerable to disruptions.

The taller the building, the more difficult it is to service its energy and water needs and the greater the reliance on globally-sourced materials to build and maintain them. Further, in the event of a catastrophe that cripples a structure's system, the chance of escape diminishes with every vertical story that occupants must descend. At extreme heights, our cities and buildings become less resilient. What happens to be the maximum height that works without elevators? Six to eight stories...

#### **Argument Four – Way-Finding and Defining Place**

Kevin Lynch's great book, *The Image of the City*, describes how people know how to get around in their city or any city they are visiting by locating paths, edges, nodes or other wayfinding devices and comparing the locations of these markers to where they need to head. Our concept of a place is incredibly wrapped up in our "markers," which also say a lot about what we value as a society. The rise of corporate towers and expensive high-rise condos is telling, but perhaps diminishes our sense of place and the "specialness" of our communities.

When all city structures reach to the sky and hide important visual markers, it becomes difficult for us to find our way and we lose any sense of architectural or sociological hierarchy. We should reserve extreme height for structures with societal importance, and leave a visual path that winds through our cities. It is noteworthy that maps of many modern American cities highlight corporate headquarters as the most prominent downtown buildings. We must be able to navigate our way through landscapes containing both natural and man-made vistas.

#### **Argument Five – 3,000 Years of Cultural Legacy**

I'll keep this point simple. Perhaps several thousand years of continuous civilization means we got some things right? The most sought-after places to visit — the cities we view as cultural legacies of humanity — always fall within our sweet spot of height and density. Paris, Barcelona, Rome and Kyoto are just a few that come to mind. Enough said?

#### **Argument Six – The Need for Nature in the City: Biophilia**

Biologist and researcher Edward O. Wilson popularized the notion of biophilia, which he described as "the connections that human beings subconsciously seek with the rest of life." We thrive emotionally and physically, Wilson wrote, when we are in the presence of other organic forms. Even in our built environment, it is important that we retain this connection. (It is no accident that people put flowerpots on their high-rise balconies, indoor Ficus trees in their offices and electric tabletop fountains on their desks.) When density is disproportionate to nature and we are disconnected from our earthly surroundings, we face the very real risk of what writer Richard Louv has identified as "nature deficit disorder." In this discussion, the question of New York always comes up. The extreme height and density of parts of Manhattan are exciting and intense, but I believe what makes New York work is that its green heart – Central Park – is like a giant biophilic pressure release valve. If Central Park were paved over with equally tall buildings as in mid-town Manhattan, I believe the city would fail.

#### **Argument Seven – Too High to see Faces: Evolutionary Support for Limited Height**

There is an important architectural concept known as "Prospect and Refuge." It is based on the idea that people derive psychological comfort from shelter that affords us a good view of the surroundings – enough to see threats coming, yet never too high to be disconnected from the landscape in order to make our escape. This makes sense if you consider our evolutionary history on the savannah, where prospect was afforded from a knoll or from a tree, such as the acacia that grows to no higher than 100 feet. (People would climb 40-60 feet at the most; there's our sweet spot again.) One still sees this behavior in our closest evolutionary cousins: great apes.

There was no need to go higher; mid-rise elevations offered long-range visibility while retaining visual clarity of what lay beneath. What is interesting about this degree of prospect is how it relates to our physiological abilities.

The ability to recognize human features diminishes as we move away from a person's face. Studies show that at 10 feet away, we can no longer see individual eyelashes. At 200 feet, we cannot distinguish the person's eyes and have a difficult time distinguishing one person from another. At 500 feet, we can make out a head but it appears blurry. So as we move out of our sweet spot above the ground, we are unable to visually process our fellow humans who stroll along the sidewalk below.

This is okay from time to time, but how does this really affect us if this is our daily experience? Even more dramatically, what if this is our everyday experience during our formative years? What happens to our connection to life when people and all of the natural world are rarely more than a mere blur? This, I believe, creates a dangerous disconnection within the species.

#### **Equitability**

As we move toward a renewable world, it is imperative that we grant all people equal access to sunlight. It would be a tragedy if a building were to invest significant resources to install integrated photovoltaic's, only to have another taller building put it in shadow and render it obsolete. Like access to fresh air, access to your own sunlight on your property should be a right. It is possible to plan for "solar envelopes" that guide city development and ensure that each property always has access to the light and free energy that it needs. But doing so means

restricting building heights to within the “sweet spot” based on rational street widths.

### Thinking Ahead

The greatest human societies — European, early North American, North African and Asian — built their cities in a height range that fits within the proposed “sweet spot” for culturally rich, ecologically sound and socially just communities (although none of these is guaranteed by urban fabric, only enabled by it). They did this based on the reality of “limits” that did not burden them but allowed them to express culture and place for great local differences. The greatest of those still stand today as testaments to enduring cultural and societal legacies that stretch back for generations.

It's really only been in the last century when we have felt the need to rise to such architectural heights. Undeniably, there are skyscraping marvels standing in the world's most impressive cities, but I look at them as exceptions to what should become a new urban rule.

If livability is the goal and sustainability is the necessity, then we must start planning now for our cities to return from the clouds to grounded carbon-neutral communities. Perhaps, like our oil-addicted culture, the skyscraper was a brief interlude in human history — a 100-year experiment in density and height that was impressive but never meant to last.

To be clear, I'm not talking about creating whole new cities from the ground up. Instead, I propose that we should gradually transform our existing communities. Cities, like living organisms, evolve over time. With careful and thoughtful planning, the urban areas of today can transition to the more environmentally sound cities that we envision for our future.

Only a fraction of the buildings that currently stand in a city will remain in place 100 years from now. We are quick to forget how completely we transformed every major metropolitan area in North America to make room for the automobile from 1945-1975. Surely, with the urgent need to address climate change and other global environmental and energy problems, we can do the same again.

In America, our efforts will result in greater overall density for almost every city and produce compact, walkable, pedestrian-oriented communities. But it must be done within a density that allows urbanity without crowding out our connection to the natural world and diminishing our connections to each other and the scale of place.

As outdated structures are torn down, or as better infill development occurs, we must replace them with alternatives that adhere to saner height and density guidelines. This will more likely result in ideal ecological, cultural and sociological performance. If we succeed, our future cities will be built to last, supporting us as well as they support themselves. And there is no sweeter spot than that.

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