Building for the Future

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A Knowledge Product Collection
by Bauhaus Earth

Series 2 — Regenerative Buildings

Less is More – Building Sufficiently

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What to Expect:

Globally, we are witnessing an increase in resource consumption in the building and construction sector. This increasing demand is driven not only by a growing global population, but also by an increase in the amount of space per person and resource-intensive urban sprawl. To effectively mitigate climate change, we must reverse this trend. One promising solution lies in the concept of sufficiency, which means developing high-quality spaces with fewer resources. How can this help us reduce resource consumption in the building and construction sector? Learn about sufficiency as a guiding compass for architects and designers and different strategies for building better with less.

Housing the Future

By 2050, the Earth will be home to nearly 10 billion people[1]. As a result, the global building stock is expected to double over the next few decades[2], with a new city of one million people being built every five days[3]. An enormous amount of material and energy resources will be needed to house and service this growing population. Even if we can reduce the environmental impact of this monumental building project by transitioning to bio-based and circular materials, the strain on our planet will still be substantial.

In many regions across the globe, per capita resource consumption and emissions continue to rise[4]. In the building sector, this upward trend is primarily driven by increasing floor area per person and associated settlement patterns. In the last 10 years, floor area has increased by more than 20 per cent, while built-up areas are expanding twice as fast as the world's population[5]. The consequences of this development include the loss of agricultural land and ecosystems, as well as an increased demand for various resources, including materials for buildings and infrastructure such as roads, electricity, and water. Additionally, increased emissions from freight transport in low-density developments add to the pressure (see Fig. 1: Comparison of high-density vs. low-density neighbourhoods).

Efficiency, consistency, and suffi- ciency are seen as three comple- mentary approaches to sustaina- bility[7]. While there is no commonly agreed definition of these terms, they can be described as follows:

Efficiency refers to improving the ratio of "input to output" by using technologies, processes, or prod- ucts that help minimise the use of resources such as materials or energy to produce an output[7]. This may, for example, include smart manufacturing of wood to produce the maximum amount of high-quality timber with the minimum amount of waste. Materi- al or energy efficiency achieves a relative reduction in the use of resources.

Consistency refers to the transi- tion to material flows and prac- tices that are in harmony with nature or at least adapted to the surrounding nature in such a way that they are environmentally compatible[7]. The transition to renewable energy and bio-based materials is an approach of con- sistency.

Sufficiency is defined as reducing or limiting resource use to a level that still allows needs to be ade- quately met[7]. It seeks to strike a balance between consumption and living within planetary boundaries. Sufficiency strategies or actions require behavioural change, aiming at a lifestyle that uses resources differently or less than before.

So, how can we find a balance between meeting human needs and respect- ing our planetary boundaries, while also curbing the ever-growing demand for materials, land, and energy? One possible solution lies in the concept of sufficiency. This principle involves not only a responsible consumption, but also access to resources and their fair distribution. Although it is not a new idea, sufficiency remains largely overlooked in climate change mitigation efforts and is often mistakenly associated with renunciation[6].
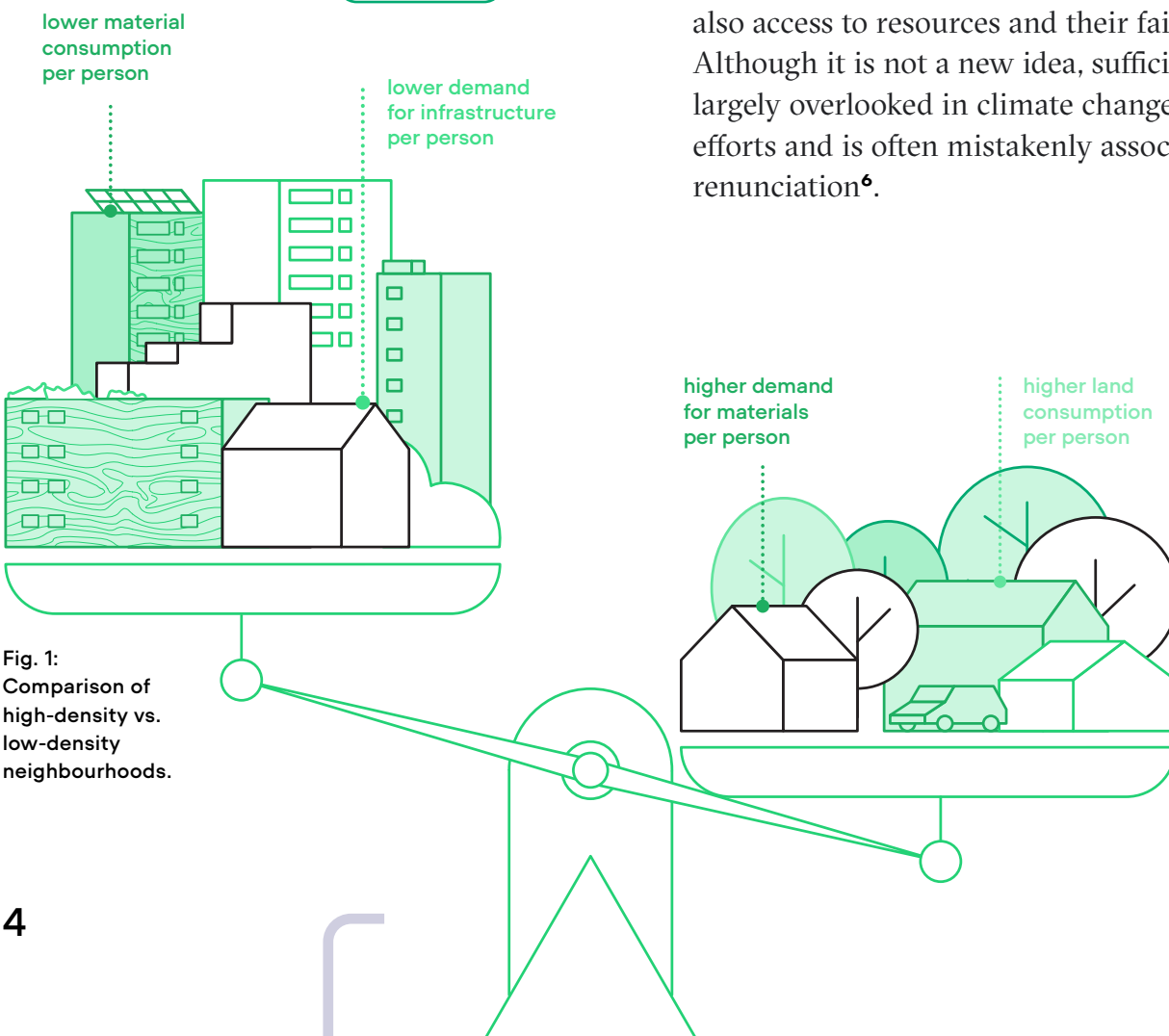
lower material
consumption
per person

lower demand
for infrastructure
per person

higher demand
for materials
per person

higher land
consumption
per person

Fig. 1:
Comparison of
high-density vs.
low-density
neighbourhoods.

The concept of planetary boundaries, introduced in 2009, defines the environmental limits within which humanity can safely operate and thrive for generations to come[8].
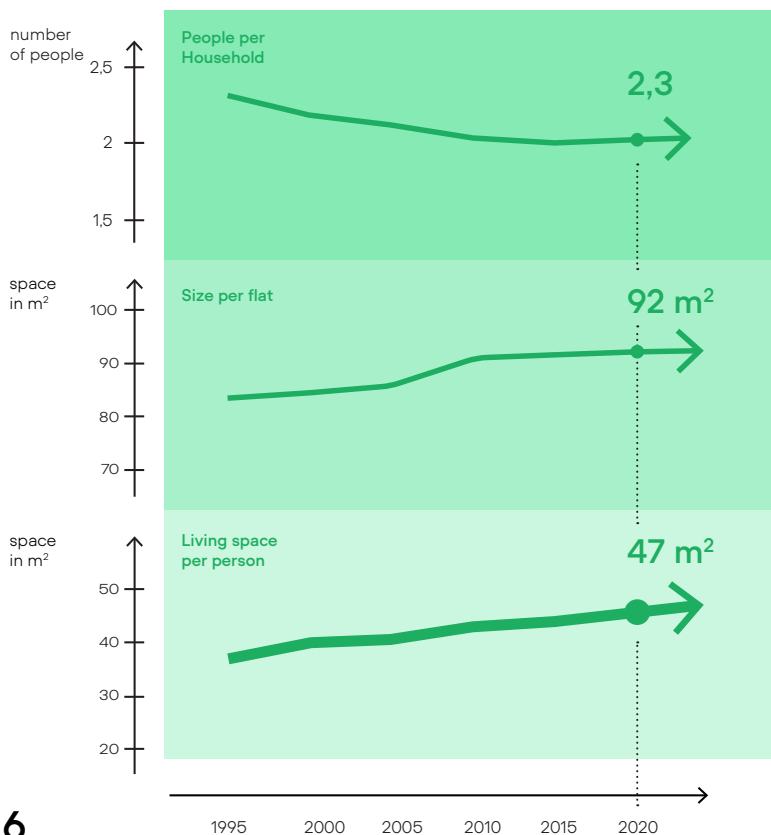
Understanding Sufficiency in the Built Environment

" Sufficiency can be a compass for planners and architects, helping them to (re)design the built environment in a way that minimizes the use of resources while maintaining a good quality of life."

Sufficiency is the goal of avoiding unnecessary demand for energy, materials, land, and water, while ensuring human well-being for all within planetary boundaries. Unlike efficiency, which primarily relies on technological advances, the path to sufficiency requires a fundamental change in our behaviour and mindset. It requires us to critically reassess our consumption habits and what is *really* needed for a decent life. While lifestyles that exceed planetary boundaries are currently more prevalent in higher-income countries, they are likely to become a critical issue in lower- and middle-income countries as their economies continue to grow.

Sufficiency can be a compass for planners and architects, helping them to (re)design the built environment in a way that minimizes the use of resources (especially materials, land, and energy) while maintaining a good quality of life[9]. Buildings often fail to meet the needs of their occupants. Whether it is oversized rooms or layouts that are not adapted to people's behavioural or cultural characteristics, such design flaws resulting in a waste of resources. This waste extends beyond the amount of land and materials used; it also includes the energy required to operate a building, which is largely influenced by its design and size. In addition, the choice of location and typology of a building have a significant impact on the resources used. Constructing a detached house on a greenfield site requires more building materials and infrastructure to connect it to a wider network than an infill development. This choice also leads to higher emissions from occupants, especially if long distances require car travel.[10]

In addition to prioritizing people's needs in planning, designing for energy and material efficiency, and encouraging densification of inner cities, it is also important to recognize floor space per person as another critical lever for achieving sufficiency and reducing overall resource consumption in the built environment. To illustrate this point, a mere reduction of 1m² of floor space per person in Germany would make a barely perceptible difference to most occupants, yet in total, this amounts to the equivalent of one million homes, each averaging 80 m² [11]. This seemingly modest adjustment would have a substantial impact on overall resource use.

In order to effectively identify ways to reduce land use, it is crucial to understand the drivers behind the current steady increase. In many countries, there is a general trend towards smaller household sizes due to declining birth rates, longer life expectancy, and the traditional nuclear family model becoming less relevant. As households become smaller, floor space per person increases as certain areas, such as the kitchen, hallway, or living room are no longer shared by multiple household members. However, there is also a general tendency for new houses and apartments to be larger in size than they were a few years ago.

Fig. 2:
Development of average flat size, people per household and floor space per person in Germany. Graphic based on Statistisches Bundesamt (2023)[12] and Statista (2023)[13]

Moreover, in many parts of the world, the dominant type of housing revolves around single-family and detached houses, which are on average larger than apartments. As the share of these types of dwellings steadily increases, so does the percentage of larger dwelling units and hence the average floor space per person. At the same time, however, there is a growing interest in alternative forms of housing that better reflect today's social structures, such as shared housing for senior citizens. While this interest may stem from societal needs rather than environmental awareness, communal living often has the potential to reduce the amount of floor space per person.[14]

Sufficiency in Practice

Although very few projects explicitly aim for sufficiency, many examples have demonstrated what can be achieved with less, both in terms of social cohesion and environmental impact. These examples illustrate the range of possibilities that exist in the design of both new and existing buildings to reduce the consumption of resources while simultaneously ensuring a high quality of life. The following section explores different strategies, from a collective commitment towards building for sufficiency to reducing the floor area per person by sharing space and optimising its use.

A Collective Commitment to Sufficiency

There are numerous ways of incorporating sustainability into buildings, many of which inherently encompass sufficiency, whether deliberate or unintentional. By setting collective goals for the necessities of a 'decent life' during the initial planning stages, it becomes easier for individuals to embrace and live by these principles. One example of this is the housing cooperative 'mehr als wohnen' in Zurich, Switzerland, which adopted the concept of the '2000-watt society' (the current average annual consumption is around 5,000 watts per person) at the planning stage. As part of this commitment, factors such as access to public transport played an important role in site selection, alongside considerations such as occupancy rates and space limitations per person. While the Hunziker Areal is now officially certified as a '2000-watt society', the collective commitment has been refocused on achieving a net-zero lifestyle.
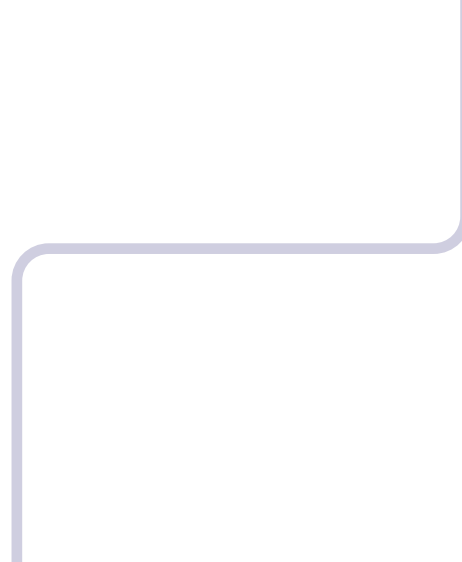
Fig. 3: Hunziker Areal

— Architects: Duplex Architekten, Futurafrosch, Müller Sigrist Architekten, Architekturbüro Miroslav Šik, pool Architekten, Müller Illien Landschaft-sarchitekten
— Completion: 2015
— Location: Zurich, Switzerland

The Hunziker Areal is a cooperative housing development on an inner-city former industrial site, consisting of 13 compact buildings housing approximately 1200 people and providing workspaces for further 150 people. Living space per person is limited to an average of 32m². However, residents have access to some non-commercial communal areas as well. Mehr als wohnen is committed to being a 'car-less' housing cooperative. This means that it primarily rents out

apartments to individuals actively refraining from privately owning a car. There is shared infrastructure for renting out electric bicycles and cars. Additional opportunities for sharing infrastructure, like communal laundries, urban gardening initiatives, or repair cafés, foster a sense of community while reducing individual resource consumption.

Participatory Design to Define People's Needs

Users are frequently excluded from the design and planning of buildings. Even when their input is sought, the discussion rarely extends to considering how housing needs might evolve over time, such as when children move out. Consequently, buildings and apartments often conform to a generic 'one-size-fits-all' approach that may not effectively meet the needs of future occupants. This discrepancy becomes evident when examining the striking similarities in modern building designs and layouts across different cultural and climatic contexts. By engaging users in a collaborative design process, we can create buildings that more accurately reflect their needs and aspirations and facilitate a conversation about how housing can adapt to changing life stages. This ensures that residences are responsive to evolving social dynamics, the needs of ageing individuals, and shifting preferences.

The municipality of Dötlingen was facing the issue of demographic change and was planning to provide housing for senior citizens. Together with the Wi helpt di cooperative, Baupiloten BDA organised a participatory process, inviting citizens, politicians, and administrators as well as representatives of companies and associations. The result was an architectural and social vision for intergenerational coexistence in the rural neighbourhood. The concept of 'Together

Fig. 4 & 5: Intergenerational Living

— Architect: Baupiloten BDA
— Completion: 2014
— Location: Dötlingen, Germany

Alone' is used in the design of five different housing typologies, where individual and community needs are met.

Building for Shared Living

Shared accommodation is a common living arrangement, particularly among younger people who are still in education. Typically, the bedroom is used as a private space, while the kitchen, bathroom, and occasionally the living room are shared. Cost can be a major factor in young people's decision to opt for shared living, which reduces the amount of space used per person. However, shared living is gaining popularity as a deliberate lifestyle choice for many.

Shared living provides opportunities for social interaction and companionship, which can alleviate feelings of isolation and loneliness. Additionally, it fosters a sense of community among residents as they can rely on each other for different needs. As the number of older people, single-person households, and lone parents with children increases, this social aspect becomes even more crucial[15].

Building Multi-Functional

The way we use and operate buildings greatly affects resource consumption. Often, rooms or even entire buildings remain completely unused for certain times of the day, like schools and nurseries that are typically vacant in the afternoon and evening. However, by assigning additional purposes to these
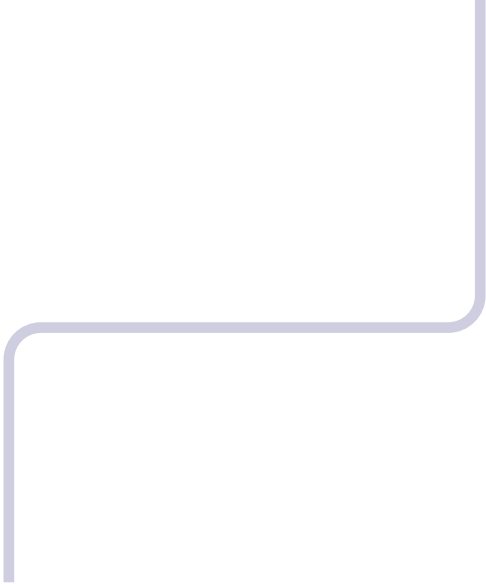
spaces, we could extend their occupancy to a reasonable maximum so that the construction of separate structures is no longer necessary. A school or nursery could be used as a yoga studio in the evenings or as a space for private events at weekends. The principle of multiple use thus adds a temporal component to the spatial programming of a building: instead of serving a single purpose, certain areas can be assigned a different use for a specific period of time. An interesting example in this respect is the editorial office of the architecture magazine ARCH+. It serves both as a workplace for 10 employees and as a residence for the editor and his partner.

The layout of (ARCH+'s editorial office) and the editor's home echoes the grid of the supporting structure, dividing the spaces into 3x3 areas of approximately equal size. An ingenious system of sliding doors, curtains and large double doors allows these different areas to be connected in a variety of

Fig. 6: Editorial Office ARCH+

— Architect: Arno Löbbecke,
  Anh-Linh Ngo
— Completion: 2018
— Location: Berlin, Germany

combinations. The central room is not only the heart of the design, but also the central passageway, so other access areas have been minimised. In addition, all rooms are accessible from at least two sides, so that, depending on the room combination, it is still possible to enter the rooms from other sides. All the rooms can be closed off temporarily for intensive work or meetings or opened up via the central room to accommodate events for up to 80 people, where the private kitchen becomes a bar. During the day, the workspace expands into the living areas, while in the evening, the central room is also used for private purposes.

How to Overcome the Challenges and Barriers of Designing with Less

Despite the environmental and social benefits, the choice to reduce consumption and floor space is often not driven by environmental concerns but by external constraints such as financial difficulties. This raises the question of how we can actively encourage optimized use of living space and give it a positive connotation by highlighting the advantages it offers. The following table summarizes some key challenges and the novel approaches and initiatives that have emerged in recent years to address them.

TYPE OF CHALLENGE	DESCRIPTION OF CHALLENGE	INNOVATIVE APPROACHES AND INITIATIVES
FINANCING	In cities such as Berlin, where rents have risen enormously in a relatively short period of time, many people can no longer afford to move out of their apartments and downsize to smaller ones, as rents on new leases are much higher. As a result, older people often stay in their oversized homes long after their children have moved out, as it would be more expensive for them to move to a smaller apartment with a new rental contract[16].	Municipal housing agencies can play a key role in identifying housing needs in the neighbourhood, providing advice to housing seekers, arranging alternative accommodation, or initiating home exchanges. As part of the OptiWohn project, such housing agencies have been set up and are currently being tested in three German cities, with a particular focus on older people living in flats and houses that have become too large[17].
POLICY AND REGULATORY ENVIRONMENT TO ENHANCE LIVING SPACES	Sufficiency policies in relation to space reduction are scarce, and when applied, do not target households with the financial means to live in larger dwellings. Instead, these policies focus on people dependent on government aid. These households are restricted by law to a maximum space per person – even though, due to their low disposable income, they do not tend to occupy big flats or houses in the first place.	The city of Berlin has announced plans for a cooperation agreement with state-owned housing companies to ensure a better ratio of household to flat size in the future. In practice, this means that flats will be allocated according to the number of people in the household (e.g. one room per person)[18]. Such an agreement could serve as an example for other cities and municipalities to tackle the high per capita consumption of space.
PERCEPTION AND CULTURAL ACCEPTANCE	The quest for constant economic growth, expressed in the desire for more material goods and more space, is deeply rooted in capitalist cultures. As a result, the question of what is really necessary for a 'decent life' is rarely asked, and the notion of sufficiency is even equated with personal sacrifice.	To gain social acceptance, sufficiency needs to be presented in a way that does not feel restrictive or burdensome, but as a shift towards greater possibilities, an improvement in quality of life and living conditions, and a means to achieve greater comfort and financial benefits. The Energy Agency Regio Freiburg is already leading the way in this respect with its public engagement initiatives "smaller living, better living" campaign[19].
PLANNING AND DESIGN CULTURE	Many people tend to underestimate the impact of their own actions, believing that their ability to make a difference is limited - and indeed, individuals are rarely given the opportunity to participate in a building design process. Architects and planners have a crucial role to play in introducing a participatory culture to the housing sector.	In some cases, particularly in co-operative housing projects such as R50 in Berlin, residents have been closely involved in the planning process[20]. The role of architects and planners is then to guide individuals, to distinguish between needs and wants, to devise space-efficient solutions, to discuss the long-term use of the building and to adapt it to the future needs of its users.

Adopting the
Sufficiency Approach

The principle of 'less is more' should become a key pillar in the construction of regenerative buildings and infrastructure. In an era of climate change and diminishing resources, we can no longer afford resource-intensive developments such as large residences, low-density communities, and sprawling settlements. Architects and planners must take the lead in demonstrating that less material use, less energy demand, and less waste of living space does not have to mean sacrificing quality of life.

On the contrary, the sufficiency approach can foster greater social interaction while simultaneously mitigating environmental damage, thereby paving the way for a liveable future for all.

KEY TAKEAWAYS

→ Architects and planners should look to sufficiency as a guiding principle, helping them reshape the built environment to reduce resource consumption, particularly in terms of materials, land, and energy without compromising quality of life.

→ To effectively mitigate climate change, we must find ways to reduce global resource consumption.

→ One effective strategy to reduce resource consumption in the building and construction sector is to reduce the floor space per person.

→ The early involvement of users in the planning and design processes not only opens up the possibility of setting and pursuing ambitious goals collectively, but also allows architects and planners to design for the actual needs of the users.

→ Encouraging shared living or multifunctional use of spaces can significantly save space and resources.

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About Bauhaus Earth

We envision a future where buildings, cities, and landscapes proactively contribute to climate restoration and have a positive impact on the planet and its inhabitants. Our mission is to transform building and human settlements from a driver of climate and societal crises into creative forces for systemic regeneration.

Only a complete systemic overhaul of our built environment will prevent a global climate catastrophe.

The Knowledge Product Collection "Building for The Future: Strategies For A Regenerative Built Environment" is an ongoing project. The present publication is part of Series 2: "Regenerative Buildings."

Impressum