Socio-ecological approach as a basis for local and neighborhood scale to promote urban and community resilience to climate change

Abordagem socioecológica como base para a escala local e do bairro para promover a resiliência urbana e comunitária frente às mudanças climáticas

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Abstract

The aim of this article is to work the socio-ecological approach as a basis for local and neighborhood scale to promote urban and community resilience in the face of climate change. For this, we started from the analysis of the concepts of resilience, urban ecosystems, ecological urbanism and urban villages (ANDRADE, 2014; FARR, 2013; PICKETT, CADENASSO, MCGRATH, 2013; MARE 2008, ALEXANDER et al, 1977) that point to the neighborhood scale as the ideal scale to promote resilience and then go deeper into the settlements and their human and community aspects for sustainability, taking as examples the emerging movements of ecovillages and econeighborhoods (BARTON, 2000; FINDHORN ECOVILLAGE, 2016; FREITAS, 2016; JOUBERT; DREGGER, 2015; SILVA, 2013; VERDAGUER, 2000).

Resumo

O objetivo deste artigo é trabalhar a abordagem socioecológica como base para a escala local e do bairro para promover a resiliência urbana e comunitária frente às mudanças climáticas. Para tanto, partiu-se da análise dos conceitos de resiliência, de ecossistemas urbanos, urbanismo ecológico e de vilas urbanas (ANDRADE, 2014; FARR, 2013; PICKETT, CADENASSO, MCGRATH, 2013; MARE 2008, ALEXANDER et al, 1977) que direcionam para a escala de bairro como a escala ideal para promover a resiliência para então aprofundar mais detalhadamente sobre os assentamentos e seus aspectos humanos e comunitários para a sustentabilidade, tendo como exemplos os movimentos emergentes da ecovilas e ecobairros (BARTON, 2000; FINDHORN ECOVILLAGE, 2016; FREITAS, 2016; JOUBERT; DREGGER, 2015; SILVA, 2013; VERDAGUER, 2000).

Introduccion

This paper aims at describing the socio-ecological approach necessary for human survival on the planet as a theoretical and methodological basis behind local and neighborhood scales considering an uncertain future with scarcity of natural resources, such as the shortage of potable water, the dwindling of biodiversity, oil decline, climate change, the global economic crisis, increasing social inequalities, pandemics, syndemics, and the high food prices leading to hunger.

Irreversible damage and major human loss due to the pandemic, as well as the toll on biodiversity, have given rise to the mobilization of different social forums at a global level. A UN document (2020) entitled “Shared Responsibility, Global Solidarity: Responding to the Socio-Economic Impacts of COVID-19” acknowledges the urgency in seizing the opportunity afforded by this crisis to strengthen the countries' commitment to the implementation of the 2030 Agenda and of the 17 SDGs with a view to achieving a more inclusive and sustainable future.

As signaled by that paper, if we had made progress towards achieving the Sustainable Development Goals and complying with the Paris Agreement on Climate Change, we could be better positioned to meet this challenge. There is no question we are currently facing a global health crisis unlike any other in the United Nation’s 75-year history.

At the same time, a bombastic draft report on climate, released in June 2021 by the Intergovernmental Panel on Climate Change[1] (IPCC) – a United Nations (UN) advisory group – points out that climate change resulting from human actions should fundamentally affect life on Earth for the next 30 years, even if there is a scaling back of greenhouse gas emissions.

Despite the adherence to the global warming target of 1.5°C, climate status will change at a level that is above and beyond the capacity of many organisms to adapt. Currently, as a result of global warming, every region on the planet is being affected by extreme weather events, such as heat waves, heavy rains, droughts, and tropical cyclones.

According to the IPCC report, the 1.5°C rise in global temperatures will lead to a 100%-200% increase in the number of people affected by floods in Brazil, Colombia, and Argentina; these figures grow to 300% in Ecuador and Uruguay and to 400% in Peru. It is estimated that some regions, i.e., Eastern Brazil, Southeast Asia, the Mediterranean, Central China, and the coastal areas around the world will be hit by three, four or even more disasters at once, namely droughts, heat waves, cyclones, forest fires, and floods.

An official IPCC report entitled “Climate Change 2021: The Physical Science Basis" was released in August 2021. It includes a never-before-published quantification of human action’s irrefutable and irreversible responsibility in the 1.07ºC climb in Earth's temperature, an unprecedented increase even when considering the hundreds of thousands of years of continuous sea level rise. However, according to that same report, a strong and sustained decrease in carbon dioxide (CO^2) and other greenhouse gas emissions could still curb the effects of climate change.

According to a paper entitled “Panorama of Cities and Biodiversity”[2], the world’s population will reach the 9 billion-mark by 2050, of which 6.3 billion people will be living in cities. By then, the planet will have suffered the largest and fastest urban expansion in humankind’s history; an irreversible shift towards a predominantly urban world, a trend which entails major changes to the use processes linked to land, water, energy, and natural resources.

The same document also states that urban areas are expanding faster than urban populations; by 2030 urban territories are set to expand at a rate between 800 thousand to 3.3 million square kilometers.

Urban expansion will take a significant toll on biodiversity, natural habitats, and on the very ecosystem services society depends on. Thus, it is recommended that

[1]The IPCC was created in 1988 by the United Nations Environment Program and the World Meteorological Organization with the mission of compiling and disseminating state-of-the-art knowledge on climate change.

[2]Convention on Biological Diversity (CBD) Report about the Outlook of Cities and Biodiversity, Eleventh meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 11), October 2012.

urban areas address these ecosystems[3] by taking their environmental services into consideration through "design and restoration" initiatives, minimizing any environmental impact by fostering greater efficiency in the use of energy and materials, and the productive use of waste.

It is important to highlight the extraordinary wealth contained in urban biodiversity, as well as its role in generating environmental services on which urban populations depend for food, water, and health. This means that the integration between the natural sciences and the social and human sciences fields – within the context of urbanism, including the connection between ecology and urban design – is paramount.

The question this paper proposes to address is the following: considering city planning focusing on the neighborhood level, what survival strategies could be pursued taking into consideration social inequalities and socio-environmental conflicts? At a macro-scale, regional urban planning still fails to favor local governance and sustainable urbanism. As of yet, it has been unable to create a socio-ecological convergence within neighborhoods, since the ecological infrastructure remains virtually inaccessible to low-income populations, being mostly used as a propaganda tool for neoliberal urbanism. What lessons could be learned from the ecovillage and eco-neighborhood movements and applied to low-income human settlements aiming at building urban and community resilience?

According to Andrade (2014), the Final Declaration of the People's Summit, at Rio+20, proposes to strengthen local economies and territorial rights with a view to ensuring the community construction of more vibrant economies. These local economies would provide local sustainable livelihoods and community solidarity, both vital components to the resilience of ecosystems, reducing the cities' ecological footprint.

Hence, nature's diversity, and its associated cultural diversity, become the cornerstone of a new social paradigm. Certain salient points in connection to sustainable urban development, such as alternatives to the current system, were asserted in the Final Declaration of the People's Summit.

Nonetheless, in Andrade's (2014) opinion, and despite any socioeconomic strategies, the structuring of local economies in the urban space, and their landscape impacts, failed to be debated to the fullest. The sole exception were the discussions held at the Gaia Home tent – Gaia Home being a member of the Global Ecovillage Network and of the Transition Towns Movement – where questions were raised regarding the consumerist lifestyle. However, unlike other groups fighting for their rights, this group's culture is proactive, aligning their discourse and actions, in the belief that, in today's society, there is already enough knowledge, techniques and resources available to make the transition to a sustainable world based on permaculture.

The urban regional macro-planning scale and the need for micro-planning at the neighborhood scale in the context of the pandemic

One of the greatest challenges faced by urban space planners is to systematically reconcile the demands for human survival, i.e., water, energy, food production, shelter, and waste treatment. These demands are connected to occupation densities and their social benefits (work, occupation and income, and access to health and education) and must be in balance with ecosystems, the landscape, and natural processes such as the urban water cycle.

Mare (2008) believes that, in the future, considering the decline of oil as an energy source, megacities will undergo a reverse migration process, with people going back to the countryside or to smaller cities due to the scarcity of natural resources, just as it happened with some ancient civilizations.

With the planetary crisis caused by the Covid-19 pandemic, people are already migrating from the city to the countryside, from the metropolis to the country. Cities will most certainly change after the pandemic. Discussions around a possible downsizing of the population in major urban centers to avoid overcrowding for fear of contagion and in pursuit of a better quality of life are already taking place. The stress caused by the ups-and-downs of high-flow commuting transport during the frequent intra-urban displacements for educational and work purposes are also a consideration; not to mention the benefits afforded by technology and remote communication,

[3]The term "ecosystem" was first coined in 1935 by Sir Arthur G. Tansley. In 1953, Odum published the first edition of his Fundamentals of Ecology, a holistic approach to aquatic and terrestrial ecosystems. According to Metzger (2011), the term "landscape ecology" was first introduced by a biographer named Carl Troll, a mere four years after Tansley introduced the concept of "ecosystem".

which made working from home and having remote meetings possible. Intra-city displacements, the moving through the city's streets, has become restricted to moments of greatest need. Nonetheless, large urban center migration to smaller urban areas has been even more prominent than the migration to the countryside, as well as the search for homes in gated communities, remote districts, and small farms.

The pandemic has a more significant and less democratic effect on the poorest city areas which, in turn, benefit less from state infrastructure, and are more prone to issues related to sanitation, access to water, and waste collection. As reported by the Oswaldo Cruz Foundation (Fiocruz) during their monitoring of Covid-19, this was observed and reported by residents in underprivileged communities and *favelas* in Rio de Janeiro (RJ) through the Radar Covid-19 Favelas bulletin.

On the other hand, the health crisis caused by the pandemic triggered several solidarity-based emergent governance and emergent planning initiatives, such as *Conexão Saúde*, deployed in the Maré *favela* by residents, Fiocruz researchers, and NGOs without any government support. This initiative reduced Covid deaths by 90% with a “tailor-made” isolation plan[4] created for the *favela* residents which included mass Covid testing and telephone medical care.

Emergent or "bottom-up" planning can also be observed in the Paraisópolis *favela*, where the "*favela* mayor" concluded that the best way to deal with the pandemic, short of a non-existing government support, was to organize the community by setting up management committees, creating a sense of ownership among the residents. Hence, “street presidents” were appointed and each became responsible for 50 households in the community. Their main tasks were to monitor suspected cases of the disease and deliver food baskets and hygiene kits. Women played a leading role, taking care of their own families and other families as well. Little by little, the *Favelas* Committee was consolidated, as the volunteer base grew and support came in the form of donations from over 8,000 people. These helped the Committee buy ambulances, hire healthcare professionals, cook and serve lunchboxes, and set-up shelters in schools to care for infected people.

These cases show how important bottom-up planning is to the city’s outskirts communities, affected by the State’s lack of action. In Brazil, urban planning and urban management are very far removed from people’s actual daily lives. The decision-making around planning is centralized, left in the hands of technicians in public entities, and policy approaches are sector specific.

In spite of the requirements established by the 2001 City Statute, which called for participatory management, the urban planning model currently in force in Brazil still employs a “top-down” macro-zoning definition approach. Planning solutions fail to create emergent, “bottom-up” guidelines for large urban areas, often favoring a real estate logic approach and making it difficult for local communities to understand these guidelines. This model has detached itself from the studies on urban form; it works within general guidelines and is not “in tune” with reality. There is no appreciation for spatial heterogeneity at its finest. This has hindered the interfacing with the scientific ecological approach to urbanism, such as studies on urban ecology or city ecology (ANDRADE, 2014).

As a system, the city is characterized by properties emerging from the interaction of the different parts that comprise it and their organization patterns. In Capra's (1996) view, these patterns are understood as the configuration of characteristic relationships between the system’s components, which determine the essential characteristics of that system. According to Alexander et al. (1977) a pattern can be understood as a recurring solution, and each represents a rule governing a functional part of a complex system.

This paper aims at pursuing a socio-ecological approach to local and neighborhood scales aiming at building urban and community resilience to climate change. To that end, we start by analyzing the concepts of resilience, urban ecosystems, ecological urbanism, and urban villages (ANDRADE, 2014; FARR, 2013; PICKETT, CADENASSO, MCGRATH, 2013; MARE 2008, ALEXANDER et al, 1977) which suggest the neighborhood scale as being ideal for building resilience. We then delve into a discussion on settlements and their human and community sustainability aspects, taking the ecovillages and eco-neighborhood movements as examples (BARTON, 2000; FINDHORN ECOVILLAGE, 2016; FREITAS, 2016; JOUBERT; DREGGER, 2015; SILVA, 2013; VERDAGUER, 2000).

[4]https://www.bbc.com/portuguese/brasil-56919419.

The concept of resilience, urban ecosystems, and urban villages

The concept of resilience emphasizes the system's ability to adapt to sudden or gradual change in the biogeophysical environment, in social contexts and processes, and in economic resources and controls. According to Rob Hopkins, founder of the Transition Towns movement, the concept of resilience is more applicable than the concept of sustainability since the definition of sustainability itself gives no indication of how to achieve it and what resources are necessary for a society to define itself as sustainable.

The definition of resilience, which Rob Hopkins borrowed from the field of ecology in his work "The Transition Handbook", is "the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity and feedbacks".

The Stockholm Resilience Center[5], one of the institutions where resilience is studied in the academic sphere, defines it as the capacity to deal with change and continue to develop. The concept of resilience can be used and understood to improve humanity's urban settlements. It is a tool through which urban systems can try to achieve sustainability. "Resilience refers to the ability of a system to experience internally and externally generated shocks and perturbations but still adjust to the changes that result" (PICKETT, CADENASSO, MCGRATH, 2013, p. 8).

Pickett, Cadenasso, McGrath (2013, p. 8) believe that urban settlements are the future of humankind. They question what the cities of the future will be like, whether they will meet the basic needs of all their future residents; whether they will be able to lessen the impact of human consumption of resources, of technological life support, and their consequences; and how the ecological metabolism, which is the origin and source of resources and human life support, will continue to function and adapt to an increasingly urban world.

Combining the expertise of designers, and natural and social scientists is key to thinking our futures cities and discussing issues like climate change, the oil peak, high food prices, scarcity of drinking water, the dwindling of biodiversity, heat islands, pollution, gas emissions, floods, storms, and traffic effects. Encouraging the integration of ecological theory into the practical, social, and aesthetic realities of contemporary urban development is paramount (PICKETT, CADENASSO, MCGRATH, 2013, p. 19).

The ecosystem concept can help us understand the urban environment as one that encompasses all urban organisms at the community level, from a city's physical structure and the processes within it to the interrelationships between human activity and all the levels of life within the city (SPIRN, 2011).

Cities are ecosystems interdependent on another system, i.e. their surroundings. They must be understood as a system that is characterized by the properties emerging from interactions between its parts. Hence, the concept of urban ecosystem is useful for urban design, by considering the specific area where the community of populations and organisms interact with the physical environment as the "niche" for human organisms, combining the environment and that organism's characteristics (PICKETT, CADENASSO, MCGRATH, 2013).

According to Spirn (2011), just like in any other ecosystem, the urban ecosystem acknowledges all its inhabiting organisms (including humans) and their interactions with each other and with the physical environment, which comprises constructed artifacts such as buildings, roads, wastewater systems, as well as water, soil, and plants. One could state that the urban ecosystem encompasses all the processes that sustain human and natural resources: cultural processes; flows of capital, people, and goods; flows of water, air, nutrients, and pollutants. Therefore, it is defined as the interaction amongst social, biological, physical, and built environment components (ANDRADE, 2014), as illustrated in Figure 1.

It is a dynamic system influenced by different types of driving forces: spatial analysis, historical context, and sustainability. The urban element contrasts with the landscape, characterized as nature or intended for the management of natural resources and an economy based on the commoditization of natural resources (PICKETT, CADENASSO, MCGRATH, 2013).

[5] The international center for transdisciplinary research that works on the governance of socio-ecological systems with a special emphasis on resilience. Available at http://www.stockholmresilience.org/.

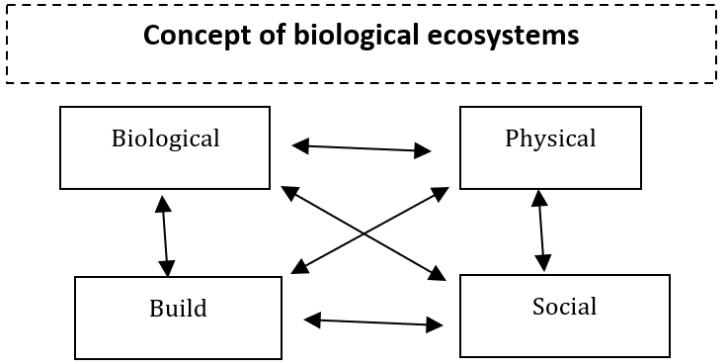

Figure 1. Concept of biological ecosystems in the context of an urban ecosystem. Source: Andrade (2014).

Urban ecosystems include physical organisms, entities and conditions, and the interactions amongst them. As stated by Andrade (2014), urban systems, and their subsystems, city downtown areas, suburbs, and peripheral cities, comprised of human beings and their institutional arrangements and artifacts, are parts of the physical components and organisms (Figure 2).

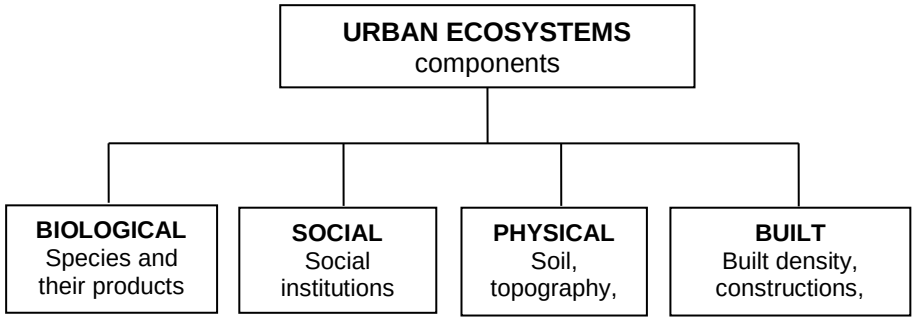

Figure 2. Components of urban ecosystems. Source: Andrade (2014), adapted from PICKETT, CADENASSO, MCGRATH, 2013.

Douglas Farr's book “Sustainable Urbanism: Urban Design with Nature” made an important contribution by associating studies on compactness (density) and biophilia (access to nature). As Andrade (2014) points out, it focuses on urban ecosystems, the landscape and community subsystems.

For Farr (2013), sustainable urbanism emphasizes the urging towards the benefits of neighborhood living, allowing people to meet their daily needs on foot. These benefits can become even greater if there is integration of five attributes: defined center and edge, compactness, completeness, connectedness, and biophilia. The prerequisite for an integrated design is a critical mass of people living in complete neighborhoods. According to Andrade (2014) these attributes can be found in Alexander et al. (1977) in the concept of community or neighborhood, for example.

The word “neighborhood” is defined by the dictionaries, in social, spatial, and character terms, as “the people who live near one another in a particular district or area” and “an area of a city or county, often referring to the characteristics or circumstances of the people who live in that area" (FARR, 2013, p. 29). For the new urban planners, it is the “settlement that has a defined center and edges”. In ecology terms, recalling Odum and Barrett (2007, p. 5), community is “the entire population that occupies a certain area.”

In a review of studies on the neighborhood scale carried out by Andrade (2014), she emphasizes that in Farr's (2013) ecological urbanism, he states that the ideal size of a neighborhood must be suitable for walking and vary between 16 and 80 hectares. On the other hand, Alexander et al. (1977) believe that cities should be divided into autonomous, small enough communities, between 5,000 and 10,000 residents, probably of approximately 7,000 residents, so that people can participate in local government and self-manage with their own budget. Studies by Mare (2008), however, reinforce that cities should be divided into urban villages of 5,000 people to facilitate access to natural resources.

Thus, it becomes feasible to discuss, decide and resolve village-specific issues such as the use of land, housing, urban maintenance, road system, parks, educational policy, welfare and safety, and community services. Natural and historical geographic boundaries should be used to delimitate these communities.

For Farr (2013), the neighborhood can vary in terms of size and shape, but it must meet the walking distance limit for pedestrians, a radius of around 400 meters, as were the neighborhoods before World War II. To that end a grid configuration must

be associated to the use of the land, so as to allow for a connection with public transportation. Density cannot be less than 17.5 dwelling units per hectare to support a bus corridor, and between 37.5 to 50 dwelling units per hectare to support a trolley or light rail system.

The integration of transportation and land use creates opportunities for people to walk or bike and favors accessibility for wheelchair users. Higher densities, with a mix of uses, are beneficial to public life and to nature, because they make it possible for people to interact and increase the population of an already urbanized location, helping to protect pristine and sensitive areas, concentrating the drainage basin in one place.

Figure 3, below, systematized by Andrade (2014), illustrates the five basic sustainable urbanism attributes for an integrated design as proposed by Farr (2013).

Biophilia is the name given to the human love of nature. According to Farr (2013, p. 168), the lack of connection with nature is responsible for numerous psychological problems, such as stress, attention deficit disorder, and hyperactivity. The probability of traveling on foot is three times greater on tree-lined routes. The ecological infrastructure must favor the improvement of public living spaces in the city and people's mobility, whether on pedestrian paths or on bicycle lanes. On a broader settlement design scale, it should contribute to urban mobility in the road layout. On the other hand, it must improve water cycle conditions in urban areas, as well as water quality, through natural drainage solutions to avoid macro-drainage techniques which impact urban soil and fail to contribute to flood prevention (ANDRADE, 2014).

Christopher Mare (2008), also mentioned by Andrade (2014), is another author working on the neighborhood scale, or rather, on an Urban Village scale. Considering the foreseen oil decline and the future scarcity of natural resources, he proposes the Urban Village model based on that of traditional villages as self-sufficient sustainable units in response to the urban concentration patterns seen in several countries (MARE, 2008, p. 78).

Community/ Neighborhood	Neighborhoods are basic units of human settlement and planning. A classic example is the 64-hectare neighborhood of Clarence Perry. Victor Dover proposes the threshold of 16 to 80 hectares. The edges and the center should be sized so as to meet the environmental and social needs of the community. Respect for pedestrians, different types of buildings, people, and uses. The limited size of a neighborhood increases the likelihood of a person being recognized by others. A radius of 400 meters is a benchmark for a neighborhood that encourages people to walk rather than drive or bike.
Compactness	Compactness recognizes that infrastructure integration opportunities increase as density increases. High densities with a mix of uses are better supported by energy systems, reducing carbon emissions by 30% and consumption by 50%. Low densities (below 15.5-20 dwelling units per hectare) do not support public transportation. Compact buildings are good for nature, increase the population of already urbanized spaces, help protect pristine and sensitive areas, concentrating the drainage basin in one place.
Diversity	The neighborhood brings people together and offers the possibility of choosing from a wide range of services and uses that meet their needs without requiring any means of transportation. Diversity and completeness also refer to the different housing types so as to accommodate people and families with different lifestyles and allow them to remain in the neighborhood even when their needs change.
Connectedness	It is important to have sustainable corridors with different types of public service infrastructure – transit corridors are the backbone of sustainable urbanism, linking neighborhoods with districts and other regional destinations. In addition, sustainable corridors may provide shelter for wildlife and connect habitat patches. The minimum density needed to support a bus corridor is of 17.5 dwelling units per hectare, and 37.5 to 50 dwelling units for a trolley or tram system. Preference should be given to places where there is a pre-existing transit corridor. Corridors, and not neighborhoods or municipalities, can provide for a work/housing combination.
Biophilia	An environmentally friendly mindset should care for non-human species living in habitats near human settlements. The great benefits of being in contact with nature should be recognized: sunlight, clean water, O2 production by plants that feed human beings and other animals. Resource flows should be visible. Green patches in low density areas become isolated and surrounded by private lots that do not make the best use of this non-urbanized land, be it for enjoyment or human habitat.

Figure 3. Table of sustainable urbanism attributes systematized by Andrade (2014) based on Farr (2013, p. 27 to 35)

As the population grows, there is also an increase in urban concentration and density. Mare highlights that contemporary society is driven by fossil fuels, which are finite natural resources, though people don't seem to realize they are quickly being depleted. As a consequence, a severe and forced withdrawal from the current model

will ensue, precisely because it cannot sustain itself. Thus, there is a need to draw a new evolutionary trajectory in search of sustainability.

Mare (2008) refers to this trajectory as the "descent into the urban village" since the urban village would fit into this context as a sustainable solution. In search of parameters for the proposition of the urban village, the author explores the relationship between the energy regime and urban densities throughout history.

Taking density as a meaningful measure for generating physical form, he tries to establish an ideal density. He notes that in pre-industrial cities the population did not exceed 100,000 people. Settlement sizes were consistent in different locations during that period. Densities suffered only minor variations until the beginning of the industrial revolution, when there was a change in the energy regime.

The author compares the figures of primitive cities with those of industrial cities, noting that the industrial revolution marked a transition to a different energy regime. He concludes that the population, size, and density of settlements were limited by their energy regimes, a determining factor that accelerated cities' metabolism and allowed for the increase and displacement of their populations. The large increase in population coupled with high densities created more precarious living conditions, making this pattern unsustainable. The population increase, together with the development of means of transportation and fuel, is behind the excessive design in cities and the urban sprawling. Hence, the emergence of the suburbs, a pattern all too real and familiar for the underprivileged, far removed from the city.

Mare (2008) states that fuels not only made these settlements possible, but also determined their shape and nature. Fuel was also behind the verticalization of modern cities, leading to the densification of major urban centers. Though there are claims that verticalization is a great achievement and that planned density is a more sustainable solution in terms of reducing urban sprawl, their viability in the post-carbon era is questionable. The reasoning being that high concentration cities have a high energy consumption that is not suitable for the current situation in which sources are increasingly declining.

As energy sources start to decline, it makes sense that migration movements from cities to towns or to the countryside are considered a response to this new reality. Movements such as the low-density ecovillages led Mare (2008) to draw his final conclusions. He states that, in order to be sustainable, the new post-carbon era regime must use drastically less energy than the previous regime, thus requiring low densities.

He considers the proposed mixed-use urban villages to be a solution for urban regeneration and retrofitting of current cities, as a path for the shaping of structures, patterns, and processes in the urban form, transforming them into self-sufficient sustainable communities, with a focus at the local human scale for production. However, they must be adapted to our times in order to meet our primary essential needs: food production, water, shelter, energy for cooking and heating, as well as non-tangible needs such as meaningful work, healthy social interaction, and the relationship with a higher power, all grounded in human ecology.

Mare (2008) defends compactness, not in the sense of a compact city, but rather in terms of reducing the total urban surface. Ergo, it would be possible to have a solar-based energy regime, which would be dependent on harvest, transformation, and extension. Also, it can be developed through organic agriculture and agroforestry systems. The new regime system will determine city densities and areas, as it was in the pre-industrial times (Mare, 2008).

Andrade's (2014) assessment is that, when Christopher Mare proposes an urban village population of 5,000 people, he is basing himself on the old villages and "Pattern 12 – Community of 7,000" from the book "A Pattern Language" by Alexander et al. (1977, p. 71). This standard states that for people to have an effective voice, the community shouldn't be larger than 5,000 to 10,000 people. He also mentions Rob Krier, who sets a 10,000-person limit for urban areas. The concept imagines the organic restructuring of the urban fabric into a self-sufficient, self-maintained cellular subset with metabolic interfaces between the units. Each urban village could be conceived as a cell within a larger urban fabric.

Mare's (2008, p. 83) view is that ecological planning is the meeting of urbanism and ecology to promote life, the breathing of the biosphere, and biomes sub-organized into ecoregions and ecosystems. It means preparing human activity within the natural limits established by environmental processes and structures. However, according to the author, traditional architectural and planning education lacks the expanded transdisciplinary vision that would allow theorists to fully appreciate the implementation of his proposals. Financial careers are within the comfortable limits of

sequential progress defined by the status quo, and with the oil peak far removed from the reality of urban populations, no urgency has been felt at the decision-making level yet.

Settlements and their human and community sustainability aspects: Eco-villages and Eco-neighborhoods

In order to understand what a sustainable human settlement can actually be, it is necessary to examine not only theories, concepts, principles, but also what is being put into practice to create an approximation of what can and will effectively be a settlement of this nature. To that end, emerging practices can help to assess the theories and concepts proposed in recent decades.

Amongst the many ideas and formulations raised, some have gained growing consensus in the discourses claiming to be urban ecology. At the territorial level, ecological thinking revolves around the concept of ecovillages and other similar concepts; at a purely metropolitan level, the idea that more clearly converges the different sustainability criteria is that of eco-neighborhoods (VERDAGUER, 2000, p.72).

As for experiments that use sustainability dimensions, eco-neighborhoods are mentioned – particularly their first generation, disseminated in Europe in the 1990s. Below, there is a reasonably detailed overview of what is being done in terms of eco-neighborhoods in general, regarding concepts, definitions, principles, and conflicts, as well as a special look at consolidated experiences and what has been happening more recently.

Eco-neighborhoods are recent experiences, the oldest initiatives dating from the 1970s, but gaining strength in the 1990s. These experiences take place at the local neighborhood scale, and most of them have been marked by the development of new projects that have environmental sustainability concepts in mind.

For Newman and Jennings (2008, p.41), there are many strategies available to transform economic and social relations, whether at the local or bioregional level. Nine strategies that could help urban economies to have a greater community and bioregional focus are outlined below.

Barton (2000, p.69) created an eco-neighborhood classification, considering that this it is "a generic term that acknowledges ecological imperatives and concerns about achieving environmental sustainability with social adequacy and economic feasibility". He makes an eclectic selection in order "to point out the contrasts in approach, location and scale, distinguishing between rural and urban projects, and municipal programs". He then proposes six eco-neighborhood categories, presented according to their contrasts of scale and implementation objectives (BARTON, 2000, p.69-81), they are: rural eco-villages, tele-villages, urban demonstration projects, urban eco-communities, "New Urbanism" developments, ecological townships.

The concept of a city built as a set of interconnected pieces – a mosaic – with a high degree of autonomy, that function as a daily connection between the local and the global, on the one hand; and the idea of ecological regeneration of the city as a fundamental framework for action, on the other hand, are the cornerstones on which the idea of eco-neighborhood rests (VERDAGUER, 2000).

Several authors have addressed this topic. Among them, Silva (2013) points to the following principles and focus: compact, diverse communities; priority to pedestrians and bicycles; restoration of urban spaces; decent housing; fostering of social justice; support to local farming; promotion of recycling and reduction of pollution and waste; working with eco-friendly companies; promotion of voluntary simplicity; and raising awareness of the local environment through activism and educational projects.

Social aspects are emphasized by different authors and, in general, environmental or ecological aspects are also structuring principles in their work.The summary of principles must encompass sustainability dimensions and increasingly incorporate local and bioregional understanding. The eco-neighborhood concept, although not yet consolidated, makes the consideration of all dimensions of sustainability, based on community and urban resilience, essential to its implementation, having a permanently engaged social management as a common thread.

The example and core competence brought by ecovillages and intentional communities to this world we dream of (and that we want to see turn into a reality) is based on the creation of a social paradigm with trusted communities at its core. Given all their common diversity, ecovillages have decided to deal with their problems and challenges as a community – and continue to do so despite any conflicts, difficulties, and signs of fatigue which inevitably occur (JOUBERT; DREGGER, 2015, p.22).

Ecovillages are communities with strong and vibrant social structures, united by common ecological, economic, social, and spiritual values, which work with the simple principle of not taking more than the planet is able to replenish. Ecovillages consciously work to progressively reduce their ecological footprint (FINDHORN ECOVILLAGE, 2016).

Today, on a global level, there is an increasingly urgent need for positive models that demonstrate a viable and sustainable human and planetary future. Ecovillages are such a model, exploring sustainable lifestyles, not only environmentally, but also in social, economic, and spiritual terms. The ecovillage principles can be applied equally to urban and rural environments and to industrialized and non-industrialized countries. They address the need for participation in human-scale communities, while nurturing and protecting the natural environment (FINDHORN ECOVILLAGE, 2016).

After Rio+20, the Global Ecovillage Network updated its definition of ecovillage. This update resulted in the following definition: an ecovillage is an intentional or traditional community that uses local participatory processes to holistically integrate the ecological, economic, social, and cultural dimensions of sustainability to regenerate social and natural environments (GEN, 2016).

Ecovillages have been representing an effective, affordable way to fight the degradation of social, ecological, and spiritual environments, showing how we can advance on our path towards sustainability in the 21st century (GEN, 2016).

The ecovillages proposal is quite unique when compared to traditional development patterns, which justifies the relevance these experiences have been gaining, particularly in an international context. So much so, the United Nation's listed ecovillages among their top 100 best practices and incorporated them into the Sustainable Community Development Programme (SCDP), SUSTAINABLE COMMUNITY DEVELOPMENT PROGRAMME. UNDP (UNEP/96/G81).

The most valuable element in the ecovillages experience is not how exceptional they are, or their size, or even the time they have for experimentation and implementation. This is all important, but the most relevant aspect that can be identified in these human settlements is that they were built outside the market logic. They were built by the people and for the people who live in these settlements, so as to meet their individual and community needs, also respecting the capacity of their bioregion's resources to meet current and future generation's needs. They work out their needs and projects, often interfacing with public authorities, but not waiting for these agents to solve their challenges, but rather expecting them to provide support in certain situations.

A study[6] published in 2007 identified that the Findhorn Foundation and Community, an ecovillage in Moray, Scotland, has the smallest ecological footprint (Figure 4) on record compared to any other community in the industrialized world. The ecological footprint is a tool for measuring resource consumption and waste generation, and is increasingly relevant to today's world, as energy efficiency and sustainability are critical aspects in the efforts to fight climate change (FINDHORN ECOVILLAGE, 2016).

The information presented aims at showing the holistic and consistent action throughout the Findhorn Foundation Community experience existence. The ecovillage is located in an urbanized setting, though it has agricultural structures. The ecovillage's life, with its residents and workers, fits into the contexts of the neighborhood, municipality, region, and country as well as into the local and global contexts. Therefore, it is not a fantasy, but rather an actual experience whose purpose is to build a close relationship that, in a communal way, moves the processes of life.

Still in regard to alternative ideas, one of the possibilities may be to remodel cities as urban ecovillage networks. This brings us to the question of how cities can be reformulated to be less dependent on cars and, at the same time, integrate the other strategies discussed in the model procedure (NEWMAN; JENNINGS, 2008, p.132).

[6]The community footprint is half the national average, the profile of the average ecovillage resident is consuming only half of the resources, while generating half of the waste when compared to the average UK citizen (Research carried out by the Global Ecovillage Network – GEN-Europe, Sustainable Development Research Center – SDRC – in Forres with support from the Stockholm Environmental Institute and York University (FINDHORN ECOVILLAGE, 2016).

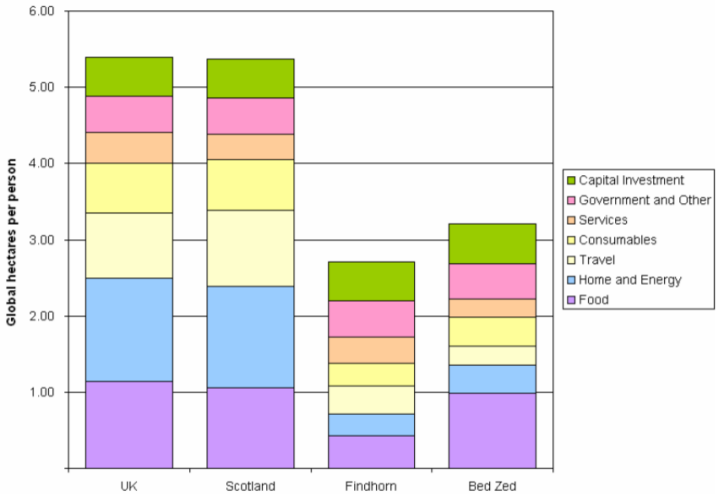

Figure 4. Comparison of Ecological Footprints for UK, Scotland, Findhorn Foundation and Community and Bed Zed. Source: Tinsley and George (2006).

Some of the best examples of such experiences are located in Europe, where eco-neighborhoods have been the object of study of many authors, as explained above. They were selected based on their potential contribution, similarities to or differences from other realities, considering aspects of urban planning, management and lessons learned in the interaction with local public policies (FREITAS, 2016).

The city of Freiburg has green infrastructure plans on two scales. At the municipal scale, there are networks of conservation areas (46% of its territory is covered by the Black Forest) and agricultural areas, which intertwine with urbanized spaces used for low-carbon transportation. At the local scale, there is a joint work conducted with residents to maintain consistency with the larger plan, prioritizing people, biodiversity, and water resources (HERZOG, 2013).

Newman and Jennings (2008, p.158) also point out that Freiburg was driven by the "learning by doing" approach. The process of working out how to make a solar, sustainable and more resilient city requires a learning by doing approach.

Frieburg must have learned a lot in the course of Vauban's development through the so-called "Learning by Planning" approach. They created an entirely new approach to sustainable urban development, setting daring targets and then calling on an NGO (Forum Vauban) to devise the implementation process. Freiburg knew there was no template for how to create a carbon-neutral, car-free city – they had to invent it. In academic circles this approach to new forms of governance is called "political learning".

Vauban is in an urban regeneration project located in an area that housed a French military base, acquired by the municipality to allow the purchasing of lots by private individuals. The district aimed at reaching a population of 5,000 people, with 600 new jobs in a 38-hectare area, coming to a density of 130 people per hectare (ARAÚJO & ANDRADE, 2014). According to Frey et al. (2010, s.p), in 2006 the population was 4,588 people, distributed in a 32-hectare area, with a population density of 141 people per hectare. Compared to Rieselfeld, another green neighborhood in Freiburg, which in 2008 had a density of 117 people per hectare (population of 8,200 people, in a 70-hectare area), Vauban's density stands out.

This number is far from what sociological dimension scholars define as ideal for a "living city", based on the density of 247 households per hectare (approximately 700 people per hectare) proposed by Jane Jacobs. However, for Christopher Mare this density is higher than that proposed for more sustainable urban villages.

Final considerations

Pursuant to the conclusions resulting from studies and practices about the current scenario, it is clear that:

- improving legislation and urban planning instruments is essential to support processes at a local scale (street, block, cluster of blocks, neighborhood). These instruments must meet the requirements for a successful planning, implementation and operation of sustainable human settlements so as to achieve the SDGs of the 2030 Agenda, especially those for eco-neighborhoods, be it in central or peripheral areas. The instruments can also be aligned with Fiocruz's projects on Healthy and Sustainable Territories in urban peripheries.

- governmental institutions should promote planning at various scales and in an integrated manner, acknowledging and including the local or neighborhood scale, paying due attention both to policies and to specific tools and instruments to allow for an appropriate and inclusive action. A classic case is the Strategic Master Plan for

the city of São Paulo, which included instruments but failed to create appropriate conditions for their implementation. A review of this plan is imminent but, again, there seems to be no interest in valuing or taking advantage of the unique contributions arising from the neighborhood scale in devising effective and more assertive plans for the city as a whole.

- creating or fostering specific civil society bodies for permanent study of this local scale, together with a permanent forum for close dialogue and participation by the population is necessary. An embryonic example of this is CADES (Regional Council for the Environment, Sustainable Development and Culture of Peace), in São Paulo. To achieve that, a methodology that contains interaction mechanisms and allocation of resources linked to the municipal budget could be helpful, as well as more dedication from the elected officials for greater capacity fulfillment. These could represent an interesting lever to kick-start and mature an eco-neighborhood process in the context of existing settlements or urban renewal, the most usual scenarios and contexts in cities today.

- an educational approach is required by these processes. Therefore, community processes aiming at supporting a development/engagement process for the co-creation of sustainable human settlements are needed, recognizing that the educational process is paramount to achieve the strategies and solutions provided for in the sustainability principles.

This highlights the gaps in terms of policies and support needed for this type of action to be scaled up, better structured, and replicated through funding opportunities. Escola da Cidade's Eco-neighborhood Research and Work Group at the Architecture and Biosphere Platform is experimenting with a path that combines the views of professors-researchers, the legislature, and activists in a process of research-action for the discussion and proposition or improvement of public policies related to sustainable human settlements in the city of São Paulo, in particular with regards to the eco-neighborhoods dialogue.

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