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Review article
Sustainable development, landscaping

Cities at the heart of climate emergency

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Abstract. I discuss the special place of cities in the general problem of climate change emergency, both mitigation and adaptation. After reviewing why cities matter enormously, I turn to a brief presentation of their strengths, weaknesses, opportunities and threats, then focus on some key model problems such as food or urban renovation, plus a few highlights (mobility, schoolyards, adaptation plan). Some specific cities are taken as illustrations, including Paris. Throughout the discussion, natural and human sciences are blended, as well as scientific and political analysis.

Keywords. Climate warming, Mitigation, Adaptation, Urbanism, Governance.

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1. Introduction

This text builds on my experience both as a scientist advising institutions[1], and as a politician[2]. Anyway politics cannot be avoided in the topic of climate emergency: be it about mitigation or adaptation, climate emergency is not only a scientific and technical issue, it is also highly political, and this word here designates not only political parties but also power forces and structures within our society, our economy and our media. One can go further: given the recent impressive achievements of geosciences in the subject, current inertia in the face of this emergency is by and large a political issue rather than a scientific one.

Actually the inability of societies, worldwide, to move forward in front of scientific findings and warnings is incarnated by the by-now iconic public dispute, also in Paris, between Jean Jouzel, France's most respected climatologist, and Patrick Pouyanné, CEO of Total and France's most identified figure of the economy of fossil fuels[3]. A key point of the dispute was whether "reality" meant the laws of physics and predictions established by the best available science, or the current state of the economic demand in fossil fuels and the economic sector's willingness to meet

[1] Besides the French Academy of Sciences, the Pontifical Academy of Sciences, the Scientific Board of the European Commission, the scientific board of the Paris region, the French strategic research council…

[2] In particular a mandate at the French Parliament, including presidency of the Scientific Parliamentary Office (Office parlementaire d'évaluation des choix scientifiques et technologiques), and also positions in committees devoted to political projects, such as the steering committee of the European Forum at Alpbach, or the presidency of the French Foundation for Political Ecology (Fondation de l'écologie politique).

[3] Conference LaREF23, 29 Aug 2023, from 5:36:00 on, https://www.youtube.com/watch?v=XXp1AA22jfg. Countless reproductions and comments of this dialogue can be found online, as well as op-eds, petitions, special broadcasts.

that demand. The dispute had no resolution and both parties kept their respective stands, as a human-scale illustration of the inner societal tensions which so far have prevented any expression of clear political will to act. In the sequel I shall further survey some of those tensions.

This review does not claim any exhaustivity, and will sometimes be marred by the fact that some of the key elements in political life are still in virgin territory from the point of view of academia (and it would be quite a bad idea to wait for them to be properly cultivated before taking them into account).

At the suggestion of the Academy of Sciences, I am focusing here on cities, which is a hugely relevant scale. It is clear that countryside territories, national and international infrastructures are no less important, and on their own would also deserve also a detailed discussion; but it makes sense to first discuss geographic areas where most people live.

Another difficulty is in the definition of "cities": for many of the topics discussed below, it would be absurd not to include peri-urban landscapes. So the notion will fluctuate at times.

As usual in climate warming issues, the challenge is dual: on the one hand, protecting citizens and the world in general from damages and catastrophes to come (adaptation); on the other hand, influence the behaviour of people and societies to reduce the amplitude of those damages and catastrophes (mitigation). Mitigation usually dominates the debate, but adaptation is no less important and will certainly become a bigger political issue. Cities are crucial in the discussion of both adaptation and mitigation.

Paris is probably the city in the world which stands as the most prominent symbol of the climate crisis. On the one hand, Paris hosted in 2015 the historical COP21 adopting the "Paris agreement" (historical indeed, in spite of its well-known shortcomings[4]) by which nations from the whole world committed to jointly reduce their greenhouse gas emissions[5]. On the other hand, the extremely high population density of Paris[6] and its dense urban fabric (involving stone, concrete, steel, zinc roofs[7] ...) make it an exposed prey for consequences of climate instability[8]. The combination of intricate urbanism and heritage protection make it particularly difficult to change and adapt it. A recent mission of information and evaluation from Paris City Council was eloquently entitled *Paris à 50 degrés : Faut-il fuir, cuire ou agir ?* (Paris at 50 Celsius degrees: flee, boil or act?)[9] The title alludes to the fact that temperatures as high as 50 degrees in Paris are likely to occur in the rather near future, with the dire consequences that this may have. As the report mentions[10], "reacting needs a never-seen-before mobilisation of means, in terms of money and people, but also democratic resources." This echoes well with the Paris tradition to not shy away from a revolutionary destiny.

At the other side of the spectrum, it is another iconic city which in political culture represents the

[4] Climate COPs (Conference of Parties) have met remarkable success in obtaining global commitments of experts and governments worldwide, but their agreements involve neither sanction for not fulfilling commitments, nor rewards for fulfilling them. See e.g. the 2018 Prize lecture from Nobel laureate W. Nordhaus, *Climate change: The Ultimate Challenge for Economics* (available from www.nobelprize.org) pointing out that the Paris agreement's effectiveness is hampered by its being "uncoordinated and voluntary" (p. 459), that over the years "the trend definitely suggests that climate policies have not tilted the emissions curve down" (p. 461) and suggesting the concept of "climate club" instead of the existing voluntary commitments.

[5] https://www.un.org/en/climatechange/paris-agreement.

[6] According to the list compiled at https://en.wikipedia.org/wiki/List_of_cities_proper_by_population_density, at more than 20 000 inhabitants/km2, Paris ranks 31st in the world in terms of population density, and is the #1 European metropole in the list. Some of its suburbs (Levallois-Perret, Montrouge, Vincennes, Pré Saint-Gervais, Saint-Mandé, are even higher than 24 000 inhabitants/km2, a density found nowhere else in Europe.

[7] presse.paris.fr/pages/21358.

[8] An anonymous referee provides the following eloquent illustrations. According to the Agence Parisienne du Climat (www.apc-paris.com/changement-climatique/climat-a-paris/connaitre-levolution-du-climat-a-paris-et-ses-consequences/) the warming observed at the Paris-Montsouris station is 2.3 °C between 1873–1902 and 2000–2019, with a marked acceleration from the second half of the 20th century onwards. With its dense urban fabric, Paris influences its meteorological environment by generating an urban microclimate known as the "*urban heat island*". This results in average temperature differences of around 2.5 °C per year between Paris and neighbouring rural areas, such as the Vexin or the forests of Rambouillet and Fontainebleau.

[9] Paris à 50 degrés : https://cdn.paris.fr/paris/2023/04/21/paris_a_50_c-le_rapport-Jc4H.pdf.

[10] Paris à 50 degrés, p. 10.

worst blindness to climate emergency: Dubai, the world's emblem of unbounded energy consumption, unbounded construction policy, unbounded international trade and unbounded social inequalities[11]. True, it also was the siege of a COP, eight years after the Paris one, and it is also in that COP that, for the first time, the concept of transition out of fossil fuels was explicitly written; still many climate experts bitterly regretted that it was coming too late and with a way too small amplitude[12], and Dubai's emblematic image has not much changed[13].

Paris and Dubai—besides these two emblematic territories, what can be said about cities in general? I shall start with the obvious: cities matter.

2. Cities do matter

Climate is a global issue and COP conclusions are global, international treatises; still a discussion of climate change cannot stay at the global level and has to consider the local scale in large detail. One reason for that is that both human impact on climate and climate impact on human societies are in large part related to the way of living of entire populations, any discussion on climate emergency, regarding either mitigation or adaptation, should, to a large extent, be *embedded* in the social habits within a territory[14], and those habits may very much differ from habitat to habitat.

Another reason is that these impacts are largely depending, not just on individual behaviour but also—and even much more—on infrastructures. According to a study[15] by the institute Carbone 4, "decarbonation is 3/4 structural, 1/4 individual behaviour". But most of these infrastructures are decided at some local level. In this respect, a recent report[16] by the specialised institute I4CE was insisting on the enormous needs of climate-related investment at the scale of territorial collectivities (not just cities but also the larger local scales; the study is set in France but the situation seems to be similar about everywhere). Actually a frequently heard political slogan says "climate mitigation is 2/3 local, 1/3 global"[17].

With those preliminaries in mind, cities, even though they occupy only a tiny minority of land[18], should have a major part in any discussion of the interaction between human activities and climate change, for at least three interrelated reasons:

(a) They constitute the most populated habitat worldwide: according to the World Urbanization Prospects of UNO, urban populations started to prevail over rural populations some time between 2005 and 2010, and already in 2018 cities were home to 55% of the

[11] Mike Davis, *Fear and Money in Dubai*, NLR 41 (2006); French edition, "Le stade Dubaï du capitalisme", Les Prairies ordinaires (2007).

[12] For a broad audience discussion, ses e.g. Jean Jouzel, La Vie, 14 Dec 2023, https://www.lavie.fr/actualite/ecologie/jean-jouzel-on-peut-etre-a-moitie-satisfait-de-laccord-obtenue-a-la-cop-28-92035.php.

[13] Actually, in 2024, one year after the Dubai COP and its statement on fossil fuels, I was arguing in an international round table with a high-level diplomatic representative of the Arabic peninsula claiming that "extraction of fossil fuels is not the problem, it is the way they are used which is an issue". And anyway production of, e.g., petrol, has increased steadily from 2023 to 2024 and is expected to be even more in 2025, according to the International Energy Agency, see e.g. https://www.iea.org/reports/oil-2024/executive-summary. So for the time being, it is not so easy to find any practical consequence of the mention of fossil fuels in the Dubai COP.

[14] So much so that, among other examples, the French national Citizen's convention in charge of Climate change found it convenient to articulate the totality of its recommendations according to chapters which are mostly about the way of living (food, housing, work and production, transportation, consumption), see www.conventioncitoyennepourleclimat.fr.

[15] Carbone 4 "Faire sa part ? Pouvoirs et responsabilités des individus, des entreprises et de l'État face à l'urgence climatique" https://www.carbone4.com/publication-faire-sa-part.

[16] Institute for Climate Economics (I4CE) & La Banque Postale : *Panorama des financements climat des collectivités locales*, https://www.i4ce.org/wp-content/uploads/2024/09/Panorama-des-financements-climat-des-collectivites-locales_V1.pdf. According to that institute, climate-oriented local investment will increase from 10% today to 20% in the future, and public authorities do not agree on who is going to pay that bill. https://www.i4ce.org/financement-local-transition-debat-escamote-climat/.

[17] I am not aware of any study substantiating precisely that, and anyway "local" or "global" would have to be made more precise.

[18] Around 3% according to Global Rural Urban Mapping Project (GRUMP), www.earth.columbia.edu/news/2005/story03-07-05.html.

population (it is expected that by 2050 it will be about 2/3)[19]. Demographic forecasts indicate that in decades to come cities will be, by and large, the dominant habitat of mankind.

(b) Cities come with certain distinct characteristics in the way of living and governance mechanisms, so the climate discussion for cities will be in many respects different from the climate discussion for other habitats;

(c) Most of the political and strategic decision making process takes place in cities.

These factors are reflected in enormous shares of cities when it comes to indicators related to climate change. For instance, the share of greenhouse gas emissions that cities are "responsible for" is somewhere between 40% and 70% (depending on definitions of "cities" and definitions of "responsible") (Crippa et al., 2021), with a considerable increase in the past half-century.

This is summarized in the following sentence[20] from IPCC: "Urban systems are critical for achieving deep emissions reductions and advancing climate resilient development, particularly when this involves integrated planning that incorporates physical, natural and social infrastructure." A number of references can be found in that source.

Let us now descend to more down-to-earth discussion.

3. The faces of climate emergency in cities

Discussing climate emergency in the context of cities rapidly leads to a number of concrete issues. First, here is a sample of some topics induced directly or indirectly by cities, which enhance the climate crisis:

- *Soil use*: Soils which are used by cities are lost for agriculture and life, increasing at the same time the pressure on biodiversity and climate. As cities tend to spread, enormous areas of land are consumed around them. The historical consumption of land in the Paris area is an emblematic case.

- *Construction:* The very materials with which cities are constructed poses huge problems by their fabrication mechanisms. Concrete alone has a huge carbon footprint, around 8% of the total footprint of mankind—more than half of all of the industry contribution, making current concrete production just incompatible with climate targets. This dramatic impact has finally made its way in the public debate: It is often stated that if concrete would be a country, it would be the third producer of greenhouse gas in the World; a few years ago, Watts (2019) called concrete "the most destructive material on Earth"; and in his book, Gates (2021) even recommends to put any decarbonisation plan to the key question "What about concrete?" (a question that the vast majority of plans fail to pass). In spite of all that, producers are not willing to change their policy in any bit: the sector has sky-rocketed since 2000 and is still growing, and so are its emissions[21]; its R&D budget remains ridiculously small in comparison with its benefits[22]; the plans to decarbonise the sector involve miraculous compensations; the representatives of that industry are doing an excellent lobbying work[23] making it their program to flood the Global South with concrete, for the sake of justice and joy. That being said, building in wood is also an enormous problem, at a time of staunch deforestation by the agribusiness, and at a time when forests have dramatically lost their capacity as carbon

[19] Data visualisation at https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS; 2018 report by UN at https://population.un.org/wup/; UN@Habitat https://unhabitat.org/wcr/.

[20] IPPC Sixth Assessment report (AR6), Section 4.5.3.

[21] Our World in Data; https://ourworldindata.org/grapher/annual-co2-cement?tab=chart.

[22] In France, that amount (for private research) is of the order of 0.1 to 0.2%, one order of magnitude less than the average. See OPECST, Note scientifique No. 6, La rénovation énergétique des bâtiments, https://www.vie-publique.fr/files/rapport/pdf/184000566.pdf.

[23] See e.g. the contributions of Edelio Bermejo (Holcim group) and Werner Sobek (University of Stuttgart, former collaborator of activities of the Holcim Foundation) at the conference *Science et architecture : L'urgence* organised by the French Academy of Sciences and Academy of Arts (24 September 2022).

sinks[24]. Intellectuals, philosophers, architects have provided stirring arguments, not just based on natural sciences but also on culture and philosophy, to construct using refurbished, recycled, reused, leftover material in a procedure devised to make sense[25].

- *Transport infrastructures*: Transport sector is also a major contributor to climate change, and that is also true in urban areas. True, the average transport emission per inhabitant is lower in a city than in the countryside, but that is by a factor at most 2, and in a country like France, there are four times more people living in cities than in the countryside—do the math! Besides, the majority of big cities in the world are plagued with traffic jams and transport-based pollution, making mass transport a huge challenge. Building efficient public transport and soft mobilities infrastructures, then making sure that they are effectively used, are an essential task for the climate fight. These systems require strong governance, and any change in the organisation of the traffic in a city is welcomed with protests and grumbling.
- *Energy consumption:* A disproportionate use of energy consumption takes place in the cities—transport, advertising, screens, air conditioning, lighting etc. Comparison shows that habits and building design play a large role.
- *Heating and cooling systems:* Heating in cold days, warming in hot days, heavily depend on the urbanisation structures. Avoiding devastating air conditioners, avoiding waste of heating energy: these are very classical and very concrete problems about climate emergency. The air conditioning issue even became the center of world attention during the Paris Olympic Games, and rightly so.
- *Consumption of goods:* Food consumption, clothes consumption, home equipment, etc. is mostly organised in cities—through stores, restaurants, facilities etc. How to organise this in a way to diminish the imprint, reduce the waste, promote short, virtuous, decarbonised supply chains is an enormous challenge. Currently the world's consumerism frenzy is driven by cities.

Conversely, some elements in city organisation make them particularly exposed to the effects of climate change:

- *Sensitivity to heat:* Heat waves are arriving everywhere and have been documented all around the world. Their dire consequences include death, fatigue, reduction in thinking abilities, etc. Cities are of course at a disadvantage to handle them, due to the reverberating surface and the lack of tree evaporation. Take the Paris urban area: there can be an increase of 6 degrees between the parks and pavilions on the one hand, and the dense centre on the other hand[26]. In many cities, the combination of heat wave with the pollution caused by urban activities and stagnation of the air make an even worse cocktail (see Cardenas et al., 2024).
- *Pollution:* Some cities achieve phenomenal levels of pollution, and this makes the impact of heat waves even worse:
- *Catastrophes:* Floods are worsened by the concrete and solid constructions, and evacuation from a city is a difficult story. Terrible images of swamped tunnels and basements have become common. Barriers, construction plans, evacuation plans are related important topics, etc.
- *Supplying shortages:* In times of war, cities have been historically the target of sieges. In times of climate crisis, cities, with their high concentration, may become traps when environment conditions, say droughts, imply a cut in the supply of water or other essential supplies (see e.g. He et al., 2021).

Also the urban dynamics and way of life is associated to indirect additional difficulties of cultural or economic nature, which may come in the way of both adaptation and mitigation, such as:

[24] Cf. contribution of Philippe Ciais, in the present conference.

[25] Figures, quotes, references may be found in Philippe Simay, *Bâtir avec ce qui reste,* Terre Urbaine, L'Esprit des Villes (2024).

[26] *Paris à 50 degrés.* p. 19.

- *Economic impact of the urban life:* The rising cost of living in cities, with housing crisis in many places of the world, makes their populations economically more vulnerable, and in particular more vulnerable to crises in general (see e.g. Trouillard, 2020).
- *Depletion of commons:* A strong historical tendency of cities is to privatise time and space (private cars, private gardens, but also e.g. restauration in private homes via delivery services); but for social link, sustainability, economy of resources the trend should be to develop commons, shared facilities, common spaces etc.
- *Inequities:* With very heterogeneous structuration, cities are prone to Inequities between districts, in the distribution of food, water, public transport, education and other essential ingredients. (A spectacular example in an OECD country is the increase of districts without regular water access in certain US cities, see Meehan et al. (2025); by the way, note that the mere fact of *Nature* launching in 2024 a *Nature Cities* subseries is another indication of the strategic importance of thought on cities.)
- *Handicap to public awareness:* Education and awareness of young and older citizens to ecological issues is not so easy in cities as in the countryside, because of the lack of connection to trees, soil, non-human life, etc. Programs of environmental education have been developed in the past years, with impressive results, but remain an enormous challenge. Besides reconnection to environment, reconnection of the city to the larger territory where it is embedded, is an important economic, cultural and ecological challenge.
- *Stressful environment:* In times of stress and anguish about the future, city life, with its high density of population, noisy environment, pollution, lack of trees, and constant haste (Rosa, 2010; Virilio, 1977), may induce further stress and addictions. At least two trends have been introduced to counter the tendency to oppressive hectic urban lifestyle: the "15-minute city" championed by Moreno et al. (2021) and the international network of "Slow cities" (Cittaslow) founded by Paolo Saturnini[27].

Preparing a plan to address all of the above is a considerable task. All the more that this should be considered for a diversity of categories (cities in, say, South Africa and Germany will have different priorities and tools at disposal). And all the more that it should be embedded in the even more tricky problem of addressing the full sustainability issue, facing not only the climate crisis but also other ecological emergencies such as biodiversity, pollution or sustainable resource management. To take just one example in which the pollution emergency arguably dwarves the climate emergency: there are huge cities in the "Global South" in which a clean sky is a very rare sight, and as I am writing this text, the concentration of particles PM2.5 in the air of Delhi and Kinshasa is more than 12 times the guide value provided by WHO[28].

While some institutes and think tanks have sketched global plans for sustainable urbanism taking into account a subset of city typologies and a subset of these issues (e.g. The Shift Project, 2021), a comprehensive view is a daunting task, almost a fully-fledged society project, with redundancies or contradictions between the different approaches. The IPCC is currently working out on a special report on Climate Changes and Cities, and chose to study this "complex system" from a multidisciplinary approach, "including following a regional approach, diverse knowledge systems (including Indigenous Knowledge), practitioner expertise, city networks, and considered time frames and spatial scales"[29]. To this goal, IPCC consulted specialists of biophysics, impacts and risks, sectoral developments, energy and emissions, governance, policy, institutions, planning and finance, civil society—spanning more

[27] www.cittaslow.org. The network and its chart are endorsed by a number of cities around the world, and the Slow Food movement as well.

[28] Cf. Documentary *Invisible Demons* by Rahul Jain, and IQair.com monitoring air quality worldwide.

[29] Report outline, Decision IPCC-LXI-5, 61st session of the IPCC, Sofia, 2024, https://www.ipcc.ch/site/assets/uploads/2024/08/IPCC-61_decisions-adopted-by-the-Panel.pdf. The decision to prepare this report was adopted in 2016 in Nairobi and the report is due by 2027.

than 50 themes of interest[30]. In comparison, the following presentation will be a very crude sketch.

4. The situation of cities

The American science-fiction writer Clifford D. Simak, in his famous novel *City*, was imagining a distant future in which human beings have abandoned cities, for fear of holocaust and for love of the pastoral way of living (Simak, 1952). Today Guillaume Faburel, Professor in Urban studies in Lyon, is a leading voice in a trend arguing that large cities will attract death and desolation in times of ecological collapse ((Faburel, 2018; Faburel, 2023), « Ces métropoles deviendront des nécropoles » (These metropolises will become necropolises) is a statement I heard from Faburel himself in a public debate in Cluny, Spring 2024). At the opposite end, some[31] argue that cities, favouring the concentration of art and science, of mixing and human interaction, of social, economic and cultural innovation, will be the best place to elaborate solutions to the global ecological crisis, especially when their planning includes striving for sustainability. They have regularly been giving rise to renovated lifestyles, values, mindsets, aesthetics, and (real-life) social networks[32], and obviously places of marvel and cultural influence. One may also argue that the concentration of human beings in cities is the best hope to achieve sustainable development by allowing at the same time for small areas to be managed by tailor-made integrated planning, while large areas of land elsewhere would remain preserved[33].

In this context of debate, let us try and perform a rudimentary SWOT analysis (SWOT = Strengths, Weaknesses, Opportunities, Threats, as consultants like to call it) of the City habitat in the context of climate emergency, compared to other habitats.

Strengths	**Weaknesses**
Concentrated action	Long time scale
Integrated planification	Challenging organisations
Innovation culture and tools	Nonsustainable mindsets
Opportunities	**Threats**
Political ecological leadership	Physical vulnerabilities
Lab for sustainable future	Economic challenges
A common cause between cities	Fragile sustainability

Let us elaborate on the above with a few explanations and comments.

(a) Strengths

- *Concentrated action:* The geographic and political concentration make it possible to have impact by acting on a relatively small territory, also offering the possibility at the same time to leave some areas untouched or preserved—if combined with a decent preservation policy. Public transport in theory can be organised very efficiently on a small scale, likewise energy policy, etc.[34]
- *Integrated planning:* The possibility of working out a dense system of interconnections, especially with the help of modern planification techniques including mathematical and computational tools, but also with human interaction, make it possible to handle

[30] https://www.ipcc.ch/report/special-report-on-climate-change-and-cities/.

[31] O. Roussel, geographer and urbanist, Urban Agency of Lyon, private communication. His analysis and feedback on "Seven concepts to understand twenty years of urbanism in the Lyon metropole" (7 Concepts pour comprendre 20 ans d'urbanisme dans l'agglomération lyonnaise) can be found on https://millenaire3.grandlyon.com/ressources/2023/7-concepts-pour-comprendre-20-ans-d-urbanisme-dans-l-agglomeration-lyonnaise.

[32] See e.g. Marc Giget, « Les grandes époques de l'innovation », YouTube channel.

[33] A goal which is also politically very difficult, as shown by the resistance encountered to open new protection areas, be it on land or sea, at national or international level, but also the fierce demonstrations against the NGO ASPAS for setting up preserved areas representing about 0.001% of France's forestry and agriculture area. But in this paper let us stick to cities.

[34] For the comparison of the environmental cost of public transport in cities or countryside, see eg. Ademe, « On ne se déplace pas à la campagne comme à la ville », https://infos.ademe.fr/magazine-septembre-2022/dossier/on-ne-se-deplace-pas-a-la-campagne-comme-a-la-ville/.

the complexity of a transition plan at city scale. Some examples are networks—water network, green network, darkness network—structuring city space. Many cities have been rather examined in data and diagnosed, with quite some accuracy. Example: A graph[35] in the report *Paris à 50 degrés* shows the variation of the expenses for air cooling going up and up, while expenses for heating go down: this kind of data analysis in principle facilitates diagnosis and can fuel action in a practical manner.

- *Innovation:* Technological innovation, for instance about equipment or diagnostic software is mostly found in cities. Innovation forums[36] and conferences providing local decision makers with the state of the art about tools, algorithms, solutions coming from chemistry, physics etc. This obviously includes artificial intelligence, via *smart cities* which, properly used, can enhance functioning or design[37]. Thousands of variables and dozens of models can be integrated in models of cities, with a view to planning, monitoring, controlling or making aware, and these technologies account only for a very small fraction of the cost, energy and materials required by urban construction. But cities are also territories of political and cultural innovation, in which new models are being figured out[38].

(b) Weaknesses

- *Long time scale:* A city is embedded in physics, made of concrete elements, huge material structures whose change is tricky and slow. In Europe, about 1% of a city is renewed each year, making the century the natural time scale for evolution! True, on other continents, cities have been sprawling at a much faster scale, but usually with constructions of low resilience and high carbon impact, also organising a lasting dependence to individual mobility and resolving the associated environmental issues will certainly be no quicker than in the European case.
- *Challenging organization, including zoning and complexity:* Cities (especially in the context of car mobility) are often conceived with zones (posh and poor districts, industry and commerce district, residential districts etc) which may induce segregation between populations, making change even more difficult by lack of communication, justice. Even when that kind of planning is not explicitly made, cities worldwide are plagued with increase of concentration, uncontrolled peripheral development and the formation of ghettos (Donzelot and Jaillet, 2004; Donzelot, 2009), making it a challenge to promote evolution of the city. Another organization plague making change tricky, is the multiplication of administration strates. France is a "leader" in this, by the enormous number of its administrative divisions, and their depth also. France represents a bit more than 15% of Europe's population, but nearly 40% of its municipalities. Even metropoles in France are often split into a network of subunits. Paris is the emblem of this: The urban area of Paris ("Greater Paris") is made of 17 arrondissements and 123 municipalities gathered in one city and 12 "territories", all of which are gathered in 4 Departments, the whole being handled by a "metropole"—so that a consistent change of policy should handle 4 administrative levels at the same time, not to mention the larger regional level.
- *Nonsustainable (arguably old-fashioned) mindsets:* An old myth from public life states it clearly: "a good mayor should build" (*maire bâtisseur*); more generally, the mythology of mayors is conveniently filled with tales of district building and roads construction, even

[35] *Paris à 50 degrés*, p. 28.

[36] Like the Innopolis annual forum in Paris. https://innopolis-expo.com/.

[37] Hubert Beroche (Urban AI), interview, L'intelligence artificielle urbaine au service de la ville durable, https://www.youtube.com/watch?v=JFlnRpX5dcU.

[38] Consider for instance the 2015 movie *Tomorrow* (*Demain)* by C. Dion, M. Laurent), which had some critical and popular success (including airing at COP21) about evoking ways in which sustainability could be achieved—among the 10 innovation examples surveyed around the world, 7 were coming from cities (Detroit, London, Copenhagen, Espoo, Bâle, San Francisco, Todmorden).

when data show that this is incompatible with climate emergency. Similarly, the culture of functional zoning, impregnating the Athens Charter (Le Corbusier: La Charte d'Athènes, Plon, 1943), has not died in spite of the grave social, democratic, economical and ecological consequences this trend had. True, there has been notable evolutions and many mayors or local politicians have twisted these clichés, yet my political life showed me that they are still influential[39]. As for citizens, they are exposed to *consumerist lifestyle:* City life is filled with consumption, addiction and tension, often disconnected from environment; besides the direct effect on ecological issues, this is favorable neither to awareness of, nor to education to, natural phenomena.

(c) Opportunities

- *Progressive governance and political leadership on the ecological transition:* Usually cities (as political entities) are more prone to change than nations. Local action can be easier for deciders to advertise for, debate is less paralysing, governance is more progressive (statistically speaking, around the world). Cities worldwide have organised into international networks like C40 [40] or the 100 Resilient cities[41], and their political willingness to change is more acute than that of states. Politically speaking, large cities are usually more to the left than countries; most of the mayors of large cities in Europe belong in a left or center-left party or coalition—a part of the political spectrum which is statistically more prone to incorporate climate action in their policies[42]. In such a political subject, this is important. In short, cities may take the lead in a more daring way than nations currently do, and in several respects have started to do so. A case in point: In the recent French debate of low-emission zones for car traffic, the national Parliament has denied major cities like Paris and Lyon the right to perform a progressive regulation of pollution by banning the most polluting cars, an evolution which those cities had long been committed to[43].
- *Lab for sustainable future:* The intricacy of all urban policies makes it natural to consider the discussion on climate change as the opportunity to address, not just the climate emergency, but the whole sustainability issue. For instance the "Climate plan" of Paris actually considers a much more comprehensive discussion on sustainability, with a list of nearly 400 actions[44].
- *Possible alliance rather than competition between cities:* Cities have been in constant competition to attract investment, talents, tourists, national and international agencies, an attitude which is certainly not adapted to the current ecological tide. But the climate emergency is one of the motivations for international alliances which have emerged in

[39] True, some mayors have famously made a point of renewing the urban area and public space, increasing the ratio of green space per inhabitants, create bike roads, and sometimes they did this courageously in the face of fierce opposition. But on the other hand, say in France, there was a strong opposition from local politicians to the "Zéro Artificialisation nette" law (Zero net Artificialisation) and as of 2025 this law has been very strongly toned down; and the obsession of mayors and local political class in the Castres area to build the A69 highway, in spite of the overwhelming academic consensus against it, coming from all fields of science, shows that mindsets still have a long way to evolve if the climate challenge is to be seriously addressed.

[40] See https://www.c40.org/ and http://www.citymayors.com/government/europe_mayors.html.

[41] https://www.rockefellerfoundation.org/100-resilient-cities/.

[42] That is a fact established by research, not a political statement: https://www.nyu.edu/about/news-publications/news/2024/may/liberals-and-conservatives-differ-on-climate-change-beliefs-but-.html. "In these measures, the participants around the globe showed significant political polarization, with liberals expressing belief in climate change and supporting climate-change policies to a far greater extent than conservatives—a finding consistent with previous surveys."

[43] The outraged but detailed reaction of the president of the Lyon metropole may be read at https://www.linkedin.com/pulse/la-sant%C3%A9-%C3%A7a-commence-%C3%A0-bien-faire-bruno-bernard-jlarf/?trackingId=YwV34hTOifOXBbZwmtnVxg%3D%3D.

[44] https://cdn.paris.fr/paris/2024/12/18/catalogue_fiches_actions_vf-64nm.pdf.

the past decades, like the already mentioned networks C40 or 100 Resilient cities; letting one hope for more general cooperation.

(d) Threats

- *Business model:* In some parts of the world[45], an important part of the budget of cities often depends on new constructions and on the housing market (quantities sold and price of real estate). In a world with less and less constructions (a necessity in the face of climate change, in territories where demography is stable) and potential economic crisis, this business model may unsustainable and probably in need of replacement.
- *Physical Vulnerabilities:* As already discussed, cities have huge adaptation challenges, due to a number of serious factors, including high population density ; sensitivity to heat waves, flood[46] and other climatic catastrophes; pollution; risk of riots in times of catastrophes; etc.
- *Fragile sustainability:* Cities in themselves are fragile in their organization of vital needs, in particular food system, due to high concentration and scarcity of resources. Urban areas depend in an inordinate way on faraway production, the share of local production between usually between 0 and 5% (a bit more than 1% for Paris)[47].

This cursory examination was considering cities as a whole, but obviously not all cities are equal, far from it. Not only are they rich or poor, powerful or weak, but also they have differing governance models, and they inherit very different forms of urbanism. One may argue that European style cities are in a better situation to adapt to climate emergency than the typical more recent metropoles from the Americas and Asia, in which the influence of car mobility and building frenzy has been even stronger (Compare Paris to Chicago or Mexico or Djakarta or Beijing). But on the other hand, the recent tragedy of Valencia[48] shows that European cities too can be devastated by environmental catastrophes.

5. Model case: urban refurbishment

Ecological transition necessarily involves a number of combined efforts from many participants, and can be sorted out only through a virtuous multi-stakeholder value chain. Listing them, say at national or international level, can be a daunting and somehow abstract task. But the best concrete metaphor which I know for that is an example rooted in city transformation, namely the renovation of a building with multiple ownership. And those renovation steps are not just a convenient metaphor, or an example among others: they are also a key step in any plan of ecological transition for a city. This gives two good reasons to examine that in more detail.

Renovation is indeed a case in point, in particular for energy consumption. In fact renovation is much more important than new constructions, because of the very slow rhythm of renewal. If we are thinking of 2050 as the date at which society must be carbon-neutral, then about 80% of buildings of that future date are those of today; so all the research about cities of the future, fascinating as it is, is minor compared to the renovation issue.

But renovation is hard, costly and politically difficult. If you live in a city, to renovate your building you need

(a) A diagnosis (showing the inefficiency of the building—high energy cost, danger, whatever)
(b) A plan (made by an architect or agency of how to renovate the building)
(c) The will to change (never easy, in view of the trouble it will entail! But that is even more difficult if it has to be a collective decision.

[45] In a city like Paris, taxes on properties are most important, but taxes on housing transactions are also important. In other parts of the world, e.g. South Africa, the budget of a city depends first on taxes from energy and water consumption.

[46] As I am completing these notes, the World Wide Web is filled with fresh pics of flooded Valencia with wrecked avalanches of cars, and the French newspaper Libération has a running title quoting experts "European cities are extremely vulnerable territories." (30 October 2024).

[47] Utopies. Autonomie alimentaire des villes (mai 2017). https://utopies.com/wp-content/uploads/2019/12/autonomie-alimentaire-des-villes-notedeposition12.pdf.

[48] https://seeingthewoods.org/2025/01/30/cities-under-water/.

Even more difficult if co-owners start political campaigns depending on their own interests, argue about who has to pay, etc)

(d) An efficient governance (you need to sort out legal problems, supervise work, decide what to do when companies work badly or costs explode, make sure that aid is efficiently used, etc)

(e) Funding (in practise you need a loan, which may be considerable)

(f) Skilled workforce (and there are many horror stories about botched renovation due to incompetent or lacking workforce)

(g) Discipline, as there are many ways to trash by behaviour what technique was expected to bring (improper use of the new features of the building, sabotage, of just the good old rebound effect by which inhabitants will increase room temperature after the isolation is repaired)

A similar seven-layer collaborative chain value by numerous stakeholders is also needed in the world climate transition (or climate revolution, or climate bifurcation, or whatever you call it). Twenty-five years after the first official alarms by IPCC, it is very clear that we have ingredient (a) in enormous quantities, ingredient (b) to some extent, but that ingredients (c)–(g) are badly lacking. This is true for the very general problem of climate emergency as for the particular case of urban renovation[49].

A few specific words about ingredient (g) in that context. Research has amply demonstrated that the "appropriate" temperature of a building is very largely dependent on culture and habit. But more disturbing is the conclusion of a specific research[50] according to which "Temperature of the housing does not depend on ecological inclination"—so that even populations who know about the necessity to spare resources, in practice have a heated thermostat.

And about rebound effects, a PhD study on energetic gains (Brockway et al., 2021) concluded that rebound effect (inadequate change of behaviour after renovation) statistically kills more than half of the gain, not to speak of inadequate renovation.

6. Model case: food

The food sector is one of the leading sectors contributing to greenhouse gas emissions (nearly 1/4 according to IPCC's AR6), it induces dramatic loss of carbon capture capacity via deforestation, it is also a massive source of biodiversity loss and a crucial contributor to world health. So it is certainly the most important sector of any ecological plan. It is worth noting that even in France, the rare attempts to evaluate movements in the economy workforce of an agro-ecological transition suggest the need for a strong increase of the numbers of farmers[51].

In the case of a city, the food issue is multiple: Fight waste and overconsumption; incentivise virtuous production (low carbon footprint, low biocide levels), improve health (remember we are currently living an epidemic of obesity, declared a pandemic by WHO)[52], providing everybody access to healthy food, supporting local agriculture economy, resolving the threats related to cities' poor autonomy (Linou, 2019). Cities worldwide have recognised the need to promote global policies on these issues: In 2015 at the occasion of the World Expo in Milan, and as COP21 was under way, emerged an International framework known as the "Milan Urban Food Policy Pact"[53].

[49] OPECST, Note scientifique No. 6, La rénovation énergétique des bâtiments, https://www.vie-publique.fr/files/rapport/pdf/184000566.pdf; and OPECST Report *La rénovation énergétique des bâtiments : Piloter, encourager et accélérer la rénovation énergétique des bâtiment* (No. 501 Assemblée nationale, No. 129 Sénat, novembre 2022) https://www.assemblee-nationale.fr/dyn/16/rapports/ots/l16b0501_rapport-information.pdf. The report insists that numbers of renovated homes remain low, that the a posteriori evaluation and governance is nonexistent, that the process is too complicated, that the efficiency of the renovations is often debatable, and that funding is lacking.

[50] Consommation et modes de vie, n° 227, CRÉDOC, March 2010.

[51] Plan de transformation de l'économie française (The Shift Project) recommends several hundreds thousands more farmers in France alone, compared to now. https://ilnousfautunplan.fr/ Solagro evaluates this number "only" at 70 000. All this is quite opposite to the current trend of farmer population decline.

[52] https://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight.

[53] https://www.milanurbanfoodpolicypact.org/.

Some of the fundamentals of nearly every sustainable plan involves favouring shorter food production circuits and promoting relations between the metropolis and the surrounding territory (bioregion, hinterland . . .), goals which also make sense beyond the food sector. As far as consumer behaviour is concerned, research and experience has shown that just telling consumers what to do, or appealing to their responsibility, is extremely inefficient, that food choice is, in practice, an illusion[54] and that the global "food environment" has to be considered (Food Environments & EU Food policy, 2021).

There are a few global plans about just and healthy transition to agro-ecology at large scale on the planet[55], but the issue of consumption is even more scarcely handled and has to involve a combination of integrated planning, economic policy, political strategy. Some organisations such as Slow Food International have run international campaigns for change driven by municipalities[56]. Certainly no metropolis can be claimed to have fully performed the transition, but experiments are being performed, and some cities are either applying their plan, or preparing it.

In August 2023 I had the luck of participating in a retreat in the European Forum at Alpbach, on the theme of 10×100 resilient cities, devoted precisely to that issue. An interdisciplinary group including specialists of urban planning, ecology, NGO's, think tank executives, city officials from Mannheim, were assembled on the invitation of Caroline Paulick-Thiel, strategic designer and expert in transformative public sector innovation. One of the participants was Anya Katalin De Cunto, Senior Manager of Engagement and European Public Affairs of the C40 Cities international network. The collaborative network examined examples, experiments, confronted viewpoints and sketched a strategy for food transition of cities, involving such elements as: Schools, refectories, bioregions, waste management, circular economy, insurances, commons, social policy, partnerships of various kinds. Besides the report[57] itself, the most important point here is that such strategies now are possible, that experiments need to be worked out and passed on worldwide.

A few examples of cities which have taken the issue seriously. Copenhague adopted its "Food strategy"[58] for the period 2020–2025, worked out in partnership with more than twenty NGO's. The city of Rennes started in 2016 a sustainable food plan[59]. Since then, France has launched « Projets alimentaires territoriaux »—about 450 of them now—such as the one of the Metropole of Lyon: « projet alimentaire du territoire lyonnais » (PATLy)[60]. It will soon be time for a first evaluation, keeping in mind that these are plans over several years, possibly decades.

7. A few examples

Climate emergency is systemic both in its causes and effects, and necessitates a global effort at all territorial levels—cities, regions, nations, international organizations etc.[61] Cities need to play their part in this with plans where short-time, medium-time and

[54] *The Illusion of choice*. Report for the "Put change on the menu|" project, endorsed by Eurogroup for Animals, the European Consumer Organization and the European Public Health Alliance (June 2023). https://www.beuc.eu/sites/default/files/publications/BEUC-X-2023-080_The_illusion_of_choice_report.pdf.

[55] TYFA (IDDRI) https://www.iddri.org/fr/publications-et-evenements/billet-de-blog/une-europe-agroecologique-en-2050-un-scenario-credible-un; Afterres 2050 (Solagro) https://afterres2050.solagro.org/decouvrir/scenario/. Besides these two institutes well-known for their reports on agriculture, other think tanks have evaluated this issue, such as Institut Rousseau https://institut-rousseau.fr/un-plan-durgence-pour-lagriculture-francaise-et-pour-une-alimentation-saine-et-abordable/.

[56] https://energy-cities.eu/transition-des-systemes-alimentaires/.

[57] *Securing food systems via multilevel cooperation. Strengthening municipal capacities to regenerate biosystems between cities and their regions.* Documentation of the 10×100 Cities Lab at the European Forum Alpbach 2023 https://www.alpbach.org/uploads/EFA23/10x100-Lab-EFA23-02_24_compressed.pdf.

[58] https://maaltider.kk.dk/sites/default/files/2022-06/The%20City%20of%20Copenhagen%20Food%20Strategy%202019.pdf.

[59] https://france-pat.fr/pat/pad-de-la-ville-de-rennes/

[60] https://www.grandlyon.com/actions/projet-alimentaire-du-territoire-lyonnais.

[61] The already mentioned I4CE report is one of the many documents addressing that https://www.i4ce.org/wp-content/uploads/2024/09/Panorama-des-financements-climat-des-collectivites-locales_V1.pdf.

long-time actions are consistently addressed. There is certainly no large city in the world which can claim to have achieved an ecological transition, but some of them have taken significant steps, and some remarkable accomplishments are politically and practically important. Here are three such examples, whose choice is very arbitrary and partly dictated by choice encounters in international forums.

(a) *Urban traffic.* Some cities have managed to cut car traffic in their cities, in impressive ways. Copenhagen, Amsterdam are emblematic for their bicycle policy; Utrecht, Anvers, Strasbourg (No.1 in France), Bordeaux, Oslo, Paris, Vienna, Helsinki are the other members of the Top10 bicycling cities according to a multi-criterion ranking[62]. But no city has attacked its car traffic problem with more outstanding success than Pontevedra. With 80 000 inhabitants, Pontevedra is the second most populous city of the province of Galicia, Spain, and when Miguel Anxo Fernández Lores was elected mayor in 1999, he solemnly pledge to cure the city from suffocation under massive traffic jams. Twenty years later, urban traffic Pontevedra had been divided by a factor 10, and a 70% reduction in CO_2 emissions from traffic. According to the European Air Quality Index, Pontevedra has enjoyed good air quality between 70% and 80% of the days in the last twelve months and is one of the best Spanish cities in this category. At the same time the city was gaining world recognition and international awards for its good governance[63]. It is now considered the golden standard of policy where pedestrian prevails over car. This was achieved by a sustained policy to make life easier for public transport and walking, and more demanding for cars. The triumphal reelection of Fernández Lores, over and over again, is a proof that courageous policy is not always electorally doomed. In France, Michel Crépeau (La Rochelle), Éric Piolle (Grenoble) and Anne Hidalgo (Paris) are three examples of mayors who were reelected after implementing a resolute, and at times very controversial, policy to strongly reduce car traffic in their respective cities.

(b) *Schoolyards.* They are central objects in a city, shaping the world's vision of kids but also potentially playing a key role in the district's life. At the beginning of the 2010's, emerged in Paris a project to rethink the ideal schoolyards for the future: OASIS (Ouverture, Adaptation, Sensibilisation, Innovation, Solidarité). An integrated approach was taken, incorporating a number of angles: recreation, education, inspiration, resilience, sustainability, intergenerational link, oasis of freshness for the whole district, especially in case of heat wave. The program was a success by all means and inspired other cities to do so[64], in France and outside, also through a European Regional Development Fund (ERDF). A key ingredients for success was the will to start the brainstorming from inside the administration, in a transversal way (more than ten divisions of the City of Paris administration worked under the coordination of administrator Sébastien Maire), ending up with a very precise project but also a strong governance[65]; there is also academic research to evaluate its impact[66]. This programme has been extended with the 'school streets' initiative, which aims to transform 300 streets, by Fall 2025, into pedestrianised lanes for children and public use[67].

[62] https://blog.inyourpocket.com/blog/the-23-best-cycling-cities-in-europe/.

[63] See https://www.theguardian.com/cities/2018/sep/18/paradise-life-spanish-city-banned-cars-pontevedra (article from 2018) and https://www.tomorrow.city/how-the-city-of-pontevedra-became-a-pioneer-in-pedestrianizing-its-streets/ (article from 2024).

[64] https://www.observatoire-oasis.fr/.

[65] Retour d'expérience : les services gestionnaires d'une cour Oasis. Interview of Laurie Dahan from CASPE, Paris. https://www.youtube.com/watch?v=x9Icq1QSQvY.

[66] Équipe de recherche sur les cours d'école OASIS, Institut des Sciences politiques de Lyon, https://www.sciencespo.fr/liepp/fr/recherche/projet/cours-decoles-oasis/.

[67] https://www.paris.fr/pages/57-nouvelles-rues-aux-ecoles-dans-paris-8197.

(c) *Adaptation plans to heat waves.* After the 2020 mayor election, Alexandre Florentin, member of the City board and, by training, engineer specialised in Carbon footprint reduction, launched and presided over the mission *Paris à 50 degrés*, a multidisciplinary study and plan for the adaptation of the Paris city to future heat waves and more generally global warming[68]. Architecture, maintenance, planning, etc: a strategy was defined, even involving rehearsal plans for heat waves[69]. The fact that all main parties of the city council participated in, and eventually endorsed the strategy, was key in its adoption. The most transformational change came with the vote in 2024 on the new Paris Bio-climate urban development plan[70]. Since then it has inspired various other capitals.

Some of the common features of these examples are: coordinated planning, ambitious goal, political endorsement. The interface between technical vision and political action is particularly important, and sometimes a few key individuals with a dual culture can play their role efficiently there.

8. Some schizophrenic attitudes

The first emergency is to stop behaviours which are absurd and nefarious. There is a long way to do so.

- Even in the face of Armageddon, long is the list of local and national leaders who prefer to blame the regulator, or would-be disaster ideology, and who refuse to apply even the little bit of regulation which has been adopted from heated debate. Those often take the form of public conflict between politicians and scientists or sustainable policy makers. As a case in point, the president of Auvergne-Rhône-Alpes region in France in 2023 was publicly claiming[71] to reject the nationally adopted policy of "zero net artificialisation" (even though, in the current crisis, "zero artificialisation" would make much more sense); and anyway in 2025 the law was significantly toned down by Parliament[72]. Another emblematic case has been the heated (!) debate on the Highway A69 in France (Toulouse-Castres), strongly promoted, among others, by the mayor of Castres, even though that project was universally criticised by academics from all spectre of academia, even economics and urban planning, gathering massive petitions[73] of academics against it. In 2023 the city of Arras was severely flooded with strong consequences, even though scientists were warning against the increasing risks[74], eventually the French government had to set up and animate a followup committee to oversee virtuous reconstruction. When the city of Cannes was flooded in 2024, its mayor publicly attacked the minister of ecology when she was pointing out scientific consensus about some urban development increasing the risk of floods[75]. Training sessions on climate issue were notoriously snubbed

[68] Paris à 50 degrés. https://cdn.paris.fr/paris/2023/04/21/paris_a_50_c-le_rapport-Jc4H.pdf.

[69] https://www.paris.fr/pages/paris-50-c-un-exercice-grandeur-nature-pour-se-preparer-aux-chaleurs-extremes-24322.

[70] https://www.paris.fr/pages/plan-local-d-urbanisme-bioclimatique-vers-un-paris-plus-vert-et-plus-solidaire-23805.

[71] Libération, 30 September 2023, https://www.liberation.fr/environnement/zero-artificialisation-nette-laurent-wauquiez-annonce-que-la-region-auvergne-rhone-alpes-se-retire-du-dispositif-20230930_ZQADTDBMLVBY5MJYFUF7PIOLGU/.

[72] https://www.lemonde.fr/politique/article/2025/05/28/zero-artificialisation-nette-a-l-assemblee-nationale-la-droite-et-le-rn-font-reculer-l-objectif_6609019_823448.html.

[73] The petition, initiated by the group *Scientifiques en rébellion*, was published by L'Obs (4 October 2023); it is online and currently has nearly 1900 signatures of scientists at https://scientifiquesenrebellion.fr/textes/positionnements/lettre-ouverte-macron-a69/.

[74] See e.g. https://reporterre.net/Dans-le-Pas-de-Calais-vivre-avec-les-inondations.

[75] https://vert.eco/articles/david-lisnard-meteo-france-et-michel-barnier-comment-la-polemique-autour-des-inondations-a-cannes-a-noye-le-consensus-scientifique.

by members of Parliament[76] and the High Council for Climate, even though set up by the government, estimated that the country is still not ready to face the challenges[77].

- Prices still don't take into account ecological value. They possibly will never, unless the state imposes it; it is a whole debate for the carbon tax. In cities, it is horribly present in the price of housing: the supposedly almighty Market has been totally unable to take ecological value into account, or to prevent construction in exposed area.
- Likewise, constructions are still thriving in areas which are exposed (floods, droughts), as any map of urban projects under way shows.
- As in any human activity, efforts for reducing the ecological footprint are more often than not eaten up by growth of the activity.

9. What about Paris?

Paris was quoted many times in this paper as a source of examples, and as the host of the Paris agreement, certainly the most famous international agreement on climate commitment, a landmark in the work of UNFCCC but also used in the political debate by countless political leaders, experts and NGOs[78]. In view of that it is legitimate to ask how Paris city itself is globally managing the transition, in quantitative terms, and whether the trajectory of Paris city is consistent with the Paris agreement.

Greenhouse gas emissions of Paris have decreased[79] from 7.4 MtCO2 in 2004, to 4.7 MtCO2 in 2021, and the total footprint from 28.3 to 18.4. (Notice, the footprint is much higher than the emissions, which is normal for an urban center in which production is all outsourced.) The first good news for Paris is, it is on track to meet the commitments. *Paris so far is respecting the Paris agreement.* The second good news is that Paris has a plan for mitigation and a plan for adaptation, as anybody should, and Paris has actually revised it (the first version goes back to 2007) in the light of scientific progress and urban management experience.

This good news should be tempered by several less good news:

(a) This evaluation only takes into account the city of Paris, not the much larger urban area of Paris, for which the bottom line is much less favorable (yet there are evaluations, and a plan at scale, adopted by the Metropole of Greater Paris).

(b) The mitigation plan of Paris only partially includes tourism[80], whose climate impact is huge, and for which Paris is an emblematic city.

(c) The mitigation plan bets on the development of "carbon compensation" to absorb the final 20% of the footprint (and it seems that every sector is counting on such a miraculous compensation, even though current compensation mechanisms systematically underdeliver and the Earth's capacity for carbon absorption are rapidly deteriorating)[81].

(d) A significant part of the progress of the Paris city has been obtained through public building renovation. This is a quite legitimate first step. But of course the remaining part, with

[76] https://www.lejdd.fr/Politique/assemblee-nationale-les-deputes-sechent-la-formation-de-sensibilisation-aux-enjeux-climatiques-4141843.

[77] https://www.hautconseilclimat.fr/actualites/le-haut-conseil-pour-le-climat-publie-son-avis-sur-le-plan-national-dadaptation-au-changement-climatique/.

[78] A notable example of explicit use of the Paris agreement by a head of state (Pope Francis) in favour of collective action in the face of climate emergency: Mongabay, 5 October 2023, https://news.mongabay.com/2023/10/pope-francis-condemns-world-leaders-for-deeply-flawed-un-climate-process/. A notable example of explicit use of the Paris agreement by a head of state (President Trump) against collective action: https://climate.law.columbia.edu/content/president-trump-announces-withdrawal-paris-agreement-0.

[79] DTEC (City Of Paris Climate and Ecological Transition Directorate), in Plan Climat Air Énergie de Paris 2024–2030, Figure 1, p. 8.

[80] Tourism is taken into account in Tertiary, transportation and food; flights are not, even though the issue of aviation is considered in other actions of Paris.

[81] In my political life, carbon compensation and carbon capture is the single sector related to green transition for which I have seen the most overwhelming amount of push and lobbying, in spite of results which are systematically two or even three orders of magnitude below promises.

all the complexity of private building renovation, can be expected to be more difficult.

10. Conclusion

In this article various faces of the climate emergency, viewed from the point of view of cities, were explored. Treatment remained introductory, and major topics such as the imaginaries conveyed by urban life have not even been touched here.

Those examples repeatedly show that the subject of cities in thee current context deserves a specific focus, and it has been long since IPCC or *Nature* came to that conclusion. Those examples also show the necessity of interdisciplinary combination of a number of themes at the interface of science, engineering, policy and politics. For cities as well as for larger territories, a roadmap to resilience can be achieved only through the cooperation of scientists and politicians: an interface which has never been easy, but which has a rich history (Pielke, 2007) and has already started to be enriched by the urban scale.

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