



Short communication

Science fiction blockbuster movies – A problem or a path to urban greenery?

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ABSTRACT

Urban greenery in cities is important for human health, for resilient and sustainable cities, and for flora and fauna. The importance of urban greenery is highlighted in numerous global, national and local policies. However, the rapid increase of urban sprawl and densification globally has reduced access, availability and quality of urban greenery. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), cities “do not know how to incorporate nature and nature contribution to people into city planning”. Perhaps this limitation is because urban planners, architects, landscape architects (urban designers) and urban ecologist (nature conservationist) view nature in cities differently. In addition, few studies on cities focus on nature and ecology. In this paper, we highlight the need to develop new designs and nature conservation approaches that promote biodiversity in cities. Science fiction (SF) and science have a history of inspiring each other and inspiring innovative solutions. For example, SF blockbusters have affected people’s engagement in climate change. Here, we evaluate how 44 of the most viewed American SF movies depict nature in cities, including diversity of species and how characters interact with nature. We reveal that these movies tend to ignore nature in their depictions of future cities. If nature is depicted in SF it is very similar to contemporary cities with monoculture lawns and ornamental gardens. Moreover, SF movies do not depict innovative ways of including nature in cityscapes, they illustrate unrealistic settings without basic ecological functions (e.g., pollinators), and their characters do not interact with nature when nature is depicted or only frame the scene as a façade. We suggest that urban designers, urban ecologists, and SF artists collaborate to imagine how to integrate nature and biodiversity into the depictions of future cities, a strategy that could help change norms about urban greenery.

1. Introduction

Throughout the world, societies are facing significant social and ecological crises where cities play numerous prominent roles (Intergovernmental Panel on Climate Change (IPCC, 2022); Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019); World Health Organization (WHO, 2017)). First, urbanization’s pollution and reduction of greenery has resulted in environmental and ecological crises (IPBES, 2019). Second, because the majority of people on the planet now live in cities, urban habitability and quality of life need to be addressed to mitigate social crises (Lederbogen et al. (2011)). Therefore, the future of cities and large metropolitan areas must be considered as part of wider social-ecological systems (Huang et al., 2018) and participate in transformative changes of societies to achieve sustainability. That is, there is a need for “[a] fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values” (IPBES, 2019, p5).

Urban greenery – i.e., the integration of indigenous as well as domesticated vegetation in cities – is important for human health (Van

Den Bosch and Sang, 2017), for resilient and sustainable cities (Gomez-Baggethun and Barton, 2013), and for flora and fauna per se (Cincotta et al., 2000; Aronson et al., 2014; CBO, 2012). The importance of urban greenery is highlighted in numerous global, national, and local policies (CBO, 2012; IPBES, 2019; WHO, 2016; SDG11, 2015). However, the rapid increase of urban populations (UN, 2019) and urban sprawl and densification (IPBES, 2019) has reduced access, availability, and quality of urban greenery globally. Although IPBES experts note a slight increase in city greenery, the process appears to be too slow to reach any sustainable development targets: “[Cities] do not know how to incorporate nature and nature contribution to people into city planning” (2019, p119).

Historically, theories on ecology and conservation biology have been based on biodiversity rather than on people (Mace, 2014). This paradigm is still largely deployed in urban ecology: “ecology-in-the-city” claims that the physical and social characteristics of urban environments constraint biodiversity but also with social and geographical sciences in an enlarged paradigm called “ecology-of-the-city”, which embraces reciprocal interactions between social and bio-geo-physical structures and integrates the understanding of urban social-ecological systems

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<https://doi.org/10.1016/j.ufug.2022.127661>

Received 5 January 2022; Received in revised form 2 June 2022; Accepted 24 June 2022

Available online 27 June 2022

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(Pickett et al., 2016). This interdisciplinary approach, for example, considers urban ecosystem services (e.g., Kremer et al., 2016). That is, urban ecology is starting to integrate more human perspectives when examining ecological dynamics.

Urban designers have also changed their approaches to urban greenery. We define “urban design” as any work that complements current specific working activities, such as architects (working at building scales), urban planners (working at city scales), and landscape architects (working in landscape and green scales). From Ebenezer Howard’s *Garden Cities of tomorrow* (Howard, 1902) and Ian McHarg’s *Ecological Planning: The Planner as Catalyst* (Mcharg, 1978) to Caroline Mollie’s *Des arbres dans la ville: l’urbanisme végétal* [Trees in the City: Green Urbanism] (Mollie, 2009), urban designers have been rewriting the relationship between the city and urban greenery (including plants and animals). This trend has resulted in landscape designers being more involved in large-scale urban development projects. However, most contemporary proposals do not consider nature as ecological systems composed of autonomous living beings (Jim, 2013) but most often consider them as technological solutions, for example, using green roofs to reduce runoff water and urban heat (Oberndorfer et al., 2007). Therefore, most design projects discount the value of plants (grasses, shrubs or trees), and often considering plants as a problem that designers must solve. In addition, urban designers mostly look for standardized products that could be replicated all over the world (following the scalability principle, Tsing, 2015). This is the case, for example, for the trees integrated in the iconic Boeri’s *Bosco Verticale* building (2014). Consequently, these projects consider plants merely as artefacts, ignoring four key aspects of natural systems: i) the dynamic and uncontrolled dimension of any living organism (e.g., seasonal, yearly, and daily changes); ii) the interactions these organisms have with their habitats (e.g., soil, water, and air) and with other species (e.g., pollinators, predators, and competitors); iii) the diversity of species and plant communities affected by habitats and abiotic conditions (e.g., climate, soil fertility, pollution, and urban subsoils); and iv) the diversity of the relations and interactions city dwellers can have with these organisms (e.g., hunting, growing, contemplating).

The gap in urban green definitions between urban ecologists and urban designers partly lies in the fact that these fields rarely engage in interdisciplinary discussions (Niemela, 1999; Pataki, 2015; Mcphearson et al., 2016). In addition, these differences could be due to differences in world visions (Cilliers et al., 2014) about how future cities should engage natural systems: “Imagination is a process that enables distancing from present circumstances to explore the past, the future, and alternative possibilities. [...] Cultural artefacts (i.e., artistic creations) present a very potent tool through which imagination can be communicated, shared, and channeled” (Hawliina et al., 2020, p31).

This lack of interdisciplinary interaction could explain why there is almost no scientific literature on future urban green cities. Jim (2013), in a review of greening compact cities, acknowledges that urban planners seem to ignore biodiversity (i.e., spontaneous plant and animal species). More generally, sustainable urban green is often *not* linked to flora, fauna, or ecological processes but to solar panels and better waste management (Tehrani et al., 2020).

1.1. What we learned from science fiction

Science fiction (SF) imagines new or other worlds reacting to social, economic, political, technological, or environmental issues that are present in the contextual realities at the time of creation (Butt, 2018; Dasilva, 2019), for example, the economic depression in the 1930 s, the “Red Menace” in the 1950 s, the Vietnam War in the 1960 s and 1970 s, and the environmental crises in recent decades (Abbot, 2007). SF extrapolates potential impacts of actual, emerging, and imaginary technologies and experiments with societal solutions (Gendron et al., 2017). Furthermore, because people (and other creatures) live in these news worlds, SF not only covers the “physical or institutional contours of

imagined tomorrows but also the emotions, colors, sounds, tastes, etc.” (Miller, 2018) but also creates scenarios that provoke forward thinking discussions (Adam, 2020) or “radical creativity” that helps audiences, even architects, urban planners, and researchers “think without a banister” (Gendron et al., 2017). Many SF authors purposefully go beyond culture and entertainment by suggesting technologies or devices that do not actually exist but are on plausible trajectories (Sterling 2005; Lindley and Coulton, 2016).

As early as the 17th century, fiction made it possible to propose new mental images of the cosmos (accelerating the value of certain discoveries) and to prefigure celestial voyages by associating the optical instrument with the fictions of discoveries, for example to the moon. Fiction writers actively participate in sciences construction of knowledge, moving from gazing at moons, planets and stars to imagining the flying machines that would take people to these celestial destination (Ait-Touati, 2011). Some scientists, such as Donna Haraway, use science fiction more directly to imagine how communities can manage environmental challenges. In her short story “Children of Compost” (Haraway, 2016). Haraway explores the relationships between living things from another space and time. This “speculative fabulation” inextricably links scientific analysis and narrative development and proposes how scientists can use the exploratory dimension of SF as a research method.

SF is present in literature, cartoons, video games, television series, and films. In each of these media, productions dedicated to niche audiences coexist with productions dedicated to the larger public. Best-seller books or blockbuster films reflect the social preoccupations at the time and place where they were created and disseminate the mainstream representation of what the future will or should be (Bulfin, 2017). Feeling close to the characters and situations, spectators are inclined to alter their own behaviors, preoccupations, and feelings (Sakellari, 2015). In the globalization context, the worldwide diffusion of popular cultural products is a kind of cultural globalization (e.g., Mahon, 2000) creating a normative mental image of how future cities are to be related to urban greenery.

This is the case for American SF blockbusters, which typically present different futures regarding environmental crises, ranging mainly between a promethean and a survivalist environmental future (Dasilva, 2019). Because they are spread world-wide, blockbusters disseminate and create a common vision of the future for their audiences. SF movies can even lead to children as well as adults accepting the need for change. For example, the release of the SF movie *Day After Tomorrow*, which depicts an ice storm covering New York as the result of climate change, has “had a significant impact on the climate change risk perceptions, conceptual models, behavioral intentions, policy priorities, and even voting intentions of moviegoers” (Leiserowitz, 2004). Similarly, Strife (2012) concludes that SF movies influence how children respond to environmental catastrophes depicted in movies:

“Several children also mentioned movies as a source of their fear about the future state of the environment [becoming] ecophobic. [...]”. In considering connections across themes such as awareness of global environmental problems and negative visions of the future, it became clear that children who received their environmental information primarily from television programs and movies tended to express highly negative emotions about environmental problems (Strife, 2012).

This is not a new phenomenon. For example, *Soylent Green*, a SF movie from 1973, explores how overpopulation in 2022 would affect New York City. This movie is still used to teach about environmental crises (Wills, 2021).

2. Method

In this paper, we expose how future cities are depicted in some mainstream American SF blockbuster movies. We watched 44 of the 57 highest grossing American SF films (based on Wikipedia’s “List of highest-grossing science fiction films” and “List of highest-grossing superhero films”). We chose 30 for SF films and 30 for superhero, minus 1

from China in each category and 1 that was quoted in both list, ending with 57). We did not watch all 57 movies because many are set in similar landscapes, for example, the *Avengers*, *Spiderman* and *Hunger Games* movies (see Table 1 for Movies). We characterized the presence and the importance of nature in those films where at least part of the story takes place in cities. Specifically, we answered the following questions:

- 1) Is green nature present in cities? What kind of nature (e.g., controlled vs. wild) is depicted? Is nature changing according to different seasons or weather?
- 2) Does depicted nature refer to ecological-type functioning (i.e., is there any ecological interaction between different non-human species or strata)?
- 3) Is there some diversity of plant species specific to the cities, habitats, or regions depicted?
- 4) Do characters have a relationship with nature? In what contexts?

We discuss our results according to the potential interest and challenges anchoring fictions to paradigm shifts and transformative changes directed at urban greenery and sustainable cities. We conclude our perspective by suggesting that a renewed dialogue between urban designers, urban ecologists, and SF artists could help society imagine new ways to integrate nature and cities.

3. Results - Urban green in current American blockbusters

1) Presence of green nature in cities

SF movies rarely depict green nature in human cities. When illustrated in public urban spaces, greenery is mostly restricted to trees lining street, short cut lawns, and some shrubs in public green parks (e.g., *The Martian*, *Interstellar*, and *Jurassic World*). However, *Aquaman in Sicily* does show a green wall. Private spaces include more diverse vegetation styles – e.g., flowers in pots or flowering creepers on the walls in *Star Wars*; crops in *E.T. The Extra-Terrestrial*; French-style gardens in *Hunger Games*; flower gardens in *Transformers* and *Independence Day*. However, urban green in human cities is always domesticated and similar to contemporary design or norms in American or European cities. An exception is present in *Dawn of the Planet of the Apes*, where a human city has been devastated and is colonized by non-controlled green nature.

Alien cities are quite rare in the blockbusters. When present, alien cities welcome mostly the same kind of poor and domesticated green nature found in human cities (e.g., the underwater city on planet Naboo in *Star Wars*). There are some exceptions: the alien tree-house in *Avatar* (if it could be called a city) has created new ways to design a network of private homes; the apes' houses in *Dawn of the Planet of the Apes* are also closely integrated in landscape and surrounding vegetation; and a lot of greenery similar to coral reefs grow on what seems to be buildings in the city of Atlantis in *Aquaman*. In *Black Panther*, the city of Wakanda reveals an afro-futuristic architectural city with fast trains and skyscrapers with green roofs, a building very similar to the building Bosco Verticale in Milan as it includes hanging trees, a meandering river, and forests with birds flying in the background. Similarly, the Amazon Island depicted in *Wonder Woman* has a lot of greenery around an arena.

2) Ecological-type functioning

In the larger majority of the explored films, nature is presented without any sign of ecological-type functioning. But see the human city in *Dawn of the Planet of the Apes*. Outside the cities, some films present some landscapes where nature has some signs of ecological functioning: numerous and diverse species (plant and/or animals), different strata in forests, evidence of soil, interspecific relationships (e.g., predation) etc. For instance in *Hunger Games*, the forests are depicted in their ecological dimensions: numerous species (both plants and animals) that interact with each other during different seasons, notably winter with snow and trees without leaves. In

Table 1

We selected 30 of the highest grossing Science fiction movies (SF) and 30 of the highest grossing Superhero movies (SH). https://en.wikipedia.org/wiki/List_of_highest-grossing_science_fiction_films and https://en.wikipedia.org/wiki/List_of_highest-grossing_superhero_films, consulted May 20, 2022. We then we excluded 1 being animated (*Incredibles 2*), 1 being Chinese (*Wandering Earth*) and 1 quoted in both lists (*The Matrix reloaded*). Additional 13 movies were excluded having many similar themes, e.g. *Avengers*, *Spiderman*, and *Hunger games*, see*. In the end we studied 44 movies. The highest-grossing science fiction films (SF, in blank) and superhero (SH, in grey *Italic*).

Category	Rank	Film	Year	Worldwide gross in Dollars
SF	1	<i>Avatar</i>	2009	\$2847,246,203
SH*	1	<i>Avengers: Endgame</i>	2019	\$2797,800,564
SF	2	<i>Star Wars: The Force Awakens</i>	2015	\$2068,223,624
SH*	2	<i>Avengers: Infinity War</i>	2018	\$2048,359,754
SH*	3	<i>Spider-Man: No Way Home</i>	2021	\$1892,667,830
SF	3	<i>Jurassic World</i>	2015	\$1670,516,444
SH	4	<i>The Avengers</i>	2012	\$1518,812,988
SH*	5	<i>Avengers: Age of Ultron</i>	2015	\$1402,809,540
SH	6	<i>Black Panther</i>	2018	\$1346,913,171
SF	4	<i>Star Wars: The Last Jedi</i>	2017	\$1332,539,889
SF	5	<i>Jurassic World: Fallen Kingdom</i>	2018	\$1308,467,944
SH*	8	<i>Iron Man 3</i>	2013	\$1214,811,252
SH*	9	<i>Captain America: Civil War</i>	2016	\$1153,304,495
SH	10	<i>Aquaman</i>	2018	\$1148,161,807
SH*	11	<i>Spider-Man: Far From Home</i>	2019	\$1131,927,996
SH	12	<i>Captain Marvel</i>	2019	\$1128,274,794
SF	6	<i>Transformers: Dark of the Moon</i>	2011	\$1123,794,079
SF	7	<i>Transformers: Age of Extinction</i>	2014	\$1104,054,072
SH	13	<i>The Dark Knight Rises</i>	2012	\$1081,041,287
SH	14	<i>Joker</i>	2019	\$1074,251,311
SF	8	<i>Star Wars: The Rise of Skywalker</i>	2019	\$1074,144,248
SF	9	<i>Rogue One: A Star Wars Story</i>	2016	\$1056,057,273
SF	10	<i>Jurassic Park</i>	1993	\$1033,928,303
SF	11	<i>Star Wars: Episode I – The Phantom Menace</i>	1999	\$1027,082,707
SH	15	<i>The Dark Knight</i>	2008	\$1005,973,645
SH*	16	<i>Spider-Man 3</i>	2007	\$890,871,626
SH	17	<i>Spider-Man: Homecoming</i>	2017	\$880,166,924
SH*	18	<i>Batman v Superman: Dawn of Justice</i>	2016	\$873,634,919
SF	12	<i>Star Wars: Episode III – Revenge of the Sith</i>	2005	\$868,390,560
SF	13	<i>The Hunger Games: Catching Fire</i>	2013	\$865,011,746
SH*	19	<i>Guardians of the Galaxy Vol. 2</i>	2017	\$863,756,051
SH	20	<i>Venom</i>	2018	\$856,085,151
SH*	21	<i>Thor: Ragnarok</i>	2017	\$853,977,126
SF	14	<i>Inception</i>	2010	\$836,836,967
SF	15	<i>Transformers: Revenge of the Fallen</i>	2009	\$836,303,693
SH	22	<i>Wonder Woman</i>	2017	\$821,847,012
SH	23	<i>Spider-Man</i>	2002	\$821,708,551
SF	17	<i>Independence Day</i>	1996	\$817,400,891
SF	18	<i>E.T. the Extra-Terrestrial</i>	1982	\$792,910,554
SH	24	<i>Spider-Man 2</i>	2004	\$788,976,453
SH*	25	<i>Deadpool 2</i>	2018	\$785,046,920
SH*	26	<i>Deadpool</i>	2016	\$783,112,979
SF	19	<i>Star Wars</i>	1977	\$775,398,007
SH	27	<i>Guardians of the Galaxy</i>	2014	\$773,328,629
SH	28	<i>The Batman</i>	2022	\$768,457,120
SH	29	<i>The Amazing Spider-Man</i>	2012	\$757,930,663
SF	20	<i>The Hunger Games: Mockingjay – Part 1</i>	2014	\$755,356,711
SH	30	<i>X-Men: Days of Future Past</i>	2014	\$746,045,700
SF+ SH	21	<i>The Matrix reloaded</i>	2003	\$741,847,937
SF	22	<i>Gravity</i>	2013	\$723,192,705
SF	23	<i>Dawn of the Planet of the Apes</i>	2014	\$710,644,566

(continued on next page)

Table 1 (continued)

Category	Rank	Film	Year	Worldwide gross in Dollars
SF	24	Transformers	2007	\$709,709,780
SF	25	Interstellar	2014	\$701,729,127
SF	27	The Hunger Games	2012	\$694,394,724
SF	28	The Hunger Games: Mockingjay – Part 2	2015	\$658,344,137
SF	29	Star Wars: Episode II – Attack of the Clones	2002	\$653,779,970
SF	30	The Martian	2015	\$630,162,235

Avatar, on the planet Pandora, all plant species, according to the scientist Grace Augustine, communicate with each other through their roots as they “signal transduction from this flower to the next”. The Earth, according to the protagonist Jake Sully, is without nature: “[N]o green there. They killed their mother”.

3) Diversity of urban green according to biogeographical zones

This question was relevant for only 13 of 44 of the explored films, i.e. those with different cities presented as being from different geographical zones. In *Black Panther*, there is a contrast between cities on the African continent and cities other than Wakanda. Wakanda has much more lush greenery than other cities being portrayed with less green (often nighttime with only buildings and artificial lights). In *Aquaman*, the human cities rarely have natural elements, but Atlantis, which is under the surface of the ocean, has a great variety of life, including sea turtles, coral reefs, whales, and sharks.

4) Relations between green nature and characters

In most of the explored blockbusters, most of the characters never interact with the greenery. There are some exceptions. In *Avatar*, the main character Jake Sully (a remotely located human operates a genetically engineered body using his brain) interacts with nature. Jake Sully explores the natural world depicted in the movie and is fascinated by the creatures in this world. The Na’Vi (non-humans) are closely connected with all life. Moreover, the movie shows nature at different times during the day, including at night. In *E.T. The Extra-Terrestrial*, E.T. (non-human) is closely connected with the flower he received as a gift from Eliot’s sister. In *Transformers*, Sam’s parents (humans), especially Sam’s mother, carefully tend to their garden. In *Hunger Games*, Katniss (human) collects plants and animals from the forest to eat, and nature is symbolic in Katniss’ and Prim’s names. Katniss asked by her friends in to sing with a Mocking Jay so does near a natural pond. In *Black Panther*, humans grow a heart-shaped herb that they use to make a drink that gives them extraordinary strengths to T’Challa (humans). And when T’Challa meets his ancestors in Wakanda, it is on a savannah with acacia trees. In the city of Atlantis in *Aquaman*, whales are pulling vehicles under water and Arthur (half-human) has contact and speak with animals, for example, by hiding in the mouth of a whale while being chased. In the *Guardians of the Galaxy*, there is a museum of the fauna of the galaxy.

Some blockbusters depict also wild green nature as very dangerous for humans – e.g., in *Avatar*, the Pandora forest has evolved without humans and is dangerous for them; in *Hunger Games*, the arena for the games is specifically designed by humans to be dangerous; and in *Jurassic Park*, the human-created dinosaurs are living on an island without humans. Finally, green nature is sometimes presented as setting for romantic scenes. In the last movie in the *Hunger Games* series, Katniss and Peeta and their children are shown in a meadow covered with different colored flowers. In *Transformers*, two romantic scenes end the first film – one under a tree and one in sunshine. In *Star Wars*, Anakin and Padme are flirting in a wild meadow.

4. Discussion

Urban green nature is almost absent of American SF and superhero blockbuster movies. Cities are illustrated as nature-free or include very controlled and domesticated greenery, consistent with current cities in Europe and the United States. Wild nature is mostly depicted in a passive setting, and when active in the narrative, it is depicted as dangerous for humans, consistent with the separation between humans and nature present in the current American and European world views (e.g., Descola and Pálsson, 1996). When presenting nature, these movies do not depict it as diverse, dynamic, and though an ecological functioning. These findings suggest there are few opportunities to make SF popular culture a creative source for future planning or as a source for changing public norms. It is important to notice that social and cultural norms can be both barriers and potential opportunities to address climate change and biodiversity (Sparkman et al., 2021). However, creating synergies between art, science, and design nevertheless remains a way forward to invent sustainable green future cities (Bennett, 2017) and change norms. Urban ecologists, urban designers, and artists could exchange knowledge and experiences in ways that challenge their respective limitations and inspire each other.

Urban ecologists could intervene in film making and cultural processes to highlight the important values of nature by telling, for example, stories about urban ecological processes, beyond lists of species that need to be protected, or by discussing how nature could be integrated in SF imaginaries. Urban designers could go beyond urban greenery as a mere fashionable material and consider spatial and temporal ecological dynamics of the living beings. Through dialogues with ecologists and biologists, they could gain additional knowledge of plant and animal dynamics and characteristics of species. Furthermore, they could invent new urban designs that not only resemble nature but also are part of nature. Mainstream SF producers could diversify the type or nature present in the settings, provide functioning ecological systems in cities, and have characters interacting with or even living in natural settings. The diversity of real plant and animal ecology offers a very large panel for science fiction imaginaries. An example of suggested way forward could be “science fiction prototype writing” (see e.g. Bell et al., 2013).

We are not able to provide a more extensive review of the SF films and literature within the format of a short communication beyond these blockbusters, but there are other promising movies where characters integrate with nature – e.g., *Minority Reports* (2002) depicts a wall of genetically hybrid plants with poisonous branches that hinder Chief John Anderton (human) from entering a greenhouse. The plants bite Dr. Iris Hineman (human) as they struggle for their lives. In *Snowpiercer* (Netflix series, 2020-), a train filled with the last of the human population travels across landscapes where the outside temperature is – 119 °C. To survive, the train passengers need to eat cockroach bars for protein. In the *Snowpiercer* gardening wagon, however we could not detect any pollinators. In *Star Trek Discovery* (Netflix series, 2017-), rebels are nature conservationists working to save species on other planets, and when the crew returns to earth 900 years later (due to a time loop) everything in the city changed except for a tree that still stands on the same spot (on a green lawn next to the Golden Gate Bridge that also somehow survived the centuries). Interestingly, the writers of *Star Trek Discovery* got inspired by Stamets (an ecologist) researching mushrooms and called him for help with the plot. Inspired by the researcher Stamets, the plot became a Lieutenant Paul Stamets in *Star Trek Discovery* who is an “astromycologist” inventing that the Starship can travel fast through space in a mycelium network. And finally, in the recent movie *Dune* (2021), the main character, Paul (human with powers and abilities), learns how indigenous people on the planet selected shrub species with deep roots in order to survive. While in the city, Paul notices that some holy date palm trees are not sustainably irrigated. Thus, there seems to be an increasing awareness of the human need to link to nature and ecology in recent SF films and series, but few

of these are about urban greenery and biodiversity. Another character Dr. Liet Kynes, who is an imperial ecologist seems to have knowledge of hidden laboratories working on making the desert planet green and lush.

In addition to movies, fiction books have recently speculated about urban greenery, blue cities, and biodiversity. The anthology *A Flash of Silver Green: Stories of Nature of Cities* has 57 short stories written by amateurs and professionals that speculate whether cities in 2099 will be lush and green (Maddox et al., 2018). In another anthology, *Multispecies in Cities and Solar Punk* (Fujii et al., 2021), 24 short stories imagine what cities will like in the future. In an IPCC publication, ten short stories and ten scientific texts examine how climate change might affect the natural world as well as human society (Our Futures: Imagining the Possibilities of Climate Change [Nos futures': Imaginer les Possibles du Changement Climatique], 2021). In *Cities that Think like Planets: Complexity, Resilience, and Innovation in Hybrid Ecosystems*, Alberti (2016), who interestingly also seems to have similar ideas as we have, concludes that "science and data answer questions we are able to formulate. To build sustainable, resilient cities requires that we both refine our predictions and expand our imagination". Ecotopia2121, a project that promotes the use of art to inspire utopian visions (<https://www.ecotopia2121.com/>), highlights possible futures and promotes greenery in real life cities from a 100-year perspective. However, all these examples are rather narrow genres of literature, as they do not reach mainstream readers and therefore probably will not change norms.

5. Conclusion

According to the IPBES, transformative changes are needed in modern economic, technological, political, and social models as humanity is facing the limits in how to implement urban nature in modern cities. Similarly, we strongly call for a shift in representations of urban nature in fiction, from a setting or mere material to living beings close to (and potentially with) urban citizens' lives. To change present norms that seem to be stuck in a negative spiral where greenery in cities as well as biodiversity is decreasing, new imaginaries have to be invented and dispersed in a renewed culture of urban stakeholders. Mainstream popular cultural products and artists may play a role in these transformations and change of norms, but they would need the help of urban ecologists and designers as well as SF artists.

Author statement

Marcus Hedblom and Ann-Caroline Prévot have equally contributed to the idea of the manuscript, studies of movies, literature searching, writing and analyses. Axelle Gregoire have contributed to the architectural parts of literature and analyses of movies.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could influence the work reported in this paper.

Acknowledgments

We would like to thank colleagues in the Futures Lab at SLU for valuable and creative inputs and ideas of the manuscript. In particular Josefin Wangel and Ishi Buffam as well as Åsa Berggren, Suvi Kokko, Alexandre Dubois, David Ljungberg, and Emma Sahlström. This study was funded by Futures Lab and the transdisciplinary platforms Urban Futures and Future Food at the Swedish University of Agricultural Sciences. Finally we would like to thank the EC REGREEN Nature-based Solutions project (regreen-project.eu/) which enabled this inter- and transdisciplinary collaboration. The EC REGREEN project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 821016, and the National

Key R&D Program Intergovernmental Cooperation in International Science and Technology Innovation from Ministry of Science and Technology of China (Grant no. 2021YFE93100).

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