



**HAL**  
open science

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

Marcus Hedblom, Anne-Caroline Prévot, Axelle Grégoire

► **To cite this version:**

Marcus Hedblom, Anne-Caroline Prévot, Axelle Grégoire. Science fiction blockbuster movies – A problem or a path to urban greenery?. *Urban Forestry and Urban Greening*, 2022, 74, pp.127661. 10.1016/j.ufug.2022.127661 . mnhn-03768370

**HAL Id: mnhn-03768370**

**<https://mnhn.hal.science/mnhn-03768370>**

Submitted on 3 Sep 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# 1 Science Fiction Blockbuster Movies – A Problem or a Path to Urban Greenery?

2  
3 **Marcus HEDBLOM<sup>1</sup>, Anne-Caroline PREVOT<sup>2</sup>, Axelle GREGOIRE<sup>2</sup>**

4 <sup>1</sup>Department of Urban and Rural Development, Swedish University of Agricultural Sciences, Uppsala,  
5 Sweden

6 <sup>2</sup> Center for Ecology and Conservation Sciences CESCO (CNRS, MNHN, SU), National Museum of  
7 Natural History, Paris, France

8  
9 Publication: Urban Forestry & Urban Greening 74 (2022) 127661

## 10 11 12 **Abstract**

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

## 34 **1. Introduction**

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

46 Urban greenery – i.e., the integration of indigenous as well as domesticated vegetation in cities – is  
47 important for human health (Van Den Bosch and Sang, 2017), for resilient and sustainable cities  
48 (Gomez-Baggethun and Barton, 2013), and for flora and fauna per se (Cincotta et al., 2000; Aronson et  
49 al., 2014; CBO, 2012). The importance of urban greenery is highlighted in numerous global, national,  
50 and local policies (CBO, 2012; IPBES, 2019; WHO, 2016; SDG11, 2015). However, the rapid increase of  
51 urban populations (UN, 2019) and urban sprawl and densification (IPBES, 2019) has reduced access,  
52 availability, and quality of urban greenery globally. Although IPBES experts note a slight increase in city  
53 greenery, the process appears to be too slow to reach any sustainable development targets: "[Cities]  
54 do not know how to incorporate nature and nature contribution to people into city planning" (2019,  
55 p119).

56 Historically, theories on ecology and conservation biology have been based on biodiversity rather than  
57 on people (Mace, 2014). This paradigm is still largely deployed in urban ecology: "ecology-in-the-city"  
58 claims that the physical and social characteristics of urban environments constraint biodiversity but  
59 also with social and geographical sciences in an enlarged paradigm called "ecology-of-the-city", which  
60 embraces reciprocal interactions between social and bio-geo-physical structures and integrates the  
61 understanding of urban social-ecological systems (Pickett et al., 2016). This interdisciplinary approach,  
62 for example, considers urban ecosystem services (e.g., Kremer et al., 2016). That is, urban ecology is  
63 starting to integrate more human perspectives when examining ecological dynamics.

64 Urban designers have also changed their approaches to urban greenery. We define "urban design" as  
65 any work that complements current specific working activities, such as architects (working at building  
66 scales), urban planners (working at city scales), and landscape architects (working in landscape and  
67 green scales). From Ebenezer Howard's Garden Cities of tomorrow (Howard, 1902) and Ian McHarg's  
68 Ecological Planning: The Planner as Catalyst (Mcharg, 1978) to Caroline Mollie's Des arbres dans la ville:  
69 l'urbanisme v'ég'etal [Trees in the City: Green Urbanism] (Mollie, 2009), urban designers have been  
70 rewriting the relationship between the city and urban greenery (including plants and animals). This  
71 trend has resulted in landscape designers being more involved in large-scale urban development  
72 projects. However, most contemporary proposals do not consider nature as ecological systems  
73 composed of autonomous living beings (Jim, 2013) but most often consider them as technological  
74 solutions, for example, using green roofs to reduce runoff water and urban heat (Oberndorfer et al.,  
75 2007). Therefore, most design projects discount the value of plants (grasses, shrubs or trees), and often  
76 considering plants as a problem that designers must solve. In addition, urban designers mostly look for  
77 standardized products that could be replicated all over the world (following the scalability principle,  
78 Tsing, 2015). This is the case, for example, for the trees integrated in the iconic Boeri's Bosco Verticale

79 building (2014). Consequently, these projects consider plants merely as artefacts, ignoring four key  
80 aspects of natural systems: i) the dynamic and uncontrolled dimension of any living organism (e.g.,  
81 seasonal, yearly, and daily changes); ii) the interactions these organisms have with their habitats (e.g.,  
82 soil, water, and air) and with other species (e.g., pollinators, predators, and competitors); iii) the  
83 diversity of species and plant communities affected by habitats and abiotic conditions (e.g., climate,  
84 soil fertility, pollution, and urban subsoils); and iv) the diversity of the relations and interactions city  
85 dwellers can have with these organisms (e.g., hunting, growing, contemplating).

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

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

98

### 99 **1.1. What we learned from science fiction**

100 Science fiction (SF) imagines new or other worlds reacting to social, economic, political, technological,  
101 or environmental issues that are present in the contextual realities at the time of creation (Butt, 2018;  
102 Dasilva, 2019), for example, the economic depression in the 1930 s, the “Red Menace” in the 1950 s,  
103 the Vietnam War in the 1960 s and 1970 s, and the environmental crises in recent decades (Abbot,  
104 2007). SF extrapolates potential impacts of actual, emerging, and imaginary technologies and  
105 experiments with societal solutions (Gendron et al., 2017). Furthermore, because people (and other  
106 creatures) live in these news worlds, SF not only covers the “physical or institutional contours of  
107 imagined tomorrows but also the emotions, colors, sounds, tastes, etc.” (Miller, 2018) but also creates  
108 scenarios that provoke forward thinking discussions (Adam, 2020) or “radical creativity” that helps  
109 audiences, even architects, urban planners, and researchers “think without a banister” (Gendron et  
110 al., 2017). Many SF authors purposefully go beyond culture and entertainment by suggesting  
111 technologies or devices that do not actually exist but are on plausible trajectories (Sterling 2005;  
112 Lindley and Coulton, 2016).

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

123 SF is present in literature, cartoons, video games, television series, and films. In each of these media,  
124 productions dedicated to niche audiences coexist with productions dedicated to the larger public.  
125 Bestseller books or blockbuster films reflect the social preoccupations at the time and place where  
126 they were created and disseminate the mainstream representation of what the future will or should  
127 be (Bulfin, 2017). Feeling close to the characters and situations, spectators are inclined to alter their  
128 own behaviors, preoccupations, and feelings (Sakellari, 2015). In the globalization context, the  
129 worldwide diffusion of popular cultural products is a kind of cultural globalization (e.g., Mahon, 2000)  
130 creating a normative mental image of how future cities are to be related to urban greenery.  
131 This is the case for American SF blockbusters, which typically present different futures regarding  
132 environmental crises, ranging mainly between a promethean and a survivalist environmental future  
133 (Dasilva, 2019). Because they are spread world-wide, blockbusters disseminate and create a common  
134 vision of the future for their audiences. SF movies can even lead to children as well as adults accepting  
135 the need for change. For example, the release of the SF movie *Day After Tomorrow*, which depicts an  
136 ice storm covering New York as the result of climate change, has “had a significant impact on the  
137 climate change risk perceptions, conceptual models, behavioral intentions, policy priorities, and even  
138 voting intentions of moviegoers” (Leiserowitz, 2004). Similarly, Strife (2012) concludes that SF movies  
139 influence how children respond to environmental catastrophes depicted in movies:  
140 “Several children also mentioned movies as a source of their fear about the future state of the  
141 environment [becoming] ecophobic. [...]”. In considering connections across themes such as awareness  
142 of global environmental problems and negative visions of the future, it became clear that children who  
143 received their environmental information primarily from television programs and movies tended to  
144 express highly negative emotions about environmental problems (Strife, 2012).  
145 This is not a new phenomenon. For example, *Soylent Green*, a SF movie from 1973, explores how  
146 overpopulation in 2022 would affect New York City. This movie is still used to teach about  
147 environmental crises (Wills, 2021).

148

## 149 **2. Method**

150 In this paper, we expose how future cities are depicted in some mainstream American SF blockbuster  
151 movies. We watched 44 of the 57 highest grossing American SF films (based on Wikipedia’s “List of  
152 highest-grossing science fiction films” and “List of highest-grossing superhero films”). We chose 30 for  
153 SF films and 30 for superhero, minus 1 from China in each category and 1 that was quoted in both list,  
154 ending with 57). We did not watch all 57 movies because many are set in similar landscapes, for  
155 example, the *Avengers*, *Spiderman* and *Hunger Games* movies (see Table 1 for Movies). We  
156 characterized the presence and the importance of nature in those films where at least part of the story  
157 takes place in cities. Specifically, we answered the following questions:

158

159 1) Is green nature present in cities? What kind of nature (e.g., controlled vs. wild) is depicted? Is nature  
160 changing according to different seasons or weather?

161 2) Does depicted nature refer to ecological-type functioning (i.e., is there any ecological interaction  
162 between different non-human species or strata)?

163 3) Is there some diversity of plant species specific to the cities, habitats, or regions depicted?

164 4) Do characters have a relationship with nature? In what contexts?

165

166 We discuss our results according to the potential interest and challenges anchoring fictions to  
167 paradigm shifts and transformative changes directed at urban greenery and sustainable cities. We

168 conclude our perspective by suggesting that a renewed dialogue between urban designers, urban  
169 ecologists, and SF artists could help society imagine new ways to integrate nature and cities.

170

### 171 **3. Results - Urban green in current American blockbusters**

172

#### 173 ***3.1) Presence of green nature in cities***

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

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

193

#### 194 ***3.2. Ecological-type functioning***

195 In the larger majority of the explored films, nature is presented without any sign of ecological-type  
196 functioning. But see the human city in Dawn of the Planet of the Apes. Outside the cities, some films  
197 present some landscapes where nature has some signs of ecological functioning: numerous and diverse  
198 species (plant and/or animals), different strata in forests, evidence of soil, interspecific relationships  
199 (e.g., predation) etc. For instance in Hunger Games, the forests are depicted in their ecological  
200 dimensions: numerous species (both plants and animals) that interact with each other during different  
201 seasons, notably winter with snow and trees without leaves. In Avatar, on the planet Pandora, all plant  
202 species, according to the scientist Grace Augustine, communicate with each other through their roots  
203 as they “signal transduction from this flower to the next”. The Earth, according to the protagonist Jake  
204 Sully, is without nature: “[N]o green there. They killed their mother”.

205

#### 206 ***3.3. Diversity of urban green according to biogeographical zones***

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

213

### 214 **3.4. Relations between green nature and characters**

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

230

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

239

### 240 **4. Discussion**

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

254

255 Urban ecologists could intervene in film making and cultural processes to highlight the important  
256 values of nature by telling, for example, stories about urban ecological processes, beyond lists of  
257 species that need to be protected, or by discussing how nature could be integrated in SF imaginaries.

258 Urban designers could go beyond urban greenery as a mere fashionable material and consider spatial  
259 and temporal ecological dynamics of the living beings. Through dialogues with ecologists and  
260 biologists, they could gain additional knowledge of plant and animal dynamics and characteristics of  
261 species. Furthermore, they could invent new urban designs that not only resemble nature but also are  
262 part of nature. Mainstream SF producers could diversify the type or nature present in the settings,  
263 provide functioning ecological systems in cities, and have characters interacting with or even living in  
264 natural settings. The diversity of real plant and animal ecology offers a very large panel for science  
265 fiction imaginaries. An example of suggested way forward could be “science fiction prototype writing”  
266 (see e.g. Bell et al., 2013).

267  
268 We are not able to provide a more extensive review of the SF films and literature within the format of  
269 a short communication beyond these blockbusters, but there are other promising movies where  
270 characters integrate with nature – e.g., *Minority Reports* (2002) depicts a wall of genetically hybrid  
271 plants with poisonous branches that hinder Chief John Anderton (human) from entering a greenhouse.  
272 The plants bite Dr. Iris Hineman (human) as they struggle for their lives. In *Snowpiercer* (Netflix series,  
273 2020-), a train filled with the last of the human population travels across landscapes where the outside  
274 temperature is 119 °C. To survive, the train passengers need to eat cockroach bars for protein. In the  
275 *Snowpiercer* gardening wagon, however we could not detect any pollinators. In *Star Trek Discovery*  
276 (Netflix series, 2017-), rebels are nature conservationists working to save species on other planets, and  
277 when the crew returns to earth 900 years later (due to a time loop) everything in the city changed  
278 except for a tree that still stands on the same spot (on a green lawn next to the Golden Gate Bridge  
279 that also somehow survived the centuries). Interestingly, the writers of *Star Trek Discovery* got inspired  
280 by Stamets (an ecologist) researching mushrooms and called him for help with the plot. Inspired by  
281 the researcher Stamets, the plot became a Lieutenant Paul Stamets in *Star Trek Discovery* who is an  
282 "astromycologist" inventing that the Starship can travel fast through space in a mycelium network. And  
283 finally, in the recent movie *Dune* (2021), the main character, Paul (human with powers and abilities),  
284 learns how indigenous people on the planet selected shrub species with deep roots in order to survive.  
285 While in the city, Paul notices that some holy date palm trees are not sustainably irrigated. Thus, there  
286 seems to be an increasing awareness of the human need to link to nature and ecology in recent SF  
287 films and series, but few of these are about urban greenery and biodiversity. Another character Dr.  
288 Liet Kynes, who is an imperial ecologist seems to have knowledge of hidden laboratories working on  
289 making the desert planet green and lush. In addition to movies, fiction books have recently speculated  
290 about urban greenery, blue cities, and biodiversity. The anthology *A Flash of Silver Green: Stories of*  
291 *Nature of Cities* has 57 short stories written by amateurs and professionals that speculate whether  
292 cities in 2099 will be lush and green (Maddox et al., 2018). In another anthology, *Multispecies in Cities*  
293 *and Solar Punk* (Fujii et al., 2021), 24 short stories imagine what cities will like in the future. In an IPCC  
294 publication, ten short stories and ten scientific texts examine how climate change might affect the  
295 natural world as well as human society (*Our Futures: Imagining the Possibilities of Climate Change [Nos*  
296 *futures': Imaginer les Possibles du Changement Climatique]*, 2021). In *Cities that Think like Planets:*  
297 *Complexity, Resilience, and Innovation in Hybrid Ecosystems*, Alberti (2016), who interestingly also  
298 seems to have similar ideas as we have, concludes that “science and data answer questions we are  
299 able to formulate. To build sustainable, resilient cities requires that we both refine our predictions and  
300 expand our imagination”. *Ecotopia2121*, a project that promotes the use of art to inspire utopian  
301 visions (<https://www.ecotopia2121.com/>), highlights possible futures and promotes greenery in real



302 life cities from a 100-year perspective. However, all these examples are rather narrow genres of  
303 literature, as they do not reach mainstream readers and therefore probably will not change norms.

304

## 305 **5. Conclusion**

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

315

## 316 **Author statement**

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

320

## 321 **Declaration of Competing Interest**

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

324

## 325 **Acknowledgments**

326 We would like to thank colleagues in the Futures Lab at SLU for valuable and creative inputs and ideas  
327 of the manuscript. In particular Josefin Wangel and Ishi Buffam as well as Åsa Berggren, Suvi Kokko,  
328 Alexandre Dubois, David Ljungberg, and Emma Sahlström. This study was funded by Futures Lab and  
329 the transdisciplinary platforms Urban Futures and Future Food at the Swedish University of Agricultural  
330 Sciences.

331 Finally we would like to thank the EC REGREEN Nature-based Solutions project ([regreen-project.eu/](http://regreen-project.eu/))  
332 which enabled this inter- and transdisciplinary collaboration. The EC REGREEN project has received  
333 funding from the European Union's Horizon 2020 research and innovation program under grant  
334 agreement No 821016, and the National Key R&D Program Intergovernmental Cooperation in  
335 International Science and Technology Innovation from Ministry of Science and Technology of China  
336 (Grant no. 2021YFE93100).

337

## 338 **References**

339 ABBOT, C. 2007. Cyberpunk cities- science fiction meets urban theory. *Journal of planning education*  
340 *and research*, 122-131.

341 ADAM, D. 2020. "Design fiction" skirts reality to provoke discussion and debate. *Proceedings of the*  
342 *National Academy of Sciences of the United States of America*, 117, 13179-13181.

343 AIT-TOUATI, F. 2011. *Contes de la lune. Essai sur la fiction et la science modernes* Nrf essais, Gallimard.

344 ARONSON, M. F. J., LA SORTE, F. A., NILON, C. H., KATTI, M., GODDARD, M. A., LEPCZYK, C. A., WARREN,  
345 P. S., WILLIAMS, N. S. G., CILLIERS, S., CLARKSON, B., DOBBS, C., DOLAN, R., HEDBLUM, M.,  
346 KLOTZ, S., KOOIJMANS, J. L., KUHN, I., MACGREGOR-FORS, I., MCDONNELL, M., MORTBERG, U.,

347 PYSEK, P., SIEBERT, S., SUSHINSKY, J., WERNER, P. & WINTER, M. 2014. A global analysis of the  
348 impacts of urbanization on bird and plant diversity reveals key anthropogenic drivers.  
349 *Proceedings of the Royal Society B-Biological Sciences*, 281.

350 BENNETT, D. 2017. Scientific eventuality or science fiction: The future of people with different abilities.  
351 *Futures*, 87, 83-90.

352 BOSCO, B. 2014. Vertical Forest.

353 BULFIN, A. 2017. Popular culture and the "new human condition": Catastrophe narratives and climate  
354 change. *Global and Planetary Change*, 156, 140-146.

355 BUTT, A. 2018. 'Endless forms, vistas and hues': why architects should read science fiction. *Arq-*  
356 *Architectural Research Quarterly*, 22, 151-160.

357 CBO 2012. Secretariat of the Convention on Biological Diversity. *Cities and Biodiversity Outlook*.  
358 Montreal.

359 CILLIERS, S., DU TOIT, M., CILLIERS, J., DREWES, E. & RETIEF, F. 2014. Sustainable urban landscapes:  
360 South African perspectives on transdisciplinary possibilities. *Landscape and Urban Planning*, 125,  
361 260-270.

362 CINCOTTA, R. P., WISNEWSKI, J. & ENGELMAN, R. 2000. Human population in the biodiversity hotspots.  
363 *Nature*, 404, 990-992.

364 DASILVA, C. 2019. Imagining decline or sustainability: Hope, fear, and ideological discourse in  
365 Hollywood speculative fiction. *Elementa-Science of the Anthropocene*, 7.

366 DESCOLA, P. & PÄLSSON, G. 1996. *Nature and society: anthropological perspectives*, Routledge,  
367 London.

368 FUJII, T., CHABRIA, P., TANEJA, S., YOACHIM, C. & CHATTERJEE, R. 2021. *Multispecies Cities: Solarpunk*  
369 *Urban Futures*, World Weaver Press.

370 GENDRON, C., IVANAJ, S., GIRARD, B. & ARPIN, M. L. 2017. Science-fiction literature as inspiration for  
371 social theorizing within sustainability research. *Journal of Cleaner Production*, 164, 1553-1562.

372 GOMEZ-BAGGETHUN, E. & BARTON, D. N. 2013. Classifying and valuing ecosystem services for urban  
373 planning. *Ecological Economics*, 86, 235-245.

374 HARAWAY, D. 2016. *The camille stories, children of the compost. Staying with the Trouble*.

375 HAWLINA, H., PEDERSEN, O. C. & ZITTOUN, T. 2020. Imagination and social movements. *Current*  
376 *Opinion in Psychology*, 35, 31-35.

377 HOWARD, E. 1902. *Garden Cities of tomorrow*, London, Swan Sonnenschein & CO LTD.

378 HUANG, C. W., MCDONALD, R. I. & SETO, K. C. 2018. The importance of land governance for biodiversity  
379 conservation in an era of global urban expansion. *Landscape and Urban Planning*, 173, 44-50.

380 IPBES 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental  
381 Science-Policy Platform on Biodiversity and Ecosystem Services. . In: E. S. BRONDIZIO, J. S., S.  
382 DÍAZ, AND H. T. NGO (ed.) IPBES secretariat, Bonn, Germany.

383 JIM, C. Y. 2013. Sustainable urban greening strategies for compact cities in developing and developed  
384 economies. *Urban Ecosystems*, 16, 741-761.

385 KREMER, P., HAMSTEAD, Z., HAASE, D., MCPHEARSON, T., FRANTZESKAKI, N., ANDERSSON, E.,  
386 KABISCH, N., LARONDELLE, N., RALL, E. L., VOIGT, A., BARO, F., BERTRAM, C., GOMEZ-  
387 BAGGETHUN, E., HANSEN, R., KACZOROWSKA, A., KAIN, J. H., KRONENBERG, J., LANGEMEYER,  
388 J., PAULEIT, S., REHDANZ, K., SCHEWENIUS, M., VAN HAM, C., WURSTER, D. & ELMQVIST, T.  
389 2016. Key insights for the future of urban ecosystem services research. *Ecology and Society*, 21.

390 LEDERBOGEN, F., KIRSCH, P., HADDAD, L., STREIT, F., TOST, H., SCHUCH, P., WUST, S., PRUESSNER, J.  
391 C., RIETSCHEL, M., DEUSCHLE, M. & MEYER-LINDENBERG, A. 2011. City living and urban  
392 upbringing affect neural social stress processing in humans. *Nature*, 474, 498-501.

393 LINDLEY, J. & COULTON, P. 2016. Pushing the Limits of Design Fiction: The Case For Fictional Research  
394 Papers. 34th Annual Chi Conference on Human Factors in Computing Systems, Chi 2016, 4032-  
395 4043.

396 MACE, G. M. 2014. Whose conservation? *Science*, 345, 1558-1560.

397 MADDOX, D., WALKER, C. & LOVEJOY, M. 2018. A flash of silver-green: stories of the nature of cities,  
398 Publication Studio Guelph.

399 MAHON, M. 2000. The visible evidence of cultural producers. *Annual Review of Anthropology*, 29, 467-  
400 492.

401 MCHARG, I. 1978. *Ecological planning: the planner as catalyst*, Washington, DC, Island Press,.

402 MCPHEARSON, T., PICKETT, S. T. A., GRIMM, N. B., NIEMELA, J., ALBERTI, M., ELMQVIST, T., WEBER, C.,  
403 HAASE, D., BREUSTE, J. & QURESHI, S. 2016. Advancing Urban Ecology toward a Science of Cities.  
404 *Bioscience*, 66, 198-212.

405 MILLER, R. 2018. Introduction Futures Literacy: transforming the future. *Transforming the Future:*  
406 *Anticipation in the 21st Century*, 1-12.

407 MOLLIE, C. 2009. *Des arbres dans la ville: l'urbanisme végétal*. Actes Sud, Paris, France

408 NIEMELA, J. 1999. Ecology and urban planning. *Biodiversity and Conservation*, 8, 119-131.

409 OBERNDORFER, E., LUNDHOLM, J., BASS, B., COFFMAN, R. R., DOSHI, H., DUNNETT, N., GAFFIN, S.,  
410 KOHLER, M., LIU, K. K. Y. & ROWE, B. 2007. Green roofs as urban ecosystems: Ecological  
411 structures, functions, and services. *Bioscience*, 57, 823-833.

412 PATAKI, D. E. 2015. Grand challenges in urban ecology. *Frontiers in Ecology and Evolution*, 3.

413 PICKETT, J. 2016. Theme issue 'The evolution of cooperation based on direct fitness benefits'.  
414 *Philosophical Transactions of the Royal Society B-Biological Sciences*, 371.

415 PICKETT STA, CHILDERS DL, MCDONELL MJ, ZHOU W. 2016. Evolution and future of urban ecological  
416 science: ecology in, of, and for the city. *Ecosystem Health and Sustainability* 2.

417 SAKELLARI, M. 2015. Cinematic climate change, a promising perspective on climate change  
418 communication. *Public Understanding of Science*, 24, 827-841.

419 SDG11 United Nations. Sustainable Development Goal number 11 Sustainable cities and communities.

420 SPARKMAN, G., HOWE, L. & WALTON, G. 2021. How social norms are often a barrier to addressing  
421 climate change but can be part of the solution. *Behavioural Public Policy*, 5.

422 STRIFE, S. J. 2012. Children's Environmental Concerns: Expressing Ecophobia. *Journal of Environmental*  
423 *Education*, 43, 37-54.

424 TEHRANI, M., FULTON, L. & SCHMUTZ, B. 2020. Green Cities and Waste Management: The Restaurant  
425 Industry. *Sustainability*, 12.

426 TSING, A. 2015. *The Mushroom at the End of the World. On the Possibility of Life in Capitalist Ruins*,  
427 Princeton University Press

428 UN 2019. United Nations, Department of Economic and Social Affairs, Population Division (2019).  
429 *World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420)*. New York: United  
430 Nations.

431 VAN DEN BOSCH, M. & SANG, A. O. 2017. Urban natural environments as nature-based solutions for  
432 improved public health - A systematic review of reviews. *Environmental Research*, 158, 373-384.

433 WHO 2016. *Urban green spaces and health a review of evidence*. . Copenhagen: WHO Regional Office  
434 for Europe.

435 WILLS, J. 2021. "What is the Secret of Soylent Green?" Using Richard Fleischer's dystopian movie  
 436 Soylent Green (1973) to discuss America's enduring environmental challenges. *Journal of*  
 437 *American Studies*, 55, 1263-1268.

438  
 439  
 440  
 441  
 442

443 **Table 1**

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

451

Category	Rank	Film	Year	Worldwide gross in Dollars
SF	1	Avatar	2009	\$2,847,246,203
<i>SH*</i>	1	<i>Avengers: Endgame</i>	2019	<i>\$2,797,800,564</i>
SF	2	Star Wars: The Force Awakens	2015	\$2,068,223,624
<i>SH*</i>	2	<i>Avengers: Infinity War</i>	2018	<i>\$2,048,359,754</i>
<i>SH*</i>	3	<i>Spider-Man: No Way Home</i>	2021	<i>\$1,892,667,830</i>
SF	3	Jurassic World	2015	\$1,670,516,444
<i>SH</i>	4	<i>The Avengers</i>	2012	<i>\$1,518,812,988</i>
<i>SH*</i>	5	<i>Avengers: Age of Ultron</i>	2015	<i>\$1,402,809,540</i>
<i>SH</i>	6	<i>Black Panther</i>	2018	<i>\$1,346,913,171</i>
SF	4	Star Wars: The Last Jedi	2017	\$1,332,539,889
SF	5	Jurassic World: Fallen Kingdom	2018	\$1,308,467,944
<i>SH*</i>	8	<i>Iron Man 3</i>	2013	<i>\$1,214,811,252</i>
<i>SH*</i>	9	<i>Captain America: Civil War</i>	2016	<i>\$1,153,304,495</i>
<i>SH</i>	10	<i>Aquaman</i>	2018	<i>\$1,148,161,807</i>
<i>SH*</i>	11	<i>Spider-Man: Far From Home</i>	2019	<i>\$1,131,927,996</i>
<i>SH</i>	12	<i>Captain Marvel</i>	2019	<i>\$1,128,274,794</i>
SF	6	Transformers: Dark of the Moon	2011	\$1,123,794,079
SF	7	Transformers: Age of Extinction	2014	\$1,104,054,072
<i>SH</i>	13	<i>The Dark Knight Rises</i>	2012	<i>\$1,081,041,287</i>
<i>SH</i>	14	<i>Joker</i>	2019	<i>\$1,074,251,311</i>
SF	8	Star Wars: The Rise of Skywalker	2019	\$1,074,144,248
SF	9	Rogue One: A Star Wars Story	2016	\$1,056,057,273
SF	10	Jurassic Park	1993	\$1,033,928,303
SF	11	Star Wars: Episode I – The Phantom Menace	1999	\$1,027,082,707
<i>SH</i>	15	<i>The Dark Knight</i>	2008	<i>\$1,005,973,645</i>
<i>SH*</i>	16	<i>Spider-Man 3</i>	2007	<i>\$890,871,626</i>

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	Star Wars: Episode III – Revenge of the Sith	2005	\$868,390,560
SF	13	The Hunger Games: Catching Fire	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	Inception	2010	\$836,836,967
SF	15	Transformers: Revenge of the Fallen	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	Independence Day	1996	\$817,400,891
SF	18	E.T. the Extra-Terrestrial	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	Star Wars	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	The Hunger Games: Mockingjay – Part 1	2014	\$755,356,711
SH	30	<i>X-Men: Days of Future Past</i>	2014	\$746,045,700
SF+SH	21	The Matrix reloaded	2003	\$741,847,937
SF	22	Gravity	2013	\$723,192,705
SF	23	Dawn of the Planet of the Apes	2014	\$710,644,566
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

452

453

454

455

456

457

458

459

460

461