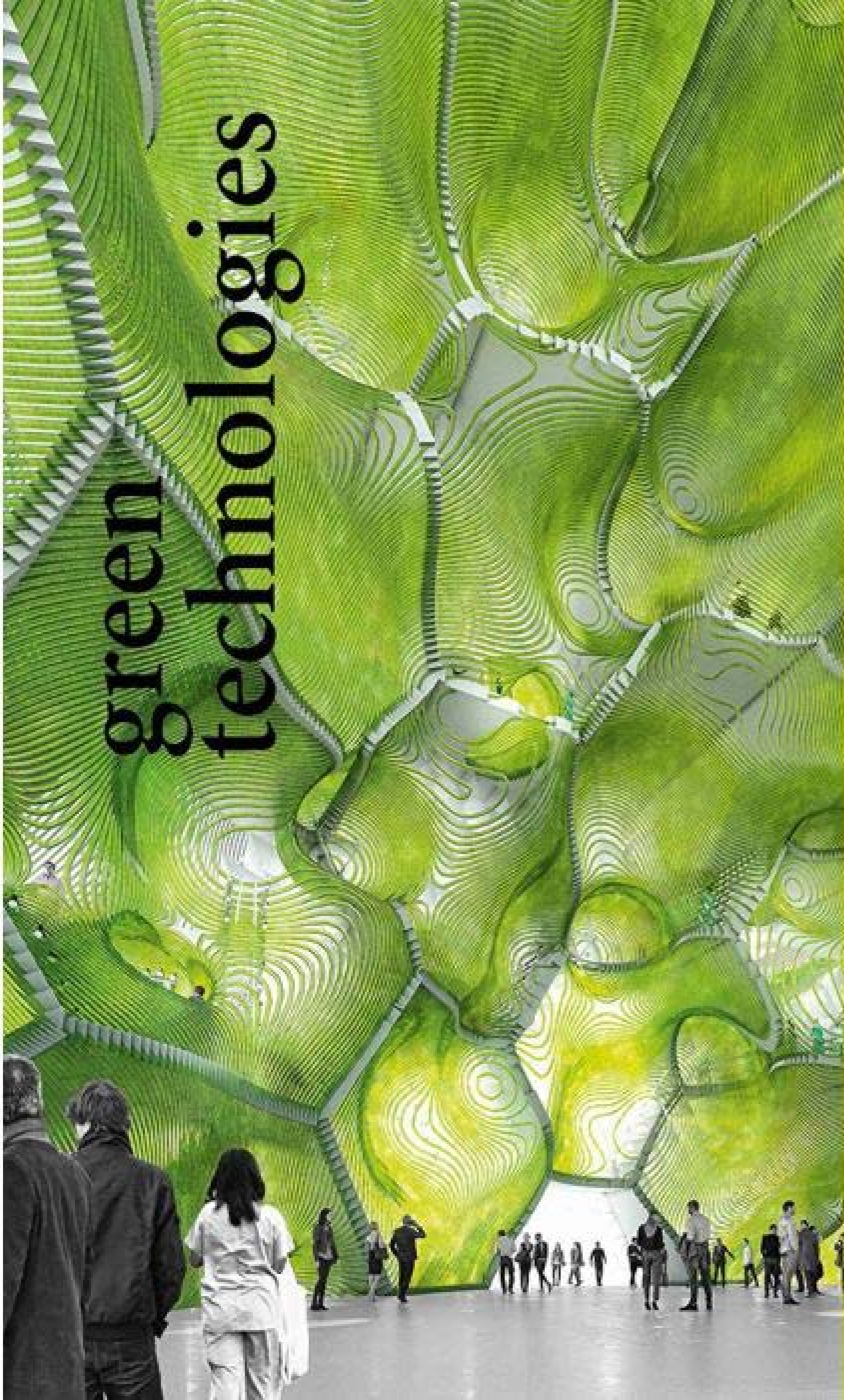

topos.

no 112
2020

DEEP GREEN
– Designing the post-anthropocentric world: Microbiological landscapes and cities as super-organisms

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MAPPING THE FLOOD
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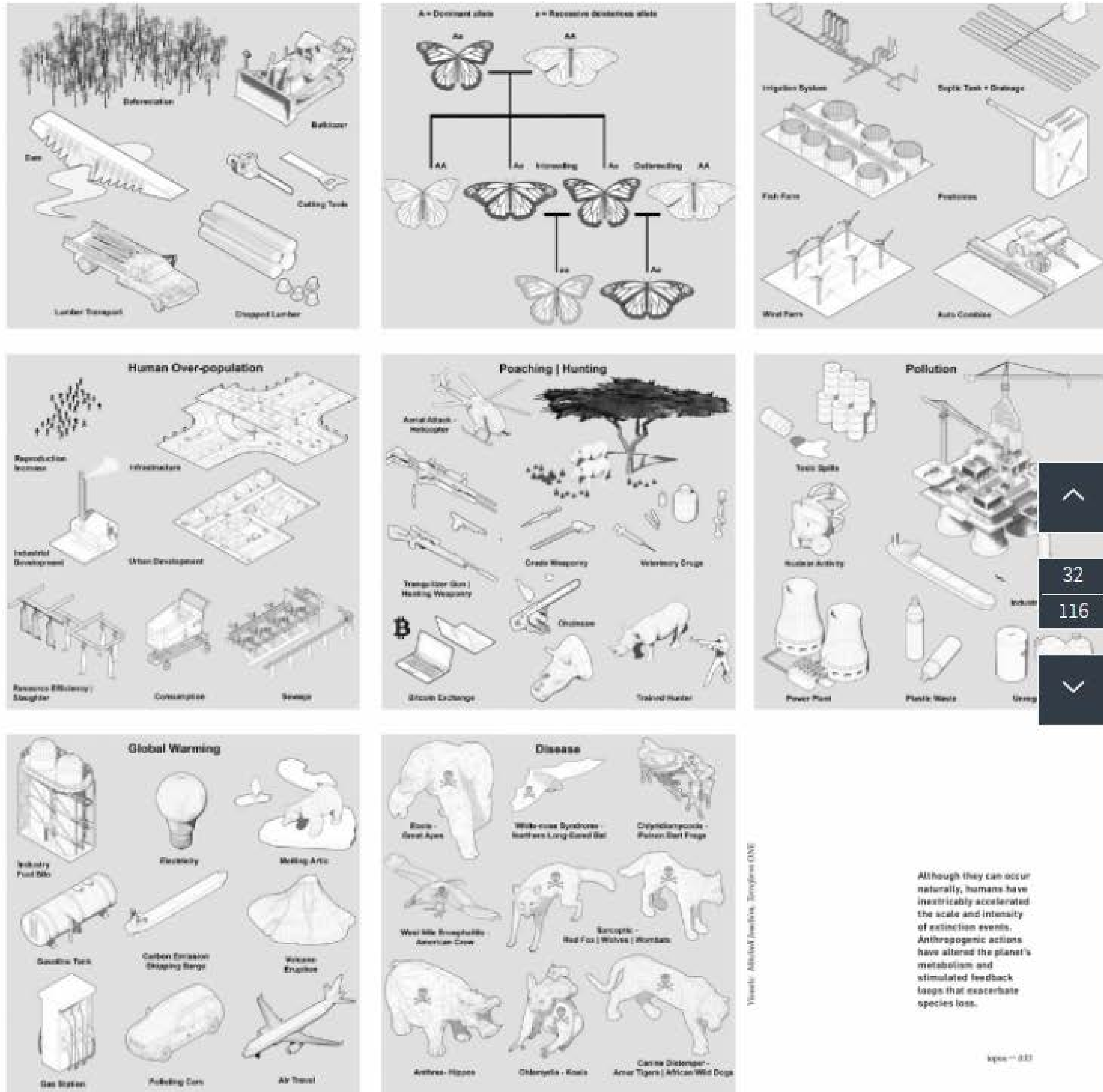
Deep Impact

With human populations increasing, there is a cumulative impact on global ecosystems, and nowhere do these impacts overlap as much as they do in cities. The urban environment is about as intense as it gets, and the natural creatures and plants that live side-by-side with us must adapt to a whole suite of perplexing conditions. Behavioral changes have shown the ability of species to adapt to city developments and technologies. However, it is to humans to implement techniques such as Animal-, Plant- or Insect-Aided Design to mitigate the stress on urban non-human species.

TERREFORM ONE: MITCHELL JOACHIM,
PEDER ANKER, NICHOLAS GERVASI



Visuals: Mitchell Joachim, Terreform ONE

Although they can occur naturally, humans have inextricably accelerated the scale and intensity of extinction events. Anthropogenic actions have altered the planet's metabolism and stimulated feedback loops that exacerbate species loss.

We tend to think of urbanization as a realm apart, somehow separate from the ecosystem, but nothing could be further from reality. In fact, we need to search below the urban veneer to reveal the wildlife that symbiotically shares our streets and dwellings. Inside the built environment we witness phenomena such as wall-eating snails that are overrunning Miami, packs of wild boars that meander Berlin, and an uncontrollable monkey incursion of Cape Town. Not to mention the all too familiar sights of city pigeons, and large colonies of rats. From carpet-hungry insects to coyotes hanging out in food shops, we have discovered streets that are far more alive than we often comprehend. With the changing conditions of the environment, animals too try to adapt, as in the case of wild polar bears entering streetscapes in Svalbard or brown bears searching for food in urban garbage dumps in Canada. This demonstrates to us how various species of animals are adjusting to city life and examines how human mindsets and society influence wildlife issues in metropolitan areas. The unmatched influence that human societies are wielding on the natural world is a given based on changes in climate and the environment, also called the epoch of the Anthropocene.

The Problem: Human Population Growth

Increasing human populations are having a cumulative impact on global ecosystems, and nowhere do these impacts overlay as much as they do in cities. The growth of cities all over the world over the last century has been exceptional, with no end in sight for when cities will stop mushrooming. The largest cities in the world have grown exponentially, with Shanghai, for example, increasing in population from about six million in the early 1950s to 24 million today. The situation is similar in smaller cities, such as in the case of Accra, which during the same time period grew from about two hundred thousand to 2.5 million. This phenomenon is spurred by the general human population growth in the world from about 2.7 to 7.7 billion people from the early 1950s until today. At the same time human consumption has increased, not only as a result of population growth but also per capita. With that comes stress on natural resources for the city, such as energy and drinking water, and the ever-increasing production of garbage.

How to understand the City

With radical city growth, the geographical meaning of what actually is urban needs to be reevaluated. Sticking to politically defined city boundaries, architecturally dominated ideas of densities, or aesthetical notions of what looks urban, suburban or countryside, may hinder a deeper understanding of the nature of a city. Humans, animals, fish, insects, plants, seed, and dead materials are constantly on the move. Humans are not the only ones arriving in cities as tourists or immigrants. Birds sitting on the roof of a skyscraper may be travelers to a different continent, and some new invasive algae in the harbor may have arrived with the ballast water from a boat traveling the seven seas. The steel for a building may have its origin in a faraway steel mill, which got its energy from even farther away in some hydroelectric dam in a different nation. Only a thorough understanding of how species and things move may create openness for sustainable policies and management of them. This movement plus the associated spatial requirements create a view of a transformative human-to-animal landscape that operates in flux.

Adaptation: Animals

With radical city growth, the wild natural creatures and plants that live side-by-side with us have been forced to adapt to a whole suite of perplexing conditions: they must survive in the city's hotter climate; they need to be able to endure either in the semi-deserts of the high, stony and spacious structures we call buildings (known as the urban heat island effect), or in the pocket-like havens of municipal parks (which create their own hazards, including smog and free-ranging pets); they must fend against traffic that causes incessant noise, a mist of superfine dust particles, and obstructions to movement for any animal that cannot fly or burrow; and they are forced to deal with nutrition sources that are chiefly human-derived. The wildlife sharing these spaces with us are not just surviving, but evolving ways of prospering. Some animals thrive while others suffer in urban conditions. There are many examples of adaptation that uncover a spectacular vision of urban evolution in which humans and wildlife co-exist in an inimitable harmony. We can expose evolution that occurs far more rapidly than Darwin envisaged, while delivering a gleam of hope that our sprint towards rampant overpopulation might not take the rest of nature down with us. These are some examples of co-evolved life: Carrion crows in the Japanese city of Sendai have adapted to use oncoming traffic to break nuts for food. Lizards in Puerto Rico are evolving feet that alter their grip on surfaces like concrete more successfully. Europe's inner-city blackbirds sing at a superior pitch than their rural counterparts, to be heard over the noise of traffic. Not to mention the ability of a host of insects, such as ants, bugs, centipedes, cockroaches, fleas, lice, millipedes, mosquitoes, moths and termites, to adapt to human structures and their impressive ability to resist aggressive termination programs. We need to investigate how that dominance is rapidly stretching over into the genes of most plants and animals, especially in urban areas. In order to better understand the architectural response in the long term, studies on mitigation techniques and subsequent species populations are paramount.

Extinction: Failing to Adapt

Most animals, however, fail to adapt to city environments. It is therefore important to identify species that are at risk of population loss due to human activities. Species can range from 'impacted but not threatened' all the way to 'near extinction.' Many species may be under habitat stress though they are not on the Endangered Species List, such as honeybees, which are crucial to human food systems. With threats looming from the linguistic to the biologic, what is most alarming about extinction is its rapid pace. Although it can occur naturally, humans have inextricably accelerated the scale and intensity of extinction events. Anthropogenic actions have altered the planet's metabolism and stimulated feedback loops that exacerbate species loss. For example, development leads to habitat destruction, which in turns leads to space for more development subsequently creating more habitat destruction. By losing key ecosystem services, the momentum of extinction garners even more strength.

Human-induced extinctions also extend to the human species itself. Ethnic cleansings, blockades of immigration, obliteration of indigenous cultures, overzealous land development and economic suppression are events that have seriously diminished and outright eradicated unique elements of our collective culture. Each loss is an irrevocable change because potential breakthroughs and gains disappear.

Sustainability and extinction overlap in the characteristic of maintaining ecosystems. Furthermore, combating extinction directly relates to protecting the current users as well as recognizing their finite quality – key components of sustainability. Due to distinct lineages of environmental and physiological factors, those species that vanish are highly improbable to re-appear. The same can be said for languages and dialects. Within the five boroughs of New York City, about 800 languages are spoken, many of which are close to extinction due to reductions in intergenerational transmission. While globalization promotes communication across fewer and widespread platforms, language remains a vital tool for self-expression and designation.

City Experts

There is host of experts in various fields ready to explain the dynamics of cities and their human and non-human inhabitants. An increasing number of urban ecologists examines how our artificial environments are hastening and altering the evolution of the animals and plants around us. Behavioral changes occurring between generations of urban-dwelling species have shown the ability of species to adapt to city developments and technologies. They expose just how stunningly flexible and swift-moving natural selection can be in the urban environment. City planners have followed suit by laying out the ways in which the human and the non-human world interact, while also planning for a more harmonious interface. Recognizing the colossal surface areas of buildings and roads, planners are injecting bioreceptive gestures into development patterns in order to address cohabitation. These metropolitan environmental studies are taken seriously at trendsetting universities. Likewise, certain architects have begun to take seriously the fact that buildings include both human and non-human inhabitants, and they seek to build for both, regardless of whether the inhabitants are desired or not desired. Urban designers of a host of artifacts such as lampposts, benches, and trenches have also been working hard to make them inclusive for non-humans, work that has been informed by the field of inner-city informatics. More generally, the various communities of 'urban humanities,' such as historians, playwrights, novelists and musicians, have begun to include the realm of non-human life in their work. How to mitigate the stress on urban non-human species runs at the core of the work of all these academics.

Mitigation: Animal-Aided Design

Animal-aided design operates at the threshold between human technology and the natural environment. It transcends the separation of wilderness and the built environment. Architecture becomes a bioinformatic that can be repeated, adapted and scaled to the intrinsic climatic demands of its context. Through this adaptation, it is able, in an ecological sense, to productively impede the current extinction moment by functioning as a registrar of how living creatures mobilize, inhabit and reproduce in the spatial realm. Furthermore, this methodology can be used to connect cities to their surrounding hinterlands, and beyond to the larger biogeographical region in order to provide ecosystem continuity. It allows, for example, urban infill sites to contribute to regional trends. The inclusion of site-specific species within the early stages of the design and planning process will create appropriate frameworks to boost species numbers as opposed to late-stage superficial greenwashing or hastily conceived measures. Instead, planning here responds to all portions of a species' life-cycle, including predation and dependencies.

This framework can guide decisions about the contents of open or green spaces. The spectrum of how lush or barren, wet or dry, and permeable or impermeable a space or structure is, can be calibrated to mirror ideal conditions in the natural habitat. Intermixing and multi-use zones can foster better upkeep by paying greater attention to the overall design scheme. By determining the spatial requirements of a given species, the site can be adequately divided. This spatial determination is then further broken down into smaller parcels that correlate to the various breeding, feeding, mating and nesting activities. Accurately positioning and sizing these spaces will influence whether or not the species can survive on the project site. Without close attention to these parameters, the probability of survival is significantly hindered.

Mitigation: Insect-Aided Design

As the most diverse group of animals, insects pose the challenge of their accelerated life-cycles and various growth stages. From molting and metamorphosis, to hatching eggs and pollinating flowers, insects engage in a multitude of behaviors that present their own habitat demands. Insects have also most likely co-evolved with flowering plants, which creates a synergy that architects must respect. Operating above, below and atop the ground plane, these animals have many characteristics that can be translated into morphological responses in architecture. Pollination is a critical ecosystem service for human food systems. Insect populations on site may traverse large distances to reach flowers and return. Urban fragmentation has stymied this process as routes have been disrupted by buildings oblivious to this phenomenon. This greatly impacts their ability to fulfill their niche and stabilization of food outputs. Living at the micro-scale, insects depend upon a level of granularity that can be ignored by building materials and dynamics. Delicate habits and breeding regimens cause issues for designers because these traits call for a higher resolution in detailing neither budgets nor time allotments traditionally grant. Surface treatments and deformations that are suitable for insects are the first step towards making this boundary between artificial and natural systems amenable. Perforation and reflectivity also influence insect navigation and wayfinding abilities. Another obstacle to designing for insects is the perception of them as pests or nuisances to urban life. Doused with insecticides or pesticides, the human response to insects can escalate to complete termination. Whether it be an outdoor space that has been colonized or a building edge or overhang that hives have been built into, this is perceived as problematic. Therefore, the common perspective is that eradication is the primary objective. This unfortunate attitude positions the discourse in punitive territory. Certainly, insects that act as vectors for diseases do not ease these tensions. However, building awareness on the intricacies of ecosystems and the role insects play in maintaining that balance, ameliorates concerns of their value.

Mitigation: Plant-Aided Design

Technological advancements fundamentally change the way we cultivate our food, build our homes, and move throughout the landscape. Seemingly ceaselessly, they accelerate our means of production and extend our lives. Urban farming promotes edible plant growing practices in cities that substitute large swaths of land for space efficient lighting and stacked aeroponics that culminate in higher yields without agrochemicals. Advocating for the ancillary and leftover spaces, such as alleyways, sidewalk swales, rooftops and facades, farming in the city dictates an examination of altered growing conditions and feasibility in terms of a reliable alternative to peri-urban farm systems. From this array of city spaces, building materials and forms can be designed for bio-receptivity, through crevices, niches and deformations for plants to take hold. Using knowledge gained from examining holdfasts and root structures, architecture can produce an outer membrane that fosters plant growth. Vascular plants are a foundational element in terrestrial ecosystems, thus designing for their life conditions creates opportunities for insects and other animals alike. As primary producers, plants serve all animals through their ability to convert light into eventual biomass. Urban environments have also created an ideal habitat for epiphytes, which climb masonry walls to dedicate their precious resources to leaves as opposed to stem rigidity. Plant-aided design emphasizes a systems approach to trees in that groupings and clusters fare better in resistance to disturbances. With new uses or applications for plants continually being discovered, plant-based replacement products that perform as effectively as the originals are quickly supplanting their carbon-intensive incumbents. Genetically engineered plant-based foods are matching color, texture, taste and content of rival meats. Thus, plant-aided design extends beyond optimization for a singular plant, but advocates for cross-species interventions.

Mitigation: Carbon Footprint

As we continue to expand the scope of the concepts "ecological footprint" and "carbon neutrality" of cities, more variables are added to the calculation to determine our impact. Traditional inputs, such as consumption of natural resources, energy exerted to power buildings and transportation, land area developed are augmented by biodiversity indexes and species counts. Recording and distillation methods provide a comprehensive understanding of human inhabitation upon the landscape. Furthermore, these formerly immeasurable attributes are becoming increasingly quantified through sophisticated modeling and machine learning. Biodiversity monitoring presents temporal and regional challenges, with baselines and reference areas difficult to establish, since the human-to-animal interaction on a specific site is difficult to replicate.

Biodiversity averages can be added to carbon footprint calculations as part of the systems approach that is now covering the complex interactions between humans and animals. Adding species loss or gain per dedicated area to food, transportation, and energy usage statistics clarifies our environmental impact. By tracking human consumption trends with species recovery or decimation surges, our footprint gains coherence and robustness. Often, our most damaging environmental activities can be better quantified through the impact on species, because of the diversity and variety of responses by species. This mixed response depicts a spectrum of impact that has been calibrated by natural resiliency forces.

Mitigation: Indigenous Knowledge

Novel investigations into how indigenous cultures live with non-human species have enriched our conversations about a more inclusive urbanity. Impoverished and segregated communities have given us hard-learned tools for urban adaption. How to live in a more productive way with the non-human world is often a type of know-how generated far away from highbrow academia and fancy design studios. These empirical sets of information, often passed down from ancestors, present field-verified approaches to sustainability. By relying on reverse engineering theory, as opposed to imposing theory upon practice, tested methods that are climate-specific can become guidelines for an altered living condition in which non-human species thrive concurrently. Generally, it is important to begin unlocking the practical skills of living with nature that exist in many urban societies of the Global South. Among these are skills that have already identified the advantageous materials and methods of construction endemic to a locale; structures that have been designed with nature in a manner that is innately resilient to the region's forces; site-specific interventions composed of the site itself; or building materials that coalesce and lignify over time, gaining strength and longevity. Likewise, the idea of "progress" may hinder an appreciation of the sustainability of traditional urban fabrics wherever they are, as in pedestrian-informed European cities or animal husbandry in Chinese municipals.

Mitigation: Technology

These strategies are not abandoning or halting technology. A return to pastoral landscapes or pre-industrial times is not an option. As global population nears eight billion people and energy usage continues to rise, technology has the scalability to address these burgeoning demands. Machines do not innately improve or impair our lives, but rather it is the application of machines that determines if they make a positive or negative contribution. Human ingenuity embodied in microchips to the Large Hadron Collider, for instance, the world's largest and most powerful particle accelerator at CERN in Geneva, Switzerland, teaches us phenomena about the natural world in order to better understand and live within it. Environmental Luddites are not productive. Instead new technologies, such as wind turbines, solar cells, energy-saving batteries, electric cars, geothermal energy, heat exchange systems, etc. may help the urgently needed urban transformation. As implementation scales upward, the systems will become more efficient with performative benefits. The search for sustainable technologies is not only a search in the unknown. The transfer of know-how from one geographical region to another may be of help. Releasing the spatial constraints of successive environmental responses will combat globally shared issues that have been mitigated in one part of the world, but still remain in other regions. The problem of increasing heat waves in Australia and California, for example, may be addressed through contemporary as well as traditional design solutions to high temperatures in Islamic cultures of design. After all, a host of design solutions to heat were widely used architectural and urban design strategies developed before the invention of air-conditioning systems. Technology didn't harbor the lackluster building interiors that resulted after air-conditioning was implemented. Rather, buildings shifted cultural and spatial attributes to technology, which led to mass minimalism and the disconnection from nature.

Promoting Biodiversity

As clusters of human activity and environmental impact, cities need to recognize their role in promoting biodiversity within their ecological footprints. With animal-aided design as well as with the other mentioned mitigation techniques, architecture can allocate physical space to facilitate ecological processes and recovery from intensive development. Often settled around or atop relics of natural habitats, such as forests or rivers, cities inherited biodiversity due to these resources. Humans specifically chose regions to settle with gargantuan amounts of resources to exploit and convert into economic gains. They often did this without concern for the long-term consequences of the disruptions they caused. As centers of importation, cities spread and naturalize invasive species. These actions have negatively shifted growth patterns and distribution. As we traverse and infiltrate areas previously undisturbed, we bring with us our methods of extraction and waste production, ultimately leading to the decline of the non-human sector. Animal-aided design re-orients site analysis, design and construction towards inclusion of species needs within our urban fabrics. Expanded calculations and metrics perpetually quantify human-to-animal interactions as studies depict the far-reaching results of urbanization.

REFERENCES

Cronon, William. 1991. Nature's Metropolis: Chicago and the Great West. New York: W. W. Norton.

Forman, Richard T. T. 2016. Urban Ecology: Science of Cities. Cambridge: Cambridge University Press.

Kolbert, Elizabeth. 2015. Sixth Extinction: An Unnatural History. New York: Picador.

McKibben, Bill. 2006. The End of Nature. New York: Random House Trade Paperbacks.

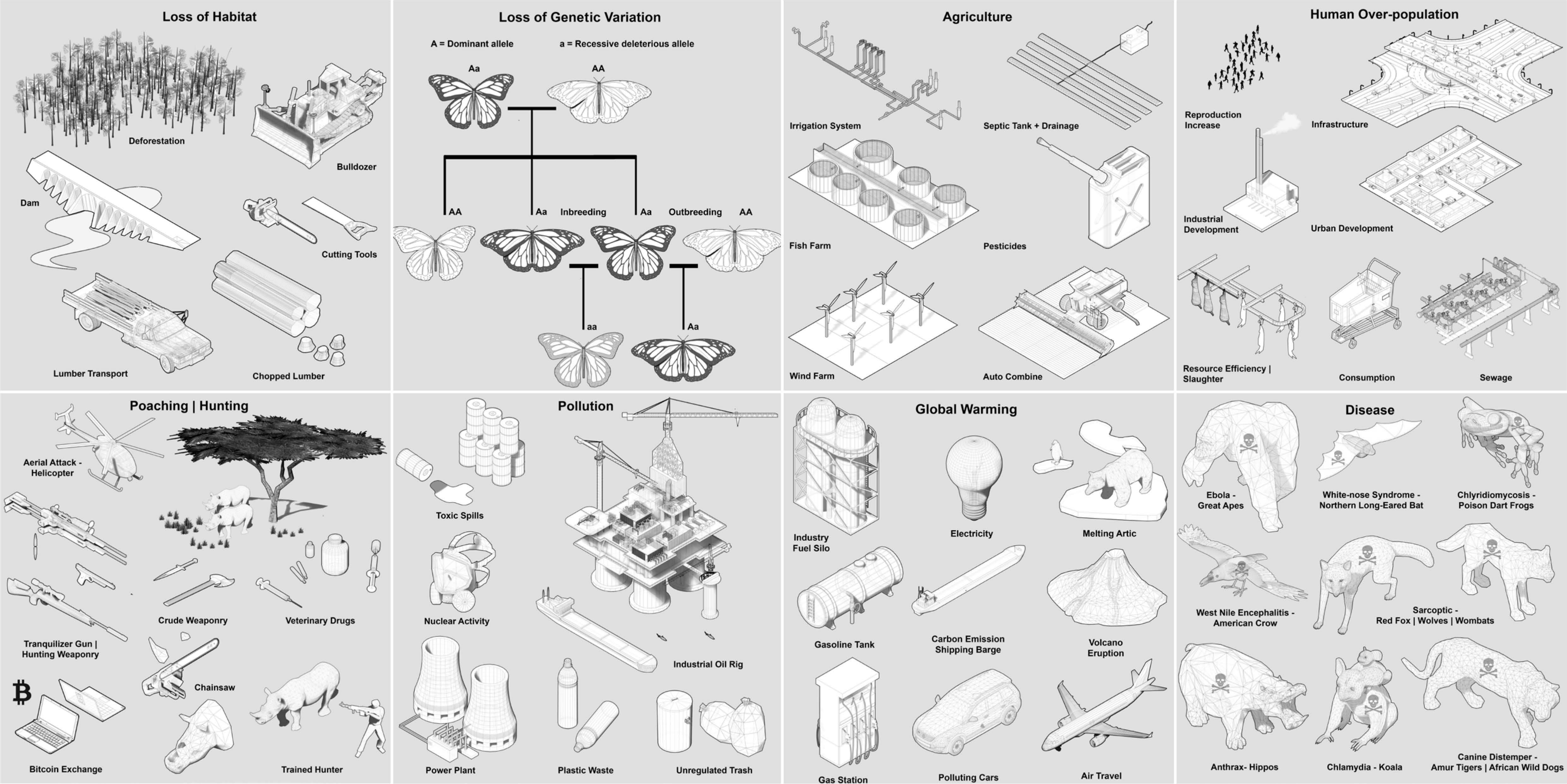
Monbiot, George. 2015. Feral: Rewilding the Land, the Sea, and Human Life. Chicago: The University of Chicago Press.

Schilthuizen, Menno. 2019. Darwin Comes to Town: How the Urban Jungle Drives Evolution. London: Quercus.

Tree, Isabella. 2019. Wilding: The Return of Nature to a British Farm. London: Picador.

Weisser, Wolfgang and Hauck, Thomas. "Animal-Aided Design – Using a species' life-cycle to improve open space planning and conservation in cities and elsewhere." bioRxiv. 2017 – biorxiv.org. (preprint article)

Wilson, Edward O. 2017. Half-Earth: Our Planets Fight for Life. New York: Liveright.


Loss of Habitat
Deforestation
Bulldozer
Dam
Cutting Tools
Lumber Transport
Chopped Lumber
Loss of Genetic Variation
A = Dominant allele
a = Recessive deleterious allele
Aa
AA
AA
Aa
Inbreeding
Aa
Outbreeding
AA
aa
Aa
Agriculture
Irrigation System
Septic Tank + Drainage
Fish Farm
Pesticides
Wind Farm
Auto Combine
Human Over-population
Reproduction Increase
Infrastructure
Industrial Development
Urban Development
Resource Efficiency | Slaughter
Consumption
Sewage
Poaching | Hunting
Aerial Attack - Helicopter
Crude Weaponry
Veterinary Drugs
Tranquilizer Gun | Hunting Weaponry
Chainsaw
Bitcoin Exchange
Trained Hunter
Pollution
Toxic Spills
Nuclear Activity
Industrial Oil Rig
Power Plant
Plastic Waste
Unregulated Trash
Global Warming
Industry Fuel Silo
Electricity
Melting Artic
Gasoline Tank
Carbon Emission Shipping Barge
Volcano Eruption
Gas Station
Polluting Cars
Air Travel
Disease
Ebola - Great Apes
White-nose Syndrome - Northern Long-Eared Bat
Chlyridiomycosis - Poison Dart Frogs
West Nile Encephalitis - American Crow
Sarcoptic - Red Fox | Wolves | Wombats
Anthrax- Hippos
Chlamydia - Koala
Canine Distemper - Amur Tigers | African Wild Dogs