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# POST-ANTHROPOCENE PEDAGOGY: CRITICAL SUSTAINABLE DESIGN IN ARCHITECTURE

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# Post-Anthropocene Pedagogy: Critical Sustainable Design in Architecture

## Abstract

Though architectural praxis is preoccupied with the design of an anthropocentric built world, it has only relatively recently been sensitive to its impact on the ecosystems it inevitably engages. Despite claims that architecture as a discipline has overtly integrated sustainability through mandated, accredited curricula and standardized sustainable rating systems, they are readily refuted by the rote methodologies undertaken by students and practitioners alike. Sustainable design is not something memorized and applied generically; however, it is the current paradigm of operation. If architecture students are expected to be creative designers and aware of the ecological impacts of their construction proposals, then conventional architectural pedagogy fails to address this concern specifically through the lens of sustainability. This paper presents an inversion of the conventional, anthropocentric model of architectural pedagogy. Rather than myopically greenwashing their bold building designs through conventional metrics of green rating systems, students were instead asked to design entirely new ecosystems and creatures that would exist in a world after human extinction, a post-anthropocene condition. Instead of designing buildings for humans over a specific timeframe, students instead creatively learned about their ecological impact as they designed creatures that would inevitably exist in a world built upon the detritus and indelible impacts of human civilization. Through a series of examples and student responses, this presentation reaffirms novel ways of inculcating sustainable design thinking without compromising creativity, technical development, and student engagement.

## Introduction

The foundation of knowledge within architectural pedagogy originates primarily within the design studio culture. Unlike other course structures, the studio is an intensive educational environment where students synthesize knowledge from other complimentary courses in a hands-on feedback continuum with professors through design projects. Typically, studio pedagogy involves technical and detailed aspects of architecture, but is increasingly becoming transdisciplinary in nature, as sustainable design becomes an increasingly mandated dimension of contemporary praxis. In response to the rapid effects of global warming giving rise to issues of land degradation, rising sea levels, and extreme climates, humanity can no longer support carbon-intensive buildings which trigger these phenomena (Altomonte 2009). Therefore, architectural pedagogy is expanding its scope and depth of design strategies which reduce energy consumption and promote the preservation of nature. However, these methods within the studio are often oversimplified and mimicked by students, without a holistic understanding of what a sustainable building truly means, causing cascading repercussions for the success of green architecture in the future.

As a response, the development of a post-anthropocenic studio aims to bridge the gap within sustainable education. Through innovative studio structure and assignments, students are tasked to critically research the relationship between the built world and nature through design and estimation of future projections and ecological narratives through patterns of current-day architectural phenomena. By removing the anthropo-centrism of the studio through the context of post-human extinction, students are encouraged to focus on larger built world and natural systems in a transdisciplinary manner through the perspectives of plants, animals, and their evolution to the deteriorating nature of structures. By introducing timescales and analyzing contemporary design decisions., typically steeped in cultural, political, and economic contexts, the studio provides a meaningful perspective of the implications of architecture on the natural world. Through an analysis and comparison with student work, the studio achieves an in-depth understanding of the sustainable field of architecture through the enthusiasm for new worlds, transformed ecologies, and the vanguard of creativity.

## Origins of Sustainable Design and Perspectives

The environmental impact of the built world is increasingly becoming an important aspect of the architectural profession. While buildings contribute to over half of the world's global carbon dioxide emissions, the topic has instigated a series of international design movements which aim to alter the trajectory of architecture to one that reduces its impact on the natural earth. Since the 1970s, this topic has been coined terms such as "environmental design", "ecological design", and most commonly known in the 2000s, "sustainable design" (Hassanpour, Atun, and Ghaderi 2017). Through cultural revolutions that have led to the prominence of more environmentally friendly architecture, designers are faced with the challenge of holistically understanding and executing sustainable strategies so that buildings may function symbiotically with greater ecosystems.

As sustainability and design are inherently connected, the role of the architect is critical. During the insurgence of global warming, standards and regulations are growing to be more rigorous to improve the protection of nature through an influx of research within the field. While the energy efficiency of buildings was once primarily suited for engineering professions, the technical aspects of architecture now turn to the designer, increasing the responsibilities and importance of the role (Altomonte 2008). The development of architectural certifications such as LEED, EnerGuide, and BREEAM provides benchmarks that encourage design firms to set goals for their built projects. Obliging by these guidelines can influence design decisions that pertain to energy and cost saving, support of public or green vehicles, water use efficiency and innovation of sustainable strategies. Alongside, new construction methods and techniques within the building industry are increasing opportunities for designers to spearhead sustainability from perspectives of creative design to technical details (Altomonte 2009). However, as the knowledge of sustainable practices is rapidly expanding, the role of designers is complex. The architectural profession is demanding to be multi-disciplinary.

Sustainability is defined by three focii: environmental, economic, and social (Hassanpour, Atun, and Ghaderi 2017). Within specific geographic locations and other cultural conditions, sustainable design strategies of buildings can vary greatly, and architects are often expected to appropriately integrate them within their projects. Some fundamental principles include efficient HVAC systems, implementation of green space, good ventilation, use of natural materials, and optimal orientation of the building (Williamson, Radford, and Bennetts 2004). It is extremely important for designers to also address the flexibility of space so that projects may adapt well to cultural and social changes in the avoidance of demolition or high-energy renovations. The goal of these sustainable methods focuses on the resilience of buildings which derives from predictions of the future such as understanding climate changes, needs of the context, material degradation, maintenance issues, and more, in conjunction with sustainability. For a building to tackle these strategies, architects often consult professionals from a diverse range of fields such as landscape designers, structural engineers, and those within the building science sector, requiring the design field to be opportunistic for transdisciplinary learning (Khan, Vandevyvere, and Allacker 2013). Designers are also expected to be highly knowledgeable about these concepts on an applicable level through verbal and visual collaboration as well as proficiency in digital tools for accurate modeling and simulation. As the designer is expected to address the complex and multi-faceted topic of sustainability, the education of these practices originates within architectural pedagogy, namely, within the studio.

**Sustainable Design in Architectural Education**

Students today are learning about sustainability as a shared responsibility of designers. Understanding the impact of the construction sector as a large consumer of energy, with architects being a mediator in designing buildings that inevitably affect the built environment (de Gaulmyn and Dupre 2019). Within design studio courses, problem-solving, and design thinking skills are assessed as key outcomes where students create a conceptual response to a design problem. Relevance to modern design problems is entangled with concepts of sustainability such as urban growth, horizontal and vertical, population density, thus leading to topics of housing design such as multi-use residential buildings. Students are also taught about green building technologies that reduce the number of ecological assets needed especially in carbon emissions. This ranges from understanding the carbon impact of building materials to active and passive

technologies. Through understanding active and passive technologies, students are taught the concept of designing a building that delivers the same function with less energy input (de Gaulmyn and Dupre 2019). Multi-story buildings aim at density efficiency, ecological footprint, and energy efficiency.

However, the approach to sustainability within the conventional architectural classroom can give the impression of a conclusive solution to sustainability through only green building technologies and techniques without examining how buildings built before and today are impacting the environment. Students are taught through metrics of the energy saved, the percentage of carbon emissions reduced, but they are not taught to think of the longevity of building life, leading to a 'fast fashion' approach to architecture that effectively "green washes" design with a veneer of ecological sensitivity. While the growing trend of implementing the green technologies, it begs the question of whether the trend is only a visual application of sustainability. It leads to the conclusion that the showcase of greenery and technologies hints at a sustainable design. For example, an excessive use of green roofs within a building development shows a very elegant garden on the rooftop and drapes the overall design with ephemeral qualities, however in the long timescale of the building's life questions the serviceability of the roofs such as the amount of maintenance required to keep the green roof. The label of sustainability in the industry as a measurable standard that is charted to obtain a marketable title. Green certification becomes a decision maker for developers and designers to meet a minimum to become a marketable trait for their buildings (Orr 2014). The idea of certification means that a minimum can be reached without being the most sustainable the building can be. Thus, the concept of sustainability as a cultural and social process adopts to mainly economic needs that are driven by technological inventions where the understanding of environment is skewed from nature's biological perspective.

## Genesis Ecologies of the Post Anthropocene Studio

To bridge the gap between the need to provide sustainable architectural education without falling into the pitfalls of current sustainable studios, the studio examines a three-pronged approach to challenge the students in their designs. By incorporating future projections and timescales, introducing ecological systems, and capitalizing on multi-disciplinary perspectives, the Genesis Ecologies of the Post Anthropocene Studio (GEPA) introduces students to a revolutionary approach to studio education.

### *Future Projections and Timescales*

An important aspect of architecture involves the ability to design for the future. The expected permanence of many architectures often exceeds several decades, with some in use for hundreds of years. This, along with lengthy construction periods, connects buildings inherently with the aspect of time as they must adapt to the impending needs of civilization and changes in the environment (Hemsath 2017). As designers require predictive powers within their work, this perspective of design is often encouraged within architectural studio courses. However, projection of the future is often a weak point within many architectural design studios, especially in consideration of how design decisions of the building will impact natural ecosystems and the world as a whole (Clune 2014). As there is not a strong framework for sustainability within many design pedagogies, the projection is often short-sighted, more of an immediate future, which oversimplifies issues of population density, rising waters, material degradation, and other

issues (Ismail, Keumala, and Dabdoob 2017). The GEPA studio aims to rejuvenate the gap between students and a holistic critical analysis of humanity's way of life and its consequences on the natural world.

To immerse students completely within the concept of time, the studio sets its context deep into the future. The course questions what happens to buildings beyond the extinction of humans and how current systems of civilization may affect the evolution and relationships of the natural living world. Students are presented to critically think and design two futures, namely the apex (Year 2200) (Image 1) and downfall of humanity (Year 4400) (Image 2), and to research how these narratives will develop through the building, human, and ecological scale. Inquiries of the influence of the architect's role within society as a response to social, political, and cultural factors and its impact on the natural earth in relationship with time is a core exploration within the studio. Focusing beyond quickly transferable architectural strategies of the future such as green roofs and living walls (Webster 2008), students are fully engaged with overarching consequences of architecture through research of material deterioration and the role of buildings with living animals and plants, providing a more thorough understanding of the implications designers are responsible for in the phenomenon of catastrophic futures.

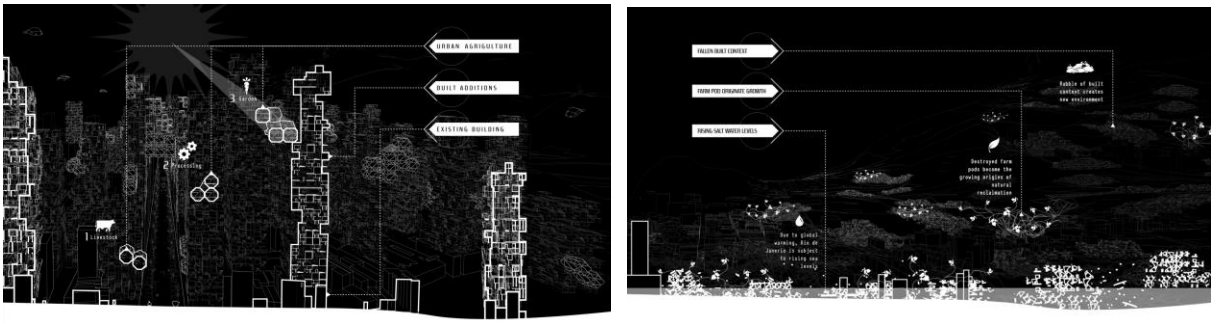


Image 1 & 2: Rio de Janeiro in year 2200 (Apex) and 4400 (Post-Anthropocene).

***Understanding of Ecological Systems***

As students learn to design and contribute to the built environment, the study of surrounding ecosystems is an important role in understanding the relationship between humans and other living organisms ranging from other living animals to plant life. Through understanding the fundamentals of the biosphere within a design project's site, students are given a greater awareness of the plasticity of a living environment and the organization of living systems. Developing an architectural design that conforms to the environment cannot be created through a refined static object, but should consider the complex systems which affect the building and vice versa through the study of ecology (Dinur 2004). The level of site analysis research beyond human functions, such as infrastructure proximity, puts a lens on the whole relationship of buildings and landscape, rather than solely the building itself as conventionally taught in architectural programs.

While the technical nomenclature of biological species and systems becomes convoluted in the identification within studying ecologies, the understanding of life cycles, relationships

between plants, environments, and other animals are the most important aspect in relation to understanding the environment through questioning the past, present, and future impact and contribution of the built environment. The existing process of a living environment should be understood first with the addition of built environments being a major contributor and enactor of a sequence that changes the environment for better or worse (Dinur 2004). Within the Post-Anthropocene studio as a method of teaching architecture, students are asked to research in depth on the past, present, and future conditions of their built environment and utilize the designed creature to explain the impacts of the human-built environment on nature. Moreover, diagrams and analysis of how creature life cycles and food chains have evolved due to the specialized Anthropocene event.

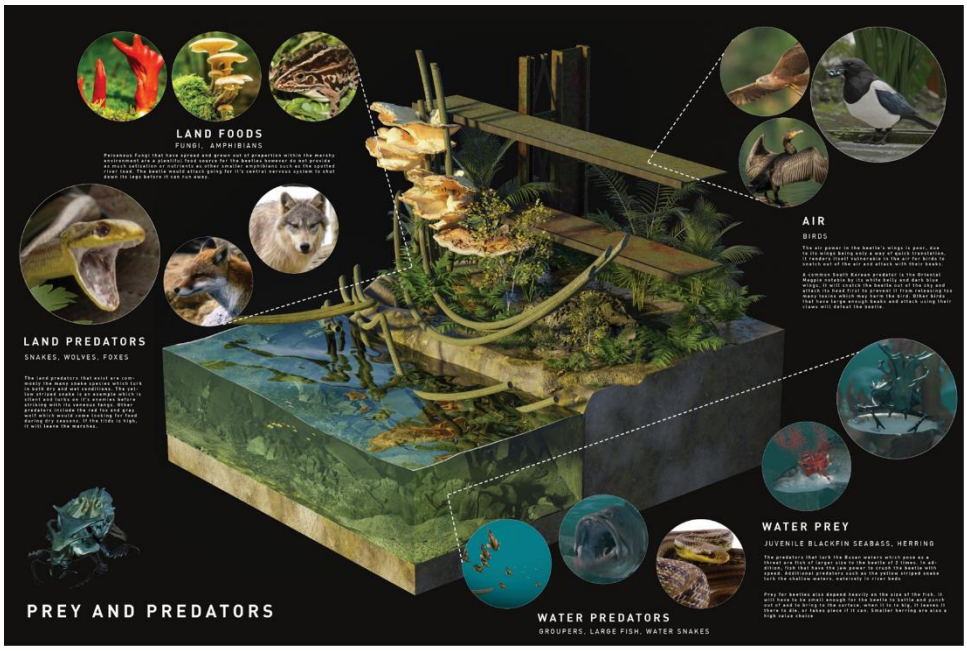

Image 3: Ecological System diagram of the Busan beetle project.

Through the emphasis of ecology in architectural education, designers, architects, and planners can truly integrate the process of nature in reflection to processes of social and cultural behavior in conventional building design (Dinur 2004).

***Multi-disciplinary Perspectives***

As architecture at its core is a collaborative field in practice, it is vital to give architecture students exposure to cross-disciplinary design issues. Where previously architecture studios were designed to encourage inward explorations within the niche of architectural design, there recently emerged a movement to push for outward-facing design studios and challenges (Irizarry, Meadati, and Gheisari 2010; Koo 2012; Spence, Macmillan, and Kirby 2015)

Many architectural studios, especially those dealing with sustainable issues, tend to focus on building- or neighborhood-scale design challenges and solutions. As it is difficult to tackle larger-scale environmental issues at these smaller scopes, these projects tend to become more focused on decreasing emissions and creating more liveable environments. By increasing the

scope of the projects in this studio, students were able to explore more holistic ideas, and possibilities for larger magnitudes of change, thus rendering the projects more conceptual and fantastical.

While many disciplines have significant organic overlaps with architecture in professional practice, biological sciences tend to emerge more subverted (Yedeki Arslan 2014). Although architectural design and construction have direct impacts on biological environments, this studio unceremoniously links impacts of human construction and urbanism with biological systems, introducing this awareness to students and challenging them to research and design within the biological realm, to which they are unfamiliar.

Whether consciously or not, popular culture has a significant impact on architectural design. This studio brings this overlap to the forefront of the design challenges, actively encouraging students to explore films and other media as an explicit step within their design processes. Along with deliverables which ranged from comic strips to movie trailers, that gave students the opportunity to analyze and derive their own meaning and ideas from popular media, the outputs grounded the studio both in the present reality but also removed some of the boundaries that architecture students frequently face when designing – their quest for buildability and realism. By opening the door to more fantastical scenarios seen in film and literature, opportunities emerged for students to engage with more fantastical architectural ideas without being confined to the thinking traps frequently encouraged within architectural pedagogy.

**Resulting Projects**

The GEPA studio has been offered for two semesters, engaging a total of 22 students and producing 29 distinct projects across the terms. The studio encompassed two primary projects; the first was a collaborative exercise in which students established a post-anthropocenic condition within a chosen metropolis, while the second challenged students to design a biological evolution of a creature that inhabits these projective environments.

The studios began with the first project, “In a World”, which required the students to work in teams of three to select a major urban settlement and project the city’s human apex condition in the year 2200 and its ultimate downfall and the end of the Anthropocene for the year 4400. The outcomes of this project are outlined in Table 1. As this assignment encouraged students to examine the future of the built environment from a city-scale, teams jumped on the opportunity to propose a diverse collection of possibilities both from urban design and architectural perspectives.

**Table 1: Comparison for “In a World” Projects**

| City | Issues Tackled | Architectural Solutions | Disciplines Encountered | Imagery |
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| | | | | |
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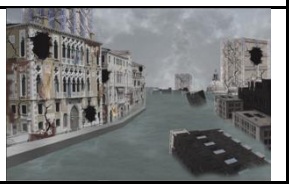
| *Tokyo* | World conflict, nuclear war | Urban framework for nuclear resilience | Political science, Biology, Chemistry |  |
| *Seoul* | Power generation | Towers for the generation of nuclear power throughout the city | Chemistry, Urban Planning |  |
| *San Francisco* | Seismic concerns, Soil degradation, Rising sea levels | Bio-architectural buildings from cross-bread tree species to reinforce existing infrastructure | Biology, Urban planning, City infrastructure |  |
| *Rio di Janeiro* | Deforestation, Animal extinction, Food production | Pod construction for the production and manufacturing of genetically modified food | Biology, Genetics, Food infrastructure |  |
| *Auckland* | Seismic issues, power generation, geothermal power | Urban infrastructure capitalizing on the harnessing of seismic power generation | Geothermal power, Residential architecture |  |
| *Busan* | Air and water pollution, surveillance, urban maintenance | Infrastructure for city-cleaning robot swarms | Political science, Biotechnology, Electronics, Robotics, Bio-mimicry, City waste infrastructure |  |
| *Venice* | Rising sea levels, volcanic activity | Floating residential architecture | Geothermal power, Global warming |  |

The proposals themselves emerged from in-depth research into the cities selected and their unique situations with regards to historical conflict, ecological disaster, and technological advancements. Several of the projects became grounded in environmental concerns or issues plaguing the cities, such as the San Andreas fault and destabilized soil in San Francisco, rising sea levels in Venice, and deforestation in Rio di Janeiro. Several of the projects also examined possibilities of harnessing natural elements such as canals and volcanos for power generation, while others explored the upcoming possibilities of a nuclear power or outright nuclear war.

These large-scale urban issues can uniquely be addressed in such a project via examination of urban-scale, long timescales, and an openness to fantastical solutions.

Projects not only examined exceptional environmental characteristics of metropolises from architectural and design perspectives, but they also proposed the apex urban conditions which specifically responded or capitalized to these issues. For instance, the students working on the city of Aukland proposed an architectural future in which buildings serve to extract and generate energy from geothermal sources. On the other hand, the group engaging San Francisco proposed a future in which the crossbreeding of sequoia trees and strangling figs leads to a bio-infrastructure to support existing buildings against the existing unsteady soil.

The highly successful proposals for this phase of the studio were able to not only ground the apex of architectural development in the city's present concerns and issues, but also address the potential issues or downfalls with such proposals in examining the end of the Anthropocene. These students were challenged to carefully narrate how the human response to the environmental issues in the area lead to a space unsuitable for human inhabitation. In the projects this emerged in many forms, from more biological issues such as the revolt of genetically modified flora and fauna in Rio di Janeiro or the growth of toxic fungal species within the proposed bio-architecture of San Francisco, to environmental tragedies, such as the volcanic eruption in Venice.

Over the course of this project, students were able to clearly engage with a diverse set of knowledge bases to feed their design work, ranging from history to biology to political science to urban planning. This is an uncommon opportunity for architecture students, allowing them to holistically understand the environmental change and issues emerging from the current path of global climate change. Rather than the more typical approach within a studio which examines the isolated emissions and environmental conditions of a particular building or urban block, these projects are able to architecturally tackle large-scale climactic questions.



Figure 4 & 5: Post-Anthropocene Busan (right) and Rio (right).

The next phase of the studio, completed individually, confronted students with the design of a creature inhabiting the post-anthropocenic conditions of their group's metropolis. Each student was assigned a primary habitat, aquatic, terrestrial, or aerial, for their creatures to inhabit. Here students were required to examine the environmental system they designed from an ecological system perspective and examine how an existing animal would evolve and change in order to adapt to such an atmosphere.

The students emerged with a diverse collection of creatures, combining imaginative biological elements and environmental characteristics to design new life forms. Students were required to have the creatures respond to conditions specific to their ecosystems, leading to unique creatures to emerge specific to those environmental conditions. Within the depths of the post-anthropocenic ocean lives the next evolution of the garpike, which camouflages amongst the garbage-filled water to then snap at its predators (Image 6). Meanwhile, the ducts within the abandoned buildings of San Francisco are inhabited by crabs, which evolved to have a symbiotic relationship with glowing fungi, which are abundant in the post-anthropocenic condition (Image 7).

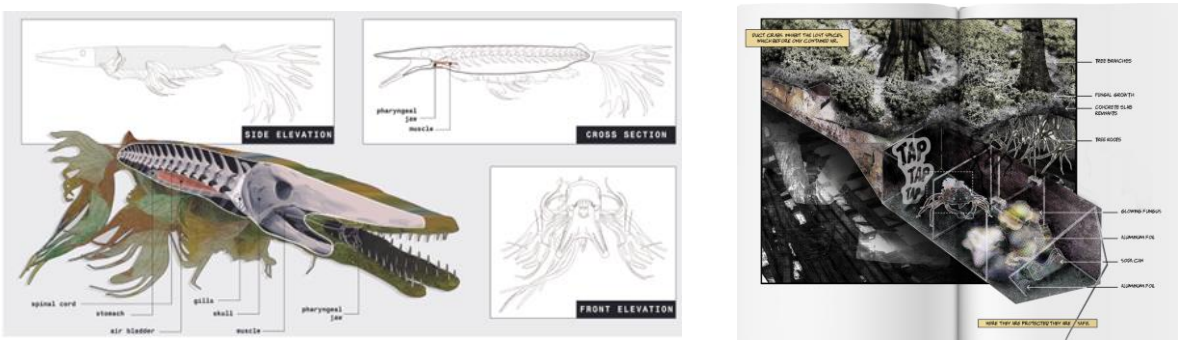



Image 6 & 7: Rio Garpike (left) and San Francisco Crab (right).

Each creature was designed not only in its adult state, but also in their various growth stages, where students were expected to describe how the lifecycle of the creature was also inherently tied to their environment and how the creature's lifestyle in different phases changed and shifted. For many animals explored in the studio, the creatures went through molting or growth processes that involved a number of distinct cycles for the animal (Image 8 & 9). In addition, each group designed a collection of additional creatures that would participate in the ecological chain. Relationships were examined from a systemic perspective, looking at the ecosystem in its entirety. Several of the creatures explored the architectural spaces they occupied and created. For instance, the San Francisco bird was designed to build nests out of the branches of the bio-architecture, while the Rio Rhea assembled nests with concrete rubble remaining from the buildings of the past.

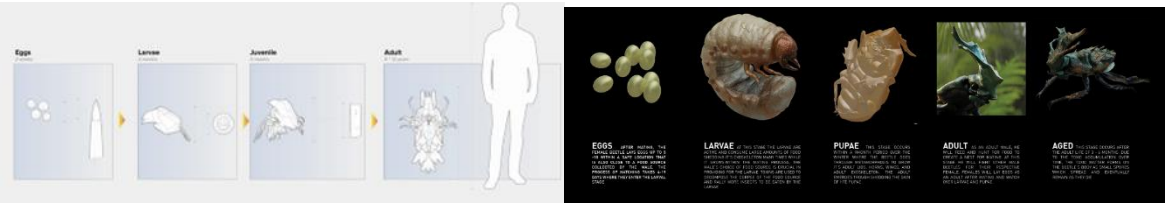



Image 8 & 9: Life cycles and stages of San Francisco's Prawn (left) and Busan Beetle (right).

**Conclusion**

Through the method of the post-Anthropocene studio integrated within core architectural curriculum, the gap within sustainable design education is filled. Students are able to critically research and design the relationship between the natural and built environment. The wider perspective of timescale influence on the built environment emphasizes the impact of built environments on nature's ecosystems, food chains, and existence of animal species. The examination of large-scale natural disasters within the narrative of the studio explores the effects of global warming giving rise to issues of land degradation, rising sea levels, and extreme climates to which students narrate the downfall of infrastructure, social order, to ultimately understand the social, political, and economic systems implanted today. Through student work, the studio offers a holistic approach to sustainable design by addressing fundamental understanding of the cyclic systems that exist in nature and the great impact of the built environment.

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