**Graduation Plan for AE students**

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**Studio**
Name of studio: Architectural Engineering  
Professor: Thijs Asselbergs  
Main Tutor: Tjalling Homans  
1st Teacher (Architecture): Annebergje Snijders  
2nd Teacher (Building Technology): To be announced in P2  
3rd Teacher (Technical Research): Siebe Broesma

**Argumentations of choice of the studio:**
Architectural Engineering studio focuses mainly in the technical aspect of architecture and it has the purpose to encompass elements of other engineering disciplines. In this sense, the studio asks for a technical challenge where engineering principles become an evident contribution to the planning, design and construction of buildings and other structures. By being assessed by teachers in the architecture, building technology and sustainability fields, the studio shows an overall approach that combines theory with a profound sense of technique. This combination will allow to produce not only architectural solutions, but rather buildings with one additional challenge, which is to provide the building with the technical capabilities to perform in favour of the building itself, its surroundings or even the region. The openness and possibilities within the studio to include eco-friendly practices in the architectural and technical approach encouraged me to opt for it. Based on this, my objectives reflect the need to
design and propose a building with an architectonic value, but also with a defined technical and scientific frame that supports its optimal and efficient performance without compromising the environment.

**Title**

**Re-greening Nature**

**Turning negative externalities into opportunities**

**Graduation Project**

**Problem Statement**

The story is getting old, modern man is rapidly exhausting the planet. Not only water or air pollution, but also large areas of rainforest and jungles are burnt each week or leveled with machines for agriculture, cattle or oil extraction purposes. The rate at which jungles and primary forests are being depleted grows every day and we are not only finishing one of the world’s richest natural resources, but we are also threatening the atmosphere. Deforestation accounts for approximately 30 percent of the atmospheric buildup of carbon dioxide over the past century. Furthermore, the rainforest plays an important role in the health of ecological chains of the Earth’s biosphere.

As a general rule, environmental design and engineering, instead of taking part from an early design stage, usually remains as a question of post-design optimization. A way to solve such problem may be found in looking at nature and working architecture along with ecology, where iteratively the design process involves varied relations and mutual modulation between natural forms, natural processes, and natural ecosystems, rooted in the intuitive creative process of architecture, where any result will be measured against life’s principles.

**Context**

The project will take place in the heart of the jungle, in one of the most bio-diverse regions of the world, but also the place where many South American countries gather their wealth, petroleum. Based on the fact that there are already dry oil wells, that the new ones eventually will "dry up" and that extraction companies will probably leave the site, the idea is to take the space left behind and use it to design a building with high environmental value.

Yasuni National Park (Spanish: Parque Nacional Yasuni) holds an area of 9.820 km2 between the Napo and Curaray rivers in Napo and
Pastaza Provinces in the Amazonic region of Ecuador, the oriental part of the country. The national park is primarily rain forest, where amphibian, bird, mammal and vascular plant diversity all reach their maximum levels. The park is about 250 km from Quito and was designated a UNESCO Biosphere Reserve in 1989. It is within the claimed ancestral territory of the Huaorani indigenous people. Yasuni is also home to two uncontacted indigenous tribes, the Tagaeri and the Taromenane.

A few weeks ago the Ecuadorian Government decided to initiate the extraction of oil from the Yasuni ITT, instead of avoiding the emission of 407 million metric tons of Carbon Dioxide (CO2). There is no defined location in the Yasuni Park for constructing the oil well; nevertheless, the building should be suited for wherever the extraction takes place, or in any other locations left behind. The design must incorporate strategies to “recycle” these installations and transform them into an environmental healing installation, instead of a contamination source.

**Technique**

Even though, the natural setting provides a beautiful scenario to work with, the design method should be able to be replicated when necessary in other parts of the country, or the world. The method needed is one that looks to nature as a starting point for inspiration, and brings the natural technology of biology into the work since early stages of design. Biomimicry, being a relatively new design method, is the technique chosen; however, the method should be adjusted to be used as an architectural design aid.

Further on, while akin to a methodology, biomimicry could become a framework intended to help introduce innovative solutions found. If we had to provide a phrase to define Biomimicry, I prefer one of Janine Benyus’ practical ways of understanding biomimicry: “a way of seeking sustainable solutions by borrowing life’s blueprints, chemical recipes, and ecosystems strategies” (Baumeister et al, 2013, 19). However, it is up to the designer to search for the best solutions and implement them in the best possible way.

**Program**

Nowadays the Tiputini Biodiversity Station (TBS), a scientific field research center in the Ecuadorian Amazon, is located on the northern bank of the Tiputini River. The TBS, although separated from the Yasuni National Park by the river, is part of the Yasuni Biosphere Reserve. TBS preserves a tract of 6.5 km² which mostly includes primary non-flooded forest. The Station is privately managed as as a center of education, research and conservation. Although, the TBS is geared towards research and education, touristic activities take place as well.

As stated before, the actual oil extraction activities, plus the discovery of further oil deposits in the region, especially in the Yasuni, has
evidently put the Station at risk. For the Graduation Plan, I propose a Biodiversity Station located at the Yasuni Park by reusing the oil extraction platform to be built. It could work as a complement to the TBS or as a replacement of the same if it were to cease to exist. The program of the Station would be similar to the one in the TBS, which includes as a two-story laboratory as the main building, 9 cabins, a few smaller laboratories, and a cafeteria. Four cabins are for the head researchers and employees that work there full-time, which include 2 beds and a full bath. The other 5 cabins are for additional researchers and student groups that visit; these cabins include bunk beds and a full bath. The Station has a large cafeteria that can comfortably accommodate about 60 individuals.

Since the intention is to provide proper assessment and solutions for environmental degradation after the oil extraction activities conclude, the building’s program should also include laboratories for research and environmental remediation. Finally as an additional end to potential tourism, larger accommodation facilities and an auditorium for communication purposes will be included.

Objective
The main objective of this work is to provide a clear architectural design method towards sustainable buildings. The location and contextual background already sets high objectives for such building, proposing to reuse an existing abandoned oil well space and infrastructures left behind, and turn them into a center for education, research and conservation and, further on, into a healing installation, with the intention to fall into the category of regenerative design, one step further from sustainable design (Michael Pawlyn, 2011, 118).

Technical Research Question
How can the use of biomimicry and environmentally friendly materials and construction systems contribute to turn an abandoned oil well from the Ecuadorian jungle into a center of education, research and conservation in the Amazon basin, while helping regenerating the rainforest?

Sub questions
- Indentify and establish a framework of practices to translate biology to architecture.
- Which nature’s solutions are to emulate for rainforest to regenerate?
- Which nature’s solutions can be useful to aid fit the building within life's criteria, in terms of climate control?

Methodologies
Literature study: This methodology requires gathering relevant data from specified documents and compiling databases in order to analyze the material and arrive at a more complete understanding of an oil well installation and how geothermal energy can be generated. This methodology will also provide the means to evaluate the best type of constructions for the rain forest in Ecuador and the
type of materials to be utilized.

**Collection, Organization and Analysis of Data:** Data collection consist on a rational organization of information gathered, internet posts, journal logs and any other multimedia source with regards to the use/further development of the technology. Also, this method will aid in establishing the boundary conditions for the design in the proposed context.

**Reference analysis:** This method is used mainly to evaluate and review a reference project in order to establish trends and the best practices when approaching similar problems. This process will be used principally to study the nature of selected buildings, determining its essential features and how can that be of relevance to the design.

**Research by design:** Known as a non-traditional form of research, the art/practice based research is an eminent exploratory practice within the traditional model of academic research. Nevertheless, the limitations of this type of research must be taken into account, such as incommensurability with traditional results and the lack of shared definition of scientific criteria. Therefore, this type of technique can be used as a way of forming and testing hypothesis.

**Planning**

**Appendix B**

**Relevance**

Sustainable architecture, in the past decades, has been a crucial turn in our effort to thrive, however, creating buildings that do less harm is not good enough, we must move forward. We need to design, build and operate buildings that actually do more good, by being part of the natural cycles that keeps life renewing. I guess, that’s where regenerative design comes in.

The Amazon’s basin owns several vast and extent areas with rain forest that are considered one of the most bio diverse regions of the world. These regions need to be controlled and studied, but for that, infrastructure is needed. The potential for these places to provide medicines and solutions for modern world problems are high. Preserving and keeping them healthy has to be our priority.

On the other hand, oil wells will become the scars that the industrial world would leave behind in order to obtain fossil fuels to power its machines. These scars could remain closed as milestones to remember us the destructive power of men to satiate their modern needs, or, they could become places where man could reconnect again with nature, while learning from her. By reversing any ecological damage, further exploration and studies into one the earth’s most precious natural patrimony would be possible.
Literature

Primary sources:


Articles and presentations:

- Christoph Kleineidam, C; Ernst, R; Roces, F., Wind-induced ventilation of the giant nests of the leaf-cutting ant Atta vollenweideri, 2001, Springer-Verlag, Naturwissenschaften, 88, pages 301–305.
- Putz F. E. and Holbrook, N. M., Strangler fig rooting habits and nutrient relations in the llanos of Venezuela, 1989, Amer. J. Bot. 76(6), pages 781-788.
- Nadkami, N. M., Epiphyte biomass and nutrient capital of a neotropical elfin forest, Biotropica 16(4), pag. 249-256.

**Internet sources:**

Appendix A
## Appendix B

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