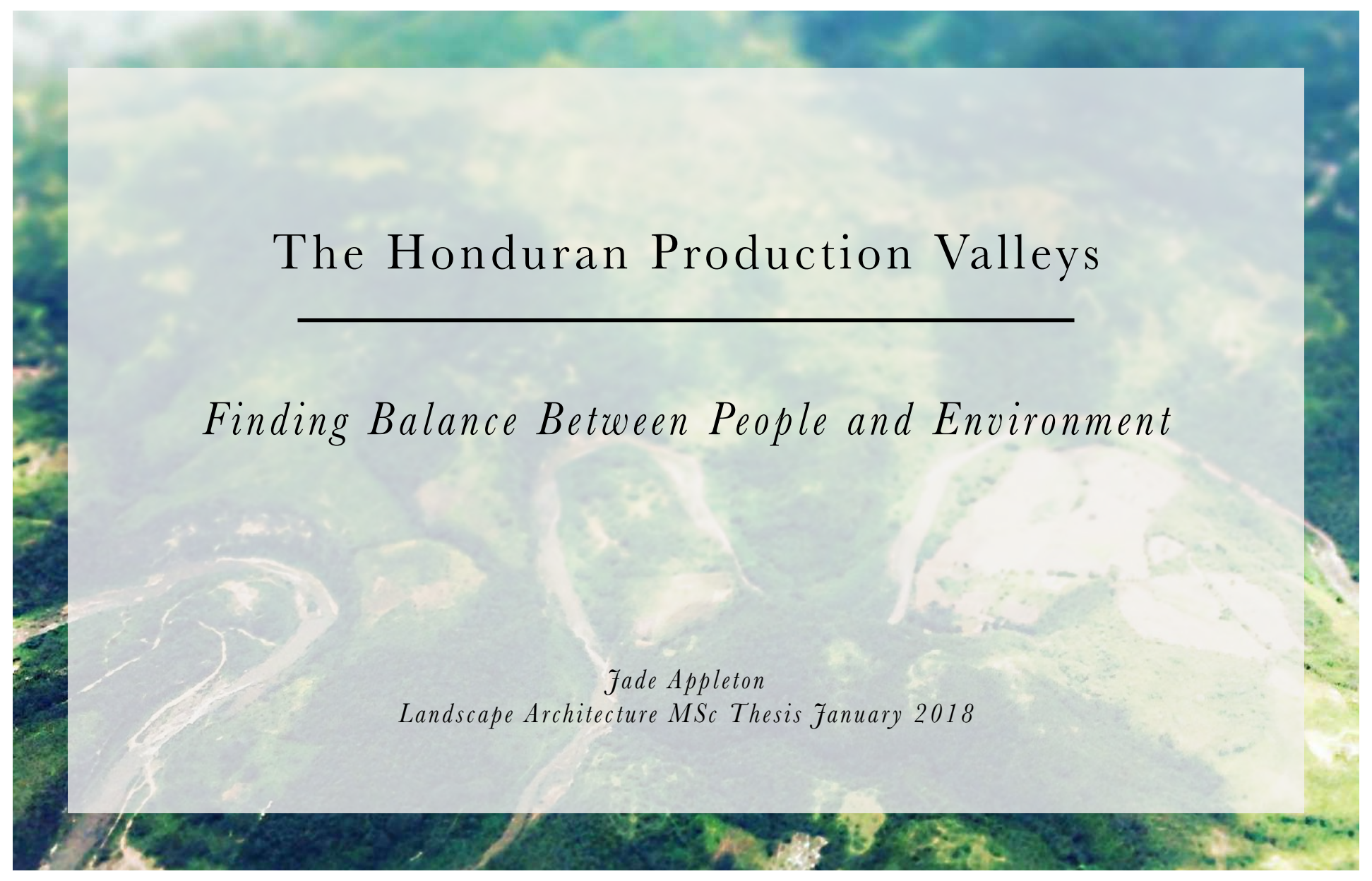

The Honduran Production Valleys

Finding Balance Between People and Environment

Jade Appleton

Landscape Architecture MSc Thesis January 2018

Planbureau voor de Leefomgeving

TU Delft Delft University of Technology

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Master Thesis
The Honduran Production Valleys:
Finding Balance Between People and Environment
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January 2018

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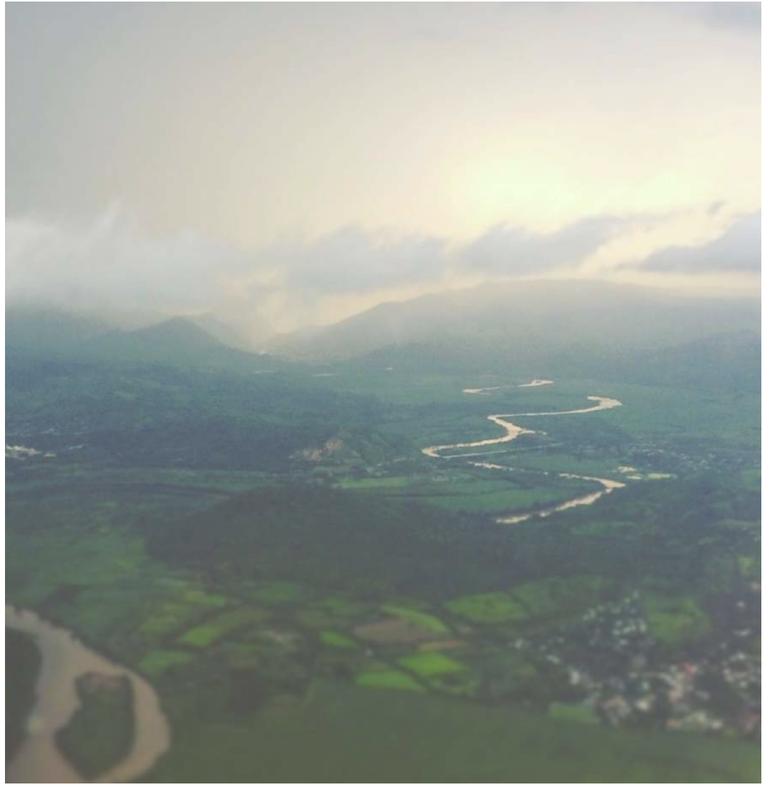

Contents

Acknowledgements

The following work is result of my Master Graduation project in Landscape Architecture at Delft University of Technology.

I would like to thank the PBL for the opportunity of an internship during the beginning of my thesis work. As well as being a great footing for my continued individual thesis work, it gave me great insight into the possibilities and applications of Landscape Architecture in the world outside of my studies. I would like to give thanks to ALexandra Tisma for her kindness and guidance during this period.

I would also like to give huge thanks to my mentors, firstly being Inge Bobbink, whom guided me through the whole project. It was always a joy to talk with you and discuss the project, and your valuable advice constantly pushed my work to new levels. Secondly, my gratitute goes toward Luisa Calabrese whose optimism and energy always bought be back to excitement to this project and whose advice was always so helpful.

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Fascination

Whilst agricultural landscapes are products of the local ecosystem, and community in which they are situated, they are increasingly becoming affected by the same global issues and converging under the dynamics of globalisation[1]. The main global issues being the inevitable population growth and consequential worldwide food insecurity. How we spatially manage this growth in consideration of population and agricultural production is very prominent an issue faced by landscape architects and the future plans for land use; it is an issue which is uniting our landscapes globally. But intriguing to myself is the connection between the people who live in these landscapes and the global context to which they are being defined.

This curiosity has followed me through my studies. Starting in that of architecture it was always a question, to me, of our potential as architects and potential influence over problems socially, economically and environmentally. Curious to see the potential, I pursued a masters in urbanism, in effort to see the bigger role of the architect within the city. However this only questioned our being within the man-made world, and it was a question of our growth within the environment, and our cultural relation to nature which I was more fascinated. What is our position toward global issues such as resource management, social aspects in a country and economic stability of people, and how can we spatially design to influence this. Naturally, this led me into the study of Landscape Architecture, the field which has led me to writing this thesis.

It was such that the opportunity to work at the PBL was so intriguing, to learn more about other landscapes which are being pulled by agendas globally. This project has bought insight to myself of the role played by the profession of landscape architecture in such projects which question the globalising landscape and our influence over human growth and climate change. I hope the work produced can add to the dialogue of this topic.

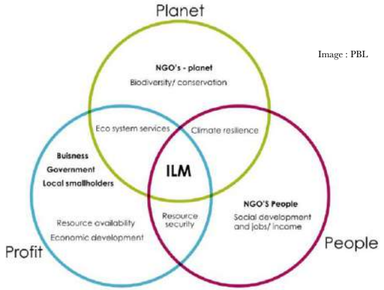
How can the Landscape Approach provoke a spatial design in the Northern coastline of Honduras to create a future sustainable environment, accounting for the area's landscape values?

Abstract

This thesis initiated from a project worked on in conjunction with the PBL, the Environmental Agency of the Netherlands. The project, with PBL, follows three case studies of landscapes to research the implementation of the landscape approach for reaching the new framework of sustainable development goals, developed at the 2015 climate change talks. The landscape approach uses integrated landscape management (ILM) to attempt to achieve these SDG's. This is with the integration of all the varying stakeholders on the landscape level to address global challenges. ILM addresses the planet and environment, economic stability and governmental agendas as well as social development. It addresses all the stakeholders in the scope of the place, for agreed management of future landscape development.

The landscapes researched were firstly the Northern Coastline of Honduras, secondly the Atewa Range in Ghana and thirdly the Ihelmi Cluster in Tanzania, all three with challenging land use issues by numerous actors, both locally and globally.

This thesis has come as follow up to the research, by choosing one of the landscapes; that being the Northern Coastline of Honduras. As addition to the research done on the landscape, the thesis will result in a spatial landscape design which hopes to bring the research learnt of Honduras, and knowledge gained from using the landscape approach as methodology, into a reality.



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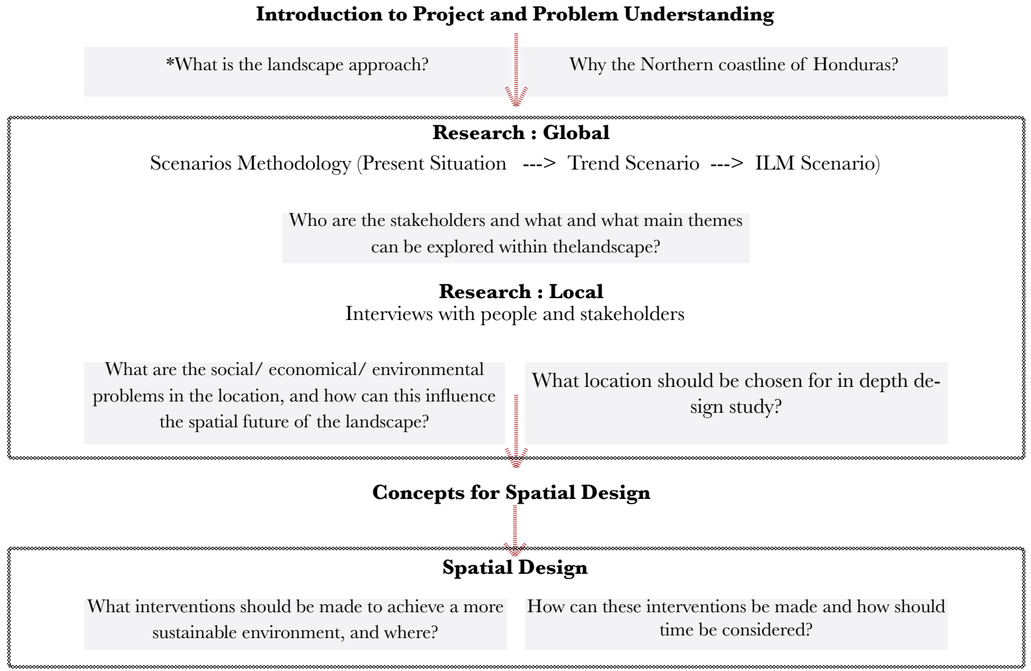
Introduction to the Project



Introduction

This project is worked on in conjunction with the PBL, the Environmental Agency of the Netherlands. The project researches a series of landscape case studies in three countries. The projects aims to research the implementation of the landscape approach in reaching the Sustainable Development Goals (SDGs); by minimising tradeoffs and maximising synergies between stakeholders in the differing landscapes. The project researches the potential use of spatially explicit modelling and scenario tools to help inform stakeholders in large landscape initiatives about the results of land-use management to achieve multiple SDGs[2].

Because landscapes are coupled socio-ecological systems, complexity and change are inherent properties that require management. A landscape approach is a long-term collaboration among different groups of land managers and stakeholders to achieve the multiple objectives required from the landscape. These typically include agricultural production, provision of ecosystem services (such as water flow regulation and quality, pollination, climate change mitigation and adaptation, cultural values); protection of biodiversity, landscape beauty, identity and recreation value; and local livelihoods, human health and well-being. Stakeholders seek to solve shared problems or capitalise on new opportunities that reduce trade-offs and strengthen synergies among different landscape objectives.

The project explores three different landscapes under threat: the Northern Coastline of Honduras, The Attewa Range and Accra City in Ghana, and the Ihelmi Cluster in Tanzania.

Members of the project at the PBL tackled land-use questions using large software systems such as CLUmondo. Adding in varying frameworks into the program, and generating potential land use maps at the end. These maps could then be analysed for guidance with the targeted SDG's. My role within the internship was to visualise more of the local scale of such scenarios for view of the landscape on a more human level, and to add visual ideas to the stakeholders with the large mapping, for the encouragement of dialogue amongst the stakeholders.

The case study of Honduras was the first case study of research as well as the project I researched the most. As such I decided to take this research for continuation into my thesis. The research conducted in the project looked at the larger scale potentials for land use in the area and stimulating discussion amongst stakeholders for possible synergies. However what was not addressed in the research was concrete ideas as to interventions to create the possible ideas for the future. As the research was conducted with many different inputs, I thought it interesting to continue as a project for potential realisation of the research.

As predicted by the UN, the world's population by the year 2100 will be between 9.5 and 13.3 billion. In accordance to the average American with a food footprint of 1.4 hectares, 93% of the world's surface would be needed for a '2100 middle class world'. This seems not to account for technological development in food production, which is likely to happen, but still affective illustration of the issue of global food security; space for production is a serious issue which landscape architects need to discuss. As such there is a large amount of pressure on rural areas and the agricultural industry for future development; with huge consequences on the environment and our spatial landscape.

Honduras is prime example of a landscape largely affected by our consumption habits. It is a landscape which has been defined by the monopolisation of agriculture. The rich landscape of Honduras has been historically monopolised by corporations for agricultural exports. Historically known as the banana republic, the landscape is again being transformed into a new monopoly, this time with the growth of Palm Oil.

Since 2000, oil palm production in Honduras has more than tripled[4], as has the area under cultivation and currently, Honduras is the largest palm oil producer in Central America and a player in the global market. Because palm oil production is an important source of economic development and income generation, many stakeholders in the landscape would like to see production increase sustainably. The rapid expansion of the crop has led to encroachment onto critical habitats and protected areas, as well as unsuitable terrain, such as steep slopes. This has led to soil degradation, deforestation, decrease in water quality and quantity, degradation of fragile ecosystems, and threats to biodiversity[5].

Sustainable management of watersheds to provide clean and sufficient water, prevent erosion and pollution, and support irrigation remains a challenge in the region. Expansion of oil palm onto slopes has degraded hydrologically sensitive recharge sites and watersheds and caused erosion and runoff into streams and rivers. Likewise, deforestation caused by over extraction of timber and agricultural expansion affects water quality and availability downstream. Water scarcity has been an issue that has affected the availability of water for irrigation and for the population in the Valle de Sula, particularly during drought conditions and dry months. While legislation exists to regulate the management of natural resources, such as preserving vegetative cover on riverbanks and point and non-point source pollution, government institutions lack the human and financial resources to effectively implement them. Improved management of hydrological resources will be necessary to ensure that the adequate quantity and quality of water is available both for human and agricultural needs.

As a coastal region, the landscape is vulnerable to hurricanes, flooding, and drought. In recent years, the landscape has experienced lower rainfall levels and an extended dry season; but also extreme flooding in the valleys. These vulnerabilities particularly affect the agriculture sector, and farmers who rely primarily on agriculture for their livelihood:

lower rainfall causes a strain on valuable water resources, whereas flooding can damage crops. Better management of natural resources, particularly water and vegetation cover, can help mitigate these risks. Likewise, extreme weather events, such as hurricanes, are a threat.

Many biodiversity rich ecosystems that provide a host of services are located in the Caribbean coast of Honduras. An important proportion of the mountains and hills in this area are still covered by tropical humid forests, while mangrove and coastal lagoon ecosystems can be found in and near the shore line. However, land use change, slash and burn agriculture and deforestation continue to threaten these ecosystems, endangering the wellbeing of the rural, resource-poor population that depends on this environment and the health of the marine ecosystems that are affected by the pressures inflicted upstream. With 32% of the landscape under cultivation by agro industrial actors and impoverished rural populations that are vulnerable to the effects of climate change and associated threats to food security, agriculture is both a central challenge and a key opportunity to more sustainable resource management. Balancing biodiversity conservation, agricultural production and livelihood enhancement requires an integrated approach to development in Northern Coast of Honduras[7].

Looking toward the future, there is ambition to double the production of palm oil within the next 15 years. This economic attractiveness of this industry is causing the expansion of palm oil plantations into areas that are used for food production and are either conflicting with RSPO guidelines or are becoming less or even unsuitable due to the effects of climate change.

Also to consider is the population growth, by 2030 there is to be an additional one million people. In 2016, the rural poverty index was 67%, with 56% in extreme poverty and 31% living on less than $1/day. Currently, 19% of the population under 5 years old is malnourished. Much of the rural population depends on agriculture for their livelihoods, with their income vulnerable to market price fluctuations, pests and diseases, and abnormal weather conditions due to climate change. With added population a question of stopping the poverty is also at question[9].

The northern coastline of Honduras is prime example of a landscape largely affected by global consumption habits. It is a landscape which has been defined by the globalisation of landscape and spatially through the monopolisation of agriculture. Such a landscape which is being so defined by actors internationally should also be considered in its unique qualities for the people who live there and its role outside of economic potential but social and environmental. For Bunge, the discipline of geography should be engaged in the radically democratic project of providing pedagogical resources to enable suppressed and exploited communities to manage for themselves, to facilitate flourishing geographical lives. I hope this thesis can lead toward spatial design which can realise the local context in a globalising landscape[10].

Location

The project location is that of Honduras, this is a small country in Central America, bordering the Caribbean Sea and Pacific Ocean. In terms of scale, this country is about double the size of the Netherlands, but with about half of the population.

Looking at the country closer the capital is Tegucigalpa, in the south of the country. The city, among others surrounding, developed through mining in the mountainous landscape. The edges of the country were shaped by the rivers which run from the mountains to the surrounding seas. They are defined by large flat river plains of rich and fertile soils, and as such developed through a more agricultural industry. San Pedro Sula being the largest city in this area, the industrial city of Honduras, which grew from the exporting of goods mainly north to the US.

Banana Exports to the USA

Puerto Cortès
The city grew rapidly in the twentieth century, thanks to the then railroad, and banana production. The seaport is the largest in Central America.

San Pedro Sula
Identified as the industrial centre of Honduras. The city developed through funding by banana corporations for exports to the USA. This was the agricultural centre for trade from the rural agricultural communities.

Tegucigalpa,
The Capital of Honduras. The city initiated as a mining city, it is now the economic and political centre of the country.

Mountaineous areas with communities developing around mining

River plains where agriculture defined the communities and later the infrastruture from foreign corporations for exporting of goods.

History

Large companies have, through the 19th and 20th century, exploited the rich valley landscapes for agricultural goods. The rich soil and climate aiding growth of specifc crops which were wanted for exportation.

The main crop which defined this era was the banana; Honduras was known as the first banana republic.

In the 21st century however, a new crop is defining the monopolised landscape; Palm Oil.

The Northern Valley plains have suffered this monopolisation of agriculture; and is the area for the research.

1899
First banana concession granted to the Vaccaro Brothers. Later to be the Standard Fruit Company. (USA owned)

1912
Construction of Tela railroad by Standard Fruit Company. These "golden" exports were supported by more than US$40 million of specialized banana company investment in the Honduran infrastructure

1913 - 1929
Between 1913 and 1929, its agricultural exports rose from US$3 million (US$2 million from bananas) to US$25 million (US$21 million from bananas).

1917
Labour strike against Cuyamel fruit company

1927
African Oil Palm was first introduced to Honduras in 1927

Post 1950's
Honduran governments encouraged agricultural modernisation. As a result of these improvements and the strong international export prices—beef, cotton, and coffee became significant export products for the first time. Honduran sugar, timber, and tobacco also were exported, and by 1960 bananas had declined to a more modest share (45 percent) of total exports.

1960's
Industrial growth was stimulated by the establishment of the Central American Common Market

1970's
There were 11,000 hectares of Palm Oil planted throughout the northern part of the country.

1998 - 2000
Hurricane Mitch wiped out most banana crop.
By 2000 crop had been bought back to 57% of pre-Mitch levels.

2006
The Honduran government launched a five year program to promote the use of agrifuels with the aim of expanding the total cultivation area of Palm Oil from 84,000 hectares to 200,000 hectares

From Bananas....

To Palm Oil

Palm Oil Agriculture

50 % of our supermarket products, processed foods, as well as beauty products, contain palm oil. It is an inherent product to our modern lives.

This crop is affecting many landscapes across the globe; as can be seen in the map to the right. The growth of the product is so influenced by the more western way of living where it is imported to.

Globally the industry employs about 6 million people, and makes tens of billions in revenue.

With such high need for the product, and its great impct in the economic market; growth of palm oil is only increasing.

This research concerns the landscapes which are impacted by this large scale problem.

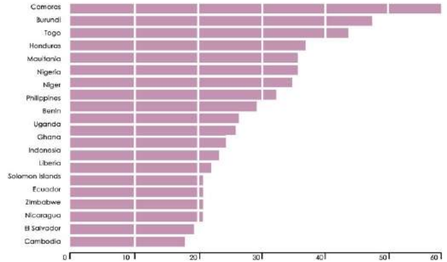
Map of Palm Oil imports vs exports

Above: Palm Oil in the Honduran landscape
Below: Products reliant on the crop

Impact of Palm Oil

Environmentally, palm oil is destructing landscapes. Deforestation is wiping out land ready for agricultural use for more palm oil, and destructing the biodiversity which is lying in its path. This deforestation is not only a cause for present loss of biodiversity but in the larger context, a massive cause to global warming. There is a lot of carbon stored in these precious tropical forests that get released with deforestation.

As well as environmentally, it is causing a mass upheaval socially for the nationals, who are fighting over land rights and the right to their land. Corporations are moving indigeneous people from their land to make room for more palm oil. Many local environmentalists have been killed in aid of this cause.



PERCENTAGE FOREST LOSS, 1990 - 2005

https://earthobservatory.nasa.gov/Features/Deforestation/deforestation_update3.php

Expansion of the crop is destroying environments and biodiversity

Socially, the crop is causing upheaval to the indigenwous people

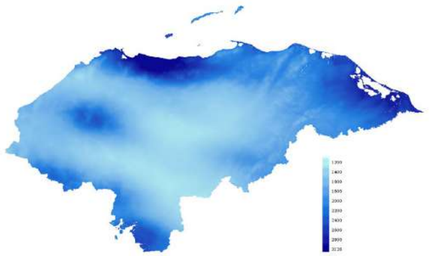
African Palm: Elaeis Guineensis

The palm oil tree; African Palm, or Elaeis Guineensis. It is native to west and southwest Africa, specifically the area between Angola and the Gambia. Oil palms are able to produce fruit for harvest within 4 to 6 years of planting, if fertilised well. Life expectancy is 28 to 30 years on average, at which point they are usually 40 feet / 12 metres high.

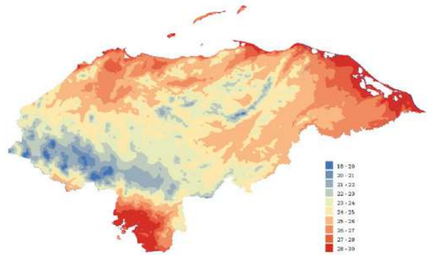
It is their fruits that contain the oil kernal in which we so relay on. As shown in the right hand image. The rest of the fruit material can be used for biogas fuel.

It terms of trees, the palm oil is in fact one of the most productive, in comparison to other oil seed of soybean or canola, which is why it is becoming such a monopoly.

The northern coastline of Honduras is unique in tropical climate which is perfect for the groth of the crop.

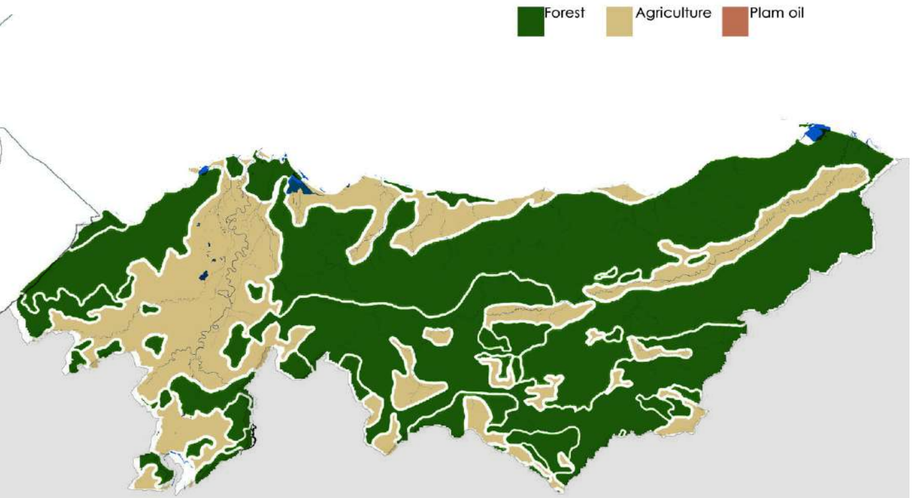


Annual Precipitation (mm)
http://hidro.sinia.gob.hn/



Annual Temperature (degrees C)
http://hidro.sinia.gob.hn/

Land use 1960

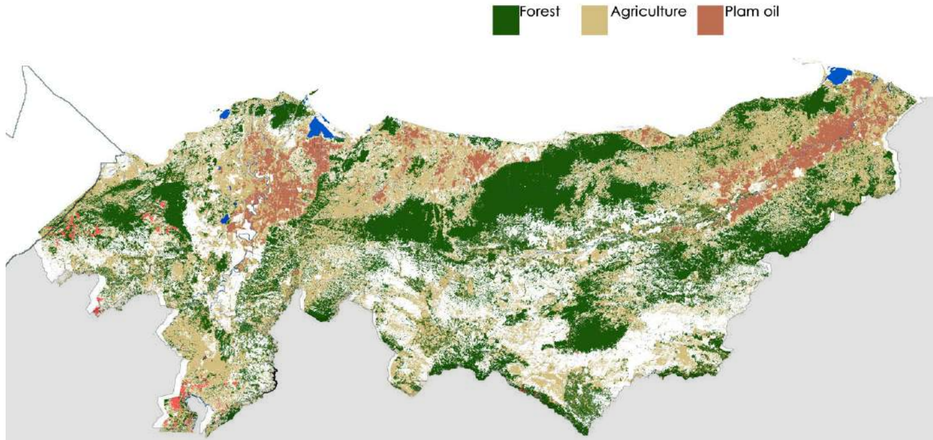


Looking at land use maps from the 1960s, on the left, to the most recent recorded from 2014, on the right. The map from 1960, although in less detail shows the basic comparison of agricultural to natural landscape.

Source: PBL

Land use 2014

The land use map from 2014 has seen a dramatic change in land use. There has been huge increase in deforestation and for agricultural land, and much of which has been turned into palm oil agriculture.



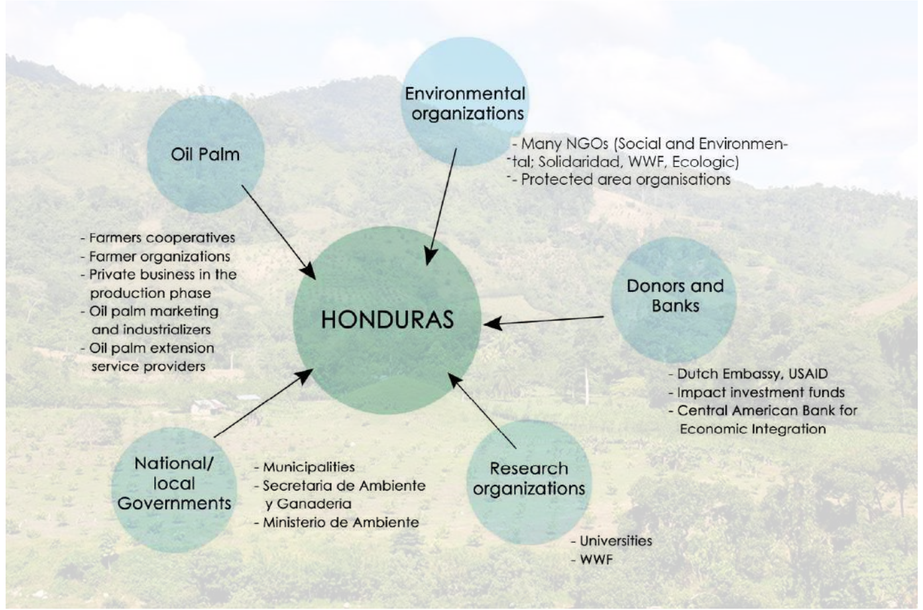
Source: PBL

The Landscape Approach

With a growing world population and a related growing demand for food and other resources, there is an ever increasing pressure on natural resources and climate. So the question is, what is the future landscape for Honduras. The landscape faces these common global problems as well as the undergoing rapid expansion of Palm Oil agriculture.

The landscape approach looks at competing claims from a large variety of stakeholders converging on a landscape level. When individually addressed, the approaches taken to reach these goals could have negative tradeoffs. The idea of landscape approaches is to find cross-sectoral solutions. The landscape approach aims to contribute to sustainable development by supporting economic and social development combined with local biodiversity conservation, in which biodiversity is regarded as a basic element for sustainable growth.

The right image illustrates the varyig stakeholders whom were considered and used in discussions of the landscape.



Introduction to Project and Problem Understanding

*What is the landscape approach?

Why the Northern coastline of Honduras?

1. Research : Location

2. Research : Global

Scenarios Methodology (Present Situation ---> Trend Scenario ---> ILM Scenario)

Who are the stakeholders and what and what main themes can be explored within thelandscape?

3. Research : Local

Interviews with people and stakeholders

What are the social/ economical/ environmental problems in the location, and how can this influence the spatial future of the landscape?

What location should be chosen for in depth design study?

Concepts for Spatial Design

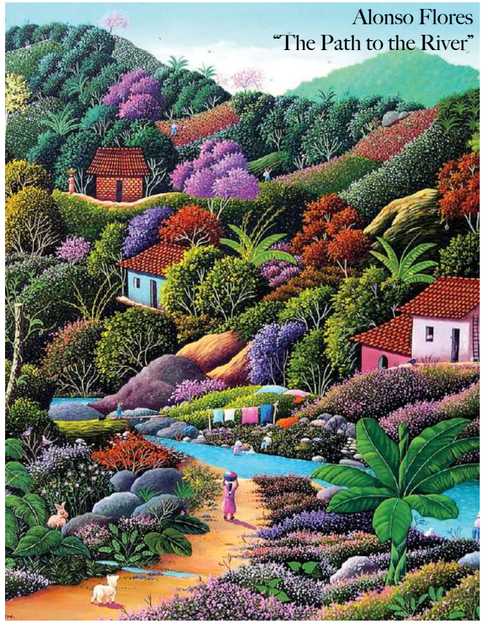
Spatial Design

What interventions should be made to achieve a more sustainable environment, and where?

How can these interventions be made and how should time be considered?

How can the Landscape Approach provoke a spatial design in the Northern coastline of Honduras to create a future sustainable environment, accounting for the area's landscape values?

Research



Alonso Flores
"The Path to the River"

The Landscape: Past and Present

To understand the future of the landscape, I looked at it in its' past and present. Landscape paintings depict a traditional sense of the landscape, in its rich and diverse landscape centered around these rivers and rural agricultural life.

The present landscape however shows a different Honduras. Colonisations and exploitation has defined the recent history. All too often, the government's main interest in the country's economy leads them to allow corporations to take the land owned by indigenous peoples for their own financial benefit.

With plantations systematically destroying the rainforest land that the local people depend on, communities are continuously finding themselves with no choice but to become plantation workers. Faced with poor and degrading working conditions, some earn barely enough income to survive and support their families. Instead of being able to sustain themselves, indigenous communities become reliant on the palm oil industry for their income and survival, leaving these villagers incredibly vulnerable to the world market price of palm oil which they have no control over.

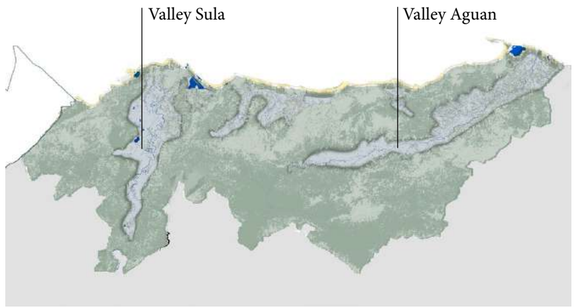
The traditional rural lifes in Honduras have severely changed from this idlyic paintings of the landscape.

The country is extremely catholic and conservative, these iconic churches are found in most villages.

Much of the rural areas jobs are agricultural and there is much poverty in these areas.

The northern coast is the most indigenous and rural. They depict the rural life of the country.

Problems in the country are gangs and problems with drugs, causing much violence.



Coastal Landscape

River Plain Landscape

Mountaineous Landscape

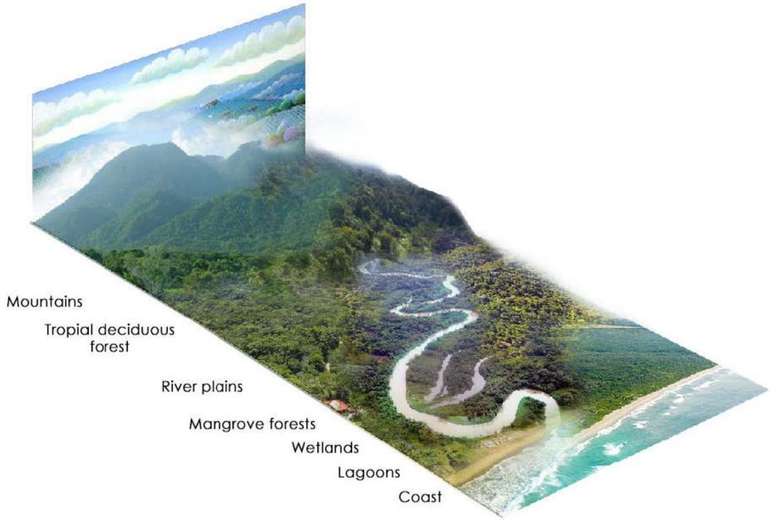
The Landscape: Past and Present

There are three main landscape types which make up this area: being the mountainous landscape which is mainly forested, the large river plains where the agriculture is very present, and the northern coastal landscape, bordering the Caribbean Sea.

Within this landscape, are a hybrid of specific landscape types which house much biodiversity. Honduras is considered a hot spot of biodiversity. Due to its geographical location which converges on tropical and subtropical ecosystems, Honduras possesses a high degree of diversity of terrestrial, marine and coastal and freshwater biological resources.

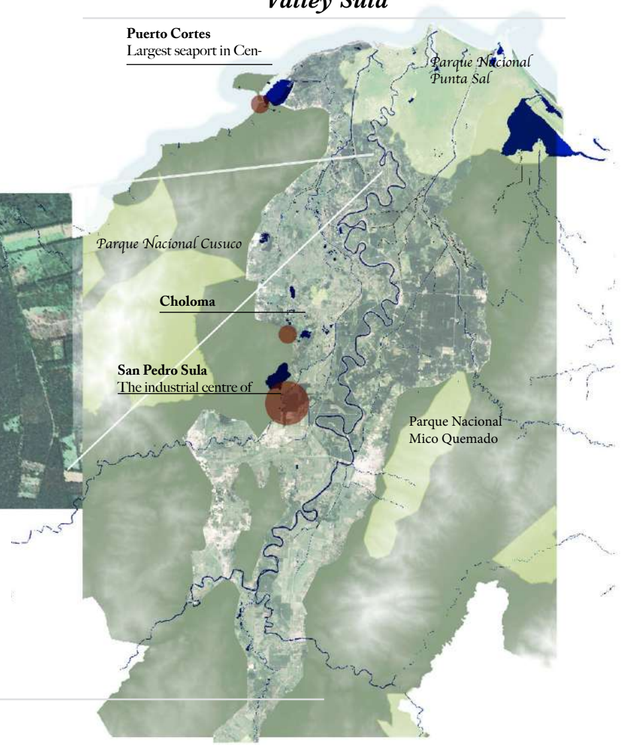
The following pages research the two larger valleys in the project location: the Valley Sula and the Valley Aguan.

The vast majority of palm oil production is based in this 'Zona Litoral del Norte' or 'Northern Littoral Zone,' an area comprised of the Ulua, Chamelecon and Aguan river watersheds, which together compromise 135,000 ha and drain directly into the Caribbean Sea.



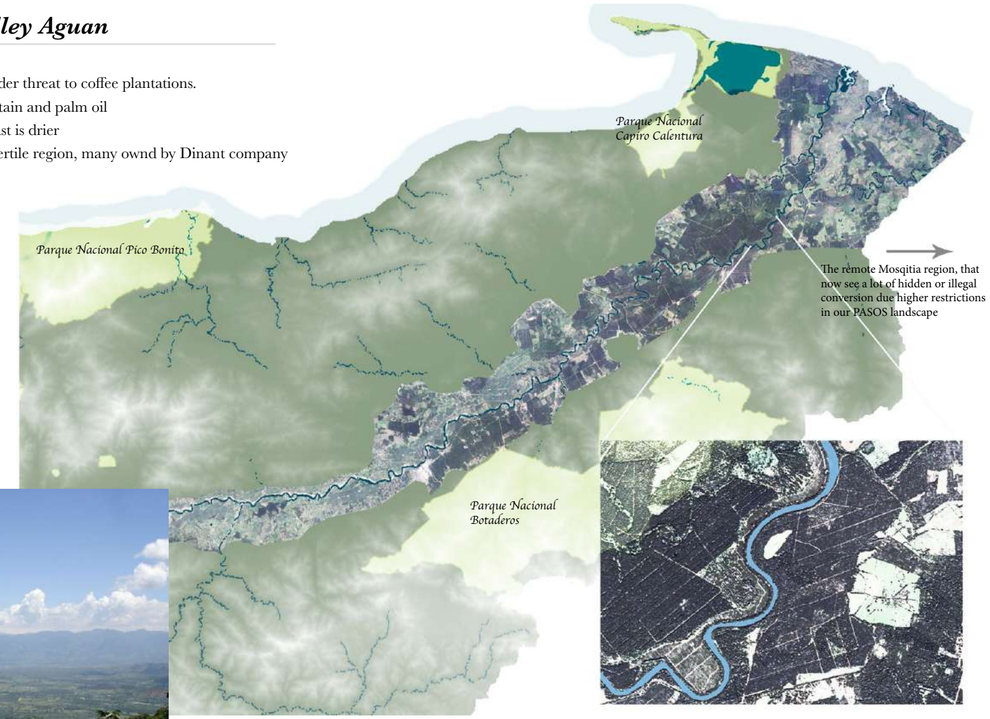
Valley Sula

- Extended dry season (iirigation systems in use)
- Oil palm from mid water shed to the river mouth
- Other agriculture in sugar cane, king grass, plantain and banana
- Important ecological areas are tropical forest, wetlands, lagoons, mangover forests.



Valley Aguan

- Mountains of Bizinia are under threat to coffee plantations.
- Agriculture in bananas, plantain and palm oil
- The landscape toward the east is drier
- Palm oil is very high in this fertile region, many ownd by Dinant company



Research Lens: Global

The general view of landscape design approaches has changed during recent years; until around the year 2000, these approaches were strongly connected with biodiversity conservation as a major objective[11]. Examples of such approaches are 'Integrated Conservation and Development Projects'[12]; such that people and society were not considered as integral parts in the landscape system. Increasing since then and toward the 21st century has been stakeholder involvement[13]. This was a development in the western way of thinking, to see more complexity in development issues, the focus was no longer on top-down implemented biodiversity goals, but methods to address economic, social and ecological for long term landscape sustainability. Thus, the view on landscapes changed from that of a perception solely based on nature and thus its conservation, toward landscapes in which processes of nature as well as people play a decisive role. As such, stakeholders became involved for more integrated approaches.

As well as people becoming a defining part of their landscapes, we are also becoming a part of a globalised landscape, no longer are our activities considered to be guided (and limited) by the natural conditions and boundaries of our physical landscapes[14]. With increasing globalisation, technological development and the integration of people in global supply chains, landscapes today are seen on larger spatial scales on which many different stakeholders, from global to local level, need to cooperate. Balancing competing interests and risks also needs to take place on these levels as landscape development does not necessarily need to be based on western principles[15].

This shift to a landscape which is the link between nature and culture has led to new thoughts which include the involved interaction of all parties with ties in a landscape. This calls into question the methods for a new view onto landscape and communication between everyone with ties onto that landscape. Thus, the method of how these interactions occur for the mutual development of our landscapes is called to question.

In constructing landscape; landscape architects provide some of the most revealing explorations of the interface between culture and nature, thus forging essential components of the construction of reality[16]. Applied to a more methodological basis, we have the ability and power to visualise these future realities as influential tools in development. But future landscapes cannot be predicted. As present landscapes, they will be a product of interactions among nature, humans, historical remnants, and future technical, economic and social conditions. Therefore, it is easier to design a set of possible future landscapes, based on different underlying assumptions or influences, than to predict one future landscape. Future landscapes can hardly be reduced to a defined set of predictions[17], as too many conditions are uncertain and unknown. The scenario methodology has come as answer to this problematic; where scenarios are narrative descriptions of possible or desirable futures that focus attention on causal processes and decisions[18].

Scenarios have an advantage over predictions because they can provide more inspiration. The reason for this is that they explore different directions in which nature policy may develop in the future. In addition, scenarios do more justice to the uncertainty regarding the long term future since they explore alternate directions in which political, societal and physical developments with an impact on nature may evolve[19].

The choice of these scenarios is an extremely important decision, and the successive communication of them between actors. They have ability to create awareness of the landscape itself, awareness of the challenges to tackle as well as awareness onto potentials. It is this method of choosing specific scenarios and the communication of them, for landscape development, which this paper continues to address.

In hand with more commonly developed GIS mapping and data is more localised visuals to represent the scenario possibilities and potentials. Visualisation of landscape changes combined with scenario techniques enables planners, decision-makers, researchers, and stakeholders to grasp the possible impact of alternative developments [20].

The projects I have worked on in three different landscapes are a creation of scenarios of potential futures, which have been visualised as tools for the communication between stakeholders for discussions to follow, and influence on the successive design policies. In the study, we presented a mix of geographical information system (GIS)-based map making with more localised three-dimensional (3D) visualisations, mainly using realistic photographs.

The development of the project for scenarios only resulted in two scenarios; that being a trend scenario, if things were to continue in the same manner without change, and an optimum integrated approach to increase sustainability. Both considered population increase of 1 million by the target year of 2030.

The ILM scenario was not visualised, instead four main themes which would support the development of the scenario were visualised. These as such provided visual basis of potential tools to be implemented in the landscape to reach the main goal of the common landscape. These tools were then sent to the stakeholders in Honduras, in which they were encouraged to label the positive and negative consequences on each theme. Through giving the stakeholders visualisations of the tools to create potential in the landscape, based upon real fact; it was then put upon themselves to understand potential consequences of tools upon one another.

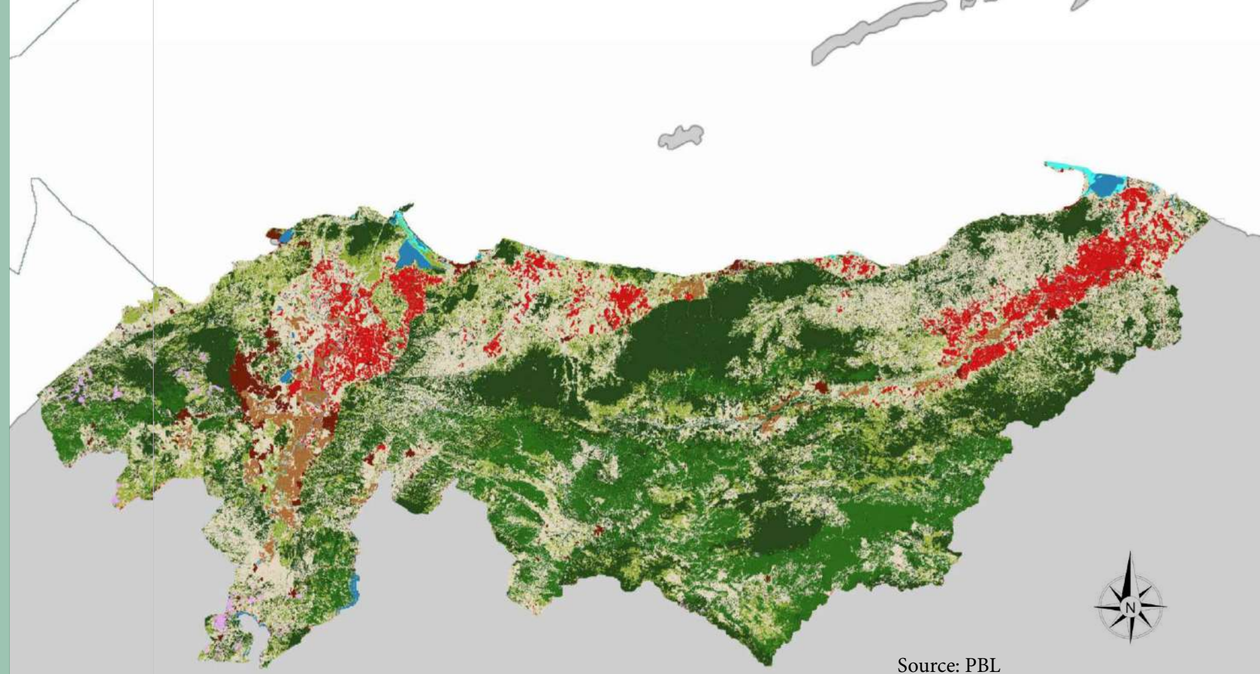
Rather than showing definitive end products of certain ideas, they instead showed tools which could be starting points to help sustain an environment, in which optimum integration occurs between parties. In allowing all parties to be involved in discussion on consequences, it was a good way to communicate potentials in the future understanding of each other. The method was more of a focus on the process and awareness of consequences to a shared optimum future, rather than toward set concrete futures which maybe did not represent everyone.

In a visualisation of process toward an optimum scenario for all the parties involved, everyone can be represented and the ideas can be more flexible. Exploring the consequences within the communication can allow everyone to evaluate them in consequences for themselves as well as all other parties for more of an integrated method toward a developed future.

Map at Present

This map was developed by the team at the PBL. Using the program of CLUMondo, to develop maps of the existing land use in the project location. The maps looks at land uses in blocks of 250 by 250 metre frames. The data in this map was then used to think about the future land uses in the location.

The legend for the map is on the following page. The map on the right shows the present situation of the Northern Coastline of Honduras.



Each cell defines a space of 250m x 250m

0_Urban

Cells of urban development. Cells vary from small rural built areas, at a balance with landscape; medium urban spaces, with sharper lines against the landscape ; and large urban hubs, with no intercation with the landscape.

1_Intensive agriculture

Intensive agriculture, for example: Bananas; plantain; pinapple.

2_Palm Oil

The cell is sustainable palm-oil production

7_Forest Needleleaf

8_Bare

Bare and sandy ground, normally adjacent to rivers and beachers.

9_Water

Rivers, lagoons and lakes

10_Extensive agriculture with spread

The cell is >20% extensive agriculture and < 15% forest

3_Shrubland

4_Mangrove

5_Wetland

6_Forest Broadleaf

11_Mosaic extensive agriculture with

The cell is >20% extensive agriculture and < 40% forest

12_Forest with extensive agriculture

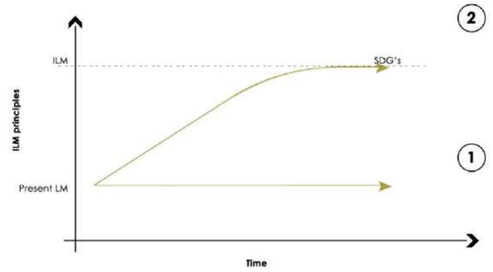
The cell is >20% extensive agriculture and >40% forest

13_Cash tree crops, mixed with trees

The cell is >20% cash tree crops and <40% forest

14_Forest mixed with cash tree crops

The cell is >20% cash tree crops and >40% forest



1 Continued expoiltation of land with increasing mono landscape of Palm Oil. Projected with numbers of intended Palm Oil increase.

2 Toward Sustainable Development Goals. A mixture of the five future themes, as illustrated above, but developed further in a spatial plan.

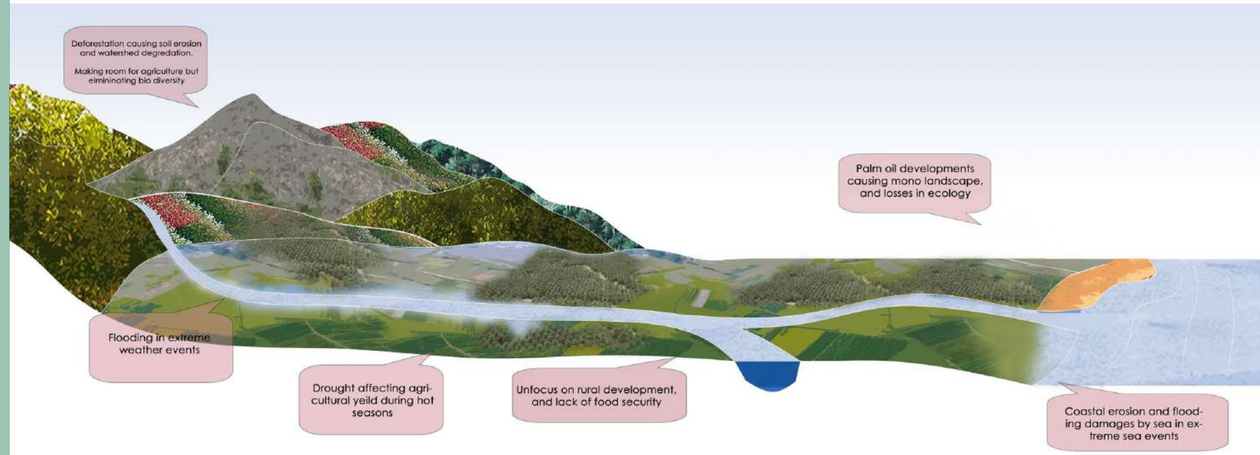
ILM = Integrated landscape management

Challenges in the present landscape

From research the main challenges in the present landscape are as follows:

- More extreme flooding and drought through climate change
- Contaminated water from fertilisers
- Land use conflicts between communities and corporations
- Unsafte image of Honduras
- Disconnection between urban and rural life
- Environmental destruction
- Food instability
- Less young involvement in agriculture.

With the team at the PBL, two follow up maps were map; illustrating the trend scenario of continued exploitation of the landscape, and the ILM scenario, designating land use to achieve the sustainable development goals. These are shown on following pages.



Mass deforestation to make room for palm oil

Landscape of palm oil mono culture

More severe flooding and drought events.

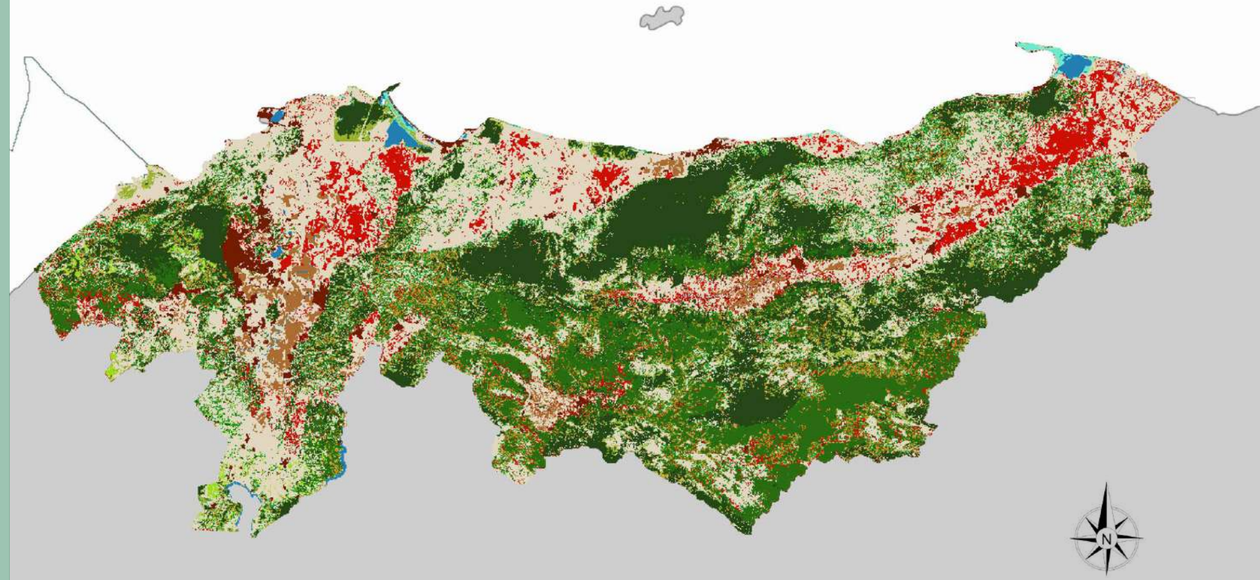
Trend Scenario Map

This map shows the trend scenario; where continued exploitation and use of resources was continued without consideration of people or planet.

The map is predicted for the year 2030, with a population increase of 1 million.

The trend scenario shows a Honduras of deforested mountains, to make room for the palm oil agriculture. Monoculture in the river plains with predominantly palm oil, and a flooded Honduras without protection to climate change.

Although many stakeholders will see the economic value as most important, it is an awareness of the biodiversity and landscape values which must be realised and focused on. That was the aim through these images.

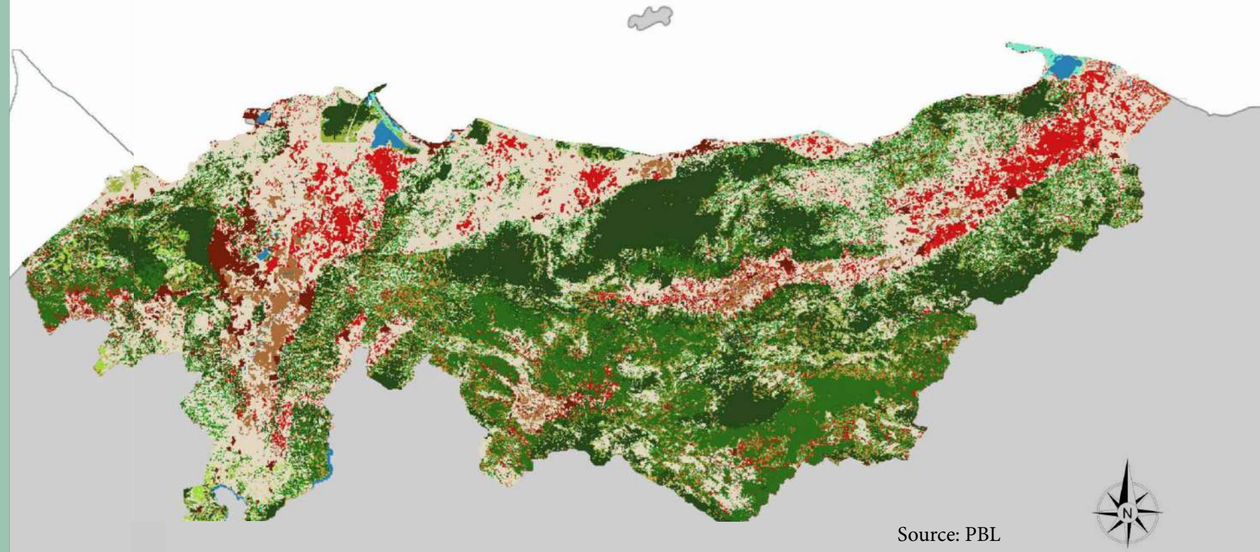


Source: PBL

ILM Scenario Map

The integrated landscape approach focuses on how to sustain the palm oil in the most sustainable way to ensure food security in the landscape as well. The maps look at blocks of 250 by 250 metre frames. The principles of creating the map were to continue palm oil on existing sites, but not to cause any more deforestation for increase of palm oil productino. It also ensured the growth of palm oil was only done on suitable land, ensuring none was continued on hillsides. More space is accounted for food agriculture in prediction of the population increase, this is on new land and on existing palm oil land. It also considers potential areas for urban densification.

The map is predicted for the year 2030, with a population increase of 1 million.



Scenarios of Integrated Landscape Management

As a landscape architect, I was more curious as to the consequences on the landscape in a spatial level, as well as how more localised landscape interventions can be implemented for solution.

Within this ILM overview, specific themes are looked into for intervention on a smaller scale. These were analysed further. The research conducted came from a report on the project, produced from discussions with stakeholders in the landscape.

EcoAgriculture Partners For the Solidaridad Network | Supporting Sustainable Landscapes in Northern Honduras; Landscape assessment (scoping) for the northern zone of Honduras: Recommendations for program design and implementation | December 14, 2016

From data and comments from the differing stakeholders, four main themes were deduced. To understand these themes more within the context and the impact they would hav.e, they were analysed further, thinking in terms of the environment, social aspects, economic aspect and spatially.

Food security

This is a focus on food security for the locals. Agriculture is focused onto food, and diversity of food for security. The power is with small holders. This is estimated in regard to the local population, which will increase by 1 million people towards 2030

Water management

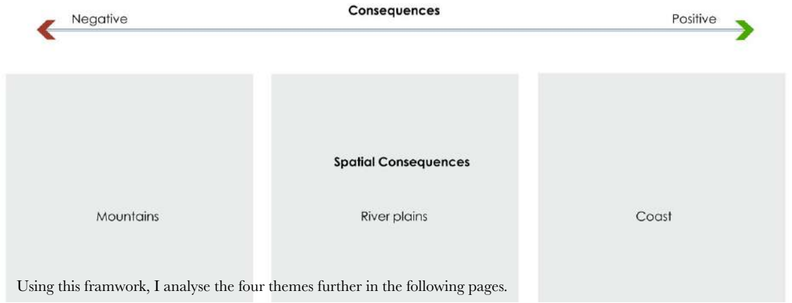
This theme focuses on water. Through reforestation, the watershed of the rivers is restored to tackle challenges of drought in the landscape. Flooding in the river plains is also tackled in this theme in river buffer zones. Also climate changes negative affect on precipitation is causing area to get drier. Water strorage is also thought about in this theme.

This theme focuses on the continued growth of sustainable palm oil. The agricultural growth is continued but in a sustainable way, increasing productivity from the same area, using new improved tree varieties.

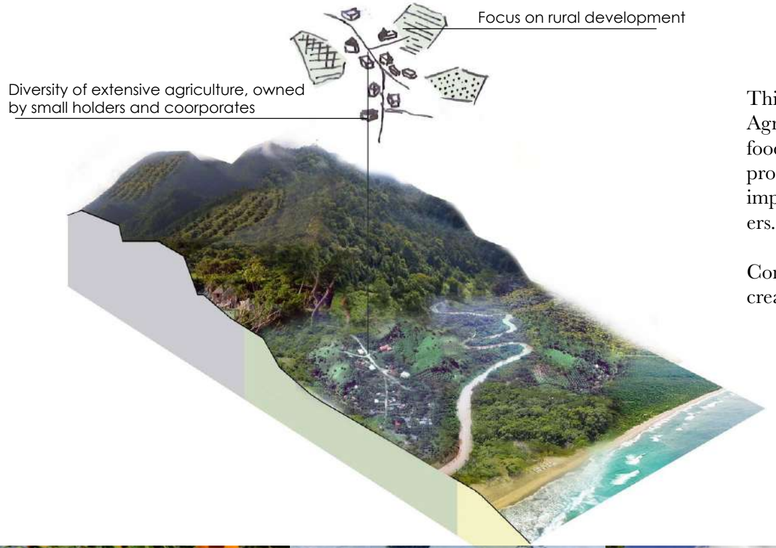
Sustainable palm oil

This theme is a focus of the preservation of nature and biodiversity. This is a restoration of the environment, and true nature. The economy focused on natural beauty and tourism from it.

Eco tourism



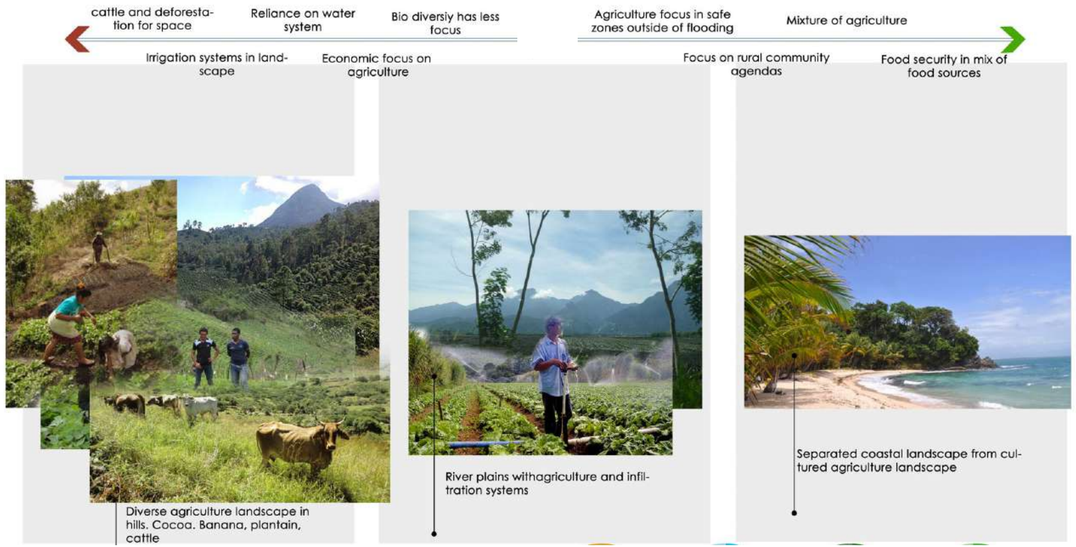
Using this framwork, I analyse the four themes further in the following pages.

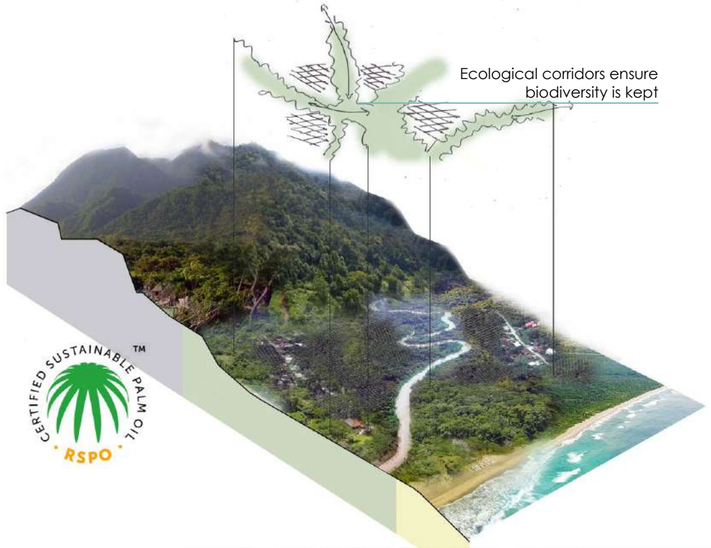


Food Security

This is a focus on food security for the local people. Agriculture is focused onto food, and diversity of food for agriculture stability and resiliance in food production. The power is with small holders, and improved land tenure security of small holder farmers.

Common crops seen in Honduras, which can be increased in productino are highlighted below.





Sustainable Palm Oil

This theme focuses on the continued growth of sustainable palm oil. The agricultural growth is continued but in a sustainable way, increasing productivity from the same area, using new improved tree varieties. This is still aimed at the economic growth in one dominant industry, but done in a more sustainable way, under the RSPO. This ensures natural biodiversity is an important aspect in the continued production of palm oil, and work with the local communities. With this theme, there is a stability of jobs in this economy. Palm oil is also used as biofuel for energy in the area.

Hondupalma is a medium-sized palm oil cooperative located about an hour away from San Pedro Sula. This is a cooporative palm oil company that is already starting sustainble measures in its practice.


Small holders scale.


Palm oil in coorporates of small holders.


Palm oil on large corporation scale.

Privatisation of land
Hillside growth harm soil condtions
Mono culture
Fertilisers affect on ground water

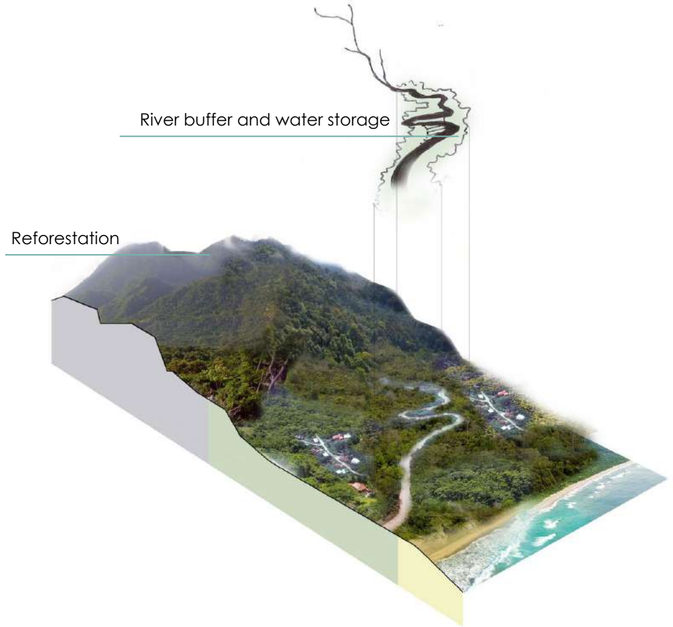
Rural and urban development together
Economic development
Job security - economic security for country
Infrastructure development
Security in drought and flooding - no affect on small holders
Job growth outside of agriculture

Mountaineous terrain characterised with palm oil fields

Growth of economic urban centres

River plains dominated with mono agriculture

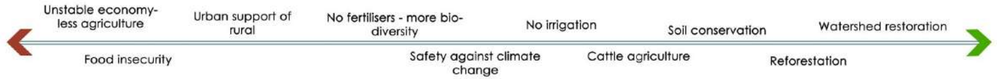
Coast separated from economic development



Water Management

This theme focuses on water. Through reforestation, the watershed of the rivers is restored to tackle challenges of drought in the landscape. Flooding in the river plains is also tackled in this theme. Agriculture will be out of flooding zones, and river buffers implemented for protection.

Water storage is important for use in rural commmunities and in agricultural production. Quality is also important to ensure enviornmental guarding of river eco systems and coral.




River buffers

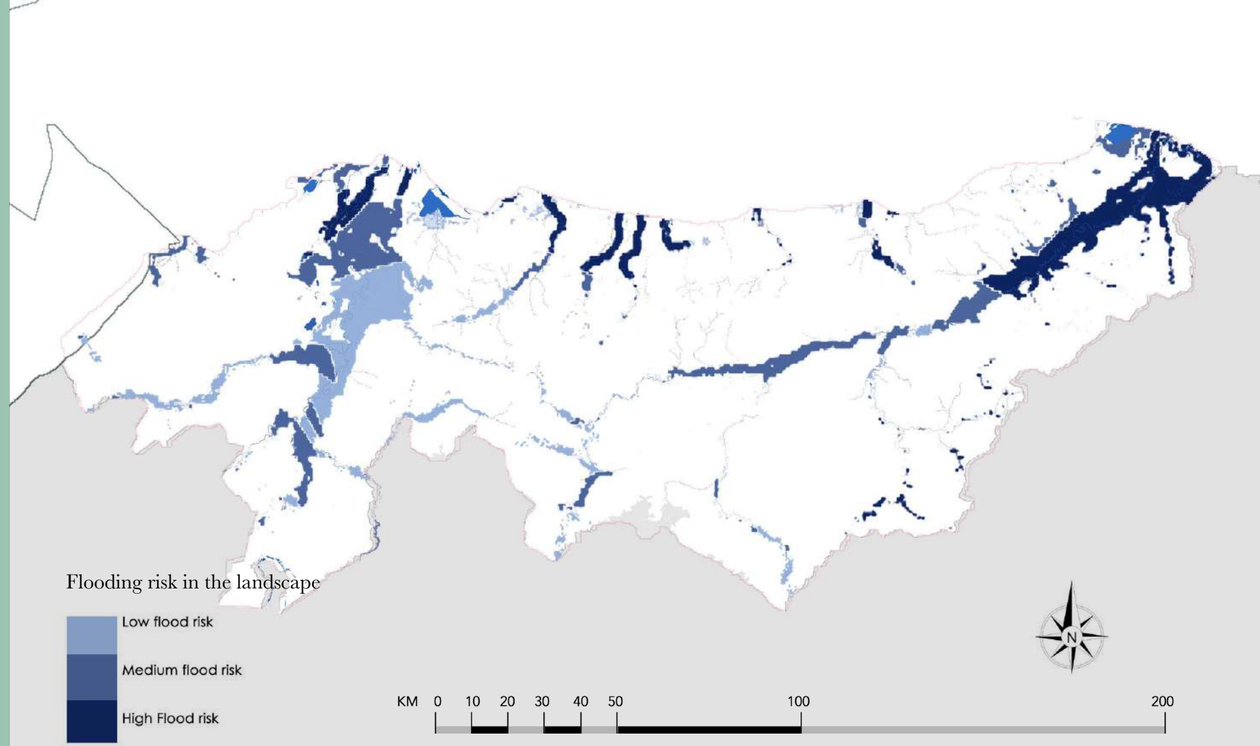

Room for the river project NL


Reforestation

Water Management

Water if an important issue in the landscape at present, the map on the right indicating flooding threat. Flooding is an common issue in the landscape, affecting the production of many agricultural fields in the valleys.

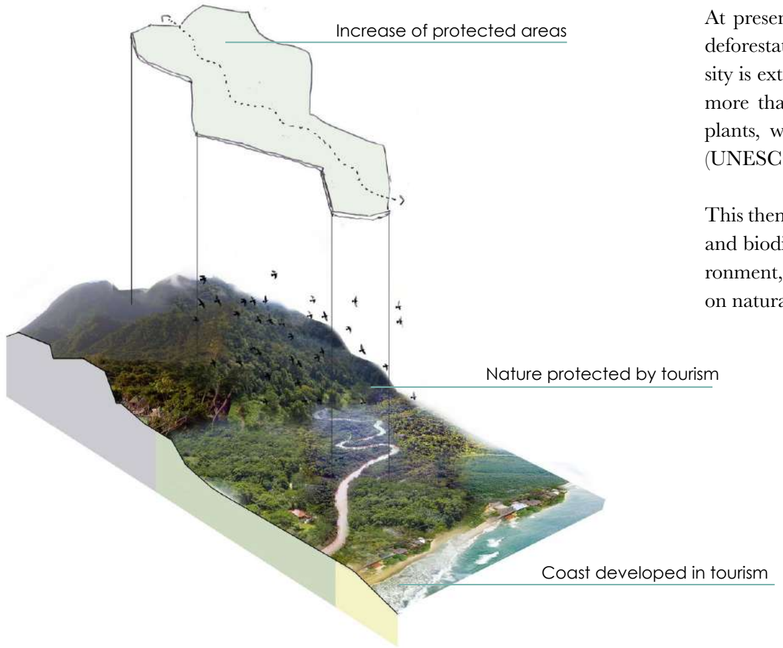
The left indicates to practical solutions which can be implemented in landscapes to aid this issue.

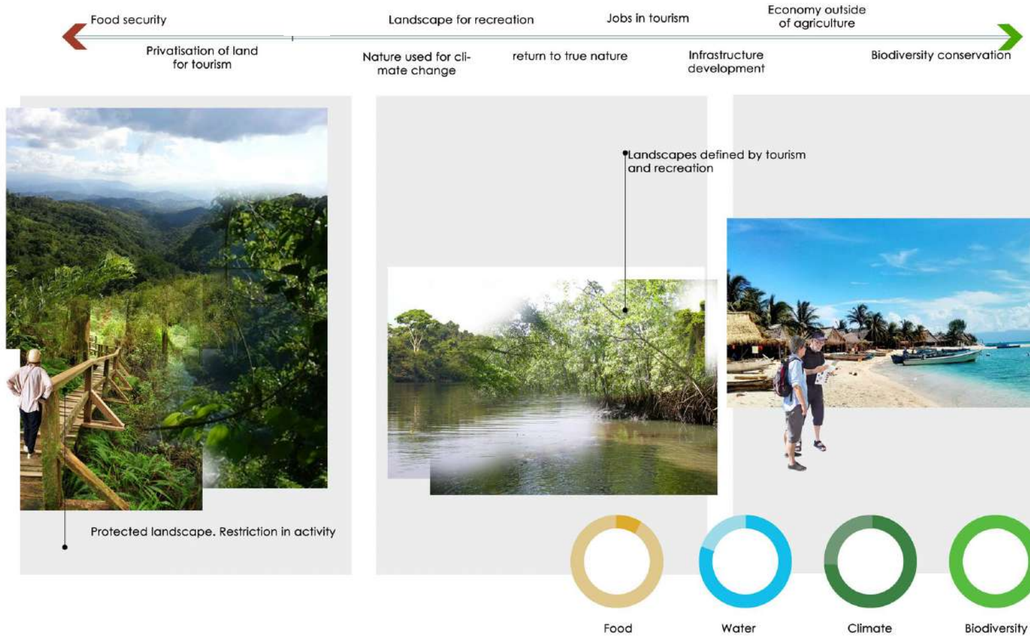


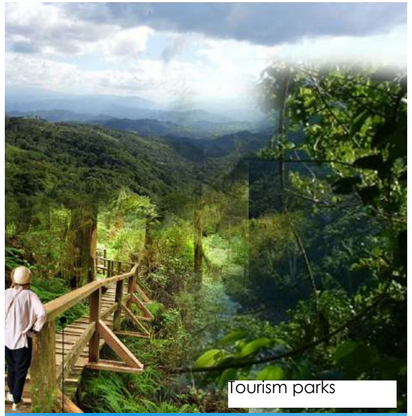
Eco Tourism

At present a lot of space is still under threat of deforestation for agriculture and cattle. Bio diversity is extremely threatened. RPBR has has noted more than two thousand species of endangered plants, with perhaps some yet to be discovered (UNESCO World Heritage Centre 2009).

This theme is a focus of the preservation of nature and biodiversity. This is a restoration of the environment, and true nature. The economy focused on natural beauty and tourism from it.



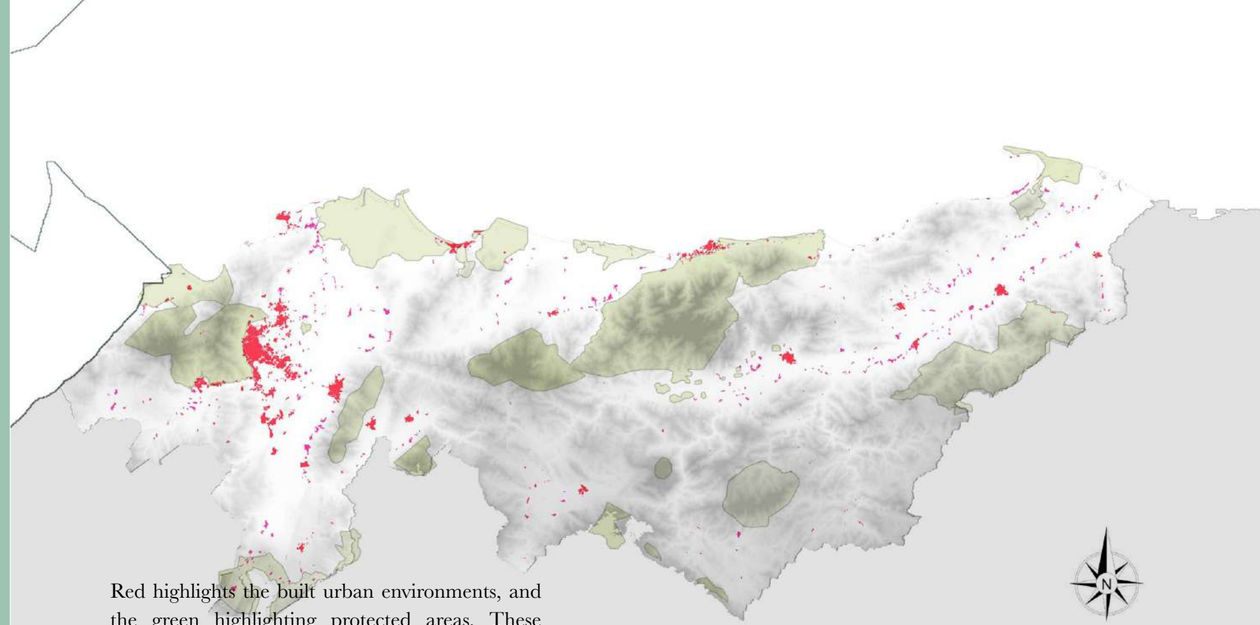




Eco Tourism

The map on the right indicates the areas in the location which are already protected. This themes looks to increase these areas, and buffer zones adjecent to them, as well as how they can be connected to one another.

Economy can develop thorugh tourism of this unique and beautiful nature.



Red highlights the built urban environments, and the green highlighting protected areas. These would be extended to protect more space and restore bio diversity.

Tools in the Landscape

This led on to a research into the tools possible in the design. The table shows potential interventions with labelling of each theme in which they would benefit.

Split into three groups, the first being working with nature which would be river, room for the river projects, reforestation and mangrove coastal protections.

Then were tools more related to agricultural processes, such as ecological corridors, water storage, sustainable farm and palm oil practices.

Then there're more architectonic developments such as urban development, rural development, tourism development and tourism parks.

Food Security

Sustainable Palm Oil

Water Management

Eco Tourism

Food security · Sustainable palm oil · Water management · Eco tourism

Working with nature	N - 1 River buffers Protection of water in extreme weather events. Soil erosion protection	N - 2 Room for the river Space for water in extreme weather events	N - 3 Reforestation/ protection of forest areas Soil conservation Biodiversity conservation Water shed restoration	N - 4 Mangrove coastal protection Protection from extreme sea flooding
Agricultural tools	A - 1 Ecological corridors Biodiversity conservation	A - 2 Water storage Water for irrigation in extreme drought	A - 3 Sustainable farming practice Food security	A - 4 Sustainable palm oil cultivation Sustainable practices to ensure biodiversity conservation
Architectonic developments	D - 1 Urban densification and expansion	D - 2 Rural development	D - 3 Coastal tourism development	D - 4 Tourism parks

Stakeholder Discussions

The scenario themes were presented to the stakeholders of the project to create discussion on what could be the consequecnes of each theme for each stakeholder. Labels were made to prompt discussion.

Based on the feedback of this workshop, the team could feed back into the land-use models.

In general the exercise was extremely useful in creating awareness of the landscape as a system and the consequences of their actions on the landscape, as well as awareness of one another's goals.

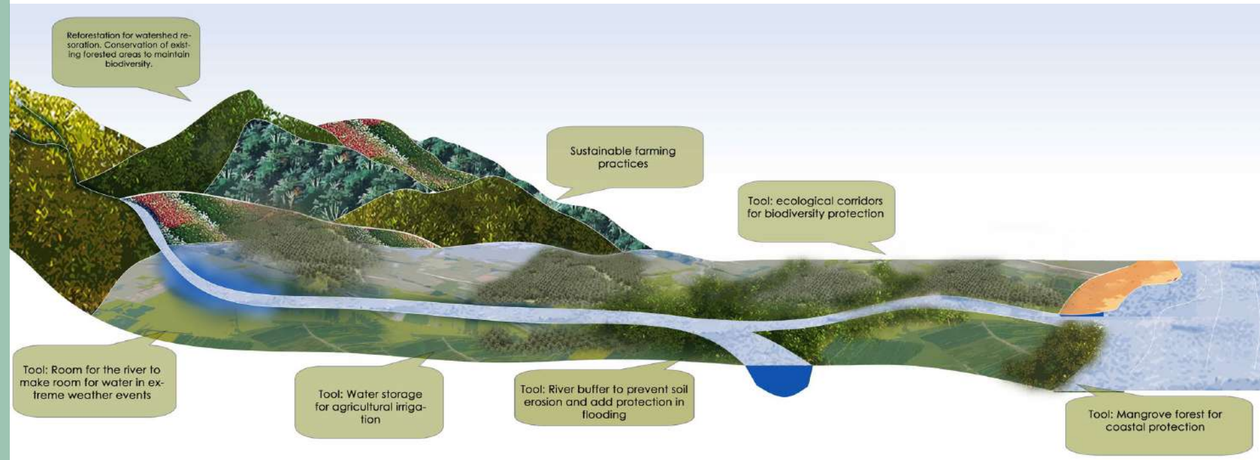
Economic focus on agriculture	Flooding protection	Return to true nature	Restoration of watersheds
Development of rural communities	Drought protection	Biodiversity Conservation	Food security
Mixture of agriculture	Small holder protection	Safety against climate change	Privatisation of land
Soil conservation	Job security	Reforestation	Recreational Landscape

Conclusion from Research

The visualised models were vastly simplified models of the vast complexity of the landscape of the Northern coastline of Honduras. They are however successful in illustrating the potential scenarios for the future of Honduras, and the areas for interactions for future action.

The visualisations themselves were able to bring the global problems, which the landscape area faced, to practical solutions. In highlighting potentials in the landscape, they were able to show the landscape as a system for the needed awareness of consequences to the stakeholders individual decisions.

It was for me fascinating work done in conjunction with the PBL. But in continuation for my own thesis project I felt a lack of understanding the real culture of the place. So in hand with the research on the global level, I felt I needed more understanding with that on the local level. The following pages highlight the research done for more understanding of the area on the local landscape level.



Research Lens: Local

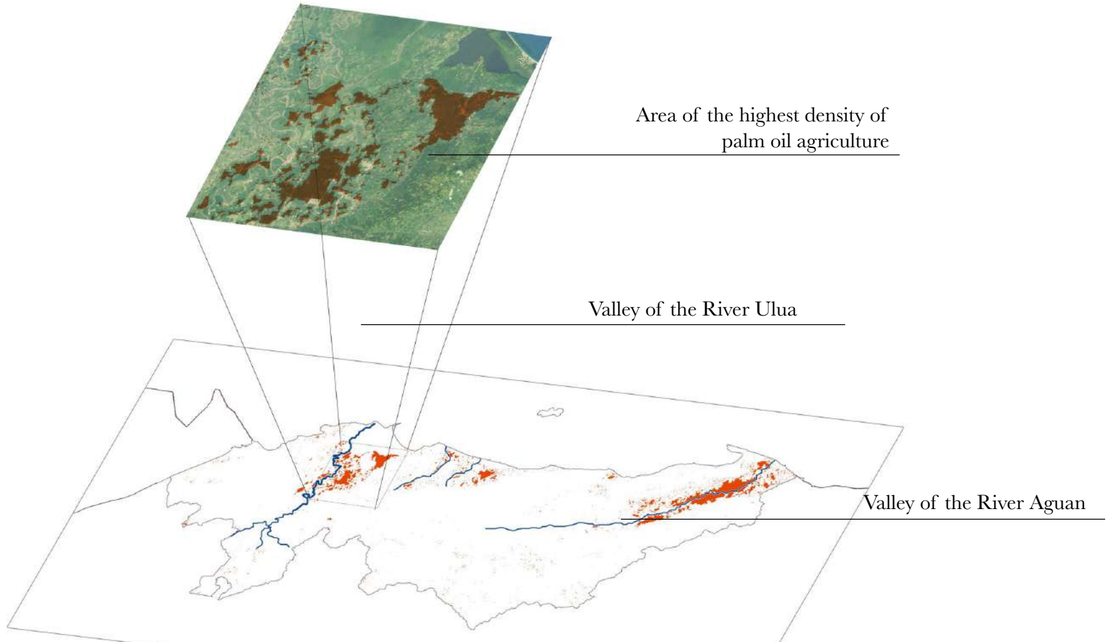
To Honduras

To aquire the research on a more local level, in hand with my previously conducted research done on the global scale with the PBL, I decided to go to Honduras. With the help and funding of TU DELFT Global Initiative, I was able to spend a month in Honduras in August of 2017.

In consideration of implementing a landscape design, I thought back to the main problem in the landscape; the expanding economy of palm oil agriculture. Looking at the northern coastline of Honduras, I looked at the areas with the most dense problem of Palm Oil agriculture. The valley of the river Ulua and the valley of the river Aguan, had the most palm oil agriculture.

I decided to zoom into the Valley of the River Ulua for the design as it is the most populated; many rural towns surorund the palm oil feilds as well as the industrial city of San Pedro Sula is situated here. In the design I am interested in the interaction between the environment, and productive identity of the valley, and the people whom live there.

So as such, it is to the valley of the river Ulua to which I went, and the city of San Pedro Sula.

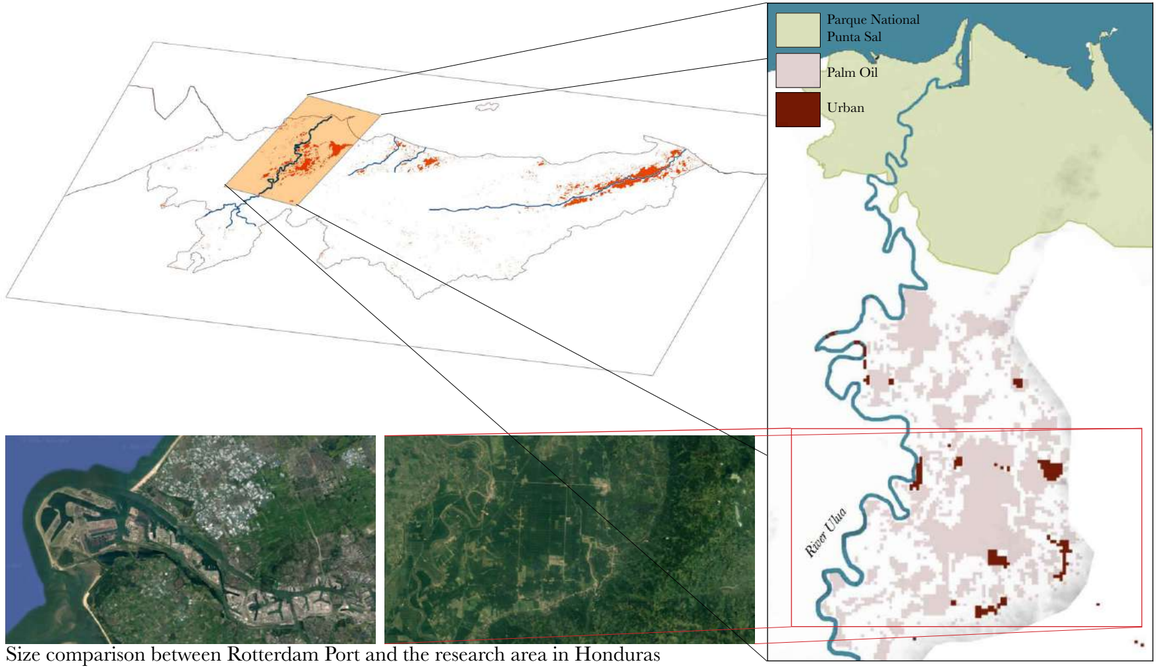


Map of the given area on the Northern Coastline of Honduras, shows the main rivers and consequent valleys and palm oil production, in red

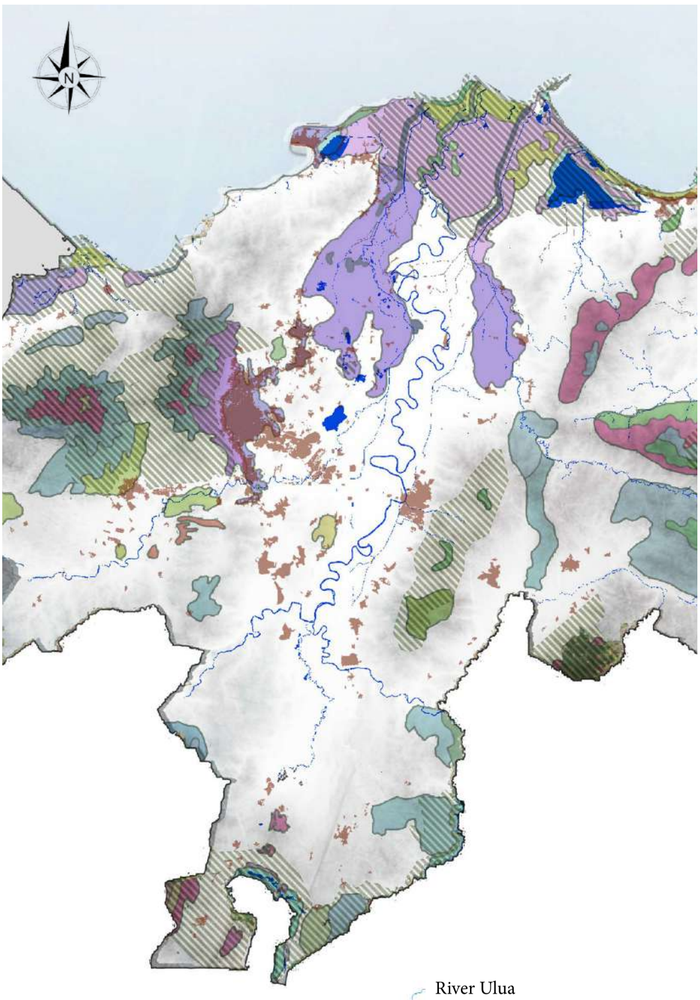
Local Perspective

The area of design research will be in the valley of the River Ulua, in the area of dense palm oil production. The specific location is very rural, there are many small rural towns situated here grown from the agricultural economy. In my research I hope to answer the following.

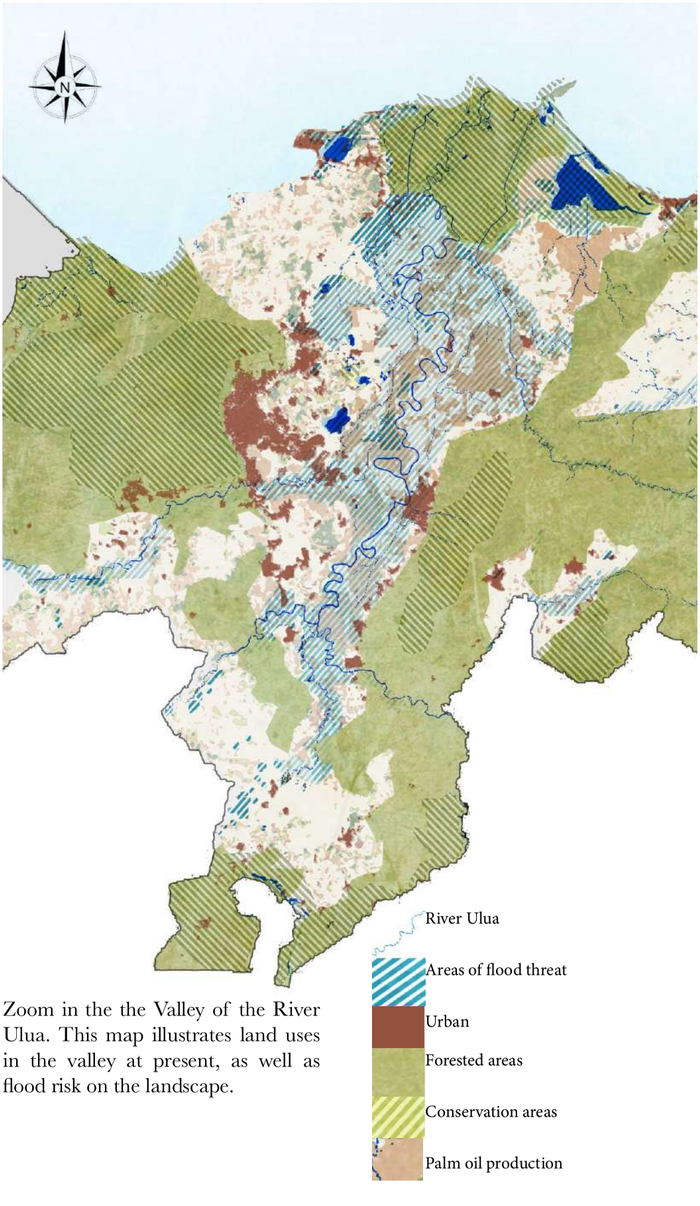
- How can the Rural towns develop?
- What specific habitats should be protected?
- What other types of agriculture can be used?
- What flooding protection can be implemented and where?
- How can the sustainable palm oil practice be implemented?
- How can power be brought back to small holders?
-What is the relation with the small holders and large corporations?
- What are the locals relation to the landscape?



Size comparison between Rotterdam Port and the research area in Honduras



Zoom in the the Valley of the River Ulua. This map illustrates the areas of ecological interest and areas of conservation



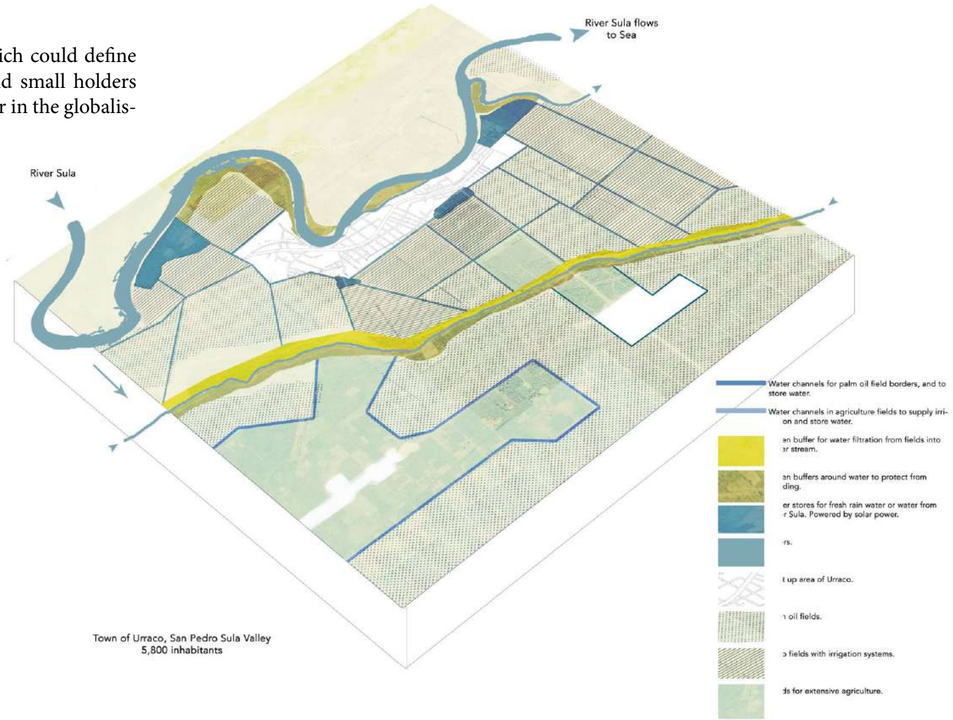
Zoom in the the Valley of the River Ulua. This map illustrates land uses in the valley at present, as well as flood risk on the landscape.

Initial design thoughts

Before I left for Honduras I was very keen to develop a new strategy to phase out the progress of palm oil and find new economies such as eco-tourism or other agriculture. I also considered creating a uniting water system for the people to define the areas of food agriculture away from the large corporations bringing in palm oil. In initital thought, this could define the limits of palm oil growth and more defined areas of ownership, to safeguard land for the people.

A small study of the town of Uracco looks into this idea in more detail.

A water system which could define areas for people and small holders to bring them power in the globalising landscape.



Experience of the Landscape

Most notable to myself, whilst in Honduras was the separation between people and landscape. The people whom live in the rural towns of the valley, indigenous to their landscape, are now so disconnected from it. It is a loss of power, place and their presence. The landscape is no longer theirs, as it transforms around them, the towns seem disconnected form the production and business as well as the globalising technology.

The towns are left in under developed conditions, in comparison of that of the cities. There is little space of recreation, people gathering to local water holes to relax. The towns sit alone in their landscape; surrounded by agricultural production which is out of their power.

My ideas for landscape intevrentions separated the people and the corporations. However, it was through seeing the cooporative palm oil producer of hondu palma, and talking with landscape initiatives the such as WWF and Redmuch, in which I could see the need to work together as a whole, co-opratoves working with people for job and food security because it is much easier to give them awareness of the landscape as a system and implement agricultural standards for them.

Many independent and smallholder producers are not involved in RSPO certification efforts, are not trained in sustainable practices, and do not have access to extension services. Meanwhile, yield remains low; the current average yield is 17 MT/ha of oil palm fruit, whereas the potential is 24 MT/ha or higher. Current extraction facilities are only operating at a portion of their capacity, creating a high demand for fruit and encouraging further expansion onto unsuitable areas (Sebastian and Lee 2016). To achieve this ambition will require a combination of increased productivity, increased adoption of sustainable agricultural practices, substitution of oil palm for more suitable crops such as cocoa on steep slopes, and improved land use planning and natural resource management.

Discussions I conducted whilst in Honduras, are expanded upon in the following pages.

The amount of palm oil production in the landscape was astounding; it had taken over the valley.

Opinions of Locals

Red of Women Cocoa and Chocolatiers of Honduras (REDMUCH)

We want to empower women to lead their own careers and buisnesses as women are so underapreciate din this country. We create cooporatives to ensure womans inclusion in the agriculutral buisness. We do this in hand with teaching them sustainable standards in regard to agriculture in the hope of future business can grow sustainably and empower woman here.

We hope a landscape design can help empower small holder farmers and give them more security, so they can earn in the same market as the large corporations.

We also hope this can start extending to future gernerations, who see no advantage to staying in this buisness at present.

World Wide Fund For Nature

We want to work with coporations to help them meet sustainable standards of palm oil growth. Palm oil is good for stability in the economy here, we don't want to get rid of it, just make people aware of the affects and the standards we are trying to reach.

There is a lot of palm oil growth within national parks at the moment, which needs to be stopped. As well as on mountain sides and there is high soil erosions here already due to agriculture.

The corporations are good to help us reach the global agricultural standards we want. They just need to work more with local people, to help them stay aware of the standards of sustainability as well. Rural areas of Honduras are getting lazy, people are moving to cities and are no longer wanting to work in agriculture. Corporations will take over, we just need to ensure enough food is also available in the future plans. We work with these corporations to meet a sustainable future.

Opinions of Locals

Honduras Foundation of Agricultural Investigation

The need to develop an effective capacity for the generation and transfer of technology in Honduras led to the establishment of the Honduran Foundation for Agricultural Research. We help farmers understand their land and soil for the continued growth of food on the land. We test the soil and give advice on how to make sure it stays with nutition.

Our landscape is part of a global food chain. Much of our food is exported, but a lot imported as well. Even the most basic food of rice and maize, is imported for four months a year. We help research and teach farmers what we know for continued process of agriculture and food stability.

We are a Agroindustrial Cooperative for Agrarian Reform, belonging to the Social Sector of the Economy, which has become an important source of development for the Valley of Sula and all Honduras ... A reality that has forged thanks to the effort and dedication of its associates ... A reality that is projected towards the future with only one idea: to improve the living conditions of our families and collaborators, as well as to seek the development of the country. We love the green of this country and the beautiful nature and we want to ensure that stays.

Palmas Aceiteras of Honduras, Hondupalma

Angela, Architect and resi-

Palm oil production is ruining our landscape, their roots are destroying the ground for other agriculture. It will ruin our environment. Maybe we should consider other economies such as bamboo produtcion, which we can use to create houses. We need crops less harmful to the environment.

Honduras

Visiting Honduras gave me new insights into how best to plan for this landscape, away from the computer and desk. Talking to the people and stakeholders here helped to see the reality of the problem and needs of the people, and the landscape where the environment and people are both considered. I was able to see the areas where people recreate and what their areas of beauty were, as well as the importance of job security in their productive landscape. It was also highglighting to me and un-awareness of the landscape as a system and its role in the global chain.

My time in Honduras was extremely impacting in what my perception was of the country, and completely changed my ideas for the project itself. It was incredible to see the spatial impact of palm oil in the landscape of Honduras. It only ignited the need for such a project as this to start discussions on the future of the landscape.

My drawing of Honduras, on the right, depicts the Honduras I saw. The rural towns sit separated from the productive value of their surroudings. The life in Honduras seemed very rural, and in poor conditions. There was a large separation between the people and their landscape.

Spatial Design

Conclusion from Research

Two main concepts drive the spatial design thinking in the project, from my two lens of research.

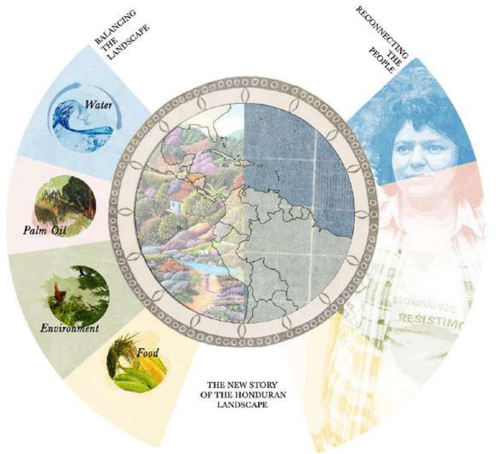
The first, from the global lens, being to create balance in the landscape in consideration of profit, planet and people. As consequence to the obviously unbalanced landscape in which this project sparked. Using the four main themes of research together to work toward the idea of a balanced landscape which considers people, profit and planet.

The second, from the local lens, being to reconnect the people back to their landscape. As history has depicted, the local people have steadily lost power over their landscape, mainly to actors outside of the landscape seeing the valley as site for valuable production. The people have constant limitations to their freedom within the landscape. Ownership becoming more and more to that of corporations and little public, natural and recreational space for the local people. This is for the empowerment of people within the landscape.

The research I conducted led me to certain key points to keep in mind during my design process, such as the following.

- Reduce pollution into water from agriculture.
- Promote income through food, sustainable palm oil products, and agrotoruism.
- Watershed protection with vegetative cover near rivers all year around.
- With urban growth of 33% , limit urban sprawl and improve density in urban areas.
- Limit deforestation, and try to create reforestation wherever possible.
- Ensure habitat protection with areas for habitats and eco corridors.
- Minimise affects of drought and flooding, affects from natural occurrences.
- Improve productivity of palm oil through replacement of more resilient species and the limitation of expansion.
- Respect slopes with agroforesty to stop landslides.
- Improve food security with increased productivity of staple foods and promotion of mixed crops with livestock.

How can the Landscape Approach provoke a spatial design in the Northern coastline of Honduras to create a future sustainable environment, accounting for the area's landscape values?



Both lens of my research led to a main idea integral to my design, being the idea of balance; in the planet, between production and nature; in people, between ownership by corporations and by locals; and in profit between monopolisation and diversity of economy.

The concept for the design is to connect the people of Honduras with their landscape. Bringing them together with the productive identity of the landscape into one system for water and food security as well as to meet global goals. The idea is to create a uniting system, which can unite people with the larger corporations. Working together with this system, which understands the landscape as a system as well as the future problems it faces, will bring people and the environment to one uniting goal.

In hand with a rethink of the land use of the specific area, two main systems are introduced as means of interventions as answer to the previous research and in target of the concepts to rebalance the landscape and reconnect people to their landscape. The two systems represent the two natural elements in the landscape; blue system to address water and green system to address the biotic environment. In terms of design I looked to these two natural systems already there and how I could make interventions and emphasise these more in meeting my concepts.

The blue system is a sequence of water collection and distribution. This not only manages the extreme seasonal weather conditions in the rainy season, but distributes water equally through the landscape to ensure better production of palm oil and food for efficiency of the productive landscape. The different landscape elements; the valley flat and the mountainous hills are considered separately in their collection of water.

The green system ensures a rebalancing of the abiotic and biotic system in consideration of this productive landscape. With introduction of different landscape conditions for creation for new habitats as well as connections to larger green corridors for the ensured able movement of wildlife. This also considers the changing of land uses for more environmentally friendly land use such as agroforestry or bamboo production, which can restore the soil, as well as eco tourism which can be introduced through the landscape. A main part of the project, and thought of in the proposed green system, is new types of economy, so that the area is less reliant on just one type of economy and production. These economies are as follows.

Cocoa
Stakeholders identified increased production of cocoa within diversified farming systems as a potential strategy to mitigate some of these risks for rural farmers. Cocoa is profitable and Honduras is competitive in the global market. Additionally, cocoa is suitable

for agroforestry systems and can be grown alongside bananas, avocados, and other fruits, providing both additional nutrients for familial consumption and additional income if these products are sold.

Tourism
Tourism is growing in the Northern Coast of Honduras. Beach resorts and hotels exist on the coastline between Tela and La Ceiba. Eco-tourism is growing around Pico Bonito National Park and the Cangrejal River, and outfitters offer rafting, hiking, and horseback riding excursions. Stakeholders in the landscape would like to see eco-friendly and sustainable tourism grow, as it offers great potential to provide additional jobs and stimulate economic growth. Agro-ecotourism is to be introduced potentially offering hikes and tours of sustainable oil palm farms in the region or cacao agroforests.

Bamboo.
Increasing populations and the growth of a global middle class results in a rising demand for wood and fibre based products, placing further pressure on the planet's remaining forests. Meanwhile, there are global commitments to restore 150 million hectares of degraded and deforested land by 2020.
Bamboo plantations can be grown on degraded land, providing positive restoration properties while at the same time reducing deforestation and degradation through the provision of a sustainable source of fibre. Grown on degraded land, EcoPlanet Bamboo's plantations can provide a secure and sustainable raw resource for industries, companies and consumers.

The table highlights the interventions I make in the system and how it connects to each each concept, which are explained in more detail on the following pages. Each intervention is shown in my story of drawings, creating a new story for the landscape of Honduras.

Interventions Table

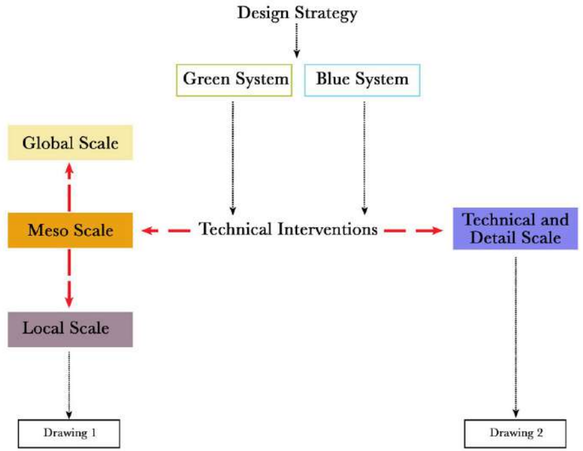
- *Food Security*
- *Sustainable Palm Oil*
- *Water Management*
- *Eco Tourism*

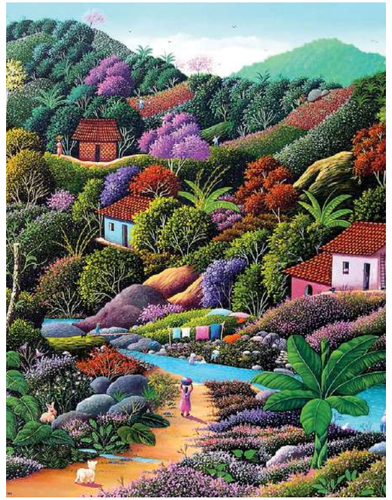
	Balancing the Landscape	*Technical Landscape Interventions*	*Reconnecting People back to their landscape*
Blue System	*Water management*	*River water collecters*	*Recreation and space in landscape*
	Soil erosion and food production on hills	*Hill water collecters*	*Water and power access*
	Flooding prevention	*Town water collecters*	*Water points through town*
	Food production on valley and more produtive palm	*Distributing water ways*	*Water access across landscape*
Green System	*Egoloical diversity watershed restoration*	*Agroforesty and extensive agriculture*	*Food security/ power for people*
	Egolocial diversity green movement	*Green corridor*	*Natural route and connection through landscape*
	New economies Food security	*Community gardens and tourism activities*	*Food security/ new economy space and power for people*
	Flooding protection Ecological diversity	*River buffers and marshland*	*Reconnection to true nature*
Ownership	*Diversity of economy*	*Ownsership change*	*Diversity of power, back to people*

Drawing the Landscape

In design of the project, many stakeholders were considered in the design for a united landscape system, in want of representation of everybody in the landscape. However, as landscapes are becoming globalised and their futures a matter of global decisions, uniformity threatens our places. Although place influenced my means of design, it is also carried through to the drawings in which I display the final project. Traditional paintings depicting the landscape have inspired my drawing of such. The compositions tell the landscape in a story capturing both tradition and invention, colloquial and academic, whilst showing link of the global to its local influence, my project tries to be the link between these scales.

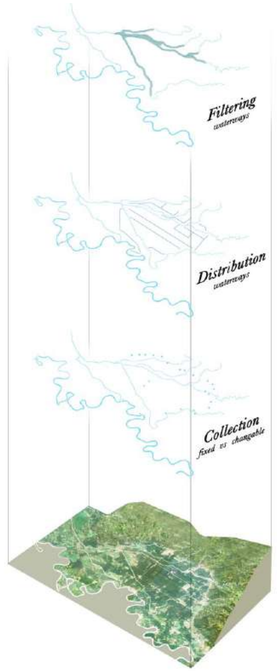
Each intervention which makes up the new story of the landscape is shown in two drawings, linking the scales of project. The first, showing the intervention linking the global and local, and the second showing its working on a technical and detail scale.






KM 0 2 4 6 8 10
Rivers
Formal water collection
Primary waterway
Secondary waterway

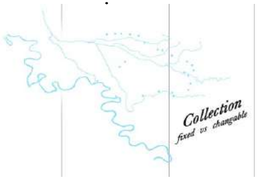
Blue System

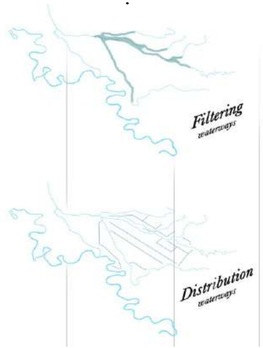


The blue system

The blue system is a sequence of water collection and distribution. This not only manages the extreme seasonal weather conditions in the rainy season, but distributes water equally through the landscape to ensure better production of palm oil and food for efficiency of the productive landscape. The different landscape elements; the valley flat and the mountainous hills are considered separately in their collection of water.

Hill water collection | River water collection | Town water collection | Waterways





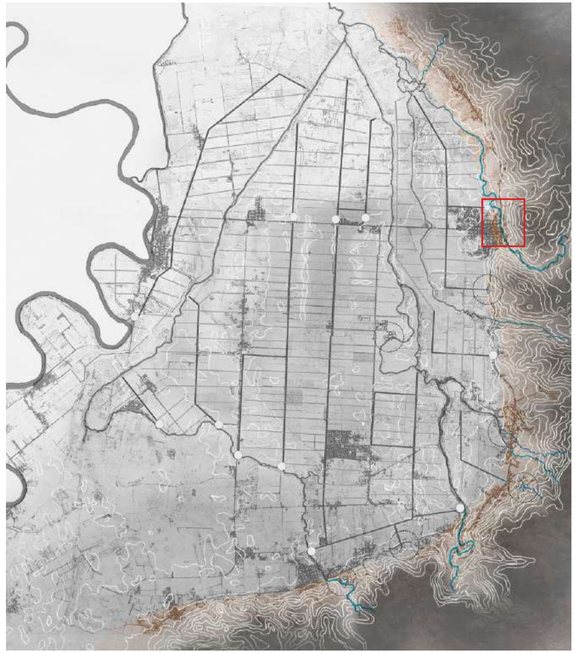
Hillside Water Collection

Global - There is extreme soil erosion, from an over intensification of intensive agriculture and palm oil agrciculture.

Intervention - Flexible water collection systems implemented by farmers into the landscape. These sit on hillside farms to colect water, to stop the soil eroision in the landscape.

Local - Water systems collect water in which cattle can drink from or farmers can use for irrigation. The systems can be added to with roofs, and place making for the people to enjoy.

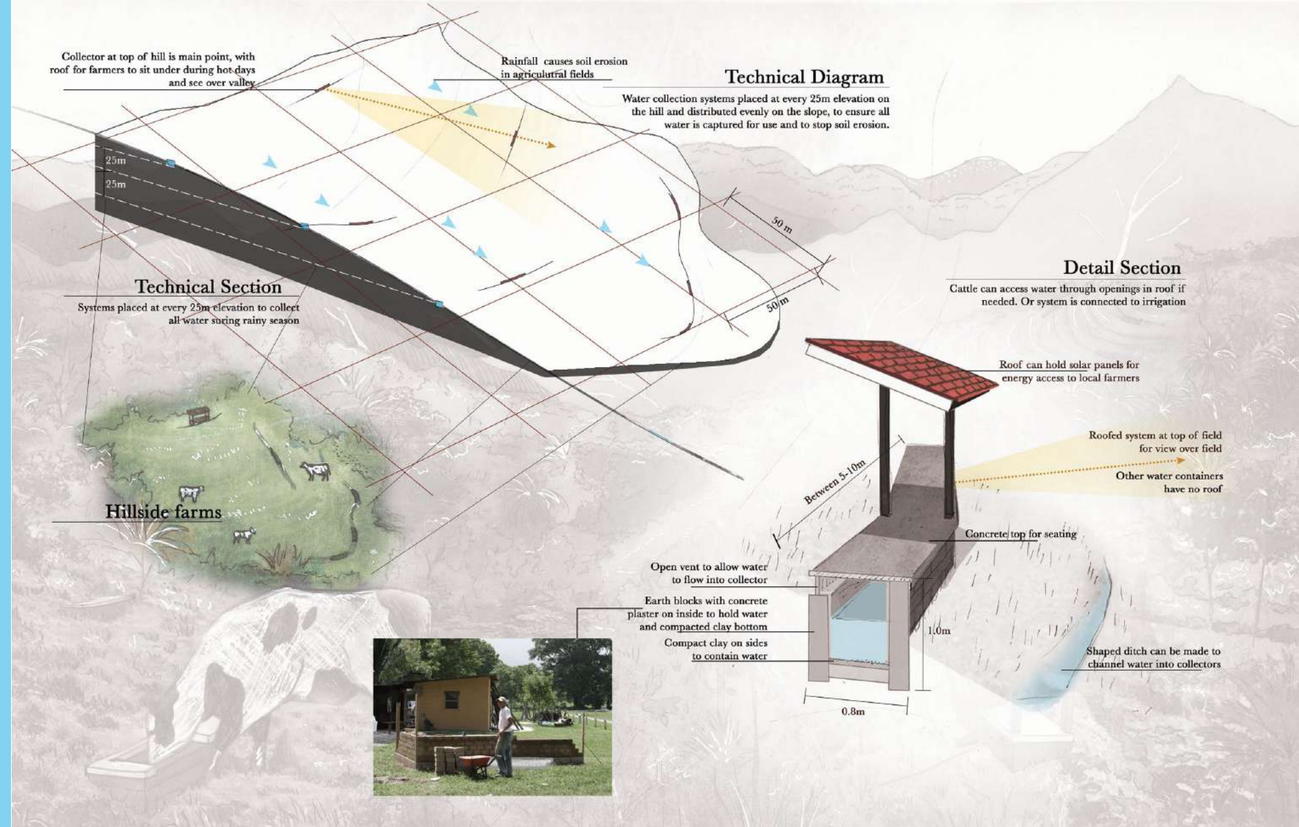
Hillside Water Collection



From study of precedents of collecting water on hill landscapes, the design has taken the main concept and been adapted for this specific context. This intervention concerns the landscape on the sloped edges surrounding the valleys.

These water collectors are situated following the natural slope of the hill. Built into the landscape, they collect excess water flowing down the hill. This not only stops soil erosion in the areas of agriculture, but also collects water for use on the farms in the drier months. Built in conjunction with trenches in the hill, access water can be directed into the systems.

Built with local materials; earth blocks for the main structure, with compacted clay on the inner walls to contain the water. I look into a specific farm on the hill bordering the town of Mezapa for design. Looking at amount of water flowing on each 50 by 50m area, interventions are placed to capture all falling water. The system at the top of the hill is roofed as viweing point over the farm and valley.



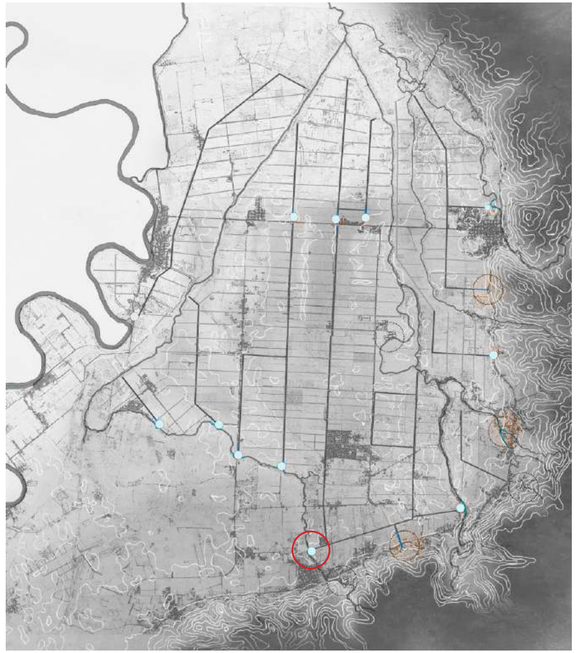
River Water Collection

Global - The designed reservouirs collect water rom the rivers, at the points that the valley flat starts. Adjacent to areas of water overflow, they capture water during the rainy seasons, from storm surges in the river, to protect farmland from floods, and to better distribute the water.

Intervention - The long pools of water link altogether and push water into the agricultural lands for peoples individual access to water. With trees between to create shade, they can hold water for use in drier months. These sit at the edges of the valley side.

Local - The water plaza not only helps in the balance of landscape, but on a local level connects to the local people. Recreational pools are created at the side which vary in depth for people to relax in. Weekends see many people head to the rivers for recreation with friends, as well as where locals go to wash their clothes and as places to cool down from the heat. These areas sit close to towns in the valley. This pools mark the start of the system, the regonisable orange tiles on the water houses mark the system throughout the landscape.

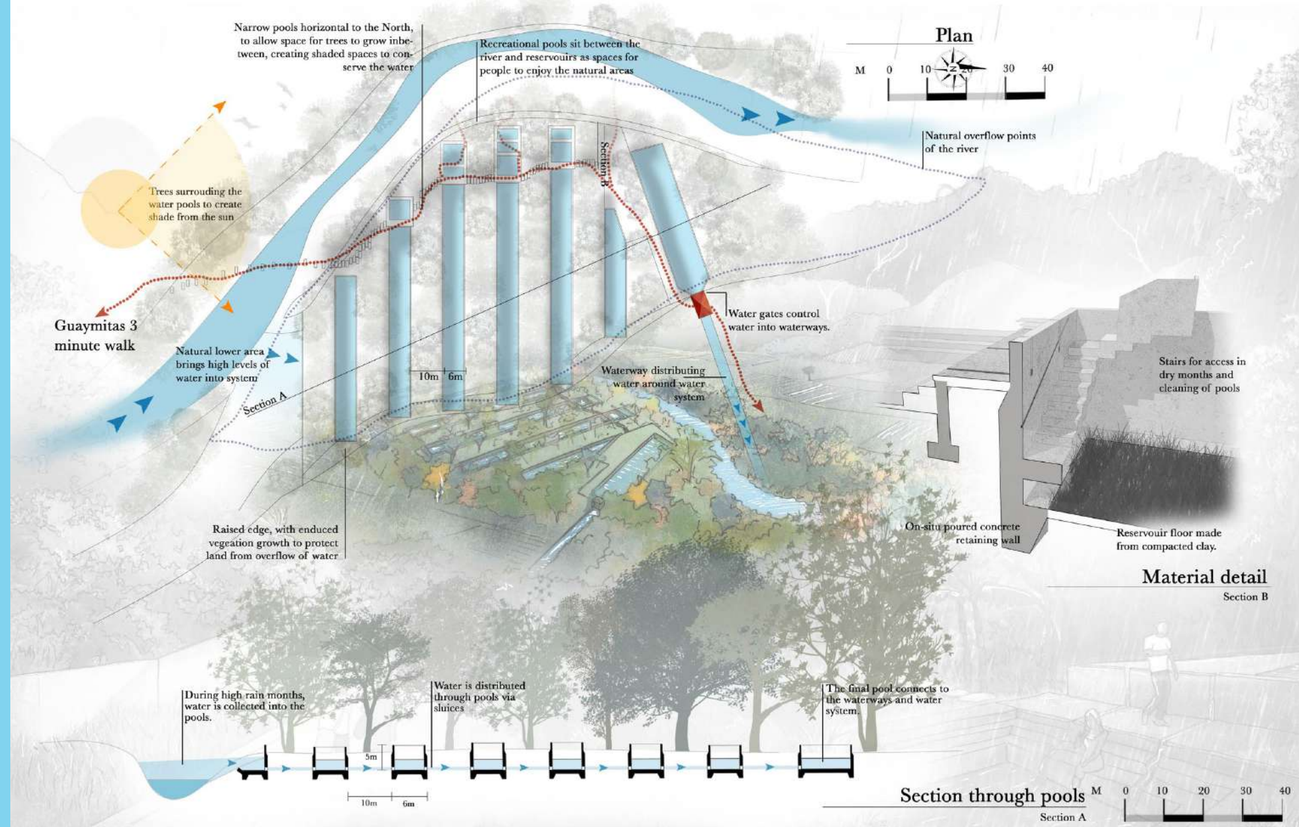
River Water Collection



There already exists several water collection points in the valley area,(marked in circles on the left). The design introduces more interventions to collect water at the base of the mountains to the valley. These are the start of the water system. They sit on the edges of the rivers, in the areas of 'natural overflow points' which have marked the landscape. Following the shape of these, the new reservoirs are formed. Highlighted in red is the reservouir designed in detail.

The reservoirs are long and thin pools sitting horizontally to the north direction. They are only 6m in width, with 10m to separate them, as space for vegetation and trees. This has been decided in a way to create shade over the pools in aid of stopping evaporation. During heavy rainfall or storms, when the river naturally overflows, the water will be captured within these pools and saved for utilisation in the water system during drier months of the year.

The design is strict in form, and the pools are made from in-situ concrete following this formal design thought. These start the balancing of the landscape system by helping distribute the water during the extreme seasonal variations. They also help protect the landscape from flooding in the areas where there is extreme threat.



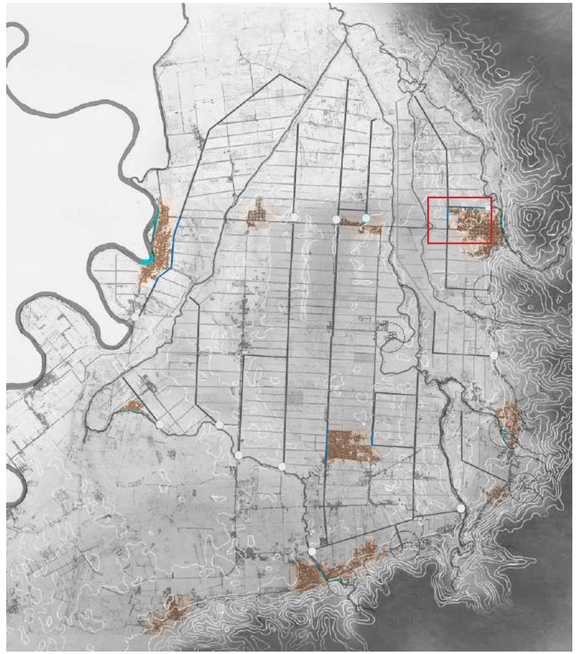
Urban Water Collection

Global - The towns suffer from extreme flooding during rain season, the threat increasing with climate change. Situated on the valley flats they are prone to the overflows of the rivers during storms.

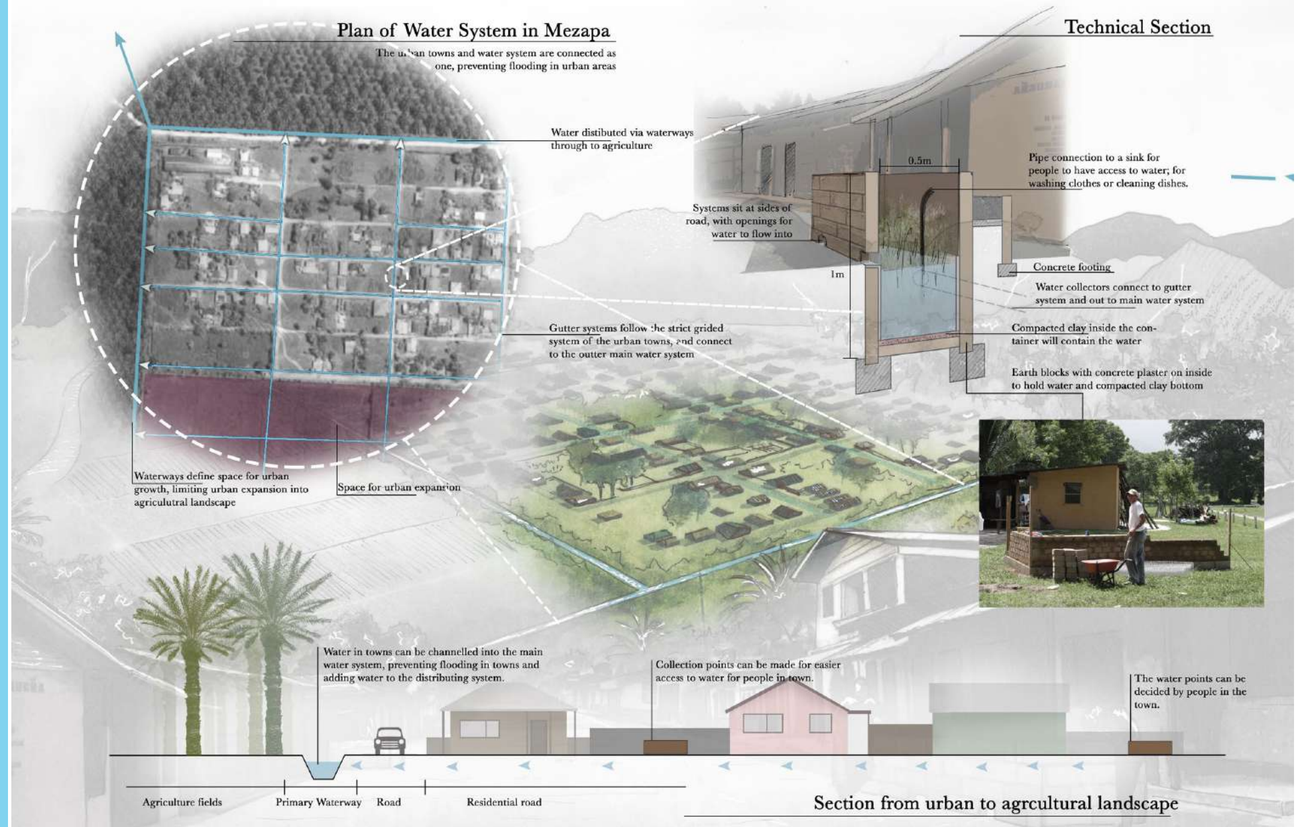
Meso - As such, water systems are also designed for the towns. These interventions can easily be built by the people themselves. They are designed to collect water overflow from the streets, and through a gutter system in the streets, can connect back to the water system of whole. Towns and landscape are united and no longer separated. The water flows into new waterways bordering the urban land, which in hand limit town growth into the natural landscape but also designate areas for future housing development for the soon population increase.

Local - Many of the rural towns in Honduras lack constant access to water supply. These points in the street hold the water and linked to a hand pump, these points can be used by the people as water for washing and cleaning clothes.

Urban Water Collection



Water collection is also introduced into the towns of the valley. I zoomed into the town of Mezapa for detail. Many face problems of flooding due to bad drainage systems. There is also additional problems of lack of water in towns in some drier months. The idea for these water collectors is similar to that of the collection points on the hills. They are situated at the sides of the road, for excess water on the streets to flow into. The water is held in these systems, the ground being compacted clay for the potential of plant growth. These are attached to manual pumping taps, as the water can then be used by town residents for washing clothes or washing up. They can become communal points in towns for daily activities. The overflow of water from these points connect to one another and into the water system of the valley.

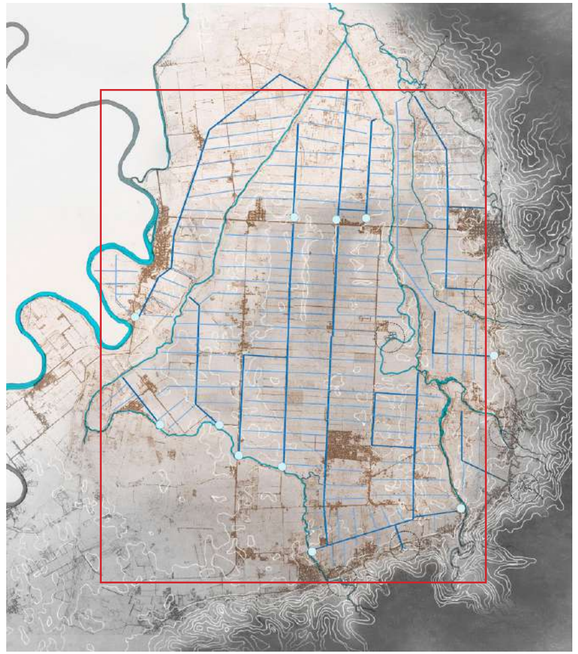


Distributing Water Ways

Global - Honduras does not lack water, but fails in distribution of this water. With better distribution, the agricultural production in the valley will be better, and individual farmers will have more security. The production will be more efficient and less space will be needed to this use.

Intervention - A system of waterways connect throughout the landscape distributing the water from collection points, to the individual farms. The main large waterways work from the south valley edge down toward the north low valley. These connect to smaller waterways which take the water to individual farms. The system follows the existing lines of infrastructure, turning this colonised grided road system into a system which empowers the local people again.

Local - Farmers can take water from these trenches at their own need for irrigation of their farms and better productivity of their business. Simple hand pumps can be attached at the sides of the waterways for easy access to the system by not only large businesses but the small holders. Canal houses sit along the water system, controlling the flow of water, and highlighting infrastructure crossings. These houses, tiled in iconic red clay tiles, create a new language of the system over the valley tying into the industrial city of San Pedro Sula. These can incorporate solar panels on the southern side as energy generation to control the water as well as local access to electricity by local people.



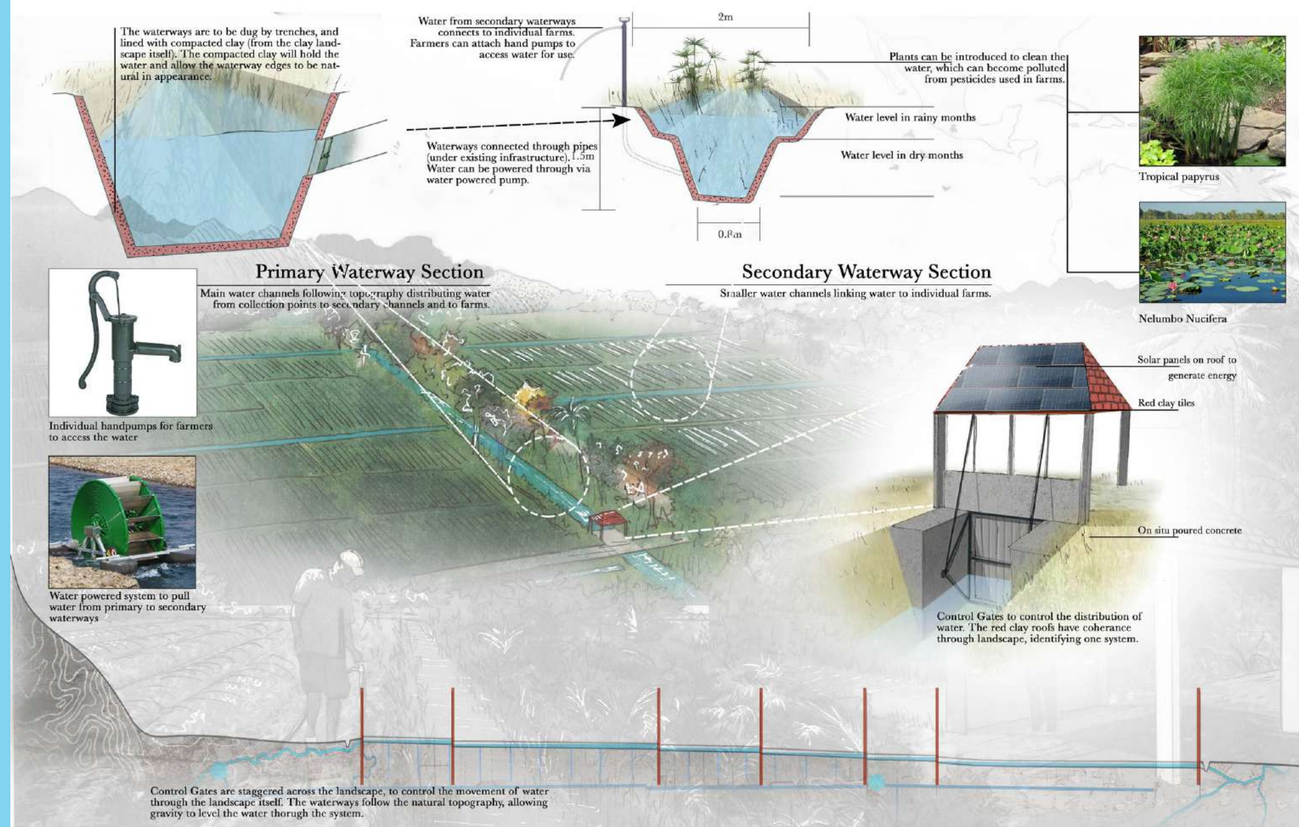
Distributing Water Ways

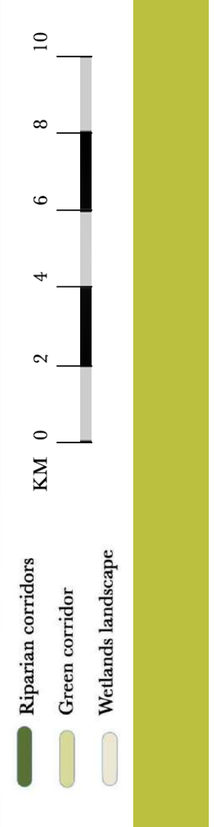
Following these set interventions in the landscape, in order of collecting water, it is then all bought into the system of waterways for distribution of the water. This water system has two main principles; the primary water way system and the secondary waterway system. The primary system is a larger waterway design, as the main channels for distributing the water in the landscape. These follow the natural topography of the landscape, using the natural slope for distribution. These lines follow the main infrastructure pattern along the landscape.

The secondary water network is linked to the primary system, these are smaller channels which run horizontal to the main and connect to the individual farms. They connect from the primary system through small pipes. These are powered by small systems to enable water to flow into these trenches. Farmers can connect to them in their individual farms though hand pumps which can connect into the water.

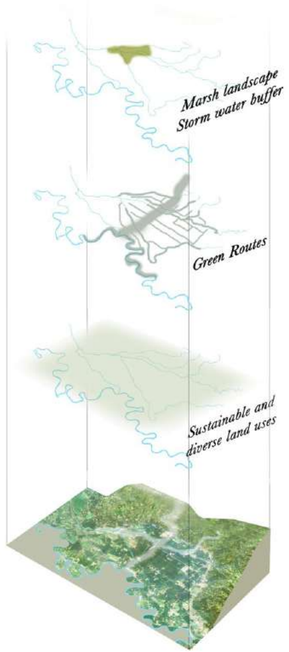
Canal houses define this water system. They intersect at infrastructure crossings. At certain points they also act as gate houses to control the flow of water. These are also adaptable to solar panels on the roofs for the generation of energy to the local people. The climate is perfect for solar panels, and it can also bring individual power supply to the people; connecting to plug points in the canal house and to main infrastructure energy system. Much like the pavilion in the main city squares - these can become social hubs for local people, shaded places to relax from working in the farms.

These will stand iconic in the landscape, with the honduran red tiles on the roof, they will be seen across the valley as points emphasising the water system.



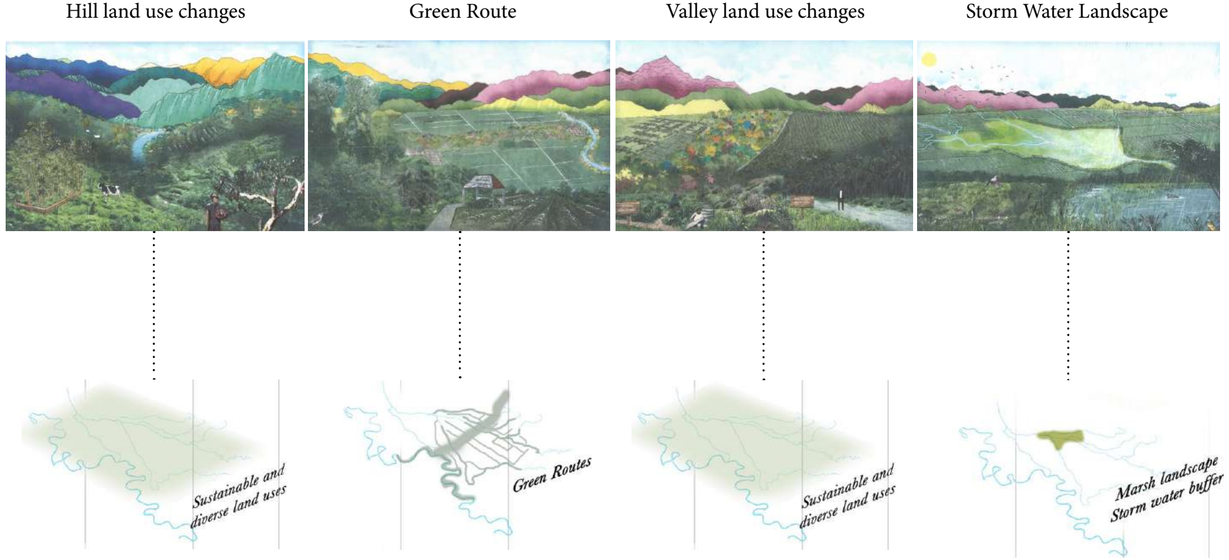


Green System



The Green System

The green system ensures a rebalancing of the abiotic and biotic system in consideration of this productive landscape. With introduction of different landscape conditions for creation for new habitats as well as connections to larger green corridors for the ensured able movement of wildlife. This also considers the changing of land uses for more environmentally friendly land use such as agroforestry or bamboo production, which can restore the soil, as well as eco tourism which can be introduced through the landscape. A main part of the project, and thought of in the proposed green system, is new types of economy, so that the area is less reliant on just one type of economy and production. These economies are as follows.



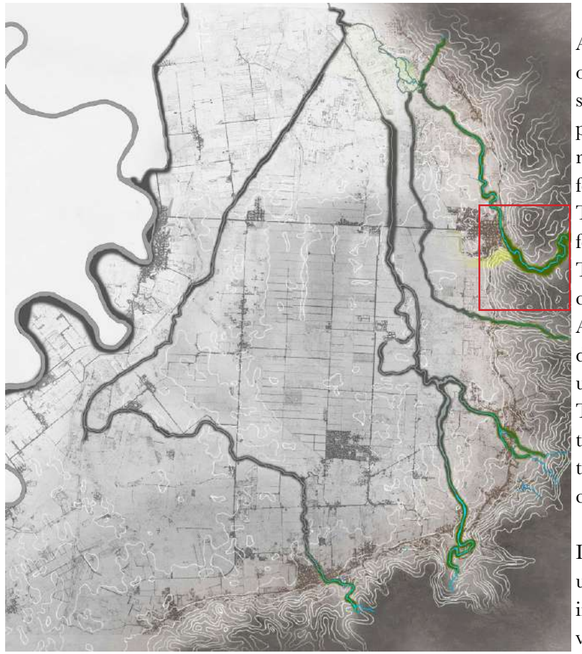
Hill Landscape Land Use

Global - The increased intensity of palm oil agriculture has started to encroach upon the hills surrounding the landscape. The new design encourages the loss of all palm oil agriculture on the hills, over time, because of the caused soil erosion and loss of watersheds.

Intervention - Instead encouragement of agroforestry and extensive agriculture such as cattle is introduced. Agroforestry such as cocoa and coffe production is introduced which can be a large economy for the area and buisness for local people, and sustain the environment.

Local - Cattle will still be grazed here but in combination with a small amount of bamboo production. Controlled by the cattle the bamboo can be grown small at first, the materials for use in the irrigation system and housing development.

Hill Landscape Land Use



A main objective within the design is to restrict palm oil growth on the hillsides as this cause lots of soil erosion and loss of watersheds. As such, a change of palm oil agriculture to mostly food production happens on the hill sides, as well as reforestation to restore watersheds. In terms of this new type of land use, agro foresty is mainly introduced for crops such as coffee and cocoa. The production of these crops is mixed amongst trees and shrubs for the insurance of continued habitats and reduced soil erosion. There is also introduction of more extensive agriculture such as cattle, which after palm oil can bring nutrients back into the soil. Also as an alternate economy, bamboo agriculture will be introduced into the landscape. Initially as an experiment to see its usefulness in the market. The species is native to central america. The bamboo has restoration properties which could help restore the land after palm oil agriculture, whose roots can be very extensive within the ground. Mixed with cattle, the bamboo itself can be controlled.

Introduction of this crop has been considered because it is also a useful material for the system as well. It can be used in hand with irrigation, as well as building material for new homes within the valley.

Existing Land Use Plan

Proposed Land Use Plan

Introduction of new agriculture, for a more diversity in economy

Palm oil agriculture

Green areas

Food agriculture

Existing green corridors

Proposed green corridors

100m 500m 1km

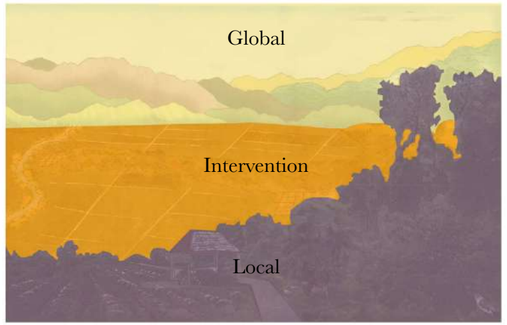
Bamboo production amoungst cattle agriculture.

Bamboo for housing in valley or irrigation. Cattle for food security in country.

Cocoa and coffee agroforestry, helped my initiatives such as REDMUCH

Guadua Bamboo is native to Central America

Valley Green Route

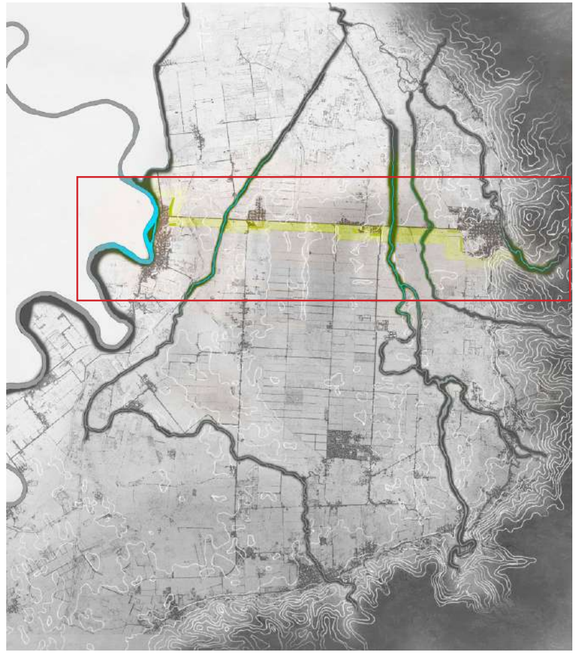


Global - The new green route connects the main communities of the valley, bringing space and nature back to the people, whom have been so disconnected to their landscape and other communities over past centuries.

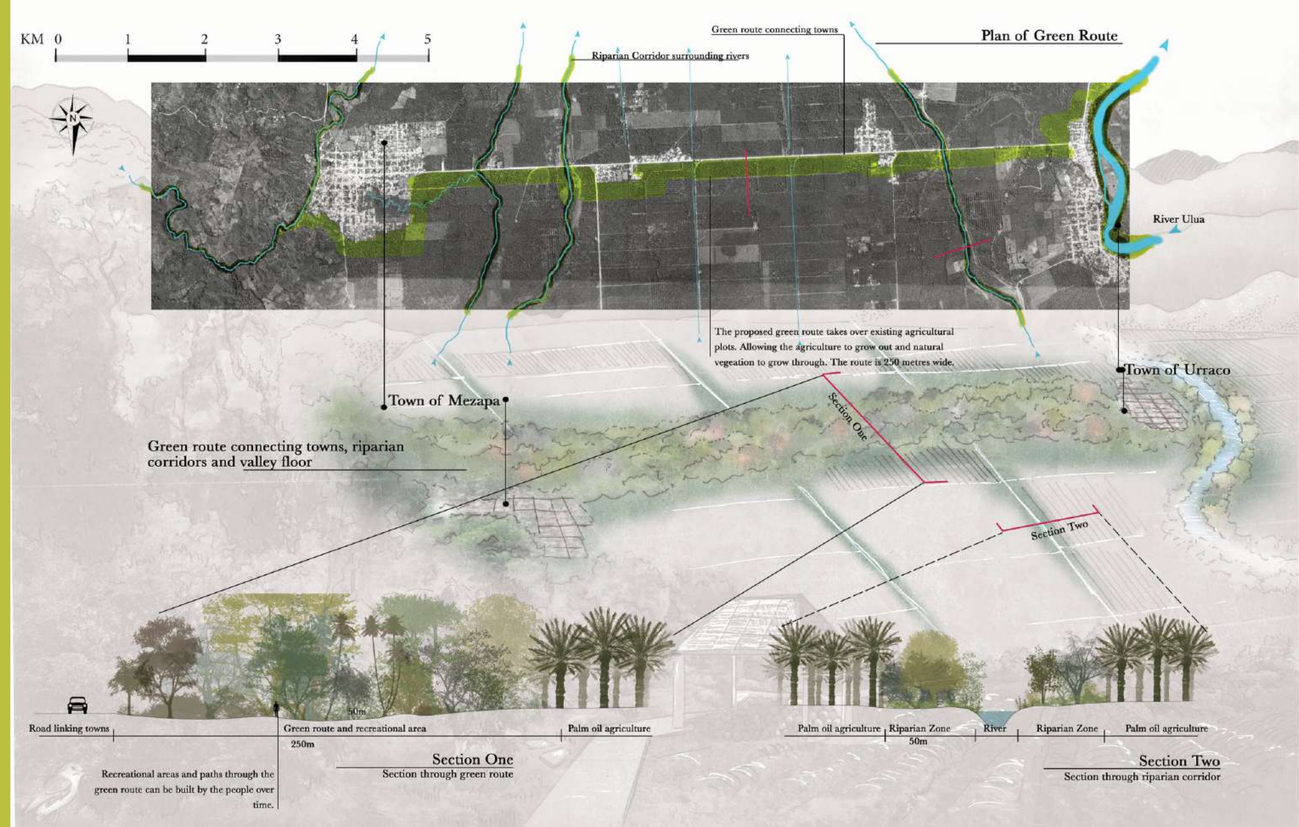
Intevrention - The previously agricultural plots will be left to 'wild' growth of nature. In initial stages of design, endangered trees can be bought here and planted by the community to bring back the beautiful diversity of nature which used to flourish in the valley.

Local - Creation of the paths and routes through can be built up over time by the people who live here. Using local materials to create the paths so people can walk or cycle through the natural valley. Houses similar to the canal houses are also implemented with solar energy generation which people can use to sell fruits under. This type of hut is very common on the roads through the valley to sell fruits.

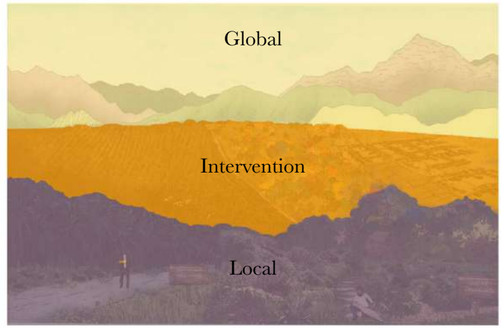
Valley Green Route



As existing there is very little natural areas in the valley flats, there is a large disconnection between the town and people and the landscape. The landscape is restricted, the ownership of the valley being strongly taken away from the people. As such, is a large green route is added to the valley which connects the different towns together. Running horizontally to connect all the towns, it is also connecting of different landscape elements, from the main River Ulua through the valley flats and to the side of the hill. Not only is this for the restoration of natural habitats in the valley area, but as a way to bring nature back to the people whom inhabitant this place. Sectioned from existing plots which will be left to grow as true nature, The people can help encourage the growth one day with addition of fruit trees. Although this acts as the main green corridor, it connects to many smaller ones which will be implemented along river banks and the new water ways, both for wildlife movement and movement of people. This main corridor connects to the marsh landscape as well as larger eco corridors on the top of the hill side.



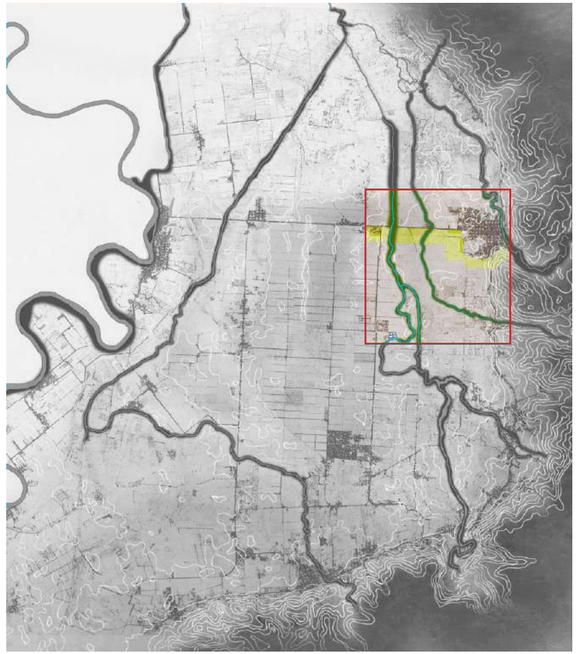
Valley Plains Land Use



Global - The valley has become monopolised by palm oil agriculture, the areas economy becoming reliant on this industry, controlled in the hands of a few. The people are losing space to this economy and power in their landscape.

Meso - A new economy in the form of activism toruism is introduced, working with palm oil agriculture. This starts from the town of Mezapa to join through to the factory of HonduPalma. In addition, local gardens are intorduced as space for the local people to grow their own food.

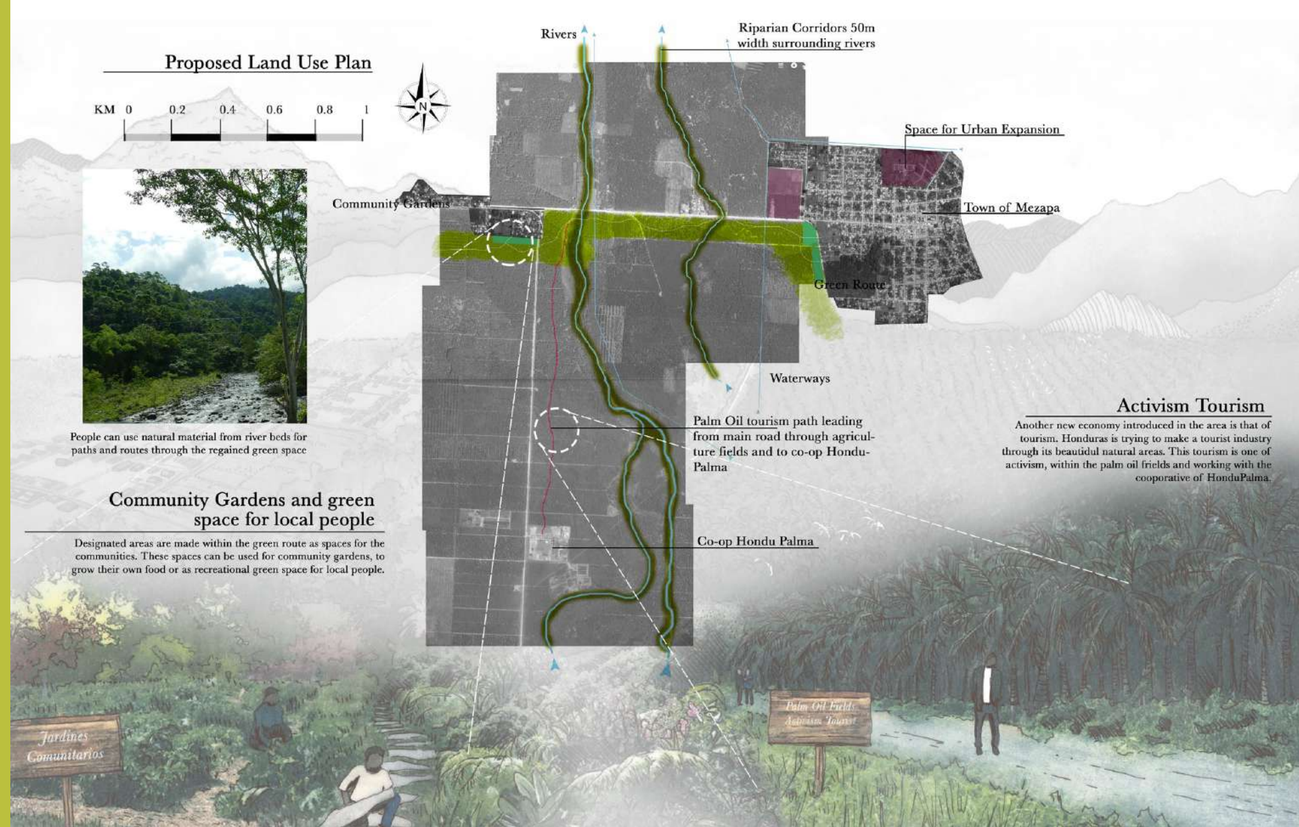
Local - Local communities utilise the new gardens, which surround their towns, to grow their own food. These areas are designated just for the local people to transform into their own garden space. Admist the green route which connects these communities and the new gardens is introduced a new road for encouragement of tourism. This road connects the town of Mezapa through to the cooperative factory of HonduPalma. This 'activism tourism' not only generates new economy in the area, but brings a new image to the valley; from 'dangerous area' to holiday destination. This activism tourism encourages the idea of this project as well as support to sustainable thinking cooperatives.



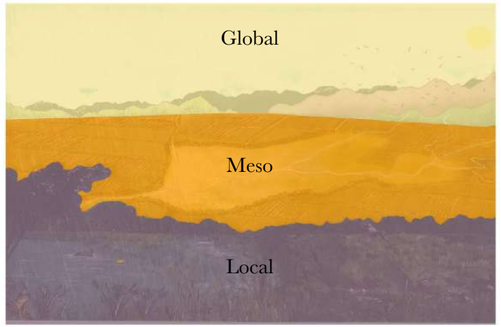
Valley Plains Land Use

On the valley flats there is also a large change in land use. Much of the palm oil agriculture will be changed into food agriculture, both of intensive and extensive use. The palm oil agriculture which through the help of cooperatives will follow the rules of RSVPO to be more productive in production. Pointed out already, much of the land in the valley will be restored to natural areas.

Introduced as a new land use through the proposed naturul corridor are community gardens for the added food security for local people. In addition, tourism through the palm oil fields is introduced as a tourism aimed at activism which encourages the management of the land use of palm oil and the work done with the local people in the area. This is centred around the palm oil factory of HonduPalma in the valley. A path leads from the toen of Mezapa to the factory to encourage the start of this economy.



Storm Protection Wetlands Landscape

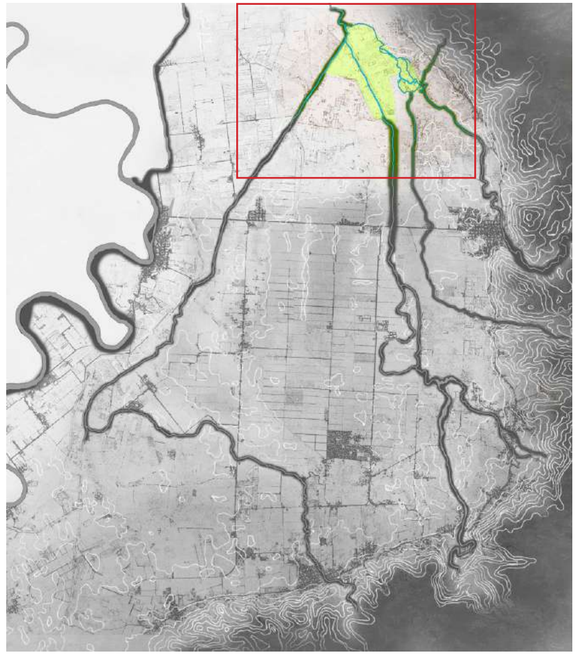


Global - The intense variation in seasons in this climate results in a huge amount of water in the rainy season, increasing dude to climate change.

Meso - At the end of the designed system is a new wetlands landscape. The large space sits at the end of the system, at the meeting point of the rivers that flow through the valley and ends of the water ways.

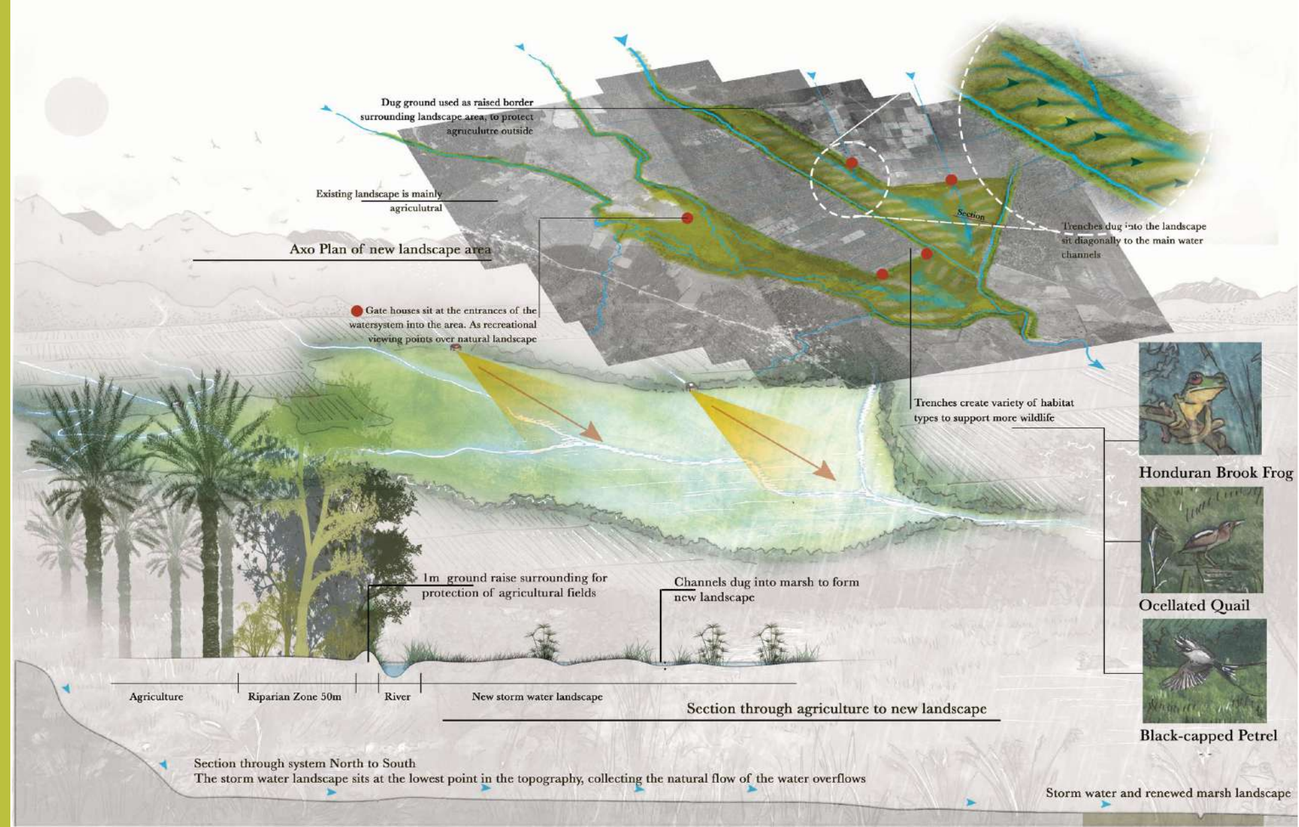
Local - Canal houses at the end of water ways can also control water into here. This area has been converted from agricultural land into space for excess storm water, through the digging of ground to make new paths in the landscape over time. This is an area for nature to flourish, a nature which has been condensed in the agricultural expansion. Birds and amphians can flourish here in their habitats.

Storm Protection Wetlands Landscape



Overlapping with the blue system is the introduced marsh landscape. This natural element in the production landscape is introduced as a tool for storm water holding. The large space offers a large buffer for the channeled water to distribute into, to protect the towns and farms from impact of water during the rainy season, especially in the outlook to a future of severe climate change which will affect the rural people most. This sits at the lowest topographical point of the landscape area.

This area, which at present is farmland, will through the digging of trenches, diagonally to the flow of the adjacent rivers, transform into the marshland over time. It sits at the end of the water system, at the end of the waterways which can let water into the marsh. This natural landscape will also be a renewed landscape to the area which has long be lost to the productive function for the simulation of more habitats for wildlife.



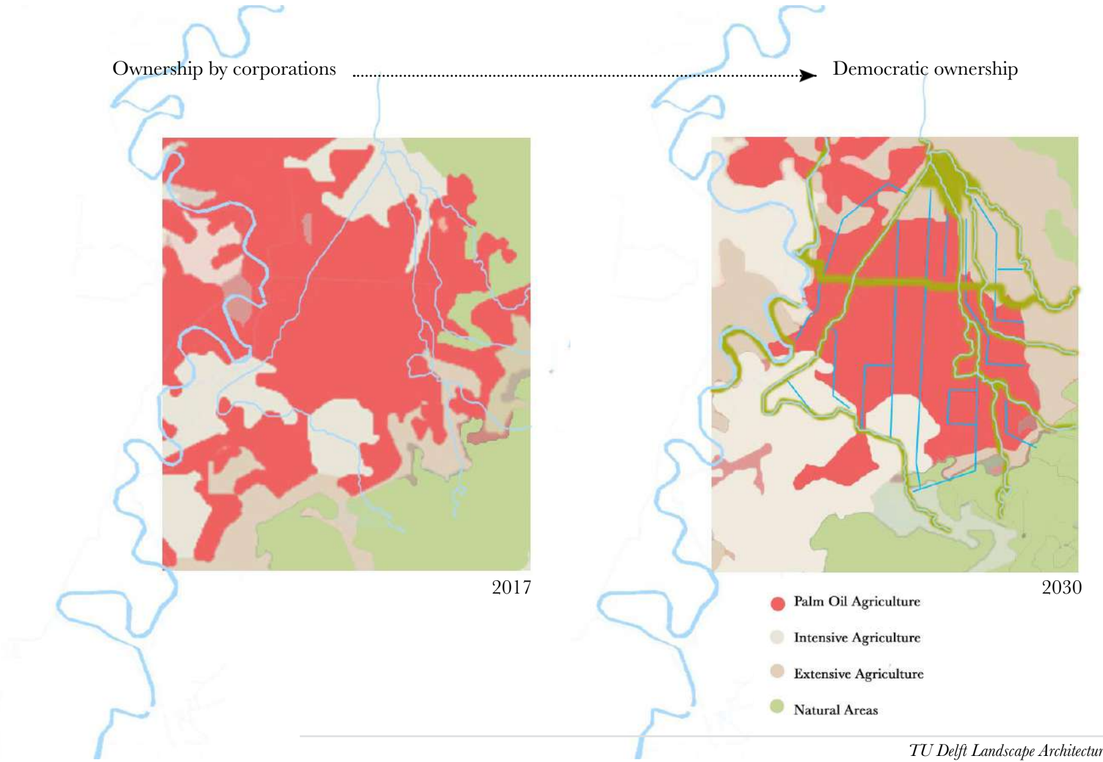
Ownership

Taking reference of the land use maps, carefully created by the PBL, of future land use in the year of 2030, I zoom into my area of research.

The final outcome of the project utilises the suggestion of land use change, in addition to the interventions I design.

The maps on the right show the schematic drawings of land use changes in the area, and the area with addition of the intevrentions.

In addition to this design, is thought about the ownership of the project. At present, the landscape is becoming more privately owned and as such is the people of the landscape are being forced off of their land and losing power in their landscape. The idea is of the landscape changes as suggested here also goes in hand with more democratic ownership of the landscape; as explained on the following pages.



An equal system

The design connects the landscape in a united system. The design itself tackles global goals of the landscape in a more balanced system, but in hand connects the people back to their landscape.

The design as explained above, shows the balancing of the landscape in terms of planet; production vs environmental stability, of profit; divsersity and stability of economy, and people; reconnecting people to their natural landscape. **In addition the project aims to empower the local people in their landscape. This empowerment of the local people has been thought about in terms of ownership and through the construction of the project itself.**

Construction and Change of Ownership

The landscape project in vision is one of a united landscape, and this also concerns the ownership. With farmers put at an equal within the landscape. The new system is about equalising the landscape in a shared vision, and with the cooperative hondu palma at the front of its making, it will be one which the people both help to make and can own.

The first elements of the project to be constructed are the most important to the project. In the blue system, this is initially the waterways, and following their construction, the water collection points adjacent to the rivers. The thought is to have these main elements mainly funded and constructed by the Palm Oil corporations and Co-op of Hondu Palma. As the system will help the productivity of their own buisness, as well as help them to become certified with the RSPO, incentives for their time within the project.

Along with initiation of the blue system, the green system will also begin. Firstly, is the matter of designating new land uses across the area; that being intensive food agriculture, extensive agriculture, palm oil production, and the proposed interventions being the green route, the storm water landscape, and riparian zones adjacent to rivers. This task will be assigned to official representatives in the landscape, so the land use changes can start in changing, letting the old agriculture uses grow out.

The storm water landscape is to be constructed following this, and post the construction of the waterways. This is also a task to be headed by the palm oil industries in the area, helping connect the system as one. The first above tasks as mentioned are to be completed within the first five years of the project.

As new land uses come into place within the landscape, in time with the gradual decline of palm oil trees, new types of agriculture and land use are bought into the landscape. This includes more diverse food agriculture, such as bananas, sugar cane, pineapples, and cattle; as well as agro forestry with the production of coffee and cocoa.

In hand with these new land uses and the introduced diversity in economy, local people are able to buy into the landscape. They can purchase plots of land for starts in buiness with these new production uses. The aim is for more balance in ownership over the land; an aim for 50/50 ownership of companies to local people. Local landscape iniatives and organisations can contribute to the helping of local farmers to become empowered within the landscape, such as WWF and Hondu Palma. They can aid the farmers in the common global market.

With these new land uses coming into action, and more diverse productions taking place, farmers can start implementing some of the tools in the design. Landscape initatives can help aid farmers and local people in this. These tools include the water pumps to have access to the water from the waterways, and access to local construction materials to build the water collectors on the hills and in the towns. These sets of tools, the water collectors on the hills and in the towns, do not follow the strict design principles of the initial elements built. The design suggests how they can be made, but the design is not implied to be a strict set of rules for their construction. The local people can interpret the tools in their own farms or in the urban areas. The materiality of these come from local materials which can be easily adapted by the people.

Alongside developments in the productive agenda of the system, is the green spaces for people. As the green route and storm water landscape grow into more natural areas, the local people can start engaging with their landscape. Creating local gardens around their communities, as well as places for recreation and routes thorugh their landscape. This is when the people start in their reconnection to the landscape, and take it over for their own. In addition to this, trees can be purposely planted which may be seem endangered, to spark growth of certain species.

Through the timeline, the whole system whill start to come together, in hand with the palm oil fields becoming more sustainable to RPSO standards, as well as increase in amount of agro forstry. From this a new economy will form through tourism. This tourism is to be aimed at activism tourism, based around walking tours of the palm oil farms and eco agriculture. This buisness will start to grow in the area.

By the year 2030, the plan would be to have all the new land uses in place as well as the water system, and both green and blue system unite as one in the area. In hope of the projects succession, the general principles in the design can expand through the valley.

The construction starts with the most formal elements, that being the water ways and water collectors at the rivers, which are funded by the palm oil corporations. As the timeline moves on, construction and funding comes more from the people and initiatives. The language of the design in general follows this format too, the beginning more strict design parts are designed very formally in structure; the river water collection and the water ways following the existing strict lines of infrastructure. Through the construction, the design elements become a lot more subtle and flexible in implmentation.

Constructing the new landscape

Construction by the Palm Oil Corporations involved

Construction by the Local people with help of initiatives

Funded by

Materials and tools

Consequence to

New economy introduced

Strict in design and form

Flexibility in design

Green System

Areas in landscape designated their new land use.

green links surround waterways join. riparian zones encouraged to grow at 50m bordering rivers.

STORMWATER LANDSCAPE

storm water landscape constructed

2018

2023

NEW LAND USES

New landuses initated and increase in diversity of economy. Agroforestry; cocoa and coffee, extensive agriculture such as cattle, and diverse food agriculture

GREEN ROUTE

Green recreational areas start in construction - natural areas have been left to grow, endangered trees planted by people in valley.

Blue System

Digging of the waterways through the landscape, during the Dry months.

WATERWAYS

Creation of main water collectors at the points adjacent to the river. Constructed in dry season.

RIVER WATER COLLECTION

Farmers can buy tools to access water, such as water pumps. Funding of local iniatives

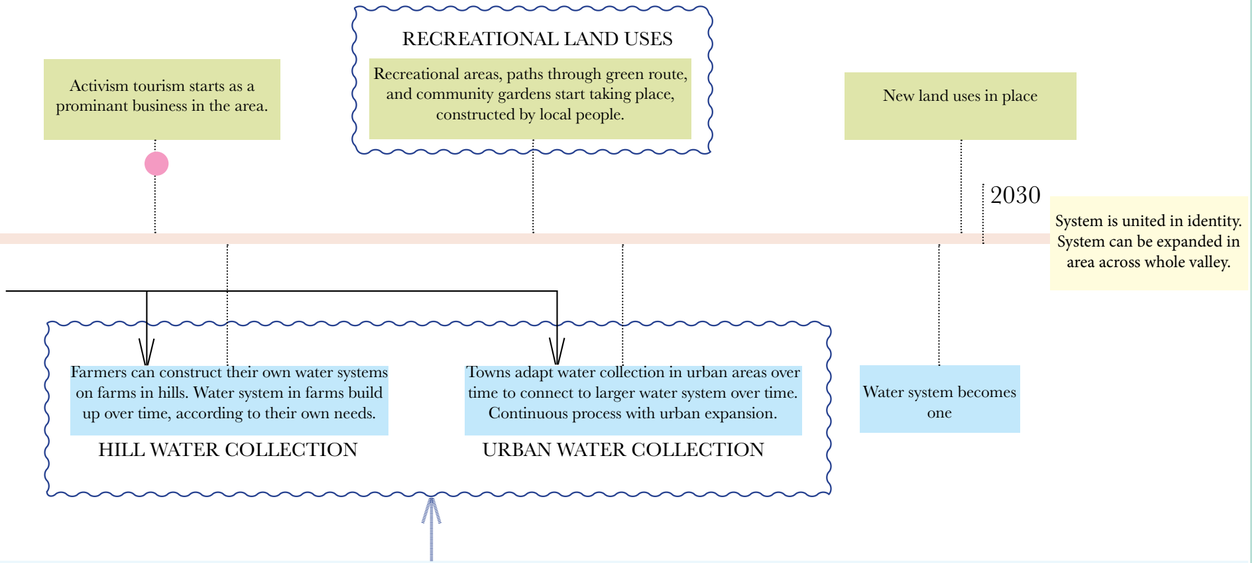
The cooporative of HonduPalma and the corporation of Palcasa hold land in the area and will help initiate the proposed design.

People able to buy into landscape, in coherance with the new land uses; to start their own businesses or have their own land.

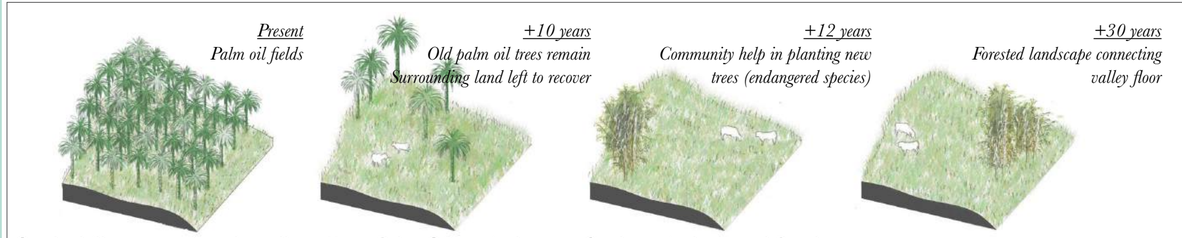
The aim is for a 50/50 in ownership, bewtwen co-ops/ corporations to people.

Landscape initives help people start buisness and join common market, such as WWF and REDMUCH

Water pumps in secondary waterways, connecting water to individual farms

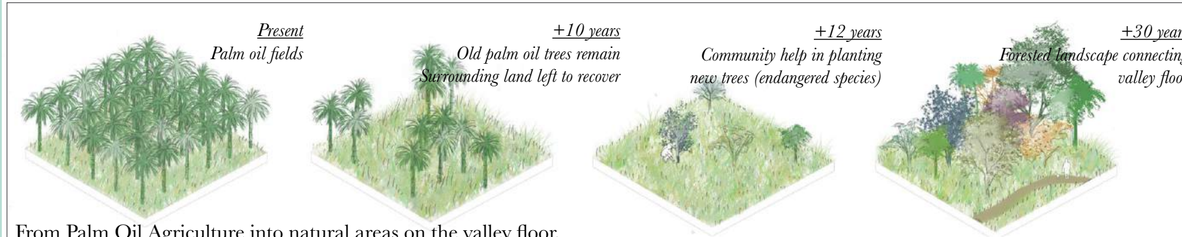


The more flexible 'tools' for water collection can be used by local material, farmers can buy locally or recieve from the palm oil corporations. The construction is open to interpretation and how local builders can create these tools. The suggested tools use earth bricks covered with compacted clay for water retention. This is a construction method used a lot currently in the area.



On the hills surrounding the valley - From Palm Oil Agriculture to Cattle agriculture and Bamboo

On the hills surrounding the valley - From Palm Oil to Agroforestry



From Palm Oil Agriculture into natural areas on the valley floor.

Reflection

In reflection to the wider context

Whilst agricultural landscapes are products of the local ecosystem, and community in which they are situated, they are increasingly becoming affected by the same global issues and converging under the dynamics of globalisation. The main global issues being the inevitable population growth and consequential worldwide food insecurity. As predicted by the UN, the world's population by the year 2100 will be between 9.5 and 13.3 billion. In accordance to the average American with a food footprint of 1.4 hectares, 93% of the world's surface would be needed for a '2100 middle class world'. I think this project is extremely relevant at present for landscape architects, the mediators of environment, to offer solution to the growing need for agricultural space, and most importantly how this space works with the environment and people whom make up the landscape.

In addition to this problem on a spatial level, I think it very relevant as well to address the people of whom make up the landscape. My work at the PBL allowed me to explore three case studies of agricultural landscapes and their possible futures; in all three it was a multitude of actors contributing to the discussion. The agricultural landscapes in question are more and more being controlled by outsiders and influenced as such. Locals to the landscapes are continuously loosing power in their landscapes. I think the project relevant in this way as it proposes balance to this problem and new ways for people to engage with their surroundings. As the world becomes more globalised, our way of life affecting those of whom live half way across the globe; we face these global challenges together. But it is important to see how the individuals of the landscapes themselves relate to these global frontiers.

In reflection; I think my project was able to add technical solution to this large problem on a spatial level toward a future where production landscape and environment are in balance, but it also considered the empowerment of people within the landscape at every stage.

In reflection to the method and ethical dilemmas

I was very fortunate to work with the PBL during the initial stages of this project which could really support the research being conducted. Through my work at the PBL I had access to a great amount of information in regard to the problem in the specific area of Honduras, and from interviews with various actors within the landscape such as NGOs, Palm Oil companies as well as banks and donors of the project. This was extremely useful in seeing the project from a very real perspective and in the end for a more realistic approach of implementation, especially from an outsider perspective.

The interviews conducted were able to lead to scenarios which, through research in more depth and through illustration, were able to be brought back to the actors for real discussions on the varying scenarios. This was a great moment to make actors in the landscape aware of

one another and their needs, as well as how the landscape works as a system and the consequences of their decisions.

It is as such that I think what this project really compels in is its social aspect; throughout the project actors of the landscape have been in discussion a large range of people have been talked to. As a landscape architect, I think it essential to bring these global problems into technical solutions in the landscape but always in consideration of the people and place. I think this especially relevant in my more western perspectives and design approaches to global contexts.

Again, in my own visit to Honduras, I set about to really talk to people there to fully understand the landscape. As well as living with an architect whom works in San Pedro Sula and could really bring me insight to the context, I conduced interviews to various landscape initiatives as well as at a palm oil company.

In reflection of design and ethical implementation

It was the ambition of my project to bring this large global issue to a realised design of site specificity. Although I think the concept and spatial design as whole works very well as solution to the problem, both balancing landscape and reconnecting people to their landscape, I think there are many aspects which still require much more research by in depth design. For the further in detail design, I think the project requires more knowledge on the landscape such as predicted rain falls and specialists on water management to realistically implement the project.

However I think the design is successful in its spatial quality it brings to the landscape, taking elements specific to the landscape itself and working with the natural form of the landscape itself. The design in places is not only about the technical solutions but subtle characteristics which tie together the valley of the Sula for interactions on an individual level.

I think the design in materiality successfully offers a realistic way of implementation. There are a few formal and set interventions in design, but much of the project is flexibly designed for interpretation by the locals themselves. As a project, I wanted to offer a united system but ensure enough freedom for the open interpretation by the people , so it is not too controlled, but even in implementation can empower the people of the landscape for their own control of their landscape.

Even in thinking of the construction of the project, I bought people at the foreground of its implementation. Using the cooperative of HonduPalma as the starting point, which ensures the fair working with local people, people in the landscape will be involved in the construction and able to interpret it throughout.

Through land use changes and ownership change, this part of the pro-

Reflection

Through land use changes and ownership change, this part of the project may take a long time to ensure, which can only come with cooperation of many actors within the landscape. I hope through the story I tell, which highlights the project to global issues and brings awareness of the whole system, that this can be influenced. This story is carried through to the drawings in which I display the final project. The compositions tell the landscape in a story capturing the link of the global to its local influence.

In conclusion

The project highlights as to a possible future, of a united landscape, envisioned in a new story of the landscape. The project offers ideas of the landscape at whole, linking the global issues to the local situation. As well as real ways of construction and how the project may be implemented. With more focus on technical aspects of the project, I think the project could in reality be successful and a starting point to the entire northern coastline of Honduras.

The project in whole is display of possibility for the future of this landscape, and in though can start discussion to the future. It is also display of landscape architects influence on large global issues such as food production, and the technical solutions we can offer.

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