



# Restructuring the resettled landscape

Guiding informal activities and settlement in the riparian landscape of the Volta Lake, Ghana.

**The man-made Volta Lake in Ghana is one of many artificial lakes in Sub-Saharan Africa, but distinctive because of its large size [85.000 km<sup>2</sup>] and old age [the Akosombo Dam was finished in 1964]. In the riparian landscape around the Volta Lake, informal activities and settlement occur on a large scale, despite planning precautions. A landscape approach is used to mediate the conflict of interest in this zone and explore an integrated, sustainable future.**

Sub-Saharan Africa holds over 1300 dams. The impact of these mega structures on the landscape goes much further than just the inundated land. In the area surrounding a reservoir, the environment adapts to the new circumstances, setting the transformation into a new landscape in motion. This riparian landscape is often heavily influenced by human settlement as a result of the attractive power of water. Lessons can be learned from dams which have been constructed many decades ago.

The Ghanaian Volta Lake is one of the first and largest reservoirs in Sub-Saharan Africa, and until recently also the largest reservoir in the world. In this thesis, the Volta Lake serves as a case study on the transformation of the landscape surrounding a reservoir.

The relief of the Ghanaian landscape forces the water flow of the Volta River system through a natural gorge near Akosombo, creating the opportunity to generate hydroelectricity. Combined with local natural resources [bauxite] and transport [a sea harbor], a lucrative economy could be created [the production of aluminum] This was already acknowledged by sir Albert Kitson in 1915, but not exploited until the 1960's. In 1958, Ghana became the first Sub-Saharan African country to gain independence. President Nkrumah implemented the idea as a part of a

large development and modernization scheme. The Akosombo dam, completed in 1964, inundated 85.000 km<sup>2</sup> and forced over 80.000 people to move. They were to be resettled from over 700 villages into 52 resettlements. However, the people did not stay in these resettlements.

## **Problem context: Processes in the riparian landscape**

The creation of the Volta Lake resulted in migration of people all over Ghana and far beyond to the lakeside. They were and still are attracted by the potential that the lake and the riparian landscape offer. They spontaneously settle at the Lakeside to benefit from the relatively large abundance of natural resources, which provides the potential to conduct multiple livelihood activities to sustain their living.

However, the riparian landscape is vulnerable, and the growing pressure is causing environmental degradation. Meanwhile, power generation at Akosombo Dam remains extremely important, supplying a large part of the country with electricity and ensuring revenues from neighboring countries. However, the lifespan of the Akosombo Dam is threatened by sedimentation. This jeopardizes electricity generation in the future. The main cause is erosion, created by the increase of human activities in the riparian zone around the lake. To stop

## **Miranda Schut**

Master student Landscape Architecture  
miranda.schut@wur.nl

## **Ilse Verwer**

Master student Landscape Architecture  
ilse.verwer@wur.nl

*In collaboration with KU Leuven*



erosion and protect the dam, the Volta River Authority [VRA] prohibited activities and settlement below the topographical 280ft contour line. On top of that a 50 m buffer zone was added. Within the riparian landscape the restricted area is not visible though. This implies that there is a conflict of interest in the riparian zone, caused by the contradictory needs of parties on national and local scale. The uniform government policy to stop sedimentation appears to be an inadequate planning approach; it is incompatible with the needs and lifestyle of the inhabitants around the Volta Lake. Despite the policy, the lakeside continues to attract settlers, generating informal activities and settlement.

In the thesis, the possibilities of an integrated landscape based strategy are researched. It is hypothesized that 'the riparian landscape around the Ghanaian Volta Lake offers the potential to support livelihood, without jeopardizing Akosombo dam's efficiency and durability. A sensible integral landscape design can restructure the riparian landscape and guide informal activities and settlement'.

#### **Analysis: Exploration of the riparian landscape**

To gain an understanding of the interactions between the lake, the

settlers and the surrounding environment, two strategic sites in the riparian zone were selected and analyzed using 4 themes: productivity, accessibility, sanitation & waste and climate change. The following is concluded:

*Productivity.* The first settlers were attracted to the lakeside by the potential for fishing. The fish stock is at the moment however declining. The agricultural practices increased when the potential of the nutrient rich soil in the drawdown zone was recognized [Drawdown is the alternating exposure and submergence of a strip of land as a result of the fluctuating water levels of the lake throughout the year. This area is potentially 100.000 Ha]. The restrictions of the VRA forced the drawdown agriculture into [small scale] informality.

It is important to note that the soil is very vulnerable for severe erosion. The majority of farmers depend on rain fed agriculture at plots more distant from the lake, which are often depleted, threatening food security. Irrigated farming could introduce year-round farming, improving food security.

*Connectivity.* The original settlement pattern and the position of the road network [before the lake] has a strong link to the topography. Communities settle within close proximity of the lakeside, below the 280 ft contour line set as boundary by the VRA, to

maximize the access to the drawdown zone and Volta Lake. The lakeside settlements in the riparian landscape form an exception to the original settlement pattern. Position of settlements at the lakeside and topography negatively influence the accessibility. The access to the lakeside settlements is limited because the connection is perpendicular to the topography and original road network. The relief forms a barrier between the original settlement and the lakeside. Often, the lakeside can only be reached by foot, crossing large distances and/or steep mountainous terrain. Often the communities are forced to transport over water. Some larger, strategically located settlements form an exception and are moderately well connected by road.

*Sanitation & Waste.* Due to the informal nature of the lakeside settlements, there is a lack of basic facilities, like sanitation. The lack of facilities forces people to use the water of the lake for domestic purposes. Solid waste is disposed in the drawdown zone and washed away into the Lake. This poses a health threat.

*Climate Change.* Due to [global] climate change, the rainfall pattern could become more extreme in the future, shifting towards a higher peak in a shorter period. The consequence could be a larger drawdown zone, putting the



dwellers near the lakeshore in danger of flooding. Also, rain fed agriculture will become less reliable.

**Design: Interventions in the riparian landscape**

A design is created that aims at balancing informal settlement and lakeside dwellers' livelihood strategies with the protection of the environment to diminish sedimentation and degradation. The new regional strategy favors a landscape based approach, based on spatial context, over the uniform VRA policy. Characteristics like local diversity and potential, accessibility, environmental sensitivity and the actual level of degradation are taken into account. Based on these characteristics, settlements are pointed out that could develop into strategic located centralities at the lakeside. In these settlements strategic functions and services are provided and from there, development can open up the hinterland.

On a local scale, the strategy attempts to trigger development in suitable locations within the riparian landscape, instead of limiting development at the vulnerable lakeside. A framework for development is created using a [new] road as a tool to restructure the riparian

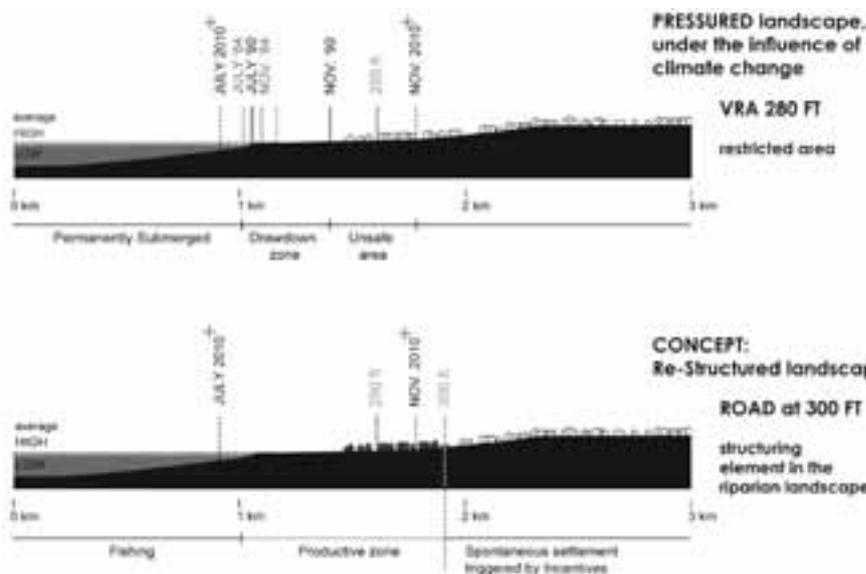
landscape. This physical element also enhances the visual clarity of the spatial organization.

The position of the road [infrastructure] is strategically merged with the topography [landscape]; a link is made between safe [higher up the slope, towards the 300ft contour line, anticipating extreme water level heights in the future as a result of climate change] and efficient [transport from A to B, using the minimal amount of resources]. This stimulates settlements to develop higher up the slope, creating a new settlement pattern that leaves room for production.

At strategic sites along the network [an intersection with existing paths], infrastructure and facilities are linked to the main road, like [secondary] roads, potable water & sanitation facilities, lighting & electricity and social facilities. These interventions are used as incentives and play a central role in the development of activities and settlement. The provision of basic needs will trigger concentrated development of private initiatives and settlement along the network. The pressure is relieved from the most vulnerable part of the landscape, towards safe settlement locations with a minimal risk of flooding, while

obtaining minimal land ownership and using limited financial resources. At the settlement level, the allocation of [social] infrastructure and facilities provide a base that guides and supports development; roads, a sewage system and other utility lines form a spatial framework. The design applies a flexible, open-ended strategy, allowing people to settle spontaneously into a sustainable and suitable living environment and develop the settlement in their own way, while at the same time preparing for development and a growing population.

To reduce food insecurity and adapt to population growth, agricultural production should be increased. This is possible if the potential in the riparian landscape is utilized to its fullest extent, while taking sustainability into account: production and protection are balanced. Productive zones are distinguished based on topography [slope percentage], vulnerability for erosion [presence of vegetation & degree of disturbance] and resources [water & nutrients availability]. This results in four categories: No activities, Drawdown agriculture, Agro-forestry and Afforestation. In the zones where agricultural activities are allowed, erosion remains a point of concern. Soil conservation techniques [researched in a series of reference studies] like intercropping, the planting of rows of Black Vetiver grass [Vetiveria Nigriflora] and trees like the Ana tree [Acacia albida] and the African fan palm [Borassus aethiopicum] could diminish erosion and depletion and fix nitrogen. In response to the over reliance on rain fed agriculture in the light of climate change, irrigation possibilities are introduced to ensure year-round farming. By creating water catchments to control the runoff from perennial streams during the rainy season, the water retention capacity of the landscape is increased. The water is collected into a small reservoir instead



of flowing directly into the lake, which makes efficient use for irrigation possible. The water is guided over the productive fields by the use of gravity. Terraces are created by retaining walls to halt erosion.

### Conclusion

The design provides a spatial solution to the conflict in the riparian landscape of the Ghanaian Volta Lake. The plan provides infrastructure and facilities, so that it becomes possible to conduct multiple livelihood activities by creating

the opportunity to make use of the relative abundance of natural resources in the riparian landscape. It is not necessarily the only way in which the problem could be bridged. A landscape based approach is however a method that could have a substantial contribution because of its spatial and integrated qualities, suitable and appropriated for the situation and context.

#### INCENTIVE PLANNING



NOW



START implementation of **BASIC INFRASTRUCTURE & FACILITIES.**



EVOKED DEVELOPMENT People are attracted to the higher, **SAFE** location.



URBAN DEVELOPMENT along the road, including a **COMMERCIAL AREA.**

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### Samenvatting

In het oeverlandschap rondom het Volta Meer [Ghana] komen op grote schaal informele activiteiten en bewoning voor, ondanks planningsmaatregelen. Het landschap is echter extreem kwetsbaar, en de groeiende druk resulteert in degradatie van het systeem. Ook wordt de toekomst van elektriciteitswinning door de Akosombo Dam bedreigd door sedimentatie als gevolg van menselijke activiteit. De thesis onderzoekt de mogelijkheid om in dit spanningsveld een ruimtelijke, duurzame en geïntegreerde oplossing te creëren door middel van een strategie gebaseerd op het landschap.