

Living with Water

Creating a vision and integrated land use strategy to improve water and soil conservation and quality of life aspect.

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Abstract

The city of Bandung is representative of the destiny of many cities in the tropical developing world. Demand driven population influxes combined with a lack of planning and infrastructure leads to massive problems of sustainability. The city faces the twin paradoxical problems of flash floods and the chronic lack of access to drinking water. Land use changes in the upper Cikapundung catchment of Bandung city are largely responsible for these water issues. The climate change dynamics only hasten the process of humanitarian disaster. Within this context, it is extremely important to find cost- efficient, sustainable solutions that can alleviate these problems and enable human activity to sustain without suffering. Research suggests that spatial solutions with circular systems may allow for the appropriate channelling of rain water and use it for sustenance. Landscape interventions aim to improve the hydrological order in the catchment, whereby sustained efforts are made to convert hard surfaces resulting from unregulated growth into water absorbing surfaces, via bio engineered systems like Agro-forestry.

Besides water retention and prevention of floods, these interventions have aesthetic appeal and spatial relevance to intervention through landscape design. They also achieve goals of more sustainable agriculture that further contributes to the appeal of the city and its aesthetic aspects. The efforts have the possibility of promoting eco-tourism for a city that already has abundant natural beauty owing to a volcanic terrain and evergreen rainforest cover (albeit covered under a layer of pollution today). Thus, proposed efforts through phased spatial interventions can create a positive circle of reinforcement where the benefits are much more far-reaching and sustainable beyond the primary goals of the project.

Strategies for living with water need great innovation in developing countries where the fast pace of city expansion and population growth cannot keep up with the very slow pace of infrastructure development. The city can be restored to its former glory through a series of affordable hydrological and bio- engineered strategies of surface water and ground water management. In such challenging circumstances, creating case study for vulnerable catchments around the world. There is great promise that landscape infrastructural solutions and circular systems can transform the developing world.

Reflection

History and Context of the Site

The city of Bandung was known as the Paris of Java, colonized by the Dutch for its pristine location, was a town surrounded by volcanic mountains that offer protection and resources, a constant food, water and energy nexus, with a cool climate. It is located at 768 m above sea level. It is the capital city of West Java province, represents the textile and fashion capital of Indonesia. It is the most important educational hub of the country. Bandung's textile and fashion development commenced when the Dutch as a colony connected capital Jakarta and Bandung in 1900 and it became a luxurious city with Art Deco villas, luxurious cafes, boutiques and hotels with colonial plantation estates. However, agriculture was and is still the backbone of the economy. In 1960, new technologies boosted the industrialization and economic development. There is continuous influx of people in the fashion industry, business industry (pharma, telecom, IT, real estate) or for education. This floating population adds further pressure on the already dense urban tissue.

Today, this fast- expanding, complex urban city is plagued by polluted rivers and the deteriorating public health due to lack of water and sanitation facilities is concerning. Over abstraction of ground water reserves, industrial and domestic pollutants contaminating the rivers and streams, unregulated real estate development in the catchment, rapid and haphazard growth of informal settlements, sedimentation, challenging topography making it hard for the centralized water supply system to reach the entire city, lack of rainwater management, public negligence, leading to drought, flash floods, fluvial floods. These issues contribute to the low performance of the over populated urban fabric. The uncontrolled, unregulated growth of informal settlements has led to overuse of groundwater resources. Sudden population growth and the shortage of housing, has also led to denudation of forest cover in Northern Bandung.

The true scenic experience of nature in its glory, the cultural milieu, the pride and legacy of the colonial city is now felt only at the peri- urban area of the dense city - draped by volcanic terrain of the Lembang hills. They are symbolic of the dense evergreen forests clustered between the deciduous forests at higher altitudes, with glimpses of agrarian bounty nested within them. The site is located in Dago region in the upper Cikapundung Catchment zone in North Bandung.

Landuse changes in this Catchment in the past 50 years (unregulated real estate development, forests replaced by dryland farms) are responsible for reduction in sponge function of the catchment. This has led to rise of flood and drought scenario in Bandung city. Additionally, several areas in peri-urban Bandung are now highly prone to landslides. The issues faced now include land degradation, soil degradation and erosion. The urban area relies on water supply from the rural areas located outside their administrative boundaries in Bandung. For this reason, It is essential to improve the health of the peri urban environments in Bandung. Environmental health and socio- ecological condition can be improved by addressing the issue of water resource management through surface and subsurface strategies. Soil and water conservation measures in such fragile peri-urban areas are implemented. They include water infrastructures at different scales and afforestation strategies. This new blue green layer facilitates an integrated landuse. Benefits of this landuse system include food sustainability and security, water availability, and improved sponge capacity of the Cikapundung catchment. This in turn helps the flood and drought situation from worsening.

Role of Landscape Infrastructural strategies

Designing for rainwater- new water infrastructure and bio engineered interventions for aquifer recharge at various locations in the catchment will have a steady positive effect to make water available locally in the catchment itself, but also downstream in the city eventually.

The idea behind this intervention is also to help people realize the value of the natural resources around them : abundance of fertile soil and land, climate conducive to agriculture, possibility of aquifer recharge by channeling the precipitation, and to instill pride in them about their rich natural setting. A new social, agro-forest neighbourhood is envisioned, to be in symbiosis with nature with communally managed orchards, home-gardens and terraced farmlands nested within the Agro- forest Community.

Three main strategies are the basis of Landscape intervention :

1. *Improve Hydrological Condition of the Catchment* : reorganisation of landuse as per hydrological adaptability. This involves implementation of different types of surface water infrastructure (constructed wetlands, overhead tanks, etc.) - that act as buffers, filters or infiltrators, to clean water and supply it locally for re-use. This facilitates availability of water for domestic use, plus additional for home garden agroforests and water channels/ canals, regional water buffer, sawah pools, septik tanks, etc. Their size and locations are chosen based on aquifer recharge potential, necessity of slope stabilization and soil quality etc. to initiate an Agro-forest based community with its own water management system.
2. *Bio - Engineered Landscapes* : Promote slope stabilization in the catchment- based on Upland, Midland Lowland Assessment.
This strategy proposes zoning of agroforest and pastureland in place of organically rich primary and secondary forest areas, complementary to the primary forest cover and zoning of area suitable for construction of settlements based on slope and soil analysis.
Bio engineering aims for strategic planning with specific trees like Eucalyptus, Mahogany (to enable groundwater recharge, enhance riparian edges by improving moisture content of the soil and bio diversity), and efficient clustering of vegetation- agroforestry, community orchards, and

home gardens along the gradient. These interventions naturalize the landscape and enable water filtration, soil conservation and eventually slope stabilization.

Relevance with the wider context

Vulnerable Catchments in developing countries:

The societal relevance of this landscape intervention lies in the social and environmental field. The existing, pressured, environment at the peri-urban area - the Catchment - needs to plan adaptively given the consequences of rapid urbanization, overexploitation of resources and climate change. It is already very prone deforestation, unregulated real estate development, etc. In many South East Asian cities, the urban tissue of the city relies largely on the peri-urban area for water and energy resources.

The scenario of flood and drought in Bandung City calls for an effective rain-water management system at the source - the Catchment area. Hence, it is necessary to introduce landscape interventions for efficient rainwater management. If the informal neighborhoods are transformed sustainably in symbiosis with nature, it will lead to a long term environmental security and increase the quality and livability of the living environment. It will also improve the overall health of the city, both for its current and future inhabitants. So there is an urgent need for a range of affordable infrastructure with bio engineered solutions that help to harvest, conserve and reuse the available resources (water, soil, land).

Relationship between Graduation topic, Studio topic, Master Track

Flowscales studio addresses relevant sociocultural, ecological and technological issues from the perspective of spatial planning and design. Urbanization, ecological crisis and climate change are complex problems that only can be addressed transdisciplinary and from an international perspective – in particular regarding environmental issues and sustainability. (Nijhuis et al., 2017). Landscape infrastructure facilitates meaningful interaction of man with his environment. Through the flowscales studio, it is a valuable opportunity to address the issue of the slow pace of infrastructural development, which is a peculiar problem of many south East Asian cities. We need to review the centralised and top down planning approaches in view for bottom up solutions tailored to the particular landscape and relatively cheap. We also need to review the landscape technologies and circular systems from the past that could guide the infrastructure development today.

In the Master's thesis, I wish to address the issue of growth of informal settlements and their design in symbiosis with nature. West Java experiences one of the highest rates of deforestation in the world. The land use in Cikapundung catchment has changed from 47.3% forests in 2000, to 21.8% in 2015. The forests have been steadily replaced by real estate development and - dryland agriculture, and this extreme land use change scenario has led to increase in the surface water runoff. This situation can be reversed, with Sustainable agricultural methods coupled with afforestation strategies.

The Dago region in North Bandung is explored for its potential as a water reservoir at a meso and micro scale. Improved water retention capacity of the Cikapundung watershed, for drinking water access and also to mitigate the flash floods in south Bandung. The need for surface water infrastructure, and the possibility of circularity makes this project directly relevant to the Circular Water Stories studio. Implementation of strategies to make room for the rain water, by reducing hard surfaces, building buffers to hold the rain, install biophores to recharge deep aquifers, promote sawah- wetland agriculture and possibly permaculture and aquaculture. Landscape interventions designed, allow building with nature, and can promote a sustainable method of agri-'culture' through the Agroforestry and Silvopastoral system, which has already been witnessed in some other cities in West Java.

Social and Scientific relevance of the work

The societal relevance of this investigation hides both in the social and environmental field. It is expected that the negative consequences of the changing climate(e.g. increase in rainfall) will increase in the future. These consequences will further damage the existing, pressured, dense urban environment. In case of

Bandung, deteriorating public health due to lack of water and sanitation facilities is already a major concern. Hence, it is necessary to integrate a landscape infrastructural layer at Regional and neighborhood scale to adapt to the climate change and improve the overall resilience of the entire city. Awareness about this issue plays an important role, especially in socially and economic vulnerable environments. To involve all stakeholders in a clear manner in this process, this investigation takes place on the regional scale of the city. If the formal and informal neighborhoods are transformed in such a way to cope with the impacts of climate change, it will lead to a long term environmental security and steadily increase the quality and livability of the living environment. Both for its current and future inhabitants.

Much research has already been done on the fact that our urban environment must adapt to changing circumstances and what the damaging effects could be. This graduation project would like to add a participatory strategy on the regional-scale. In the economic circumstances of today, investments are decreasing and bottom-up initiatives are desired. But in what way can various actors contribute to an integral strategy? This investigation tried to examine what link could be established between the results of research in the field of climate change, the field of spatial planning and strategy and in (citizen) participation and how this could be translated to a spatial solution existing out of a strategy and design, to contribute to the body of knowledge.

Ethical issues and dilemmas

As with any interventionist solutions, there is a cost- both financial, with a complex stakeholder network. While implementing said solutions, care must be taken to minimize human costs as it is easy to neglect them when proposing large scale changes. To affect change, the people affected by the changes must be systematically brought on-board and their needs and anxieties properly addressed.

Conclusion/ Evaluation

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