

Location - Tainan, TAIWAN

Impact of Climate Change on Coastal Cities

In the past few decades, coastal disasters all over the world reveal the high vulnerability of coastal cities and the urgent demand of building coastal-city resilience. More than 70% of large cities are located along the coast because of abundant natural resources and facilitated sea transportation. The demographic trends show that over 75% of the global population will live in coastal communities before the end of this century. Research found that economic development in the coastal region will speed the growth of real-estate markets, and change the land use and land cover changes as well. The coastal land use and cover changes not only alter the coastal environment, but also affect the interaction between the marine and territorial system. Addition to the vulnerability of coastal ecological and social-economic environment, impacts from the climate change increase the coastal risk dramatically. The research focuses on the impact of climate change on coastal city, especially the land adaptation abilities. The case study site, Tainan City, is one of six municipalities in Taiwan with almost 1.9 million population. This historical coastal city was one of the earliest developed cities in Taiwan, which has dense urban development on the southwest coast, and coast related industry, such as fish farms, salt field, along the coast. With the land sub-

sidence, sea-water level rise and extreme rainfall, coastal cities, such as the Tainan City, face critical challenges of flood and related issues of public health.

There are various strategies and action plans applied on coastal city adaptation. Since Tainan City is a highly developed area, it is impossible to retreat communities located in highly flood risk area. Protect and prevent strategies will be suitable in this region. However, how many areas are left for climate adaptation? This research study the overlapped area of flooding and potential spaces which can be used to reduce the flood impact, such as parks, water ways, wetlands, agricultural lands etc. More overlapped areas indicate higher adaptation abilities. Six scenarios are analyzed in this research to compare the adaptation abilities of coastal cities under different development strategies



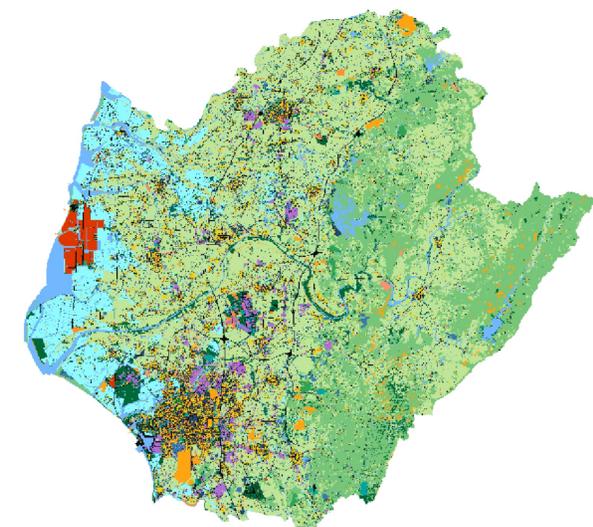
Requirements and Assumptions

Design Assumptions are list as following:

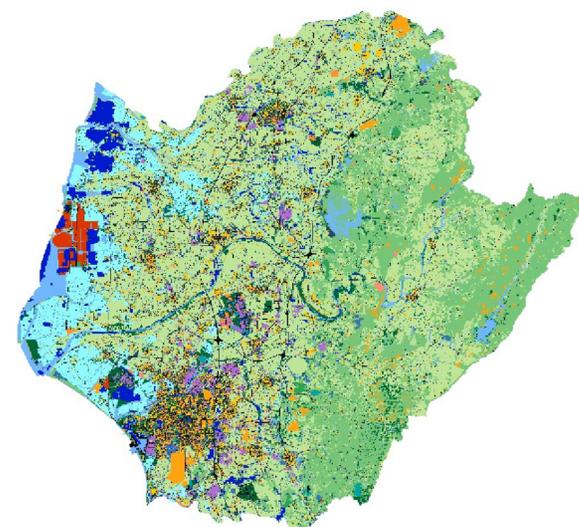
1. Population Will Continue to Grow
2. Populations Will Grow Older
3. Populations Will Be Concentrated in Urban Areas (especially coastal areas in this case)
4. Global Temp. Will Rise, Climate Variability Will Increase
5. Sea Levels Will Rise
6. Freshwater Scarcity Will Become More Prevalent

Major Innovations Employed

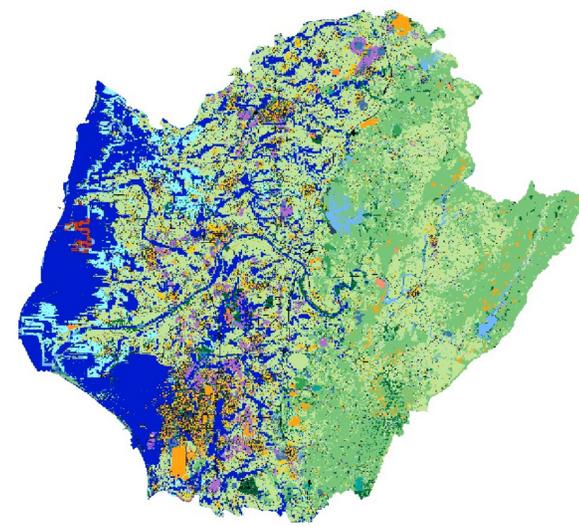
Design Innovations employed in this research are list as following: **WAT2** (Water Retention), **WAT3** (Agricultural Water Conservation Best Practices), **WAT7** (Porous-floored Parking Garage); **AGR11** (Urban Agriculture), **AGR12** (Rooftop Gardening); **GRN1** (Resilient Landscape Infrastructure), **GRN2** (Resilient Rural Community Landscape Infrastructure), **GRN3** (Integrated Vegetated Stormwater Infrastructure), **GRN9** (Connected Green Infrastructure), **GRN11** (Daylighting Lost Streams and Rivers), **GRN15** (Climate Change Adaptation), **GRN16** (Coastal Urban Resilience), **GRN17** (Resilient Green Coastal Infrastructure); **MIX1** (Mixed Use Development), **MIX4** (Emerging Public/private Spaces)



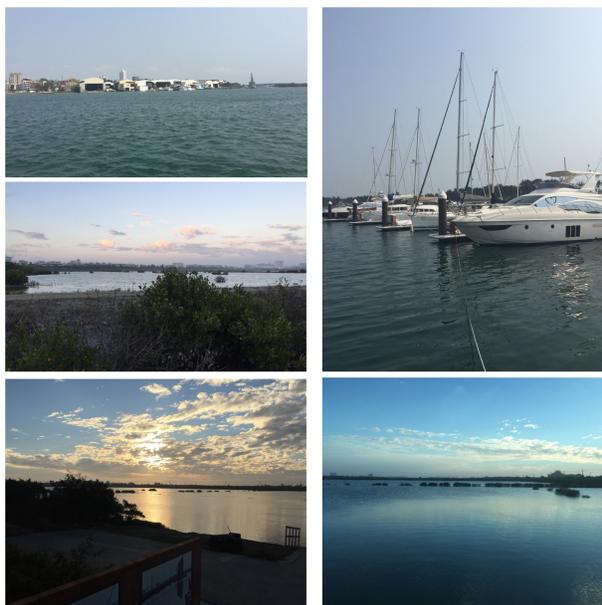
Existing 2020



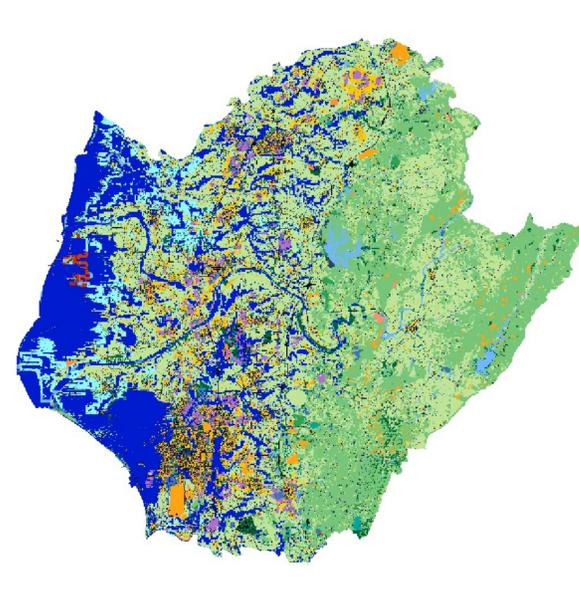
Early Adopter 2035



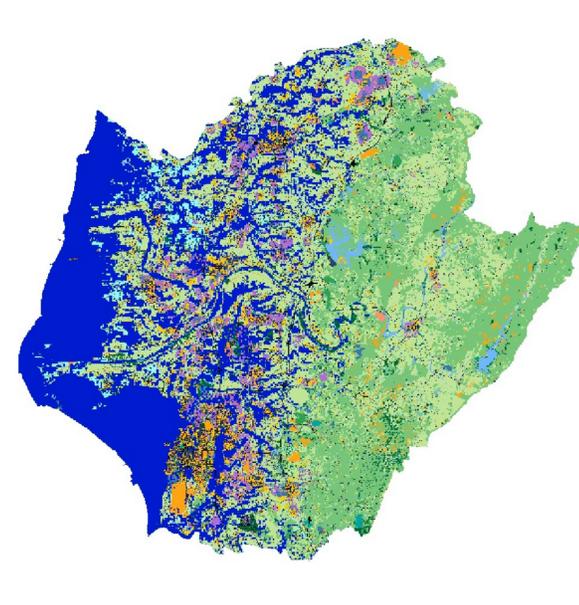
Early Adopter 2050



Project Surroundings

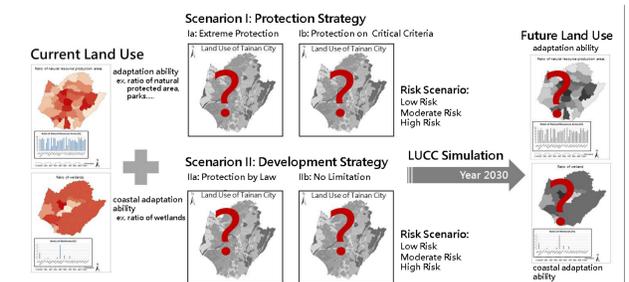


Non and Late Adopter 2035



Late Adopter 2050

Under the high protection scenario (early adapter), main green spaces are protected and climate factors are concerned in the earlier stage. The further land allocation of development will be highly constrained. It can reduce the later risk of flooding. The impact on coastal districts are higher, since coastal wetlands and sand dune can play critical role to increase the climate adaptation abilities. It seems that the direct impact from climate change in coastal cities is flooding. However, the protection scenario limit the development sprawl to the foot of the hill, which is most possible areas for land development allocation. This indirect impact reduce the risk of landslide to hill districts under extreme rainfall.



Late adaptation scenario accept the sprawl, and no climate adaptation actions employed. Flood and sea water level rise may affect the coastal districts in the earlier stage, and reduce the adaptation abilities in the late phase. Even though, the earlier these actions employed, the adaptive abilities increased.

