

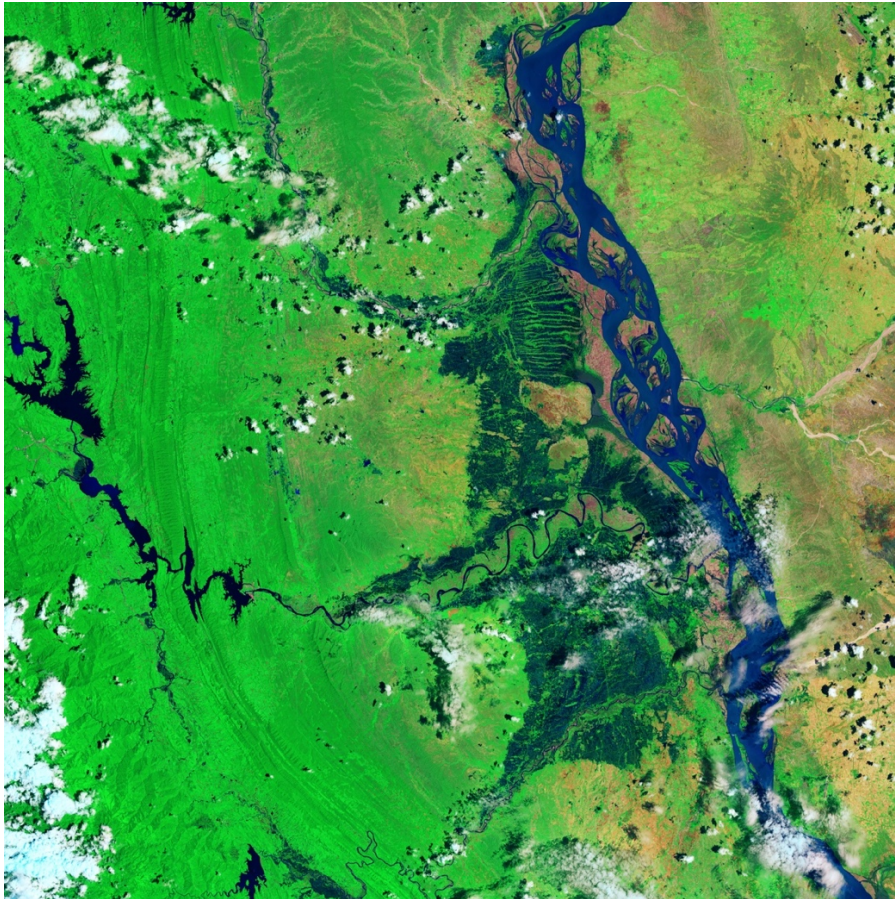
DS18_2018/19

MONSOON ASSEMBLAGES MYANMAR

COSMOPOLITICAL DESIGN IN A MONSOONAL RIVER BASIN

Lindsay Bremner, John Cook and Ben Pollock

STUDIO INTRODUCTION



The Ayeyarwady River 24.01.2013.

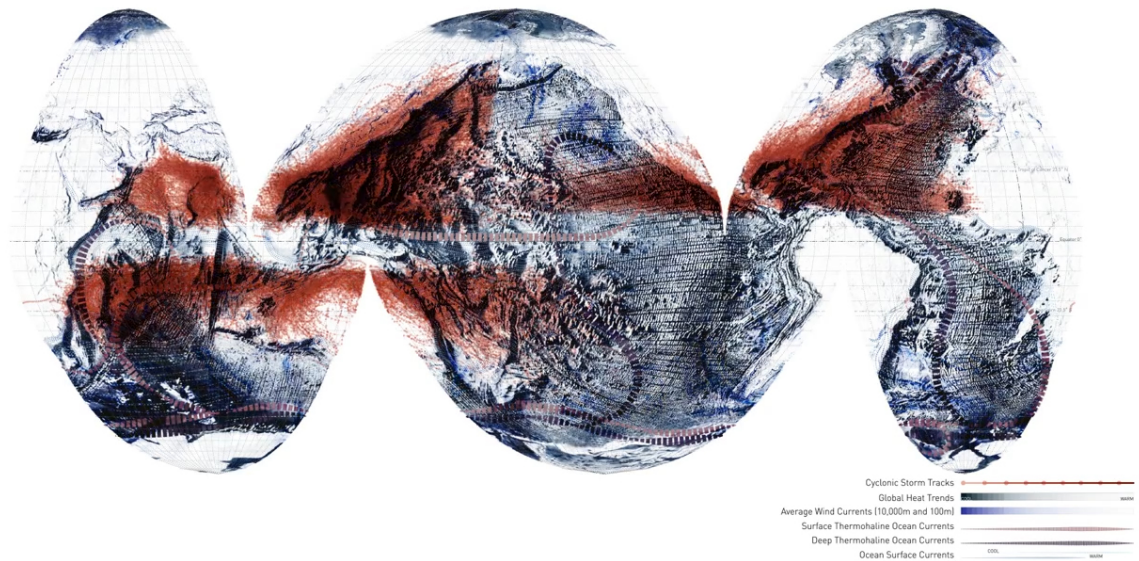
Source: <https://earthobservatory.nasa.gov/images/86394/flood-waters-on-the-irrawaddy>

OVERVIEW

This is the third and final of three DS18 studios contributing to the research agenda of Monsoon Assemblages, a five-year long research project funded by the European Research Council (ERC). This project is investigating the impacts of changing monsoon climates and rapid urbanization in India, Bangladesh and Myanmar through design and ethnographic research methodologies.¹ In 2016/17, DS18 worked in Chennai in south India, where an encroached wetland, the Pallikaralai Marsh was the focus of the studio; in 2017/18 the studio worked on a number of sites in the shifting delta of Bangladesh threatened by climate change and urbanisation, and in 2018/19 it will work on the Ayeyarwady (sometimes spelled Irrawaddy)-Chindwin River Basin in Myanmar, a monsoonal territory and ecological system currently being rapidly transformed by climatic, industrial and agricultural pressures.

¹ The Monsoon Assemblages team comprises Lindsay Bremner (PI), Research Fellows Dr. Beth Cullen (anthropologist) and Christina Geros (landscape architect) and PhD researchers Anthony Powis and Harshavardhan Bhat. In 2018 they will be joined by John Cook as Research Associate.

MONSOON



Global Monsoon. Drawing: Christina Geros.

The monsoon is a dynamic planetary-wide weather system, or rather assemblage of many out-of-phase interconnected weather systems that affects the lives of more than one third of the world's population. It is driven by air pressure and temperature differentials and the rotation of the earth. The south-southeast Asian monsoon is one of its most impressive features. The present understanding by scientists is that it is driven by a range of interconnecting dynamics: by different rates of heating and cooling of the Indian Ocean, the Bay of Bengal and the Asian plateau that produce on and off shore winds; by the sea saw of air mass and ocean temperature known as the El Nino-Southern Oscillation (ENSO) in the Pacific Ocean, and by the Madden-Julian Oscillation (MJO), an eastward moving tropical rain-belt that circulates the globe every 30-60 days. It is also affected by the timing and depth of snowfall in the Himalayas and by anthropogenic factors such as fossil fuel emissions, deforestation and land use changes. Today, while climate models suggest that the south-southeast Asian monsoon will persist and that the average annual rainfall may even increase by around 5%, these models also predict greater variability within seasons and from year to year, with extreme precipitation or weak monsoons occurring more often and with increased severity. The IPCC's 5th Assessment Report predicts that this will have severe, pervasive and irreversible effects on the lives of the billions of lives, human and non-human in the region.

- The monsoon is at the centre of the investigations and imaginations of the studio, forming the theoretical core of the design intelligence we wish to develop.

Further reading:

Intergovernmental Panel on Climate Change (IPCC). (2013). WG1AR5. Chapter 14, Regional Climate Change and Chapter 24, Asia. Available here: <http://www.ipcc.ch/report/ar5/wg1/>

MYANMAR

GENERAL INTRODUCTION



Administrative Map of Myanmar.

Source: http://www.nationsonline.org/oneworld/map/myanmar_map2.htm

Myanmar borders Thailand, China, Bangladesh, Laos and India, with a coastline that fringes the Bay of Bengal and the Adaman Sea. It has long been described as the place where China meets India. It has an area of 678,578 km², most of which lies in the Ayeyarwady-Chindwin valley that runs in a north-south direction between the Arakan mountains on the west and the Shan Plateau on the east. Geologically speaking Myanmar straddles the Indian and Eurasian plates, meaning that it is shaped by ongoing dynamic tectonic processes. Myanmar's population in 2009 was 47.6 million, expected to reach 86 Million by 2025. In 2009, 67% of its people lived in rural areas and were actively involved

in agriculture, rice being the main crop, followed by peas and beans, sesame, groundnut and sunflowers.

MYANMAR

HISTORY



Bagan, capital of the Bagan Empire (1044-1277).

Source: <http://www.orangesmile.com/extreme/en/budda-art/bagan-ancient-city.htm>

Myanmar's history is turbulent and violent. The record begins in 200 BC when the Pyu arrived in the Ayeyarwady Valley from present day Qinghai and Gansu in China. They established trade routes between China and India, brought Buddhism to Myanmar from south India and founded a number of city-states in the Ayeyarwady Valley. These were absorbed into the the Pagan (or Bagan) Empire (1044-1277), which united the Ayeyarwady valley and its periphery for the first time and became a dominant power in south-east Asia along with the Khmer Empire, the Song dynasty of China and the Chola dynasty of India. Its leader, Anawrahta, is considered to be the Father of Burma. In 1277, the Mongols invaded and a turbulent period followed; the Pagan Empire split into four smaller kingdoms, with shifting alliances and constant wars. In the 16th C the area was re-unified as the Restored Taungoo Kingdom (1510-1752), a legal and political system was put in place and the country remained stable and prosperous for almost a century. In the 18th C it was taken over by the Konbaung dynasty (1752-1885), whose leaders went to war with Siam and China and conducted a series of invasions to the west, eventually reaching the border with British India. This resulted three Anglo-Burmese Wars (1824-1886), which ended in the annexation of Burma to the British Raj. During British rule, differences between the country's myriad ethnic groups was highlighted, leading to ongoing civil war, some of which is still unresolved, including with the Rohingya in Arakan State.

In 1942 Burma was invaded by the Japanese. Aung San, co-founder of the Communist Party of Burma and others set up the Burma independence Army, which initially worked with the Japanese in anticipation of independence, but then called on the British for support against them. This alliance resulted in the Japanese being driven out of Burma in May 1945 and all forces disarmed in the

Kandy Conference in Sri Lanka in September 1945. In January 1947, Aung San signed an agreement with British Prime Minister Attlee, assuring Burmese independence. However, he and several of his cabinet were assassinated on 19th July 1947 by U Saw, a conservative pre-war Prime Minister, and, when independence did come on 4 January 1948, Thakin Nu, the next socialist leader took over. This was followed by a period of relative peace and economic growth until a general election in 1960, which led to a coup staged by Ne Win who set up of a socialist state run by the Union Revolutionary Council. The country was isolated from the rest of the world, a one party system put in place and commerce and industry were nationalised. In 1988, demonetization led to riots all over the country, known as the 8888 (08/08/88) Uprising, in which Aung San Suu Kyi, daughter of Aung San rose as a leader. In response, the military took over and set up martial law. Elections followed in 1990, when the National League for democracy (NLD) led by Aung San Suu Kyi defeated the National Unity Party (NLU), successor of the previous government. She was placed under house arrest by the military until 1995 and again from 2000 to 2002. In 2012 by-elections, the NLD won a majority in parliament and in 2015 in both chambers. In 2016, with Aung San Suu Kyi constitutionally barred from being president, her colleague Htin Kyaw was nominated to be the first non-military President of the country since 1962 and she became State Counsellor, effectively Prime Minister.

Further Reading:

http://www.fao.org/nr/water/aquastat/countries_regions/MMR/MMR-CP_eng.pdf

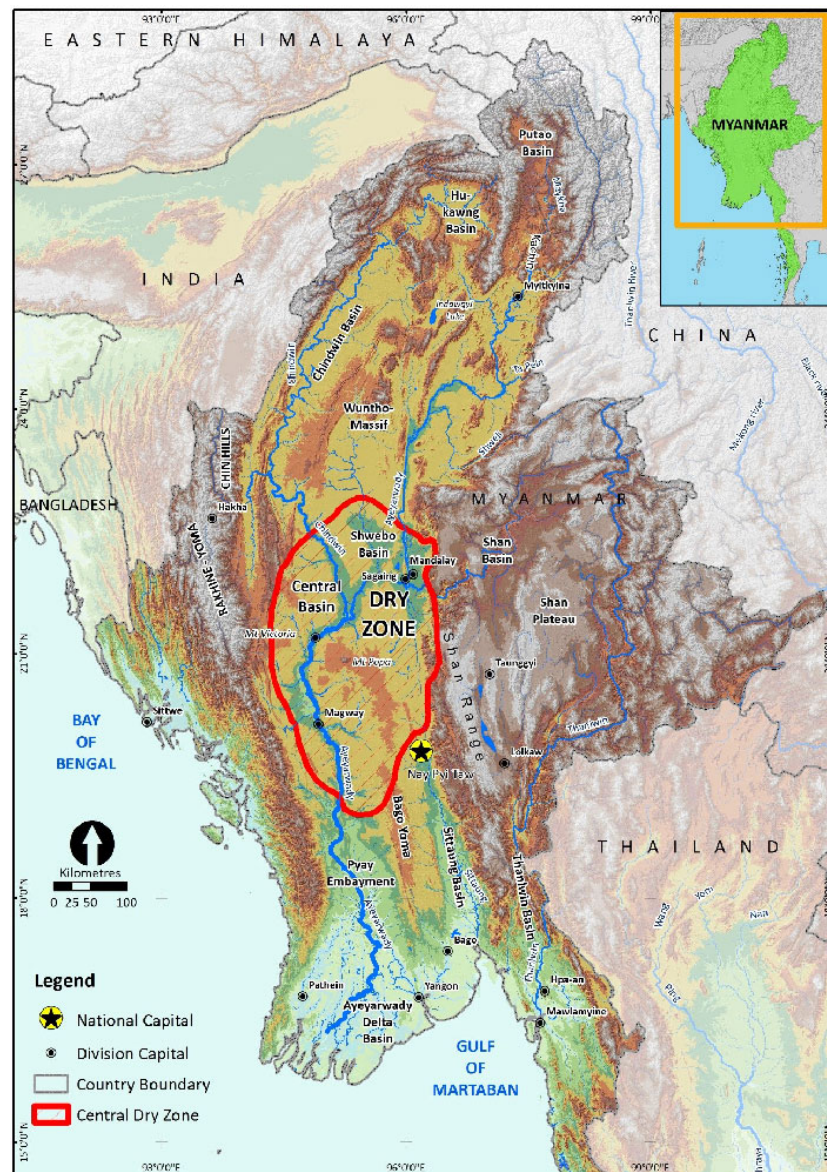
https://en.wikipedia.org/wiki/History_of_Myanmar



The Burma Road between Burma and China in WW2. Source:
<https://www.allpar.com/model/ram/burma-road-military-trucks.html>

MYANMAR

CLIMATE AND CLIMATE CHANGE



Myanmar's Dry Zone.

Source: <https://waterpartnership.org.au/work-on-the-hydrogeology-of-myanmars-dry-zone-to-be-published-after-30-years/>

Myanmar has a tropical monsoon climate with three seasons: a hot, dry summer, a wet monsoon season and a cool, dry winter. The summer starts in March and lasts till May, the monsoon season starts in May and lasts till October and the winter period lasts from November to March. The way the monsoon behaves and how much rain it brings is influenced by its orography. Most of Myanmar is flanked by two north-south mountain ranges – the Arakan Yomas (mountains) along the Bay of Bengal to the west and the Shan Plateau on the east. During the monsoon, humid air from the Bay of Bengal is pushed up by the Arakan Yomas, cools down, forms clouds and drops huge amount of rainfall in the coastal areas. As the air passes over the mountains it becomes much drier (known as the rain shadow effect), creating a dry zone in the centre of the country. The Ayeyarwady delta, where Yangon is located and the long tail of the country lying along the Andaman Sea are not

sheltered by mountains, so receive the full brunt of the monsoon. It is these areas that are impacted by devastating cyclones, storm surges and sea level rise.

These patterns are being altered by climate change, resulting in shorter monsoon periods, hotter temperatures and more violent, extreme weather occurring more frequently. According to a number of studies, Myanmar is one of the most vulnerable countries in the world to climate change. It becomes interesting to think about why. Events such as Cyclone Nargis in 2008 that killed more than 130,000 people, heatwaves in 2010 and large floods in 2015 are evidence of this and have had disastrous impact on lives and the economy of the country. Less dramatic but more treacherous changes such as sea-level rise, salination of water sources and slowly rising temperatures are pushing many to migrate to cities. Coupled with human pressures such as mining, deforestation, use of pesticides and dams, these changes are altering the aquatic ecologies of Myanmar's river systems and the lives dependent on them.

Further reading:

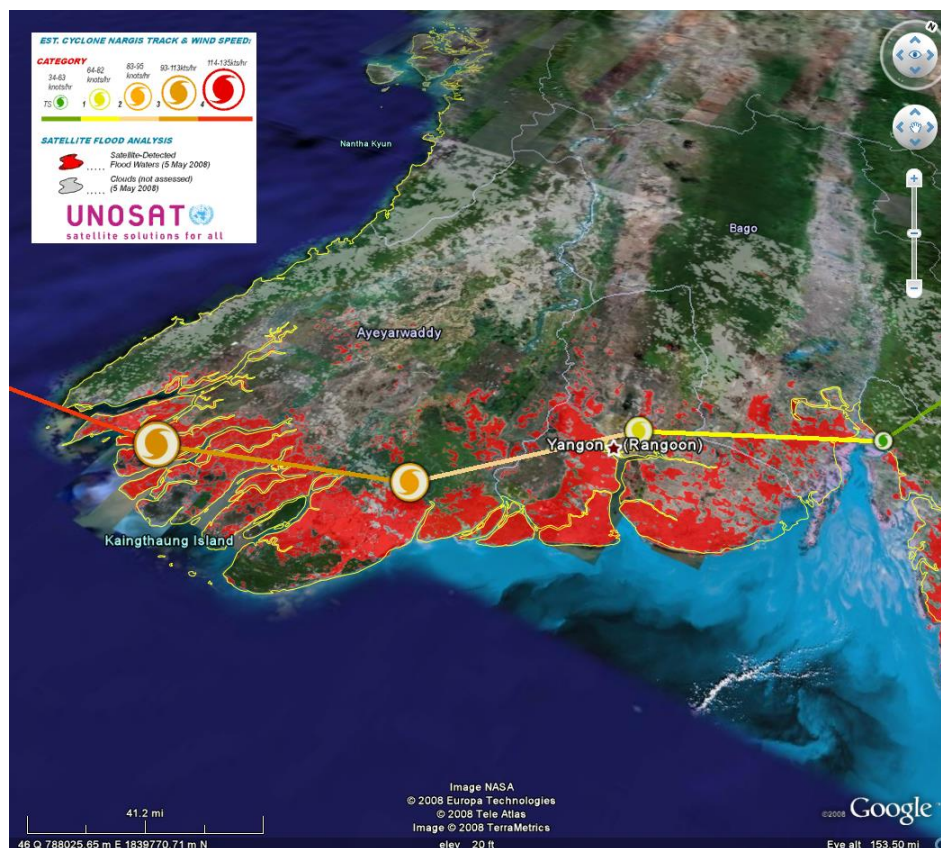
<http://bytelife.altervista.org/monsoon.htm>

<https://myanmarccalliance.org/en/home/>

Video:

<https://www.youtube.com/watch?v=Q29I3ADT2wM>

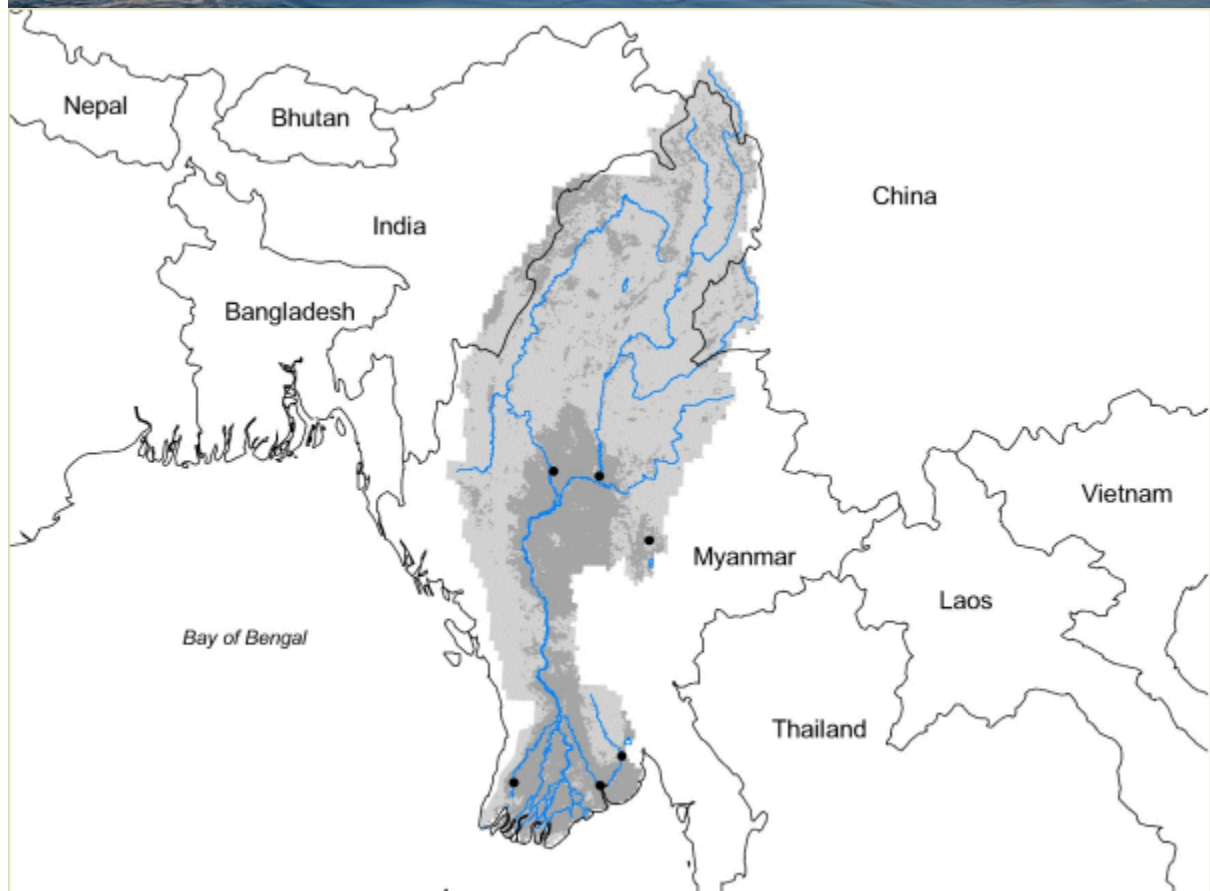
- Questions of these climatic and territorial dynamics and their consequences are key to the investigations and imaginations of the studio. Through mapping, simulation and conceptual design, we will nurture an architectural intelligence that engages non-human entities, scientific data, natural history, urban history, material science, and landscape sensing and measuring technologies in order to improve the socio-ecological outcomes of the territory.



Cyclone Nargis (2008).

Source: <http://mandalapprojects.com/ice/ice-cases/cyclone-nargis.htm>

THE AYEYARWADY-CHINDWIN RIVER BASIN



The Ayeyarwady River and the Ayeyarwady-Chindwin River Basin

Sources: <http://projects.worldbank.org/P146482?lang=en>,

https://commons.wikimedia.org/wiki/File:Irrawaddy_Watershed.gif

Myanmar's rivers closely follow the monsoon pattern of rainfall, which means that about 80% of their flow occurs during the monsoon season and 20% in the dry season. The Ayeyarwady and Chindwin Rivers drain about 58% of the territory of Myanmar. They can be divided into a number of basins – the Upper, Middle and Lower Ayeyarwady, the Ayeyarwady Delta and the Chindwin. The Chindwin rises in the very north west of Myanmar and flows south west, with several tributaries. It is a river of high sediment transport as it drains soft geological structures with high soil erosion potential. It joins the Ayeyarwady just north of Bagan. The Upper Ayeyarwady extends from its source in the mountains of Kachin State to its confluence with the Namthampak. Its main stem starts at the confluence of the Mali Hka and Mai Hka Rivers at Myitison. The Middle Ayeyarwady is taken from the confluence of the Namthampak to that with the Chindwin, over which distance it receives additional flows from significant tributaries. The Lower Ayeyarwady extends from the confluence with the Chindwin to the delta. Here it is a broad braided river with a wide floodplain. When it reaches the delta, it divides into nine channels forming in a wide floodplain. This covers an area of about 50,000 km² with tidal influence extending to Myan Aung, 290 km inland from the Bay of Bengal. The delta region is densely populated and plays an important role in fishing and the cultivation of rice. Yangon lies in the delta region on the Hlaing River, connected to the Ayeyarwady through the Twante Canal.

Further Reading:

http://wwf.panda.org/knowledge_hub/all_publications/?328353/Ayeyarwady-River-and-Myanmar-Economy (download report)

http://www.fao.org/nr/water/aquastat/countries_regions/MMR/MMR-CP_eng.pdf

http://myanmarpreview.iwmi.org/sites/default/files/Documents/WWF_Mekong_River_Reach_Classification_Final_Report_July2014.pdf



The second defile of the Ayeyarwady River. Source: <https://steemit.com/travel/@juliebawk/beauty-of-myanmar-second-defile-or-narrow-gorge-of-the-irrawaddy-river-julie-bawk>

IDEAS FRAMING THE STUDIO

A cosmopolitical perspective would acknowledge that there is no objective definition of a virus or a flood that everyone would share ... Instead we need to account for the active participation of all those whose practice effectively engages in multiple modes with the virus or with the river. That is what will give us access to the cosmos and to the unknown constituted by multiple divergent worlds (Yaneva and Zaera-Pollo 2015:4).

Key ideas framing the studio this year are:

(i) that what used to be called nature (weather, climate, a river etc.) is no longer a stabilising pattern or a backdrop for human activity. Instead nature is “done, created, instigated ... composed” (Yaneva and Zaera-Polo 2015:3) (ii) that the modernist idea of nature as external to human experience, that can be mastered by architects, engineers and scientists from the outside no longer exists. It requires an active process of manipulation and reworking from within, in which human and non-human ways of being and ways of knowing are taken into account, to build a more inclusive cosmos in which all things have their place. This is the goal of cosmopolitical design.

(ii) that current processes of environmental change are taking place at scales and times very often imperceptible to humans. We ask whether the instruments, tools and techniques available to architecture - spatial, material, technological, can be deployed to make these processes more available to human perception and if so why and how.

Further Reading:

Yaneva, A. and Zeara-Polo, A. (2015). *What is Cosmopolitical design? Design, Nature and the Built Environment*.

Belanger, P. (2017). ‘The Limits of the Plan.’ *Fore-ground*. 05 October. Available here: <https://www.foreground.com.au/culture/pierre-belanger/>

The architectural outcomes of the studio will arise from these two sets of ideas.



AIM OF THE STUDIO



Hilsa fish, dietary staple in Bangladesh and Myanmar.
Source: <https://www.bbc.com/news/world-asia-39856799>

Human history is the history of our entanglements with other species and materialities. Cosmopolitical design seeks to make explicit the agency of nonhuman entities - other species, particles, minerals, earthly forces, in the composition of a 'cosmos' or common world. With this in mind, you will begin the year by each selecting a non-human entity found Ayeyarwady and Chindwin River Basin (a fish species, dolphin, gold, jade, cyanide, fertiliser, rice, pots, bricks, dams, boats, pagodas etc.) to be treated as a design consultant throughout the year. You will develop experimental cartographies of its river, challenging conventional maps that depict rivers as single lines, by depicting them as materials, gradients, ecologies and flows inhabited by a multitude of living entities. You will then deepen your sensibilities towards the river and how it is changing for your entity by simulating a material process at a micro scale. You will then design an instrument to augment your entity's perspective and the impact of climatic and development pressures on it, in order to make it more perceptible to humans. This will conclude Semester 1.

In the second semester, you will design a collective space where the interests of your entity become catalysts of design, social transformation and collective self care in one of the cities we visit. This could for example be a museum, an educational space, a cultural space, an institutional space or some kind of hybrid institution that operates across existing institutional or socio-political registers etc.

A number of questions will frame these design explorations:

- What is a monsoonal river and how can it be mapped? What should be mapped to represent a monsoonal river?

- Where does the river start from, extend to (an atmospheric, not only a topographic or geological question)?
- How does this fluctuate over time, with the seasons?
- How is this river being impacted by climate change and other developmental pressures?
- How is the changing river experienced by a non-human entity?
- How can this be drawn, mapped and simulated?
- How can enhancing and making this perceptible to humans be the basis of a design brief?
- How can this perspective be translated into an architectural brief in one of the cities visited on the field trip – Yangon, Bagan or Mandalay?

FIELD TRIP

The field trip to Myanmar will take place from 01-13 November. It will start in Yangon, where we will engage with a number of organisations about our research and explore the city, its river frontage, and the Twante canal, a piece of colonial infrastructure built by the British to connect Yangon to the Ayeyarwady. We will travel by overnight bus to Bagan, the capital city of the ancient Pagan Kingdom, famous for its temples, pagodas and monasteries. From there we will take a river boat to Mandalay, Myanmar's second largest city, which is situated in the dry zone on the banks of the Ayeyarwady and where the Chinese influence in Myanmar is most evident. Bombed flat in World War 2, it is now known as the cultural capital of the country. From there we will then fly back to London. Students will be required to research one of the places we will visit and serve as tour guide for that place, and gather data of relevance to their entity in some way while on the field trip – through e.g. scanning, sampling, measuring, walking, eating etc.



ASSESSMENT

Assessment will take the form of verbal feedback at pin ups and written feedback after reviews throughout the year. At the end of the first semester, you will be given an indication of whether your work is at a fail, low, medium or high level on the basis of your interim portfolio submission. This will be accompanied by written comments and suggestions as to how the work can be improved. You will only receive a grade for your work on the basis of your final portfolio submission.

The first semester's work will be assessed against the following criteria:

Year 1

- The ability to respond to a given studio agenda through wide reading, experimentation, and theorisation, and to use these initial speculations to develop a critical approach to an individually focussed, design-led topic.
- The capacity to analyse a complex range of relevant information, to identify and define clear questions and problems.
- The ability to predict and simulate outcomes in hypothetical situations and unfamiliar contexts, drawing conclusions that enable future decision-making.
- The ability to distil knowledge of social, political and economic habitats, and to translate this macro information into particular tactics of architectural design.
- The ability to conduct initial design-related research, then to test, analyse and appraise different design options.
- The ability to use combinations of visual, verbal and written methods to communicate design ideas and proposals.

Year 2

- The ability to respond to a given studio agenda through wide reading, experimentation, and theorisation, and to use these initial speculations to develop a critical approach to an individually focussed, design-led topic.
- The capacity to analyse a complex range of relevant information, to identify and define clear questions and problems.
- The ability to predict and simulate outcomes in hypothetical situations and unfamiliar contexts, drawing conclusions that enable future decision-making.
- The ability to distil knowledge of social, political and economic habitats, and to translate this macro information into particular tactics of architectural design.
- The systematic ability to test, analyse and appraise different design options that integrate knowledge of design theory, materiality, cultural context and socio-spatial issues.
- The systematic ability to use a range of media to communicate design proposals.

The second semester's work will be assessed against the following criteria:

Year 1

- The capacity to analyse a complex range of relevant information to identify and define a set of question to drive a clear design brief.
- Refined understanding of the broader social relevance of design theory, cultural context, physical context, sustainability etc. in relation to a design brief.
- Ability to distil knowledge of social, political and economic habitats, and in turn to translate this macro information into particular tactics of architectural design.
- The ability to conduct initial design-related research, then to test, analyse and appraise different design options that integrate knowledge of visual, thermal and acoustic

environments, and of climactic design, energy consumption and human and non-human well-being.

- The ability to use combinations of visual, verbal and written methods to communicate design ideas and proposals.

Year 2

- The ability to develop a brief and a critical approach to the integration of aesthetic and technical requirements into a complex design project.
- The capacity to produce and demonstrate coherent and sophisticated architectural designs that integrate knowledge of the social, political, economic and professional context of architecture in relation to the project defined.
- The quality of analysis of complex data and analytical understanding of social, political, economic and professional context of architecture in relation to the project defined.
- The systematic ability to apply knowledge in unfamiliar contexts and to test, analyse and appraise different design options that integrate design theory, materiality, cultural context and socio-spatial issues.
- The systematic ability to select and use appropriate architectural representations at a highly advanced level to explore and convey design ideas.

REFERENCES FOR THE STUDIO

These are a start! You will probably need to find more.

[G] = In Google Drive

[L] = In library

DS18 Reading List available here: <http://readinglists.westminster.ac.uk/lists/2DB9ED6E-F091-49C0-2301-58B52336D958.html>

[M] = In MONASS office

[W] = Web

General Theory (Books)

[L] Bastion, M. et al. (2016). *Participatory Research in More-than-Human Worlds*. London: Routledge.

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[L] Yaneva, A. and Zaera-Polo, A. (2015). *What is Cosmopolitical Design? Design, Nature and the Built Environment*. London: Routledge.

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[W] Calvillo, N. (2017). *Cosmopolitical Visualisations*. In: Bremner, L. and Trower, G. (ed.). *Monsoon* [+ other] *Airs*. London: Monsoon Assemblages, pp. 22-25.

[L] DeLanda, M. (1992). *Nonorganic Life*. In: J. Cracy and S. Kwinter (eds.). *Incorporations*. New York: Zone Books, pp. 129-167.

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- [L] Gissen, D. (2009). Subnature: Architecture's Other Environments. New York: Princeton Architectural press.
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- [L] Tironi, M. and Calvillo, N. (2016). Water and Air: Territories, tactics, and the elemental textility of urban cosmopolitics. In A. Blok and I. Farias (ed.). Urban Cosmopolitics. London; Routledge, pp. 207-224.

Design Theory (Web)

- [W] Milligen, B. (2015). Landscape Migration. Landscape Design in the Anthropocene. Places. June. <https://placesjournal.org/article/landscape-migration/>
- [W] More-than-human participatory research and design: <http://www.morethanhumanresearch.com/> (look under workshops tag)
- [W] See this conference call for other references: <http://pd4more.urbaninformatics.net/cfp/>
- [W] The Nature of Cities. Much useful content here including:
Global Roundtable on Urban Waterfronts:
<https://www.thenatureofcities.com/2015/01/06/urban-water-fronts-have-typically-been-sites-of-heavy-development-and-often-are-sites-of-pollution-or-exclusive-access-but-they-have-enormous-potential-benefits-how-can-we-unlock-these-benefits-for/>

Design (Books)

- [L] Acciavati, A. (2015). Ganges Water Machine: Designing New India's Ancient River. Oro Editions.
- [L] Alday, I. and Vir Gupta, P. (2018). Yamuna River Project: New Delhi Urban Ecology. Barcelona: Actar. And here: <http://www.yamunariverproject.org/>
- Berger, A. (2009). Systematic Design can Change the World. Sun Publishers.
- [L] Design Earth. (2018). Geostories: Another Architecture for the Environment. Barcelona: Actar.
- [L] Desvigne, M. (2009). Intermediate Natures: The Landscapes of Michel Desvigne. Basel: Birkhauser:
- [L] Infranet Lab / Lateral office. (2011). Coupling: Strategies for Infrastructural Opportunism. Pamphlet Architecture 30. New York: Princeton Architecture Press.
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<https://www.youtube.com/watch?v=isvfy9CuCew&t=5277s> (from 17.32)
- [W] Ants of the Prairie: <http://www.antsoftheprairie.com/>
- [W] Atelier Descombes Rampini
Renaturing of the River Aire, water erosion as design tool
<http://www.landezine.com/index.php/2016/06/renaturation-of-the-river-aire-geneva/>
- [W] Carolina Gonzales Vives, hidra.design: <https://hidra.design/>
Various hydrological projects and texts including:
Visualising Urban Hydrology: The Design of a Wet Surface:

<http://www.mascontext.com/issues/15-visibility-fall-12/visualizing-urban-hidrology-the-design-of-a-wet-surface/> and <http://gonzalezvives.es/portfolio-item/visualizing-urban-hydrology/>

[W] Dredge Research Collective

Sediment Management through Design Research

<http://dredgeresearchcollaborative.org/about/>

[W] Francois Roche: <http://www.new-territories.com/>

[W] Landzine: <http://www.landzine.com/index.php/landscapes/landscape-architecture/realized-projects/>

Collection of landscape projects related to water, rivers, waterfronts etc.

[W] Philippe Rahm: <http://www.philipperahm.com/>

[W] Explore and Restore Maryland Streams:

http://dnr.maryland.gov/education/Pages/Biological_Assessment.aspx

Some useful ideas on how to assess the health of streams

Myanmar (General)

History (web)

<https://www.rickshawtravel.co.uk/blog/a-brief-history-of-burma-why-it-became-myanmar/>

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Myint-U, T. (2008). *The River of Lost Footsteps: A personal history of Burma*. London: Faber and Faber.

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Tea Circle: Oxford Forum for New Perspectives on Burma/Myanmar

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Good blogs on more cultural aspects of water and watery lives

Climate /Climate Change

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Monsoon

<http://byteline.altervista.org/monsoon.htm>

Myanmar Climate Change Alliance:

<https://myanmarccalliance.org/en/home/>

Very comprehensive, has links to global documents and Myanmar policy documents

Including: <https://myanmarccalliance.org/en/climate-change-basics/impact-of-climate-change-and-the-case-of-myanmar/>

<https://teacircleoxford.com/2017/09/04/climate-change-a-permanent-reality-for-myanmar/>

UNDP: <http://www.mm.undp.org/content/myanmar/en/home/ourwork/environmentandenergy/overview.html>

Myanmar Climate Change Action Plan: Myanmar CC action plan:

<https://unfccc.int/resource/docs/napa/mmr01.pdf>

Climate Change and Biodiversity: <https://myanmarbiodiversity.org/2015/impacts-of-climate-change-on-biodiversity-in-myanmar/>

Slagle, J. T. (2014). Climate Change in Myanmar: Impacts and adaption. PhD Thesis, Monterey, California: Naval PG School.
https://calhoun.nps.edu/bitstream/handle/10945/44672/14Dec_Slagle_John.pdf?sequence=1&isAllowed=y

Climatic bio-indicators:

<https://www.tandfonline.com/doi/full/10.1080/21553769.2016.1162753>

<http://www.navhindtimes.in/interpreting-bioindicators-of-early-monsoon/amp/>

<https://www.google.co.uk/amp/s/www.aljazeera.com/amp/indepth/features/2013/12/predicting-rain-indian-style-20131219124855584479.html>

<http://www.eco-business.com/news/common-moss-may-prove-a-cheap-city-pollution-monitor-say-scientists/>

https://tropicalconservationscience.mongabay.com/content/v8/tcs_v8i1_138-149_Syaripuddin.pdf

Dragon flies:

<http://fes.org.in/studies/macroidvertebrate-survey-and-dragonfly-inventory.pdf>

https://books.google.co.uk/books?id=pOO75z3LrqgC&pg=PA114&lpg=PA114&dq=bioindicators+myanmar&source=bl&ots=5qW_jr7yzK&sig=Q24xlfslb3yg65KFylltKHSIxzl&hl=en&sa=X&ved=2ahUKewjJ_ZmDkIndAhUrB8AKHa7XBol4FBDoATAEegQIBBAB#v=onepage&q=bioindicators%20myanmar&f=true

Neem tree

<https://books.google.co.uk/books?id=PyYRUCoIdk4C&pg=PA155&lpg=PA155&dq=bioindicators+myanmar&source=bl&ots=yWrcNpMPg0&sig=SO7RM6c-ZeCmEiP2vEl8-bNpRtw&hl=en&sa=X&ved=2ahUKewjQ9JrUkondAhUmM8AKHR9tCWQ4HhDoATAEegQIABAB#v=onepage&q=bioindicators%20myanmar&f=false>

The Ayeyarwady-Chindwin Basin

Ayeyarwady (General)

Aquastat Myanmar

http://www.fao.org/nr/water/aquastat/countries_regions/MMR/MMR-CP_eng.pdf

plus links to some data on this site:

http://www.fao.org/nr/water/aquastat/countries_regions/MMR/index.stm

Stamp, L. D. (1940). The Irrawaddy River. The Geographical Journal 95(5), May: 329-352.

Available at: https://www.jstor.org/stable/1787471?seq=1#page_scan_tab_contents

Ketelsen, T. et al. (2017). River Health in the Ayeyarwady. State of Knowledge 7.

Available at: <https://cgspace.cgiar.org/rest/bitstreams/119407/retrieve>

World Bank Integrated River Basin Management Project

<http://projects.worldbank.org/P146482?lang=en>

[https://www.worldbank.org/content/dam/Worldbank/document/EAP/Myanmar/ESMF%20Executive%20Summary%20AIRBM%20Project\(English\).pdf](https://www.worldbank.org/content/dam/Worldbank/document/EAP/Myanmar/ESMF%20Executive%20Summary%20AIRBM%20Project(English).pdf)

Excellent Reports on River Basins with maps:

https://www.ifc.org/wps/wcm/connect/c01ac2f3-0b6d-4f94-b281-db9488bc8a91/Chapter+5_SEA_Baseline+Assessment_+Fisheries+and+Aquatic+-+21+Sep.pdf?MOD=AJPERES

https://www.ifc.org/wps/wcm/connect/c01ac2f3-0b6d-4f94-b281-db9488bc8a91/Chapter+5_SEA_Baseline+Assessment_+Fisheries+and+Aquatic+-+21+Sep.pdf?MOD=AJPERES

http://myanmarpreview.iwmi.org/sites/default/files/Documents/WWF_Mekong_River_Reach_Classification_Final_Report_July2014.pdf

Organisations and Projects

*WWF Report 2018: The Ayeyarwady River and the Economy of Myanmar

http://www.panda.org/knowledge_hub/all_publications/?328353/Ayeyarwady-River-and-Myanmar-Economy

Ayeyarwady River Research Organisation

<https://www.arbro.org/>

Water, development and environment

Ayeyarwady River Commission

<https://www.irrawaddy.com/news/burma/parliament-forms-commission-to-protect-irrawaddy-river.html>

<https://www.mmtimes.com/national-news/4199-waterway-commission-proposed.html>

Myanmar Environment Institute

<http://www.enviromyanmar.org/>

Mainly training, but some useful environmental impact studies done; involved in Chindwin Futures project

Ayeyarwady Futures Partnership (2012-13)

https://www.sei.org/mediamanager/documents/Publications/sei_factsheet_ayeyarwadyfuture_spartnership_2015_for_web.pdf

Video on AFP here: <https://www.sei.org/projects-and-tools/projects/chindwin-futures-project/>

or here: https://www.youtube.com/watch?time_continue=655&v=c8pYvhAEKZ8

Chindwin Futures Partnership (2015 -2016)

<https://www.sei.org/featured/developing-river-basin-management-solutions-myanmar/>

video here: <https://www.youtube.com/watch?v=Gv7oiPKGQ9w&feature=youtu.be>

Stockholm Environment Institute Myanmar Projects

<https://www.sei.org/region/myanmar/>

Turquoise Mountain (Prince Charles)

<http://turquoisemountain.org/myanmar>

Portals

Myanmar Water Portal: <https://www.myanmarwaterportal.com/pages/16-dwir.html>

DWIR Repository, Community Publications has many useful documents

Myanmar Environment Portal: <http://mya.gms-eoc.org/>

Government Departments

Department of Water Resources and Improvement of Rivers: <http://www.dwir.gov.mm/>

Dams

<https://theconversation.com/dams-on-myanmars-irrawaddy-river-could-fuel-more-conflicts-in-the-country-84386>

<https://www.pri.org/stories/2012-10-29/myanmar-power-play-irrawaddy-river>

Bio-indicators to assess the impacts of dams: <http://riversymposium.com/profiles/nye-in-thandar-ko/>

Sediment

<https://www.sciencedirect.com/science/article/pii/S0009254116303023>

Delta

<https://earthobservatory.nasa.gov/images/40257/sinking-river-deltas-irrawaddy-river>

Monsoon Flooding

<https://earthobservatory.nasa.gov/images/86394/flood-waters-on-the-irrawaddy>

<https://www.earthobservatory.nasa.gov/images/51633/monsoon-transforms-the-irrawaddy-river>

Dolphins

<https://myanmar.wcs.org/Wild-Places/Irrawaddy-River.aspx>

<https://www.nytimes.com/2017/08/31/world/asia/irrawaddy-dolphins-myanmar-fishing-conservation-cooperation.html>

Fish and fishing

World Fish: <https://www.worldfishcenter.org/>

<http://sdg.iisd.org/news/fao-report-projects-climate-change-impacts-on-worlds-fisheries/>

Confluence of rivers, source of the Irrawaddy:

<https://wle.cgiar.org/confluence-start-irrawaddy-river>

Science

<https://www.bbc.com/news/av/science-environment-39888749/diy-science-on-the-irrawaddy-river>

<https://www.tudelft.nl/en/ceg/research/stories-of-science/charting-the-irrawaddy-river-with-balloons-and-gps-trackers/>

Sediment load

<https://www.journals.uchicago.edu/doi/abs/10.1086/521607>

<https://www.sciencedirect.com/science/article/pii/S0009254116303023>

Diverse Perceptions of the River:

<http://www.dvb.no/analysis/diverse-perceptions-irrawaddy-river-valley-among-inhabitants/74168>

Erosion

<https://www.irrawaddy.com/news/burma/nearly-170-houses-relocated-irrawaddy-river-bank-erodes.html>

Pottery

<https://hladaymyanmar.org/blog/reviving-clay-crafts-twante>

<http://alixknipe.com/tag/burmese-pottery/>

<http://clayinternational.org/asian-pottery-techniques/>

https://link.springer.com/referenceworkentry/10.1007%2F978-94-007-3934-5_10195-1

Mining

<https://oxfordbusinessgroup.com/overview/digging-new-course-set-recent-reforms-just-beginning>

Impacts of: <http://www.myanmar-responsiblebusiness.org/pdf/SWIA/Mining/00-Myanmar-Mining-Sector-Wide-Assessment.pdf>

Impacts on rivers:

https://www.researchgate.net/profile/Josiah_Bowles/publication/258045519_Irrawaddy_River_Research/links/59732920aca2728d02483e2b/Irrawaddy-River-Research.pdf

<https://frontiermyanmar.net/en/the-mercury-menace>

* Connette, K. (2016). Assessment of Mining Extent and Expansion in Myanmar based on Freely-Available Satellite Imagery. *Remote Sens* 8: 912.

Jade: <http://ohrh.law.ox.ac.uk/jade-and-conflict-in-myanmar-regional-regulatory-instruments-regulatory-gaps-and-future-implications-for-ethical-business/>

<https://www.globalwitness.org/en/campaigns/myanmar/jade-and-generals/>

<https://www.globalwitness.org/en/campaigns/oil-gas-and-mining/myanmarjade/>

<http://www.lotusgemology.com/index.php/library/articles/283-burma-s-jade-mines-an-annotated-occidental-history>

Gold: <https://www.slideshare.net/aung3/map-telling-the-story-of-gold-mine-in-myanmar>

<http://www.ibiblio.org/obl/docs/gold%20pdf1.pdf>
Ruby: <https://www.gia.edu/ruby-mines-burma-reading-list>
<http://lotusgemology.com/index.php/component/content/article?id=158:a-brief-stay-in-heaven-mogok-revisited>
<https://blog.nationalgeographic.org/2016/10/29/the-legendary-gem-mines-of-mogok-myanmar-burma-is-responsible-sourcing-possible-beyond-sanctions/>
<http://www.solitaireinternational.com/images/1502175331single.pdf>

Maps

These PDF's contain some useful maps (low res):

https://www.gwp.org/globalassets/global/gwp-sas_images/gwp-sas-in-action/ldai/bagladesh_ppt.pdf
<https://www.ifc.org/wps/wcm/connect/48d77c00471bb512b04efc57143498e5/2.3.Zaw+Win.pdf?MOD=AJPERES>

Data

Data creation: <https://link.springer.com/article/10.1007/s00267-013-0016-x> OneMap Myanmar

<https://portal.onemapmyanmar.info>

Funded by SDC (Swiss Agency for Development and Cooperation)

Main Implementers: University of Berne, Land Core Group

Project Partners: 25 Government Partners, MIMU and 'Servir Mekong'

(Can search through 'gallery' of datasets or view on an interactive map. Lots of information but difficult to download at times)

OpenDevelopmentMyanmar

<https://opendevlopmentmyanmar.net>

Open Data portal and interactive platform for exploring and downloading datasets.

(Very easy to search for and download in available formats -.shp.TIFF files)

Myanmar Information Management Unit (MIMU)

<http://geonode.themimu.info/>

Majority of MIMU data is demographic information, mapped to zones within district boundaries and displayed using an excel (.xsl file) process.

(There is an interactive map tools with 56 layers of geospatial data from number of sources - roads, rivers, boundaries, land classification, forestry information, mining - again this is quite tricky to download at times)

Natural Earth

<https://www.naturalearthdata.com/>

(General worldwide GIS data - some of the above sources use this information for their basemaps)

NASA Data

Sentinel 1, 2 & 3 satellite data

<https://scihub.copernicus.eu>

(provides imagery of land areas every 12 days - used to study and produce flooding maps)

Sentinel - 1 data products

Level-1

GRD

Instrument: SAR-C

(Full, High or Medium resolution - FR,HR,MR)

Of interest:

ALOS2

T100_floodmap_MMR_comp.tif (Map of water depth / flood areas covering whole of Burma)

Scripts

Generative landscapes: <https://generativelandscapes.wordpress.com/>

Yangon

Daniel Brook. (2014). History of the Present: Yangon. Places, September.

https://placesjournal.org/article/history-of-the-present-yangon-myanmar/?gclid=Cj0KCQjw2f7bBRDVARIsAAwYBBt7po-6yrCRhu3m9YilQo3Z1HzqOK3-JQoOn3dy-z3vBWQGDSh5KD0aAkWyEALw_wcB

Yangon Heritage Trust

<https://www.yangonheritagetrust.org/home>

Heritage and development, closely linked to planning and development in the city

Including link to Yangon heritage Strategy

<http://www.yhtliveableyangon.org/en/home/>

Planning

Yangon Heritage Strategy

Yangon Strategic Urban Development Plan (JICA) Reports 1 and 2

Yangon YCDC 2040

Neighbourhoods (flooding related)

Shwe, T. et al.(2015). Quick Scan Methodology for Climate Change Adaption Planning in the case of Developing Country. International Journal of Architecture, Planning and Building Engineering 2(3).

Myanmar Environment Institute. Dagon Myothit (Seikkan) Township EIA.