



Climate Change Mitigation & Adaptation

In the Malaysian context

Through a systems thinking lens

Jen Ho Ker & Alka Kaur, Malaysian Youth Delegation (MYD)

July 2020

Introduction to MYD



Capacity Building



Workshops and research projects to **enhance youth literacy** on climate change and policy

International Policy



Connect Malaysian youth with **global climate policy** and environmental institutions

Stakeholder Engagement



Engage state, civil society and academic leaders to **influence policy and research** priorities

Public Education



Make the latest thinking on climate change **more accessible** to the general public

Introduction to presenters



Alka Kaur



- Pre-university student
- MYD Capacity Building
- Interested in geo-engineering as a means of mitigating the effects of climate change, as well as the intersections of human rights with climate change

Jen Ho Ker



- Chemical engineer
- MYD Capacity Building WG
- Involved in climate advocacy at university
- Data analyst in downstream oil and gas; internships in materials R&D, sustainability, and oleochemicals
- Interested in negative emissions and climate adaptation

Syaqil Suhaimi



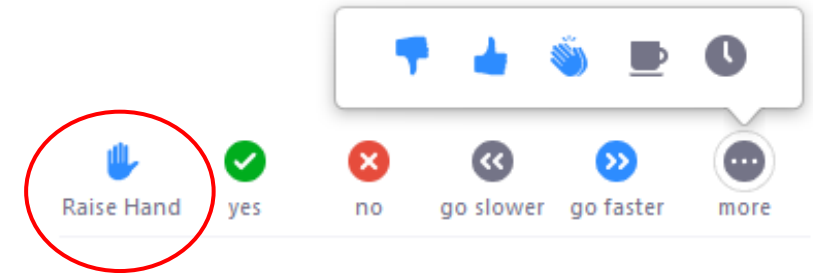
- Environmental science graduate
- MYD Focal Point
- Works in biogas industry
- Interested in inter-ministerial efforts to combat climate change at a national level

House rules



During the session:

- **Mute** your microphones when you are not speaking
 - **Be thoughtful** of when you speak
- **When the speaker asks a question**, you can **respond by voice or chat**
- For clarification on concepts or terminology:
 - **Ask questions in chat**, or
 - **Raise your virtual hand** and we will ask you to unmute
- **Minimize distractions and be present** by putting away phones, closing unrelated work, closing the door, etc.
- If your internet connection makes your audio difficult to hear, we will request that you utilize the chat option



Questions for the Q&A session:

- Go to **sli.do** to ask questions for the Q&A session (<https://www.sli.do/>)

slido
Code: #MYDTS02

Workshop agenda

- Why mitigation and adaptation?
- Why systems thinking?
- What is systems thinking?
- What is being done in Malaysia?
- Where do I fit into this?

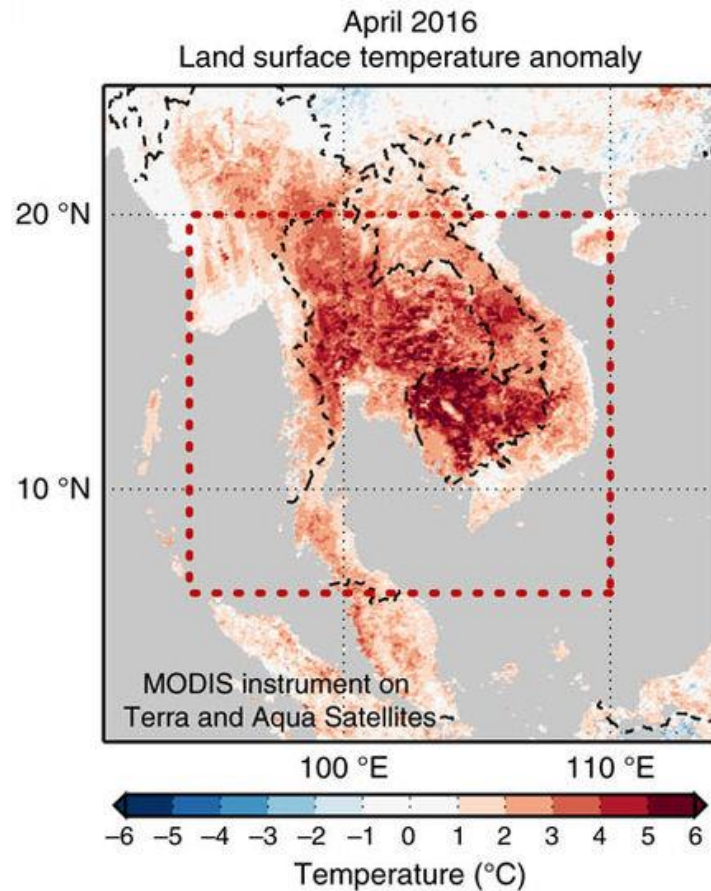


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Extreme events



Satellite-derived (MODIS instrument on Terra and Aqua satellites) land surface temperature anomaly during April 2016 in the Mainland Southeast Asia (MSA) region (base period: 2000–2016)

THE STRAITS TIMES

ASIA

SINGAPORE POLITICS ASIA WORLD VIDEOS MULTIMEDIA LIFESTYLE FOOD FORUM OPINION BUSINESS SPORT MORE

ASIA > East Asia SE Asia South Asia Australia/NZ

Malaysian farmers struggle to fight damaging heatwave

Pig farmer Chung Hock Meng hosing down his animals. Rising temperatures have forced him to cool down his pigs by giving them more water and showering them regularly, as well as by keeping electric fans switched on. ST PHOTO: TRINNA LEONG

PUBLISHED APR 25, 2016, 5:00 AM SGT

Water levels in dams and rivers have dropped sharply; farmers have been hit badly and officials are worried about a water crisis. The Straits Times bureaus assess the drought ravaging Malaysia, Indochina and India.

FEATURES | September 8, 2016

El Niño a key player in severe Indonesia fires

By Laurie J. Schmidt,
NASA's Jet Propulsion Laboratory




More extreme events to come



BH ONLINE
BERITA SUKAN DUNIA HIBURAN BISNES RENCANA WANITA Hujung Minggu SETULUS IKHL

DUNIA » Eropah
Ahad, 8 September 2019 | 10:24pm



Gambar fail diambil 27 Jun lalu menunjukkan seorang budak lelaki berbaring di bawah pancuran air di Montpellier, selatan Perancis ketika gelombang haba melanda. -Foto AFP

Tambahan 1,500 kematian akibat gelombang haba di Perancis

PARIS: Gelombang haba pada Jun dan Julai lalu menyebabkan tambahan 1,500 kematian berbanding biasa di Perancis dalam tempoh itu, walaupun jumlahnya jauh lebih rendah berbanding musim panas pada 2003, kata Menteri Kesihatan Agnes Buzyn hari ini.

Tambahan sejumlah 1,465 orang maut berbanding biasa ketika musim panas dalam tempoh itu, meningkat 9.1 peratus secara purata, data Kementerian Kesihatan menunjukkan.

BH ONLINE
BERITA SUKAN DUNIA HIBURAN BISNES RENCANA WANITA Hujung Minggu SETULUS IKHL

DUNIA » Eropah
Rabu, 4 Disember 2019 | 11:33am



Perubahan iklim, Eropah bakal terima gelombang panas melampau setiap tahun

BRUSSELS : Eropah bakal berhadapan gelombang panas melampau setiap tahun dan kehilangan separuh daripada hasil tuaian pada masa depan, melainkan usaha agresif diambil untuk mengatasi perubahan iklim.

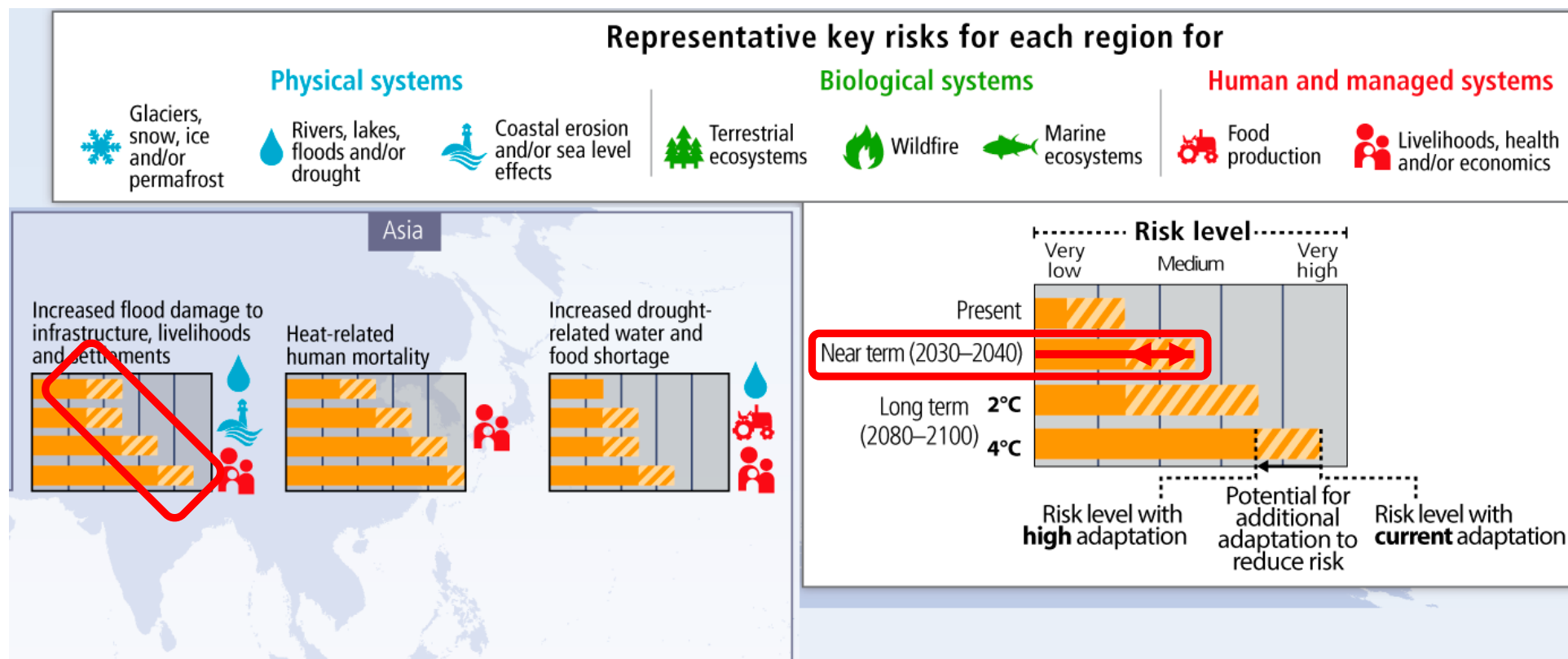
Definitions



- **Climate change:**
 - A **change of climate which is attributed directly or indirectly to human activity** that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (*Article 1, United Nations Framework Convention on Climate Change*)
 - **Any change in climate** over time that directly or indirectly affects humans and their activities as well as natural systems and its processes (*National Policy on Climate Change, 2009*)
- **Disaster mitigation:** reduction of potential negative impacts of physical hazards (natural or human-caused) by reducing hazard, exposure and vulnerability
- **Climate change mitigation:** human intervention to reduce the sources or enhance the sinks of greenhouse gases.
- **Climate change adaptation:** the process of adjustment to actual or expected climate and its effects

How much adaptation is possible?

- Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (AR5)

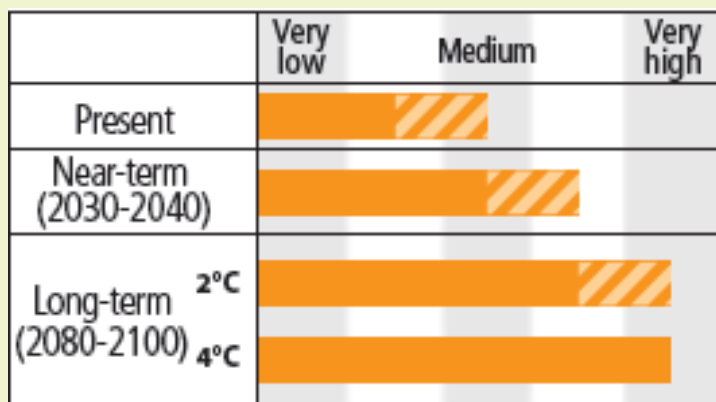


How much adaptation is possible?

- **Key takeaway:** Risk levels can be reduced with adaptation to a limited extent

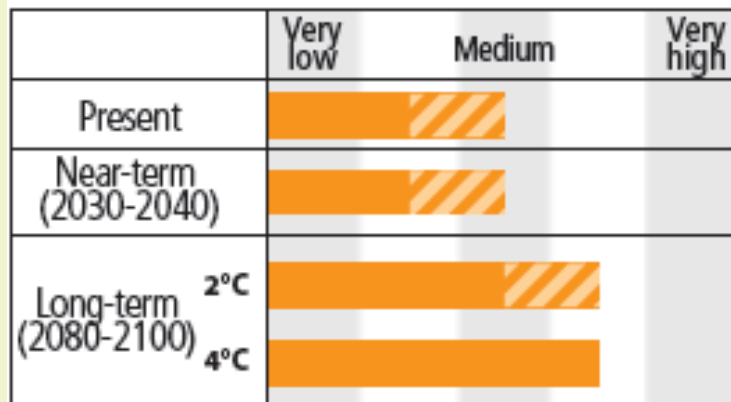
Increased risk of heat-related mortality

(high confidence)



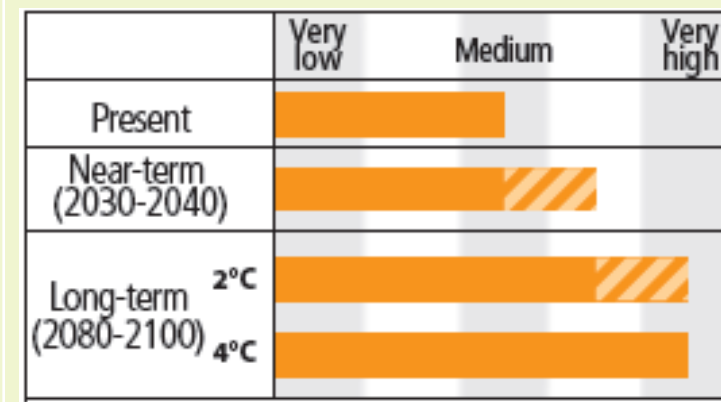
Increased risk of crop failure and lower crop production could lead to food insecurity in Asia

(medium confidence)



Coral reef decline in Asia

(high confidence)



Workshop agenda

- Why mitigation and adaptation?
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-
- The diagram illustrates a complex food web of the Bering Sea, showing numerous species and their feeding relationships. The species are organized into layers, with primary producers at the bottom and top predators at the top. The web is highly interconnected, with many species having multiple prey items and being preyed upon themselves. Key species include various fish (e.g., Salmon, Cod, Haddock, Mackerel, Halibut), marine mammals (e.g., Harbour porpoise, Minke whale), and seabirds (e.g., Puffin, Gannet, Razorbill). The diagram illustrates the flow of energy and nutrients through the ecosystem.

1: “Us versus them” narratives



1: “Us versus them” narratives



2: Language is linear

And often systems are not.

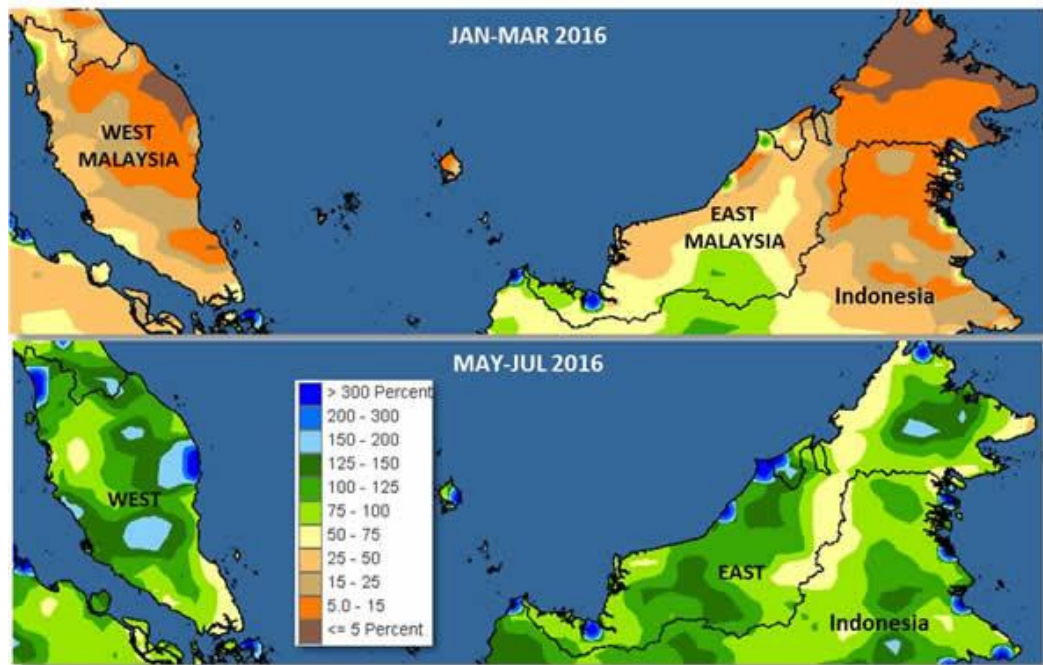


CASE STUDY!

Effect of El Niño on oil palm

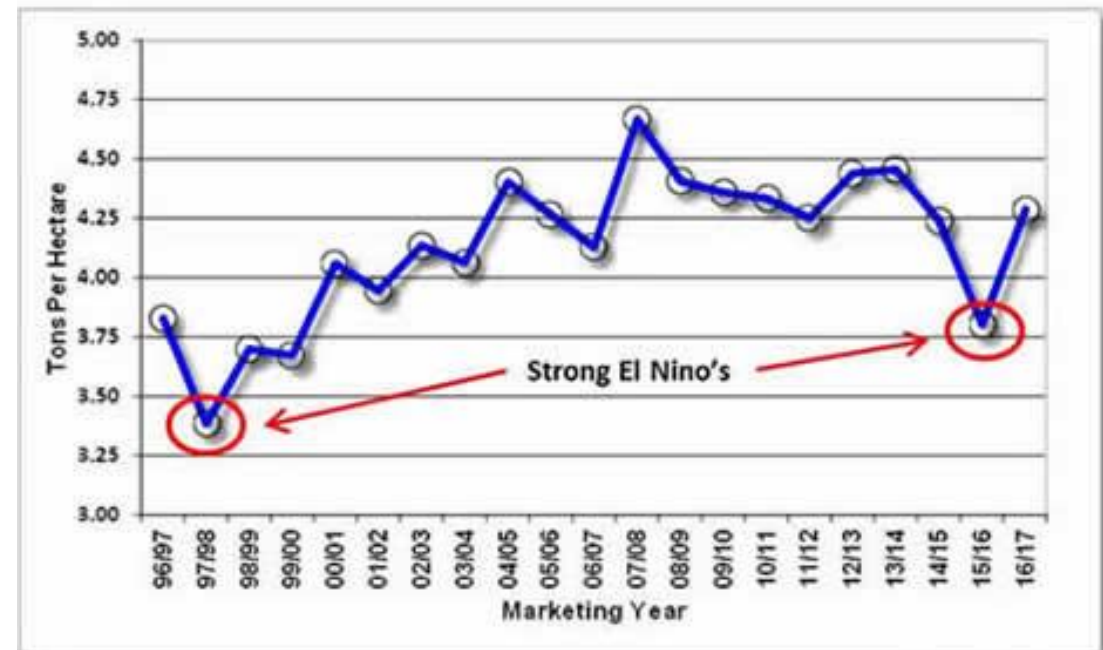


MALAYSIA: Percent Normal Rainfall



Source: NOAA CPC,CMORPH

MALAYSIA: Palm Oil Yield



Source: USDA

Effect of El Niño on oil palm

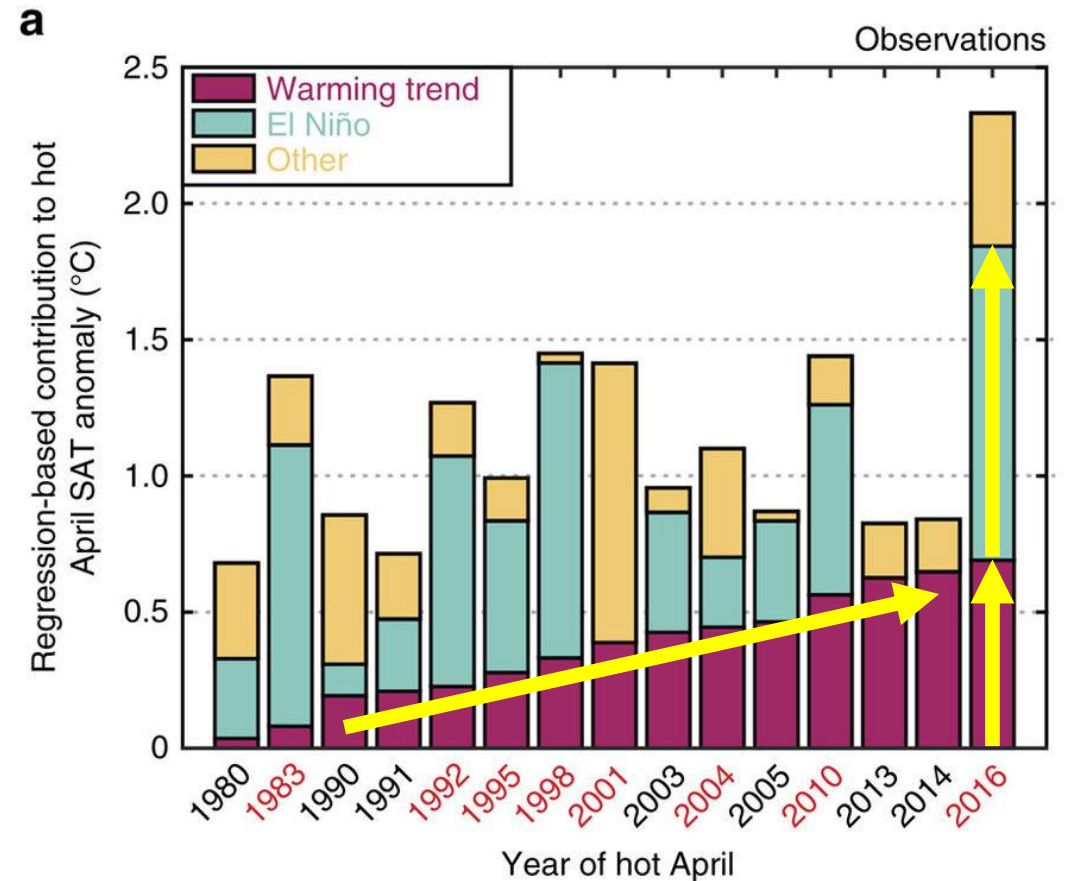


African oil palm weevil
Elaeidobius kamerunicus

Effect of global heating on El Niño



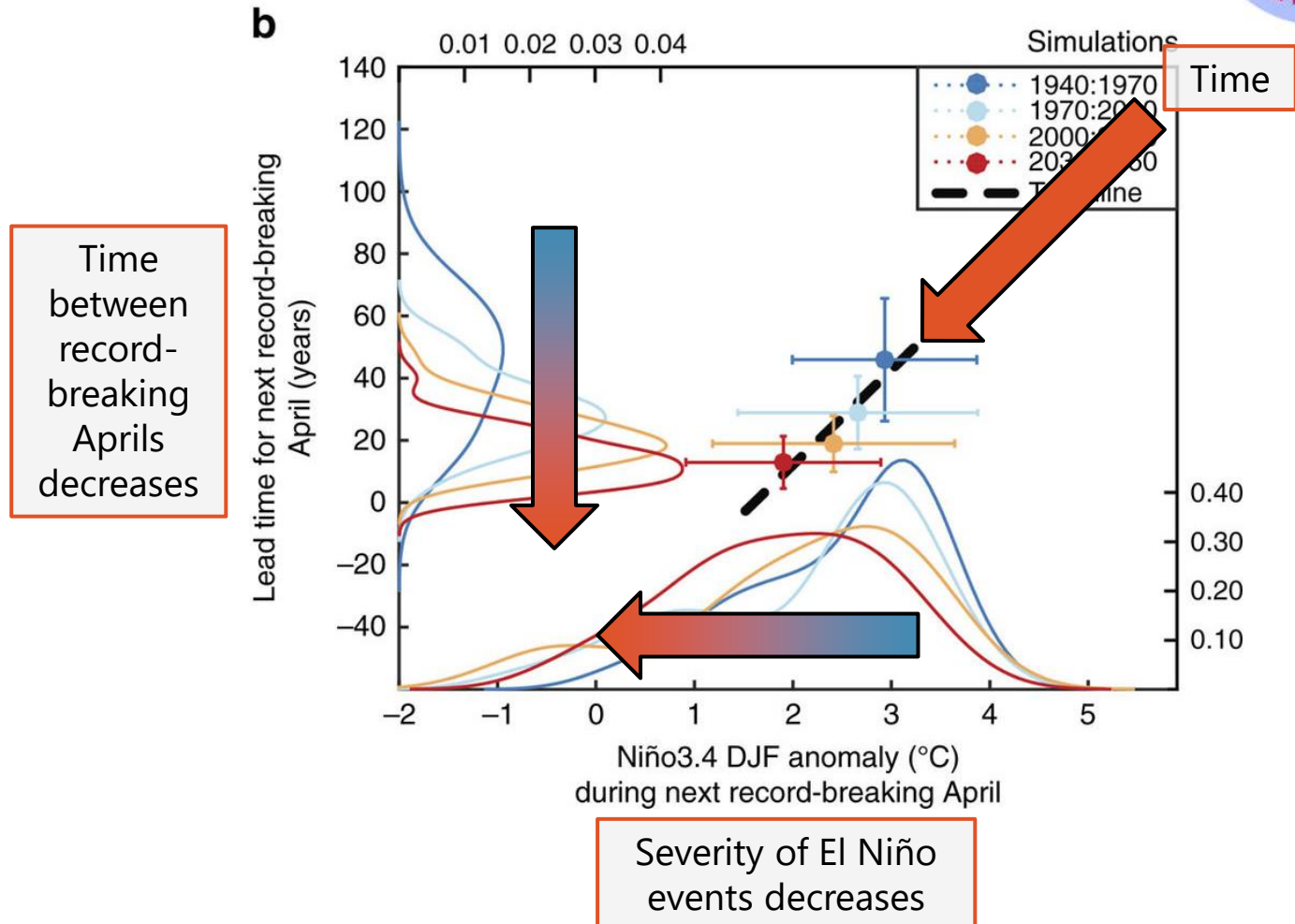
- Global warming and El Niño can explain record-breaking April extremes well
- Estimated **29%** of the anomaly in April 2016 surface air temperatures (SATs) was caused by warming, and **49%** by the 2015-16 El Niño



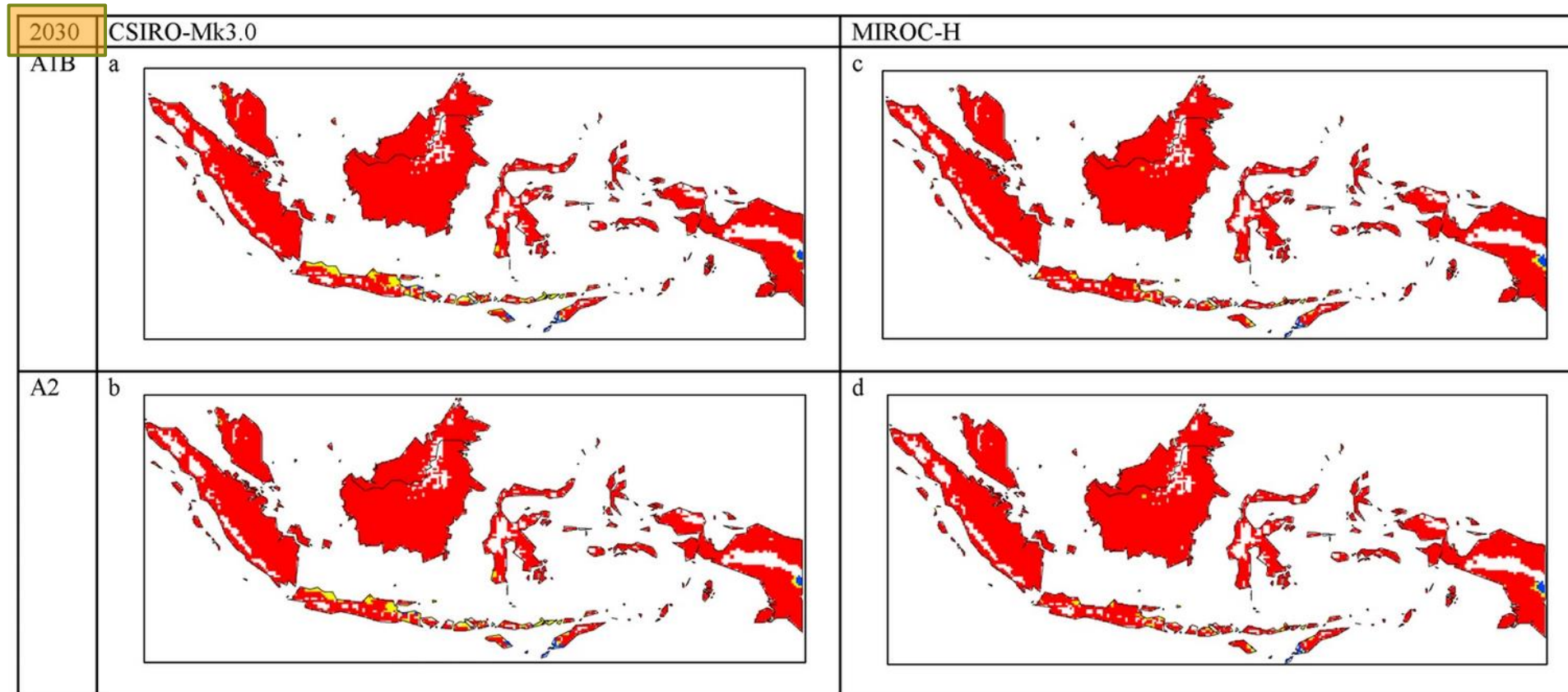
Effect of global heating on El Niño



- Record-breaking April SATs occur more frequently with time, **and** during less severe El Niño events

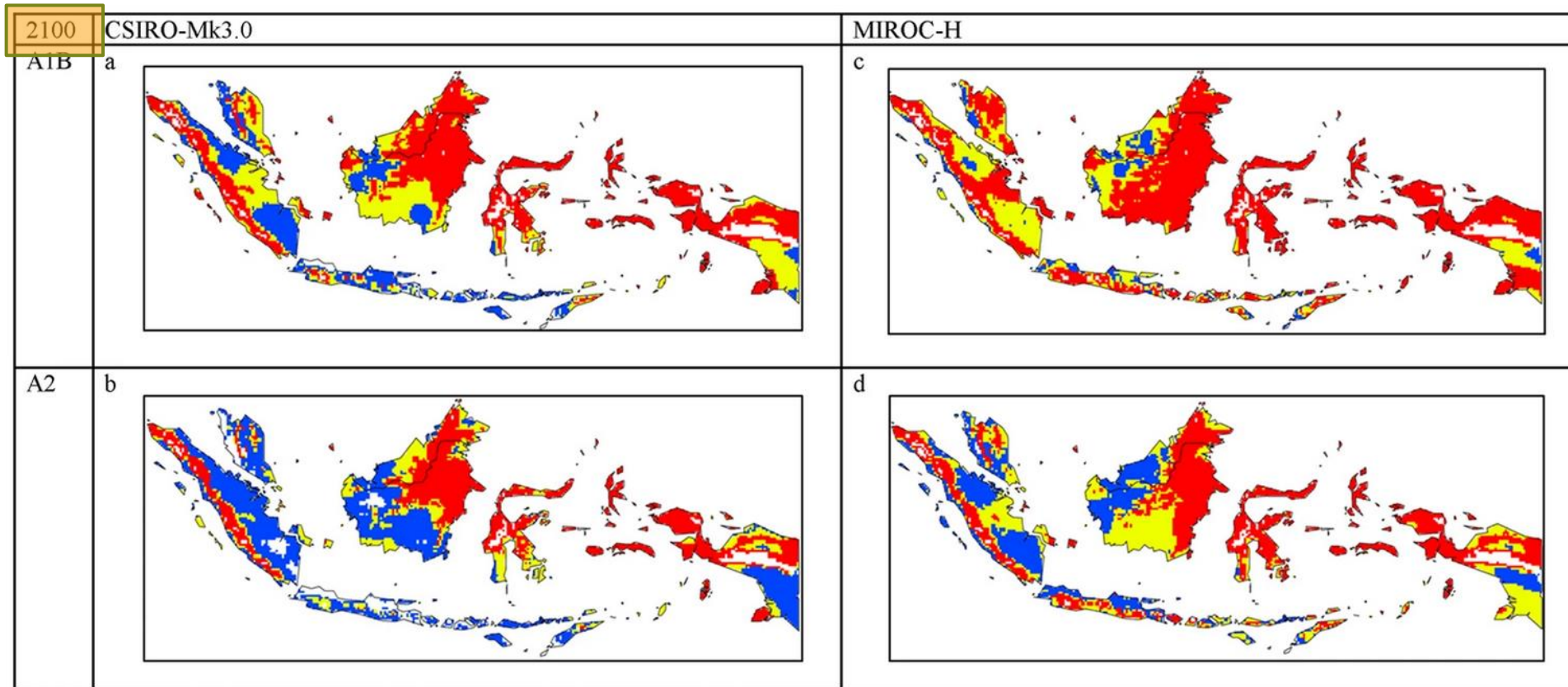


Regional suitability for oil palm



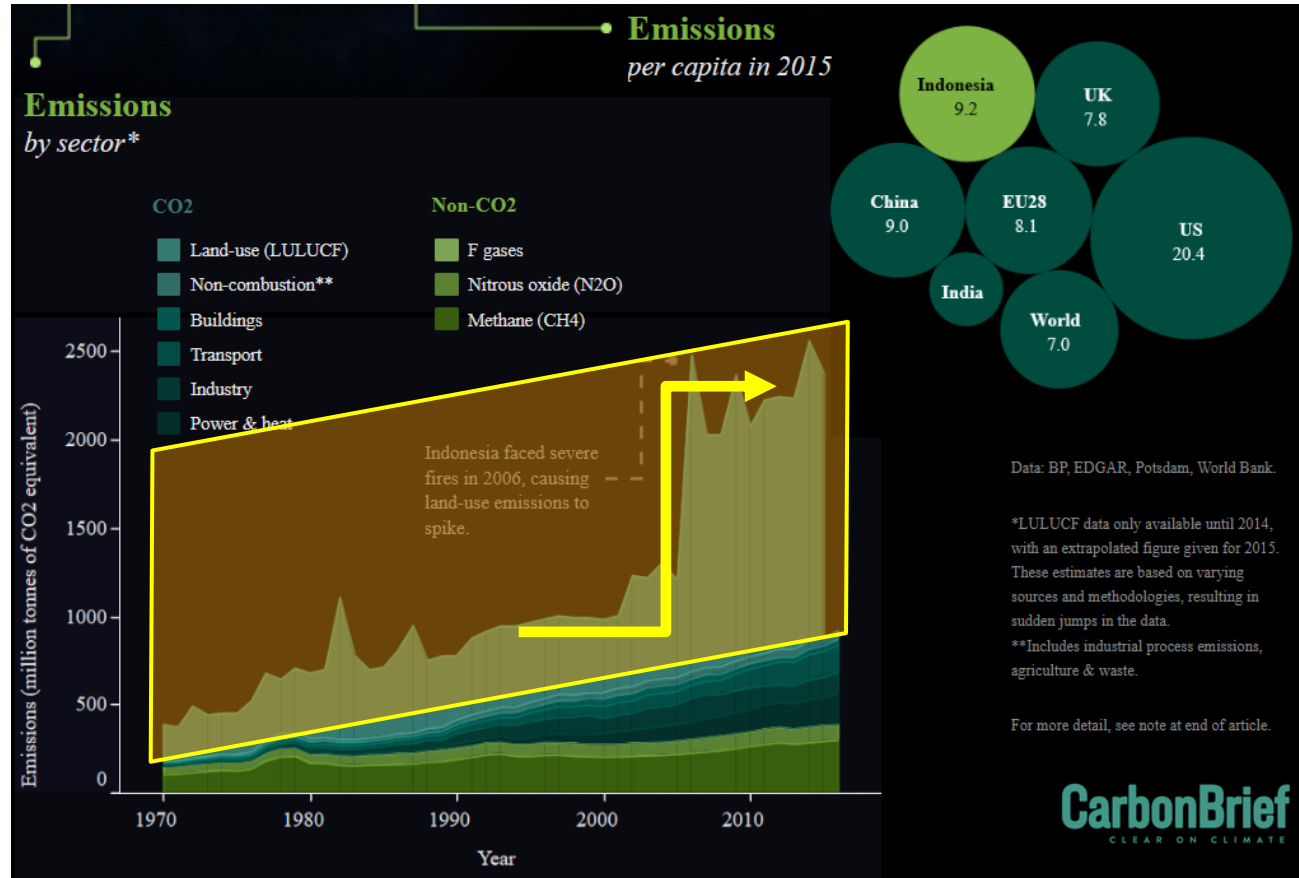
White areas indicate unsuitable climate areas ($EI = 0$), blue areas indicate marginal climate areas ($EI = 1-10$), yellow areas indicate suitable climate areas ($EI = 10-20$) and red areas indicate highly suitable climate areas ($EI > 20$).

Regional suitability for oil palm



White areas indicate unsuitable climate areas ($EI = 0$), blue areas indicate marginal climate areas ($EI = 1-10$), yellow areas indicate suitable climate areas ($EI = 10-20$) and red areas indicate highly suitable climate areas ($EI > 20$).

Effect of land clearing on global heating



CARBON BUDGET

Average rate of emission from 2015-2100

for a 66% chance of remaining below 2°C of global warming

~12

GtCO₂ / yr



2: Language is linear

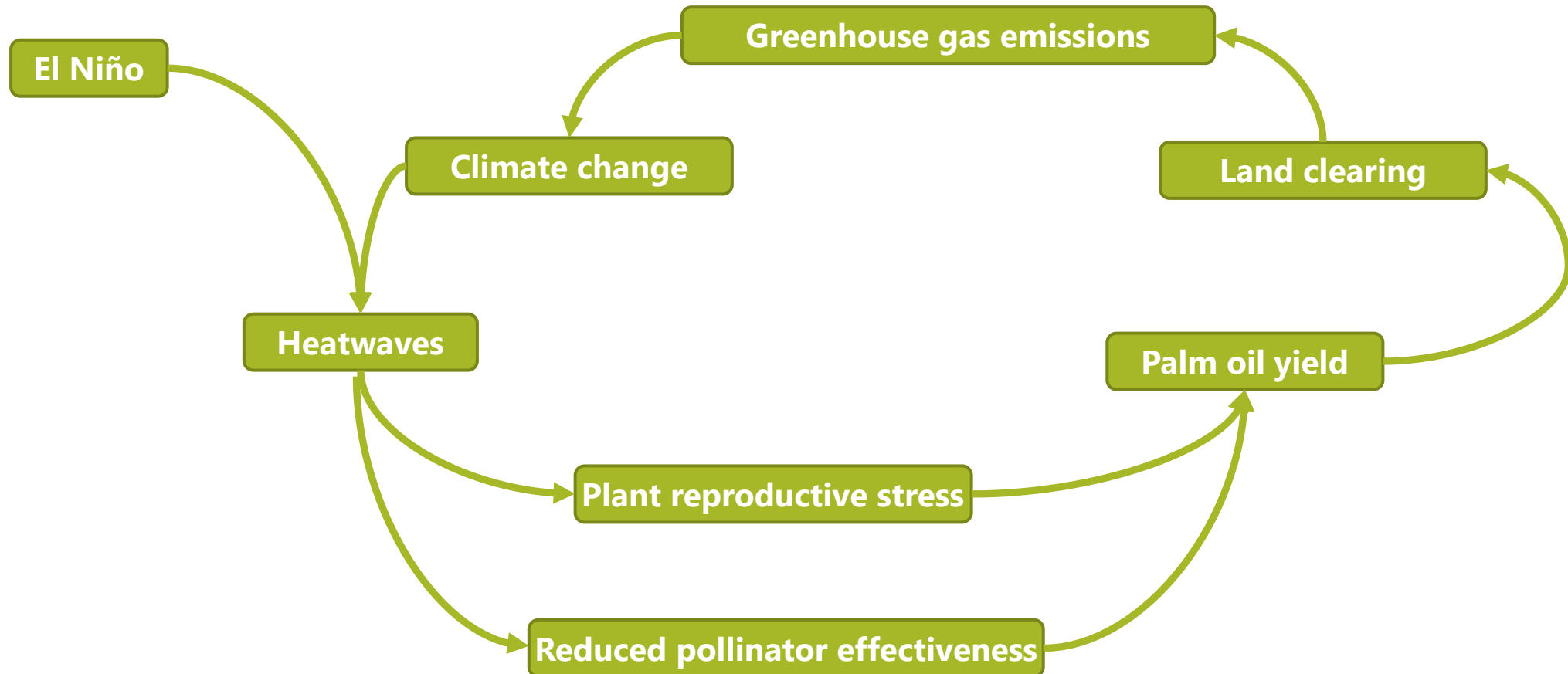


- Climate change makes heatwaves worse and more frequent
- El Niño makes heatwaves worse
- Heatwaves stress plants out and reduce pollination by weevils
- Stressed-out plants and weevils that are less sticky result in lower palm oil yield
- Lower palm oil yield encourages more clearing of land to get the same amount of output
- Clearing of land by burning creates more greenhouse gas emissions, especially if the land used to be peat swamp
- More greenhouse gas emissions leads to global heating
- Global heating causes climate change

2: Language is linear

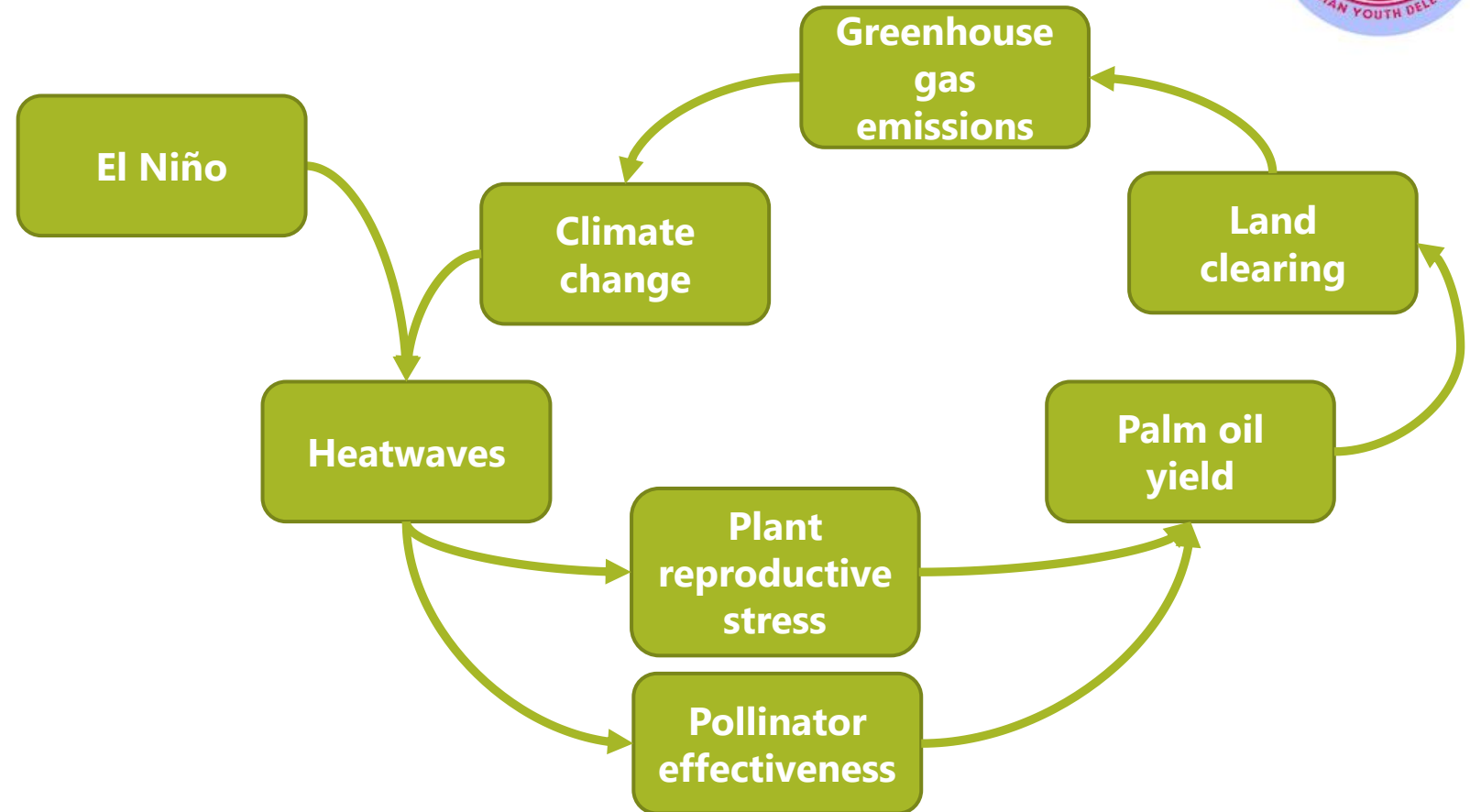
- **Climate change** makes heatwaves worse and more frequent
- **El Niño** makes heatwaves worse
- **Heatwaves** stress plants out and reduce pollination by weevils
- **Plant reproductive stress** and **Reduced pollinator effectiveness** result in lower **Palm oil yield**
- Lower palm oil yield encourages more clearing of land to get the same amount of output
- **Land clearing** by burning creates more greenhouse gas emissions, especially if the land used to be peat swamp
- More **Greenhouse gas emissions** leads to global heating
- Global heating causes climate change

2: Language is linear



3: Other benefits

- Loops / "Closed interdependencies"
 - x influences y
influences z
influences x
- Visual
- Adds precision
 - Makes mental models explicit
- Allows inquiry and solutions that address the whole
 - "Fire prevention" rather than "firefighting"



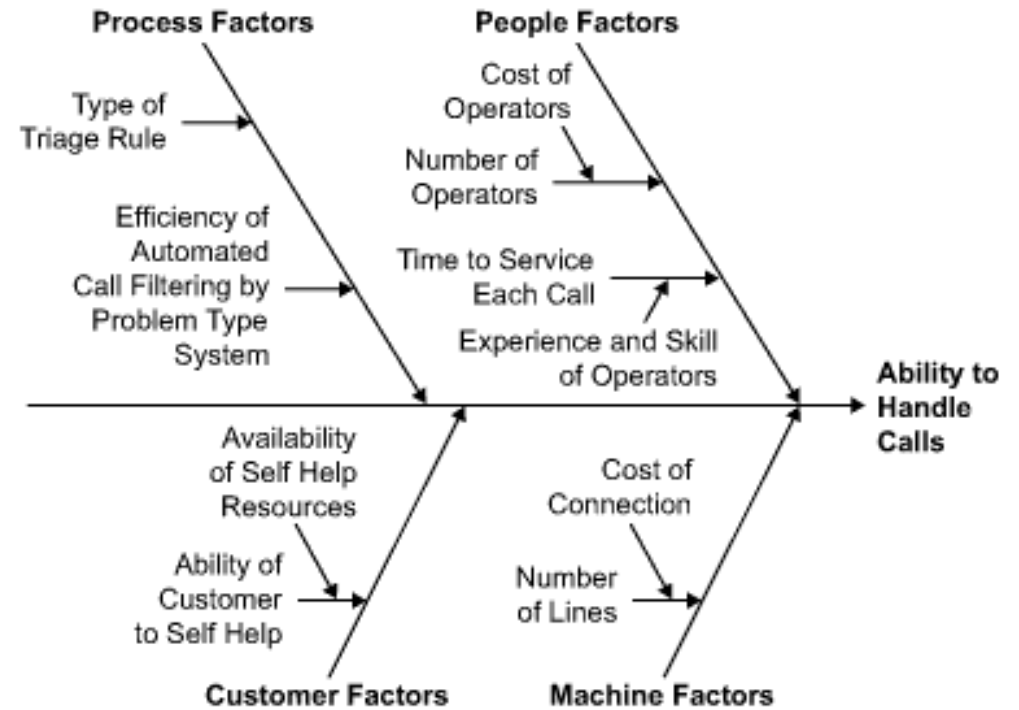
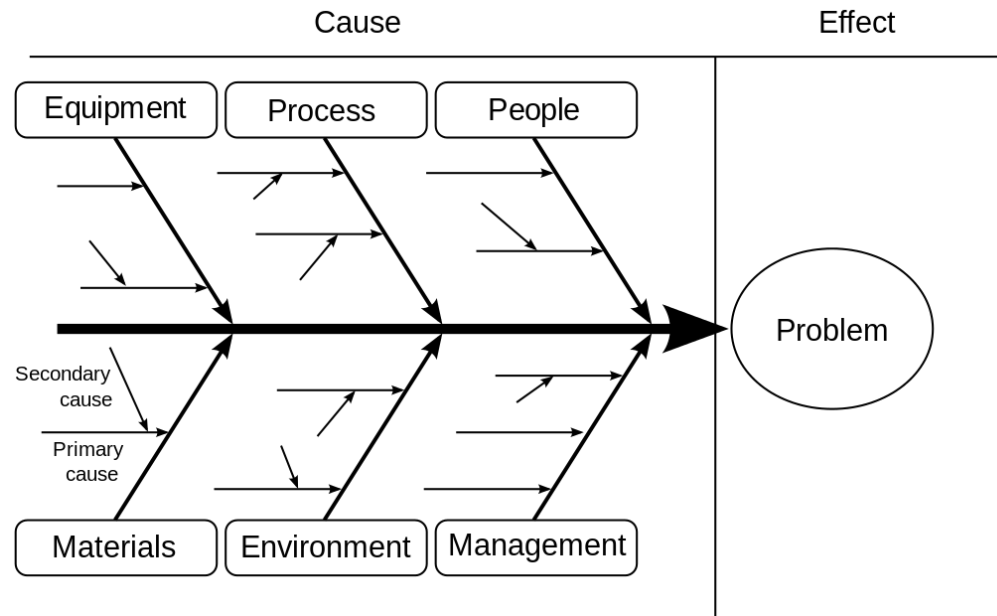
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Tools: Brainstorming

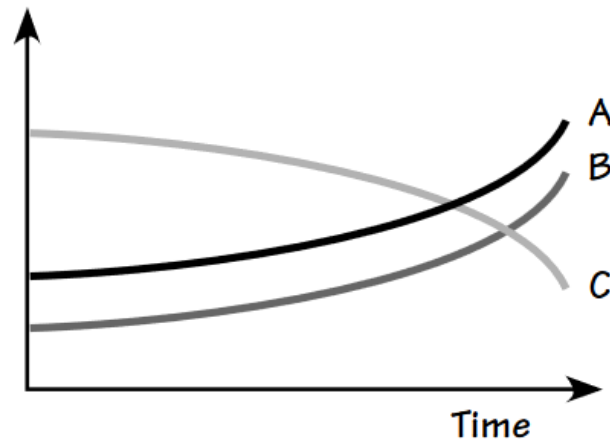
- Ishikawa (fishbone) diagrams



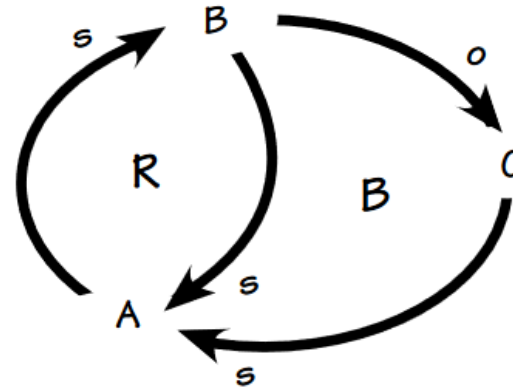
Tools: Dynamic thinking



Behavior Over Time Diagram



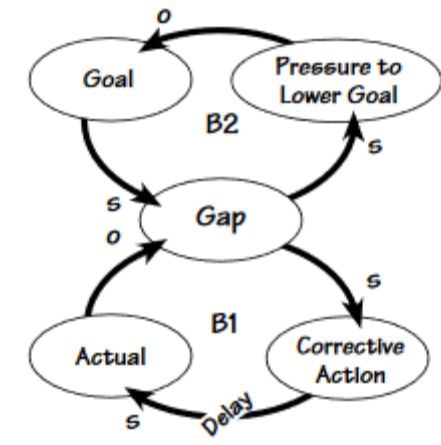
Causal Loop Diagram



Causal loop diagrams (CLD)
are also referred to as
Causal Flow Diagrams (CFD)

Systems Archetype

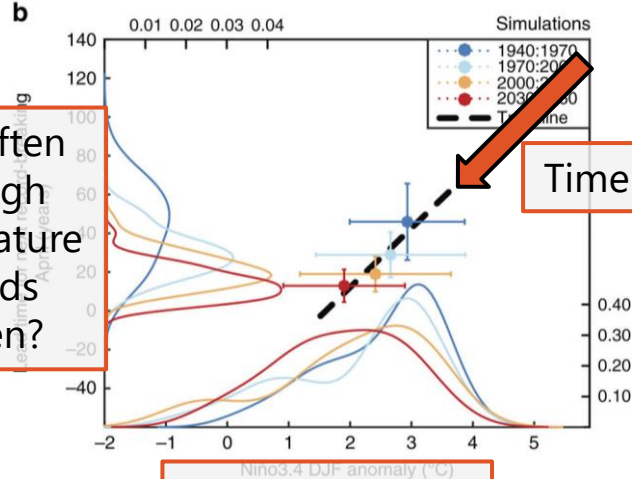
Drifting Goals



Tools: Structural thinking



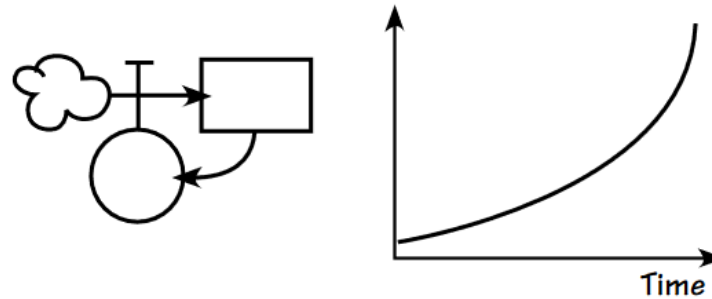
Graphical Function Diagram



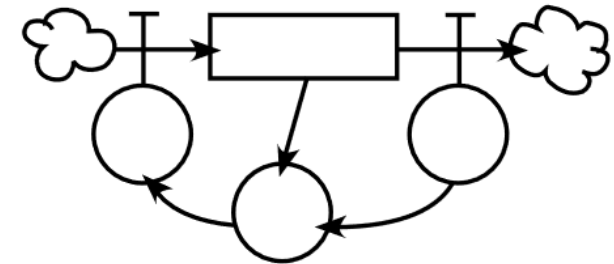
How often
are high
temperature
records
broken?

How severe is
the El Niño?

Structure-Behavior Pair



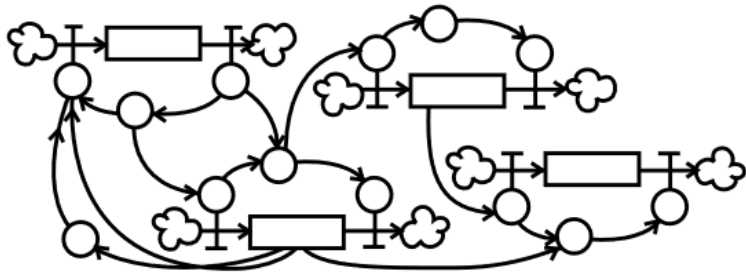
Policy Structure Diagram



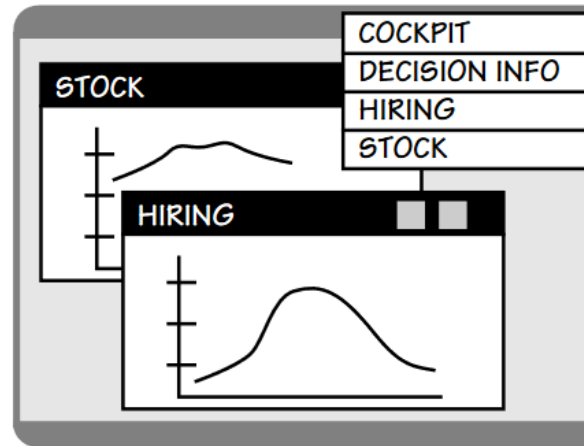
Tools: Computer-based



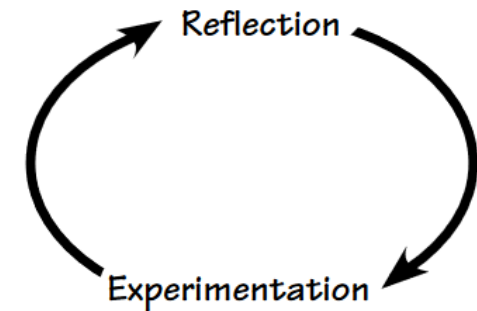
Computer Model



Management Flight Simulator



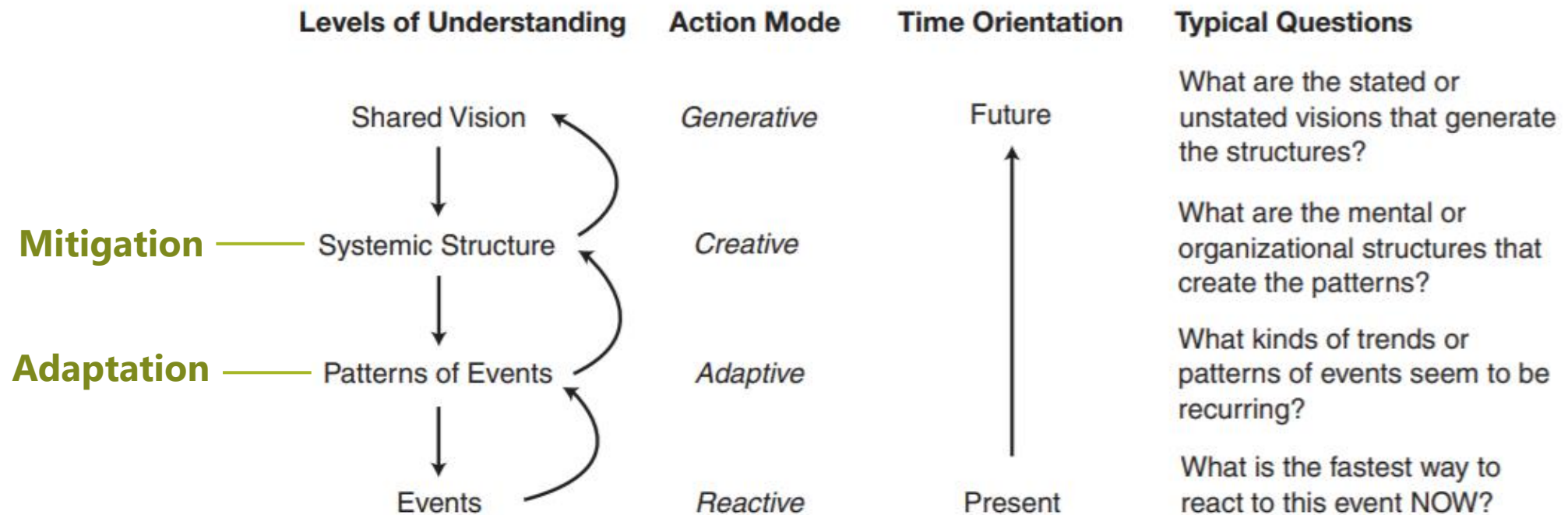
Learning Laboratory



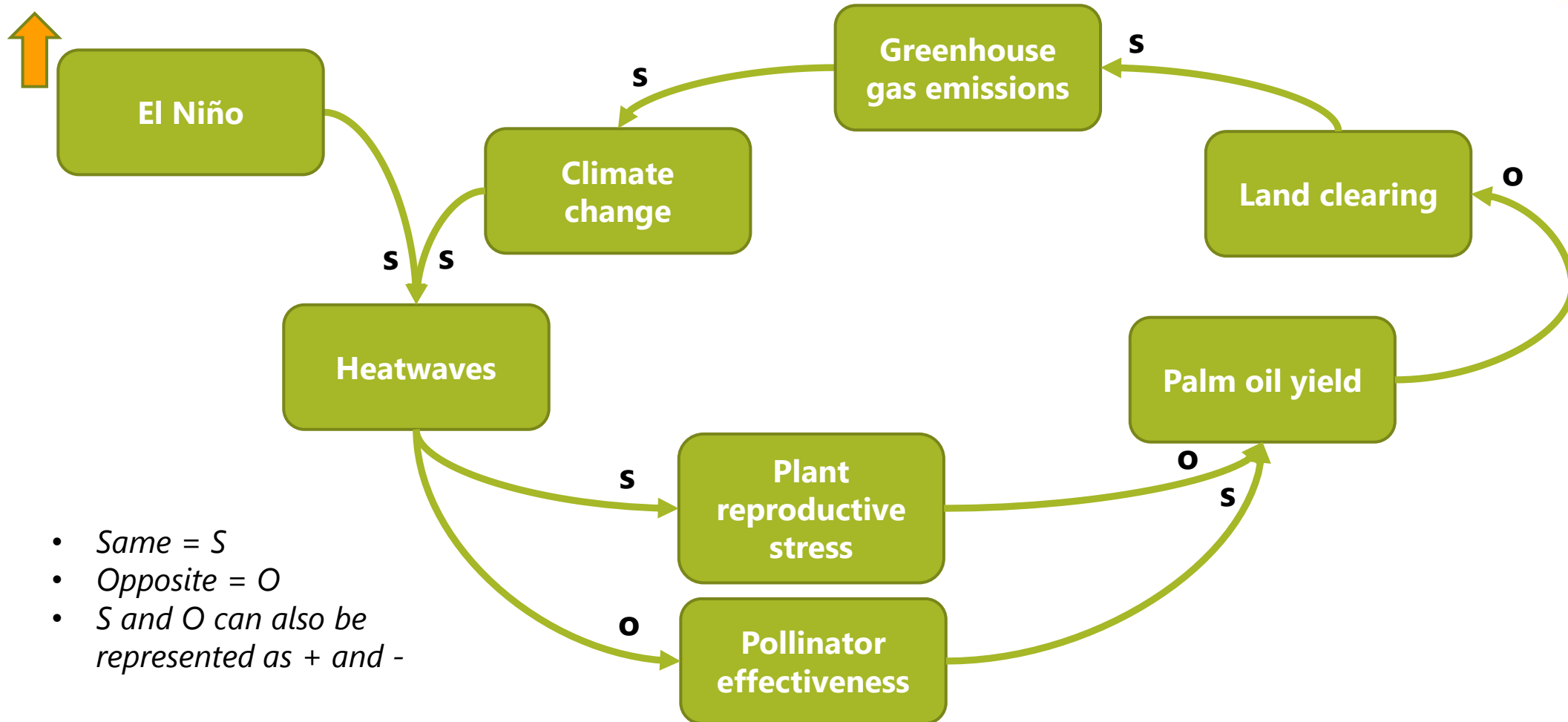
Mitigation & adaptation in systems



LEVELS OF UNDERSTANDING

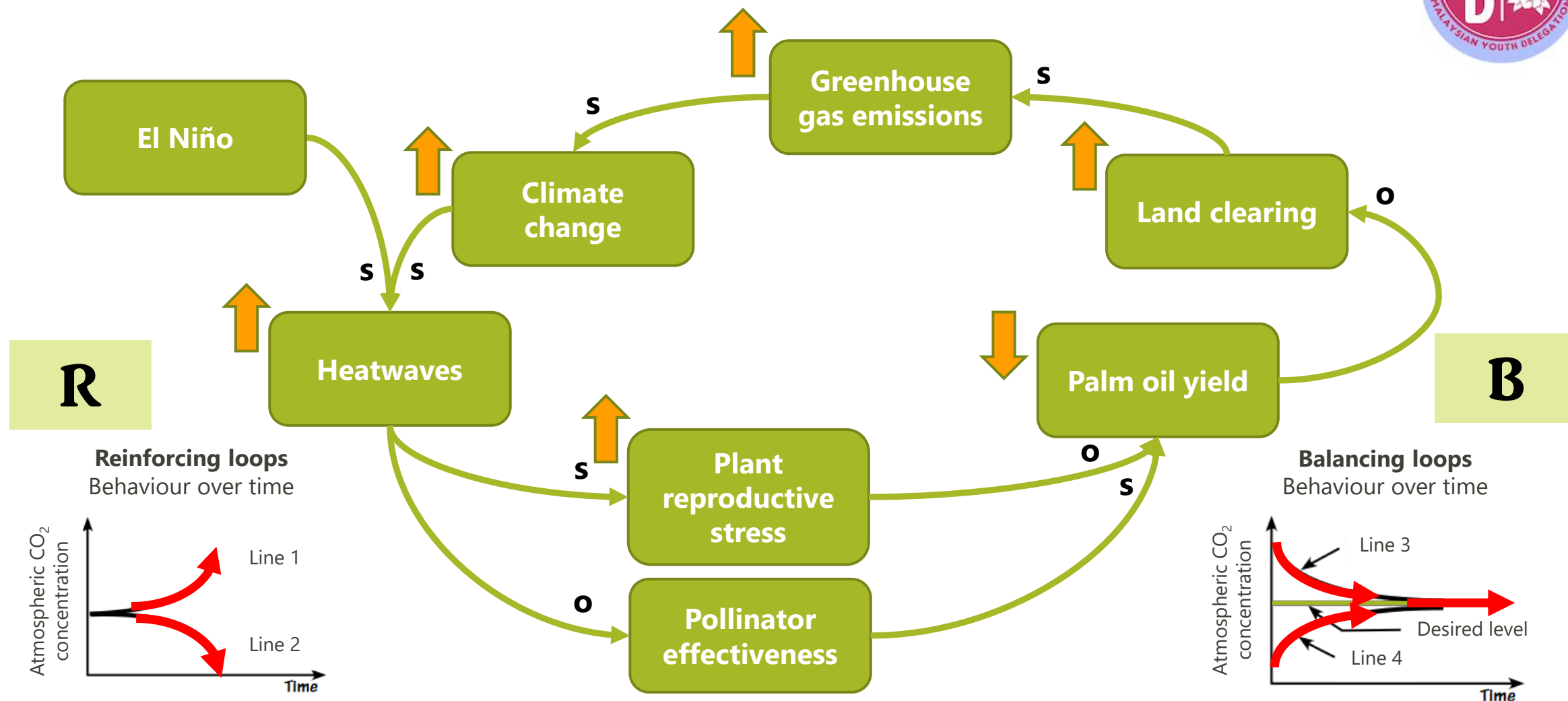


CLD concepts: same vs opposite

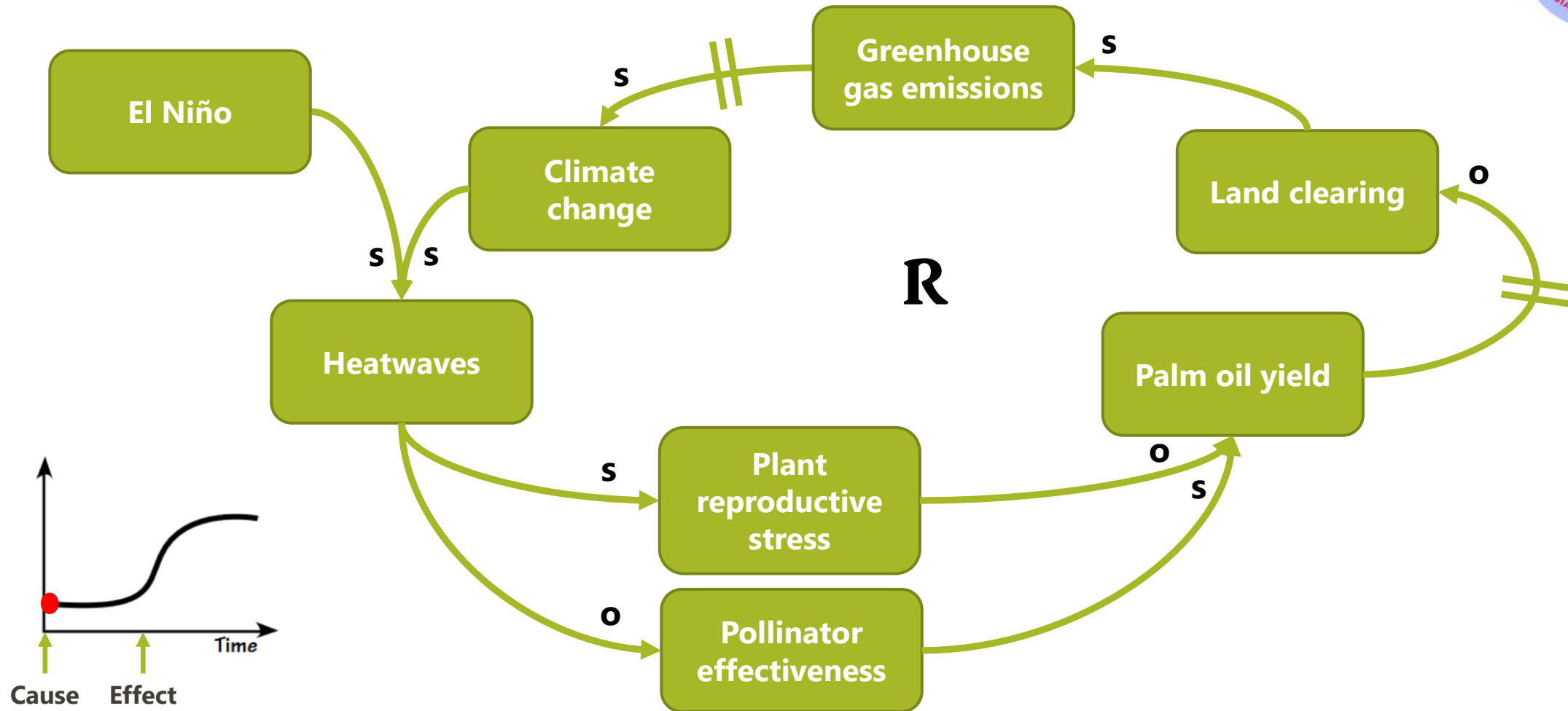


- Same = S
- Opposite = O
- S and O can also be represented as + and -

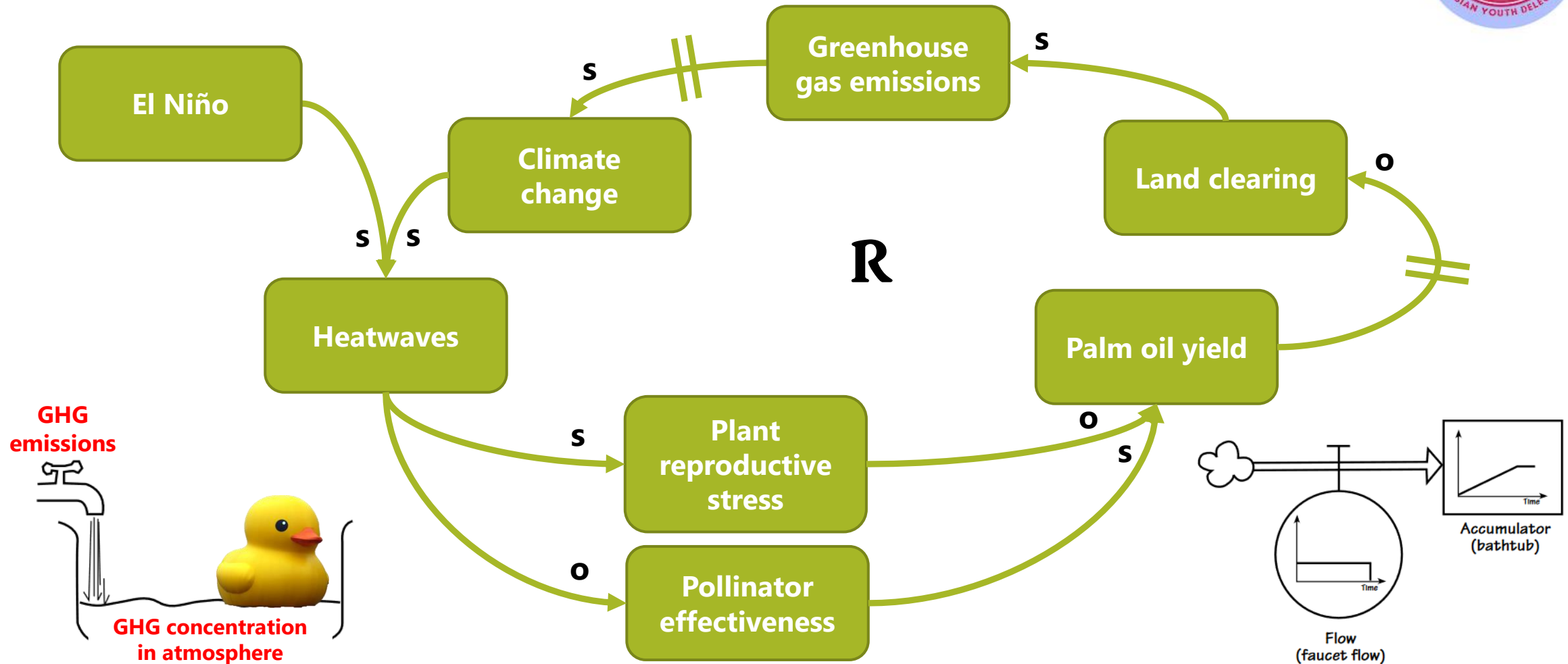
CLD concepts: reinforcing vs balancing



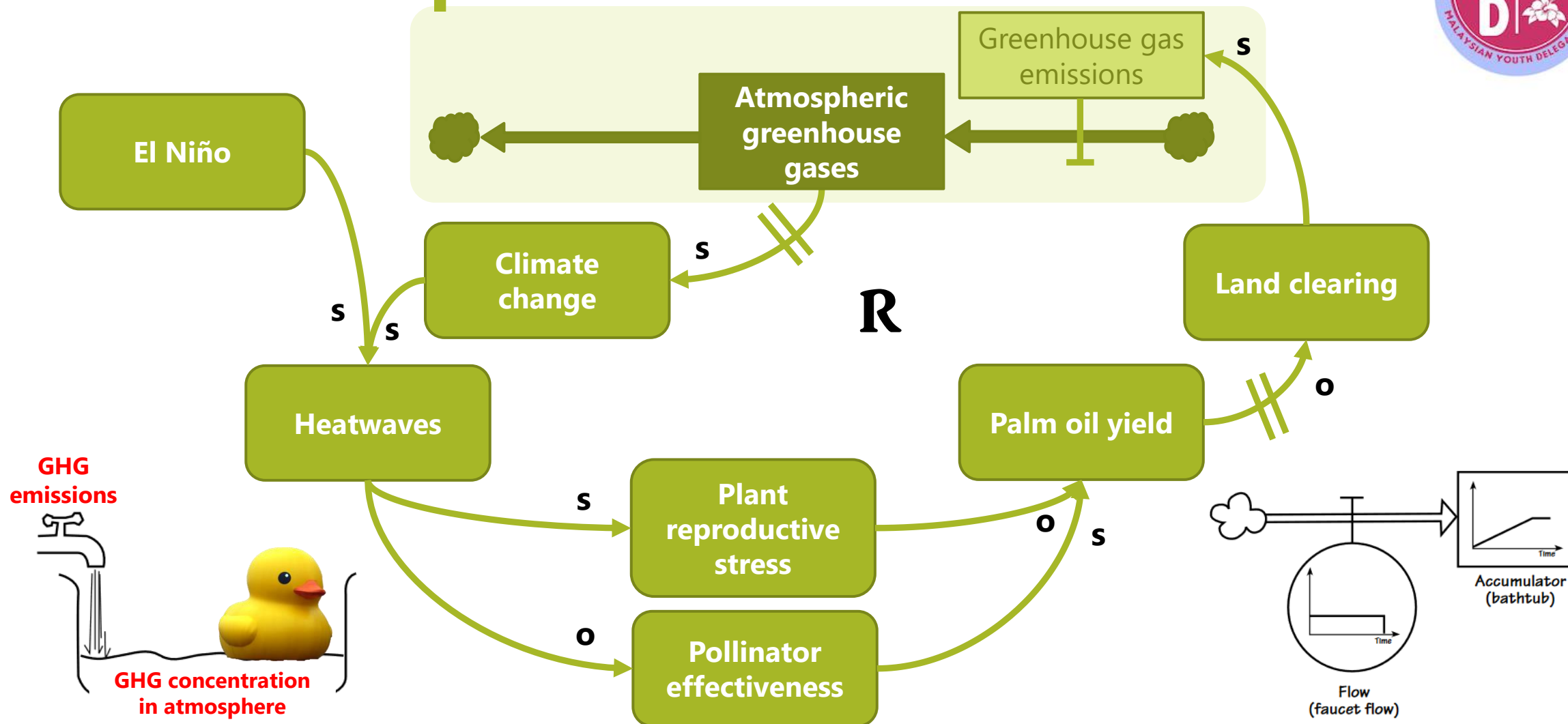
CLD concepts: delays



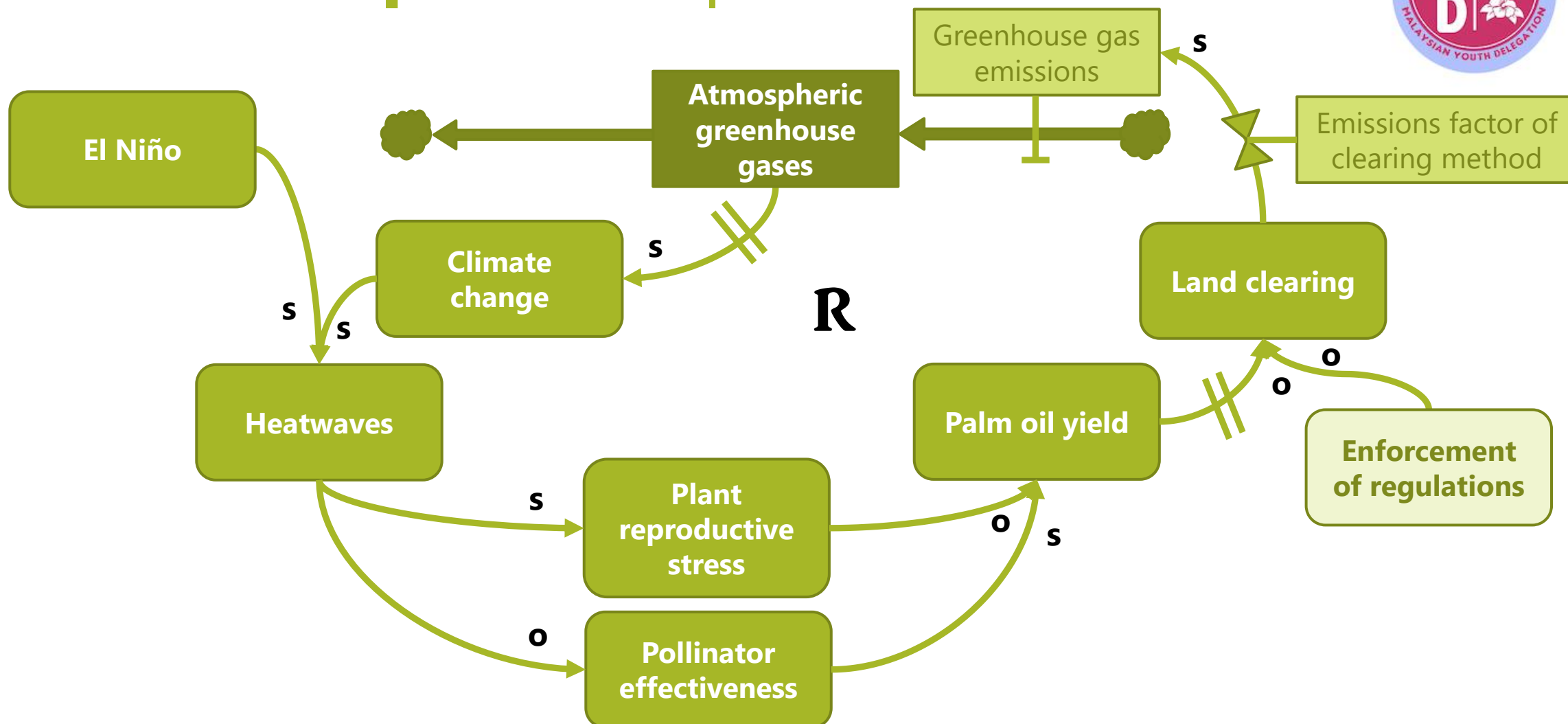
CLD concepts: flows and accumulators



CLD concepts: flows and accumulators



CLD concepts: multiplication factors



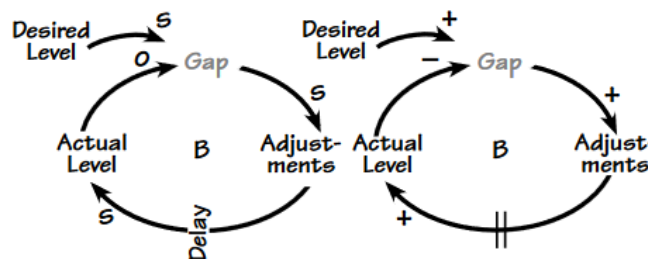
CLD concepts: summary

- Same vs opposite (+ vs -)
- Reinforcing vs balancing loops
- Delays
- Flows, regulators, accumulators

THE LANGUAGE OF LINKS AND LOOPS

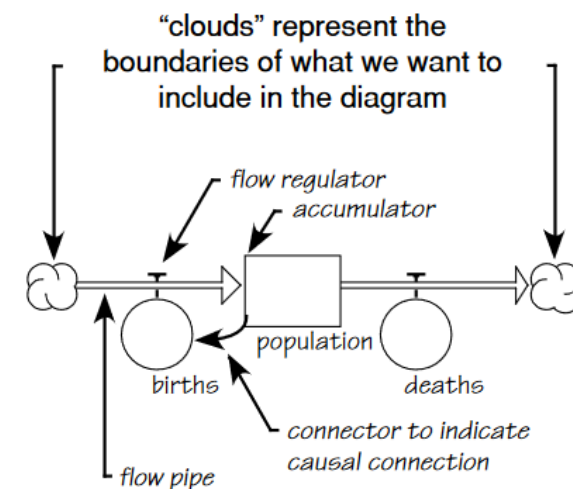
- $\rightarrow S$ A causal link between two variables, where a change in X causes a change in Y in the same direction, or where X adds to Y.
- $\rightarrow +$ A causal link between two variables, where a change in X causes a change in Y in the same direction, or where X adds to Y.
- $\rightarrow -$ A causal link between two variables, where a change in X causes a change in Y in the opposite direction, or where X subtracts from Y.
- $\rightarrow R$ A “reinforcing” feedback loop that amplifies change.
- $\rightarrow B$ A “balancing” feedback loop that seeks equilibrium.

BALANCING LOOP EXAMPLE



If there is a gap between the desired level and the actual level, adjustments are made until the actual equals the desired level. The starting variable is grey.

THE LANGUAGE OF ACCUMULATORS



Your turn!



INTERACTIVE ACTIVITY!



Interactive activity

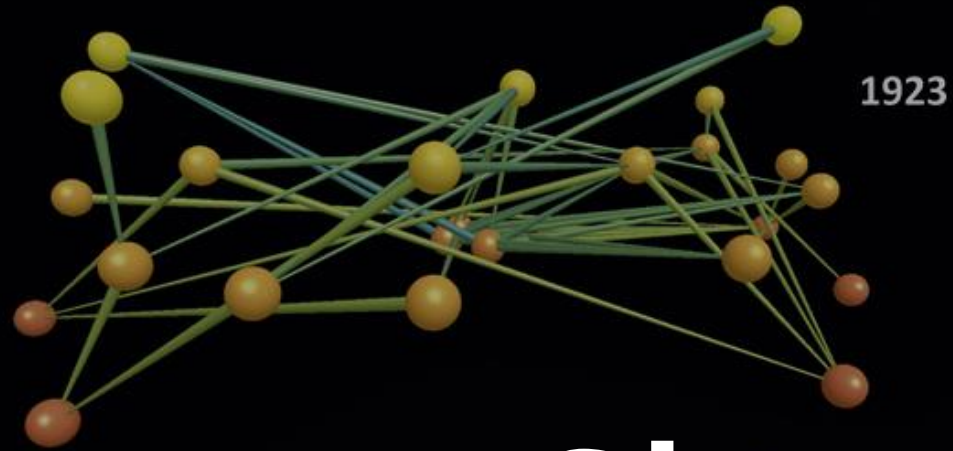
- In your breakout rooms:
 - Introduce yourselves – name, profession, area of interest or expertise **(3 min; 10 sec per person)**
 - Assign someone to share their screen to draw the diagram based on group input **(1 min)**
 - Choose one of the topics from the table **(1 min)**
 - Construct a simple causal loop diagram – *doesn't mean there has to be a loop in it* **(15 min)**

Environmental	Social
Plastic pollution	Refugee crises (e.g. Rohingya, Syria)
Logging	Teen suicide
Flooding	Drug abuse
Haze	Homelessness
Recycling	COVID-19

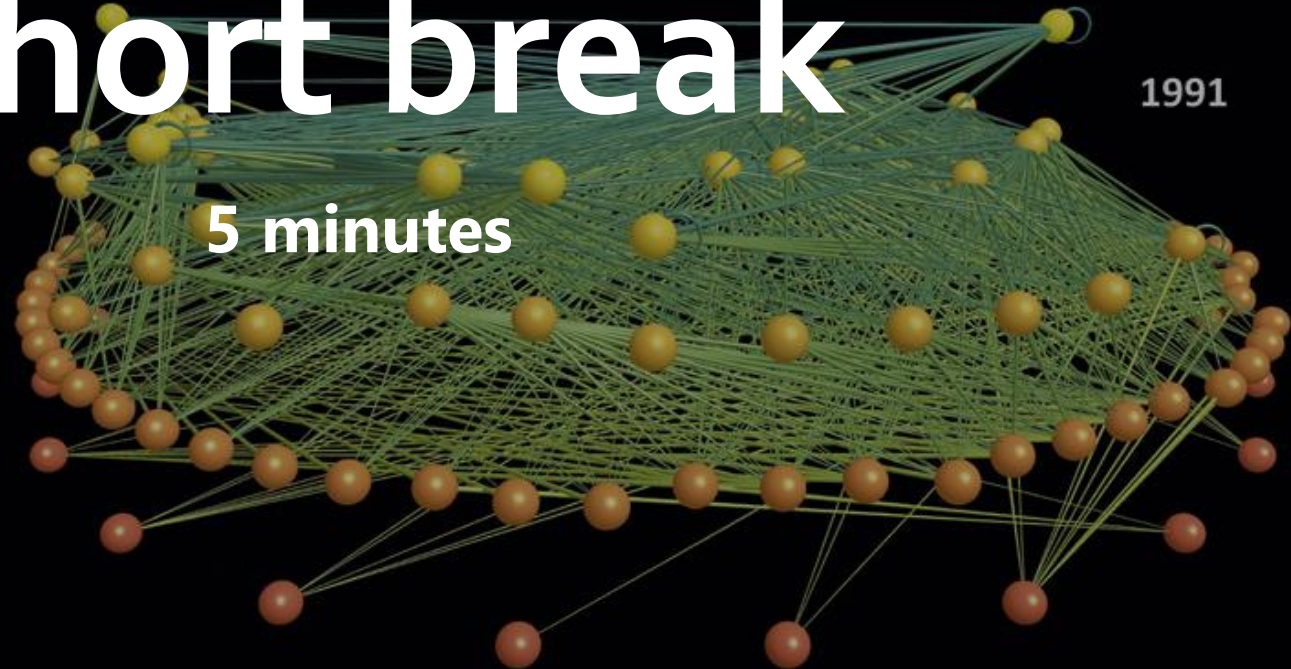
Your turn!

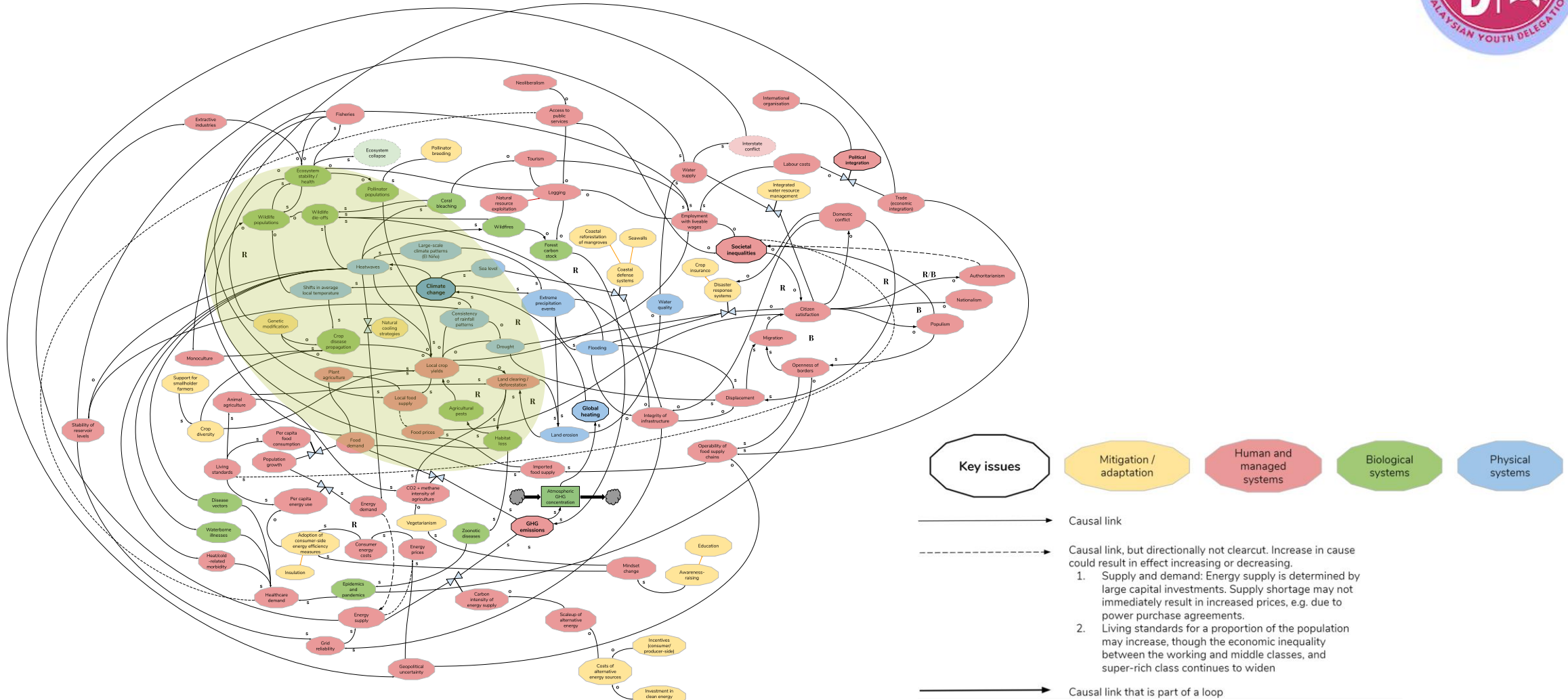


DISCUSSION!



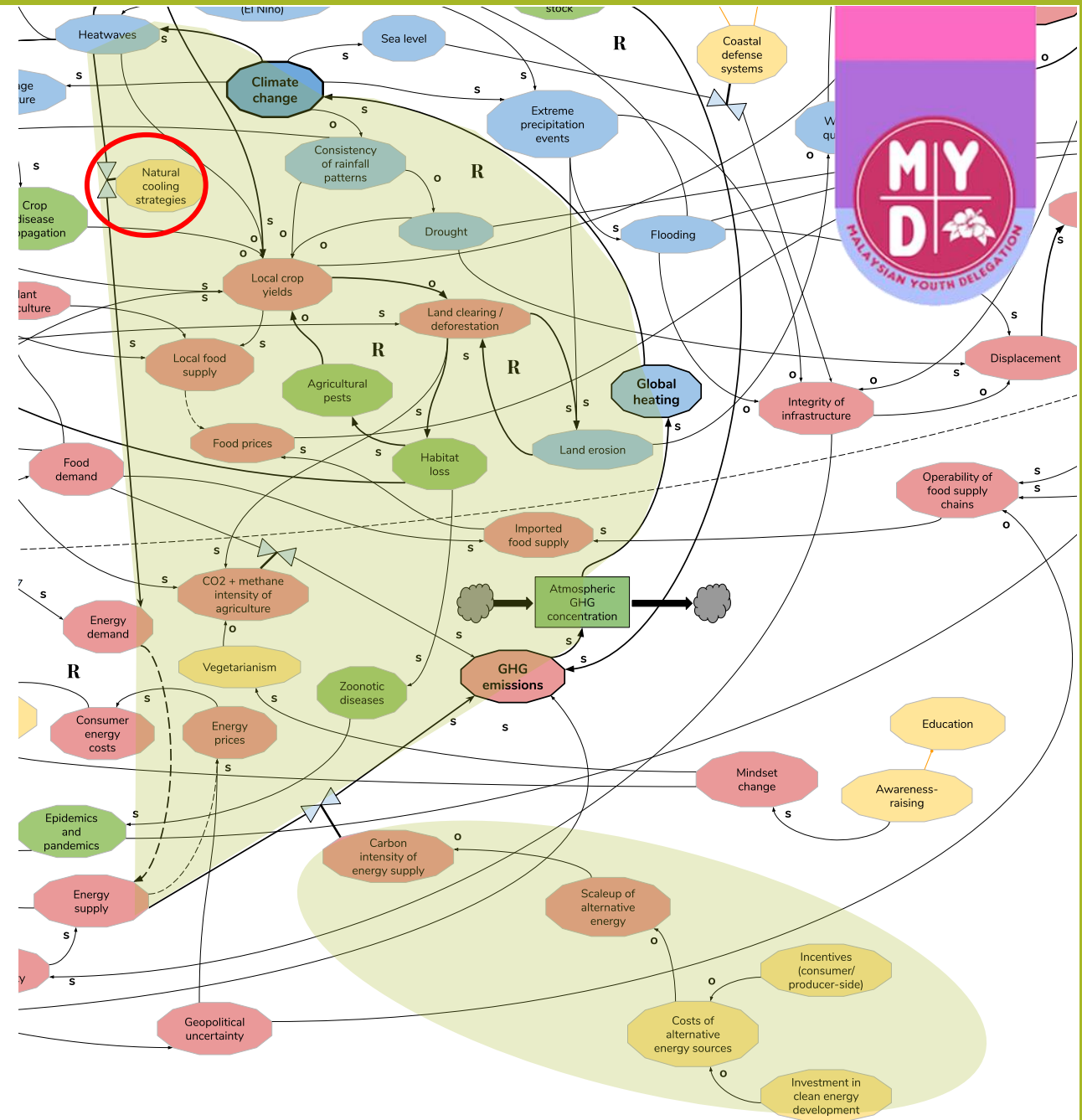
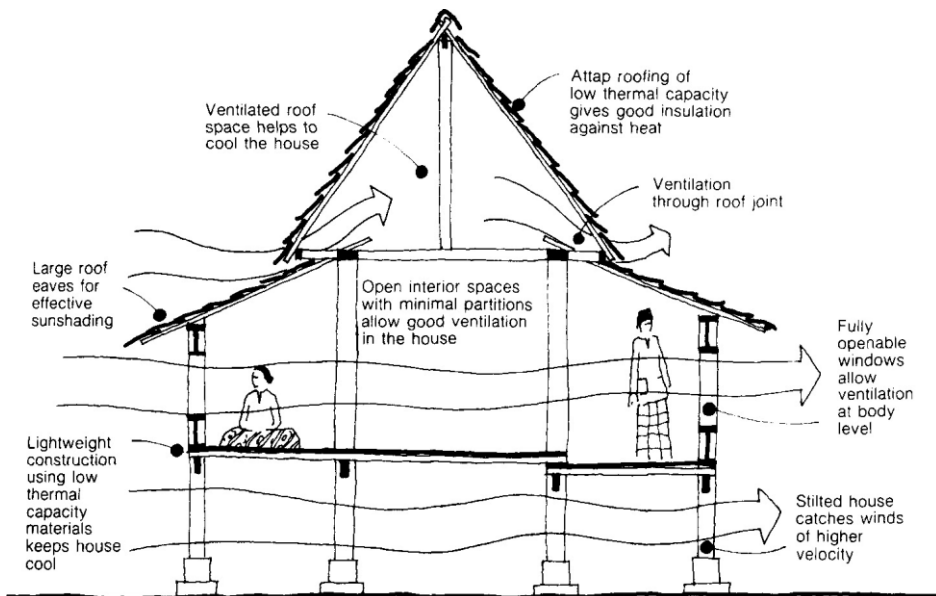
Short break

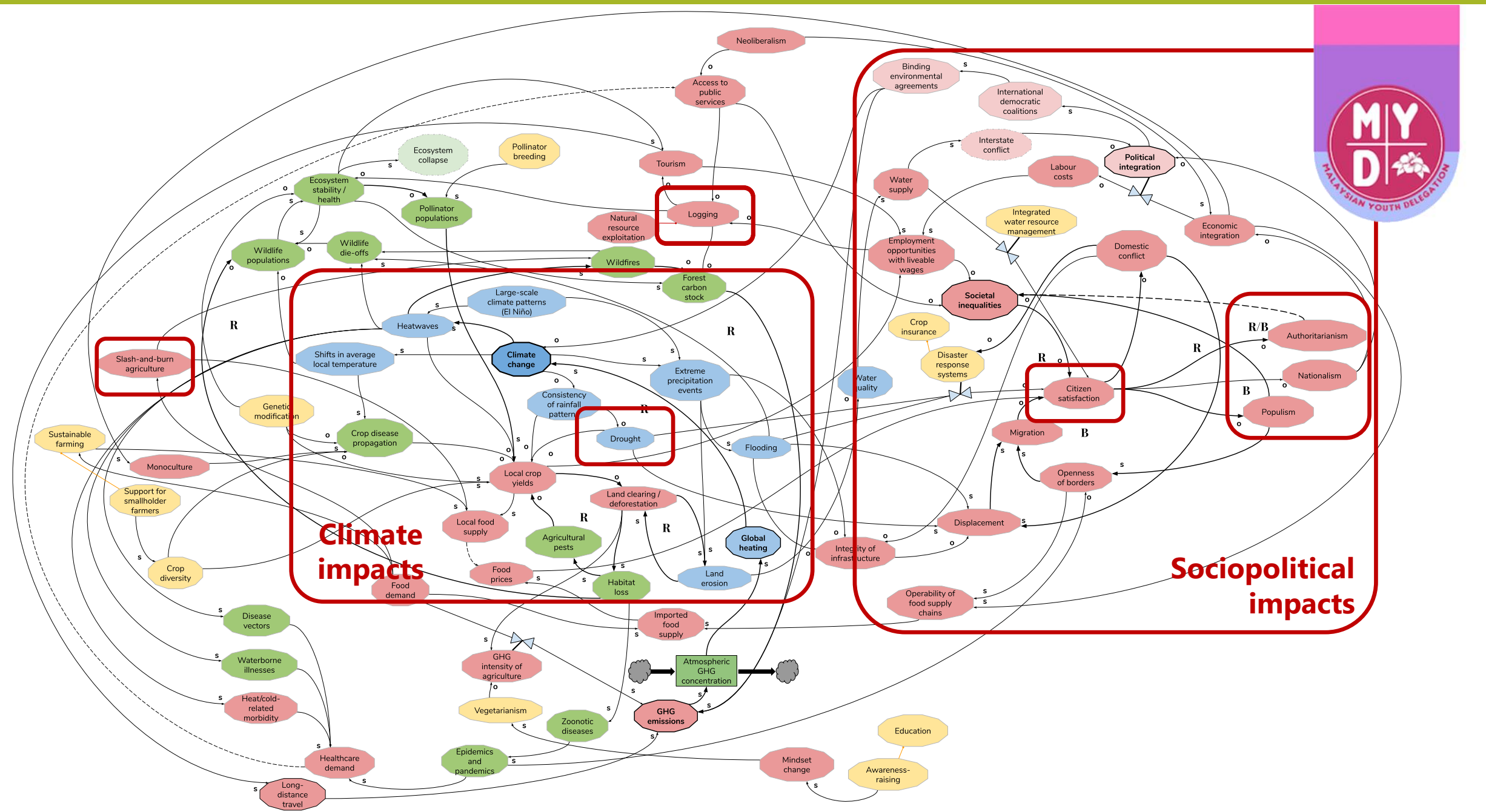




Example CLD

- Mitigation or adaptation methods as regulators
 - Air-conditioning vs natural cooling during heatwaves
 - Kampung houses as inspiration?
 - Carbon intensity of energy supply





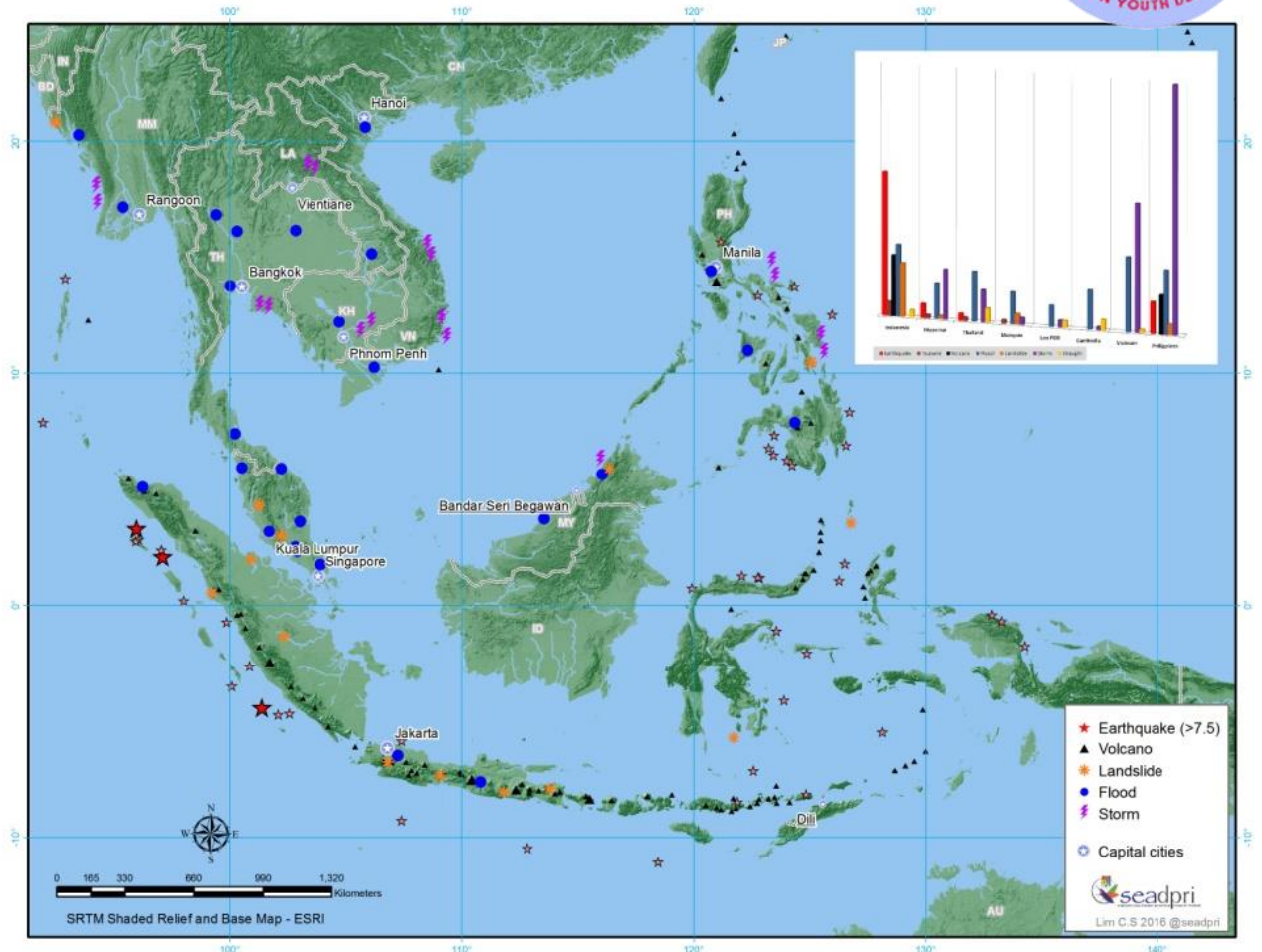
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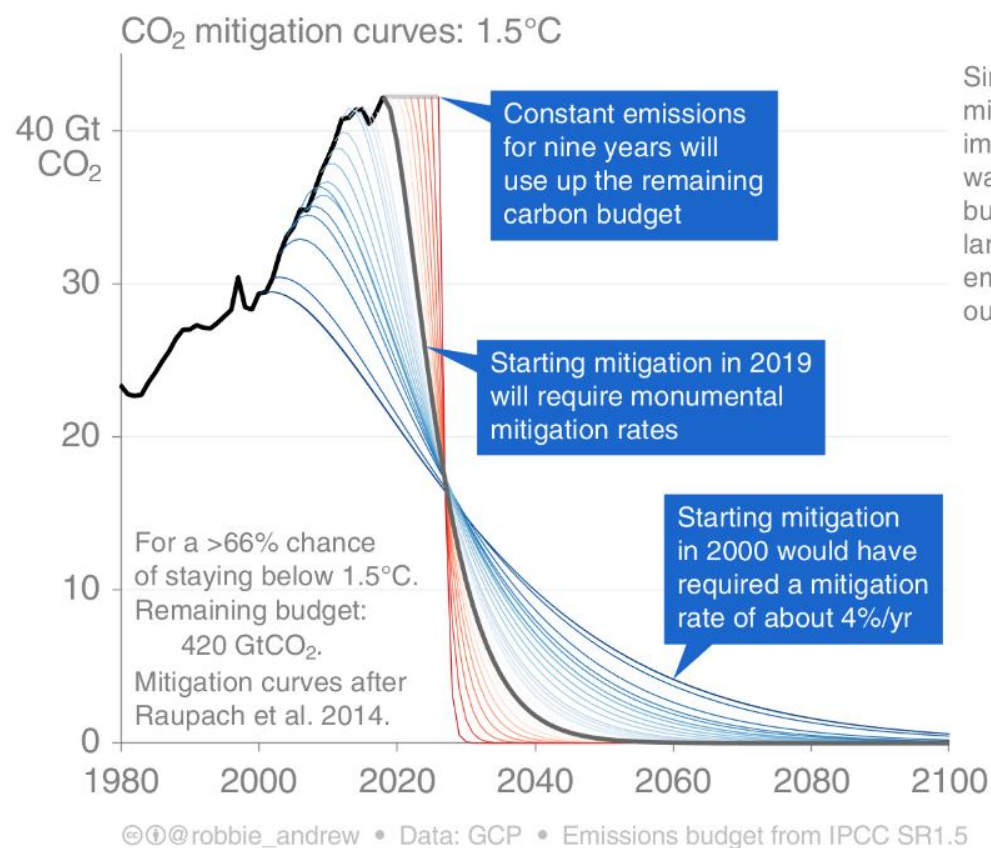
Climate-driven disasters in SEA

- **Tropical countries** are projected to experience **largest climate change impacts on economic growth** if global warming increases from 1.5 to 2°C
- Account for **30%** of total projected GDP damage across cities in SEA
 - Total GDP-at-risk as high as 5%



The mitigation challenge ahead

- For a 66% chance of staying below 1.5°C of global warming:
 - Global CO₂ emissions need to peak around **2030**
 - Global CO₂ emissions need to reach 'net zero' around **2050**



Since such steep mitigation is impossible, the only way to achieve this budget is with very large "negative" emissions: pulling CO₂ out of the atmosphere.

Project Drawdown: Key insights

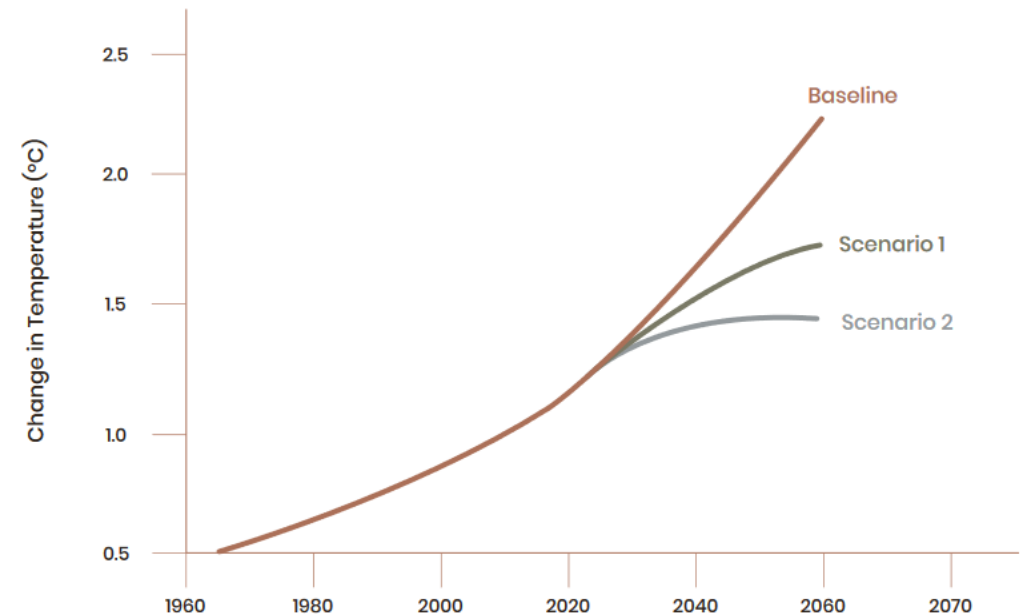


Drawdown: future point in time when atmospheric GHG levels stop climbing and start to steadily decline

Project Drawdown: Nonprofit organization; coalition of 200+ scholars, scientists, policymakers, business leaders, and activists

Key insights

1. We **can reach Drawdown by mid-century** if we scale the climate solutions already in hand.
2. Climate **solutions are interconnected as a system, and we need all of them.**
3. Beyond addressing greenhouse gases, climate **solutions can have “co-benefits” that contribute to a better, more equitable world.**
4. The financial case for climate solutions is crystal clear, as **savings significantly outweigh costs.**
5. The **majority of climate solutions reduce or replace the use of fossil fuels.** We must accelerate these solutions, while actively stopping the use of coal, oil, and gas.

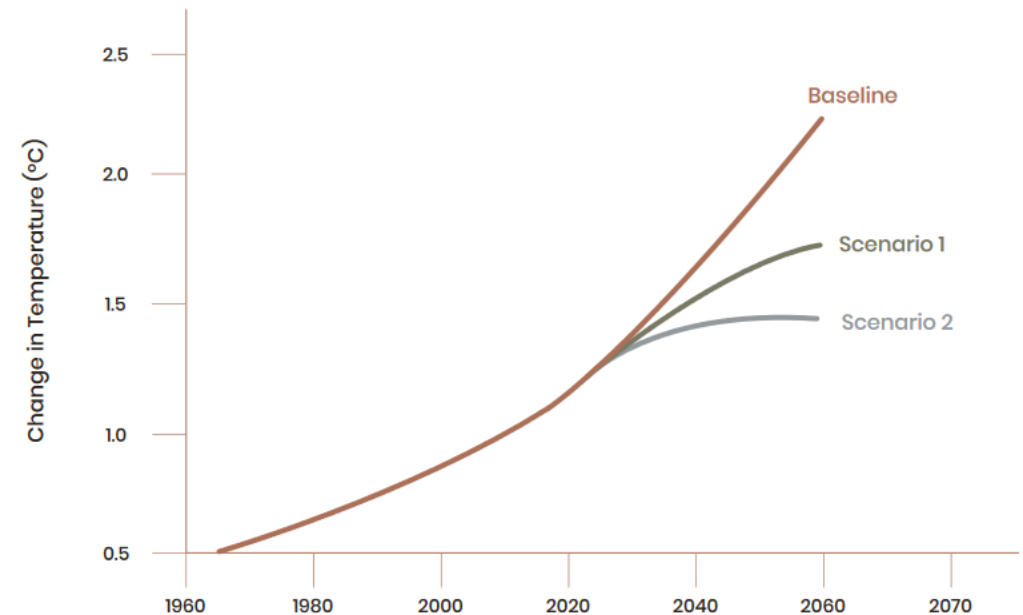


Project Drawdown: Key insights



Key insights (continued)

6. We **cannot reach Drawdown without simultaneously reducing emissions toward zero and supporting nature's carbon sinks.**
7. Some of the most powerful climate solutions receive comparably little attention, reminding us to **widen our lens.**
8. **Accelerators** (e.g. policy, capital, culture, political power) **are critical** to move solutions forward at the scale, speed, and scope required.
9. Footholds of agency exist at every level, for all individuals and institutions to participate in advancing climate solutions. (i.e. **anyone can participate at any level**)
10. **Immense commitment, collaboration, and ingenuity will be necessary** to depart the perilous path we are on and realize the path that's possible. But the mission is clear: make possibility reality.



Best practices in mitigation



Scenario 1: Drawdown in the 2060s

Overall Ranking	Solution	Total CO ₂ -eq (Gt) Reduced/Sequestered (2020–2050)	Net First Cost to implement solution (Billions \$US)	Net Lifetime Cost to operate solution (Billions \$US)	Net Lifetime Profit after implementation and operation (Billions \$US)
1	Reduced Food Waste	87.4	-	-	-
2	Health & Education	85.4	-	-	-
3	Plant-Rich Diets	65.0	-	-	-
4	Refrigerant Management	57.7	-	600	-
5	Tropical Forest Restoration	54.5	-	-	-
6	Onshore Wind Turbines	47.2	800	-3,800	-
7	Alternative Refrigerants	43.5	-	-	-
8	Utility-Scale Solar Photovoltaics	42.3	-200	-12,900	-
9	Improved Clean Cookstoves	31.3	100	1,900	-
10	Distributed Solar Photovoltaics	28.0	400	-7,800	-

Note: Relative importance of solutions can differ significantly depending on context and particular ecological, economic, political, or social conditions

Best practices in mitigation



Scenario 2: Drawdown in the 2040s

Overall Ranking	Solution	Total CO ₂ -eq (Gt) Reduced/Sequestered (2020–2050)	Net First Cost to implement solution (Billions \$US)	Net Lifetime Cost to operate solution (Billions \$US)	Net Lifetime Profit after implementation and operation (Billions \$US)
1	Onshore Wind Turbines	147.7	1,700	-10,200	-
2	Utility-Scale Solar Photovoltaics	119.1	-1,528	-26,500	-
3	Reduced Food Waste	94.6	-	-	-
4	Plant-Rich Diets	91.7	-	-	-
5	Health & Education	85.4	-	-	-
6	Tropical Forest Restoration	85.1	-	-	-
7	Improved Clean Cookstoves	72.6	300	4,191	-
8	Distributed Solar Photovoltaics	68.6	300	-13,600	-
9	Refrigerant Management	57.7	-	630	-
10	Alternative Refrigerants	50.5	-	-	-

Note: Relative importance of solutions can differ significantly depending on context and particular ecological, economic, political, or social conditions

Best practices in adaptation



Emerging technologies



- **Energy**

- Generation
 - Novel fuel cells
 - Novel photovoltaics
 - Biofuels (algae, second-generation)
 - Modular nuclear reactors
 - Allam power cycle (*fossil fuels)
- Storage
 - Gravity-based
 - Batteries

- **Industry**

- Carbon capture, utilisation & storage (CCUS)
- Energy-efficient technologies
- Carbon-efficient technologies (e.g. iron and steel, cement industries)

- **Climate engineering / geoengineering**

- Solar radiation management
 - Albedo enhancement
 - Space reflectors
 - Stratospheric aerosols
- Carbon dioxide removal
 - Afforestation
 - Biochar
 - Bio-energy with carbon capture and sequestration
 - Ambient air capture
 - Ocean fertilisation
 - Enhanced weathering
 - Ocean alkalinity enhancement

Malaysia: Existing mitigation measures/policies



- UNFCCC country submissions
 - Nationally Determined Contribution (NDC)
 - National Communication (NC)
 - Biennial Update Report (BUR)
 - Biennial Transparency Report (BTR)
- Malaysia Plans
 - National Key Economic Areas (NKEA)
- National Policy on Climate Change (NPCC) 2009

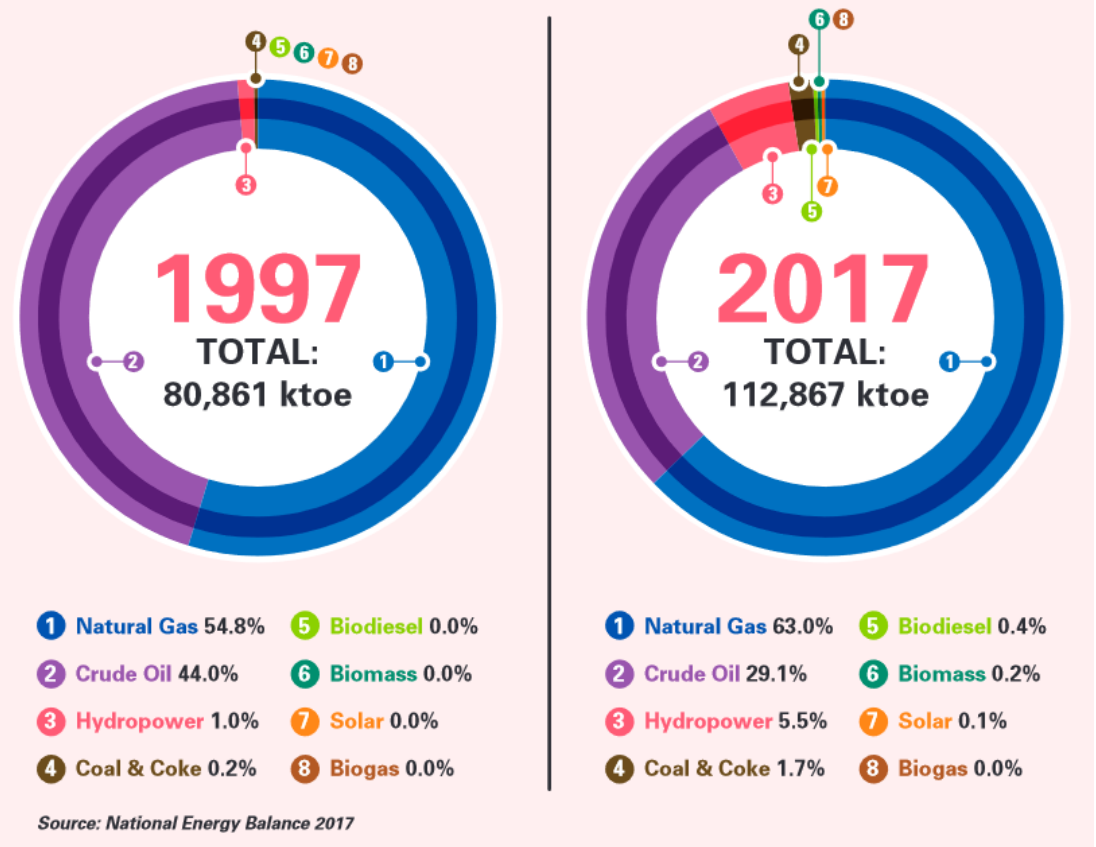
Summary of focus areas Eleventh Malaysia Plan, 2016-2020



Malaysia: Existing mitigation measures/policies



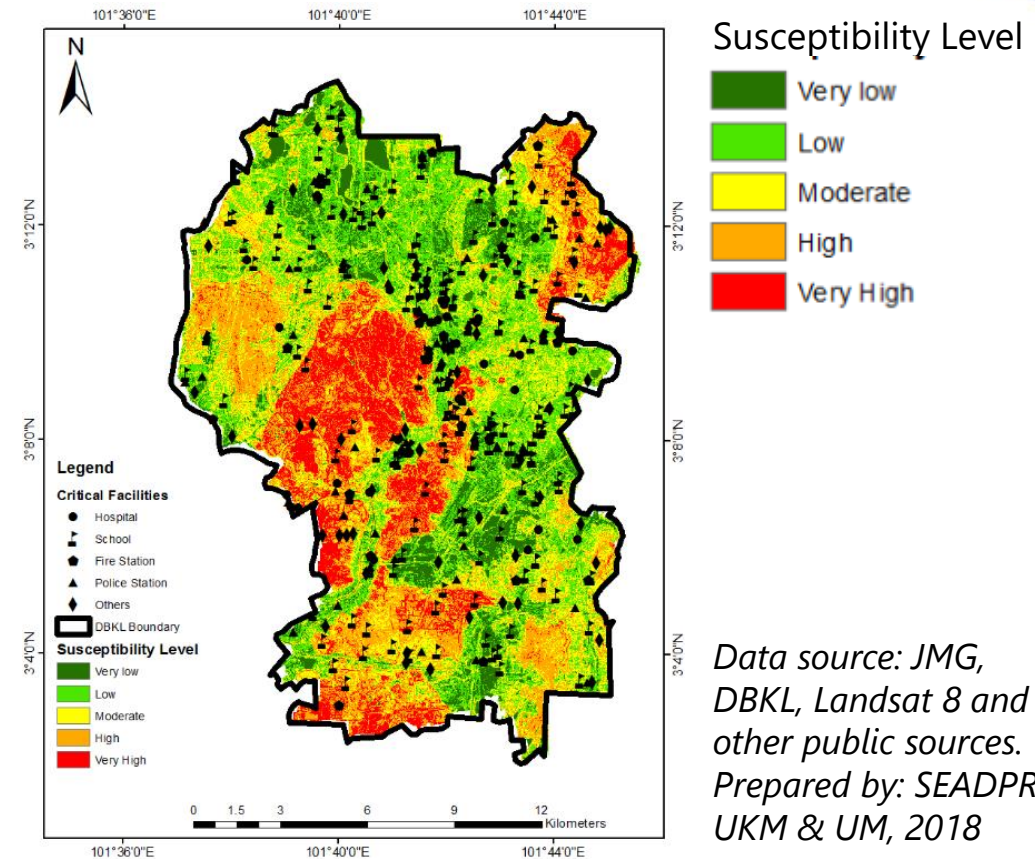
- National Land Public Transport Master Plan 2012
- REDD+ Strategy
- Sustainability certifications
 - Malaysia Sustainable Palm Oil
 - Malaysian Good Agricultural Practices (MyGAP)
- Environmental laws
 - Environmental Quality Act 1974
- Energy policies
 - Net Energy Metering (NEM)
 - 20% renewables target



Malaysia: Existing adaptation measures/policies



- Federal level:
 - National Disaster Management Agency
 - Integrated flood and rainfall management
 - Early warning systems
- State level:
 - Planning
 - Penang Climate Adaptation Plan
 - Disaster-Resilient Kuala Lumpur
 - Social entrepreneurship in disaster risk management



*Data source: JMG, DBKL, Landsat 8 and other public sources.
Prepared by: SEADPRI-UKM & UM, 2018*

Malaysia: Planned measures/policies



- Environmental Quality Act revision
- Central Forest Spine Project (with KATS)
- Climate Change Act

	2016	2018	2020	2021	2022	2023	2024	2025	2026
UNFCCC					New Supplementary Guidance on Communicating Adaptation (<i>Decision 9/CMA.1</i>)	Global Stocktake	First BTR is due on 31 Dec 2024		
Malaysia's Obligations	NDC1 (<i>Nov 2016</i>)	NC3 & BUR2 (<i>Sept 2020</i>)	BUR3 NDC1 (Update)		Submission of NC4 & BUR4	? NAP	? BTR	? NDC2	? NC5

Malaysia: Challenges for the government



- **Planning and policy**
 - Climate projections
 - Transparency and inclusivity
 - Impact evaluation (e.g. NPCC)
 - Synchronisation with local efforts
 - Synchronisation between ministries
 - Establishing a local knowledge network
- **Building resilience** with adaptation & mitigation
 - Food and water security
 - Infrastructural resilience
 - Environmental protection
- **Education**



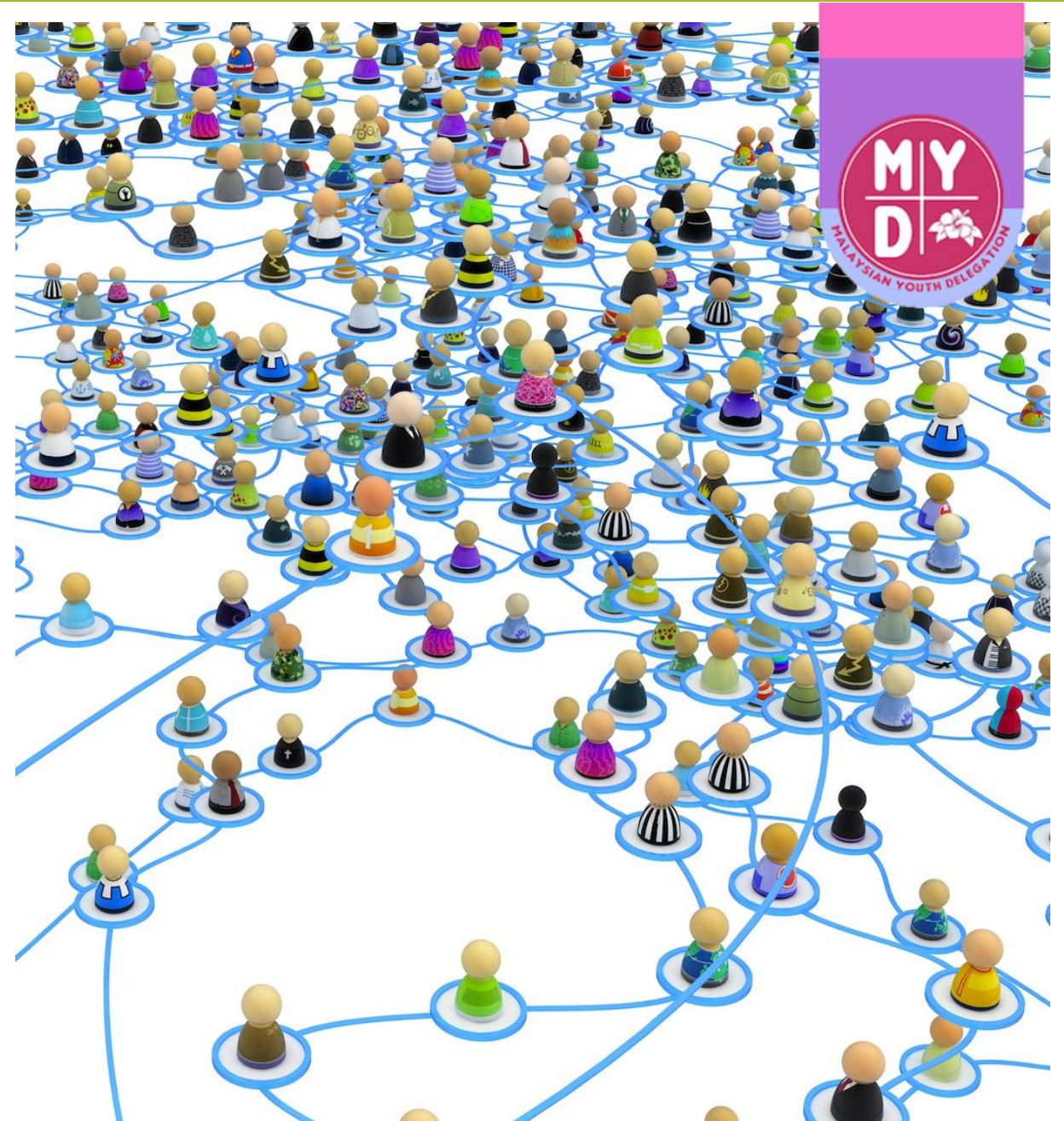
Workshop agenda

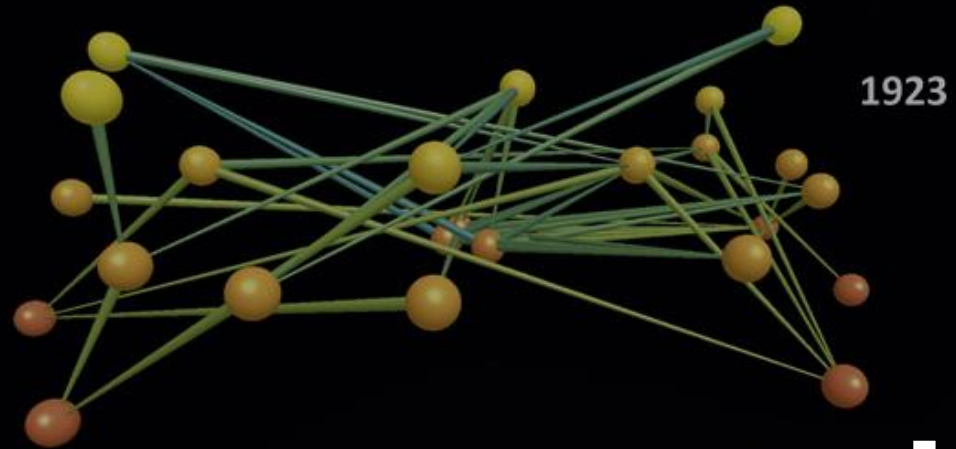
- Why mitigation and adaptation?
- Why systems thinking?
- What is systems thinking?
- What is being done in Malaysia?
- **Where do I fit into this?**



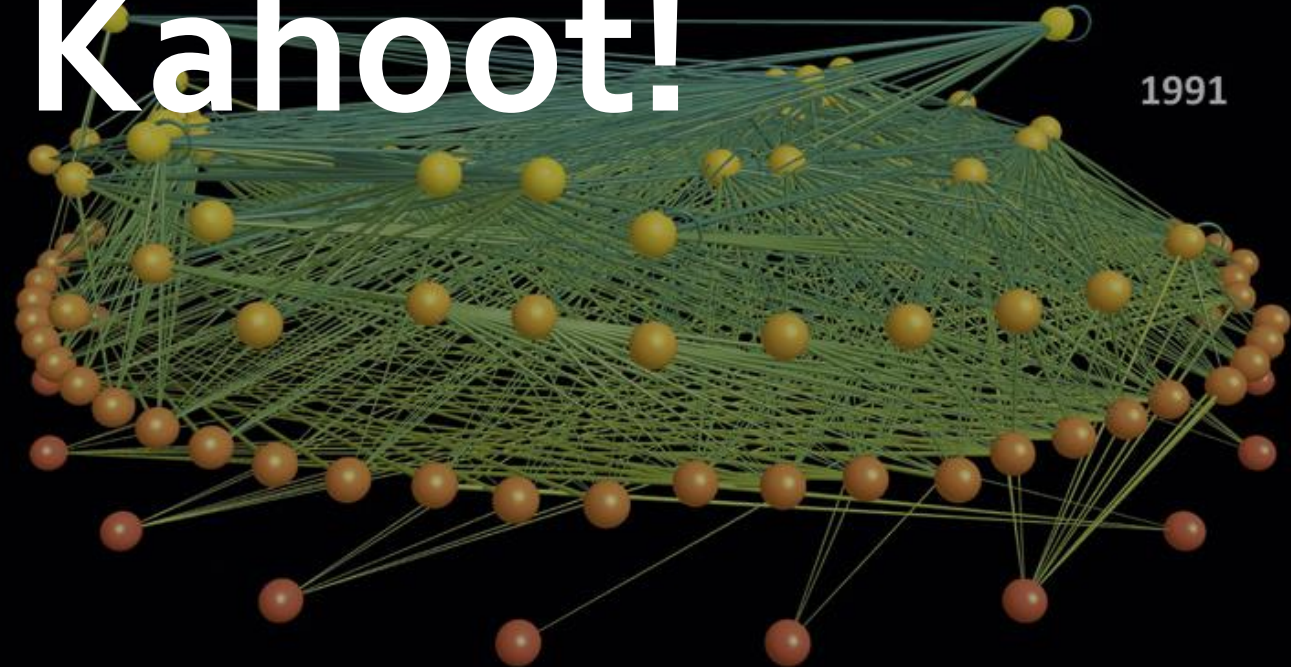
What is my role?

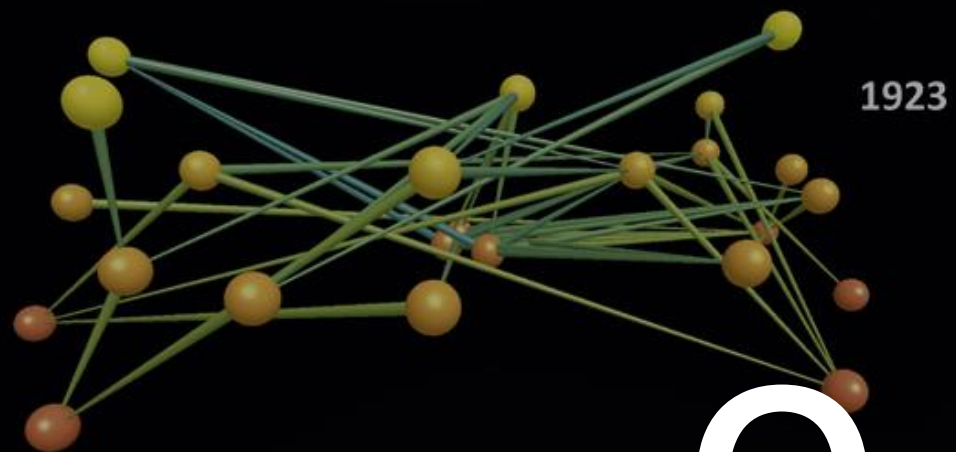
- We need people contributing their unique skillsets at all levels, everywhere!
- Hopefully, utilising this framework can give you a better idea of:
 - Where your skills **fit** best and would have the most **impact**
 - How you and your groups can create new **synergies** with other groups
 - What **compromises** we have to make to advance the welfare of the whole



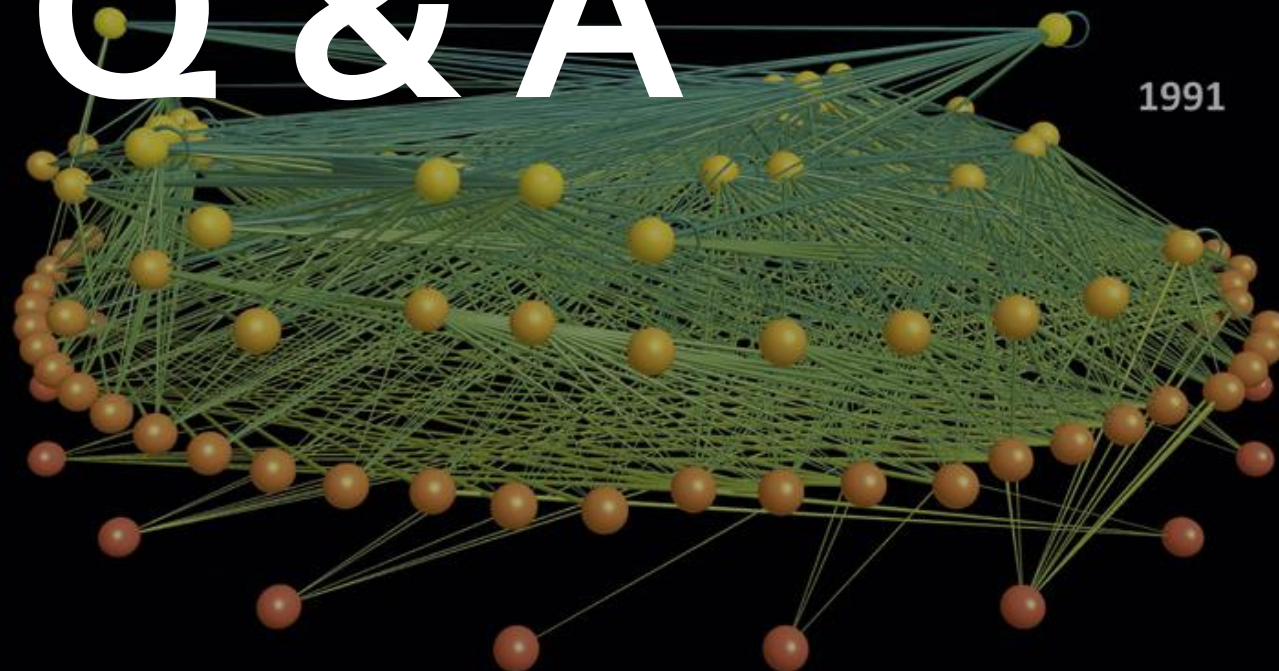


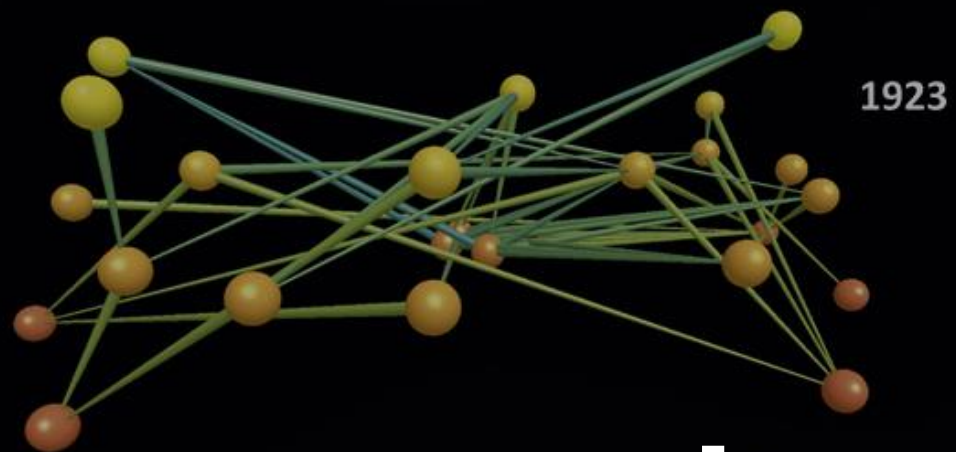
Kahoot!





Q & A





Thank you

