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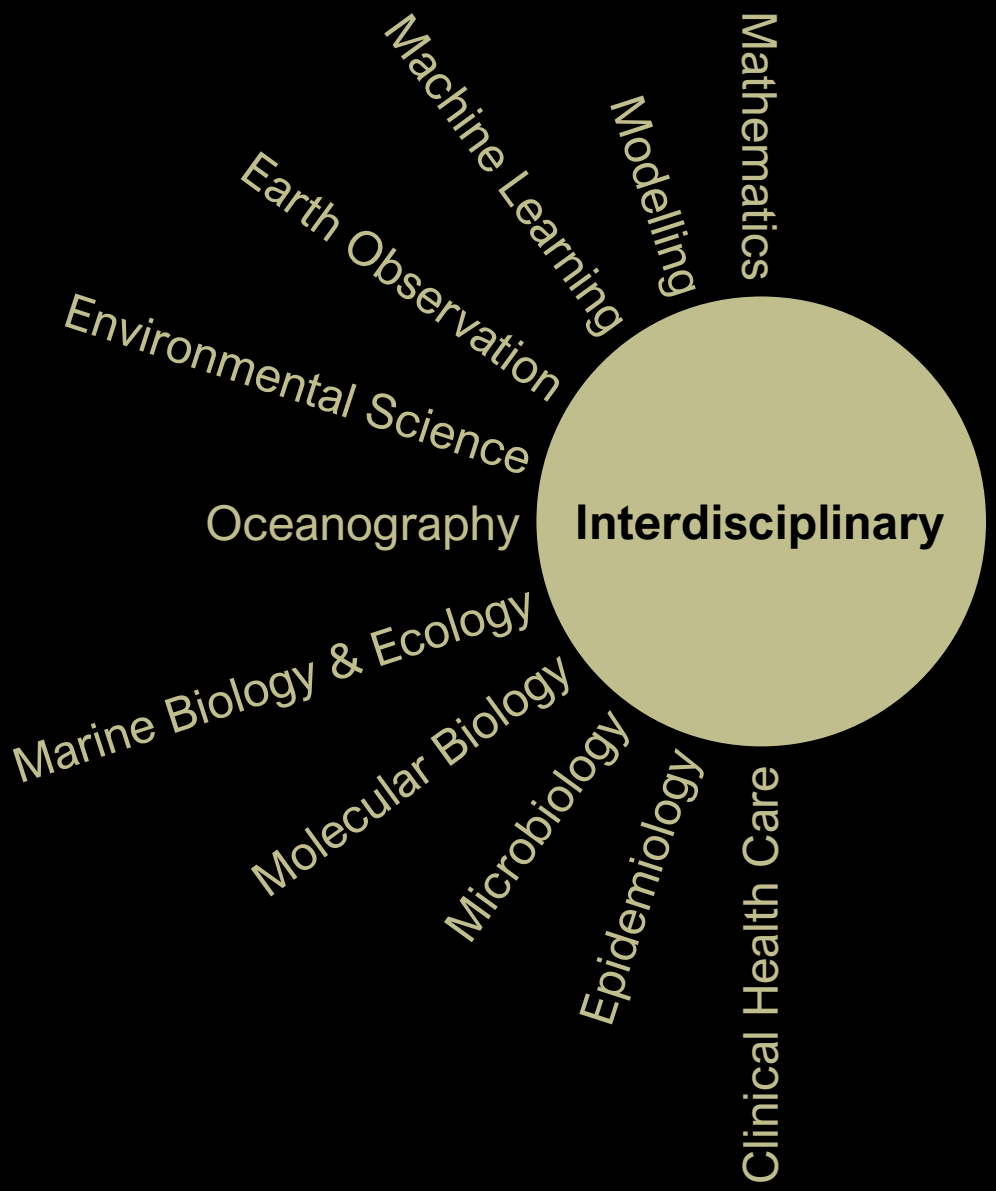
Climate, extreme events and human health: threats and solutions associated with water

Gemma Kulk & Shubha Sathyendranath

Research approach



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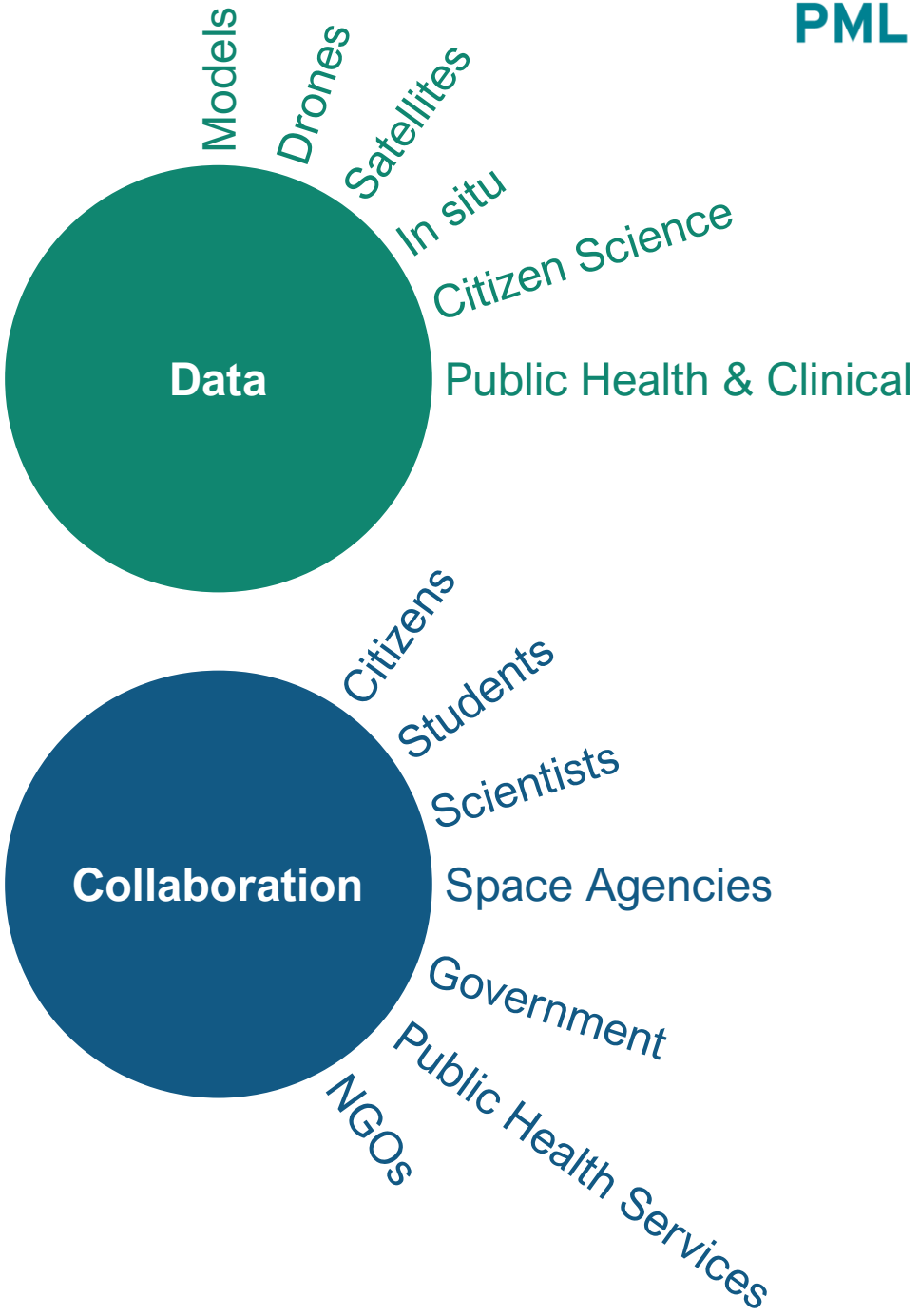

Lake Vembanad

- ~100 km long lake on southwest coast of India
- Protected under (inter)national treaties
- Important resource for local communities
- Highly polluted, poor water quality & aquatic weed infestation
- Endemic waterborne diseases, such as *Cholera*
- More extreme weather events in recent years

Water quality

- Anthropogenic activities remain cause of poor water quality
- Adverse ecological and socioeconomic impacts
- Achieving UN Sustainable Development Goals
- Understanding effect of natural and anthropogenic processes

Water quality

Study water quality in Lake Vembanad during a period of reduced anthropogenic activities

- National lockdown during March-April 2020

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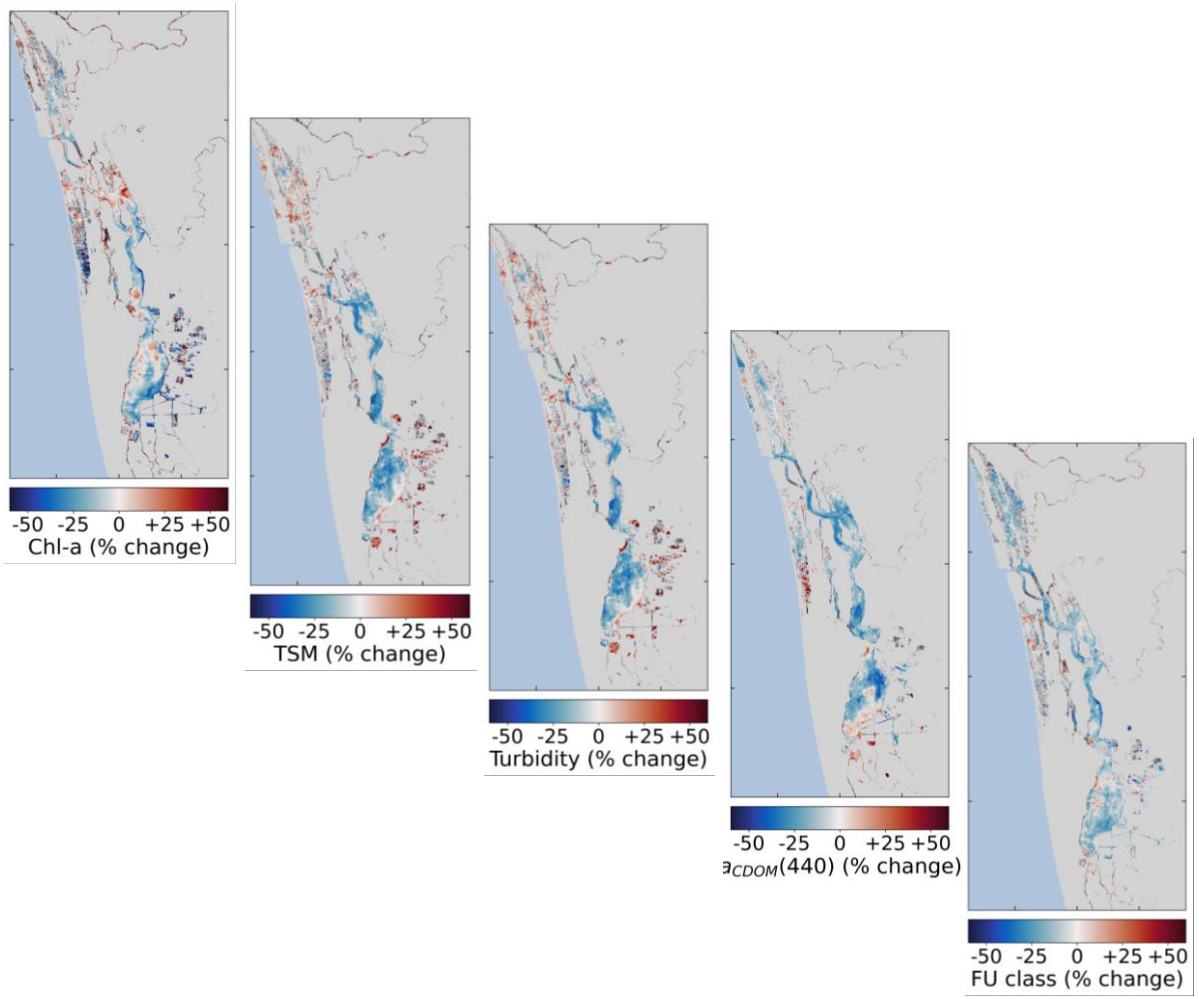
Water quality

Study water quality in Lake Vembanad during a period of reduced anthropogenic activities

- National lockdown during March-April 2020
- Study water quality indicators amendable to remote sensing
- Compare pre-lockdown, lockdown and post-lockdown periods



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Water quality

Study water quality in Lake Vembanad during a period of reduced anthropogenic activities

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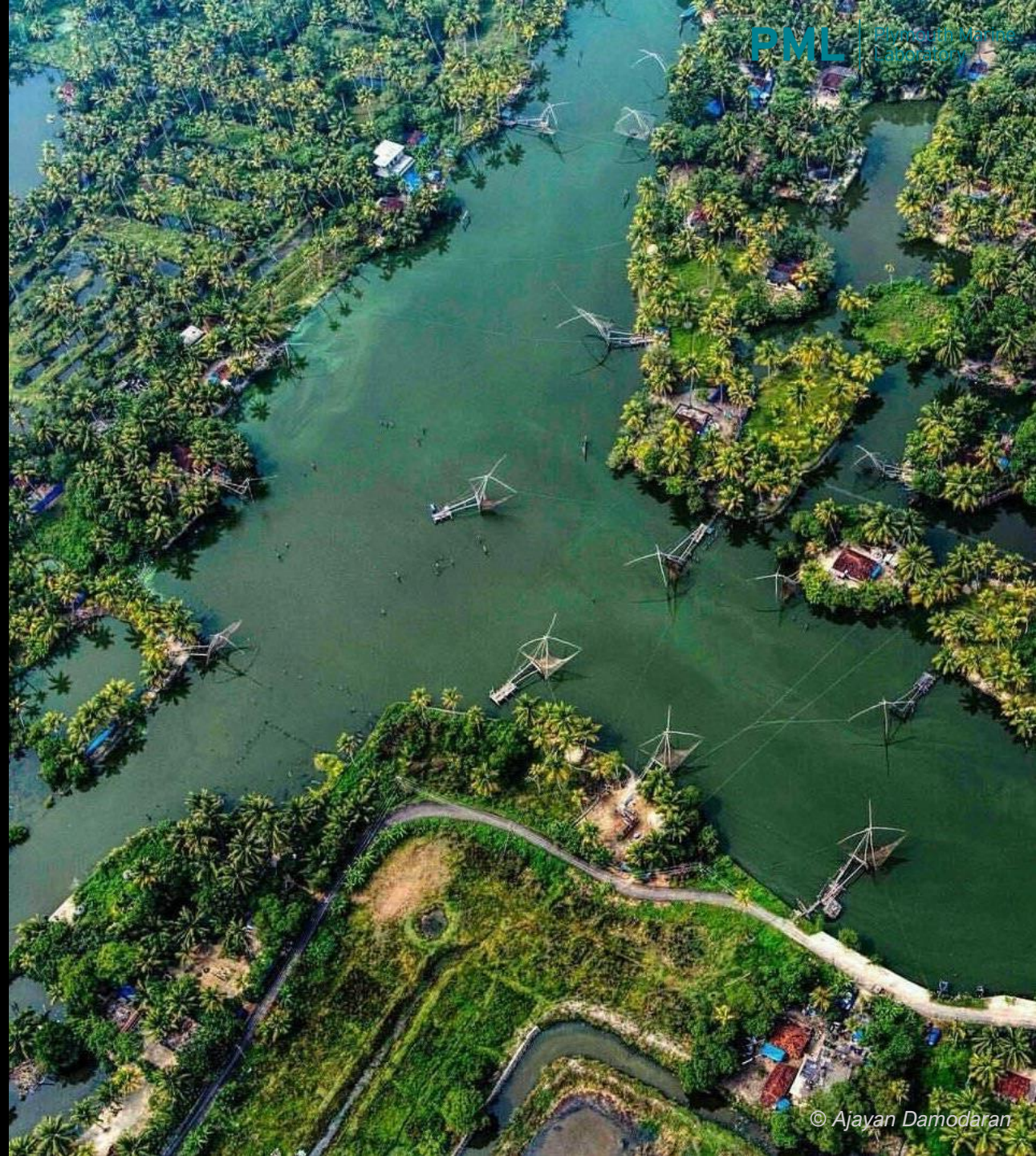
Observed improvement in water quality under reduced anthropogenic activities can inform policy and sustainable management



Waterborne diseases

- Diarrhoea and cholera remain important public health problems in Kerala
- Less than 16% of cases are reported

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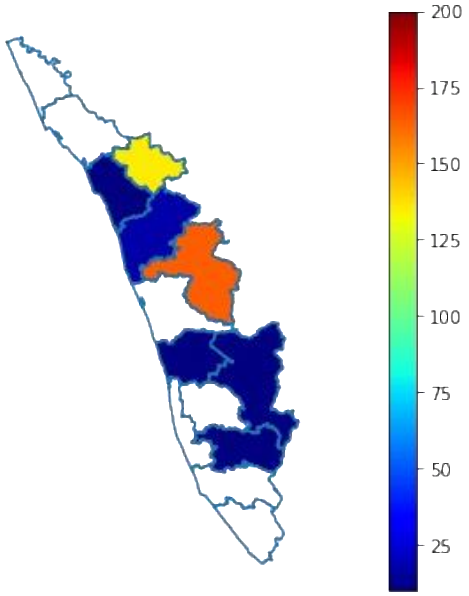
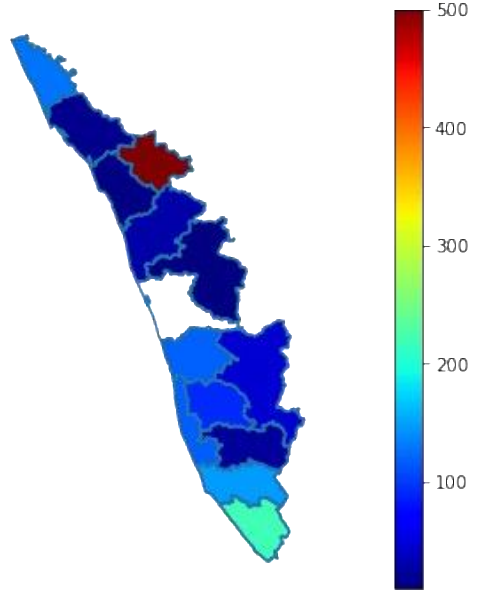
2010-2020
Cholera



16 outbreaks
331 cases
16 deaths

2010-2020
Acute Diarrhoeal Disease



45 outbreaks
1505 cases
1 death

Data from digitalised Integrated Disease Surveillance Programme (IDSP) (ESA WIDGEON project)

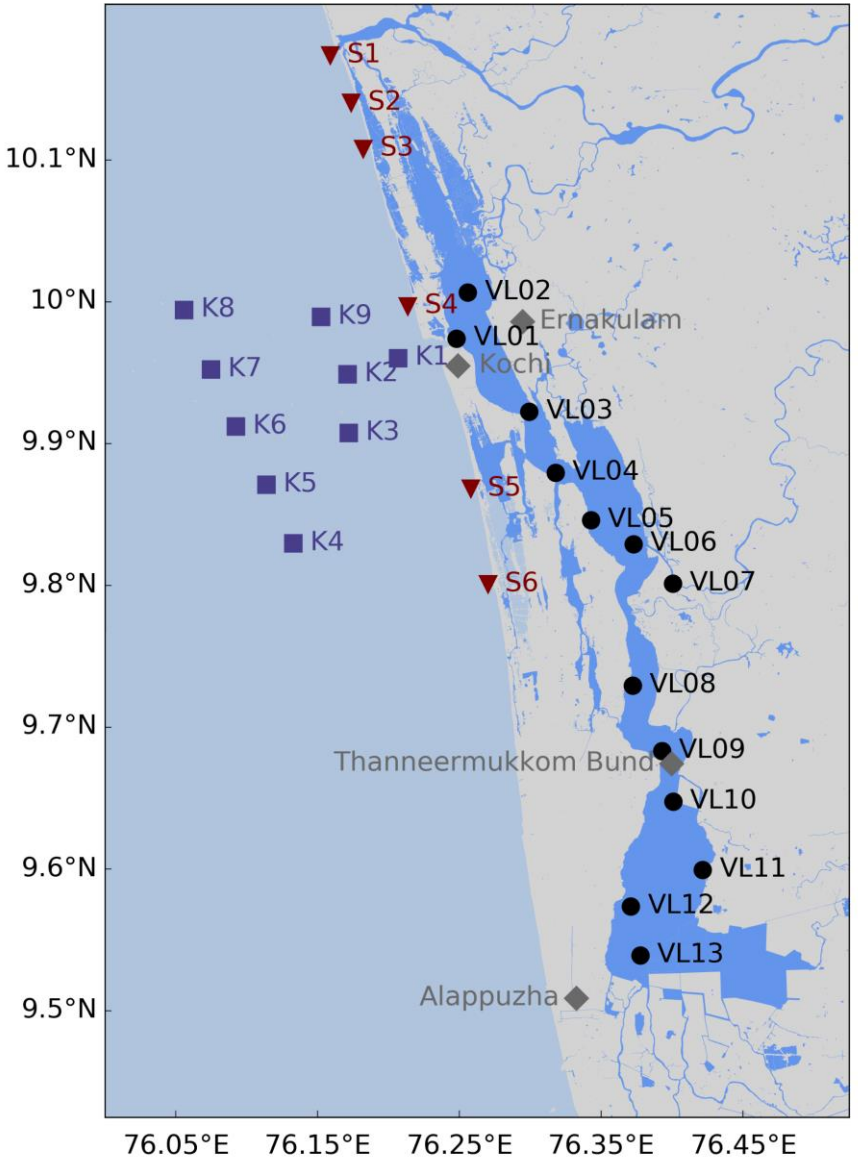
Waterborne diseases

- Diarrhoea and cholera remain important public health problems in Kerala
- Less than 16% of cases are reported
- Infections through indirect routes, such as the environment

Waterborne diseases

What is the risk of human pathogens in the environment?

- Field campaigns in 2018-2019 & 2021-2023



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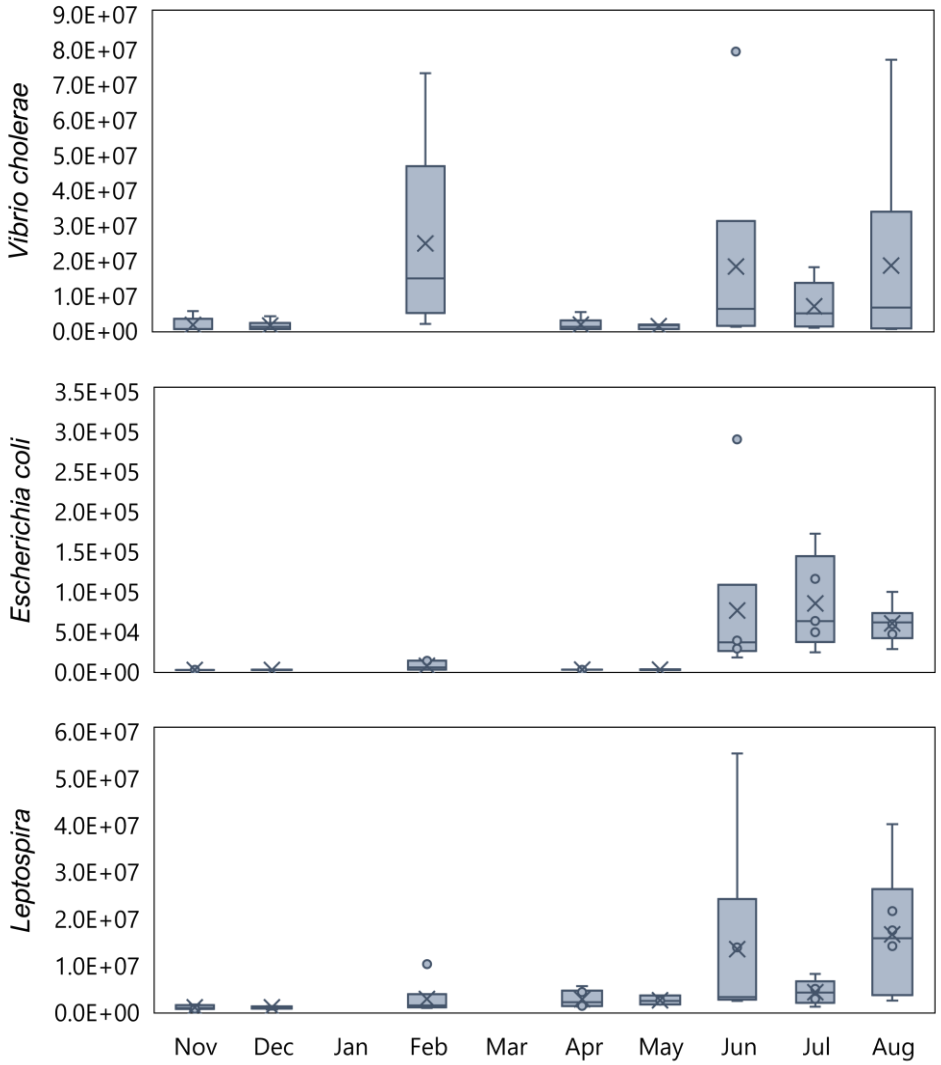


Menon et al. (ESA WIDGEON project)

Waterborne diseases

What is the risk of human pathogens in the environment?

- Field campaigns in 2018-2019 & 2021-2022
- Monitoring presence of *Vibrio cholerae*, *Escherichia coli* and *Leptospira* bacteria
- Identifying environmental reservoirs
- Using Earth Observation for risk mapping

Understanding environmental reservoirs of pathogens can help reduce the disease burden

Natural disasters

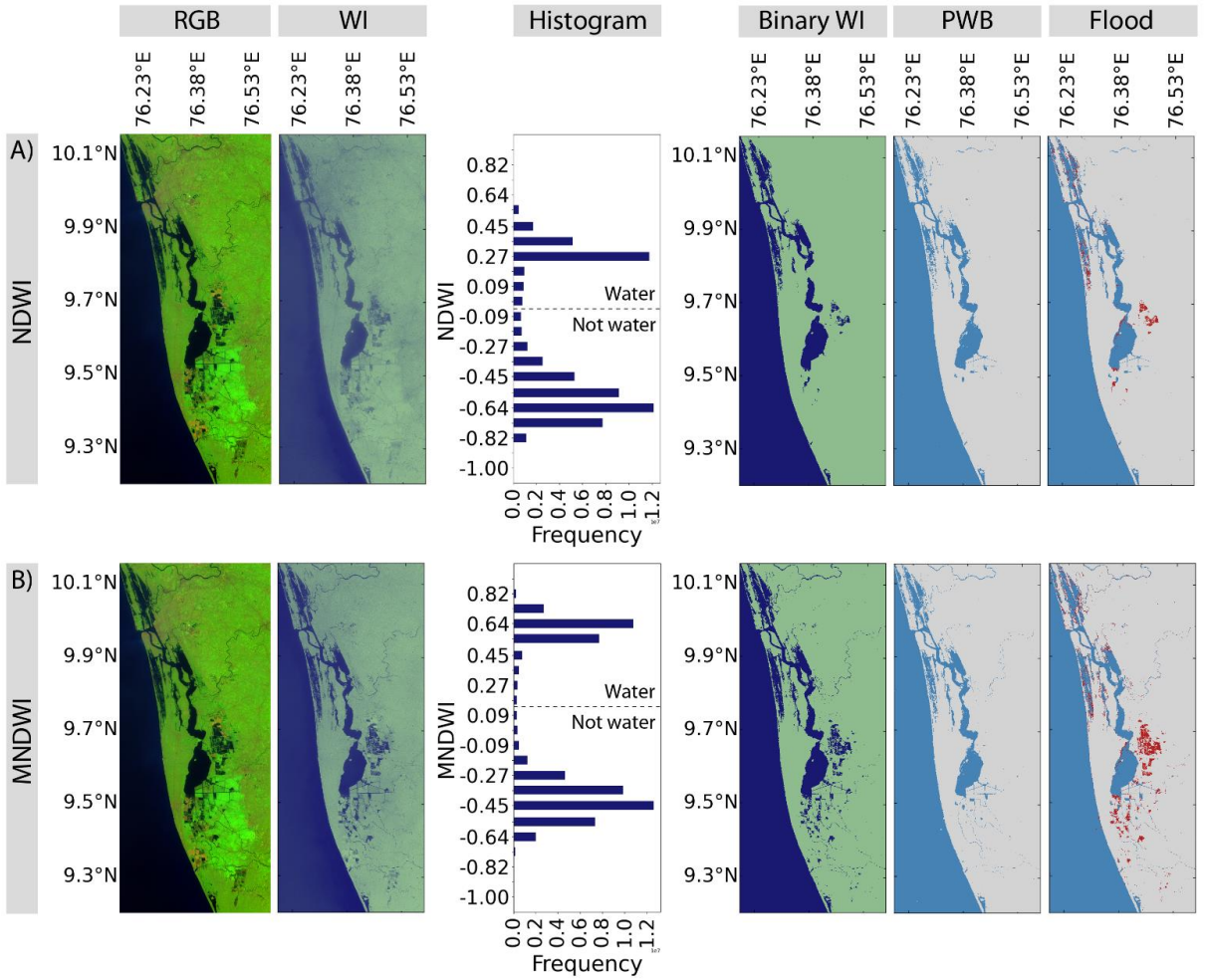
- Floods are the most common natural disasters worldwide
- Devastating consequences for human populations
- First response should include identification of flooded areas
- Kerala experienced once-in-a-lifetime floods in August 2018

Kulk et al. (ESA WIDGEON project)

Natural disasters

Can multispectral imager satellite data be used to map floods?

- Identify floods using Sentinel-2 data and water index algorithms



Kulk et al. (ESA WIDGEON project)

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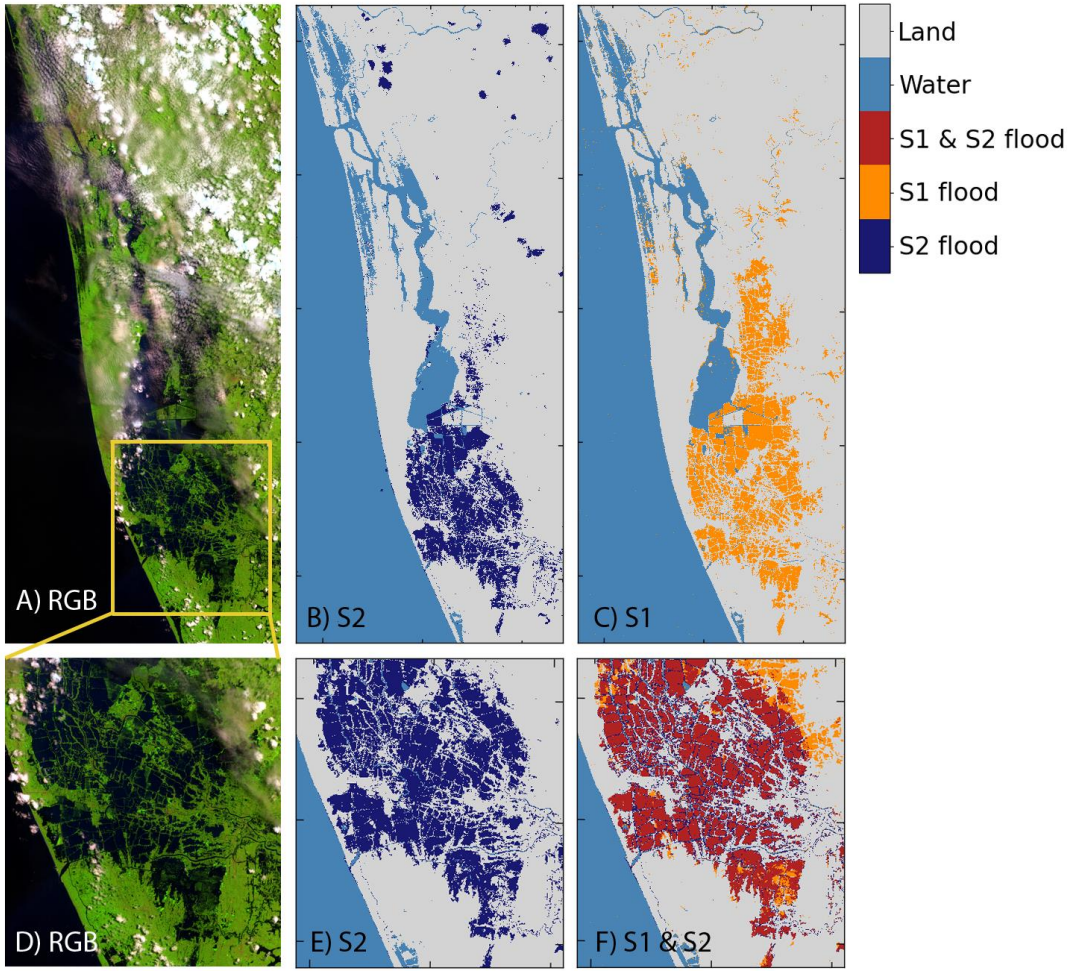

Kulk et al. (ESA WIDGEON project)

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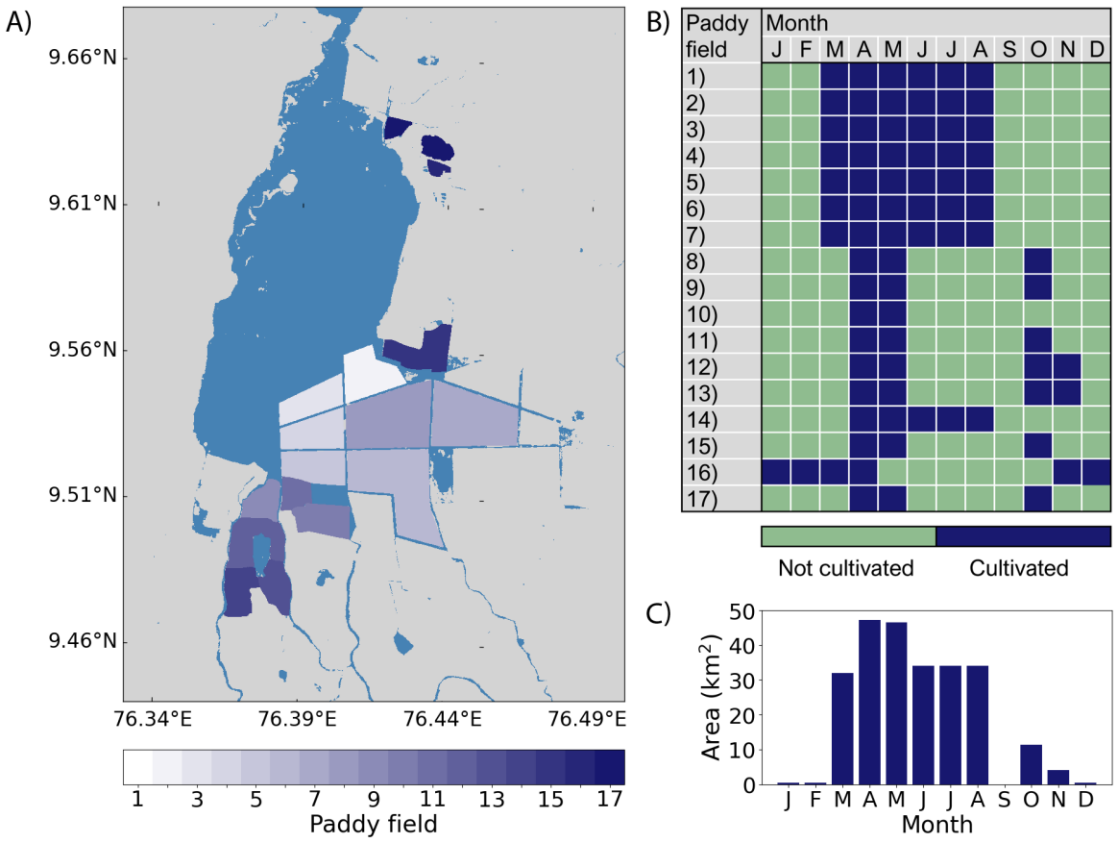

Kulk et al. (ESA WIDGEON project)

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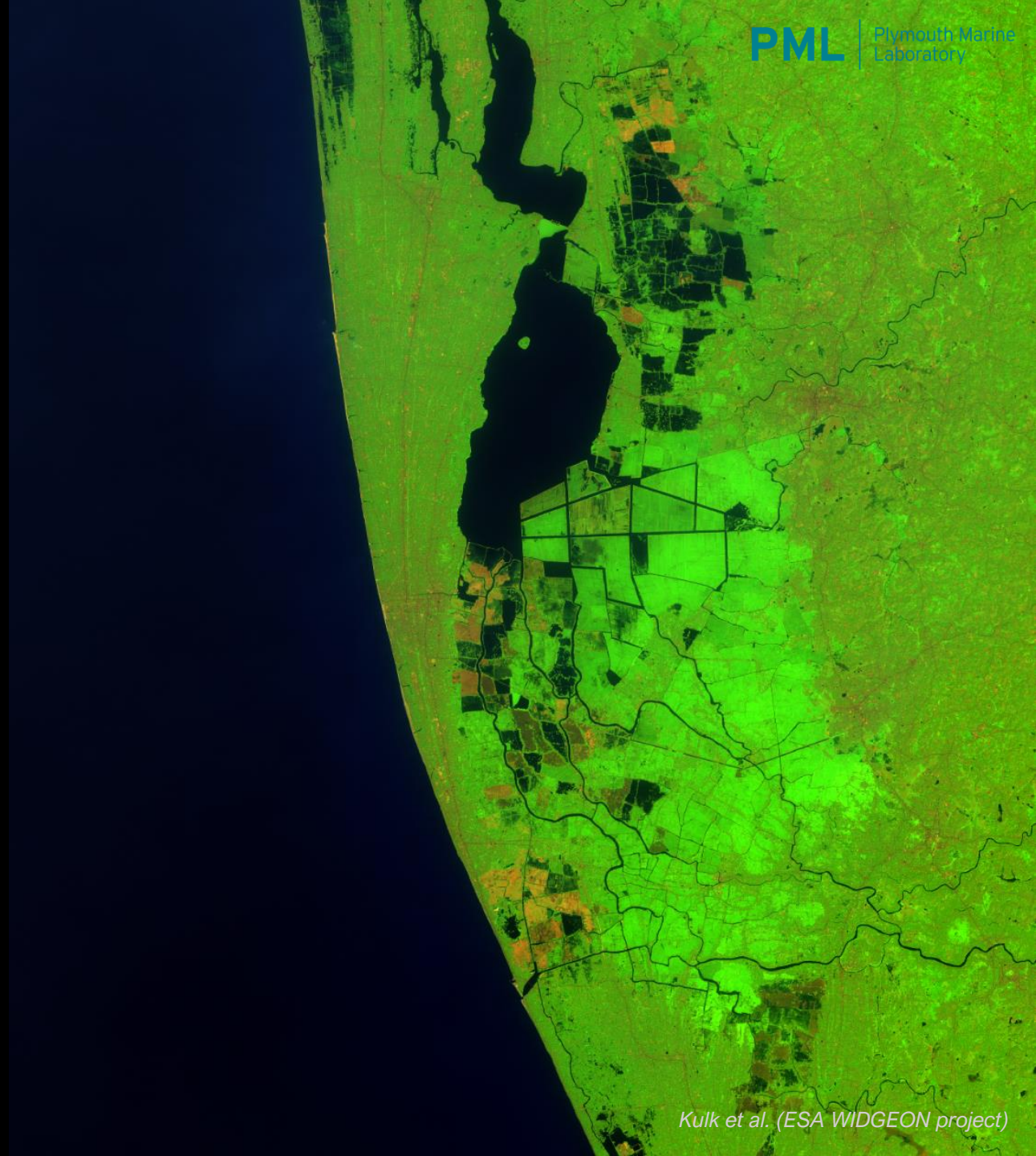
Potential to provide simultaneous information on floods, water quality and waterborne diseases

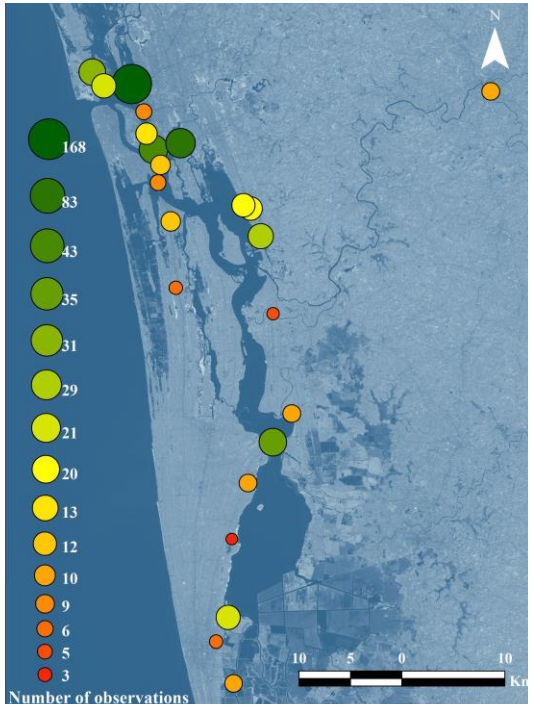


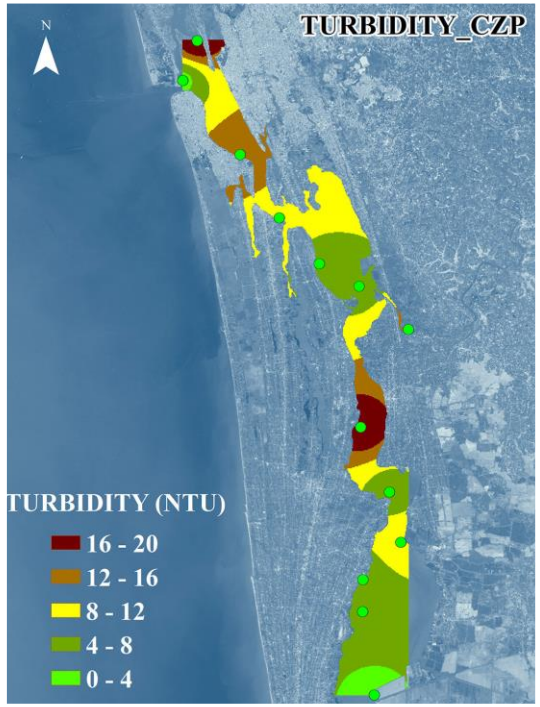
Kulk et al. (ESA WIDGEON project)

Capacity building

Empowering citizens through science projects

- Monitoring of water quality
- Mini Secchi disks & smartphone application
- App data used for scientific research



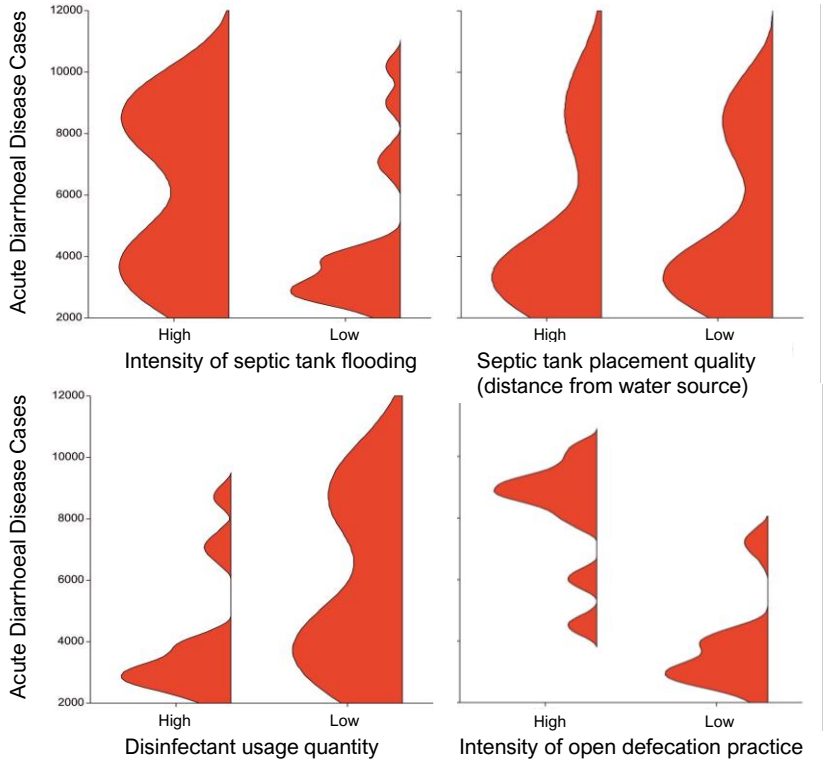


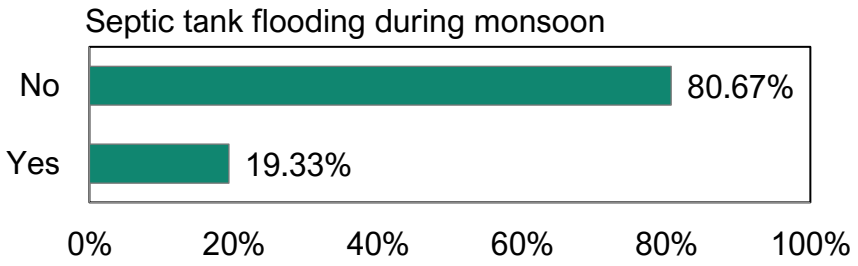
George et al. 2021

Capacity building

Empowering citizens through science projects

- Poor sanitation conditions play major role in spread of waterborne diseases
- In-person surveys in local villages to map sanitation conditions
- Development of smartphone application CLEANSE to improve collection of and access to data





Menon et al. (PODCAST and WIDGEON projects)

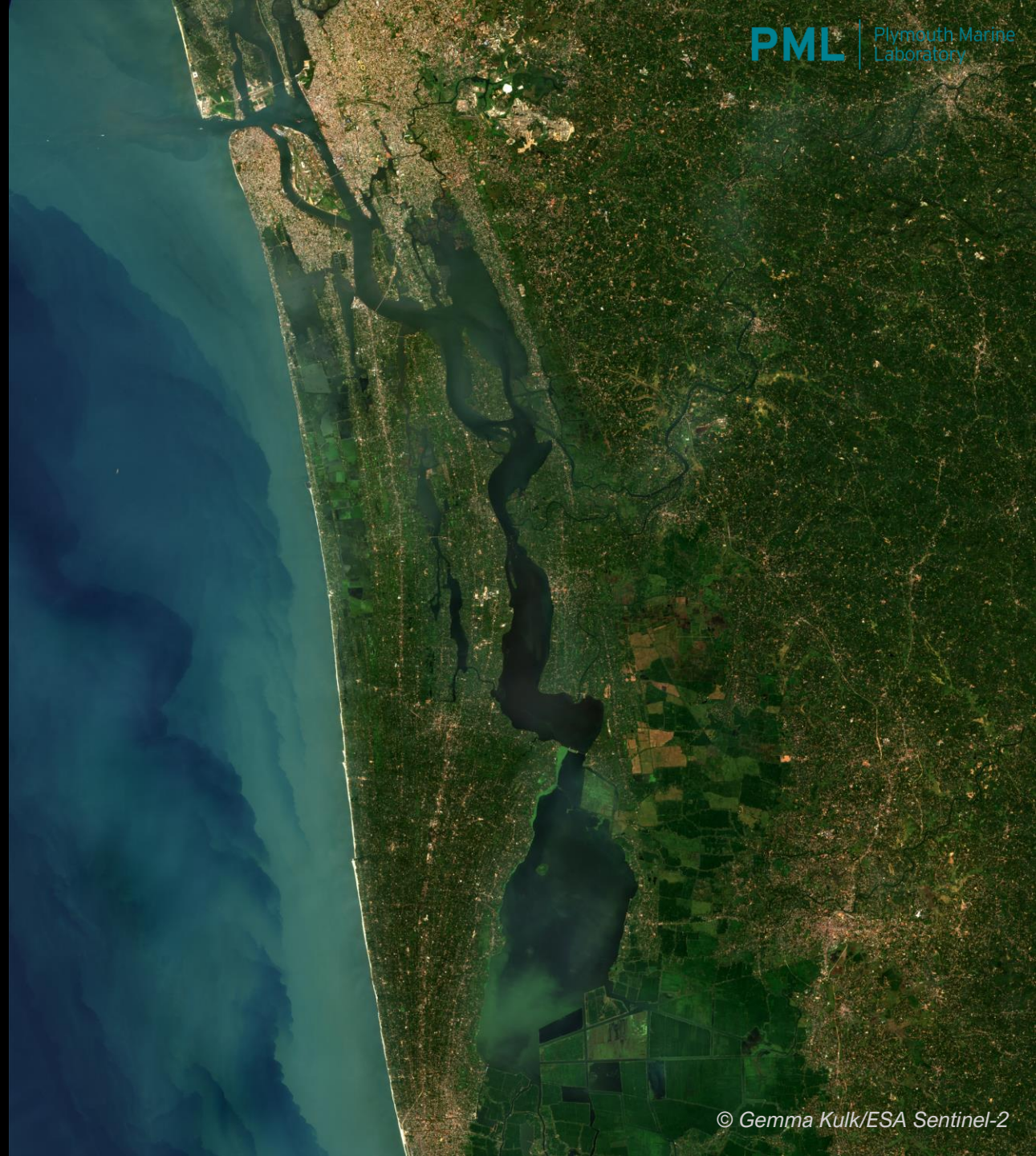
Capacity building

Empowering students through education

- Lecturing at colleges in Kerala
- Education for medical students through curriculum development and lecturing
- Webinar series of the Open Network for Water-Related Diseases
- Training course ‘Satellite-based tools for investigating aquatic ecosystems’ of the Trevor Platt Science Foundation

Solutions

- Sustainable environmental management
- Building resilience and strengthen capacity
- Problems are complex and require multi-sectoral and whole system approaches
- EO data has potential to develop cost-effective methods to monitor risk



Commercialisation

- EO provides opportunities to reduce disease burden and cost of public health interventions
- Provide information in understandable way to public health services and citizens
- Open Science approach

Collaboration

- Research projects including REVIVAL, PODCAST, WIDGEON & WADIM
- Open Network for Water-Related Diseases
- Trevor Platt Science Foundation

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Thank you

Trevor Platt, Nandini Menon, Anas Abdulaziz, Grinson George, Milton Kampel, Bob Brewin, Varunan Theenathayalan, Craig Baker-Austin, Jasmin Chekidhenkuzhiyil, Angelo Ciambelli, Michael Dillon, Hayley Evers-King, A. Gopalakrishnan, Elizabeth Goult, Chiranjivi Jayaram, Kiran Krishna, Christina Kong, Somy Kuriakose, K.G. Mini, Shreya Murali, P. Pranav, Devika Raj, Ranith Rajamohananpillai, Velakandy Sajin, Neelam Taneja, Balu Tharakan, Nick Thomson, Jithin Vengalil, Syam Kumar Vijayakumar, Hridya Kuttiyilmemuriyil Vikraman & Abdul Jaleel Koovapurath Useph

Contact
References
Acknowledgements
Funding