Place-based Citizen Science as a “Heartware” Tool to Build Shared Values and Capacity for Watershed Management

Open Science Forum 2: Open Science

Interactive workshop 1: Citizen Science and Open Dialogue with other Knowledge systems

23 – 24 October 2024

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WATER WARRIORS

INSPIRASI KAWA

AKADEMI SAINS MALAYSIA

Newton Ungku Omar Fund

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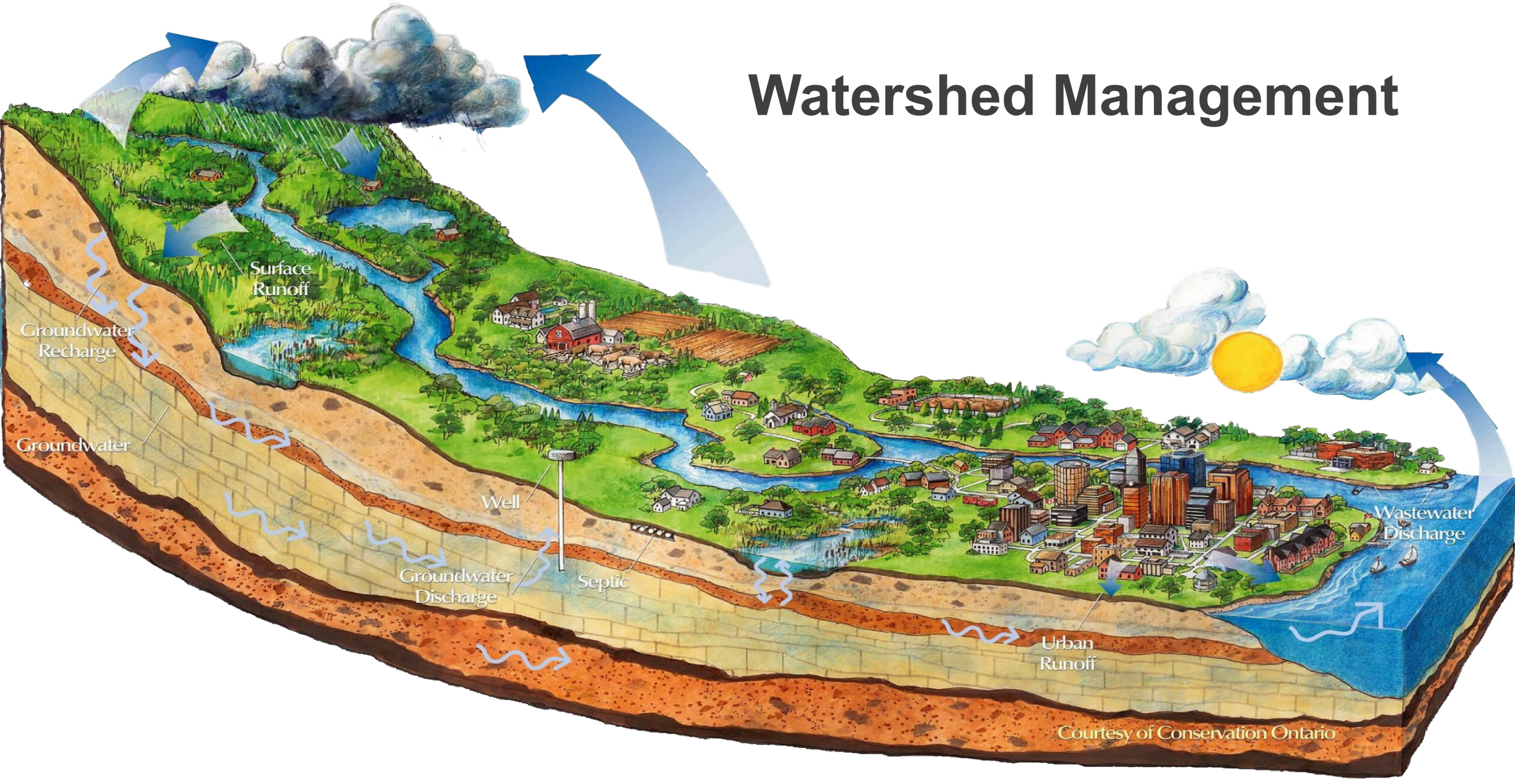
Watershed Management

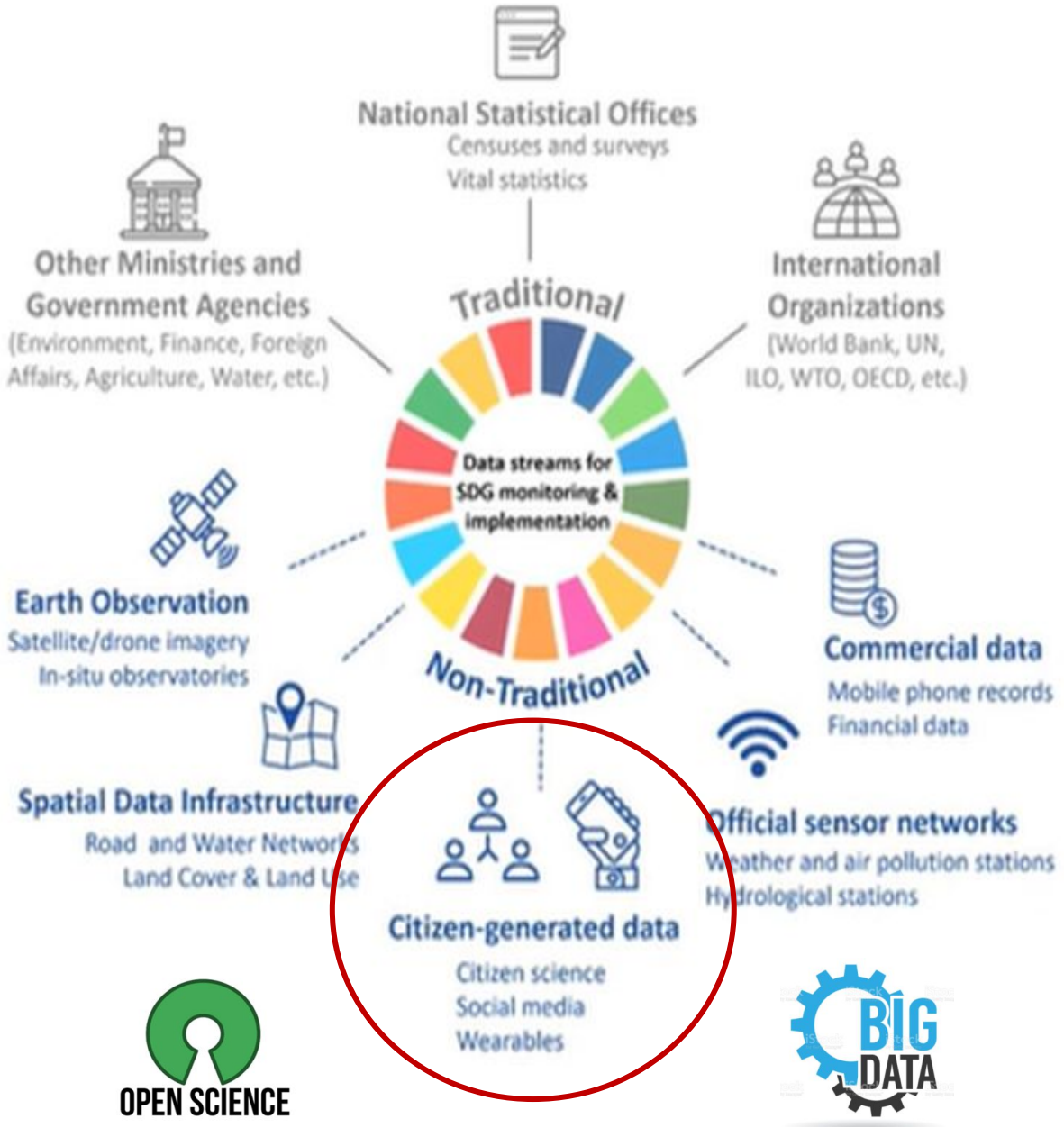


Ensure availability and sustainable management of water and sanitation for all

TARGET 6.3
By 2030, **improve water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

Indicator 6.3.1:
Proportion of wastewater safely treated

Indicator 6.3. 2:
Proportion of bodies of water with good ambient water quality



- UNEP, 2018. **Progress on Ambient Water Quality: Piloting the Monitoring Methodology and Initial Findings for SDG Indicator 6.3.2** ISBN No: 978-92- 807-3711-0. UN Environment
- Fritz, S., See, L., Carlson, T., Haklay, M. M., Oliver, J. L., Fraisl, D., ... & Wehn, U. (2019). **Citizen science and the United Nations sustainable development goals.** *Nature Sustainability*, *2*(10), 922-930.
- Quinlivan, L., Chapman, D. V., & Sullivan, T. (2020). **Validating citizen science monitoring of ambient water quality for the United Nations sustainable development goals.** *Science of The Total Environment*, *699*, 134255

FRESHWATER Watch

earthwatch
EUROPE

Streamwatch
A Greater Sydney Landcare Program

WATER RANGERS

RIVER WATCH
PEOPLE. SCIENCE. PURPOSE.

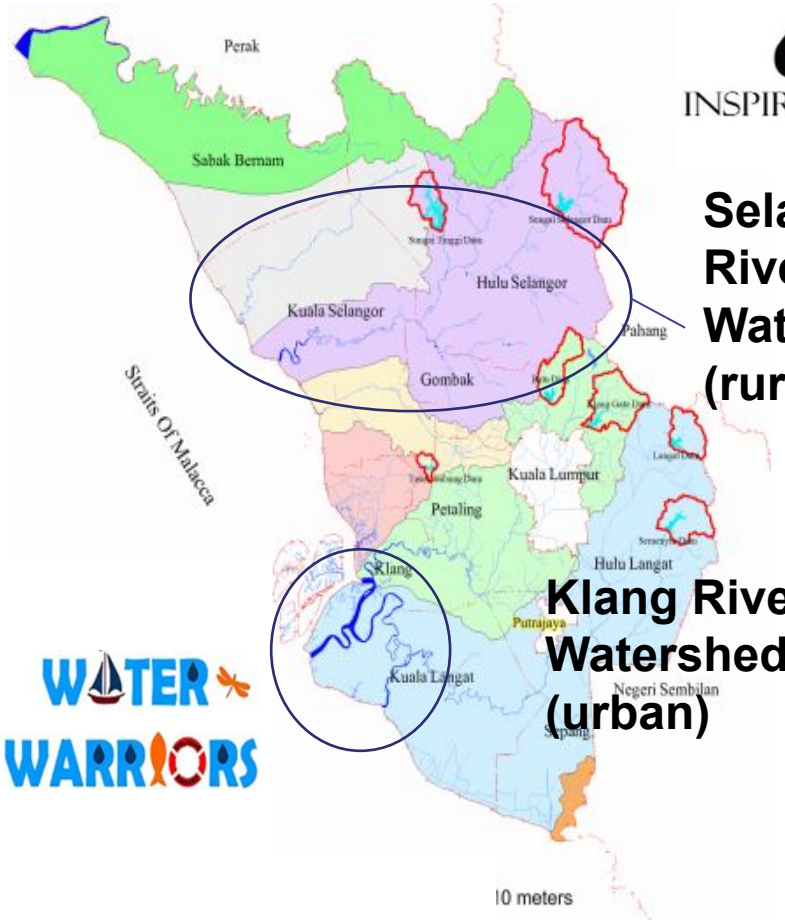
River RANGER 2.0

Place-based Citizen science (PBCS)

- citizen scientists work with researchers to collect and analyse scientific data to solve questions that are relevant to the **sustainability aspiration of a particular place or local area.**

Key criteria of PBCS:

- ✔ **Place based elements** as a precursor to the design of PBCS programmed
- ✔ Priority in **integrating scientific knowledge with local knowledge** by emphasizing the process of the meaning and value of citizen science data and process to the local context.
- ✔ Emphasizes **ethical consideration** on ecological protection and long-term social welfare and empowerment
- ✔ Contributes to an innovative form of citizen science by being **more robust from a social science perspective and reflexive from an ethical perspective**



INSPIRASI KAWA

Selangor River Watershed (rural)

Klang River Watershed (urban)

WATER WARRIORS

JSPS Japan-Malaysia Asian Core Programme (ACP) on "Asian-oriented Integrated Watershed Management"

Heartware

Organic and voluntary approach driven by internal motivation based on local values
(Voluntary human processes)

Software

Institutional, policy, regulatory and financial approach
(managed human processes)

Hardware

Technological approach

Place-based shared values

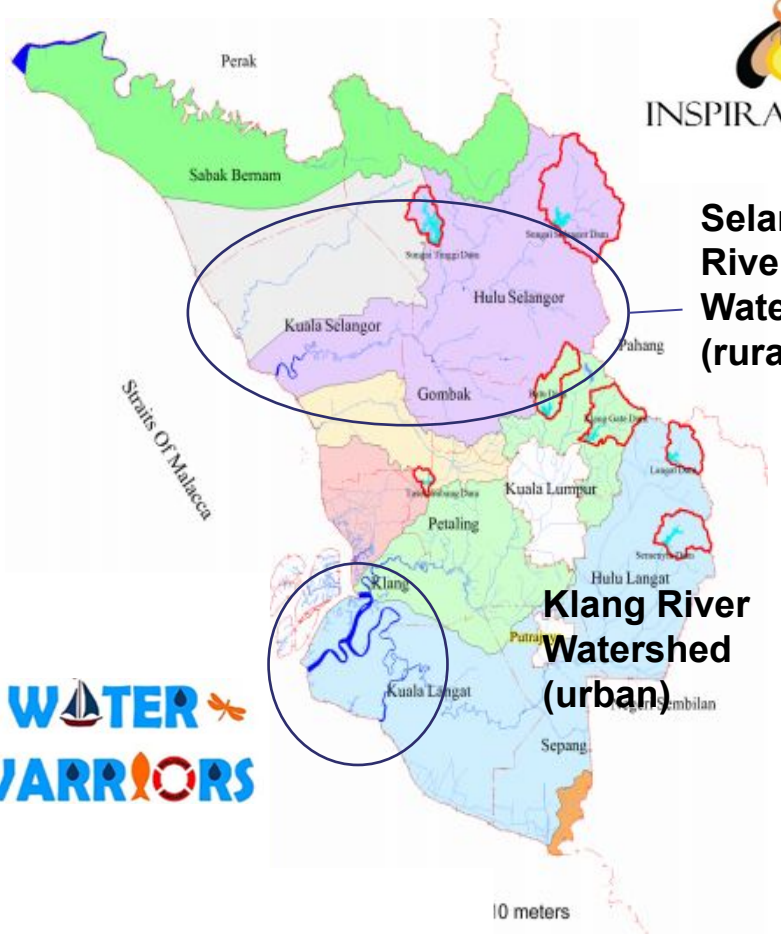
- Landscape appreciation
- Local traditions
- Retention of historical memories of human nature relationship
- Citizen movements inc. ***citizen science***

Science – Policy – Community Interface


滋賀県で確認されているホタル
ゲンジボタル
ヒメボタル
オバボタル
ヘイケボタル
クロマドボタル
スジグロヘニボタル
ゲンジボタル
Luciola cruciata

JAPAN

MALAYSIA



INSPIRASI KAWA

Selangor River Watershed (rural)

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WATER WARRIORS

Place-based Citizen Science (PBCS)

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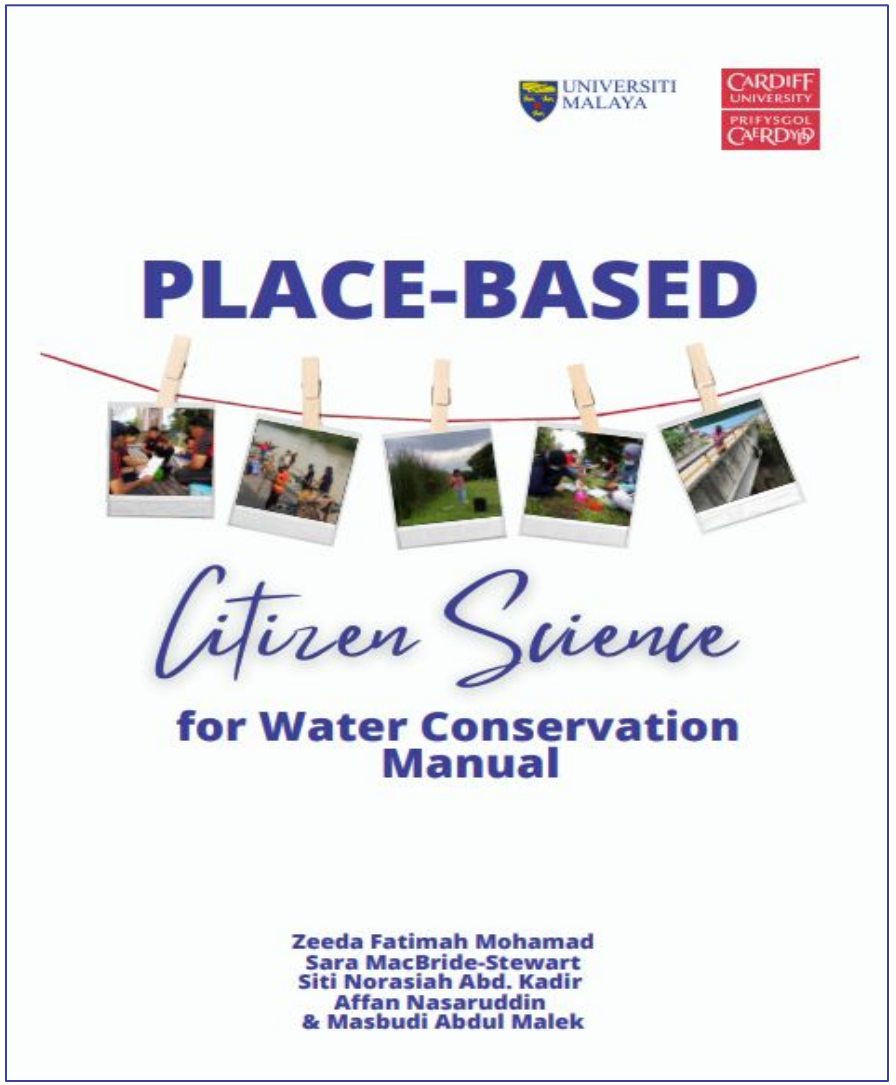
The Application of Place-based Methods for Enhancing Citizen Science as a Participatory Approach for Watershed Conservation

Generic PBCS Programme Design

Understanding your place

Developing your PBCS team and toolkit

Conducting Place-based Citizen Science



Understanding your place

STEP 01 Understanding your watershed and getting to know your community

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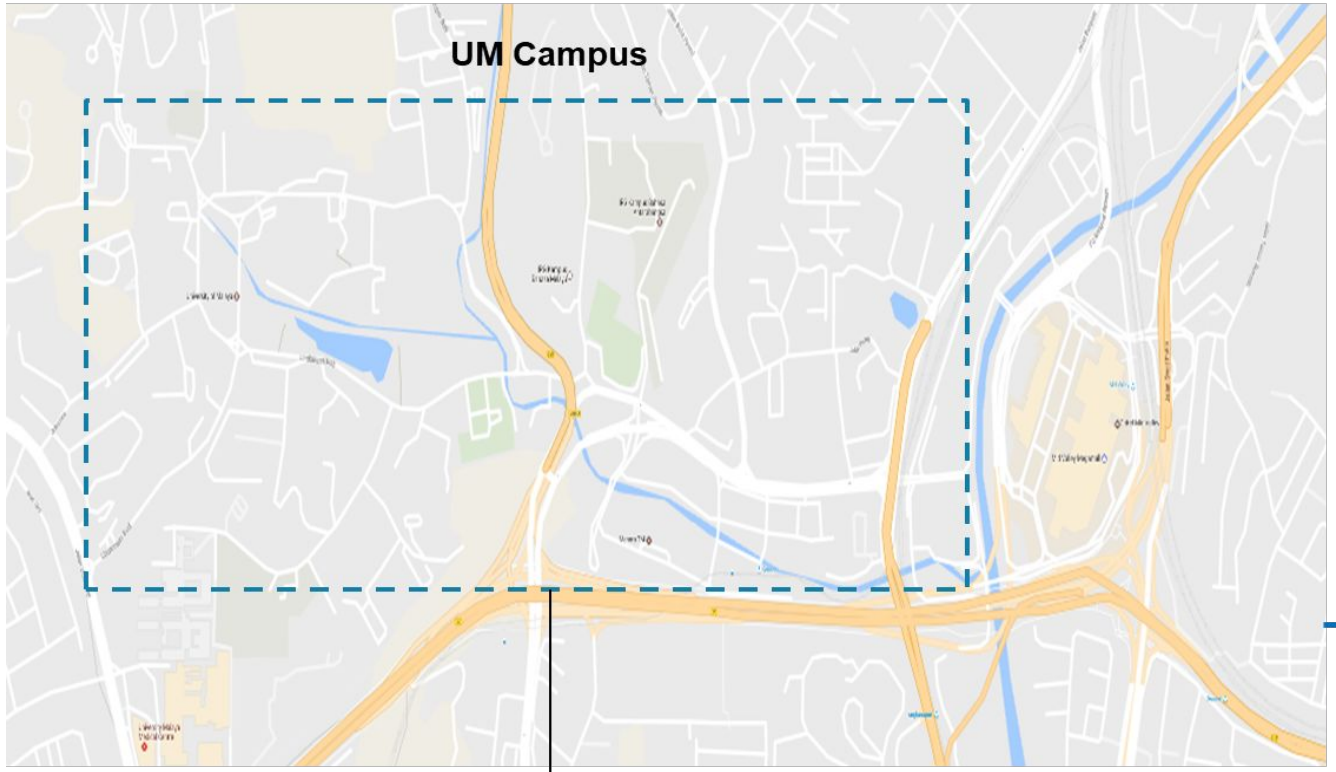
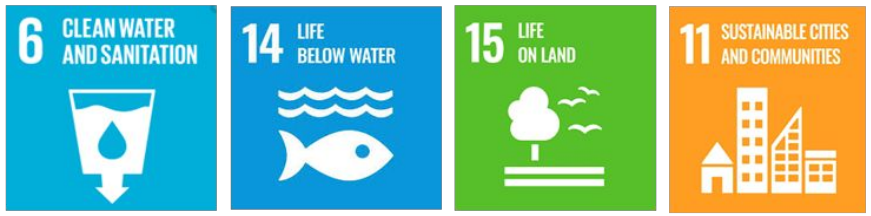
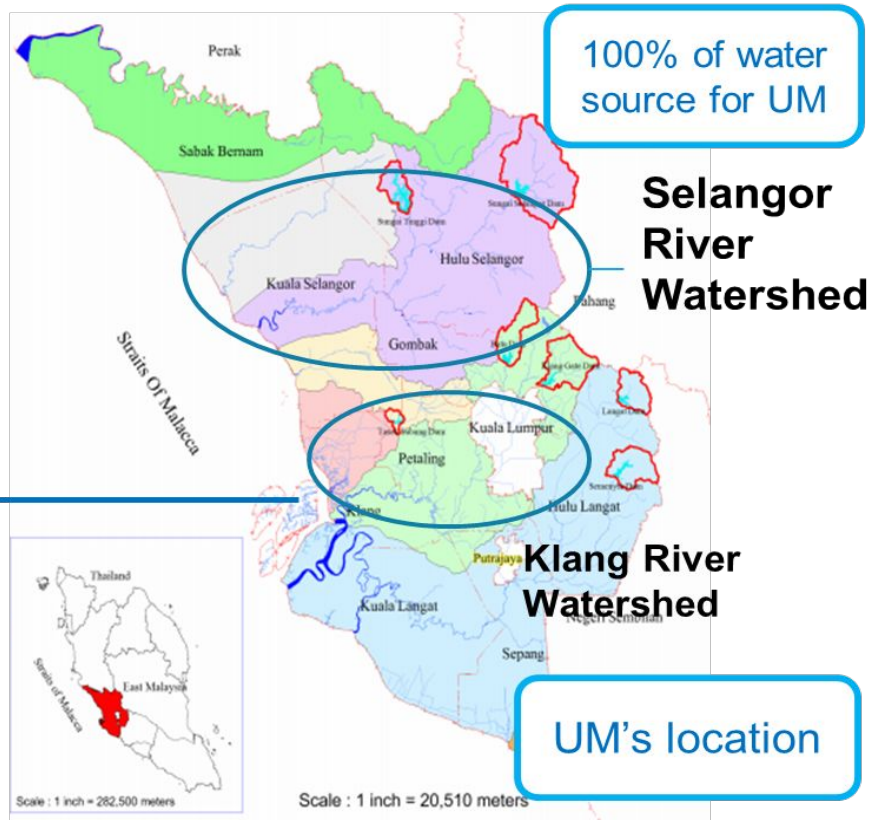
Watershed address

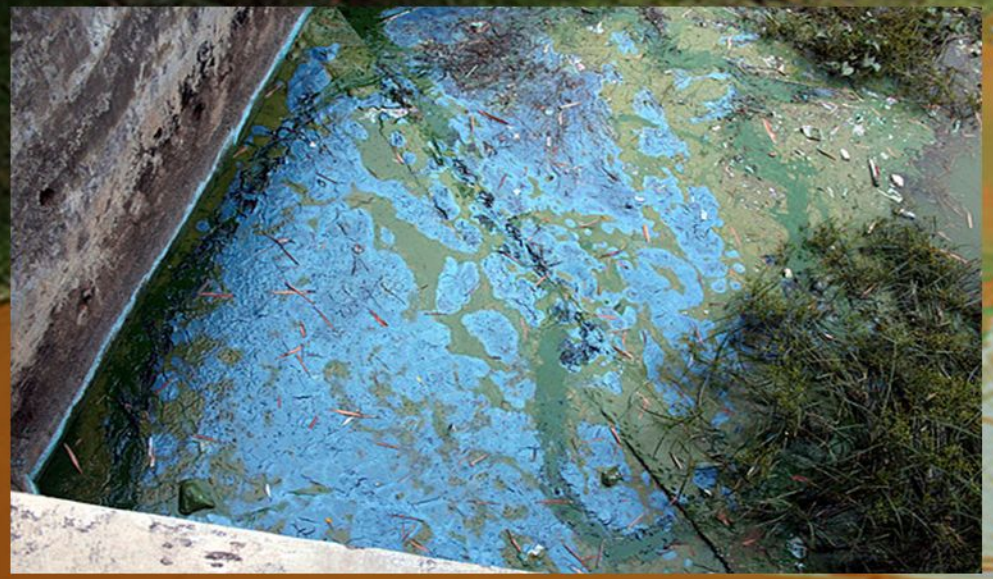


Network of water bodies within the campus





Tasek Varsiti, Klang River Watershed (2013)



Mukim Pasangan, Downstream of Selangor River (2013)

Understanding your place

STEP 02 Identifying the water conservation problems

STEP 03 Reflecting on the purposes of the PBCS

Ask the local community to identify:

- Any concerns about their water bodies
- The function/or purpose of the water bodies
- Any concerns about land activity near the water
- Changes they have notices over time and/or differences from other places
- How identified concerns can impact water quality
- Who is impacted or challenged by, or benefits from these problems?
- Community or civic activities being conducted to help address identified problems
- Any concerns about problems that might occur in the future
- How existing measurements can be adapted so a community member can collect data in a way that fits within their daily life
- What they want to know more?

When developing the PBCS team, get to know:

Who are your audience?

Who are the experts?

Who are your volunteers?

The ethical requirements

Informed consent | Privacy and confidentiality | Equity and Inclusiveness | Transparency | Scientific Integrity | Respect | Community Engagement | Environmental Cultural Sensitivity | Accountability | Education & Capacity Building

Adhere to ethical research & citizen science guidelines e.g. by European Citizen Science Association & the British Sociological Association

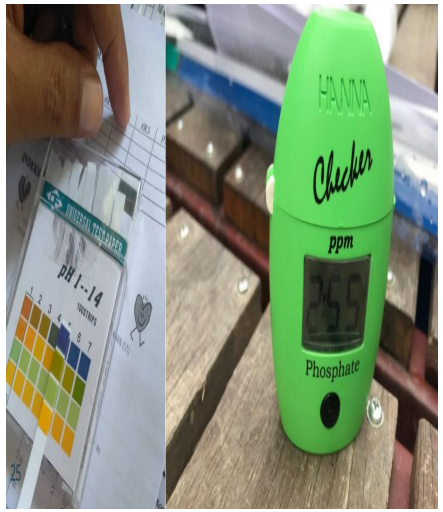
Developing your PBCS team and toolkit

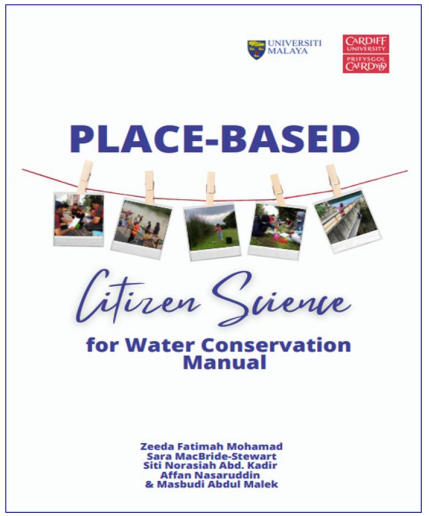
STEP 05 Co-producing the toolkits

STEP 06 Choosing your site, developing protocols and testing your toolkit

CO- PRODUCE the toolkits and procedures by deciding how and to what extent you and your community will monitor the water:

- Co-decide the **water conservation issues** that is of shared interest by the community and those involved
- Co-decide the list of **suitable parameters** that can be used to monitor the issue of concern:
  - Water quality monitoring (temperature, DO, BOD, pH, Turbidity, TDS, TSS, Conductivity, Phosphate, NH3, Total Coliform, Fecal Coliform, Heavy Metal)
  - Place observation: Physical observation (sight, smell, hearing, touch); Photographs/drawings & Descriptive accounts of the place
- Co-design the **tools** (Accuracy, Price, Brand, Size, Ease of use)
- Co-choose your **monitoring sites**
- Co-develop the **protocol**
- Co-test your toolkits and protocol, and improve them accordingly





Conducting Place-based Citizen Science

STEP 07 Training and supporting your citizen scientists

PBCS is often best when scientists and citizen scientists work together to collect, analyse and share data about issues of shared-concern in a particular area.

Training the citizen scientists for data collection

- ✔ how to collect representative water quality samples
- ✔ how to use each toolkit
- ✔ practice until protocols are followed without error
- ✔ how to submit and interpret data
- ✔ how to use data for different purposes

Supporting and empowering the team of citizen scientists:

- ✔ Coordination
- ✔ Supporting materials
- ✔ Continuous training
- ✔ Feedback
- ✔ Providing additional resources that are suitable for the group (online tools; videos; pocket size instructions, project website)

Conducting Place-based Citizen Science

STEP 08 Analysing, visualising and sharing your data

Once the citizen scientists have collected and submitted their data, relevant communities in the area of focus will be in a position to make sense of the collected data and to share the findings to relevant stakeholders.

Analysing the data

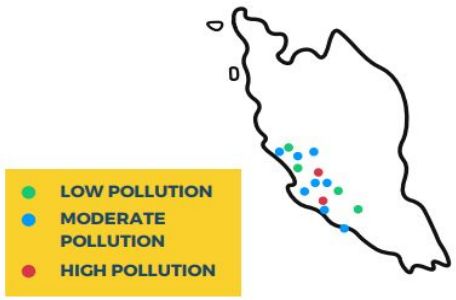
- ✔ Cleaning the data:
- ✔ Making sense of the data
- ✔ Interpret your data

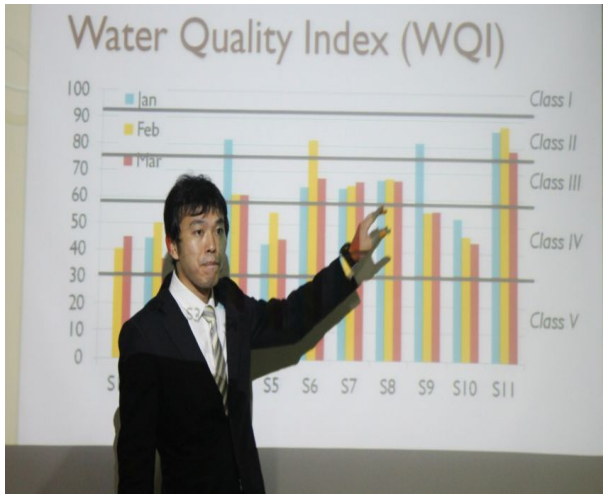
Visualising the data

- ✔ The mapping approach
- ✔ Scientific/professional approach
- ✔ Data that is words, still pictures, moving images or sound
- ✔ Public-friendly approach

Sharing the data and providing feedback to the community

- ✔ One-off, scheduled event
- ✔ On-going sharing and feedback





Eco-Heart Index as a PBCS tool

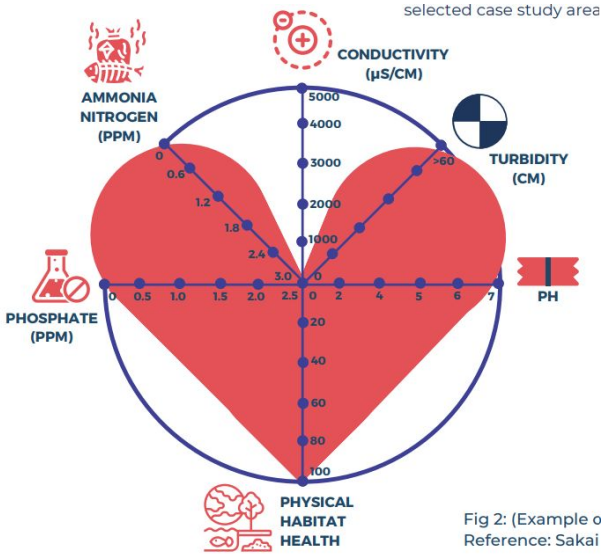
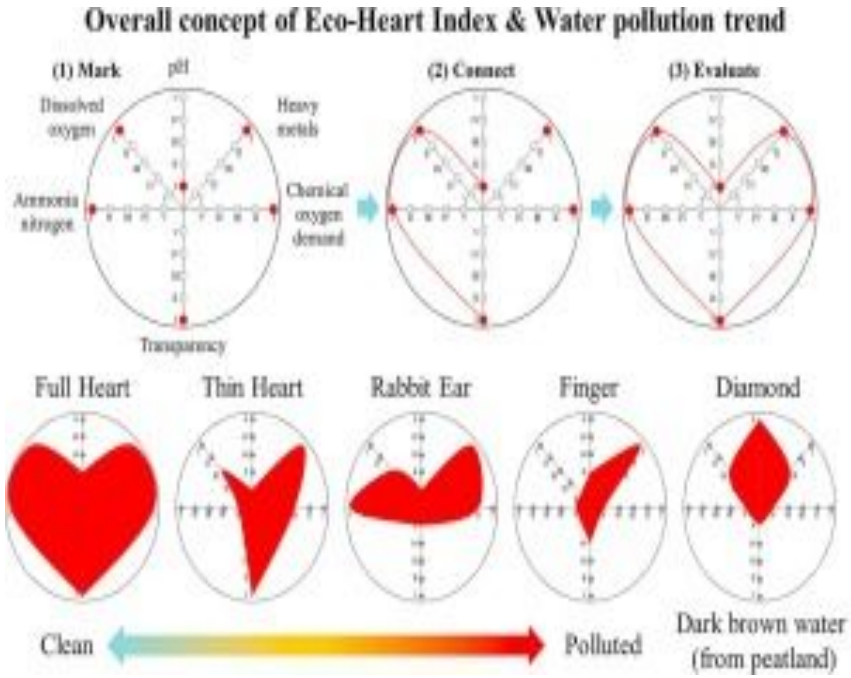
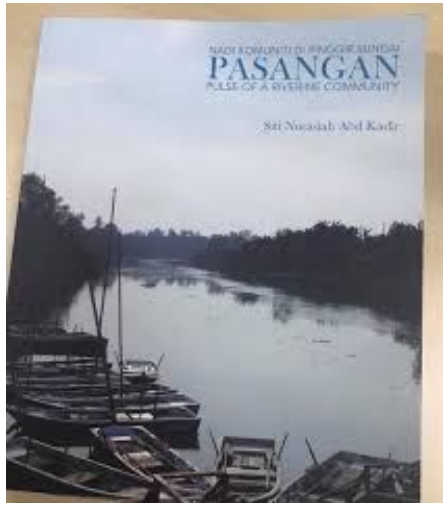


Fig 2: (Example o
Reference: Sakai





Reference:

- Sakai, N., Mohamad, Z. F., Nasaruddin, A., Kadir, S. N. A., Salleh, M. S. A. M., & Sulaiman, A. H. (2018). **Eco-Heart Index as a tool for community-based water quality monitoring and assessment**. *Ecological Indicators*, 91, 38-46.
- Kadir, N., Nasaruddin, A., Kadir, S. N., Musa, M. N., Ong and Mohamad, Z. F. (2015) **PASANGAN: Pulse of the Riverine Community**. A Sustainability Science Cluster and JSPS Asian Core Program Publication. UM Press. Kuala Lumpur ISBN: 978-967-0380-71-1
- Abd. Kadir, S.N., MacBride-Stewart, S. & Mohamad, Z. F. (2024). **Unpacking place-based narratives: Enhancing campus community participation in watershed conservation.** International Journal of Sustainability in Higher Education, 22(2), 404-422.

Results

Conceptual, Theoretical and Methodological articulation based on existing practices (Akanoi Biwako, Inspirasi Kawa & Water Warriors)

Pilot Test (Phase 1) with Critical Friends within the community and key stakeholders

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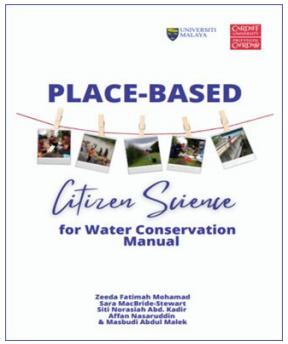
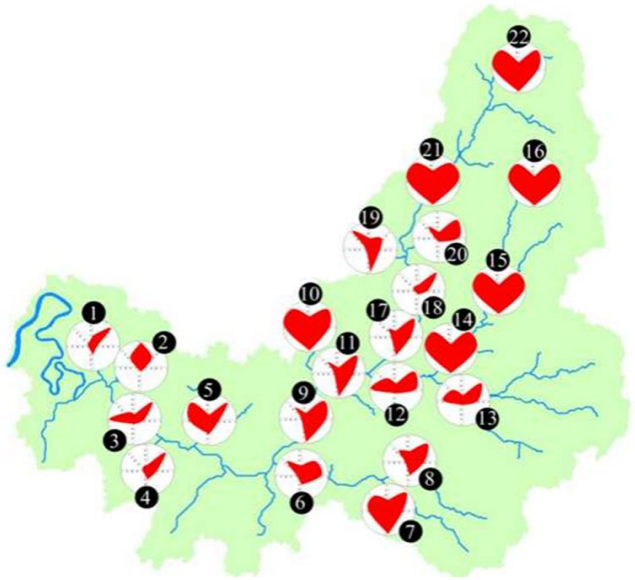
Pilot Test (Phase 2) with improved protocols/tools & broader engagement





Broader Programme deployment

Potential

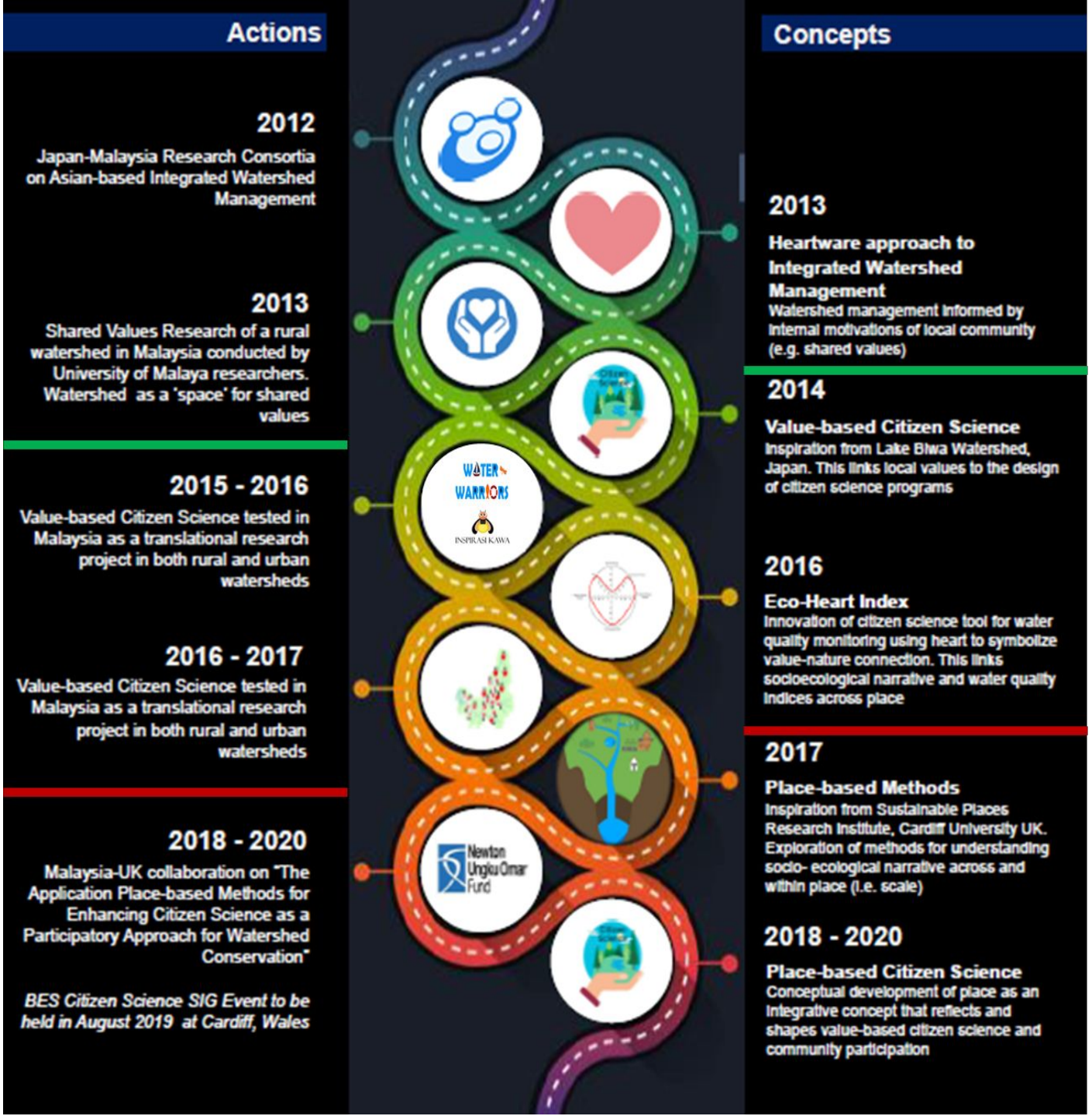
- LUAS/Air Selangor – **Rawang Industrial Area**
- Risks and Solutions: Marine Plastics in Southeast Asia (RaSP-SEA): **Freshwater – Marine Monitoring**

European Forum for Studies of Policies for Research and Innovation

(Possible) further improvements on the value of PBCS based on the framework of "**responsible innovation**"

Anticipation	Systematic thinking aimed at increasing resilience, while revealing new opportunities for innovation and the shaping of agendas for socially-robust risk research
Reflexivity	Holding a mirror up to one's own activities, commitments and assumptions, being aware of the limits of knowledge and being mindful that a particular framing of an issue may not be universally held.
Inclusion	Inclusion of new voices in the governance of science and innovation as part of a search for legitimacy & "opening up" framings of issues that challenge entrenched assumptions and commitments has been emphasized.
Responsiveness	Capacity to change shape or direction in response to stakeholder and public values and changing circumstances.

Source:
Stilgoe, J., Owen. R., & Macnaghten, P. (2013). *Developing a framework for responsible innovation. Research Policy*, 42, 1568– 1580



Publications

Journals

1. Mohamad, Z. F., Nasaruddin, A., Kadir, S. N. A., Musa, M. N., Ong, B., & Sakai, N. (2015). Community-based shared values as a 'Heart-ware' driver for integrated watershed management: Japan-Malaysia policy learning perspective. **Journal of Hydrology**, 530, 317-327.
2. Sakai, N., Mohamad, Z. F., Nasaruddin, A., Kadir, S. N. A., Salleh, M. S. A. M., & Sulaiman, A. H. (2018). Eco-Heart Index as a tool for community-based water quality monitoring and assessment**. Ecological Indicators**, 91, 38-46.
3. Mohamad, Z. F., Abd Kadir, S. N., Nasaruddin, A., Sakai, N., Zuki, F. M., Hussein, H., ... & Salleh, M. S. A. M. (2018). Heartware as a driver for campus sustainability: Insights from an action-oriented exploratory case study. **Journal of Cleaner Production**, 196, 1086-1096.
4. Ong, B., Goh T. G., Tan, K.R., Nasaruddin, A. & Mohamad, Z.F. (2019) Citizen Science Prospects and Pitfalls: A Developing World Reflection. **ROOTS - Botanic Gardens Conservation International Education Review**, 16(2), 11-1
5. Abd. Kadir, S.N., MacBride-Stewart, S. & Mohamad, Z. F. (2024). Unpacking place-based narratives: Enhancing campus community participation in watershed conservation. International **Journal of Sustainability in Higher Education**, 22(2), 404-422.

Book/Book Chapter

1. Kadir, N., Nasaruddin, A., Kadir, S. N., Musa, M. N., Ong and Mohamad, Z. F. (2015) **PASANGAN: Pulse of the Riverine Communit**y. A Sustainability Science Cluster and JSPS Asian Core Program Publication. UM Press. Kuala Lumpur ISBN: 978-967-0380-71-1
2. Mohamad, Z. F. (2024) P**lace-based Citizen Science as a Heartware approach to build shared values and capacity for watershed management**. In J. Marquardt, L. L. Delina & M. Smits (Ed.), Entanglements of Designing Social Innovation in the Asia-Pacific. Routledge

Guidebook

1. Mohamad, Z.F., MacBride-Stewart, S., Abd. Kadir, S. N., Nasaruddin, A. and Abdul Malek, M. (2021). **Place-based Citizen Science for Water Conservation Manual**. Cardiff University, UK and Universiti Malaya, Malaysia
2. **Air Selangor Water Handbook**

Thank you

DISCUSSION + Q&A