6th Symposium on Urbanization and Stream Ecology

Low-cost turbidity sensors to understand suspended sediment dynamics in complex landscapes

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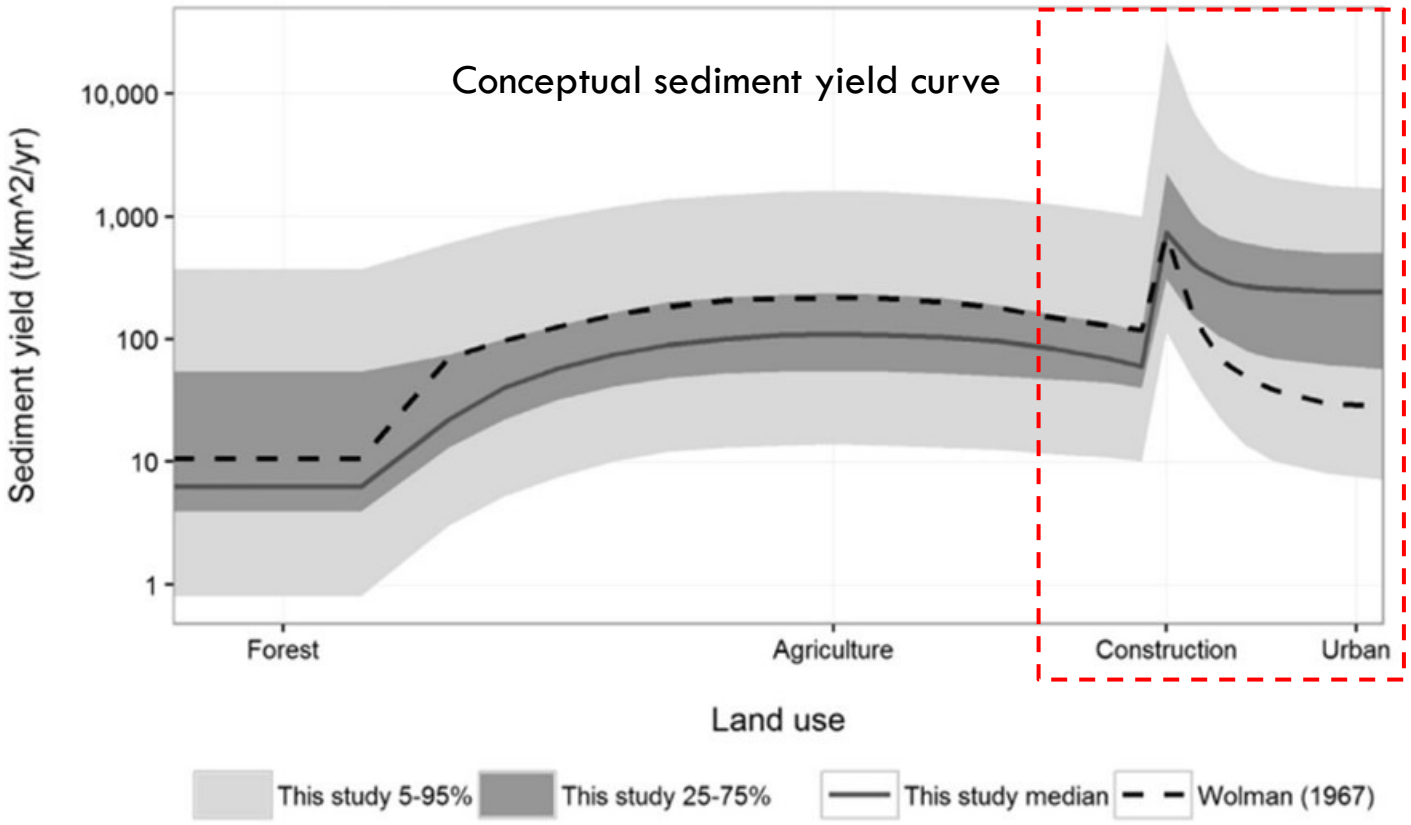
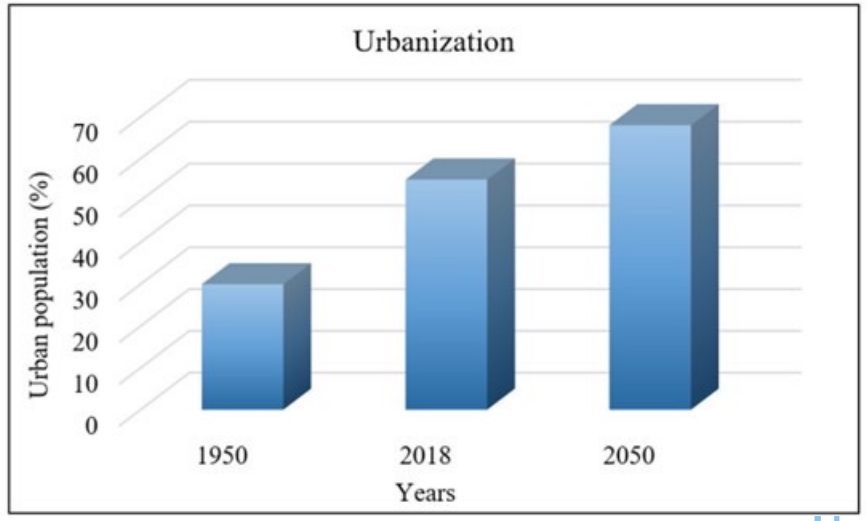
Motivation

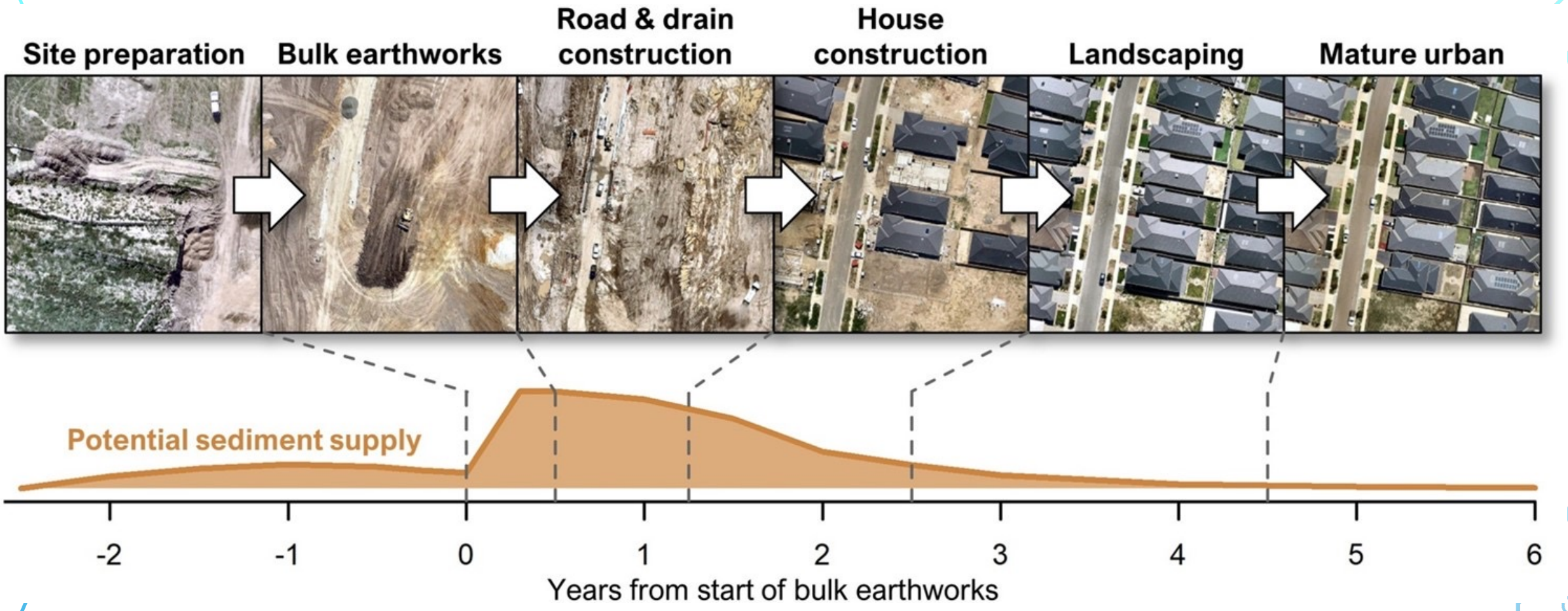


Russell et al. (2017)



United Nations et al. (2019)

Stages of Urban Development



Russell, K. (2021)

Monitoring

Sampling

- Time-consuming
- High costs
- Low temporal and spatial resolution

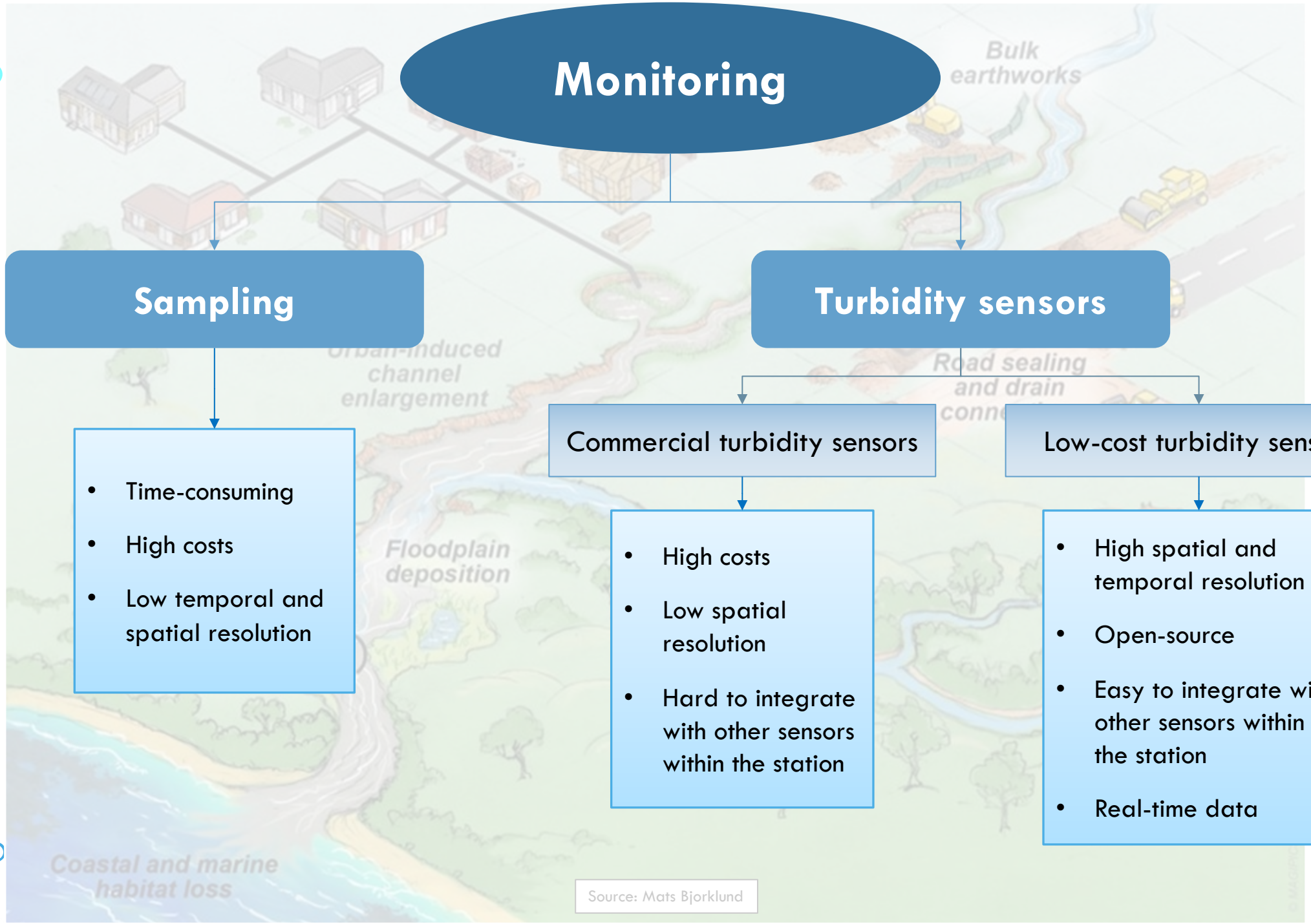
Turbidity sensors

Commercial turbidity sensors

- High costs
- Low spatial resolution
- Hard to integrate with other sensors within the station

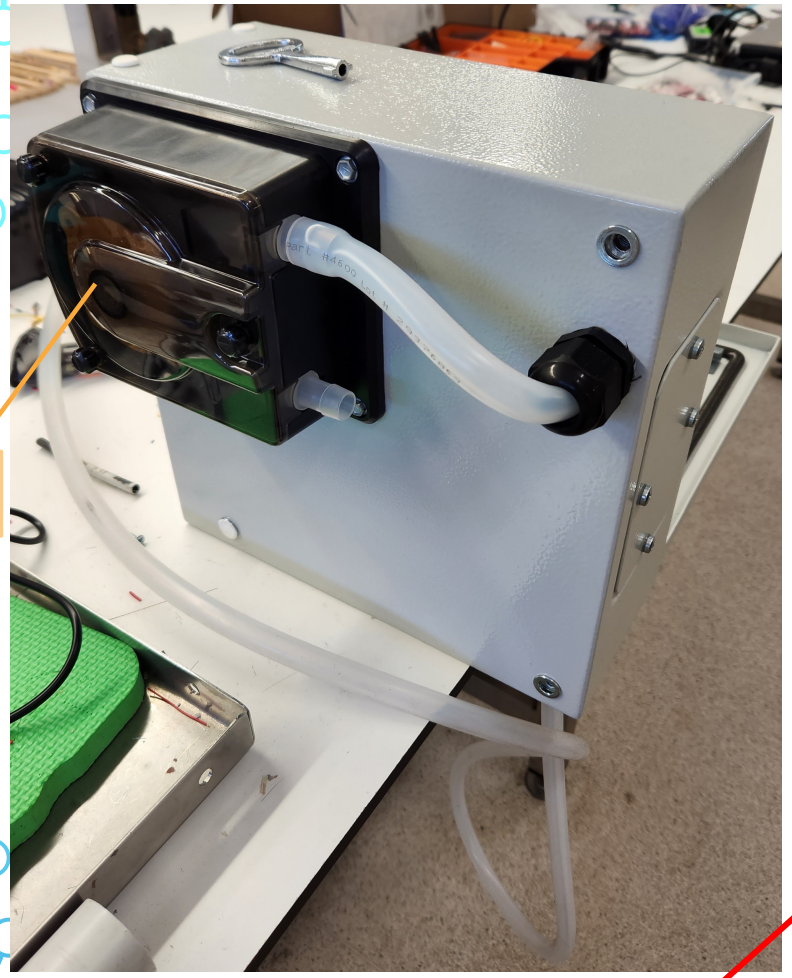
Low-cost turbidity sensors

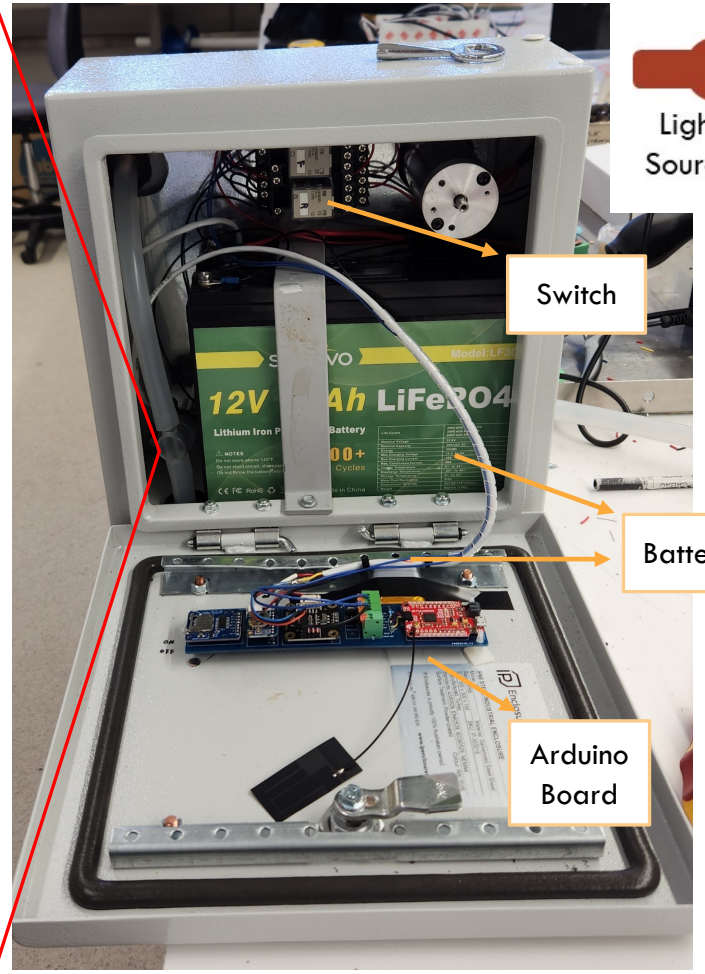
- High spatial and temporal resolution
- Open-source
- Easy to integrate with other sensors within the station
- Real-time data



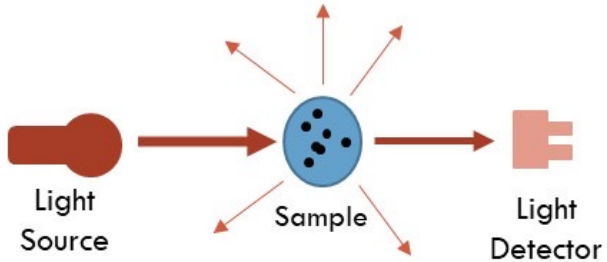
Source: Mats Bjorklund

Mobile Turbidity Sensor Unit



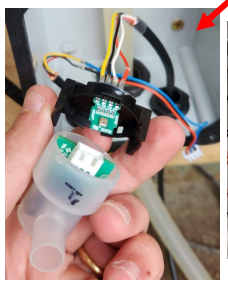


Light attenuation method



Water Level sensor

Turbidity and Temperature sensors



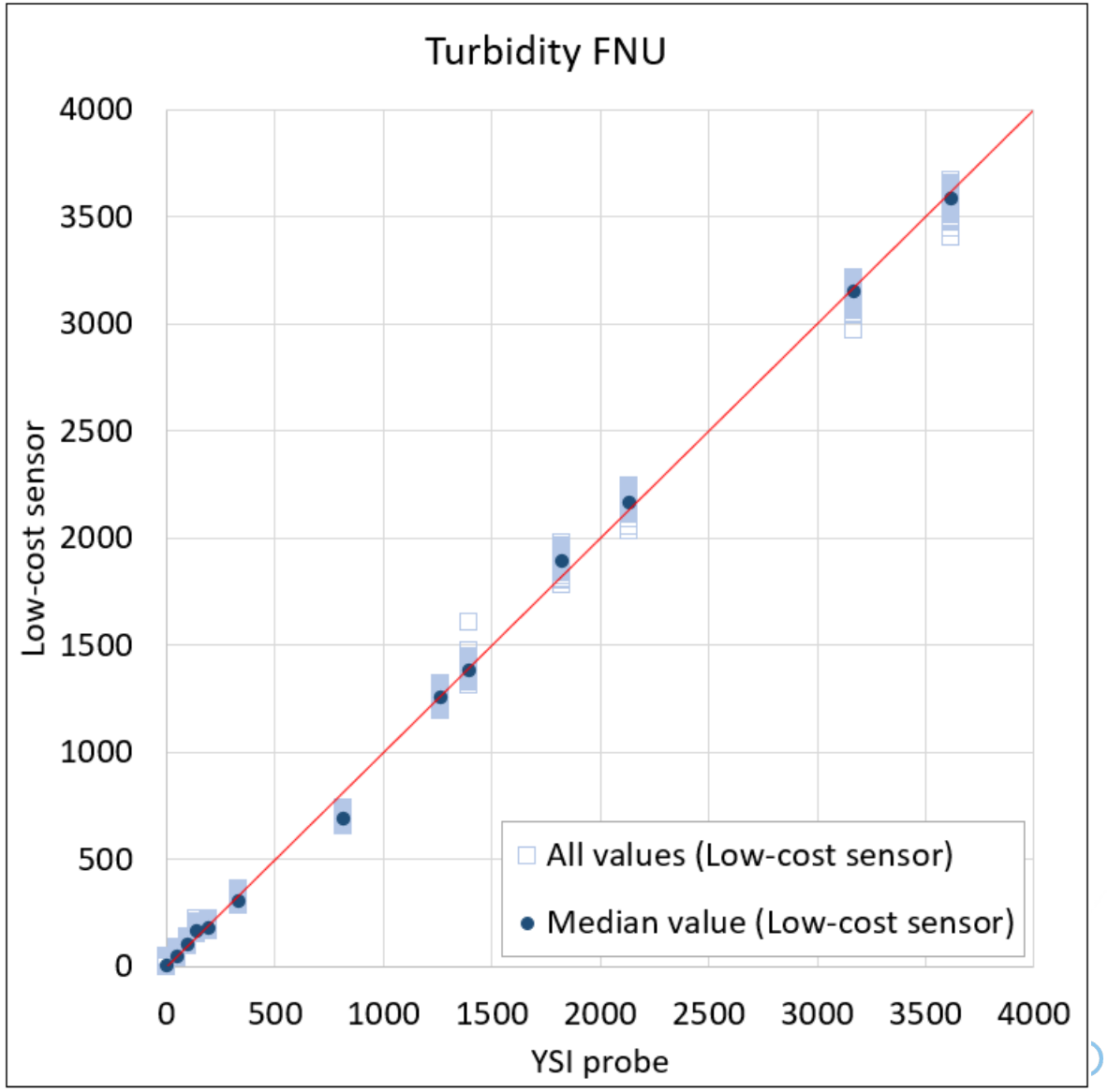
Laboratory Experiments

✓ Results

$$Turbidity = 44228.22 * Voltage^{-0.2} - 4.02 * Temp - 8376.82$$

$$R^2 = 0.9986$$

Sample	Turbidity (FNU)		
	YSI Probe	Low-cost sensor	
		Median	# of measurements
R.O.Water	0	2	1257
Sample 1	46	48	1231
Sample 2	94	106	1740
Sample 3	140	163	1658
Sample 4	194	178	1227
Sample 5	330	306	2531
Sample 7	817	689	938
Sample 8	1263	1255	903
Sample 9	1392	1384	919
Sample 10	1825	1893	1764
Sample 11	2133	2169	1022
Sample 12	3167	3157	1109
Sample 13	3617	3588	1185



Lab Experiment - Calibration


ST03
ST05 / ST06
ST03
ST05
ST06
ST02
200
Meters
ST02
ST03
ST04
ST05
ST06

Conclusions and Expectations

- ✓ Powerful monitoring tool;
- ✓ Continuous monitoring of Turbidity and Suspended Solids Concentration (SSC);
- ✓ High turbidity range (0 – 4000 FNU) / SSC (0 – 10 g/L);
- ✓ Temperature compensation and control of ambient light;
- ✓ Improvement of spatial and temporal resolution of data;
- ✓ Allows a better understanding of the main sources of suspended sediments and their spatial and temporal variability in peri-urban catchments.

Acknowledgments

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  - Axel Baylon
  - Robert James
  - Peter Poelsma