

Mapping pond aquaculture for the entire coastal zone of Asia using high resolution Sentinel-1 and Sentinel-2 data

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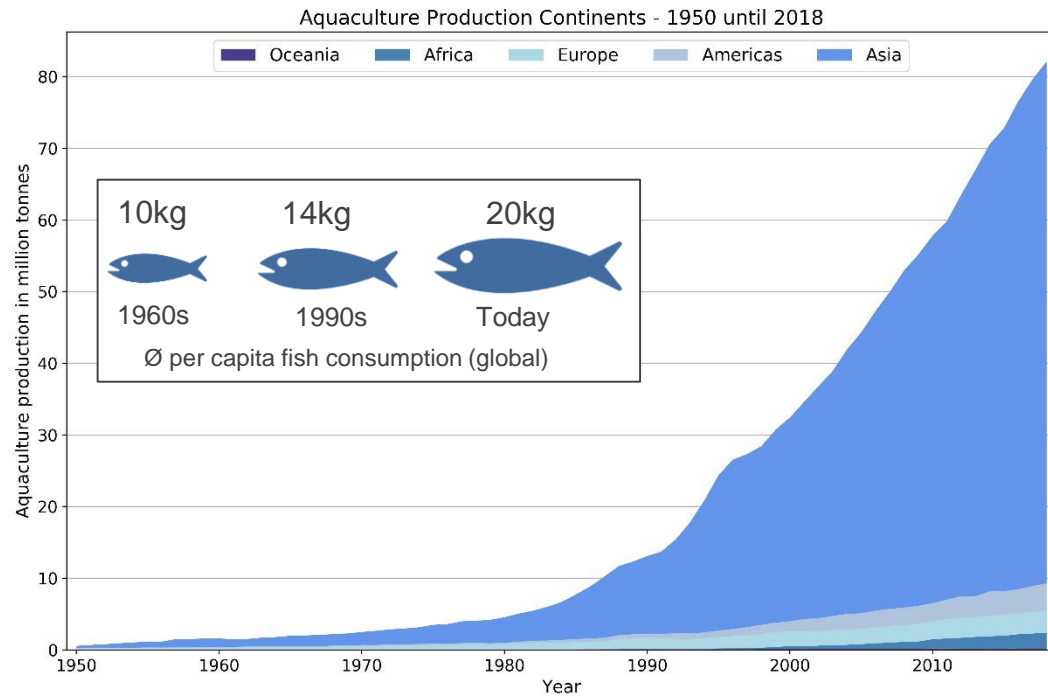
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Researchgate:

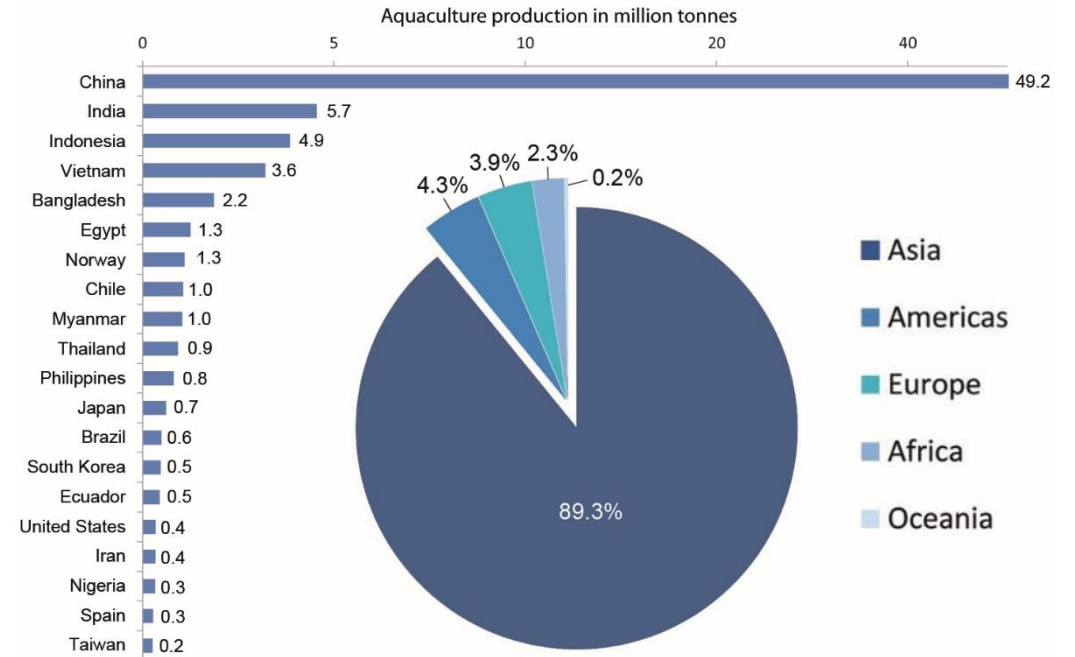


Development of the Aquaculture Sector in Asia

- Asia contributes more than 88% of total aquaculture
- The world's most important aquaculture production centers for farmed fish, shrimp, and crustaceans are located in South Asia, Southeast Asia and East Asia
- Aquaculture as a major protein source is vital for the region's food security



Annual total aquaculture production among continents from 1950 to 2018. Data source: FAO (2020)



Global total aquaculture production of top 20 producers and share among continents for the year 2018. Data source: FAO (2020)



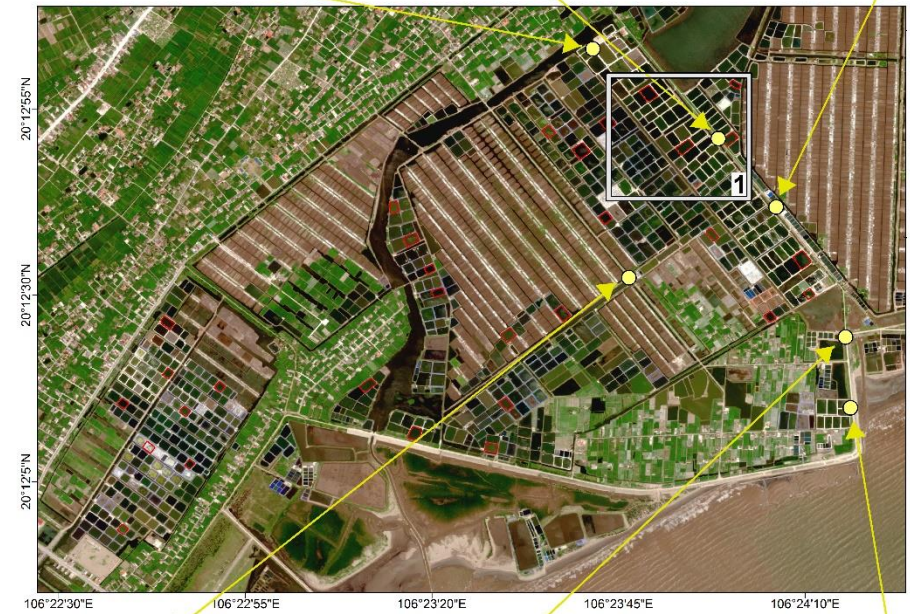
Pond Aquaculture in Earth Observation Data

Specific characteristics of aquaculture ponds:

- Rectangular water surfaces
- Enclosed by dikes, dams, levees



Exemplary photos of aquaculture (shrimp ponds) in Southeast Asia (here: Mekong Delta, Vietnam).
Source: DeltAdapt project, 2017.



Images of different aquaculture production systems (cages, raceways, ponds). Image source: Google Earth.
Modified according to Ottinger et al. (2016).

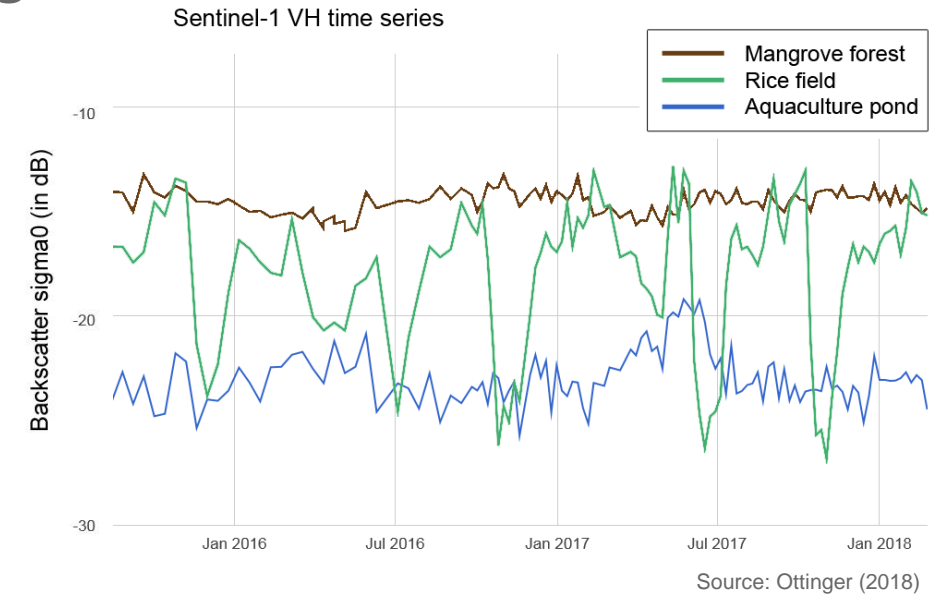
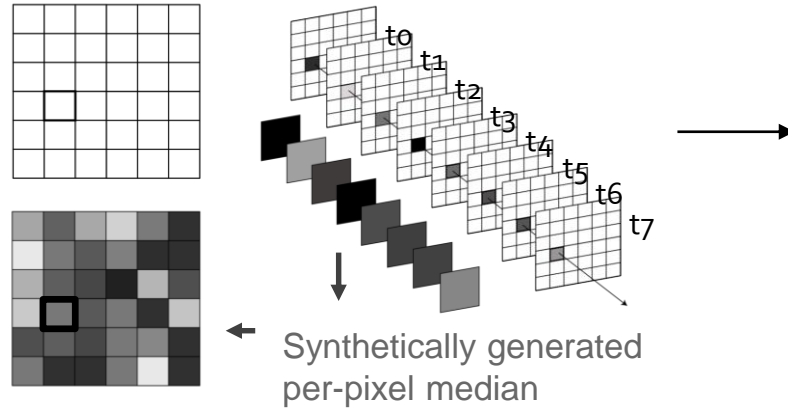


Separation of Aquaculture from Other Land Uses

Time Series Data & Temporal Signatures

PERMANENT !

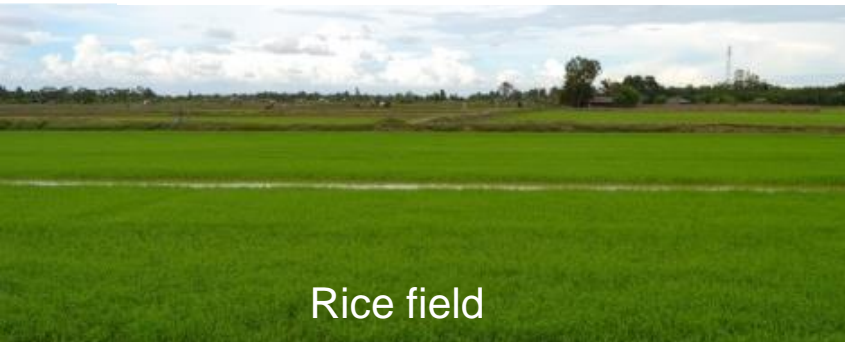
→ Time series



Water coverage

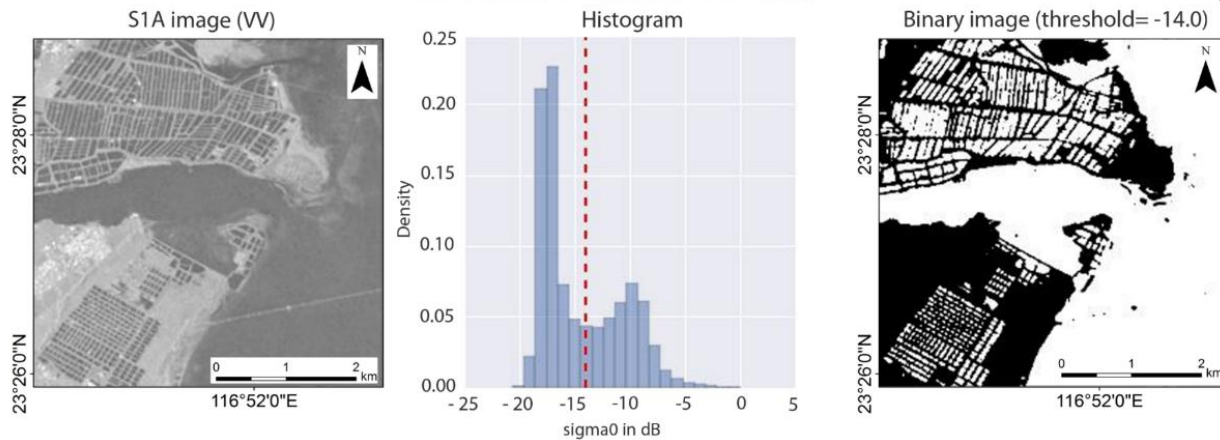
periodic

permanent

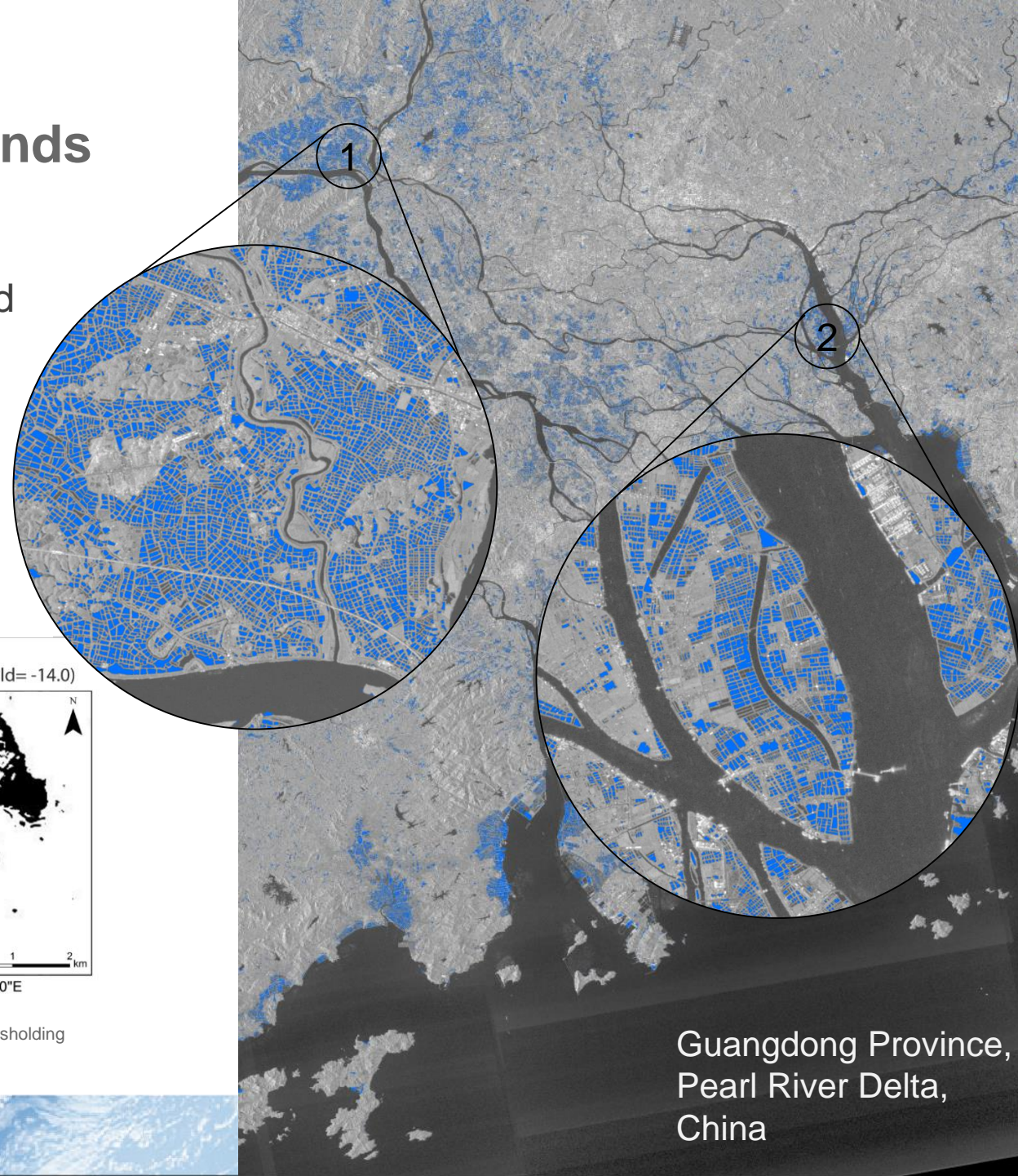


Automatic Extraction of Aquaculture Ponds with Sentinel-1/2 Time Series

- Automatic, object-based approach using Sentinel-1 and Sentinel-2 time series data (complete year 2019)
- Sentinel-1: VH temporal median image for object segmentation based on image thresholding
- Sentinel-2: SWIR and NDWI (annual mean) for enhancement of water separation



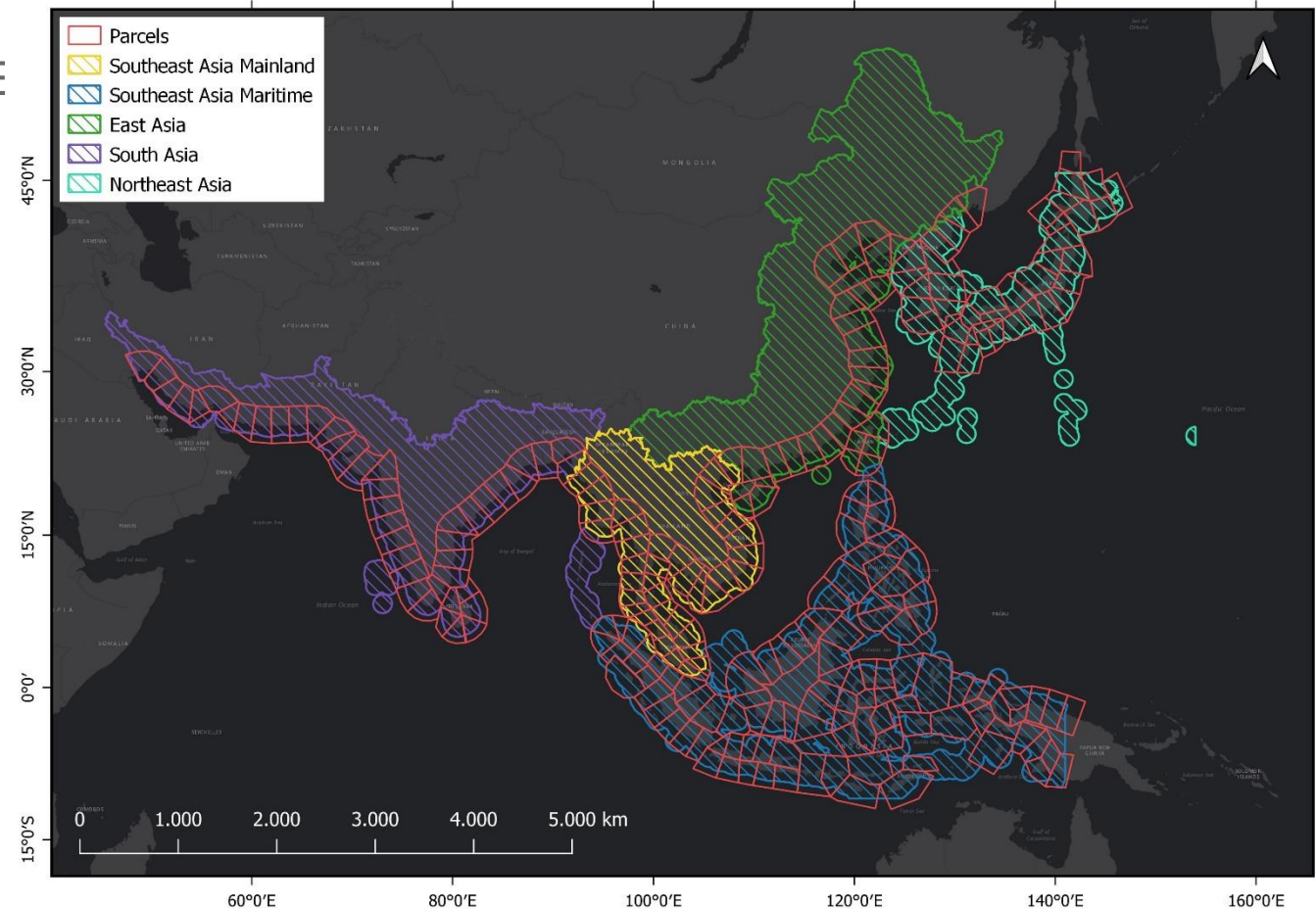
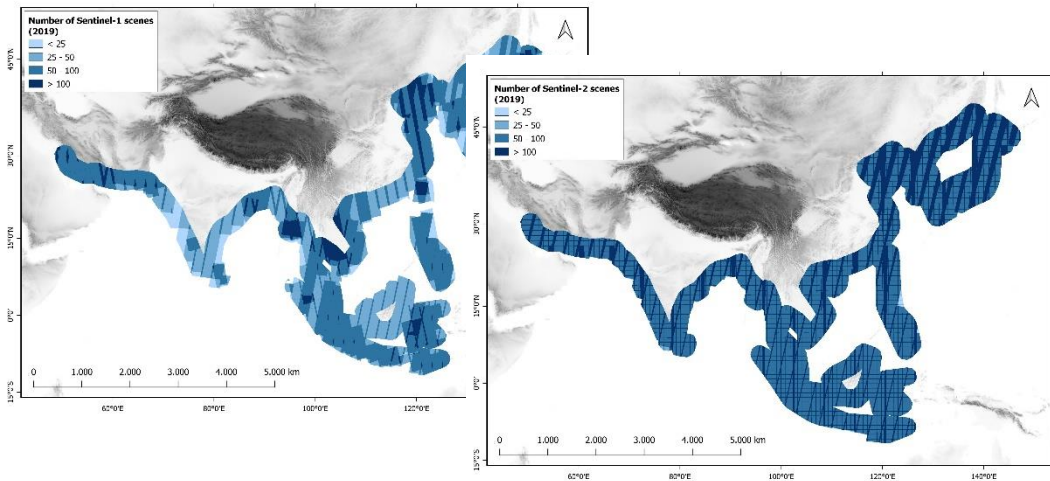
Histogram-based water thresholding



Guangdong Province,
Pearl River Delta,
China

Study Area – Coastal Asia

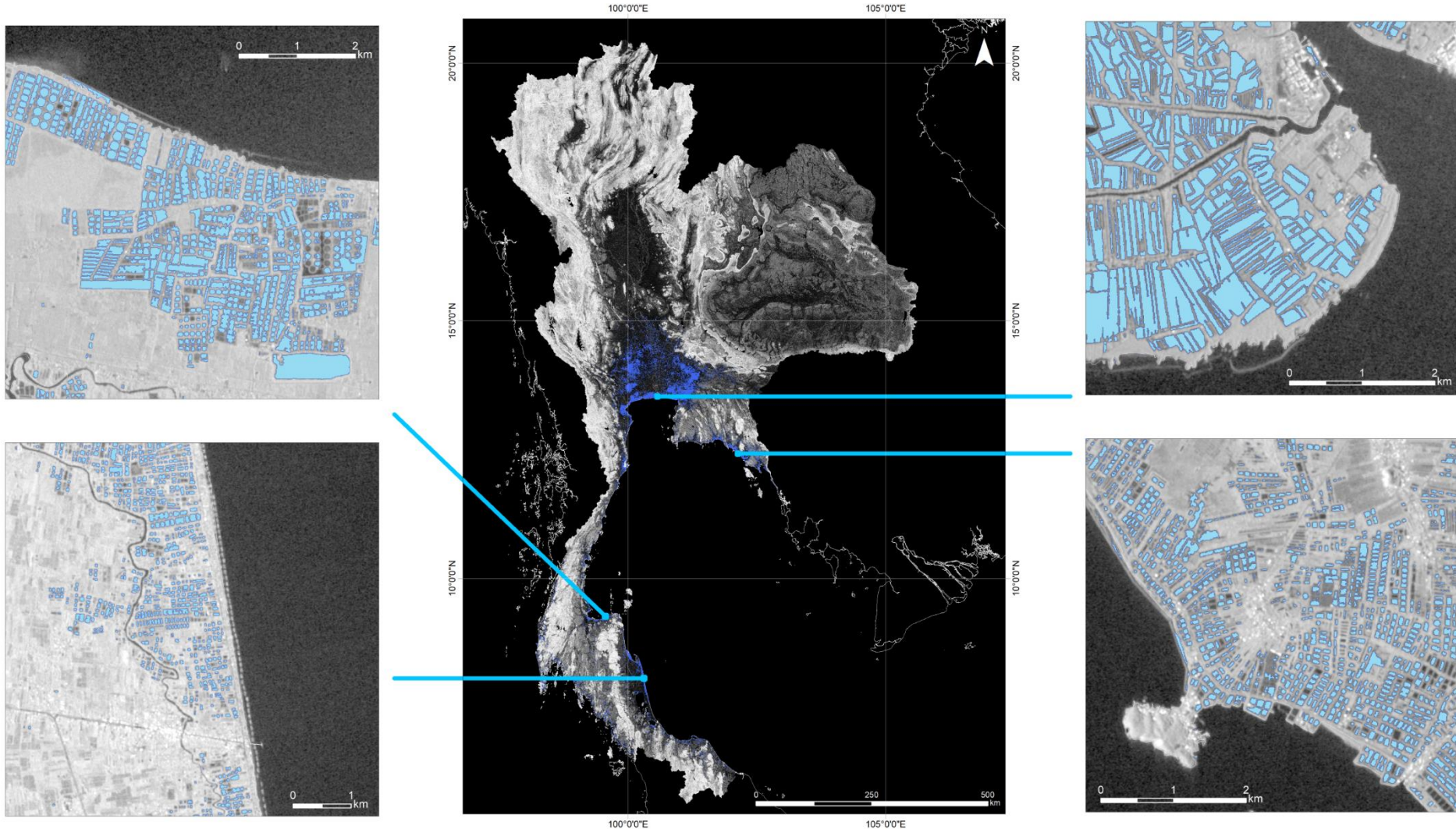
- Subdivision of Asia into 5 macroregions
- Automatic pre-processing and export of pond objects for coastal parcels (>500) within the GEE
- Post-processing, e.g. filtering, based on
 - spectral indices,
 - backscatter percentiles,
 - object related area/shape features,
 - topographic SRTM and
 - OSM data (river and water)



Coastal parcels (200km coastline length) and macroregions for the processing pipeline. Source: Ottinger (2021).

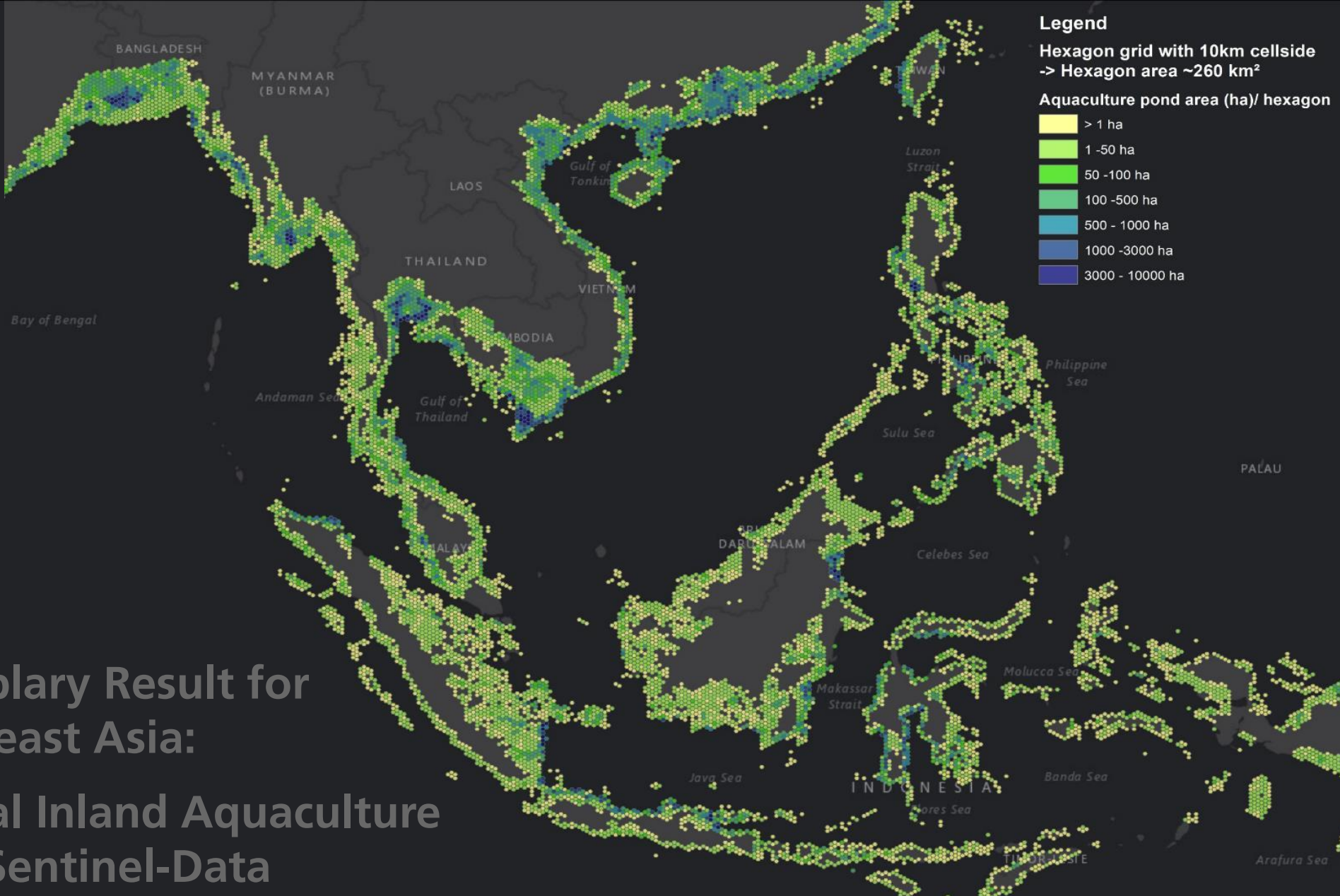


Exemplary Result: Aquaculture ponds in Thailand



Source: Ottinger (2021)





Exemplary Result for
 Southeast Asia:
 Coastal Inland Aquaculture
 from Sentinel-Data

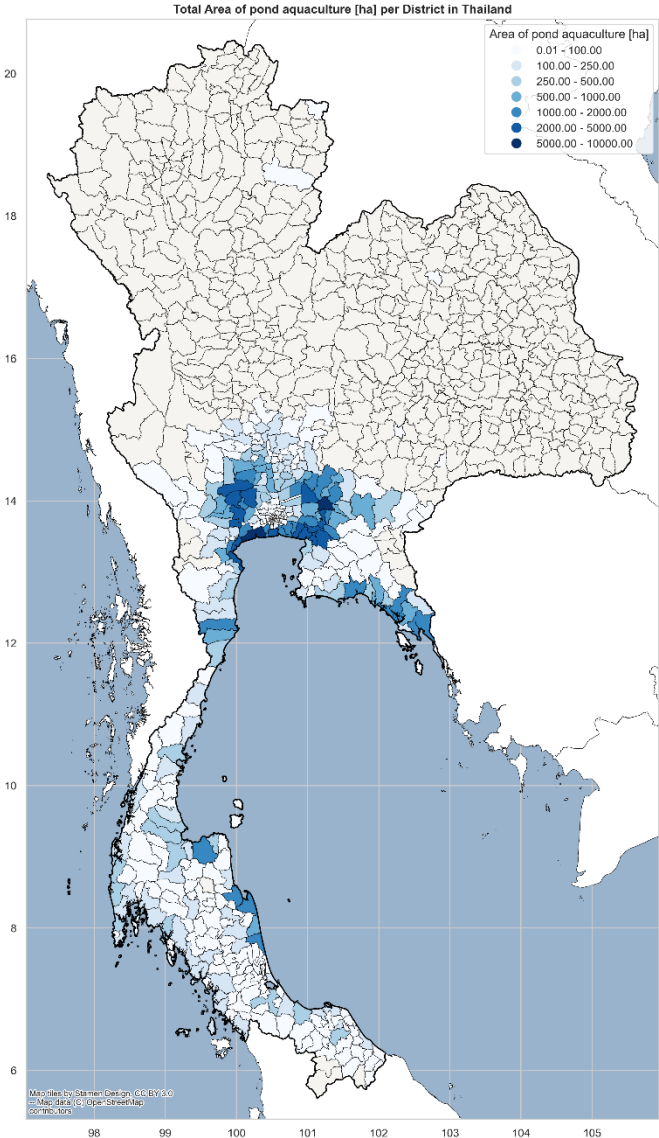
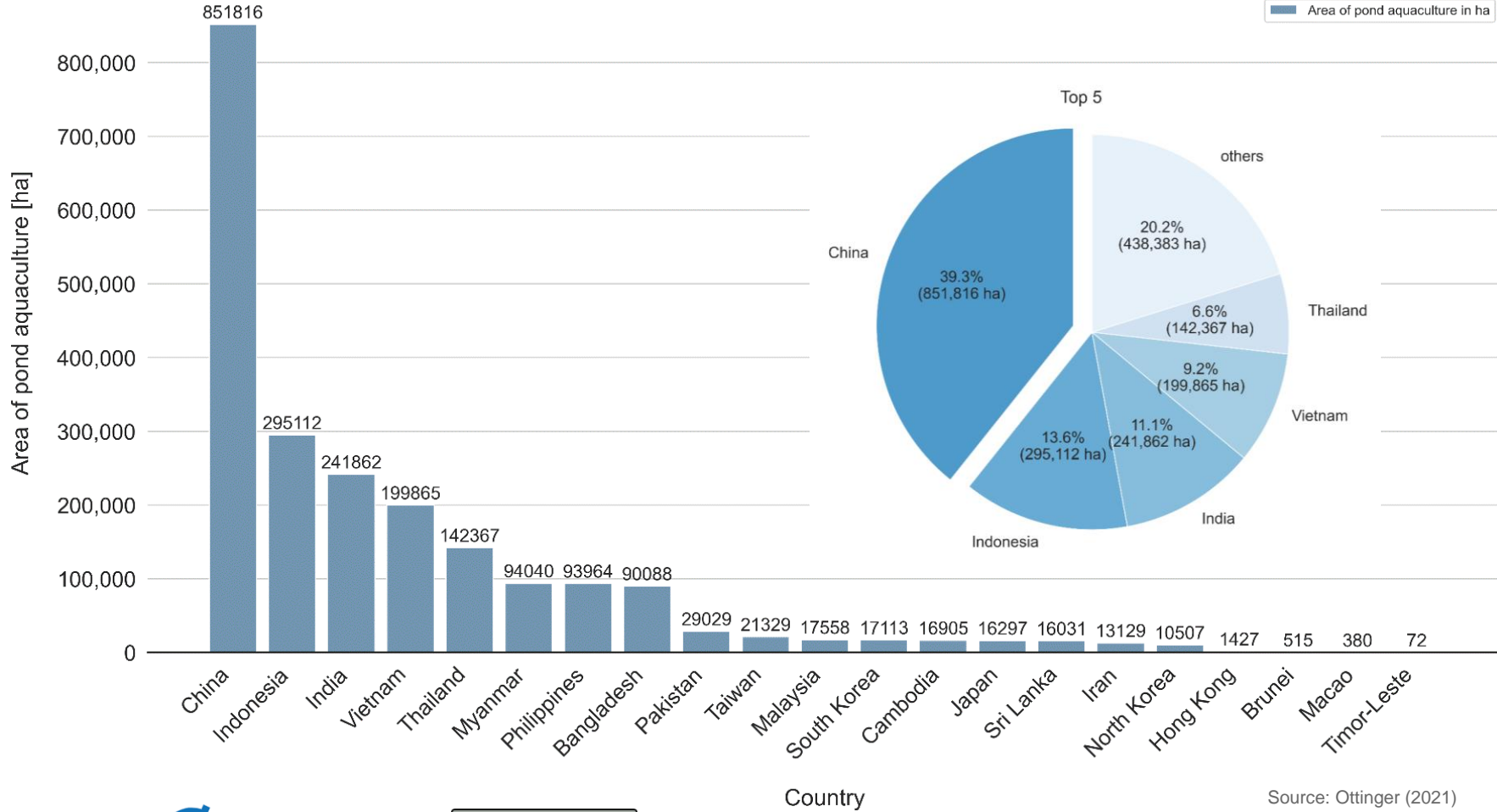
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Source: Ottinger (2021)



Asia Coastal Aquaculture – Statistical Analyses

Total Area of pond aquaculture [ha] per country



Source: Ottinger (2021)



Thank you for your attention

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References

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