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Water storage is crucial for water security in countries with monsoon driven climates (Anand, Kakumanu, and Amarasinghe 2019). As a result, village water storage tanks have been used in countries in Southeast Asia like India and Sri Lanka since as far back as the third millennium BC (UNDP 2019) and are one of the oldest traditional water harvesting structures. They contribute to water security, particularly for agriculture dependent populations (Rodrigues et al. 2012) by creating a buffer to mitigate the impact of floods in the monsoon months and provide additional supply for crops during water shortages and droughts in the dry season (Anand, Kakumanu, and Amarasinghe 2019). Given increased rainfall variability associated with climate change (Bayissa et al. 2022; IPCC 2023), the role of water storage is becoming ever more important. There are three types of tank classification in Sri Lanka: minor, medium and large.

This paper focuses on small tanks of 80 hectares or less, which are classified as minor irrigation systems or minor irrigation works (Vidanage, Kotagama, and Dunusinghe 2022). According to the National Tanks Survey, Sri Lanka has some 23,000 small tanks[1] of 80 hectares or less. However, some 21 percent are currently estimated to be non-functional (either damaged or abandoned) due to decades of neglect with the gradual advent of canal and groundwater systems of irrigation. The Ministry of Agriculture and organisations like UNDP are now attempting to revive some of these neglected tanks (Vidanage, Kotagama, and Dunusinghe 2022)

technique (see section 3.2) to compute missing siltation information for the remainder, bringing back up the total to 11,014 tanks under analysis.

First of all, we sought to reach a conceptual understanding of the factors to consider when thinking about tank prioritisation. We grouped the factors to consider under three thematic categories as laid out in the research quesa9(q)3(u)ot thematic categories as laid

All of the analysis described below was conducted in python. Scripts and corresponding public datasets are available on GitHub at https://github.com/fdlopane/SL-Tanks/.

longer be needed, or the surrounding population could no longer be engaged in agricultural activities. With this in mind, we consider demand side factors and seek to compute the agriculture dependent population for each tank using a combination of spatial datasets and the HIES household survey for calibration.

This step uses three data sources: the Sri Lanka Policy and Planning Department Land Use raster; a WorldPop population count raster; and the Household Income Expenditure Survey (HIES)[3] district level agricultural dependent population from 2016 (Figure 2).

To start with we use HIES survey data to estimate the agricultural dependent population we would expect at the district level. These HIES district level estimates are computed by a research team at the Water GP of the World Bank, and take into account population dependent on agriculture, not necessarily as the main occupation, but also considering secondary occupations. The estimate made

At this point we made a comparison between HIES household survey estimates on the agriculture dependent population at the district level and the computed estimates. Where the geospatially computed estimates of ADP are more than 5% lower than the HIES estimates, we then iteratively regions of Tamil Nadu in southern India and found that shallow groundwater recharge increased by more than 40%. Another recent study (Brauns et al., 2022) in three catchments in the crystalline basement of the Cauvery Basin within Karnataka State of southern India looked at the impact of cascade of tanks on recharge to aquifers using groundwater chemistry and water-level data. They concluded that recharge contributions from tanks to groundwater are small and dependent on local geology and land-use practices. Brauns et al. (2022) cautioned that careful planning and monitoring of groundwater levels and quality are necessary as chances of groundwater contamination from agricultural chemicals and other sources (e.g., urban pollutants) are high. VanMeter et al. (2016) concluded that while recharge potential from rainwater harvesting in tanks could be seen as a 'nature-based solution' to water scarcity, it may lead to negative environmental consequences by dramatically reducing (up to 75%) natural runoff. Though the full impacts of tank rejuvenation on groundwater recharge in the Sri Lankan context are under-researched, we have included this element to the analysis as a theoretical exercise for when more information becomes available that re-inform the index structure.

There are six main aquifers in Sri Lanka with an additional aquifer found throughout the weathered basement (Figure 4). Geology and hydrogeology of these aquifer systems vary considerably across the country, which in turn affects the utility of tanks upon which they are situated. A final layer of this analysis is to consider the pumping yield of each of the respective aquifers in the prioritisation of tanks for rejuvenation.

Well-yield data from Sri Lanka's National Water Supply and Drainage Board (NWSDB) show that the highest yield aquifers are shallow alluvial (920 L/min), followed by deep confined aquifers (up to 585 L/min), next are shallow karstic aquifers found in the Jaffna peninsula which have considerable productivity (yield 400 L/min), shallow sandy aquifers have a yield of 225 L/min. Those with lower yields are basement regolith aquifers (150 L/min), regolit or fractured aquifers (75 L/min) and laterite (Cabook) aquifers (70 L/min)(Joseph et al. 2022). Despite being low in productivity, focused groundwater recharge via leakage from tank cascades is highly likely in regolith or fractured aquifers in the north and southeast of the country.

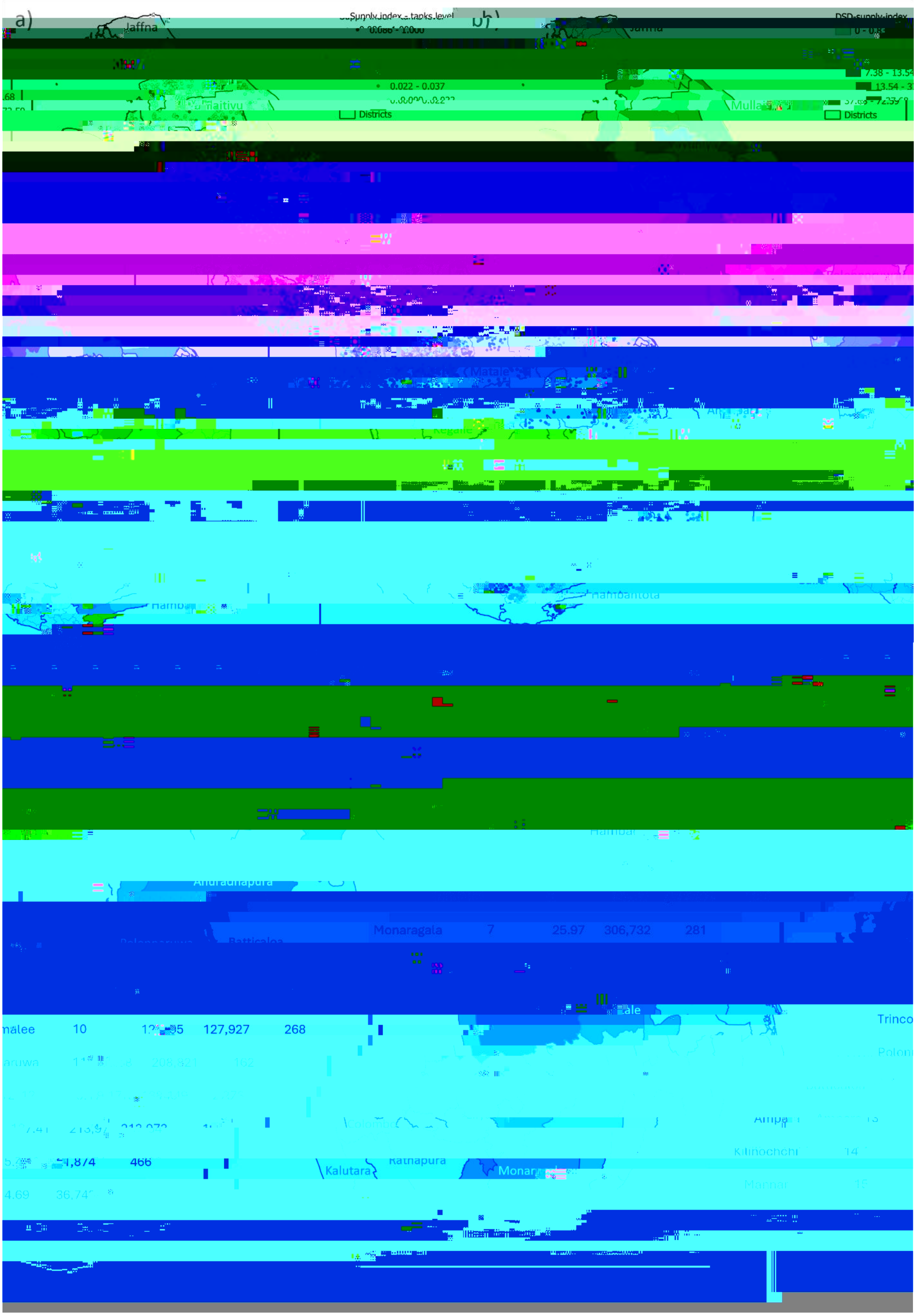
With the tank demand, tank supply and tank utility indices all separately calculated, we then create a combined composite index. First of all we rank the tanks depending on the supply-demand index score with the highest scoring being those that are most likely to require rejuvenation based on both sets of characteristics.

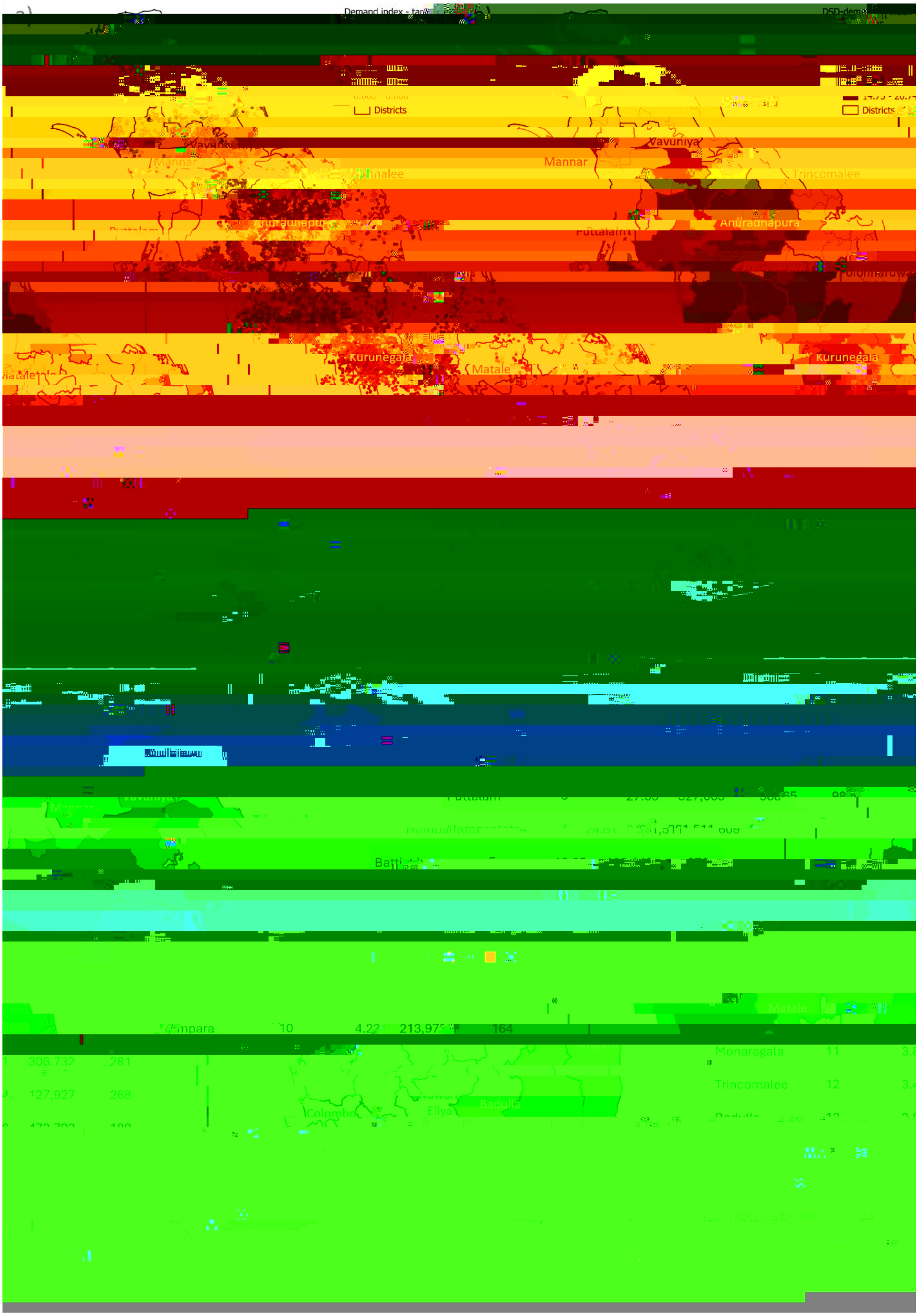
For the top 10% scoring tanks according to this ranking, we apply the groundwater recharge index so that we can sub-

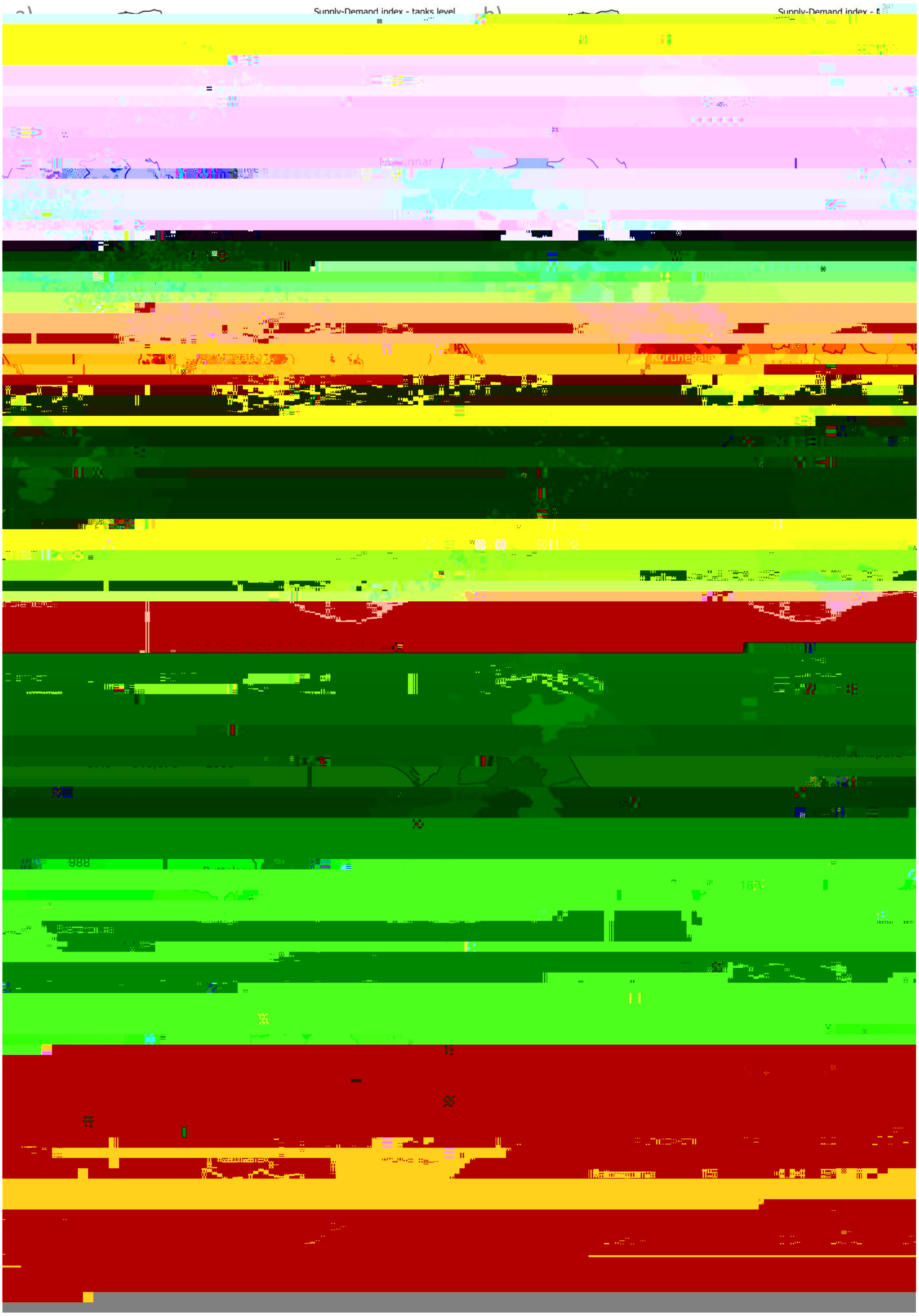
Examining the visualisation of both supply (Figure 5) and demand (Figure 6) side indices, tanks in Kurunegala and Anuradhapura rank highest, partly because there is a large concentration of tanks in these two regions (4,434 in Kurunegala and 2,905 in Anuradhapura, with the remainder of the sample having under 1000 in each district). Their siltation and soil erosion rankings also cause them to rise in the rankings for those in need of rejuvenation. Kurnegala has the second highest supply index score in the country, while Anuradhapura is sixth out of sixteen. Matale and Hambantota are next in priority according to their supply index scores, but have comparatively small numbers of tanks (294 and 609 respectively), implying that a larger proportion of the tanks in those districts are in need of greater attention for rehabilitation.

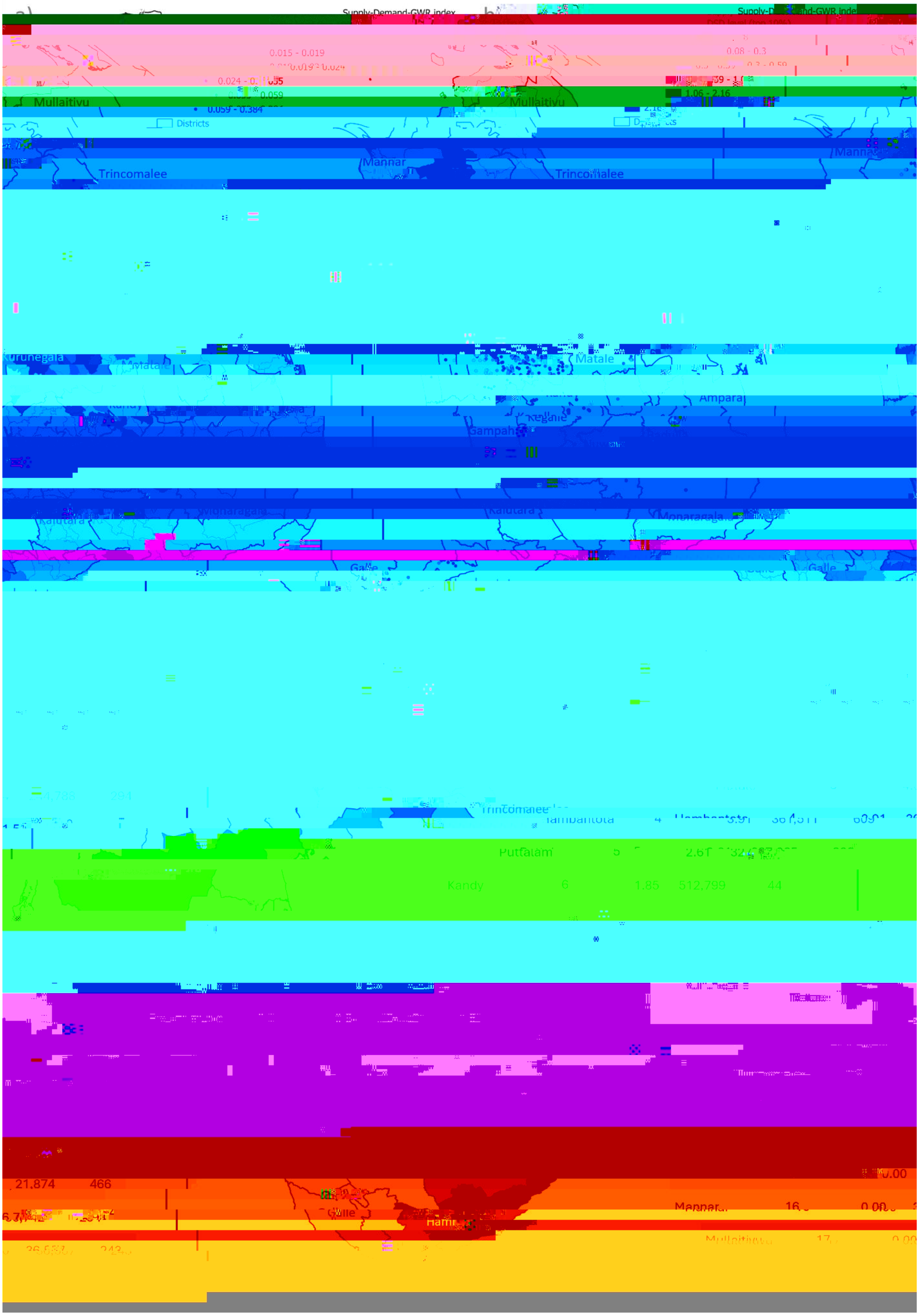
When we compare district and DSD level maps, we see the level of variation within the priority districts. This is particularly notable in Hambantota on the combined supply-demand-GWR index where the targeted tanks are all in DSDs to the west of the district. Within both Anduradhapura and Kurunegala we also see DSDs of much greater focus.

The demand index also /F1 lph, i7( )-66(als)13((h)3(est)-3(,)-23(p-5(f)s)4(in)5177(c)12(69-5(r)-33(tho)-653(ra)13(6(


a)
Jaffna
0.022 - 0.037
Districts
b)
DSD-supply-index
7.38 - 13.54
Districts
Hambantota
Anuradhapura
Batticaloa
Monaragala
Trinco
Kalutara
Ratnapura
Colombo
Ampara
Kilinochchi
Mannar


Demand index
Districts
Vavuniya
Mannar
Trincomalee
Anuradhapura
Puttalam
Kurunegala
Matale
Districts
Vavuniya
Mannar
Trincomalee
Anuradhapura
Puttalam
Polonnaruwa
Kurunegala
Matale
Monaragala
Trincomalee
Colombo
Nuwara Eliya
Badulla


a)
Supply-Demand index - tanks level
b)
Supply-Demand index -
Mannar
Kurunegala


a)
Supply-Demand-GWR index
0.015 - 0.019
0.019 - 0.024
0.024 - 0.055
0.055 - 0.059
0.059 - 0.384
Districts
b)
Supply-Demand-GWR index
0.08 - 0.3
0.3 - 0.59
0.59 - 1.06
1.06 - 2.16
Districts
Mullaitivu
Mannar
Trincomalee
Kurunegala
Matale
Kandy
Ampara
Kegalle
Gampaha
Kalutara
Monaragala
Galle
Hambantota
Tambantota
Puttalam
Mullaitivu

of pre-processing that was needed to combine information from across multiple sources before

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Board January 2005.

Forest	Forest Land
Forest – Protected	Forest Land
Grass	Forest Land
Mangroo	Forest Land
Palmyra	Forest Land
Inland-Island	Island
Sea-Island	Island
Salter	Other
Prawn	Prawn
Quarry	Rocks
Rock	Rocks
Sand	Sandy areas
Tank	Water source - Tank
Well	Water source - Well
Bay	Waterbodies
Chanel	Waterbodies
Lagoon	Waterbodies
Lake	Waterbodies
Pond	Waterbodies
Reservoir	Waterbodies
Stream	Waterbodies

Lewaya	Wetland
Marshland	Wetland

There are six main aquifers in Sri Lanka with an additional aquifer found throughout the weathered basement (Figure 4). Geology and hydrogeology of these aquifer systems vary considerably across the country (Table 3). Shallow karstic aquifer composed of Miocene limestone with sandstone sequences is found in Jaffna peninsula that is of considerable productivity (yield 400 L/min) and has been extensively used over the years (Panabokke and Perera, 2005; Indika et al., 2022). Shallow sandy aquifer is et 2

Shallow alluvial aquifer	Holocene	Unconsolidated sand and gravel	Unconfined; hydraulically connected to rivers	920	Recharge annually from rainfall and river water	Highly likely if present	Vulnerable to saltwater intrusion; drawdown risk is low
Shallow karstic aquifer (Jaffna peninsula)	Miocene limestone	Limestone with sandstone sequences	Confined and karstic in nature	400	Recharge annually from rainwater	Potentially highly likely if present	Vulnerable to pollution and over-exploitation
Shallow sandy aquifer	Sands of Quaternary age	Freshwater lenses in sand layers or dunes	Unconfined; highly productive	225	Recharge annually from rainwater in the season a	Highly likely if present	Highly vulnerable to saltwater intrusion

In this paper, we mask out populations classified as urban, dense urban, semi-dense urban and peri urban. That is we remove populations located in grid cells type 30, 23, 22 and 21 from consideration in agriculture dependent population calculations.