

Spatial and temporal variations of trophic state in a tropical reservoir and its relation with land use land cover

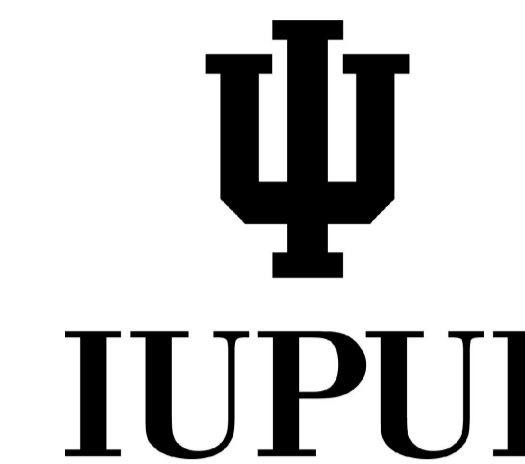


2015 Aquatic Sciences Meeting
AQUATIC SCIENCES: GLOBAL AND REGIONAL
PERSPECTIVES — NORTH MEETS SOUTH

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Background

- * Land Use Land Cover (LULC) impacts water quality;
- * Trophic state is related to the carbon emission (Pacheco et al. 2013);
- * BALCAR project (<http://www.dsr.inpe.br/hidrosfera/balcar/>):
 - Study of greenhouse gas emissions in tropical reservoirs.
- * Objective: evaluate the relation between the watershed LULC and the trophic state in a tropical reservoir.

Study area - Funil Reservoir

- * Located in the Paraíba do Sul River Basin - Southern Brazil;
- * Primary use: drinking water, irrigation, power generation and aquaculture;
- * Receive waste from one of the main Brazilian industrial areas.

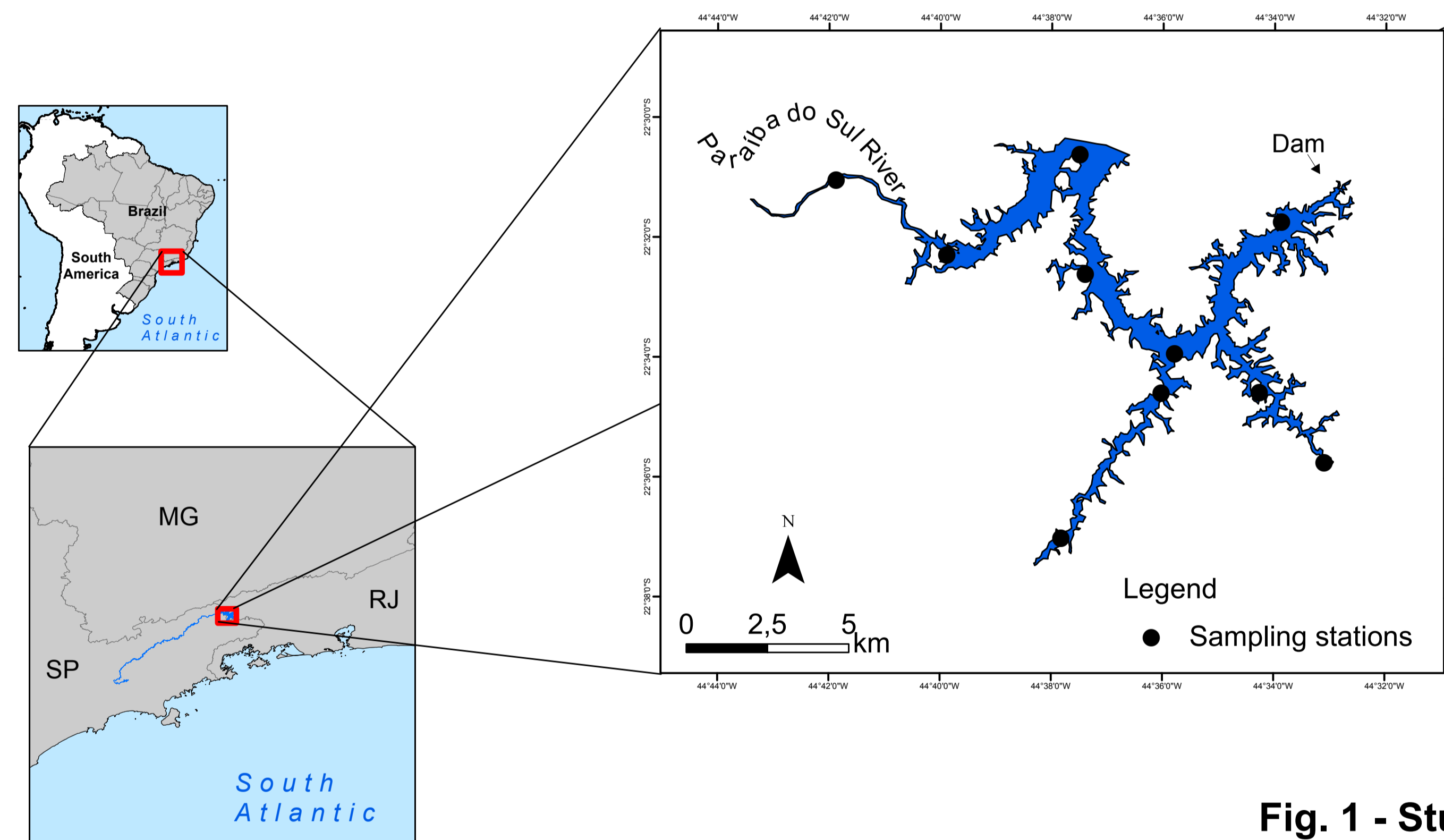


Fig. 1 - Study area

Material and Methods

Remote Sensing data - LULC maps

- * Multispectral Scanner (MSS) onboard Landsat-1 (1970);
- * Thematic Mapper (TM) onboard Landsat-5 (2010).

Limonological data:

- * Total phosphorous (Pt) (see sampling points in Fig. 1);
- * Collected between 2011/2012 - different seasons.

Trophic State Index (TSI) - (CETESB, 2007):

$$TSI = 10 \times (6 - (1.77 - 0.42 \times \ln(Pt) / \ln(2)))$$

Trophic State	TSI	Pt (mg m ⁻³)
Ultraoligotrophic	TSI ≤ 47	Pt ≤ 8
Oligotrophic	47 < TSI ≤ 52	8 < Pt ≤ 19
Mesotrophic	52 < TSI ≤ 59	19 < Pt ≤ 52
Eutrophic	59 < TSI ≤ 63	52 < Pt ≤ 120
Supereutrophic	63 < TSI ≤ 67	120 < Pt ≤ 233
Hipereutrophic	TSI > 67	Pt > 233

Table 1 - TSI classes

Preliminary results

- * Increase in the urban area from 1970 to 2010: ~130%;
- * Forestry areas: reduction of 30%;
- * Agriculture/Pasture: increase of ~15%.

Table 2 - LULC analysis

LULC class	Area (km ²)	
	1970	2010
Agriculture	140	154
Pasture	3916	4309
Water	51	55
Sand extraction	23	25
Forestry	2603	1796
Reforestation	66	387
Urban areas	169	400
Cloud	154	0

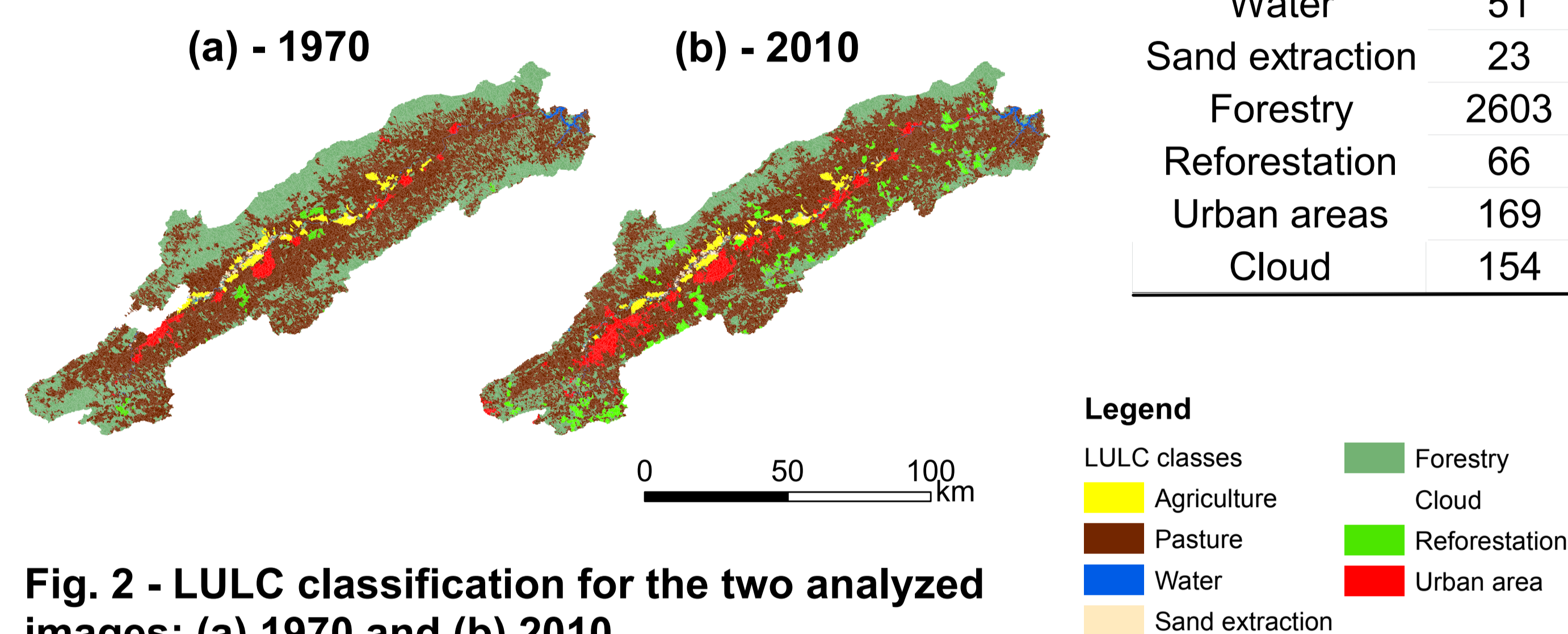


Fig. 2 - LULC classification for the two analyzed images: (a) 1970 and (b) 2010.

- * High (low) TSI during spring and winter (summer and autumn);
- * Higher TSI in the transition zone compared to the region near the dam.

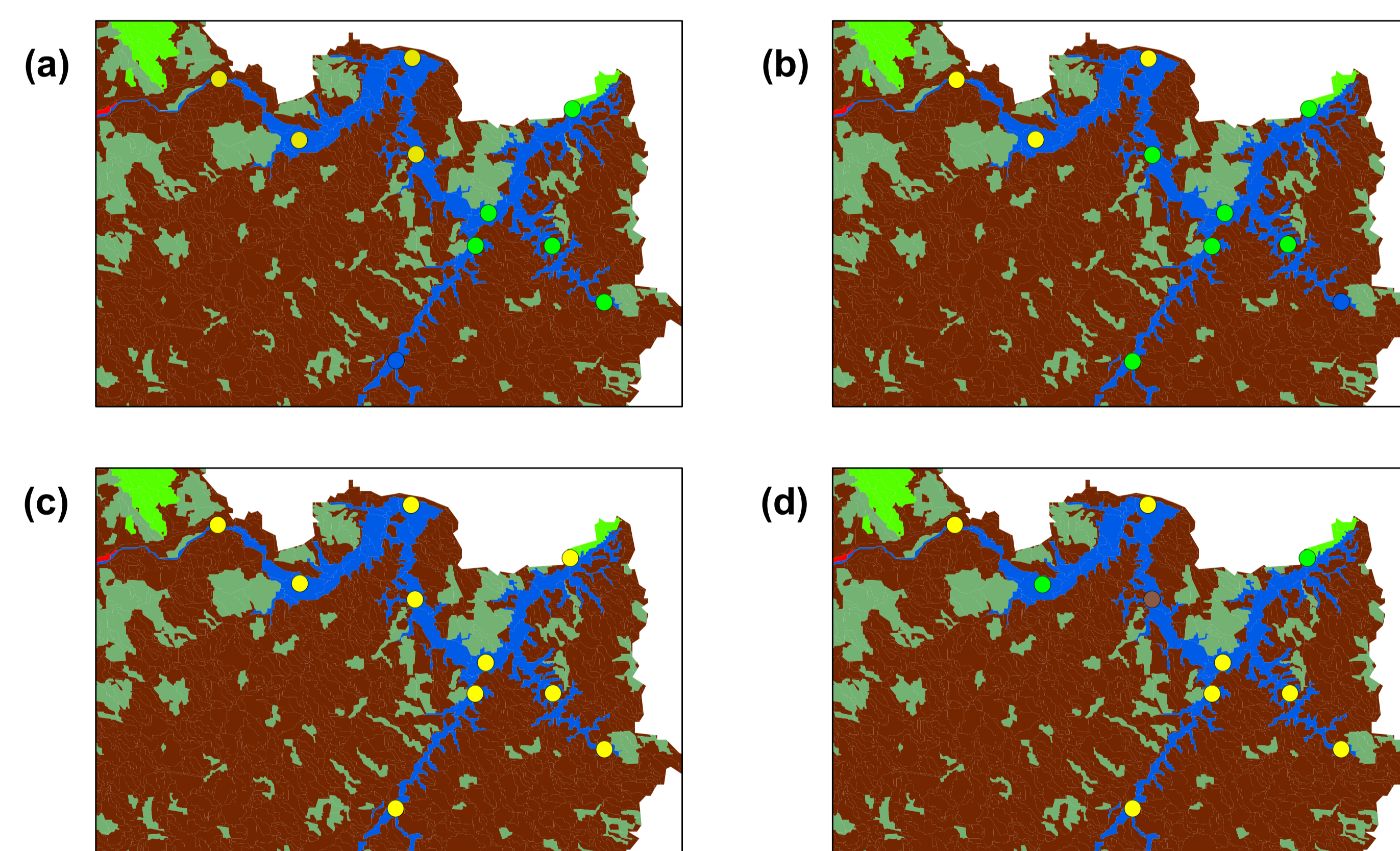


Fig. 3 - Trophic State Index analysis: (a) Summer; (b) Autumn; (c) Winter; and (d) Spring.

● Ultraoligotrophic ● Oligotrophic ● Mesotrophic ● Eutrophic

Conclusions

- * The LULC has changed considerably in the last 4 decades;
- * The increase of unplanned urban areas and agriculture activity impacted the water quality of Paraíba do Sul River;
- * The TSI of Funil Reservoir is related to the LULC of its watershed, which is predominantly agricultural;
- * Future studies: relation of agriculture cycle and TSI.

References

- 1 - F.S. Pacheco, F. Roland and J.A. Downing, "Eutrophication reverses whole-lake carbon budgets," *Inland Waters*, 4, 41-48, 2013.
- 2 - CETESB. "Inland water quality in São Paulo State" Report, 2007.