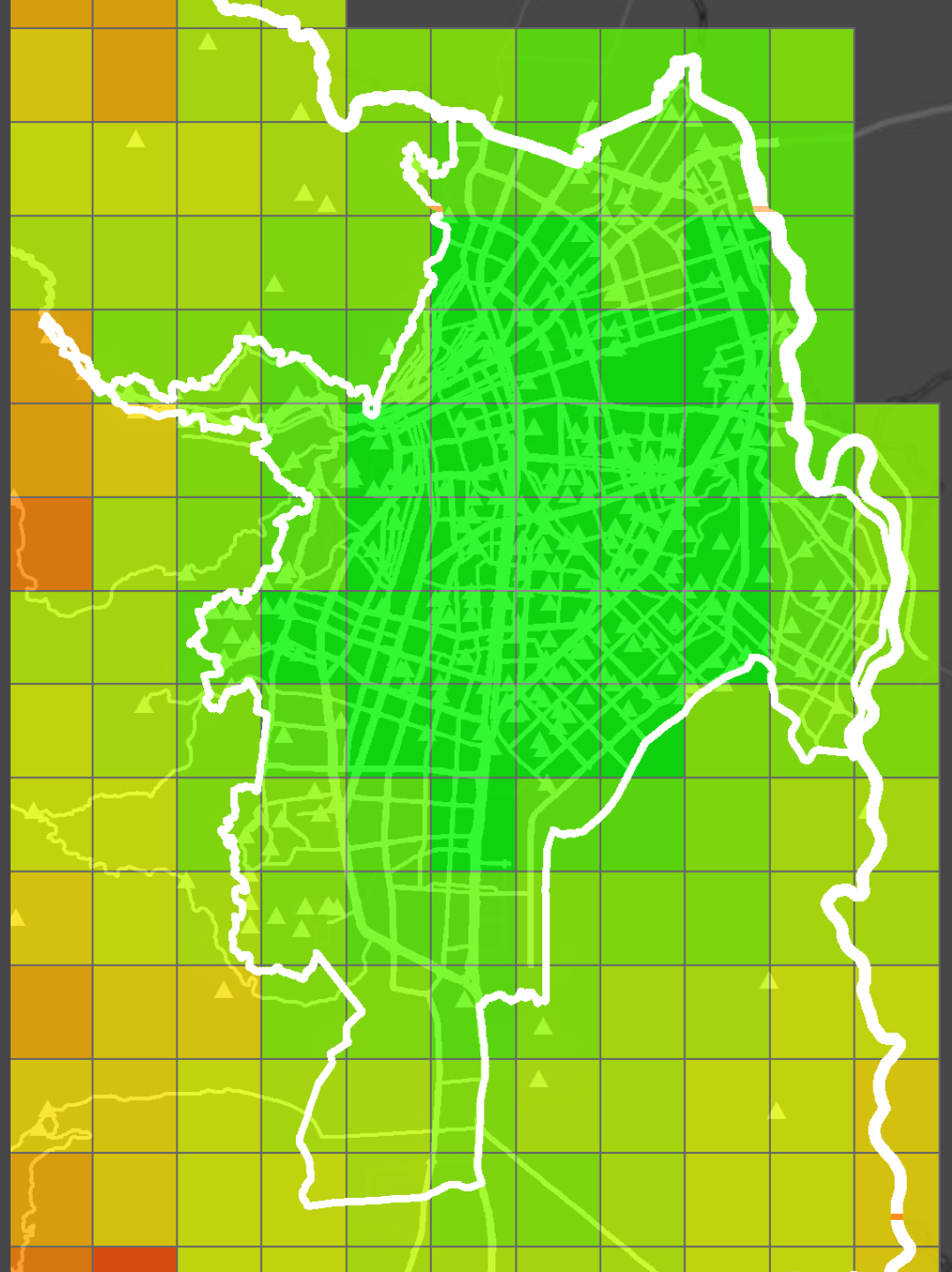
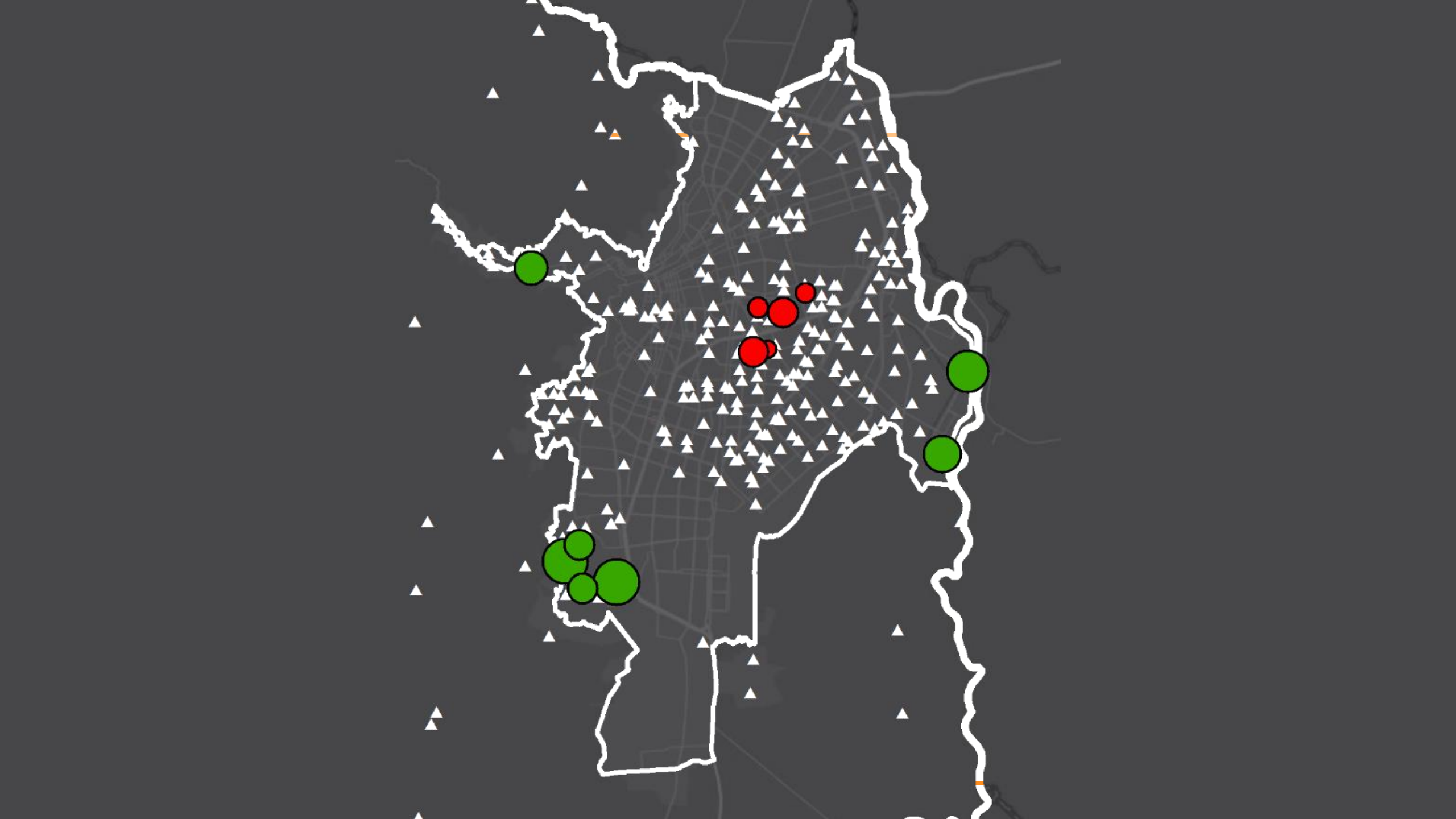
World Bank, Cali

Optimization of school infrastructure networks

Riccardo Scarinci

29/03/2019, Lausanne

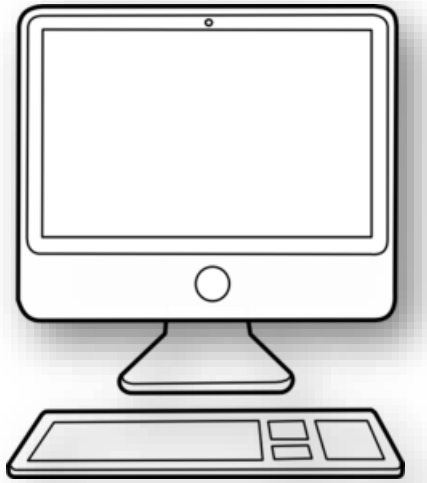




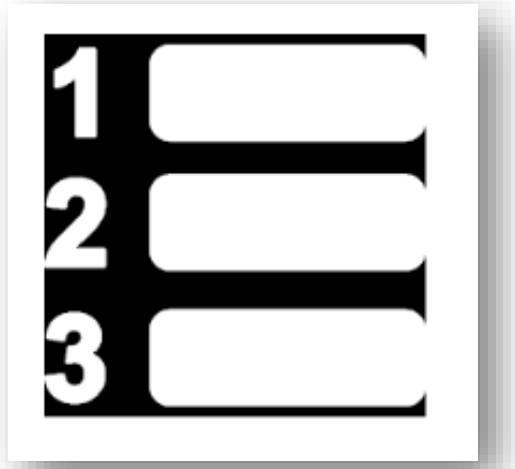
Optimization software

Inputs

Software



Output



accessibility limitations

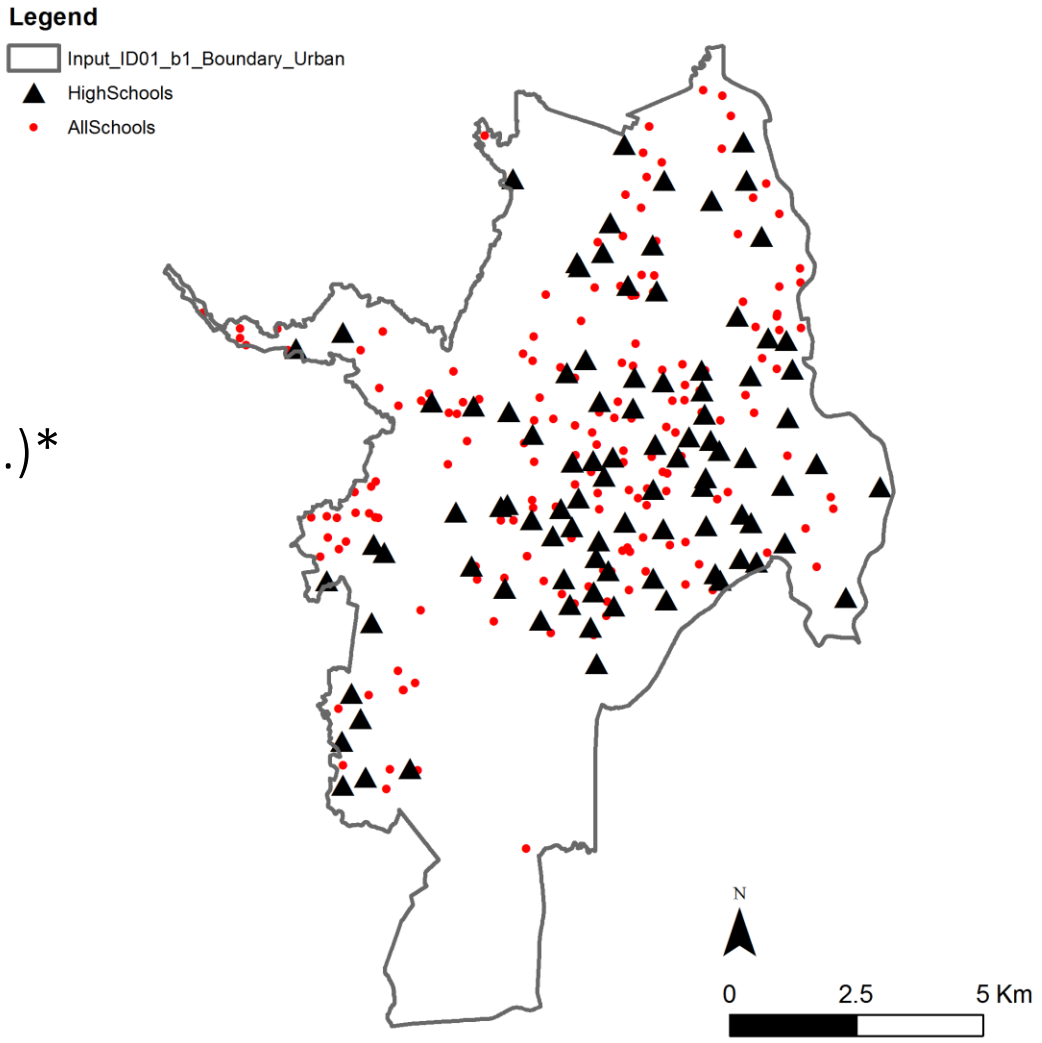
mathematical model Mix Integer Linear Prog.

opt. school interventions

Data input

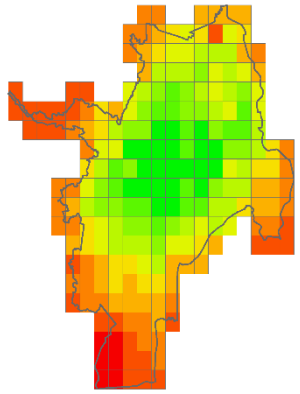
High-Schools	84
Budget 2019	20 Million USD
	84/392 % school proportional
Cost increase capacity	4,500 USD/student
Cost decrease capacity	1,000 USD/student (USA comp.)*
Cost fix modification	70,000 USD (10% avg modif.)*
Min capacity	10% less than current
Max capacity	10% more than current
Scenarios	4 evaluated

*RS estimate



Scenarios

S1 - maximize accessibility



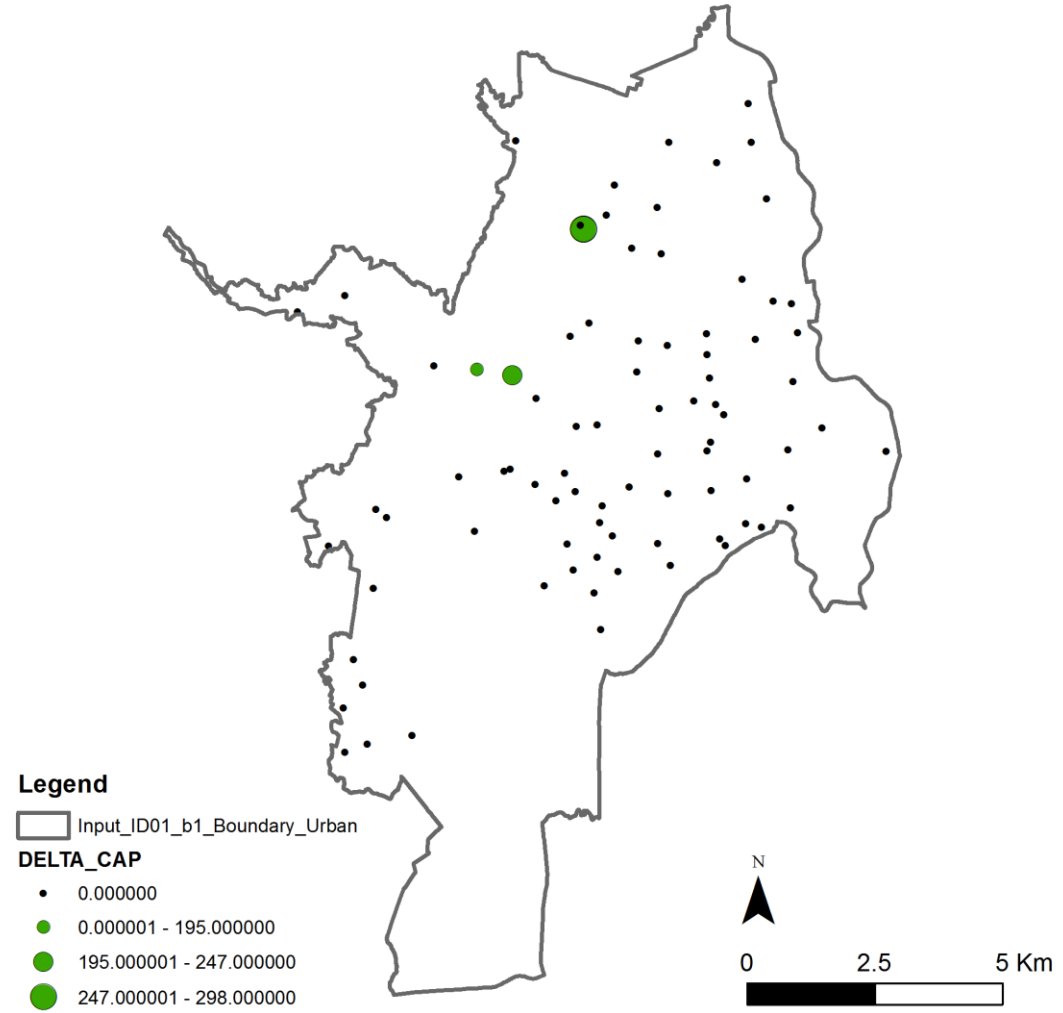
S2 - minimize infrastructural gap

S3 – max accessibility and min infrastructural gap

S4 – max accessibility and min infrastructural gap **with equity**

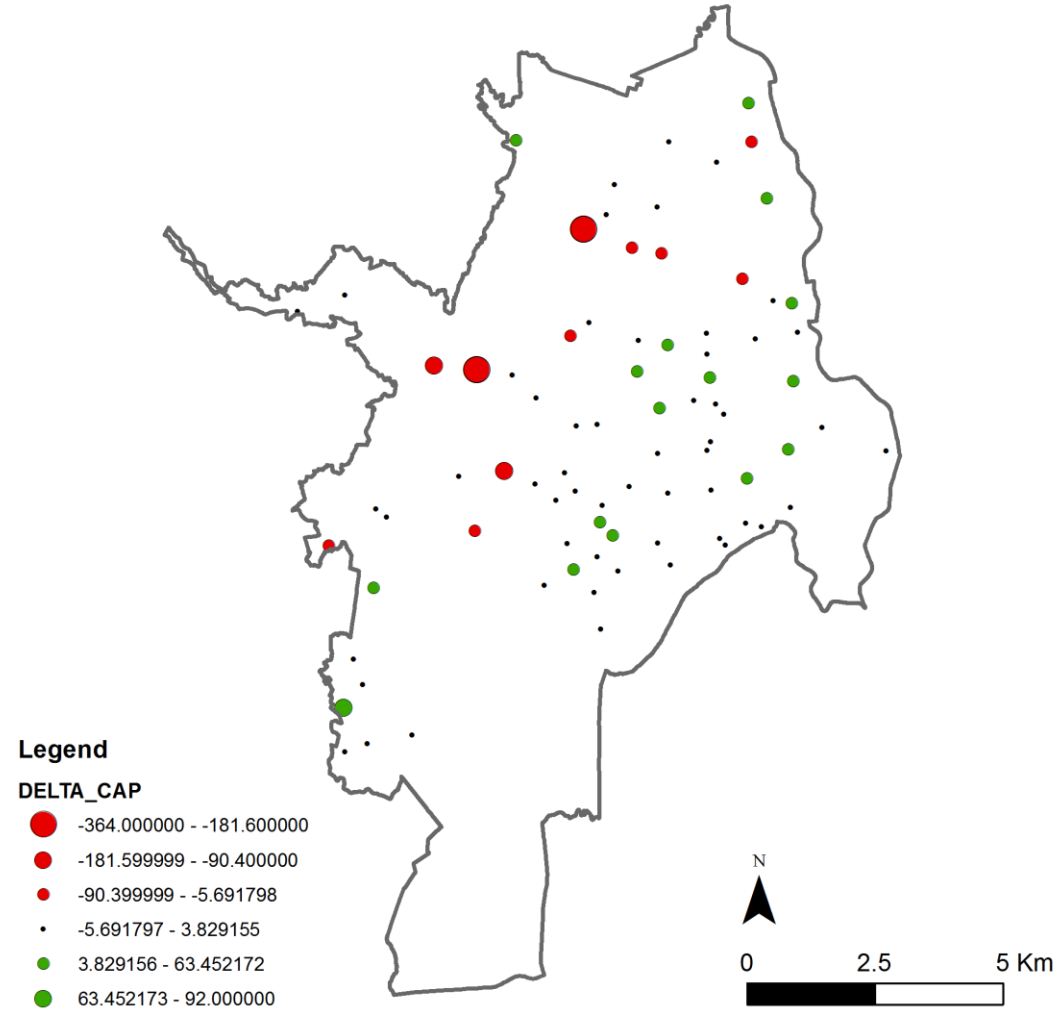
S1 - maximize accessibility

Accessibility:	+1.7%
Equity:	-2.0%
Infrastructural gap:	+3.7%
Places added:	741
Places removed:	0
Budget used:	100%
Total school modified:	3
Computation time:	29 min



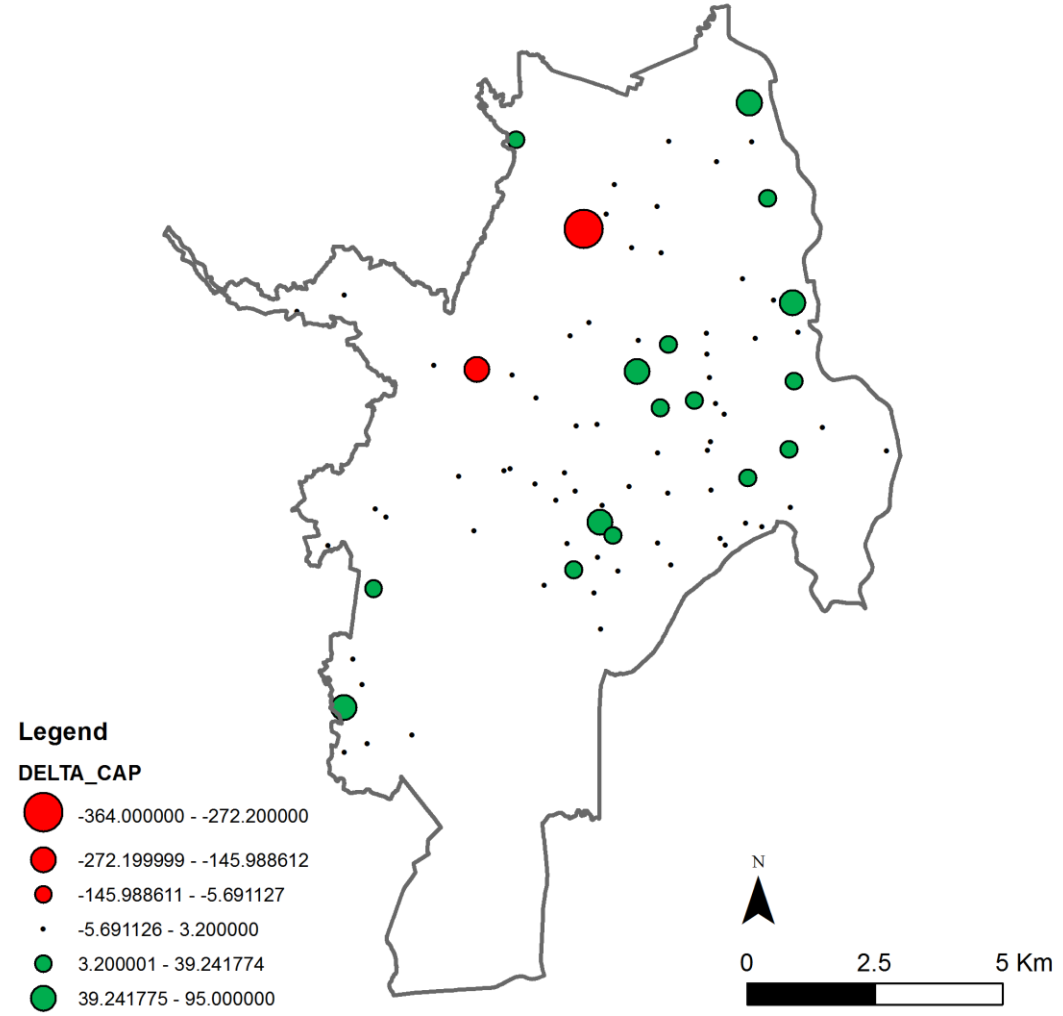
S2 - minimize infrastructural gap

Accessibility:	-1.3%
Equity:	+1.8%
Infrastructural gap:	-9.3%
Places added:	646
Places removed:	1,226
Budget used:	100%
Total school modified:	28
Computation time:	60 min* (5%)



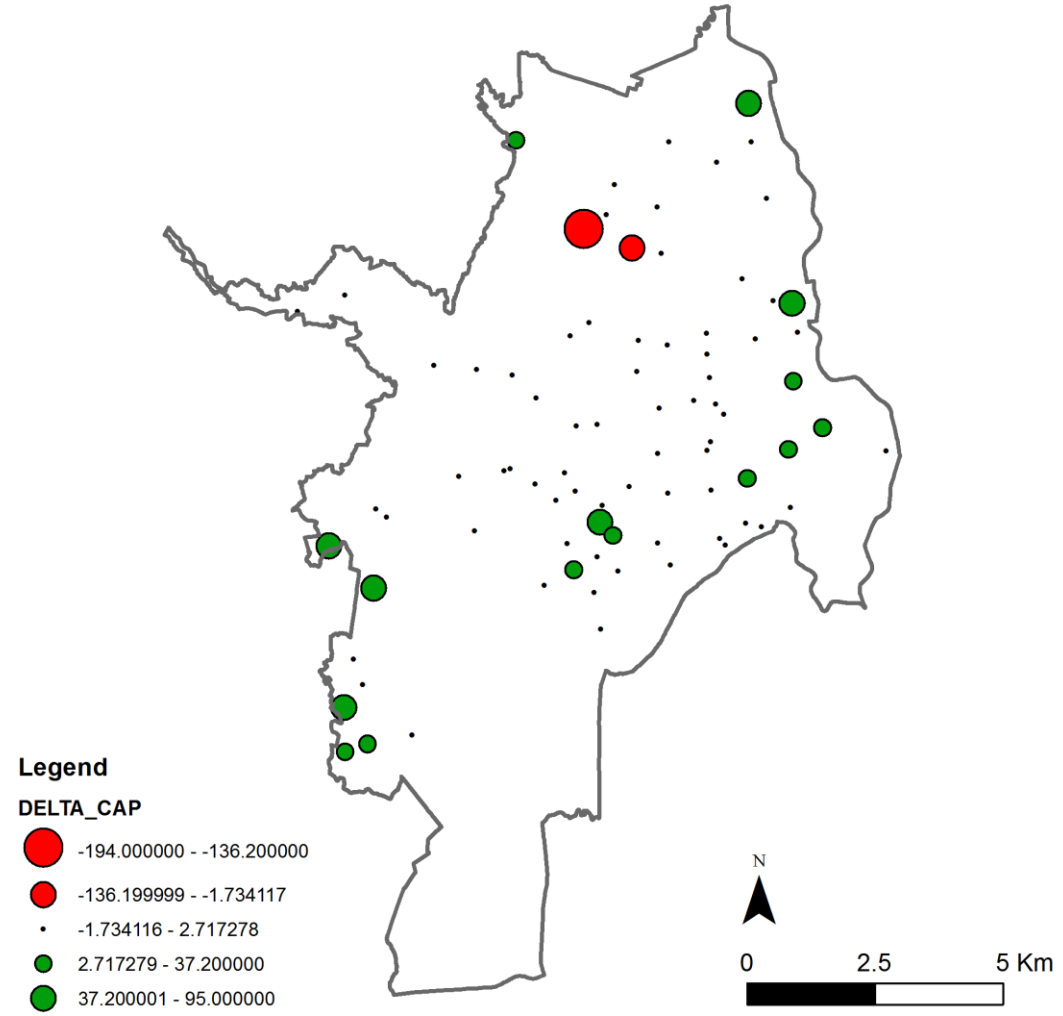
S3 – max accessibility and min infrastructural gap

Accessibility:	+0.1%
Equity:	-0.2%
Infrastructural gap:	-5.7%
Places added:	633
Places removed:	526
Budget used:	100%
Total school modified:	19
Computation time:	60 min* (9%)

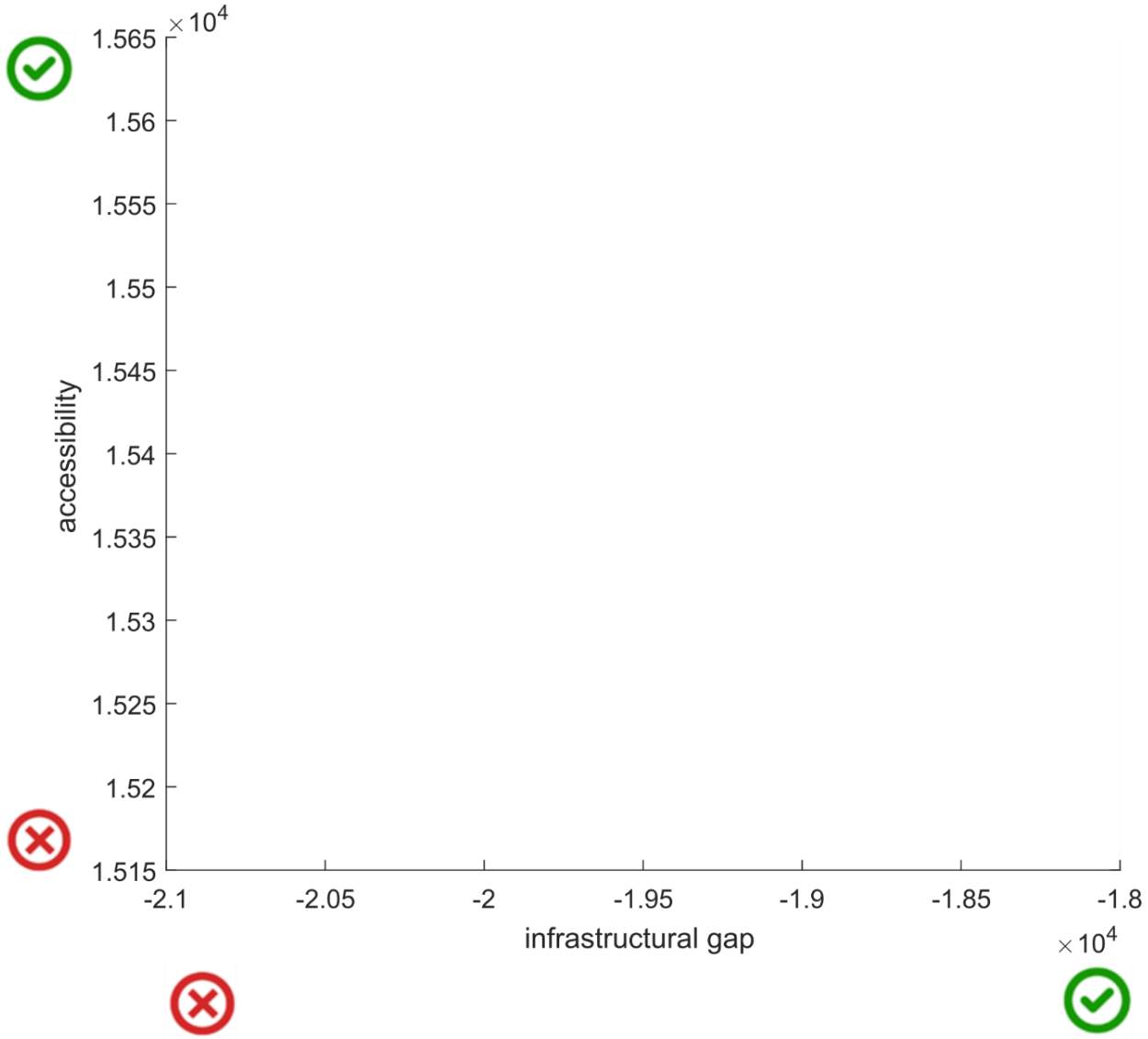


S4 – max accessibility and min infrastructural gap with equity

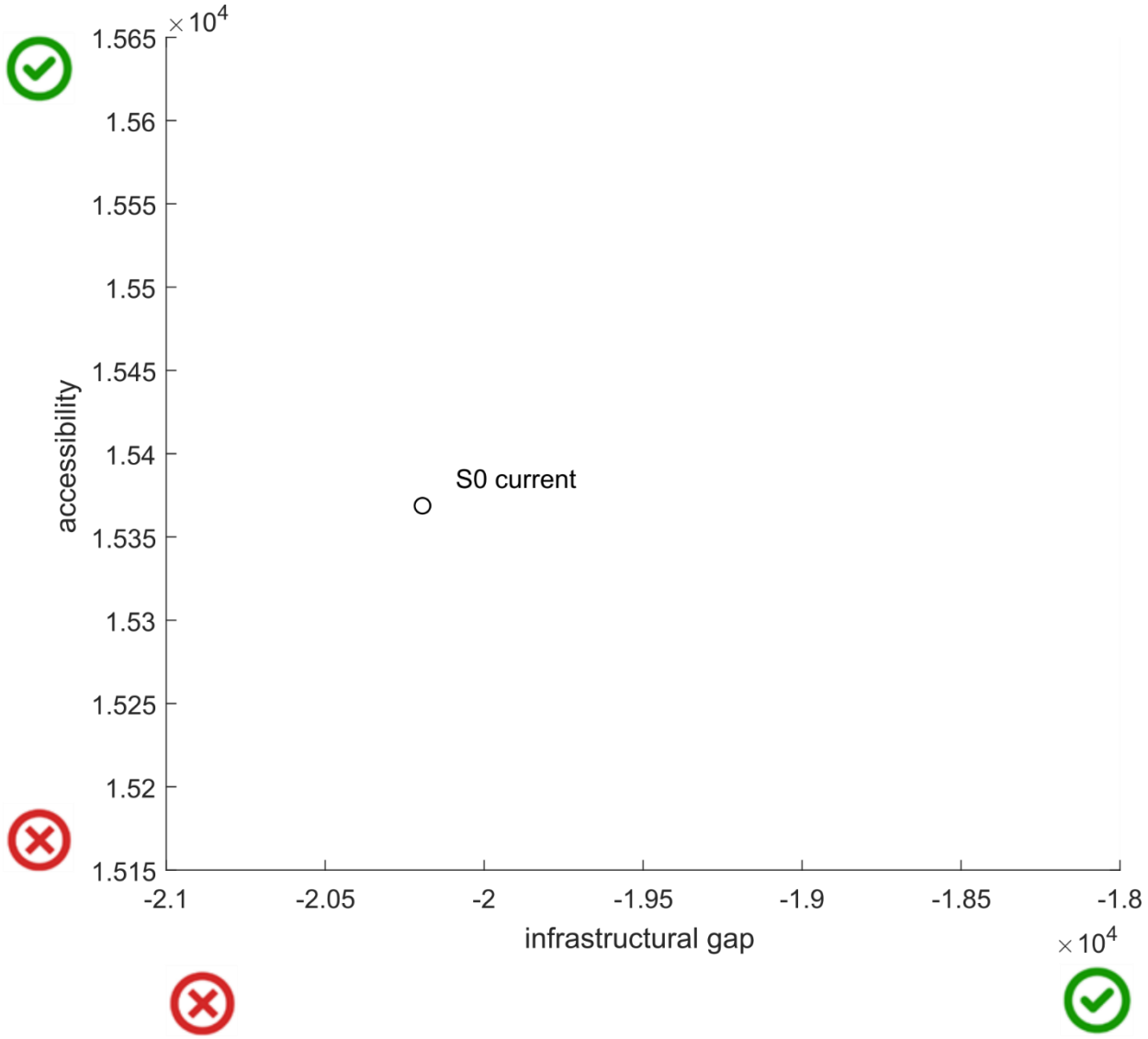
Accessibility:	+0.6%
Equity:	0.0%
Infrastructural gap:	-3.2%
Places added:	608
Places removed:	273
Budget used:	100%
Total school modified:	17
Computation time:	60 min* (0.4%)



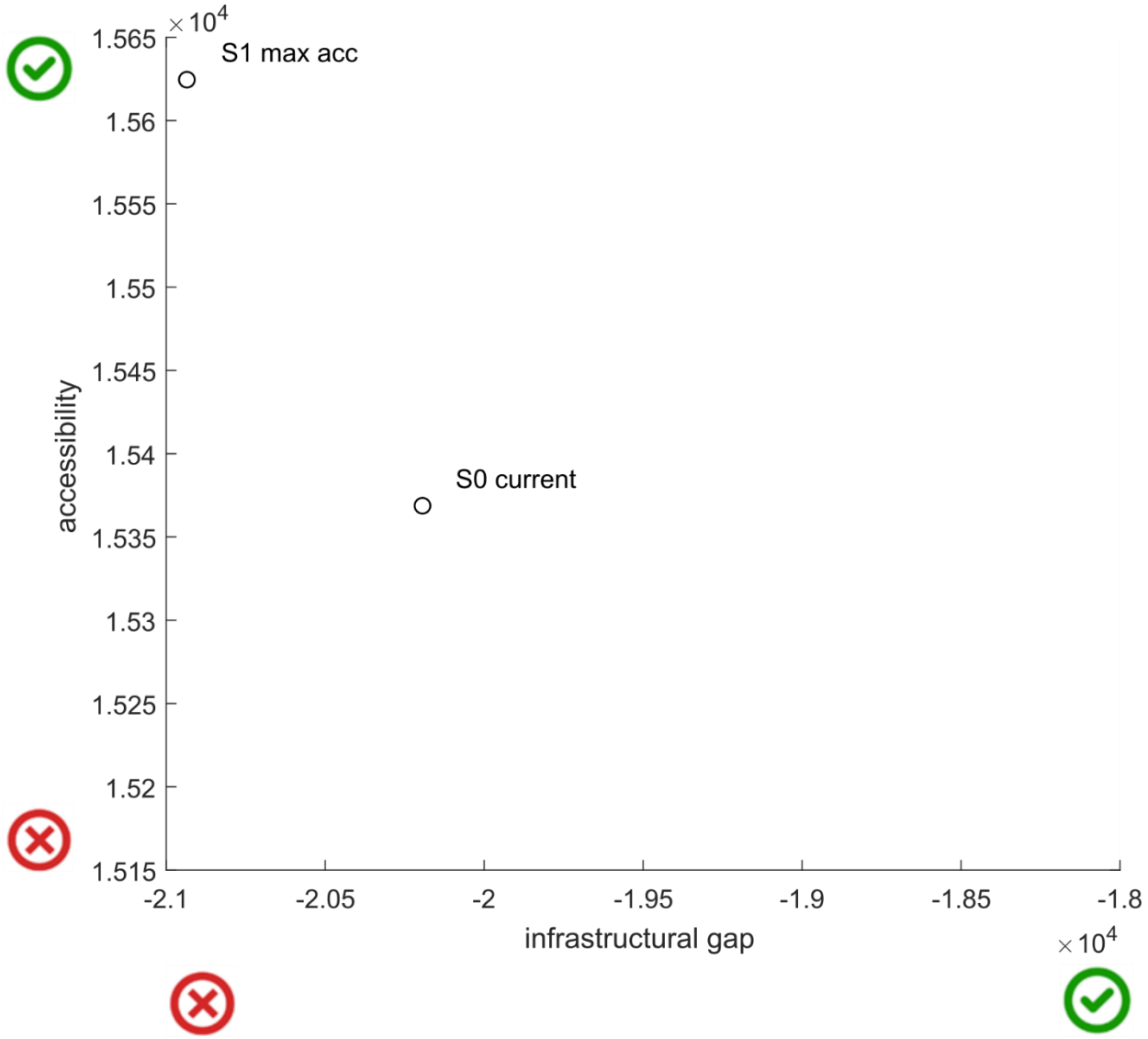
Scenario summary



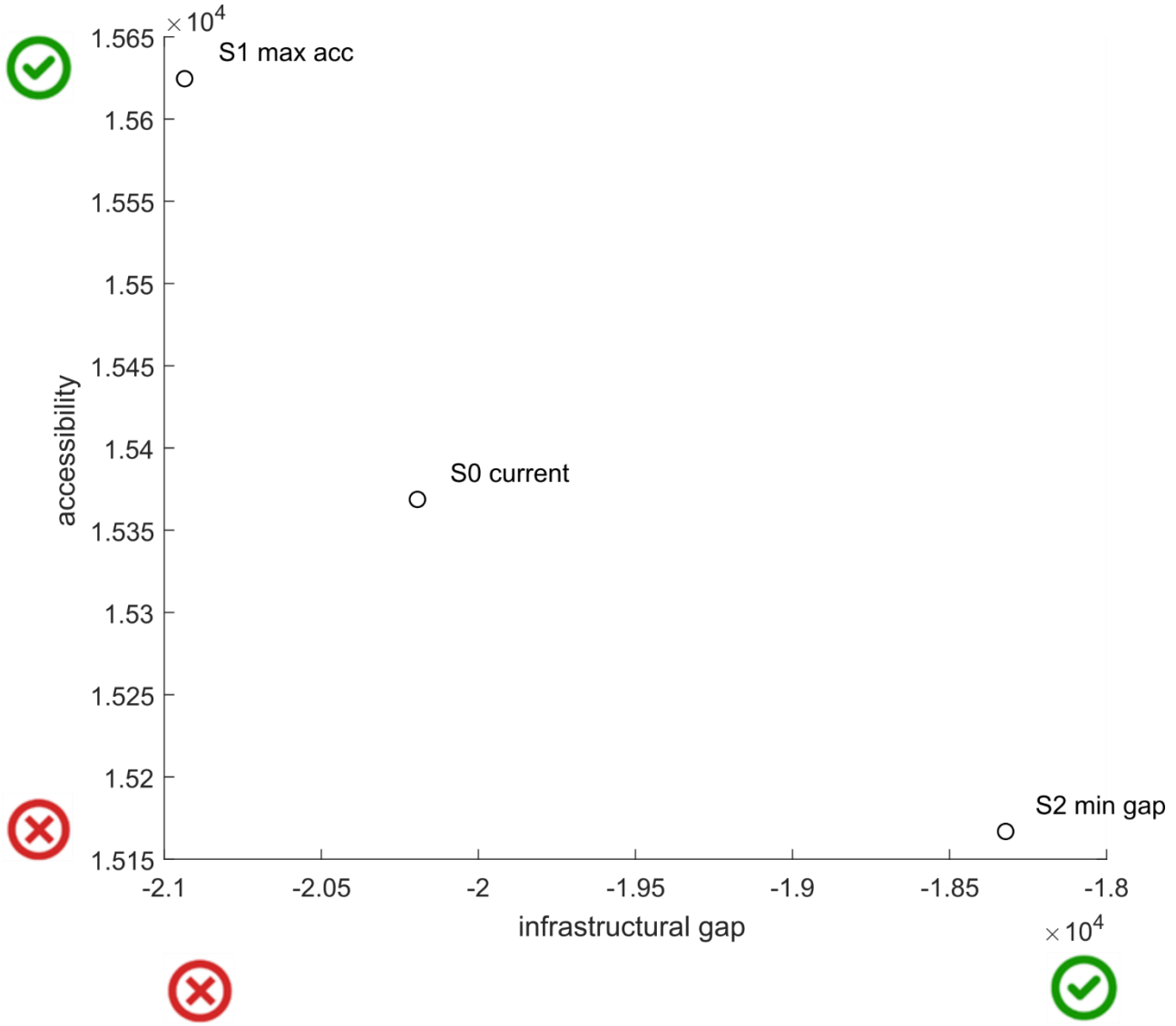
Scenario summary



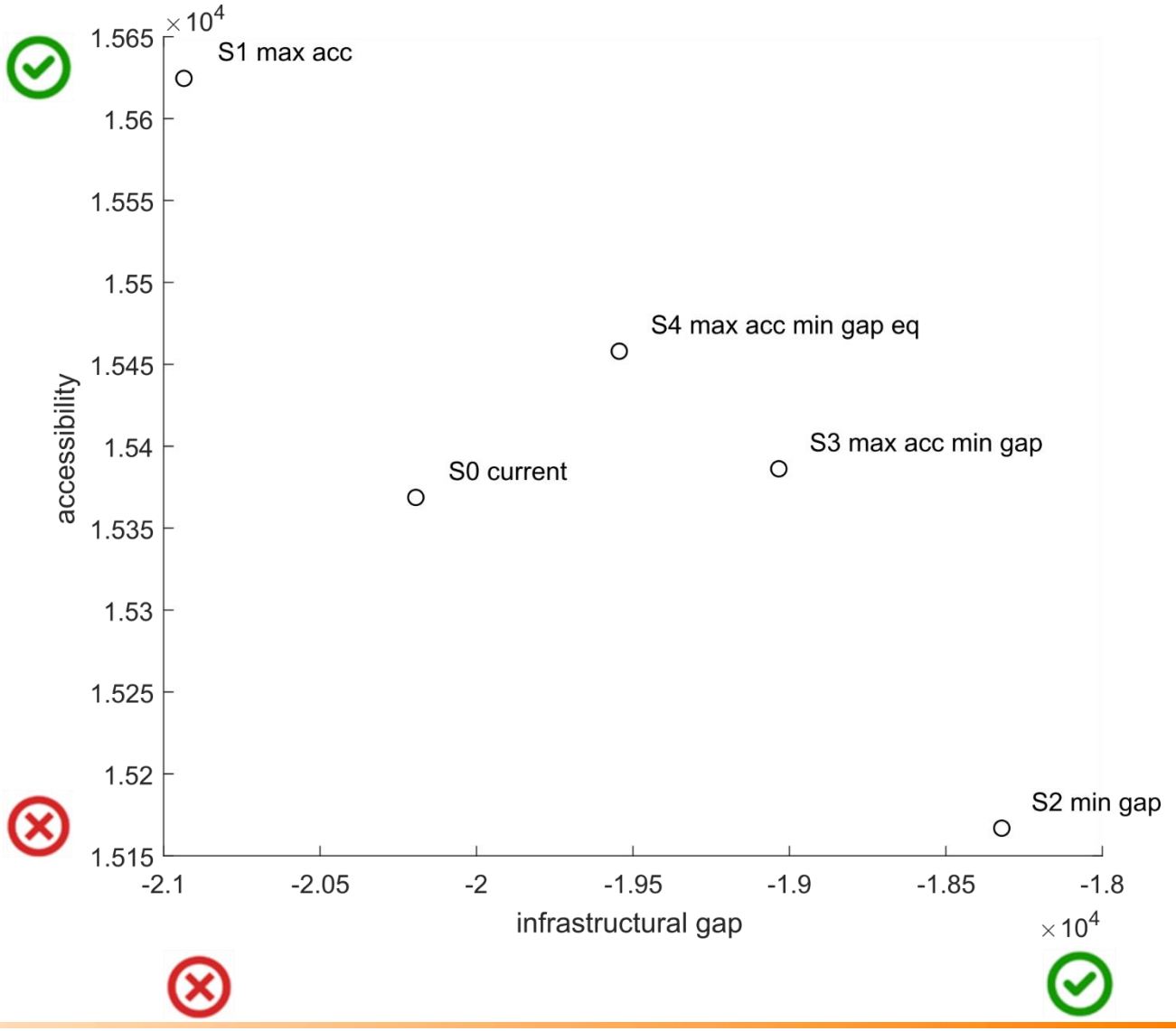
Scenario summary



Scenario summary



Scenario summary



Conclusions

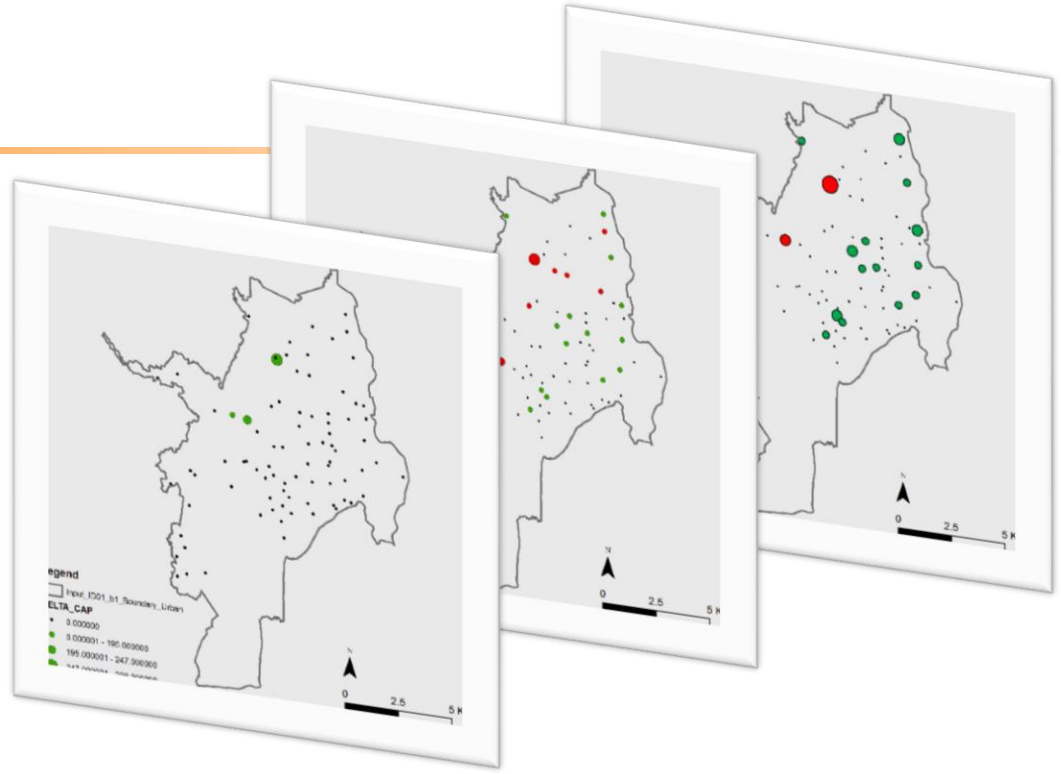
Optimal investment interventions

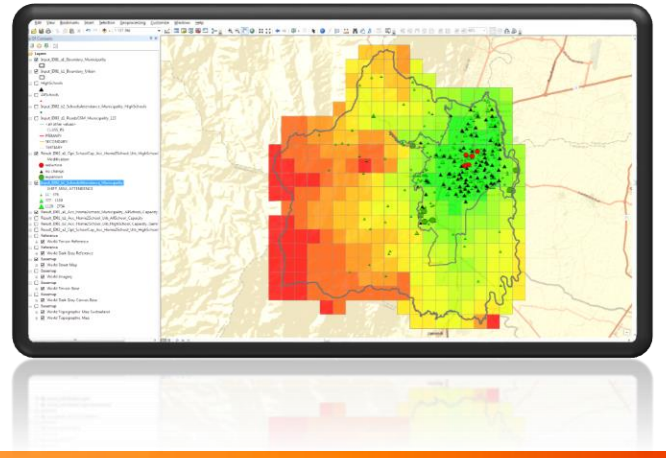
(technical solution, NO POLITICAL DECISION, DSS)

Trade-off between objectives (accessibility, gap)

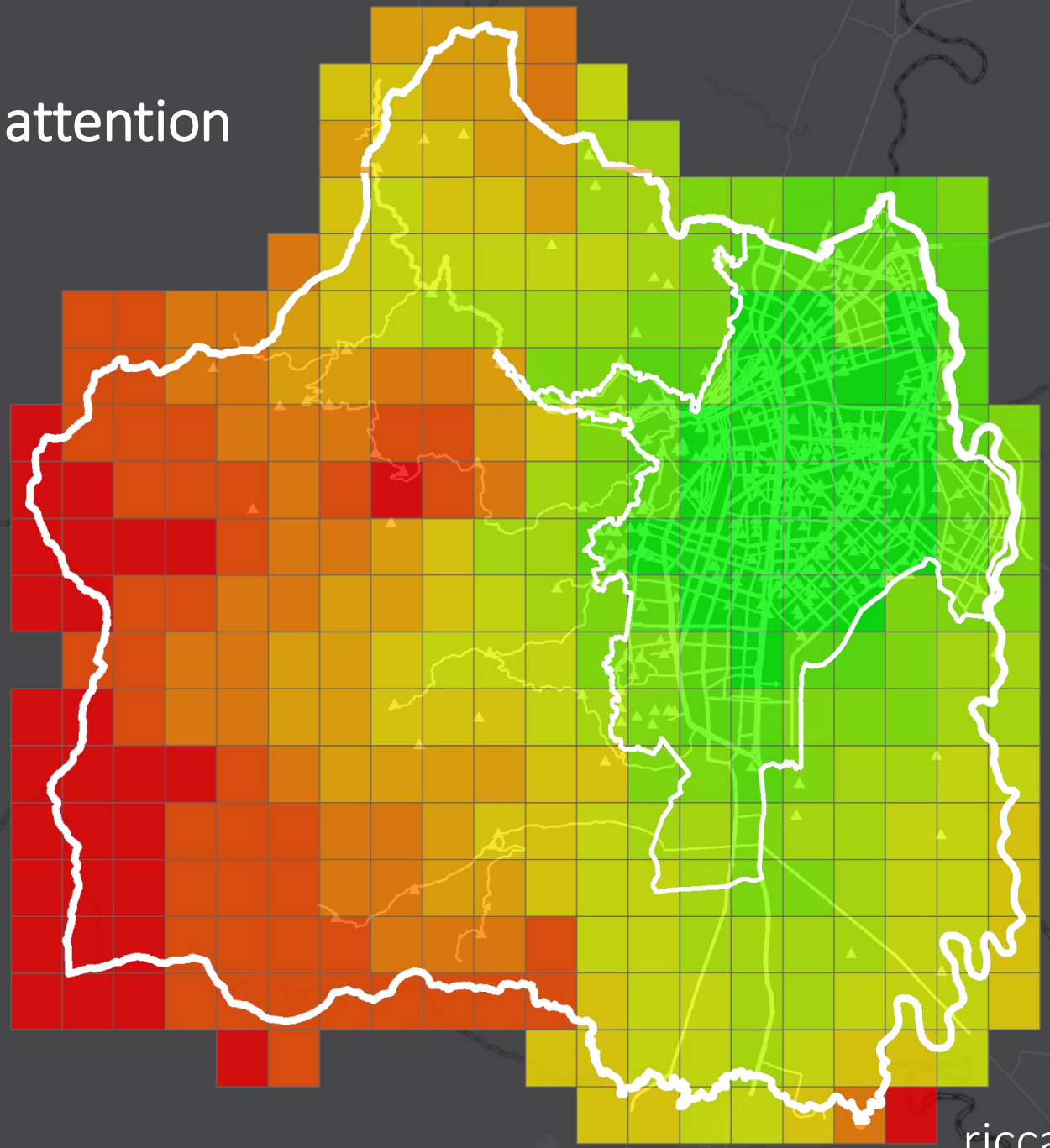
Output

- GIS geodatabse





Thank you for your attention



Riccardo Scarinci
riccardo.scarinci@gmail.com