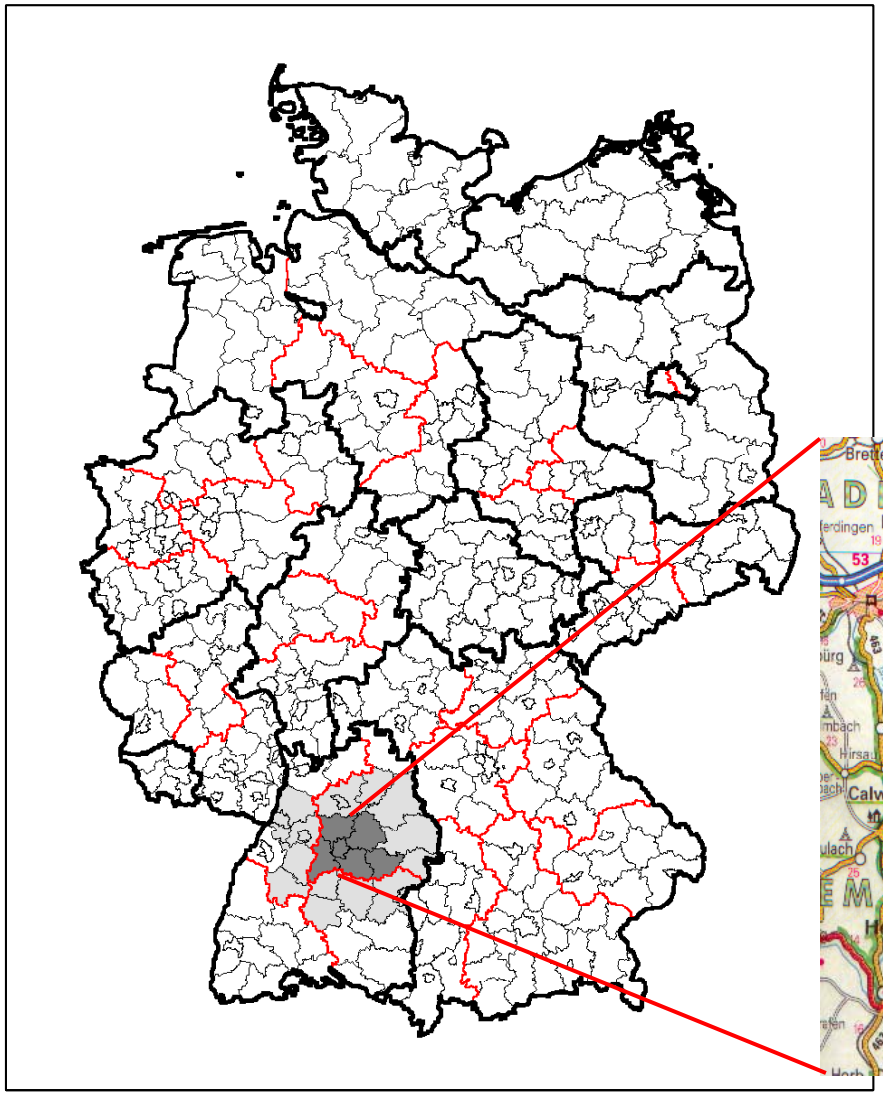
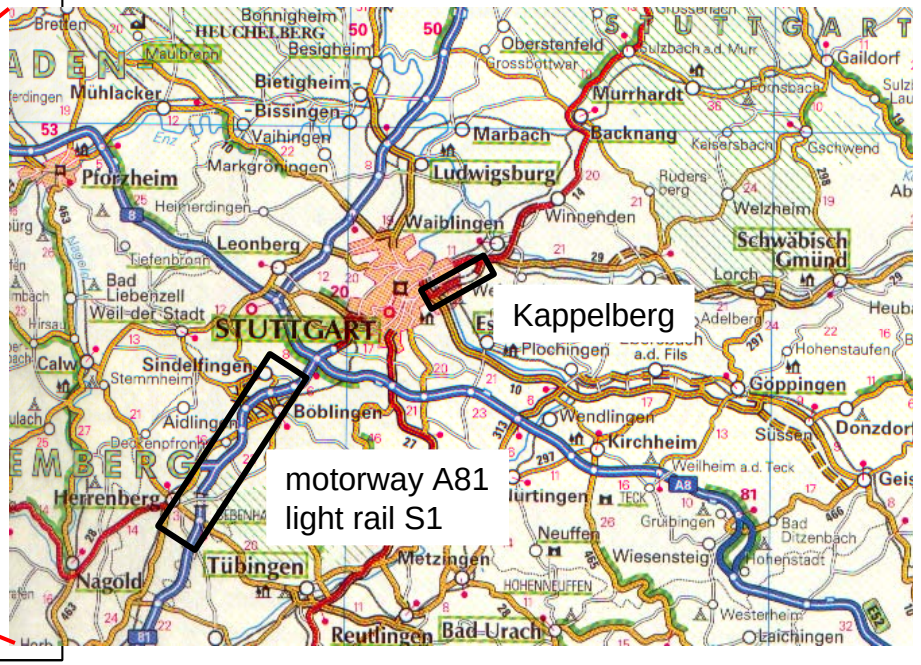
Stuttgart Case Study

Inhalt

- The Case Study Area
- The Structure of the Simulation Model
- Common Policies
- Results

The Stuttgart Case Study I





The Stuttgart Case Study II

Population:

Region 2,6 mill. inhabitants

5 administrative districts (Kreise)

179 municipalities (Gemeinden)

Stuttgart 570,000 inhabitants

148 town quarters (Stadtviertel)

Economic Situation:

workplaces:

Region 1,24 mill. (513 workplaces per 1000 inhabitants) in 1995

30 % of the economic power of Baden-Wuerttemberg

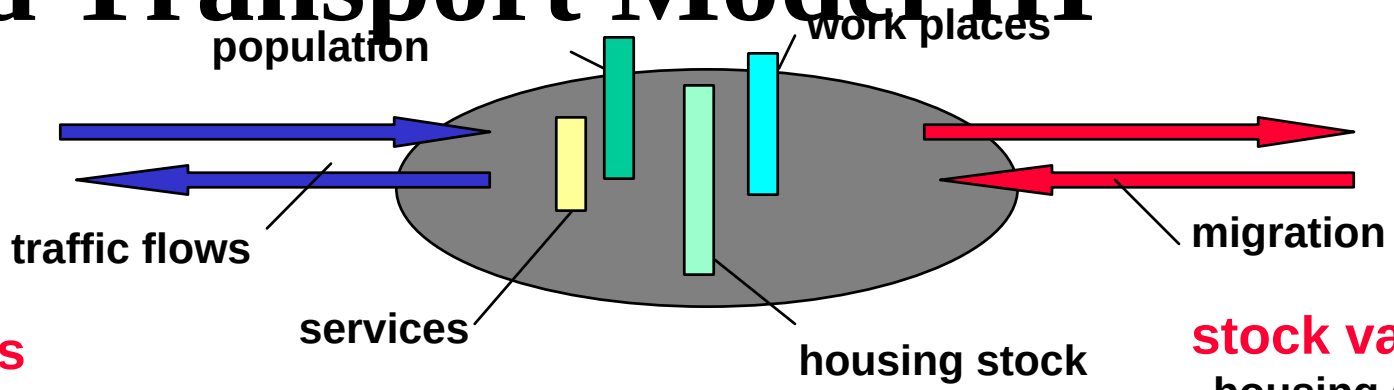
industry and research institutes

DaimlerChrysler, Porsche, Siemens Nixdorf, IBM, Hewlett Packard, Kodak,

2 universities (40,000 students), 6 academies, German Aerospace Centre DLR, Fraunhofer Institute, Max-Planck-Institute

100 different credit institutes, 133 publishing houses

The Structure of the Urban and Transport Model III



flows

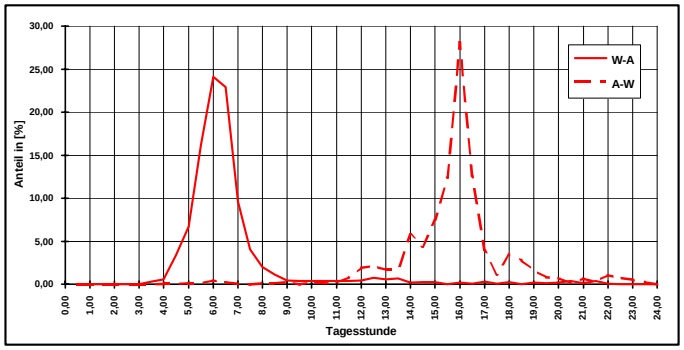
- information
- traffic
- commodity
- etc.

needs - facilities
demand - supply

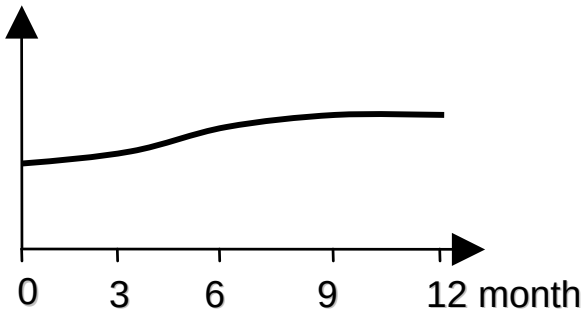
stock variables

- housing stock
- workplaces
- population
- etc.

short-time development

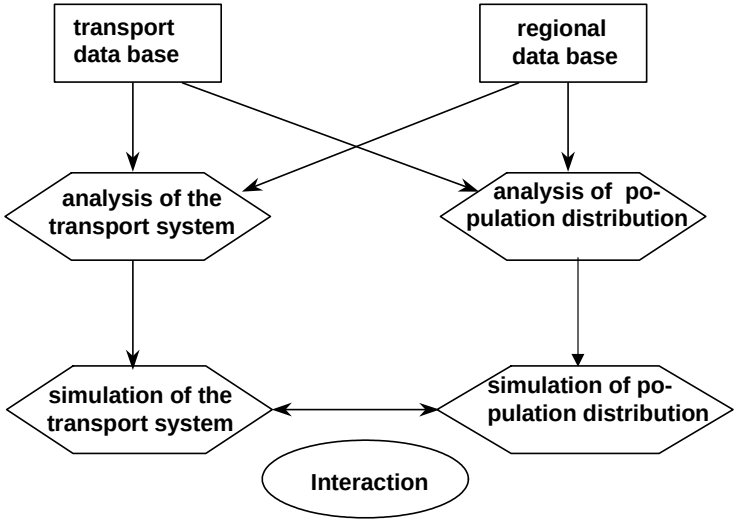


long-time development

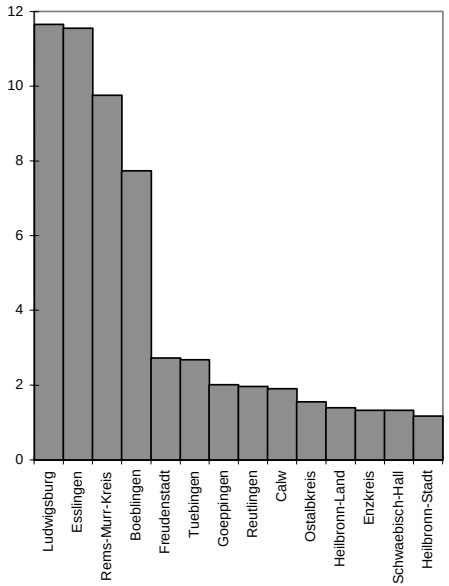


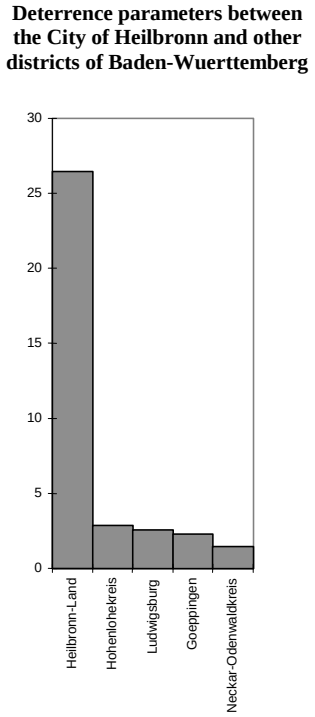
The Structure of the Urban and Transport Model II

The structure of the integrated transport and urban/regional modell

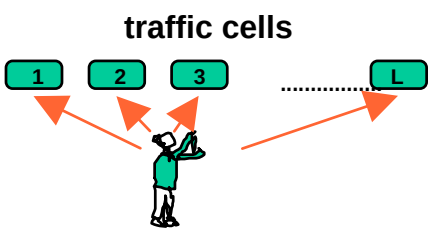


Examples of networking effects of cities

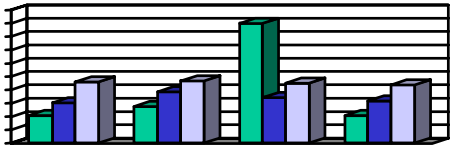




The Structure of the Urban and Transport Model IV



Urban/Transport System
multi-component system
with non-linear interactions

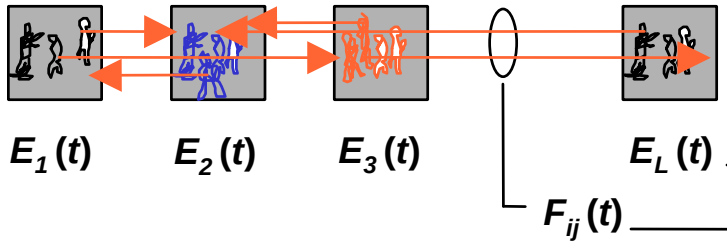


short-time population distribution

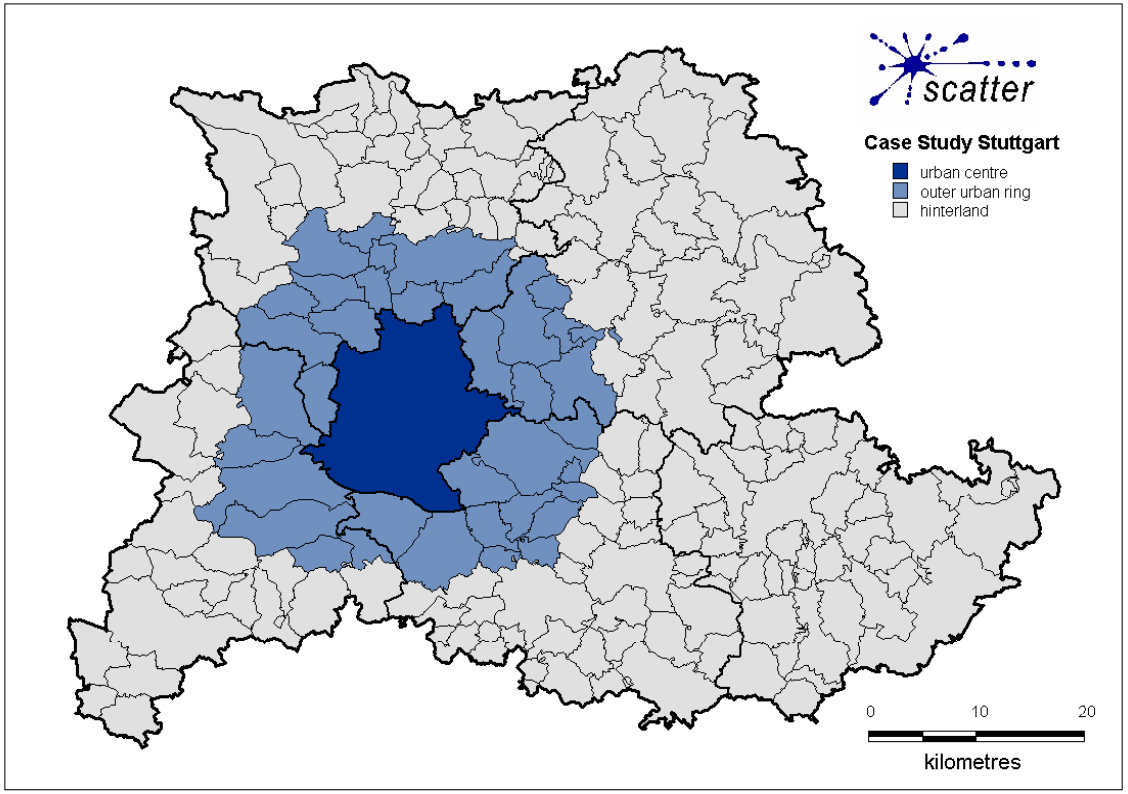
micro level
decisions of individual agents:
e.g. trip and migration decisions

macro level
behaviour of macro variables:
trip frequencies, stock variables

master equation
probability in configuration
space: decision pattern



Zoning System



Reference Scenarios

- **001S**: without motorway A81 and without extension of the light rail line S1 and without road tunnel (tunnel Kappelberg) of the Bundesstrasse B29, in east-direction Schwäbisch-Gmünd / Aalen
- **002S**: with A81, with S1 and without tunnel Kappelberg
- **003S**: with A81, with S1 and with tunnel Kappelberg

Policy Code 111 to 211

Implementation of a radial transport infrastructure linking centre and periphery : rail infrastructure, motorway, buses, HOV

Extension of the light rail (S-bahn) S1 (parallel to the motorway A81) and/or motorway A81:

111S: without A81 / with S1

112S: with A81 / without S1

113S: with A81 / with S1

114S: with A81 / with S1 / with Park&Ride facilities

115S: 114S and building of a new road tunnel (tunnel Kappelberg) of the Bundesstrasse B29, in east-direction Schwäbisch Gmünd / Aalen

External factor : relocation of work places

211S: Relocation of 10.000 workplaces from Esslingen and Stuttgart to Sindelfingen (due to shift of a production plant of DaimlerChrysler)

Policy Code 311S – 331S

Fiscal measures applied to residential developments

311S : annual tax (development impact fee, 670€ / household / year) applied on households locating in non-A- type zones

→ redistribution of the revenue of impact fee to the urban areas, as fiscal incentive to all households located in A-type zones (Stuttgart, Ludwigsburg, Waiblingen, Sindelfingen, Böblingen, Esslingen and Göppingen)

Regulatory measures applied to companies, inspired form the ABC theory

321S : ABC-type policy applied to a part of the tertiary sector:

→obligation (regulatory measure) for all jobs of the employment sector "business services", to locate in A-type zone

Fiscal measures applied to companies, inspired form the ABC theory

331S: ABC-type policy applied to a part of the tertiary sector:

→tax on jobs of the employment sector "business services" locating in non-A-type zone: the tax amounts to 976 €/job

An A zone is a zone of the capital of a district (NUTS3). In general those zones are also served by high quality public transport at regional scale. In these scenario, there are 7 A-zones in the Stuttgart Region

Policy Code 411S to 521S

Measures aiming at a modal shift towards public transport by increasing travel costs or time by private car

411S: increase by 50 % of the cost per km for all drivers.

412S: cordon pricing (the cordon is located just inside the city of Stuttgart and the adjacent communes Ludwigsburg, Sindelfingen, Böblingen and Esslingen): tariff : 7.5 €/day applied to all drivers

Measures aiming at a modal shift towards public transport by decreasing travel costs or times by public transport, or by providing P&R facilities

512S decrease of fare by 20%, applied to all public transport users

Policy Code 811S to 813S

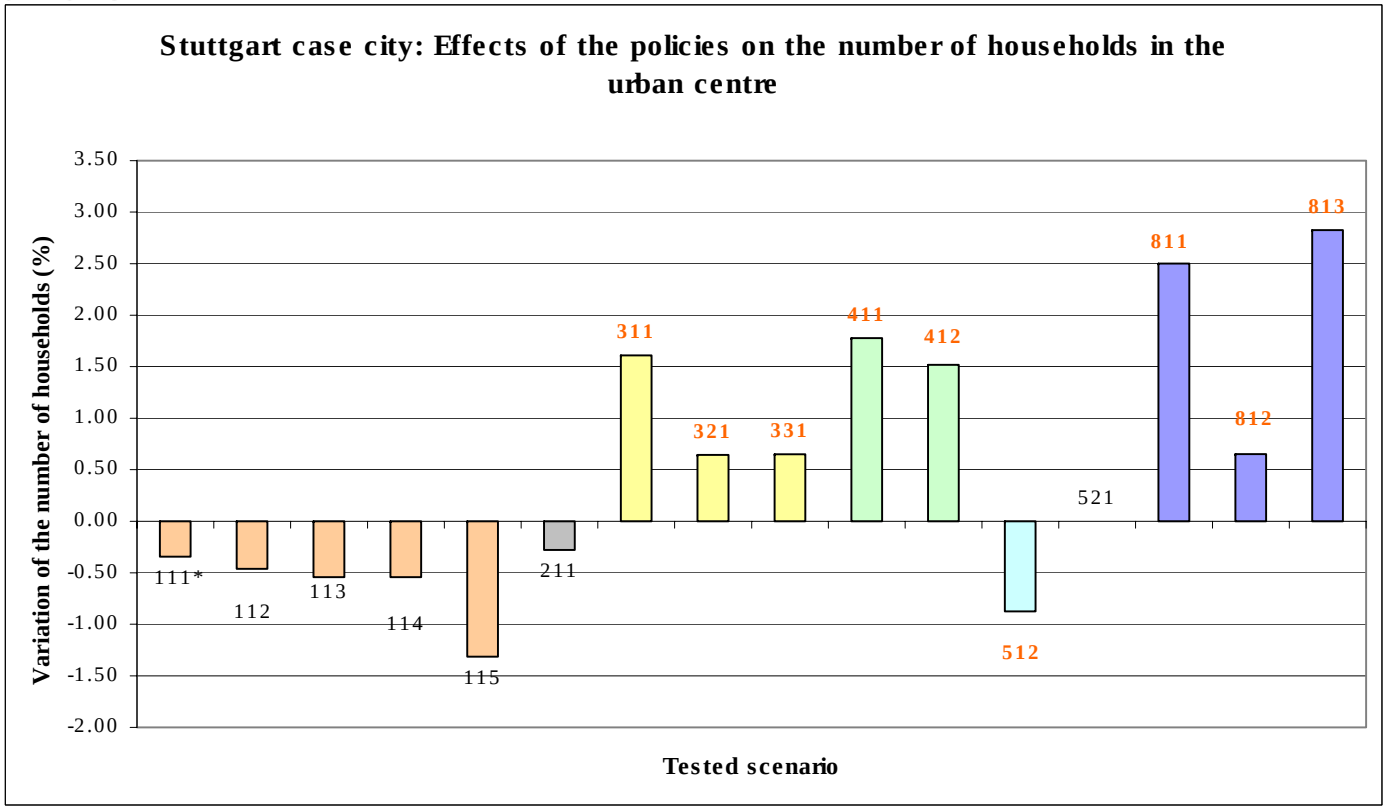
Combination of Measures

811S: increase by 50% of the private car cost/km applied to all drivers,decrease of PT fare by 20% for all trips, fiscal measure on residential developments: see scenario 311

812S: increase by 50% of the private car cost/km applied to all drivers, decrease of PT fare by 20% for all trips, ABC-type policy applied to a part of the tertiary sector: see scenario 331

813S: increase by 50% of the private car cost/km applied to all drivers, decrease of PT fare by 20% for all trips, fiscal measure on residential developments: see scenario 311, ABC-type policy applied to a part of the tertiary sector: see scenario 331

Results of the Different Policy Codes



Type of scenario:

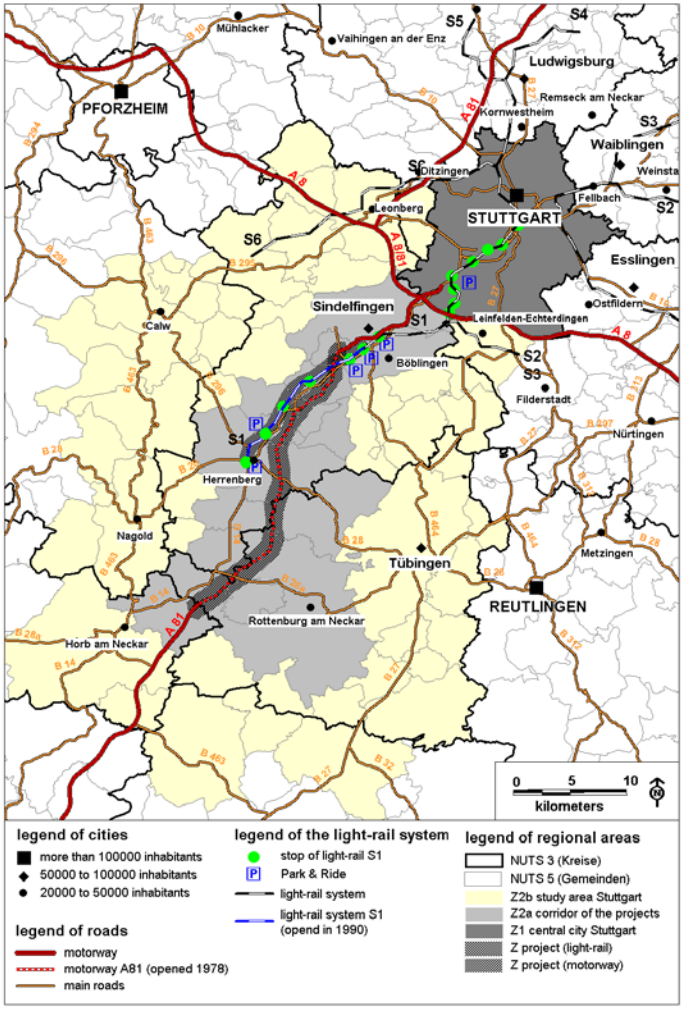
- Transport infrastructures / services
- External factor : relocation of work places
- Land use measures having an influence on urban sprawl
- Measures aiming at a modal shift towards public transport by increasing travel costs or time by private car
- Measures aiming at a modal shift towards public transport by decreasing travel costs or times by public transport, or by provinding P&R facilities
- Local investment plan and combinations of measures

* The effect of motorway A81 and leight rail S1 (111,112,113,114) is calculated by comparison with scenario 001 (situation without motorway and leight rail).
The effect of tunnel Kappelberg (115) is calculated by comparison with scenario 002 (which is also 114 - situation with motorway A81 and leight rail S1).
The effects of the other measures are calculated in comparison with scenario 003 (present state)

linking centre and periphery :

rail infrastructure S1, P&R

Extension of the light rail S1 and motorway A81:



111S: without A81 / with S1

112S: with A81 / without S1

113S: with A81 / with S1

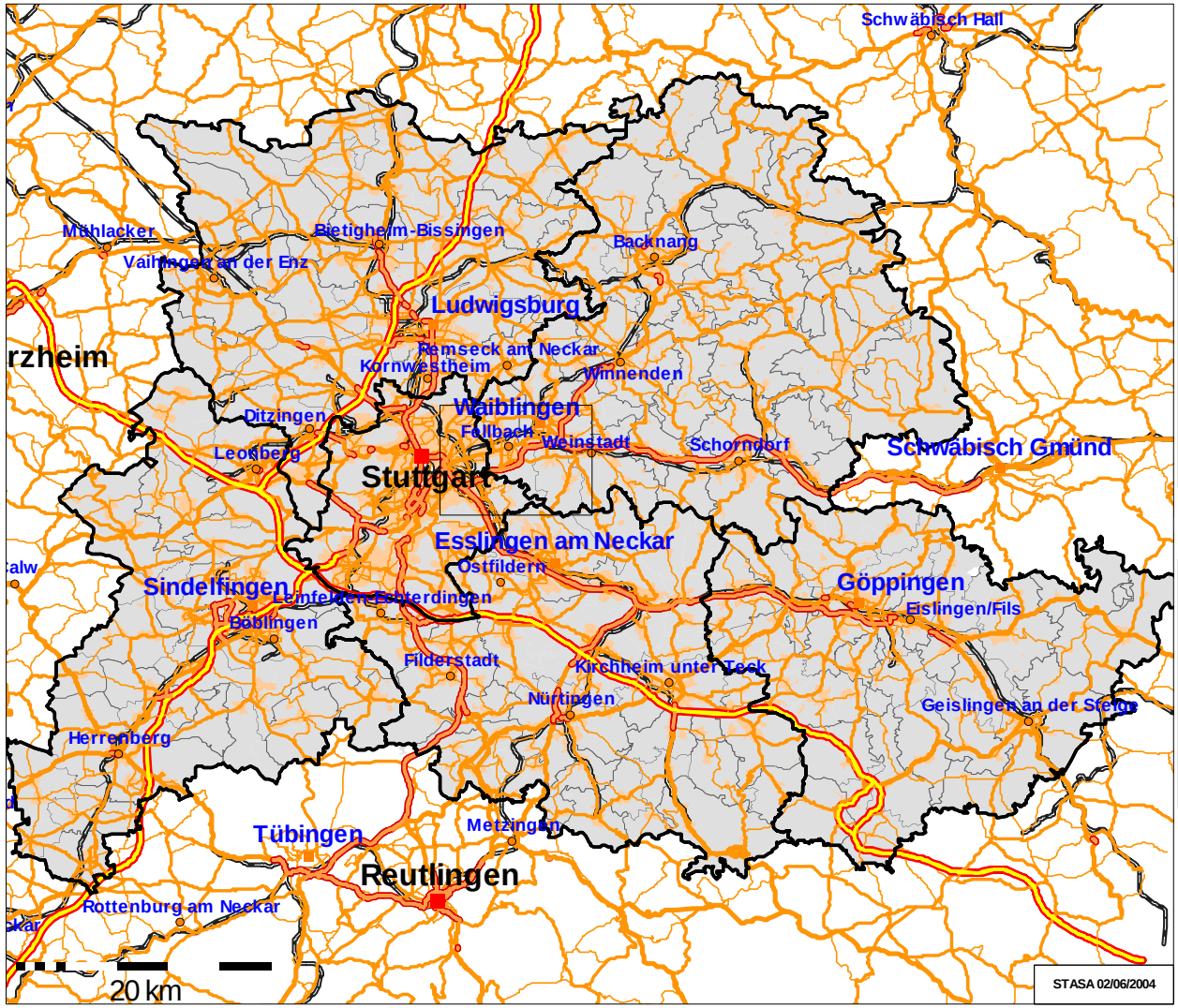
114S: with A81 / with S1 / with Park&Ride facilities

linking centre and periphery : rail infrastructure S1, motorway A81, P&R

		reference	changes to the reference scenario in %			
		001S	111S	112S	113S	114S
Indicator	Unit	with A81, without S1	without A81, without S1	without A81, with S1	with A81, with S1	with A81, with S1, with P&R-facilities
Number of households in urban zones	inhabitants	1427566	-0,5%	-0,5%	-0,1%	-0,1%
Number of households in the urban centre	inhabitants	594273	-0,1%	0,1%	-0,1%	-0,1%
Number of jobs in urban zones	**jobs**	**728453**	**-1,0%**	**-1,1%**	**-0,2%**	**-0,2%**
Number of jobs in the urban centre	jobs	350265	-0,1%	0,2%	-0,1%	-0,1%
Total car mileage in the study area	**million vehicle-kilometers (day)**	**47,42**	**-0,4%**	**-6,7%**	**-0,1%**	**-0,4%**
Average modal share of public transport, in the study area	%	19,58	1,5%	4,4%	0,5%	1,5%
Average travel time (all modes, all purposes)	minutes	36,80	-0,2%	-0,4%	-0,2%	-0,2%
Average home-work travel distance (all m	**kilometers**	**13,68**	**-3,8%**	**-5,4%**	**-3,8%**	**-3,8%**
Average road traffic speed in the whole study	kilometers/hour	39,21	-0,2%	-1,1%	0,0%	-0,2%
Number of passenger-kilometers by public transport	million passenger-kilometers (day)	14,84	-11,7%	-12,2%	-13,5%	-11,7%

radial transport lines increase urban sprawl
motorways have a bigger effect than light rail systems

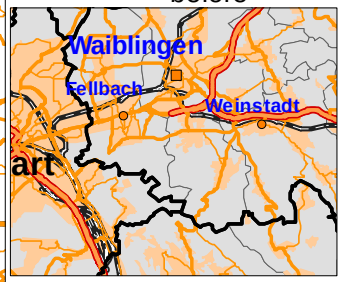
transport infrastructure linking centre and periphery :



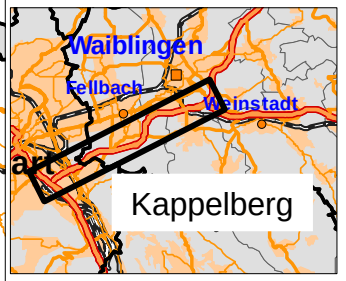
Stuttgart Region

Scenario 115S
Tunnel Kappelberg

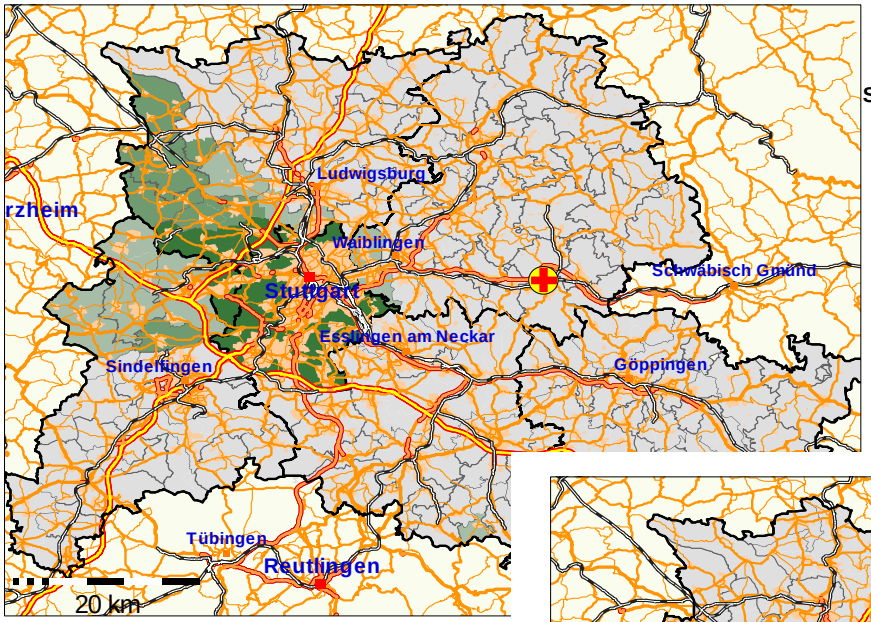
before



after



linking centre and periphery :

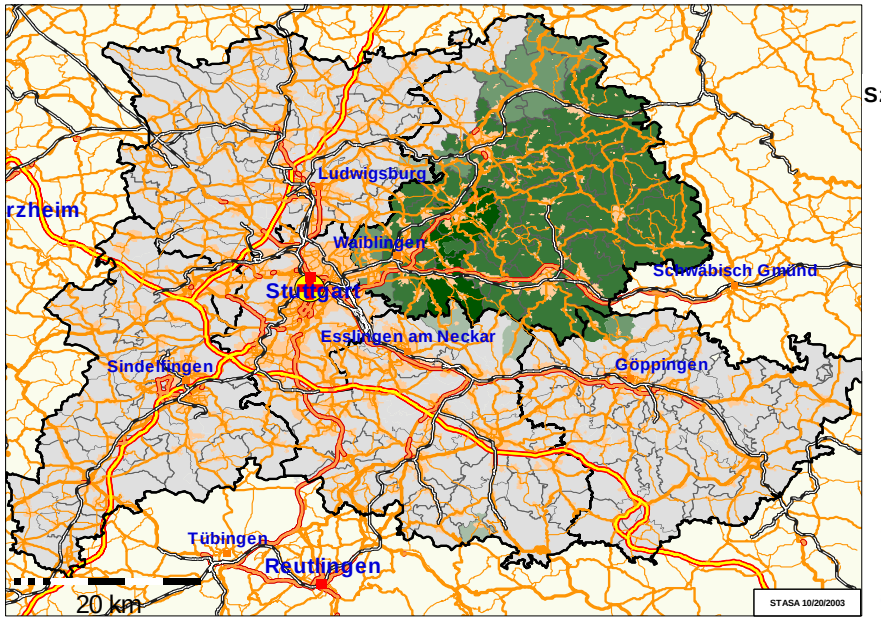


Stuttgart Region

Szenario Tunnel Kappelberg

travel time decrease from/to Schorndorf [minutes]

-8 =< -6	(0)
-6 =< -4	(4)
-4 =< -2	(6)
-2 =< 0	(10)
no change	(159)



Stuttgart Region

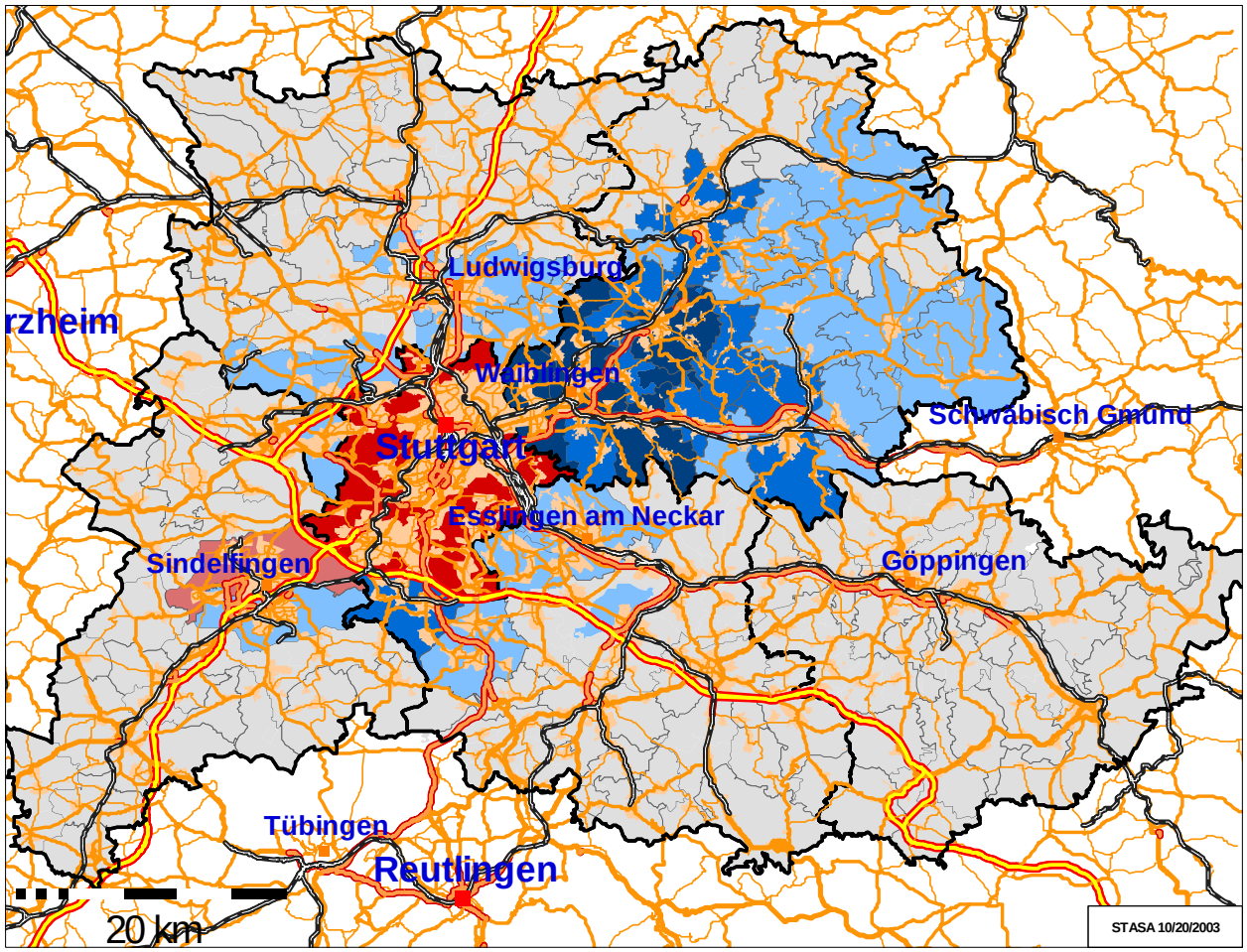
Szenario Tunnel Kappelberg

travel time decrease from/to Stuttgart [minutes]

-7.5 =< -6	(3)
-6 =< -4	(21)
-4 =< -2	(6)
-2 =< 0	(4)
no change	(145)

linking centre and periphery :

tunnel Kappelberg



Stuttgart Region

Scenario S115
Tunnel Kappelberg

population redistribution

	-10,000	=<	-500	(1)
	-500	=<	-100	(1)
	-100	=<	100	(140)
	100	=<	500	(24)
	500	=<	2,000	(9)
	2,000	=<	6,000	(4)

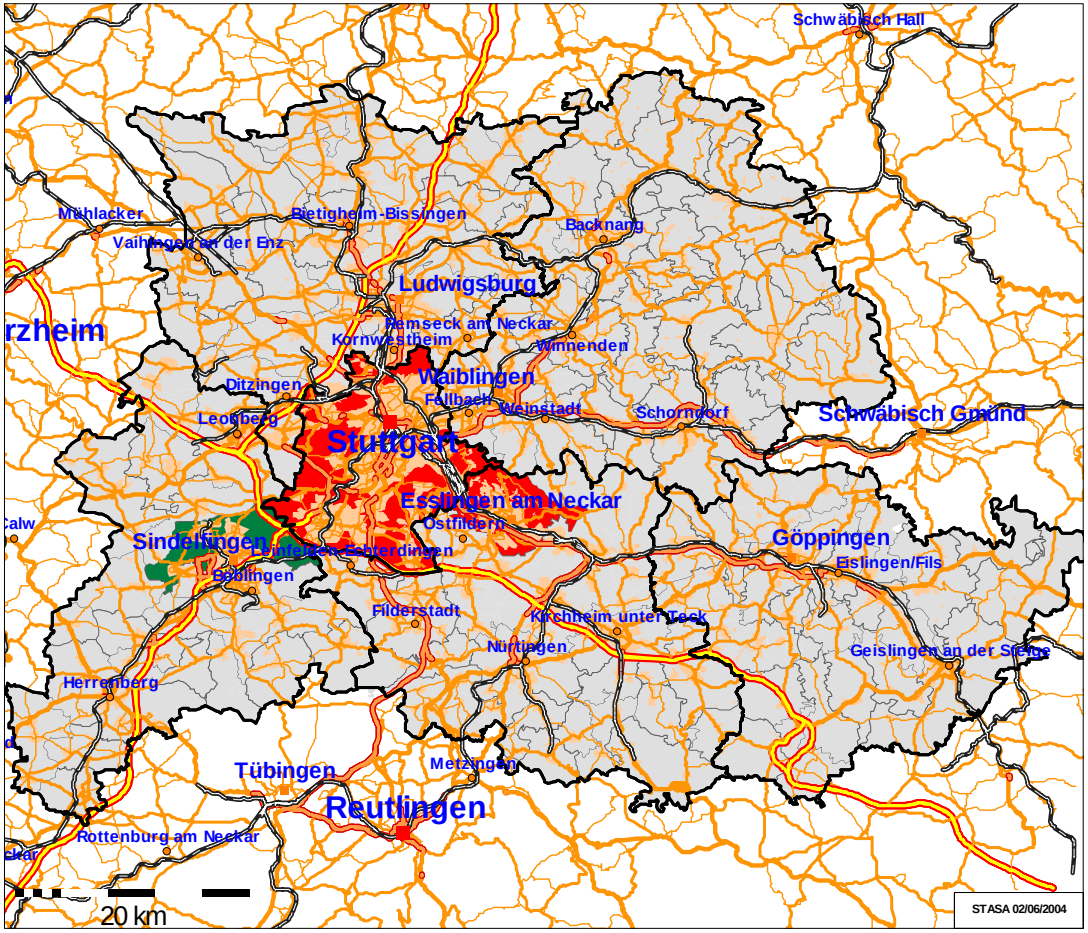
radial transport infrastructure linking centre and periphery : tunnel Kappelberg

Indicator	Unit	reference 002S with S1, with P&R-facilities	changes to the reference scenario in % 115S tunnel Kappelberg
Number of households in urban zones	**inhabitants**	**1426149**	**0,7%**
Number of households in the urban centre	**inhabitants**	**593783**	**-1,7%**
Number of jobs in urban zones	jobs	727097	0,0%
Number of jobs in the urban centre	jobs	349867	0,0%
Total car mileage in the study area	**million vehicle-kilometers (day)**	**47,22**	**2,7%**
Average modal share of public transport, in the study area	**%**	**19,87**	**-2,9%**
Average travel time (all modes, all purposes)	minutes	36,73	0,2%
Average home-work travel distance (all mode	kilometers	13,16	1,4%
Average road traffic speed in the whole study	kilometers/hour	39,14	1,5%
Number of passenger-kilometers by public transport	million passenger-kilometers (day)	13,11	-2,8%

radial transport lines increase urban sprawl

Relocation of Workplaces

211S: Relocation of 10.000 workplaces from Esslingen and Stuttgart to Sindelfingen (due to shift of a production plant of DaimlerChrysler)



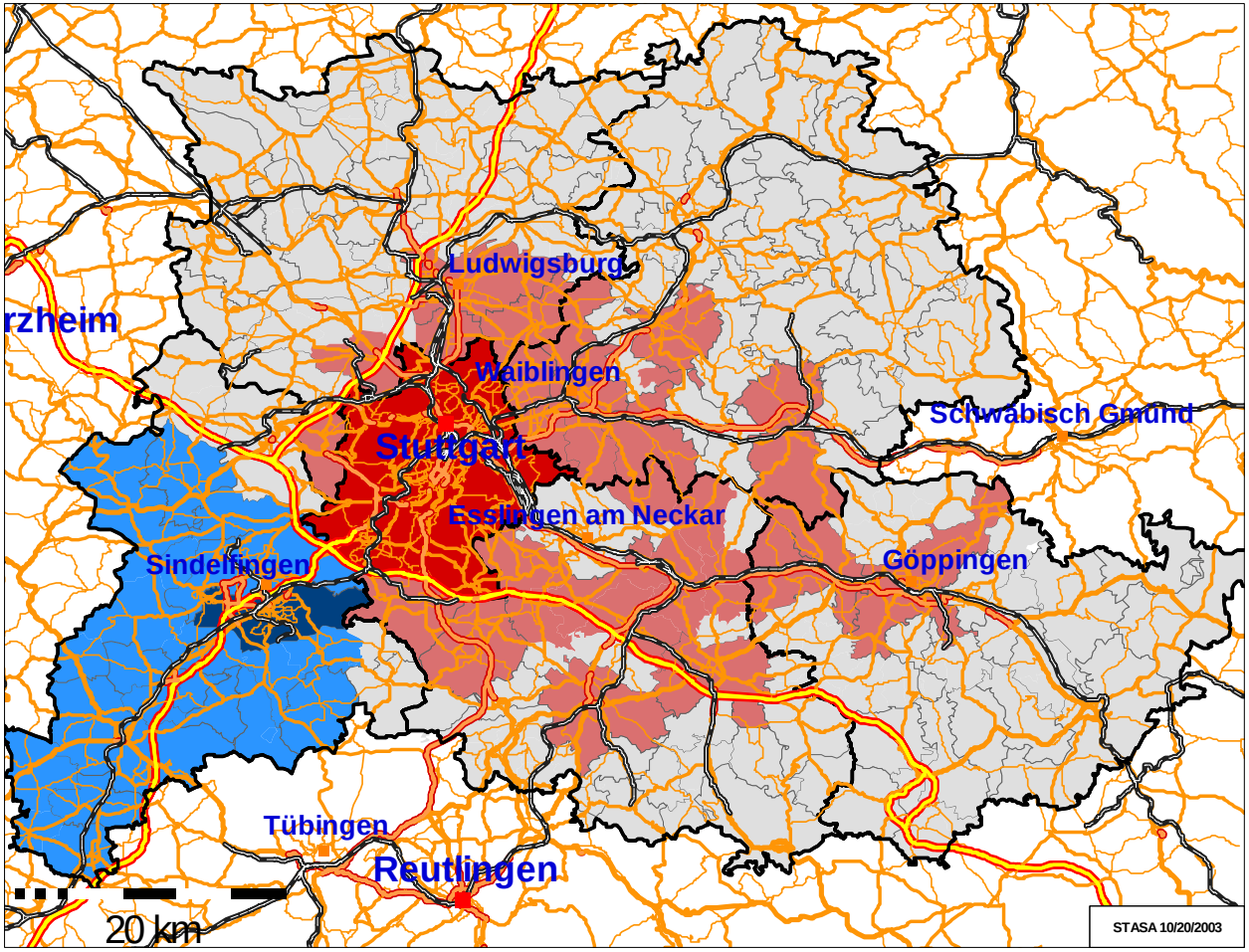
Stuttgart Region

Scenario 211S
relocation of workplaces

relocation of workplaces

	- 5,000	(2)
	0	(176)
	+ 10,000	(1)

Relocation of Workplaces – population redistribution



Stuttgart Region

Scenario relocation of workplaces

population redistribution

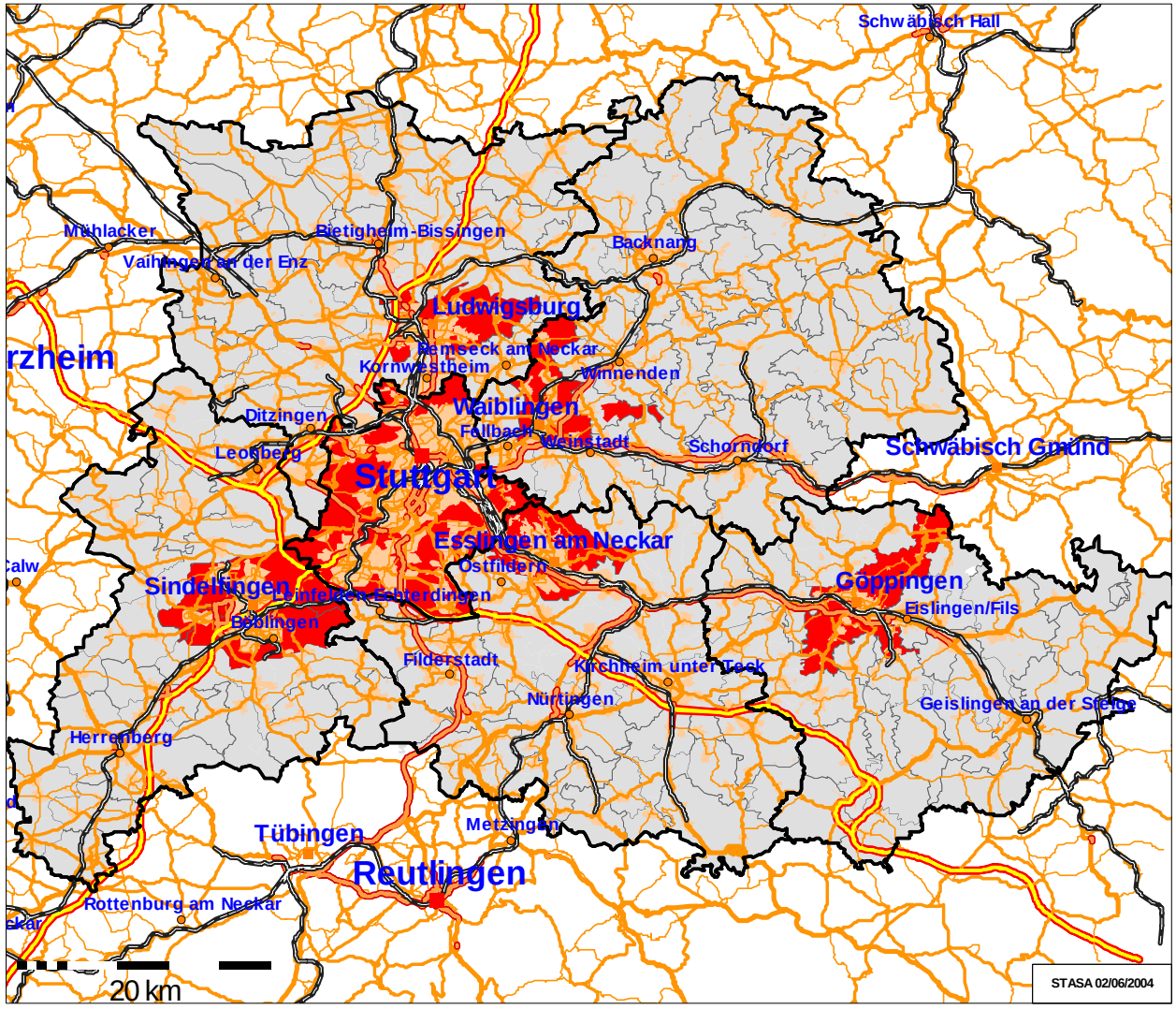
-2,500	=<	-1,000	(1)
-1,000	=<	-100	(31)
-100	=<	100	(126)
100	=<	1,000	(20)
1,000	=<	2,200	(1)

Results: Relocation of Workplaces

		reference	changes to the reference scenario in %
		003S	211S
Indicator	Unit	year 2000	relocation of workplaces
Number of households in urban zones	inhabitants	1436535	-0,3%
Number of households in the urban centre	inhabitants	583874	-0,4%
Number of jobs in urban zones	jobs	727097	0,0%
Number of jobs in the urban centre	jobs	349867	-1,4%
Total car mileage in the study area	million vehicle-kilometers (day)	48,50	-0,3%
Average modal share of public transport, in the study area	%	19,30	-0,6%
Average travel time (all modes, all purposes)	minutes	36,78	-0,2%
Average home-work travel distance (all mode	kilometers	13,34	-0,2%
Average road traffic speed in the whole study	kilometers/hour	39,73	0,1%
Number of passenger-kilometers by public transport	million passenger-kilometers (day)	12,75	-1,1%

relocation of workplaces from A-zone to A-zone may lead to a small increase of sprawl,but also to positive effects on mobility

ABC – type zones



Stuttgart Region

Scenario 311S/321S/333S regulatory and fiscal measures applied to companies

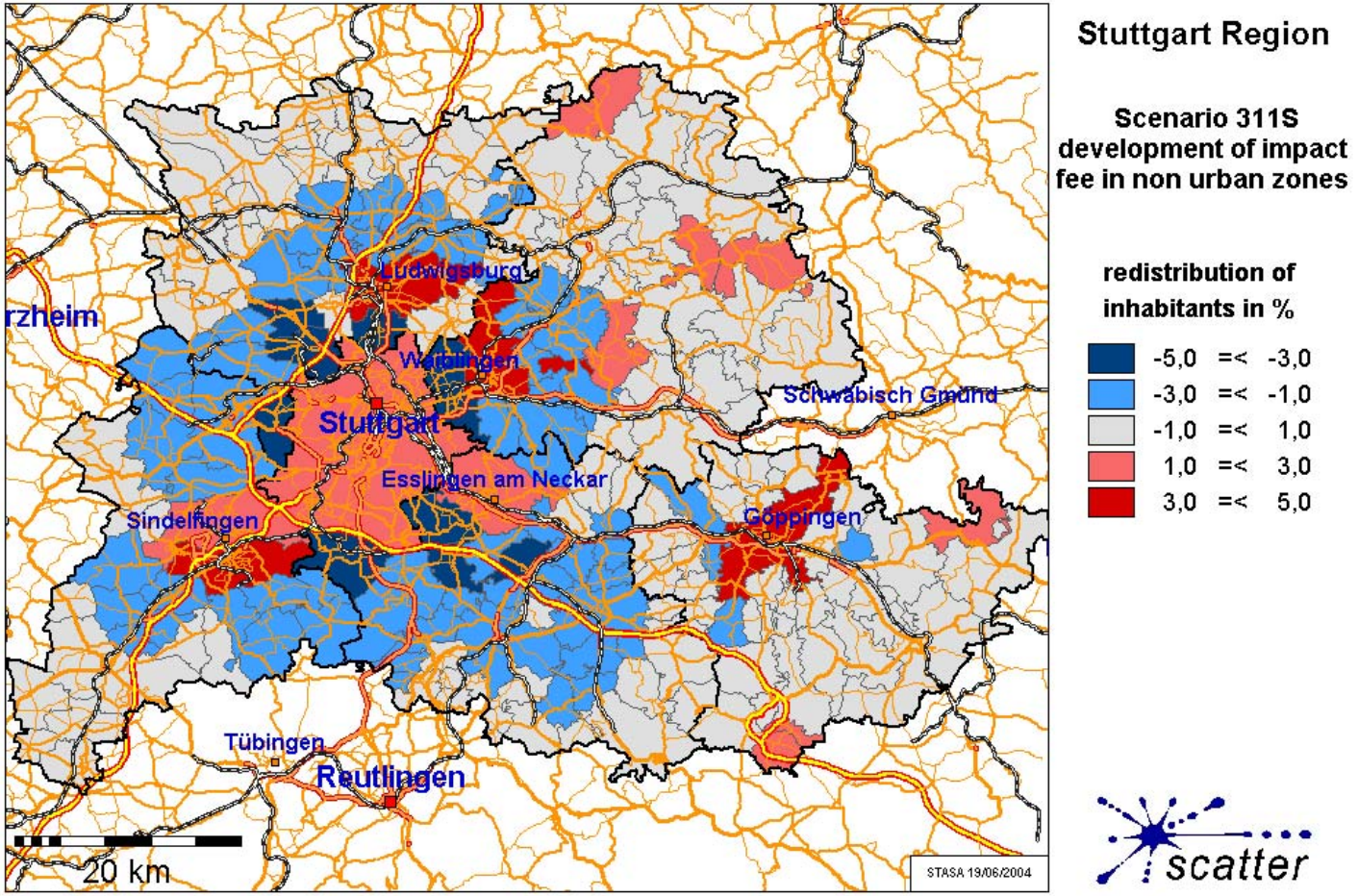
ABC-type definitions

A-zones	(7)
non-A-zones	(172)

residential developments

population redistribution

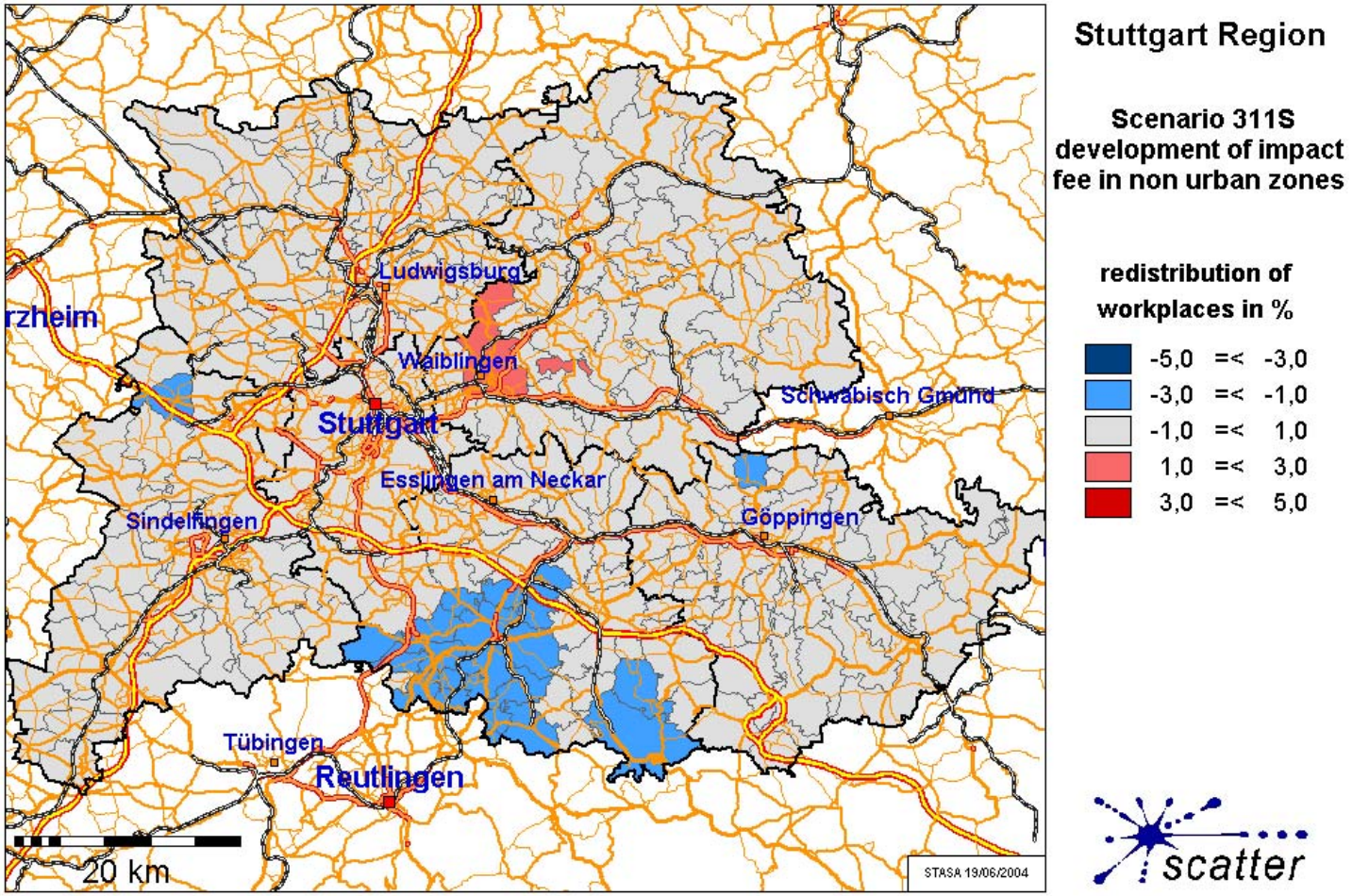
311S : annual tax (development impact fee) applied on households locating in non-A zones



residential developments

workplace redistribution

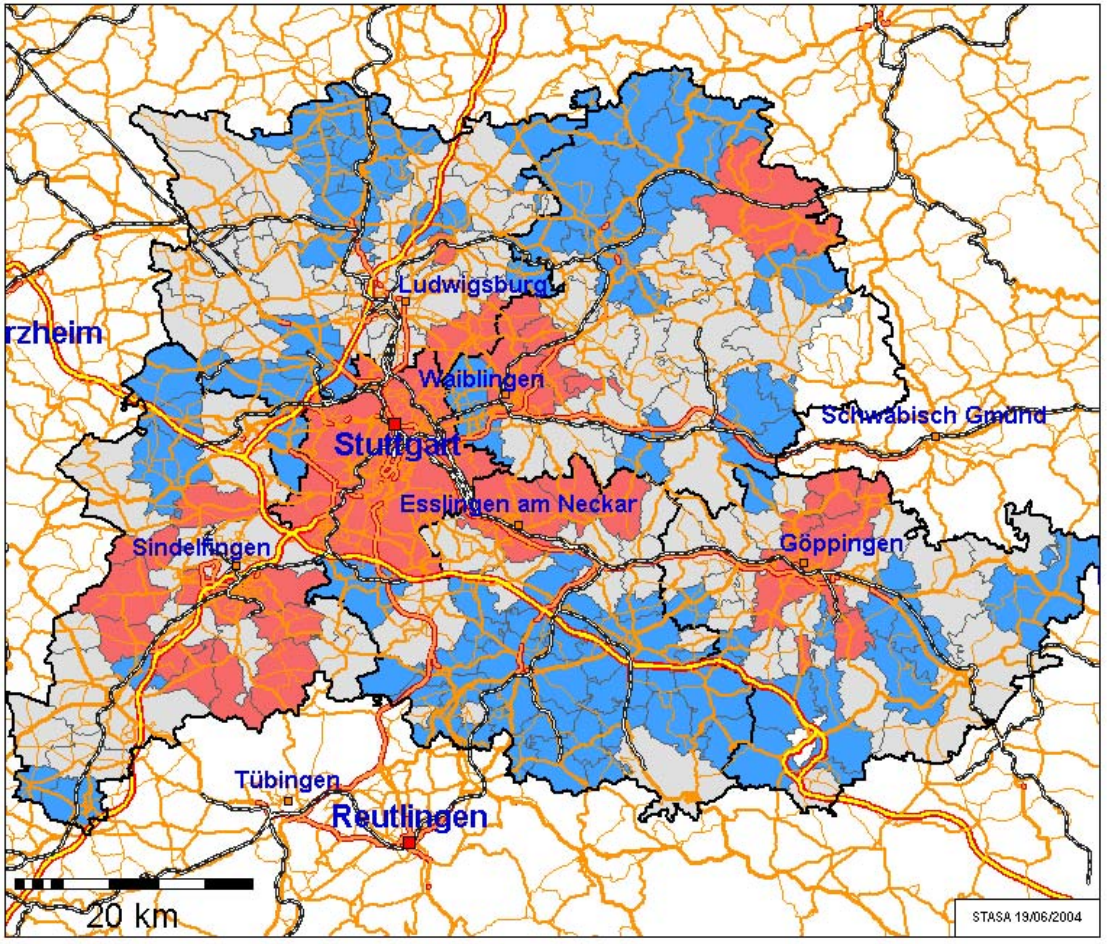
311S : annual tax (development impact fee) applied on households locating in non-A zones



companies

population redistribution

321S: obligation (regulatory measure) for a part of jobs of the employment sector "business services" to locate in A-type zone



Stuttgart Region

Scenario 321S
ABC-type policy obligation to a part of jobs of the tertiary sector

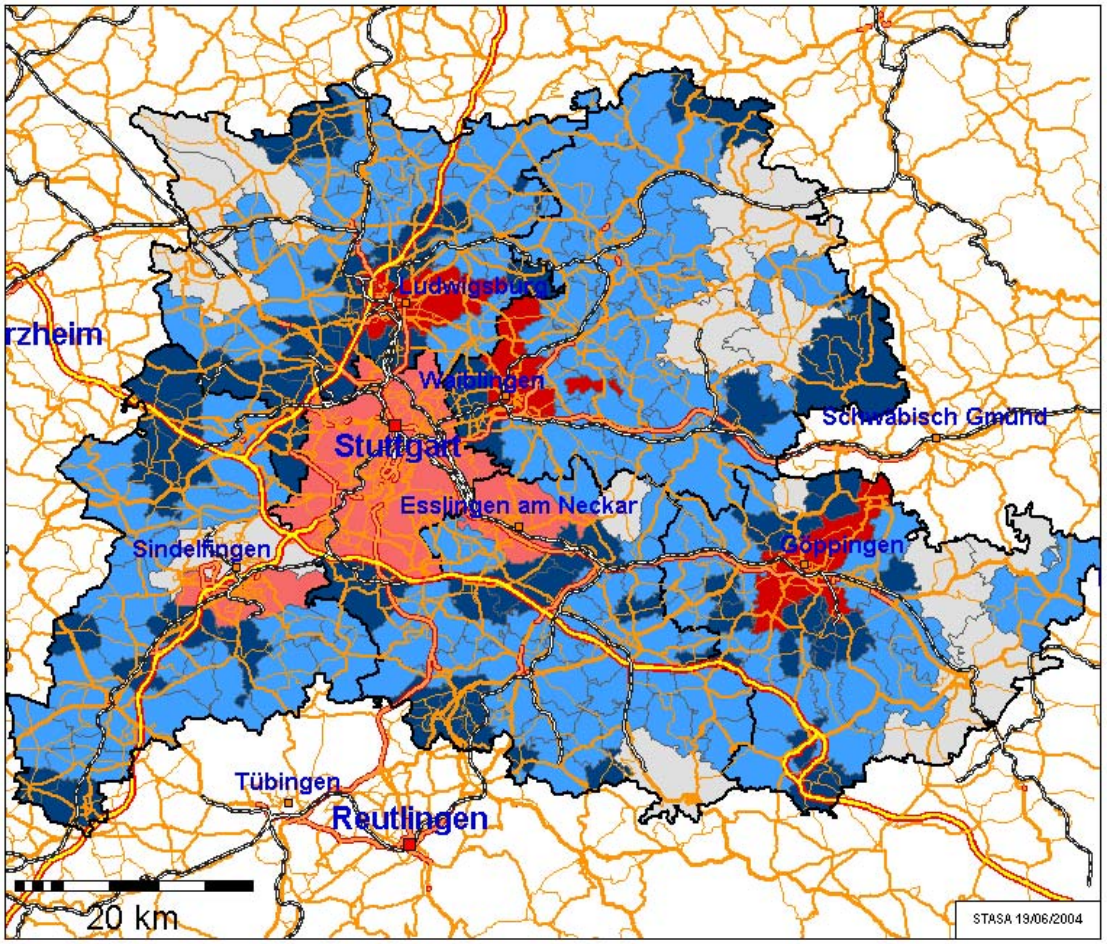
redistribution of inhabitants in %

-5,0	=<	-3,0
-3,0	=<	-0,5
-0,5	=<	0,5
0,5	=<	3,0
3,0	=<	5,0

companies

workplace redistribution

321S: obligation (regulatory measure) for a part of jobs of the employment sector "business services" to locate in A-type zone



Stuttgart Region

Scenario 321S
ABC-type policy obligation to a part of jobs of the tertiary sector

redistribution of workplaces in %

-8,0	=<	-3,0
-3,0	=<	-1,0
-1,0	=<	1,0
1,0	=<	3,0
3,0	=<	8,0

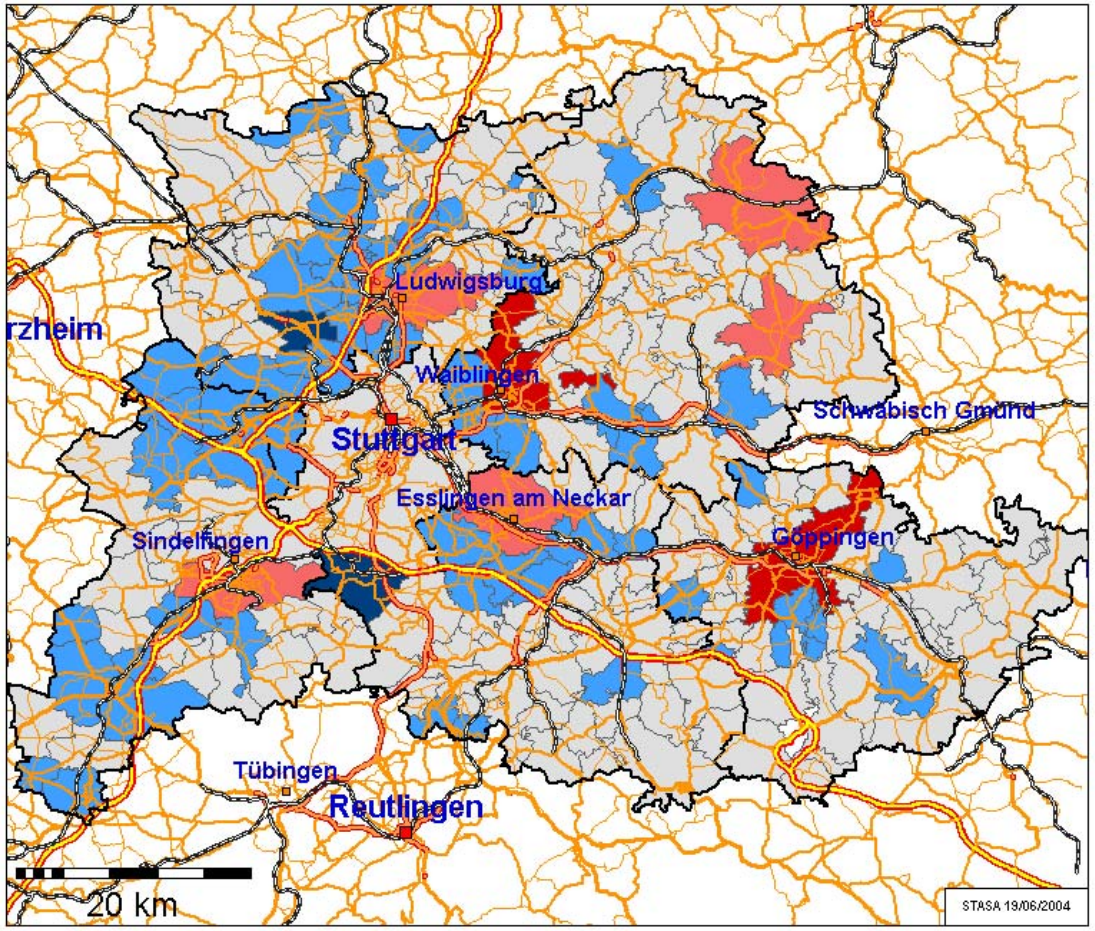
applied to households and companies (311S and 321S)

Indicator	Unit	reference 003S year 2000	changes to the reference scenario in % 311S tax on housholds in non-A-type zones	321S obligation on some jobs to locate in A-type zones
Number of households in urban zones	**inhabitants**	**1436535**	**0.5%**	**0.5%**
Number of households in the urban centre	**inhabitants**	**583874**	**2.2%**	**0.7%**
Number of jobs in urban zones	**jobs**	**727097**	**0.2%**	**0.7%**
Number of jobs in the urban centre	**jobs**	**349867**	**0.7%**	**1.5%**
Total car mileage in the study area	million vehicle-kilometers (day)	48.50	0.0%	0.2%
Average modal share of public transport, in the study area	%	19.30	2.2%	0.5%
Average travel time (all modes, all purposes)	minutes	36.78	0.5%	0.3%
Average home-work travel distance (all mo	kilometers	13.34	0.9%	0.4%
Average road traffic speed in the whole stu	kilometers/hour	39.73	0.2%	0.0%
Number of passenger-kilometers by public transport	**million passenger-kilometers (day)**	**12.75**	**2.9%**	**1.0%**
CO2 emissions	tons per day	11640	0.0%	0.2%

regulatory and fiscal measures may decrease the effects of sprawl

Policy Code 331S

331S: ABC-type policy applied to a part of the tertiary sector: tax on new jobs of the employment sector "business services" locating in non-A-type zone. The tax amounts to 976 €/job



Stuttgart Region

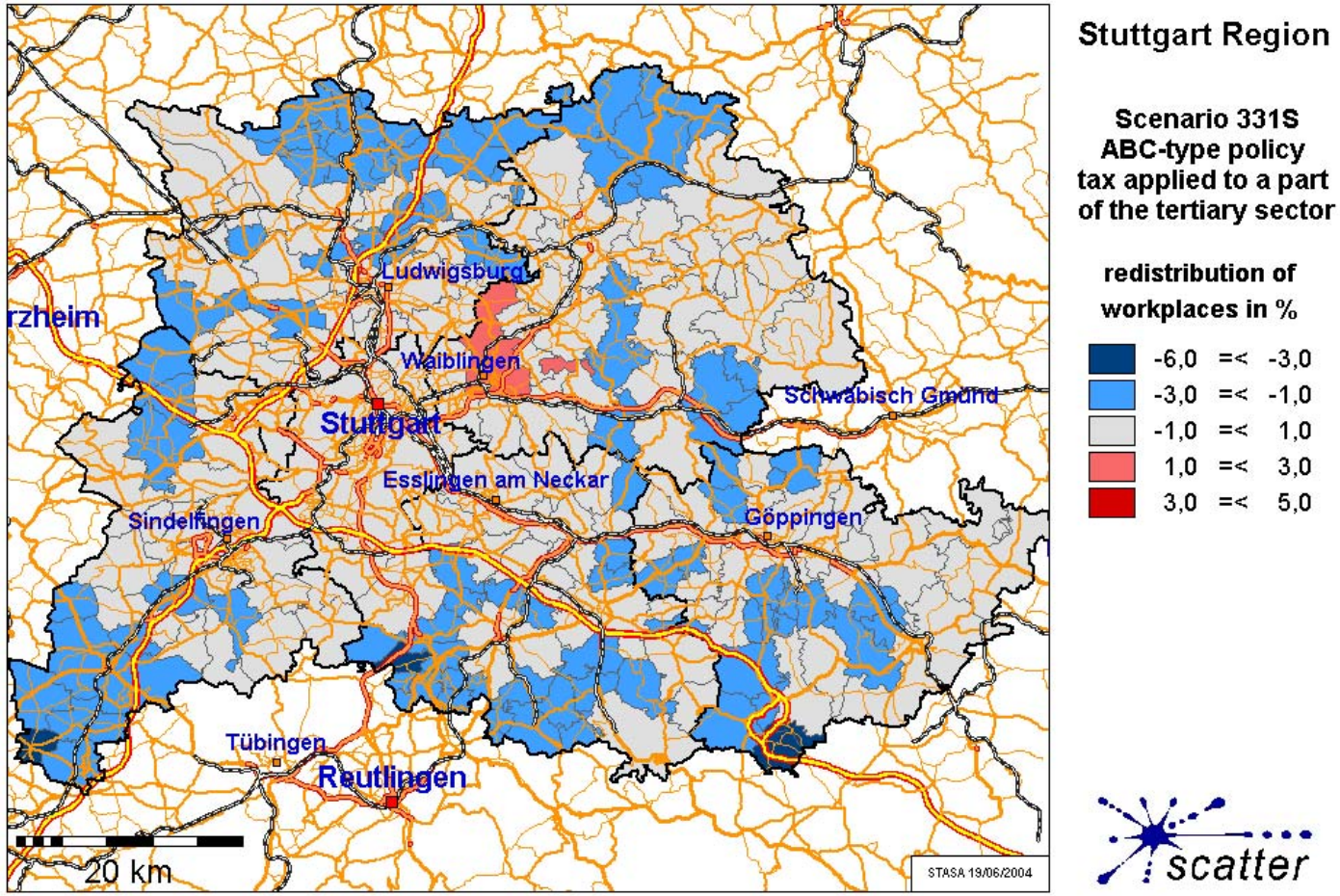
Scenario 331S
ABC-type policy
tax applied to a part
of the tertiary sector

redistribution of inhabitants in %

-5,0	=<	-3,0
-3,0	=<	-1,0
-1,0	=<	1,0
1,0	=<	3,0
3,0	=<	5,0

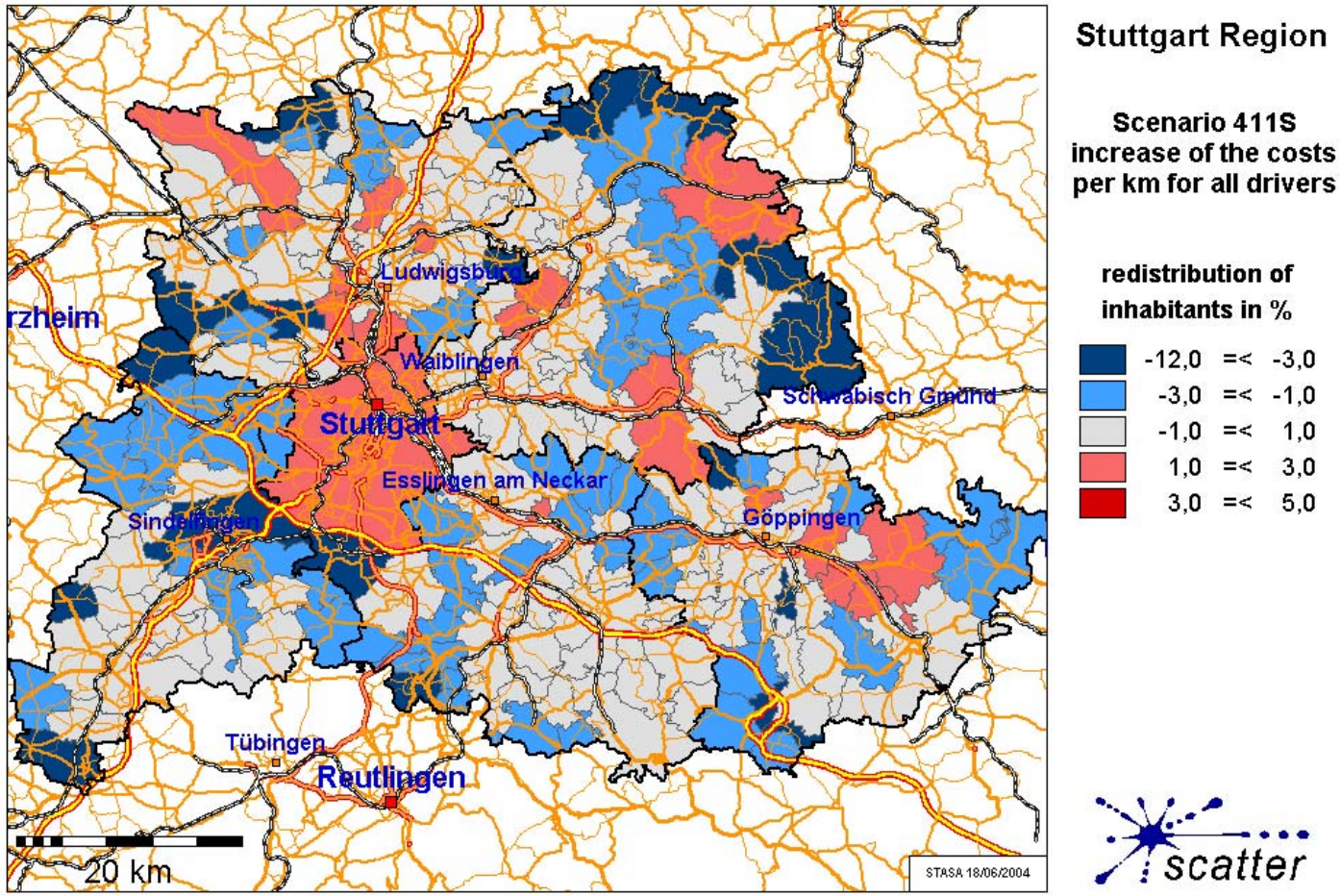
Policy Code 331S

331S: ABC-type policy applied to a part of the tertiary sector: tax on new jobs of the employment sector "business services" locating in non-A-type zone. The tax amounts to 976 €/job



Policy Code 411S

411S: Increase by 50 % of the cost per km for all drivers



Stuttgart Region

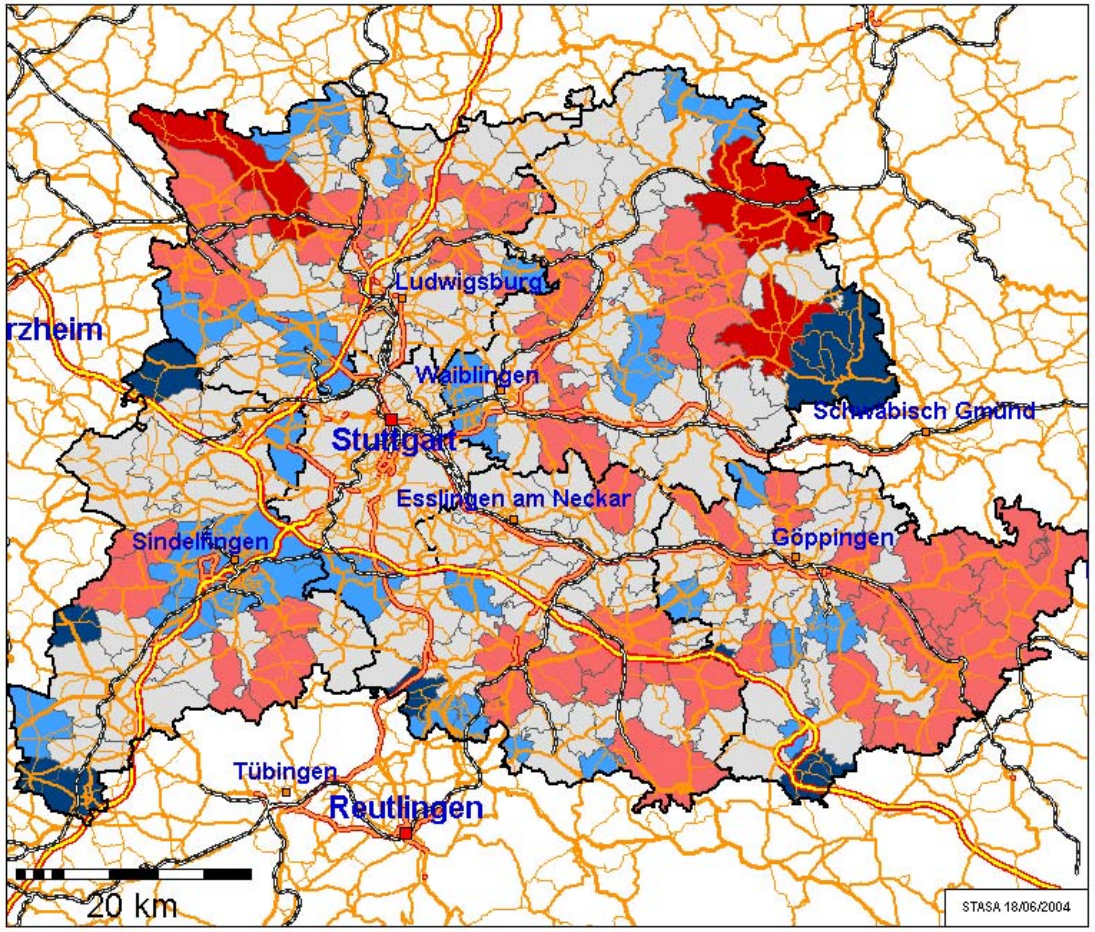
Scenario 411S increase of the costs per km for all drivers

redistribution of inhabitants in %

-12,0 =<	-3,0
-3,0 =<	-1,0
-1,0 =<	1,0
1,0 =<	3,0
3,0 =<	5,0

Policy Code 411S

411S: Increase by 50 % of the cost per km for all drivers



Stuttgart Region

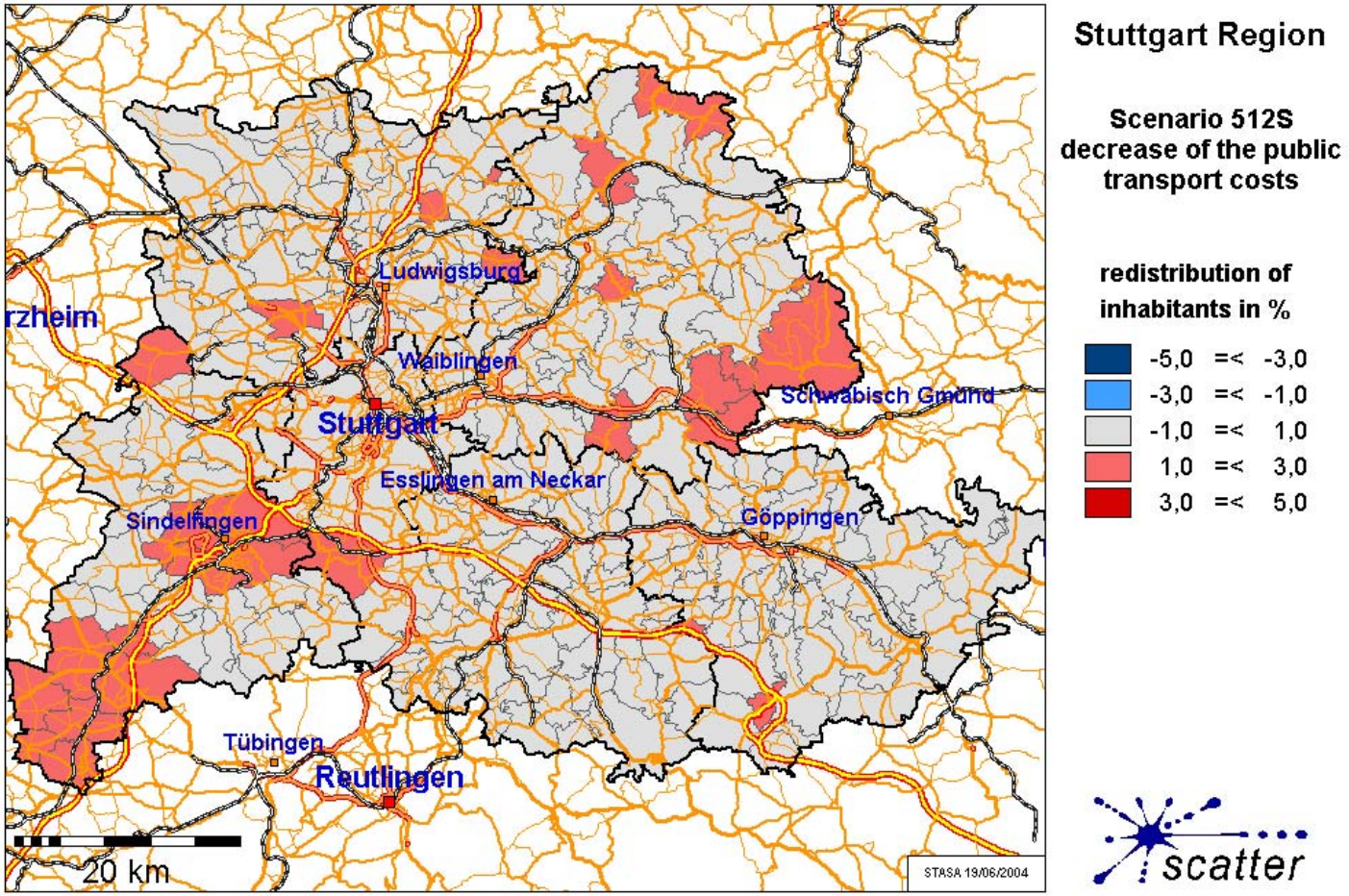
Scenario 411S increase of the costs per km for all drivers

redistribution of workplaces in %

-8,0 =<	-3,0
-3,0 =<	-1,0
-1,0 =<	1,0
1,0 =<	3,0
3,0 =<	5,0

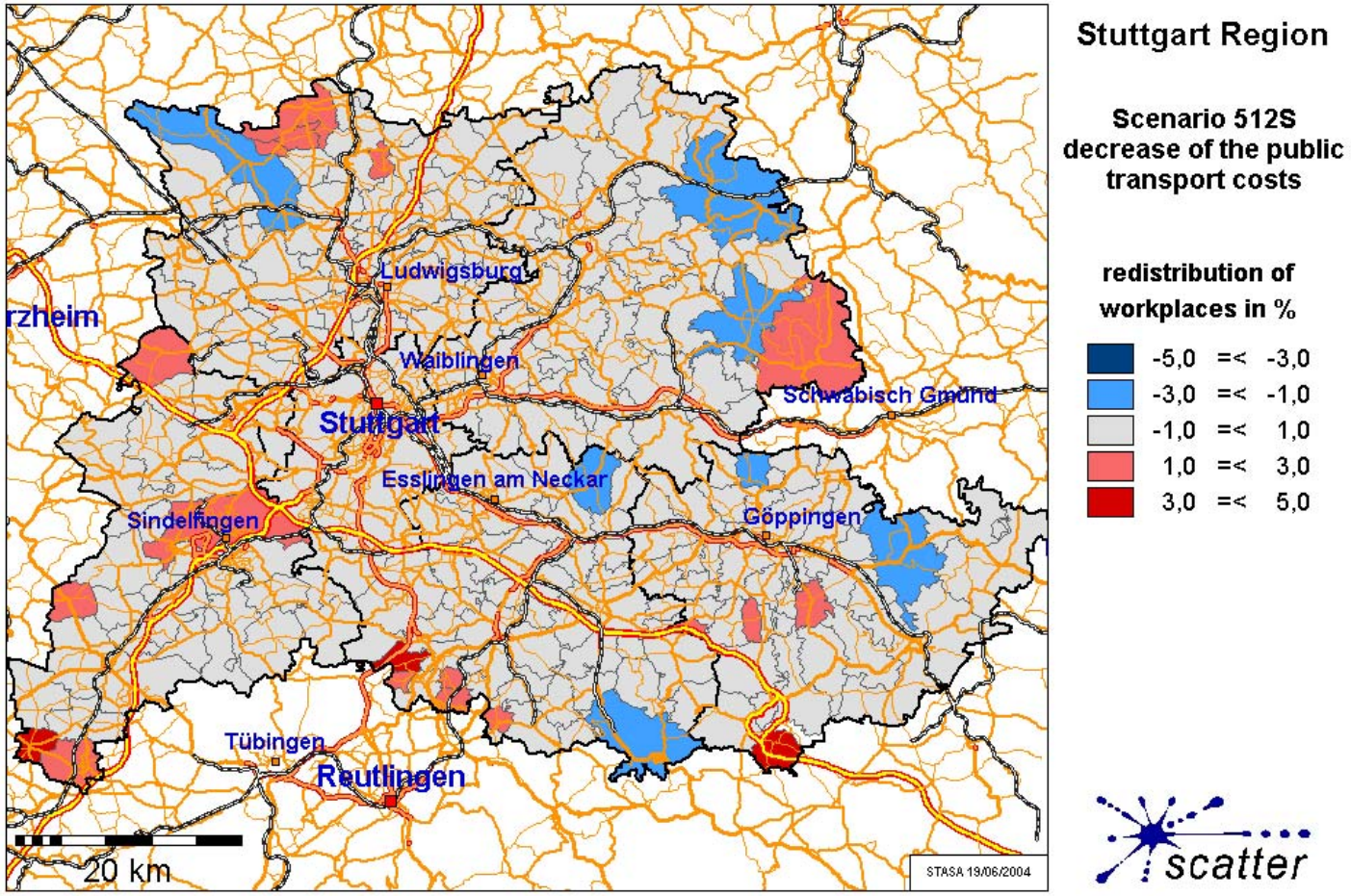
Policy Code 512S

512S: decrease of fare by 20%, applied to all public transport users (reference scenario 003S)



Policy Code 512S

512S: decrease of fare by 20%, applied to all public transport users (reference scenario 003S)



Stuttgart Region

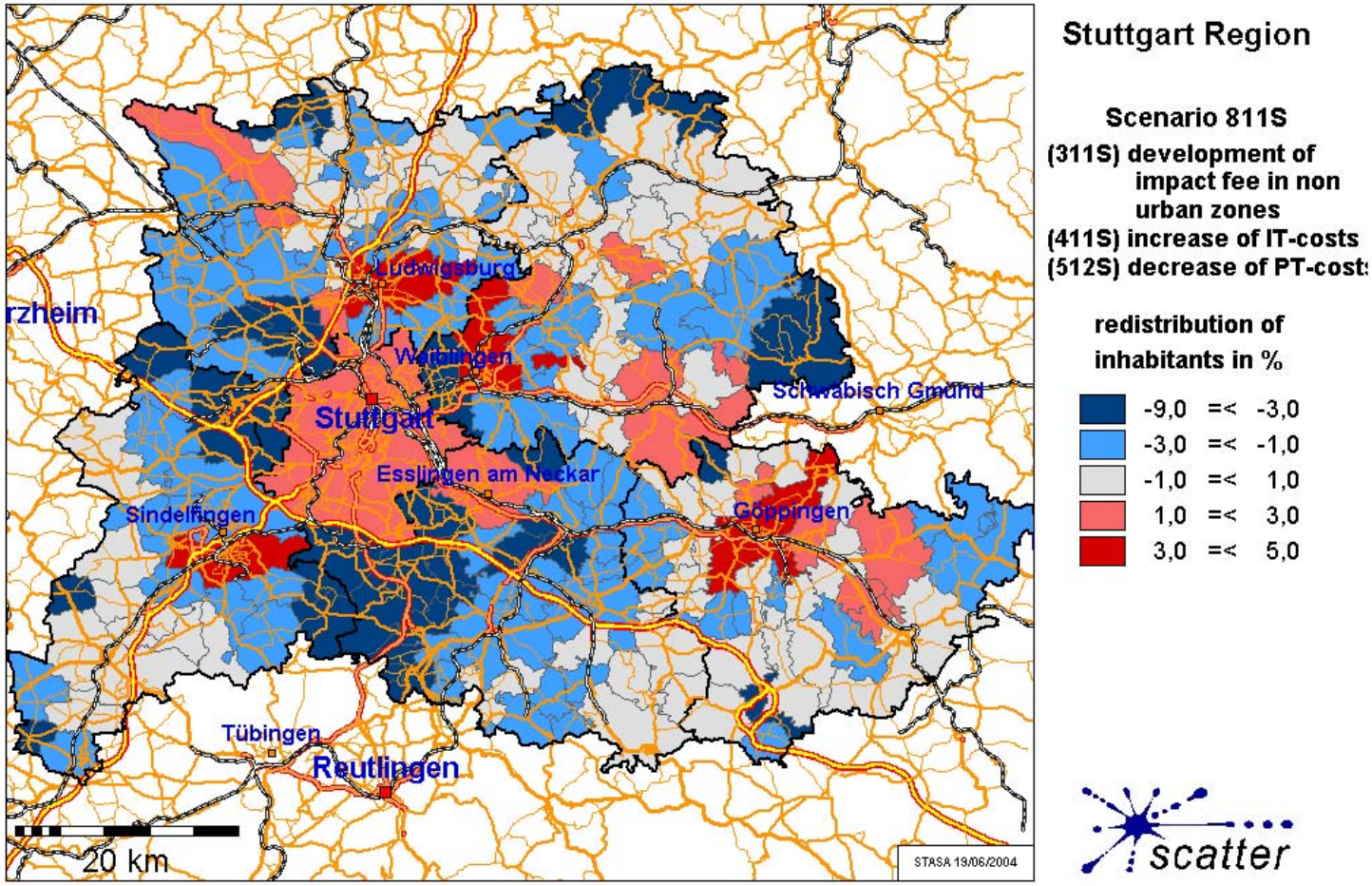
Scenario 512S decrease of the public transport costs

redistribution of workplaces in %

-5,0 =<	-3,0
-3,0 =<	-1,0
-1,0 =<	1,0
1,0 =<	3,0
3,0 =<	5,0

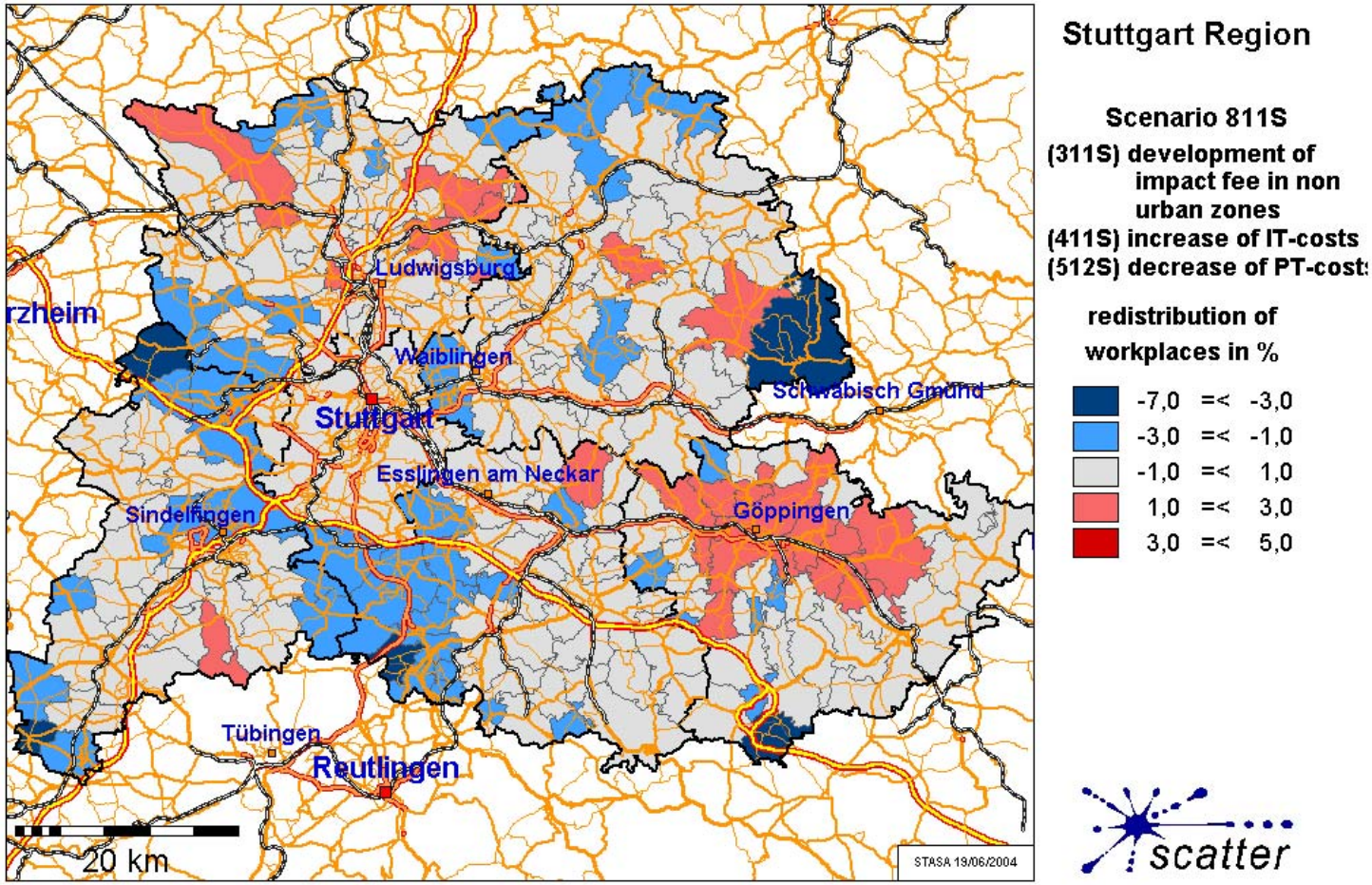
Policy Code 811S

811S: increase by 50% of the private car cost/km applied to all drivers,decrease of PT fare by 20% for all trips, fiscal measure on residential developments: see scenario 311



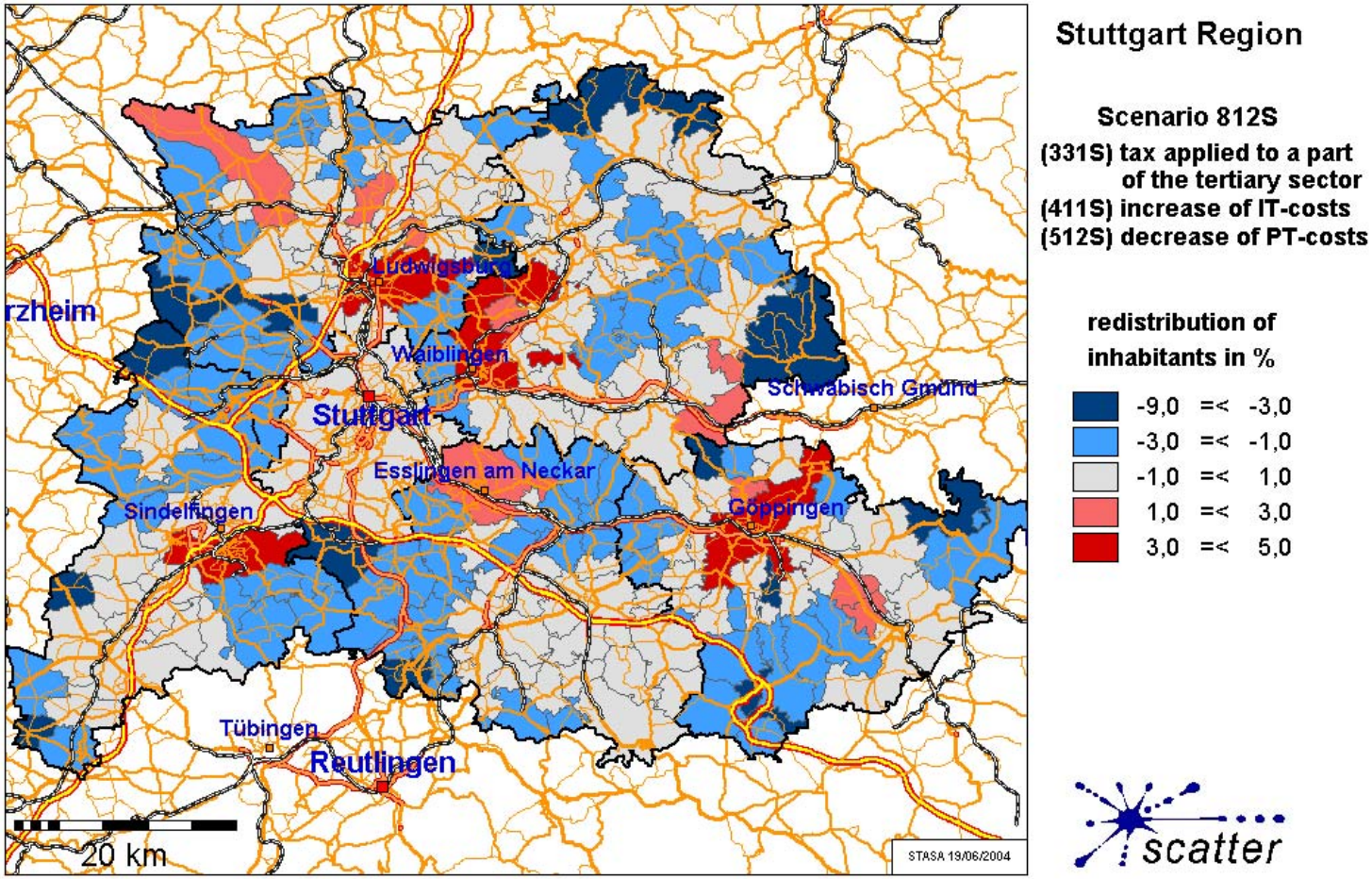
Policy Code 811S

811S: increase by 50% of the private car cost/km applied to all drivers,decrease of PT fare by 20% for all trips, fiscal measure on residential developments: see scenario 311



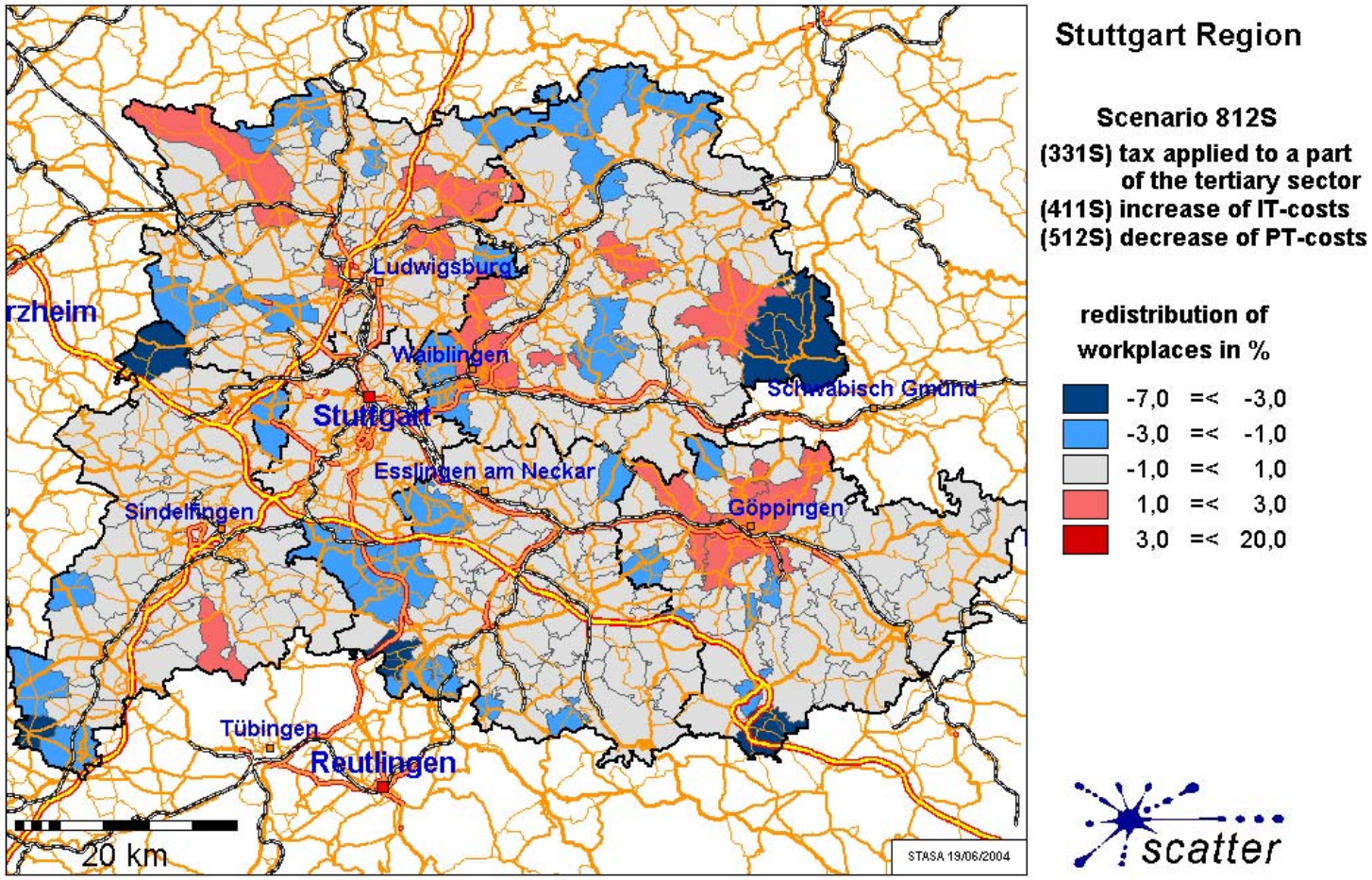
Policy Code 812S

812S: increase by 50% of the private car cost/km applied to all drivers, decrease of PT fare by 20% for all trips, ABC-type policy applied to a part of the tertiary sector: see scenario 331



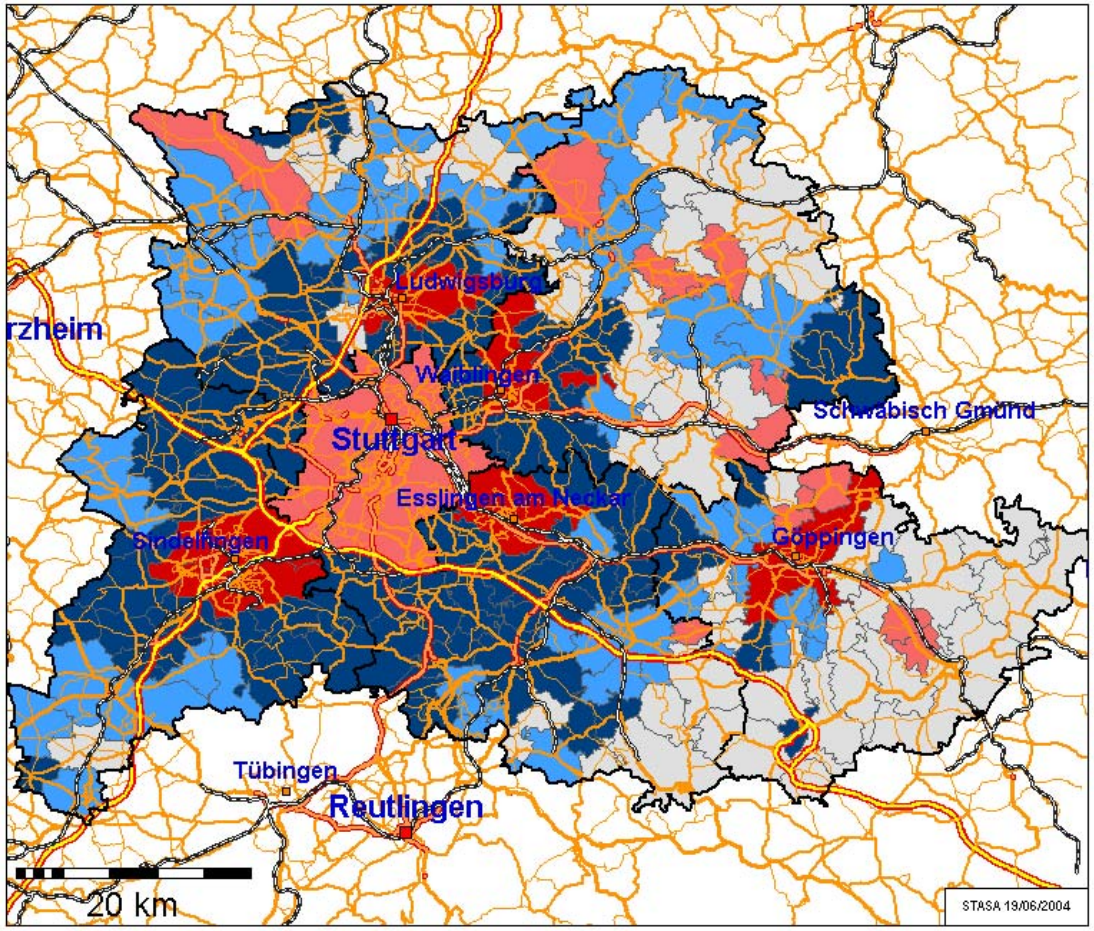
Policy Code 812S

812S: increase by 50% of the private car cost/km applied to all drivers, decrease of PT fare by 20% for all trips, ABC-type policy applied to a part of the tertiary sector: see scenario 331



Policy Code 813S

813S: increase by 50% of the private car cost/km applied to all drivers, decrease of PT fare by 20% for all trips, fiscal measure on residential developments: see scenario 311, ABC-type policy applied to a part of the tertiary sector: see scenario 331



Stuttgart Region

Scenario 813S

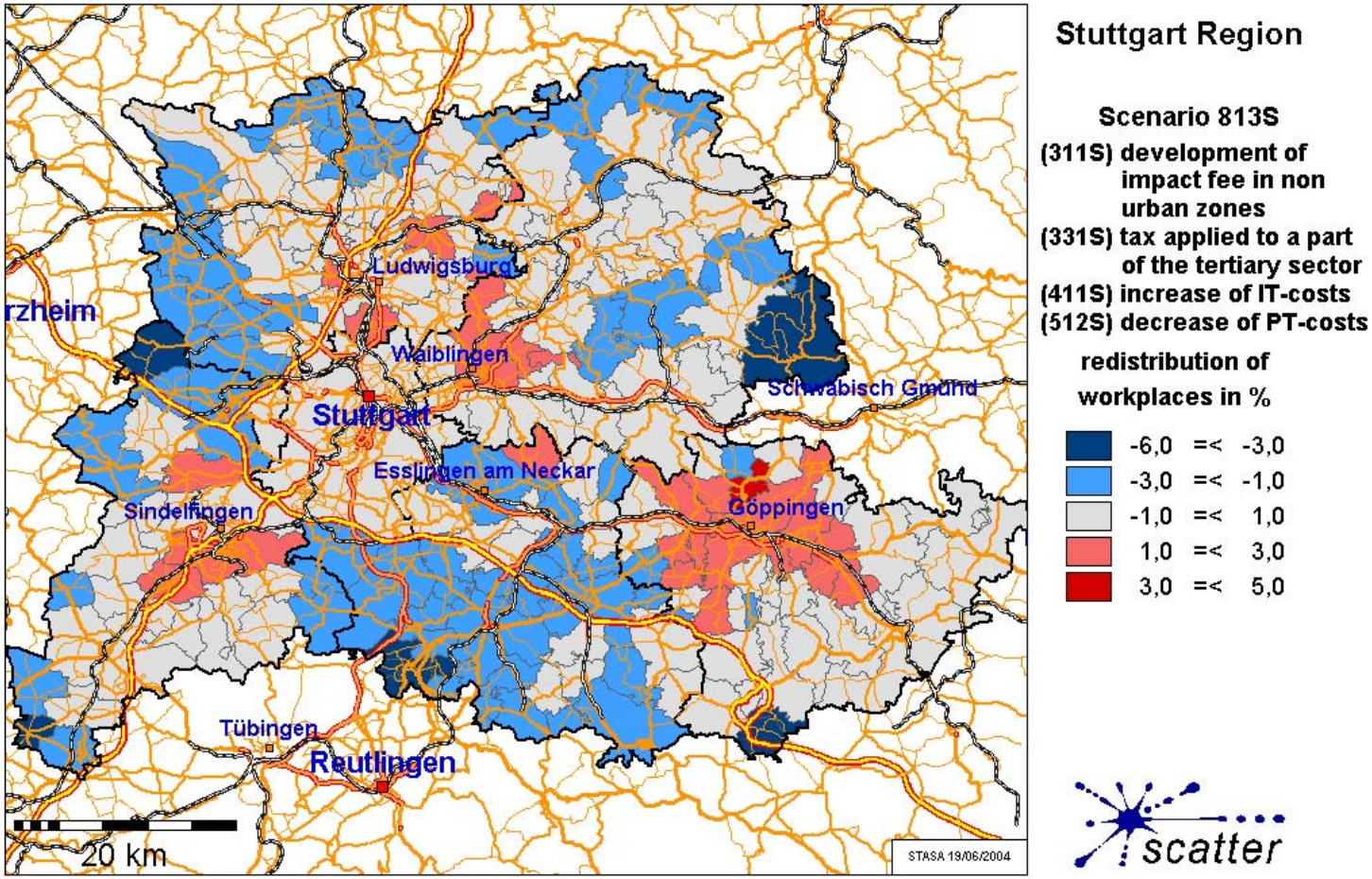
(311S) development of impact fee in non urban zones
(331S) tax applied to a part of the tertiary sector
(411S) increase of IT-costs
(512S) decrease of PT-costs

redistribution of inhabitants in %

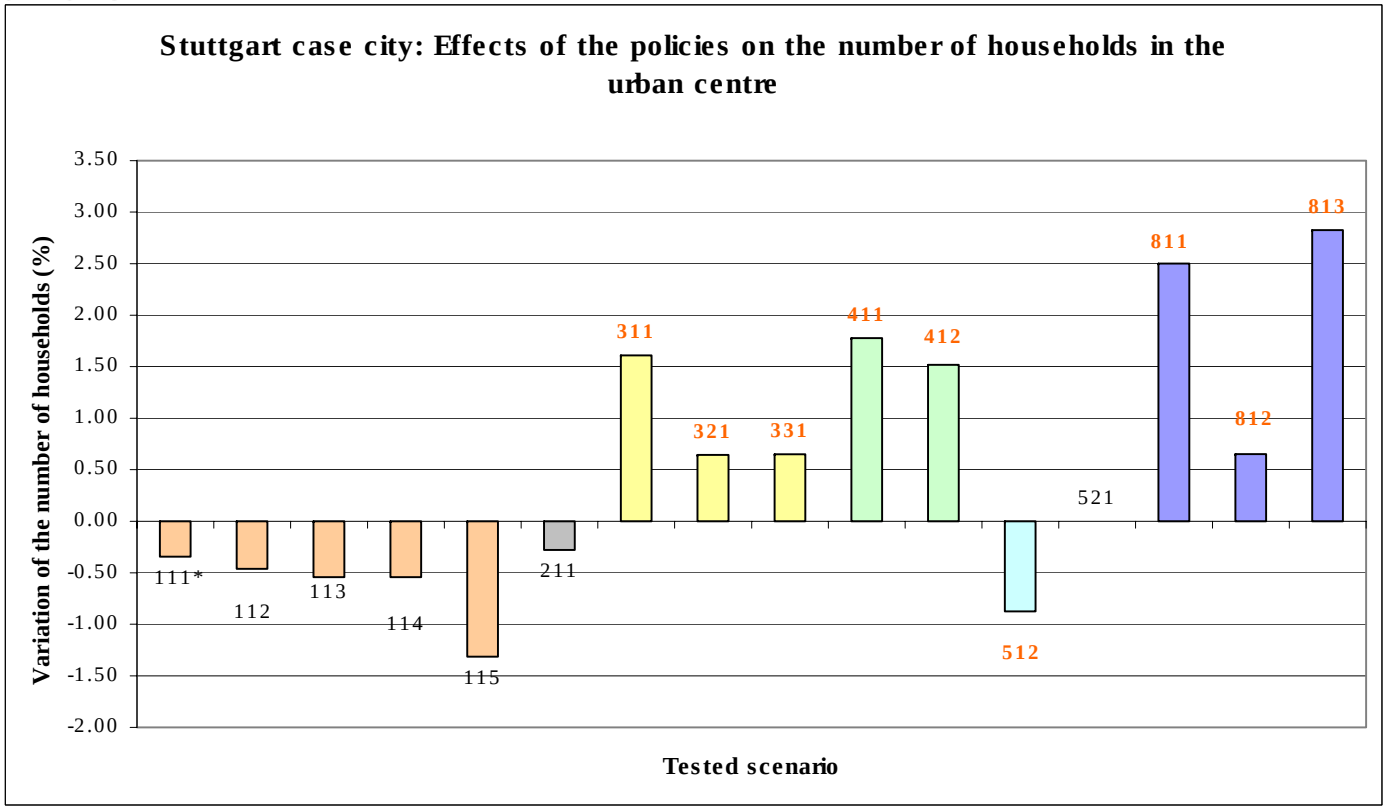
-11,0 =<	-3,0
-3,0 =<	-1,0
-1,0 =<	1,0
1,0 =<	3,0
3,0 =<	12,0

Policy Code 813S

813S: increase by 50% of the private car cost/km applied to all drivers, decrease of PT fare by 20% for all trips, fiscal measure on residential developments: see scenario 311, ABC-type policy applied to a part of the tertiary sector: see scenario 331



Results of the Different Policy Codes



Type of scenario:

- Transport infrastructures / services
- External factor : relocation of work places
- Land use measures having an influence on urban sprawl
- Measures aiming at a modal shift towards public transport by increasing travel costs or time by private car
- Measures aiming at a modal shift towards public transport by decreasing travel costs or times by public transport, or by provinding P&R facilities
- Local investment plan and combinations of measures

* The effect of motorway A81 and leight rail S1 (111,112,113,114) is calculated by comparison with scenario 001 (situation without motorway and leight rail).
The effect of tunnel Kappelberg (115) is calculated by comparison with scenario 002 (which is also 114 - situation with motorway A81 and leight rail S1).
The effects of the other measures are calculated in comparison with scenario 003 (present state)