



Climate change impact on nutrient loads from the diffuse sources (agriculture, forest, urban)

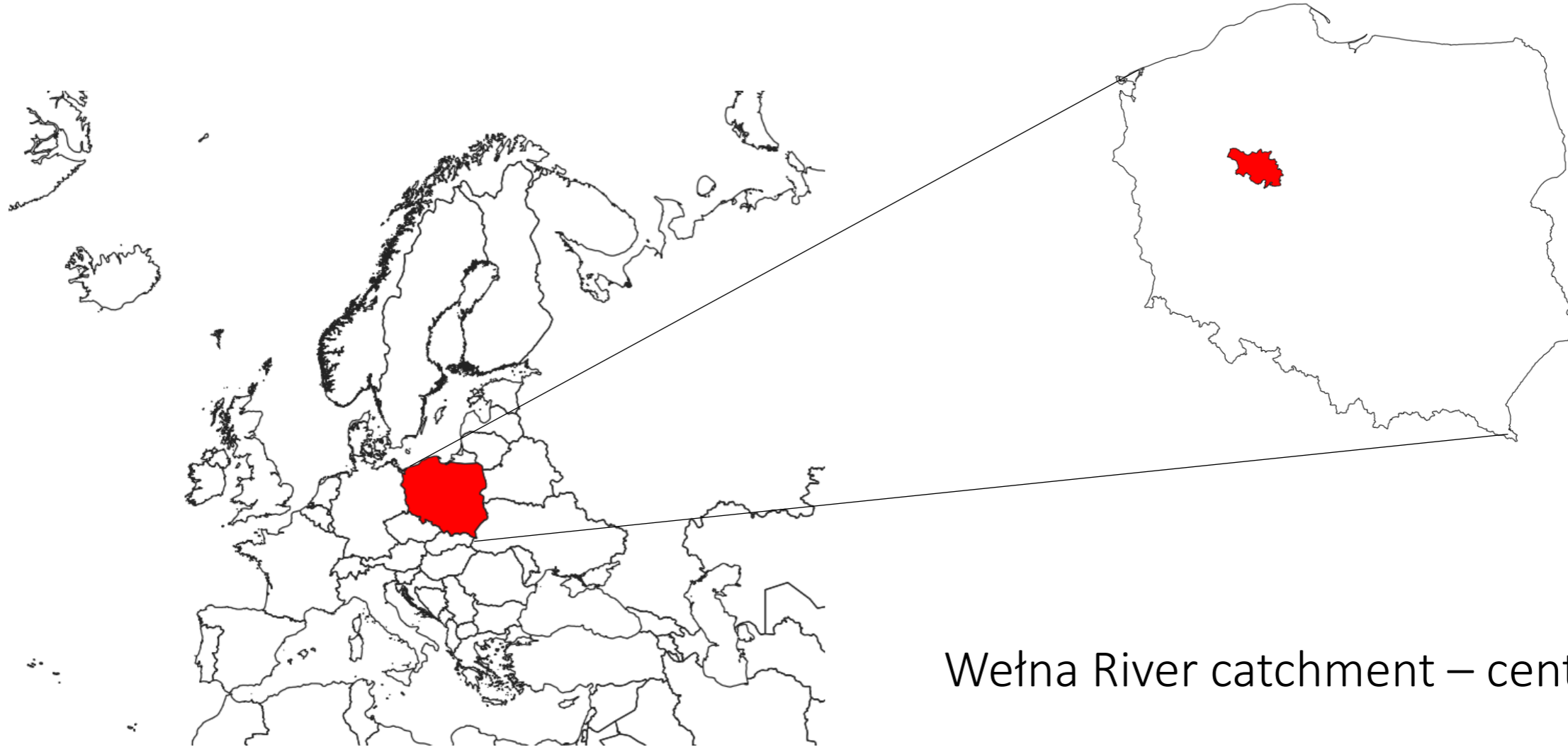
Damian Bojanowski¹, Paulina Orlińska-Woźniak², Paweł Wilk², Ewa Szalińska¹

1) AGH University of Science and Technology

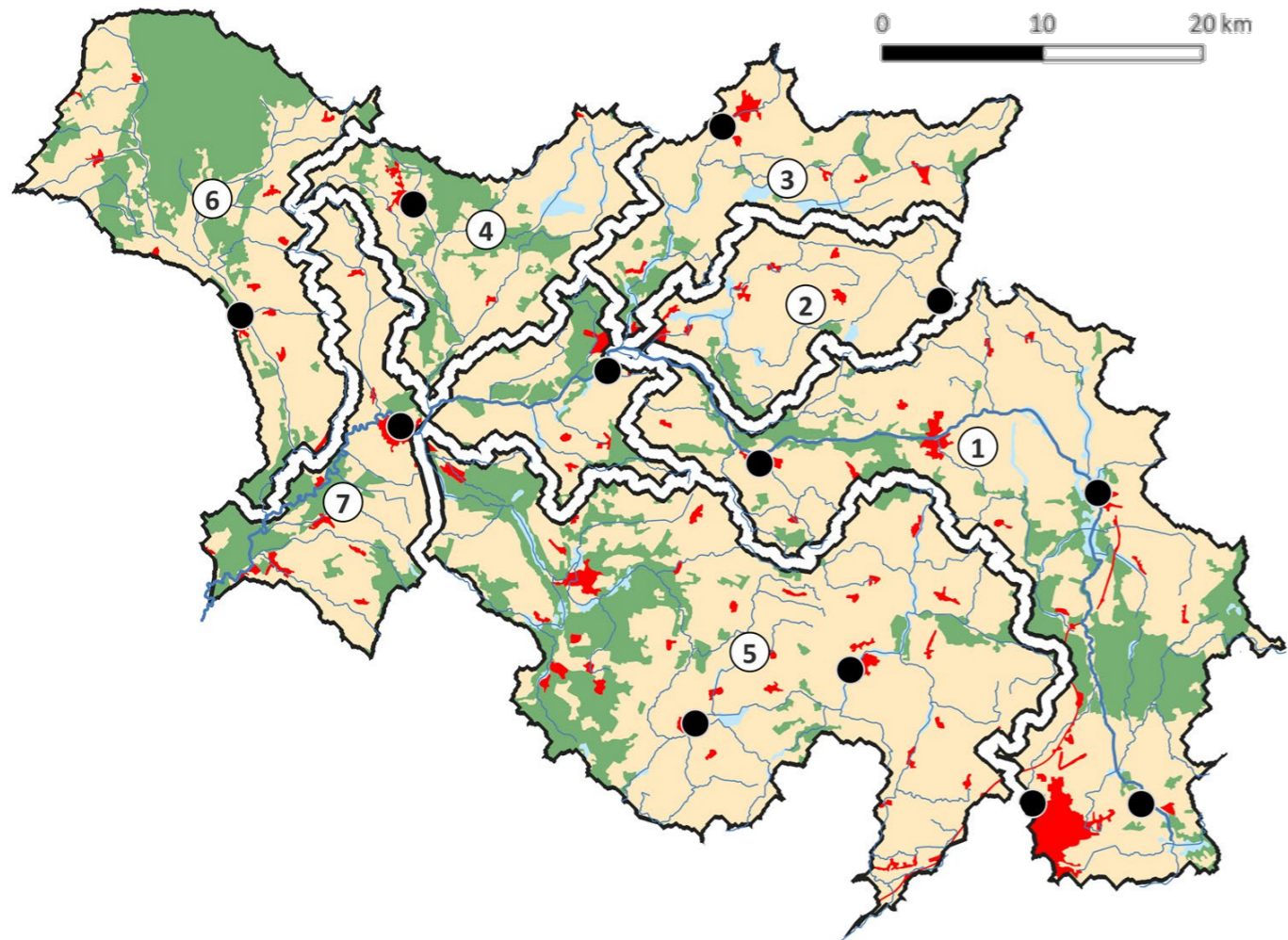
2) Institute of Meteorology and Water Management – National Research Institute

Aarhus, July 28th 2023

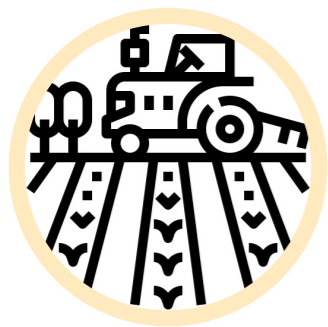
Analysed area – Wełna River



Wełna River catchment – central Poland



- Main watercourse: 118 km length
- Catchment area: 2 621 km²
- Agricultural development (72%)
- 7 subcatchments
- 5 sources including natural background
- 4 climate change scenarios



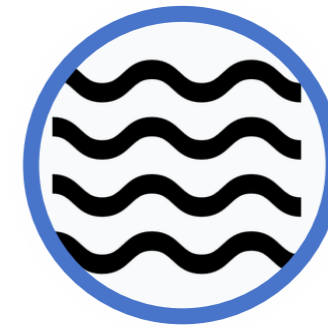
agriculture:
72%



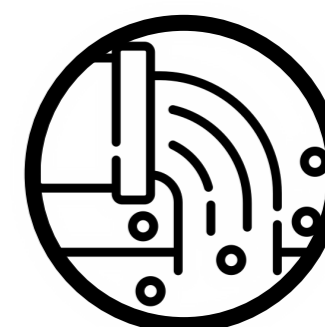
forestry:
22%



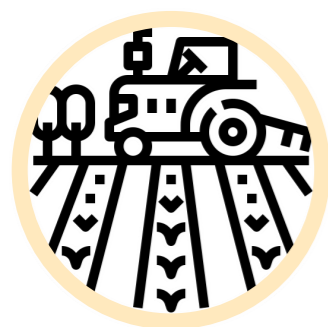
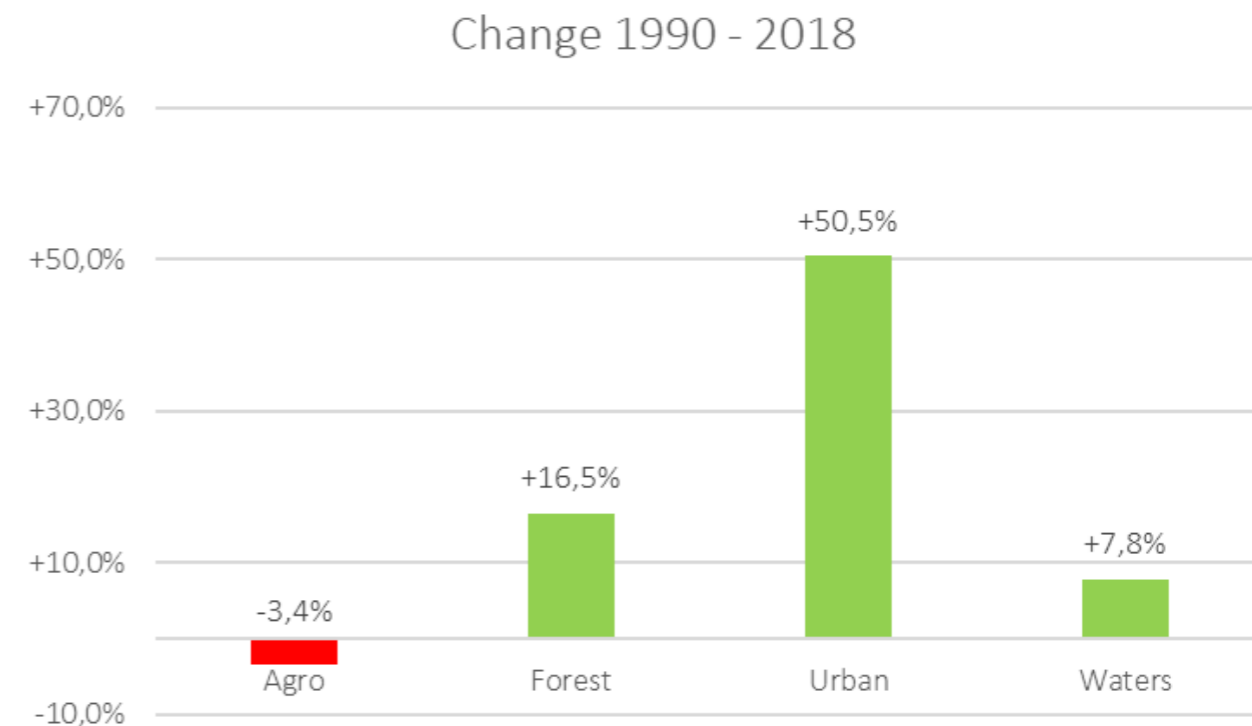
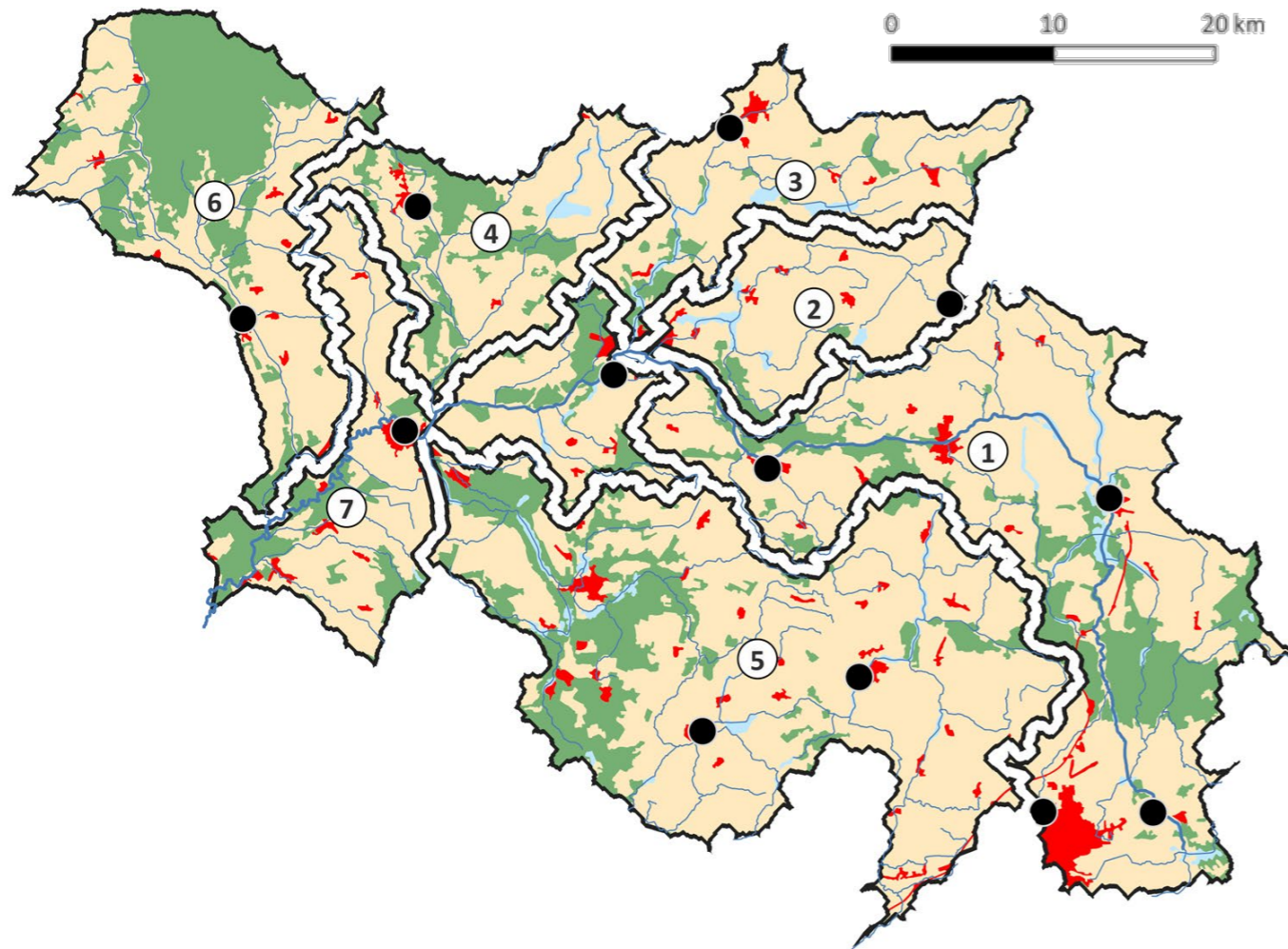
urban:
4%



waters:
2%



point sources



agriculture:
72%



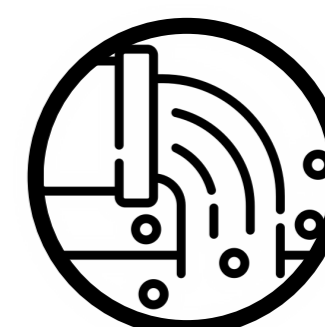
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waters:
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point sources

Baseline Scenario

Subcatch.	TN [kg/year]					
	Agro	Forest	Urban	Point	Background	Total
1	373 651	1 333	11 975	83 789	29 960	500 709
2	216 826	123	5 841	11 870	10 735	245 396
3	277 445	7 344	4 946	14 708	7 328	311 771
4	144 080	6 875	0	2 613	12 414	165 982
5	620 593	22 597	9 263	39 913	26 975	719 340
6	95 225	13 251	0	12 178	8 354	129 007
7	72 303	4 955	5 000	27 543	3 235	113 036
TOTAL	1 800 123	56 478	37 026	192 614	98 999	2 185 241

Subcatch.	TP [kg/year]					
	Agro	Forest	Urban	Point	Background	Total
1	7 472	64	606	3 068	1 747	12 957
2	4 280	5	276	579	610	5 750
3	3 416	332	221	1 750	597	6 316
4	1 921	287	0	249	613	3 070
5	7 451	746	536	4 430	1 270	14 432
6	2 223	483	0	1 613	357	4 676
7	2 002	314	185	1 721	280	4 503
TOTAL	28 766	2 231	1 823	13 410	5 473	51 703

Baseline Scenario

TN [kg/year]

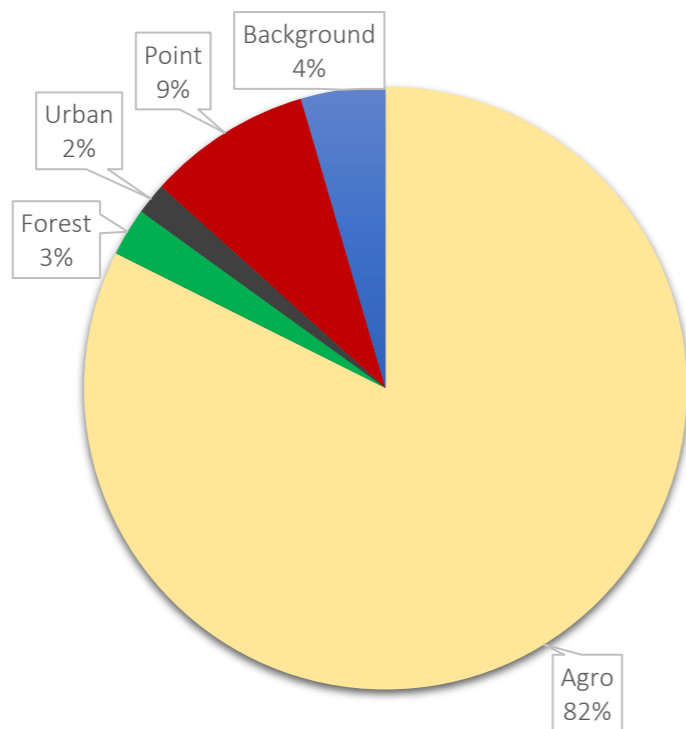
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TP [kg/year]

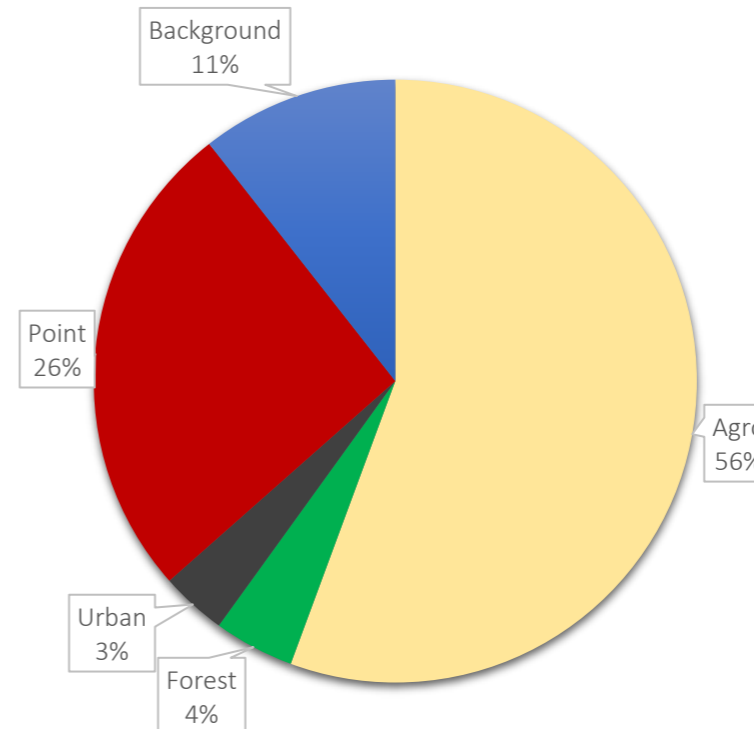
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BL – Load structure

TN

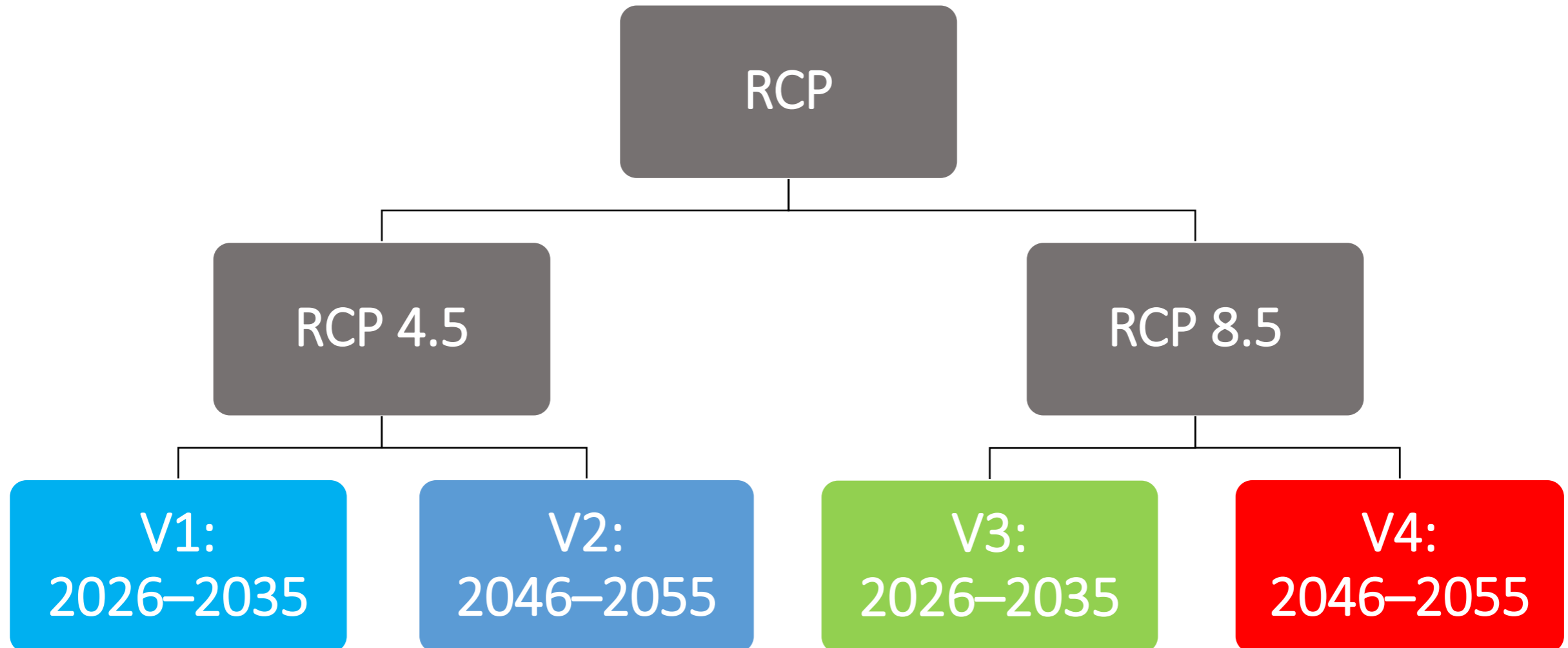


TP

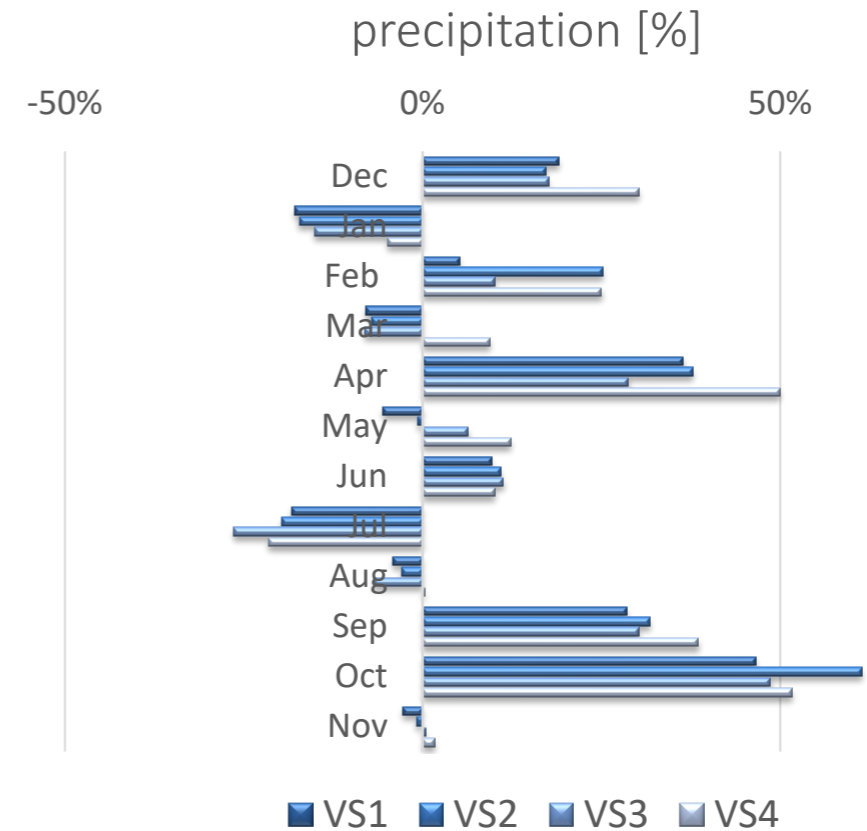
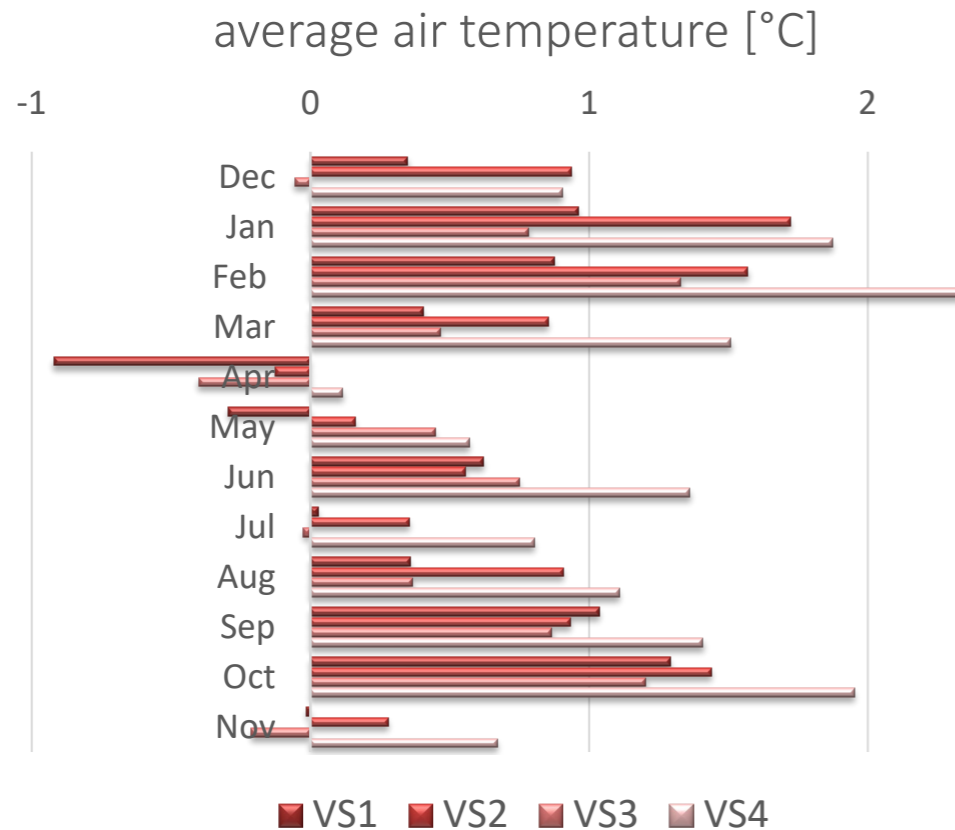


■ Agro
 ■ Forest
 ■ Urban
 ■ Point
 ■ Background

Climate scenarios

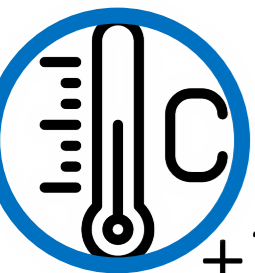


Input modifications

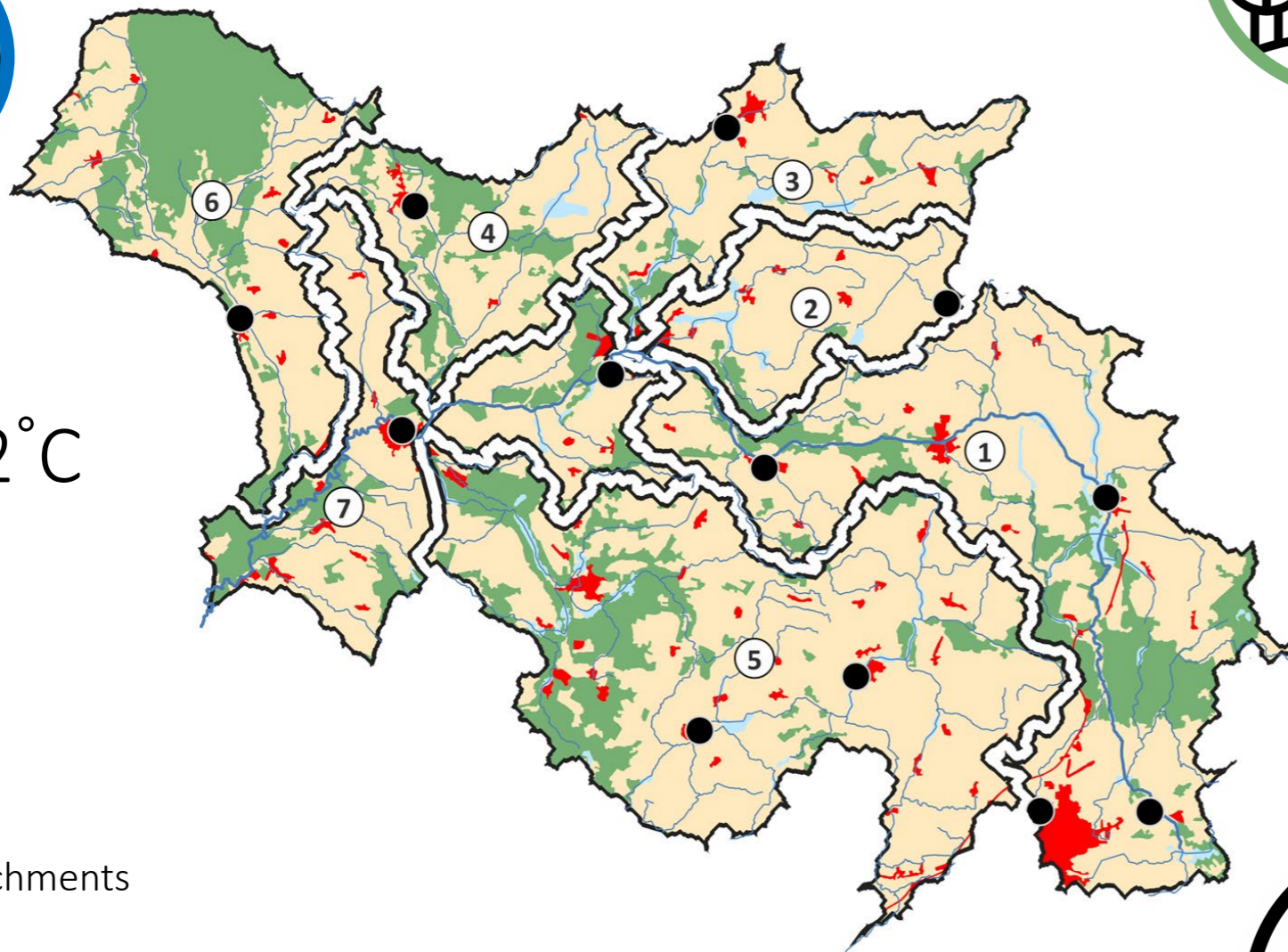


All forecasts has been provided from Urban Adaptation Plans (UAP) for the station Poznań located 25 km from catchment outlet (outside the catchment): <http://44mpa.pl>

up to +60%



+2°C



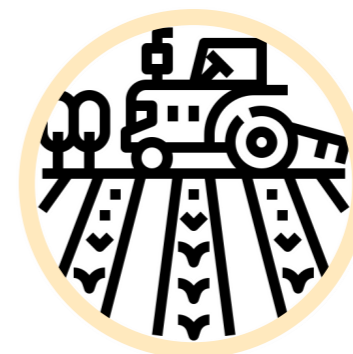
TN: up to +126%

TP: up to +248%



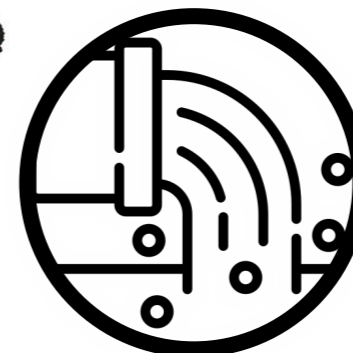
TN: up to +51%

TP: up to +302%



TN: up to +187%

TP: up to +225%



no major changes

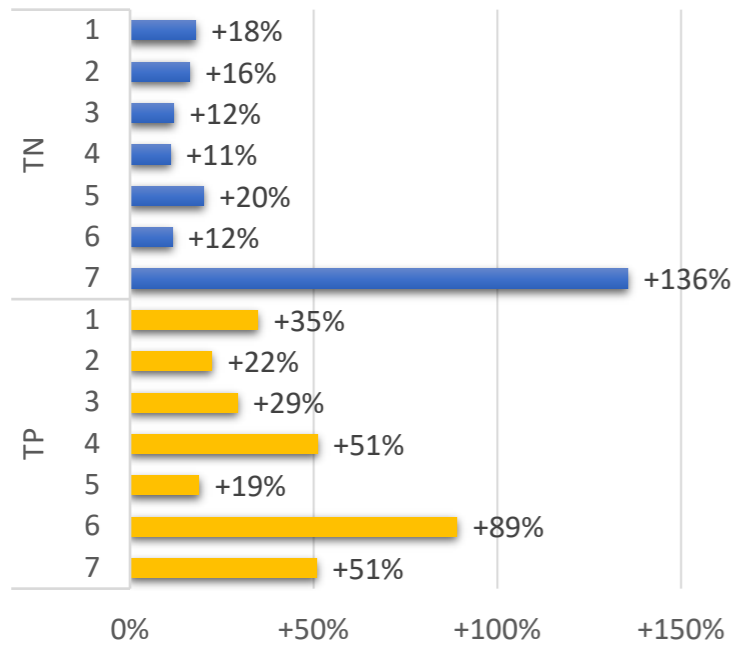
① subcatchments

● RCP scenarios – input

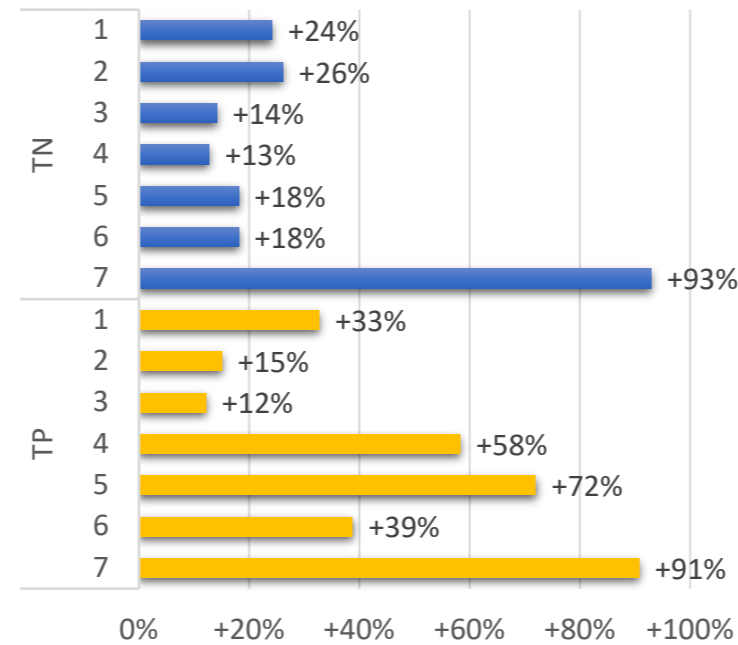
● nutrient emission – output

V1 results

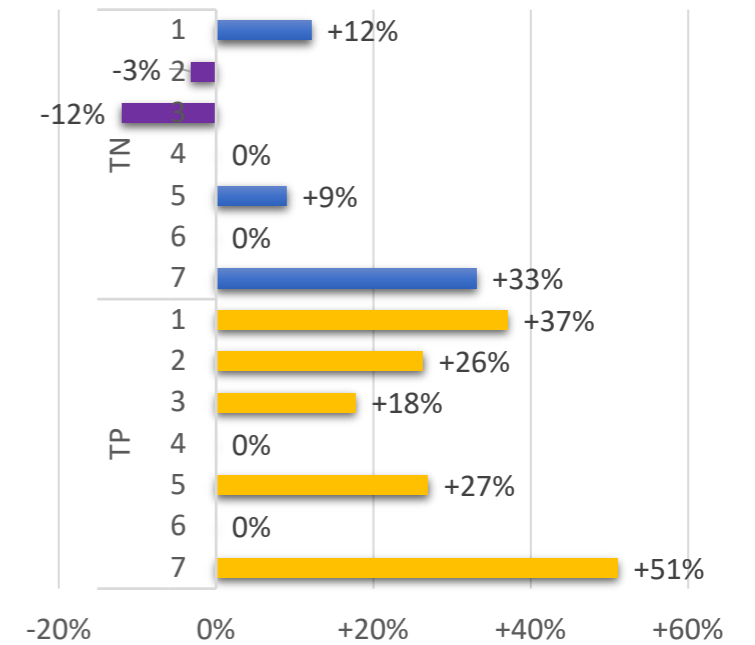
Agro



Forest

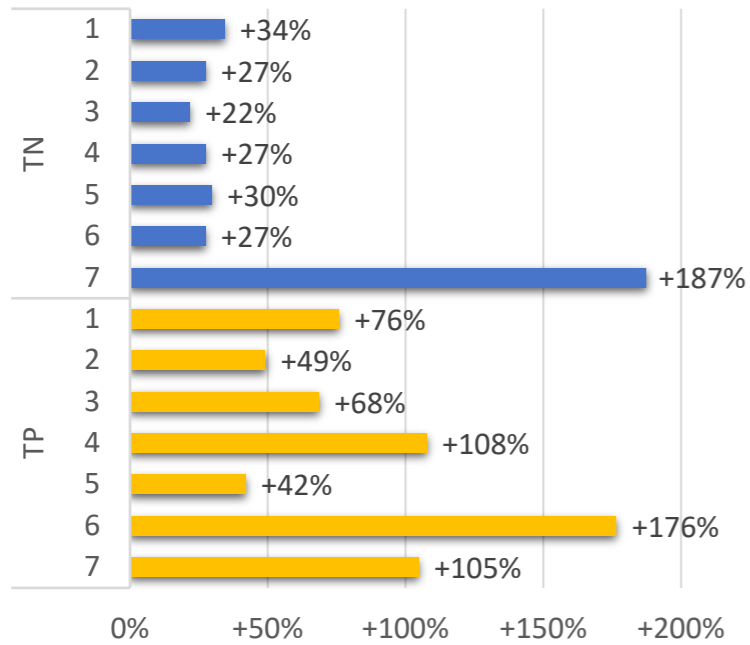


Urban

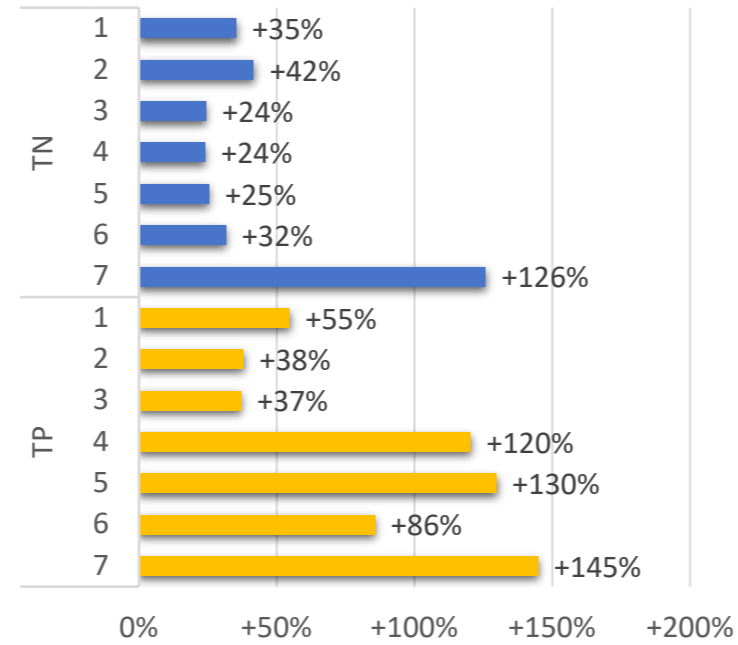


V2 results

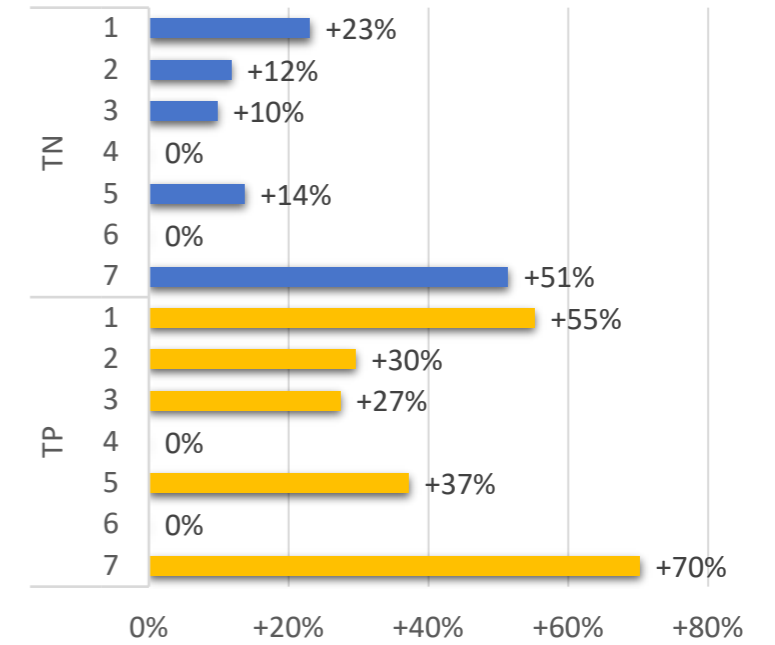
Agro



Forest

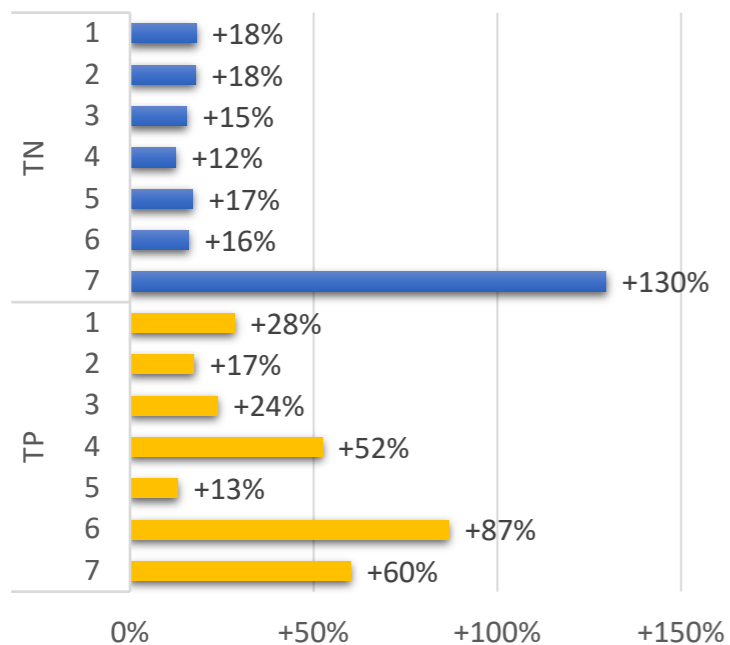


Urban

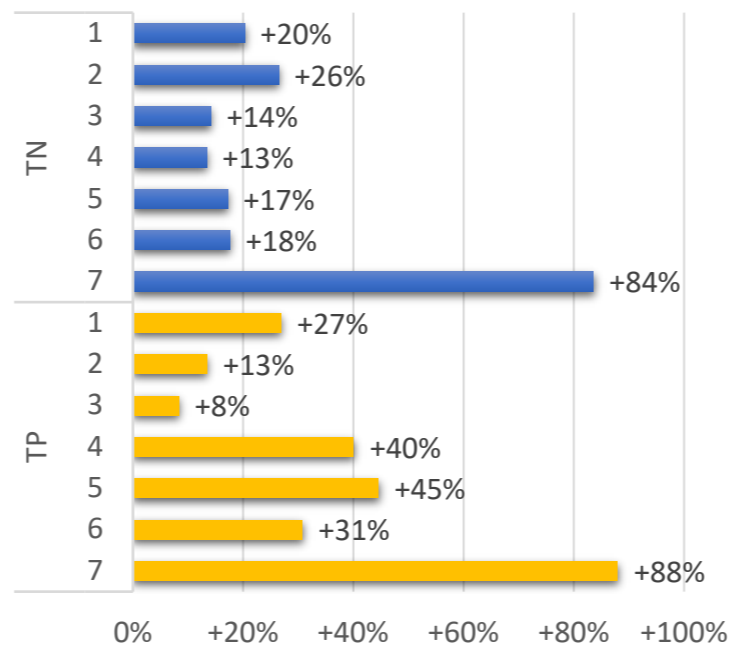


V3 results

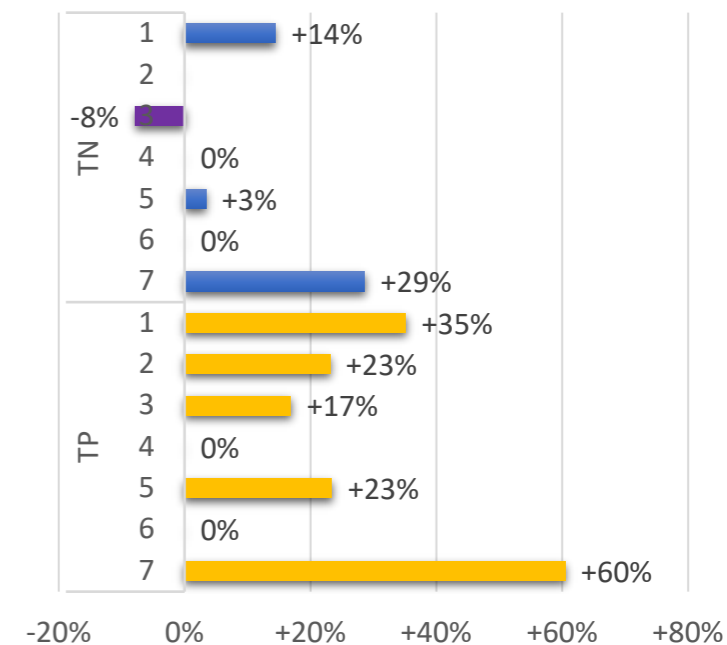
Agro



Forest

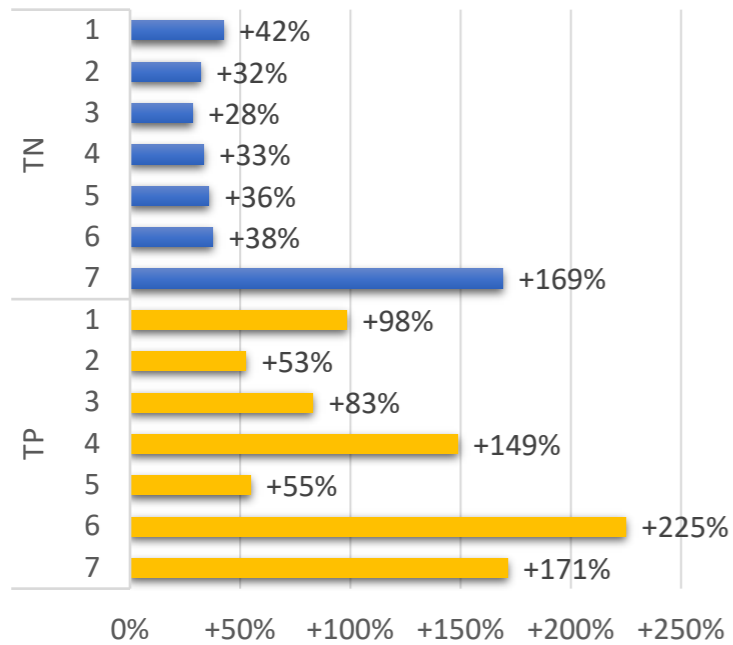


Urban

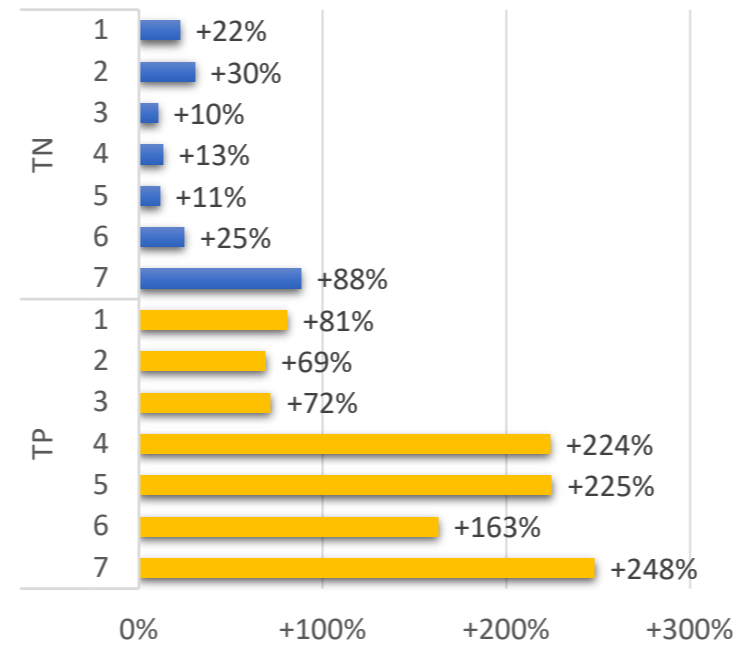


V4 results

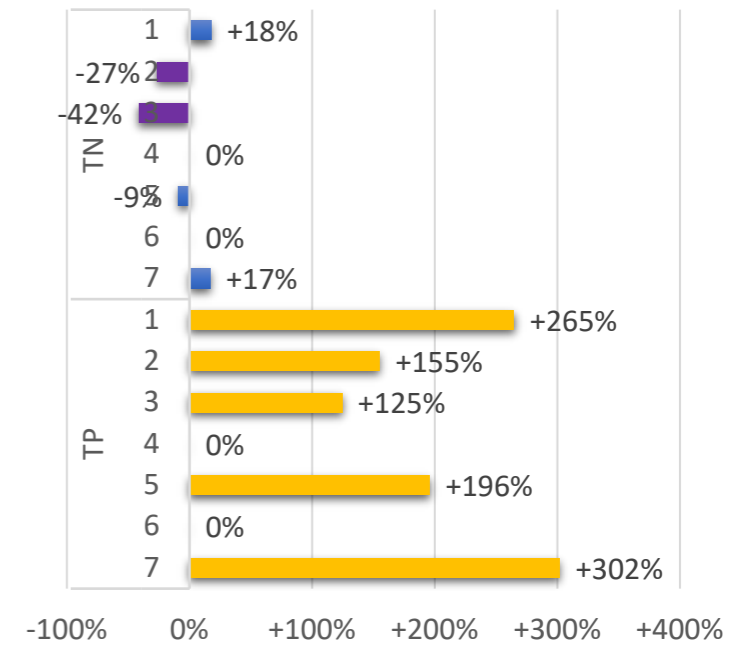
Agro



Forest

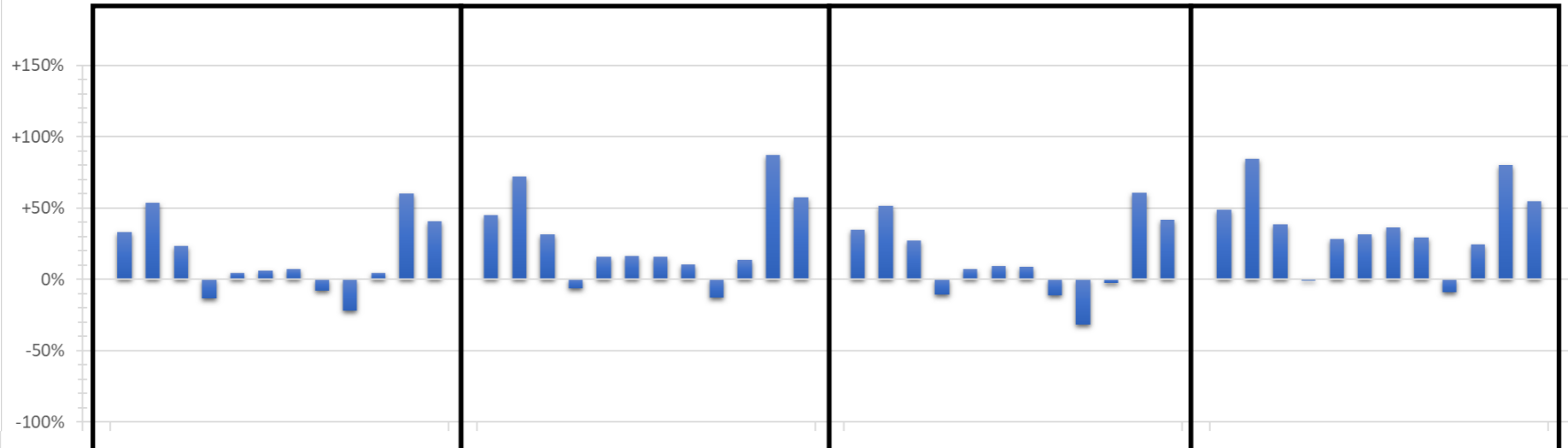


Urban

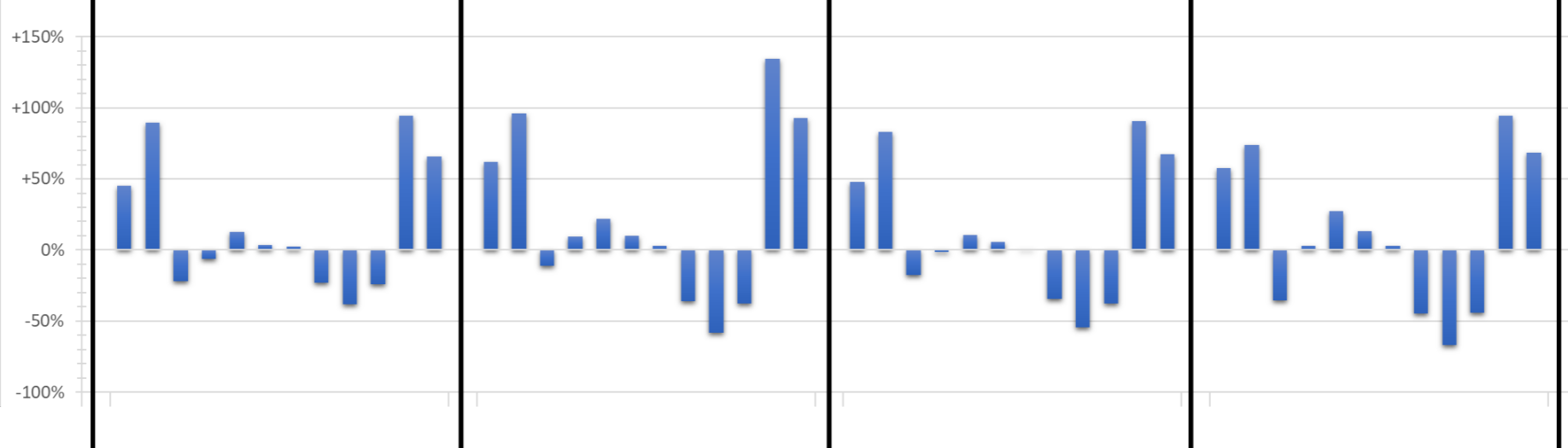


TN – monthly
(change to BL)

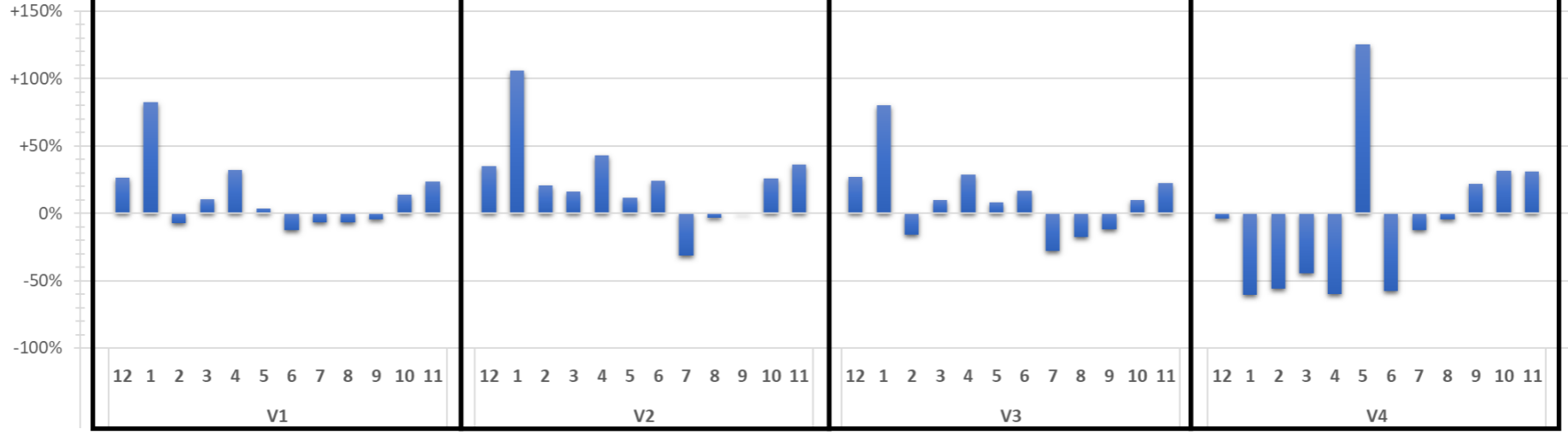
Agro



Forest

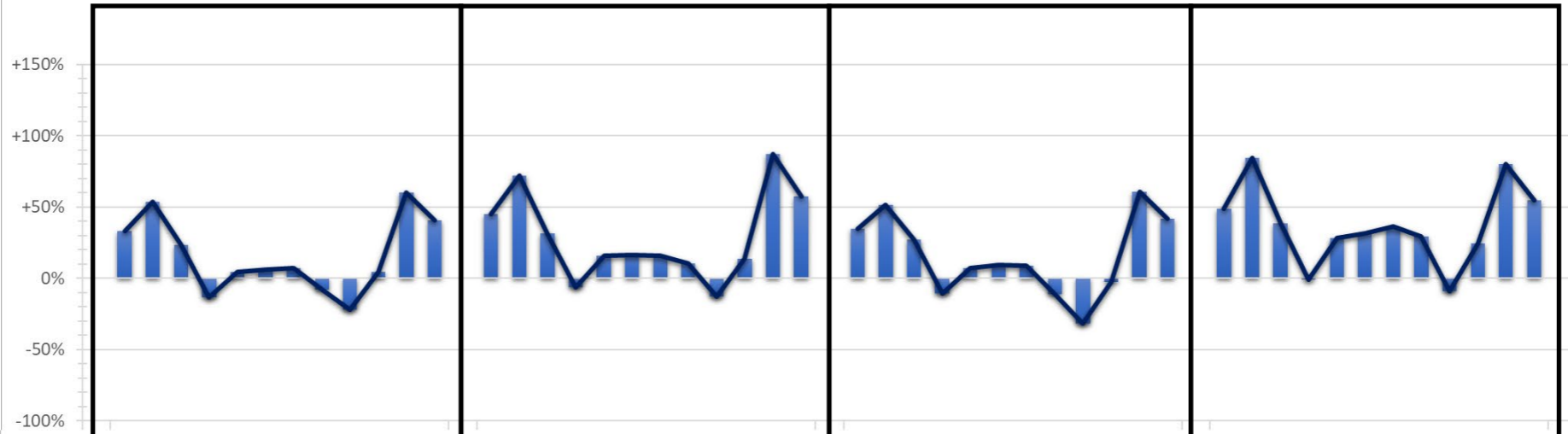


Urban

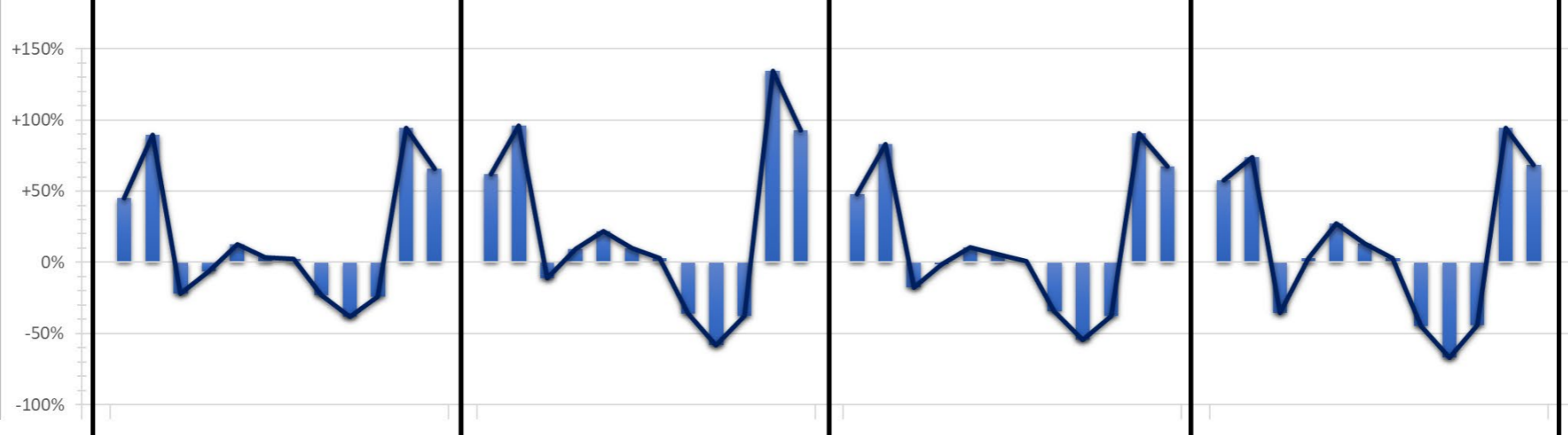


TN – monthly
(change to BL)

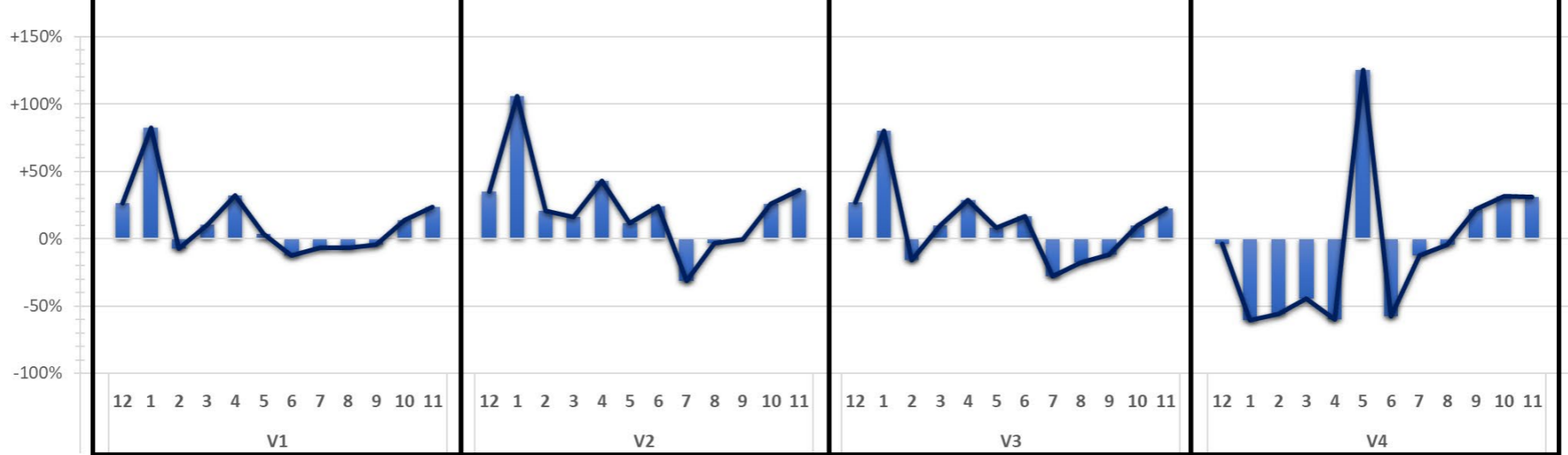
Agro



Forest

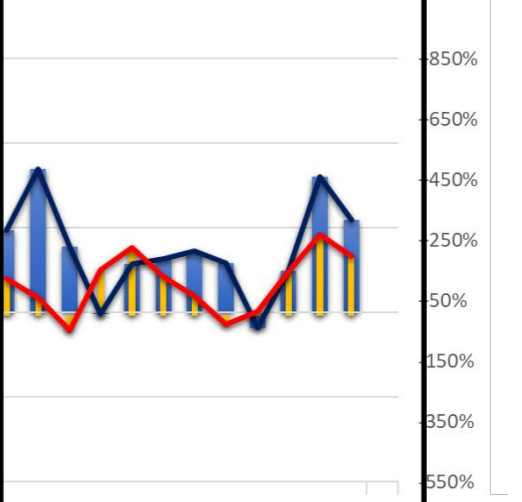
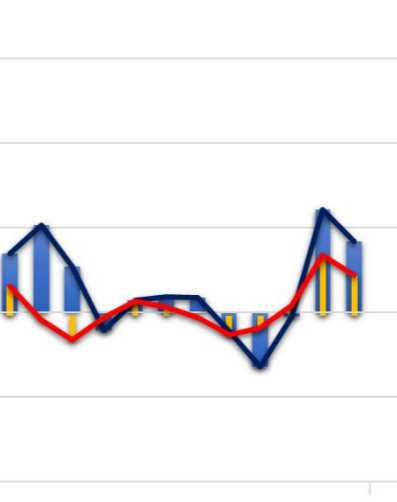
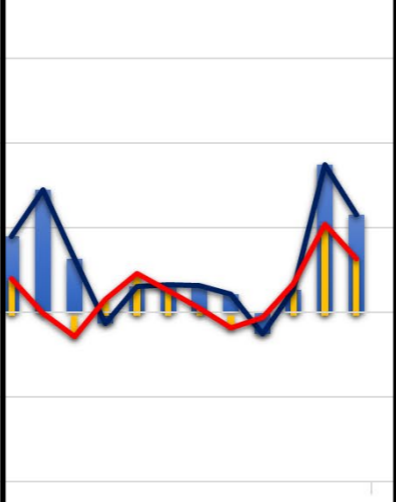
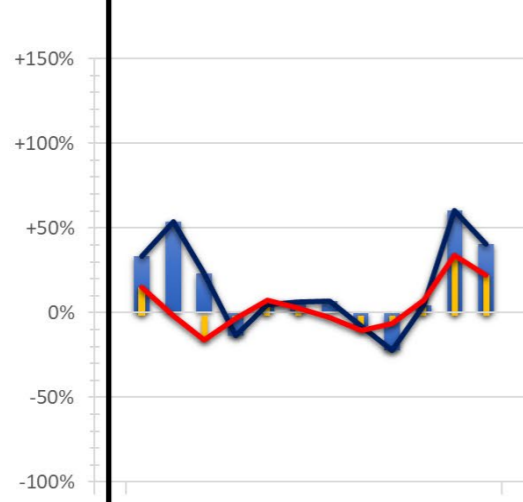


Urban

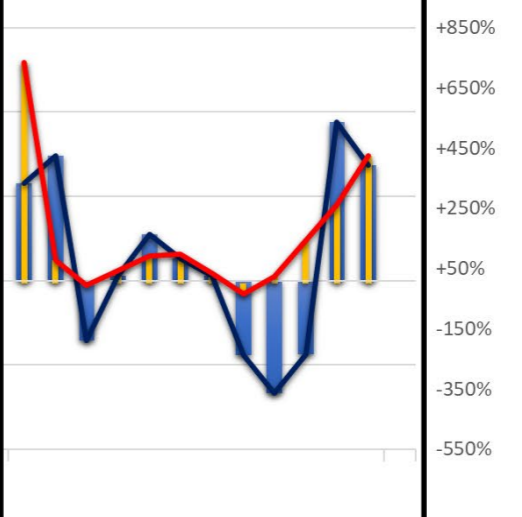
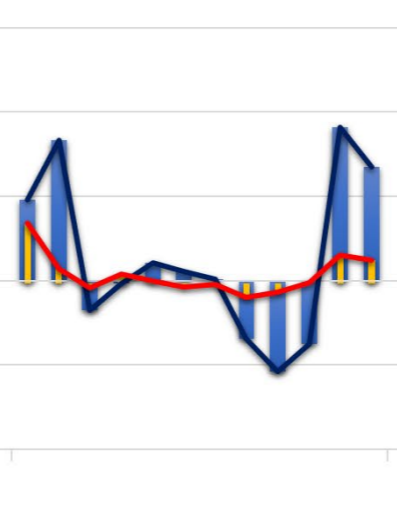
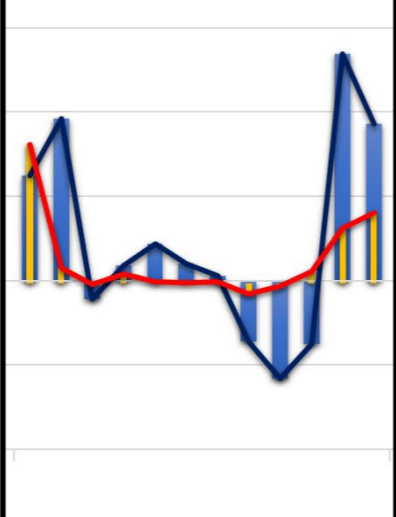
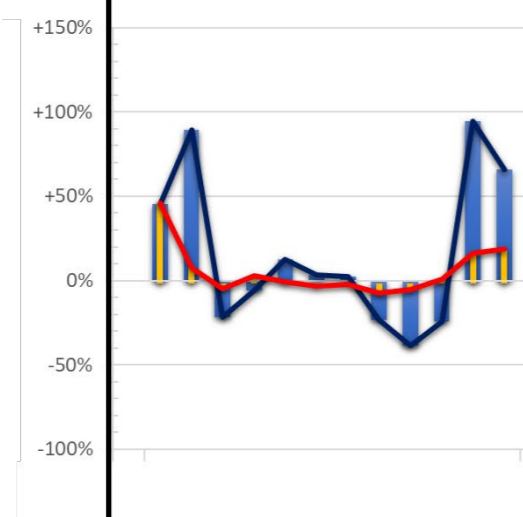


TN/TP – monthly
(change to BL)

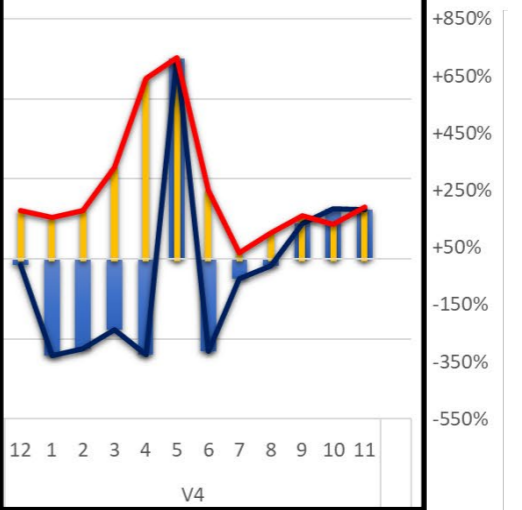
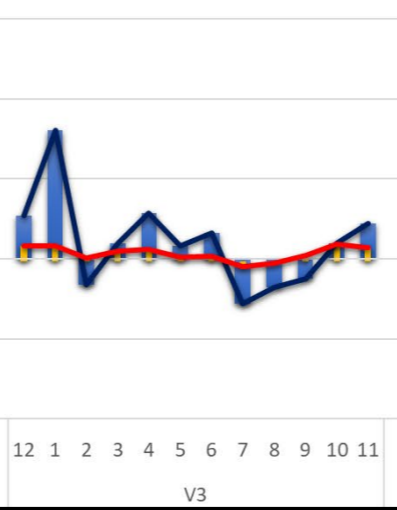
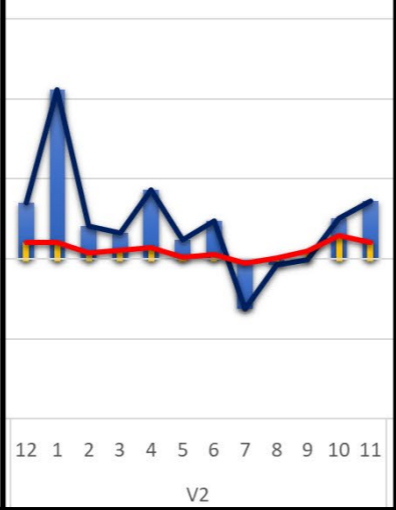
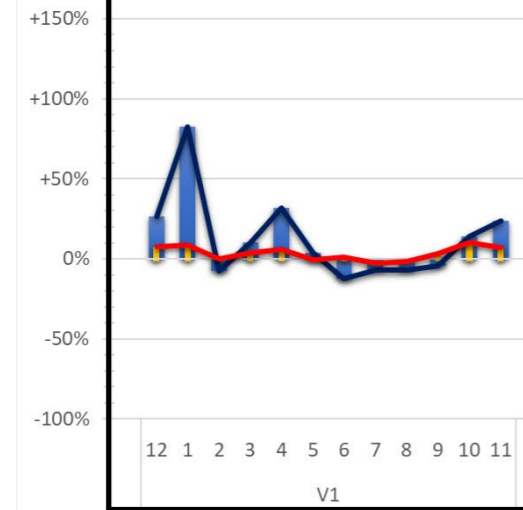
Agro



Forest



Urban



- TN
- TP
- TN line
- TP line

Conclusions

- Results confirmed the increase of the nutrient loads under the predicted climate changes in all the subcatchments
- Climate change will result in the load increase from the whole catchment by 34% for total nitrogen and 85% for total phosphorus
- Outputs from individual nutrient sources could grow up even by 187% for total nitrogen and 302% for total phosphorus
- Model based nutrient predictions may be used to plan actions mitigating climate change scenarios f.e in the RBMPs



Next step





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