KALME

VALSTS PĒTĪJUMU PROGRAMMA
KLIMATA MAIŅAS IETEKME UZ LATVIJAS ŪDEŅU VIDI

UNIVERSITAS LATVIENSIS
SCIENTIAE ET PATRIAE

River Basin Hydrology and Nutrient Run-off from Land to the Surface Waters

WP2

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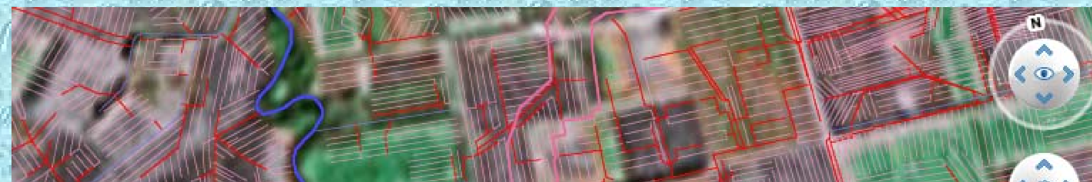
WP2. Task 1. Collect and upgrade data sets necessary for river modeling

Final version of GIS map with data sets for modeling was prepared for Berze river



Sub - basin	Sub catchments' area,		%	Agricultural land km2		%
	From former maps	From drainage map		Corina LC	From farm register	
1	12,19	9,32	76	1,06	0,75	71
2	73,31	69,28	94	34,7	29,11	84
3	120,69	121,16	100	59,54	58,71	99
4	68,20	57,22	84	16,29	16,84	103
5	27,94	27,90	100	5,27	6,21	118
6	4,06	4,19	103	3,27	3,41	104
7	43,15	43,16	100	24,28	24,06	99
8	103,20	100,94	98	46,86	51,85	111
9	109,87	105,59	96	54,73	53,92	99
10	40,41	53,00	131	13,91	18,35	132
11	14,80	20,62	139	4,68	4,63	99
12	21,16	12,81	61	6,05	5,28	87
13	94,47	89,49	95	35,41	36,38	103
14	92,67	93,68	101	63,08	69,65	110
15	69,71	63,69	91	38,54	47,00	122
Total	896	872	97	408	426	105

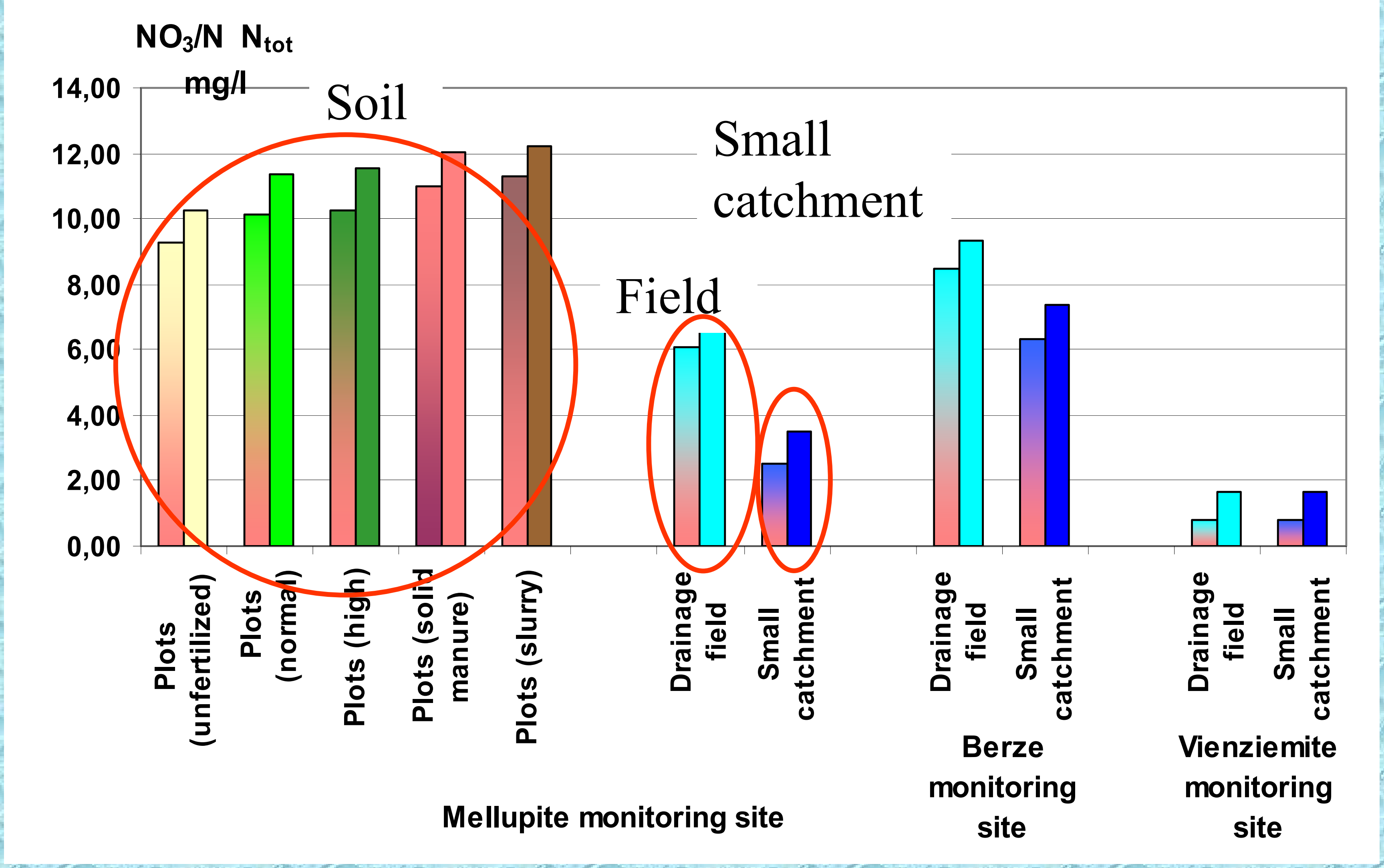
WP2. Task 2. Investigate nutrient retention processes in soil-field -channel -river system

Small

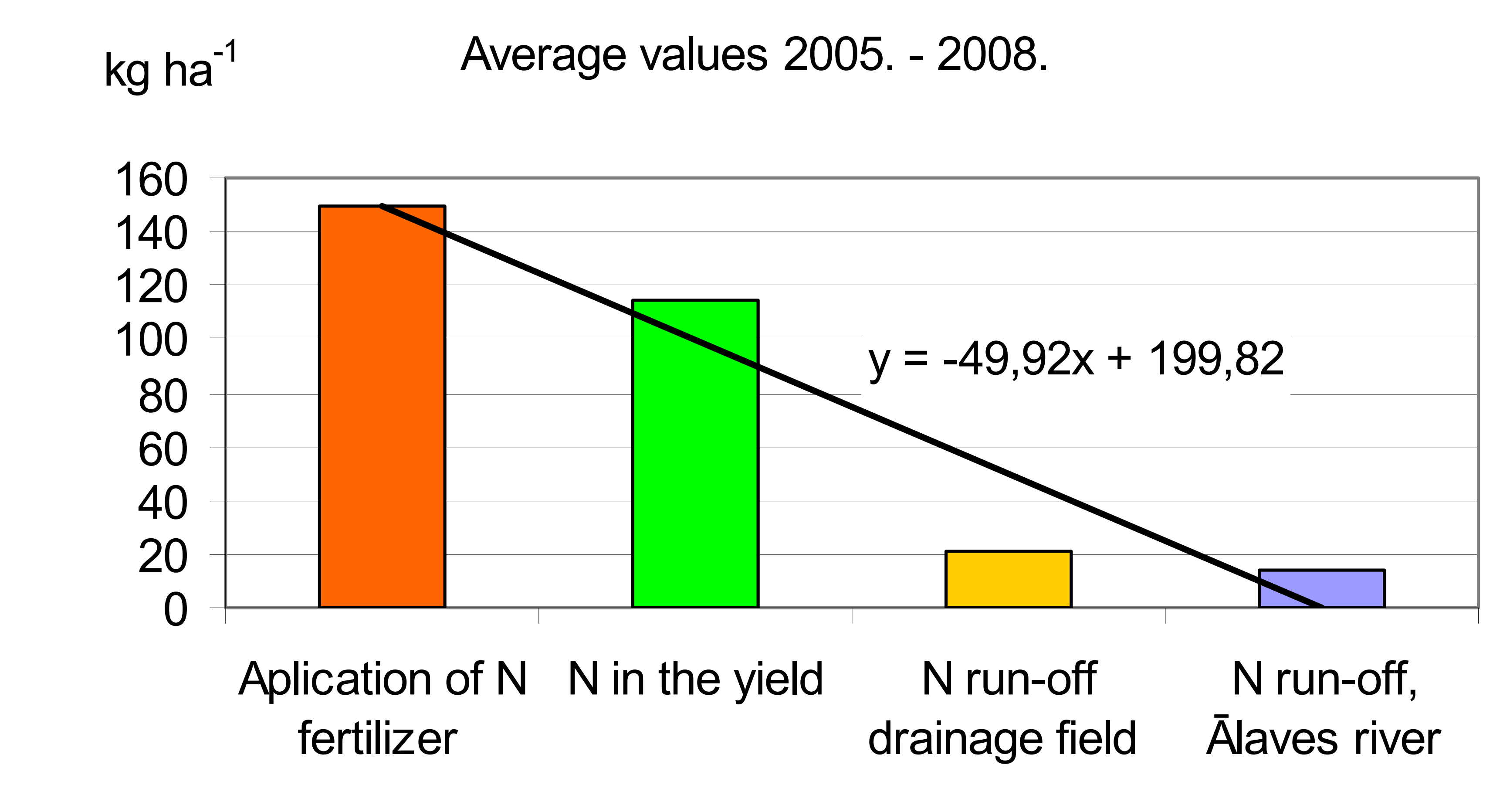
Soil

ver

Results (leakage of N and retention)



Nitrogen pathways
(Bērze drainage field)



WP2. Task 3. Catchment Modeling

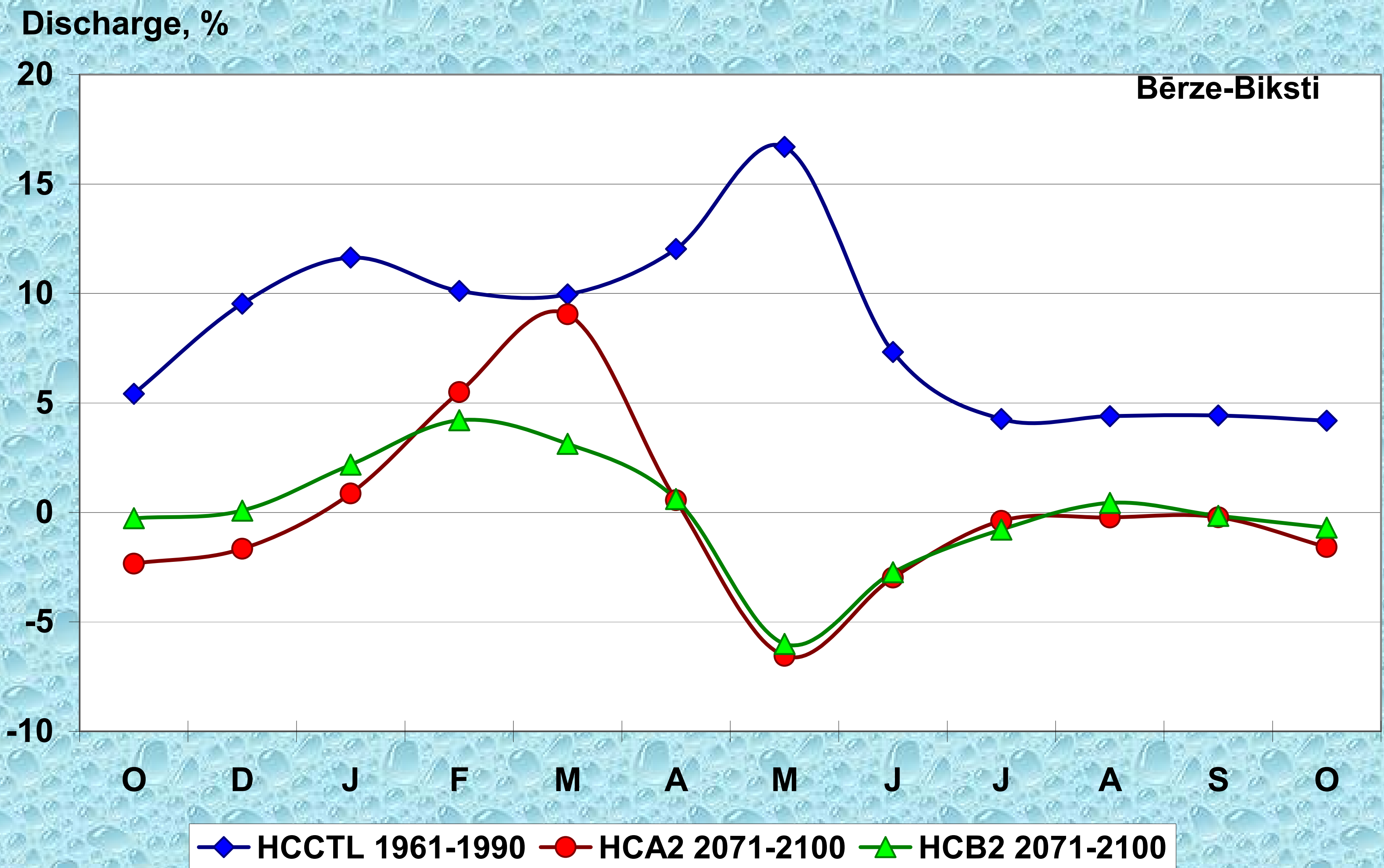
1. Hydrology

Last version of METQ model (METQ2007BDOPT, developed by A.Zīverts) was used in five type river basins (Bērze, Salaca, Vienziemīte, Iecava and Imula) and for sub-basins of the Salaca River.

Results

River basin and hydrological station	Period of the calibration (1961-1990)		Period of the validation (1991-2000)	
	R^2	r	R^2	r
Imula – Pilskalni[4)]	0.66	0.77	0.43	0.70
Bērze - Baloži	0.72	0.85	0.62	0.80
Bērze – Biksti[3)]	0.67	0.83	0.43	0.76
Iecava – Dupši [4)]	0.66	0.82	0.44	0.79
Vienziemīte – Vienziemīte	0.86	0.91	0.63	0.84
Salaca – Lagaste	0.80	0.93	0.87	0.95
Salaca - Mazsalaca	0.76	0.88	0.77	0.87
Briede - Dravnieki	0.69	0.85	0.72	0.87
Seda – Oleri [2)]	0.60	0.81	0.62	0.87
Rūja – Vilnīši [1)]	0.52	0.75	0.57	0.77

Results of modeling



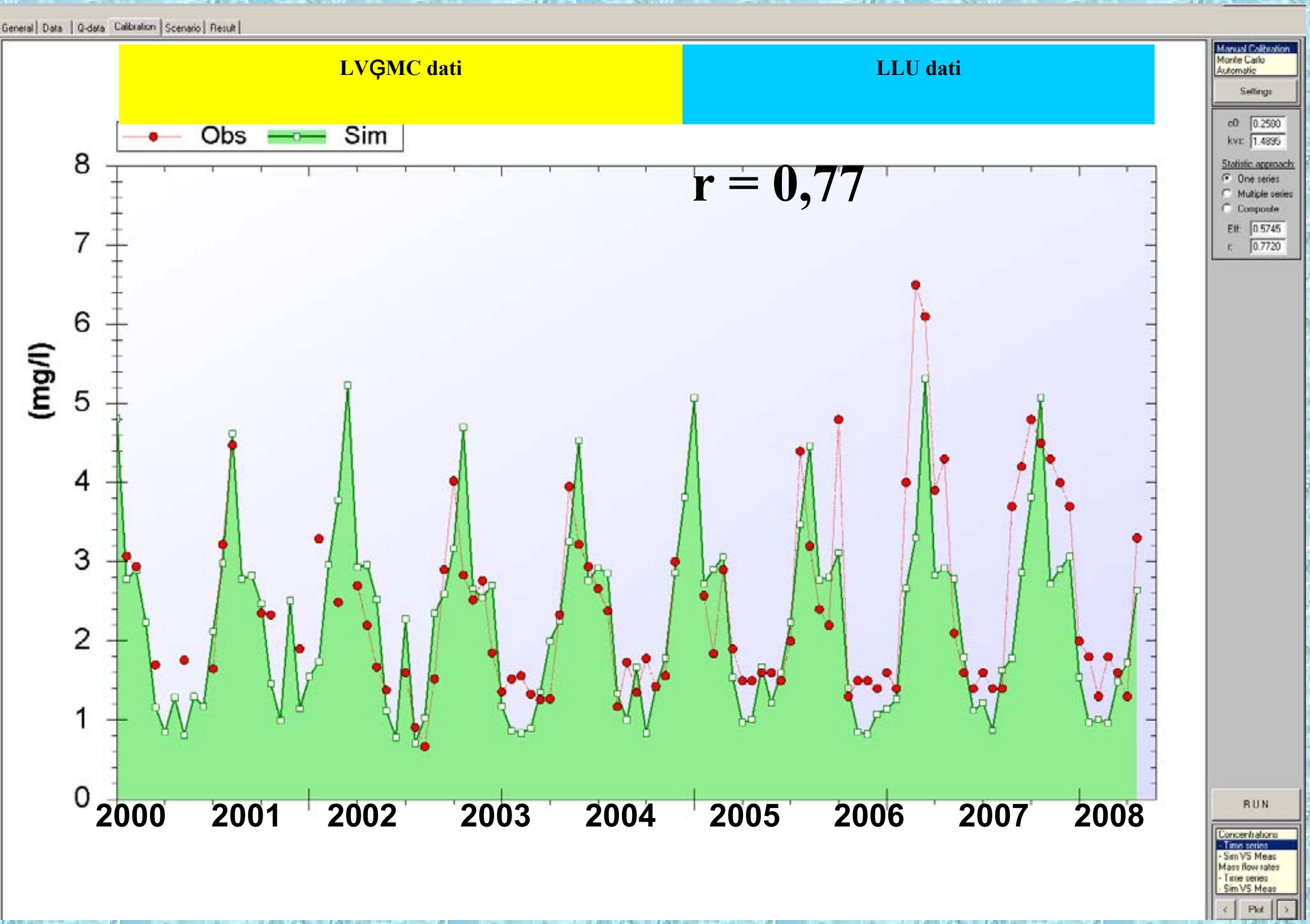
The eventual impacts of climate change on hydrology of River basin

1. **Climate change** may increase normal year air temperature by 2-4 C^o, increase may occur during all seasons, highest increase is predicted during autumn and winter;
2. **Climate change** may create an increase of the precipitation, especially during winter;
3. **Climate change** could decrease and change seasonal distribution of the river run-off e.g., less run-off during spring and autumn floods, increase of run-off in winter;

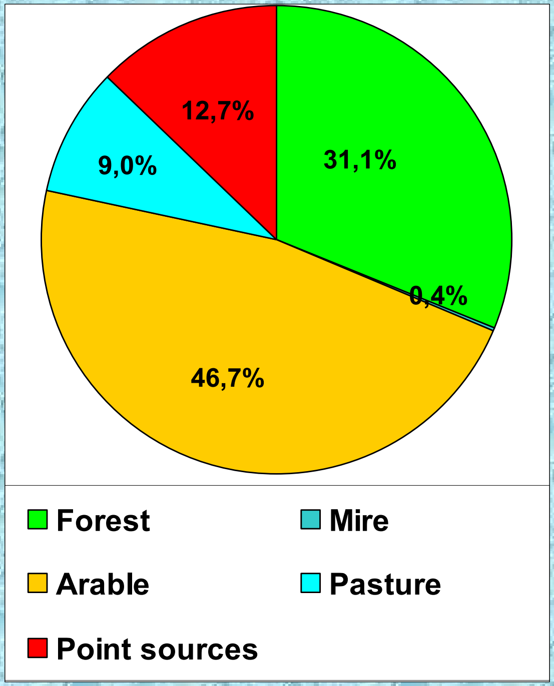
2. Modeling of the Water quality (Fyris model, SLU)

Bērze River sub catchment 12. (Downstream Dobele town)

Nitrogen



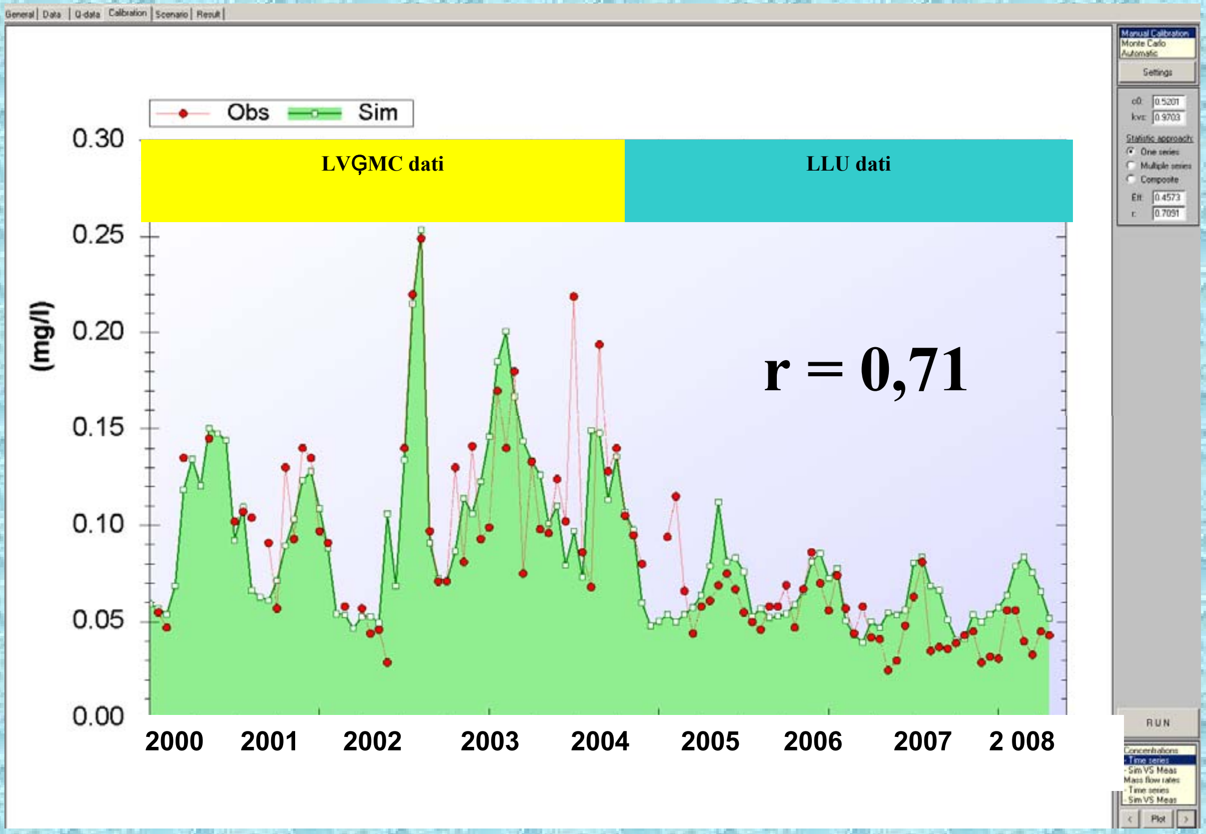
N pollution sources



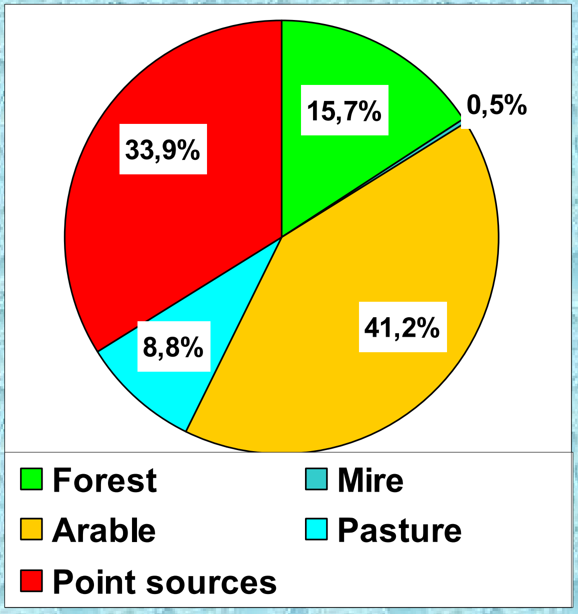
Modeling of the Water quality (Fyris model, SLU)

Bērze River sub catchment 12. (Downstream Dobele town)

Phosphorus

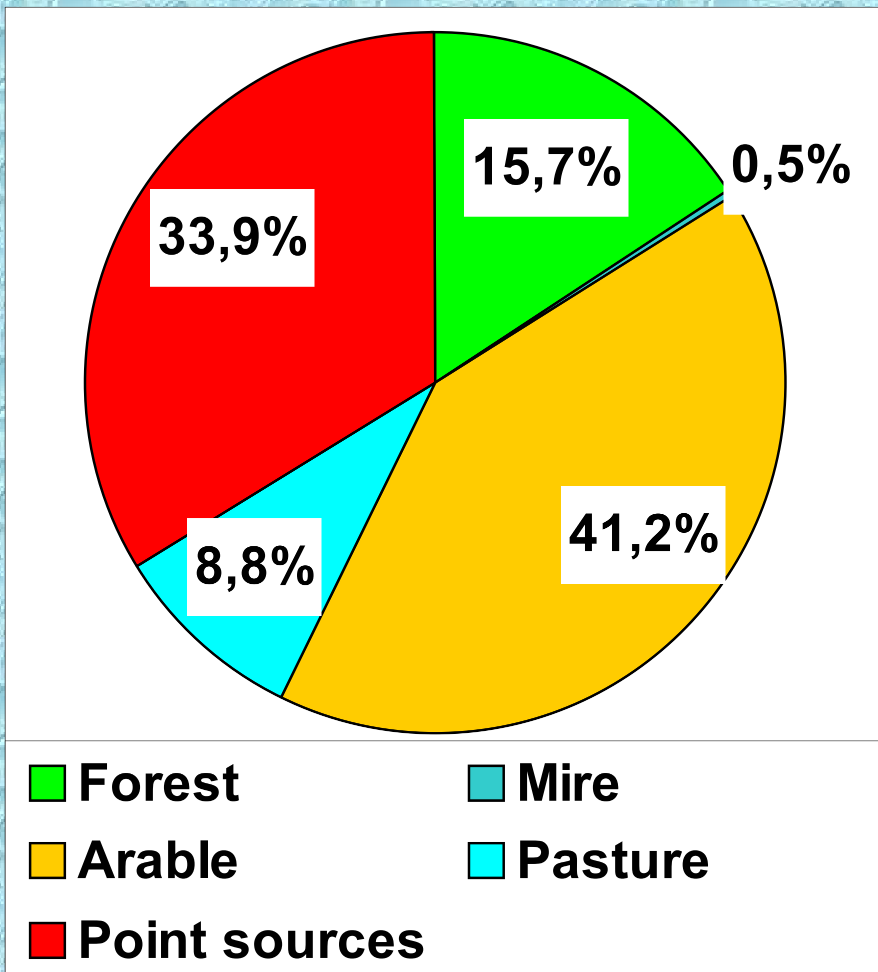


P pollution sources

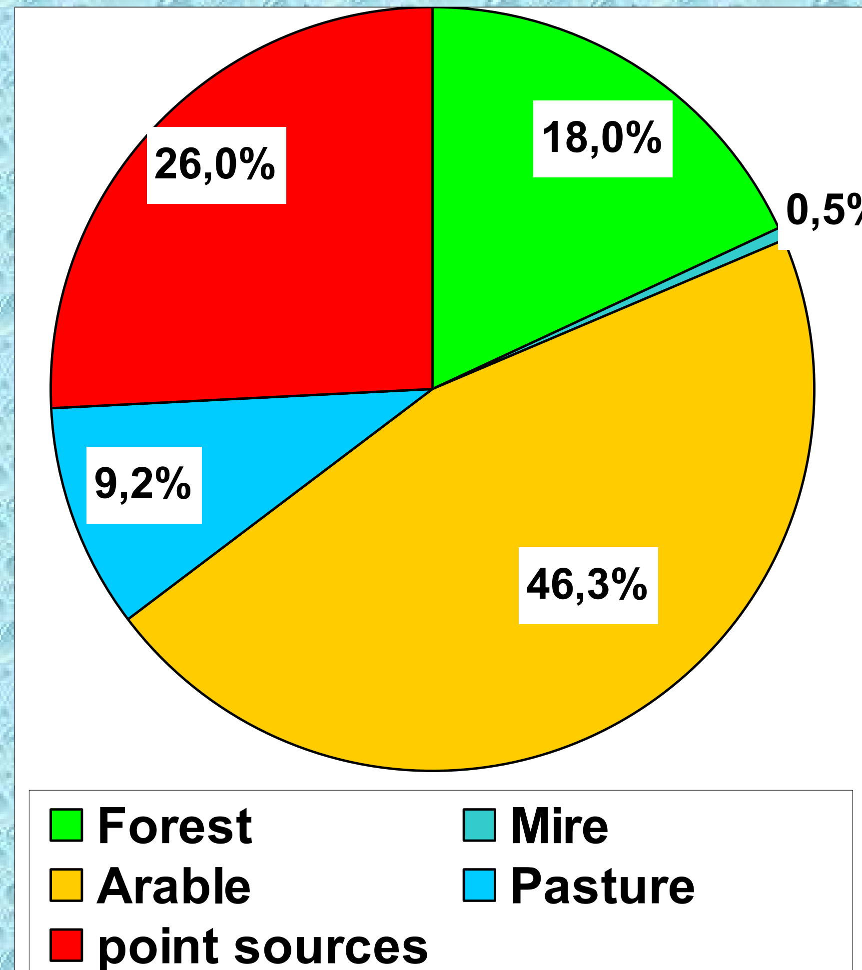


Climate changes could change source apportionment for phosphorus load

2000 - 2008

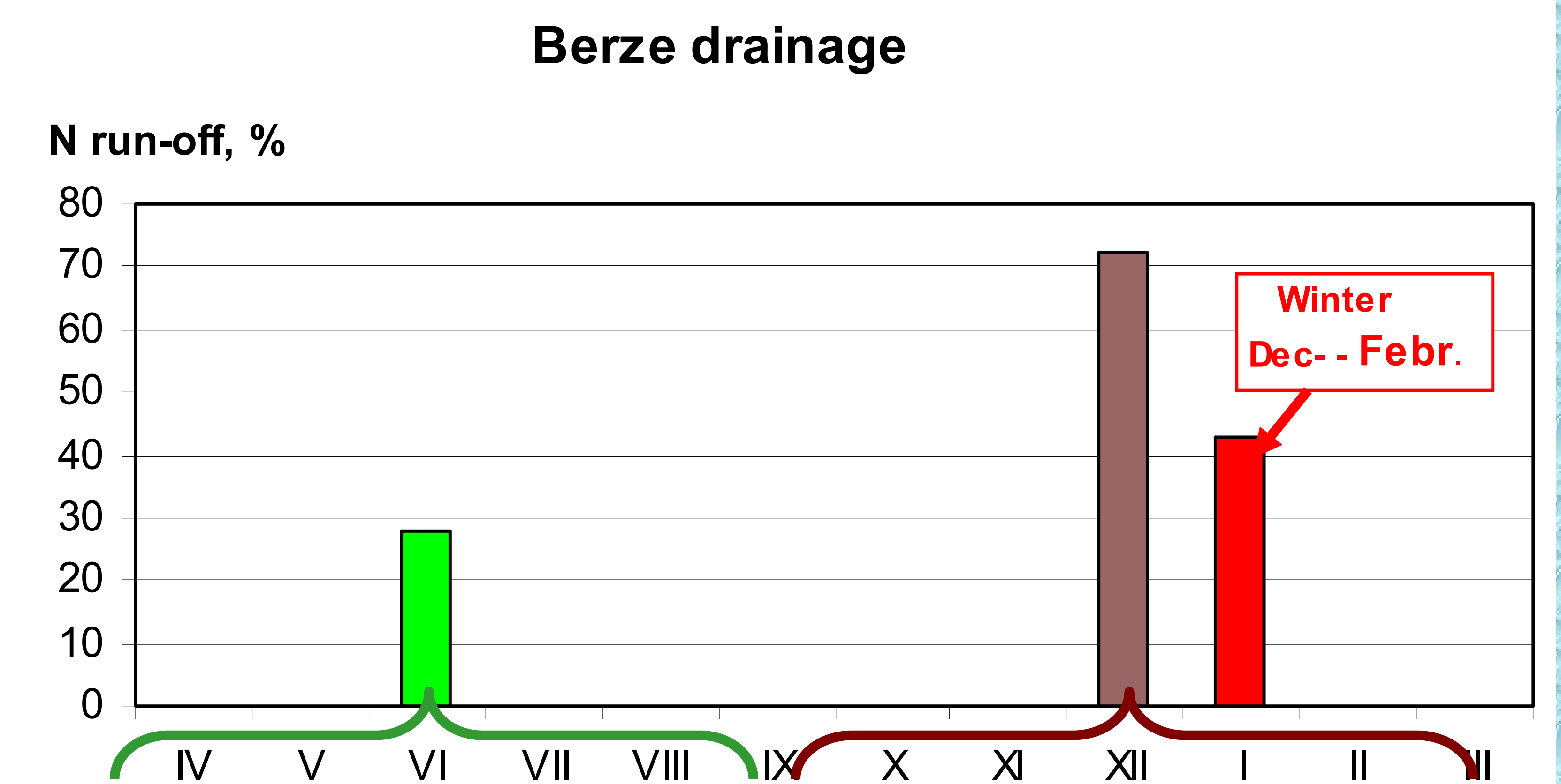


HCB2



The eventual impacts of climate change on water quality in Berze River basin

Climate change could increase yearly plant nutrient run-off (loads) by 6-20% , especially during winter



Seasonal distribution of the nutrient run off (average X.1993. –XII.2008.)

But:

The modeling applications still have a lot of uncertainties estimating proper scale, direct impact and combinations of the impacts (field, small catchment and river basin level):

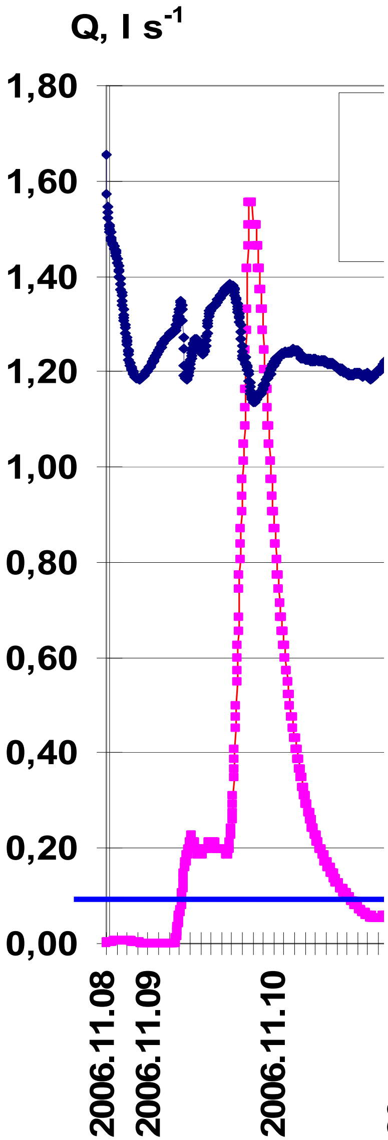
- **Seasonality in nutrient runoff will change.** It is hard to prove a cause-effect relationship between climate change and individual extreme events promoting nutrient run-off in winter.

- **Intense precipitation** shown to increase, even where mean precipitation decreases. Large differences in average mean daily and maximum discharge depending on scale. Most of yearly nutrient runoff e.g. P could discharge in relative short time (few days in field and small catchment scale).

- **New crops** could be introduced and cultivation of winter types could increase. Leakage coefficients? Effects of climate change on cropping systems have already been observed (e.g. winter rape, corn).

- **Length of growing season.** Impact on leakage during spring and autumn period?

Impact of the extreme weather events (dry summer 2006, mild winter 2006-2007)



Field	*Soil layer* (cm)	*Content of the mineral nitrogen, mg kg^{-1} dry soil* 2006.g. *autumn*		2007.g. *spring*	
		NO_3- N	NH_4-N	NO_3- N	NH_4-N
Silarāji	0 - 30	21.4	6.6	2.6	4.1
	30 - 60	6.8	3.3	6.1	3.1
	60 - 90	1.3	2.7	8.2	2.7
Dzelzarāji	0 - 30	2.3	3.6	2.2	3
	30 - 60	0.5	3.1	0.8	2.4
	60 - 90	0.5	2.9	0.6	2.3
Klaipiņi	0 - 30	16.6	4.1	7.1	2.9
	30 - 60	3.3	3.3	5.7	3.1
	60 - 90	0.9	3.4	5.1	2.6
Puķes	0 - 30	11.4	3.9	3.4	3.5
	30 - 60	1.7	3.1	3.1	3.2
	60 - 90	1.3	2.6	2.4	2.7
Vāverītes	0 - 30	14	4.1	3.5	3.2
	30 - 60	9.6	3.4	5.5	3.4
	60 - 90	1.9	3	4.9	3
Kāpas	0 - 30	34	3.7	5.9	3.7
	30 - 60	18.9	3.7	7.9	3.3
	60 - 90	7.1	3.2	11.3	3.1