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CENTRAL EUROPE

European Union
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Final Project Conference

FramWat - Framework for improving water balance and nutrient mitigation by applying small water retention measures



KAMIENNA AND STATIC TOOL



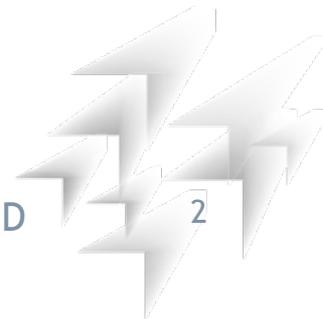
Dorota Pustowska-Tyszewska, PhD

Introducing the
catchment

Problems
occurring in the
catchment

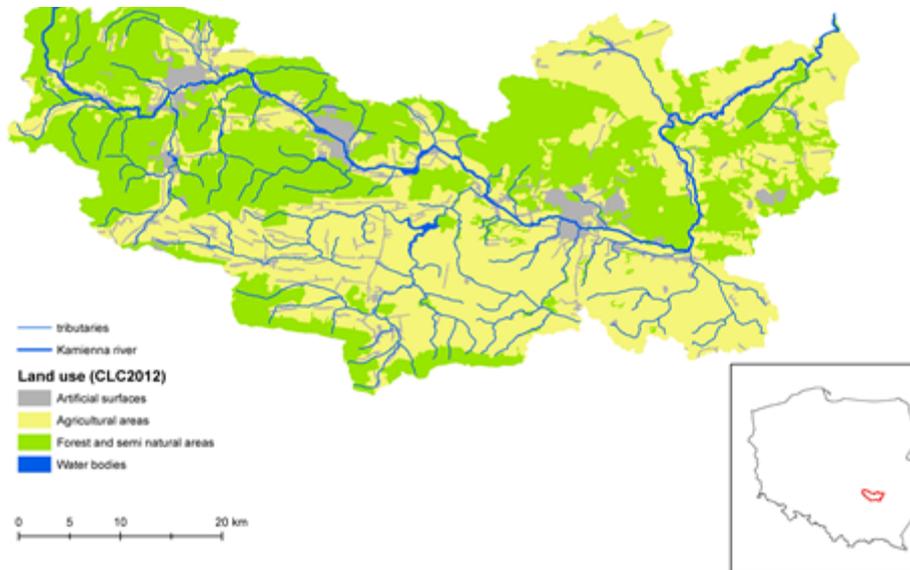
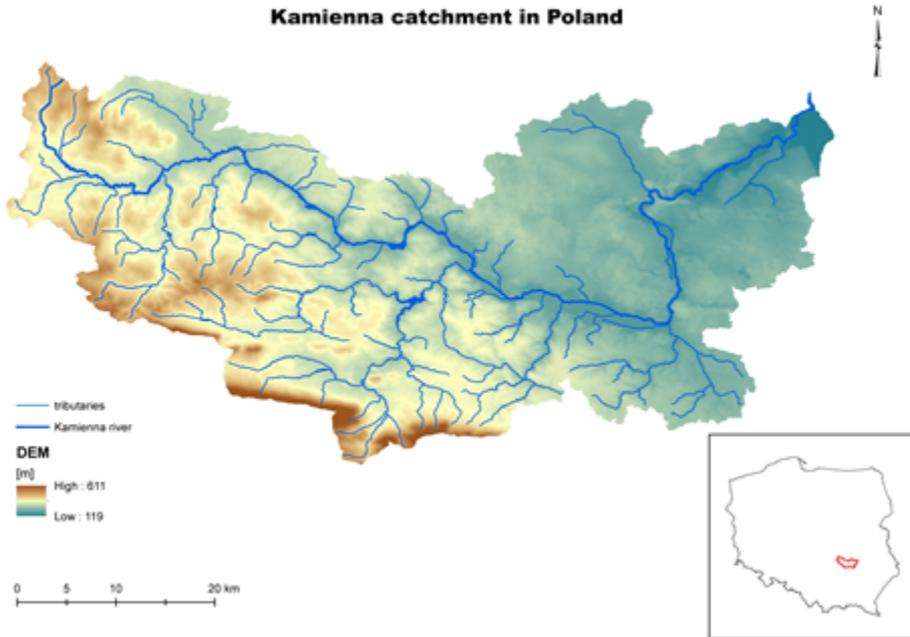
Static Tool

Static Tool
results



THE KAMIENNA RIVER CATCHMENT

Kamienna catchment in Poland



Characteristic	Unit	Value
Character of catchment		Lowland/piedmont
Catchment size:	km ²	2020
Average flow low/avg/high*	m ³ /s	2.9/8.3/40
Extreme flow low/high*	m ³ /s	0.07/113
Annual precipitation low/avg/high*	mm	420/640/920
Annual air temperature min/avg/max*	°C	3/6/12
Agriculture area	%	49
Urban area	%	6.4
Forest area	%	44.2
Open Water area	%	0.4
Flooded area (1/100 years)	km ²	55.6
Artificial drainage area	km ²	59.2
Ecological status (No. good / bad)	water body	2/11
Major problems to achieve good ecological status		Phytobenthos, Macrophytes NH4, PO4, Norganic

* 1951-2013

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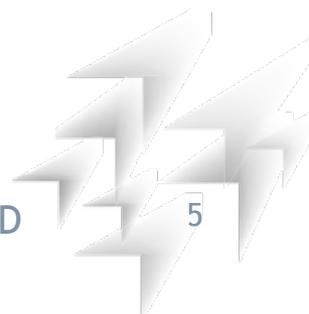
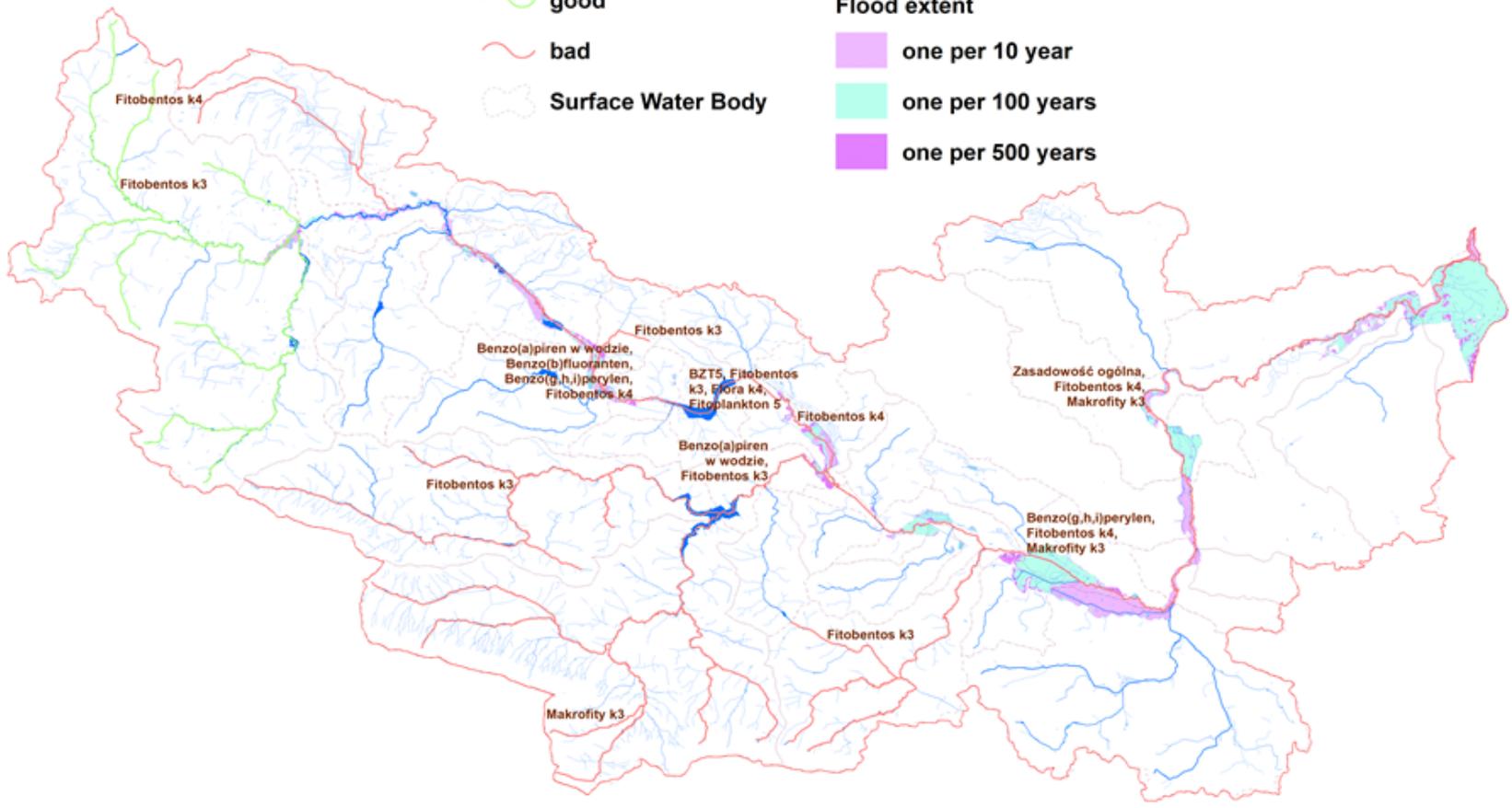
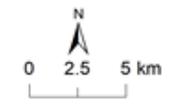
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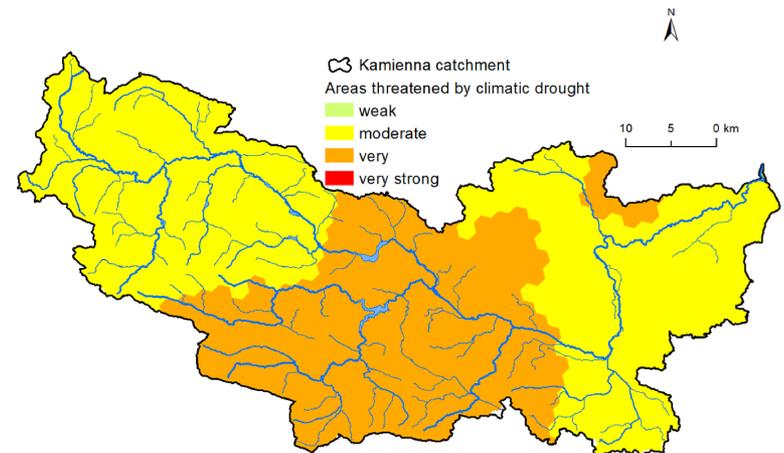
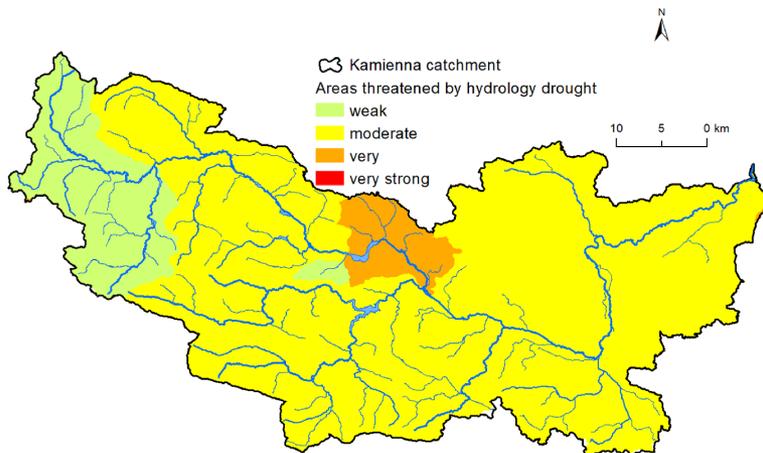
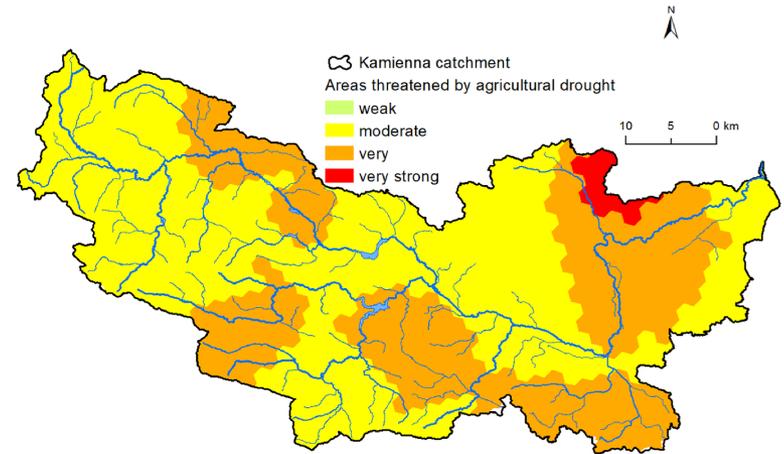
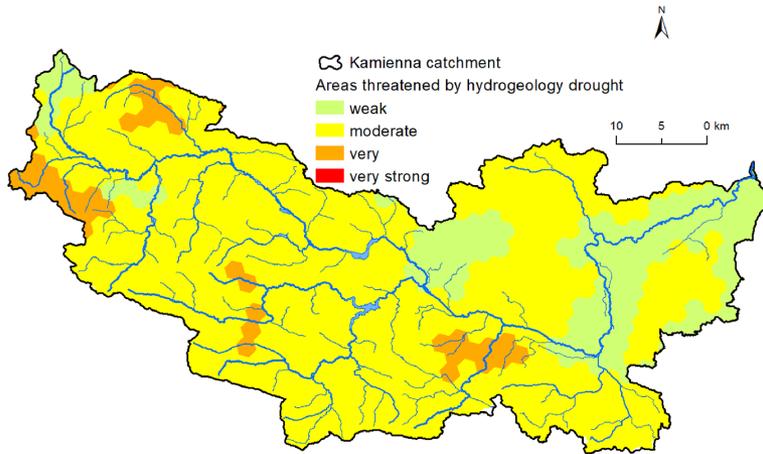


WATER BODIES' STATUS & FLOOD EXTENT

-  Rivers & ditches
-  Lakes & reservoirs
- Water Body Status (2010-2016)**
-  good
-  Ponds
-  bad
- Flood extent**
-  Surface Water Body
-  one per 10 year
-  one per 100 years
-  one per 500 years



DROUGHT PROBLEM



Introducing the
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Static Tool

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results



Purposes:

- To estimate the effects of the implementation of a Natural, small water Retention Measures program (NSWRM program) in a simplified way
- To compare variants of the NSWRM program

Basics:

- Expert knowledge
- Grading

Application:

- StaticTool.xlsm (Excel workbook + VBA)



The potential effects of individual NSW measure depend on the measure intensity

- This relationship may be determined based on expert knowledge
- May vary depending on the climatic and physiographic conditions (e.g. slopes, ground permeability) of the analysed area
- Method parameters should be adapted to local conditions

The StaticTool application

1. Parameters Module,
2. Evaluation Module.



Improvement of catchment retention properties contributing to:

- increasing low flows (LowQ),
- reducing high flows (HighQ),
- limiting the load of pollutants yielded from the catchment area (Qual).

Aggregated measure name in English	Impact on (0-5):			AVG
	Low flows	High flows	Qual Erosion	
Buffer strips and hedges	1	1	3	1,67
WRAL - best practices for Water Retention in Agricultural Lands	0	2	4	2,00
Traditional terracing	1	4	4	3,00
Reduced stocking density	0	0	4	1,33
Forest riparian buffers	0	1	3	1,33



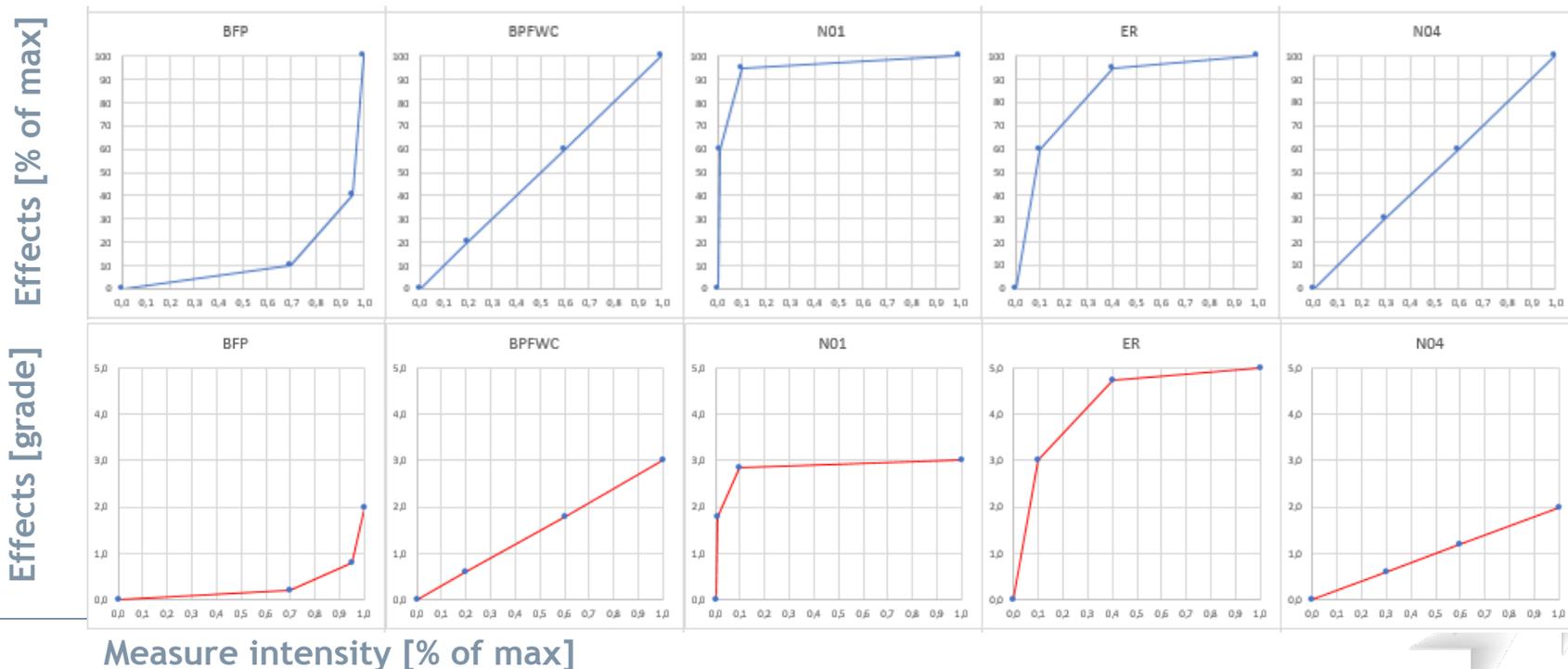
MeasuresFramWat

SelectedMeasures

Intensity

MaxIntensityImpact

- Select the NSWRM
- Individual and aggregated measures
- Relationship: measure intensity – expected effects



CONSULTATION OF STATIC METHOD WITH EXPERTS AND STAKEHOLDERS

AggregN	23	Accept definitions, Threshold values & NEXT					
		Threshold values of measure's intensity - low / medium, medium / high & max					
Measure ID	Definition of the intensity criteria in English	Definition of the intensity criteria in Polish	T0	Tlow	Thigh	Tmax	Units
A01	Area of arable lands changed into meadows and SPU area ratio [km ² /km ²]	Stosunek powierzchni gruntów omych przekształconych na łąki do powierzchni SPU [km ² /km ²]	0	0,1	0,4	1	km ² /km ²
A02	Buffer strips density - total length of strips and SPU area ratio [km/km ²]	Długość pasów buforowych na jednostkę powierzchni SPU [km/km ²]	0	0,5	2	6	km/km ²
WRAL	Arable land area on which best practices of water retention are applied and SPU area ratio	Stosunek powierzchni gruntów omych, na których stosowane są dobre praktyki ochrony wód, do powierzchni	0	0,3	0,8	1	km ² /km ²
A10	Terraced area and SPU area ratio [km ² /km ²]	Stosunek powierzchni objętej tarasowaniem do powierzchni SPU [km ² /km ²]	0	0,05	0,3	1	km ² /km ²
A12	Area of pastures on which reduced stock density is applied and SPU area ratio [km ² /km ²]	Stosunek powierzchni pastwisk o zmniejszonej obsadzie zwierząt do powierzchni SPU [km ² /km ²]	0	0,3	0,8	1	km ² /km ²
F01	Total length of forest riparian buffers and doubled length of water courses in SPU ratio [km/km]	Łączna długość zadrzewionych pasów nadbrzeżnych wzdłuż cieków / 2 X sumaryczna długość cieków w SPU	0	0,3	0,7	1	km/km
KF	(-) There is no change in hydrological conditions; undesirabled impacts are prevented	(-) Nie zmieniają się własności zlewni; niekorzystne przekształcenia nie zachodzą	0	0	0	0	-
AF	Newly afforested area and SPU area ratio [km ² /km ²]	Stosunek powierzchni zalesień do powierzchni SPU [km ² /km ²]	0	0,05	0,2	1	km ² /km ²
F0	0000	0000	0	0	0	0	-
BF		orych stosowane są	0				
BPFV		o powierzchni SPU					
NO		ch stosowane są dobre					
		cieków					
		tek wod					



Test Static
Tool



TAKING CO

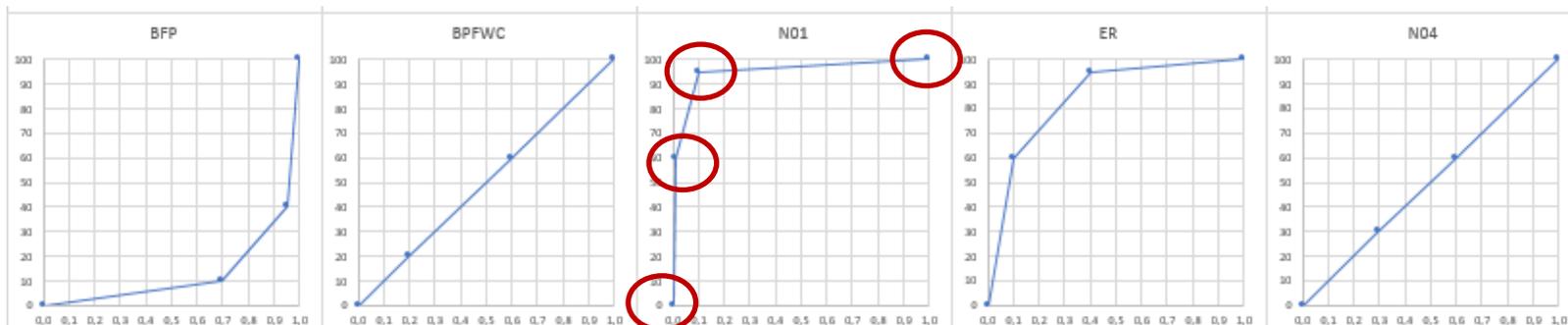
PARAMETERS MODULE: MEASURE INTENSITY - EXPECTED EFFECTS

MeasuresFramWat | **SelectedMeasures** | **Intensity** | **MaxIntensityImpact**

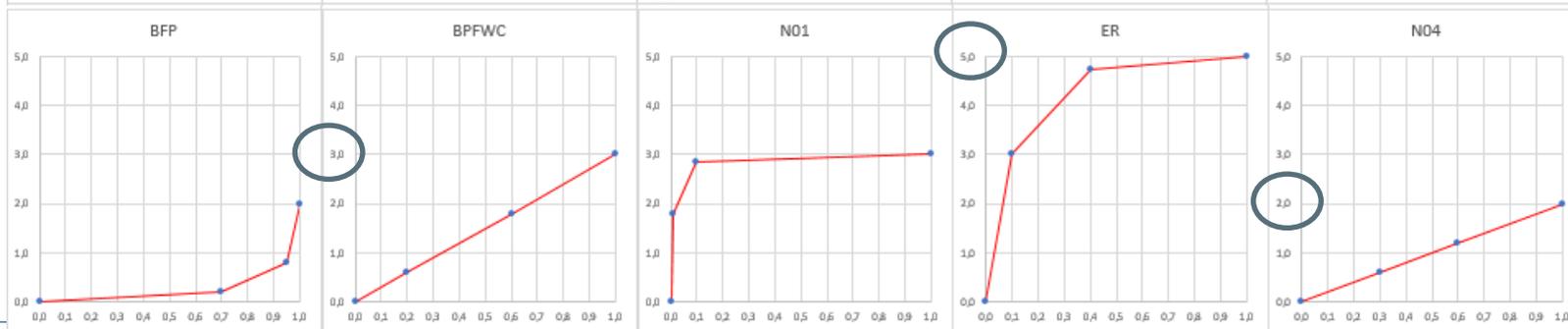
Aggregated measure name in English	Impact on (0-5):			AVG
	Low flows	High flows	Qual Erosion	
Buffer strips and hedges	1	1	3	1,67
WRAL - best practices for Water Retention in Agricultural Lands	0	2	4	2,00
Traditional terracing	1	4	4	3,00
Reduced stocking density	0	0	4	1,33
Forest riparian buffers	0	1	3	1,33

- Intensity thresholds:
- T0 - no action,
- Tlow - low / medium intensity,
- Thigh - medium / high intensity,
- Tmax - max (hypothetically) possible.

Effects [% of max]



Effects [grade]



Measure intensity [% of max]



Code	Measures (NWRM/NSWRM)	Initial values Impact on (0-5):			Accepted values Impact on (0-5):			AVG
		Low flows	High flows	Qual Erosion	Low flows	High flows	Qual Erosion	
A02	Buffer strips and hedges	1	1	3	1	1	3	1.7
WRAL	WRAL - best practices for Water Retention in Agricultural Lands	1	2	5	0	2	4	2.0
F01	Forest riparian buffers	0	0	3	0	1	3	1.3
KF	KF - Keeping forests	0	0	0	0	0	0	0.0
F04	Targeted planting for 'catching' precipitation; Mediterrenian region	0	0	0	0	0	0	0.0
BFP	BFP - Best forestry practices	0	2	1	0	2	1	1.0
BPFWC	BPFWC - Best Practices for Forest Water Courses	1	3	2	1	3	2	2.0
ER	ER - Ecosystems Restoration / renaturisation of water dependent ecosystems	2	5	4	0	5	4	3.0
BPDA	BPDA - Best practices on drained areas	1	3	2	2	3	2	2.3
T1	Polders, dry flood protection reservoirs, sediment trapping dams	0	4	3	0	5	3	2.7
T2	Widening or removal of flood protection dikes	0	3	3	0	3	3	2.0
T3	Construction of small reservoirs on rivers (dammed reservoirs)	4	4	2	4	4	2	3.3

Expert assessment of NWRM impact on catchment retention properties – for maximum intensity level

Increasing low flows (**LowQ**), reducing high flows (**HighQ**) and limiting the load of generated pollution (**Qual**)

STATIC TOOL

A list of possible measures

Intensity of planned measures

Parameters and calculations

Results

Code	Measures (NWRM/NSWRM)	Aggregated						
		Number of measures:	24					
A01	Meadows and pastures	Number of SPU:	187	1	2	3	4	5
A02	Buffer strips and hedges	No.	SPU Id	A1	A2	A10	A12	WRAL
A03	Crop rotation	19	SPU_19	0,00	0,00	0,00	0,00	0,05
A04	Strip cropping along contours	20	SPU_20	0,00	0,03	0,00	0,00	0,06
A05	Intercropping	21	SPU_21	0,00	0,36	0,00	0,00	0,17
A06	No till agriculture	22	SPU_22	0,00	0,00	0,00	0,00	0,17
A07	Low till agriculture	23	SPU_23	0,00	0,00	0,00	0,00	0,09
A08	Green cover	24	SPU_24	0,00	0,05	0,00	0,00	0,15
A09	Early sowing	25	SPU_25	0,00	0,05	0,00	0,00	0,03
A10	Traditional terracing	26	SPU_26	0,00	0,45	0,00	0,00	0,17
A11	Controlled traffic farming	27	SPU_27	0,00	0,01	0,00	0,00	0,09
A12	Reduced stocking density	28	SPU_28	0,00	0,49	0,00	0,00	0,06
A13	Mulching/fertilization	29	SPU_29	0,00	0,00	0,00	0,00	0,19
A15	Deep plowing (removing the plow's sole)	30	SPU_30	0,00	0,13	0,00	0,00	0,04
F01	Forest riparian buffers	31	SPU_31	0,00	0,67	0,00	0,00	0,23
F02	Maintenance of forest cover in headwater areas	32	SPU_32	0,00	0,33	0,00	0,00	0,22
F03	Afforestation of reservoir catchments	33	SPU_33	0,00	0,28	0,00	0,00	0,04
F04	Targeted planting for 'catching' precipitation	34	SPU_34	0,00	0,13	0,00	0,00	0,09
F05	Land use conversion	35	SPU_35	0,00	0,03	0,00	0,00	0,08
		36	SPU_36	0,00	0,54	0,00	0,00	0,20
		37	SPU_37	0,00	0,12	0,00	0,00	0,09
		38	SPU_38	0,00	0,00	0,00	0,00	0,12
		39	SPU_39	0,00	0,02	0,00	0,00	0,05
		40	SPU_40	0,00	0,00	0,00	0,00	0,20
		41	SPU_41	0,00	0,00	0,00	0,00	0,16
		42	SPU_42	0,00	0,36	0,00	0,00	0,16
		43	SPU_43	0,00	0,06	0,00	0,00	0,08
		44	SPU_44	0,00	0,45	0,00	0,00	0,33
		45	SPU_45	0,00	0,10	0,00	0,00	0,14
		46	SPU_46	0,00	0,08	0,00	0,00	0,06
		47	SPU_47	0,00	0,96	0,00	0,00	0,04
		48	SPU_48	0,00	0,07	0,00	0,00	0,20
		49	SPU_49	0,00	0,00	0,00	0,00	0,03
		50	SPU_50	0,00	0,00	0,00	0,00	0,04
		51	SPU_51	0,00	0,41	0,00	0,00	0,05
		52	SPU_52	0,00	0,00	0,00	0,00	0,00

Sorted by AVG

Code	Aggregated measure name in
KF	KF - Keeping forests
N09	Removal of dams and other longitudinal barriers
N14	Re-naturalisation of polder
N12	Lake restoration
BFP	BFP - Best forestry practices
A12	Reduced stocking density
BPRC	BPRC - Natural channels and practices of river channels
F01	Forest riparian buffers
N04	Re-meandering
A02	Buffer strips and hedges
BPFWC	BPFWC - Best Practices for F Water Courses

Number of measures:	24	Valorisation improvent		
Number of SPU:	187	1	2	Total improvement in the catchment
Total improvement due		0,00	0,75	5,73
No.	SPU Id	A1	A2	Valorisation improvement in SPU
174	SPU_174			0,09
175	SPU_175		0,00	0,01
176	SPU_176			0,69
177	SPU_177			0,00
178	SPU_178		0,01	0,01
179	SPU_179			0,72
180	SPU_180		0,01	0,02
181	SPU_181			1,07
182	SPU_182			0,00
183	SPU_183			0,24
184	SPU_184			0,22
185	SPU_185			0,00
186	SPU_186			0,00

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Expert variant

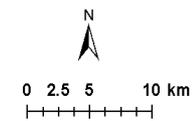
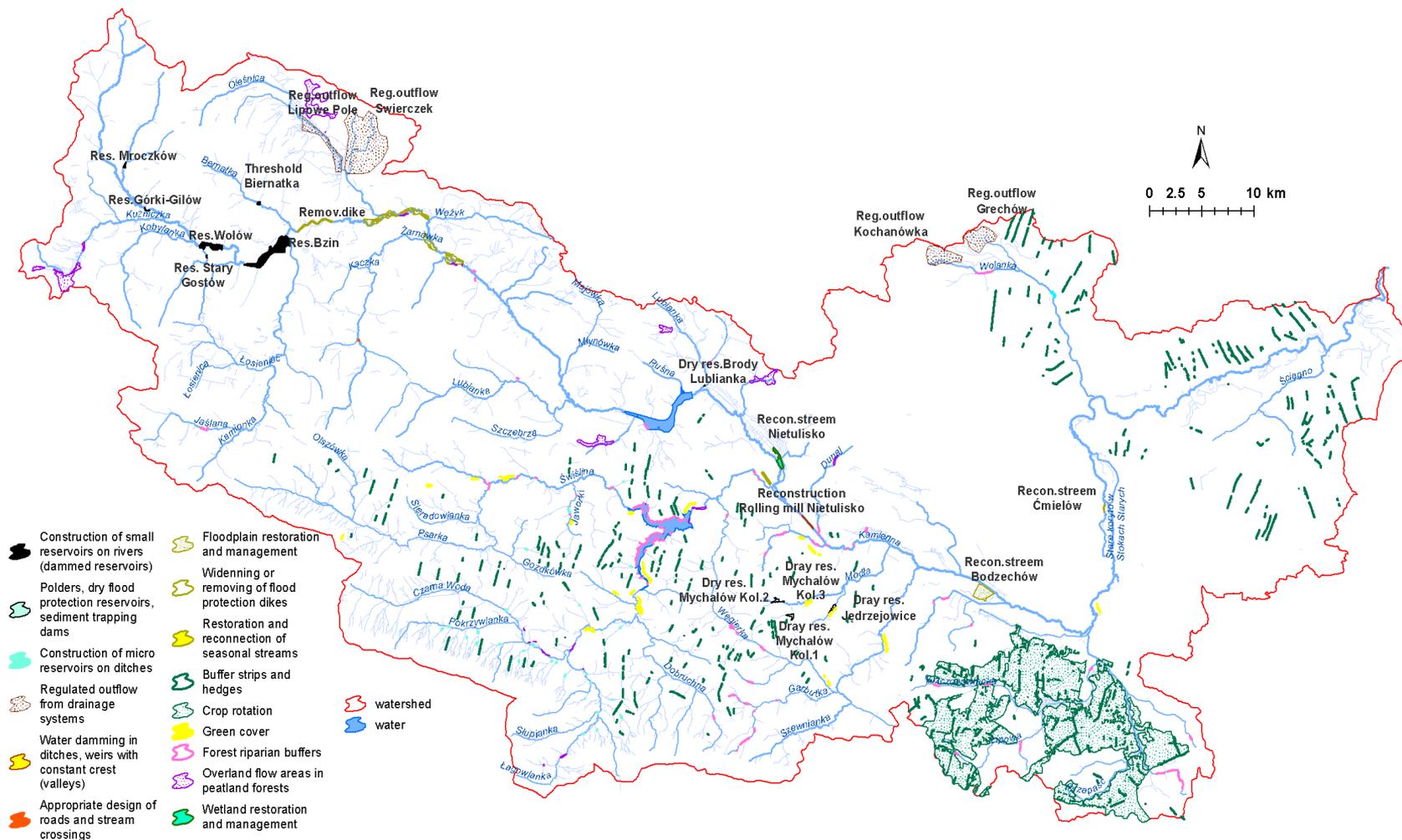
No	Aggregated measure ID	Aggregated measure
1	A02	Buffer strips and hedges
2	WRAL	WRAL - best practices for Water Retention in Agricultural Lands
3	F01	Forest riparian buffers
4	F08	Appropriate design of roads and stream crossings
5	F14	Overland flow areas in peatland forests
6	ER	ER - Ecosystems Restoration / renaturation of water dependent ecosystems
7	N06	Restoration and reconnection of seasonal streams
8	BPDA	BPDA - Best practices on drained areas
9	T1	Polders, dry flood protection reservoirs, sediment trapping dams
10	T2	Widening or removing of flood protection dikes
11	T3	Construction of small reservoirs on rivers (dammed reservoirs)

Local preferences variant

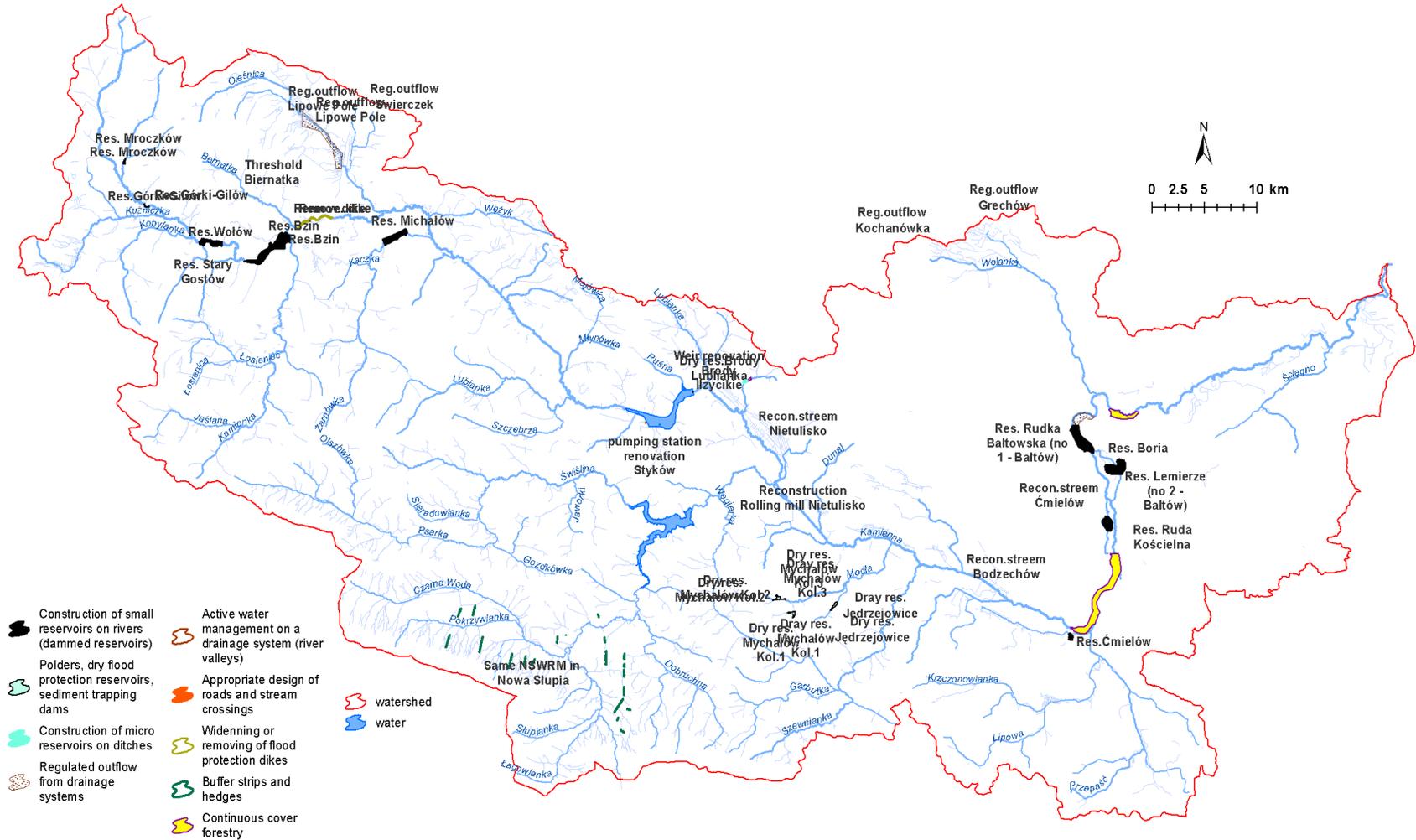
No	Aggregated measure ID	Aggregated measure
1	A02	Buffer strips and hedges
2	F06	Continuous cover forestry
3	F08	Appropriate design of roads and stream crossings
4	BPDA	BPDA - Best practices on drained areas
5	T1	Polders, dry flood protection reservoirs, sediment trapping dams
6	T2	Widening or removing of flood protection dikes
7	T3	Construction of small reservoirs on rivers (dammed reservoirs)



MEASURES IN THE EXPERT VARIANT

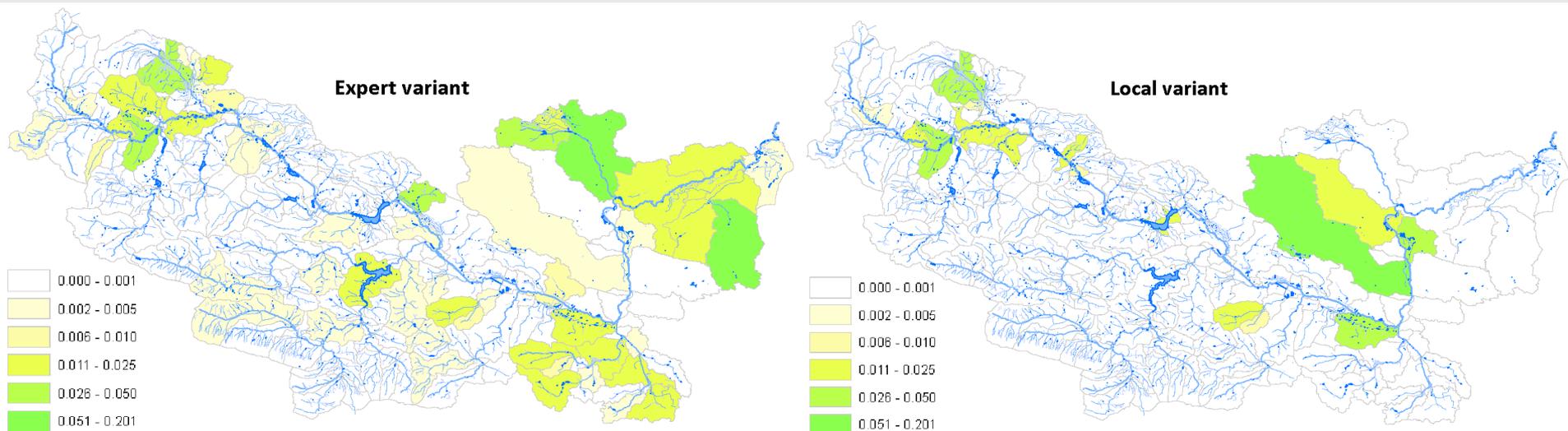


MEASURES IN THE LOCAL PREFERENCES VARIANT



-  Construction of small reservoirs on rivers (dammed reservoirs)
-  Polders, dry flood protection reservoirs, sediment trapping dams
-  Construction of micro reservoirs on ditches
-  Regulated outflow from drainage systems
-  Active water management on a drainage system (river valleys)
-  Appropriate design of roads and stream crossings
-  Widening or removing of flood protection dikes
-  Buffer strips and hedges
-  Continuous cover forestry
-  watershed
-  water



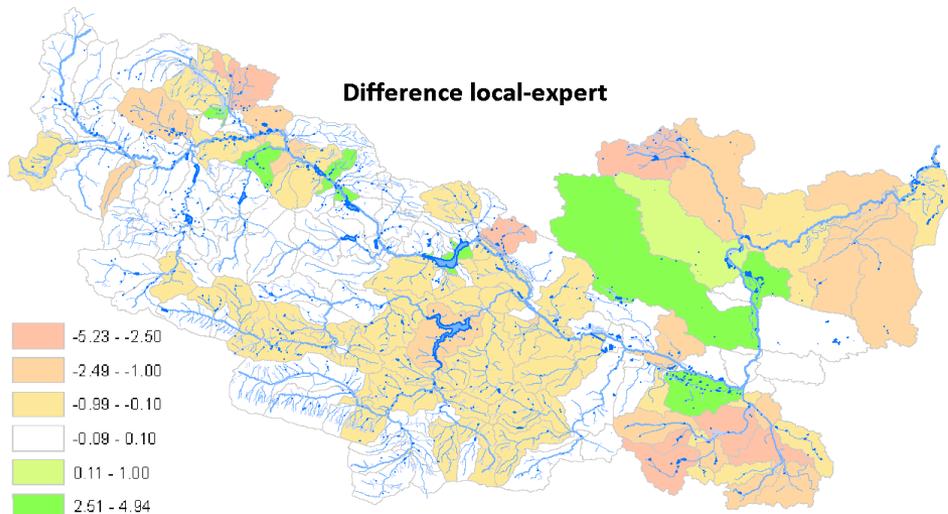


The **expert variant** is characterized by a large number of diverse measures spread over a vast area (15 types and 11 groups of measures spread over 128 SPUs).

The **local preferences variant** contains only 9 types and 7 groups of measures placed in 33 SPUs.

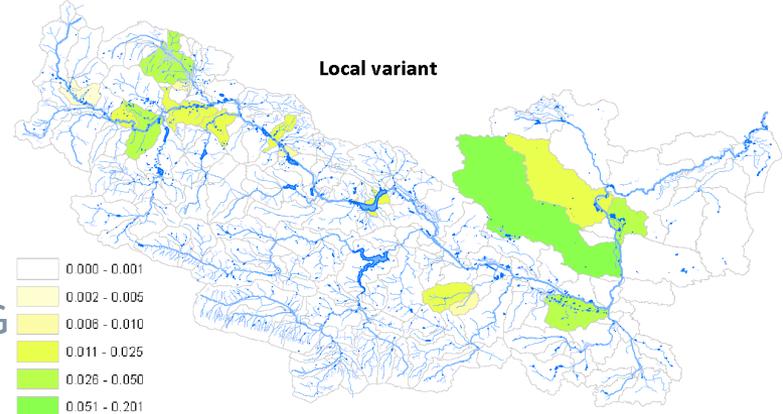
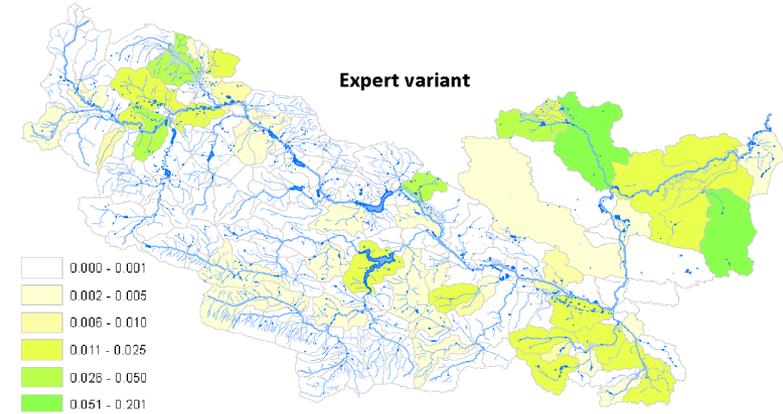
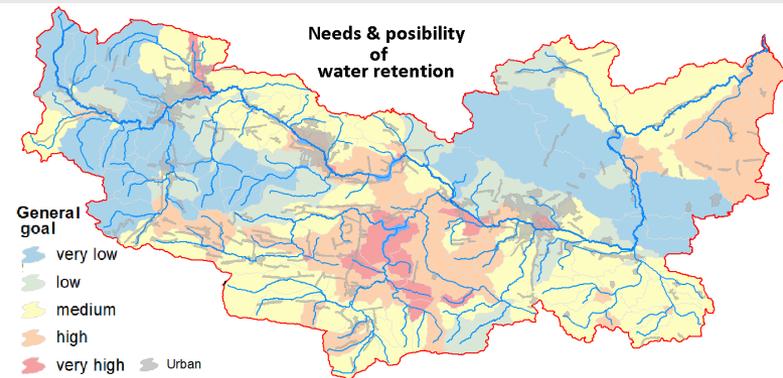


VARIANTS VS VALORIZATION MAP



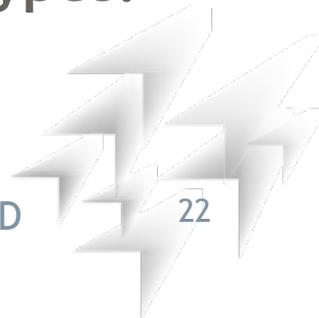
(green color shows dominance of local variant and red shows the opposite).

- Introducing the expert variant will reduce the need for water retention in particularly sensitive areas
- The local variant, in most cases, would improve areas with low water retention needs.



TAKING

- The overall grade for the catchment is low (0.71 / 0.49) comparing to potential max grade of certain measures (5):
 - affected by the number of SPUs with no measures,
 - hypothetical max intensity level.
- Despite these large differences, the ratio of the final score of the expert to local variant is only 1.45 (0.71 / 0.49).
- The local variant dominates in only 10 out of 128 SPU.
- **The Static Tool allows to objectively compare variants of a NSWRM program, regardless of how they were developed (local preferences, expert).**
- **The grading method adopted in the Static Tool allows to compare programs containing activities of different types.**
- **The tool cannot replace modeling.**



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