
FramWat Final Conference
June 9th, 2020 (web online conference)

# FroGIS tool

## Landscape valorisation method to support planning process of Natural Small Water Retention Measures. Application in Slaná river basin, Blh sub-catchment.

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# LANDSCAPE VALORIZATION METHOD

**Main objective** of water retention in the landscape is to identify localities with different predisposition to plan (planning purposes) Natural (Small) Water Retention Measures out of urban areas within the catchment.

Method shall be **universal** and that is why few statistical methodes, which helps to choose adequate indicators, are used.

**Purpose:** to develop a valorization map that shows posibility and need for water retention as the basis to plan measures.

**How:** using generally available spatial data and GIS analysis

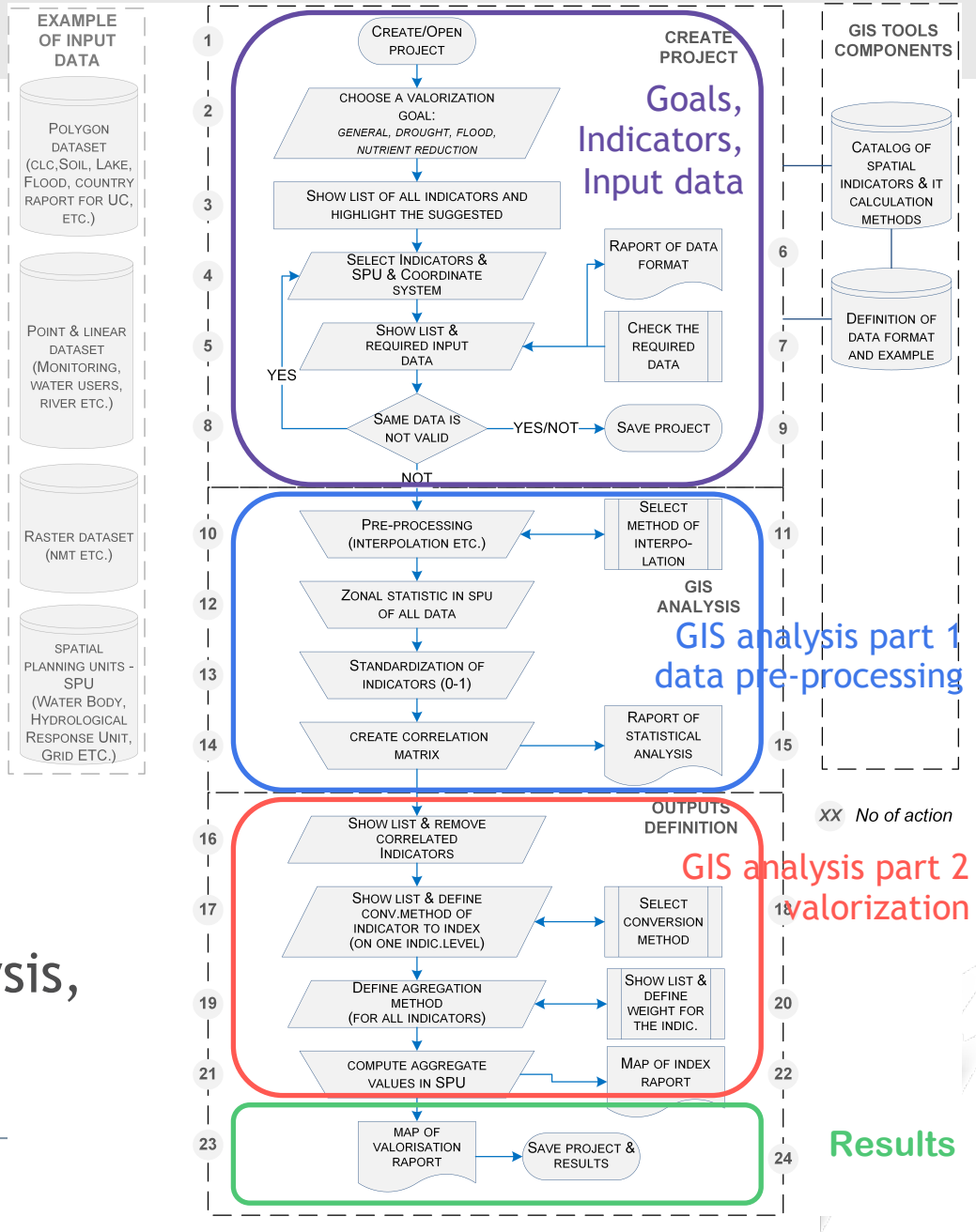
**Users:** Water Managment Autority, Expert, Company, Teacher, Student

# LANDSCAPE VALORIZATION METHOD

## Benefits:

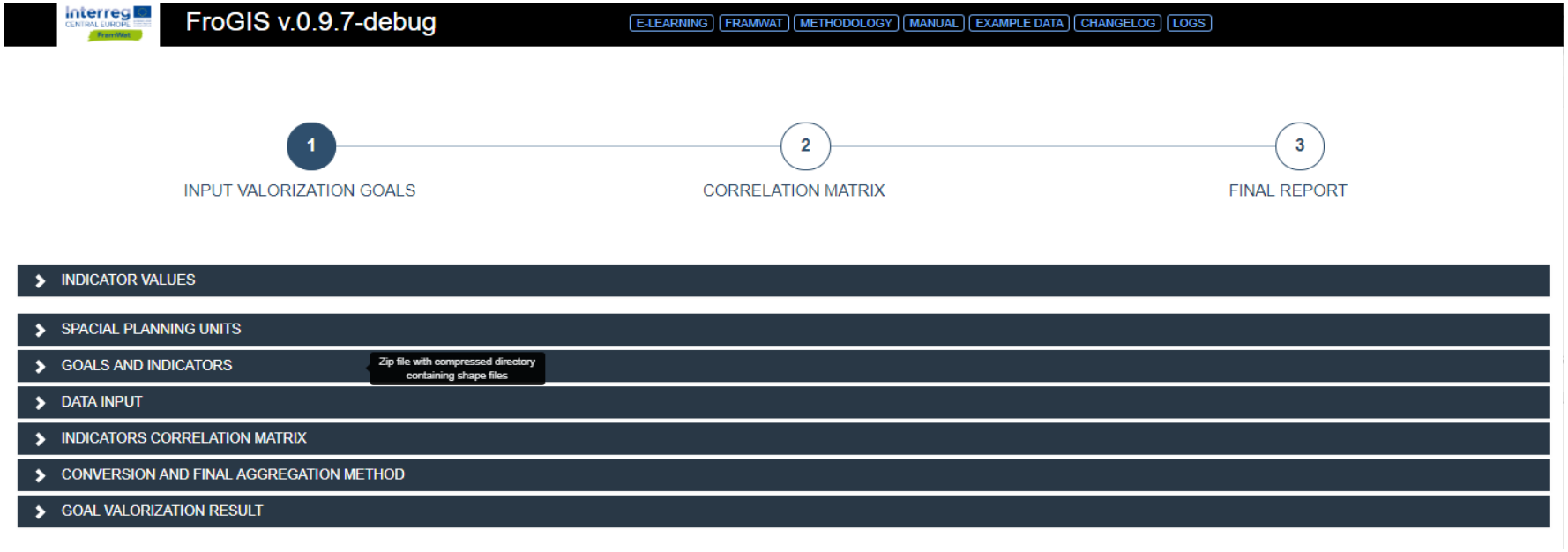
- improving the planning process at the beginning by considering environmental conditions
- increasing awareness of the integrated approach to water management
- improving the use of public data

**Web based:** multicriteria analysis, special planning tool



# FROGIS WEB APPLICATION

- to simplify landscape valorization process




available at: http://waterretention.sggw.pl

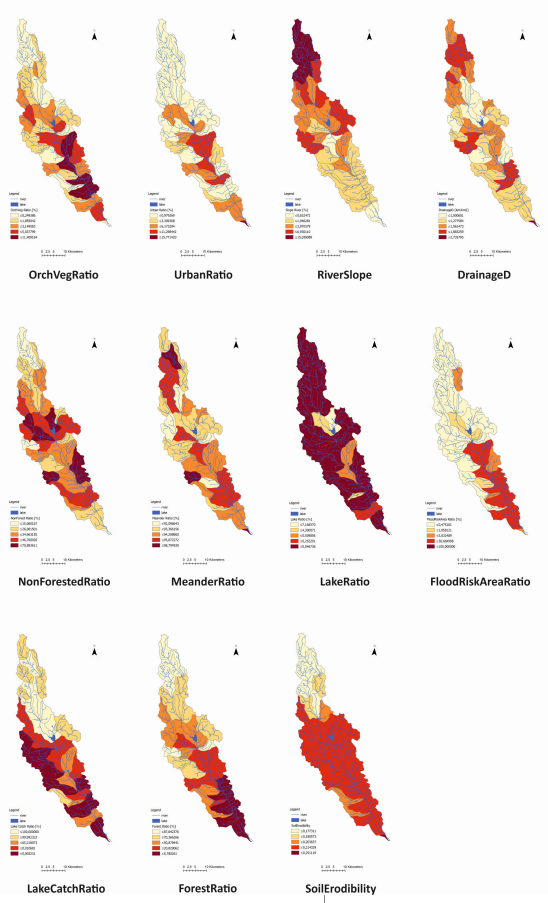
for developers (open-source code):
https://gitlab.com/framwat
can be installed on Unix, OS or Windows

FroGIS

# INDICATOR CHARACTERISTICS

| Purpose of N(S)WRM | Indicator type: Climate | Hydrology | Hydrogeology & soils | Topography & hydrography & land use | Quality of water & ecosystems |
|---|---|---|---|---|---|
| Drought (24) | 4 | 7 | 2 | 9 | |
| Flood (21) | 1 | 5 | 1 | 13 | 1 |
| Water [illegible] | | | | | |
| Sedim[illegible] | | | | | |
| Gener[illegible] | | | | | |

| Goal | Group | Inicator | Full name |
|---|---|---|---|
| Drought prevention | Climatic | CWB | Climatic Water Balance |
| | | CWB_Var_a | Monthly Climatic Water Balance Var |
| | | CWB_Var_m | Climatic Water Balance Variability ir ratio |
| | | Pre_Var_a | Precipitation sum - average intra year variability |
| | | Pre_Var_m | Precipitation Variability for the multiannual period - ratio |
| | | PrecFreqLow75 | Frequency of precipitation lower than 75% of the multiannual average |
| | Soil | SWR | Soil Water Retention |
| | Hydrogeological | GRR | Ground Renewable Resources |
| | Hydrological | FloVarRatio_m | Flow Variability multiannual |
| | | FloMinAvgRatio | Ratio of mean low flow [swMLQ] to mean high flow [swMHQ] |
| | | WaterYieldMinFlow | Water yield (specific runoff) for low flow [swMLQ] |
| | | WaterYieldAvgFlow | Water yield (specific runoff) for mean flow [swMMQ] |



# INDICATOR CHARACTERISTICS

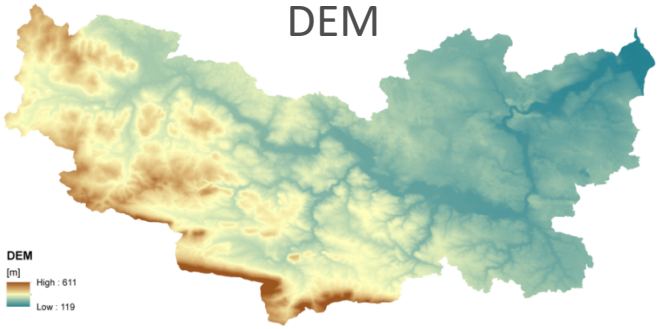
| Indicator name | Description | Popis | Jednotky | Topics | Required input data | Goal drought | Goal flood | Goal waters quality | Goal sediment transport | stimulant / non-stimulant | Importance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ArableRatio | Arable area in SPU area ratio | pomer výmery ornej pôdy k výmere SPU | % | Landuse | Arable layer; | | | | | | 1 |
| BFI | Base Flow Index | miera podielu riečneho odtoku, ktorý pochádza zo zdrojov podzemných vôd. Čím väčšia je priepustnosť horniny, tým vyššia je hladina rieky v období suchého počasia | - | Hydrology | BaseFlow Index; BaseFlow Index; | | | | | | 1 |
| CWB | Climatic Water Balance | klimatická rovnováha vody počas vegetačnej sezóny – priemerná teplota od 10 st. C, pomer zrážok k potenciálnej evapotranspirácii ( je maximálny možný výpar z pôdy | mm | Climate | Avarage Climatic Water Balance; | | | | | | 1 |
| DrainageD | Drainage Density | Hustota odtoku je celková dĺžka všetkých tokov a riek v povodí delená celkovou plochou povodia. | km/km2 | Hydrography | River; | | | | | | 1 |
| EcoAraBuf20mRatio | Arable lands in 20-meters buffer around surface waters area to SPU area ratio | pomer výmery plochy 20 m buffer okolo vodných plôch a tokov k výmere SPU | % | Ecology | River; Lake; Arable layer; | | | | | | 1 |
| EcoAreaRatio | Semi-natural land cover types area to SPU area ratio | pomer výmery poloprírodnej pôdy k výmere SPU | % | Ecology | Semi-natural land; | | | | | | |
| EcoBadRHS | Bad morphological elements length to total length of river in SPU | pomer dĺžky úsekov so zlou morfológiou k celkovej dĺžke tokov v SPU | % | Ecology | River; River Hydromorphology Status; | | | | | | 2 |
| EcoCombined | Combination of number of semi-natural land cover patches and their area | kombinácia počtu poloprírodných oblastí k ich výmere | - | Ecology | Landuse layer; Semi-natural land; | | | | | | 2 |
| EcoNumRatio | Number of semi-natural land cover patches to total number of land cover patches in SPU | pomer počtu poloprírodných oblastí k celkovému počtu oblastí využitia krajiny v SPU | % | Ecology | Landuse layer; Semi-natural land; | | | | | | 2 |
| FloodRiskAreaRatio | Flood hazard zone area ratio | pomer výmery plôch povodňového rizika q100 k výmere SPU | % | Hydrology | Flood extent (e.g. probability 1% (100 years)); | | | | | | 1 |

## Indicators impact: Stimulant / Non-Stimulant

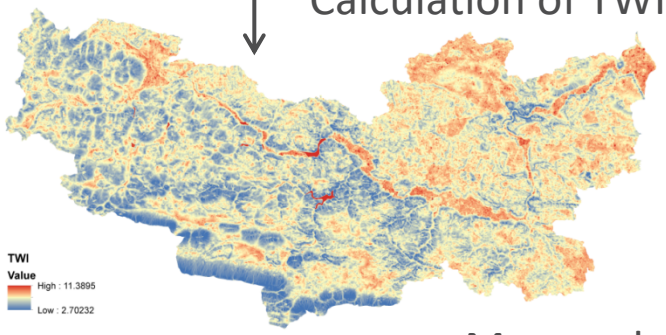
# INDICATORS CLASSIFICATION

Topographic Wetness Index (TWI)

DEM

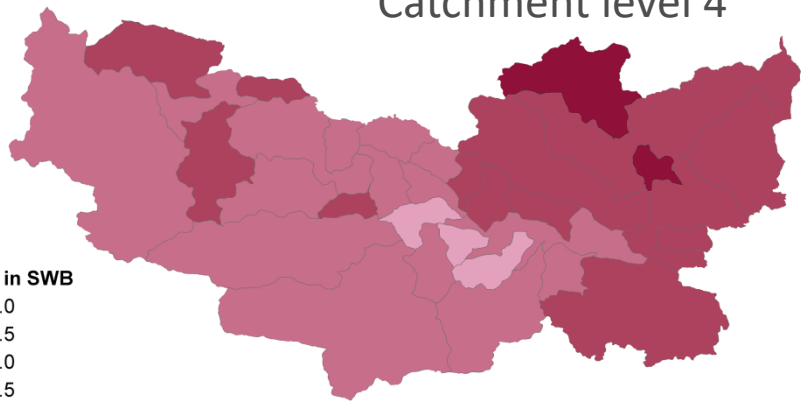



Calculation of TWI

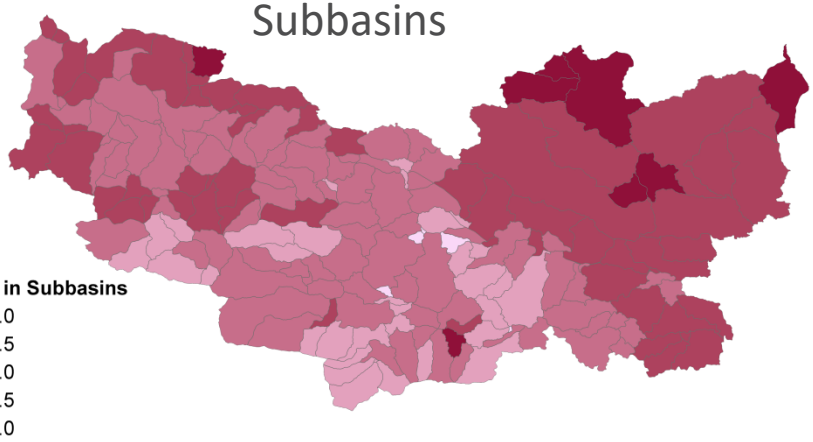



Mean value for SPU

I variant
Catchment level 4

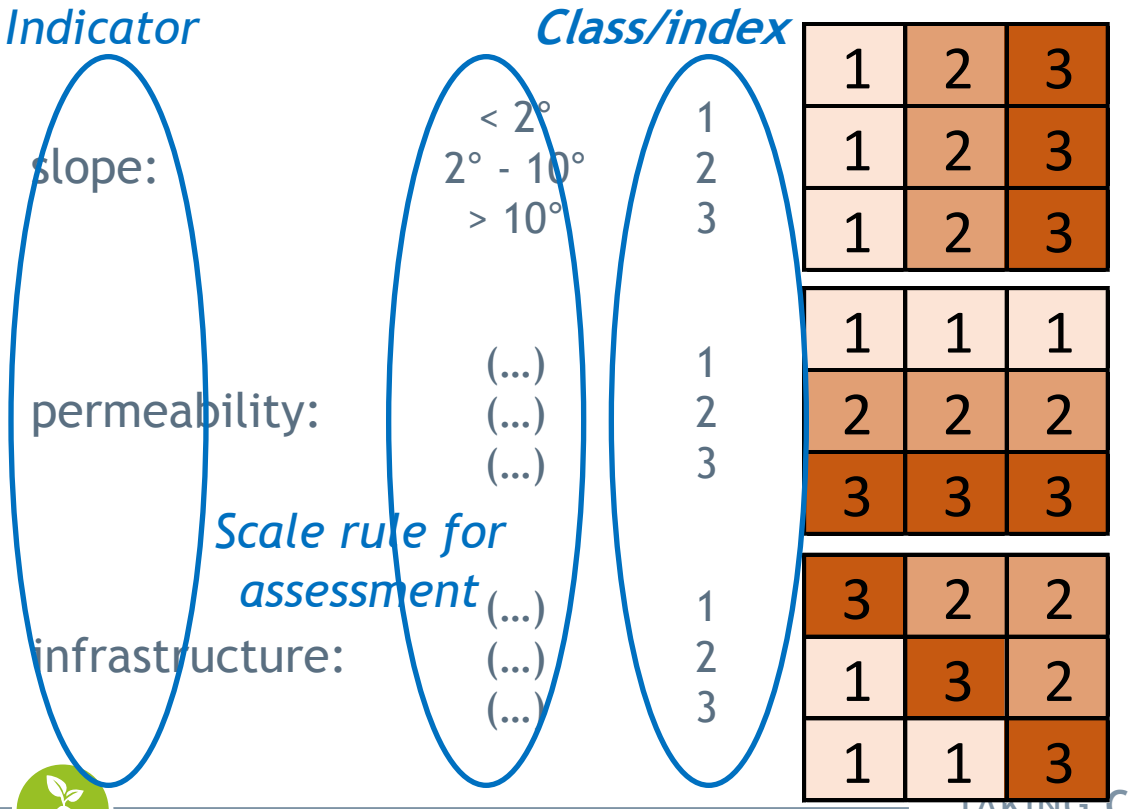



II variant
Subbasins



# VALORIZATION PROCEDURE

- Indicators: slope, permeability, presence of valuable infrastructure
- Division of indicators into classes/index: small (1), mean (2) or large (3)




**Result (general)**

- Assigning actions to limit surface runoff

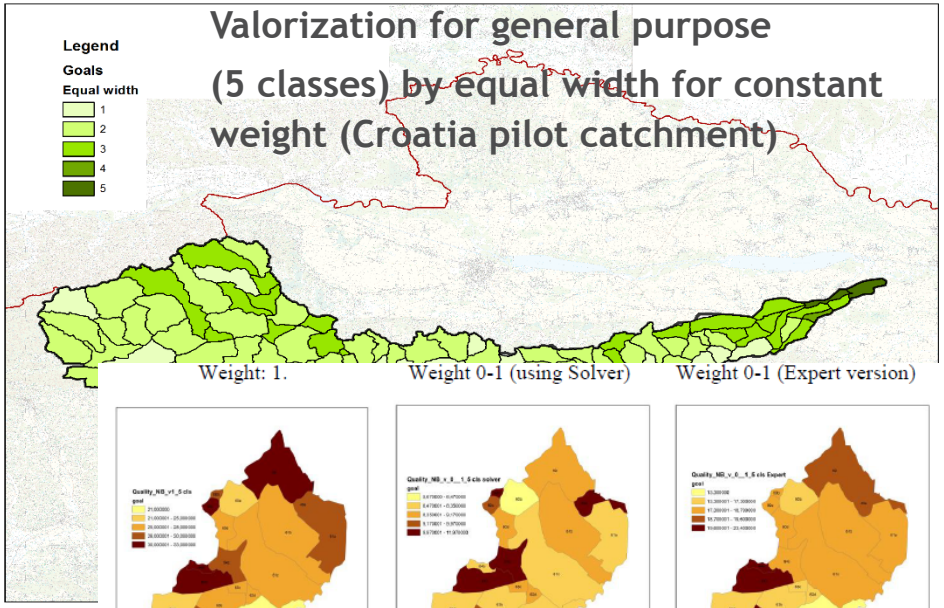
Σ →

| | | |
|---|---|---|
| 5 | 5 | 6 |
| 4 | 7 | 7 |
| 5 | 6 | 9 |

# TESTED IN PILOT CATCHMENTS

Interreg CENTRAL EUROPE
European Union European Regional Development Fund
FramWat

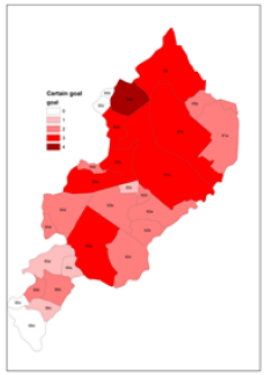

## Valorization for general purpose (5 classes) by equal width for constant weight (Croatia pilot catchment)




Weight: 1. | Weight 0-1 (using Solver) | Weight 0-1 (Expert version)



Planned measures in SPU's



## Valorization for water quality (5 classes) by natural breaks (Hungarian pilot catchment)

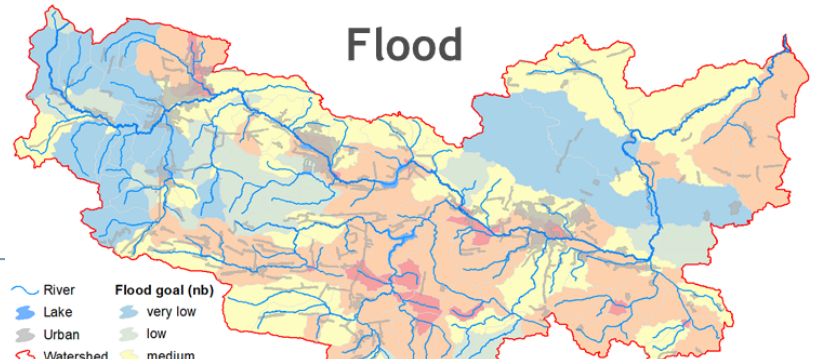
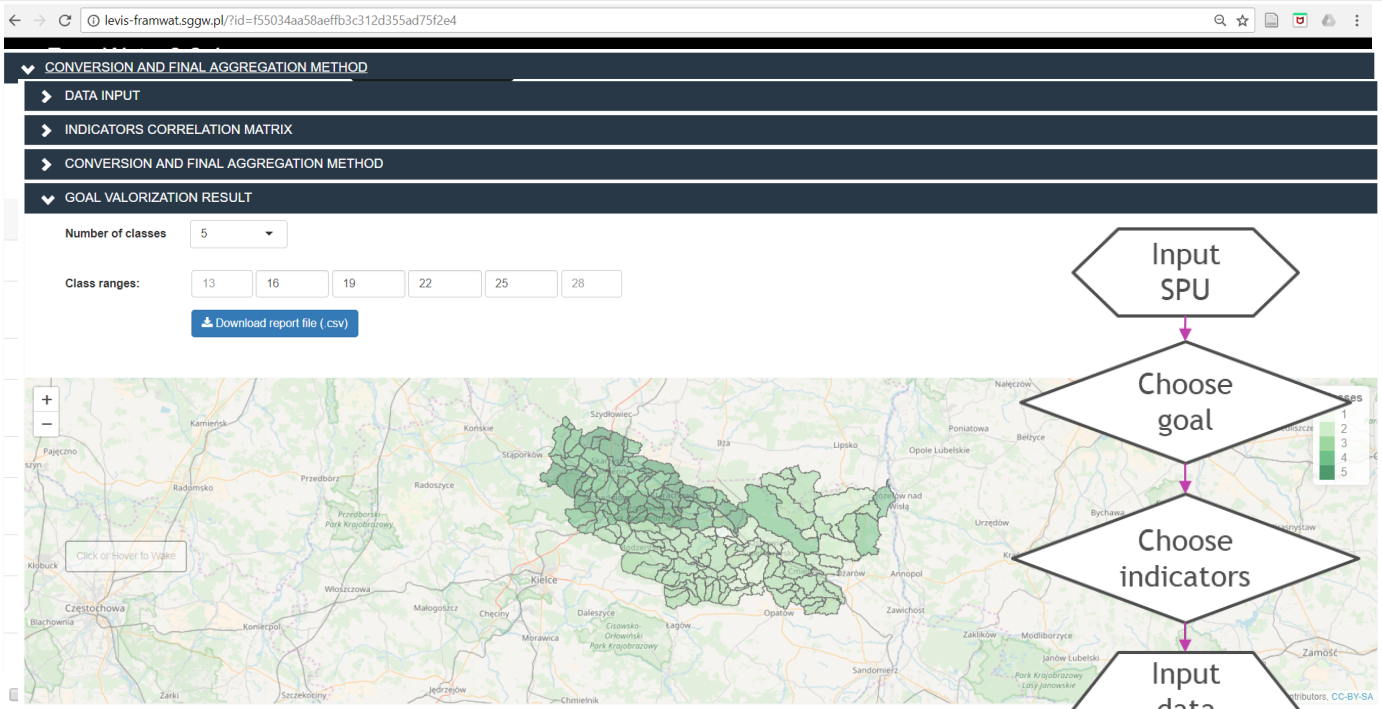



***Figure 19.*** *Comparison of maps of valorisation for water quality improvement purpose (Classification: Equal with/ 5cls) and the number of planned measures in SPU's according to chapter 3.2.2*

# FROGIS WEB APPLICATION

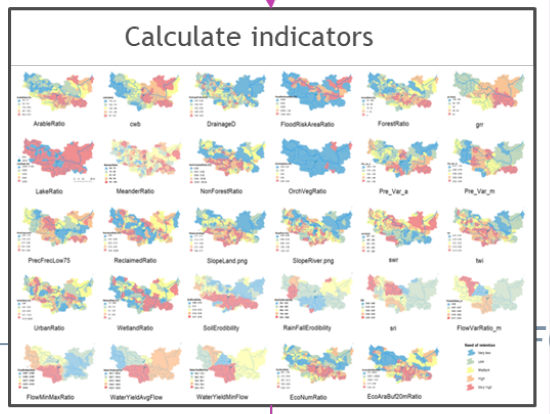
Interreg CENTRAL EUROPE
European Union
European Regional Development Fund
FramWat

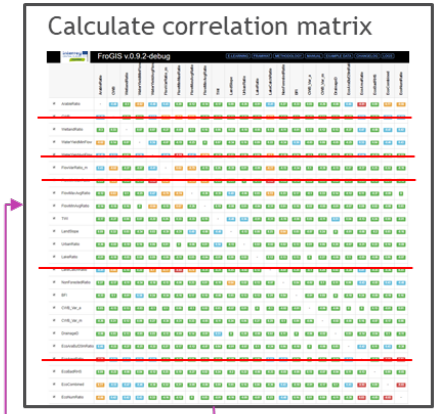


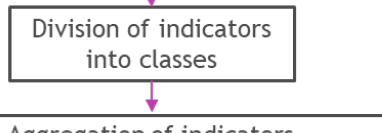


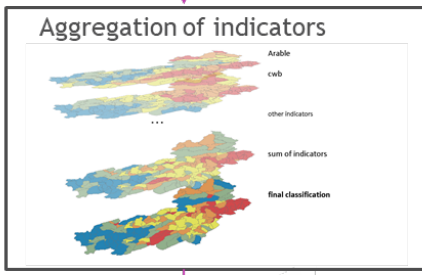


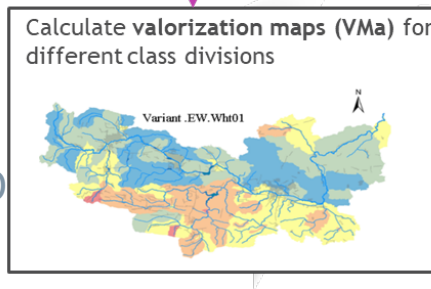
- SPUs
- goals (drought, flood, water quality, sediments, general)



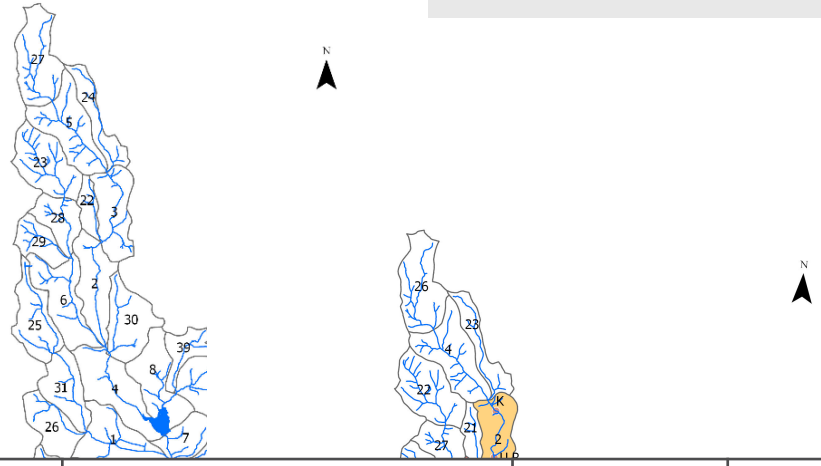



# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

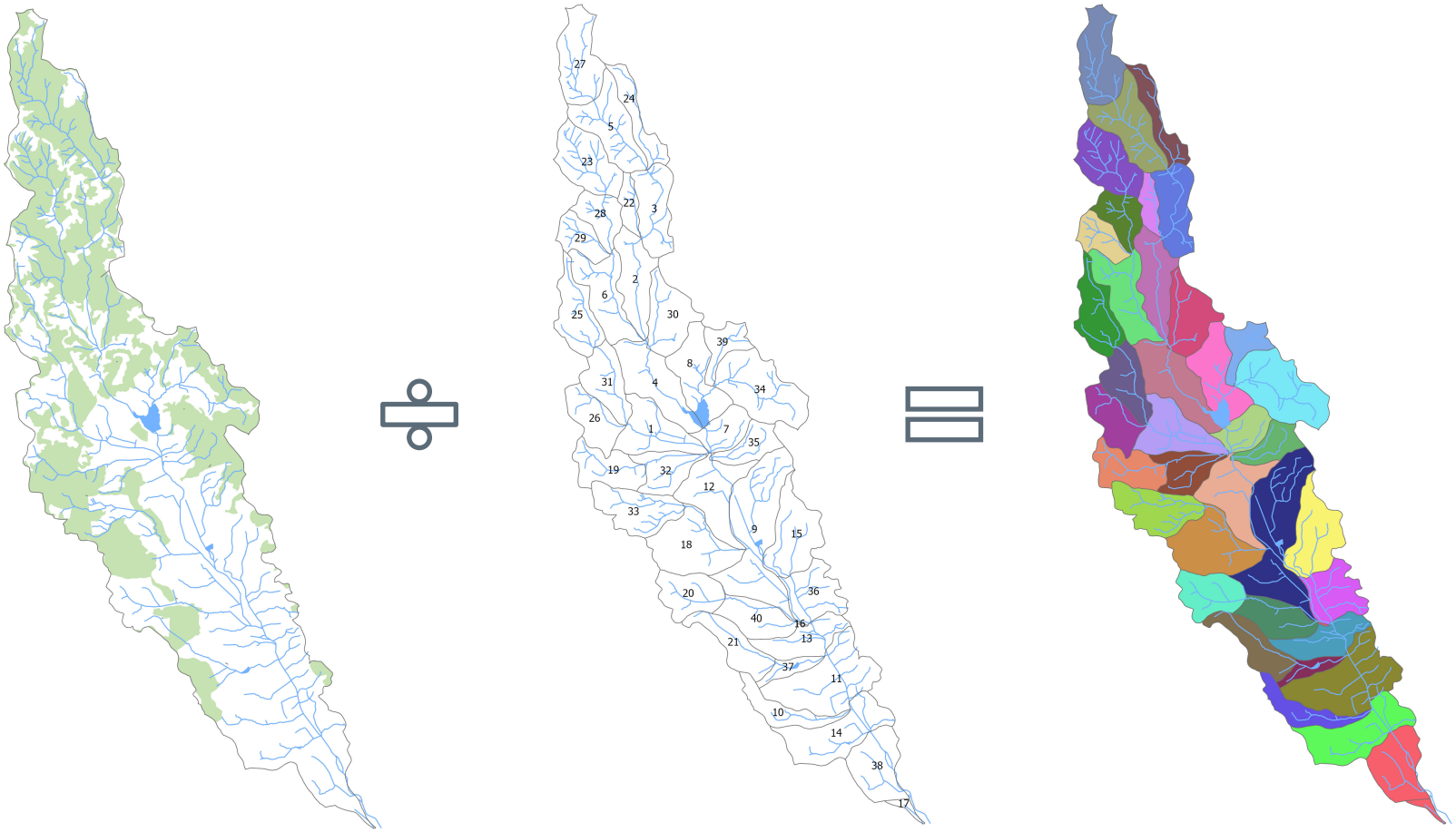
- River basin characteristics
- SPUs
- Goal maps
- Input data



| Name | Source | Data type | Accuracy |
|---|---|---|---|
| Soil data | SWME | polygon | 1:10000 |
| Lenght of Growing data | Geoportal for climate change | raster | |
| DEM | SWME | raster | 10x10 m |
| Effektive infiltration of prepitation into groundwater | Slovak Geological Institute | polyline, point | |
| River network, Water reservoirs | SWME | polyline | 1:10000 |
| Protected areas | State nature Conservancy | polygone | |
| SPU | National dataset precised by SWME | polygon | 1:50000 |
| Land use | Corine Land Cover 2012 | polygon | 1:25000 |
| Soil organic carbon content | http://soilgrids.org | raster | 250x250 m |

# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

- Indicator values calculations




forests SPUs Forests in SPUs [%]

# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

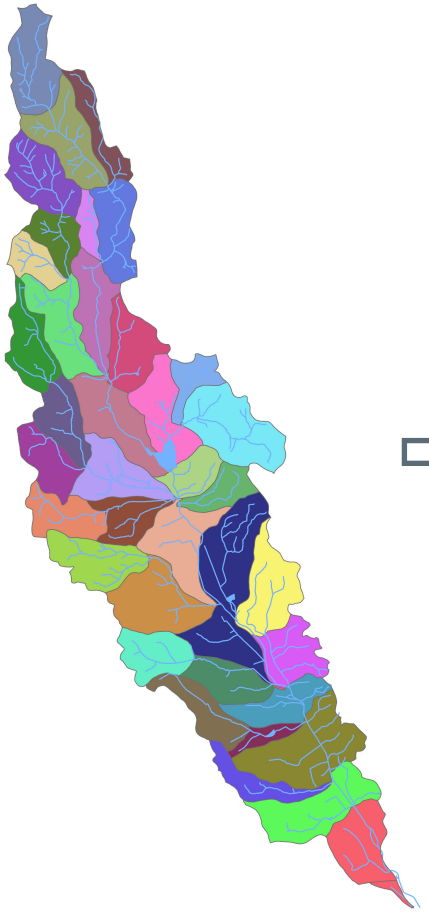
## - Analysis of correlation between indicators

| | ArableRatio | LandSlope | TWI | BFI | FloodRiskAreaRatio | DrainageD | LakeRatio | ForestRatio | LakeCatchRatio | NonForestedRatio | OrchVegRatio | MeanderRatio | UrbanRatio | RiverSlope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ArableRatio | - | -0.87 | 0.87 | 0.67 | 0.53 | 0.13 | 0.04 | -0.95 | -0.62 | 0.16 | 0.38 | 0.3 | 0.49 | -0.76 |
| LandSlope | -0.87 | - | -0.85 | -0.66 | -0.41 | -0.04 | -0.11 | 0.84 | 0.71 | -0.12 | -0.33 | -0.09 | -0.52 | 0.86 |
| TWI | 0.87 | -0.85 | - | 0.56 | 0.65 | 0.3 | 0.08 | -0.87 | -0.56 | -0.12 | 0.35 | 0.32 | 0.6 | -0.69 |
| BFI | 0.67 | -0.66 | 0.56 | - | 0.25 | 0.09 | -0.32 | -0.58 | -0.85 | 0.08 | 0.3 | 0.02 | 0.41 | -0.59 |
| FloodRiskAreaRatio | 0.53 | -0.41 | 0.65 | 0.25 | - | 0.43 | -0.07 | -0.47 | -0.25 | -0.35 | 0.09 | 0.29 | 0.08 | -0.16 |
| DrainageD | 0.13 | -0.04 | 0.3 | 0.09 | 0.43 | - | -0.14 | -0.15 | -0.05 | -0.4 | -0.16 | 0.53 | 0.21 | 0.25 |
| LakeRatio | 0.04 | -0.11 | 0.08 | -0.32 | -0.07 | -0.14 | - | -0.13 | 0.27 | 0.29 | -0.01 | -0.07 | -0.04 | -0.15 |
| ForestRatio | -0.95 | 0.84 | -0.87 | -0.58 | -0.47 | -0.15 | -0.13 | - | 0.57 | -0.3 | -0.5 | -0.34 | -0.57 | 0.78 |
| LakeCatchRatio | -0.62 | 0.71 | -0.56 | -0.85 | -0.25 | -0.05 | 0.27 | 0.57 | - | -0.12 | -0.34 | 0.03 | -0.39 | 0.61 |
| NonForestedRatio | 0.16 | -0.12 | -0.12 | 0.08 | -0.35 | -0.4 | 0.29 | -0.3 | -0.12 | - | 0.35 | -0.08 | -0.02 | -0.36 |
| OrchVegRatio | 0.38 | -0.33 | 0.35 | 0.3 | 0.09 | -0.16 | -0.01 | -0.5 | -0.34 | 0.35 | - | 0.02 | 0.42 | -0.35 |
| MeanderRatio | 0.3 | -0.09 | 0.32 | 0.02 | 0.29 | 0.53 | -0.07 | -0.34 | 0.03 | -0.08 | 0.02 | - | 0.25 | 0.03 |
| UrbanRatio | 0.49 | -0.52 | 0.6 | 0.41 | 0.08 | 0.21 | -0.04 | -0.57 | -0.39 | -0.02 | 0.42 | 0.25 | - | -0.47 |
| RiverSlope | -0.76 | 0.86 | -0.69 | -0.59 | -0.16 | 0.25 | -0.15 | 0.78 | 0.61 | -0.36 | -0.35 | 0.03 | -0.47 | - |

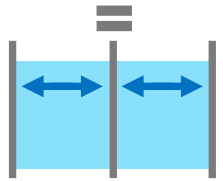
| | DrainageD | MeanderRatio | ForestRatio | LakeCatchRatio | LakeRatio | NonForestedRatio | RiverSlope | OrchVegRatio | UrbanRatio | FloodRiskAreaRatio |
|---|---|---|---|---|---|---|---|---|---|---|
| DrainageD | - | 0.53 | -0.15 | -0.05 | -0.14 | -0.4 | 0.25 | -0.16 | 0.21 | 0.43 |
| MeanderRatio | 0.53 | - | -0.34 | 0.03 | -0.07 | -0.08 | 0.03 | 0.02 | 0.25 | 0.29 |
| ForestRatio | -0.15 | -0.34 | - | 0.57 | -0.13 | -0.3 | 0.78 | -0.5 | -0.57 | -0.47 |
| LakeCatchRatio | -0.05 | 0.03 | 0.57 | - | 0.27 | -0.12 | 0.61 | -0.34 | -0.39 | -0.25 |
| LakeRatio | -0.14 | -0.07 | -0.13 | 0.27 | - | 0.29 | -0.15 | -0.01 | -0.04 | -0.07 |
| NonForestedRatio | -0.4 | -0.08 | -0.3 | -0.12 | 0.29 | - | -0.36 | 0.35 | -0.02 | -0.35 |
| RiverSlope | 0.25 | 0.03 | 0.78 | 0.61 | -0.15 | -0.36 | - | -0.35 | -0.47 | -0.16 |
| OrchVegRatio | -0.16 | 0.02 | -0.5 | -0.34 | -0.01 | 0.35 | -0.35 | - | 0.42 | 0.09 |
| UrbanRatio | 0.21 | 0.25 | -0.57 | -0.39 | -0.04 | -0.02 | -0.47 | 0.42 | - | 0.08 |
| FloodRiskAreaRatio | 0.43 | 0.29 | -0.47 | -0.25 | -0.07 | -0.35 | -0.16 | 0.09 | 0.08 | - |

# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

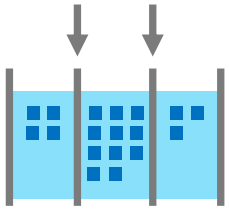
- Indices of indicators



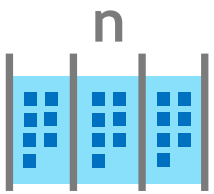
Forests in SPUs [%]



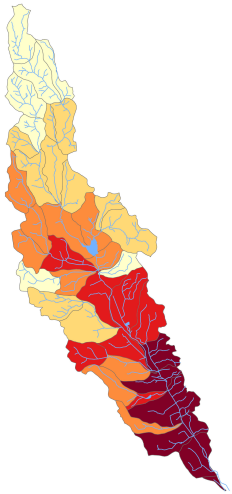
Equal Width

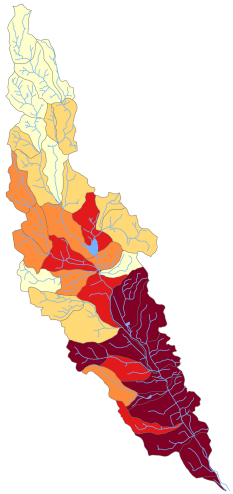


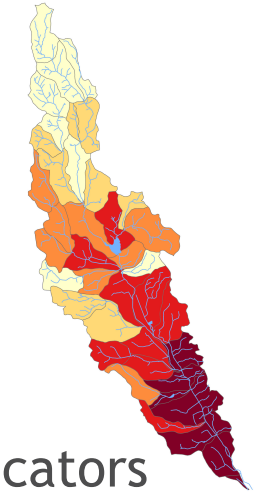
Natural Breaks




Quantile



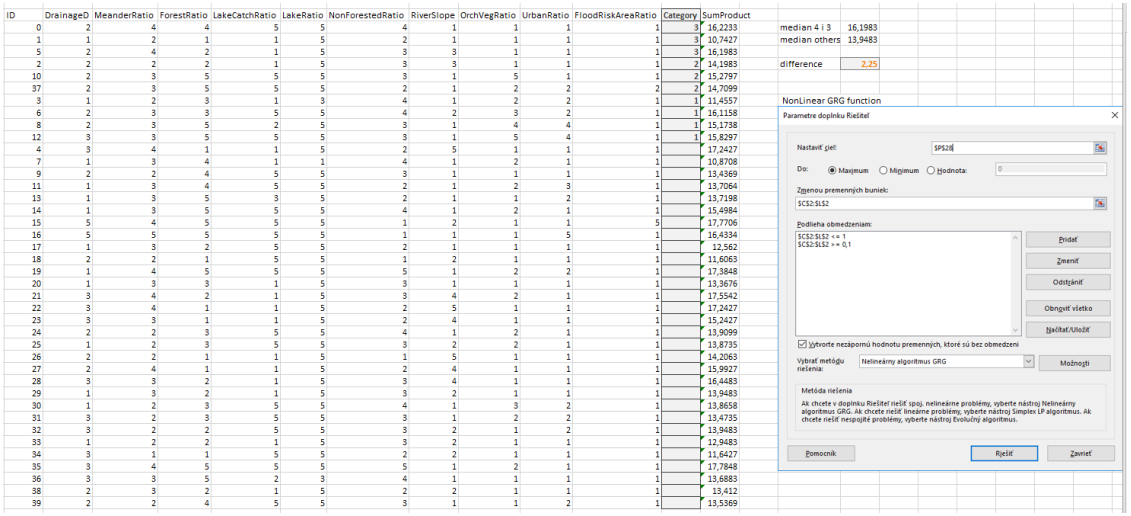




Maps of indices of indicators

- Weights of indicators

- Constant weight = 1
- Variable weight = 0,1 – 1 (method of non-linear algorithm GRG)



| ID | DrainageD | MeanderRatio | ForestRatio | LakeCatchRatio | LakeRatio | NonForestedRatio | RiverSlope | OrchVegRatio | UrbanRatio | FloodRiskAreaRatio | Category | SumProduct |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2 | 4 | 4 | 5 | 5 | 4 | 1 | 1 | 1 | 1 | 3 | 16,2233 |
| 1 | 1 | 2 | 1 | 1 | 5 | 2 | 1 | 1 | 1 | 1 | 3 | 10,7427 |
| 5 | 2 | 4 | 2 | 1 | 5 | 3 | 3 | 1 | 1 | 1 | 3 | 16,1983 |
| 2 | 2 | 2 | 2 | 1 | 5 | 3 | 3 | 1 | 1 | 1 | 2 | 14,1983 |
| 10 | 2 | 3 | 5 | 5 | 5 | 3 | 1 | 5 | 1 | 1 | 2 | 15,2797 |
| 37 | 2 | 3 | 5 | 5 | 5 | 2 | 1 | 2 | 2 | 2 | 2 | 14,7099 |
| 3 | 1 | 2 | 3 | 1 | 3 | 4 | 1 | 2 | 2 | 1 | 1 | 11,4557 |
| 6 | 2 | 3 | 3 | 5 | 5 | 4 | 2 | 3 | 2 | 1 | 1 | 16,1158 |
| 8 | 2 | 3 | 5 | 2 | 5 | 3 | 1 | 4 | 4 | 1 | 1 | 15,1738 |
| 12 | 3 | 3 | 5 | 5 | 5 | 3 | 1 | 5 | 4 | 1 | 1 | 15,8297 |
| 4 | 3 | 4 | 1 | 1 | 5 | 2 | 5 | 1 | 1 | 1 | | 17,2427 |
| 7 | 1 | 3 | 4 | 1 | 1 | 4 | 1 | 2 | 1 | 1 | | 10,8708 |
| 9 | 2 | 2 | 4 | 5 | 5 | 3 | 1 | 1 | 1 | 1 | | 13,4369 |
| 11 | 1 | 3 | 4 | 5 | 5 | 2 | 1 | 2 | 3 | 1 | | 13,7064 |
| 13 | 1 | 3 | 5 | 3 | 5 | 2 | 1 | 1 | 2 | 1 | | 13,7198 |
| 14 | 1 | 3 | 5 | 5 | 5 | 4 | 1 | 2 | 1 | 1 | | 15,4984 |
| 15 | 5 | 4 | 5 | 5 | 5 | 1 | 2 | 1 | 1 | 5 | | 17,7706 |
| 16 | 5 | 5 | 5 | 5 | 5 | 1 | 1 | 1 | 5 | 1 | | 16,4334 |
| 17 | 1 | 3 | 2 | 5 | 5 | 2 | 1 | 1 | 1 | 1 | | 12,562 |
| 18 | 2 | 2 | 1 | 5 | 5 | 1 | 2 | 1 | 1 | 1 | | 11,6063 |
| 19 | 1 | 4 | 5 | 5 | 5 | 5 | 1 | 2 | 2 | 1 | | 17,3848 |
| 20 | 1 | 3 | 3 | 1 | 5 | 3 | 1 | 1 | 1 | 1 | | 13,3676 |
| 21 | 3 | 4 | 2 | 1 | 5 | 3 | 4 | 2 | 1 | 1 | | 17,5542 |
| 22 | 3 | 4 | 1 | 1 | 5 | 2 | 5 | 1 | 1 | 1 | | 17,2427 |
| 23 | 3 | 3 | 1 | 1 | 5 | 2 | 4 | 1 | 1 | 1 | | 15,2427 |
| 24 | 2 | 2 | 3 | 5 | 5 | 4 | 1 | 2 | 1 | 1 | | 13,9099 |
| 25 | 1 | 2 | 3 | 5 | 5 | 3 | 2 | 2 | 1 | 1 | | 13,8735 |
| 26 | 2 | 2 | 1 | 1 | 5 | 1 | 5 | 1 | 1 | 1 | | 14,2063 |
| 27 | 2 | 4 | 1 | 1 | 5 | 2 | 4 | 1 | 1 | 1 | | 15,9927 |
| 28 | 3 | 3 | 2 | 1 | 5 | 3 | 4 | 1 | 1 | 1 | | 16,4483 |
| 29 | 1 | 3 | 2 | 1 | 5 | 3 | 2 | 1 | 1 | 1 | | 13,9483 |
| 30 | 1 | 2 | 3 | 5 | 5 | 4 | 1 | 3 | 2 | 1 | | 13,8658 |
| 31 | 3 | 2 | 3 | 5 | 5 | 3 | 1 | 2 | 2 | 1 | | 13,4735 |
| 32 | 3 | 2 | 2 | 5 | 5 | 3 | 2 | 1 | 2 | 1 | | 13,9483 |
| 33 | 1 | 2 | 2 | 1 | 5 | 3 | 2 | 1 | 1 | 1 | | 12,9483 |
| 34 | 3 | 1 | 1 | 5 | 5 | 2 | 2 | 1 | 1 | 1 | | 11,6427 |
| 35 | 3 | 4 | 5 | 5 | 5 | 5 | 1 | 2 | 1 | 1 | | 17,7848 |
| 36 | 3 | 3 | 5 | 2 | 3 | 4 | 1 | 1 | 1 | 1 | | 13,6883 |
| 38 | 2 | 3 | 2 | 1 | 5 | 2 | 2 | 1 | 1 | 1 | | 13,412 |
| 39 | 2 | 2 | 4 | 5 | 5 | 3 | 1 | 1 | 2 | 1 | | 13,5369 |

median 4 i 3 16,1983
median others 13,9483
difference 2,25

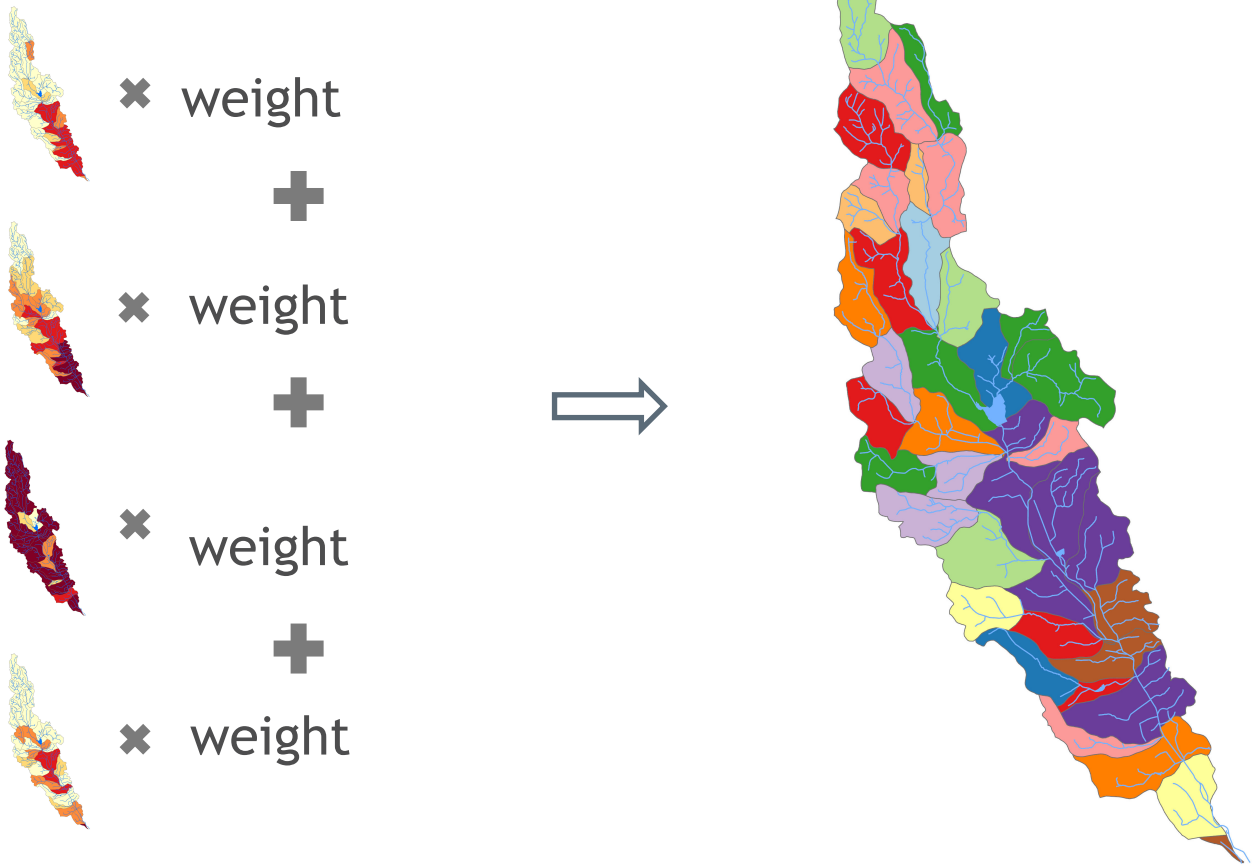
NonLinear GRG function



| Short name indicator | Calculated by Weight Solver | | |
|---|---|---|---|
| | Equal width | Natural breaks | Quantile |
| DrainageD | 0,2 | 0,3 | 0,4 |
| FloodRiskAreaRatio | 0,4 | 0,1 | 0,1 |
| ForestRatio | 0,4 | 0,4 | 0,1 |
| LakeCatchRatio | 0,1 | 0,1 | 0,1 |
| LakeRatio | 1,0 | 1,0 | 1,0 |
| MeanderRatio | 1,0 | 1,0 | 1,0 |
| NonForestedRatio | 0,8 | 1,0 | 1,0 |
| OrchVegRatio | 0,1 | 1,0 | 0,7 |
| RiverSlope | 1,0 | 0,1 | 0,9 |
| UrbanRatio | 0,1 | 0,1 | 0,1 |

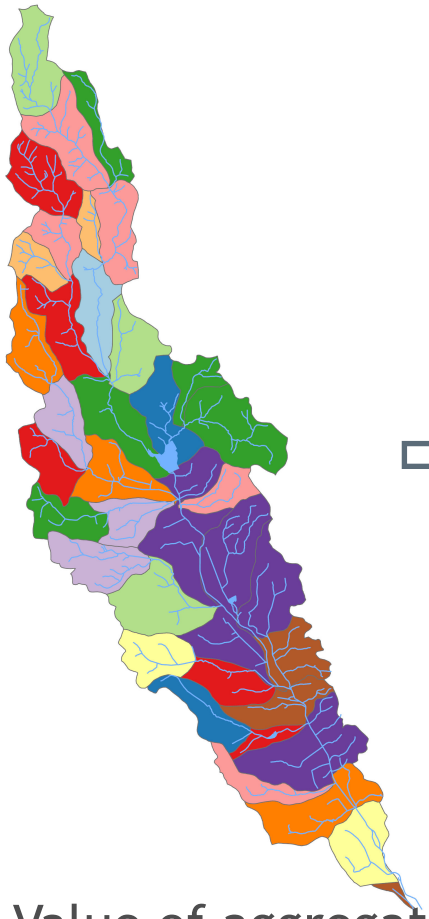
# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

- Value of aggreagted indices of indicators

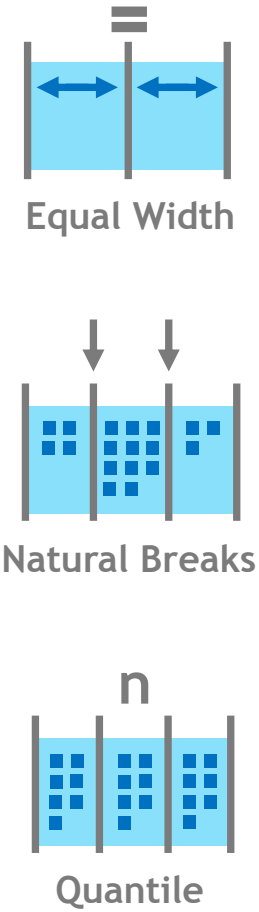


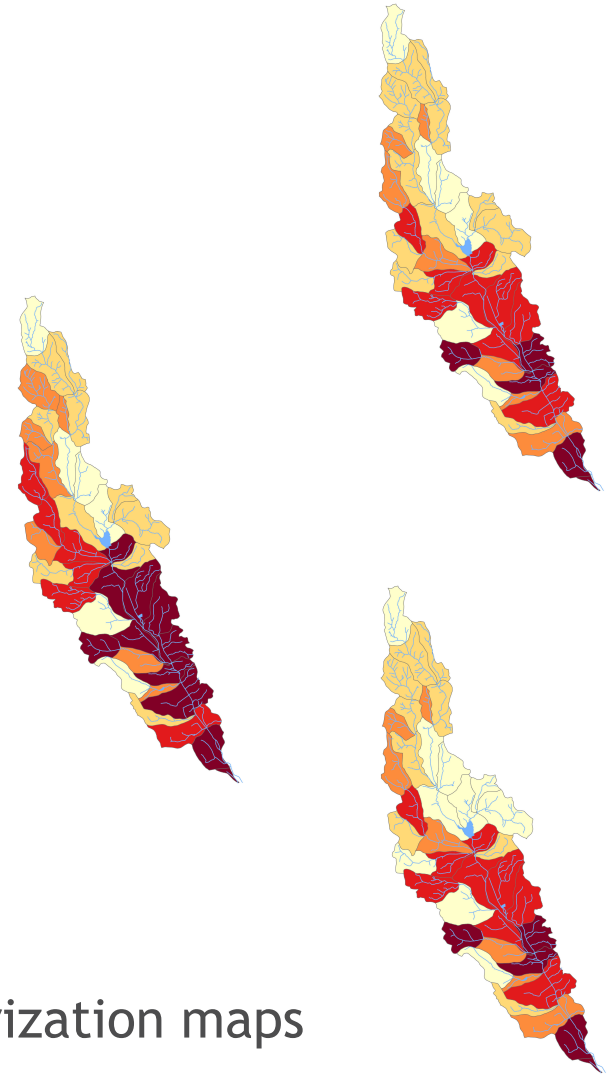
# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

- Indice of valorization map



Value of aggregated indices of indicators



Valorization maps

# SLANÁ RIVER BASIN, BLH SUB-CATCHMENT

- Comparison of results

SPU 40 – 3 classes

| | Equal width | | | Natural breaks | | | Quantiles | | |
|---|---|---|---|---|---|---|---|---|---|
| Errors | VarA.Wht01-VarA.Wht1 | Goal-VarA.Wht1 | Goal-VarA.Wht01 | VarB.Wht01-VarB.Wht1 | Goal-VarB.Wht1 | Goal-VarB.Wht01 | VarC.Wht01-VarC.Wht1 | Goal-VarC.Wht1 | Goal-VarC.Wht01 |
| MAD | 0,20 | 1,20 | 1,00 | 0,33 | 1,10 | 1,30 | 0,28 | 1,10 | 0,90 |
| MSE | 0,20 | 2,20 | 1,80 | 0,33 | 1,90 | 2,10 | 0,28 | 1,90 | 1,70 |
| RMSE | 0,45 | 1,48 | 1,34 | 0,57 | 1,38 | 1,45 | 0,52 | 1,38 | 1,30 |
| MAPE | 13,75% | 83,33% | 75,00% | 25,00% | 80,00% | 88,33% | 16,67% | 80,00% | 71,67% |

SPU 40 – 5 classes

| | Equal width | | | Natural breaks | | | Quantiles | | |
|---|---|---|---|---|---|---|---|---|---|
| Errors | VarA.Wht01-VarA.Wht1 | Goal-VarA.Wht1 | Goal-VarA.Wht01 | VarB.Wht01-VarB.Wht1 | Goal-VarB.Wht1 | Goal-VarB.Wht01 | VarC.Wht01-VarC.Wht1 | Goal-VarC.Wht1 | Goal-VarC.Wht01 |
| MAD | 0,73 | 1,90 | 1,70 | 0,83 | 2,30 | 1,80 | 0,93 | 2,30 | 1,90 |
| MSE | 1,08 | 4,90 | 3,90 | 1,18 | 7,30 | 5,00 | 1,63 | 7,30 | 5,10 |
| RMSE | 1,04 | 2,21 | 1,97 | 1,08 | 2,70 | 2,24 | 1,27 | 2,70 | 2,26 |
| MAPE | 26,58% | 143,33% | 123,33% | 40,42% | 175,00% | 133,33% | 41,96% | 175,00% | 130,00% |

SPU 80 – 3 classes

| | Equal width | | | Natural breaks | | | Quantiles | | |
|---|---|---|---|---|---|---|---|---|---|
| Errors | VarA.Wht01-VarA.Wht1 | Goal-VarA.Wht1 | Goal-VarA.Wht01 | VarB.Wht01-VarB.Wht1 | Goal-VarB.Wht1 | Goal-VarB.Wht01 | VarC.Wht01-VarC.Wht1 | Goal-VarC.Wht1 | Goal-VarC.Wht01 |
| MAD | 0,39 | 1,00 | 0,91 | 0,41 | 1,27 | 1,27 | 0,25 | 1,36 | 1,18 |
| MSE | 0,39 | 1,55 | 1,27 | 0,41 | 2,18 | 2,00 | 0,25 | 2,45 | 2,09 |
| RMSE | 0,62 | 1,24 | 1,13 | 0,64 | 1,48 | 1,41 | 0,50 | 1,57 | 1,45 |
| MAPE | 31,88% | 65,15% | 51,52% | 27,50% | 100,00% | 93,94% | 18,13% | 109,09% | 95,45% |

SPU 80 – 5 classes

| | Equal width | | | Natural breaks | | | Quantiles | | |
|---|---|---|---|---|---|---|---|---|---|
| Errors | VarA.Wht01-VarA.Wht1 | Goal-VarA.Wht1 | Goal-VarA.Wht01 | VarB.Wht01-VarB.Wht1 | Goal-VarB.Wht1 | Goal-VarB.Wht01 | VarC.Wht01-VarC.Wht1 | Goal-VarC.Wht1 | Goal-VarC.Wht01 |
| MAD | 0,48 | 1,55 | 1,36 | 1,15 | 2,09 | 1,45 | 1,09 | 2,36 | 1,45 |
| MSE | 0,58 | 3,00 | 2,82 | 2,00 | 5,55 | 2,36 | 2,19 | 7,45 | 3,45 |
| RMSE | 0,76 | 1,73 | 1,68 | 1,41 | 2,35 | 1,54 | 1,48 | 2,73 | 1,86 |
| MAPE | 20,40% | 116,67% | 110,61% | 89,1% | 166,7% | 97,0% | 46,40% | 190,91% | 109,09% |

# FroGIS v.0.9.7-debug

E-LEARNING | FRAMWAT | METHODOLOGY | MANUAL | EXAMPLE DATA | CHANGELOG | LOGS

1 INPUT VALORIZATION GOALS

2 CORRELATION MATRIX

3 FINAL REPORT

- INDICATOR VALUES
- SPACIAL PLANNING UNITS
- GOALS AND INDICATORS
- DATA INPUT
- INDICATORS CORRELATION MATRIX
- CONVERSION AND FINAL AGGREGATION METHOD
- GOAL VALORIZATION RESULT

# CONCLUSIONS

1. The methodology is universal and can be used in various locations, but requires individual selection of indicators and valorization scales.
2. Valorisation enables taking into account **natural**/environmental **conditions** already at the initial stage of planning process.
3. Work in the GIS environment and possibility of selection of SPUs and of set of indicators, facilitate the analysis of the needs of small retention activities and introduces greater flexibility to planning tool.
4. The methodology is developed to be used for **planning purposes** not for developing/design of project, therefore, when designing specific activities or measures, the needs of water users and environmental protection requirements, including environmnetal flows, should be taken into account.
5. The quality of valorisation results depends on the quality and scale of the **input data** used, and the knowledge of the expert developing the valorisation.

**Links to other similar tools:** ToolKit nutrient , FreeWater software

# THANK YOU FOR YOUR ATTENTION!

Name: Framework for improving water balance and nutrient mitigation by applying small water retention measures
Project acronym: FramWat
Project code: CE983

https://www.interreg-central.eu/Content.Node/FramWat

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