

Optimization of sampling configuration for DSM in a historical wine region, Hungary

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Introduction

- Tokaj is a historical region in Hungary for botritized dessert wine making
- Recently the sustainable quality wine production in the region was targeted, which requires detailed soil surveys, digital soil mapping procedures and uncertainty assessments
- The objective of our work was to plan the sampling strategy considering predefined constraints for digital mapping of primary soil properties.



An overview of the whole sampling strategy



1st phase sampling:

- specifying the sampling constraints,
- characterize the relationship between the soil properties and the auxiliary information,
- estimate the variograms of the soil properties,

2nd phase sampling:

- respecifying the sampling constraints,
- optimizing the sampling design for DSM of soil properties,
- High resolution DSM...



An overview of the 1st phase sampling

- Determine the soil properties of interest:
 - Soil organic matter (SOM), pH, calcium carbonate
- Sampling constraints: inaccessible areas,
- Relevant auxiliary information:
 - Digital elevation model, geology, climate, satellite images,
- Main goals:
 - Characterize the relationship between the soil properties and the auxiliary information
 - Estimate the variograms





2nd phase sampling

- Respecifying the sampling constraints according to the end-user's demands:
 - Inaccessible areas,
 - Priority areas,
 - Uncertainty constraints,
 - Previously collected samples,
 - Cost-effectiveness (as possible),

VAR:	SOM	рН	CaCO ₃
W ^{priori} 90%	0.5%	1.2	5.0%



2nd phase sampling

Optimization for DSM:

Optimization algorithm: Spatial Simulated Annealing (SSA),

Quality measure: Spatially averaged regression kriging error variance,

Prerequisites of the optimization:

(1) regression structure,

(2) variogram model,

Dominant soil property: Soil organic matter

- (1) highest spatial variability,
- (2) most complex regression structure,
- (3) severest uncertainty constraint,



Optimization for <u>SOM</u>:

VAR:	SOM	рН	CaCO ₃
W ^{priori} 90%	0.5%	1.2	5.0%



Soil organic matter





Optimization for <u>pH</u>:

VAR:	SOM	рН	CaCO ₃
W ^{priori} 90%	0.5%	1.2	5.0%

$$W_{90\%}^{\rm pH} = 0.7$$
 (< 1.2)







Optimization for <u>CaCO</u>₃:

VAR:	SOM	рН	CaCO ₃
W ^{priori} 90%	0.5%	1.2	5.0%

$$W_{90\%}^{CaCO_3} = 3.1\%$$
 (< 5.0%)







- Second-phase sampling:
 Overall sample size: 500
 - SOM have to be measured for each sampling point,
 - **pH** have to be measured **for 400** from the 500 sampling points,
 - CaCO₃ have to be measured for 325 from the 500 sampling points,

01. 2nd_sampling				x		
	x	Y	CaCO3	pH	SOM	^
1	818517.141820	319588.323890	0	1	1	
2	821676.614300	326721.063190	1	1	1	
3	822730.569860	321102.683610	1	1	1	
4	822676.738460	313526.403040	0	1	1	
5	815395.115910	322498.657510	0	0	1	
6	815386.976320	320469.429200	1	1	1	
7	828593.796800	332553.640720	1	1	1	
8	804441.294470	318335.675750	0	0	1	
9	822230.257880	328514.252050	0	0	1	
10	815794.568800	317099.276730	1	1	1	
11	833362.217860	338521.822620	1	1	1	
12	832392.141730	333631.262370	1	1	1	
13	827544.849290	333332.940950	0	1	1	
14	817616.092950	317846.739490	0	0	1	X
15	829980.646560	331571.849970	0	0		
16	821248.676740	329429.518070	0	0		
17	819355.118910	319073.794200	1	1		
18	812561.521570	323941.048660	0		1	
19	808212.722970	315126.701300	0	1	1	
20	823335.258000	313921.365460	0		1	
21	818772.713260	329200.771890	0	0	1	
22	837128.949710	337262.264640	0	0	1	
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Thank you for your kind attention!!

