

Accuracy assessment of the high-resolution soil sealing second dataset for Italy

In order to validate the Italian soil sealing layer, quantitative analysis has been conducted. The applied methodology, that follows the EEA specifications (Recommendations GMES HR soil sealing final300408), has been applied to verify if the classification accuracy per hectare (based on a 100 m x 100 m grid) of built-up and not built-up areas reach at least 85%.

To perform the validation, two vector layers have been created. The first one containing 500 (100x100 m) random cells distributed inside the built-up class, and the second made up of 2000 random cells distributed inside the not built-up class.

It has been successively compared the HR layer classification with 2006 aerial images in correspondence of the 2500 cells, identifying as a sealed area a 100x100 m polygon having at least the 80% coverage built-up, including in these areas also mines, dumps and construction sites.

Over 2500 sample polygons, it results 88 over 500 wrong classified cells about the built-up areas and 24 over 2000 wrong classified cells about the NOT built-up areas.

The quantitative analysis conducted is resumed on table 1, that shows 82,40% accuracy for the built-up classification and 98,80% for the NOT built-up one (Overall: 95,54%). Respect the first dataset received the built-up accuracy increase despite a decreasing of the overall one (table 2).

		Reference data			
		B	O	Sum	User's accuracy
Classified data	Built-up (B)	412	88	500	82,40%
	Other (O)	24	1976	2000	98,80%
	Sum	436	2064	2511	
	Producer's accuracy	94,50%	95,74%		
Overall accuracy:					95,54%

Table 1 – Second dataset HR soilsealing layer accuracy.

		Reference data			
		B	O	Sum	User's accuracy
Classified data	Built-up (B)	402	97	499	80,56%
	Other (O)	9	1991	2000	99,55%
	Sum	411	2088	2499	
	Producer's accuracy	97,81%	95,35%		
Overall accuracy:					95,76%

Table 2 – First dataset HR soilsealing layer accuracy.

It also came up a very small accuracy decreasing on the NOT built-up layer, but impacting significantly on the probability of having more than 15% error respect the first dataset (tables 3 & 4).

Table 3 shows the probability to have more than the 15% classification error in the soil sealing layer; in the built-up case the mean error is 17.84% and the probability to have more than 15% error reach 95.22% and, for the NOT built-up area, the probability of having more than 15% error is very high respect the calculate value about the first dataset as well as the mean error (from 12,72% to 30,72%).

Statistical validation results of the Italian HR built-up database (n_1, n_2) = (500,2000) , $P_{class} = 4\%$, $P_{exlc} = 0\%$, $\alpha_0 = \alpha_1 = 5\%$							
Error type	Number of all samples	numbers of wrong samples	Statistical results of the validation				
			P0 (Pmin)	P1 (Pmax)	mean error	confidence interval	Probability of having more than 15% error real in the database
Commission	500	88	15,03%	20,65	17,84%	2,81%	95,22%
Omission	2000	24	20,88%	40,56	30,72%	9,84%	99,89%

Table 3 – Statistical result of the second soilsealing layer.

Statistical results of the validation of the Italian HR built-up database (n_1, n_2) = (500,2000), $P_{class} = 4\%$, $P_{exlc} = 0\%$, $\alpha_0 = \alpha_1 = 5\%$							
Error type	Number of all samples	Number of wrong samples	Statistical results of the validation				
			P ₀ (p _{min})	P ₁ (p _{max})	Mean error	Confidence interval	Probability of having more than 15% error real in the database
Commission	499	97	16.75 %	22.59 %	19.67 %	2.92 %	99.7 %
Omission	2 000	9	6.48 %	18.96 %	12.72 %	6.24 %	20.06 %

Table 4 – Statistical result of the first soilsealing layer.

Considering the efforts to produce the layer dataset, the application of the same classification algorithm for different latitudes, the spectral limiting of Spot Imagery for the pattern identifying, the HR soil sealing layer is accepted even if the built-up accuracy is not fully achieved and the statistical response does not furnish confortant results. A very cautelative approach must be accomplished before using the HR soilsealing layer in integrated analysis or environmental planning.

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