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Thematic accuracy and completeness of topographic maps

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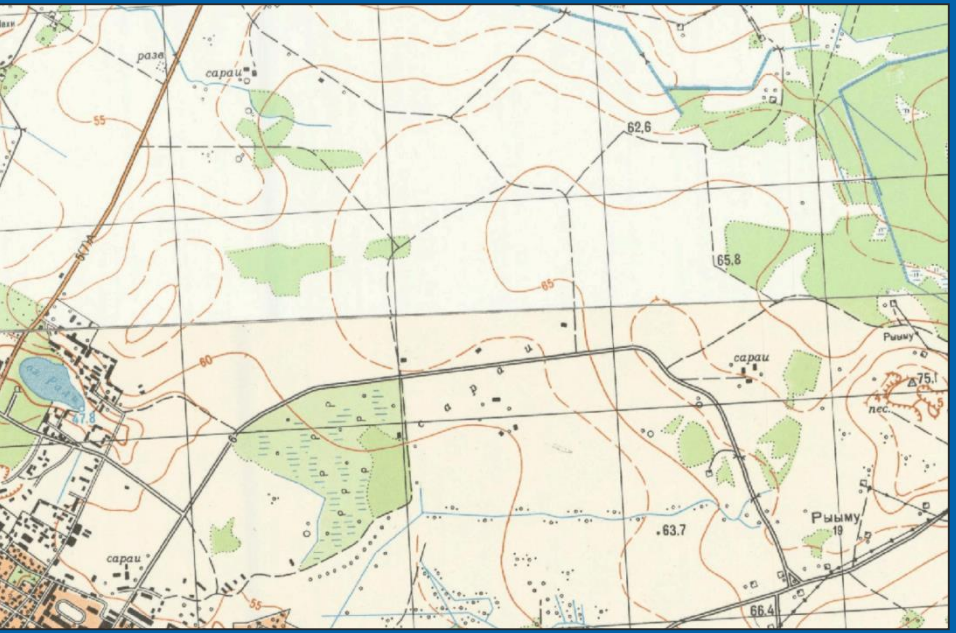
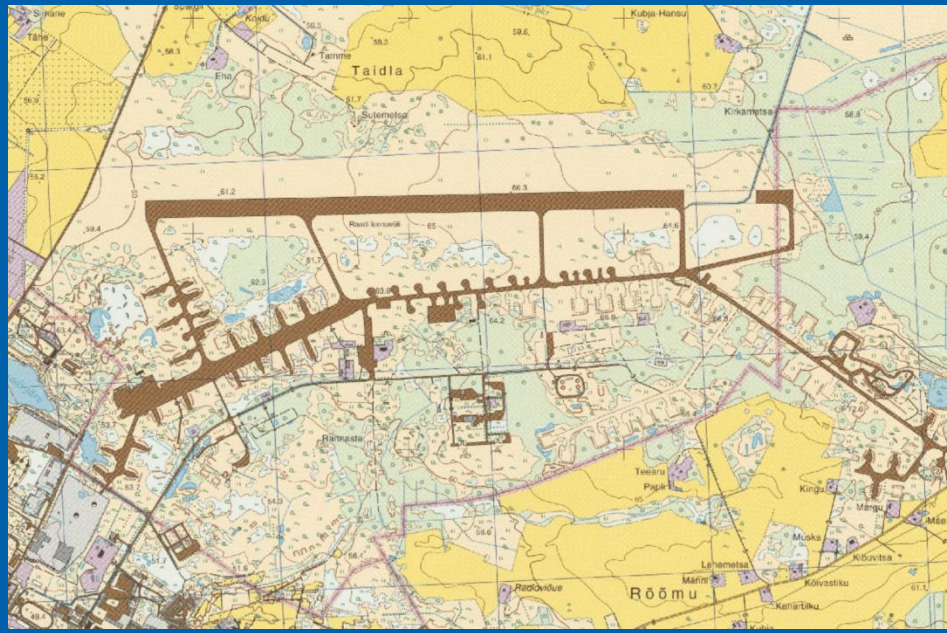
Background



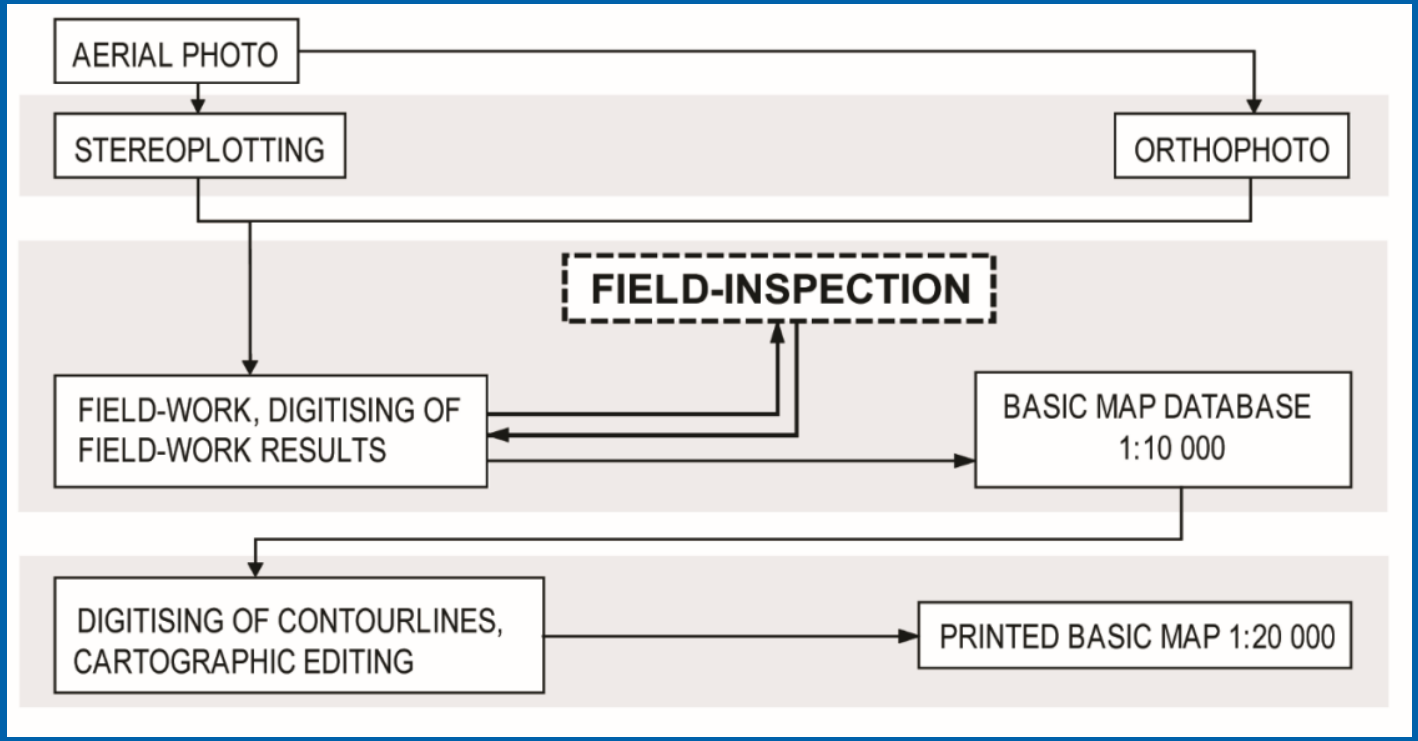
Soviet military map 1:25 000



Estonian Basic Map printed 1:20 000

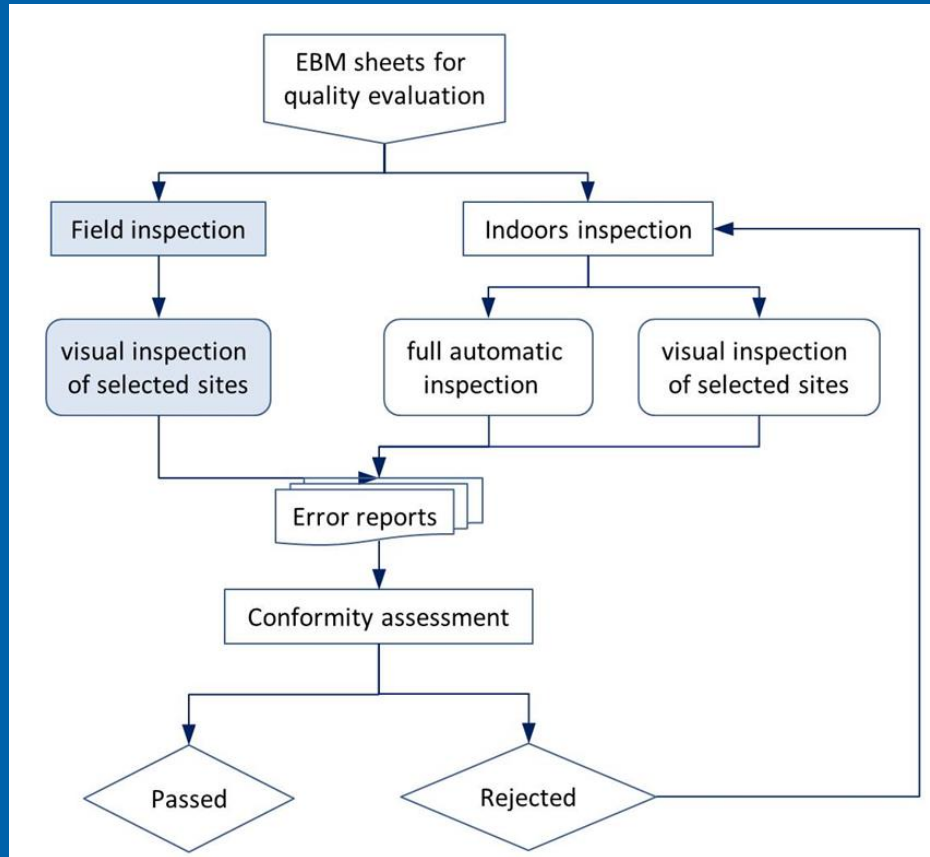
(in digital 1:10 000)

Background


AERIAL PHOTO
STEREOPLOTTING
ORTHOPHOTO
FIELD-INSPECTION
FIELD-WORK, DIGITISING OF FIELD-WORK RESULTS
BASIC MAP DATABASE 1:10 000
DIGITISING OF CONTOURLINES, CARTOGRAPHIC EDITING
PRINTED BASIC MAP 1:20 000

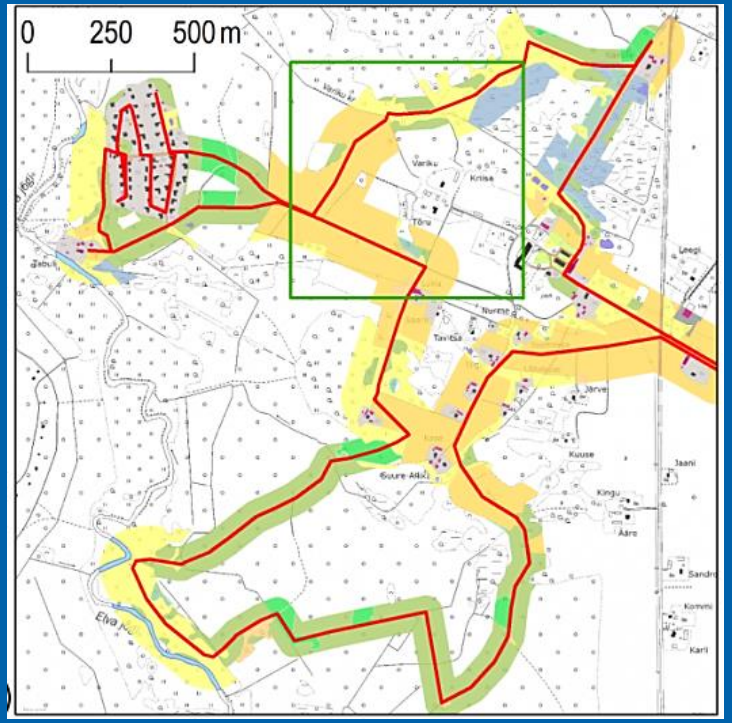
Quality control process

- Field inspection
  - classification correctness of features
  - omission of features
  - commission of features
  - wrong place
  - wrong size



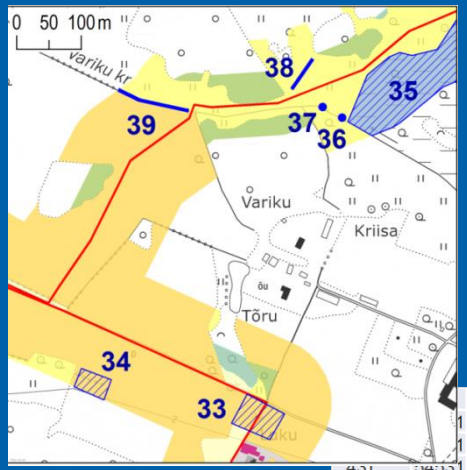
Quality control process

- Determination of field inspection area
  - 100 m in open area
  - 50 m in closed area



Quality control process

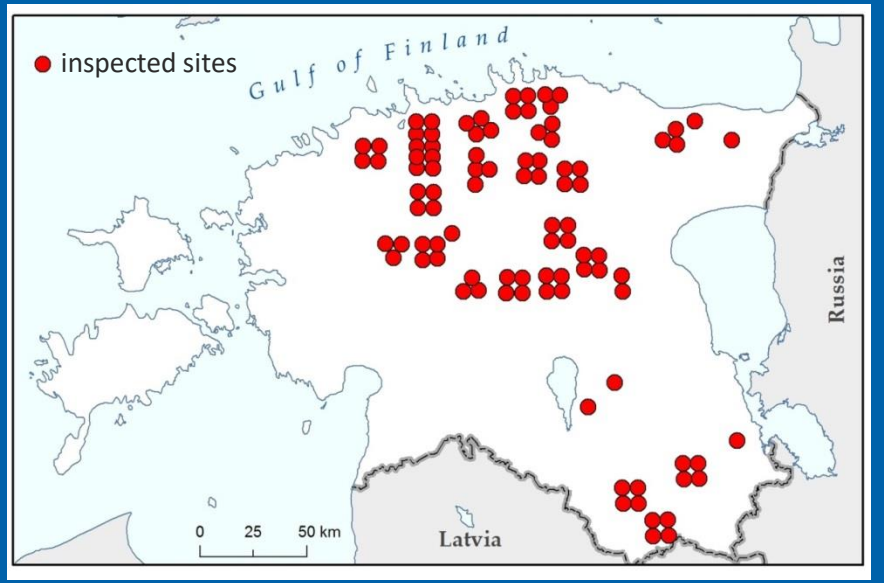
- Error reports of field inspection
- 6 field inspectors of Estonian Land Board



		Liigne	Puudu	Oli	ON	Vale koht	Vale mõõt	S/V
			LMRK_1					v
			237					v
43 j	54531		149					v
44 a	54531			236	237			v
45 a	54531		232					s
47 a	54531			64	106			v
48 j	54531		140					v
49 a	54531			104	62			v
410 a	54531			104	62			v
411 a	54531			104	64			v
412 j	54531		140					v
413 j	54531		37					v
414 j	54531	36						v
415 j	54531		140					s
416 j	54531		140					s
417 j	54531		140					s
418 j	54531		159					s
419 p	54531		hpoos1					
420 j	54531			137	138			s
421 a	54531		237					v
422 a	54531			104	64			v

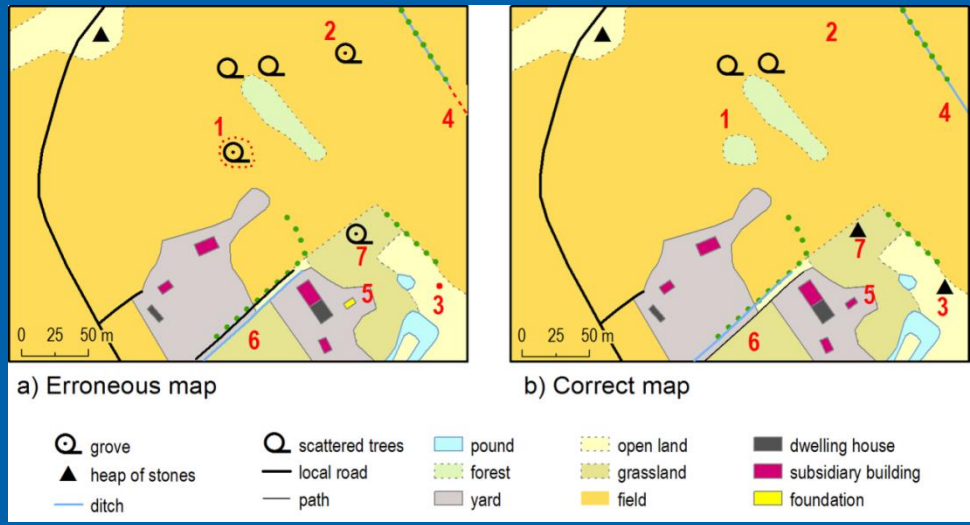
Unique data of field inspection

CHARACTERISTIC	VALUE
Quality control period	2003–2006
Number of field inspectors	6
Number of inspected field workers	21
Field workers' gender	6 female, 15 male
Field workers' years of experience	2–11 years
Number of inspected sites	93
Total length of inspection routes	1 455 km
Length of inspection routes	11–15 km
Total area of inspected sites	159 km^2
Minimum area mapped by one field worker	¼ of map sheet



Error database

- In total 5100 errors
- Harmonization of error types
  - points can have all error types
  - lines can have all error types, except wrong size and wrong place
  - polygons could only misclassified
  - in case of change of geometry type, the point or line is recorded as an error of commission and polygon as a misclassification



Some theoretical anchor points

- About quality
  - Data quality could be analyzed and presented at more detailed levels of granularity (Hunter et al. 2009, Devillers et al. 2010)
  - Data quality can vary spatially (Sadiq et al. 2006)
- About human factor
  - Fieldworkers interpret the landscape subjectively (Cherrill and McClean, 1999; Stevens et al., 2004)
  - Increasing years of experience and experience with mapping certain landscape types improved mapping quality (Hearn et al. 2011)
  - Men and women interpret spaces differently (Coluccia and Louse 2004, Lawton 1994, Matthews 1986)

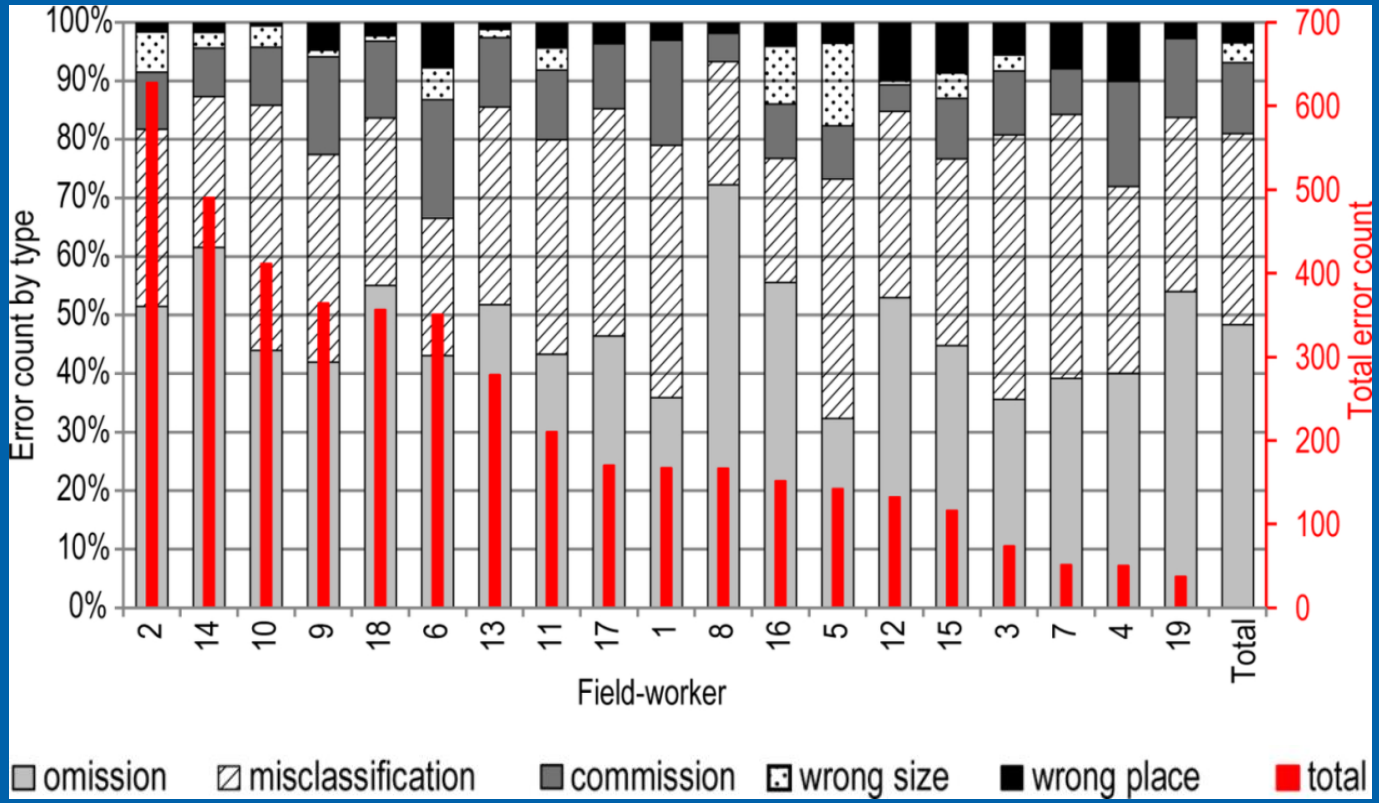
Error analyses

- Two levels of granularity
  - **in general** level (whole database)
  - **in detailed** level (by individual field worker)
- Quality measure calculation

ANALYSIS	MEASURE	DEFINITION
Type of errors	error count	number of incorrect items
Geometry of errors		
Feature classes of errors	error sum	total: number of incorrect points length of incorrect lines area of incorrect polygons
Most misclassified feature class		
Differences in errors among filed worker by gender and years of experience	error rate	total number, length or area of erroneous items in a geometrical type divided by the total number, length or area of items in that geometrical type and multiplied by 100
Differences in errors among filed worker by landscape types		

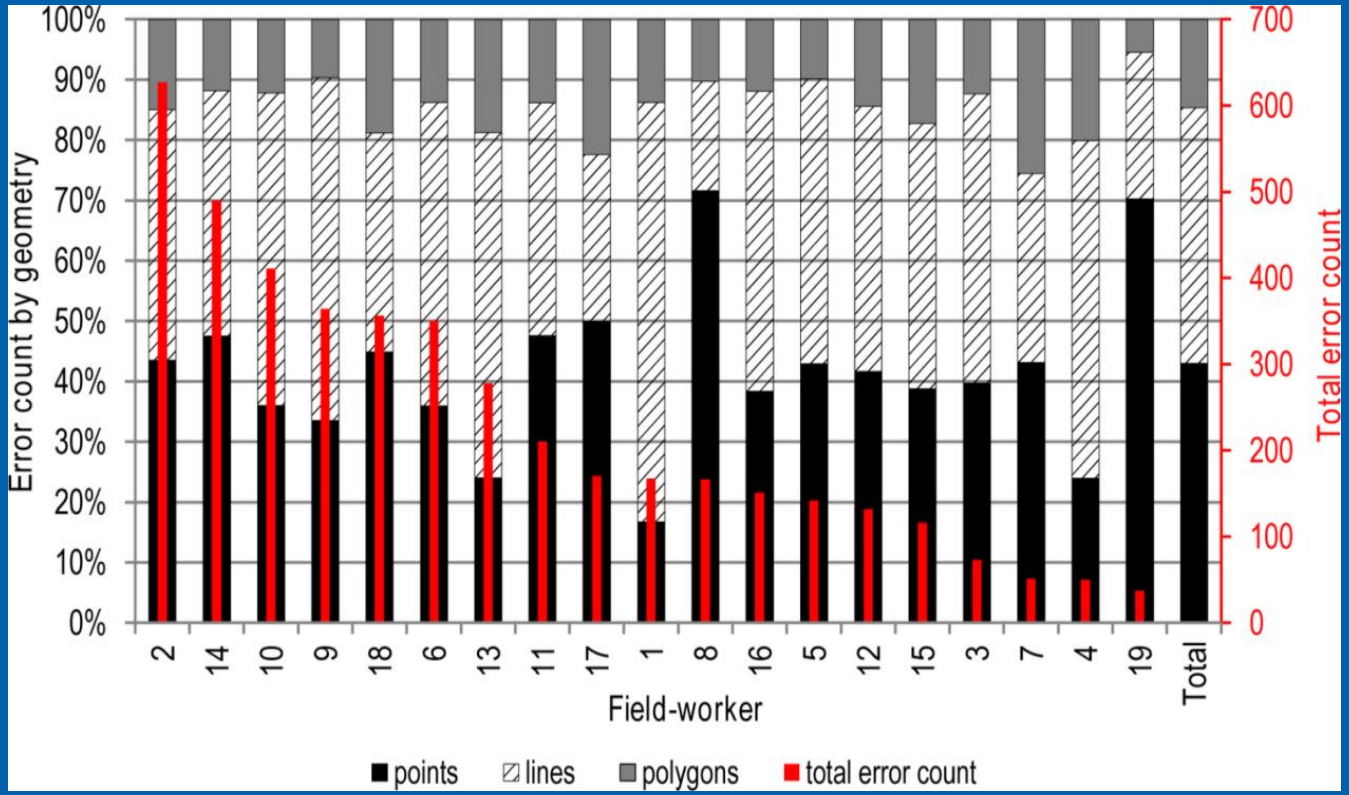
The structure of errors by error types

- In general:
  - 48% omission,
  - 33% misclassifi-cation
- In detail:
  - Variation among field workers



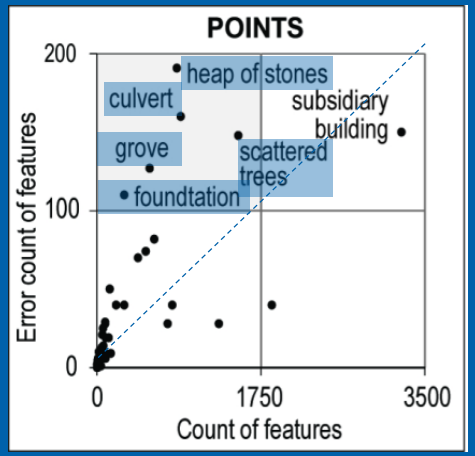
The structure of errors by geometry

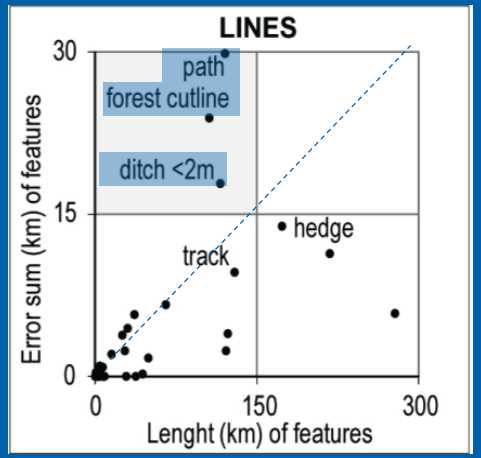
- In general:
  - 46% lines
  - 40% points
  - 14% polygons
- By field workers:
  - more errors in line objects
  - more errors in point objects
  - similar to the general database

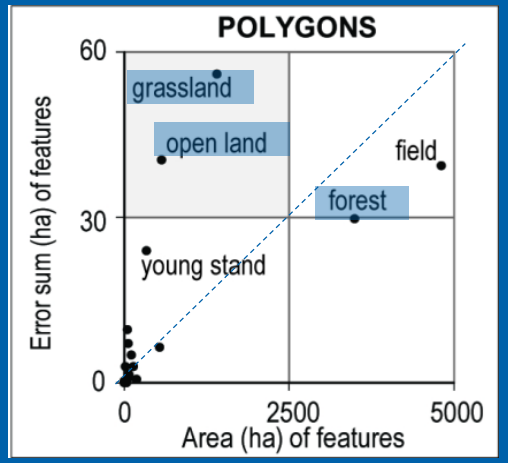


Most critical feature classes

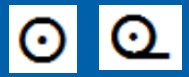
- At both level of granularity
  - frequently missing
  - mostly misclassified
  - tended to be committed in excess
- Only at field worker's level
  - misclassification of forest
- Only for few field workers
  - misclassification of narrow ditch <2m
  - misclassification of grassland

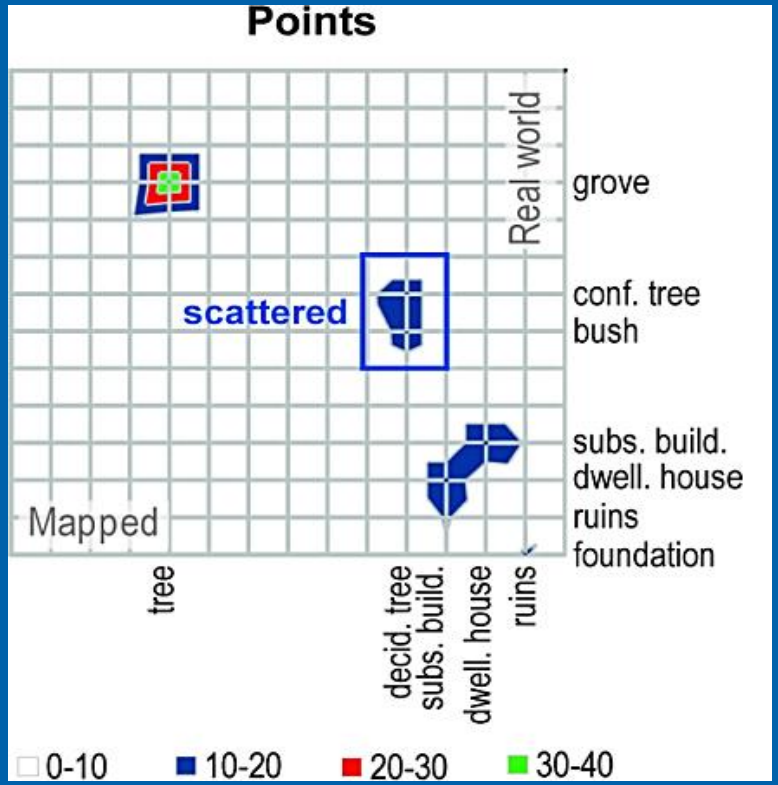




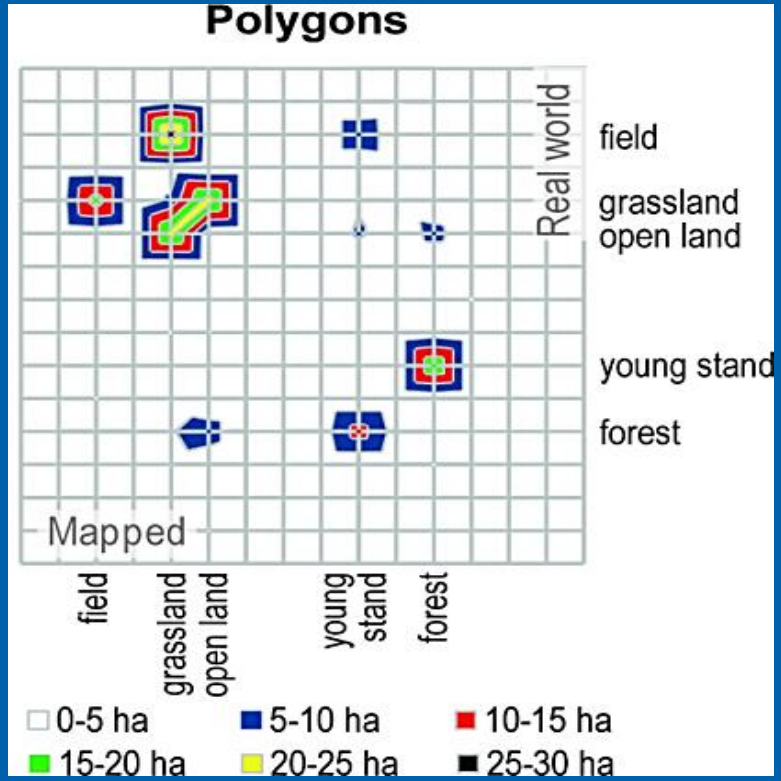


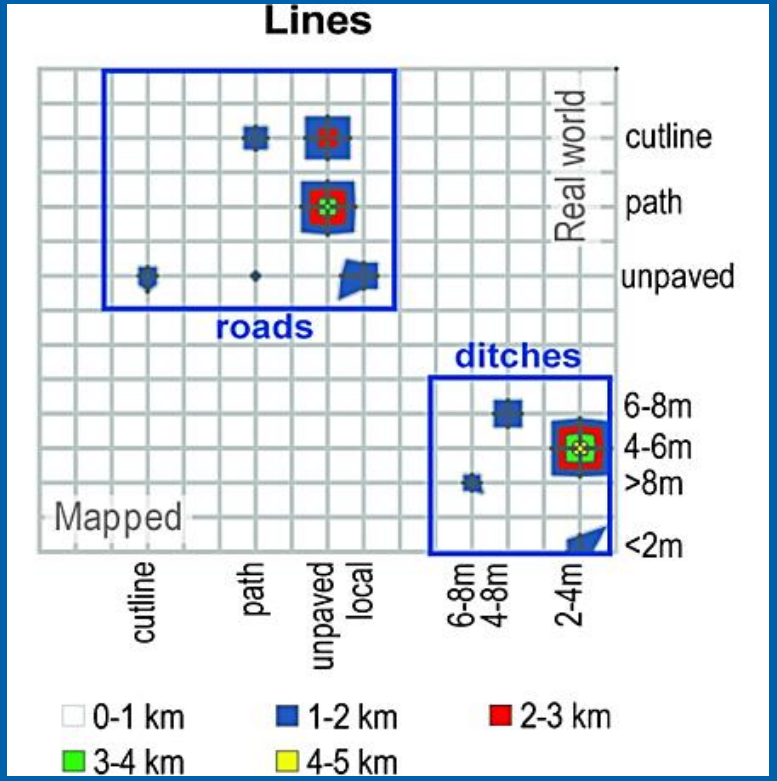
Most misclassified feature classes

- “Neighbouring” each other
- Symbol of grove in stereoplotting 
- Path in a higher class, ditch in lower class
- Field – grassland – open land
- Young stand - forest



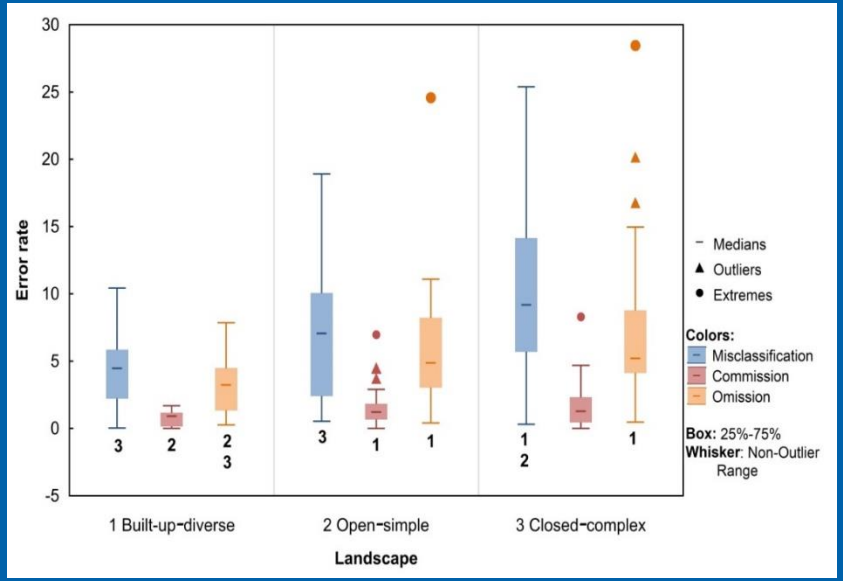
Most misclassified feature classes



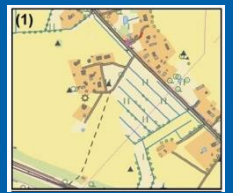


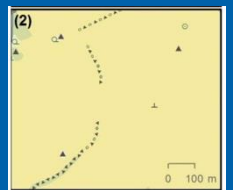
Errors in different landscapes

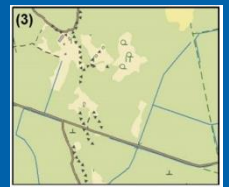
- Statistically significant difference in landscapes
- Relatively low in built-up landscapes
- More errors in closed-complex landscapes than in open-simple landscapes



statistically significant difference from: 1 – built-up–diverse landscape type, 2 – open–simple landscape type, 3 – closed–complex landscape type

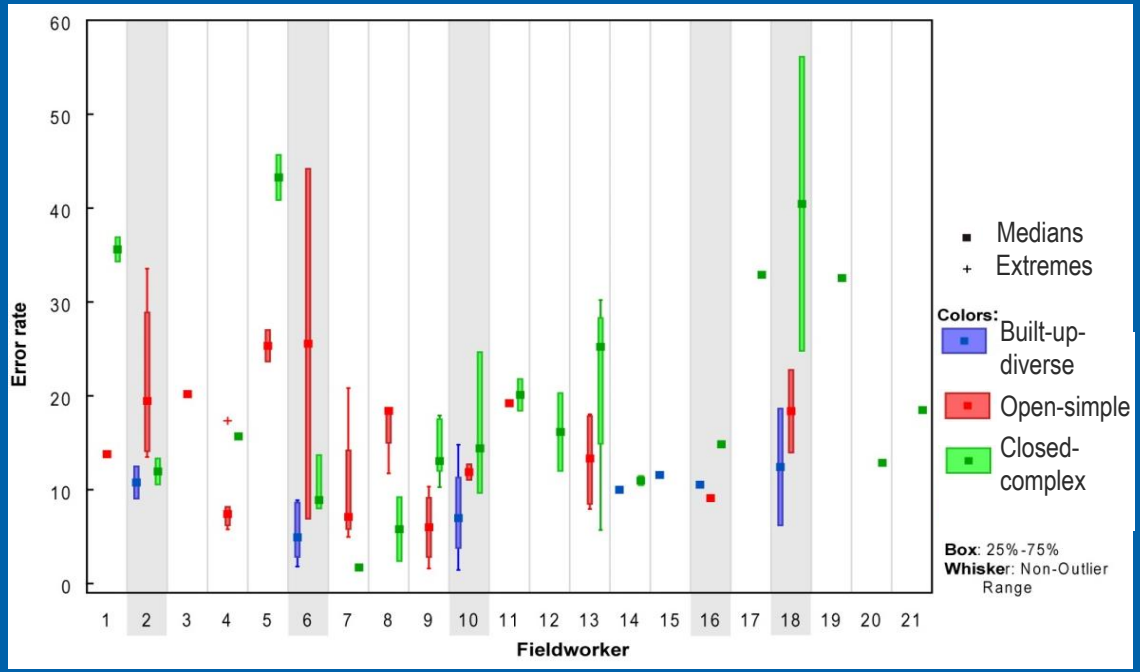


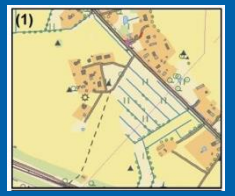


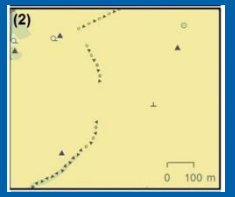


Errors in different landscapes

- By field workers - within the landscape type large variation in error rates

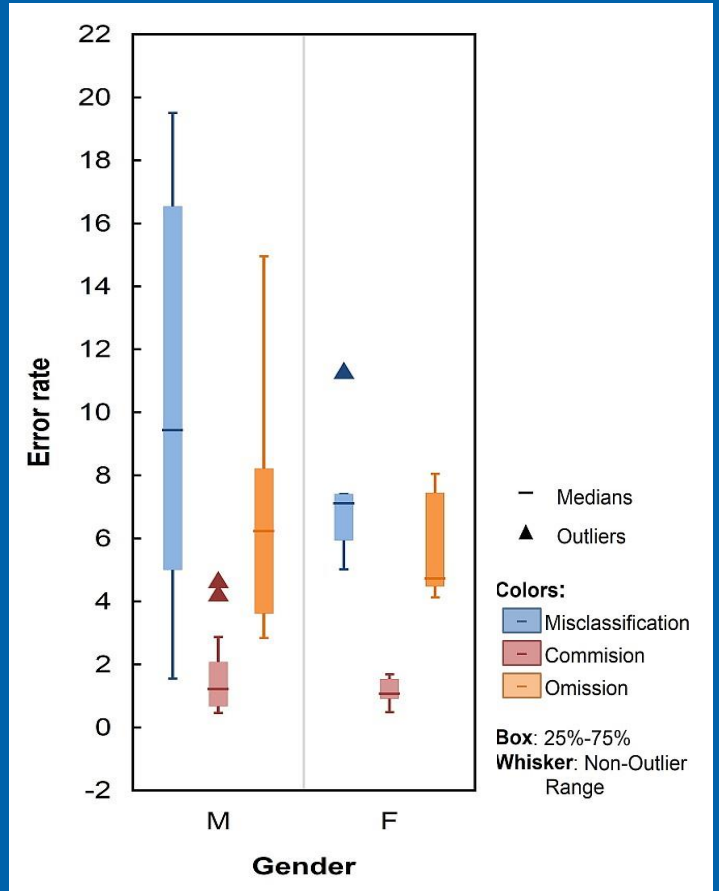






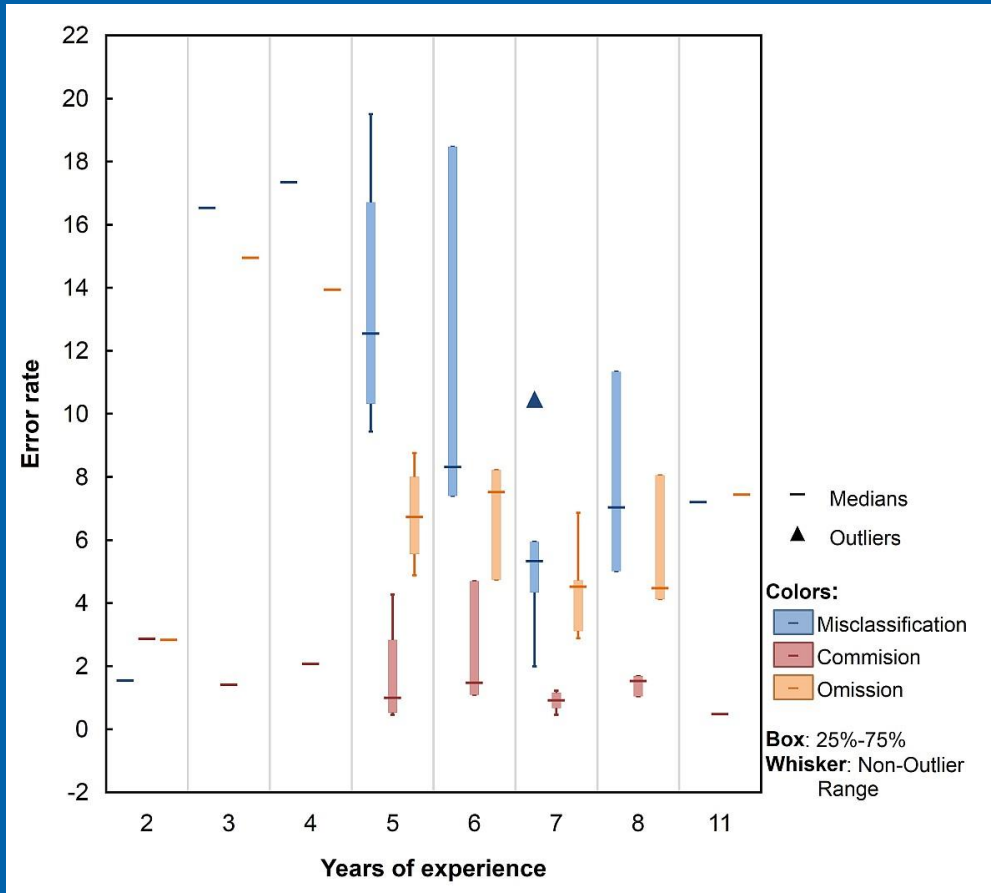
Who makes more mistakes?

- Uneven distribution of field workers
- No statistically significant differences in gender



Who makes more mistakes?

- Differences in the years of experience
  - decreasing trend
  - not significantly correlated



Conclusions

- Differences at the general and field workers' level.
- The most critical feature classes: heap of stones, relict foundation, scattered trees, path, forest cutline, grove, and open land
- Less errors in built-up – diverse and more errors in closed – complex landscapes
- Years of experience has a positive trend, gender did not have an influence on data quality
- To improve the mapping quality:
  - possibility to choose landscape
  - monitoring and training the field workers
  - if necessary, to revise map specification






References 1

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