



European Topic Centre
Land Use and Spatial Information



CLC2006 2nd verification report, Macedonia CARDS Project 2007-2008

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Implementation of CLC2006 in the West Balkan Countries

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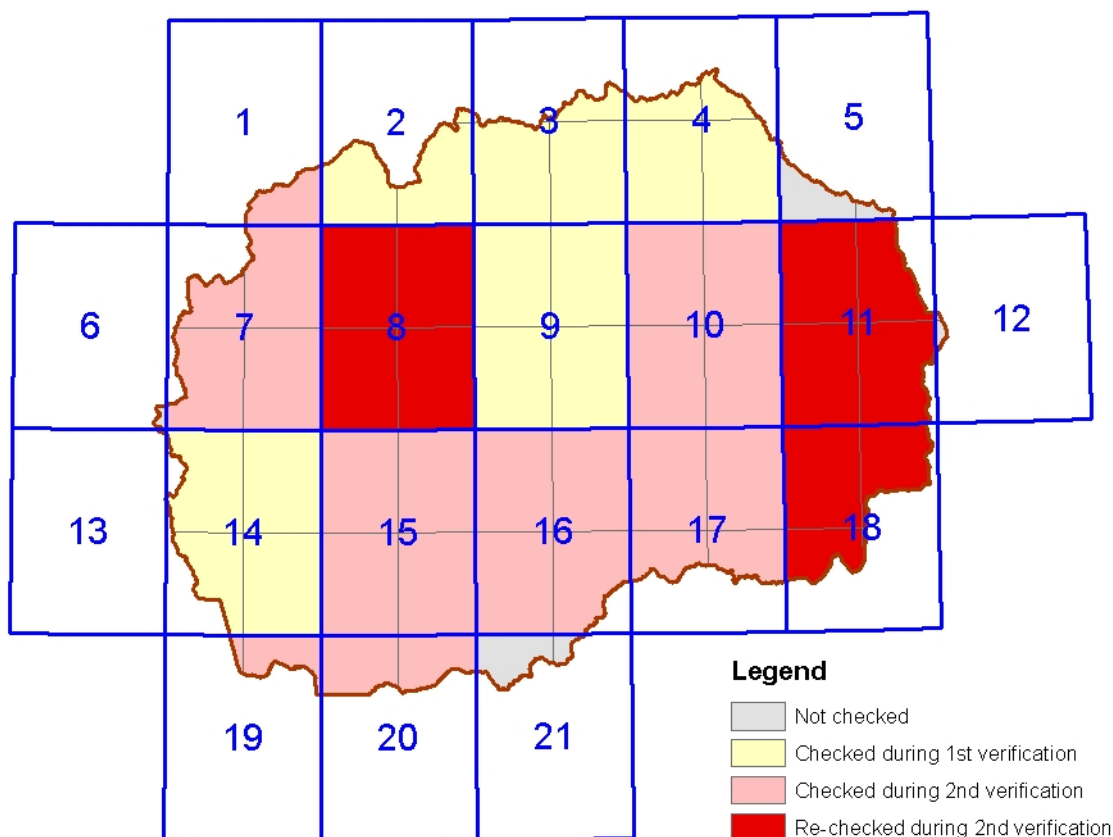
1 ACTIVITIES LINKED TO THE PREPARATION OF THE VERIFICATION

The CLC2006 project is implemented in Macedonia in the frames of the CARDS programme. Some of the experts in the national team had also taken part in the 1st CLC inventory in the country between 1999 and 2000. A training on CLC2006 (change mapping) was requested and conducted in February 2008. Following a preliminary remote verification, the first verification was held also remotely in FÖMI in August 2008. The 2nd verification – to be organised on-site in Skopje - was agreed by Zoran Velickov, national project manager and George Buttner, CLC TT coordinator. The entire area of the country has been interpreted by the time of this mission.

1.1 VERIFICATION PROCEDURE

The objectives of the verification missions are manifold:

- To assist the national team in producing the CLC2006 databases and to assure a homogenous implementation across Europe.
- Corrective goal: reveal and discuss specific problems occurred during the production in order to correct databases if necessary, and hereby assure a harmonised European CLC database.
- Provide the EEA with information about the overall quality of the work performed by the country.



Map 1 Working units checked during 1st and 2nd verifications in Macedonia (working units are the 1:100.000 scale topographic map sheets)

2 AGENDA AND PARTICIPANTS

Place of the verification: GOVe doo, Paloma Bjanka 2K/13L, Skopje, Macedonia

2 October 2008

9.00 – 12.00

Preparation of the verification by national team

12.00 – 19.30

Verification of CLC2006 databases produced by the Macedonian Team

3 October 2008

9.00 – 13.00

Discussion of results with the Macedonian Team

The following experts participated:

From the Macedon National Team:

- Zoran Velickov, project manager
- Casle Tosevski, photointerpreter
- Gjorgji Gjorgjiev, photointerpreter
- Vanco Gjorgjiev, photointerpreter

From the ETC-LUSI Technical Team:

- Barbara Kosztra
- George Büttner, coordinator

3 SUMMARY CONCLUSIONS

3.1 METHOD OF VERIFICATION

The InterCheck2.1 software running under ArcView 3.x was used as a support tool for verification. IMAGE2000 and IMAGE2006 data were available for each working unit. Altogether 8 working units have been checked (2 of them being only fragments). 3 of the working units of the previous verification were re-checked to see how the remarks had been implemented. See Map 1.

The checking process was as follows:

- a) Checking validity of codes, size errors and neighbouring polygons with the same code (merge errors) in CLC2000.
- b) Checking CLC2000 statistics (to reveal non-relevant codes)
- c) Checking validity of codes, size errors and neighbouring polygons with the same code (merge errors) in CLC-changes.
- d) Checking CLC-changes statistics (to reveal non-relevant codes).
- e) Visual checking of minimum 10 % of polygons for all classes / visual checking of examples from most classes, with additional thorough checking within selected 10x10km verification units (vu).
- f) Visual checking of all changes.

Additionally the whole wu area was examined visually to find missing changes, if any.

Results of the verification (remarks by the Technical team experts with coordinates) are included in ArcView point coverages for each wu, which are provided to the national team in order to load them into their GIS used for photointerpretation. Naming convention: Remark_r means: remarks for the revised CLC2000; Remark_c means: remarks for the CLC-Changes database.

3.2 GENERAL CONCLUSIONS CONCERNING THE RESULTS

The Macedonian database has improved significantly following the 1st verification. The summarised results of the verification are presented in Table 1. Working unit level results are presented in Table 2 (data of the 2nd phase) and Table 3 (re-checked data).

3.2.1 Technical quality

Table 1 Summary of 2nd verification in Macedonia

Technical issues (25 ha / 5 ha, valid codes, 100 m width, etc)	Small polygons in revised CLC2000; topological mistakes ("double" polygons) in CLC-Changes; invalid codes.
Consequent applications of the CLC nomenclature	Good, except 212 (irrigated agriculture); some invalid codes left.
Geometrical precision (compared to IMAGE2006)	Good.
Correction of CLC2000 in view of IMAGE2000	Lots of corrections have been done; some more will be needed (e.g. 213).
Have the majority of changes been found?	Almost; omitted changes in built-up and forestry.
Is the area of change polygons realistic?	Not always; overestimation of 311-324 and non-changed parts are not cut.

Do the attributes of change polygons properly describe the evolution processes?	Usually yes.
Overall evaluation	Needs improvement.

Table 2 Summary of verification in Macedonia

Working unit (wu) no.	Findings	Evaluation (A, CA or R)	Remark
Wu01	Missing changes (forestry and built-up)	A	small
Wu05	---	--	small, not checked
Wu07	Missing corrections in natural vegetation and built-up, missing changes in forestry and mining	CA	
Wu10	Missing dump site (132) reclamations; missing corrections and changes in rice fields (213)	CA	partly checked also in 1 st verif.
Wu15	Problematic use of 212, many missing changes in built-up, mining and forestry, overestimated 311-324	CA	partly checked also in 1 st verif.
Wu16	Some missing tech. Changes, some invalid codes	CA	
Wu17	River sections were not connected; many omitted changes in forestry and mines. Overestimated 311-324.	CA	
Wu19	A few missing changes	A	small
Wu20	Missing corrections on high mountain areas (31x->321)	A	
Wu21	---	--	small, not checked
Total checked: 8	Accepted: 3 Conditionally accepted: 5 Rejected: 0		

'Accepted' means: after correction of the few mistakes found, the database is accepted.

'Conditionally accepted' means: the database includes more mistakes, which are relatively easy to correct. Following corrections the database will be accepted.

'Rejected' means: the database contains considerable amount of mistakes, which should be corrected and the wu is to be re-checked during next verification.

Table 3 Repeated checking in Macedonia

Working unit	Evaluation on 1 st verification	Evaluation on 2 nd verification
8	R	Most of the remarks of the 1 st verification were not corrected; the wu is still conditionally accepted - CA
11	R	Remarks corrected; the wu is considered accepted - A
18	CA	Most of the remarks of the 1 st verification were not corrected; some of the remarks were retained for discussion; the wu is still conditionally accepted - CA

3.2.2 Revised CLC2000

Technical quality:

- Some invalid codes were found in revised CLC2000 (232, 234).
- Some polygons are below the size limit.

Thematic quality:

- Lots of corrections were done on CLC2000 (Figure 1), general quality is good.
- Airport without visible infrastructure was coded as 124.
- Agricultural fields without permanent irrigation were coded as 212.
- Rice fields (213) are not corrected (some missing in CLC2000), some rice field polygons left on slopes (not possible in reality).
- Connectivity of rivers was not always kept.
- Some rivers or channels with width much below the 100 meter limit were drawn as correction.
- Reservoirs and fishponds were drawn in CLC2000 not according to the highest water level (largest coverage). As a consequence, some invalid changes have been drawn (temporal changes in water level).

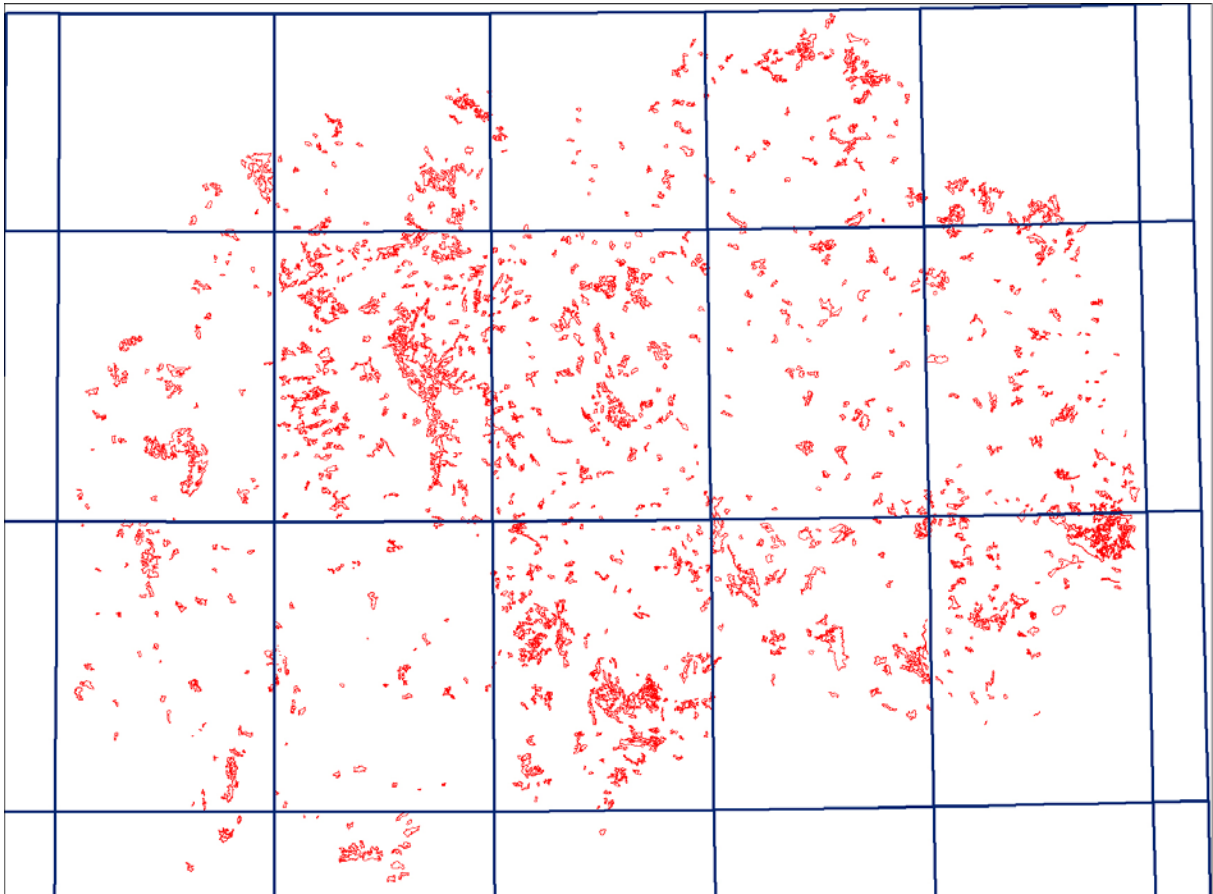


Figure 1 Corrections applied to CLC2000 database in Macedonia are marked in red.

3.2.3 CLC-Changes dataset

Technical quality:

- Some changes have double change polygons (polygon on top of other).

Thematic quality:

- Not always the latest image was interpreted, which results in missing changes.
- Not always the right change code pair applied (e.g. 321-311 instead of 324-311).
- Non-changed parts (larger than 5 ha) were sometimes not separated from the change polygons, providing false results on change area.
- Some unreal changes found between agriculture classes (e.g. 242-243, 243-211) due to seasonal differences between images.
- Many changes found as invalid between agriculture and built-up. The interpreter was sometimes confused by the better resolution of IMAGE2006.
- Still some changes from grassland to forest (231-31x, 321-31x) and back (31x-321) have been found, although criticised in previous verifications.
- 311-324 changes are not always real / correctly delineated. Check all available images when drawing these changes. May images might sometimes mislead interpreters as some tree species are not in full canopy, showing colour similar to 324. Always check a June-August image before drawing a change. However, some 311-324 changes criticised during previous verification proved to be real, as verified by orthophotos. Interpreters demonstrated and technical team accepted that on certain May images 321 and 324 look as bright red as forest.

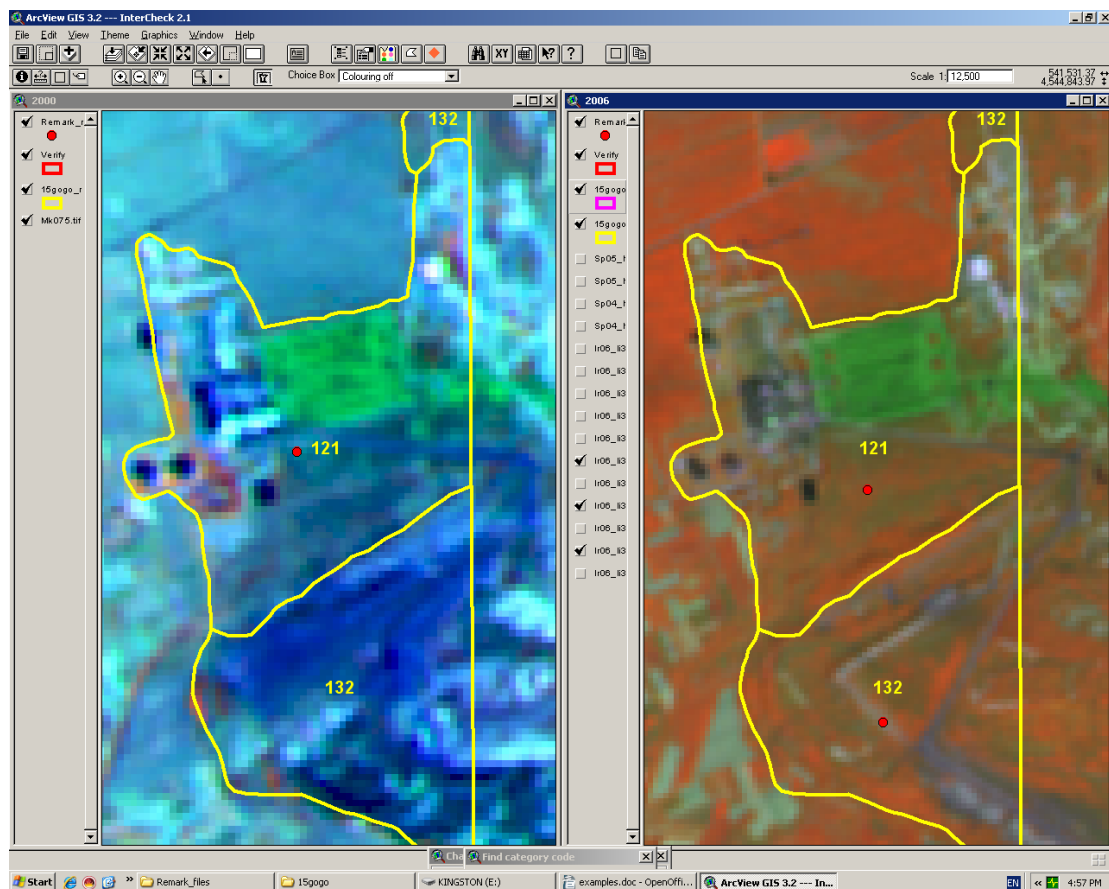


Figure 2 Abandoned mining areas (131) and dumpsites (132) are covered by vegetation as part of the reclamation. These are to be mapped as 121-324 and 132-324 (local information is needed to verify)

- Missing forest growth (324-311) polygons in change database.
- Missing changes of mine reclamation – where mineral extraction sites are abandoned or vegetated after cultivation finished (131-231 or 131-324, see Figure 2).

3.3 METADATA

Metadata were checked.

4 RECOMMENDATIONS CONCERNING CONTINUATION OF CLC2006 IN THE COUNTRY

Study the remarks of the Technical Team using the remark_r.shp and remark_c.shp files (attached), and this report. ALL REMARKS SHOULD BE CONSIDERED AND APPLIED IF NECESSARY, INCL. REMARKS OF THE FIRST VERIFICATION AS WELL. Corrections should be applied not only for the polygons with remarks, but all the completed working units (the re-checked ones, too) have to be revised, especially in order to reveal still missing changes. Internal quality control is very important.

When applying the remarks it is recommended to start with the correction of CLC2000, then to continue with correction of the change database in order to avoid inconsistencies between the two databases.

4.1 REVISED CLC2000

- Correct invalid CLC codes. The easiest way is to do that is to build it into the software used. Check and correct all merge errors.
- Check topological consistency and the 25 ha size limit.
- Airport without visible infrastructure (e.g. concrete runway) should be coded as 142 (sport and recreation).
- 212 class means permanently irrigated arable land. Crops should be irrigated in the entire growing season. Consequently satellite images in the standard colour combination should show fields in dominating red colour. Check all 212 polygons in wu15.
- Check areas of rice cultivation (213). Do necessary corrections (missing rice fields) based on all satellite data. Note, that rice fields are sometimes left to rest, other crops grown on them, then cultivated as rice again. This means that if any of the 2000 images the area looks rice field, it should be coded as 213, regardless of what it looks like on the other 2000 image. 213 does not exist on slopes in Europe, check topomaps to filter out these false polygons.
- The Vardar river being just around the 100 m is better to draw connected, than in several shorter sections. Due to the previous technology the geometry (shape) of the river is not good. Natural changes related to the river course are better mapped if these inaccuracies are eliminated. It is proposed to redraw the river, especially where changes have taken place.
- Reservoirs and fishponds should be drawn in CLC2000 according to the largest water coverage in order to avoid mapping temporal changes as CLC changes.

4.2 CLC-CHANGES DATASET

- Check topological consistency including the elimination of double change polygons.
- Try to use the real change code pair in change polygons. Please note that the 2000 code of the change code pair can be different from the original polygon's CLC2000 code in order to describe the process properly. E.g. if a small forest patch inside a 243 polygon was cut, the right process is 311-324 and not 243-324.
- Non-changed parts > 5 ha in change polygons have to be cut and deleted from change to keep the real area of changes.

- Many changes found invalid between agriculture and built-up especially around larger settlements. Try to avoid confusion because of the higher level of detail (better resolution) of IMAGE2006.
- However, still some new 1xx are missing because not always the latest image was interpreted.
- Internal changes in agriculture (e.g. 242-243, 243-211) are frequently questionable. Sometime these are just seasonal differences between images. Apply them carefully if you clearly understand what has happened. 211-22x changes always must be verified by orthophoto.
- Revise the area around existing 213 polygons to find missing changes (increases and decreases) of rice fields.
- Changes from grassland to forest (231-31x, 321-31x) and back (31x-321) are not possible in 8-10 years. The right process is either/first grassland (231 or 321) to transitional woodland (324), then from 324 to forest. Similarly, if a forest is cut, the „result“ is 324.
- The 311-324 changes – a frequent change in Macedonia – were discussed in detail. The Technical Team was convinced by orthophoto, that IMAGE2006 cannot always show the clearcut and therefore can be misleading in mapping this process. The reason can be a quick growth of grasses or shrubs after cutting having similar reflectance as forest Therefore clearcuts in Macedonia is better to delineate based on orthophoto (in this case taken in 2004). The effect of time difference (photo and IMAGE2006) should be considered using IMAGE2006. This will reduce the number of omitted 311-324 cases.
- Draw missing changes of mine reclamation, where mineral extraction sites are abandoned or vegetated after cultivation finished (131-231 or 131-324, see Figure 2).
- Try to find missing forest growth (324-31x) in order to have a balance between clearcut and new forests, and avoid a false picture about forestry in Macedonia.
- Apply technical changes where relevant in order to have better-quality CLC2006 database.

5 OTHERS

5.1 DIFFICULTIES ENCOUNTERED DURING THE WORK AND SOLUTIONS APPLIED

No difficulties were encountered.

5.2 SUMMARY OF ACTIONS TO BE UNDERTAKEN

- Following corrections proposed by the Technical Team prepare the seamless revised CLC2000 and CLC-Changes databases.
- Use the macro developed by the ETC-LUSI to derive CLC2006 (using the seamless CLC2000 and CLC-Changes).
- Complete the metadata sheets (working unit, country).
- Check everything according to "Guidelines of CLC2006 deliveries".
- Send deliverables (CLC-Change, CLC2006, working unit metadata, country metadata) to ETC-LUSI partner GISAT, and upload to CDR (Central Data Repository) of EEA. If you do not have the password, ask the ETC-LUSI Technical Team for this task.

5.3 NEXT FORESEEN MISSION IN THE COUNTRY

No more formal missions are planned in connection with CLC2006 in Macedonia.

5.4 MATERIALS COLLECTED

A few screen shots.

5.5 ANNEXES

Detailed remarks (shape files) for working units.