CORINE Land Cover update
I&CLC2000 project
Technical Guidelines

Final version
August 2002

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SUMMARY

The objective of the EEA is to provide policy makers with timely and relevant environmental information. Regarding land cover, EEA aims to provide those responsible for and interested in European policy on the environment with qualitative and quantitative data on land cover (LC) – data which is consistent and comparable across the continent. As part of the EEA mandate, the CORINE Land Cover (CLC) database initiated by the Commission in 1985 should be further maintained and regularly updated. Consistent geo-referenced LC information has been identified by different national and European policies as a key database for integrated environmental assessment.

To reach this goal EEA and JRC launched the IMAGE2000 and CLC2000 Project (I&CLC2000) which consists in the update of the CLC database. The satellite image 'snap shot' of the EU territory (IMAGE2000) will be the basic material to undertake the up-date of CLC database for the year 2000 (CLC2000) and identify main LC changes in Europe during the period 1990-2000. The project is also extended to the ten Phare Accession Countries (also new EEA member countries from January 2002).

The main outputs of the I&CLC2000 Project will be as follows:

- a satellite image based spatial reference of Europe for the year 2000,
- a national and European CLC inventory for the year 2000,
- a database of LC changes between 1990's and 2000 at national and European level,
- a corrected national CLC inventory for the 90's (CLC90) and corrected European CLC90,

The execution of the work will be divided in five main tasks:

1. IMAGE2000, satellite image acquisition and ortho-rectification.

2. CLC2000, detection of LC changes.

3. Data validation, integration and dissemination.

4. Quality assurance/quality control and metadata.

5. Project management.

The dissemination and use of the database is defined in an agreement between the EEA, the European Commission and the participating countries about a common policy for the use and dissemination of the I&CLC2000 products.

1.　BACKGROUND

From 1985 to 1990, the European Commission implemented the CORINE Programme (Co-ordination of Information on the Environment). During this period, an information system on the state of the European environment was created (the CORINE system) and nomenclatures and methodologies were developed and agreed at EU level.

At the Dobris Conference in 1991 the European Environment Ministers requested that the program should be applied to the Central and Eastern European countries covered by the EC Phare programme.

Through the support of the Phare Programme, the CORINE databases were as well implemented in the 13 eligible countries.

Following the European Council decision to set up the European Environment Agency (EEA) and the establishment of the European Environment Information and Observation Network (EIONET), the responsibilities of the CORINE databases (and their up-dates) rely now to the EEA.

The CLC90 inventory and its updates are key reference data sets, which will provide the basis for the development of spatial analysis and integrated environmental assessment.

Today, CLC is recognised by decision-makers as a key reference data set for spatial and territorial analysis at different territorial levels. Within the European Commission Services such as DG-Regional policy, DG-Environment and DG-Agriculture as well as in EEA and its European Topic Centres (ETCs), there is a growing need to use spatial analysis for integrated environmental assessment.

The need for an updated CLC database was expressed by several users at national and European level. Preparatory work to update the CLC database for the reference year 2000 started in 1999. The I&CLC2000 project is based upon a number of key elements: lessons learnt form earlier CLC Projects, a current list of user needs, the options available for satellite images and the processing and management requirements for the vast amount of data. The overall aim of updating is to produce the CLC2000 database and the CLC changes database between the 1990's and 2000. To guarantee full coverage and to maximise consistency with the previous inventory, the I&CLC2000 project will call upon existing local expertise and will require access to both the ancillary data and the satellite data used for the first CLC inventory.

The I&CLC2000 project consist of 2 main components which are interconnected:

- IMAGE2000: covering all activities related to satellite image acquisition, ortho-rectification and production of European and national mosaic and
- CLC2000: covering all activities related to detection and interpretation of LC changes.

2 USER REQUIREMENTS

Table 1 gives an overview of the main user needs for an updated LC information at European level which were identified by EEA after discussion with key clients.

Table 1. Main user needs for updated CLC information at European level

Needs	Client	User	Analysis/ Assessment LC information needs
Assessing impacts of policy against regional development perspectives, spatial planning (Structural Funds, ESDP)	DG-REGIO	DG-REGIO, DG-ELARG	• territorial analysis • LC, land use and land quality assessment • LC changes • landscape assessment
Assessing impacts of agriculture policies on the environment	DG-AGRI	DG AGRI, DG-ELARG	• LC changes • landscape indicators • watershed analysis for water use, fertiliser input • soil cover management, conservation practices
New strategy on integrated coastal zone management	DG-ENV	DG-ENV, DG-ELARG	• land use and LC change along coastal zones
Implementation of biodiversity convention, habitat and birds directive (NATURA2000)	DG-ENV	DG-ENV, DG-ELARG	• development NATURA2000 GIS • LC reference layer • LC and land use changes • habitat fragmentation • pressure on designated areas
Integrated watershed analysis	EEA	DG-ENV, DG-ELARG	• support to the development of watershed indicators
Assessment of air emission and air quality measures, carbon sinks	EEA	DG-ENV, DG-ELARG DG-RECH	• estimates CO_2 sinks/sources • LC around measurement stations • re-allocation of air parameters to LC
Assessment of the territorial dimension, Strategic environmental assessment of trans-European transport networks, Transport and Environment Reporting Mechanism (TERM)	EEA	DG-TREN, DG-ENV, DG-ELARG	• land take • fragmentation of habitats, partitioning of land • tranquil zones • pressure on protected areas

3   I&CLC2000 CHARACTERISTICS

3.1   Basic specifications CLC

The CLC specifications have been defined during the CORINE programme (EC, CLC Technical Guide 1994). The three determining elements of the CLC Project are:

- **The mapping scale is 1:100 000.**

    A mapping scale of 1:100 000 has been chosen. Mapping accuracy is at least 100 m for national and European products.

    By using IMAGE2000 as the geometric reference for the CLC database with minimum accuracy of 25 m, this scale and precision is ensured.

- **The minimum unit for inventory is 25 ha, minimum width of unit is 100 m. Only area elements (polygons) are identified.**

    Areas smaller than 25 ha are allowed in the national land cover database as additional thematic layers, but should be aggregated/generalized in the European database.

- **The CLC nomenclature is hierarchical and distinguishes 44 classes at the third level, 15 classes at the second level and 5 classes at the first level**.

    The nomenclature has been developed in order to map the whole Community territory (EC, CLC Technical Guide 1994; Addendum 2000, EEA), including the foreseen extension to Phare accession countries. The use of the CLC nomenclature with 44 classes at three hierarchical levels is mandatory. Additional national levels can be mapped but should be aggregated to level 3 for the European data integration. No unclassified areas should appear in the final version of the data set.

3.2   Improvements CLC update 2000

Based on the lessons learnt from the first CLC inventory (CLC90), the novelties listed in Table 2 are considered for I&CLC2000 project:

Table 2.   Description of novelties I&CLC2000 project

User requirement	CLC1990	CLC2000
The updated CLC inventory shall be more time consistent	mainly 1986-1995	2000 +/- 1 year
The geometric accuracy shall be improved. RMS error of: • satellite images • thematic LC data	 50 m 100 m	 25 m better than 100 m
The thematic accuracy remains the same	≥ 85 %	≥ 85 %
Changes smaller than the minimum mapping unit (25 ha) shall be identified	-	**area change should be minimum 5 ha (for a contiguous area)**
The results shall be provided faster (project duration as short as possible)	10 years	3 years
The production costs shall be substantially lower than those of the first inventory (average cost/km^2)	6 €/km^2	3 €/km^2
The documentation of the data and the production process shall be improved	incomplete metadata	standard metadata
The access to the data shall be easier	unclear data dissemination policy	**agreed dissemination policy from the start**

The basic geographical databases, including the satellite images and LC used for spatial analysis at European level shall be harmonised	inconsistencies between GISCO reference DB and CLC90	close cooperation with JRC and Eurostat for a common GI/GIS policy

3.3 Geographical coverage

The area of interest of the I&CLC2000 project is shown in Figure 1. I&CLC2000 project will be implemented in the 15 Member States of the European Union and Liechtenstein, as well as in the 10 Phare accession countries (see Table 3). Initiatives to extend the inventory to other geographical areas are under preparation.
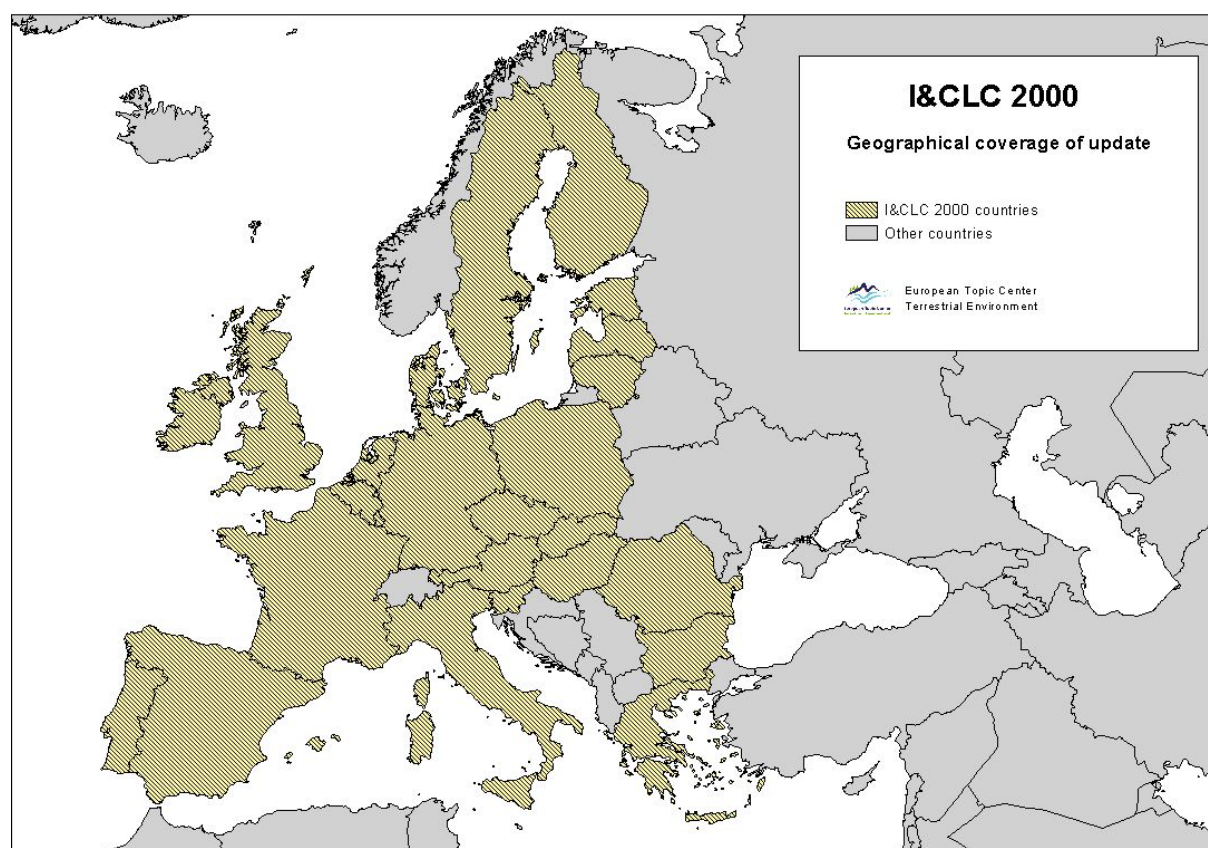
Figure 1: Geographic coverage for updating of CLC

Table 3. Participating countries CLC2000 update (status 2002)

• Austria • Belgium • Bulgaria • Czech Republic • Denmark • Estonia • Finland • France • Germany • Greece • Hungary • Ireland • Italy	• Latvia • Liechtenstein • Lithuania • Luxembourg • Poland • Portugal • Romania • Slovak Republic • Slovenia • Spain • Sweden • The Netherlands • United Kingdom

4 ORGANISATIONAL SET-UP OF THE PROJECT

The organisational structure of the I&CLC2000 coordination has been defined on Figure 2:

I&CLC2000 Project

EEA
- Manage CLC2000
- Contribute to co-funding together with Commission Services and countries
- Monitor co-funding
- Organise European Steering Committee
- Inform NFP/EIONET on products use and dissemination
- Manage extension to Phare countries (incl. image orthocorrection)
- Check the ETC-TE deliverables

JRC
- Manage IMAGE2000
- Inform Commission services on products use and dissemination
- Support on methodological development
- Participate in European Steering Committee
- Responsible for IMAGE2000 mosaic
- Participate in IMAGE2000 tender evaluation for Phare countries
- Participate in CLC2000 Technical Team

European Steering Committee
(DG ENV, AGRI, REGIO, EUROSTAT, JRC, EEA, NFP)
- Monitoring and steering European project development

CLC2000 Technical Team
- Manage Technical Support
- Training
- CLC2000 data management
- QA/QC
- Validation
- Data integration, European products
- Use of CLC2000 results

IMAGE2000 Team
- Satellite data purchase
- Ortho-rectification to national and European reference systems
- IMAGE2000 data management
- QA/QC IMAGE2000
- National and European IMAGE2000 mosaic

National CLC2000 teams
- Coordination national CLC2000 project
- Interpretation of images IMAGE2000
- Mapping of land cover changes CLC2000
- QA/QC

National Steering Committee
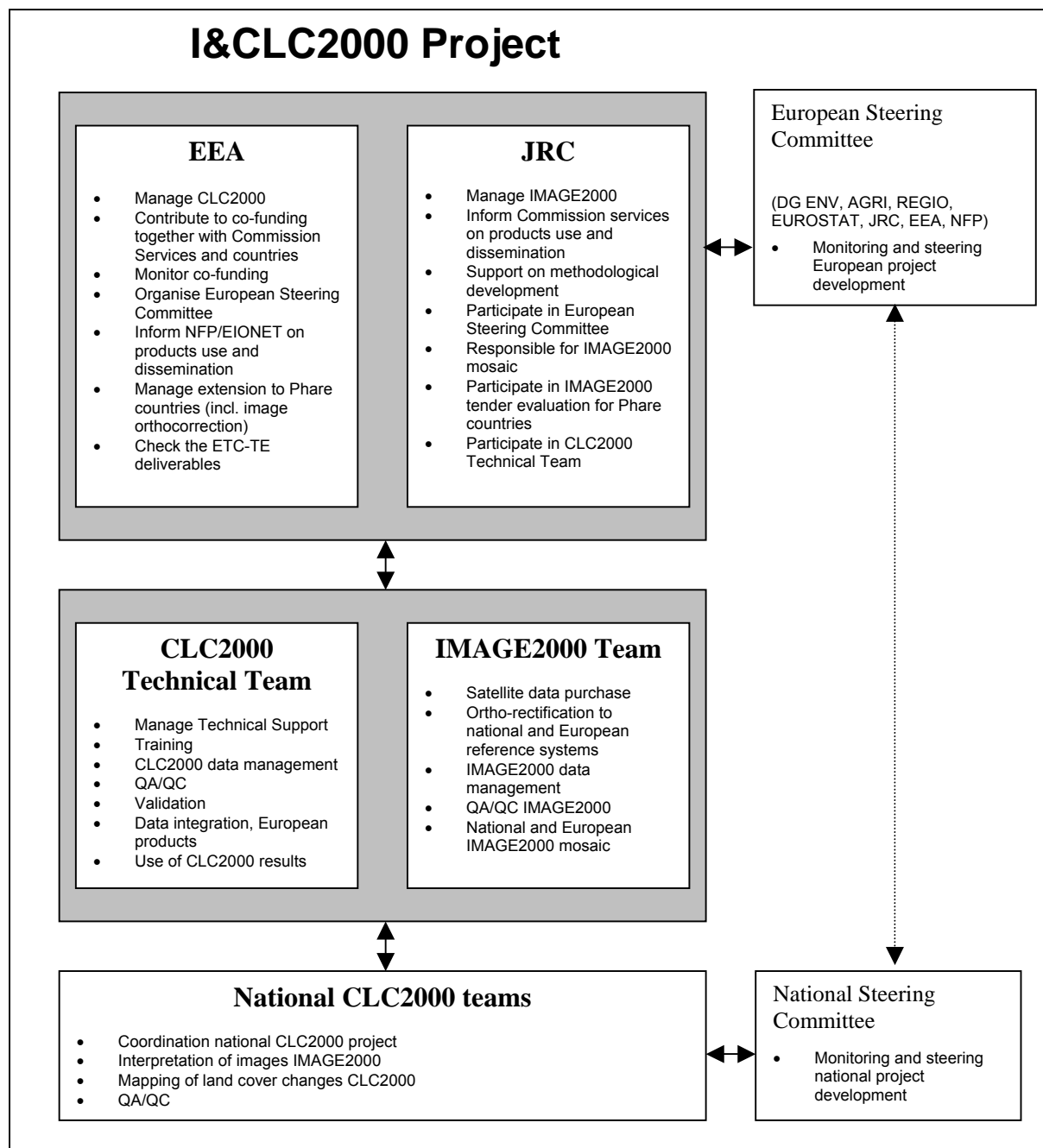- Monitoring and steering national project development

Figure 2.   Organisational set-up of I&CLC2000

I&CLC2000 is a joint EEA / JRC project in which the JRC has the responsibility for the IMAGE2000 part and EEA is responsible for CLC2000. EEA is overall coordinator of the project.

European Steering Committee
The Steering Committee consists of representatives of the EEA, JRC, DG-Environment, DG-Regional Policy, DG-Agriculture, DG-Eurostat, EEA Scientific Committee, NFP/EIONET and ETC-TE. The EEA and JRC will report to the Steering Committee on a regular basis on the ongoing work, time-table,

budget commitments, data dissemination, tendering and subcontracting to external contractors, problems encountered and proposed solutions. The Steering Committee will meet twice a year during the lifetime of the project. The Steering Committee meetings will be organised through the EEA Advisory Group on Spatial Analysis.

I&CLC2000 National Steering Committee

National Steering Committee will be set up by each participating country in order to monitor the national project development. The liaison with the European CLC2000 Steering Committee will be ensured through the National Focal Point .

EEA

EEA has the overall responsibility for the CLC2000 component. Therefore EEA establishes an information chain to ensure that all bodies involved have access to information on the ongoing CLC inventory and reports to the European Steering Committee. EEA is coordinating the CLC 2000 Technical Team.

JRC

JRC is responsible for IMAGE2000 component. JRC is coordinating the IMAGE2000 team, which will involve European organisations specialised in satellite image processing.

CLC2000 Technical Team

The CLC2000 Technical Team will assist both the national teams and the EEA. It consists of experts of ETC-TE and an expert from the IMAGE2000 team in order to ensure coordination of the work.

The tasks of the CLC2000 Technical Team are as follows:

1. Participate in Steering Committee meetings.
2. Finalise the CORINE Land Cover update Technical Guidelines.
3. Coordinate the work with national teams on land cover data collection.
4. Coordinate the quality assurance and quality control of CLC2000.
5. Support the national teams upon request during CLC2000 national project development (country visits).
6. Implement training sessions for national teams.
7. Assist and control the national teams in performing the database validation.
8. Merge the national land cover data into one consistent European database.
9. Use of the CLC2000 results in combination with other data and spatial analysis.
10. Production of a set of derived products for dissemination via the EEA website (e.g. 100 m and 250 m grid data, 1 km^2 statistics, land cover changes 1990-2000).

IMAGE2000 team

The IMAGE2000 team comprises JRC staff and the contractors responsible for satellite image purchase and ortho-correction. The IMAGE2000 team will coordinate, define, monitor, control and report all activities of IMAGE2000 component, in close cooperation with the participating countries and the EEA.

National CLC2000 Teams

The national CLC2000 teams are responsible for the LC interpretation to produce the CLC2000 database and the CLC changes database by using the satellite images (IMAGE1990 and IMAGE2000) and the revised CLC90. National teams collaborate with IMAGE2000 team for image selection and validation of IMAGE2000. The national team leader is responsible for the project implementation, organisation of the training and verification missions with the CLC2000 Technical Team. The national team should organise the data delivery to the EEA.

The following reports will be submitted to the EEA by the national teams:

- Quarterly progress reports presenting the status of the work, difficulties encountered, solutions proposed, cooperation with other partners involved in the process etc.

- Final report presenting the main conclusions of the work, an overall assessment of the results, proposals for improvement, etc.

In order to create an environment that will ensure harmonisation of the final European CLC products, it is planned to organise training session(s) for all participating countries, upon request and depending on their readiness to start with the interpretation activities. This will assure that the training will lead to the same level of understanding of the I&CLC2000 methodologies and quality of the end products. During the training, an overview of the different classes used in the CORINE nomenclature will be presented and mapping and generalisation rules will be explained. Practical examples will be provided.

As part of EIONET, a network will be established between the different national CLC2000 teams. A dedicated web site for activities of this network will be organised and maintained by the CLC2000 Technical Team. The National CLC2000 teams will be able to communicate directly to the CLC2000 Technical Team and to each other. Discussion groups, FAQ's and progress information will be documented on this site. In case of specific problems, questions or other crucial information related to the definition and classification of specific features as seen on the satellite images, this information can be forwarded to all the national teams. This electronic forum will assure a quick exchange of information among the experts and institutions involved and will result in homogeneous European LC database. All questions will be logically stored in an on-line database so that parallel to the interpretation progress the CLC documentation will be improved and extended.

5 DESCRIPTION OF TASKS

Important note: If a country wishes to use a different method to derive the defined I&CLC2000 output products e.g. conversion of high resolution National LC data to CLC standards, this is permissible under the condition that the method is accepted by the EEA and JRC, fully described and the results are compatible with the standard approach. Technical details (e.g. additional metadata fields, methodological questions) which require further clarification should be discussed with the CLC2000 Technical Team.

The tasks described below are part of the recommended standard methodology for the update of the CLC database.

5.1 PREPARATORY WORK

5.1.1 COLLECTION OF INPUT DATA

Time window for data acquisition

The country has been requested to provide to the IMAGE2000 team the preferential time frame for the acquisition date of the satellite images. All countries were asked to provide this time window for data acquisition, to organise the processing of the satellite data for the EU15 and Phare Accession10.

Two periods have been specified: a narrow time frame with the optimal dates and a maximum time frame specifying the outer limits in which the acquisition dates are acceptable. The selection is based primarily on the narrow time frame, but if no cloud free images are available in this period, the IMAGE2000 team proposes an alternative selection based on the extended time frame.

Approval of quick looks

The IMAGE2000 team will provide the National Reference Centres (NRCs) with the selection of cloud free images for the country. A web-based application will allow the NRCs to view the quick looks selected for the country and its metadata. The NRCs will be notified that quick looks are posted for viewing on the www.

In case the area covered by a specific scene overlaps with areas of different countries, only one common image is selected. The selected image must be acceptable by all countries involved. The IMAGE2000 team will coordinate the cross boundary selection of images.

Image selection has been defined by the following criteria and priorities:
(a) cloud free images (i.e. 0 % or, in difficult regions <5 % cloud coverage),
(b) acquired within the year 2000,
(c) of an appropriate date (restricted window, then extended).

First priority
For the reference year 2000, cloud free images acquired within restricted time window are selected as a first priority.

Second priority
When no cloud free images are available for this year / window: the selection searches successively:
- in the extended acquisition window for year 2000,
- in the restricted acquisition window for year 1999,
- in the extended acquisition window for year 1999.

Third priority
When no cloud free images are available on the 1999 and 2000 campaigns, the search continues in 2001, in restricted, then in extended acquisition windows (ref:I-VP/I02/1.1 'IMAGE2000 - Procedure for image selection').

Selected images can be seen at the following web sites:

EU Member States: http://www.envicat.com/projects/image2000/overview.html

Phare10 countries: http://eea.eionet.eu.int:8980/Members/irc/eionet-circle/spatial/library?l=/2

Topographic map series

The geometric correction of the IMAGE2000 products will be based on the collection of Ground Control Points (GCP) using the topographic maps and the projection systems identified by the participating countries and a Digital Elevation Model (DEM). Therefore, the contractor in charge of image purchase and ortho-rectification will acquire the identified national topographic map series from the participating countries. In order to assure a high level of precision it is recommended that the GCPs are collected on the basis of large-scale map series (1:25 000 or 1:50 000 in case the 1:25 000 are not available). If digital format of the needed topographic maps (e.g. scanned) exists at national level, the IMAGE2000 team will discuss the conditions in which they can be made available for the ortho-rectification exercise.

In addition, digital ortho-photos can be used for the collection of GCPs. The NRCs are requested to provide information on the availability and conditions for acquisition to the IMAGE2000 team.

The map series used for the collection of GCPs will be used for geometric quality assessment of IMAGE2000 products.

National projection parameters

Since the national I&CLC2000 will be produced in the current national projections, the country is expected to provide the IMAGE2000 team with the national projection parameters.

National DEM

The IMAGE2000 team will use a European DEM with a 100-m grid being the minimal requirements a horizontal accuracy of 50 m with 90% confidence and with vertical accuracy of 30 m. If a more accurate DEM is available in the countries, the NRCs can consider making it available free of charge for the ortho-rectification of the national IMAGE2000 products.

Basic Working Unit

The basic working unit for the I&CLC2000 project will be preferably based on the national map series 1:100 000. Therefore the country is expected to provide the IMAGE2000 team with the coordinates of the corners of the national map sheets or the corners of the basic working units to be used by the IMAGE2000 team for subdivision of the country.

Field Photographs

It is recommended to national CLC2000 teams to take photographs in the field and use these photographs during the verification process of land cover changes. The same photographs can help the CLC2000 Technical Team during the verification missions and other national teams in their interpretation work.

To assist national CLC2000 teams, a database of field photographs illustrating of all CLC classes will be available on the ETC-TE web site. It will be gradually increased by photographs taken by national teams for the benefit of all users.

Field photographs taken during the Eurostat's LUCAS project would be useful for these purposes. The LUCAS photographs covering EU15 countries will be available on the web (under discussion between EEA and Eurostat).

5.1.2   INPUT FROM I&CLC2000 MANAGEMENT AND TECHNICAL TEAM

National boundaries

To assure a perfect overlay with the neighbouring CLC data sets, the national teams will identify LC classes for a buffer zone of at least 1 km into the neighbouring country across the national boundaries.

This will avoid the creation of gaps in the European CLC2000 database. The final national CLC2000 products will be delivered using national boundaries selected by the NRC.

To realise the smooth processing of this cross boundary information it is important that the same national boundaries are used at the European level. Therefore the corresponding European boundary reference database, Seamless Administrative Boundaries of Europe (SABE) of EuroGeoGraphics (former MEGRIN) will be used during the production of the European CLC2000 databases.

Coastline

In order to match coastline with other European databases, the interpreted coastlines of the national databases will be replaced by the harmonised European coastline data (source: EuroGeoGraphics (former MEGRIN) during the production of the European CLC2000 databases.

5.2 TASK 1: IMAGE2000 – IMAGE PURCHASE, ORTHO-RECTIFICATION AND PRODUCTION OF EUROPEAN AND NATIONAL MOSAIC

5.2.1 Objective

The aim of IMAGE2000 is to produce an image reference database with cloud free satellite data that can be used for the production of the CLC2000 products. Processing of satellite data is centralised. The centralised approach gives advantages in the management and production phases resulting in consistent quality and lower costs.

In order to meet the need of time consistency, satellite data are acquired with the shortest time span for a European coverage. The year 2000 is selected as reference year (summer period), allowing a deviation of maximum one year (summer 1999 or 2001) for acquisition of cloud free multispectral satellite image coverage.

To meet the quality requirements in the production process and in the final CLC product, satellite data have to be geometrically and radiometrically corrected using accurate and effective processing and correction methods. Hence, all data will be produced and delivered as ortho-rectified. A similar approach was followed for the Phare accession countries were the images acquisition and ortho-rectification were carried out with consultancy support and managed directly by EEA.

To be able to detect LC changes correctly the resolution and the radiometry of the satellite images has to be compatible with the satellite images used for CLC90.

5.2.2 Task description

JRC is preparing detailed technical guidelines for the IMAGE2000 component of the project. These guidelines wil be published seperately.

5.2.3 Responsibilities

- JRC is in charge of the overall management of IMAGE2000 component (in cooperation with EEA) as well as technical support, links to national teams and quality control.
- National teams should provide acquisition window and should realise the selection of images.
- Contractors are in charge of purchase of images and ortho-rectification.

5.2.4 Timing

The IMAGE2000 Team makes the national IMAGE2000 products available to the country after the confirmation of the acquisition dates of the images by the country: product 1 after the ortho-rectification; product 2 after full coverage of a country, product 5 later on, when mosaic is ready.

5.3   Task 2: CLC2000 – detection of land cover changes

5.3.1   Objective

The aim of CLC2000 is to produce the CLC database for the year 2000 and to detect LC changes in Europe during the last decade (1990-2000). The inventory of LC changes is necessary for the analysis of causes and consequences of natural and artificial processes, impact assessment, identification of trends, maintenance of ecological balance and its consideration in the decision-making processes.

5.3.2   Task description

The change detection process and the mapping of the CLC changes is carried out by means of image comparison, using computer assisted image interpretation tools. The CLC90 will be used as reference data set. The methodology was developed by the JRC/SAI in collaboration with the ETC/LC and is available as a joint JRC-EEA publication (Perdigão *et al.*, 1997). The method was successfully applied by national teams within the LACOAST Project (Perdigão and Christiansen 2000) and by Phare Topic Link on Land Cover Project (Feranec *et al.*, 2000) and was applied by different national teams for the evaluation of the update methodology for national CLC databases. The production flow is presented in Figure 3.

The CLC nomenclature is described in the CORINE Land Cover Technical Guide (CEC, 1994) and related Addendum (EEA, 2000). Basic rules of generalisation relevant for the CLC classes (including a priority table to handle small polygons) are presented in Annex 1.

Geometric adaptation of IMAGE90

IMAGE90 data (Landsat TM images used to derive CLC90 database) should be made available for the project. Without IMAGE90 data, it will be difficult to correct thematic errors of CLC90, and consequently false changes might be identified.

IMAGE90 data and IMAGE2000 data are compared concerning geometry using an image processing system. If a systematic deviation larger than 50 m is observed, the IMAGE90 data have to be corrected in order to have similar geometry than the IMAGE2000 (having positional accuracy better that 25 m). This image to image correction should be done by selecting minimum 4 evenly distributed control points on both images, defining a first order transformation and applying cubic convolution resampling. After that working units of IMAGE90 and IMAGE2000 are registered geometrically and suited for detection of real changes. (Perdigão *et al.*, 1997, pp.36-37.)

Systematic correction of CLC90

CLC90 data might have several different types of errors:
- systematic geometric shift (compared to corrected IMAGE90),
- topological problems.

These errors have to be removed before starting updating.
- CLC90 data and the geometrically correct IMAGE90 data are compared concerning geometry using an IP/GIS system. If a systematic deviation larger than 50 m is observed between CLC90 data and IMAGE90 data on any parts of the working unit, CLC90 data have to be corrected. A linear transformation can be interactively defined for CLC90 data to ensure an optimal correlation to the IMAGE90 geometry. Obvious LC feature on the image and their respective boundaries (e.g. forest/arable land, lakes, etc) on CLC90 data could be used for defining the transformation.

- When IMAGE90 data are not available or not precise enough, IMAGE2000 data can be used for this purpose. However, a special attention has to be taken to select such LC features which have not changed between the 90's and 2000.

- The topology of the coverage have to be checked and topological errors (dangles, more than one label, unnecessary boundaries, etc.) have to be corrected.
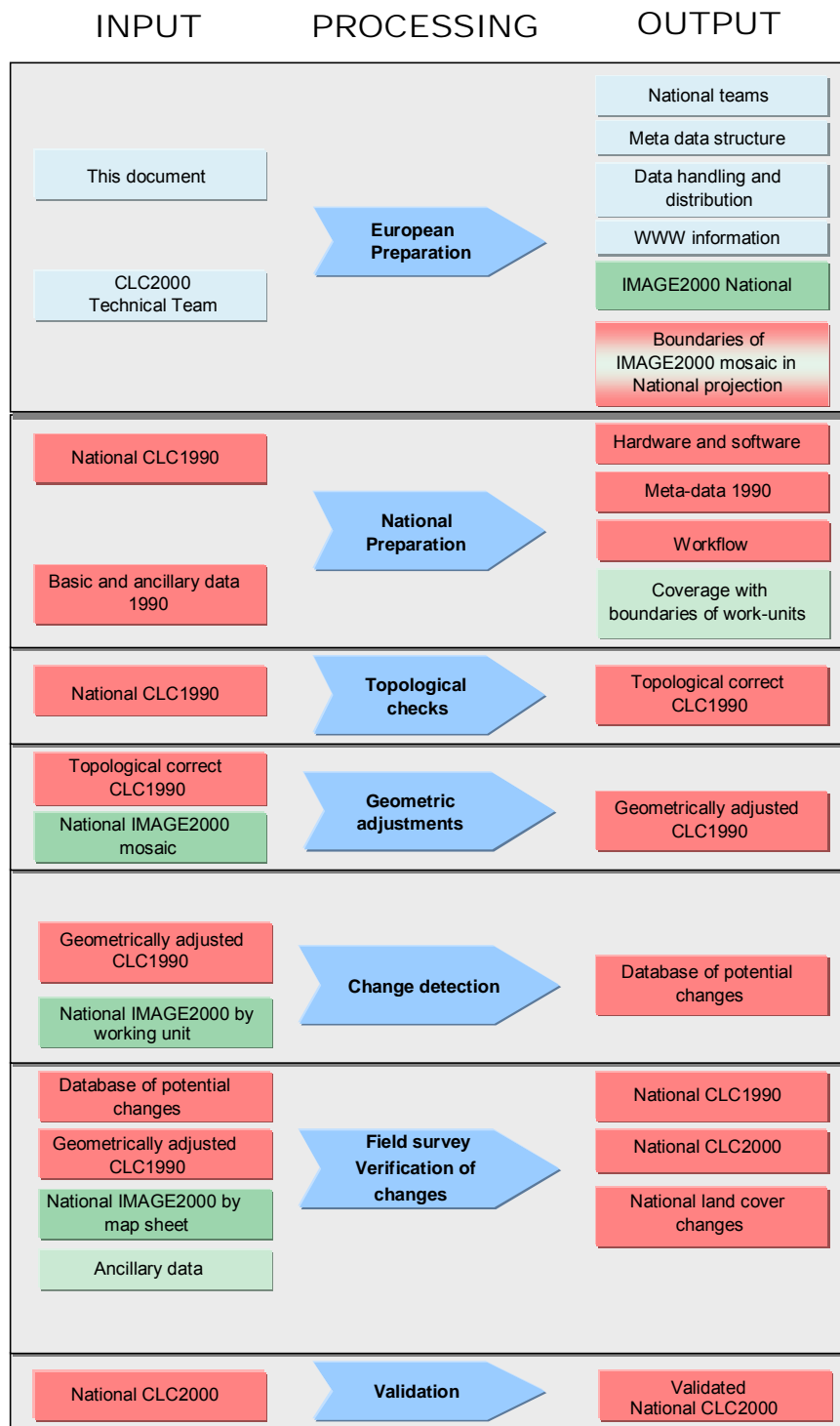
INPUT **PROCESSING** **OUTPUT**

INPUT	PROCESSING	OUTPUT
This document CLC2000 Technical Team	European Preparation	National teams Meta data structure Data handling and distribution WWW information IMAGE2000 National Boundaries of IMAGE2000 mosaic in National projection
National CLC1990 Basic and ancillary data 1990	National Preparation	Hardware and software Meta-data 1990 Workflow Coverage with boundaries of work-units
National CLC1990	Topological checks	Topological correct CLC1990
Topological correct CLC1990 National IMAGE2000 mosaic	Geometric adjustments	Geometrically adjusted CLC1990
Geometrically adjusted CLC1990 National IMAGE2000 by working unit	Change detection	Database of potential changes
Database of potential changes Geometrically adjusted CLC1990 National IMAGE2000 by map sheet Ancillary data	Field survey Verification of changes	National CLC1990 National CLC2000 National land cover changes
National CLC2000	Validation	Validated National CLC2000

Figure 3.   Production flow interpretation of LC changes

Integration of Landsat-7 TM+ and Pan data (Optional use)

As IMAGE2000 products include not only multispectral bands with 25-m pixel size but also a panchromatic band with 12,5-m pixel size, it is possible to produce a merged product. The TM + PAN integrated product combines benefits of a usual colour composite image (TM 4,5,3-RGB) and a higher resolution black and white image.

Among the many different merging algorithms it is recommended to use only those, which are colour preserving (does not distort the usual colours). The use of merged TM + PAN product is highly recommended in those areas where high spatial frequency elements (e.g. settlements) are important. A recommended algorithm (High Frequency Addition method) is described in Chavez *et al.* (1991). The method was successfully applied during the Phare project: 'CLC mapping at scale 1:50.000 in four countries' to merge Landsat TM and SPOT Pan data.

Thematic and geometric corrections of CLC90

This correction includes random geometrical errors and thematic errors. The CLC90 working unit has to be examined:
- The validity of CLC codes has to be checked. CLC code of zero is also not allowed.
- All polygons having area < 25 ha have to be generalised.

There are two basic types of corrections: geometric and thematic.
Any random geometric errors have to be corrected if the inaccuracy of the delineation (displacement of the LC boundary from the right position as seen on the IMAGE90 data) is larger than **100 m**. If the area of a polygon has changed, it is necessary to control the **25 ha** minimum area limit. If a thematic error is discovered, the CLC code of a polygon has to be corrected.

Sometimes thematic and geometric improvement occurs together: e.g. subdivision of a polygon into two parts. This means drawing of a new boundary and changing a code*.*

Methodology of updating

The two criteria of interpretation of changes of an existing polygon are seen on Figure 4: The changed polygon should have a width of at least **100 m** and an area of at least **5 ha**. This means that not all detected (visible) changes have to be interpreted in order to produce homogeneous results for the country within the available time and budget. Consistent delineation of smaller changes would require a highly adjusted CLC90 database.

In case of a completely new polygon (not present in CLC90) the CLC mapping criteria have to be met: minimum 25 ha area and minimum 100 m width. This means that a change inside a polygon having area between 5 ha and 25 ha will not be recorded as change. On the other hand, if the real size of a polygon is less than 25 ha in 2000 because of changes, it will be excluded from CLC2000.

It is allowed at this stage to delineate a polygon as potential change, without knowing the exact nature of the change. This uncertainty has to be resolved during field checking. These polygons have to be clearly labelled during the interpretation phase. Simple examples of LC change are presented in Figure 5, while Figure 6 includes complex LC changes. An example of LC change interpretation is shown in Figure 7.

> <u>*Note*</u>: Generation of sliver polygons in the change database should be avoided. Slivers are more easily generated if boundaries of the same LC object are delineated separately in the CLC90 as well as in the CLC2000 database.

The definition of most of the items from the standard CLC nomenclature has been refined in the CORINE Land Cover Technical Guide, Addendum 2000. It is recommended to use this refined nomenclature both in the revision of CLC90 and in the updating process. In this sense, e.g. it is recommended to include forest clear-cuts, young forest plantation, and forest nurseries (inside forest) to class 324 if they are discernible on the satellite images.

Changes to be considered (width of change must be ≥ 100 m, at scale 1:100 000 it is ≥ 1 mm; area of change must be ≥ 5 ha)

Changes not to be considered (if area is smaller than 5 ha)
- width of change is ≤ 100 m (≤ 1 mm at scale 1:100 000)
- area of change ≤ 5 ha

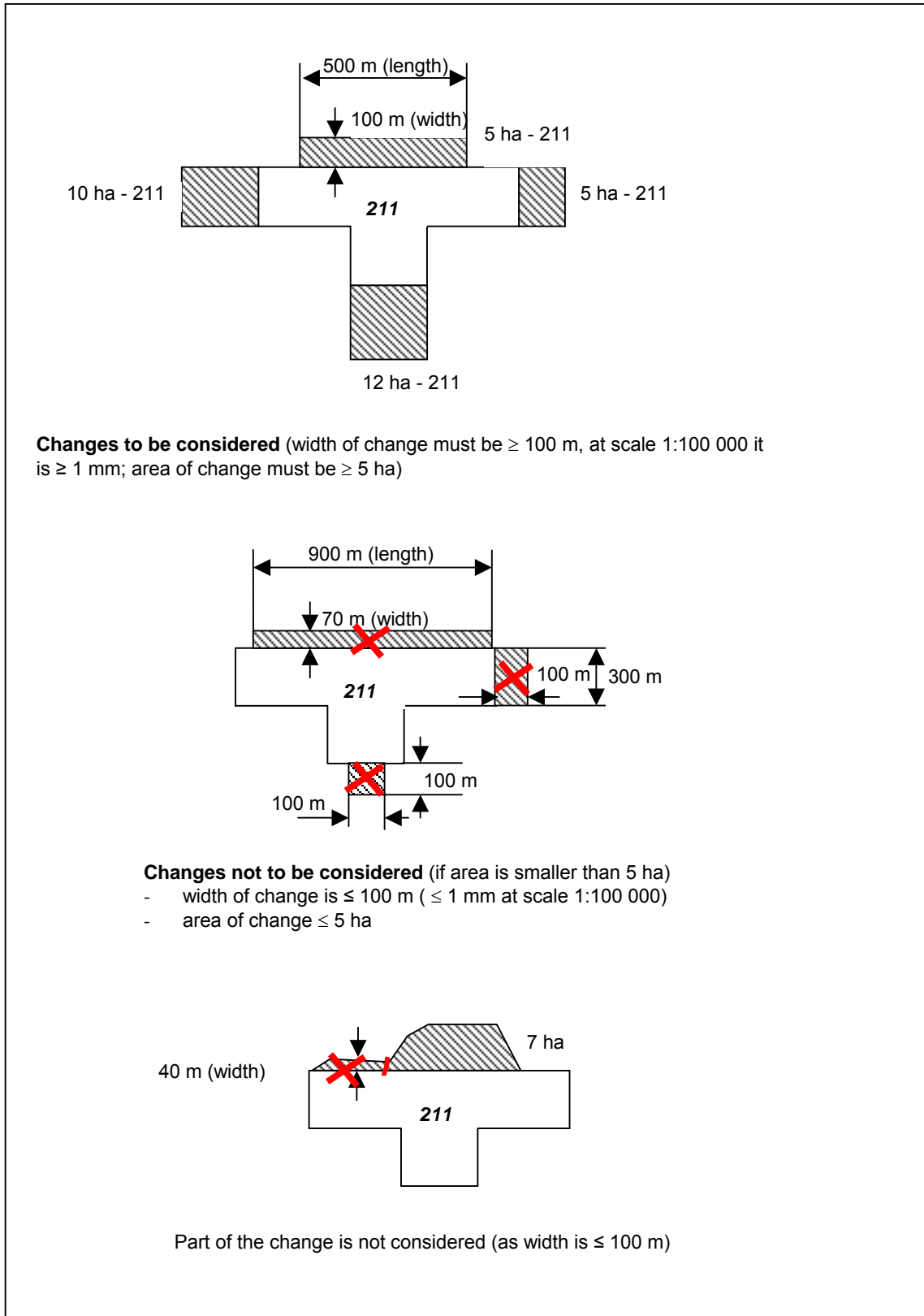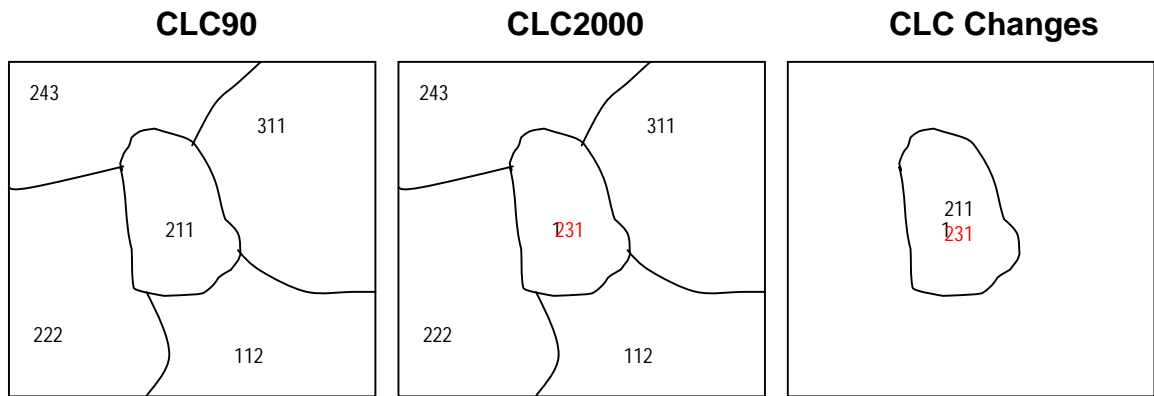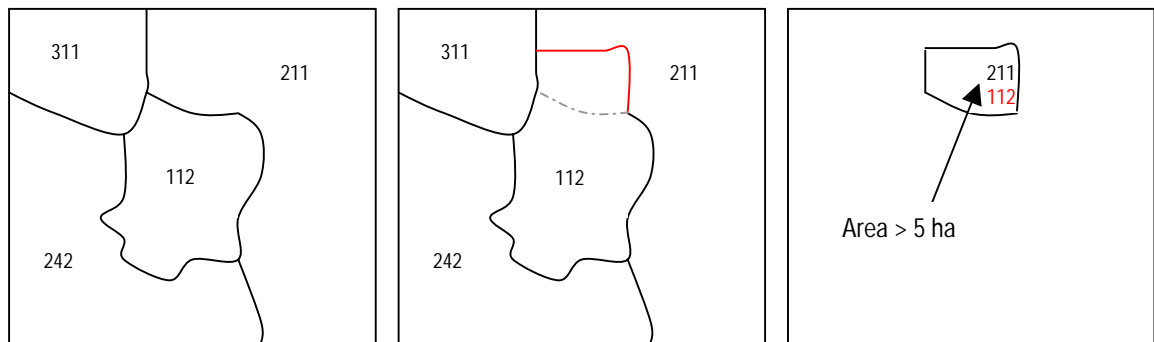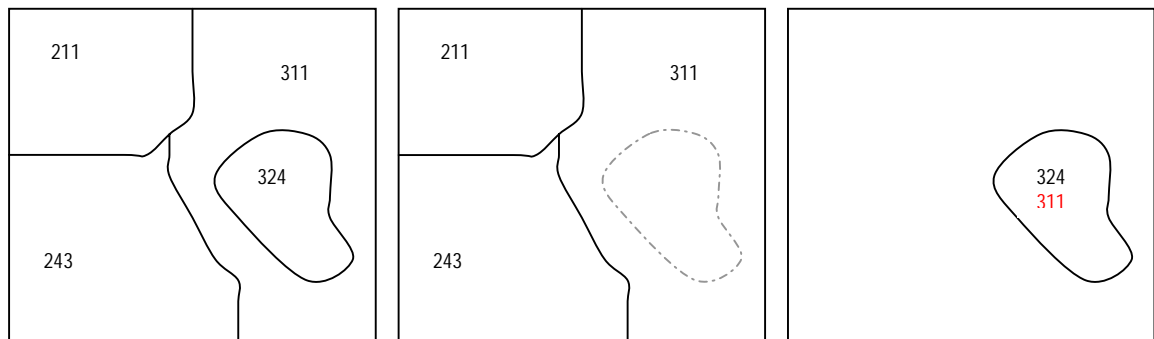Part of the change is not considered (as width is ≤ 100 m)

Figure 4. Criteria for detection of the smallest land cover change at scale 1:100 000.

CLC90   **CLC2000**   **CLC Changes**

1. Change of the CLC code: the polygon with 211 code has changed into 231

2. Area exchange between two polygons: 112 has increased, 211 decreased (change > 5 ha)

3. Disappearance of a polygon: 311 has increased, 324 ceased (area became < 25 ha)
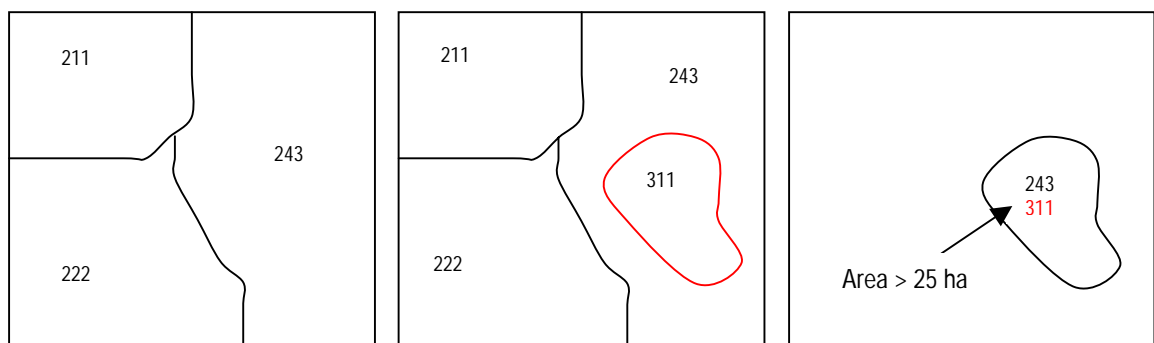
4. Appearance of a new polygon: a 311 was born inside 243 (area must be >25 ha)

Figure 5: Examples of simple LC changes

CLC90	CLC2000	CLC Changes
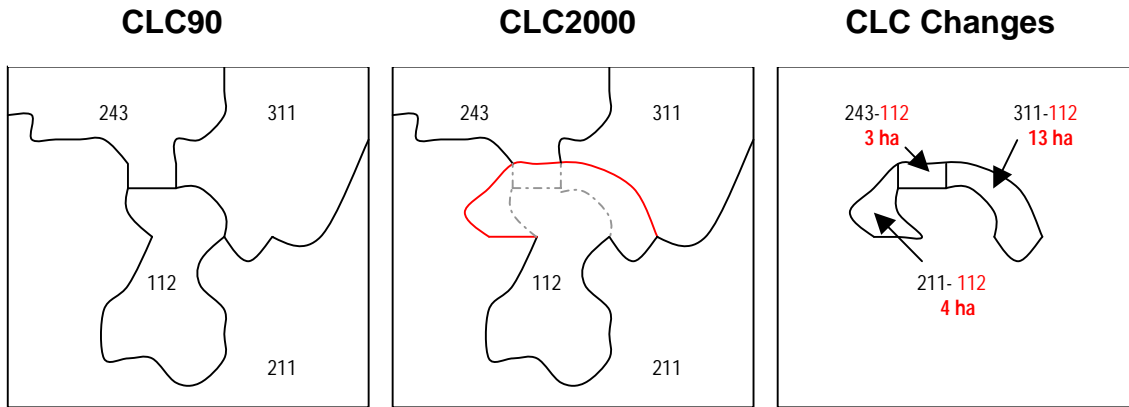
Example 1:
Total increase of a polygon (> 5 ha) can include several contiguous elementary changes, some of them smaller than 5 ha. The example illustrates the growing of a settlement.
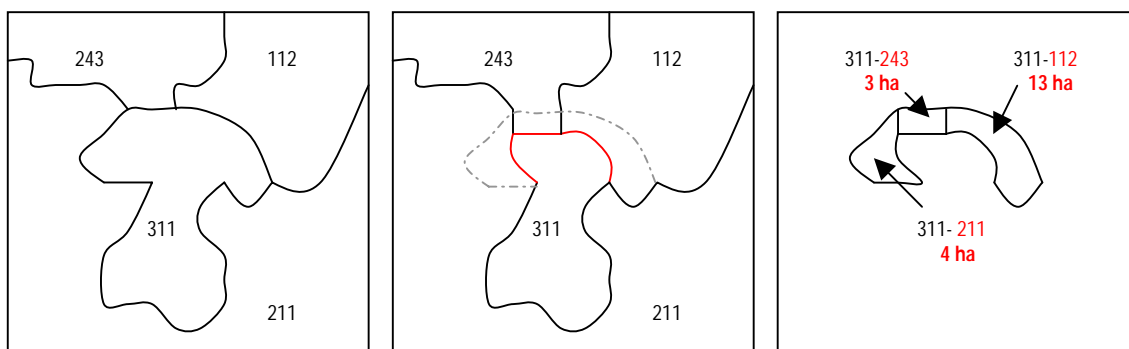
Example 2:
Total decrease of a polygon (> 5 ha) can include several contiguous elementary changes, some of them smaller than 5 ha. The example illustrates the shrinking of a forest.

Figure 6: Examples of complex LC changes

Internal quality control of photo-interpretation

Internal quality assurance is mandatory in order to assure a common quality standard both thematic and geometric and to ensure that the product meet the pre-defined requirements.

It is recommended to follow some standard principles and production process:

- The production process should be split into steps with clearly defined inputs and outputs (eg. data preparation, photo-interpretation and validation).
- The quality of the output product has to be quantified by standardised checks that are performed during the particular production step.
- After every production step the project leader has to decide whether the product reaches the quality standards which has to be corrected before entering the next step.
- At the end of the production chain, it should be decided if the product reaches the previously defined quality level.
- The results of every check have to be documented, in order to ensure transparency during the production process.
- At the end of the production chain, the product should be delivered with a complete documentation of the Internal Quality Control.

Following photo-interpretation, it is recommended that the leader of the national (regional) photo-interpreters' team verifies the work. Optimally this expert should have a high level of expertise in satellite image interpretation in general and CORINE Land Cover in particular. In case the result is not satisfactory, the work has to be returned to the interpreter for further refinements. A written protocol of

this internal quality control should include advises for improvements. It is the task of the national project leader to fulfil the accuracy (reliability) of 85 %.

Additional (optional) way of quality control of interpretation is to provide the work (as preliminary result) to potential users having various areas of expertise (e.g. nature protection experts, agricultural advisors). This process is called national external verification. The external verification should clearly identify the problematic area and propose a solution.

The results of field verification have to be integrated into the database. Remarks from external verification have to be well checked by a CLC expert before entering them into the database.

CLC90   CLC2000
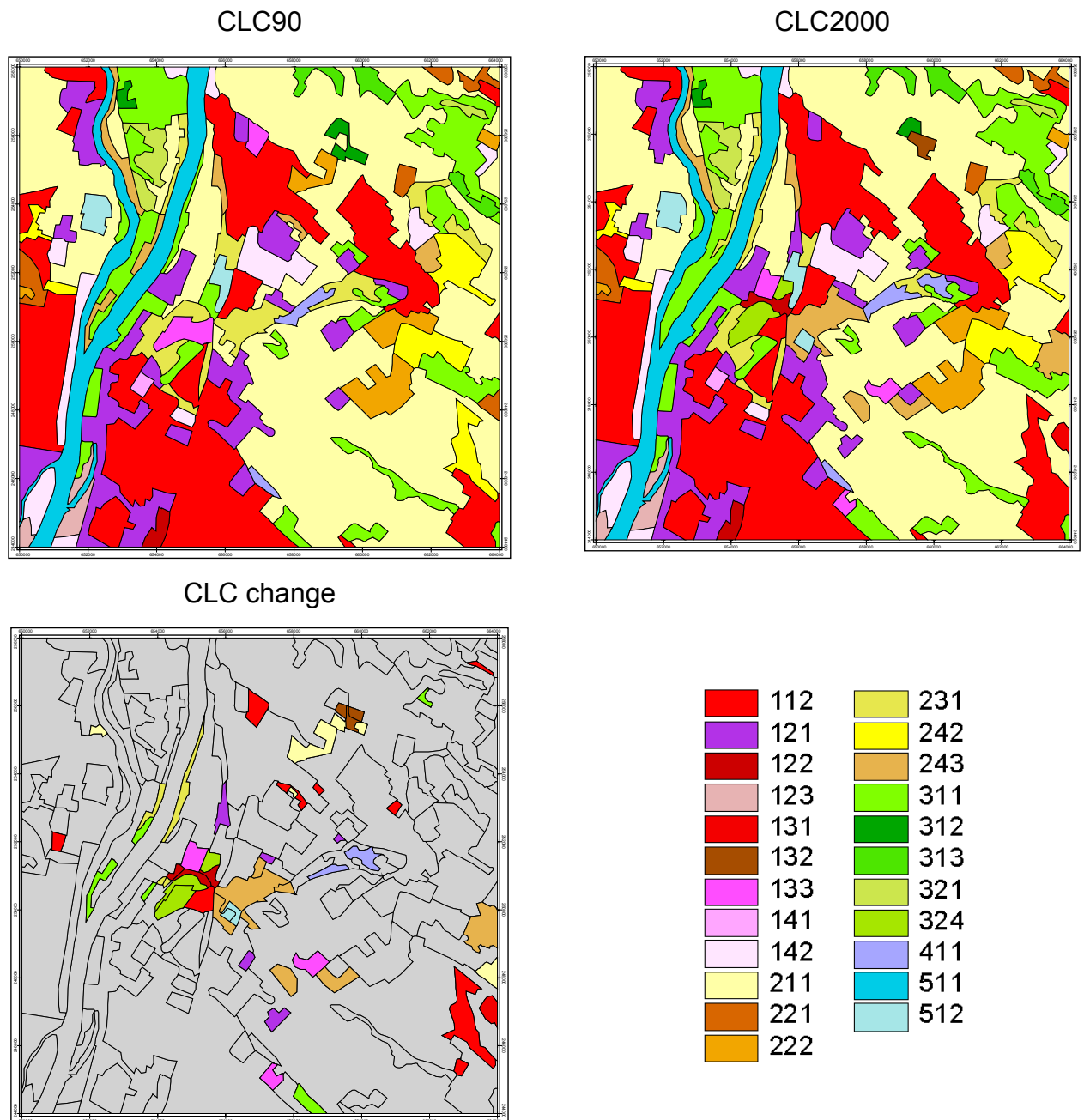
CLC change

Figure 7. An example of change interpretation (NE of Budapest, original scale 1:100 000)

Table 4. Matrix of CLC changes seen on Figure 7

year → 2000 1990 ↓	112	121	122	123	131	132	133	141	142	211	221	222	231	242	243	311	312	313	321	324	411	511	512	Total
112	4062																							4062
121		1502								11														1512
122			50																					50
123				127																				127
131					0																			0
132						0																		0
133	86						0													59				146
141								27																27
142									644															644
211	54	54	10		31	22	114			6656			4		247	42							9	7243
221										31	186													217
222										80		368												448
231		32	19										412		132	8			38	56			15	712
242	142													427										569
243	16									4			22		188	50								279
311			16										55			1715			23					1810
312						14				23							55							92
313																		184						184
321																			184					184
324																				0				0
411															13						70			82
511																						1071		1071
512																							141	141
total area (ha):	4360	1588	95	127	31	36	114	27	644	6804	186	368	493	427	579	1815	55	184	184	120	126	1071	165	19600

Integration of working units

This point refers to the CLC2000 as well as to the corrected CLC90 database. The working units have to fit together to provide a topologically correct seamless database for the entire country. During this process, the following points have to be considered:

- checking neighbour polygons with the same code; dissolving them if needed (uncontrolled automatic dissolve might cause serious errors!);
- merging polygons of neighbour working units having the same code;
- resolving contradictions if a polygon on the sheet border does not continue on the neighbouring sheet;
- unnecessary lines should be checked and dissolved;
- checking the 25 ha limit for polygons (CLC90 and CLC2000); reinterpreting or deleting polygons smaller than 25 ha;
- checking un-likely class changes (in CLC change database).

5.3.3 Responsibilities

- EEA is in charge of the overall management of CLC2000 component (in cooperation with JRC). The CLC2000 Technical Team will ensure technical support, follow up and quality control (verification).
- National teams are performing the interpretation, internal verification, database construction and final quality control (validation).

5.3.4 Timing

A timetable per country describing major activities, products and milestones will be made available on the ETC-TE web site and regularly updated. The expected milestones are:

- IMAGE2000 processing completed for all images covering the country,
- national IMAGE2000 mosaic completed,
- delivery of national CLC2000 and change databases,
- validation of CLC2000 completed.

5.4 TASK 3: DATA INTEGRATION, VALIDATION AND DISSEMINATION

5.4.1 Objective

The final national CLC2000 is delivered to the CLC2000 Technical Team who will integrate it into the seamless European CLC2000 database and validated. Results will be disseminated on-line through the EEA web site and on CD-ROM.

5.4.2 Task description

- Data integration into a consistent European database: the country delivers the national CLC2000 updates to the CLC2000 Technical Team who further integrates the national results into a seamless European CLC2000 database. Data are stored in geographical coordinates (ETRS89).

- Data validation is to be carried out by the CLC2000 technical Team once all european data is available. The purpose of the validation is to check the thematic accuracy of the final product. If interested, the countries can carry out a validation of their national data, however this activity is opitional at this level.

- Data dissemination of the European database: EEA is in charge of the management and dissemination of the integrated European CLC data and coordinates within EIONET the data use for European level analysis and assessments including integration with other datasets.

- To ensure a wide use and facilitate a broad dissemination of the I&CLC2000 products, a number of aggregated products are produced from the I&CLC2000 main outputs at European level. Most of the users are interested in raster CLC data sets allowing easy data handling for analysis of the LC information at European scale. A 100-m and 250 m raster database will be derived as well as 1 km² statistics. Data will be disseminated on-line over net and off-line on CD-ROM.

5.4.3 Responsibilities

- Management: EEA, ETC-TE
- Data integration: CLC2000 Technical Team
- Validation: CLC2000 Technical Team
- Dissemination: EEA, National authorities in charge of I&CLC2000 project (NRC)

5.4.4 Timing

- Integration of the national land cover data in the European database should start as soon as national data was verified and accepted by the CLC2000 Technical Team.
- Data validation of the European databse will only be carried out when all national datasets were received and integrated in the European database.
- Data dissemination should be organised as soon as national data was verified and accepted by the CLC2000 Technical Team.

5.5 TASK 4: QUALITY ASSURANCE/QUALITY CONTROL

5.5.1 Objective

For the I&CLC2000 project with several organisations working towards a common output, the assurance of a quality proof product is very important during the entire life cycle of the project. The quality control validates the different steps of the update, which serve as input to a subsequent work step.

The objective of this task is to ensure that the European requirements for the CLC are met by the countries, well documented and to create an integrated and harmonised European database from the national contributions.

5.5.2 Task description

- Each processing step of the update, i.e. topological correction, geometric adjustment, thematic correction and change detection is followed by a number of checks to assure consistency in the LC database. The checks have to be recorded as part of the meta-information production (Annex 2).
- The CLC2000 Technical Team organises regular visits to the national teams to verify the thematic and geometric consistency of the final products interpretation (Table 4-5).
- The overall responsibility of QA/QC relies with the national project leader. The national teams have to assess thematic and geometrical quality control all along the project:
  - thematic QA/QC: CLC90 and CLC2000. The target thematic accuracy (reliability) is at least 85 %.
  - geometric QA/QC: CLC90 and CLC2000. The target geometrical accuracy is better than 100 m.
- The national teams collect the necessary metadata to document the different steps and products of the project. The CLC2000 Technical Team will manage the metadata for the European products.
- The CLC2000 Technical Team organises the centralised European metadata, adding information on the used procedures and persons responsible for the development of the European mosaics and raster databases. The European metadata also includes information on data dissemination.

5.5.3 Responsible partners

- Management: EEA and JRC
- Implementation: national teams and CLC2000 Technical Team

5.5.4 Timing

- Quality control/quality assurance is carried out during the full duration of the project.

Table 5. CLC2000 Verification / Quality assurance implemented by the CLC2000 Technical Team during country visits

	CLC2000 database	Remark	CLC changes database	Remarks
Technical matters (for automatic control)				
	Topological consistency	No dangles, all polygons are closed, only a single code per polygon, no neighbour polygons with the same code	Topological consistency	No dangles, all polygons are closed, only a single code per polygon, no neighbour polygons with the same code
	Area limit = 25 ha	No polygons with area < 25 ha is permited	Area limit = 5 ha	No change polygons with area < 5 ha is permitted
	Valid CLC codes, no '0' code	Only valid CLC codes are permitted	Valid CLC codes, no '0' code	Only valid CLC codes are permitted
Thematic matters (expert control)				
	Geometrical accuracy (correction of CLC90)	All geometric errors >100 m are removed	Accuracy of delineation of changes	Delineation of changes should have an accuracy within a pixel size (25 m)
	Width of linear elements (>=100 m)	All linear elements are at least 100 m wide	Boundary displacement of changes >=100 m	No change is recorded if the boundary displacement is less than 100 m
	Consistent application of CLC nomenclature	The CLC nomenclature (with extended definitions (see Addendum 2000 and TG) is applied in a consistent manner (right codes, enough details, right application of refined definitions and generalisation rules)	Consistent delineation of changes	All changes larger than the limits (5 ha, 100 m) are mapped (according to TG). Only real changes taken place between 1990 and 2000 are included in the database of CLC changes.
Meta-data sheets	metadata sheets filled in for each working unit will be checked (obligatory, see Annex 2 of TG - format could be changed, if relevant)			

Remark: TG = Technical Guidelines (present document)

5.6   TASK 5: PROJECT MANAGEMENT

5.6.1   Objective

The main objective of the management of the I&CLC2000 project is to ensure the smooth implementation of the project at national and European levels. The management at European level is ensured by EEA jointly with JRC, while the management at national level is entrusted to the national authority in charge of the project.

5.6.2   Task description

When addressing the management component of the project a clear distinction should be made between:

- the overall management of the project, performed centralised by EEA jointly with JRC; and
- the management of the activities carried out as components of the overall project.

The main objective of the European project management of the I&CLC2000 project is to ensure an end product, harmonised across Europe. To this goal management procedures will be established by EEA and JRC in order to:

- prepare the I&CLC2000 project terms of reference;
- inform at any stage the partners about the status of the project ;
- provide adequate communication channels;
- encourage dialogue, exchange of views and experience, identify and propose new solutions.

A Steering Committee is set up with participants from EEA, EIONET, JRC and other Commission services. This activity will be organised by EEA through the Advisory Group on Spatial Analysis (AGSA). It is foreseen to organise at least two meetings every year.

5.6.3   Responsible partners

EEA:
1. Overall management and coordination of the I&CLC2000 project together with JRC.
2. Coordinate the CLC2000 component of the project and maintain contacts with the IMAGE2000 team and EIONET partners.
3. Participate in the coordination of IMAGE2000, together with the JRC.
4. Contribute to co-funding of the I&CLC2000 project together with the Commission services and participating countries.
5. Monitor the co-funding of the project in relation with participating countries.
6. Organise and chair the European Steering Committee for I&CLC2000.
7. Ensure CLC2000 management with support from the European Topic Centre on Terrestrial Environment (ETC/TE) and the CLC2000 Technical Team.
8. Inform NFP/EIONET group and Commission services on the use and dissemination of I&CLC2000 products.
9. Promote I&CLC2000 project and its extension to other geographic areas.
10. Manage the ETC/TE to ensure the technical coordination of the project (as part of the technical team) and check the ETC/TE deliverables.
11. Manage the project extension to the Phare candidate countries.
12. Acquire the satellite images for the Phare candidate countries.
13. Organise and finance the ortho-correction process for the Phare candidate countries.

14. Evaluate tenders for IMAGE2000 extension to Phare countries.

15. Participation in Steering Committee (through EEA Scientific Committee representative).

JRC:
1. Overall management and coordination of the I&CLC2000 project together with EEA.

2. Coordinate the IMAGE 2000 component of the project and maintain contacts with the CLC2000 team.

3. Participate in the coordination of CLC2000, together with the EEA.

4. Participate in the European Steering Committee for I&CLC2000.

5. Inform other Commission services on use and dissemination of I&CLC2000 products.

6. Provide technical support (when necessary) on methodological developments related to I&CLC2000.

7. Ensure the link between I&CLC2000 and other institutional activities of JRC on GI-GIS.

8. Promote I&CLC2000 and its extension to other geographic areas.

9. Manage the contract with SSC for IMAGE2000 component for the Member States EU15.

10. Manage jointly with EEA the technical team activity.

11. Manage DG ENV financial contribution for the technical team.

12. Responsible for IMAGE2000 mosaic.

13. Define technical specifications for IMAGE2000 European mosaic.

14. Responsible for QC of IMAGE2000 outputs, including coordination of the Technical Team work on the QC for the Phare candidate countries.

15. Ensure the completion of IMAGE2000 phase according with the schedule.

16. Participate in the technical team (preparation of guidelines, training, QC).

National Authority:
1. Organise the national tender.

2. Monitor the national implementation of the project (elaborate the national specifications of the project, ensure the liaison with the CLC2000 Technical Team, monitor the work of the national team, etc.), follow-up of financial aspects.

3. Inform EEA on progress of work.

4. Sign the agreement for use and dissemination of I&CLC2000 products.

5. Maintain contacts with the I&CLC2000 overall management.

6. Participate (on a voluntary basis) at European Steering Committee meetings.

5.6.4 Timing

- Project management will cover the full project duration.

6 PRODUCT SPECIFICATION

6.1 I&CLC2000 OUTPUT

The I&CLC2000 Project will create a number of defined standard output products. Table 6 lists the product type and the responsible authority for the delivery.

Table 6.   Description Output Products and Providers

OUTPUT PRODUCTS	DELIVERED BY
Product 1 - Ortho-rectified images + working units	EEA / JRC
Product 2 - National IMAGE 2000 Mosaic	EEA / JRC
Product 3a - National CLC2000 *Product 3b - Revised National CLC90 (optional)*	Countries
Product 4 - National CLC Changes	Countries
Product 5 - European IMAGE2000 Mosaic	EEA / JRC
Product 6a - European CLC2000 Product 6b - Revised European CLC90s	EEA / JRC
Product 7 - European CLC Changes	EEA / JRC
Product 8 - CLC 250 m raster	EEA / JRC
Product 9 - CLC 100 m raster	EEA / JRC
Product 10 - CLC 1 km^2 statistics	EEA / JRC
Product 11 - National Metadata	Countries
Product 12 - European Metadata	EEA / JRC

Product 1: Ortho-rectified images and working units

Based on the quick looks approved by the NRCs, the IMAGE2000 team will acquire the raw Landsat 7 data for the selected acquisition date (JRC 2001). The following bands are provided with the original Landsat 7 TM:

Band number	Spectral range (microns)
ETM 1	.45 to .515
ETM 2	.525 to .605
ETM 3	.63 to .690
ETM 4	.75 to .90
ETM 5	1.55 to 1.75
ETM 6	10.40 to 12.5
ETM 7	2.09 to 2.35
ETM Pan	.52 to .90

The IMAGE2000 team will perform the ortho-rectification in order to establish a homogeneous image coverage:

- Because of inherent problems in the digital data caused by the sensors the following radiometric corrections are applied: destriping; dropline correction; bit errors.
- No atmospheric calibration is performed on the images to allow the end-user to work with the full, radiometrically uncorrected data.

- The images are geometrically corrected on the basis of Ground Control Points (GCPs). The GCPs are based on topographic maps (scale 1:25 000 or 1:50 000).
- A DEM is used to create ortho-rectified map projected images. If the IMAGE2000 team has been provided with an accurate national DEM, this is used for the correction. By default, a European DEM with a 100-m grid giving a horizontal accuracy of 50 m with 90 % confidence and with a vertical accuracy of 30 m is used.
- On the basis of the national projection parameters as provided by the NRCs, the images are projected according to the different national standards. In the case that the area covered by a specific scene overlaps with areas of other countries, the IMAGE2000 team will provide different projections of the same scene for the different countries, on condition that both countries agree on the quality of the scene used. (e.g. cloud cover acceptable to both countries).
- The image is resampled using the cubic convolution approach. This results in the following final pixel size:

Band number	Final pixel size (m)
ETM 1	25
ETM 2	25
ETM 3	25
ETM 4	25
ETM 5	25
ETM 6	25
ETM 7	25
ETM Pan	12.5

- On the basis of the coordinates provided by the NRCs (e.g. following the map subdivision of the 1:100.000 topographic map series), the IMAGE2000 team produces a national coverage of ortho-rectified images per country. The map sheets are used as the Basic Working Unit for the CLC2000 phase. In some cases, different scenes might have to be used for the production of a single ortho-rectified image sheet. This is due to the fact that a map sheet can be covered by different scenes (path/row) or because different dates of the same scene have been used to provide a cloud free coverage. To describe the actual scenes used for the map sheet an additional raster layer (so called stitching coverage) is produced showing for each pixel which scene and which acquisition date was used.
- The file format used for storage and delivery of the images is Band Interleaved by Line (BIL).

A standard header form is specified in the IMAGE2000 Reference Book (number of bands, rows, columns, number of header bytes, pixel size, georeferencing, etc) and actual information are included in the metadata.

Under Product 1 the following items are delivered to the country by the IMAGE2000 team:

- CD-ROMs with: - ortho-rectified Landsat 7 images
  - image subsets (imagettes) of GCPs, size of 41x41 pixels

Product 2: National IMAGE2000

Product 2 is described as **National IMAGE2000**. On the basis of the working units as described in Product 1, a full seamless mosaic per country is established. To provide information on the precise position of the used images an additional raster layer (stitching coverage) is produced by the IMAGE2000 team showing for each pixel which scene and which acquisition date was used.
- The National IMAGE2000 mosaic is:
  - produced in national projection based on the new IMAGE2000 geometry,
  - produced for all spectral bands,
  - having the same resolution specifications as Product 1,
  - stored using Band Interleaved by Line (BIL) as the file format,
  - stored on CD-ROMs.

Product 3: National CLC2000 and the Revised National CLC90

Each participating country delivers Product 3: the **National CLC2000**, which is the national CLC database characterising the LC situation of the year 2000. This is the result of the data collection and processing exercise performed by each national team. On the basis of the revised CLC90 the land cover changes occurred since the production of the CLC90 are updated to reflect the land cover situation as seen on the IMAGE2000 products.

- The updating is based on detection of changes using a double criteria:
    - boundary displacement (width) should be minimum 100 m,
    - area change should be minimum 5 ha (for a contiguous area).
- The National CLC2000 is:
    - using a nomenclature of 44 classes with a 25 ha minimum mapping unit,
    - produced in national projection based on the new IMAGE2000 geometry (the CLC90 database must be in the same geometry),
    - produced in ArcInfo vector format, polygon topology (see under 6.2).
- In case the country is also collecting national land cover data at a more detailed level (<25 ha, >44 classes), a generalisation towards the standard CLC specifications (25 ha and 44 classes) should be carried out by the national teams before integration of national CLC2000 in the European database by the CLC2000 Technical Team.
- In order to produce an accurate national CLC2000, the countries revise the national CLC90 database. Errors of CLC90 have to be corrected in order not to influence the evaluation of the LC changes as seen between the two inventories. Therefore, the CLC90 is revised/upgraded by using the satellite data of 1990.

Product 4: National LC changes database

Each country also delivers Product 4: **National LC changes database.**

- The comparison of the LC inventories of the revised national CLC90 (reference database) and national CLC2000 results in the **National LC changes database**.
- The **National LC changes database** is:
    - the resulting quantitative change between the 1990's and 2000,
    - produced in national projection,
    - produced in Arc/Info vector format, polygon topology (see under 6.2),
    - having polygons with 2 character attributes: a 3-digit CLC code for 1990 and 2000.

Note: The National LC changes database can only be produced if:
- a first CLC inventory (CLC90) (carried out in the period of 1985-1995) exist,
- CLC90 and CLC2000 are produced with the same level of details.

Product 5: European IMAGE2000

Product 5 is defined as **European IMAGE2000**. On the basis of the images as described in Product 1 a full seamless mosaic for the EU15 and the Phare10 countries is established. To provide information on the precise position of the used images an additional raster layer (stitching coverage) is produced showing for each pixel which scene and which acquisition date was used. The European projection parameters are provided by the I&CLC2000 Project Management. The European IMAGE2000 mosaic is:

- produced for all spectral bands,
- having the same resolution specifications as Product 1,
- stored using Band Interleaved by Line (BIL) as the file format,
- stored on CD-ROMs.

Product 6: European CLC2000 and Revised European CLC90

The mosaic of all national CLC2000 contributions results in a **European CLC2000**. This European LC database reflects the CLC situation as seen on the European IMAGE2000 product.

A mosaic of national revised CLC90 contributions results in a revised **European CLC90**.

- Based on the CLC methodology as described in the technical documents (see References), the revised European CLC90 database and the European CLC2000 use a nomenclature of 44 classes with a 25 ha minimum mapping unit. More detailed information are stored in additional thematic layers and considered as optional products.

- The revised European CLC90 database and the European CLC2000 is:

    - produced in geographical coordinates (ETRS system),

    - produced in ArcInfo vector format, polygon topology (see under 6.2).

- In the database, an extra field showing the area in hectares (ha) is added.

To realise the smooth processing of cross boundary LC information (1 km is interpreted over the national boundary) it is important that the same national boundaries are used at the European level. Therefore the corresponding European boundary reference database Seamless Administrative Boundaries of Europe (SABE) of EuroGeoGraphics (former MEGRIN) is used during the production of the European CLC databases.

Product 7: European LC changes database

The **European LC changes database** is the result of a mosaic of the national LC changes databases.

- The evaluation of the LC changes is based on a double criteria: boundary displacement of at least 100 m, and an area change at least of 5 ha (for a contiguous area).

- The European LC changes database is:

    - the resulting quantitative change between 1990 and 2000,

    - produced in geographical coordinates (ETRS system),

    - produced in ArcInfo vector format, polygon topology (see under 2.4).

- In the database an extra field showing the area in hectares (ha) is added.

To ensure the widest use and to facilitate broad dissemination of the I&CLC2000 results, a number of aggregated products are produced from the I&CLC2000 outputs at European level. Many users are interested in raster LC data sets that allow easy data handling for analysis of the LC information at European scale. Following products are derived:

Product 8: CLC 250 m raster database

- A **CLC 250 m raster database** is produced in Lambert Azimuthal Equal Area projection based on the European LC vector database.
- The aggregation is performed through a vector to raster conversion based on a majority calculation.
- The raster database contains converted Products 6 and 7.
- The CLC2000 Technical Team is responsible for the conversion activities and data storage.

Product 9: CLC 100 m raster database

- A **CLC 100 m raster database** is produced in Lambert Azimuthal Equal Area projection based on the European LC vector databases.
- The aggregation is performed through a vector to raster conversion based on a majority calculation.
- The raster database contains converted Products 6 and 7.
- The CLC2000 Technical Team is responsible for the conversion activities and data storage.

Product 10: CLC 1 km² statistics

- **CLC 1 km² statistics database** is produced based on the European LC vector databases.
- The selection of the 1 km² raster is based on recommendations from the EC Working Group on Reference systems, coordinated by JRC.
- The statistics database contains converted Products 6 and 7.
- The CLC2000 Technical Team is responsible for the conversion activities and data storage.

Product 11: National I&CLC2000 metadata

Each country delivers also the complete **metadata** information according to the structure as provided by the CLC2000 Technical Team. The metadata will provide information on the following items:

- identification information: basic info on the data used (images, maps, ancillary data),
- spatial reference information: map projections,
- info on basic working unit,
- responsible photo-interpreters, supervision and control,
- hardware, software,
- image processing procedures,
- field verification,
- quality assurance / quality control.

Two different metadata sheets are proposed:
- for working unit level (filled in for each working units, see Annex 2a),
- country level (characterise the country databases, see Annex 2b).

Product 12: European I&CLC2000 metadata

Based on the metadata as provided by the National Reference Centers (NRCs), namely product 11 the CLC2000 Technical Team organises the centralised **European metadata** adding information on the used procedures and persons responsible for the development of the European mosaics and raster databases.

The European metadata also includes dissemination of information.

6.2 DATA STRUCTURE

6.2.1 Database

Topologic and attribute specifications for CLC2000 vector data

Topologic specifications are required to control the data contents with regard to the requirements of the database management system. The database format should be ArcInfo, polygon topology. File name of delivered national products should be 8 characters long. The file name should include the two characters long standard EU country code (e.g. CLC00_DE, CLC90_HU, CHANG_DE).

- No lines are present more than once.
- All polygons are closed, no dangles.
- The number of polygons is equal to the number of labels.
- The feature ID must be unique; it should not contain the CLC code.
- Each polygon of CLC2000 must have a character attribute: the 3-digit CLC code.
- Each polygon of the CLC change database must have two character attributes:a 3-digitCLC code for both 1990 and 2000.
- Unclassified polygons (0 code) are not permitted, only codes compatible with nomenclature.
- The neighbouring polygons should not have the same CLC code (dissolve).
- A seamless digital database should be produced without any non-coded gaps; this means a perfect edge matching between the working units.

To ensure consistency between the three databases it is highly recommended to fulfil the following condition:

$$\textbf{CLC changes = CLC2000 - CLC90}_\textbf{rev}$$

(where " **-** " means intersect)

Geometric specifications for CLC2000 vector data

- The final delivery of the National CLC2000 and CLC changes products of each country is produced in the national projection system.
- The coordinates of the data delivered to the EEA should be in 'double precision'.
- There should be no visible map sheet boundaries in the data sets.
- There should be no gaps between data sets from adjacent countries or deliveries.
- The area of smallest polygon should be => 25 ha for CLC2000 database.
- Only LC changes larger than 5 ha should appear in the CLC changes database. The contiguous 5 ha change area could consist of more than a single change polygon, some of them not necessarily exceed the 5 ha limit (see Figure 6).

6.2.2 Metadata

Basic approach

Based on lessons learnt, the CLC2000 Technical Team is providing a metadata structure to the participating countries (see Annex 2). This will guarantee that the metadata will be recorded in a standardised way in all the countries.

Metadata is the information that gives characteristics of given dataset. Spatial metadata or geo-information (GI) metadata is the information that characterises spatial datasets. Spatial datasets are products of the I&CLC2000 project and will be described by GI metadata (Figure 8).

The I&CLC2000 datasets metadata has to provide information on the content, representation, spatial reference, quality, administration and other characteristics of a the respective I&CLC2000 products. An obstacle avoiding wider use of CLC90 dataset on various levels was just a lack of such description.
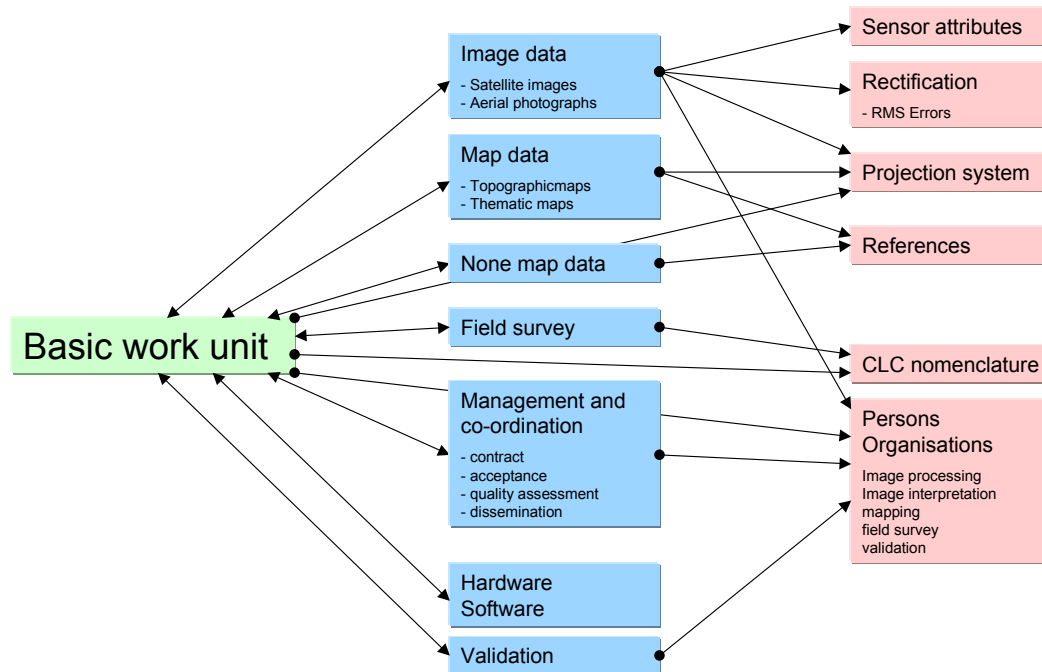

Figure 8.   Metadata structure

Standardised I&CLC2000 metadata will help users find the data they need and determine how best to use it and how to get hold of it. Standardised and well structured metadata will help the users understand the differences in quality, accuracy and precision between datasets and products even if potential users would have no or limited knowledge about the CLC2000 data.

National authorities together with EEA and JRC can use metadata to publish the CLC2000 products. Standardised digital metadata allows technical implementation of the on-line searching. When ready, the records of the metadata database will also be exported and published on the Internet, which will improve cross-IT searching.

At the present time, the official international geoinformation standard does not exist, yet. However, the International Standardisation Organisation (ISO) / Technical Committee 211 develops a family of standards related to geo-spatial information ISO 19100, including ISO 19115 – Metadata issued as draft ISO/DIS version (DIS/ISO 19115, July 2001). There are important initiatives at the Commission level concerning standards where JRC and EEA participate. COGI (Commission Interservice Group on Geographic Information) approved ISO 19100 standards use at the Commission level. The European Environmental Spatial Data Infrastructure (EESDI) aims to create the legislative framework for the adoption and obligation of ISO 19100 standards use at the Commission level. Until the standard will be officially adopted, the Commission recommended to EU services the use of the current draft of ISO/TC211 19115 Geographic Information – Metadata (Geographic Standards of the Commission Services, Working Paper No. 28, Joint UNECE/EUROSTAT Work Session, EC-JRC 28/10/2001). Being the European project and initiative, the I&CLC2000 metadata structure follows the recommendation and is based on the ISO 19115 draft.

Content

The CLC2000 metadata should hold information on the management of the project, on the basic and ancillary data used, i.e. satellite images, topographic maps etc., on data processing and the

nomenclature, on hard- and software used for data processing, important indications on data and dataset quality, possible usage, ordering information.

The metadata record should be written so that it can be read and understood not only by the specialised or technical users of the data, but also by general users of spatial information. Where appropriate, the metadata record should include references to more technical documents of particular interest to specialists.

Three principles of the Infrastructure for Spatial Information in Europe (INSPIRE) determine the strategy that should be followed for the delivery of any I&CLC2000 metadata:
1. Data should be collected once and maintained at the level where this can be done most effectively;
2. It should be possible for information collected at one level to be shared between all the different levels, detailed for detailed investigations, general for strategic purposes;
3. It should be easy to discover which geographic information is available, fits the needs for a particular use and under which conditions it can be acquired and used.

According to the type of information three groups can be introduced:

1. Metadata for *Inventory* (information supporting management of the database development),

2. Metadata for *Discovery* (database accessibility information – who, where, how),

3. Metadata for *Use* (information needed to judge the relevance and fitness-for-purpose of the database before to access it).

At the same time, all three groups of metadata can be referenced to the CLC basic object (polygon), working unit (map sheet), country (national product) and to the whole CLC project region (European product). To avoid repeating the same information on every level, relevant links and appropriate metadata structure using database and HTML tools should be incorporated.

Only specification of the CLC2000 metadata for a country level (see below) defines the standards that are obligatory for each national team**.** The Structure of metadata describing all products at mapping unit level or polygon level is given as recommendation to the national teams.

Country level CLC2000 Metadata (CNTR_MD)
At this level, CLC2000 Metadata data will be mainly of the type of *Discovery* and *Use* (by End-Users). Therefore, core elements required by ISO 19115 have been respected as minimal recommended metadata elements set required to identify a dataset. However, additional general level information is also required for production management and thus the set of Country Metadata structure elements include some from *Inventory* type as well (Annex 2).

Map Unit level CLC2000 Metadata (MAPU_MD)
At this level CLC2000 Metadata will be typically the type of *Inventory* as it will be reviewed for production purposes by National CLC2000 Teams and/or CLC2000 Technical Team. Any potential user seldom seeks production information data stored after a database creation. Content, structure and volume of the production information stored is therefore left on responsibility of national CLC2000 teams, except those parameters required by CLC2000 Technical Team for verification purposes. A recommended structure of this metadata set is presented in Annex 2.

Polygon level CLC2000 Metadata (PLGN_MD)
At this level, CLC2000 Metadata will be reviewed for production purposes only by National CLC2000 Teams or by CLC2000 Technical Team in limited cases. Therefore needs, the set of Metadata elements and structure is left on National Team responsibility.

Technical solution

The ISO19115 standard defines the content of a set of metadata elements, however it does not treat either the technique of metadata collection or the form of metadata presentation.

Although several sophisticated methods could be used for the metadata collection, a practical approach is proposed when the metadata structure for country product will be put in an ordinary table. For unity, the table will be prepared and provided to the national teams by CLC2000 Technical Team as an empty MS Access table. Storage in external tables of the relational database system ensures not only that required data will be collected in consistent way, but it also enables possible data linkage

with other relevant information in future. The linkage can be quite flexible including other statistical tables in relation databases or attribute tables of spatial datasets (Machkova 2001). Moreover, such format gives possibility to publish metadata directly on Internet using appropriate XML solution.

To use this opportunity in CLC metadata handling and presentation, each of the four levels of spatial objects (country and image, working unit and polygon) will be presented also as spatial layer with polygon topology. National teams should create these basic coverage (hereafter named CNTR_BASE, IMAG_BASE, MAPU_BASE and POLY_BASE respectively) and add mandatory relation items into their internal tables as described in following definition table (Table 7):

After simple overlay of all these coverage a united table with all mandatory related items can be created. Subsequently, the external tables for each metadata level can be inter-linked (optional) through relevant spatial objects (see Figure 9). This possibility can be applied to establish connection with another useful coverage with point topology e.g. GCPs, that might be useful during the CLC2000 dataset production and verification stages.

Table 7. Metadata layers for I&CLC2000

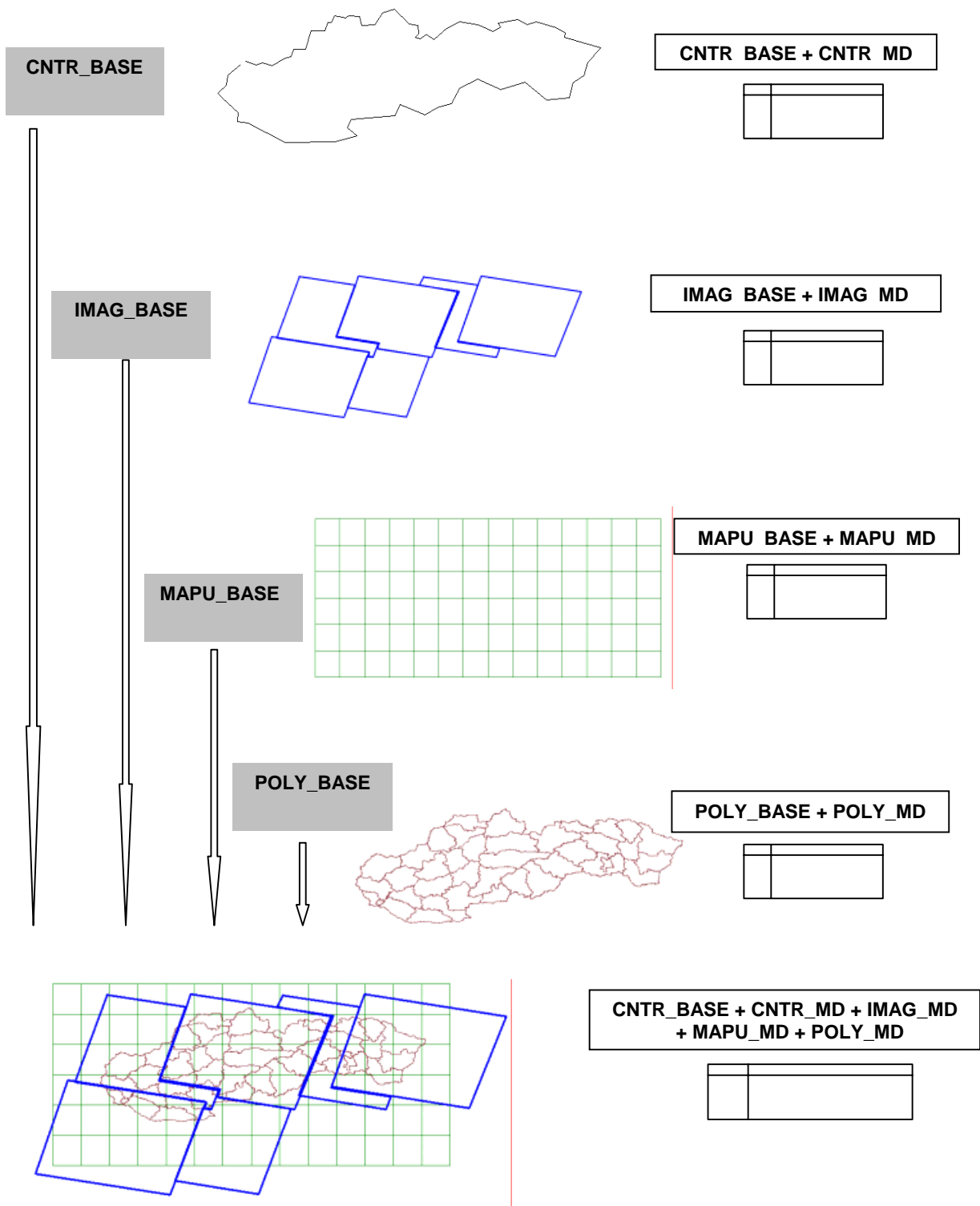| Spatial layer	CNTR_BASE	IMAG_BASE	MAPU_BASE	POLY_BASE
Object	Official administrative boundaries of state	area of used image from the satellite scene (without overlaps)	frame of the map unit at scale level 1:100000	Interpreted CLC polygon
Relation item	State ISO abbreviation	satellite path-row	national map coverage nomenclature	unique ID within state
Link	Country Title	Image Title	Map Title	Polygon Title
Format	Character (2C) XX	character (8C) ppprrst where ppp = path, rrr = row s = set (basic,ext) t = type (nominal,float)	character	Integer
Examples	PL SK HU	189025bn 189026ef 189027en	... M34101 ...	153 1056 528

CNTR_BASE

CNTR BASE + CNTR MD

IMAG_BASE

IMAG BASE + IMAG MD

MAPU_BASE

MAPU BASE + MAPU MD

POLY_BASE

POLY_BASE + POLY_MD

CNTR_BASE + CNTR_MD + IMAG_MD
+ MAPU_MD + POLY_MD

Figure 9.   CLC2000 metadata GIS concept

7 LIST OF CONTACT PERSONS

- original EEA document modified: status October 2002 -

Project managers I&CLC2000:

Chris Steenmans	European Environment Agency Kongens Nytorv 6 DK 1050 Copenhagen	Chris.Steenmans@eea.eu.int Tel: +45 33 36 71 16 Fax: +45 33 36 71 99
Adriana Gheorghe	European Environment Agency Kongens Nytorv 6 DK 1050 Copenhagen	Adriana.Gheorghe@eea.eu.int Tel: +45 33 36 72 05 Fax: +45 33 36 71 99
Vanda Lima	Joint Research Centre/ Land Management Unit, TP262 I-21020 Ispra (VA)	Vanda.Lima@jrc.it Tel: +39 0332 78 50 52 Fax: +39 0332 78 99 36

CLC2000 Technical Team:

George Büttner	FÖMI	buttner@rsc.fomi.hu
Susan Christensen	JRC	susan.christensen@jrc.it
Jan Feranec	IGNFI (IG SAS)	geogfera@savba.sk
Gabriel Jaffrain	IGNFI	gjaffrain@ignfi.fr
Tomas Soukup	GISAT	tomas.soukup@gisat.cz

IMAGE2000 team (extended EU15 + Phare10):

Vanda Lima	JRC	vanda.lima@jrc.it
Susan Christensen	JRC	susan.christensen@jrc.it
Jörgen Forsgren	METRIA/SSC	jorgen.forsgren@lm.se
Marinne Orrmalm	METRIA/SSC	marianne.orrmalm@lm.se
Michal Lodin	GISAT	michal.lodin@gisat.cz
Tomas Soukup	GISAT	tomas.soukup@gisat.cz

National Authorities in charge of CLC2000:

Austria	**The Umweltbundesamt GmbH (Federal Environment Agency – Austria)** Spittelauer Lände 5 A -1090 Vienna Tel: ++43 1 31304 5468 Fax: ++43 1 31304 5400 e-mail: struwe@ubavie.gv.at
Belgium	**Institut Géographique National** Abbaye de la Cambre 13 B-1000 Bruxelles Att: Eric Bayers Tel: +32 2 629 84 05 Fax: +32 2 629 84 19 e-mail: eba@ngi.be
Denmark	*Temporary contact:* Att: Michael Stjernholm, NERI, Silkeborg e-mail: msh@DMU.dk
France	**French Environmental Institute (IFEN)** 61 Alexandre Martin Bld. 45058 Orleans cedex 1 Tel: +33 (0)2 38797878 Fax: +33 (0)2 38797870

Finland	**Ministry of Environment** PO Box 380 FIN - 00131 Helsinki, Finland Kasarmikatu 25 Tel: 358 9 19911 Fax: 358 9 1991 9545 e-mail: kirjaamo.ym@vyh.fi
Germany	**Federal Environmental Agency (Umweltbundesamt / UBA)** Bismarckplatz 1 14193 Berlin Tel: +49 30 8903 0 Fax: +49 30 8903 2285 http://www.umweltbundesamt.de/
Greece	**National Technical University of Athens (NTUA**) Department of Rural and Surveying Engineering, Cartography Laboratory H. Polytechniou 9, 15780, Zografou Campus Athens Tel: +30 1 7722731 Fax: +30 1 7722670 e-mail: mkav@survey.ntua.gr, mkav@softlab.ece.ntua.gr
Ireland	**Environmental Protection Agency** PO Box 3000, Johnstown Castle Estate, Wexford Tel: + 353 53 60651, Fax: + 353 53 60699, e-mail: y.doris@epa.ie
Italy	**Agenzia Nazionale per la Protezione dell'Ambiente** Via Vitaliano Brancati 48 00141 Rome Att: Claudio Maricchiolo e-mail: maricchiolo@anpa.it
Luxembourg	**Ministère de l'Environnement** 18, Montée de la Pétrusse L-29 18 LUXEMBOURG Att: Jean-Paul Feltgen Tel: +352 478 6813 Fax: +352 478 6835 e-mail: jean-paul.feltgen@mev.etat.lu
Netherlands	**Alterra Centre for Geo-Information** Att: H.A.M. Thunnissen P.O. Box 47 6700 AA Wageningen e-mail: H.A.M. Thunnissen@alterra.wag-ur.nl
Portugal	**Ministry of Environment and land use Planning** **Environmental Institute** Rua da Murgueira – Zambujal Apartado 7585 Alfragide P-2721-865 Amadora Att: Maria Leonor Gomes Fax: 351 21 4719074 e-mail: leonor.gomes@dga.min-amb.pt
Spain	**National Centre for Geographic Information (CNIG) – National Geographic Institute (IGN)** General Ibañez de Ibero 3. Madrid 28003. Att: José Antonio Canas Torres Tel: +34 915979410 Fax: +34 915979753 e-mail: jacanas@mfom.es
Sweden	**The National Land Survey of Sweden** (Lantmäteriet) S-801 82 Gävle, Sweden. Tel: +46 26 633000 Fax: +46 26 687594 www.lantmateriet.com (new address) Att: Mats Halling e-mail: mats.halling@lm.se

UK	**Centre for Ecology and Hydrology** Monks Wood Abbots Ripton Cambridgeshire, PE28 2LS
Bulgaria	**Environmental Executive Agency within the Ministry of Environment and Water** 136 "Tzar Boris III" 1618 Sofia Tel: +359-2 955 98 12 Fax: +359-2 955 90 15
Czech Republic	**Czech Environmental Institute** Kodanska 10 CZ-100 10 Prague 10, Czech Republic Att: Josef Sejak Tel.: 420 2 67225226 Fax: 420 2 717423306 e-mail: josef.sejak@ceu.cz
Estonia	**Estonian Environment Information Center** Mustamae tee 33 EE-1016 Tallin Att: Leo Saare Tel: + 372 656 4151 Fax: + 372 656 4071 e-mail: leo.saare@ic.envir.ee
Hungary	**Institute of Geodesy, Cartography and Remote Sensing (FÖMI)** Budapest, Bosnyák tér 5, H-1149 Hungary Att: George Büttner Tel: + 36 1363 6670 Fax: +36 1 252 8282 email: buttner@rsc.fomi.hu
Latvia	**Latvian Environment Agency** **2, Straumes iela,** **Jurmala, LV-2015** Tel: +371-7-762282, Fax: +371-7-7664439, e-mail: vdc@vdc.lv Att: Ilze Kirstuka
Lithuania	**Ministry of Environment** Jaksto 4/9, LT-2694, Vilnius Lithuania Tel: +370 2 616 148 Fax: +370 2 220 847 e-mail: kanceliarija@aplinkuma.lt http://www.gamta.lt
Poland	**Head Inspectorate for Environmental Protection** ul. Wawelska 54 00-920 Warszawa Att:: Lucyna Dygas-Ciolkowska Tel: +4822 825 48 59 lciolkow@pios.gov.pl
Romania	**Ministry of Water and Environmental Protection** **Danube Delta National Institute** Str. Babadag 165 8800 – Tulcea Tel: +402 40 531520 Fax: +402 40 533547 e-mail: Hanganu@indd.tim.ro
Slovak Rep.	**Slovak Environmental Agency (SEA)** Tajovskeho 28 975 90 Banska Bystrica Att: Nada Machkova Tel/Fax: +421 (0)88 4132160 Tel: +421 (0)88 4132157 e-mail: machkova@sazp.sk

Slovenia	**Ministry of the Environment and Spatial Planning**
	Geoinformation Centre
	Dunajska cesta 48
	SI-1000 Ljubljana
	Tel: +386 1 478 7400
	Fax: +386 1 478 7422
	http://www.sigov.si:81/

8   REFERENCES

Bossard, M., Feranec, J., Otahel, J. (2000). CORINE Land Cover Technical Guide – Addendum 2000. Technical report No 40. Copenhagen (EEA). http://www.eea.eu.int

Chavez, S. P., Stuart, C. S., Jeffrey, A. A. (1991). Comparison of three different methods to merge multiresolution and multispectral data: Landsat ETM and SPOT panchromatic. Photogrammetric Engineering and Remote Sensing, 57, 3, 295-303.

Feranec, J., Suri, M., Otahel, J., Cebecauer, T., Kolar, J., Soukup, T., Zdenkova, D., Waszmuth, J., Vajdea, V., Vijdea, A., Nitica, C. (2000). Inventory of major landscape changes in the Czech Republic, Hungary, Romania and Slovak Republic 1970s – 1990s. International Journal of Applied Earth Observation and Geoinformation, 2, 129-139.

Heymann, Y., Steenmans, Ch., Croissille, G., Bossard, M. (1994). CORINE Land Cover. Technical Guide. Luxembourg (Office for Official Publications of the European Communities).

JRC (2001): IMAGE2000 - Procedure for image selection ref: SC-VP/I02/1.1, 28/02/01

JRC: IMAGE2000 Reference Book (in preparation)

Machkova, N. (2001). Metadata for CLC2000 production stage based on GIS approach. Working paper.

Perdigão, V., Annoni, A. (1997). Technical and Methodological Guide for Updating CORINE Land Cover Data Base. Luxembourg (JRC and EEA).

Perdigão, V., Christiansen, S., eds. (2000). The LACOAST atlas: Land cover changes in European coastal zones. Ispra (JRC).

ANNEXES

ANNEX 1

CLC generalisation rules

CLC GENERALISATION RULES

This rule should be applied to all units which do not correspond to the CLC mapping criteria of smallest mapping unit of 25 ha and minimum width of 100 m.

Two types of situation occur:

1. The small isolated unit is surrounded by a unit with area > 25 ha.
2. The small unit is included in a patchwork of small units, which all are too small to be maintained as individual classes.

1. Isolated units <25 ha

Case 1:   If the small unit is surrounded by only one unit, the small unit is aggregated to the larger unit.

Example: A small discontinuous built-up area 112 is aggregated to the surrounding arable land 211
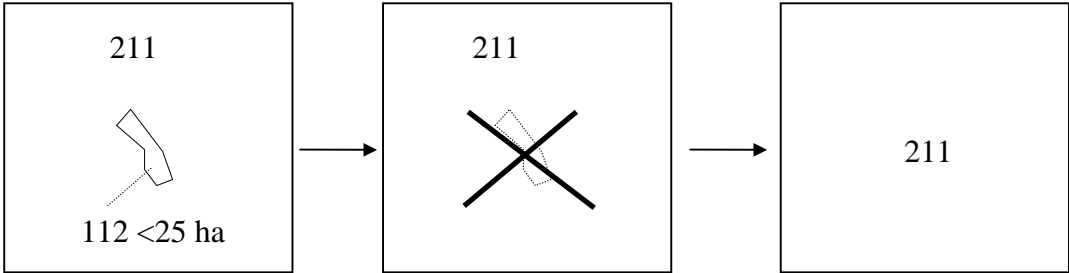
Case 2:   If the small unit is surrounded by two or more units, the small unit is aggregated or subdivided proportionally to the neighbouring units.
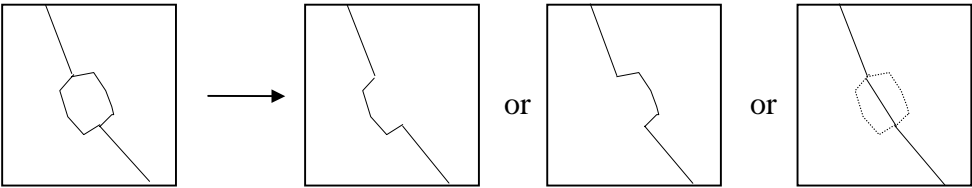
This aggregation will depend on the type of land cover which is surrounding the area. Some aggregations to a specific land cover class are more 'logical' than others, within the context of the CLC inventory. This so called 'logical' aggregation has been formalised in a priority list for aggregation of a small unit to a specific land cover class.

Priority table:

| unit<25ha		111	112	121	122	123	124	131	132	133	141	142	211	212	213	221	222	223	231	241	242	243	244	311	312	313	321	322	323	324	331	332	333	334	335	411	412	421	422	423	511	512	521	522	523
																								codes of neighbouring polygon > 25 ha																				
	111		1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	2	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
	112	1		1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	2	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
	121	3	3		1	1	1	2	2	2	4	4	6	6	6	6	6	6	6	5	5	6	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8
	122	2	2	1		1	1	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
	123	3	3	1	1		1	2	2	2	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6
	124	3	3	1	1	1		4	4	4	2	2	6	6	6	6	6	6	5	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	7
	131	3	3	2	2	3	3		1	1	4	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	8	8	8	8	5	8	8	8
	132	3	3	2	2	3	3	3		1	4	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	8	8	8	8	5	8	8	8
	133	1	1	1	1	1	1	2	2		2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
	141	3	2	3	3	3	3	3	3	3		1	7	7	7	7	7	7	7	7	5	5	5	4	4	4	4	4	4	4	7	7	7	7	7	7	6	6	7	7	7	6	6	7	7
	142	3	2	3	3	3	3	3	3	3	1		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5
	211	5	5	5	5	5	5	5	5	5	5	5		1	1	4	4	4	3	2	2	2	2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7
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	221	4	4	5	5	5	5	5	5	5	5	5	3	3	3		1	1	3	2	2	2	2	5	5	5	4	4	4	4	4	4	4	4	6	6	6	6	6	6	7	7	7	7	7
	222	5	5	6	6	6	6	6	6	6	6	6	3	3	3	1		1	3	2	2	2	2	4	4	4	6	5	5	5	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8
	223	5	5	6	6	6	6	6	6	6	6	6	3	3	3	1	1		3	2	2	2	2	4	4	4	6	5	5	5	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8
	231	6	5	6	6	5	6	6	6	6	4	4	2	2	2	3	3	3		1	1	1	1	7	7	7	4	6	6	6	5	5	5	5	8	4	4	4	7	7	8	8	8	8	8
	241	3	2	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1		1	1	1	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5
	242	3	2	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1		1	1	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5
	243	4	3	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	1	1		1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4	4	4
	244	4	3	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	1	1	1		3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5	5	8	6	6	6	8
	311	7	7	7	7	7	7	7	7	7	3	3	7	7	7	7	6	6	7	6	6	3	3		2	1	5	4	4	4	5	5	5	5	8	6	6	8	8	8	8	8	8	8	8
	312	7	7	7	7	7	7	7	7	7	3	3	7	7	7	7	6	6	7	6	6	3	3	2		1	5	4	4	4	5	5	5	5	8	6	6	6	8	8	8	8	8	8	8
	313	7	7	7	7	7	7	7	7	7	3	3	7	7	7	7	6	6	7	6	6	2	3	1	1		5	4	4	4	5	5	5	5	8	6	6	6	8	8	8	8	8	8	8
	321	8	8	8	8	8	8	8	8	8	3	3	7	7	7	7	7	7	5	6	6	2	6	4	4	4		1	1	1	3	3	3	3	8	4	4	4	9	4	8	8	8	8	8
	322	6	6	6	6	6	6	6	6	6	3	3	5	5	5	4	4	4	5	5	5	2	4	3	3	3	2		1	1	3	3	3	3	8	2	2	2	4	7	4	8	8	8	8
	323	6	6	6	6	6	6	6	6	6	3	3	5	5	5	4	4	4	5	5	5	2	4	3	3	3	2	1		1	3	3	3	3	8	2	2	2	4	7	4	8	8	8	8
	324	6	6	6	6	6	6	6	6	6	3	3	5	5	5	4	4	4	5	5	5	2	4	1	1	1	1	1	1		2	2	2	2	8	3	3	4	7	4	8	8	8	8	8
	331	6	6	6	6	6	6	6	6	6	3	3	5	5	5	5	5	5	5	5	5	2	5	4	4	4	2	2	3	3		1	1	1	1	4	4	2	4	2	2	2	3	3	3
	332	6	5	5	5	5	5	3	3	3	4	4	4	4	4	3	4	4	4	4	4	2	4	3	3	3	2	2	2	2	1		1	1	1	4	4	4	4	4	6	6	6	6	6
	333	6	6	6	6	6	6	6	6	6	3	3	5	5	5	5	5	5	4	5	5	2	5	3	3	3	2	2	2	2	1	1		1	1	4	4	4	4	4	7	7	7	7	7
	334	7	7	7	7	7	7	7	7	7	4	4	5	6	6	5	4	4	5	5	5	3	3	2	2	2	2	2	2	2	1	1	1		8	6	2	6	6	6	8	8	8	8	8
	335	8	8	8	8	8	8	8	8	8	8	5	8	8	8	8	8	8	8	8	8	8	8	6	6	6	4	5	7	6	1	1	1	7		4	4	5	5	5	3	2	5	5	5
	411	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	5	6	6	2	6	4	4	4	4	4	4	4	4	4	4	5	3		1	2	2	2	3	3	3	3	3
	412	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	5	6	6	2	6	4	4	4	4	4	4	4	4	4	4	5	3	1		2	2	2	3	3	3	3	3
	421	8	8	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	4	7	7	4	7	7	7	7	4	6	6	6	5	5	5	8	8	3	3		1	1	2	2	1	1	1
	422	6	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	2	3	1		1	4	4	3	3	3
	423	6	6	6	6	5	6	6	6	6	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	4	4	1	1		3	3	2	2	2
	511	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	2	5	5	6	6	4	4	3	3	3		1	2	2	2
	512	5	5	5	5	5	5	2	5	5	4	4	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	3	5	5	6	6	3	3	3	3	3	1		2	2	2
	521	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	6	6	4	4	3	3	3	2	2		1	1
	522	6	6	6	6	5	6	6	6	6	5	5	6	6	6	6	6	6	6	6	6	3	6	6	6	6	6	6	6	6	6	6	6	7	7	4	4	3	3	3	2	2	2		1
	523	6	6	6	6	5	6	6	6	6	5	5	6	6	6	6	6	6	6	6	6	3	6	6	6	6	6	6	6	6	6	6	6	7	7	4	4	3	3	3	2	2	1	1	

Remark: 1 is the highest priority. Larger numbers indicate lower priority.

The table should be read as follows :

Example row 3: The small individual unit 121 (<25 ha) should be aggregated to the unit with the highest priority.

unit <25 ha	11	112	121	122	123	124	131	132	133	141	...
121	3	3		1	1	1	2	2	2	4	...

priority (1=highest)

112 prio =3
123 prio =1
121 <25 ha

123
112
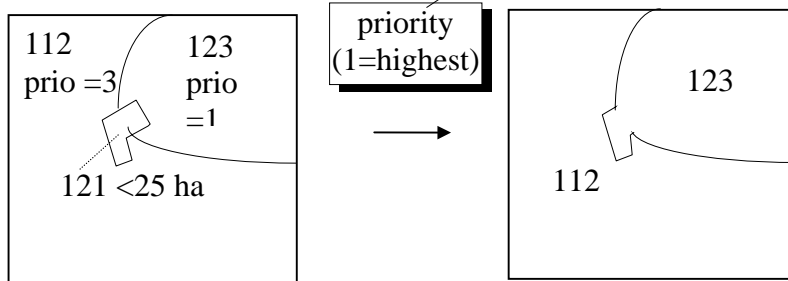
If the unit 121 is surrounded by two units with equal priority, the area of the smallest unit should be cut into two equal pieces and each part is allocated to the neighbouring unit.

133 prio =2
132 prio =2
121 <25 ha

132
133
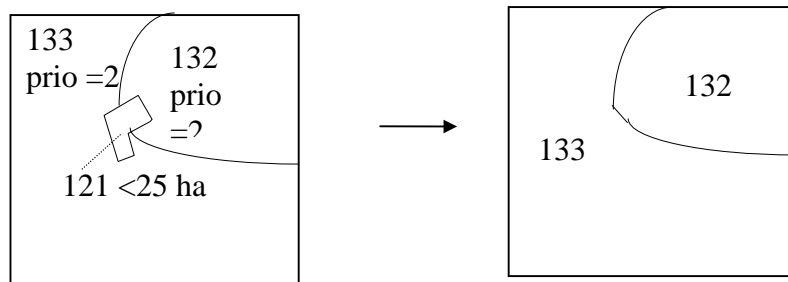
This aggregation procedure is sometimes more complex in real situations with complex geographical structures. The split of the small unit in two or more equal parts should be done according to the structure of the landscape; it will not always be possible to maintain equal areas after subdivision of the unit.

Very often, the unit is connected to more than two larger units, with different priorities.

Case 1: If one unit has the highest priority, the unit is entirely aggregated to that class.

312 prio=2
321 prio = 5
311
322 prio = 4

312
321
322
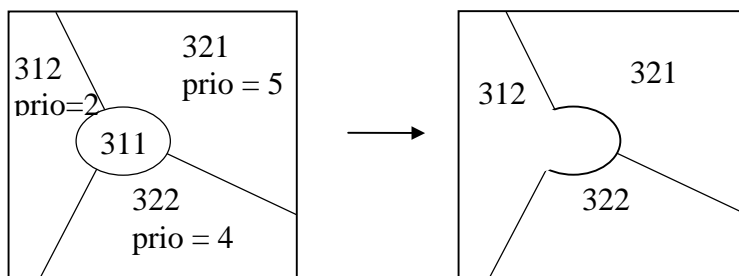
Case 2: If the priority of two units is equal, the area is split and distributed over the two classes according to the most 'logical' subdivision. In this context 'logical' means that the structure of the landscape and the geographical context should be taken into consideration
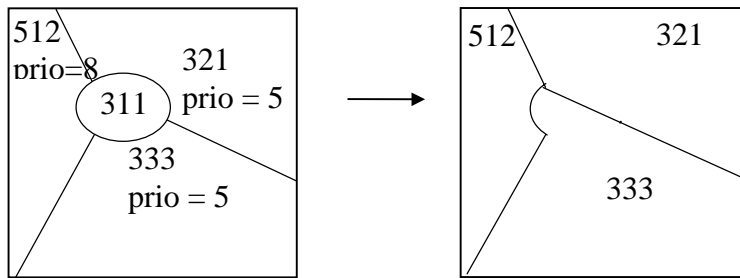
Case 3: if all priorities are equal, the unit is split up and aggregated to all the different surrounding units.
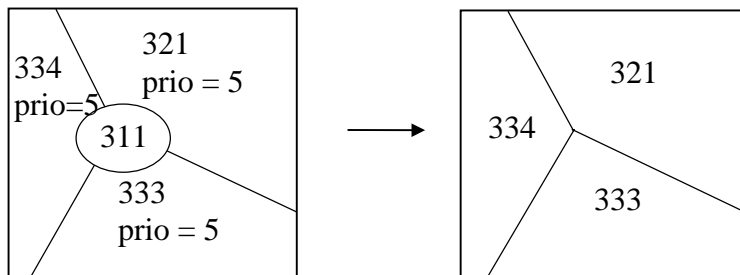
2. Patchwork of small units

When different small units (all < 25 ha) are grouped as a patchwork, a different type of amalgamation need to be considered. For the generalisation of small units located within the agricultural areas, 4 heterogeneous classes have been defined in the CLC nomenclature to generalise implicitly the land cover data. As a general rule, the induced surface of the heterogeneous class should be as small as possible.

Class 2.4.1   Annual crops associated with permanent crops:
mixed agricultural land uses by superposition (on the same plot) of arable land, permanent crops and/or pastures (except agro-forestry). None of these agricultural classes at level 3 is representing more than 75 % of the polygon area.
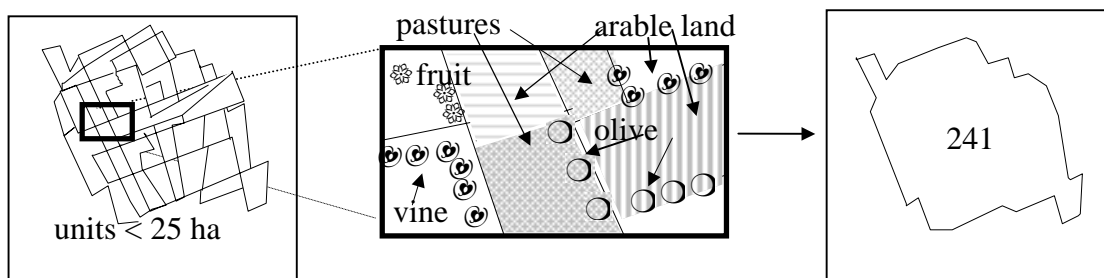
Class 2.4.2   Complex cultivation patterns:
            mixed agricultural land used by juxtaposition of arable land, permanent crops and/or
            pastures. None of these agricultural classes at level 3 is representing more than 75 % of
            the polygon area.
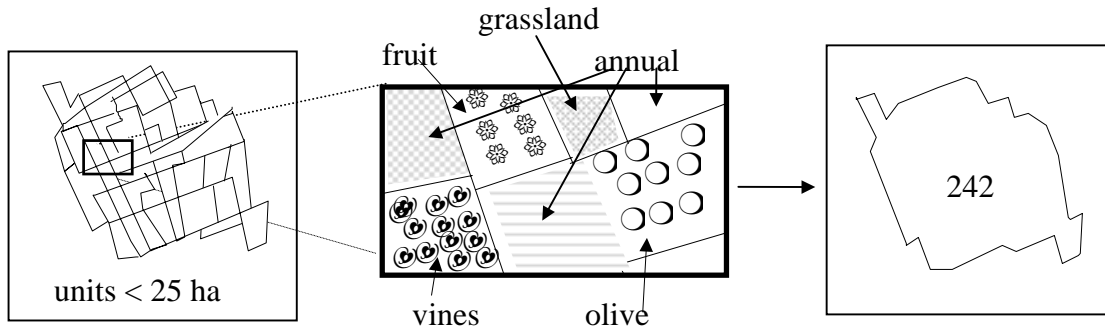
Class 2.4.3   Land occupied by agriculture, with areas of natural or semi-natural land cover :
            mixed agricultural land by juxtaposition of small natural or semi-natural areas (including
            water bodies and wetlands) with less than 25 ha, and which cover at least 25 % and
            maximum 75 % of the area.
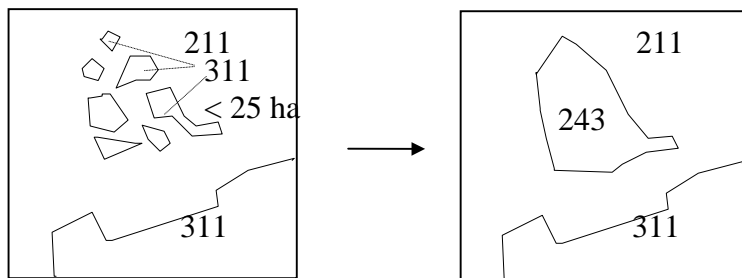
Class 2.4.4 Agro-forestry areas:
            mixed agricultural land by superposition of forestry land with agricultural land.
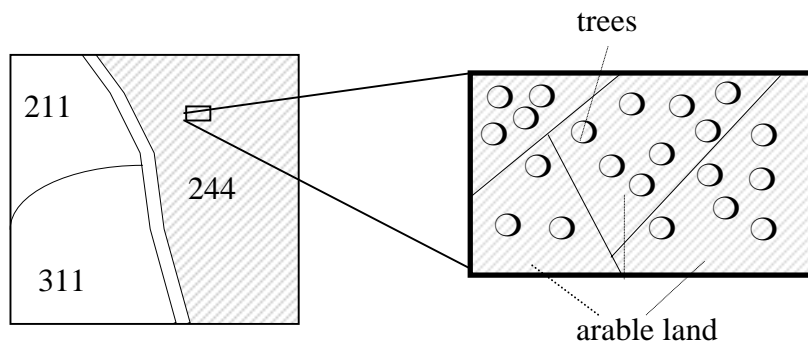
ANNEX 2

CLC2000 Metadata - Working unit level, Country level

CLC2000 METADATA

– Working unit level
- Please provide a single summary file for each interpretation sheet -

Title of working unit:	

A: GENERAL INFORMATION

Contractor:		**Contracted:**	
Address:		**Address:**	
Phone:		**Phone:**	
Fax:		**Fax:**	
Responsible:		**Project leader:**	
E-mail:		**E-mail:**	

1. IMAGE2000 data used

Landsat ETM or other scene(s)				
Satellite & Sensor	**Path-**	**Row**	**Date (m/d/y)**	**Remark (e.g. clouds)**

2. Topographic maps used *(indicate in remark if digital)*

Scale	Sheet id	Title/Name	Year of production	Year of last revision	Remark

3. Other ancillary data used (thematic data, satellite images, aerial photos, city maps, vegetation maps)

Id	Data source/type	Title (if relevant)	Date of production (m/d/y)	Scale (spatial detail)	Remark

4. Photointerpreter(s)

Name	Affiliation	Phone	E-mail	interpretation		
				start (m/d/y)	**end (m/d/y)**	**no. of days**

B: DATA PREPARATION

1. Checking and systematic correction of IMAGE90 data *(optional)*

Landsat ETM or any other satellite scenes used (e.g. SPOT)							
Satellite & Sensor	path-	row	Date (m/d/y)	Max. systematic geom. error (m)	*(optional)* Checked & corrected (name)	*(optional)* Date (m/d/y)	*(optional)* Reference data

2. Checking and systematic correction of CLC90 data

Corrections	Type of correction	Checked and corrected by	Date (m/d/y) Start	end	Remarks
Geometrical errors	Systematic correction				
	Local correction				
Thematic errors	Logical coherence*				
	Semantic accuracy** and exhaustiveness***				

* = compliance with internal rules of CLC (100 m, 25 ha) according to Technical Guidelines and Addendum
**= interpretation according to CLC nomenclature;
*** = details are appropriate

3. Verification and acceptance on national level

Date (m/d/y)	Accepted by	Signature	Remark

C: INTERPRETATION OF CHANGES AND CREATION OF CLC2000

1. Photo-interpretation and internal quality control

Date of submission (m/d/y)	Control made by	Date of control (m/d/y)	Remark (errors, corrections, etc.)

2. Field checking (*if carried out*)

Date (m/d/y)	Itinerary (main settlements crossed on the working unit)	Problems checked and main conclusions

3. Border matching with neighbour working units or countries

working unit /Country	Controlled and corrected by	Date (m/d/y)	Remark

D: FINAL TECHNICAL QUALITY CONTROL

1. Control of topology, unnecessary boundaries, 25 ha limit, invalid codes and invalid changes

	Date (m/d/y)	Controlled by	Remark
CLC Changes			
CLC90			

2. Verification and acceptance

	Date (m/d/y)	Name	Signature	Remark
National level				
CLC2000 technical team				

E: SOFTWARE / HARDWARE

Work phase	Software used	Hardware used
Systematic geometric correction of IMAGE90		
Systematic geometric correction of CLC90		
Topological and thematic corrections of CLC90		
Interpretation of changes		
Creation of CLC2000		
Technical quality control		
Database integration (border matching)		

CLC2000 METADATA – Country level

Country	

1	**LITERATURE, REPORTS**	
1.1	List of literature.	All documents and papers, used for the definition of metadata parameters.
2.	**NATIONAL PROJECT DESCRIPTION**	
2.1	General Info (Objectives, Goals, National Specifics, Comments For User)	
2.2	Project Organisation, Organisation Chart	
2.3	Funding	
2.4	National Team – List of Subcontractors	
2.5	Validation Team	
2.6	Time Schedule	
2.7	Hardware	
2.8	Software	
3	**IMAGE 2000 (Image2000 team)**	
	Image Identification	Dataset Title <Path/row/set/type combination>
	Acquisition	Date, Path, Row, Set, Type, Scene coords
	Ortho-rectification	Method, Who, GCP number, RMSEx, RMSEy, overall RMSEp
	Image enhancement	Used SW, Who, Filtering, Merging, Composition
	Quality control	Procedure description, Who, Date, Results, External geometry quality
4.	**DATA DESCRIPTION**	
4.1	**Metadata Reference**	
4.1.1.	National identifier for the Dataset	An identifier used within the national body responsible for the dataset management. It may be textual, alphanumeric or numeric.
4.1.2.	Contact	The Authority responsible for the metadata structure development and management.
4.1.3.	Last Metadata Update Date	Date when the metadata was created or last updated.
4.2	**General Information**	
4.2.1.	Dataset Title	The name by which the dataset is known, ie the explicit name of the geographic dataset, to sufficiently identify it to the users. This is the official name given to the dataset by the EEA. The name should be unique.
4.2.2.	Abstract Describing Dataset	A brief textual description of the dataset that summarises its content. This summary may include a description of the purpose of creating the dataset; a general description of the spatial extent of the data; listing of attributes of the data and its relationship with other datasets.
4.2.3.	Dataset Topic Category	This will be a word(s) or phrase(s) in common usage that describes the subject or detail within the dataset. These keywords facilitate searching of the dataset.
4.2.4.	Spatial Data Format	Spatial data format(s) used within the dataset.
4.2.5.	Dataset Scale	Range of scales within each applications of the dataset will be suitable.
4.2.6.	Coordinate Reference System	Identifier of the georeferencing system(s) used within the geographic dataset, allowing to get details of the geodetic reference system(s), ellipsoid and datum.

4.2.7.	National Responsible Party	Details of contact points for the dataset. This will include details of the dataset owner(s) or respective URL links.
4.2.8.	Main Contractor	Contacts of the person/institution responsible for the dataset creation.
4.3	**Data extent**	
4.3.1	Name of Spatial System	This element defines the system to which the boundary coordinates of the described dataset are related, i.e. the spatial system used to describe the extent of the dataset.
4.3.2	West Bounding Coordinate	The coordinate defining the western edge of the bounding rectangle in which the area of the dataset lies.
4.3.3	South Bounding Coordinate	The coordinate defining the southern edge of the bounding rectangle in which the area of the dataset lies.
4.3.4	East Bounding Coordinate	The coordinate defining the eastern edge of the bounding rectangle in which the area of the dataset lies.
4.3.4	North Bounding Coordinate	The coordinate defining the northern edge of the bounding rectangle in which the area of the dataset lies.
4.3.5.	Period Start Date	Specifies the date on which the first data in the dataset was collected.
4.3.6.	Period End Date	The last date on which data contained in the dataset was captured.
4.3.7.	Number of classes	Specifies the number of classes from the standard CLC nomenclature present in the dataset.
4.4.	**Data Quality**	
4.4.1.	Overall Positional Accuracy (CLC2000 Technical Team)	An assessment of the accuracy of the location of the spatial objects in the dataset relative to their real positions on the earth's surface. The respective parameter showing the horizontal accuracy will be defined including an methodological explanation on how to get this value.
4.4.2.	Attribute Accuracy (CLC2000 Technical Team)	This element describes a measurement of the attribute values assigned to dataset features relative to their true 'real world' values. It will be defined including a methodological explanation on how to get this value.
4.4.3.	Logical Consistency	This element will reveal the level of completeness and accuracy of polygon labelling; gaps and overshoots in line segments and polygon boundary closures.
4.5	**Data access/ Data dissemination**	
4.5.1.	Contact	Contact to the persons/institutions responsible for the dataset dissemination, incl. URL link where more detailed information on dataset accessibility can be obtained
4.5.2.	Procedure	Description of the data ordering and delivery service. The description includes instructions for the ordering of the data and the expected time-scale for the delivery of the data.
4.5.3.	Conditions	Conditions or limitations of the dataset usage.

ANNEX 3

Agreement on use and dissemination of I&CLC2000 products

Use and dissemination of I&CLC2000 products

Agreement between EEA and the participating Member State on a common policy for the use and the dissemination of I&CLC2000 products

Parties to the agreement

The present agreement is concluded between:

1. the European Environment Agency – on one side, as responsible body in charge with continuing the work (started under Decision 85/338/EEC - CORINE programme), as referred in art.2 (i) of Council Regulation 1210/90 as amended by the Council Regulation 933/1999 on the establishment of the European Environment Agency and European Environment Information and Observation Network, and

2. The…………..........…(organisation/organisations) of…............. (country) on the other side, as nominated national authority in charge with I&CLC2000 project coordination and products' dissemination.

Definitions

Within the context of the present agreement :

- *'the I&CLC 2000 products'* consists of the digital data;
- *'third party'* represent any other user of I&CLC2000 products apart from European Commission, EEA and the national authority in charge with I&CLC2000 project in the participating Member States.
- *' commercial use'* represent the use and dissemination of I&CLC2000 products with the aim of obtaining a financial benefit through their commercialisation.

Object of the agreement

The use and dissemination of the I&CLC2000 products represent the scope of the present agreement.

I&CLC2000 data ownership

I&CLC2000 is a joint co-financed project by the European Community and each participating Member State. As a consequence, the two parties represent the co-owners of the products derived from this activity (except for product 1 where the copyright remains with the providers of ortho-corrected satellite images). The I&CLC2000 project is managed by EEA together with JRC.
The final aim of I&CLC2000 data is to serve both European Community policy needs as well as national interests and respond in a commonly agreed way to the general needs for public information.

EC policy concerning the access to environmental information

According with the provisions of the Council Directive 90/313/EEC on the freedom of access to information on the environment, the Community and the Member Countries have the obligation to improve public access to information held by environmental authorities. Within this overall context, the present agreement intends to establish for the I&CLC2000 project a good public visibility by ensuring the widest possible use and dissemination of the expected products to all interested parties.

EEA role in environmental data dissemination

The EEA is jointly with JRC the coordinating body for the I&CLC2000 project and has according with its founding regulation responsibility for environmental data dissemination. In carrying this task EEA is following the general EU policy concerning information dissemination aiming as far as possible to the free and wide dissemination of its products.

I&CLC2000 products

The main outputs of I&CLC2000 project will be as follows:

Product 1:
Individual satellite scenes: ortho-rectified using national projection, resampling with cubic convolution, all spectral bands, 25 m resolution (12.5 m panchromatic band), in BIL format, including metadata.

Product 2:
National IMAGE2000: national mosaic by basic working unit (map sheet) using national projection, all spectral bands 25 m resolution (12.5 m panchromatic band), including metadata and image layer with boundaries for stitching between individual scenes, in BIL format.

Product 3:
National CLC2000: national land cover database for 2000 as result of the data collection and processing exercise performed by each national team including generalisation to 44 classes, 25 ha minimum mapping unit, in geographical coordinates, in vector format.

Product 4:
National land cover database on land cover changes larger than 5 ha between CLC1990 and CLC2000, in geographical coordinates, in vector format.

Product 5:
European IMAGE2000: European satellite image reference mosaic for 2000 using a European projection, all spectral bands, 25 m resolution (12.5 m panchromatic band), including metadata and image layer with boundaries for stitching between individual scenes, in BIL format.

Product 6:
European CLC2000: European land cover database for 2000 as result of mosaic of national datasets, including 44 classes, 25 ha minimum mapping unit, in geographical coordinates, in vector format.

Product 7:
European database on land cover changes larger than 5 ha between CLC1990 and CLC2000, in vector format. To ensure a wide use and facilitate a broad dissemination of the I&CLC2000 products, a number of aggregated products will be produced from the I&CLC2000 main outputs at European level (namely products 6 and 7).

Most of the users are interested in grid-based land cover datasets allowing easy data handling for analysis of the land cover information at European scale. The following products will be derived:

Product 8:
CORINE land cover 250 m grid-based database as a result of a vector to raster conversion.

Product 9:
CORINE land cover 100 m grid-based database as a result of a vector to raster conversion.

Product 10:
CORINE land cover 1km² land cover statistics.

Product 11:
National CORINE land cover metadata.

Product 12:
European CORINE land cover metadata

Use of I&CLC2000 products

All the above-mentioned products are addressing in particular the needs of Member States and European Community bodies, including EEA. Therefore, for all products the national authorities in charge of I&CLC2000, European Commission services and EEA are granted unlimited use beyond I&CLC2000 project.

Dissemination of I&CLC2000 products

Neither the European Commission nor the EEA are aiming to achieve any commercial benefit from the dissemination of the above-mentioned products. The sole purpose the EC and EEA will be using the above-mentioned products is to better respond to the Member States needs by ensuring a realistic and coherent scientific support to EU policy formulation and implementation processes.

At the same time, all products might be of relevance for a broader audience, therefore they will be opened for dissemination to third parties, as follows:

a) For non-commercial purposes:

- by the participating Members States for all products through the national authority in charge of I&CLC2000 project;
- by the EEA through its own services, for the European products (namely for products 8, 9, 10 and 12 and, subject to prior approval by the concerned Member State for product 6 and 7).

The I&CLC2000 products will be made available to the third parties for non-commercial use at a marginal production and dissemination costs.

b) For commercial purposes:

- by the Member States for all products (except product 1) through the national authority in charge of I&CLC2000 project;
- by the provider of the ortho-corrected satellite images for product 1.

Monitoring the use of I&CLC2000 products

For monitoring the use of the I&CLC2000 products by the third parties, a standard agreement form will be requested for signature before enabling accessing/delivery of the products (see attached form). Each request has to be duly justified in terms of potential use and regular feed-back on possible applications provided. EEA and the national authorities in charge with I&CLC2000 in each Member State are obliged to inform each other about the use by third parties, especially in terms of possible applications developed and findings related to the used products.

In case of commercialisation of I&CLC2000 products to third parties, both the Member States (through the national authority in charge with I&CLC2000 project) and the providers of ortho-corrected satellite images (for product 1) are expected to inform each other and EEA on the possible applications developed and the findings related to the used products.

Entry into force

The present agreement enters into force upon the date of signature by both parties.

Duration

The present agreement is concluded for an indefinite period.

European Environment Agency   *Name National authority (Member State)*

Date: *Date:*

Name: *Name:*

Signature: *Signature:*

End user agreement for the use of I&CLC2000 products by third parties for non-commercial purposes

1. The purpose of the present agreement is twofold:
- to facilitate the dissemination of the I&CLC2000 products to third parties exclusively for non-commercial purposes, and
- to monitor the further use of the digital data.

2. The I&CLC 2000 products, subject to dissemination are, as follows:

Product 1:
Individual satellite scenes: ortho-rectified using national projection, resampling with cubic convolution, all spectral bands, 25 m resolution (12.5 m panchromatic band), in BIL format, including metadata.

Product 2:
National IMAGE2000: national mosaic by basic working unit (map sheet) using national projection, all spectral bands, 25 m resolution (12.5 m panchromatic band), including metadata and image layer with boundaries for stitching between individual scenes, in BIL format.

Product 3:
National CLC2000: national land cover database for 2000 as result of the data collection and processing exercise performed by each national team including generalisation to 44 classes, 25 ha minimum mapping unit, in geographical coordinates, in vector format.

Product 4:
National land cover database on land cover changes larger than 5 ha between CLC1990 and CLC2000, in geographical coordinates, in vector format.

Product 5:
European IMAGE2000: European satellite image reference mosaic for 2000 using a European projection, all spectral bands, 25 m resolution (12.5 m panchromatic band), including metadata and image layer with boundaries for stitching between individual scenes, in BIL format.

Product 6:
European CLC 2000: European land cover database for 2000 as result of mosaic of national datasets, including 44 classes, 25 ha minimum mapping unit, in geographical coordinates, in vector format.

Product 7:
European database on land cover changes larger than 5 ha between CLC1990 and CLC 2000, in vector format.

Product 8:
CORINE land cover 250 m grid-based database as a result of a vector to raster conversion.

Product 9:
CORINE land cover 100 m grid-based database as a result of a vector to raster conversion.

Product 10:
CORINE land cover 1km² land cover statistics.

Product 11:
National CORINE land cover metadata

Product 12:
European CORINE land cover metadata

3. The products will be disseminated upon request, by the following Competent Authorities in charge with I&CLC 2000 as follows:

- by the national authority in charge with I&CLC 2000 in each Member State for all products.
- By EEA, through its own services for the European products (namely for products 8, 9, 10 and 12 and subject to prior approval by the concerned Member State for product 6 and 7).

4. The permission to use the above-mentioned products is granted exclusively for non-commercial purposes and the applicant is forbidden to further disseminate the received products to third parties.

5. A marginal cost for production and dissemination can be charged for each product by the Competent Authority requested to deliver the products.

6. Upon receiving the products, the applicant has the following obligations:
- to duly motivate the request describing the foreseen applications (per sectors and key environmental areas);
- to provide full coordinates of the entity using the products and the responsible persons in charge;
- to report on any findings related to the products received (errors, omissions) and assist the competent authorities in improving the respective products;
- to report on all applications developed based on the data provided and supply complete information and relevant materials produced on this basis to the Competent Authority;
- to ensure that the results of the project for which the products requested are available to EEA and the concerned Member State at a marginal products and dissemination costs;
- to acknowledge the data source in all related publications or other dissemination media;
- to submit to the Competent Authority any request for commercial purpose distribution of I&CLC 2000 products addressed to them and inform the potential users that the Competent Authority in each Member State and the provider of ortho-corrected satellite images (for product 1) are the responsible bodies in charge with the commercial dissemination of the I&CLC2000 products;
- to refrain from any actions/activities affecting the full exercise of the ownership rights and of the copy rights by the competent authorities in relation to the I&CLC2000 products.

7. The applicant acknowledge the terms and conditions for receiving the I&CLC 2000 products and agrees to comply fully with these requirements.

Applicant name:

Address:

Date:

Signature :……………………

Standard request form for the use of I&CL2000 products by third parties for non - commercial purposes

1. The applicant (full coordinates) …………………………………………………………………….
represented through (full name)…………………………………………………………………….
request the permission from the Competent Authority (full name) ………..(country)…………
to receive the following I&CLC 2000 products (please tick):

❑ No. 1 (Ortho-corrected images)   ❑ No. 7 (European LC changes 1990-2000)

❑ No. 2 (National IMAGE2000)   ❑ No. 8 (European CLC2000 250 m grid)

❑ No. 3 (National CLC2000)   ❑ No. 9 (European CLC 2000 100 m grid)

❑ No. 4 (National LC changes 1990-2000) ❑ No. 10 (European CLC2000 1 km² statistics)

❑ No. 5 (European IMAGE2000)   ❑ No. 11 (National metadata)

❑ No. 6 (European CLC2000)   ❑ No. 12 (European metadata)

2. The products requested will be exclusively used for non-commercial purposes and not further disseminated to third parties.

3. The key economic sectors where the I&CLC2000 requested products are envisaged to be used are as follows (please tick the areas):

❑ Agriculture   ❑ Public awareness

❑ Demography   ❑ Research

❑ Energy   ❑ Telecommunication

❑ Environment   ❑ Tourism

❑ Education   ❑ Transport

❑ Forestry   ❑ Households

❑ Physical planning   ❑ Health

                                      ❑ Others (eg. base mapping)

4. In case the requested products are addressing environmental issues, please specify the key environmental domains the I&CLC 2000 products are envisaged to be used (please tick):

- ❑ Air pollution
- ❑ Climate change
- ❑ Ozone depletion
- ❑ Nature conservation & biodiversity
- ❑ Water management
- ❑ Waste management
- ❑ Coastal zone management

- ❑ Urban environment
- ❑ Soil degradation
- ❑ Hazardous substances
- ❑ Marine environment
- ❑ Transboundary issues
- ❑ Others (please specify)

5. The applicant agrees and will fully comply with the terms and conditions set up in the ´End User Agreement for the use of I&CLC2000 products by third parties for non-commercial purposes', attached to the present request form.

6. Comments:……………………………………………………………………

Name:

Date:

Signature:

ANNEX 4

Suggested framework for developing the national CLC2000 project proposal

SUGGESTED FRAMEWORK FOR DEVELOPING THE NATIONAL CLC2000 PROJECT PROPOSAL

A. Rationale of the national project proposal

In legal terms, the national project proposal will become integral part of the contract to be concluded between your country and EC, as annex together with the agreement on data use and dissemination. Furthermore this document will justify the national financial contribution amounting at least 50% from the total cost of the national CLC 2000project.

In content terms, the national project proposal should focus on the specific aspects related to the country situation/needs and materials available. All general aspects are already addressed in the General ToRs prepared by EEA and disseminated to you (annex 1). In case no specific aspects apply, please refer to the general ToRs. The document needs to be clear and simple (max. 10 pages) and easy to be monitored both in the technical and financial development of the project. The quarterly progress report will follow this document and report on progress, problems encountered and future plans.

The chapters suggested as well as the points to be developed inside are indicative. For reasons of consistency and comparability a close approach on the list of contents is however recommended. The major and final aim of the national project proposal is to better respond to your specific needs and facilitate the national management.

B. Suggested Table of contents:

1. Background

2. Specific conditions for……. (country)

3. The production process and related tasks

4. Project organization

5. National products

6. Time schedule for project execution

7. Reporting

8. Contacts

9. Related projects

10. References

11. Financial proposal

C. Suggestions for the chapters'content (indicative):

1. BACKGROUND

- Reference to the previous CLC project and institutions involved,
- the national need for update,
- general characteristics of the country (optional)

2. SPECIFIC CONDITIONS FOR……. (COUNTRY)

- if a CLC inventory already exists;
- method applied (eventually type of conversion or generalization needed);
- basic input material (databases) to the project;
- time connection with other related projects

3.THE PRODUCTION PROCESS AND RELATED TASKS

- level of detail at which the project will be carried out (eventually more detailed for national needs);
- production system chosen (preparation of data, classification and interpretation, production thematic layer, generalization, vectorisation, thematic accuracy assessment, metadata etc.);
- data sources to be used (satellite data, national maps, ancillary data);
- quality assurance.

4. PROJECT ORGANISATION

- project management and control (national steering committee);
- progress meetings;
- infrastructure available;
- QA/QC at national level along project phases;
- Staff allocation/phases/tasks (for management, production etc).

5. NATIONAL PRODUCTS

List the products expected at national level (following the list mentioned in the general ToRs for CLC2000, and if the case all additional products expected)

6.TIME SCHEDULE FOR PROJECT EXECUTION

- per year (eg. 2001, 2002, 2003) and
- per project phases (project management, data preparation, production, QC, metadata, etc).

7. REPORTING

- quarter progress reports, final report
(containing status of work, problems encountered/solutions adopted, future plans, financial aspects, etc.)

8. CONTACTS

- institutions involved (national competent authority, other sub-contractors);
- full coordinates of the institutions/staff involved;

9. RELATED PROJECTS

- present/list relevant projects underway at national level or as cooperation with other partners of relevance for CLC2000;
- list expected outputs of these projects possible to be used/ or benefit from CLC2000 project;
- indicate their time table in order to better connect with CLC2000 and share results.

10. REFERENCES

List reference documents to be used during the project development

11. FINANCIAL PROPOSL

Estimate national project costs per phases and per years of development (to be easy monitored through quarterly progress reports).

LIST OF ABBREVIATIONS

AGSA	Advisory Group on Spatial Analysis
CLC	CORINE Land Cover
CLC90	CLC inventory for the 1990s
CLC2000	CORINE Land Cover update 2000
CNTR_MD	Country level CLC2000 Metadata
COGI	Commission Interservice Group on Geographic Information
CORINE	Co-ordination of information on the Environment
DB	Database
DEM	Digital Elevation Model
DG AGRI	Directorate General for Agriculture
DG ELARG	Directorate General for Enlargement
DG ENV	Directorate General for Environment
DG RECH	Directorate General Research
DG REGIO	Directorate General Regional
DG TREN	Directorate General Transport and Energy
EEA	European Environment Agency
EESDI	European Environmental Spatial Data Infrastructure
EIONET	European Environment Information and Observation Network
ESDP	European Spatial Development Perspective
ETC	European Topic Centre
ETC-TE	European Topic Centre on Terrestrial Environment
ETRS	European Terrestrial Reference System
EU	European Union
FAQs	Frequently asked questions
GCP	Ground Control Points
GIS system	Geographical Information System
GISCO	Geographical Information System for the Commission
I&CLC2000	IMAGE2000 & CLC2000 project
IMAGE90	Satellite image coverage for the reference year 1990
IMAGE2000	Satellite image coverage for the reference year 2000
INSPIRE	Infrastructure for Spatial Information in Europe
IP	Image Processing
ISO	International Organisation for Standardisation
JRC	Joint Research Centre
LACOAST	Land Cover changes in European coastal zones
LANDSAT ETM	U.S. Landsat satellite with Enhanced Thematic Mapper
LC	Land Cover
LUCAS	Land Use/Cover area framework statistical survey
MAPU_MD	Map unit level CLC2000 Metadata
MEGRIN	Multi-purpose European Ground Related Information Network
NATURA2000	European ecological network of special areas of conservation under the EU Birds directive and the Habitats directive
NRC	National Reference Centre
Phare accession countries	Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia
PLGN_MD	Polygon level CLC2000 Metadata
QA/QC	Quality assurance/Quality control
SABE	Seamless Administrative Boundaries of Europe
SPOT	Système Probatoire d'Observation de la Terre
TERM	Transport and Environment Reporting Mechanism
TG	Technical guidelines