



This project is funded by the European Union

## ENI SEIS II East

Implementation of the Shared Environmental Information System (SEIS) principles and practices in the ENP East region

# Regional Conference on the outcome of the CLC-Pilot project, potential benefits and way forward in ENI-East countries

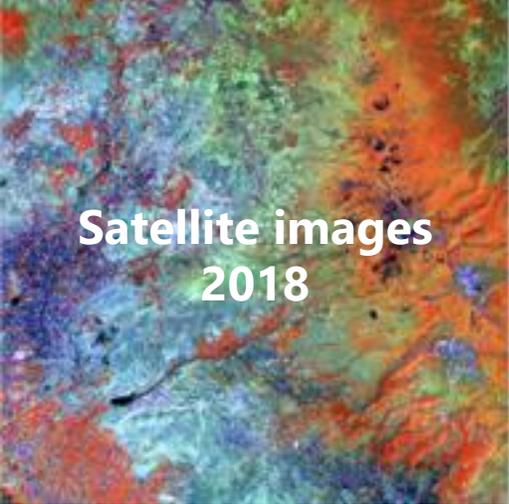
## *Armenia*

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*Samvel Nahapetyan, "Geoinfo" LLC*

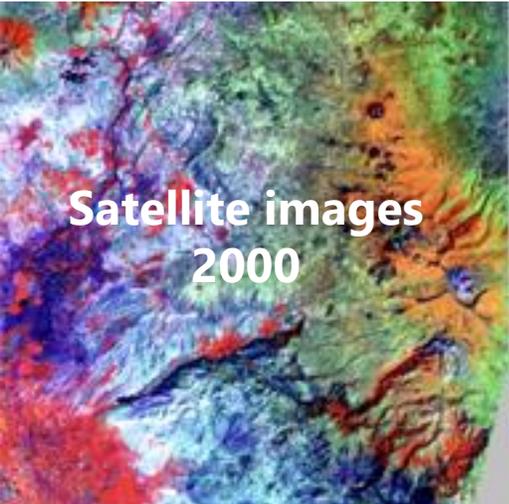


# 1. Steps of implementing the CLC-pilot

Sensor	Acquisition date (m/d/y)
Sentinel 2-A	04/07/2018
Sentinel 2-A	05/17/2018
Sentinel 2-B	07/11/2018
Sentinel 2-B	04/27/2019
Sentinel 2-A	07/31/2019
Sentinel 2-B	09/24/2018
Sentinel 2-B	09/29/2019
Sentinel 2-B	10/14/2019

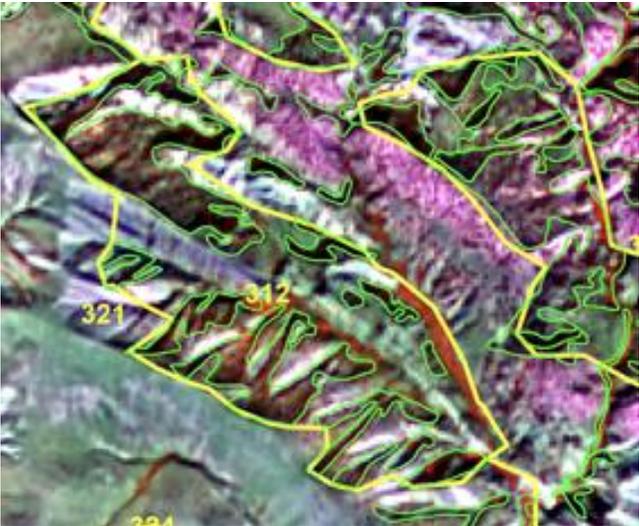


Sensor	Acquisition date (m/d/y)
Landsat-7 ETM	05/09/2000
Landsat-7 ETM	06/03/2000
Landsat-7 ETM	08/13/2000
Landsat-7 ETM	08/22/2000
Landsat-7 ETM	09/23/2000
Landsat-7 ETM	10/16/2000



### Reference data

- Forestry maps
- Maps of specially protected areas
- Cadastral maps



An example of using forestry maps as a reference data



# 1. Steps of implementing the CLC-pilot

## First training course

12-13 February, 2020

CORINE Land Cover introduction

The standard European CLC nomenclature introduction  
CLC2018 Support Package introduction

## Second (remote) training course

15,18 May, 2020

Principles of mapping CLC changes

Practical part (mapping exercises by using InterChange)

## Status layer mapping

Photo interpretation of the CLC2018  
status layer over the pilot area

## CLC-change<sub>2000-2018</sub> layer mapping

Photo interpretation of the CLC-change<sub>2000-2018</sub>  
layer over the pilot area

## Internal quality control

Internal quality checking has been carried out  
by an independent photo interpreter

## External quality control

Verification reports on both layers were  
provided by ETC-ULS experts

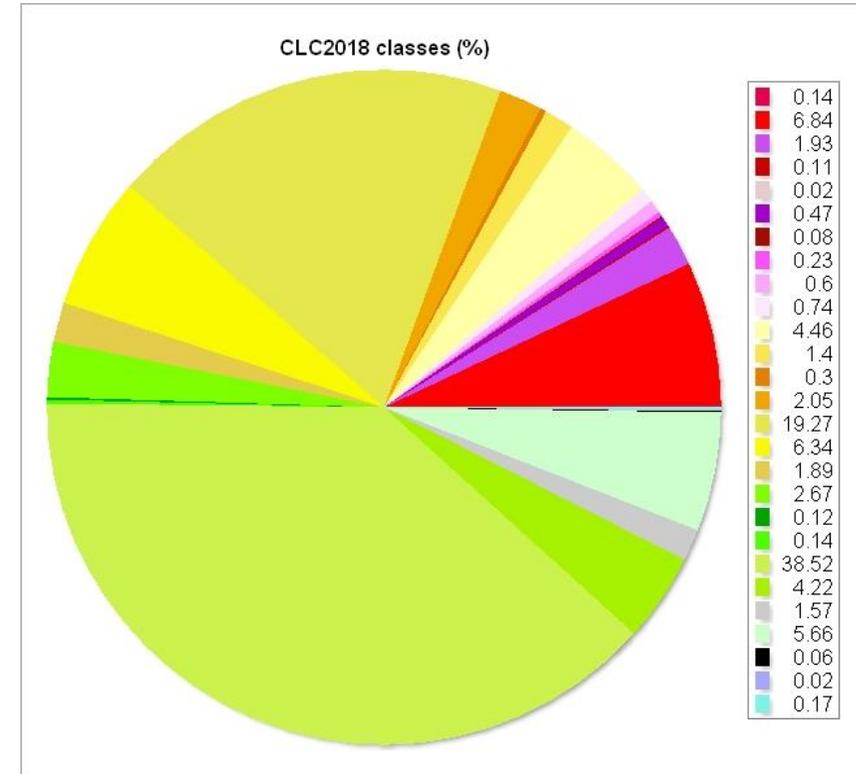
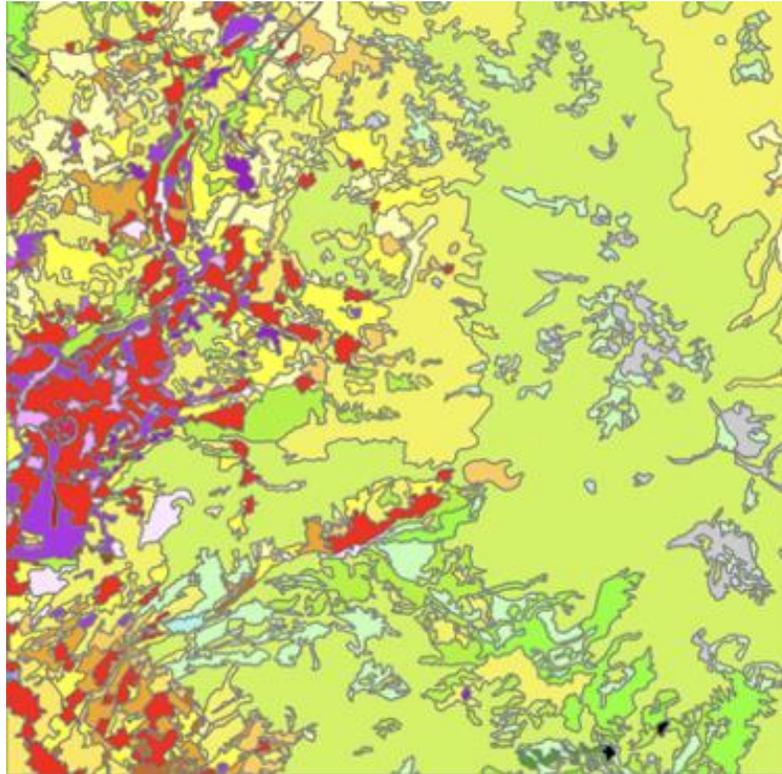
## Methodology

Mapping has been conducted on approved pilot area  
(50km x 50km, East part of Yerevan, and its surroundings, total area: 250197 ha)  
according to all principles described in "CLC2018 Technical Guidelines"



## 2. Main results of the CLC-pilot

### CLC2018 map of the pilot area and area statistics

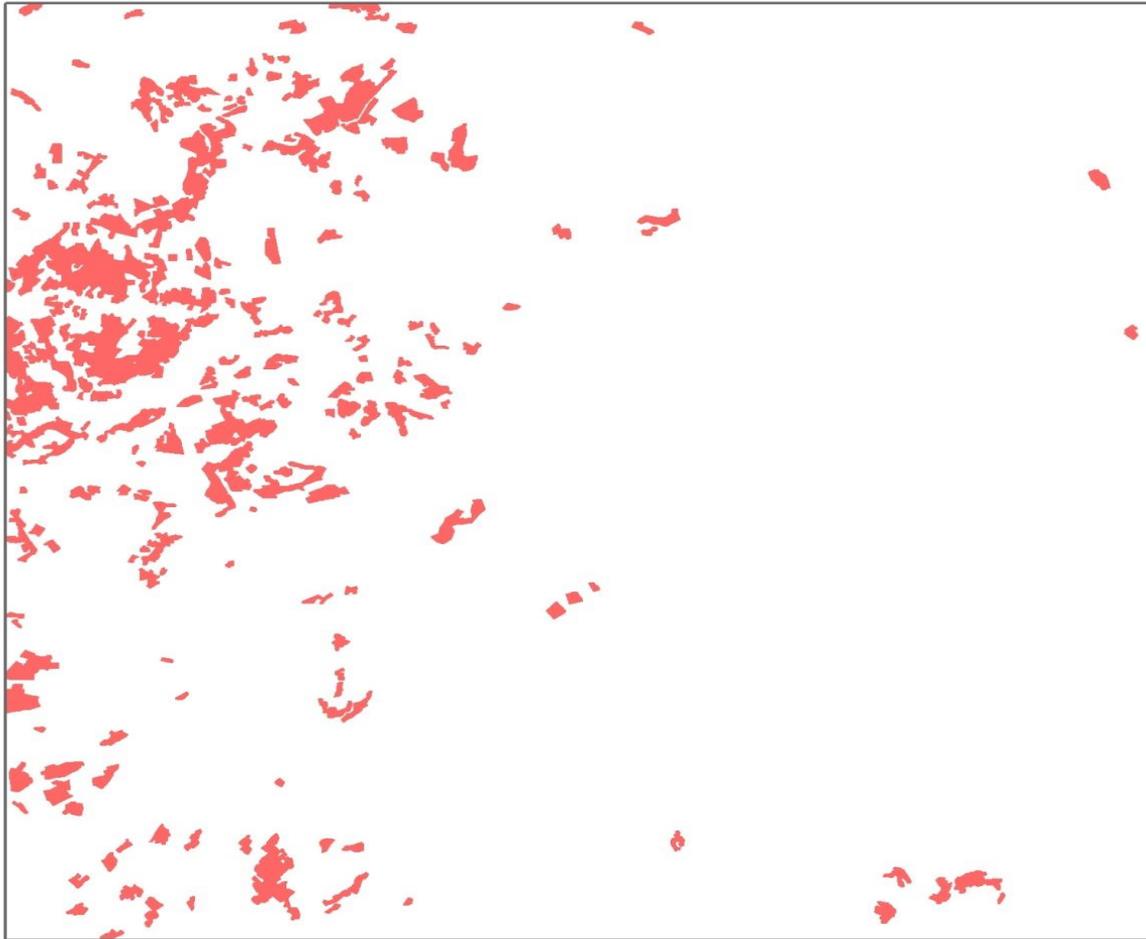


The area is dominated by **natural grassland** (39%), **pastures** (19%), **residential areas** (7%), **agriculture mosaic** (6%), **sparsely vegetated areas** (6%), **non-irrigated arable land** (4%), **transitional woodland** (4%) and **broadleaved forests** (3%)



# 2. Main results of the CLC-pilot

## Distribution of CLC-changes<sub>2000-2018</sub> over the pilot area and the dominating change types



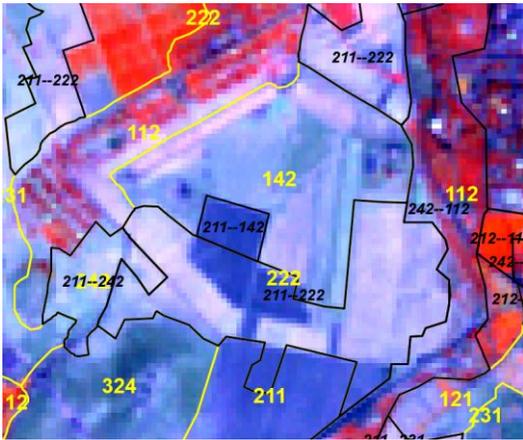
Change (2000-2018)	Process	%
242-231	Complex cultivation patterns turned into pastures (associated to abandonment of agriculture)	12.47
211-222	Non-irrigated arable land turned into fruit trees and berry plantations (increase of fruit tree and berry plantations)	10.55
211-231	Non-irrigated arable land turned into pastures (associated to abandonment of agriculture)	10.48
212-242	Permanently irrigated land turned into complex cultivation patterns (partial abandonment of irrigation)	5.54
211-242	Fruit and berry plantations turned into complex cultivation patterns (change in agriculture practice)	5.54
242-112	Complex cultivation patterns turned into discontinuous urban fabric (urban sprawl, loss of agriculture land)	4.51
221-242	Vineyards turned into complex cultivation patterns (decrease of vineyards)	3.74
242-222	Complex cultivation patterns turned into fruit trees and berry plantations (increase of fruit trees and berry plantations)	3.74

\* Only the largest change types are shown in the table

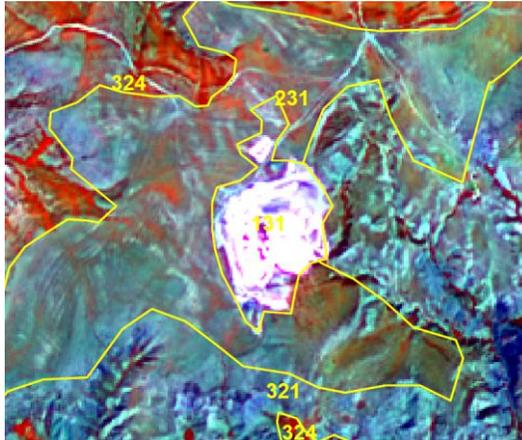
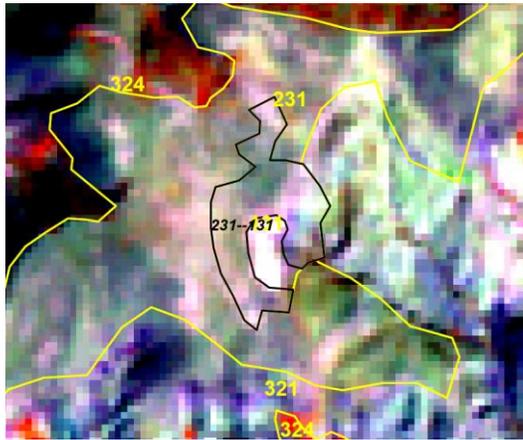


# 2. Main results of the CLC-pilot

Some examples of CLC-changes (left image: 2000, right image: 2018)

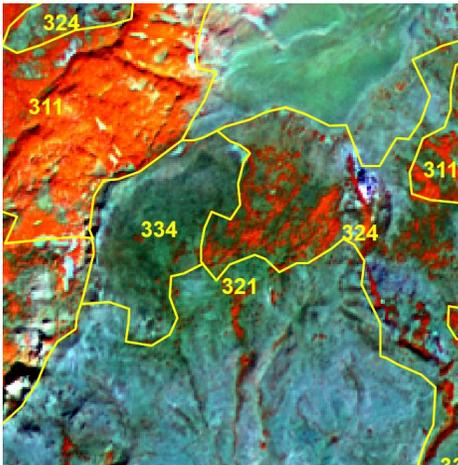
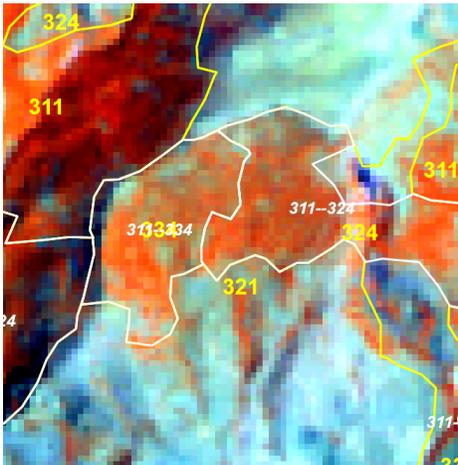


**Conversion of arable land (211) to orchards (222)**



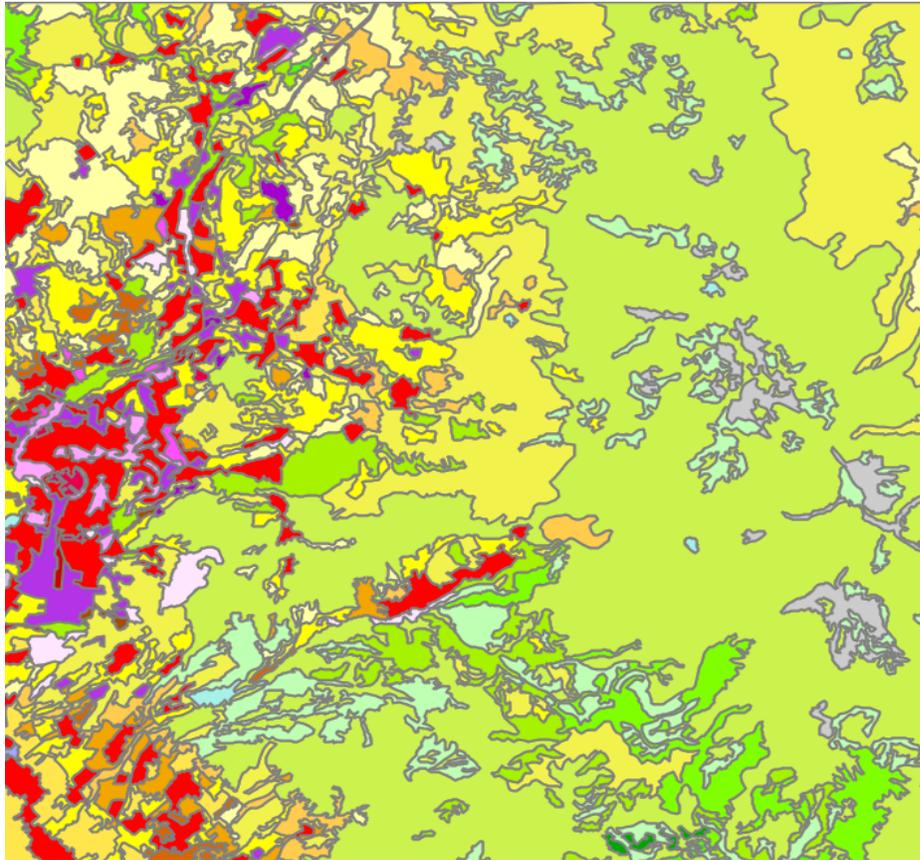
**Conversion of pasture (231) to mining site (131)**

**Conversion of forest (311) to burnt area (334)**



## 2. Main results of the CLC-pilot

### CLC2000 map of the pilot area (backdated)

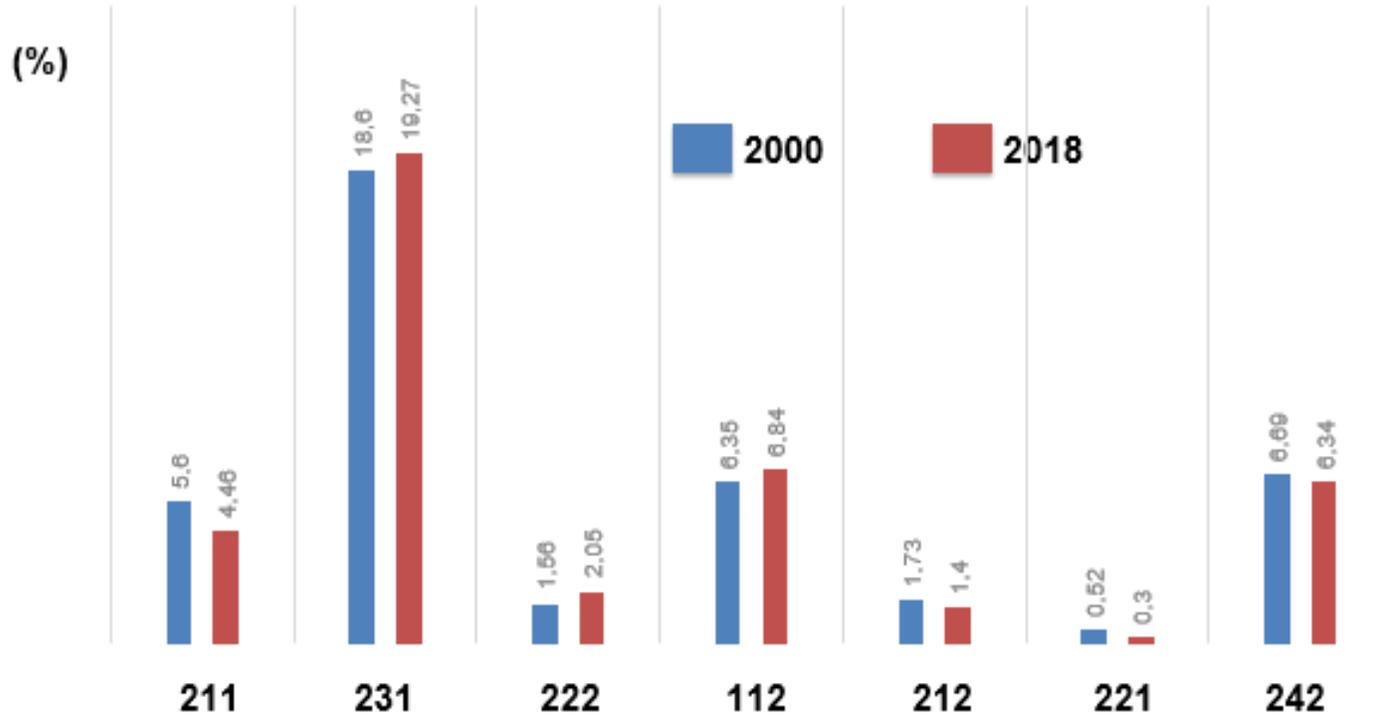


*The CLC2000 map was generated automatically  
by combining photo-interpreted  
CLC2018 and CLC-change<sub>2000-2018</sub> layers.*



# 2. Main results of the CLC-pilot

## Comparison of 2000 and 2018 land cover of the pilot area (%)



CODE	CLC land cover class
112	Discontinuous urban fabric
211	Non-irrigated arable land
212	Permanently irrigated land
221	Vineyards
222	Fruit trees and berry plantations
231	Pastures
242	Complex cultivation patterns

\* Only the dynamic classes are shown in the table

**Stable classes:** forests (311), natural grassland (321), transitional woodland (324), sparsely vegetated areas (333)

**Expanding classes:** residential areas (112), fruit trees (222), pastures (231)

**Shrinking classes:** non-irrigated arable land (211), permanently irrigated land (212), vineyards (221), agriculture mosaics (242)



# 3. Difficulties encountered in realising the CLC-pilot

## Shortage of time and COVID-19.

Few field checking activities had been carried out only.

## Adapting to InterChange software

During the first stage of mapping process, the ArcMap software was used in parallel, which caused numerous topological errors. Much time and efforts were needed to eliminate these errors.

## Interpretation of pastures (class 231) was difficult, as three sub-classes needed to describe the existing situation:

Grass covered areas around settlements without any use

Pasture, hayfield used for agricultural purposes

Pasture, permanent grassland for hay harvesting



# 5. Potential use of CLC in the country

The availability of CLC land cover maps for the whole area of Armenia (once every 6 years) would contribute significantly with practical assistance to the following spheres:

## Environment:

- Detection of the natural and anthropogenic changes in forests and specially protected areas,
- Detection of land cover changes due to mining activities,
- Observation of the changes of legal and illegal dump sites,
- Detection of boundary changes of water bodies,
- Detection of degraded areas of natural landscapes,
- Land Cover Change statistics data will help to evaluate and find the cause-and-effect relationship of changes.

## Agriculture:

- Monitoring and statistical analyzes of spatial changes of vineyards and/or arable lands,
- Monitoring and qualitative and quantitative analyzes of irrigated and non-irrigated arable lands,
- Detection of actual changes in agricultural lands, observation of the change trends, that will help to elaborate development strategies for agriculture,
- Register those areas that are not used anymore for agriculture.



# 5. Potential use of CLC in the country

The availability of CLC land cover maps for the whole area of Armenia (once every 6 years) would contribute significantly with practical assistance to the following spheres:

## Urban development and territorial administration:

Monitor and analyse the expansion of settlements (new construction areas) and the trends of urban sprawl.

## Scientific researches based on CLC data:

- Soil erosion assessment,
- Assistance to surface and ground water studies,
- Assistance to landscape planning activities.



## 6. Plans for continuation of CLC mapping

- National technical team is working with the Ministry of Environment to write proposal to extend CLC for the whole Armenia.

*Collection of applications of CORINE Land Cover, relevant to the national environmental policy is in progress.*

*This will be also beneficial for other ministries (Ministry of Economy, Ministry of Territorial Administration and Infrastructure) and for the Academia sector of RA.*

- “Hydrometeorology and monitoring center” SNCO and “Geoinfo” LLC are appropriate technical partners to continue CLC in Armenia.

Experts of these institutions were trained by ETC/ULS and developed the necessary technical skills during the ENI-CLC pilot project.

