MePAR – The Hungarian Land Parcel Identification System and its LU/LC Layer

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http://www.fomi.hu
1. The building up and maintenance of Land Parcel Identification System
Common Agricultural Policy (CAP)

• The CAP is a system of European Union agricultural subsidies and programmes.
• The aim: provide farmers with a reasonable standard of living, consumers with quality food at fair prices and to preserve rural heritage.
• Reforms are currently underway transferring subsidy to land stewardship rather than specific crop production. (GREENING)
The structure of the Hungarian Integrated Administration and Controls System (IACS) set and operated by the ARDA (Agricultural and Rural Development Agency = Hungarian paying agency)

The IACS data system:
- Land Parcel Identification System (MePAR)
- Identification system for farmers
- Identification system for payment entitlements
- System for identification and registration of animals (cattle, sheep, goat)
- Integrated control system:
  - Administrative control,
  - Control with Remote Sensing (CwRS),
  - On the spot checks with area measurement.
The role of the Land Parcel Identification System (MePAR)

MePAR (Hungarian LPIS) is the exclusive reference, land parcel identification and spatial information system (GIS) of the agricultural and rural development subsidies, financed by EU and national sources.

• MePAR is based on physical blocks (No. blocks in 2013: 373 083);
• Main support scheme: SAPS (Single Area Payment Scheme)
• Until 2013, a necessary condition of eligibility in Hungary was keeping areas in Good Agricultural Conditions on 30 June 2003 (reference date).
The elementary units of LPIS-Hu: orthophoto based physical blocks

Cadastral data

E8VQW-9-07
31.48 ha
Unique block ID number and net eligible area

Boundaries of eligible and non-eligible areas according to SAPS

Physical block boundaries

Ortophoto

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In the Land Parcel Identification System (MePAR) the delineation of the eligible and non-eligible areas in physical blocks is primarily based on orthophoto.
Data sources of LPIS creation

1. Orthophotography - geographical base (+broad land use)
2. Topographic maps - help in defining stable elements in time
3. Satellite imagery (multiannual) - checking of block land use and permanent boundaries

Multiannual satellite image series
Integration of aerial and satellite data

Orthophoto 2000-2010
Topographic map
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# LPIS in Hungary – thematic layers

<table>
<thead>
<tr>
<th>Name</th>
<th>Availability from year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer of landscape feature: Groups of trees and bushes</td>
<td>2014-</td>
</tr>
<tr>
<td>Water protection buffer strips along water courses</td>
<td>2012-</td>
</tr>
<tr>
<td>Layer of landscape feature: sweep-pole wells</td>
<td>2010-</td>
</tr>
<tr>
<td>Layer of landscape feature: Cumanian mounds</td>
<td>2010-</td>
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<tr>
<td>&gt;17% slopes (Nitrate Directive)</td>
<td>2009-</td>
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<tr>
<td>High Nature Value Areas</td>
<td>2009-</td>
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<tr>
<td>Areas under the responsibility of Ministry of Defence</td>
<td>2009-</td>
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<tr>
<td>Reedbeds</td>
<td>2009-</td>
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<tr>
<td>Floodplains</td>
<td>2009-</td>
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<tr>
<td>Areas under &quot;Plan Vasarhelyi&quot; (flood management)</td>
<td>2009-</td>
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<tr>
<td>Areas affected by wind erosion</td>
<td>2009-</td>
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<tr>
<td>Afforestation (EAGGF, Guidance)</td>
<td>2009-</td>
</tr>
<tr>
<td>Terraces against soil erosion (vineyards)</td>
<td>2008-</td>
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<tr>
<td>Afforestation (EAFRD)</td>
<td>2008-</td>
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<tr>
<td>Bare karst</td>
<td>2006-</td>
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<tr>
<td>Vulnerable water base areas</td>
<td>2006-</td>
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<tr>
<td>Nitrate Directive Annex B areas</td>
<td>2006-</td>
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<tr>
<td>Less Favoured Areas (LFA) (Update in progress from 2010)</td>
<td>2005-2009</td>
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<tr>
<td>Environmentally Sensitive Areas (ESA)</td>
<td>2005-2009</td>
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<tr>
<td>Areas affected by soil erosion (&gt;12% slopes)</td>
<td>2005-</td>
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<tr>
<td>Cadastral coverage</td>
<td>2004-</td>
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<tr>
<td>Unique block ID number and net eligible area</td>
<td>2004-</td>
</tr>
<tr>
<td>Boundaries of eligible and non-eligible areas according to SAPS</td>
<td>2004-</td>
</tr>
<tr>
<td>Physical block boundaries</td>
<td>2004-</td>
</tr>
</tbody>
</table>

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LPIS thematic layers
AEM (Agri-environmental Measures)

- Nitrate sensitive areas
- Natura 2000 Environmentally sensitive area
- Less-favoured areas Protection against wind erosion (model areas)
- High Nature Value Areas
- Floodplains Areas under “Plan Vasarhelyi” (flood management)
- Water courses and buffer strips

Scale ~ 1 : 2 200 000

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Tasks to ensure LPIS revision

• Regular, rotational update (about ¼ of the country / year)
• Block reviews launched pursuant to requests made by clients
• Block review ex officio:
  – Blocks selected for block review during the course of physical control (classical field inspections and remote sensing controls)
  – Introduction of a highway construction monitoring subsystem into the LPIS update
  – Incorporation of areas involved in scheme “afforestation of agricultural areas” into LPIS
Review and change management of physical blocks

Example #1

The reduction of eligible area because of road construction
Review and change management of physical blocks
Example #2
The reduction of eligible area because of urban development

Orthophoto 2007, MePAR 2010
Orthophoto 2011, MePAR 2012

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2. LPIS Land Cover Database
The general attributes of MePAR land cover system

Generally different land cover systems can be told from each other by

– the used methodology,
– the used data,
– applied categories (e.g. our approach is based on agriculture).

The MePAR land cover system

– established using visual interpretation,
– based on ortho imagery, satellite image time series, rapid field visits and GNSS measurements,
– methodology and basic logic is based on MePAR/LPIS methodology,
– part of the MePAR/LPIS system.

In Hungary there is no other system with this resolution, accuracy and frequent update period, using visual interpretation and raster data as data source.
The MePAR land cover system

The resolution of the MePAR land cover system is determined by:

– resolution of raster data used (0.4 m),
– laws and regulations on LPIS build up, update, maintenance and quality control,
– The aim of usage, stability and update cycle.

Objects in the MePAR land cover system are delineated above and around the size of 0.1 ha. However, there are thousands of objects smaller than this threshold because in some special cases we have to delineate smaller ones in the “base” MePAR, therefore they also appear in the land cover data.

The main aspects of creating the categories of the land cover system:

– the MePAR land cover system primarily contains agricultural areas, subdivided by different land use (e.g. arable land, pastures, plantations etc.),
– the categories even at the topmost level of hierarchy are defined on the basis of eligibility,
– the category system is more detailed within eligible areas,
– if necessary, the categories can be split into new subcategories later,
– does not only contain elements visible on ortho imagery, but special elements that may only be visible on older imagery symbolizing a past state of land cover.
The main purposes of the creation of the MePAR land cover system are:

- to improve the efficiency of control of area-based subsidies,
- to provide statistical data for developing new agrarian strategies,
- to help the creation of new thematic layers,
- to help implementing the CAP reform,
- and to help tracing agricultural changes, depending on the update cycle (3 or 4 years).
Possible uses of the MePAR land cover system

• Help in on-the-spot controls, the identification of risky areas.

• Using the land cover data, the Paying Agency can make administrative checking more reliable and robust.

• Land cover data can be used as a reference background data set in the on-line subsidy claiming system.
The MePAR land cover system

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The MePAR land cover system
The MePAR land cover system
3. Control with Remote Sensing of Agricultural Subsidies
Remote sensing control of area-based agricultural subsidies: an indirect way of updating MePAR Land Use database

The comparison of claims and real situation:

• Cultivated crop
• Parcel area
• Good Agricultural and Environmental Conditions (GAEC)


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Sites of control with remote sensing

9000-12000 dossiers (2013: 9000)
60000-80000 parcels (2013: 91000 in sites, 60000 actually controlled)
8-10 sites (2013: 9)
8000-10000 square kilometers (2013: 8800 km²)
Basic data of CwRS:
high and very high resolution satellite images (HR, VHR)

CwRS central database

Satellite images
- SPOT 2 XS
- SPOT 4/5 Xi
- Landsat 5/7 (E)TM
- IRS-1C/D/P6/R2 LISS
- RapidEye

Very high resolution (0.5-1m)
- Ikonos
- QuickBird
- Pléiades 1A/1B
- GeoEye
- WorldView 1/2

High resolution (10-25m) time series

Area measurement

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Computer-aided Photo-interpretation (CAPI) with GIS software developed within FÖMI

Claim database

Very high resolution (VHR) satellite images for area measurement

High resolution satellite image time series for crop determination

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The role of control with remote sensing in the updating of Land Use Database

During the Computer-aided Photo-interpretation, operators mark the blocks that need updating in MePAR:

• Block boundary
• The delineation of eligible / ineligible areas
• “Coding”, land use category.