# Investigation of common milkweed spreading using LUCAS and hyperspectral data

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The wildlife and richness of species in Hungary are greatly endangered by invasive plants mostly coming from other countries and continents. These invasive plants are spreading aggressively and they are taking over massive territories. One of the biggest ecological risk is caused by the common milkweed (Asclepias syriaca), which is spreading unstoppably in the sand ridges of the Duna-Tisza Interfluve in Hungary. The climate change and the decrease in groundwater levels in Kiskunság, can also contribute to its spread. Common milkweed usually spreads in meadows, pastures and uncultivated lands.

## LUCAS Database

Land Use and Coverage Area frame Survey (LUCAS) is a point based database by EUROSTAT. In each survey point four photos were taken in the 4 cardinal directions of the landscape. The survey is repeated in every 3 years. Consequently we can identify and categorise the changes over the years (Fig. 1-2). Our study area was the Southern Great Plain. In all we revised 15 130 photos and we identified that the points are infected by common milkweed. We made four categories and built a new database based on this:

- clear areas (no infection)
- softly infected points
- moderately infected points
- heavily infected points

As a result most of this invasive plant can be found in the sand ridges in Duna-Tisza Interfluve. The number of infected areas is growing.

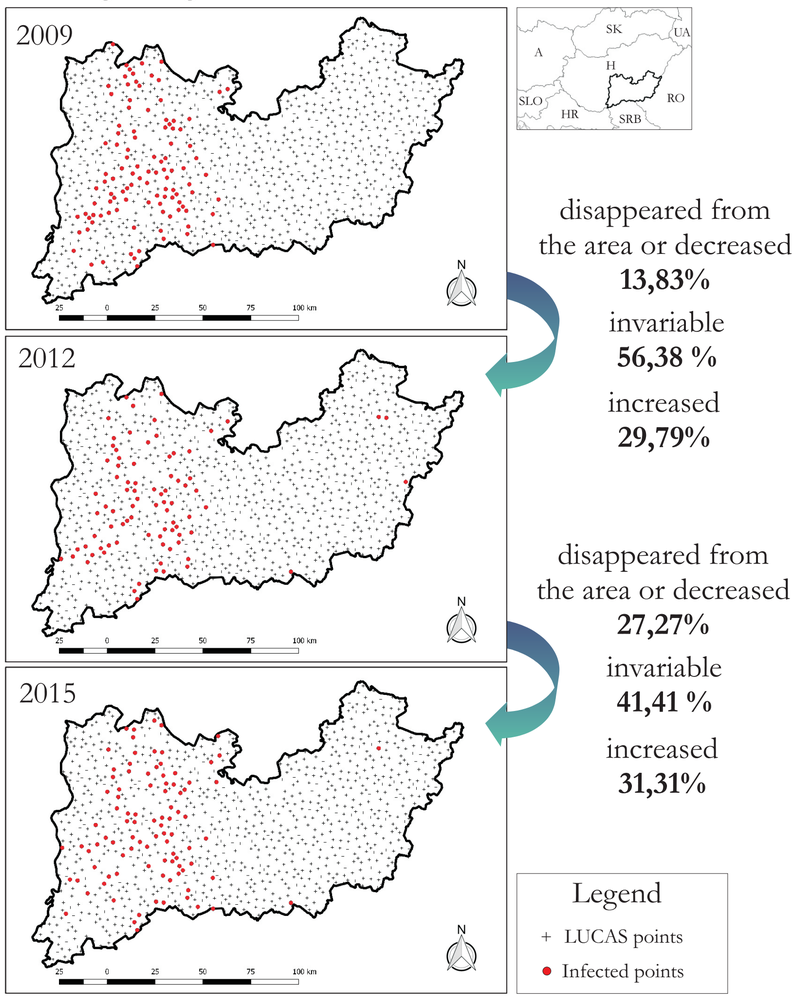


Figure 1. The infected points in Southern Great Plain

## Data Collector Application

To investigate the inflected areas closer we have developed an online data collector interface. We made a group (http://arcg.is/18W4vX) in ArcGIS Online platform and a shared webmap to collect data. This webmap is filled up with several edited layers. Each one is meant to sign an invasive plant species. To collect data we used Collector for ArcGIS application (Fig. 4). With this it is easy to collect data offline on the ground. Later everybody should synchronize the collected data to the cloud. The spread of invasive species is dynamically changeable that is the reason why we used VGI (volunteered geographic information) tools to try to build a database in several areas.

We made an investigation in the most infected areas based on LUCAS database. Our study area was in Kiskunság NP covering approximately 200 hectares (Fig. 3). We delineated the invasive species and categorized them into 4 different categories - like earlier. In case of common milkweed it was very hard to determinate homogeneous spots, therefore we needed to use UAV (Unmanned Aerial Vehicle).

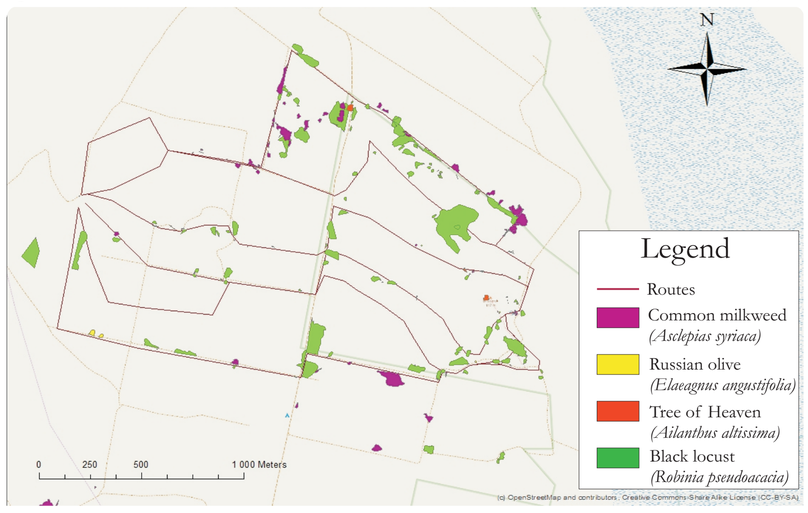


Figure 3. The results of investigation in Kiskunság National Park

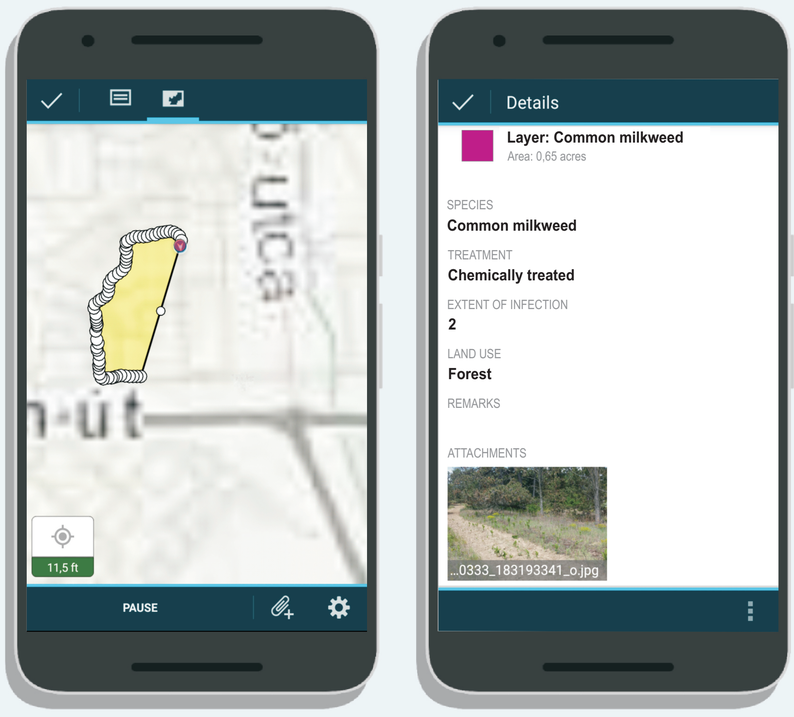


Figure 4. Data collecting (left), and the collected polygon's details (right)

## UAV mapping and hyperspectral data

For the UAV survey the study areas were only 2x2 hectares. In these areas the common milkweed was heavily spread. For the survey we used high resolution hyperspectral aerial camera with 138 spectral bands. Spectral information from the visible and near infra-red range enabled us to specify the spectral characteristics of common milkweed. For training we used field reference data. On the ground we appointed 1x1 meter quadrats with RTK GPS with centimeter accuracy. Each quadrat is registered and photographed (Fig 5-6). Digitizing this quadrats were produced a very accurate database of positions of common milkweed. It is suitable for training pixel set.

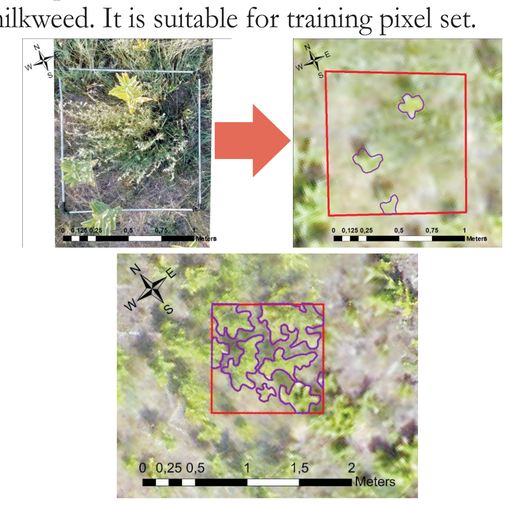


Figure 5. Quadrat where hard to identify the milkweed (up), and where easy to delineate (down).

Using field training and validation data different classification methods (Spectral Angle Mapper, Support Vector Machine, etc.) were tested with a best *producer accuracy* of 76%.

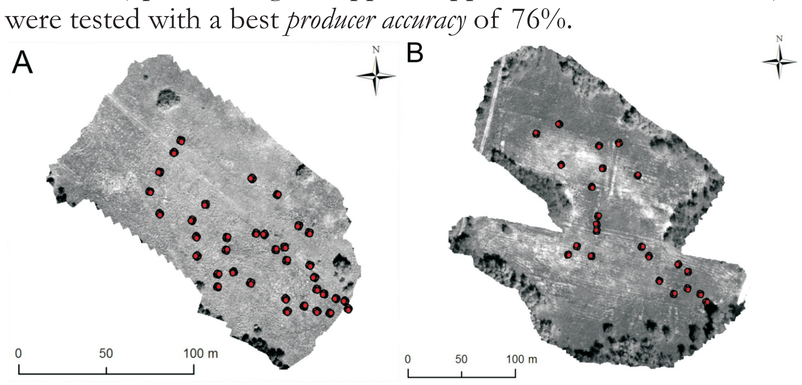


Figure 6. Quadrats (red) in the study areas

## Results

The most successful classification method was the Support Vector Machine. However false positive results (procedure of MNF and PCA transformed images) also appeared on open grassland areas (Fig 7).

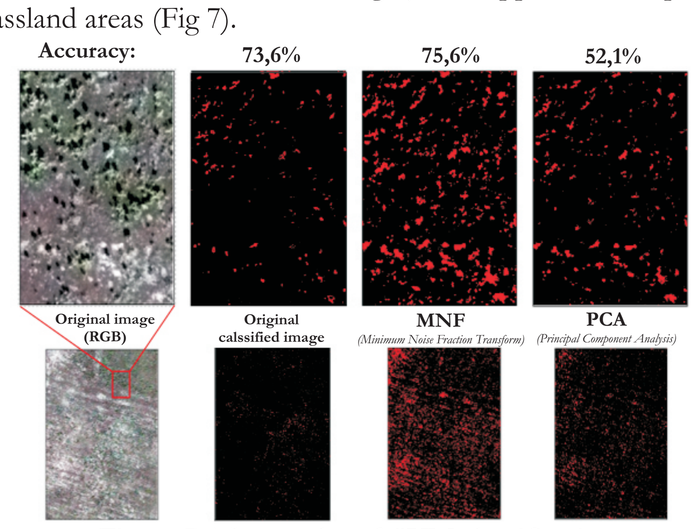


Figure 7. The results of SVM classification

In overall we managed to detect the common milkweed in different scales with different GIS and remote sensing methodology and technology.

Figure 2. The differences a LUCAS point (an abandoned vineyard) during the years based on LUCAS photos 2009, 2012, 2015