Use of laser data to update land resource map AR5

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About me

- 26 years old from Oslo, Norway
- Student at Norwegian University of Life Sciences
- Studied Geomatics and specialized in Photogrammetry
- Finished my Master this spring 2011
- Works now at the Norwegian Military Academy with military geography

My thesis

- Summarizes the experience with the use of laser data to identify opportunities to support the updating of land resource map AR5

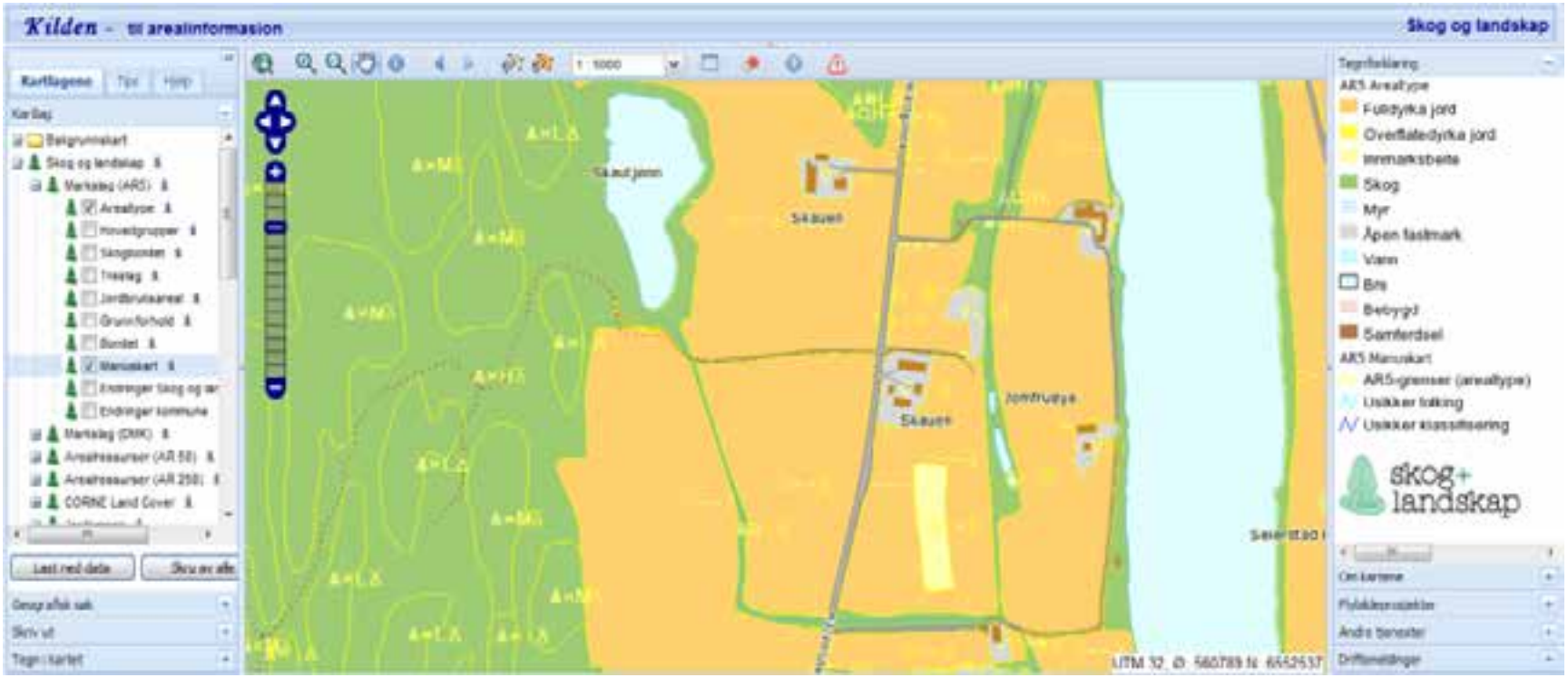
- The emphasis is on good descriptions of the various steps of the process so the Norwegian Forest and Landscape Institute will benefit from this experience and knowledge in a wider context

AR5

- Land resource map AR5 is a map data set that the Norwegian Forest and Landscape Institute offers.

- It describes Norway's land resources and therefore must be kept up to date since land use changes with time.

AR5



http://kilden.skogoglandskap.no/

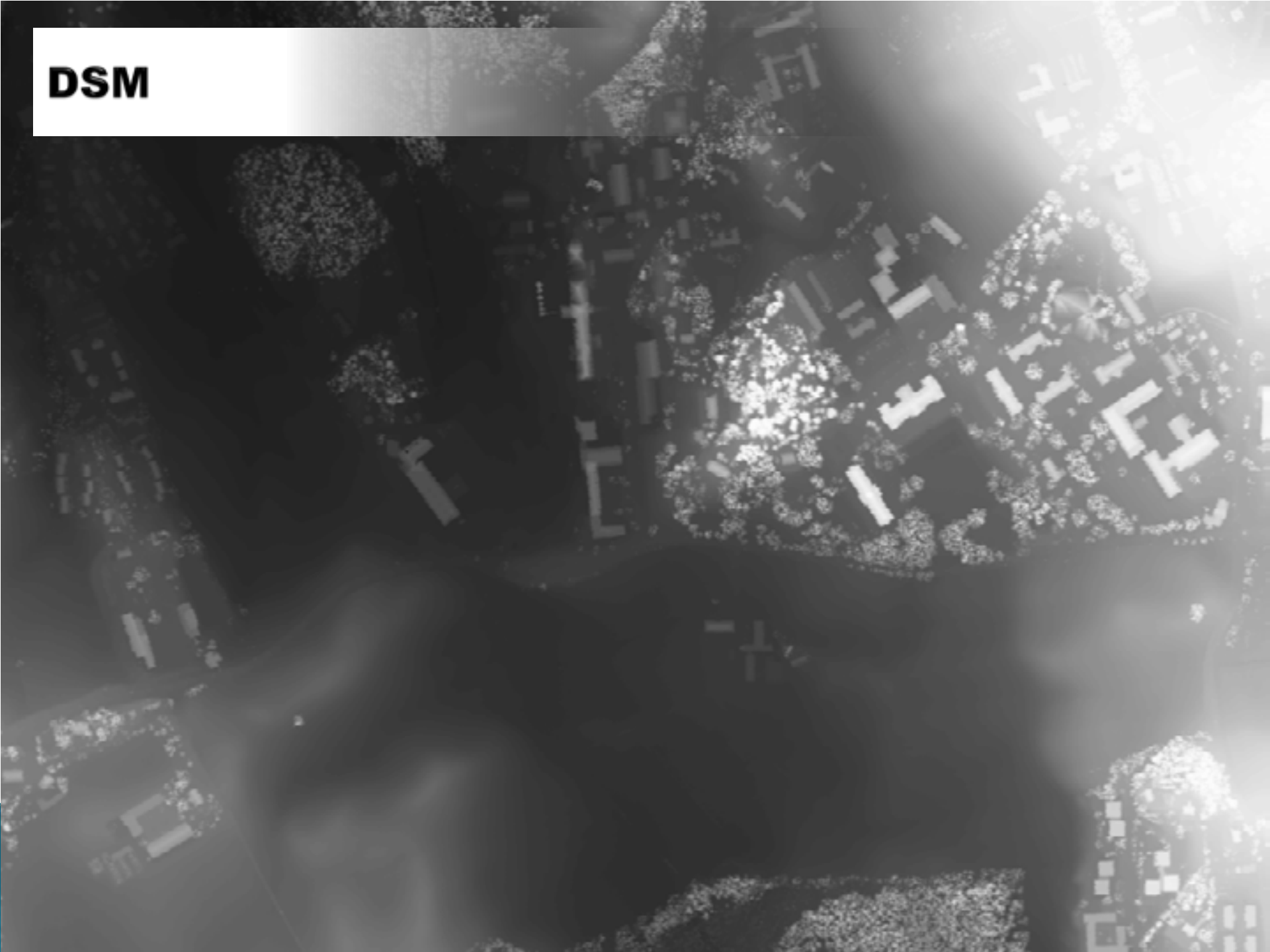
Laser data

- An area that was laser scanned in Ås, Norway, (spring 2008), has been selected as the test area
- The average point density is about 2.5 points per m^2
- ArcMap creates the raster images from the laser data with 2-meter pixel size, showing heights, pulse returns and intensities

Raster images

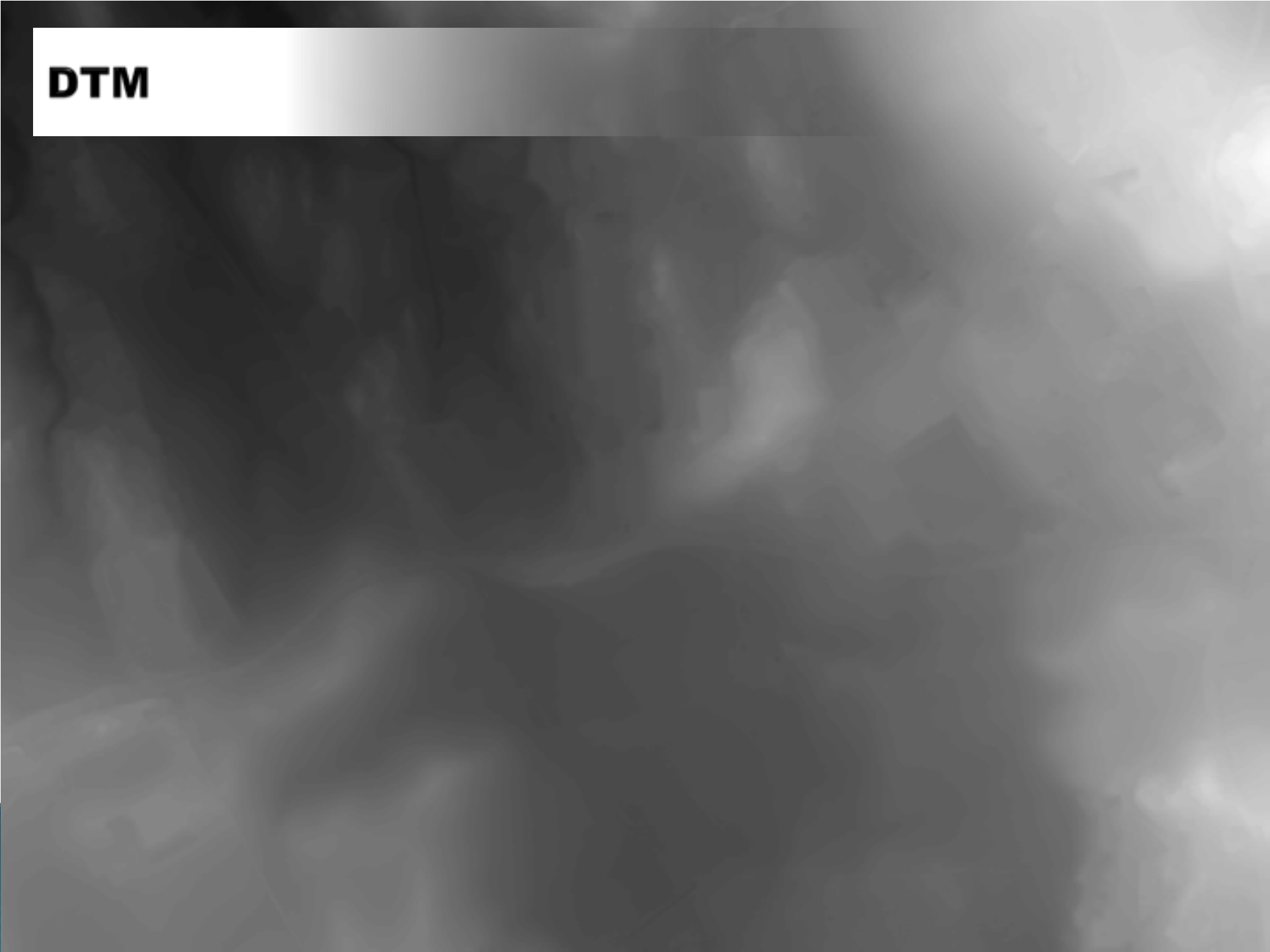
- Digital surface model (DSM)
- Digital terrain model (DTM)
- Slope
- Hillshade
- Normalized digital surface model (nDSM)
- Echo number
- Intensity

DSM



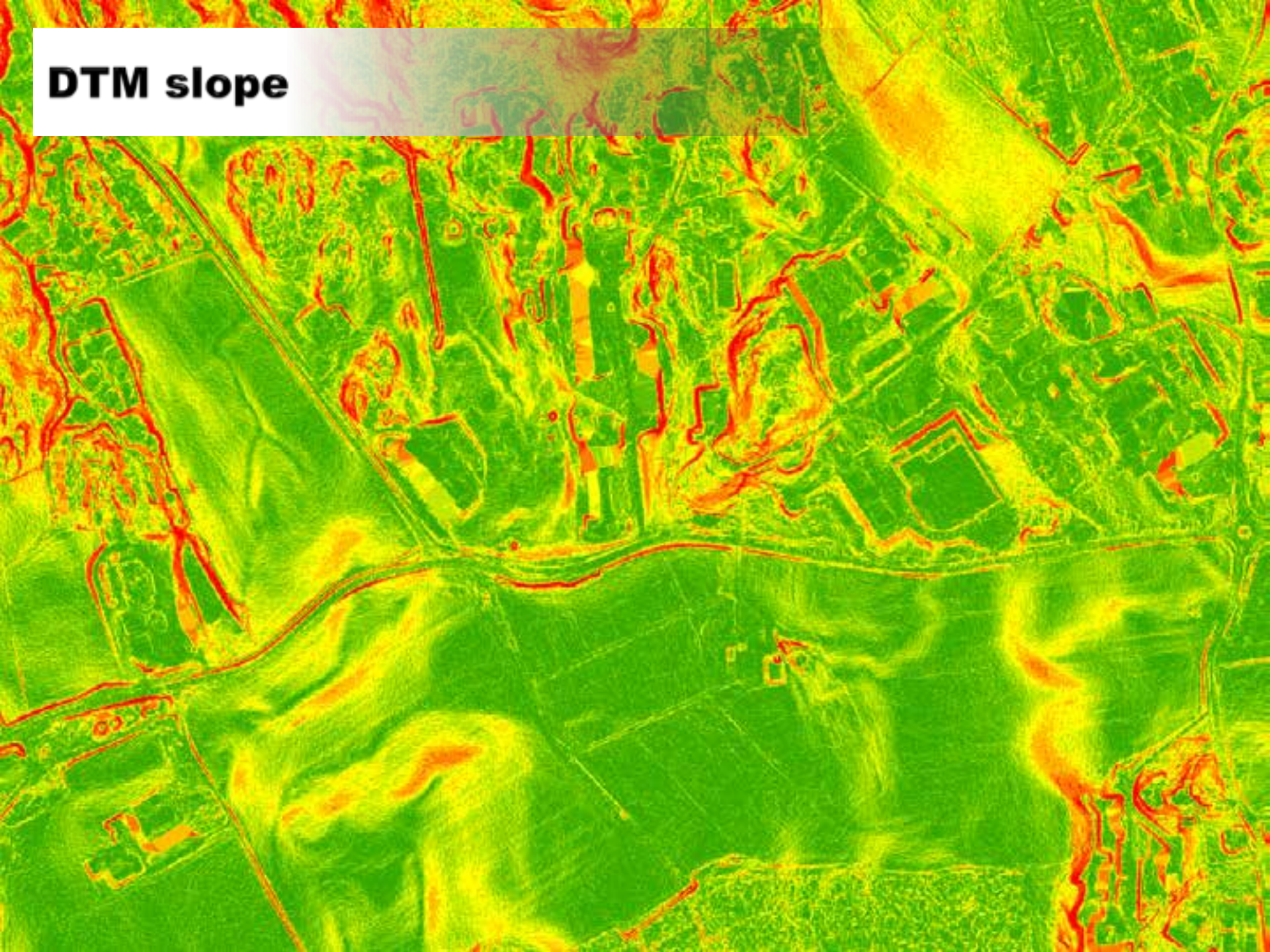
DSM hillshade

DTM

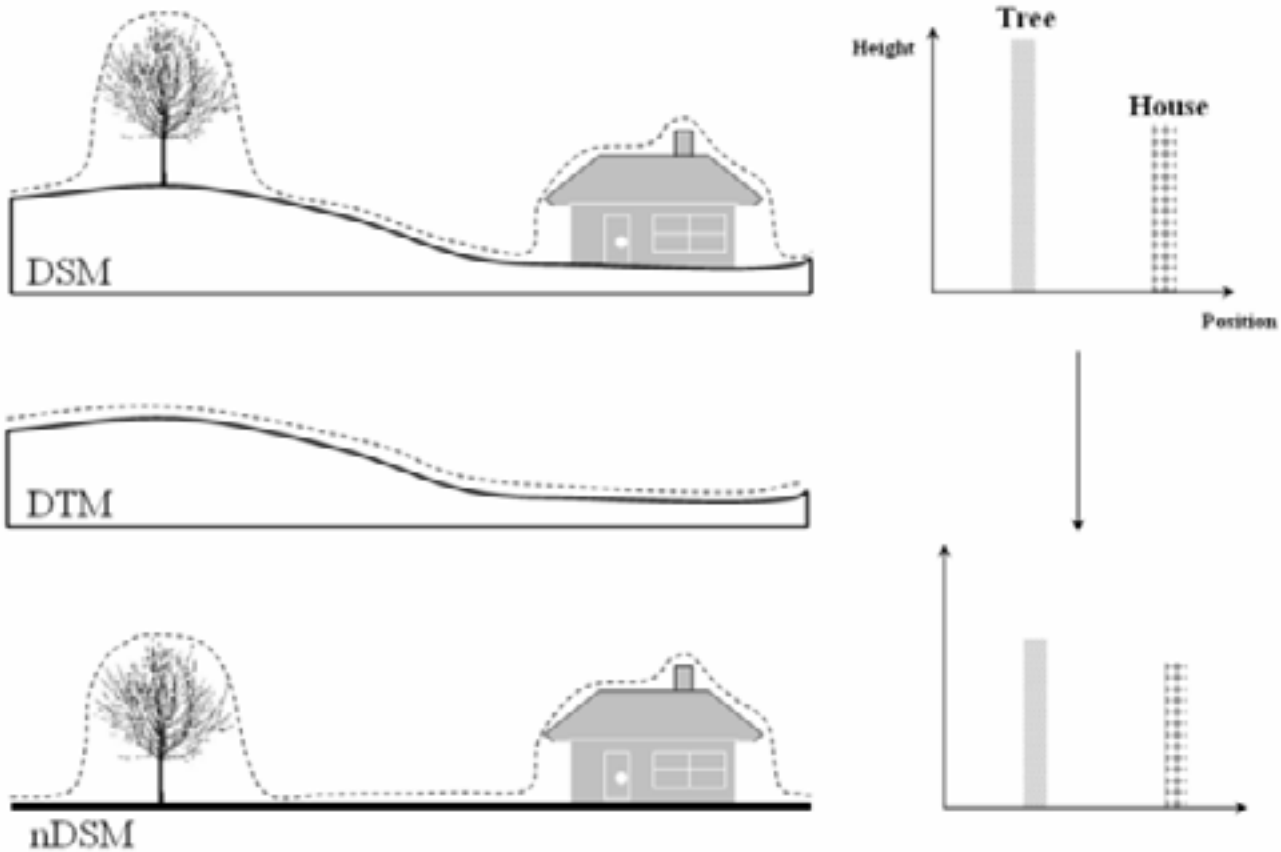


DTM hillshade

DTM slope

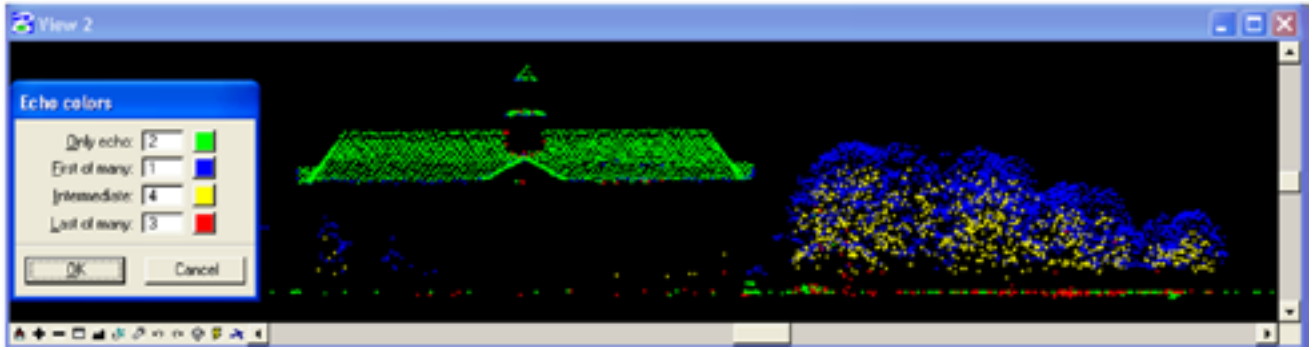


Normalized DSM



nDSM

Echo number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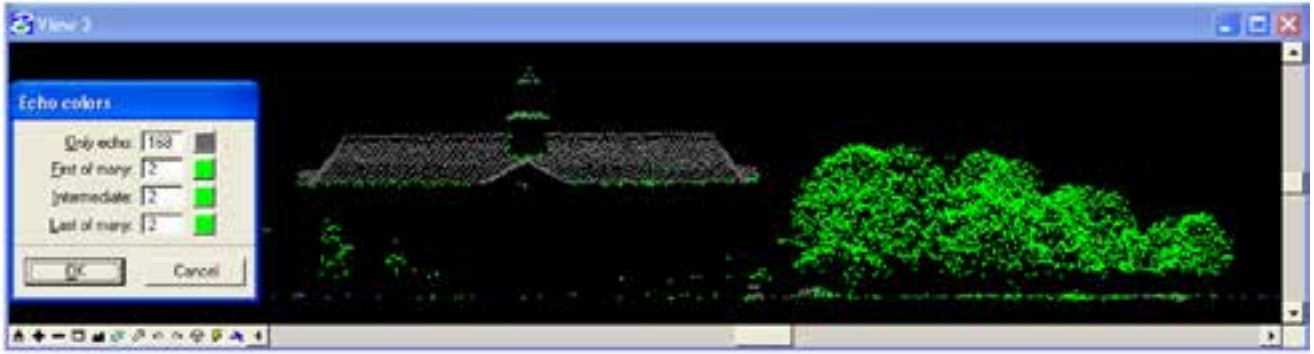
Echo colors
Only echo: 2
First of many: 1
Intermediate: 4
Last of many: 3
OK
Cancel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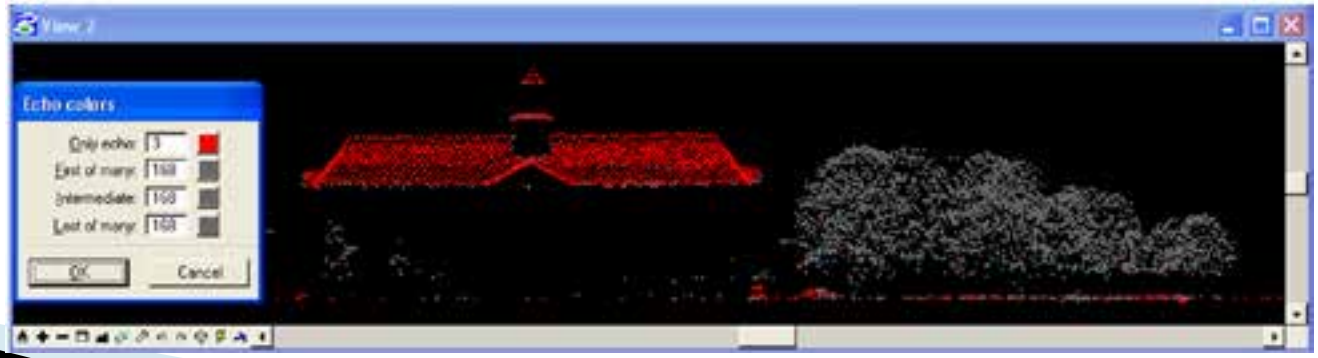
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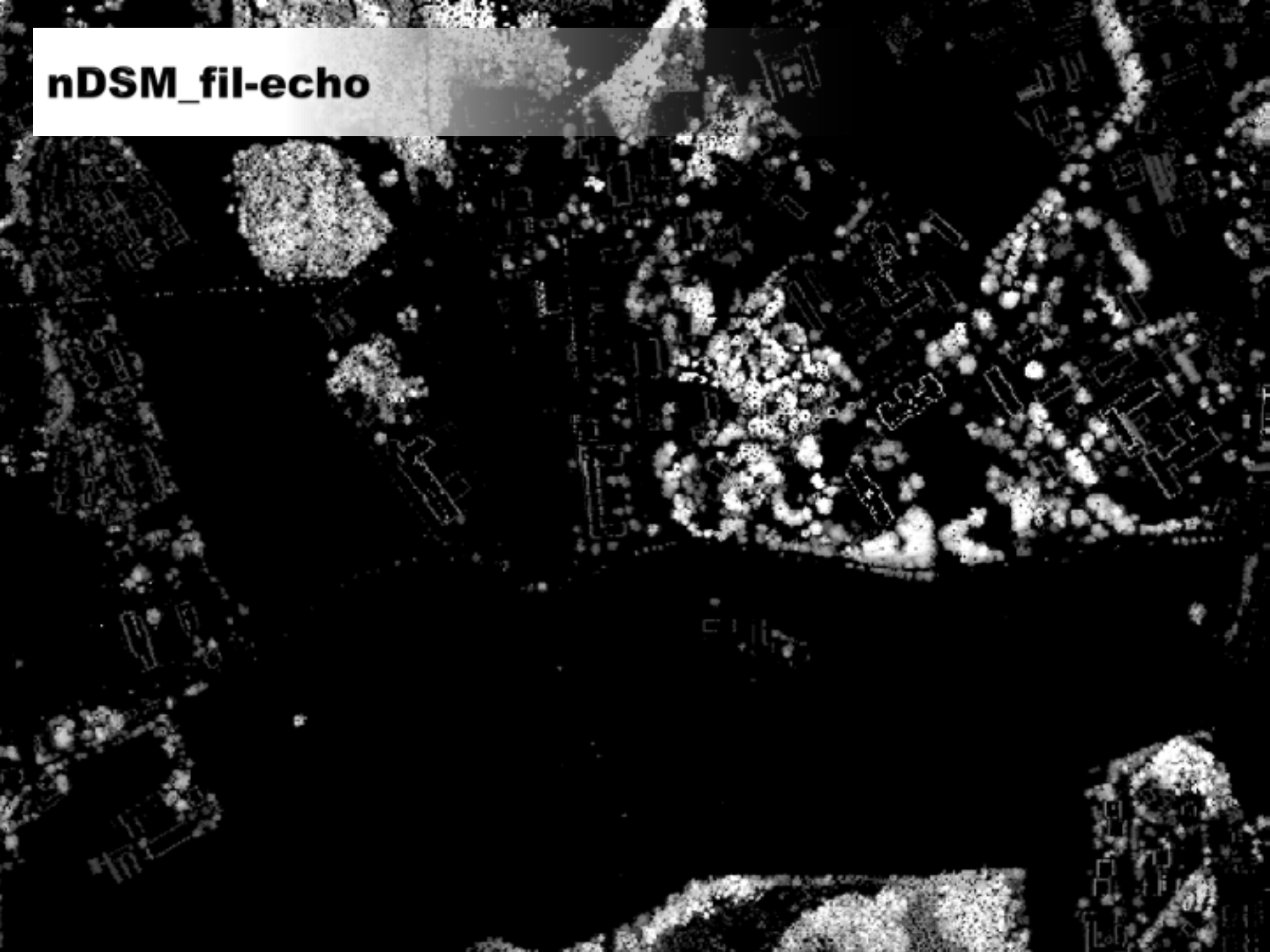

nDSM_fil-echo


nDSM_only-echo

Intensity

Analysis

The analysis of laser data is divided in two;

1. Object-based image analysis (OBIA) in eCognition Developer

2. **Overlay analysis in ArcMap**

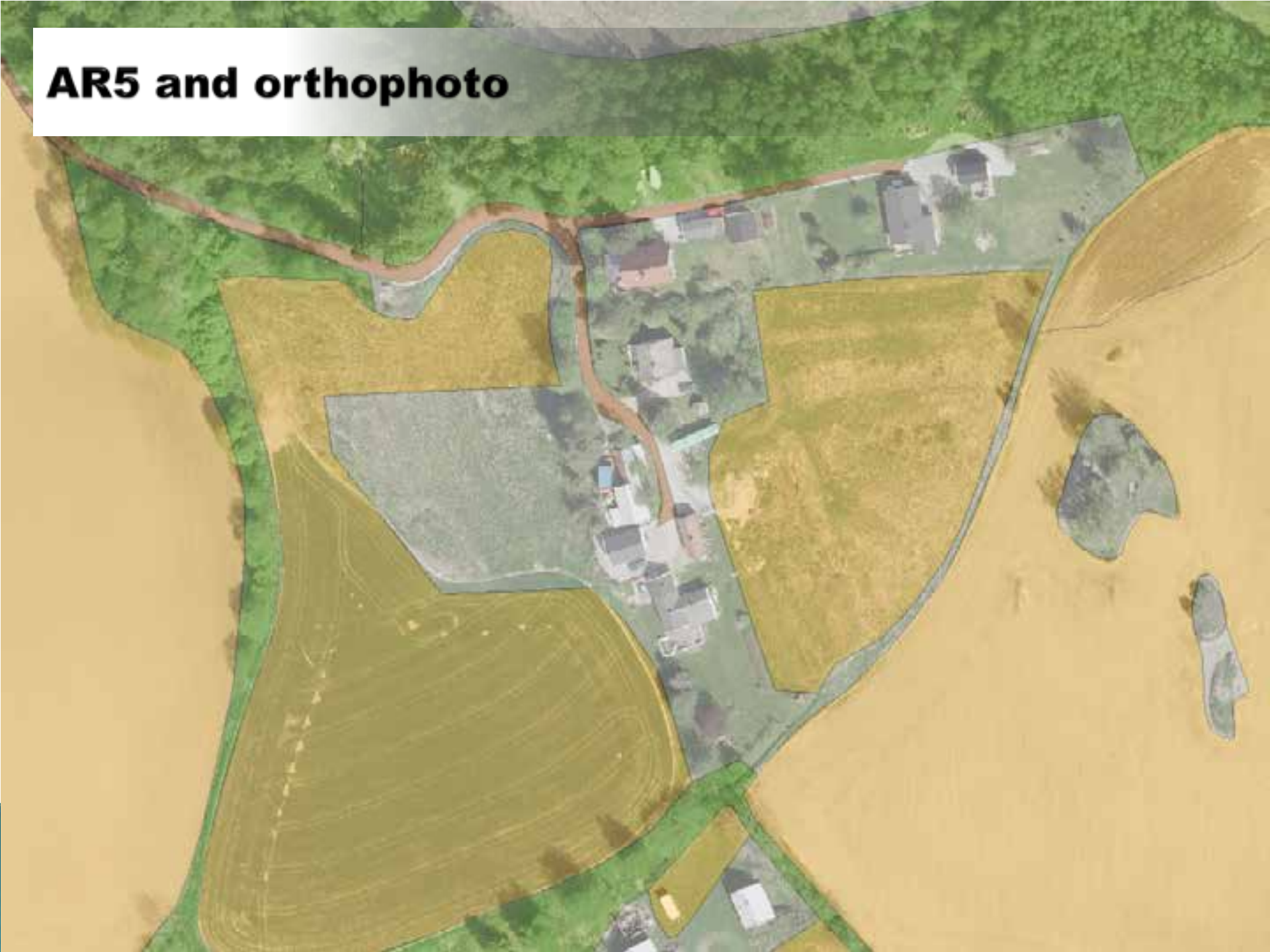
Overlay analysis in ArcMap

- ArcMap, in contrast, combines the AR5 with the established raster images
- Based on the knowledge of the various information in the laser data, raster images are selected due to suitability for their purpose and an overlay analysis draws out the areas of interest
- Several visual observations of the raster images are also done in ArcMap where the focus is to demonstrate the quality of the pictures provided by the laser data

Fields of interests

- Changes in fully cultivated lands

AR5 and orthophoto



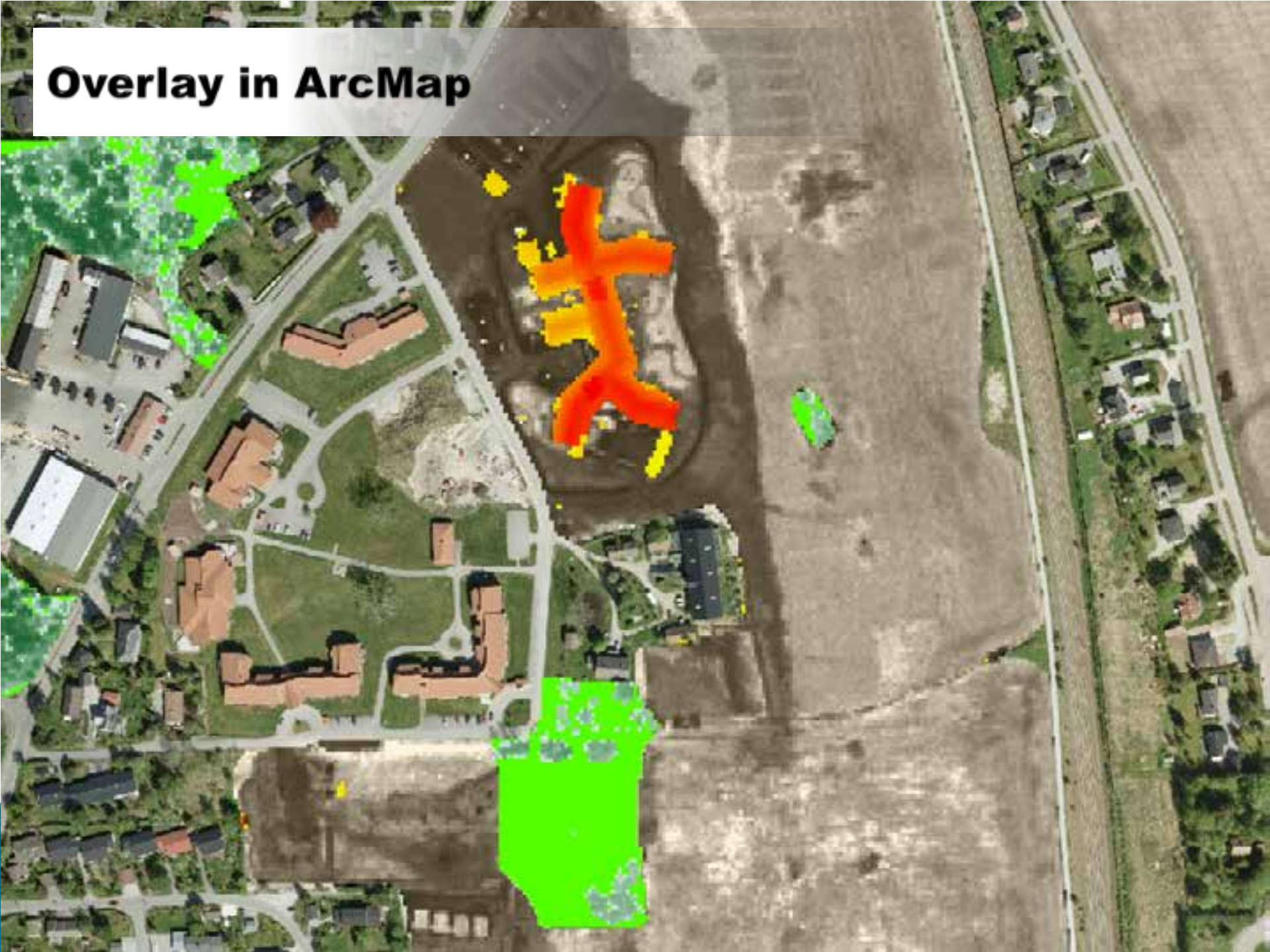
Overlay in ArcMap

Fields of interests

- Changes in fully cultivated lands
- Heights on fully cultivated lands

AR5 and orthophoto

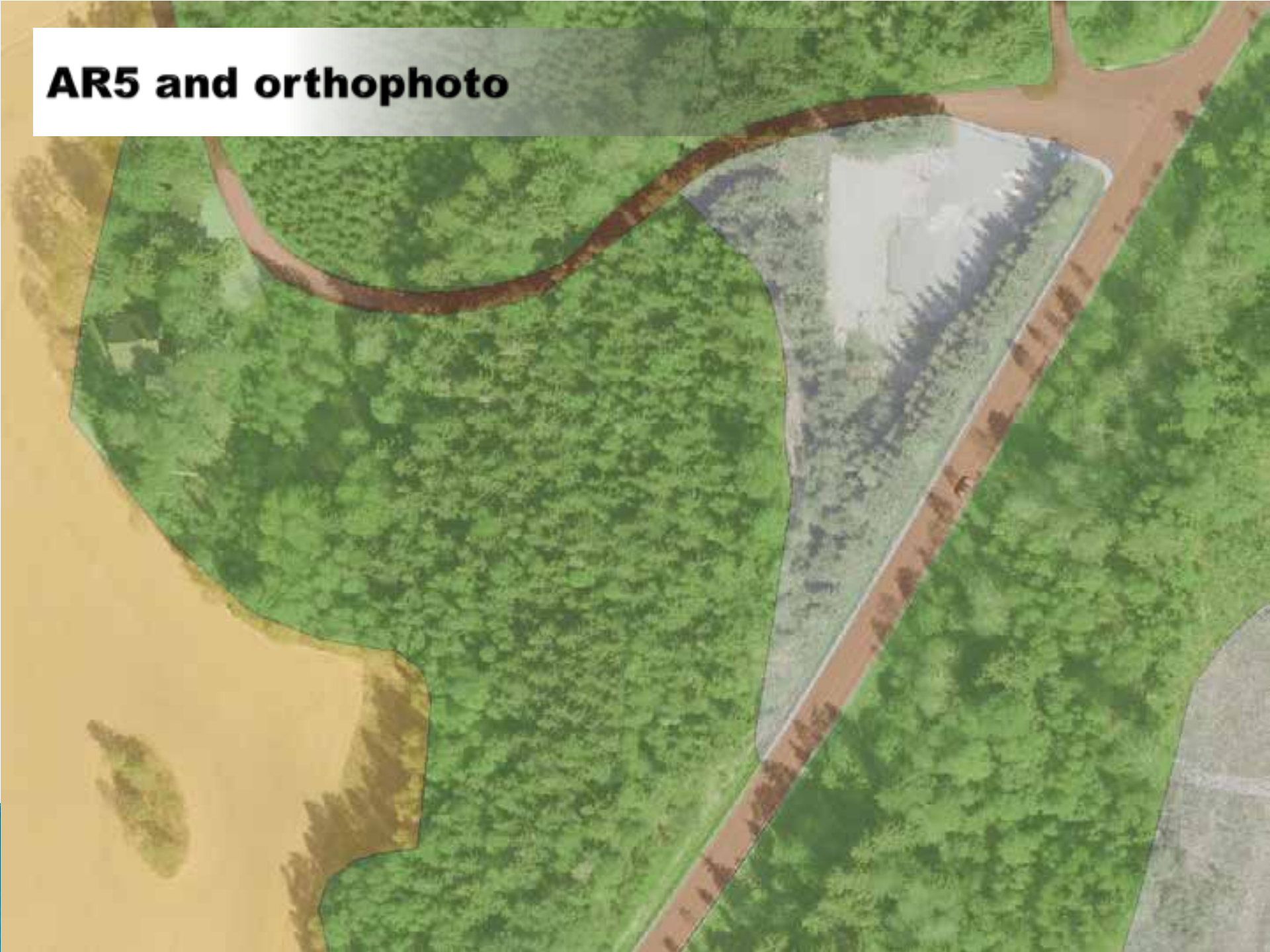
Overlay in ArcMap



Fields of interests

- Changes in fully cultivated lands
- Heights on fully cultivated lands
- Forest and non-forest areas

AR5 and orthophoto

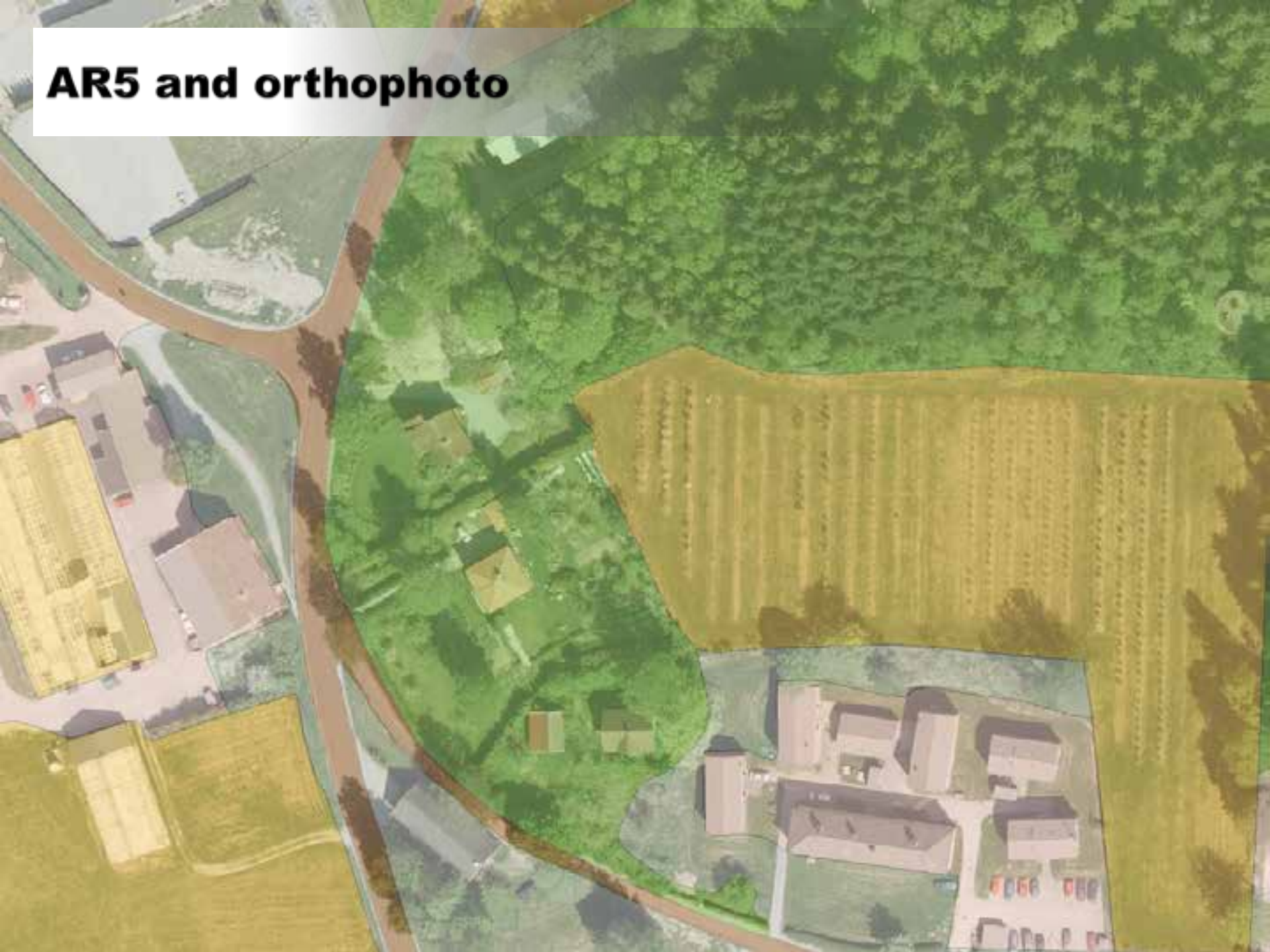


Overlay in ArcMap

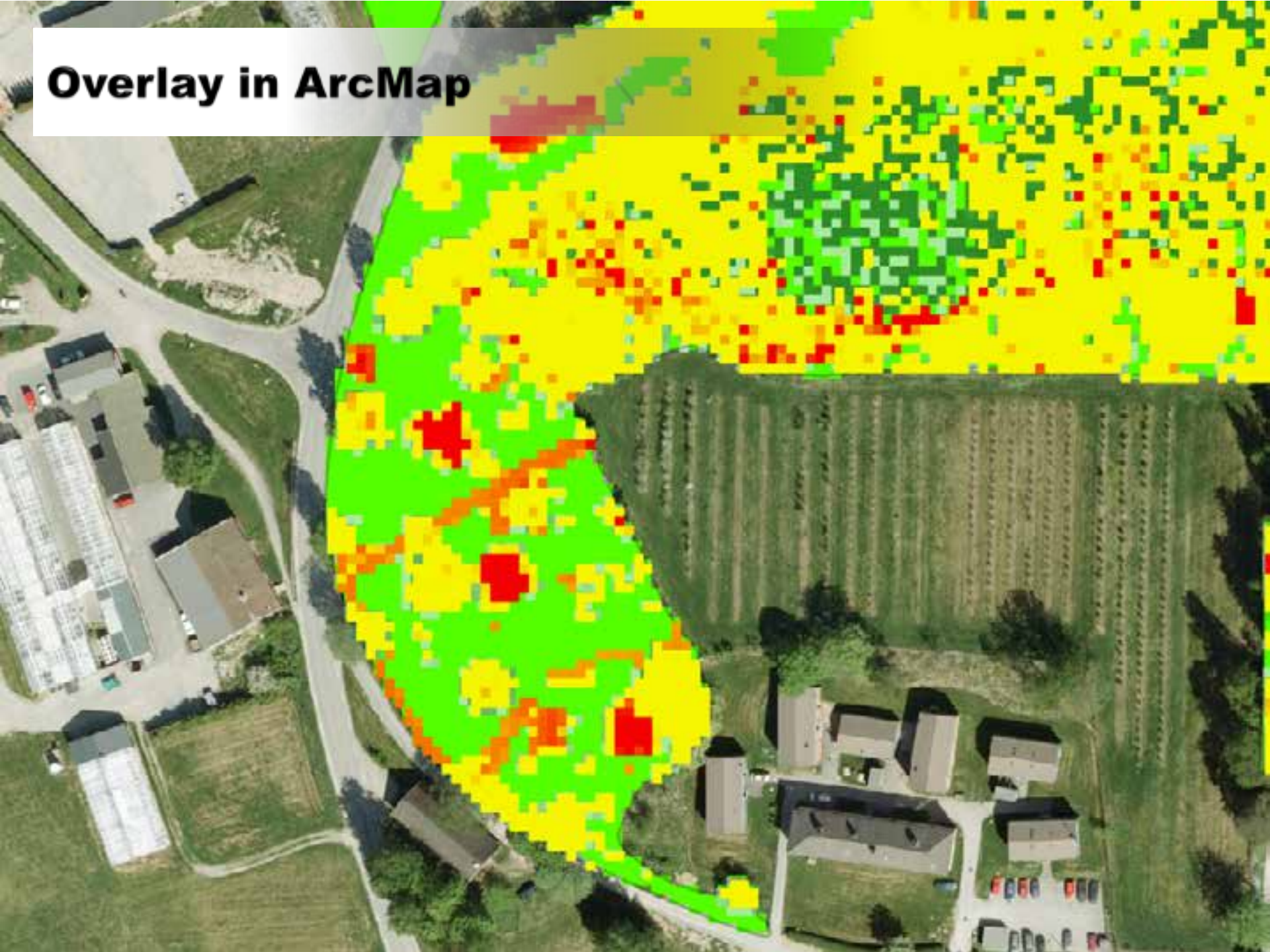
Fields of interests

- Changes in fully cultivated lands
- Heights on fully cultivated lands
- Forest and non-forest areas
- Buildings in forest areas

AR5 and orthophoto



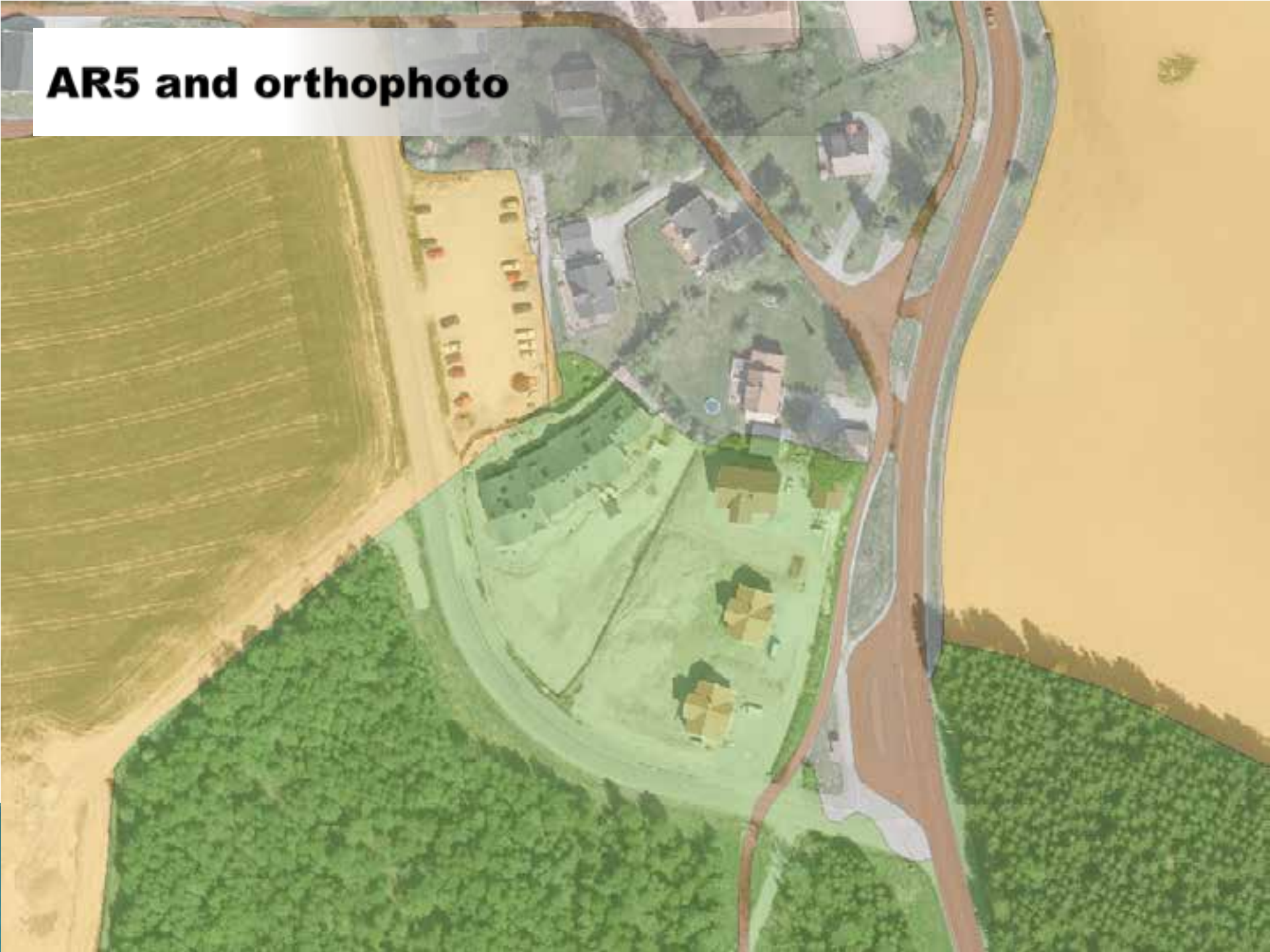
Overlay in ArcMap



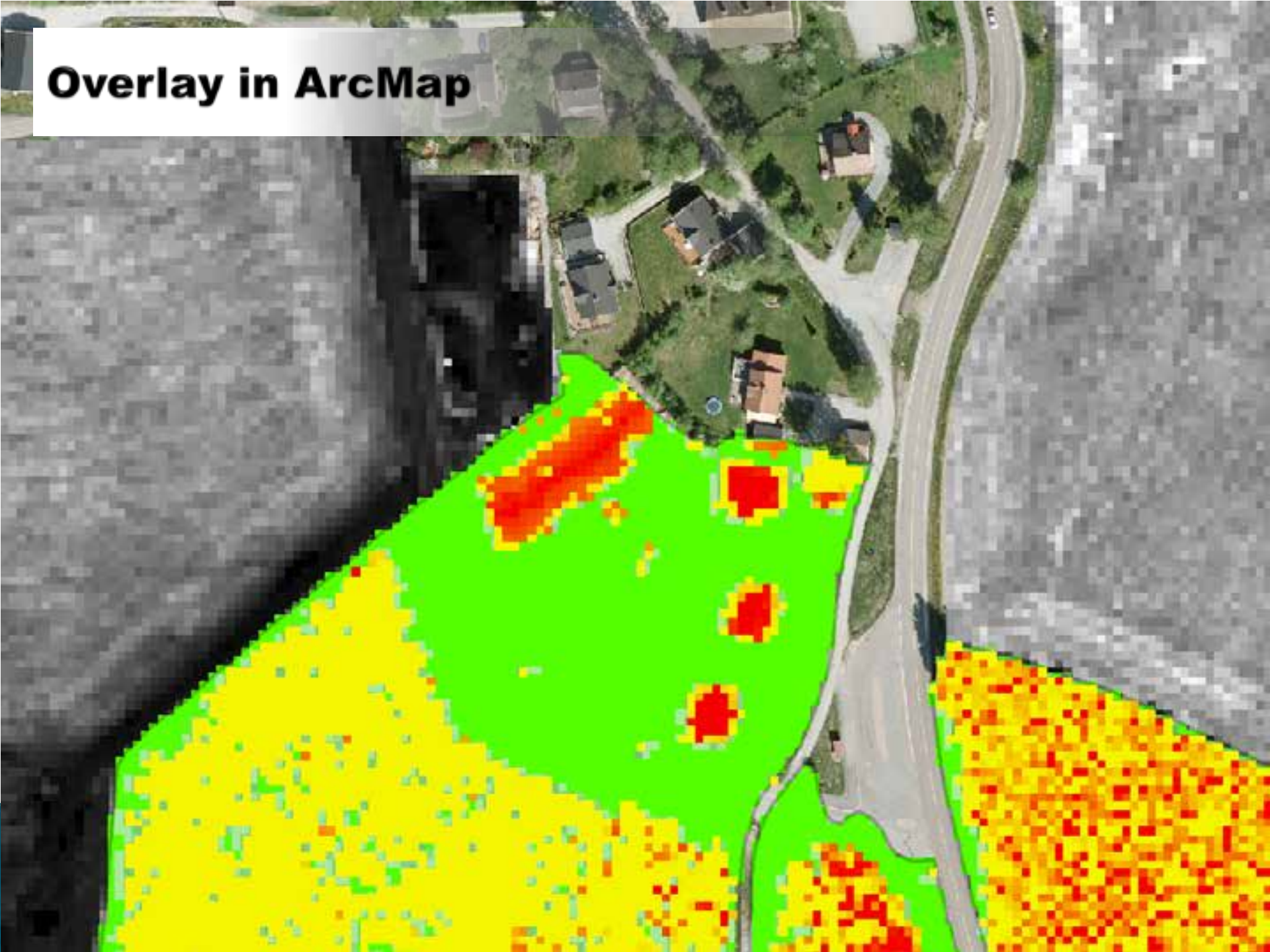
AR5 and orthophoto

Overlay in ArcMap

AR5 and orthophoto

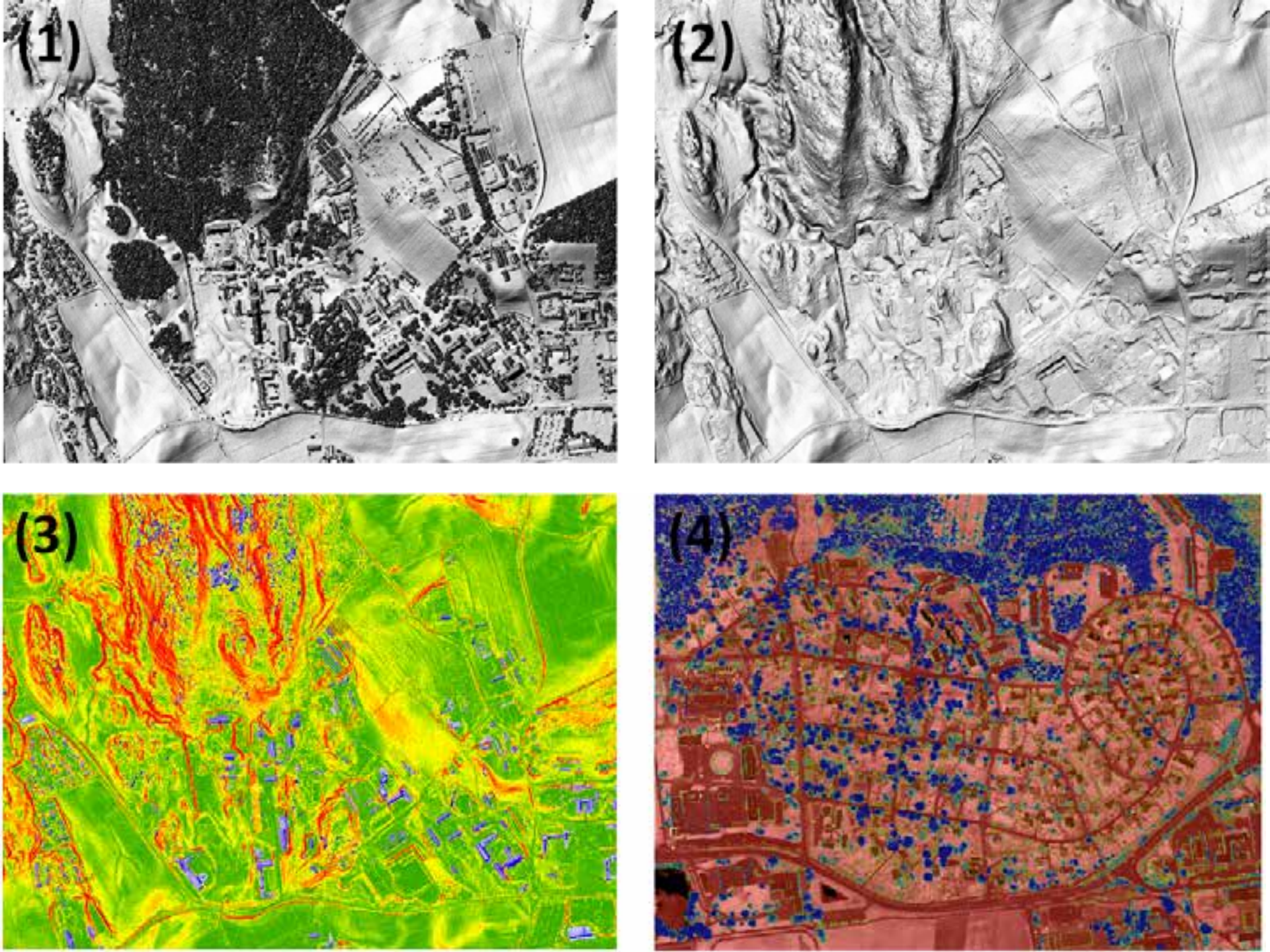


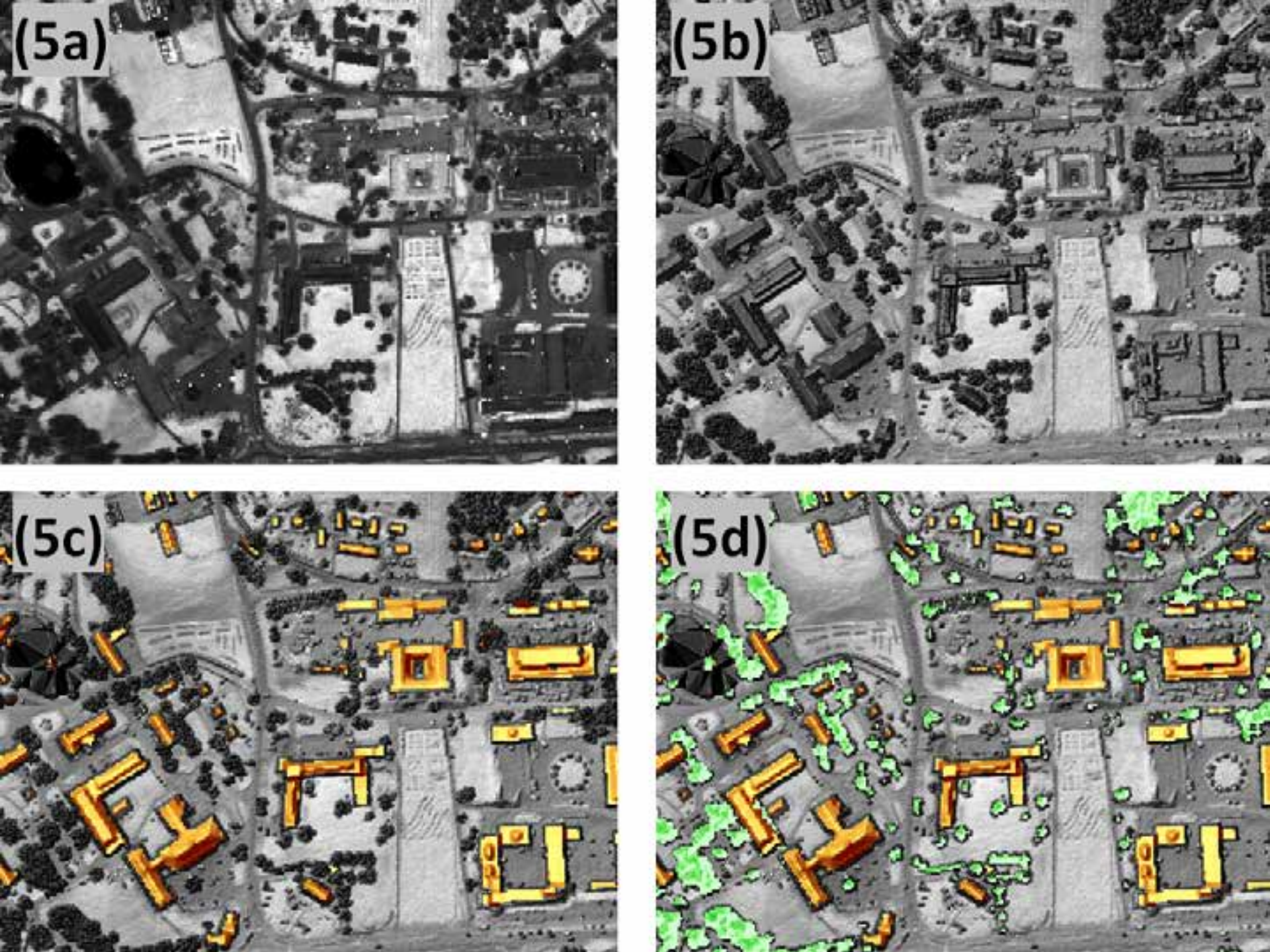
Overlay in ArcMap



Results in ArcMap

- The results from the combination of raster images in ArcMap show that the heights in both forests and fully cultivated lands are detected
- Buildings can also be separated from the vegetation by looking at different pulse returns
- With good point density raster images including intensity can resemble orthophotos, and thus create a good visual image of the ground
- Height models are used to create hillshade and slope images describing the terrain


(1)
(2)
(3)
(4)


(5a)
(5b)
(5c)
(5d)

Conclusion

- The results of this study indicate that laser data could be a useful tool with numerous opportunities to update AR5
- With sufficient point density, good visual images could be created and be used for interpreting the ground
- By making the overlay analyses in ArcMap, proposals for possible changes could be detected

Questions ??