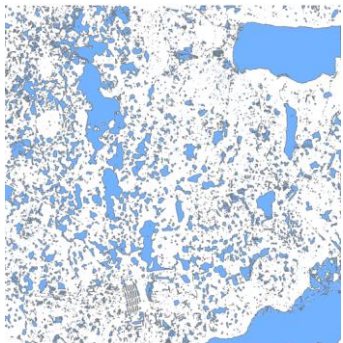
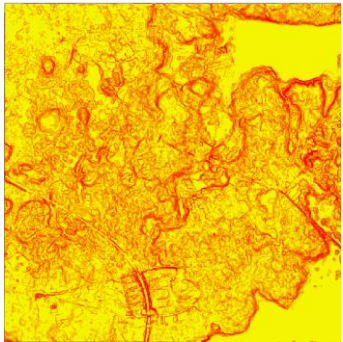
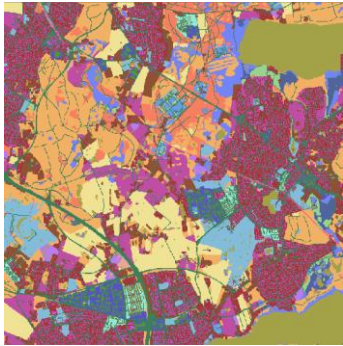
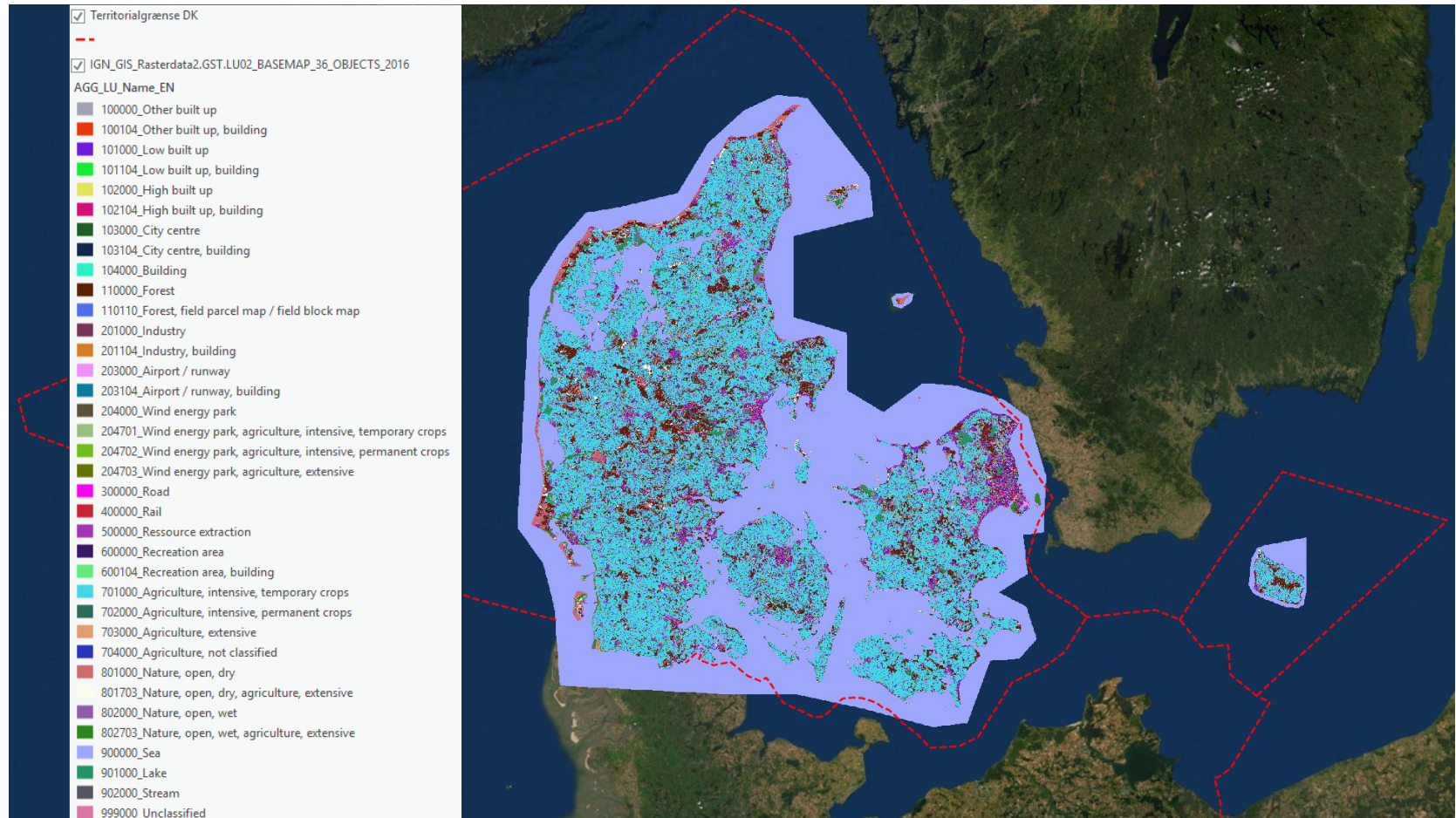


About the data sets used in the bike path exercise



Thomas Balstrøm
tb@ign.ku.dk

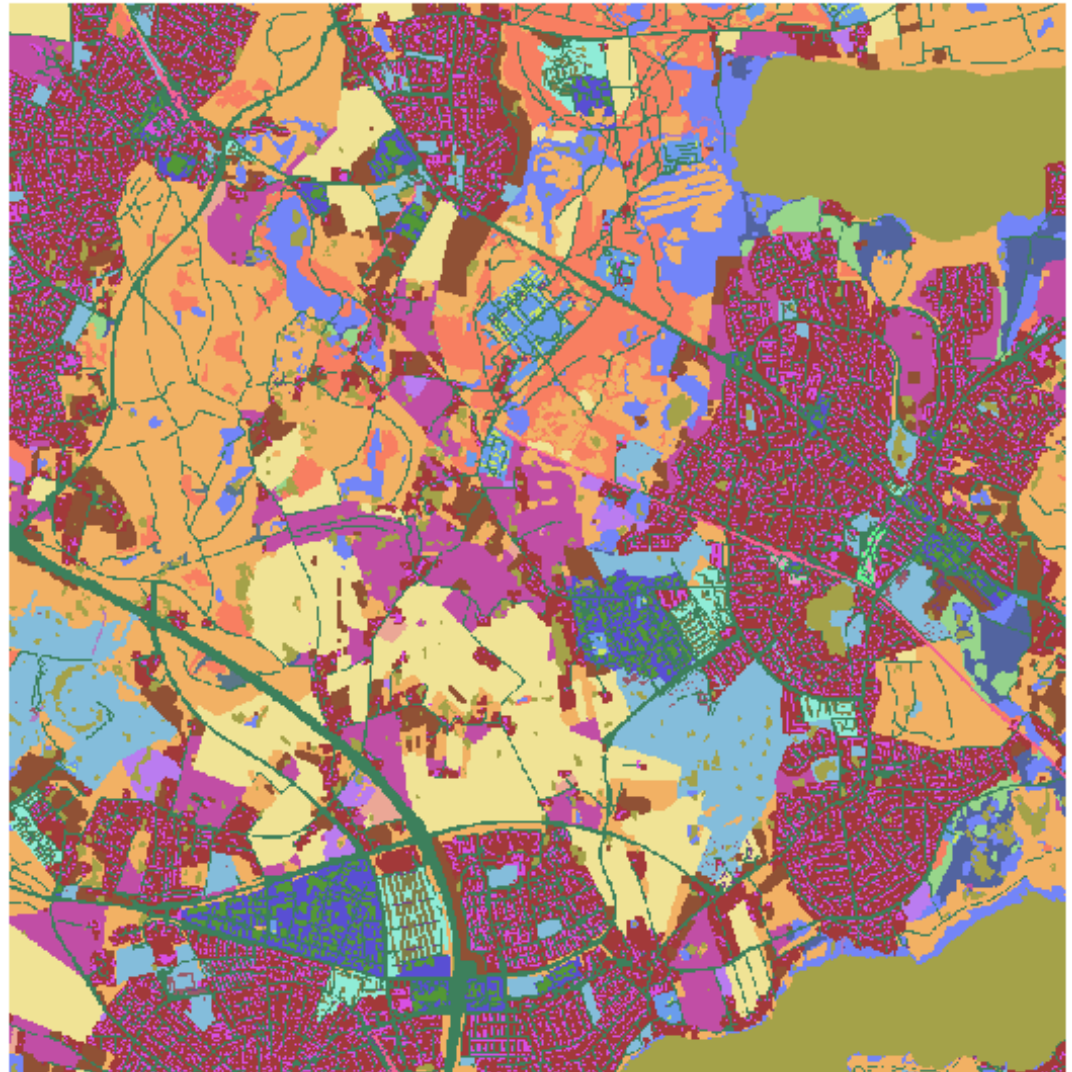
(LUCC = Land Use Class Coverage)



LUCC: a more detailed land use map than the EU based Corine map

AGG_LU_Name_DK

- 100000_Andet bebygget
- 100104_Andet bebygget, bygning
- 101000_Lav bebyggelse
- 101104_Lav bebyggelse, bygning
- 102000_Høj bebyggelse
- 102104_Høj bebyggelse, bygning
- 103000_Bykerne
- 103104_Bykerne, bygning
- 104000_Bygning
- 110000_Skov
- 110110_Skov skov markkort
- 201000_Industri
- 201104_Industri, bygning
- 300000_Vej
- 400000_Jernbane
- 600000_Rekreativt område / sportsanlæg
- 600104_Rekreativt område / sportsanlæg, bygning
- 701000_Landbrug intensivt, midlertidige afgrøder
- 702000_Landbrug intensivt, permanente afgrøder
- 703000_Landbrug ekstensivt
- 704000_Landbrug, ikke klassificeret
- 801000_Lysåben tør
- 801703_Lysåben tør, landbrug ekstensivt
- 802000_Lysåben våd
- 802703_Lysåben våd, landbrug ekstensivt
- 901000_Sø
- 902000_Vandløb
- 999000_Ikke kortlagt



LUCC – also named Basemap 2016



Land use map for Denmark from 2016
with a cell size of 10m.

A mash-up of digital maps from a large
number of data providers

- GeoDanmark/SDFE: Kort 10
- Geodatastyrelsen: Parcel map
- Landbrugsstyrelsen: Field maps
- Naturstyrelsen: Forest maps

The map's establishment was sponsored
by Denmark's Statistics and assembled by
Aarhus University, DCE

Production Workflow

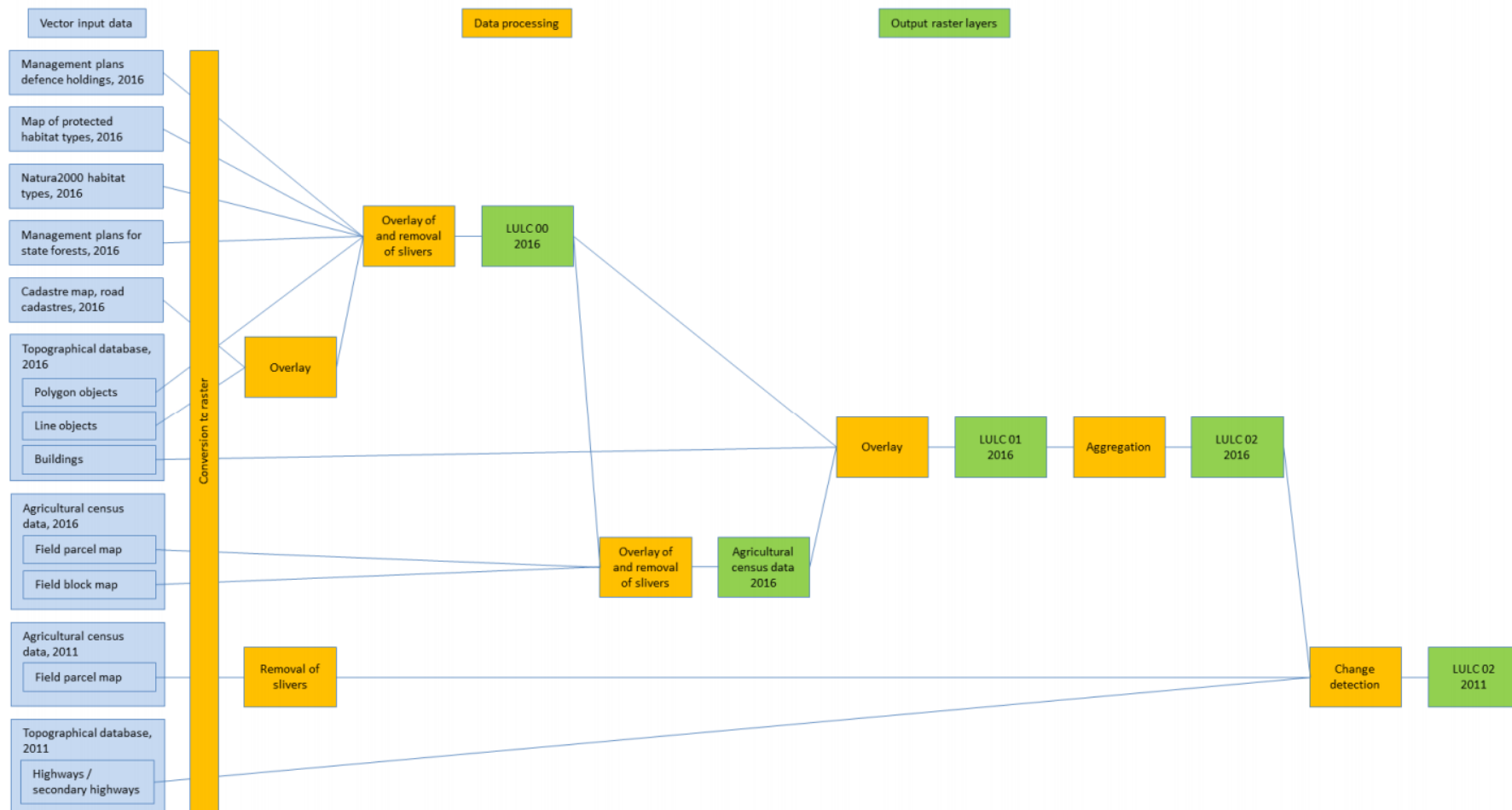


Figure 3.1 Illustration of data processing. Vector input data (blue boxes) are converted to raster format and subsequently processed (yellow boxes), resulting in 5 final output raster layers (green boxes).

Aggregation of objects

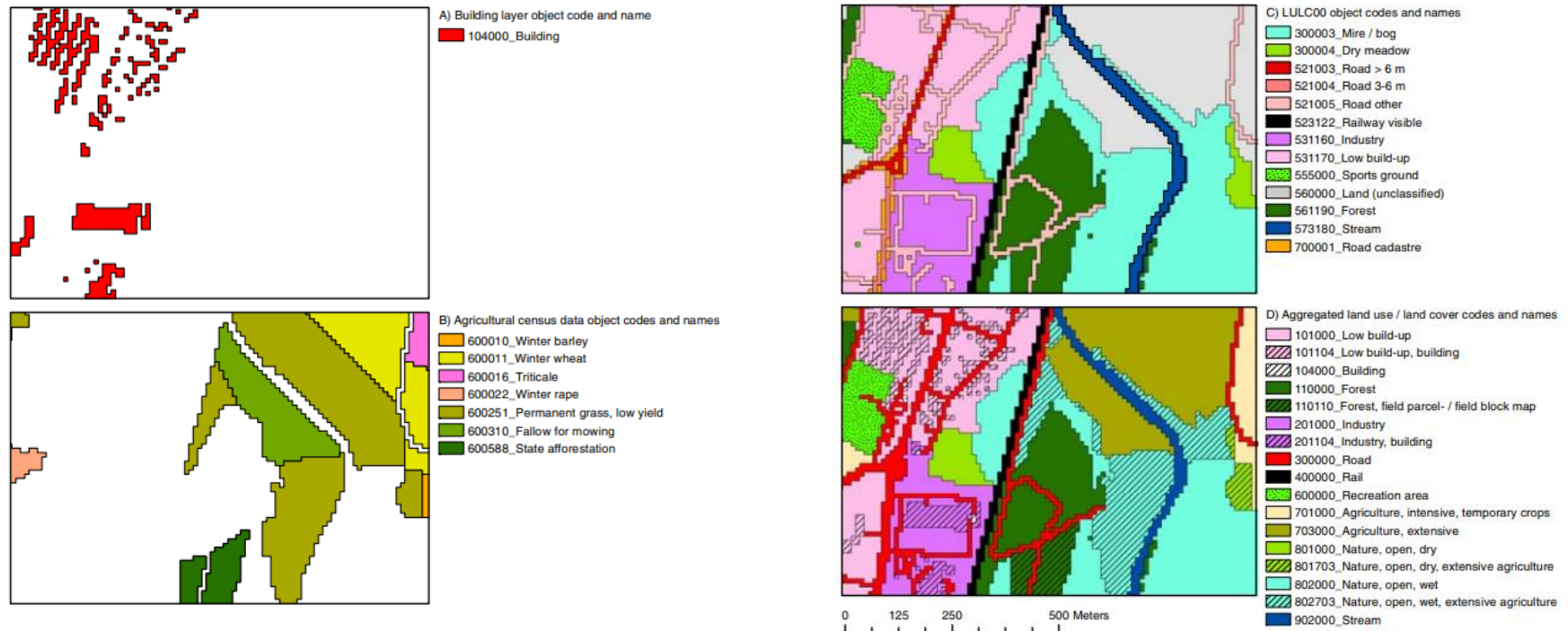
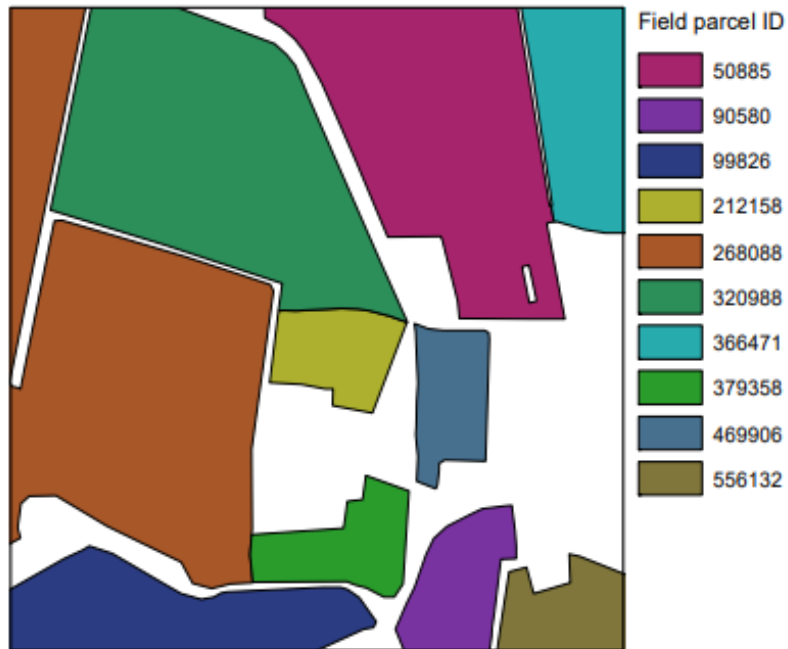


Figure 3.10 Applied method for aggregation of object types. The building layer from Kort10 (A), the agricultural census data (B) and the LULC00 layer are overlaid (C). Buildings, overlapping with build-up objects types are assigned a combined build-up/building type. Parcels from the agricultural census data, containing extensive land use and overlapping with habitat types in the LULC00 layer are assigned a combined habitat/agriculture type.

Examples of 'sliver-polygons' during conversion of the field map

A) Field parcel map in vector format



B) Field parcel map after conversion to raster format
(cell size 10 x 10 meters)



Overlay-hierarchy: Prioritization of layers

Necessary to prioritize the various datasets from different organizations during the pairwise combinations.

Topographic data supersede environmental data.

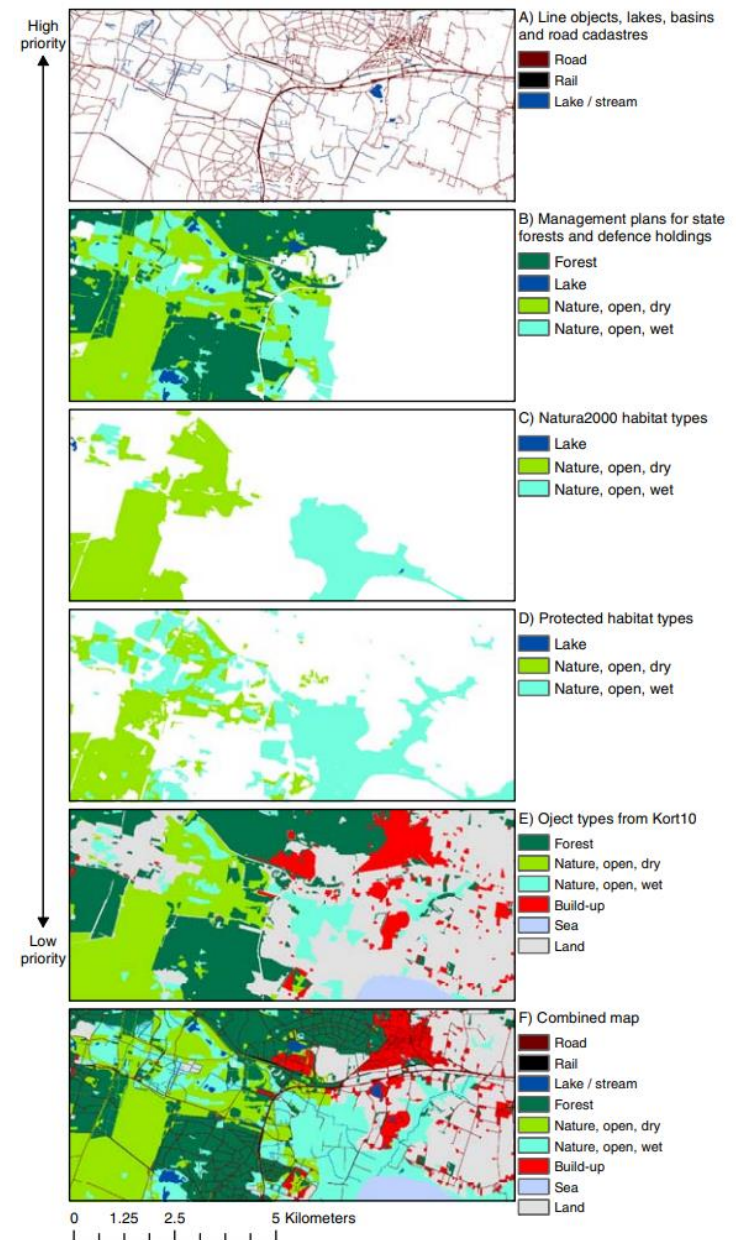


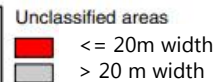
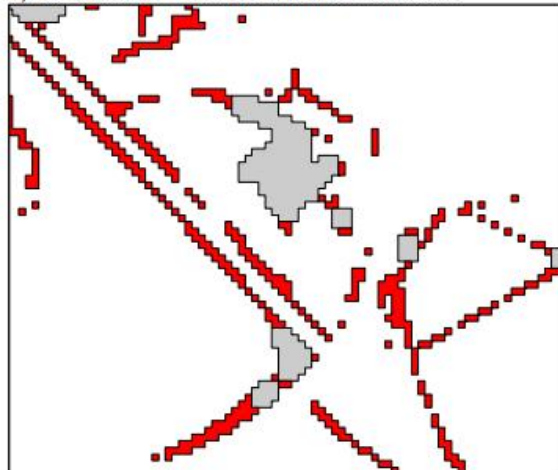
Figure 3.5 Applied method for overlay of input layers. Input layers are overlaid. Object types from layers placed in the top of the hierarchy exclude object types placed lower in the hierarchy (A-E), resulting in the final combined map (F).

Handling of non-classified areas

A) Combined map before elimination of unclassified cells



B) Identification of narrow areas with unclassified cells



C) Combined map after elimination of unclassified cell

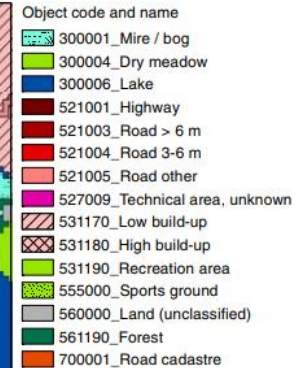
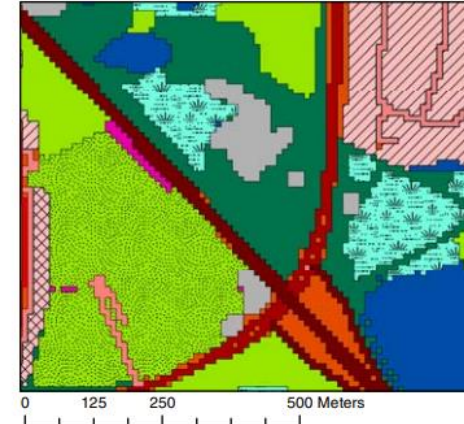
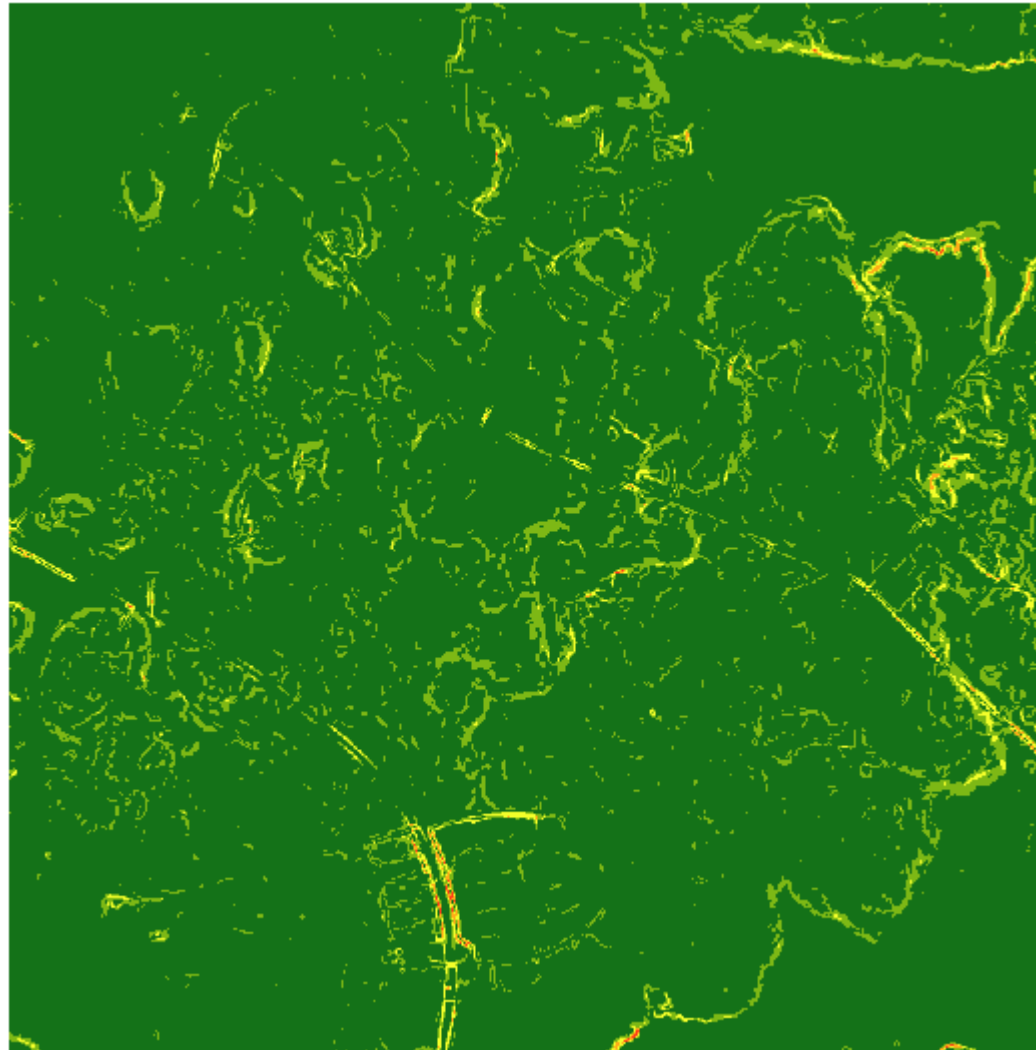
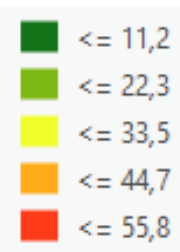


Figure 3.6 Applied method for elimination of narrow areas with unclassified cells. From the combined map (A), unclassified cells are extracted and areas with a width equal to or less than 20 meters are identified (B). These narrow unclassified areas are merged with adjacent object types (C). Unclassified areas are only merged with infrastructure or streams, if no other adjacent object types exist.

Terrain slopes (Slope)

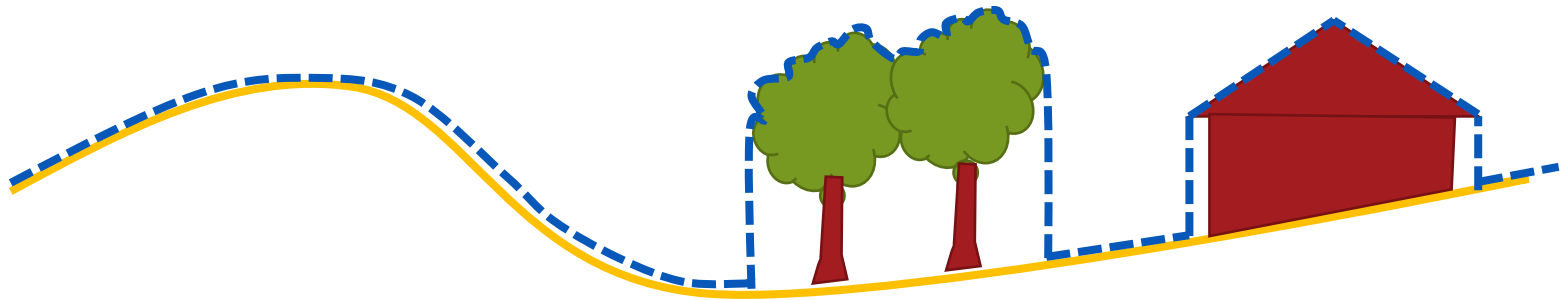


Derived from 2020
LiDAR-DTM



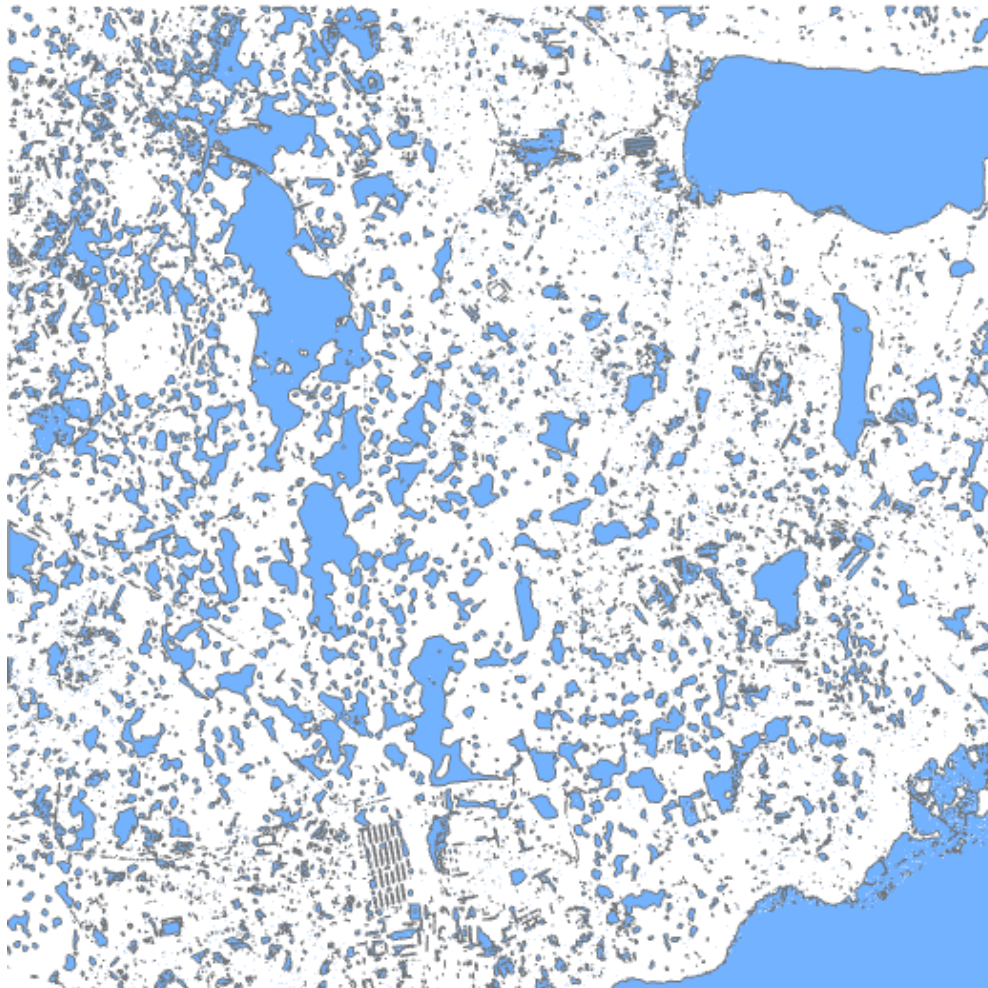
DSM vs. DTM

- DSM, Digital Surface Model
- DTM, Digital Terrain Model



DTM was produced from planning away buildings and vegetation from the DSM.

Bluespot map



Potentially water filled sinks.

Derived from the DHyM and Arc-Malstrøm software developed by TB, see

Model bluespots ...

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Model bluespots to map flood risk

Author Duration

In this lesson, you will use bluespot modeling tools to explore a drainage basin north of Copenhagen, Denmark, that has been hit by several rainstorms in the past decades. You will investigate model results and observe the severe impact of flood inundation in residential areas located within landscape sinks that are filled during rainstorms, resulting in the flooding of homes and critical infrastructure. In the last optional module, you will explore how the bluespot modeling tools may be used to prepare and model similar occurrences in your own study area.

This lesson was last tested on August 26th, 2021, using ArcGIS Pro 2.8. If you're using a different version of ArcGIS Pro, you may encounter different functionality and results.

[View final result](#)

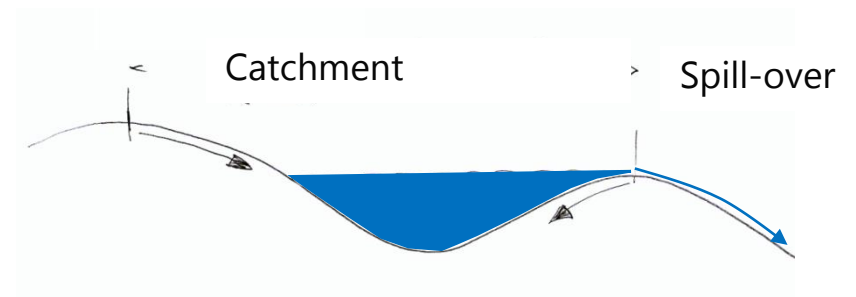
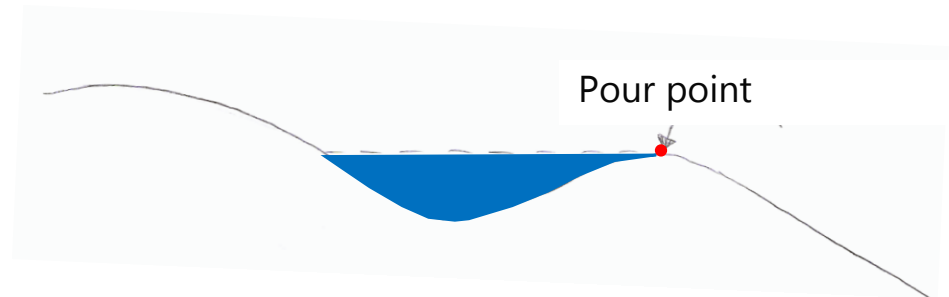
Requirements

- ArcGIS Pro (get a free trial)
- ArcGIS Spatial Analyst extension

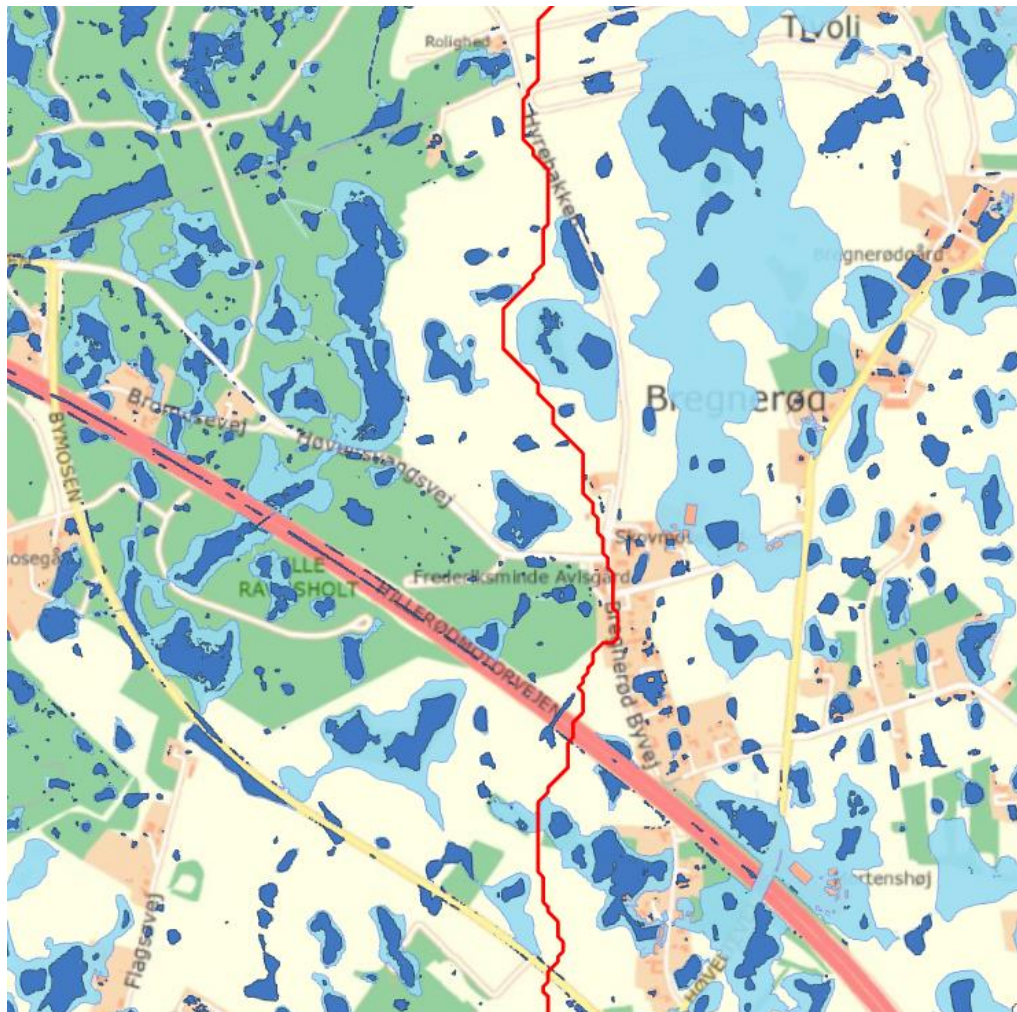
Lesson Plan

Explore the tools and data Review and set up the flood risk screening workflow, data, and tools.	30 minutes
Run the model and tools Review and explore sample data and tools to predict flooding consequences for simulated storm water events.	60 minutes
Explore the results Inspect model and tool results, create nodes and edges, and calculate downstream accumulated spillover.	60 minutes
Run the analysis with your own data Review data requirements, data preparation steps, and associated tools to predict flood risk.	90 minutes

Local sinks (bluespots)



Bluespots



Presumed bluespot
extents July 2nd 2011

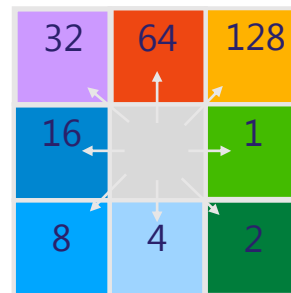
Max. bluespot extents

Terrain runoff

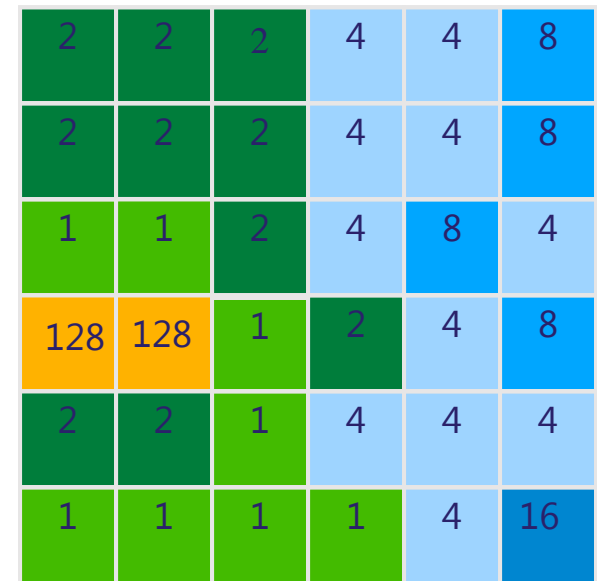
Predict flow directions cell by cell

78	72	69	71	58	49
74	67	56	49	46	50
69	53	44	37	38	48
64	58	55	22	31	24
68	61	47	21	16	19
74	53	34	12	11	12

DHyM elevation values



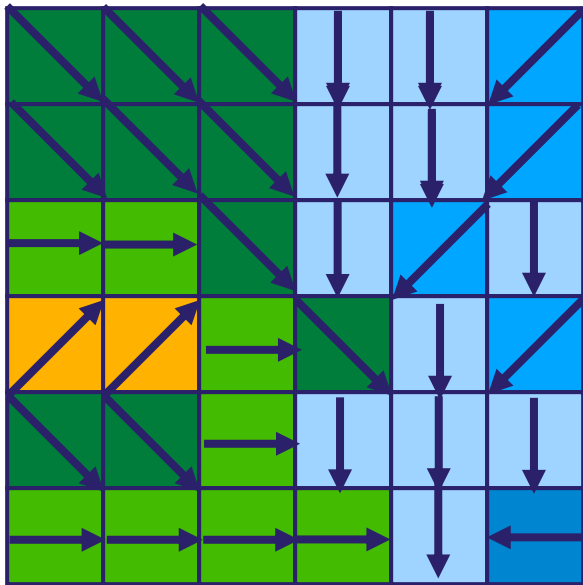
Direction encoding



Flow directions

Terrain runoff

Accumulated flow cell by cell

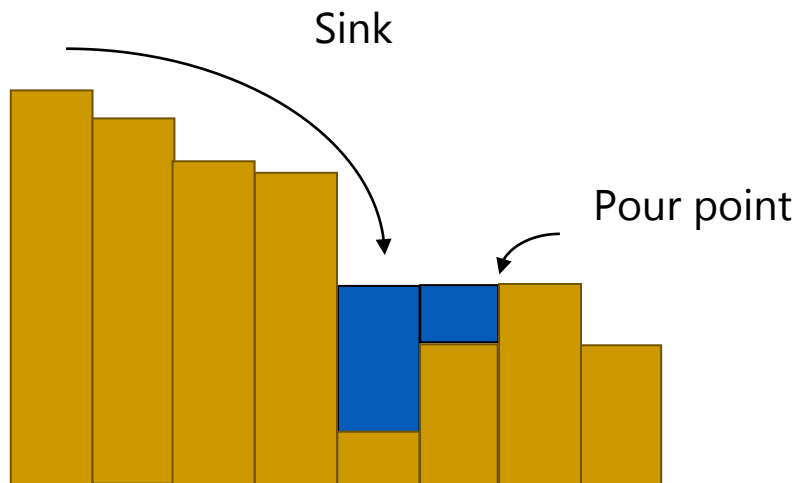


Flow directions

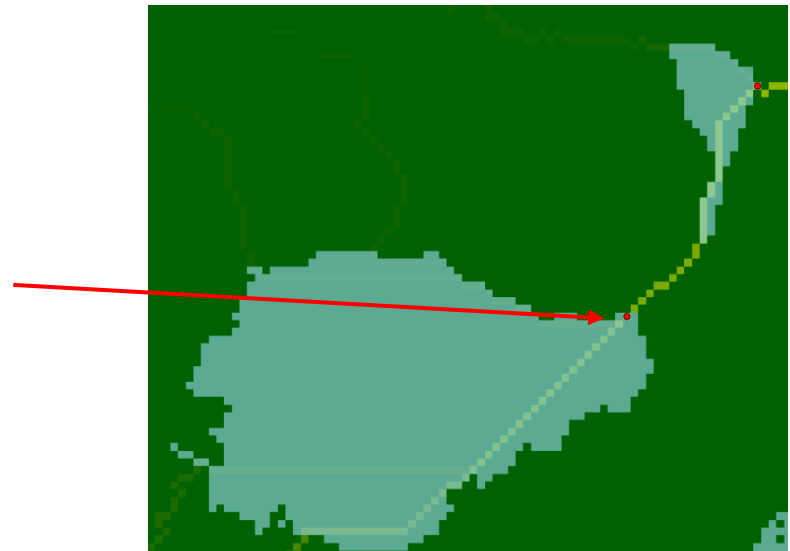
0	0	0	0	0	0
0	1	1	2	2	0
0	3	7	5	4	0
0	0	0	20	0	1
0	0	0	1	24	0
0	2	4	7	35	2

Accumulated flow

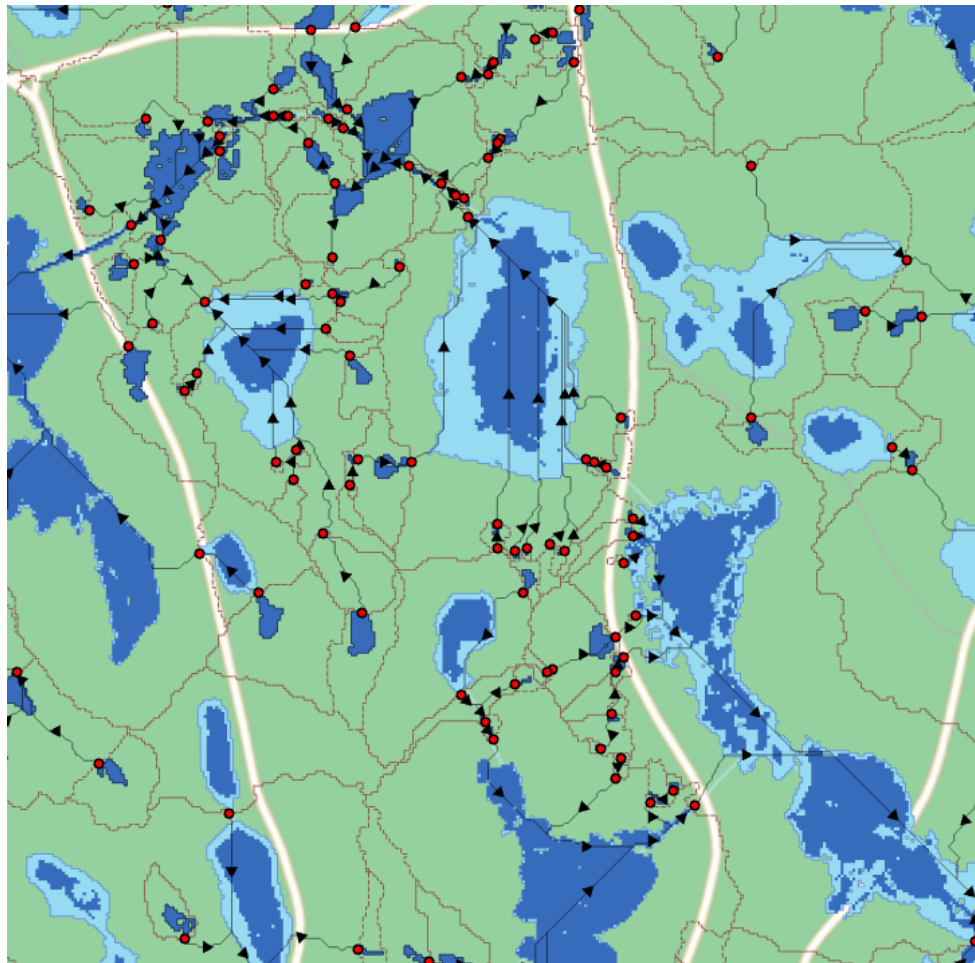
Identification of sinks to ensure a continuous downstream flow



Bluespot's pour points are located where the flow accumulation is highest.



Runoff from sink to sink



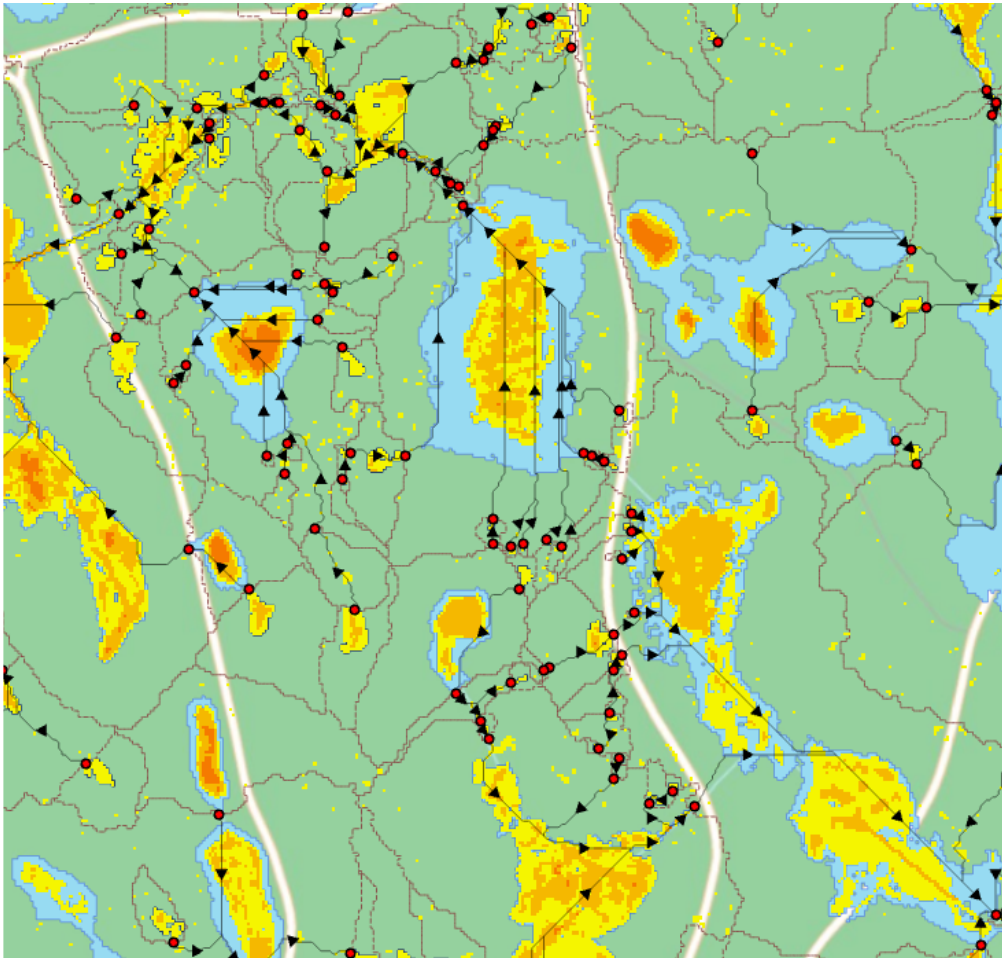
• Bluespot pour points

Expected bluespot
extents July 2nd 2011

Max. bluespot extents

Topographic catchments for
each bluespot

Bluespot depths



Expected local water depths in meters after the stormwater event on July 2, 2011

