Vegetation height maps derived from digital elevation models – the next innovation in the production of orienteering maps?
Development of Orienteering Maps.

20 years ago: Digital Cartography with OCAD 4/5/6/7

Base Map: **Scanning or Vectorizing** Survey Map
Photogrammetric plot

Surveying: Step counting
Compass bearing
Visual perception

Drawing: **Digitalization Boards**
Computer Mouse

Printing: Spot color printing
CMYK printing
Development of Orienteering Maps.

8 years ago: LiDAR data / DEM / Tablets (OCAD 10/11)

Base map: Digital Survey Maps / WMS
LiDAR data / Digital Elevations Models
→ Contour lines
→ Relief Shading
→ Slope Map
→ Cliffs

Surveying: GPS-Receiver → Tracks
Laser Range Finder
Tablet PC

Drawing: Computer Mouse

Printing: (Spot color printing) CYMK printing

Vegetation height maps, the next innovation for O-maps? - ICC Dresden 28th August 2013
LiDAR Data.

Laser Raw Data

GRID

RGB Photo

Hill Shading

Contour Lines

DSM - DTM

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**Contour Lines.**

- Problem: jagged contour lines
- Solution:
  1\(^{st}\) use Douglas-Peucker Algorithm and
  2\(^{nd}\) change into Bèzier Curve.

Illustration: B. Imhof, U. Steiner
Contour Lines.

- Individual contour interval.
- Problem: Large file of Danish Land Survey with 36 km² → several days
- Solution: Split into tiles of 1km km² → 6 minutes and merge contour lines afterwards!
- Problem: Perception of landforms in the terrain is not always identical with the derived contour lines from DEM
- Solution: not yet solved → Research at ETH Zurich
Hill Shading.

• Open hill shading as background map and vectorize the land form features, like
  - Road and track network
  - Ditches and depressions
  - Knolls

• The quality of the hill shading can differ due to the quality of the resolution.

• Experienced user can detect vegetation boundaries as well.
Contour Lines vs. Hill Shading
Cliffs.
Deriving cliffs
Orthophotos.

- Open georeferenced orthophotos as a background map and vectorize vegetation edges.
- Quality can differ a lot, due to the date of the shot.
- Restriction due to shadow and stage of vegetation
Vegetation Height Maps.

Orthophotos vs. Vegetation Heights Maps (DSM minus DTM)

Illustration: B. Imhof, U. Steiner
Vegetation Height Maps.

Orthophotos vs. Vegetation Heights Maps (DSM minus DTM)

Illustration: B. Imhof, U. Steiner
Vegetation Height Maps.

Latest tests for WC 2014 in Switzerland (DEM 0.5 m)
Detection of Vegetation Types.

Approach (Ch. Hohl and Th. Gloor 2007):
- Detect vegetation types according infrared reflection
- Use control sample areas in the terrain as reference in satellite picture
- Use “hard” and “soft” classifiers algorithm for identifying and extrapolate sample areas

Results:
- Canopy of trees disturbed identifications too much!
Detection of Vegetation Types.
Conclusion.

Laser Airborne Scanning has revolutionized orienteering maps very much:
- Step counting and compass bearing will disappear
- Field checkers can locate themself almost everywhere
- Products: Contour lines / Hill shading / Cliff
- Vegetation Height Map
  - Useful to detect vegetation boundaries
  → Challenge: Detect and classify type of vegetation (runability, undergrowth, etc.)
- Fist research with infrared satellite images has been done without success
- New approach with LiDAR and infrared pictures.
We do what ever it takes to make your maps perfect.
Cartographic Workflow I.

1. Geodata available?
   - Yes
   - No

2. Capture
   - Surveying
   - Scanning old maps
   - LiDAR-flights
   - Capture technical data

3. Import of data
   - Vector (Nat. GDB)
   - Raster-data (WMS-Server)
   - Digital Elevation-models (DEM)
   - Technical Data (DB, Lists)

4. Complete Geodata
   - GPS, Laser Range Finder
   - Orthophotos & DEM while vectorizing:
     - Contour Lines
     - Road & tracks
     - Vegetation
     - Cliffs
     - Others
   - Open Street Map

5. Representation of data
   - Complete

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