



A full scale project – from landfill to recreational area

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Sardinia, 2017

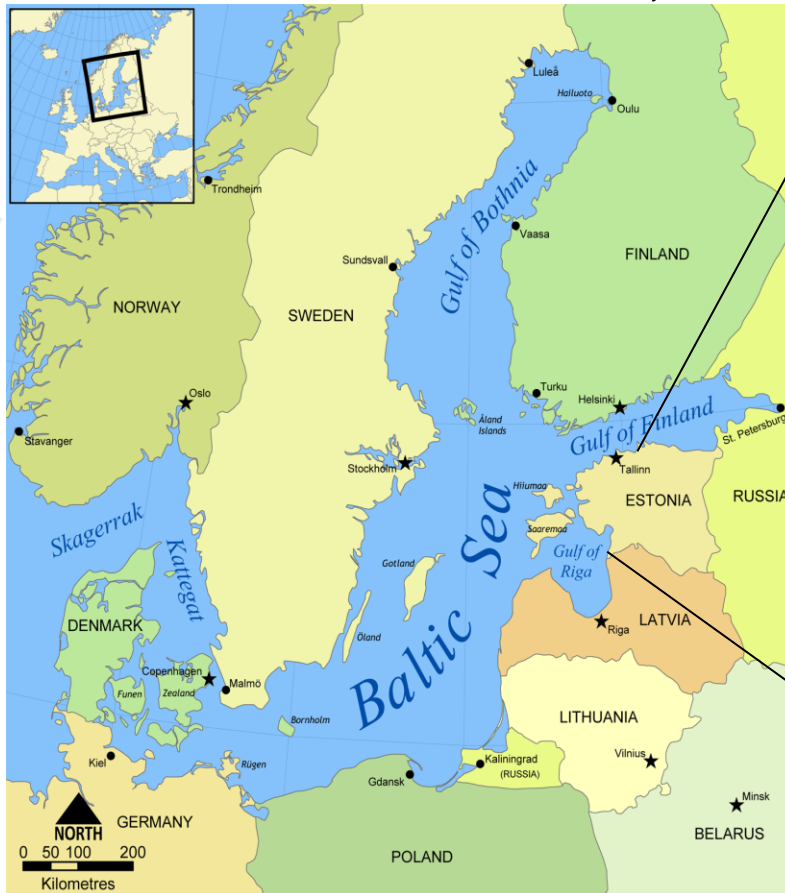


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Kudjape landfill

Baltic Sea, Estonia, Saaremaa



Background



Kudjape Landfill, Saaremaa island, Estonia

- Mostly municipal waste
- In operation 1970 – 2009
- Estimated volume 200 000 m³
- By law: had to be capped 2013
- Main issue: landfill gas
 - Gas collection? Passive ventilation?
 - Gas degradation?

Closure of the Kudjape landfill

- Regulation of the Ministry of Environmental Board
 - 1.2 m thick final cover + 0.5 m gas distribution layer
 - Alternative cover for landfill – biocover
 - Problems because of the location
- Is it possible to extract the material for biocover from the landfill?



Fine fraction

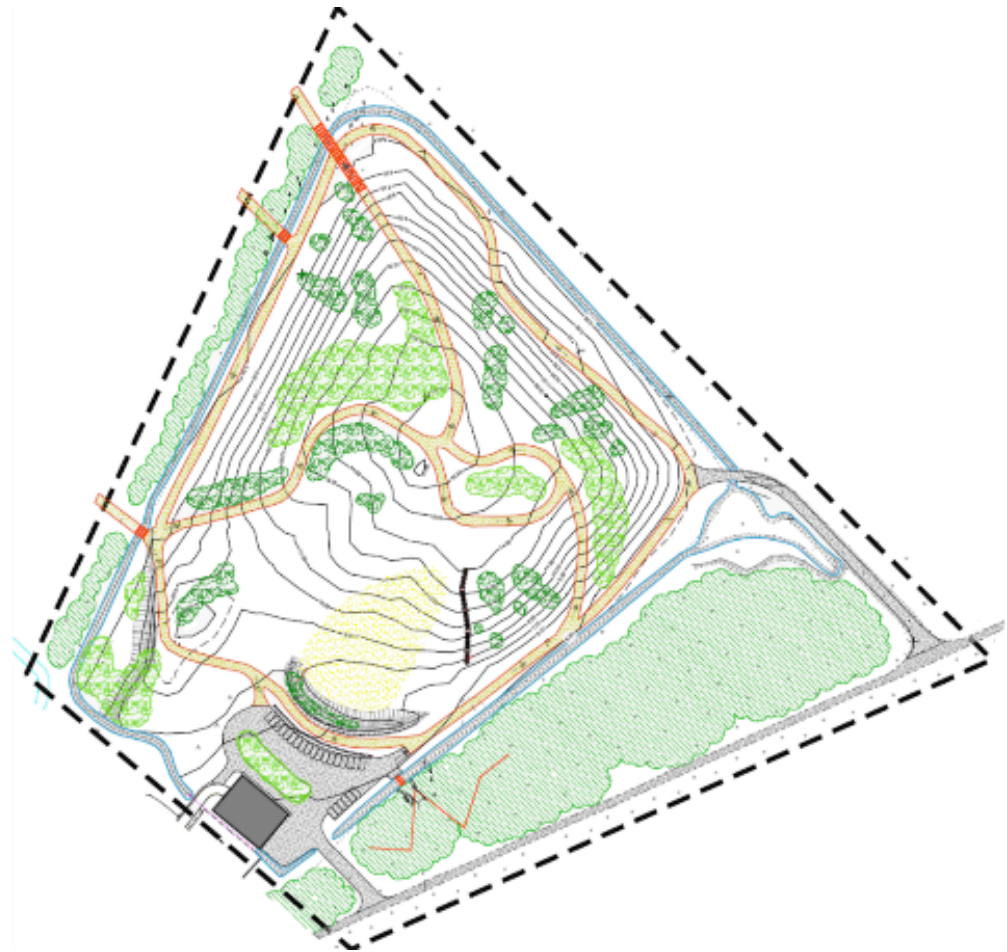
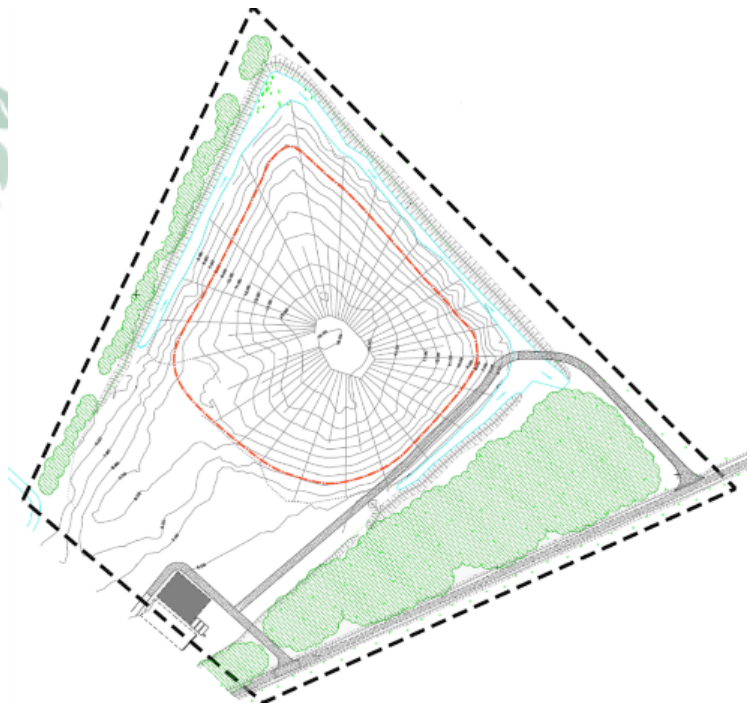
- Screened with 40 mm drum sieve
 - Totally 57,777 m³;
coarse/fine = 70:30
- Cover layer composition:
 - 60% fine fraction (FF) ≤ 40 mm
 - 20% naturally available soil
 - 20% matured sewage sludge compost



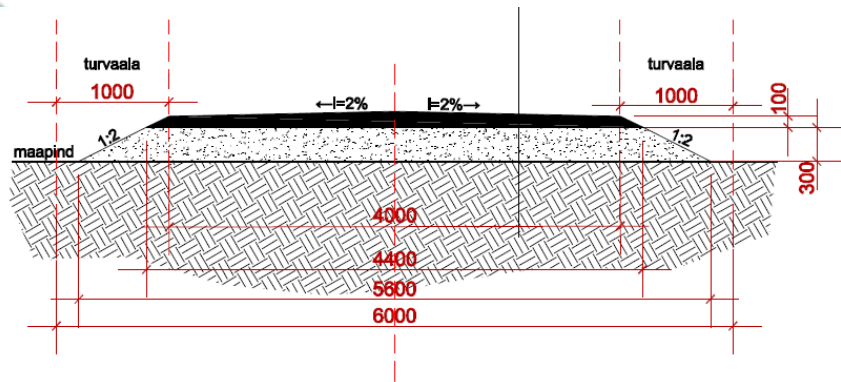
Excavation



Landscape project



Construction of sporting tracks



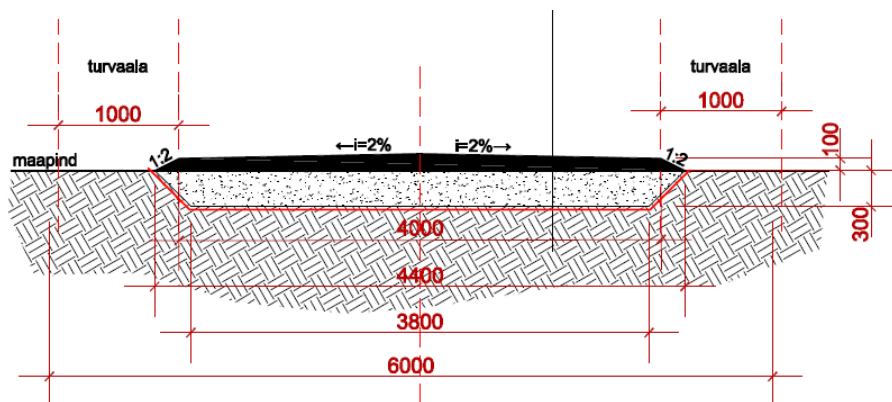
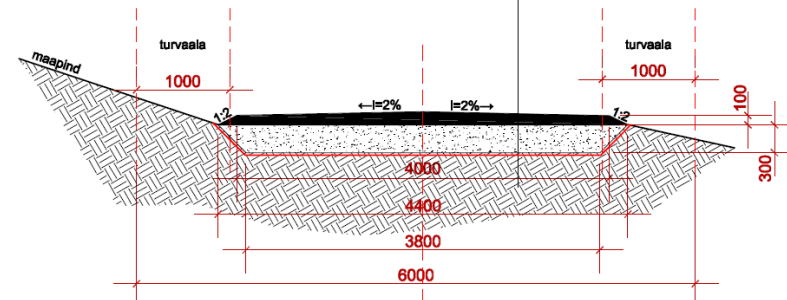
RISTLÕIGE TERVISESPORDIRAJAST PIKI NÕLVAGA

kandekiht - purustatud männikoor või mittepinnuline hakkepuit ca 60% + sõelmed või kruus (frak 0/12 mm) ca 40% 100 mm *

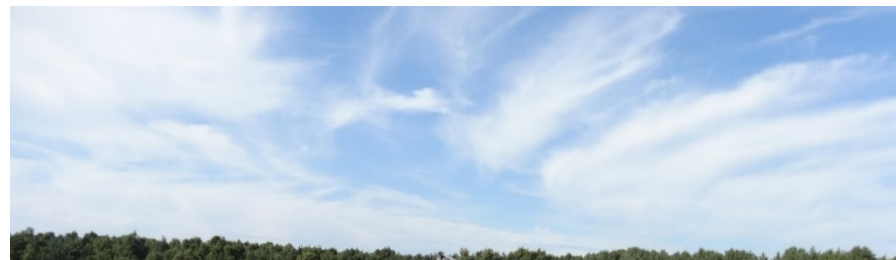
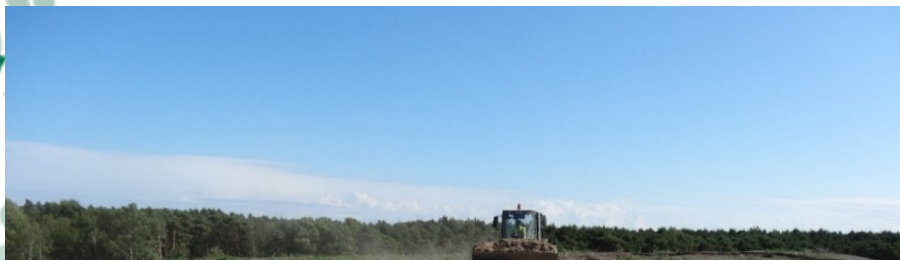
jaotuskiht - kruus (frak 0/32 mm) 300 mm

filterkiht - filterkangas Typar SF40 või analoog (II klass) ülekate 500 mm

tasandatud ja tihendatud bioloogiliseit aktiivne kiht



Construction of sport tracks



What we did



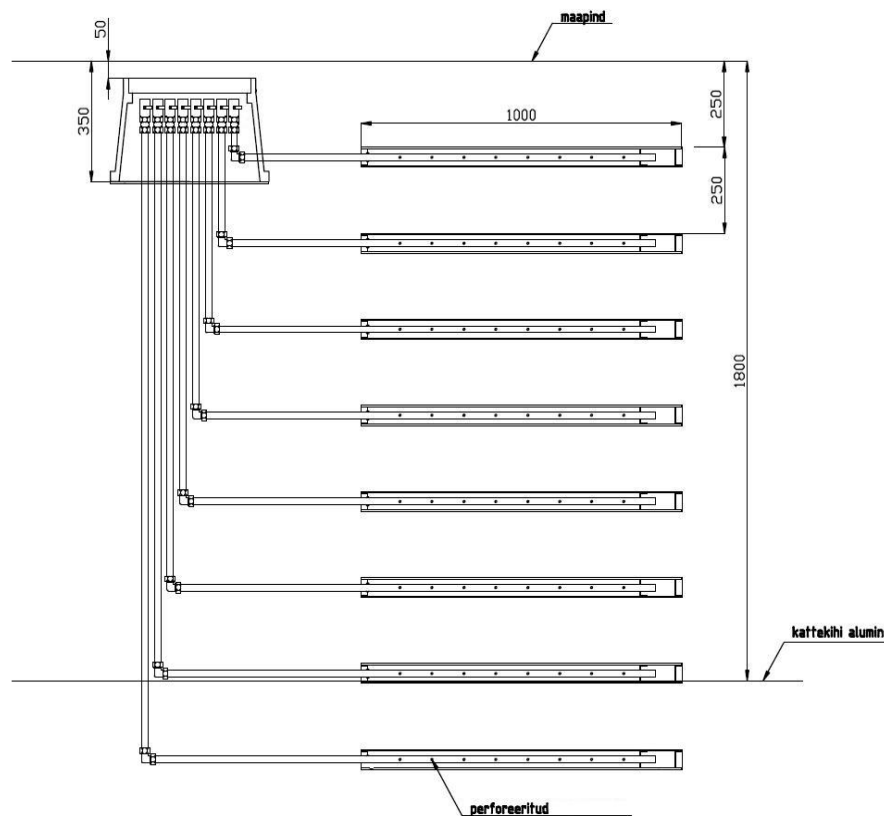


Monitoring

- Study the long-term efficiency of CH₄ degradation layer
 - *In situ* landfill gas measurements
- Influence of the CH₄ degradation layer on vegetation
 - Moisture content of the cover layer
(on site + laboratory)
 - *In situ* tree growth monitoring
- 3D modeling



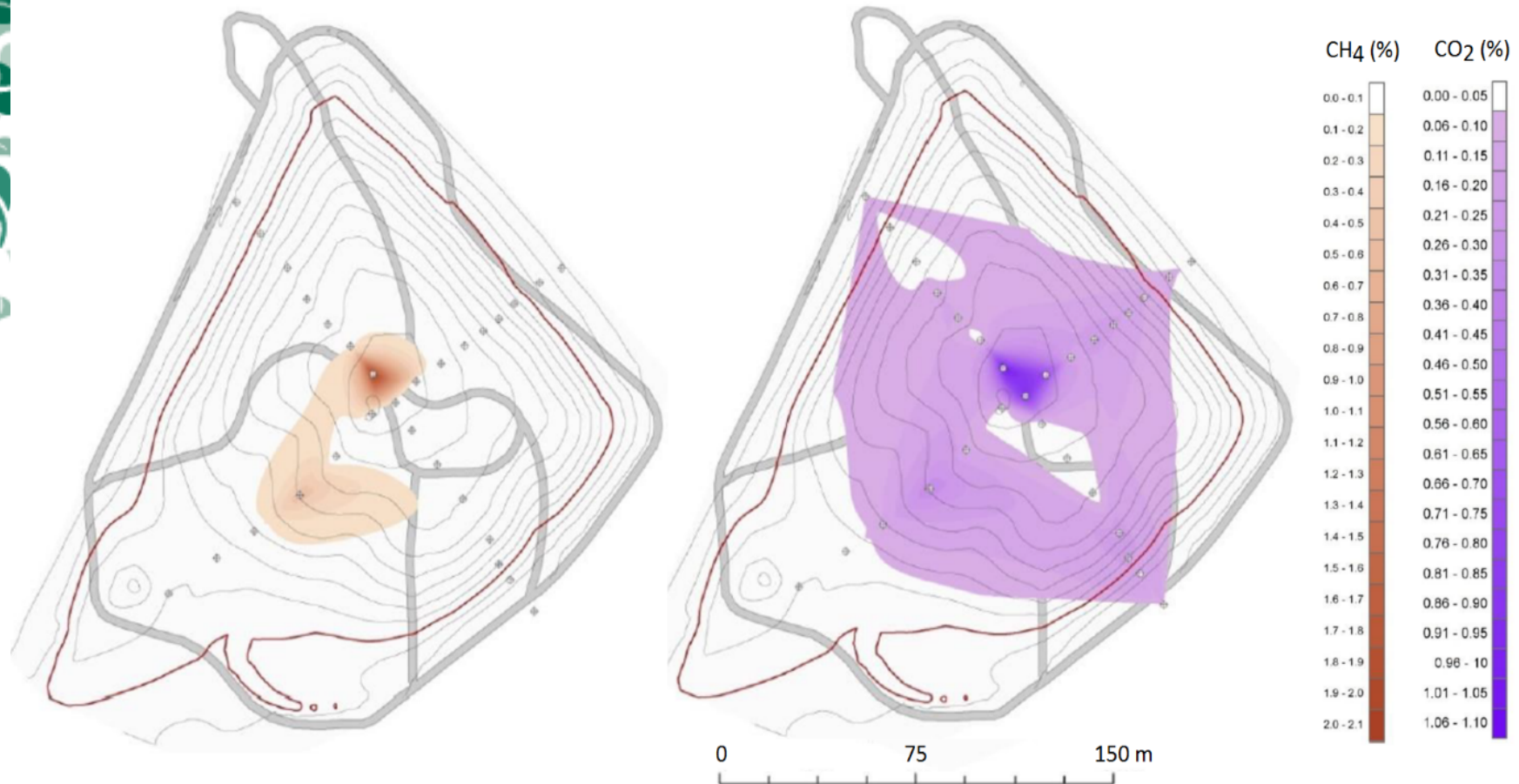
Gas-monitoring wells



Emissions through the cover layer



CH₄ and CO₂ emission



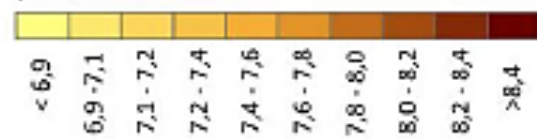
Tree growth

- European larch (*Larix decidua*) and Norway spruce (*Picea abies*) were planted
- High mortality rate two years after planting
- Field works started in autumn 2014
 - Height of the trees
 - Soil moisture and pH
 - Temperature
 - Conductivity
- Research continues





pH values

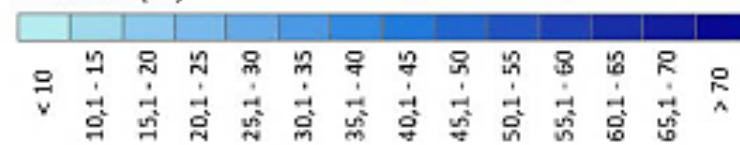


Legend:

- 2014 dead trees
- 2015 dead trees
- trees alive

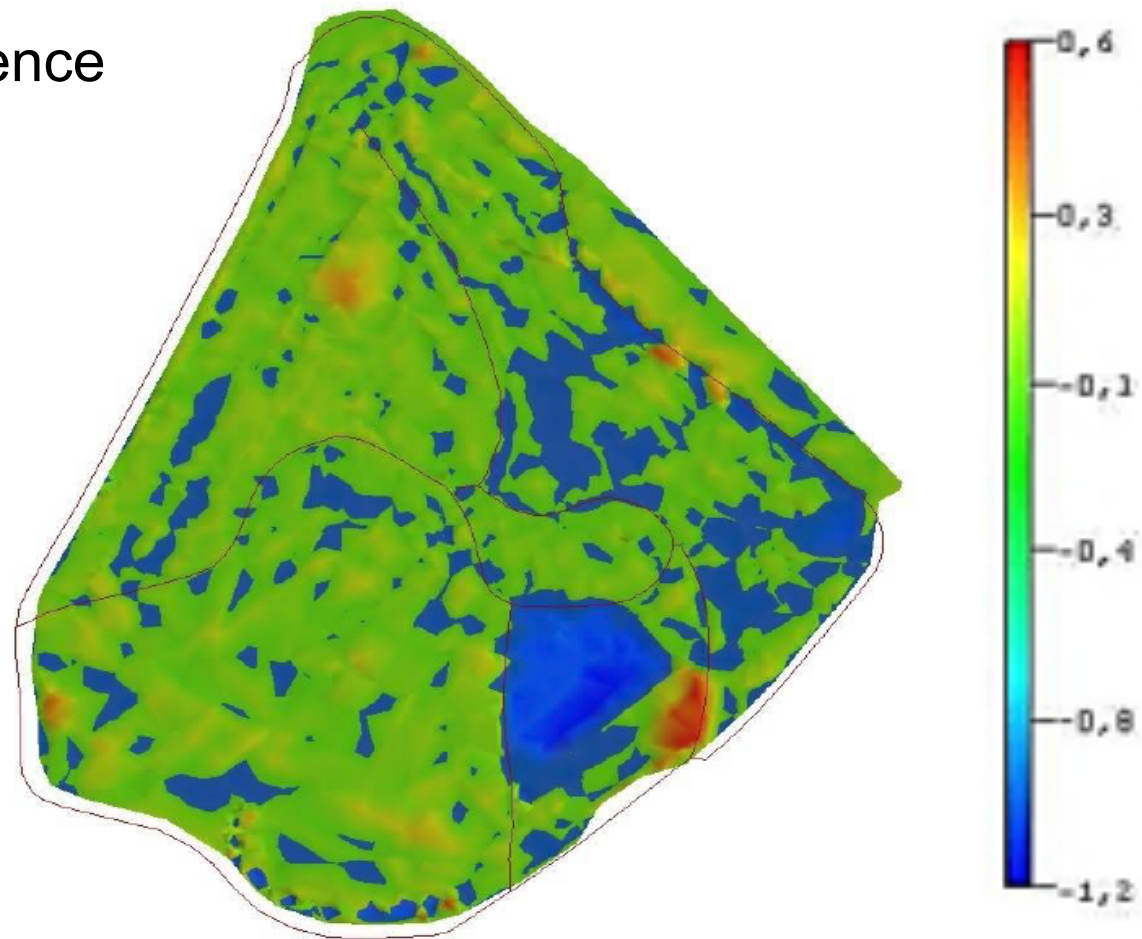


moisture (%)



3D modeling

Ground subsidence
and rising



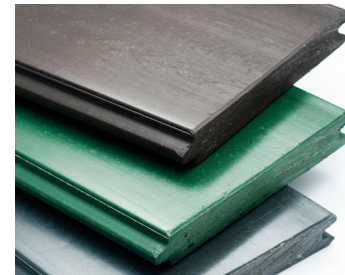
Additional experiments



RDF



Building material



Oil

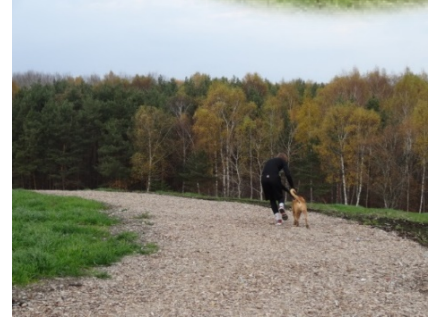
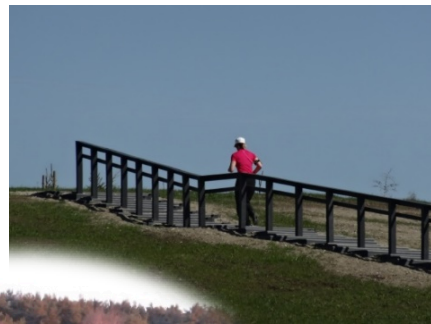




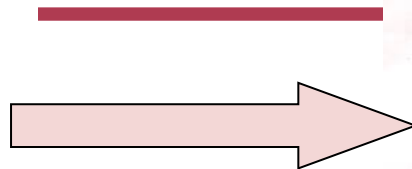
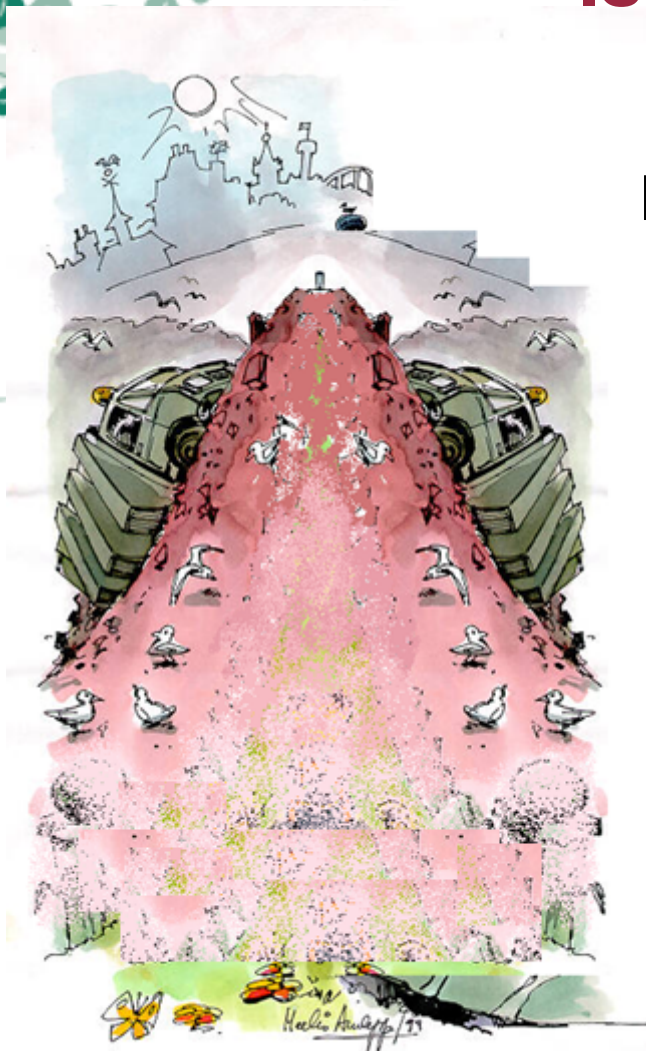
Today's findings

- LFM has not caused any environmental pollution
- The coating was extracted from landfill – no need to waste natural resources
- People get used to spending their free time at the landfill
- One goal is not enough - aim for more!
 - Material, energy, cover layer, society, green reputation ...
- Today there may not be a commercial application - the technology of the future!

Kudjape landfill in service of the society



Is it possible?



Yes!





Thank You for attention!

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October 4th 2017

See You at Kudjape!

