



Latvia University
of Life Sciences
and Technologies



UNIVERSITY
OF LATVIA



Linnæus University
Sweden

GEOPHYSICAL ASPECTS OF ABANDONED LANDFILL GEOMORPHOLOGICAL AND MATERIAL PROPERTIES MACRO- CHARACTERIZATION

XXth International Multidisciplinary Scientific GeoConference SGEM 2020



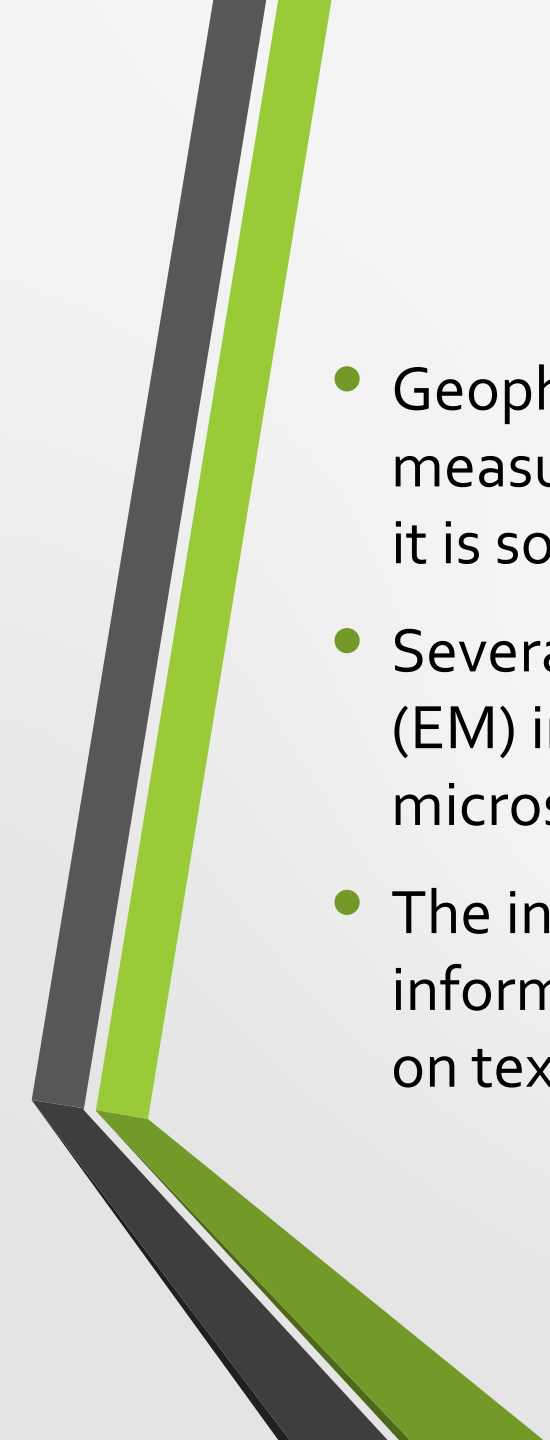
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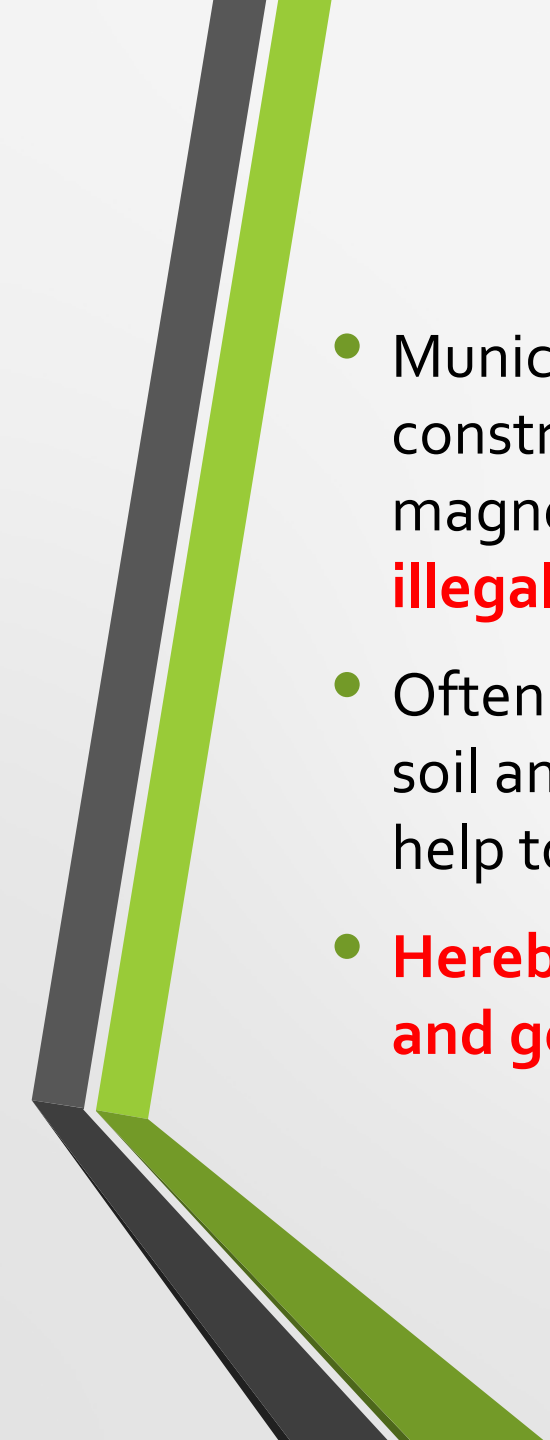
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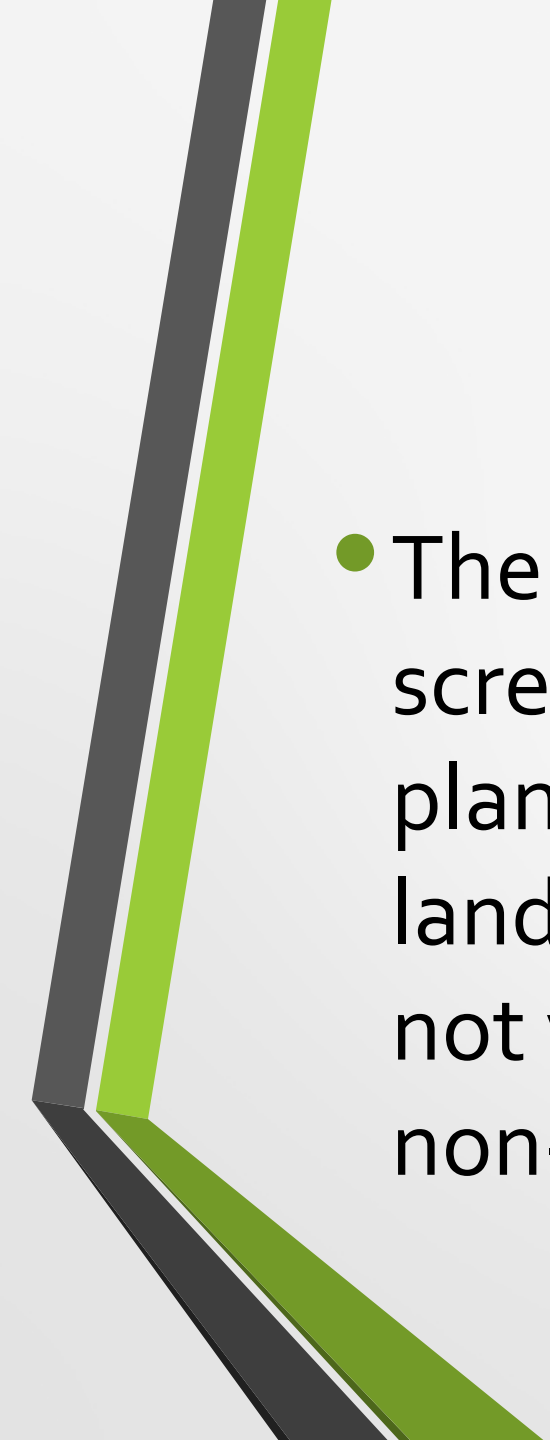
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- Geophysical exploration technologies and methods are available for indirect measurements and interpretation of data of near-surface material whether it is soil or urban material
 - Several technologies are best for shallow exploration, e.g., electromagnetic (EM) investigation, ground penetration radar (GPR) tomography, microseismic and many more
 - The induced polarization (IP) method is a technique providing direct information about the electric properties of the near-subsurface as well as on texture, structure and fluids

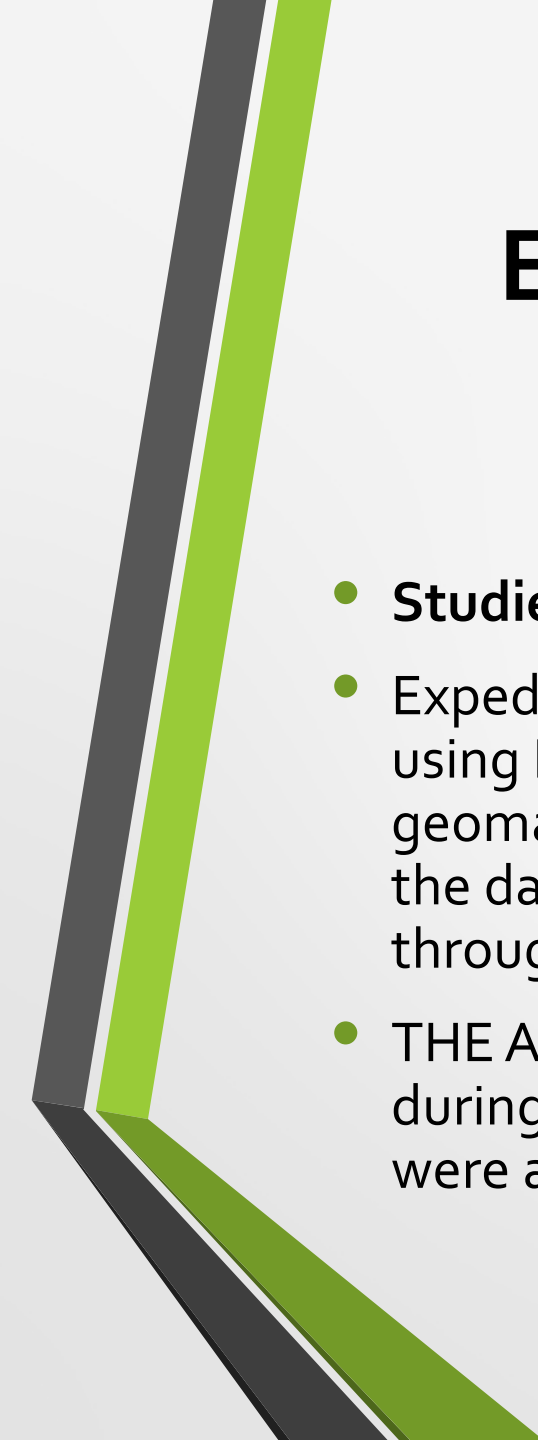
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- Spectrum of geophysics is used for mineral exploration, however, nowadays it is frequently applied in wide range of environmental quality surveys including mapping and characterisation of granulometry and soil type
 - **The characteristics of contaminated sites, degraded areas, dumps and landfills – possible to contour them as well**

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- Municipal solid waste contains various **ferrous materials**, especially in construction, demolition and industrial waste, which produce strong magnetic anomalies that are helpful in determination of unknown masses of **illegally dumped waste material** long time ago
 - Often ground surveying **EM and GPR methods** are used for studies of the soil and sediment matrixes including contamination, **magnetic methods** help to distinguish unhomogenities and artificial internal fields
 - **Hereby important to distinguish anthropogenic geomorphological forms and geophysics can provide many answers after studies**



THE AIM AND CASE STUDIES

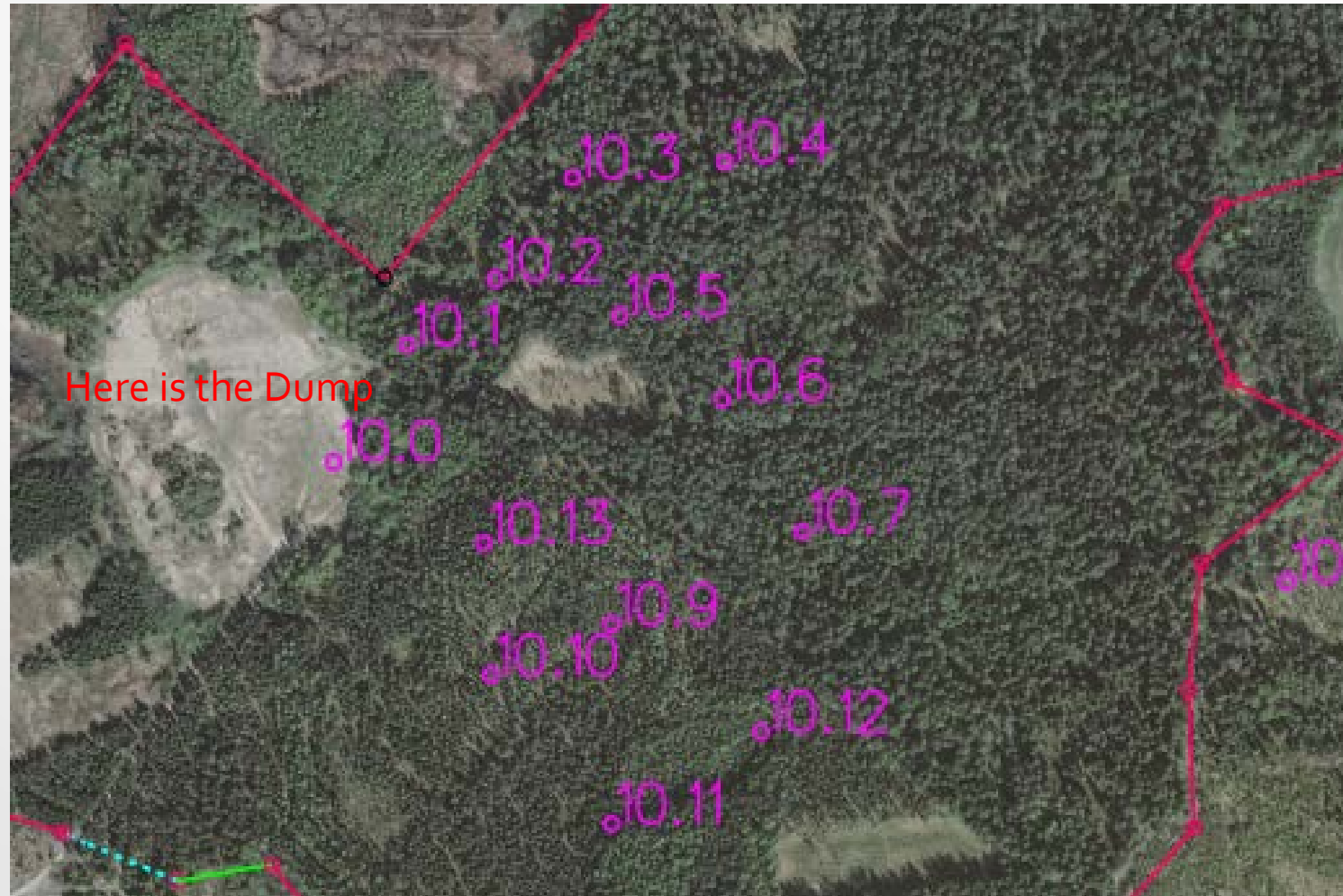
- The aim is to show the opportunities of the fast screening to determine approximate contours in plane and geomorphology of dumped masses in landscapes (e.g., forest) where waste material is not visible and archive materials on dumping are non-existent



Eastern Latvia magnetometry studies project

- **Studies reveal the buried dump through ground magnetic survey – accidentally**
- Expeditions in several locations were performed with profiling measurements by using PHP-5 protonmagnetometer, ensuring the continuity and homogeneity of geomagnetic data, making reasonable corrections for recalculating and refining the data of future “repeated measurements” and mapping sessions performed throughout Latvia within a certain model
- **THE AMENDED STUDY:** problematic dump site was discovered and contoured during expedition. At point 10.0 and in grey area (landfill) when the detailed studies were arranged – the deltas reached few hundreds up to 4000 nT instead of few nT

THE LOCATION OF GRADIOMETER NETWORK PROFILING POINTS



GEOPHYSICAL SCREENING WORKS AT THE GLASS WASTE SITE



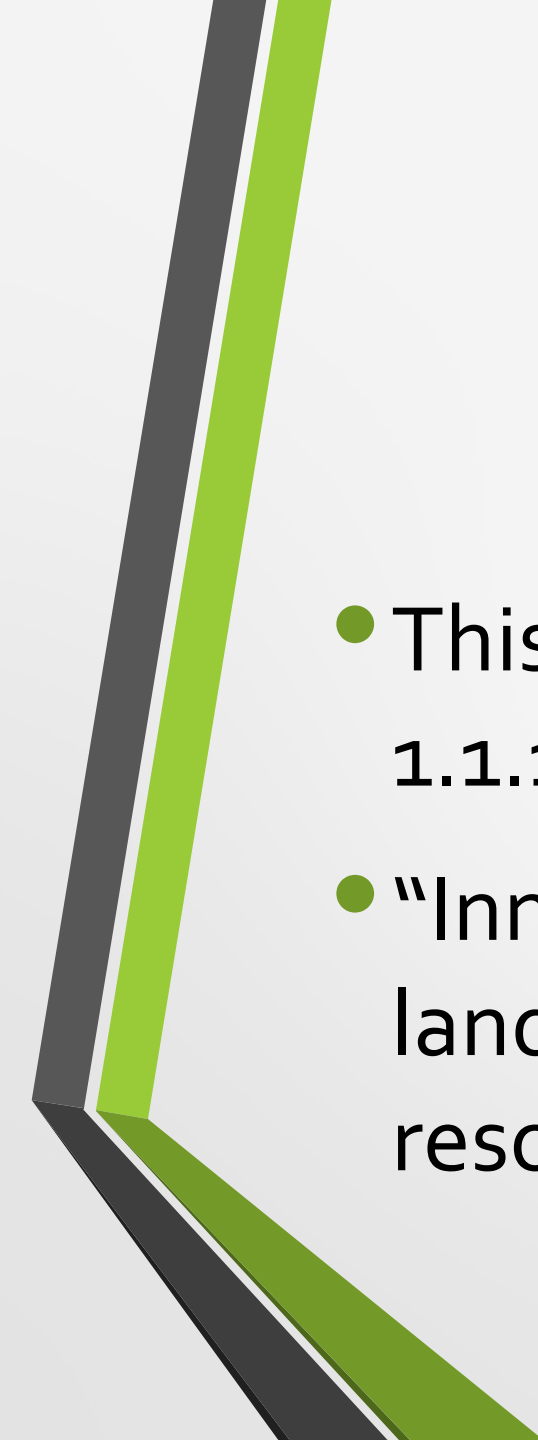
Geoelectric research in Southern Sweden

- **Why?** Results indicated that significant heavy metals are emanating according modelling data from centres of historical glass manufacture and disposal
- Elevated metal concentrations are also exhibited in groundwater, soil and homegrown vegetables, thereby presenting unacceptable cancer risks to the population
- **Study:** Preparation of the instrument for conductivity measurements and electric resistivity with induced polarization system
- Älgult landfill – dumped construction and glass waste heap buried under forest soil and vegetation in Southern Sweden

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- In this particular case study EM profiling had revealed good data
 - With no geological data the geomorphological and historical archive material studies are important to get knowledge on approximate location of glass waste
 - Industrial glass waste as was ascertained during geoelectric studies were largely mixed with construction and demolition waste in later times – empty spaces and high porosity decreased efficiency of EM studies
 - Such sites of glass waste during remediation project would be sophisticated as 50-80% of the estimated heap was construction and demolition waste and glass waste was minor part
 - IP data gave better recognition in comparison of basic electric profiling. Indirectly it shows subterranean gaps as empty spaces and increased porosity

CONCLUSIONS

- Landfills and abandoned industrial sites are the subject of compulsory remediation. Pre-investigation is important and geophysical methods of assessment are of wide use
- We used magnetometry and EM approaches to contour and define geomorphological features in old buried municipal and construction-demolition mixed with glass dumps
- Results showed good potential of geophysical surveying to spatially characterize landfill masses location and dimensions, the internal structure of a landfill site
- Protonmagnetometer use has accurately improved the visible dump contours where waste is buried
- Electromagnetic studies revealed that resistivity changes exactly give the ranges where construction and demolition waste is of different compositional material – concrete blocks, gaps, glass, fine fraction of waste, increased moisture
- Future frontiers are to implement the set of methodologies based on decision tree of best pre-investigation technology choice thus decreasing the costs of assessments



ACKNOWLEDGEMENT

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- “Innovative technologies for stabilization of landfills - diminishing environmental impact and resources potential in frames of circular economy”

THANK YOU FOR YOUR ATTENTION!
Благодаря ви за вниманието!



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