Project title: Terrain Explorers: AR adventures in topography

- Terrain Explorers
- GO! atheneum Brakel
- Brakel
- Belgium

Research question

How can drones equipped with Near Infrared (nIR) sensors, combined with field measurements and climate data, monitor the impact of climate change on soil moisture and cereal crop health during extreme weather conditions in the Flemish Ardennes?

Main results

Our measurements and analyses provided valuable insights into how vegetation responds to changes in temperature, rainfall, and other environmental factors. For example, after a dry period, we observed that vegetation was less green and contained less chlorophyll, indicating reduced growth. Plants in natural areas proved more resilient than those in agricultural or urban zones, where vegetation decline was more rapid. This underscores the importance of sustainable environmental practices. We also found that certain plant species are more drought-resistant than others, which is valuable information for agriculture and land management, especially given changing climate conditions.
By comparing drone images with satellite data, we confirmed that drones are an excellent tool for monitoring vegetation changes on a small scale. Their low flight altitude and flexibility allow them to capture more detailed images than satellites, which helps identify subtle vegetation changes.
Further analysis involved using KMI weather data and satellite images to study the impact of weather conditions and agricultural activities on vegetation health. The data, provided by expert Thomas Vanhamel, covered the period from October 1 to December 31, 2025, in Chièvres, including temperature, rainfall, wind speed, and humidity measurements. We compared this data with satellite images of agricultural fields in Everbeek-Beneden (Brakel). The NDVI satellite data comparison showed a significant decrease in vegetation index in December compared to October, mainly due to the maize harvest between October and November. Seasonal changes, such as lower temperatures in December, slowed plant growth, while humidity and rainfall remained relatively stable.
For more detailed vegetation analysis, we conducted an NDVI analysis with a Raspberry Pi camera, developing a working code to capture images, adjust contrast, and store data. The resulting images confirmed the impact of external factors on vegetation health.

Full project on: www.terrain-explorers.eu

Actions taken to make a difference

To reduce the impact of climate change on our local agriculture, we propose both short- and long-term actions:

SHORT-TERM ACTIONS:
ACTION 1:
Choosing Resilient Crops:
Our research shows that maize and potatoes are highly sensitive to both drought and

excessive rainfall. Selecting more resilient crops can help adapt to extreme weather:
– Rye: Resistant to wet conditions and cold temperatures, making it ideal for damp winters.
– Triticale: A wheat-rye hybrid that withstands both drought and excessive moisture.

LONG-TERM ACTIONS
ACTION 2:
Adopting non-inversion tillage (NIT) instead of plowing, this method preserves the soil structure, allowing better water infiltration and retention.

Benefits:
– Improved water absorption during heavy rain
– Longer moisture retention in droughts
– Reduced soil erosion

Challenges:
– Takes about six years to show significant effects
– Requires new investments in specialized machinery and precision farming

ACTION 3:
Enhancing Soil Permeability: adding materials like sand can improve drainage, preventing waterlogging and creating better growth conditions for crops.

ACTION 4:
Agri-environmental management agreements
Farmers can participate in incentive programs promoting eco-friendly solutions. For example, grass strips along fields and waterways help:
* Absorb and redirect excess water
* Reduce soil erosion
* Increase biodiversity

FUTURE OUTLOOK:
While some of these measures require initial investments, they offer long-term benefits such as improved soil health, lower fuel costs, and more sustainable farming. Raising awareness and providing subsidies (government?) can encourage farmers to adopt these sustainable practices.

Full project on: www.terrain-explorers.eu

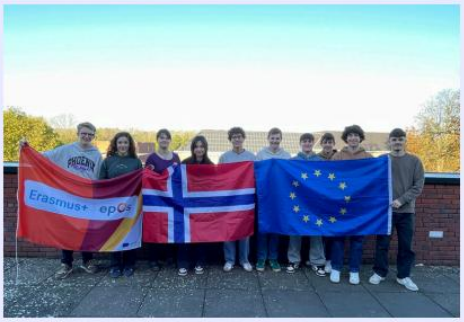
Project link:
http://www.terrain-explorers.eu

Project presentation
https://www.youtube.com/watch?v=4vNrTTxn-Vg&t=1s

Other content:

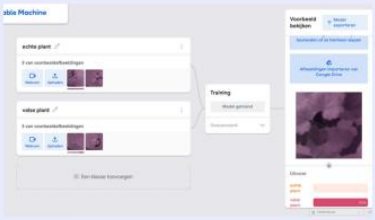
https://climatedetectives.esa.int/wp-content/uploads/formidable/54/Dossier-ESA-Climate-detectives-TERRAIN-EXPLORERS-compressed.pdf

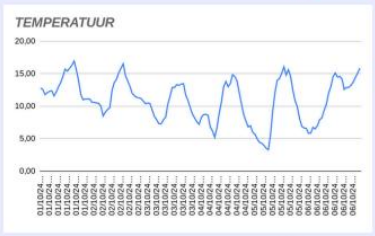
Terrain explorers : AR adventures



RESEARCH QUESTION

How can Near Infrared (NIR)-imaging with drones and field measurements be used to monitor the effects of coloration on crop health, water management and cooling by green areas during extreme drought and rainfall?





STEPS WE TOOK

- 🔥 Problem: Climate change threatens agriculture and water management.
- 🔍 Research: Drones and nIR technology analyze crops.
- 📊 Data: nIR cameras, KMI weather data, and ESA satellite images.
- 🔬 Experiment: AI and NDVI analysis (Raspberry Pi) for plant detection.
- 📈 Comparison: Weather and satellite data from Everbeek-Beneden.

✅ Conclusion: Climate insights support sustainable land management. 🌾💡

ACTIONS & CONCLUSION

Extreme weather threatens crops. Heavy rainfall and drought make farming unpredictable. Adaptation is key.

Short-term:
🌾 Choose resilient crops – Rye for wet winters, triticale for both drought and moisture resistance.

Long-term:
🔄 Non-inversion tillage – Protects soil structure and improves water management. Requires investment and takes ~6 years to show results.
🌱 Improve soil permeability – Adding sand prevents waterlogging and keeps crops healthy.
🌿 Sustainable farming measures – Grass strips reduce erosion, regulate water, and boost biodiversity.

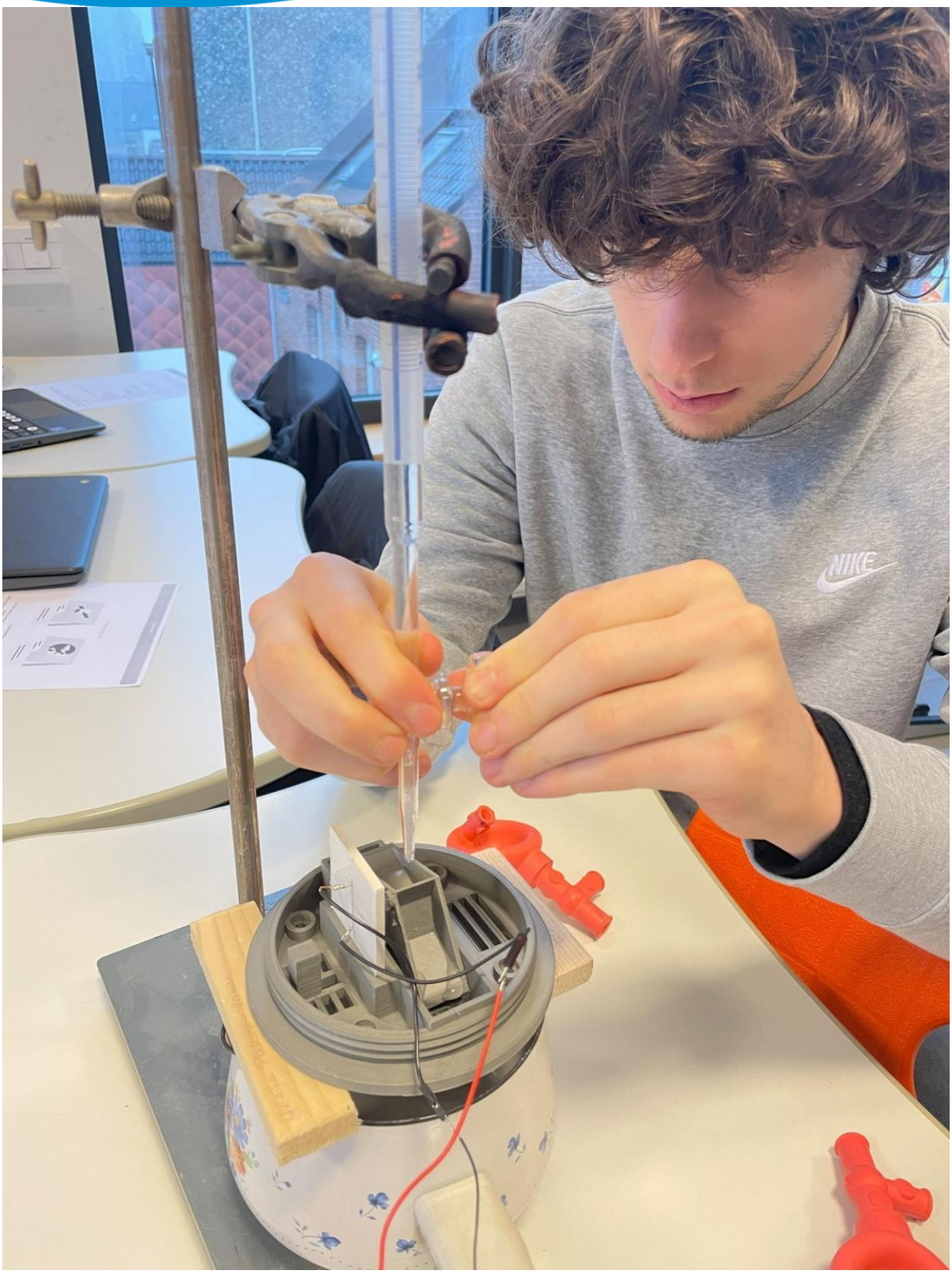
Healthy soil and better water retention strengthen agriculture. 🚜💚

Scan the qr-code to watch the video to hear the explanation more in depth

Our website

Our Youtube

Our presentation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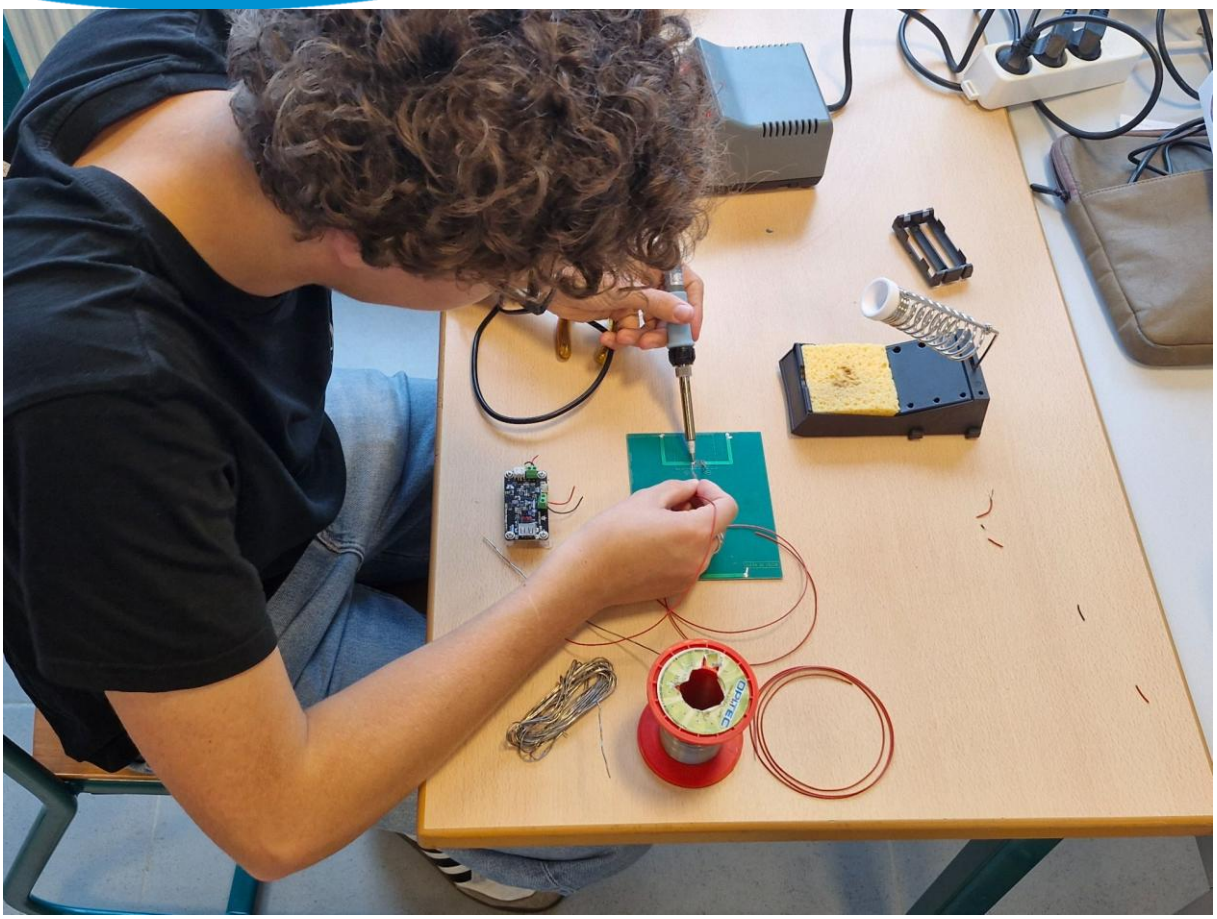

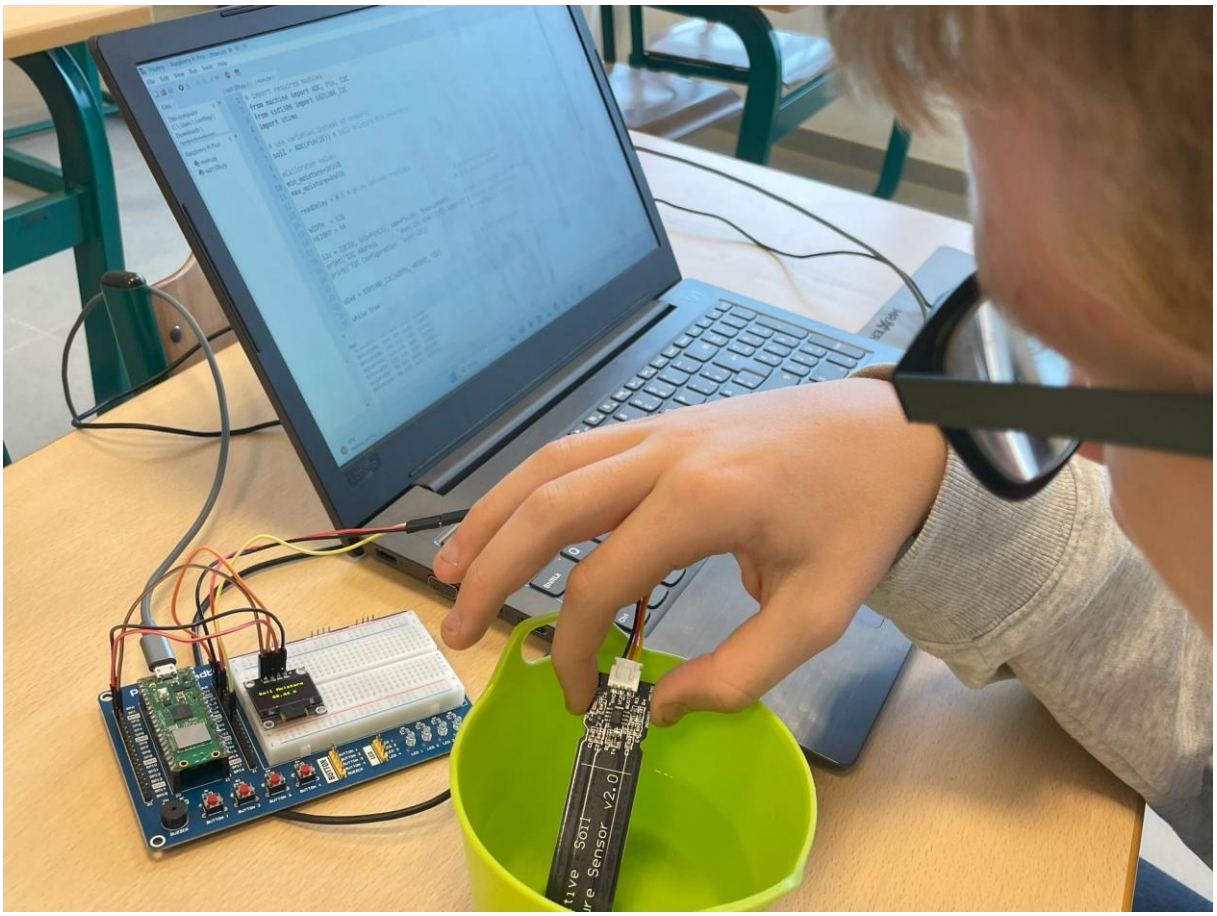

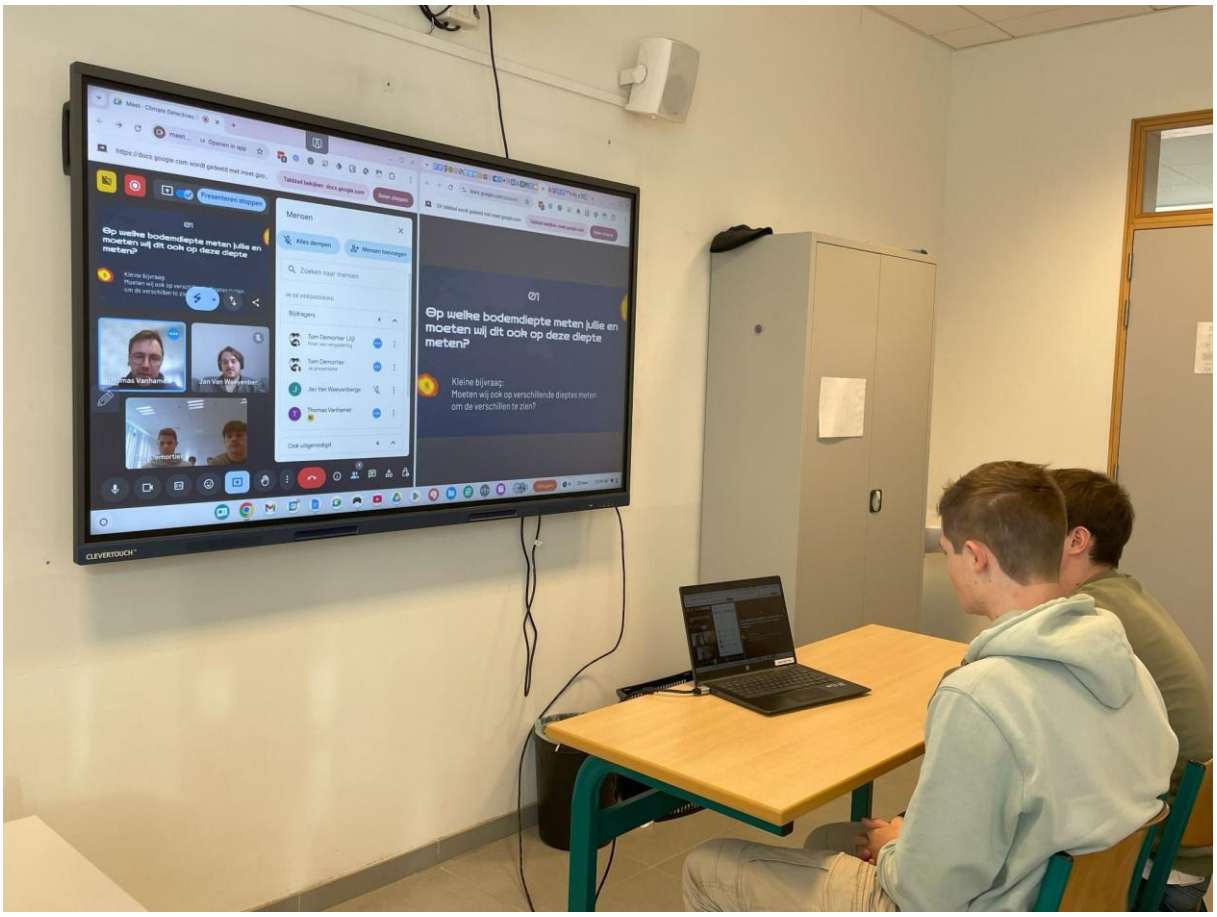
Mensen
Op welke bodemdiepte meten jullie en moeten wij dit ook op deze diepte meten?
Kleine bijvraag:
Moeten wij ook op verschillende dieptes meten om de verschillen te zien?
CLEVERTOUCH