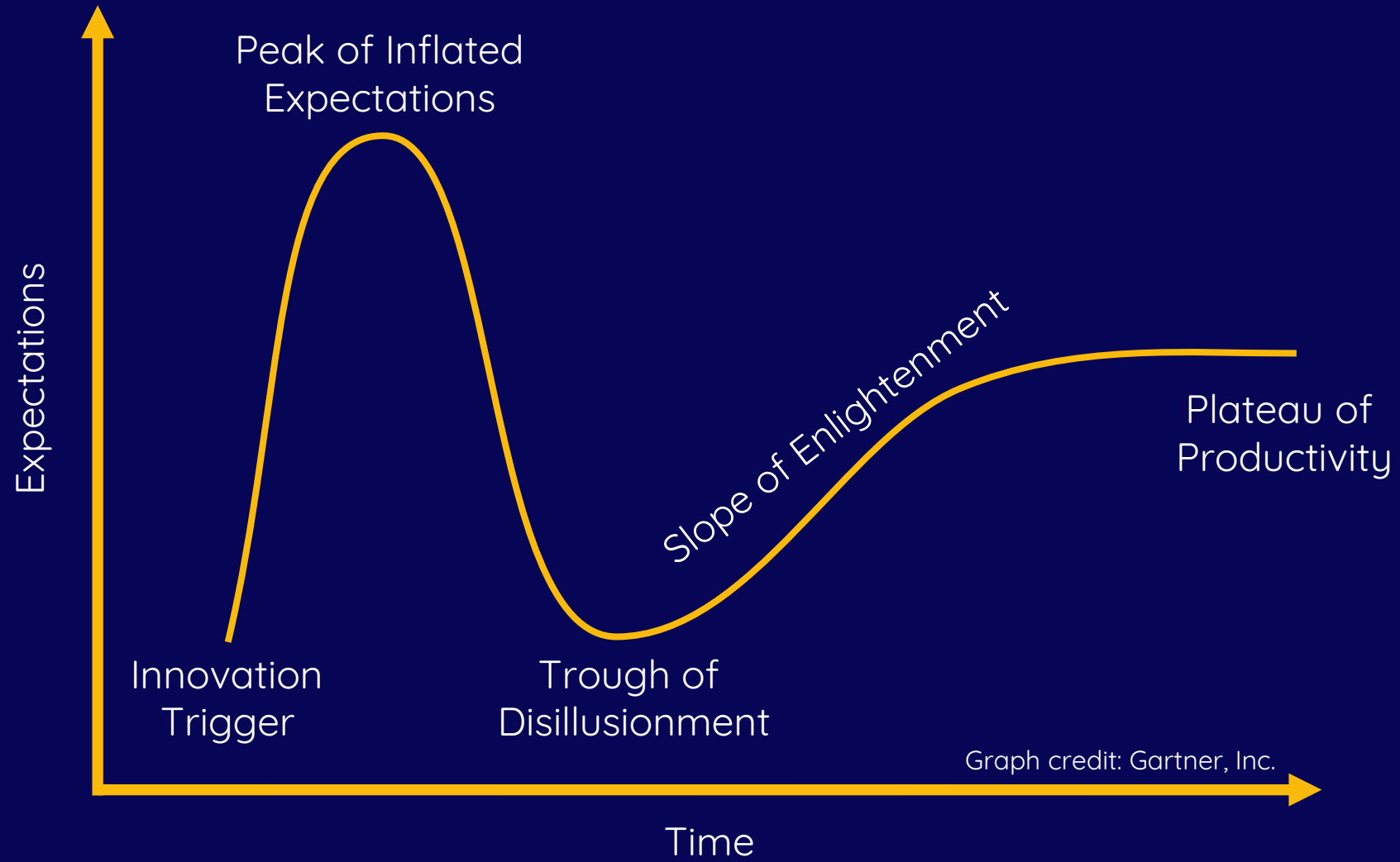


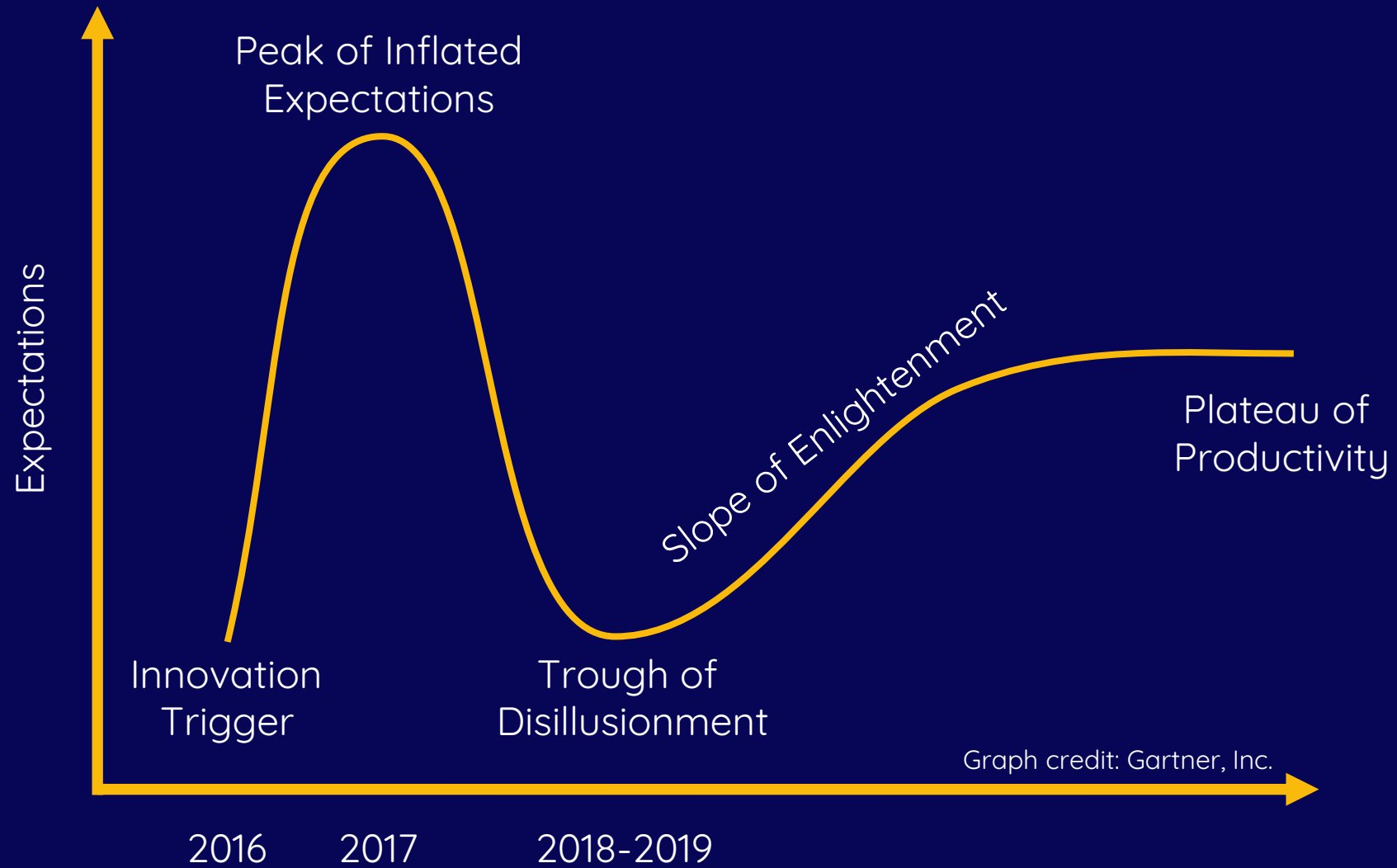
Leveraging Earth Observation Data and Artificial Intelligence to Improve Site Characterization

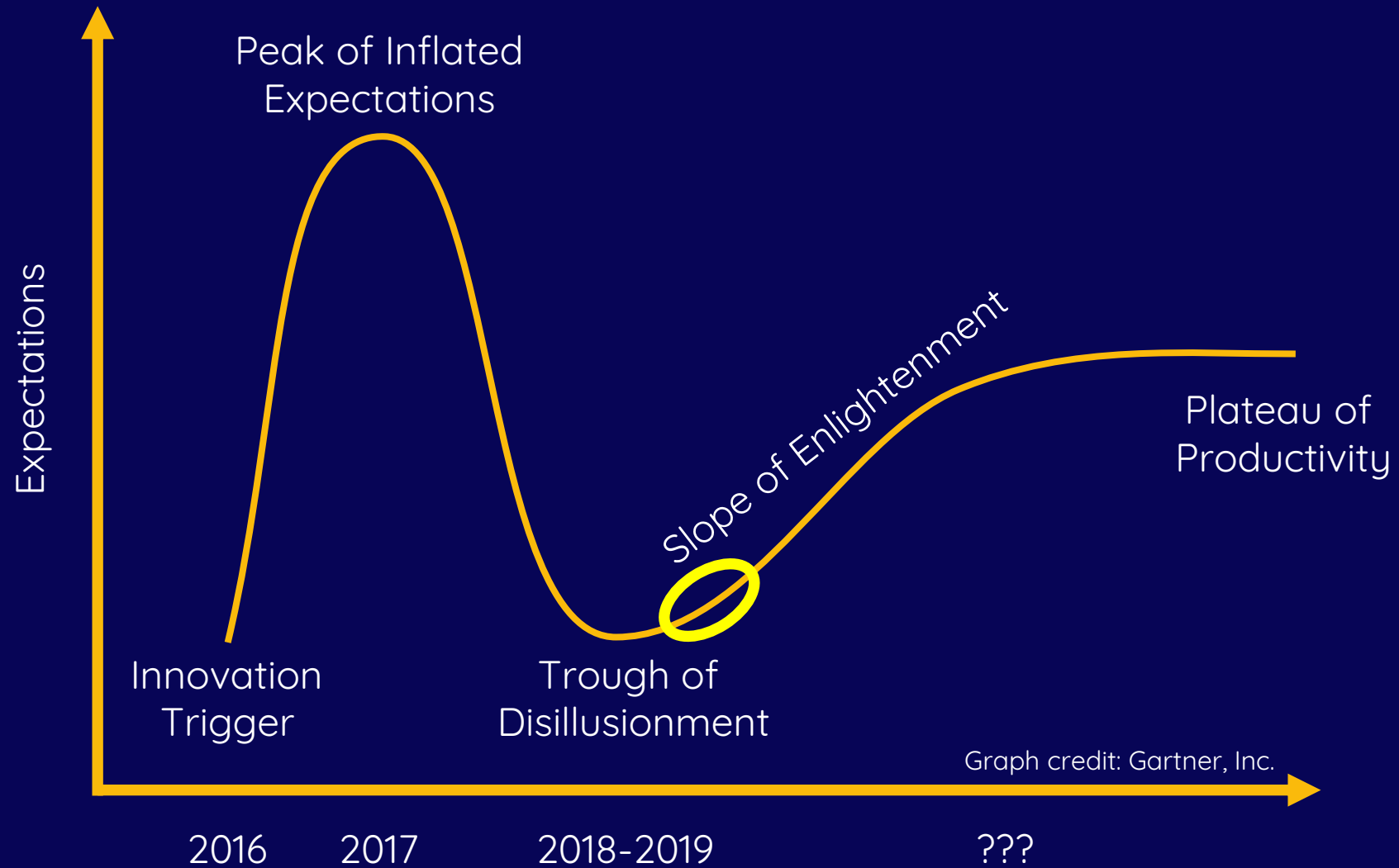
Jesse D. King, R.G.
Senior Consultant

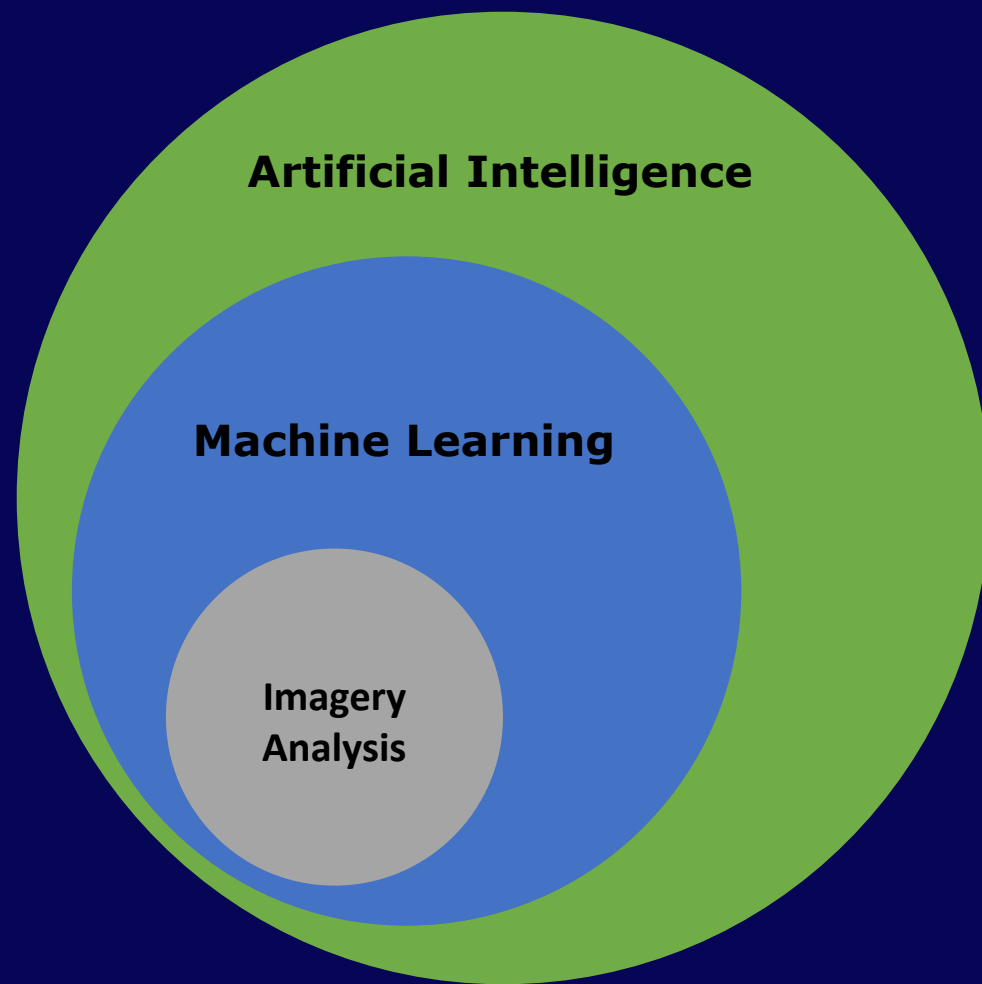




Graph credit: Gartner, Inc.









01

We use aerial and satellite imagery (this can be yours, ours, or third party) to take an inventory of your entire site.

02

Our AI-powered platform then analyses the health, growth, and distribution of vegetation in this imagery to spot signs of erosion, contamination and hydrologic issues.

03

You get a complete report which shows if, where, and how your site is deteriorating, with recommendations for what to do next.



Case Study Studies

1. Vegetation Reclamation Monitoring
2. Automated Erosion Monitoring
3. AML Feature Detection
4. Road Network Monitoring



Case Study One

Vegetation Reclamation Monitoring





PROBLEM

- Monitoring occurs over thousands of acres
- Currently, linear transects across small areas are used to determine vegetative cover and invasive species
- Want overview of entire site; resolution of available imagery is too low

The background of the slide is an aerial photograph taken by a drone. It shows a desert environment with sandy, light-colored soil and scattered patches of low-lying, dark green and greyish vegetation. A prominent red 'X' is marked on the ground in the lower right quadrant of the image. A semi-transparent white box with rounded corners is positioned on the right side of the image, containing the title and a bulleted list.

APPROACH

- Pilot study with mining company in New Mexico
- Collected very-high resolution multispectral drone imagery data
- Developed machine learning model to classify land types

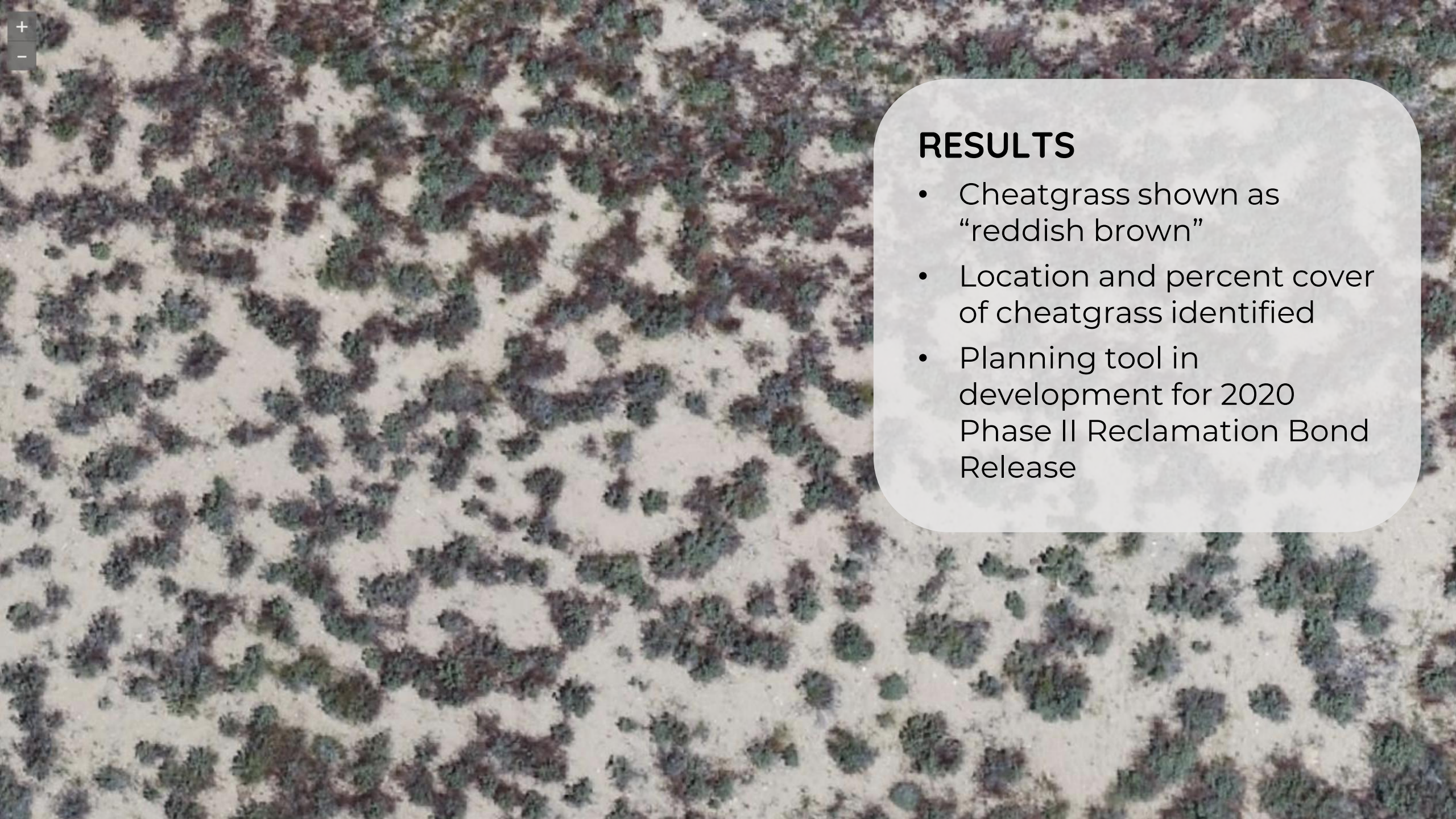


RESULTS

- Land cover classification predictions perform well
- Repeatable process lends itself to a change-over-time analysis
- Results can be used to inform regulatory process

VegetationClassification

- Soil
- Rock
- Shrub
- Grass
- Other Vegetation Cover



RESULTS

- Cheatgrass shown as “reddish brown”
- Location and percent cover of cheatgrass identified
- Planning tool in development for 2020 Phase II Reclamation Bond Release



Vegetation Classification

- Soil
- Rock
- Shrub
- Grass
- Other Vegetation
- Cheatgrass

RESULTS

- Cheatgrass shown as “reddish brown”
- Location and percent cover of cheatgrass identified
- Planning tool in development for 2020 Phase II Reclamation Bond Release



Case Study Two

Automated Erosion Monitoring



An aerial photograph of a desert landscape. The terrain is sandy and covered with sparse, low-lying vegetation in shades of green and brown. A red dashed line is drawn across the image, forming a large, irregular polygon that encloses a central area. This area contains a prominent, dark, irregularly shaped feature, possibly a rock formation or a large shrub, which is the focus of the study. The red dashed line follows the perimeter of this central feature and extends to the right, where it ends near a semi-transparent text box.

CHALLENGE

- Erosion features
- Location and geometry
- Time-consuming and manual

An aerial photograph of a landscape, likely a coastal or riverine area, with a dense network of blue lines overlaid. These lines represent erosion features, showing a complex pattern of branching and parallel channels. The background is a light brown, textured surface, possibly sand or soil. A semi-transparent white box is positioned in the upper right corner, containing the title 'CHALLENGE' and a bulleted list.

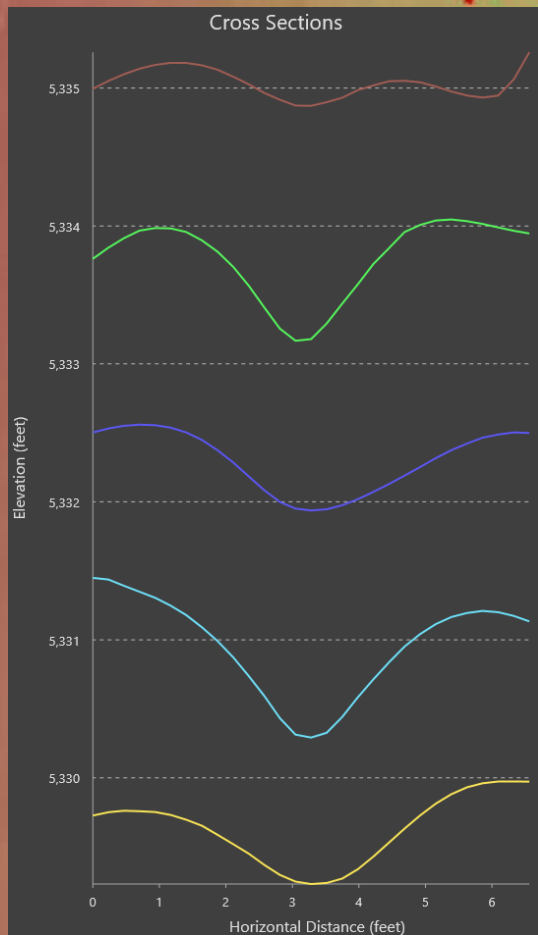
CHALLENGE

- Erosion features
- Location and geometry
- Time-consuming and manual

A topographic map showing a landscape with various erosion features. A red dashed line outlines a specific area of interest, which includes several circular features (likely cirques or cirque scars) and a central, more complex erosion feature. The map is color-coded by elevation, with green representing lower elevations and yellow/brown representing higher elevations. Blue lines indicate the locations of streams or rivers. A white text box with a red border is overlaid on the right side of the map, containing the title 'SOLUTION' and two bullet points.

SOLUTION

- Utilized very-high resolution digital terrain model
- Automated identification of surface erosion features



RESULTS

- Developing automated extraction of 3D feature geometries
- Flag features for field inspections



Case Study Three

AML Feature Detection





PROBLEM

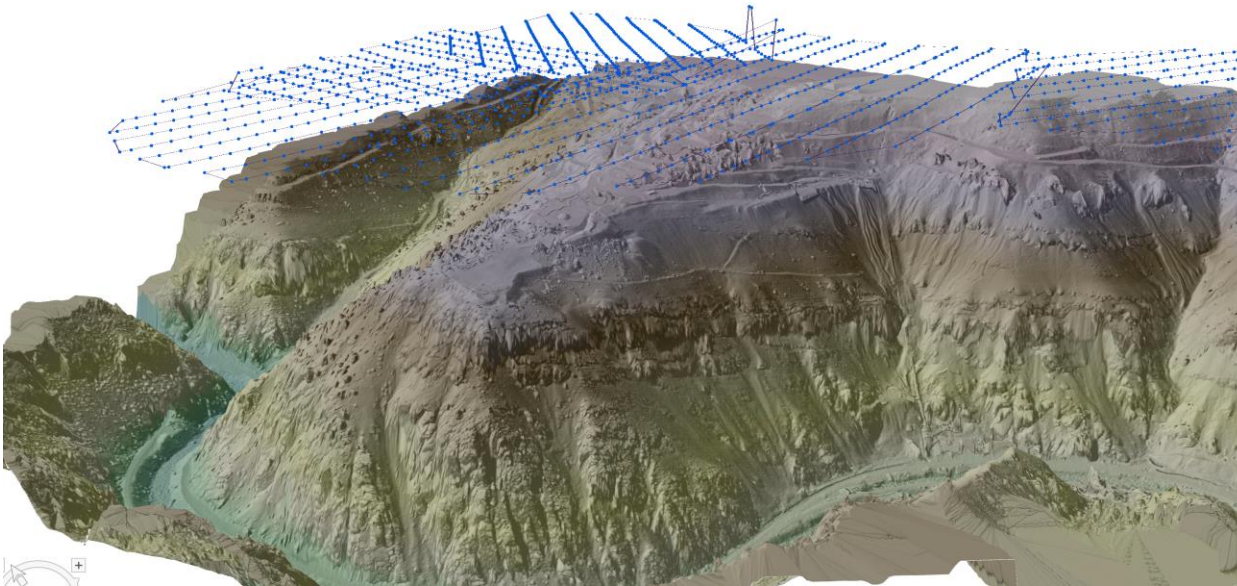
- Superfund site with acid mine drainage issue
- Large area (450 acres)
- Needed to identify abandoned mine entrances (adits and shafts)
- Significant elevation change across the site







Adits & Shafts Identified

Prioritize openings for closure



Status

-  Confirmed
-  Suspected



Case Study Four

Road Network Monitoring



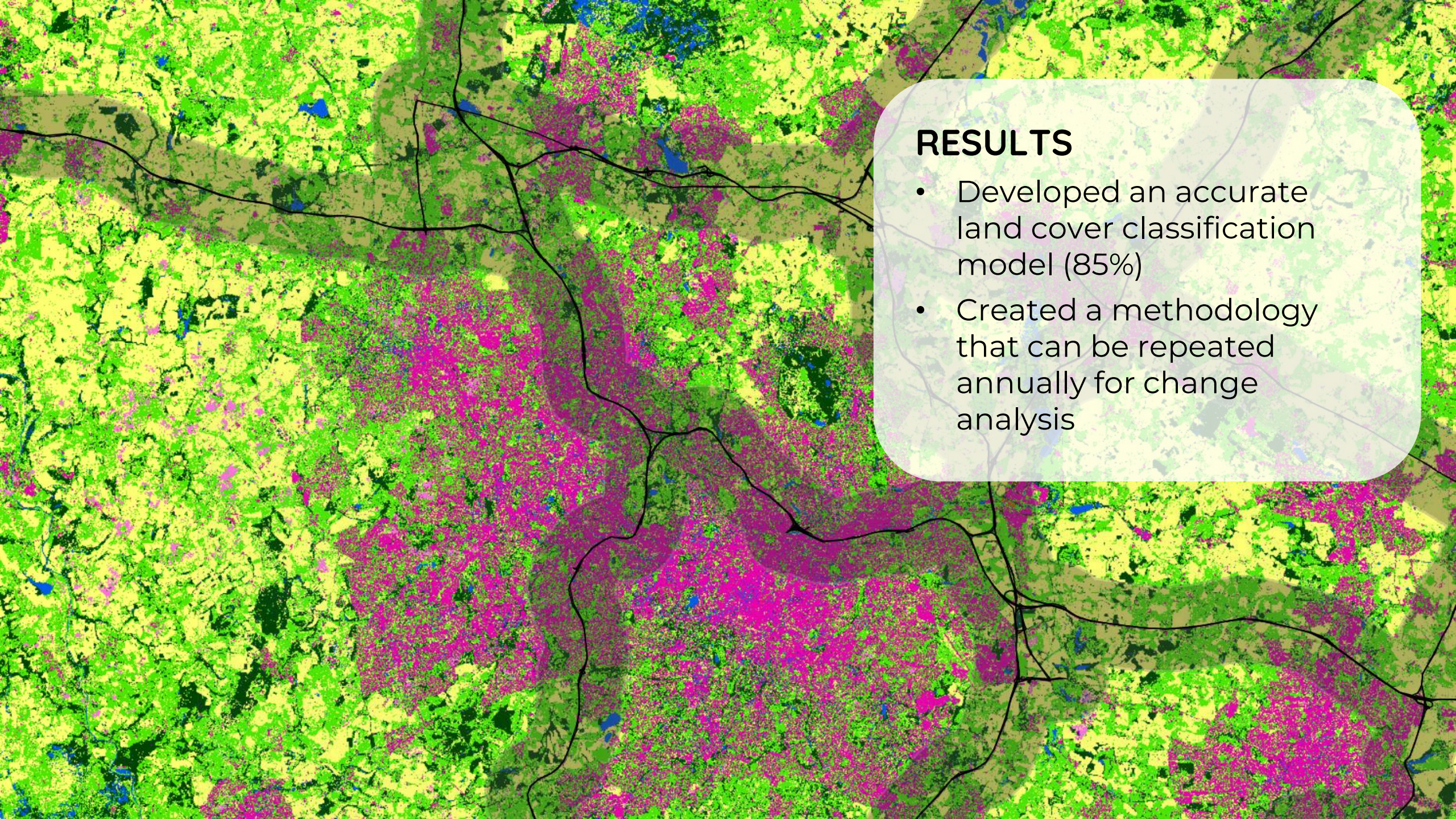
PROBLEM

- Monitor habitat and land cover change along national highway network
- Develop a “intelligent environmental estate” for Highways England

An aerial satellite image of a forested area. A large, irregularly shaped patch of land in the center-left is cleared, showing a mix of grey and white tones, likely representing bare soil or a small urban/developed area. The surrounding forest is dense and green, with some yellowish-brown patches indicating seasonal changes or different tree species. The image is used as a background for the slide.

APPROACH

- Feasibility Study
- Used readily available satellite imagery with high temporal coverage (Sentinel-2)
- Developed customized data processing and modeling pipeline for land cover classification

An aerial photograph of a landscape, likely a wetland or coastal area, with a complex pattern of green, yellow, and brown patches. A network of black lines, possibly roads or waterways, is overlaid on the map. A semi-transparent white box with rounded corners is positioned in the upper right quadrant, containing the text 'RESULTS' and a bulleted list.

RESULTS

- Developed an accurate land cover classification model (85%)
- Created a methodology that can be repeated annually for change analysis

Bright ideas. Sustainable change.

