Remote Sensing in a rapidly changing world the shift from spatial to temporal

Regional GIS Meeting
December 6, 2023

Chris Wilson - Planet Labs PBC

North Central Texas Council of Governments

Session Overview

- Satellite imagery has emerged as the most cost effective approach for evaluating large area change
- Leveraging AI, local governments derive change signals through object or feature detection.
- Change models enhance data pipelines for many areas including:

  - Emergency management and disaster response
  - Land use
  - Permit and code enforcement
  - Property assessment
  - Right of way management
  - Vegetation and irrigation management
  - Economic development

What could you do with Superpowers?

- X-Ray Vision
- Time Travel
- Fly anywhere in seconds

Monitor areas of interest, discover patterns, and get timely insights

Like superheroes, you can use your superpowers to use space to help life on earth!

But the concept of superpowers can't just be amazing,
it must be practical.

Agenda

1. Partnering/Cooperatives
2. Challenges
3. Solutions
4. Satellite Capabilities
5. Use Cases


You can’t fix
what you can’t see.

PLANET'S MISSION

To image the whole world every day, making change **visible, accessible, and actionable.**

Traditional approaches are falling short

Infrequent, unreliable data collection

Risky, manual approaches; satellite imagery could be months/yrs old

Limited coverage

Full coverage not always available (ie, drone or fixed wing)

Cost prohibitive

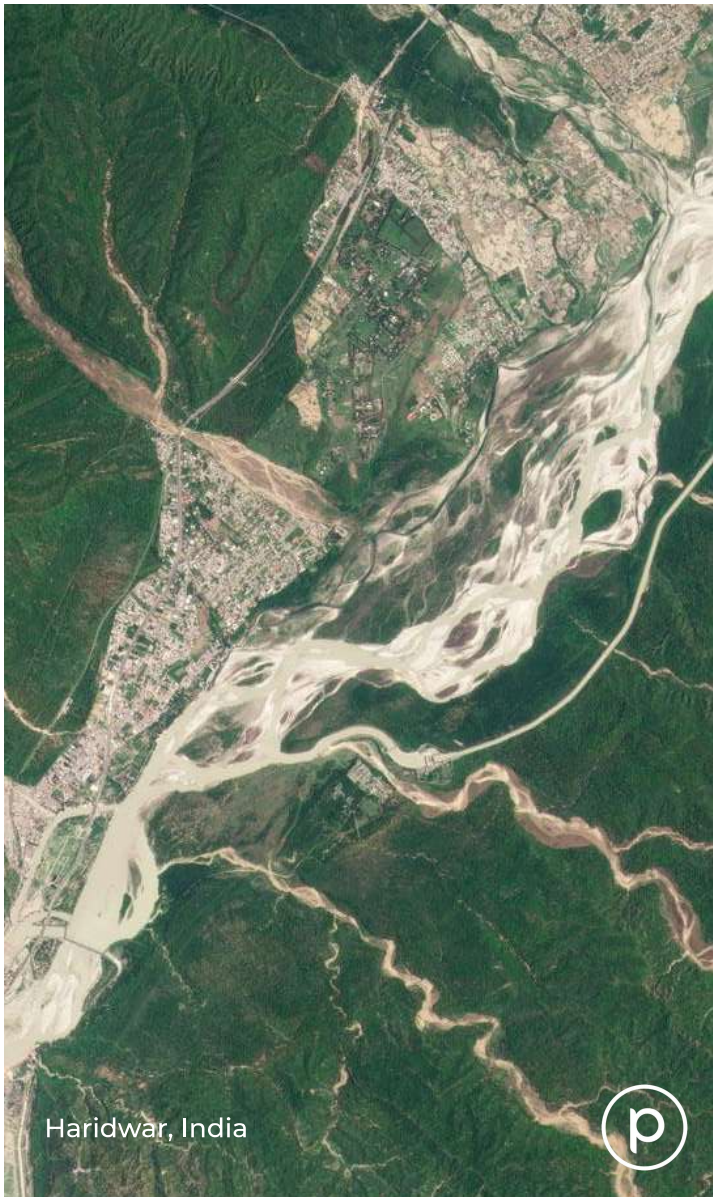
Existing solutions are outside of forest mgmt budgets

Difficult to access

Multiple parties required for processing

Government Challenges

- Doing more with less
- Rapid growth areas
- COVID Impact
- Risk Management
- Conservation and Sustainability Initiatives
- Transparency Demands
- Inspector Safety
- Fuel Costs
- Aerial Refresh 1-4 years
  -



REMOTE SENSING PIPELINE

Low-Medium Resolution

Higher revisit for change detection with visual or ML monitoring

Sentinel 2
Planet Scope

Large Areas

High Resolution

Cost effective tasking for better change identification with visual or ML monitoring

SkySat

Targeted Areas

Very High Resolution

High Cost tasking for visual assessment

Aerial-Drones

Processing Delay
Leaf Off

Sub-Systems

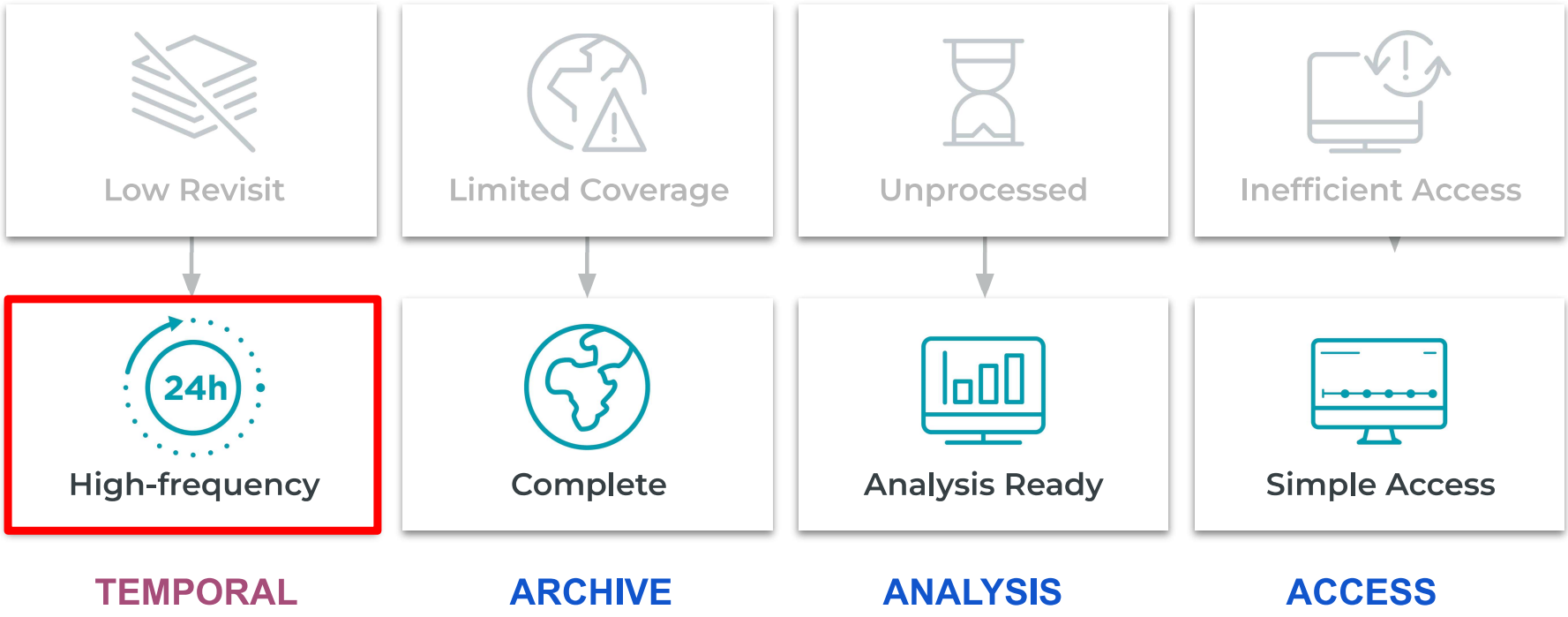
On-Site
Inspections
Ground Sensors
Device Sensors

MAKING SENSE OF REMOTE SENSING

	Drones	Aerial	High Res Satellites SkySat	Medium Res Satellites PlanetScope	Government Satellites Sentinel 2
 Coverage (Spatial)	Inches/pxl	Inches/pxl	<1 m2/pxl	11-13 m2/pxl	100 m2/pxl
 Revisit (Temporal)	Per Mission	2x/month 3mo-7+yrs	Per Mission	Near-Daily	4-5 days 2x/month
 Signal vs noise (Spectral)	Sensor based	Sensor based	4-band	8-band	4-band (10m) 6-band (20m) 3-band (60m)
 Access	Varies	Varies	Explorer API	Explorer API	Files API Service

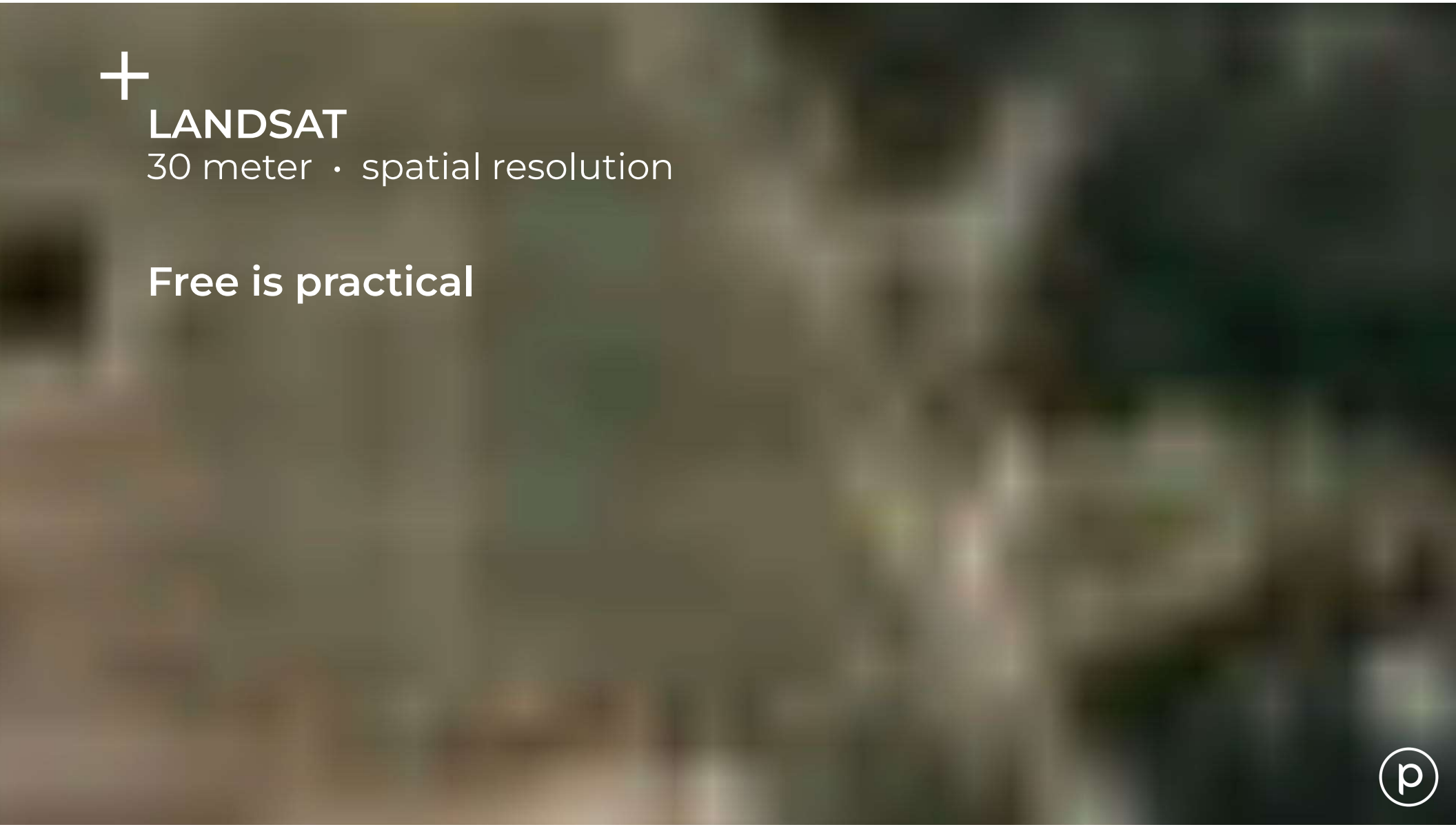
SOLUTION: A New Approach emphasizing temporal

Planet provides geospatial data at the speed of change, equipping users with the data necessary for making informed, timely decisions.



Drones are amazing...


but, it would take 5,000 drones to see this every day
Chocope Peru - 2017


LANDSAT
30 meter • spatial resolution
Free is practical

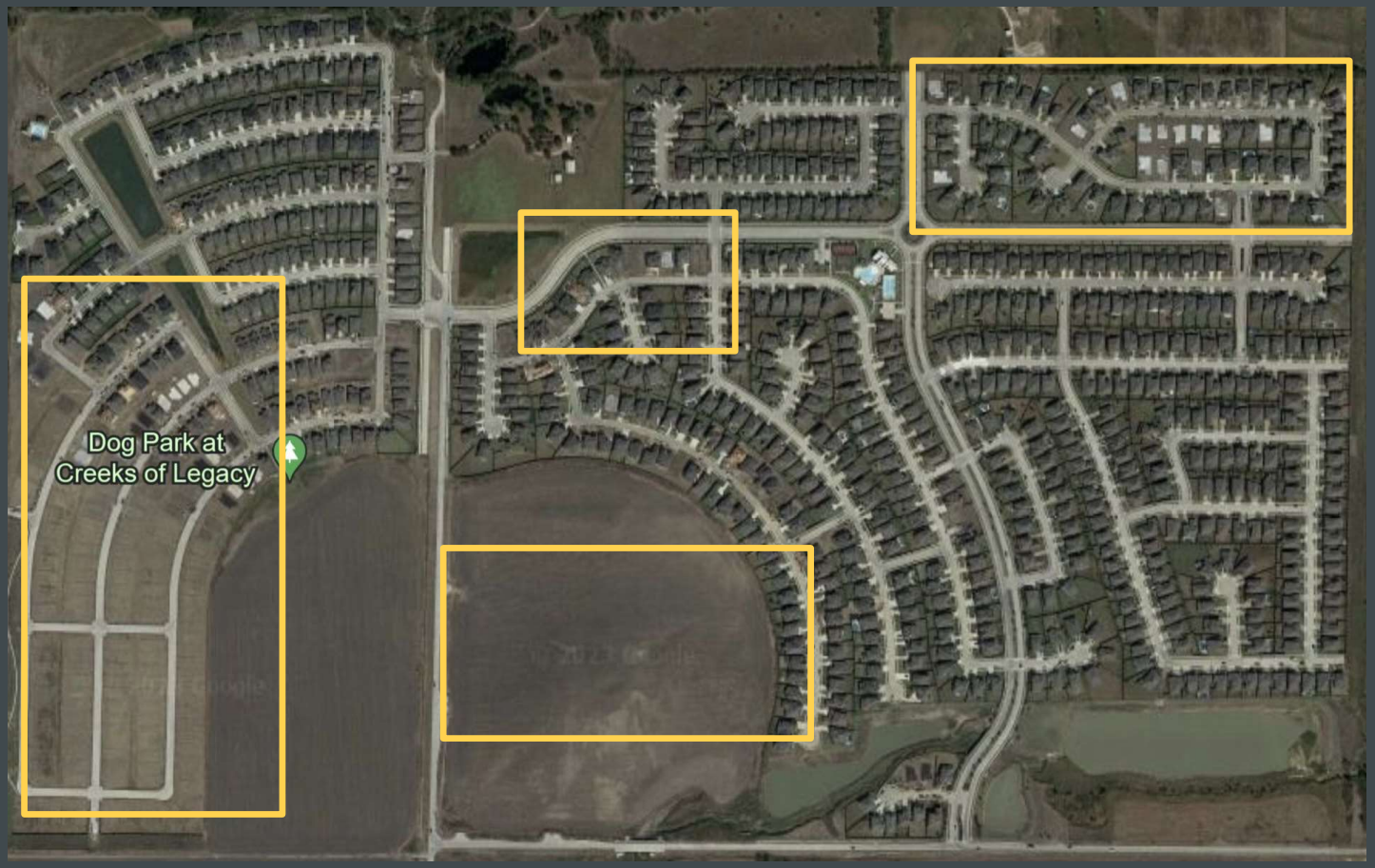

SENTINEL
10 meter • spatial resolution


PLANETSCOPE
3 meter • spatial resolution


SKYSAT
50 cm • spatial resolution

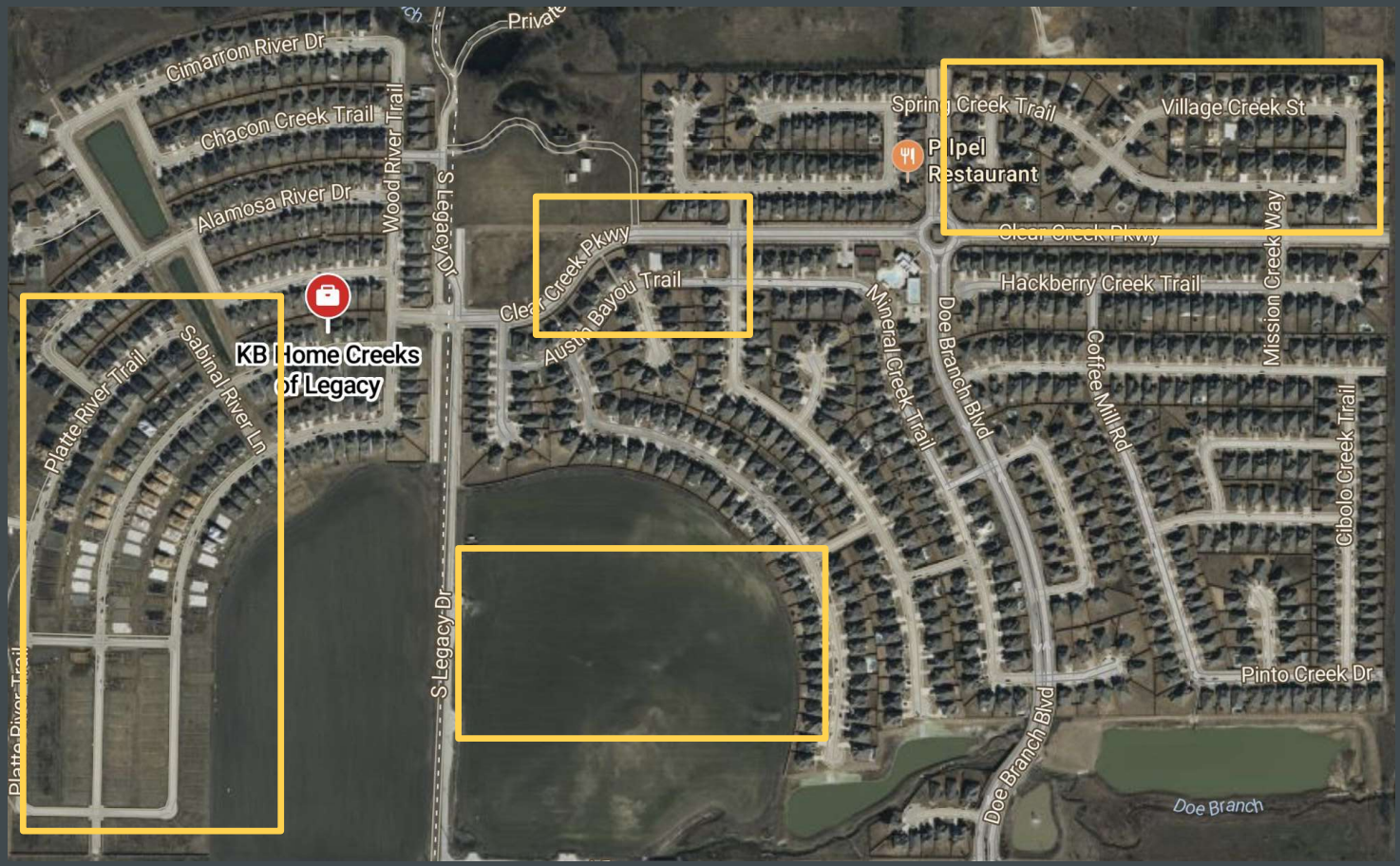
Challenges with “Free Sources”

Creeks of Legacy, Celina- Google Earth



Challenges with “Free Sources”

Creeks of Legacy, Celina- bing maps

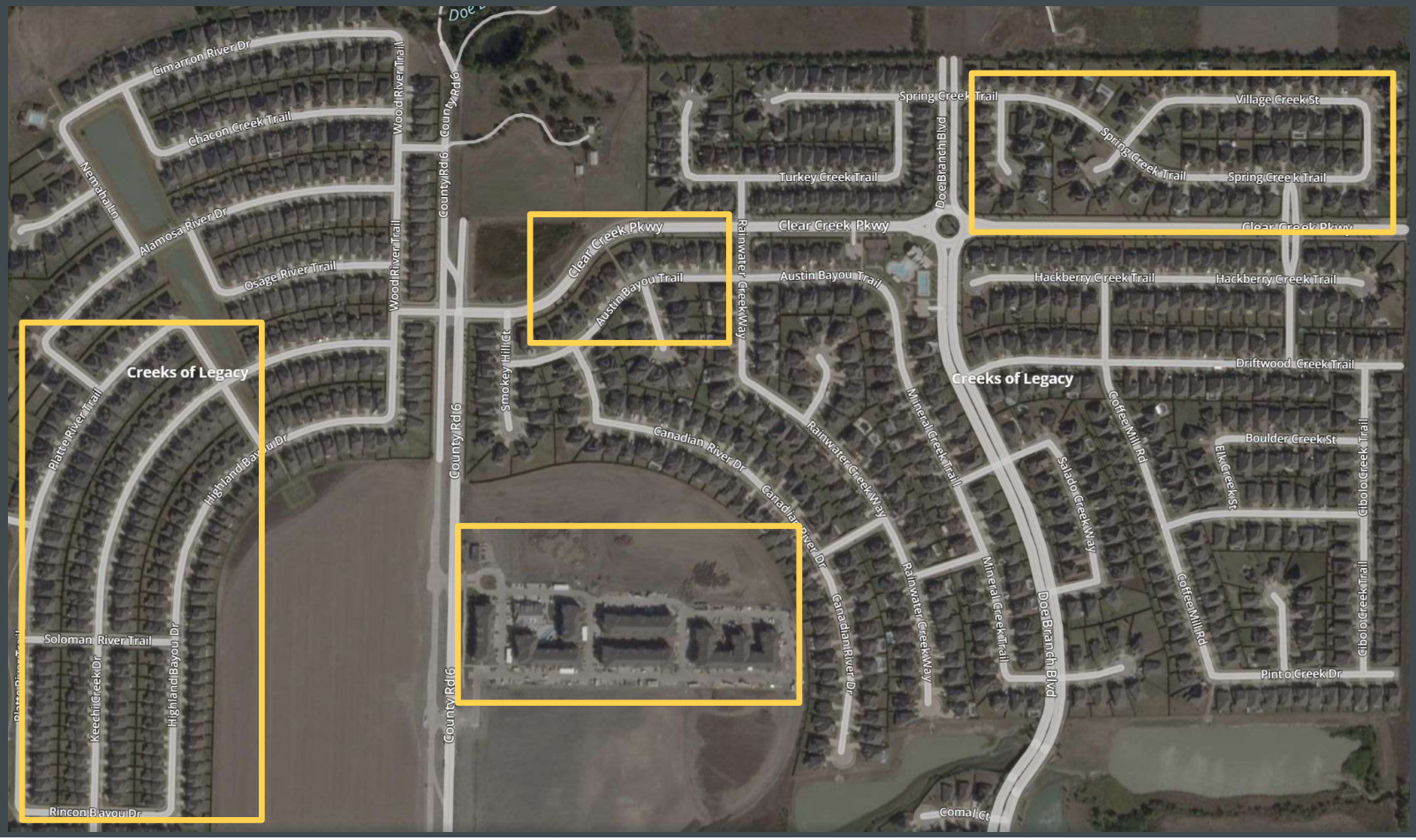


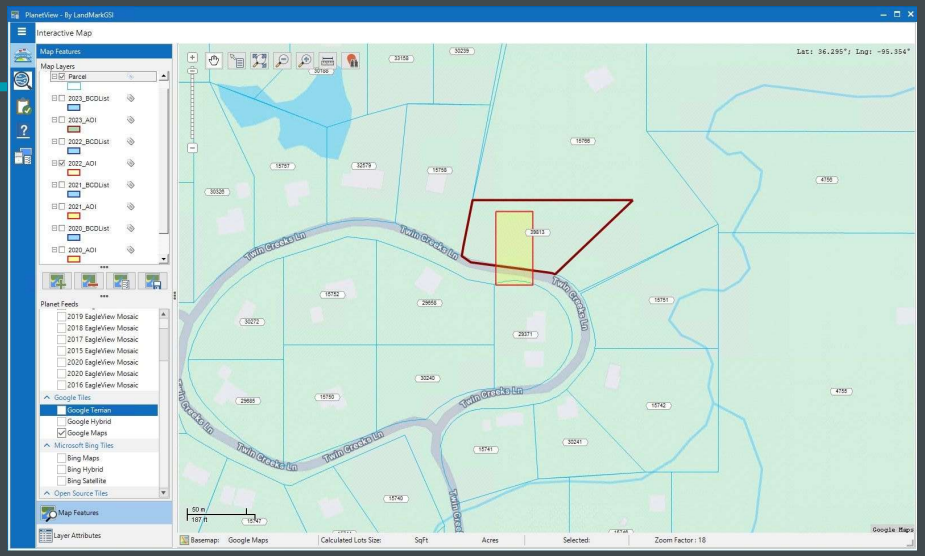
PlanetScope- Ground truth

Creeks of Legacy, Celina

Planet SkySat- October 20, 2023

Creeks of Legacy, Celina




PlanetView - By LandMarkGSI
Interactive Map
Map Features
Map Layers
Parcel
2023_BCDList
2023_AOI
2022_BCDList
2022_AOI
2021_BCDList
2021_AOI
2020_BCDList
2020_AOI
Planet Feeds
2019 EagleView Mosaic
2018 EagleView Mosaic
2017 EagleView Mosaic
2015 EagleView Mosaic
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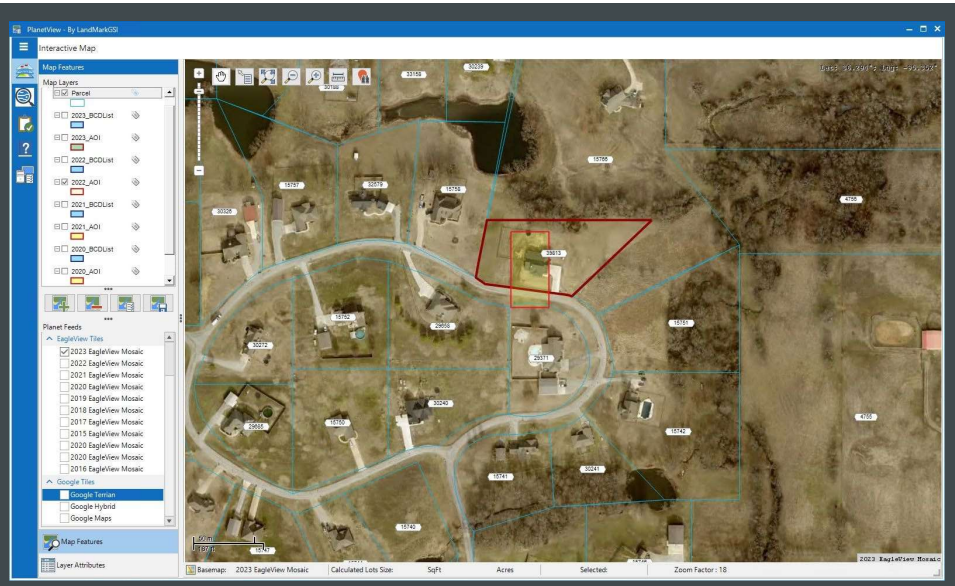
2020 EagleView Mosaic
2016 EagleView Mosaic
Google Tiles
Google Terrian
Google Hybrid
Google Maps
Microsoft Bing Tiles
Bing Maps
Bing Hybrid
Bing Satellite
Open Source Tiles
Map Features
Layer Attributes
Twin Creeks Ln
Basemap: Google Maps
Calculated Lots Size:
SqFt
Acres
Selected:
Zoom Factor : 18
Google Maps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2023 EagleView Mosaic
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2019 EagleView Mosaic
2018 EagleView Mosaic
2017 EagleView Mosaic
2015 EagleView Mosaic
2020 EagleView Mosaic
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2016 EagleView Mosaic
Google Tiles
Google Terrian
Google Hybrid
Google Maps
Map Features
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Basemap: 2023 EagleView Mosaic
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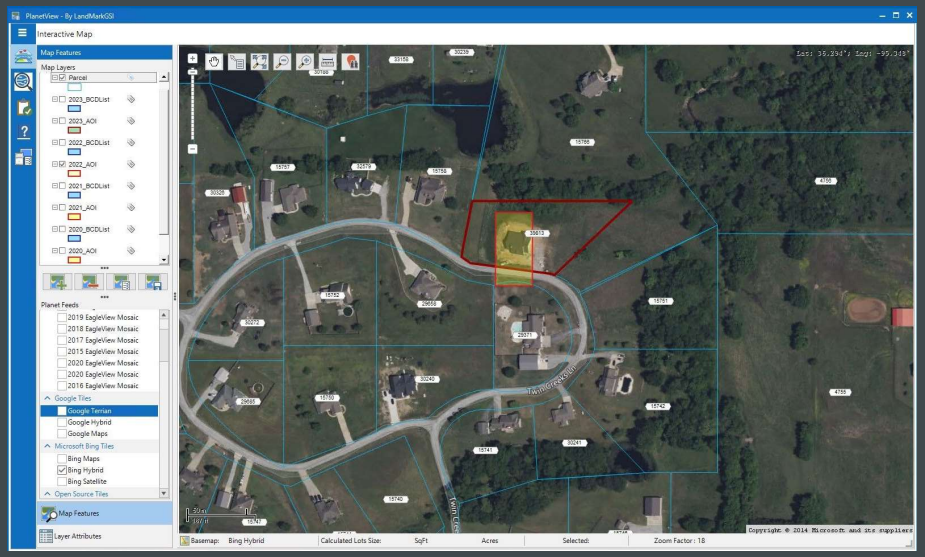
2023 EagleView Mosaic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Google Tiles
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Microsoft Bing Tiles
Bing Maps
Bing Hybrid
Bing Satellite
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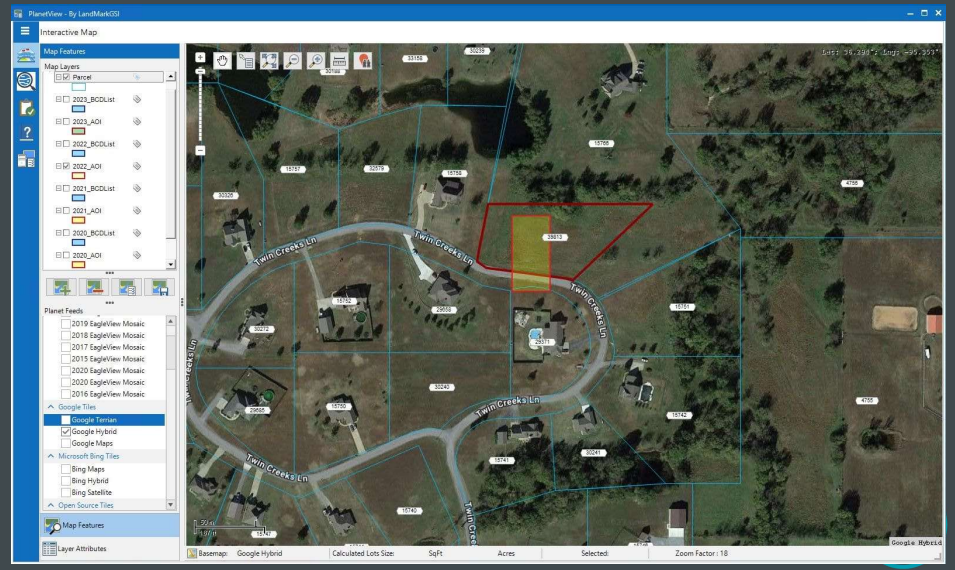
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2020 EagleView Mosaic
2016 EagleView Mosaic
Google Tiles
Google Terrian
Google Hybrid
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Bing Maps
Bing Hybrid
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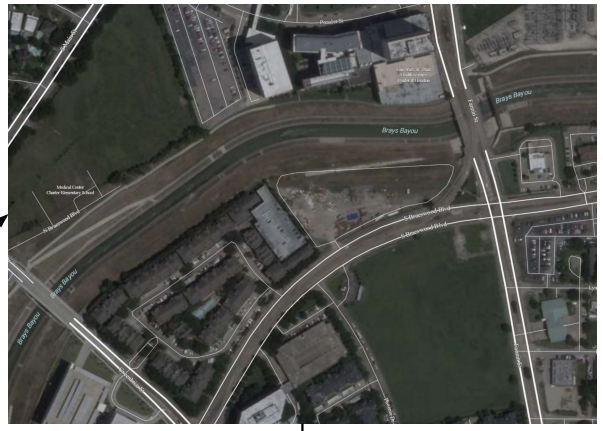
Google Hybrid

Best Practice: Make best use of high value assets (including human resources) by leveraging temporal resolution



This Best Practice enables timely decision-making while reducing costs

Track changes on the Earth **at scale** for:

Insights

Provide visibility into rural/remote areas

Respond to emergency situations

Understand impact of historical events

Transparency

Measure and report on policy impact

Increase transparency in managing sustainable transformation policies

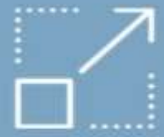
Productivity

Increase tax revenue

Prosecute wrongful activity

Allocate resources where they are needed most

Innovation

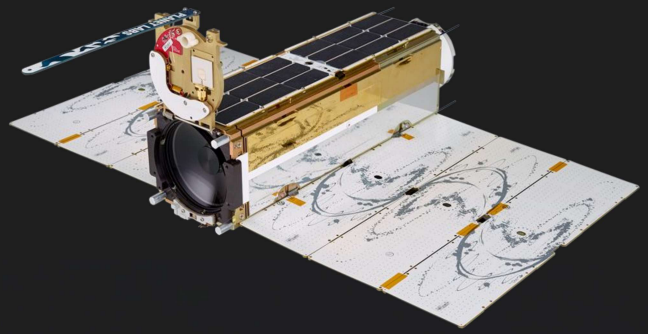


Enable a GIS community that fosters innovation and generates regional economic activity

You can’t fix what you can’t see.

And… AI is changing what we can see while satellites are changing the scope on how much and how fast we can see

CAPABILITY: MEDIUM RESOLUTION MONITORING



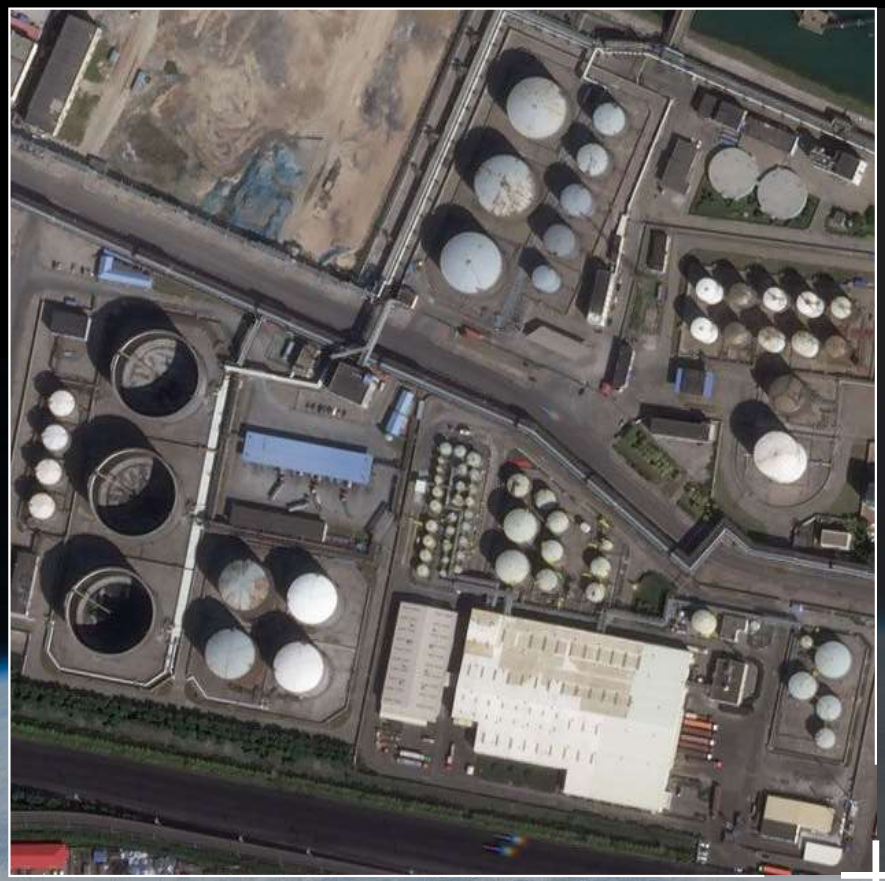
SuperDoves

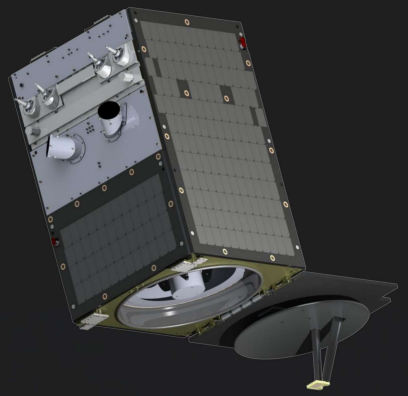
SATELLITES	GSD	CAPACITY
140+	**3.7 m**	**346 million km²**/day

ORBIT ALTITUDE	PIXEL RESAMPLE	SPECTRAL BANDS
475 km	**3.125 m**	**RGB** and **NIR**

Get more detail in Planet's Imagery Product Specification

CAPABILITY: HIGH RESOLUTION MONITORING





SkySat

SATELLITES	GSD	CAPACITY
13	**0.72 m**	**500 K km²**/day

ORBIT ALTITUDE	PIXEL RESAMPLE	SPECTRAL BANDS
500 km	**1 m**	**RGB, PAN** and **NIR**

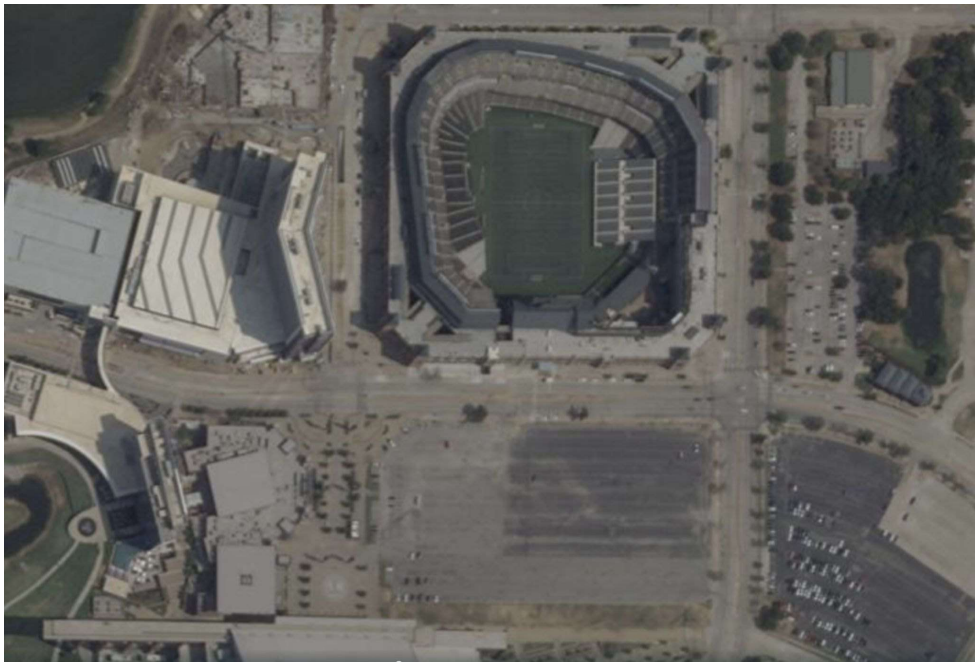
Get more product detail in Planet's Imagery Product Specification

COMPREHENSIVE COVERAGE

Pairing both **PlanetScope** and **SkySat**= Cost effective monitoring

3m PlanetScope

18 August 2023



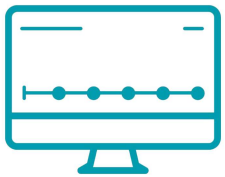
0.5m SkySat

18 August 2023

DELIVERY OPTIONS

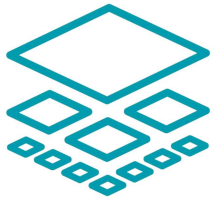
PLANET API

REST API access to Planet imagery



PLANET EXPLORER

Web-based user interface for browsing & downloading Planet imagery



WMTS

Integrate with WMTS compliant application, e.g. ArcGIS, GEE, QGIS, InterGraph, and more.

From space systems to modern APIs & everything in-between

DELIVERY


Web Applications


APIs


Streaming & Cloud Storage


Subscriptions


Integrations

INSIGHTS


Raster Operations


Object Detection


Land Cover Classification


Change Detection


Summary Statistics

IMAGERY


Visual


Analysis-Ready


Basemaps


Stereo


Video


Fusion Monitoring

SPACE SYSTEMS


Design


Manufacturing


Missions


Groundstations


Dove


SkySat

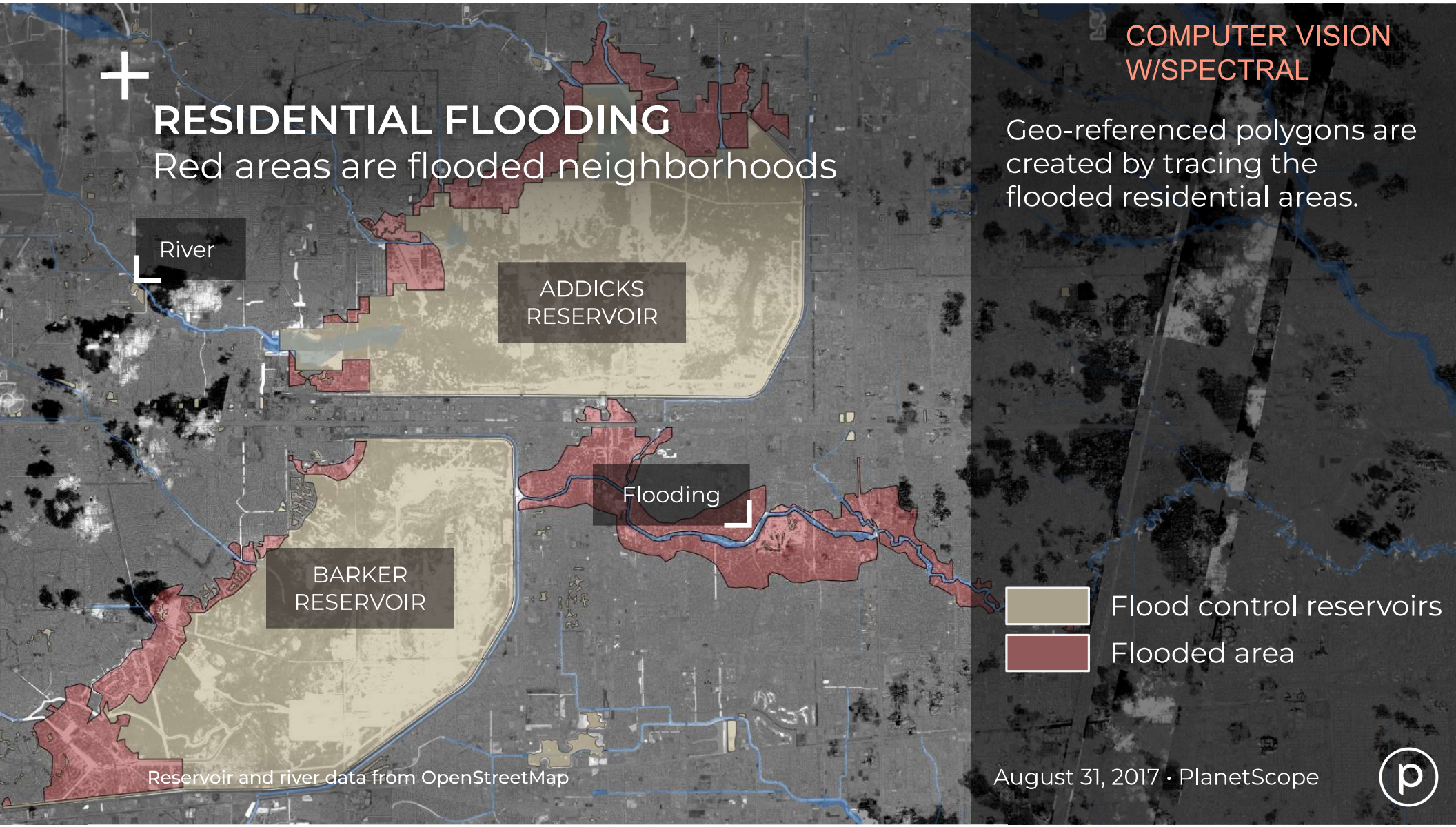
EMERGENCY MANAGEMENT USE CASES

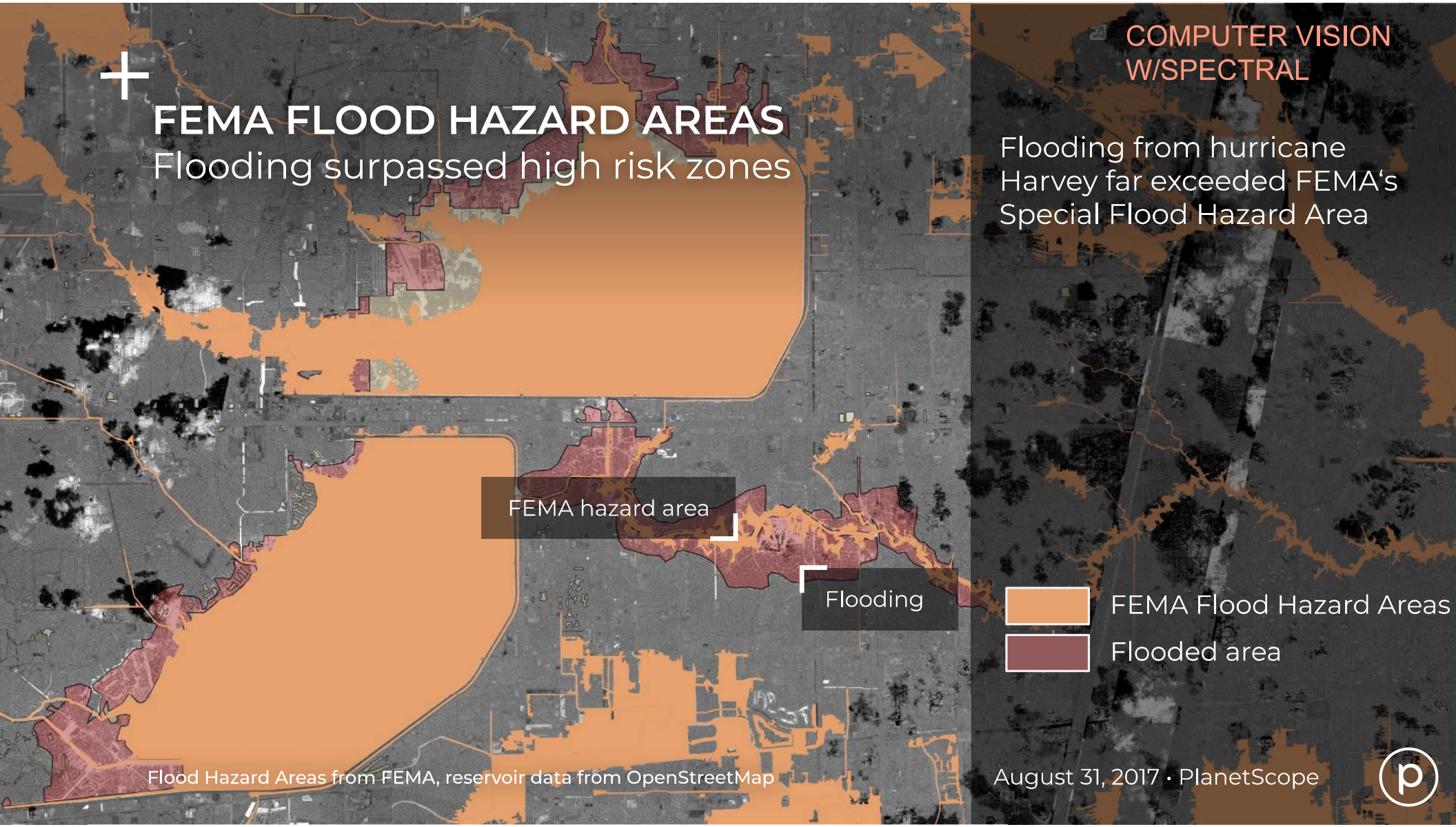
Daily monitoring and our archive ensure that customers always have ongoing coverage and the most recent pre-event disaster imagery available, enabling informed action across the disaster risk-response-recovery-resilience continuum.

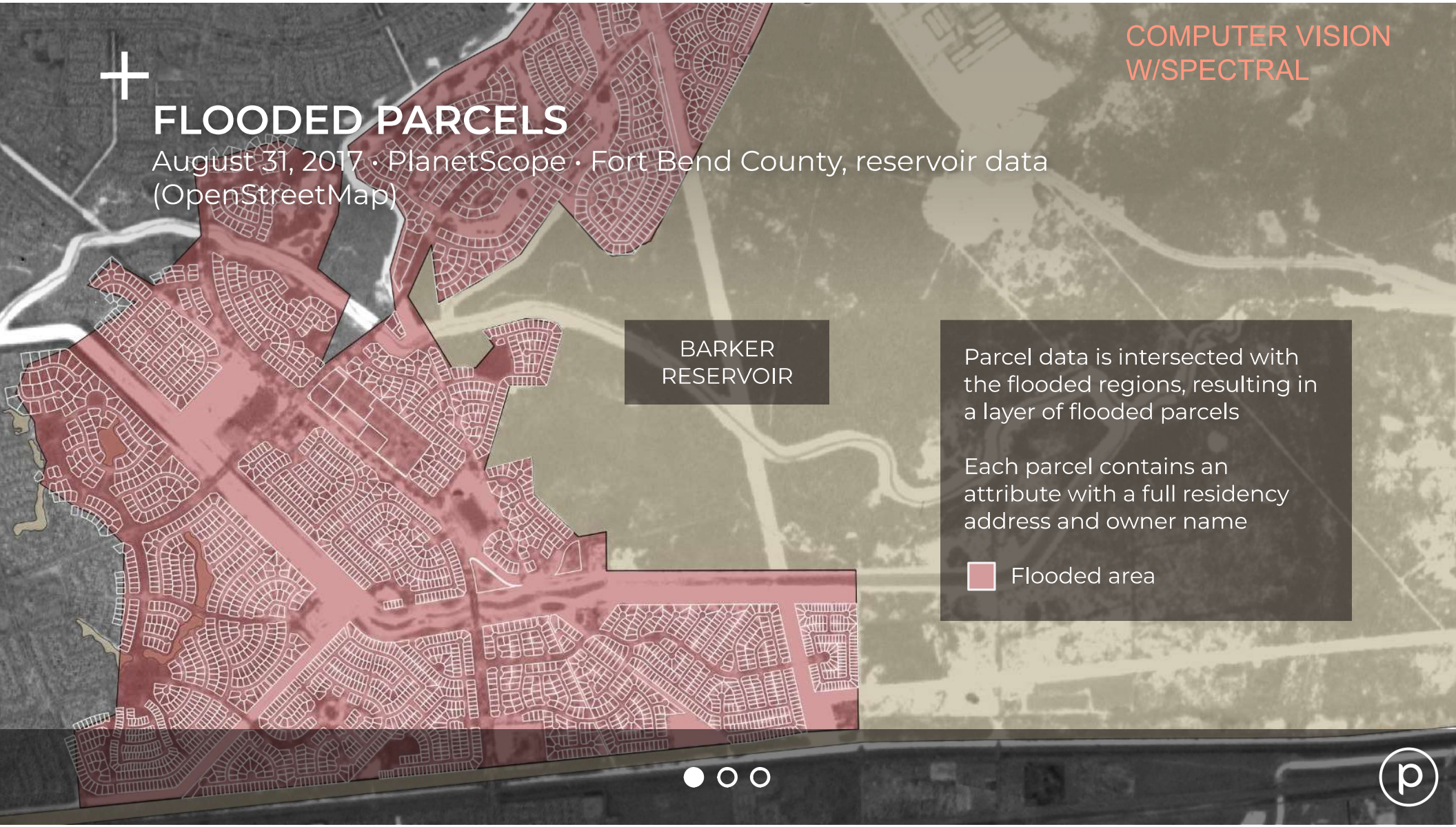
RISK REDUCTION

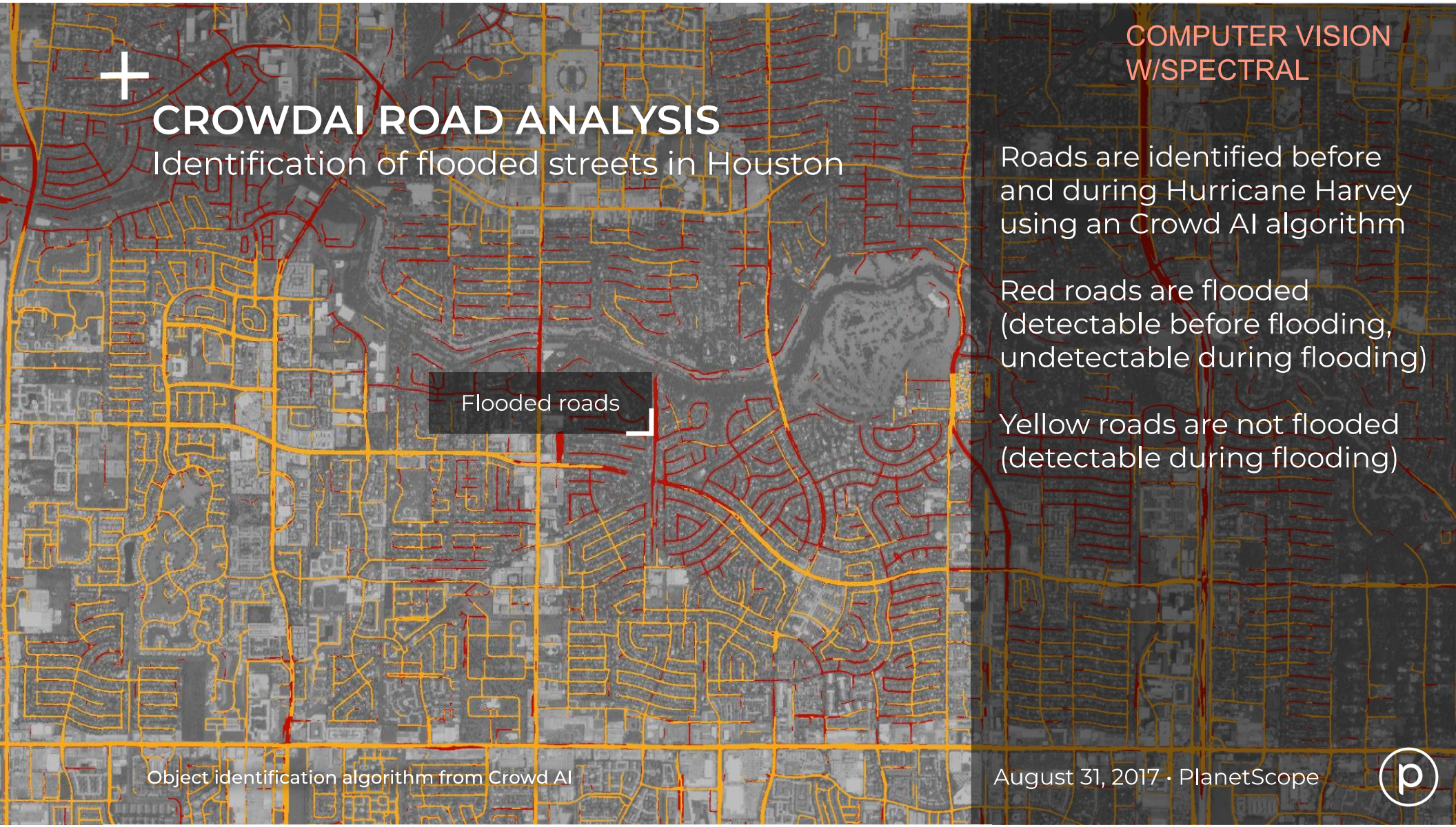
RESPONSE

RECOVERY
AND RESILIENCE


RESIDENTIAL FLOODING
Red areas are flooded neighborhoods
River
ADDICKS RESERVOIR
Flooding
BARKER RESERVOIR
Reservoir and river data from OpenStreetMap
COMPUTER VISION W/SPECTRAL
Geo-referenced polygons are created by tracing the flooded residential areas.
Flood control reservoirs
Flooded area
August 31, 2017 • PlanetScope

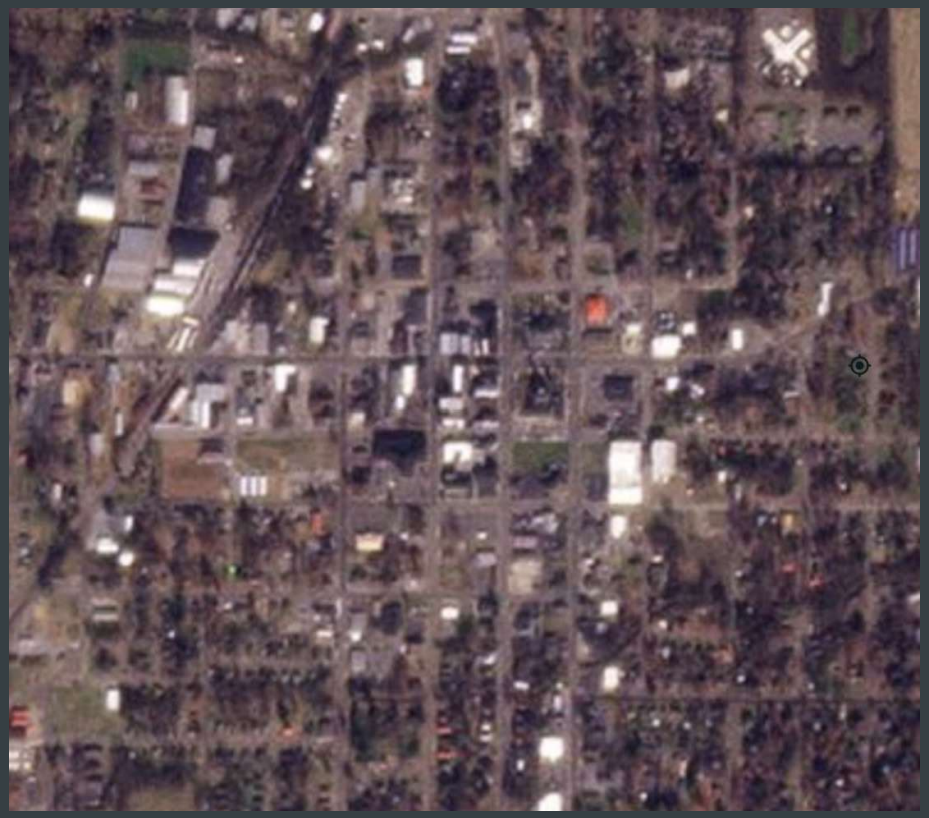

FEMA FLOOD HAZARD AREAS
Flooding surpassed high risk zones
COMPUTER VISION
W/SPECTRAL
Flooding from hurricane
Harvey far exceeded FEMA's
Special Flood Hazard Area
FEMA hazard area
Flooding
FEMA Flood Hazard Areas
Flooded area
Flood Hazard Areas from FEMA, reservoir data from OpenStreetMap
August 31, 2017 • PlanetScope


COMPUTER VISION
W/SPECTRAL
FLOODED PARCELS
August 31, 2017 · PlanetScope · Fort Bend County, reservoir data
(OpenStreetMap)
BARKER
RESERVOIR
Parcel data is intersected with the flooded regions, resulting in a layer of flooded parcels
Each parcel contains an attribute with a full residency address and owner name
Flooded area


CROWDAI ROAD ANALYSIS
Identification of flooded streets in Houston
Flooded roads
COMPUTER VISION
W/SPECTRAL
Roads are identified before and during Hurricane Harvey using an Crowd AI algorithm
Red roads are flooded (detectable before flooding, undetectable during flooding)
Yellow roads are not flooded (detectable during flooding)
Object identification algorithm from Crowd AI
August 31, 2017 • PlanetScope

VISUAL

Mayfield KY- 12/8/21 to 12/12/21- Tornado hit evening of 12/10/21

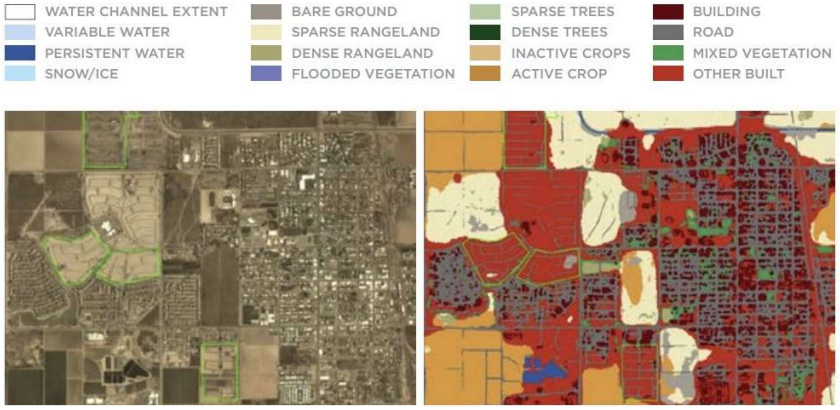


VISUAL

Mayfield KY- 12/12/21- SkySat 50cm Resolution

LAND USE

- Monitor changes in roads, buildings, and impervious surfaces as populations grow and adapt for a more sustainable and climate-resilient future.
- Understand changes and threats to rivers, lakes, and watersheds that supply populations, agriculture, and industry.
- Track usage and threats to valuable natural resources like forests and coastal wetlands that support sustainable livelihoods.

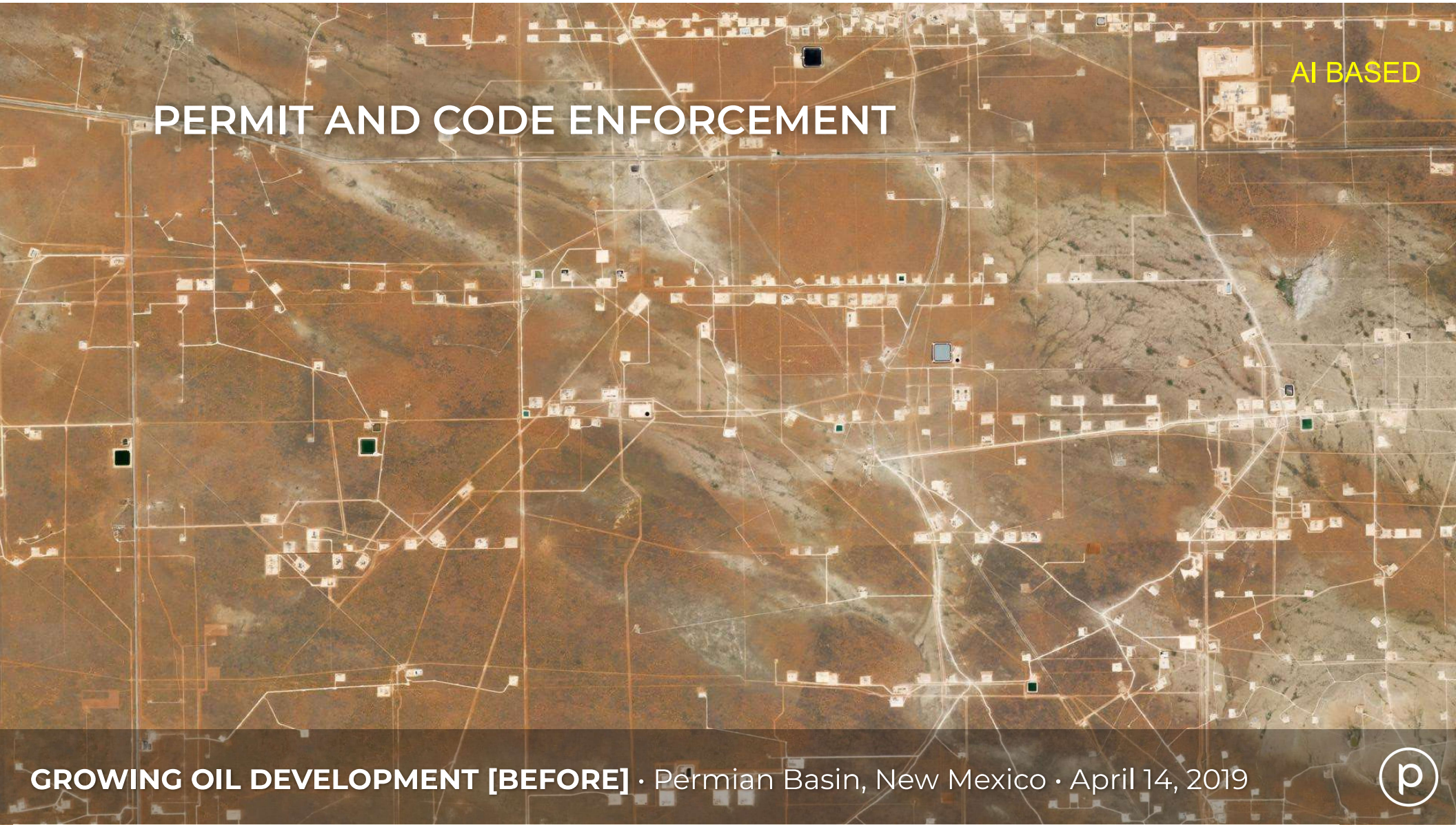


(Left) PlanetScope Monthly Basemap, June 2020, Coolidge, AZ.

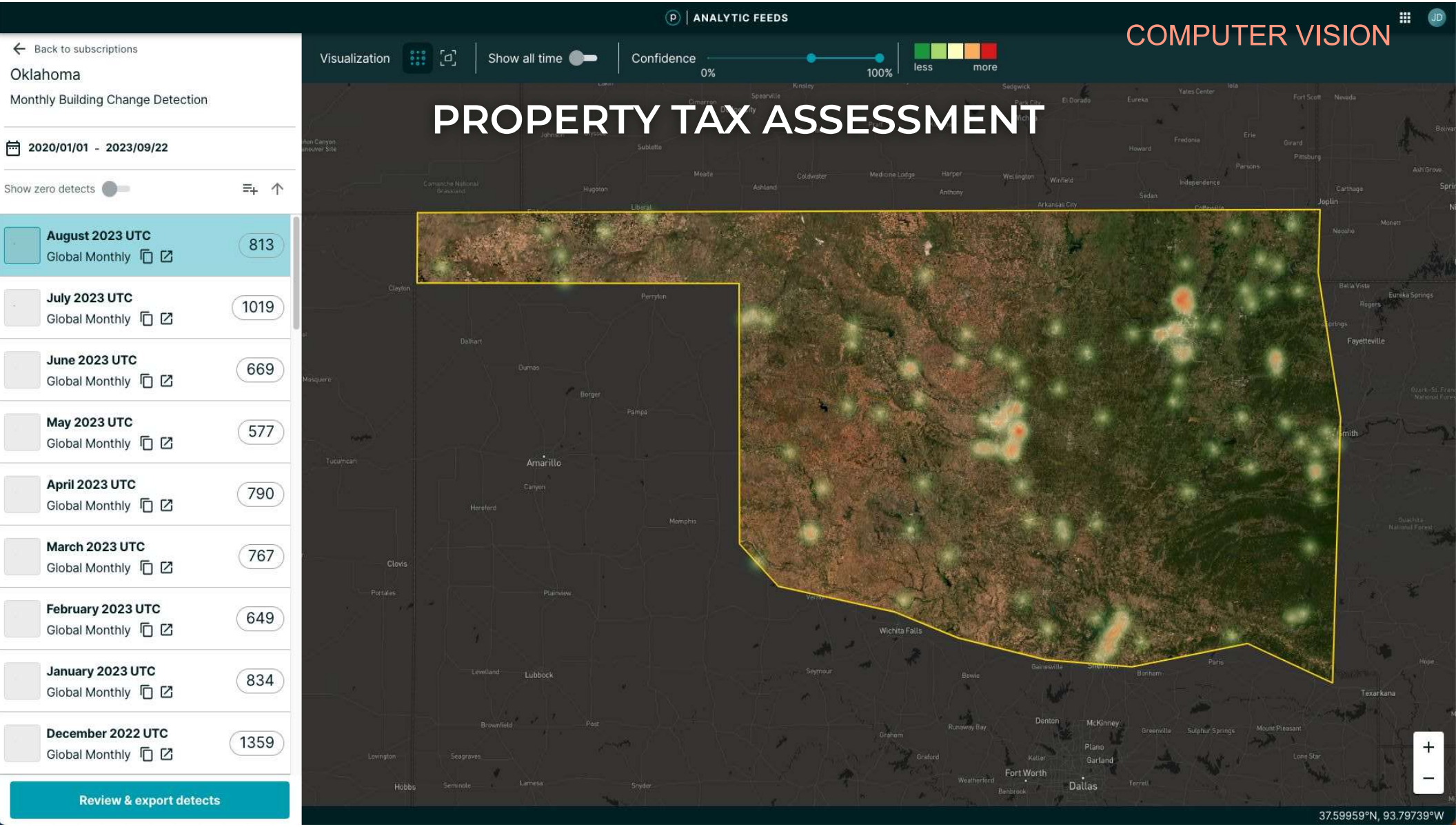
(Right) IO Monitor 3m Land Cover Map over Coolidge, AZ. Outlined areas are ground preparations for new housing developments recognized as the "Other Built" class.

(Left) PlanetScope Monthly Basemap, June 2023, Coolidge, AZ.

(Right) IO Monitor 3m Land Cover Map over Coolidge, AZ. Outlined areas have undergone construction and are now "Building." This increase in Building area between the two time periods is also reflected in the monitoring analytics data, which, when monitored regularly, can prompt the need for a visual inspection of the area.

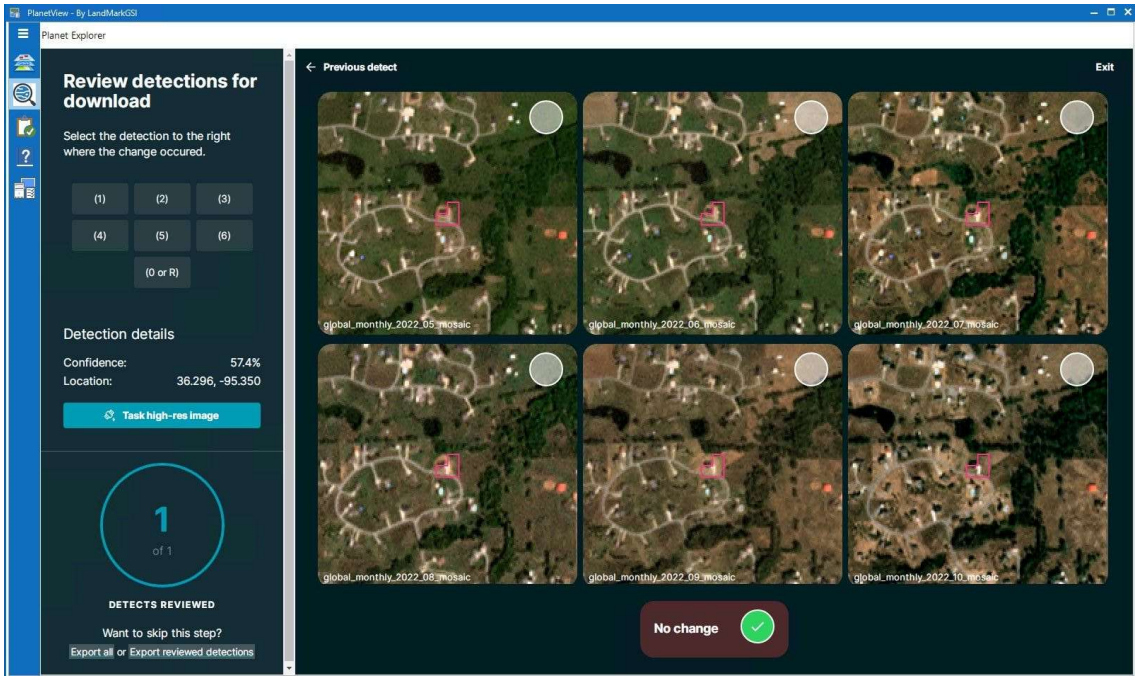

PERMIT AND CODE ENFORCEMENT
AI BASED
GROWING OIL DEVELOPMENT [BEFORE] · Permian Basin, New Mexico · April 14, 2019


AI BASED
PERMIT AND CODE ENFORCEMENT
GROWING OIL DEVELOPMENT [AFTER] · Permian Basin, New Mexico · April 23, 2020


ANALYTIC FEEDS
COMPUTER VISION
PROPERTY TAX ASSESSMENT
Back to subscriptions
Oklahoma
Monthly Building Change Detection
2020/01/01 - 2023/09/22
Show zero detects
Visualization
Show all time
Confidence
0%
100%
less
more
August 2023 UTC
Global Monthly
813
July 2023 UTC
Global Monthly
1019
June 2023 UTC
Global Monthly
669
May 2023 UTC
Global Monthly
577
April 2023 UTC
Global Monthly
790
March 2023 UTC
Global Monthly
767
February 2023 UTC
Global Monthly
649
January 2023 UTC
Global Monthly
834
December 2022 UTC
Global Monthly
1359
Review & export detects
Amarillo
Lubbock
Wichita Falls
Dallas
Fort Worth
Plano
Garland
McKinney
Denton
Texarkana
Fayetteville
37.59959°N, 93.79739°W

AI BASED

PROPERTY TAX ASSESSMENT- Pheasant Run- Enid OK



AI BASED

RIGHT OF WAY MANAGEMENT

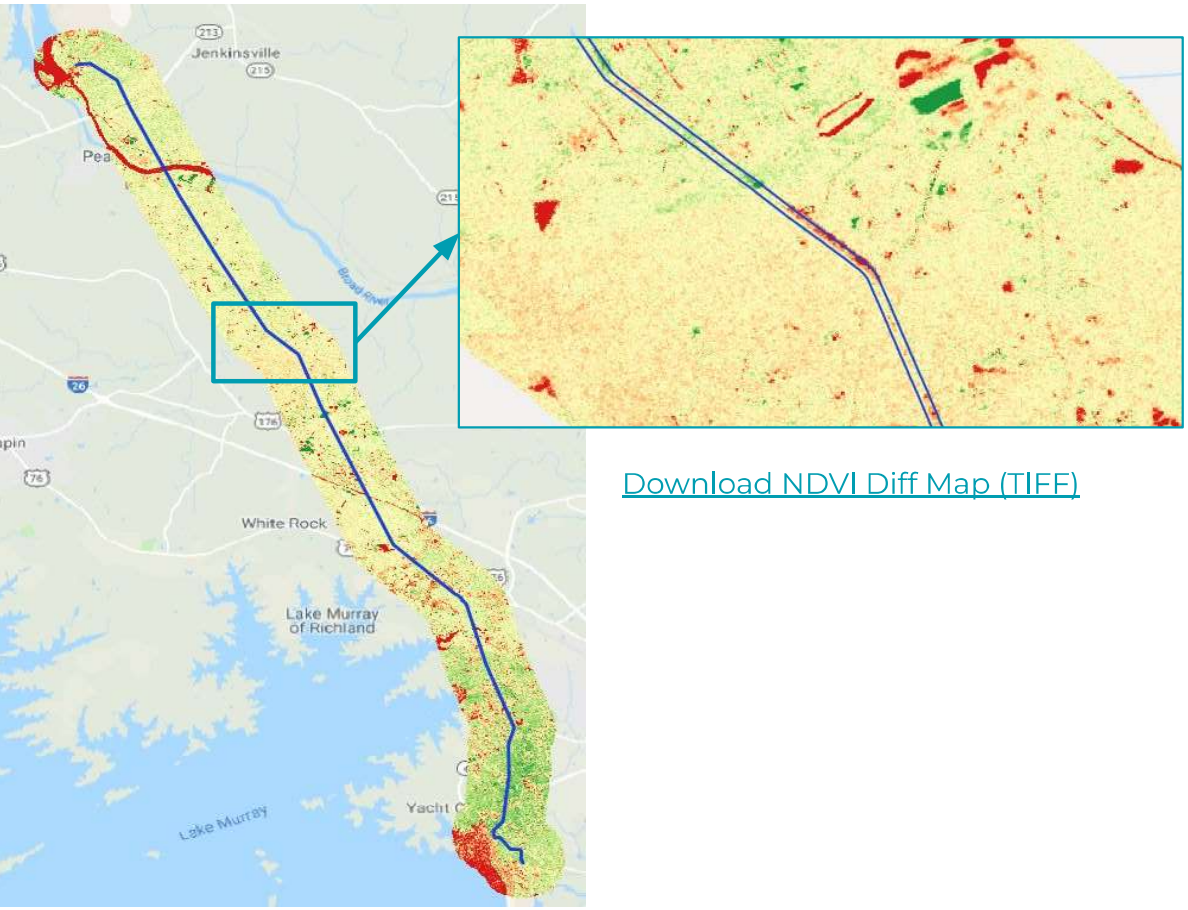
High Resolution Skysat imagery shows oil pipeline right of way in Northern Egypt

VEGETATION MANAGEMENT

Right of Way (ROW) Monitoring (North Charleston, SC)

VEGETATION ENCROACHMENT- AT SCALE

Right of Way (ROW) Monitoring (South Carolina)



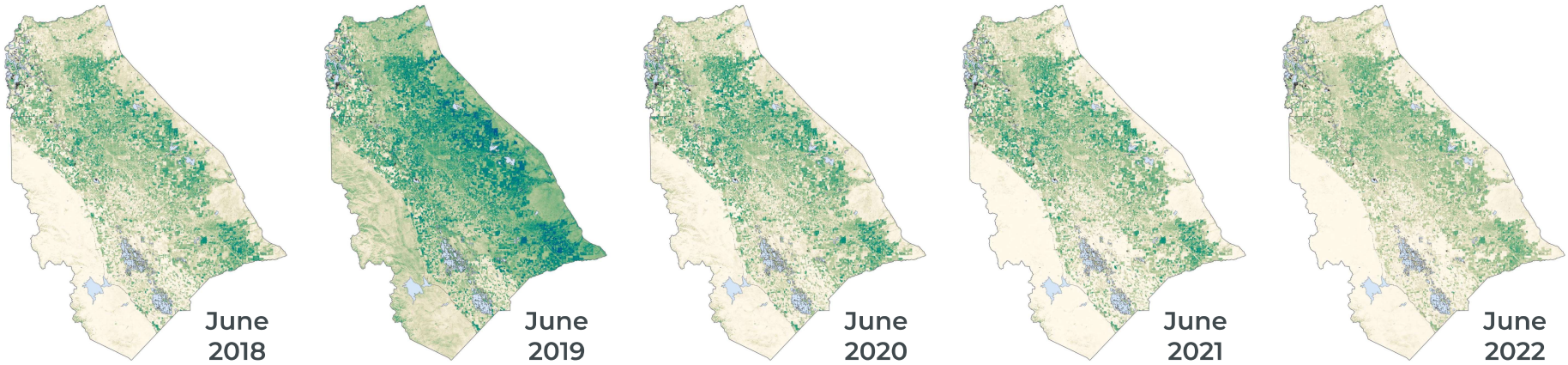
[Download NDVI Diff Map (TIFF)]

- NDVI difference between July 1, 2019 and July 29, 2019 PlanetScope 4-band Surface Reflectance images
- Added a 2 km buffer
- NDVI difference map shows regions that have seen an increase or decrease in vegetation for the month of July 2019
- There's currently no high resolution SkySat images for this particular AOI

DROUGHT MONITORING AND IRRIGATION

Soil Water Content in San Joaquin, Stanislaus, and Merced Counties, California

SPECTRAL ANALYSIS



Measuring Soil Water Content provides a consistent data feed to track dry conditions against historical norms.

ECONOMIC DEVELOPMENT

Automated Change Detection to focus analyst attention

Leveraging computer vision and machine learning, we can point user attention to the places that need it most.

Fusing these detections with existing records / focused areas can surface insightful answers.

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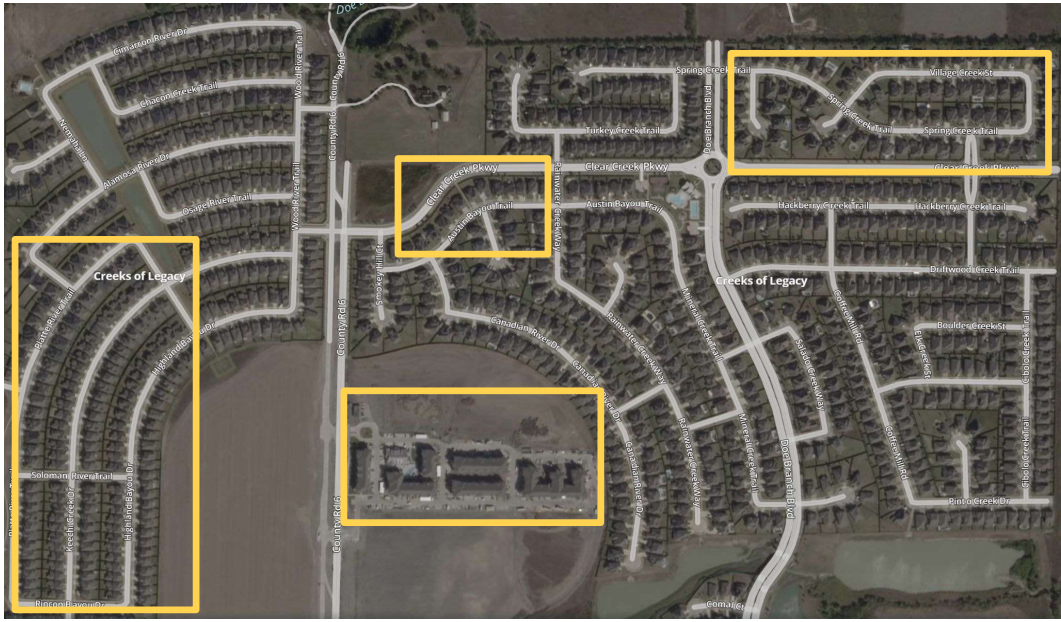
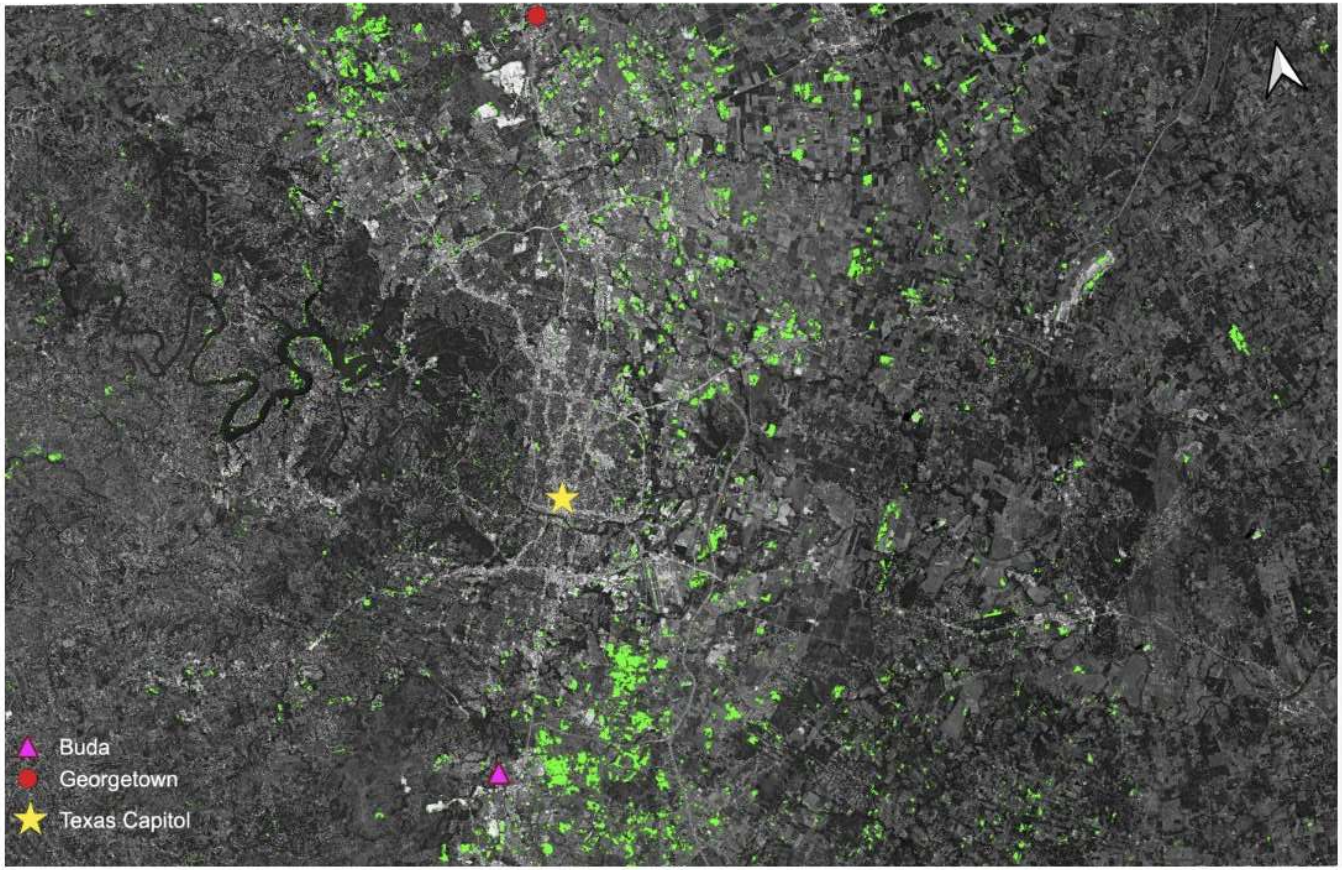


ECONOMIC DEVELOPMENT- AT SCALE

Makepath- Austin TX



We visualized the growth of Austin, Texas from 2017 to 2022.

Note how growth is concentrated along the north-south I-35 corridor as opposed to the east-west vector that follows the Colorado River.

Session Overview

- Satellite imagery has emerged as the most cost effective approach for evaluating large area change
- Leveraging AI, local governments derive change signals through object or feature detection.
- Change models enhance data pipelines for many areas including:

  - Emergency management and disaster response
  - Land use
  - Permit and code enforcement
  - Property assessment
  - Right of way management
  - Vegetation and irrigation management
  - Economic development

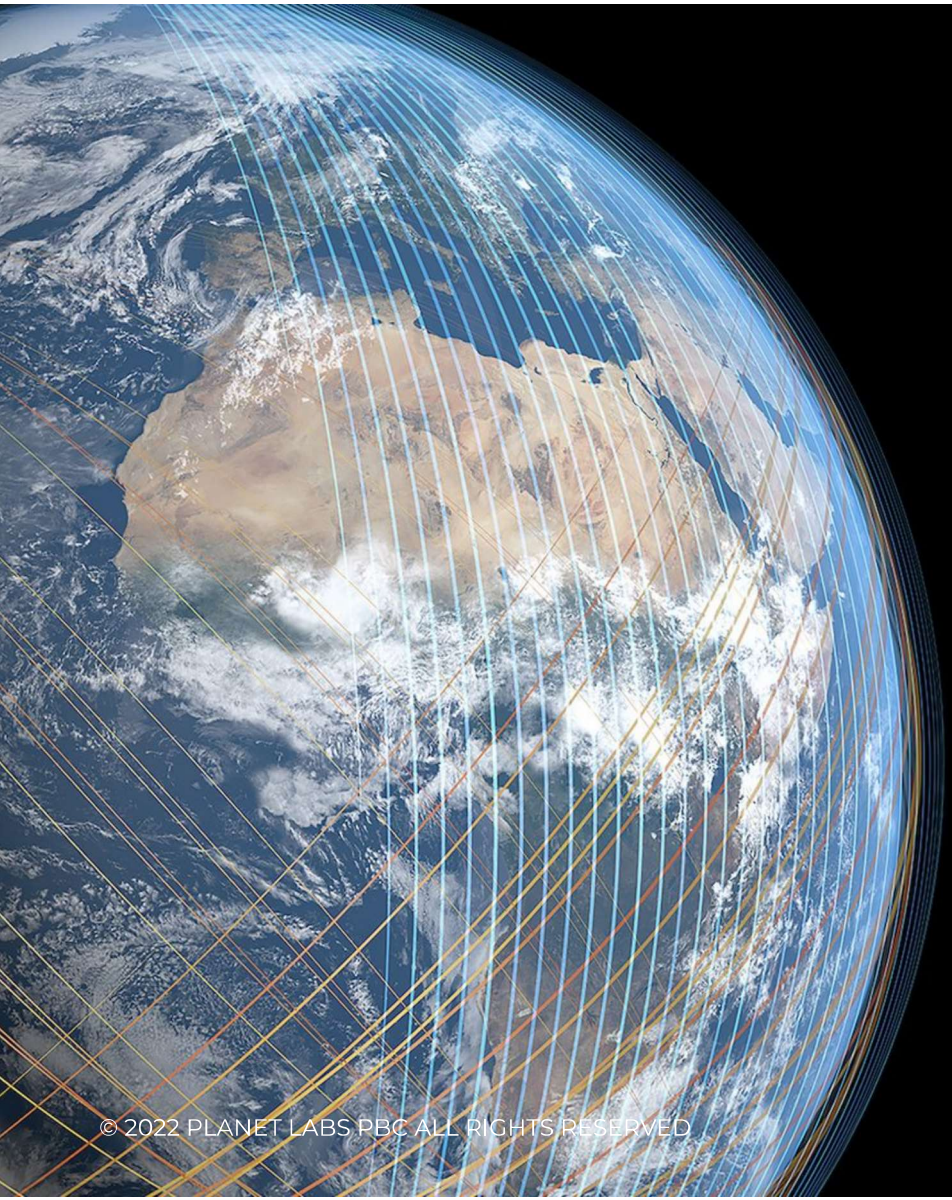
What could you do with Superpowers?

- X-Ray Vision
- Time Travel
- Fly anywhere in seconds

Monitor areas of interest, discover patterns, and get timely insights

Like superheroes, you can use your superpowers to use space to help life on earth!

But the concept of superpowers can't just be interesting, it must be useful.



Thank You.

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