



Using Imagery and AI/ML to Monitor Change in the Permian Basin

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ESRI PETROLEUM GIS CONFERENCE

Frac Hits and Well Damage

“Millions of dollars in production losses are occurring from fracture-driven well-to-well interference (frac hits) in horizontal wells in unconventional play reservoirs.” – Range Resources, JPT Article, In the Battle Against Frac Hits, Shale Producers Go to New Extremes

Lawsuit by Vertical Well Operator Settled in OKC Federal Court

June 20, 2017



\$220,000 paid in damages



Frac hit types

- Pressure
- Pressure and fluid
- Pressure, fluid, and proppant



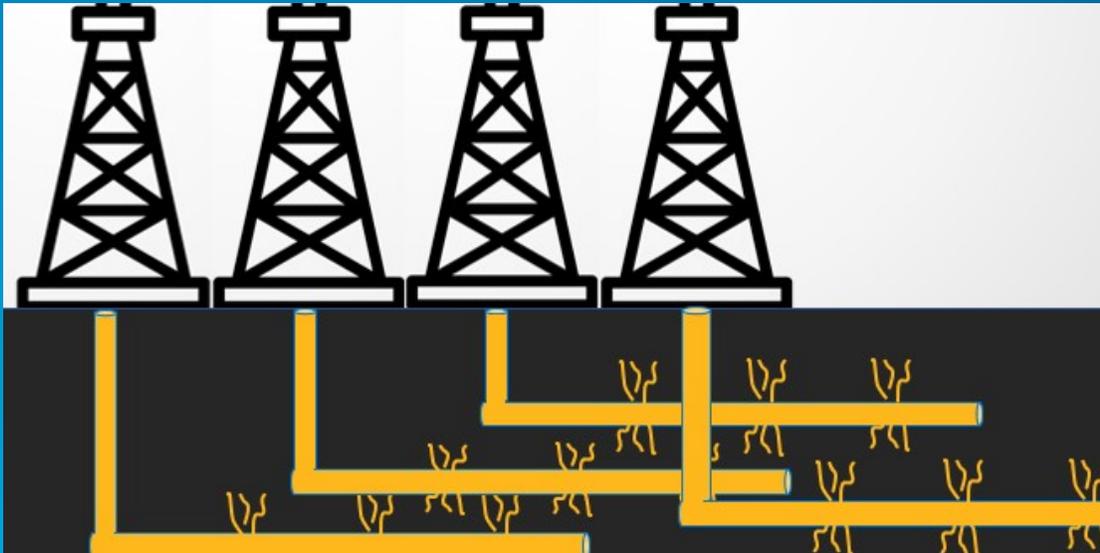
Frac hit outcomes

- Increase in production
- Decrease in production
- Loss of well control

<https://www.spe.org/en/jpt/jpt-article-detail/?art=2819>

<https://www.spe.org/en/jpt/jpt-article-detail/?art=4396>

What causes a frac hit?



- **What happens within the formation**

- Hydrologic changes due to pore pressure
- Structural changes due to rock stress
- Chemical changes due to fluid compatibility
- Combination of the above

Fracture Drive Interference Scenarios



Optimize well placement

- Maximize hydrocarbon recovery
- Minimize cannibalization between wells

Edge well ROI

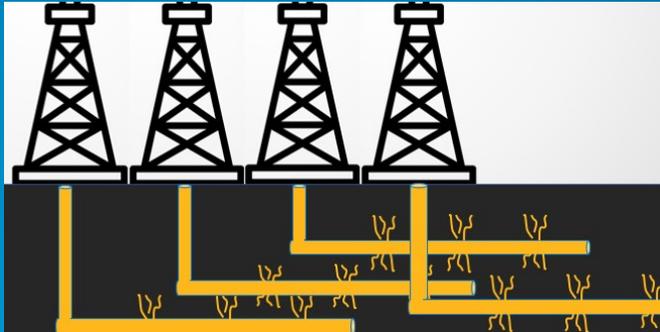
- Use publicly available data from competitors
- Predict decline curves

Frac hit warning system

- Leverage satellite imagery
- AI-based fracking prediction

<https://www.spe.org/en/print-article/?art=3510>

What will be the impact?



When will it happen?



Reinforced learning

- Problem decomposition
- Rewards-based system



Azure Computer Vision

- Cognitive service
- Pretrained model

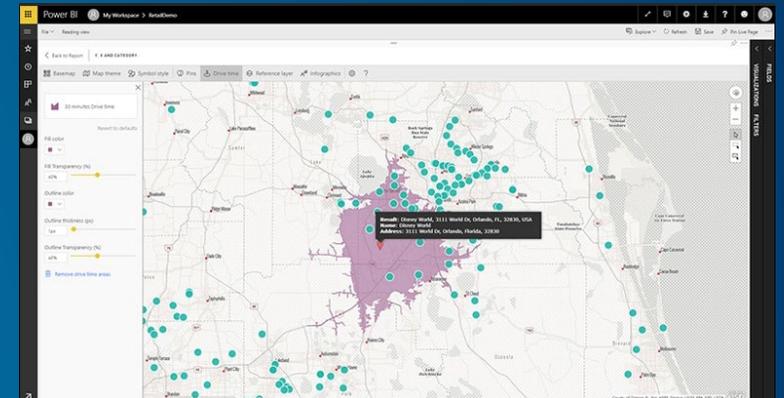
ESRI & Microsoft: Better Together



Cloud Computing



GIS Infrastructure

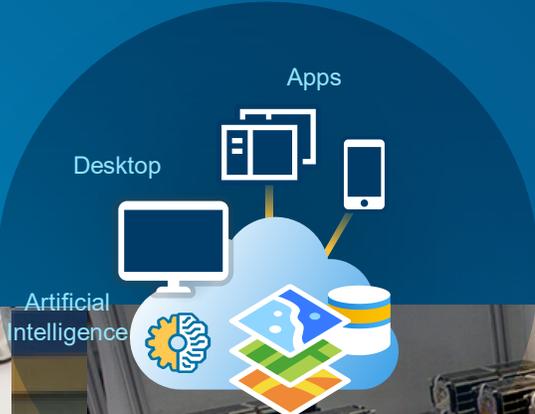


ArcGIS in Power BI

Technology Advancements allow for new Oil Field Analytics



Satellite Imagery

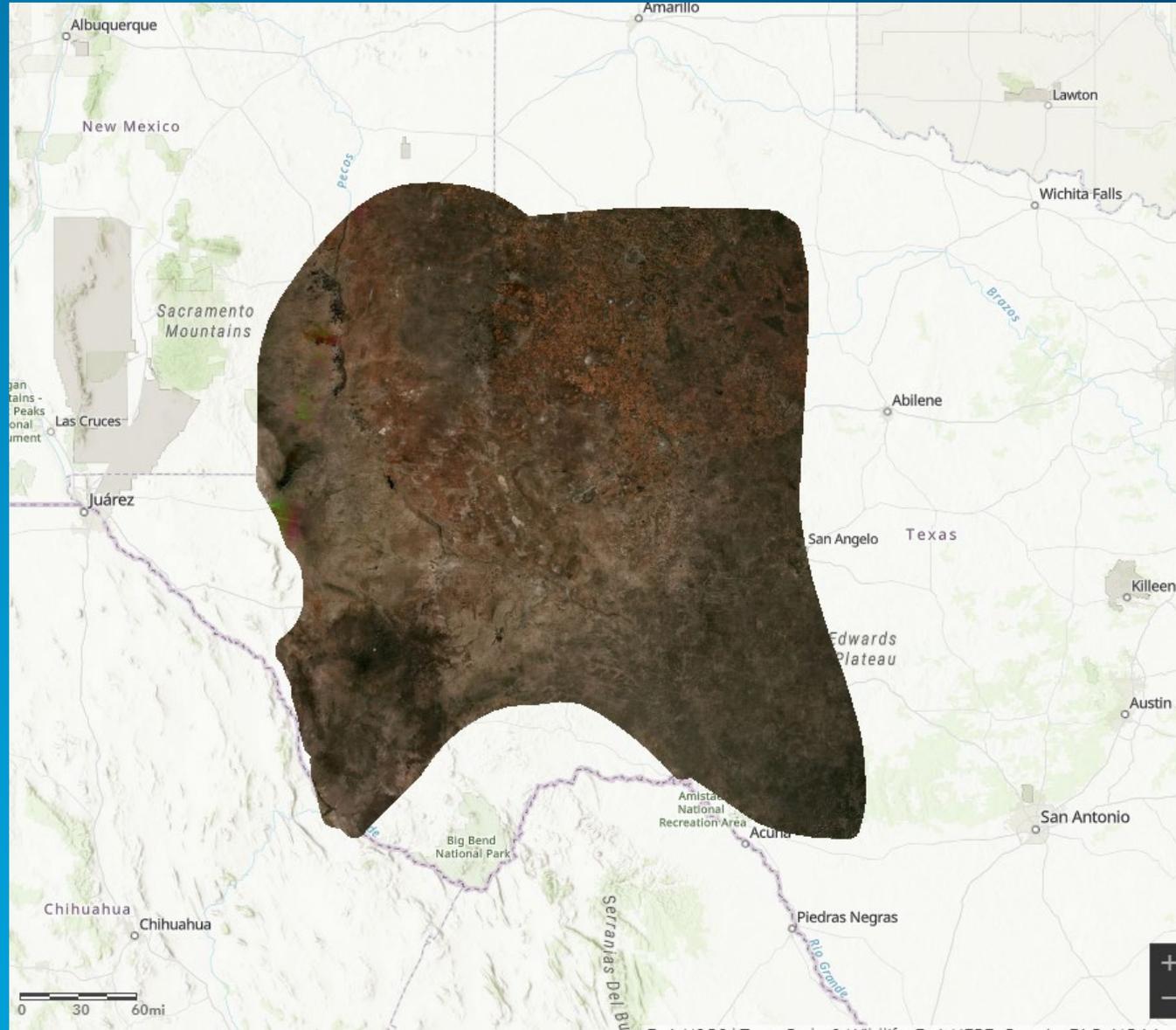


ArcGIS Imagery Management & Analytics System

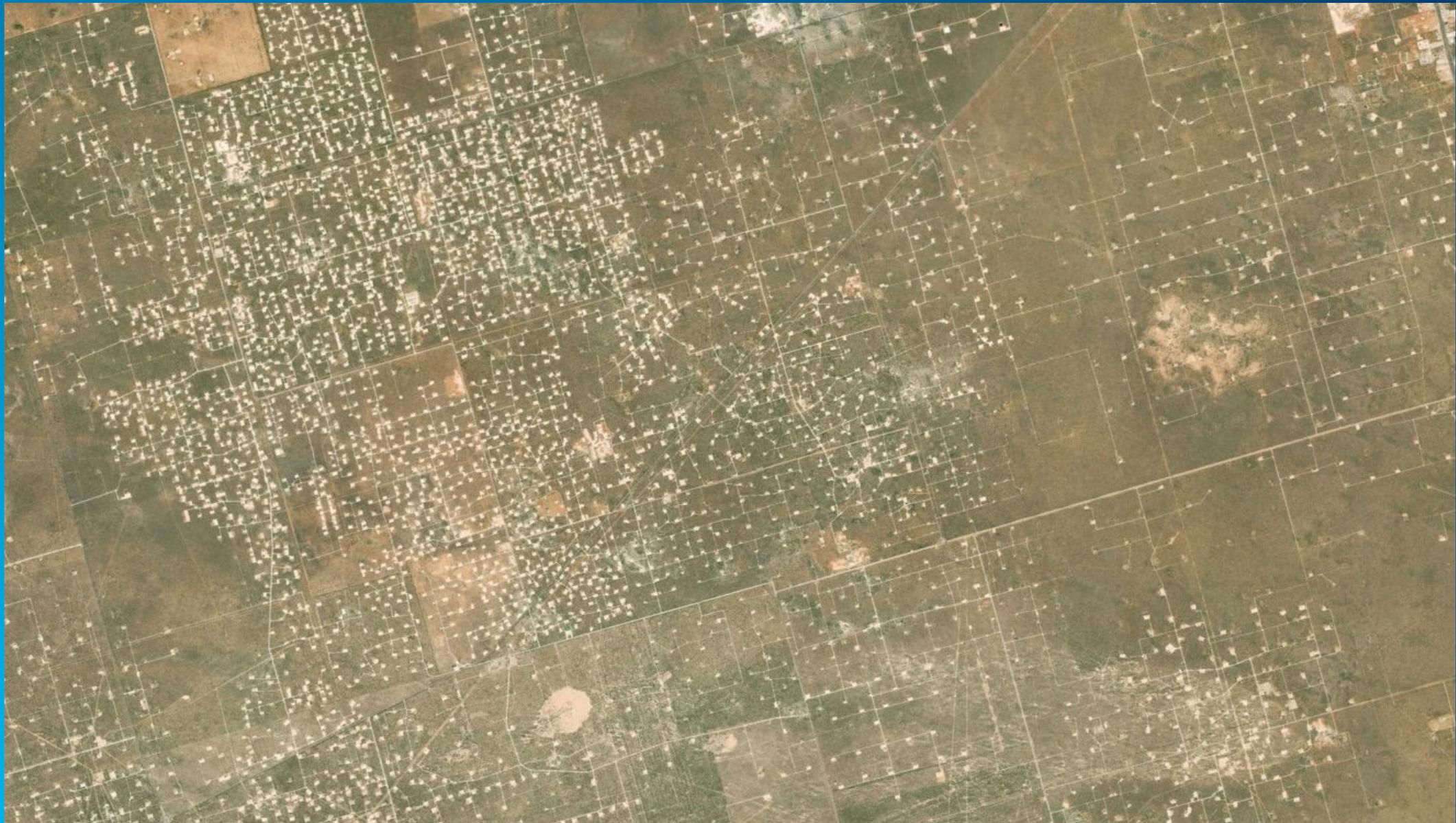


Monitoring

Weekly satellite coverage of the entire basin is now possible



Satellite View of the Permian basin



Identify new activity by comparing two dates of imagery

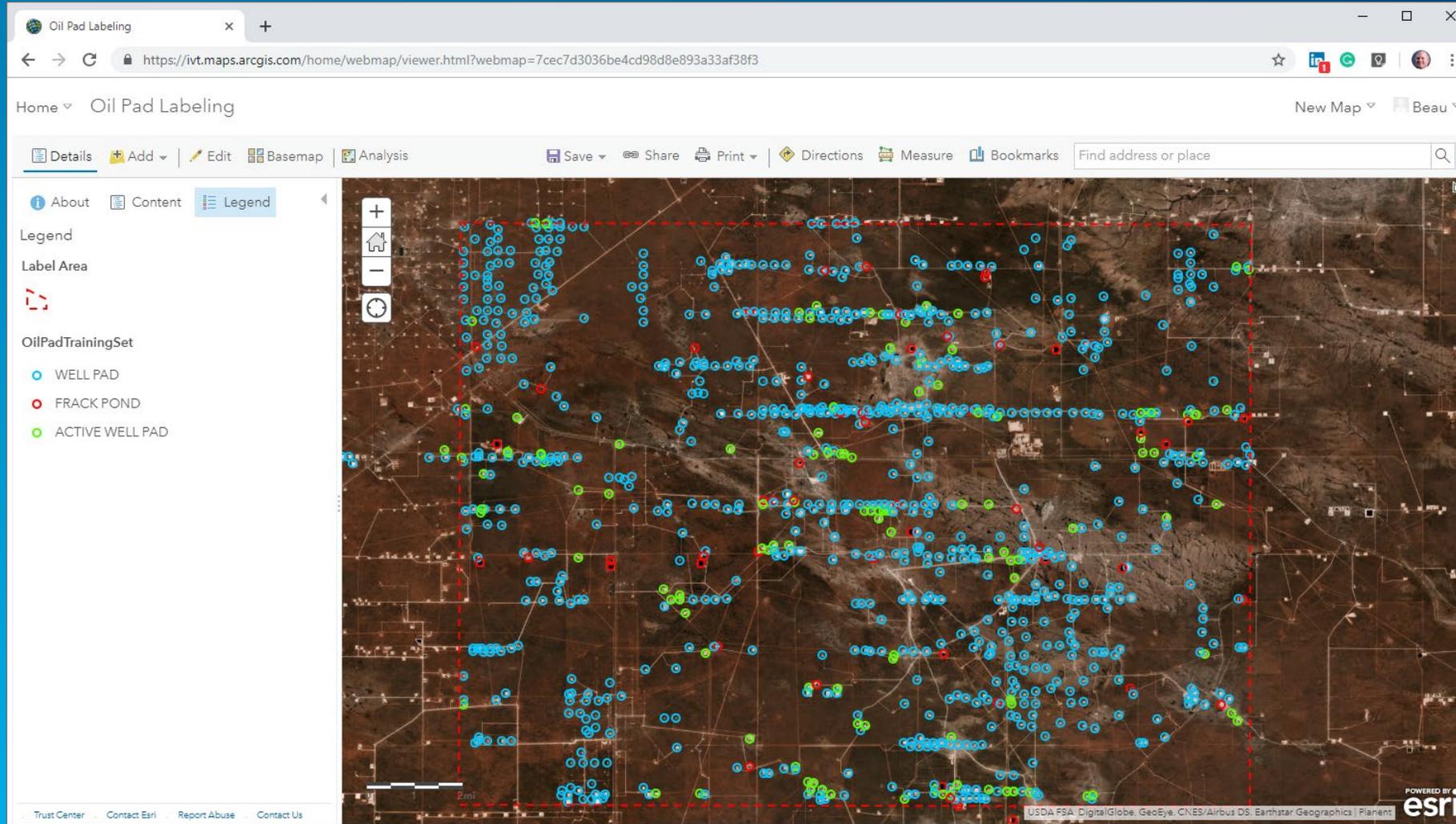


Active Site

New Ponds

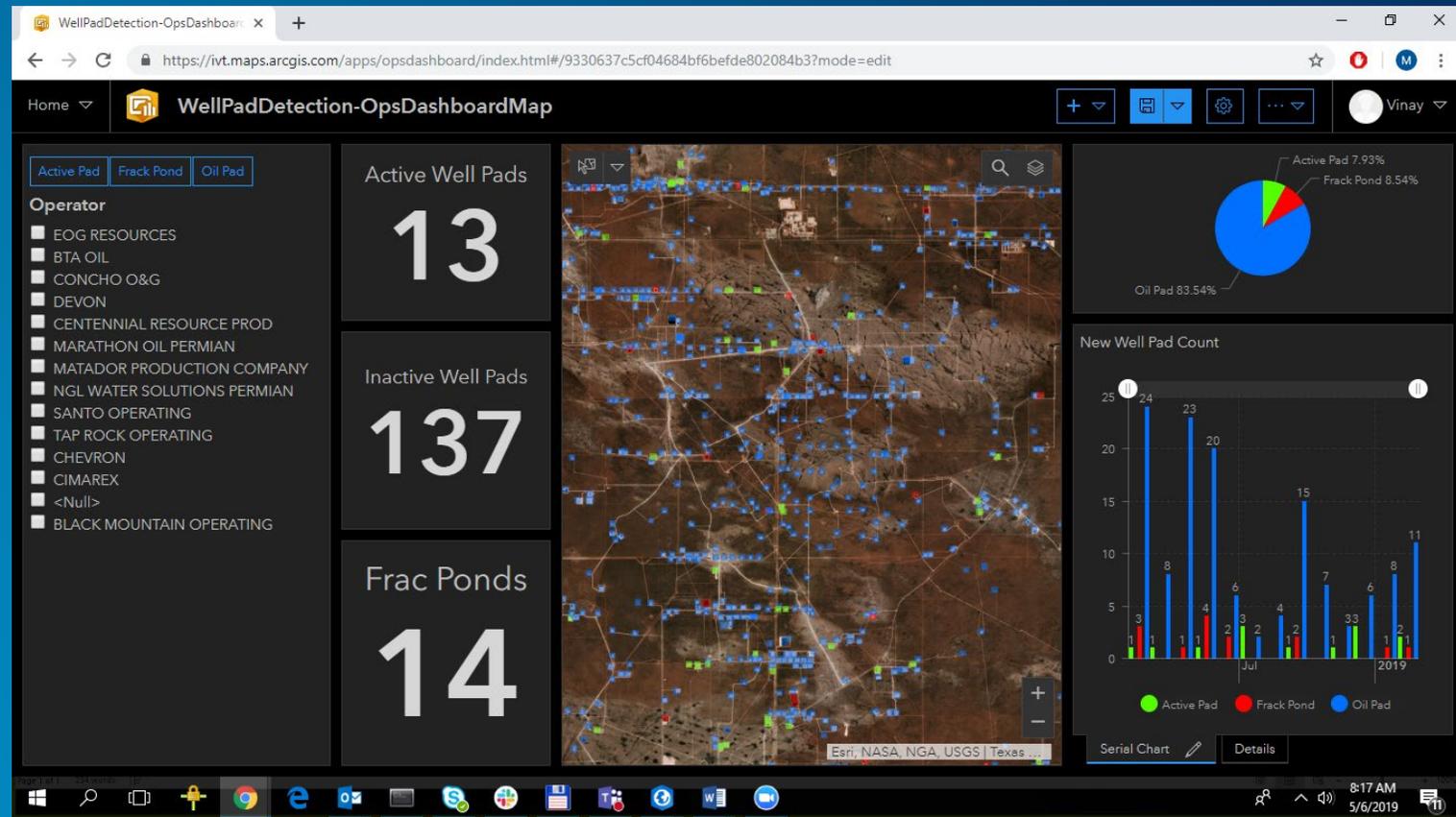
New Well Pads

Apply Artificial Intelligence and Machine Learning Models



Oil Field Operational Dashboard – Make decisions at a glance

- Web application accessed through the browser
- Provides a common view throughout the organization
- Dynamic
 - Updates as you move your area of interest





Where can I learn more?

Imagery Analytics Kiosk at the Esri booth in exhibit hall

Thursday May 16th

9:30am - 10:30am: **Imagery and Remote Sensing in ArcGIS**

Grand Ballroom A – Vinay Viswambharan – Esri

3:00pm – 3:30pm: **Better Land Acquisition with Faster Ground Truth**

Room 320 – Deven Desai – Planet



Upcoming Events

- Microsoft – Esri Artificial Intelligence Hackathon
- Houston in June
- For more information contact:
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