Data Analytics for Vegetation Management

ISA Texas Tree Conference
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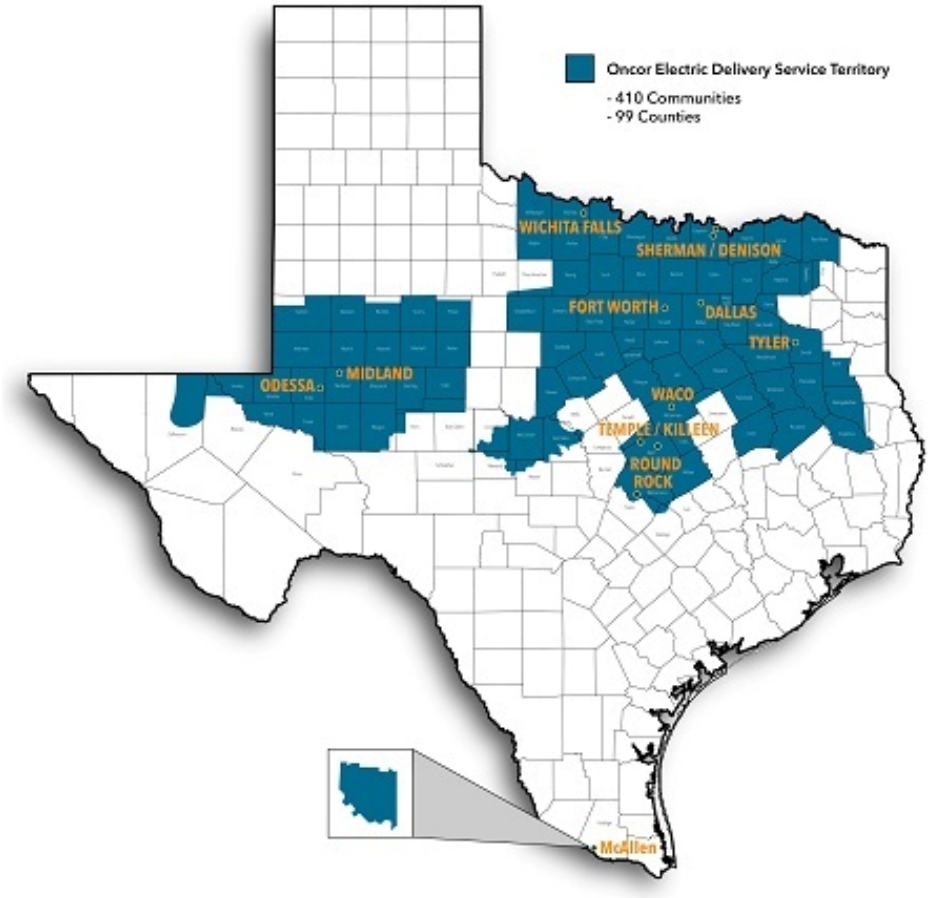
ABOUT ONCOR

CEO: Allen Nye
Headquarters: Dallas, Texas



55K	Square miles
138.5k	T&D Circuit Line Miles
3.6M	AMS Meters
250 TB	Current EDW Data storage
60 TB	New Data Records/month

Contents

Historical View of Distribution Line Clearance Scheduling

Data Analytics Overview

Reliability Data: Use and Visualization

Geospatial Data: Project with IBM

What's Next

Evolution of Distribution Line Clearance Scheduling

Through 1970's

- Managed out of local service centers
- Almost exclusively reactive
- Usually performed by line crews

Late 70's

- Utilities begin to hire foresters
- Pennelec (First Energy)
  - Begins analyzing reliability data
- Minnesota Power
  - Under pressure to improve reliability
  - Develops line clearance program

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Evolution of Distribution Line Clearance Scheduling

1980's – 1990's

- Utilities adopt proactive approach to line clearance
  - Cycle-based
  - Tree growth studies introduced
- Focus shifting to reliability-based
- Indiana Michigan Power
  - Just-in-time scheduling

1990's – Current

- Hybrid approach
  - Cycle-based
  - Reliability-based
  - Reactive
- Increasing focus on data

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Data Analytics

The process of analyzing raw data to find trends and answer questions

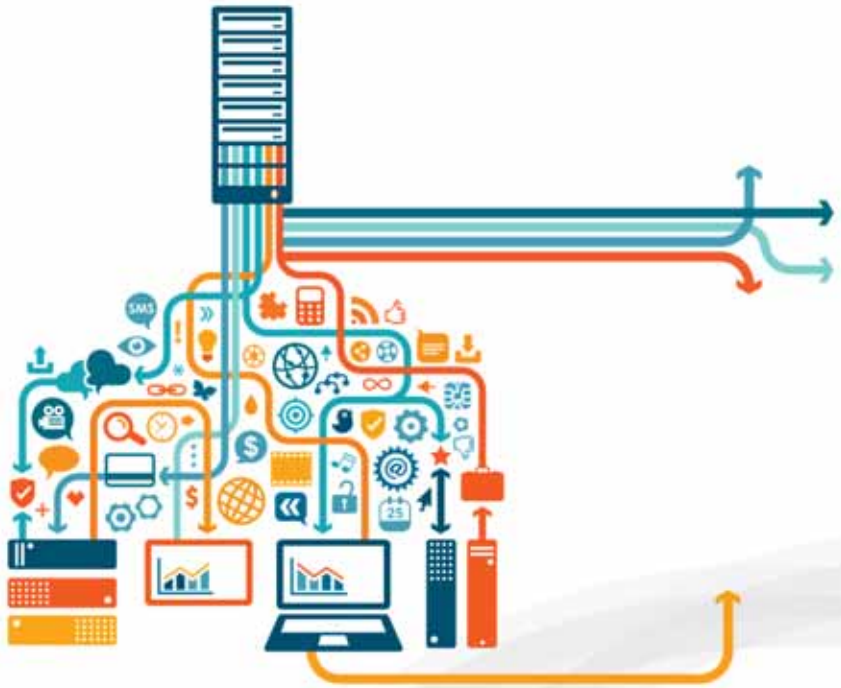
- Can be simple or complicated based on what questions are being answered and what data is being used

Goals:

- Decision support
- Decision automation
- Faster response and action

Using the data:

- What are the inputs and output
- What kind of data
  - numerical/categorical
- Is there enough data



Challenges

Amount of data

Acquisition & Processing Time

Opportunity

- Predictive model
- Improve efficiency
  - Optimize process for planning projects
  - Prioritize planned projects
- Validate work processes & scope
- Improve reliability

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Using Outage Data

Reliability Indices

- SAIDI = $\frac{\text{Sum of all customer interruption durations (CIM)}}{\text{Total number of customers served}}$

- SAIFI = $\frac{\text{Total number of customer interruptions (CI)}}{\text{Total number of customers served}}$

- MAIFI = $\frac{\text{Total number of customer momentary interruptions}}{\text{Total number of customers served}}$

- $CEMI_n$ = $\frac{\text{Total number of customers experiencing } n \text{ or more interruptions}}{\text{Total number of customers served}}$

- CAIDI = SAIDI / SAIFI

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Using Outage Data

Considerations for Calculating Reliability Indices

- Parameters / Criteria
  - How is a sustained outage defined
  - What causes to include
- Key performance indicators
  - What is important to the regulators
  - What is important to your organization
- Storm events
- Data quality
  - Connectivity model errors
  - Incorrect cause codes
- Data quantity
- Frequency of updating calculations

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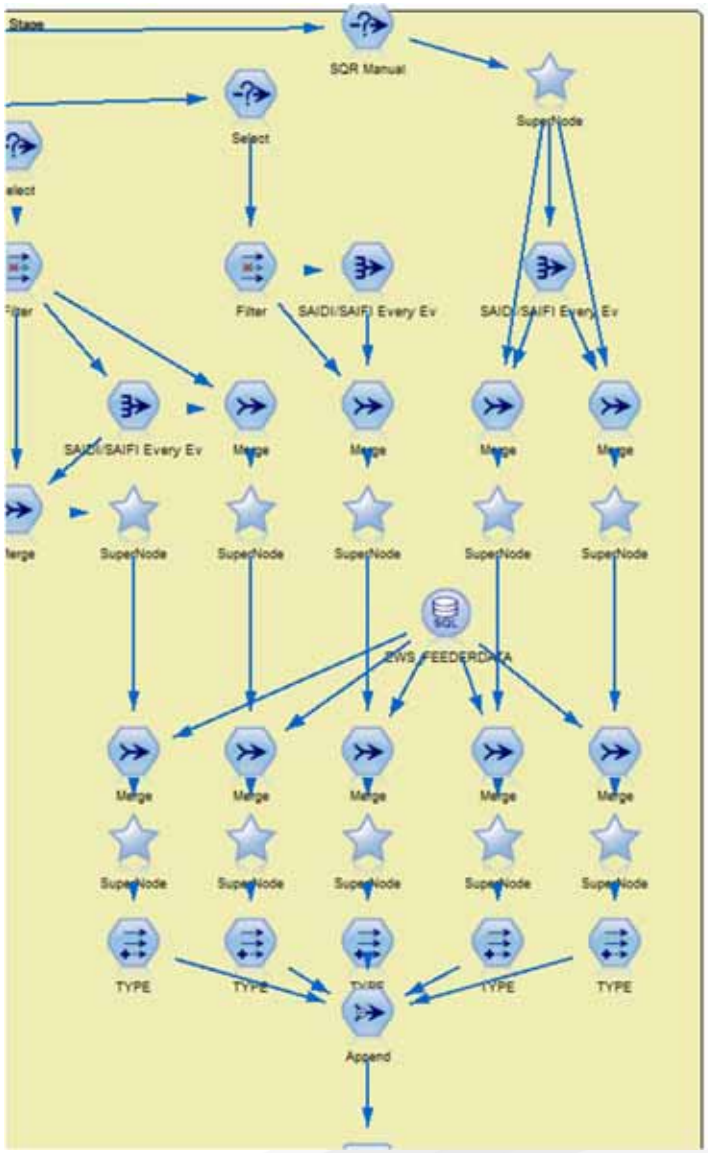
Using Reliability Data

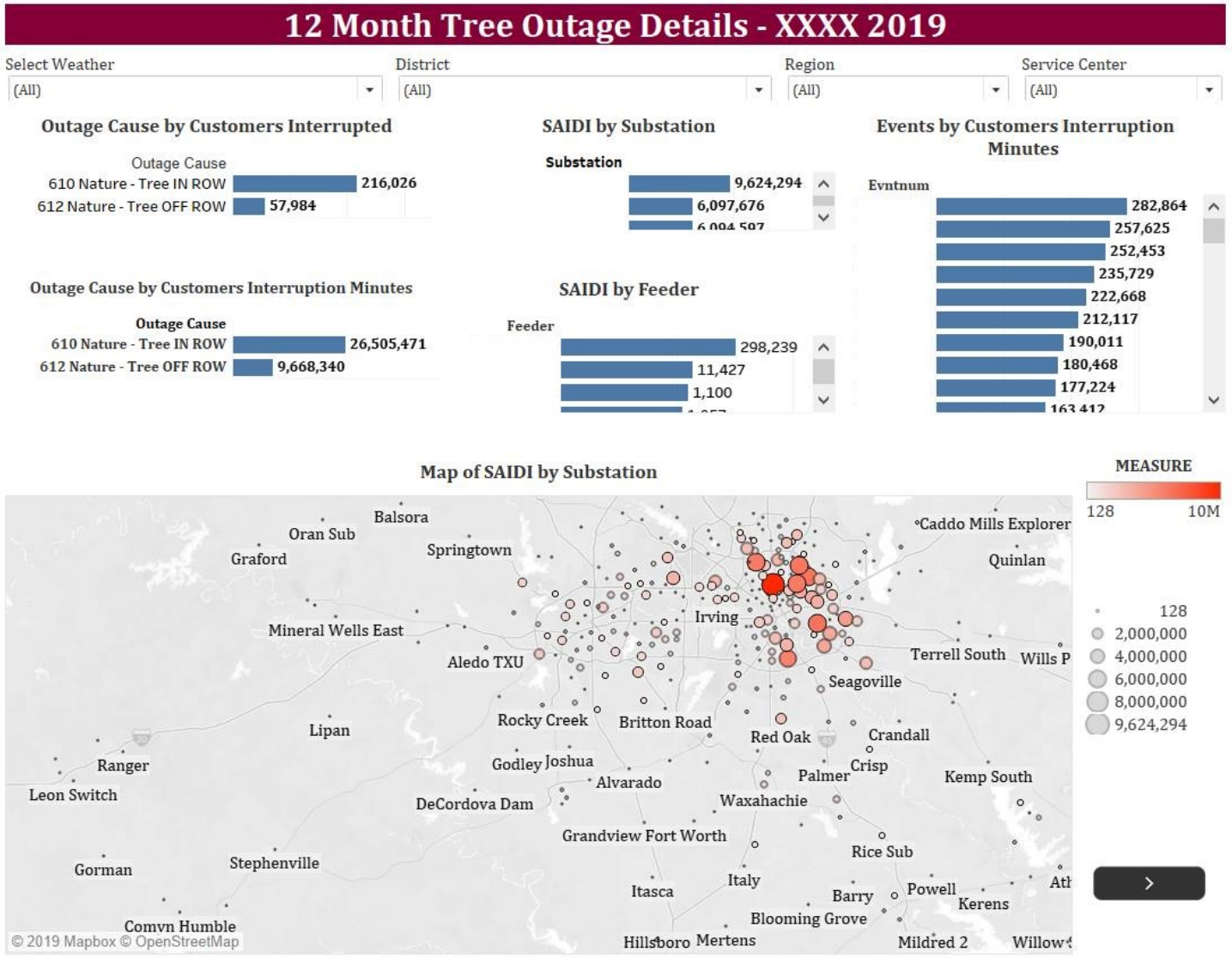
Vegetation Caused Event Analysis

- Feeder level SAIDI & SAIFI
- Every distribution feeder (over 3,000)
- Updated monthly
  - 12 month rolling
  - Year-to-date
- Ranks feeders & events
- Filter by desired criteria
- Take action where necessary
- Feeds into Tableau for visualization



Basic math, but a lot of data!

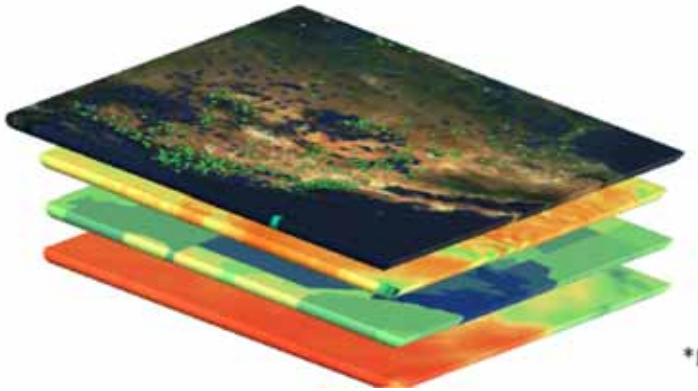
Data Visualization



IBM PAIRS* Project

Integrating Petabytes of information for VM programs

	Satellite		Weather and Climate				Other			
Source	**NAIP**	**Sentinel**	**NAM**	**GFS**	**ECMWF**	**CFS**	**Soil SURGO**	**Soil ISRIC**	**Elevation NEDS**	**Elevation SRTM**
Spatial Res & Coverage	Local 0.5 m	Global 10 m	US 5km	Global 0.5 deg	Global 0.1 deg	Global 0.5 deg	Vector US	Global 250m	US 3 m	Global 30 m
Temporal Resolution	2 year	weekly	1 hr	3 hr	1 hour	6 hr		NA	NA	NA
Forecasting Horizon	NA	NA	0-60 h	6-192 h	0 -60 h	6 months				NA
Ensemble Forecast	NA	NA	No	No	NA	4 members				



*Physical Analytics Integrated Data Repository and Services

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Project Background & Timeline

November 2017

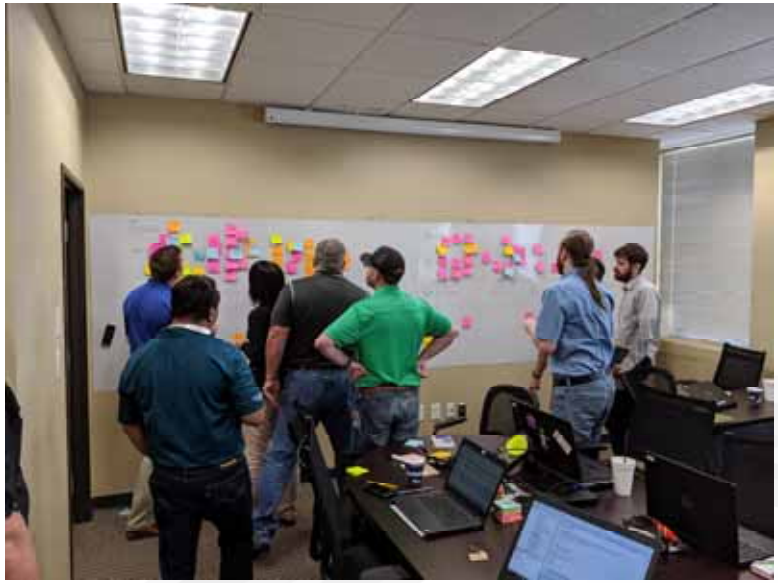
- IBM Design Thinking workshop

August 2018

- Introduced to IBM vegetation prediction model

October – December 2018

- Proof of Concept
  - Potential use cases
- Select test areas
  - Transmission & Distribution



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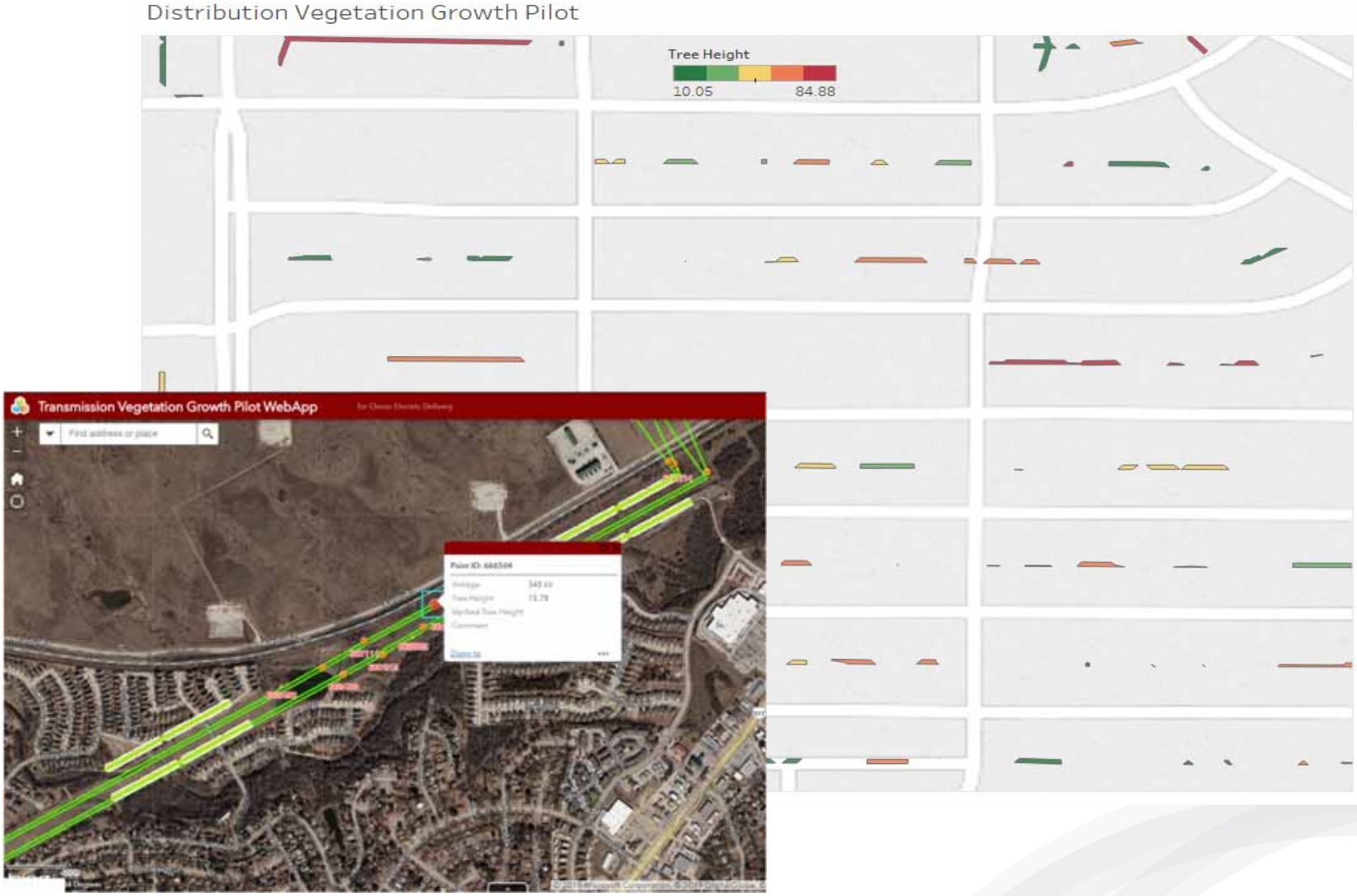
January 2019 – Initial Data Received



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January 2019 – Field Validation

Distribution VM
- Forester
- Maintenance Strategy

IBM/The Weather Co.
- IBM Project Managers
- Watson Researcher

Oncor Selected Sites
- Data looked suspect
- Line clearance recently complete

Vegetation Management Use Cases

Initial Use Cases

- Inventory managed miles
  - Tree / No-Tree (West TX)
- Mid-cycle inspections

Exploratory Use Cases

- Post-work audit
- Off ROW dead/dying trees

Future Use Cases

- Species identification
- Outage validation/investigation
- Reliability studies
- Condition-based scheduling

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Next Steps & Future Outlook

Integration of datasets

Calculating MAIFI

Device level reliability metrics

Development of risk model

- Exposure
- Consequence
- Maintenance history
- Load profile
- Critical customers

Storm damage predictive model

Approaching near real-time data

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