



OmniEarth

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# Practical Earth Observation and Analysis

## GEOBUIZ

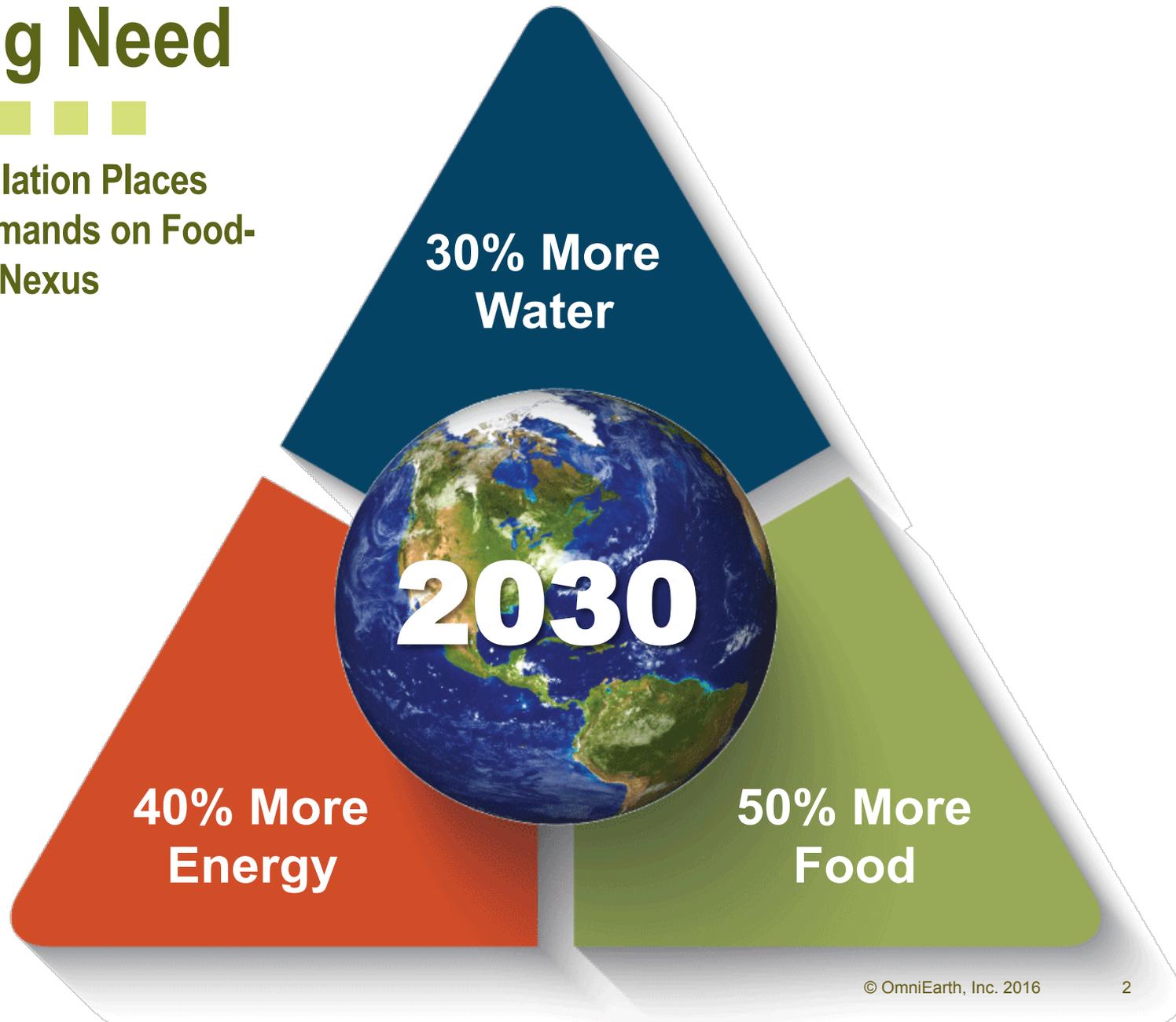
Lars Dyrud, PhD

26 April 2016

# Growing Need



Growing Population Places  
Increasing Demands on Food-  
Water-Energy Nexus



# The Global Challenge



Of the 7 Billion People on Earth Today, **2.5 Billion**  
Have No Access to Electricity



# The Global Challenge



Of the 7 Billion People on Earth Today, **2.8 Billion**  
Live in Areas of High Water Stress



# In the Next 20 Years ...



Energy Consumption Will Increase by **35%** Which Will Increase Water Consumption by **85%**



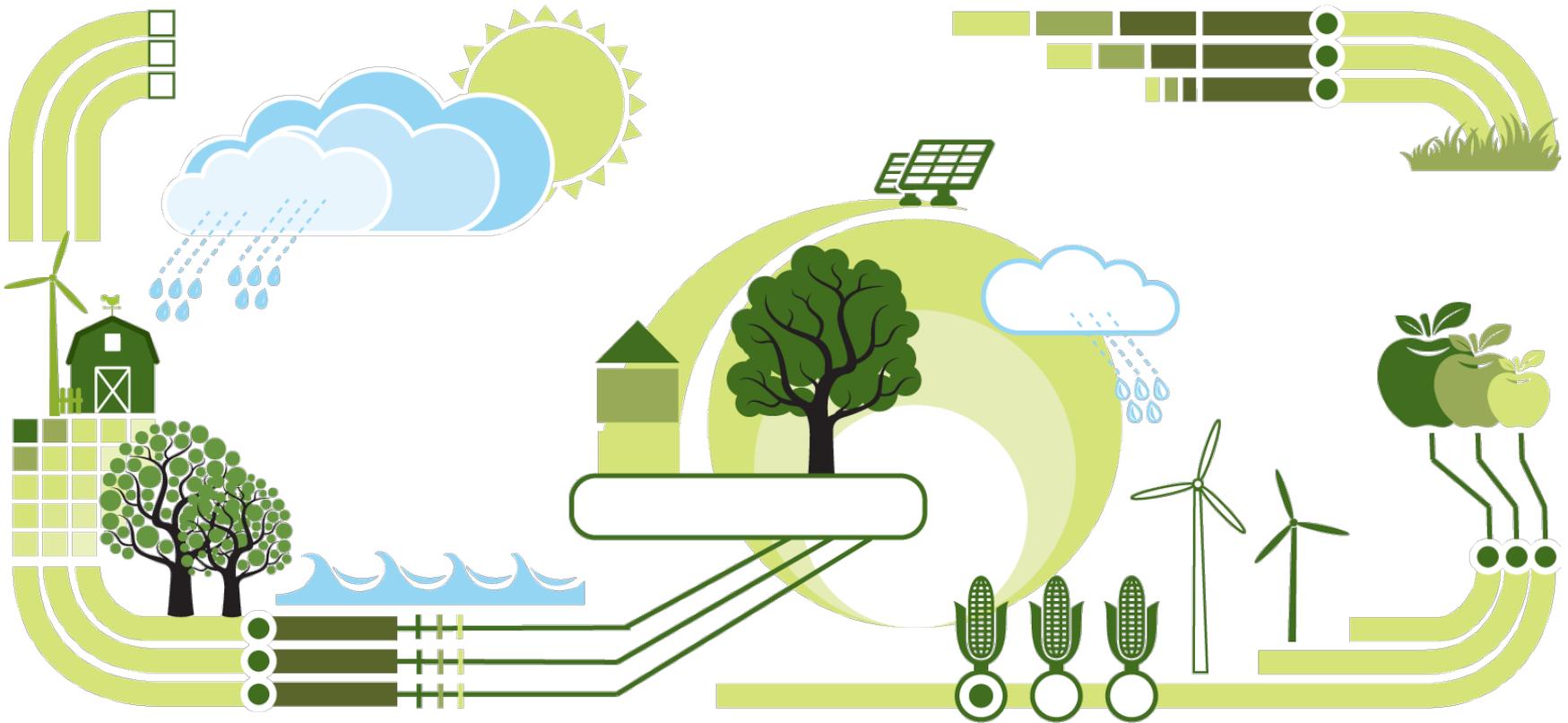
increasing pressure on energy increases pressure on **finite water resources**

**... and so on**

# Needs Are Competitive



**Agriculture Accounts for 70% of Water Withdrawal, and Food Production and Supply Uses 30% of All Energy Consumption**



# So what are we going to do about it?

*Maximizing electrical efficiency doesn't mean asking people to sit in the dark.*



# OmniEarth Satellite and Services



*OmniEarth Calibration Services for EO*



*Photo of the instrument flown on the RAVAN prototype funded by NASA grant.*

Project ERIS and Visible Calibration Target for Climate Remote Sensing



**Together, Let's Answer the Most Significant Question of Our Generation**

# Current Initiatives



Focus on Underserved Markets With Common Needs and Attributes



**Water/Resource  
Management**



**Agriculture/  
Futures**



**Insurance/  
Ad-Tech**

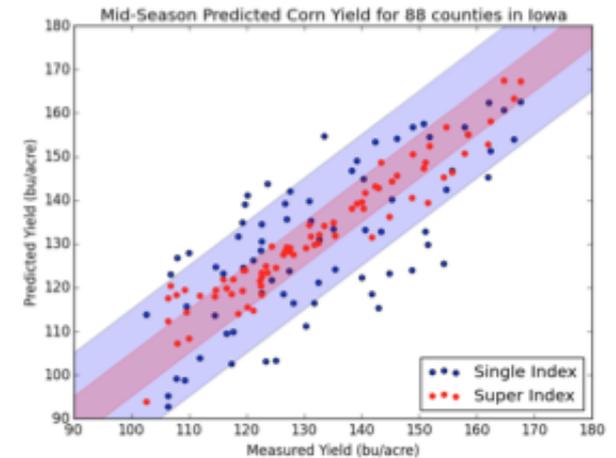
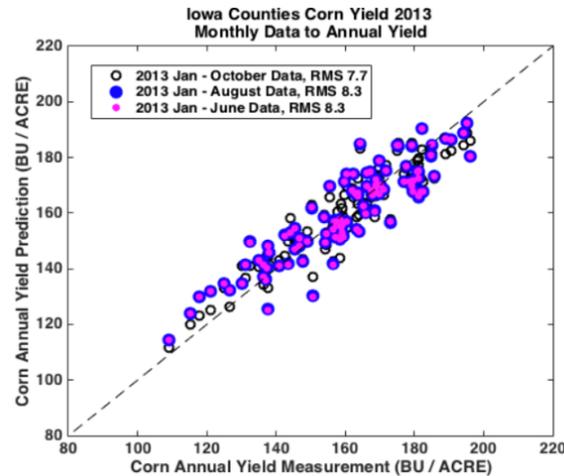
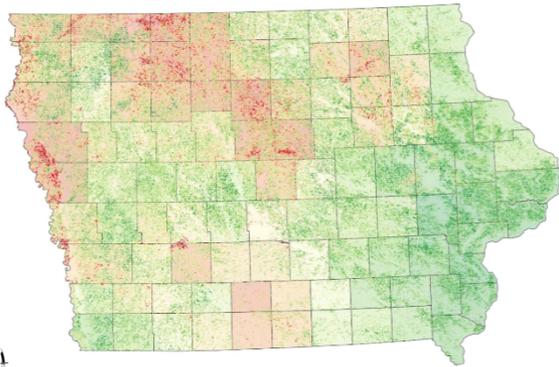


**Civil/  
Defense**

# Agricultural Yield SuperIndex™



Produced from Combination of 4-Band Imagery (imager independent) to Return 20+ Spectral Indices to Monitor Vegetation, Soil, and Water Conditions



*SuperIndex model plotted against actual corn-yield estimates.*

# Automated Feature Discovery Index



Change Detection on the Zaatari Camp in Jordan – AFDI Evaluates Temporal Change Independent of Spatial Resolution



01-Sept-2011

26-Feb-2013



Difference Image

Binary Image Indicating Significant Change

# Water Resource Management



Fast, Repeatable Process Produces Outdoor Water Budget Estimates  
Accurate to Within 5%

Aerial/Satellite Imagery Obtained & Prepared

Analyzed by “Training” the Data and  
Transitioning to Machine-Based Learning  
Over Series of Iterations

Proprietary, Patent-Pending Algorithms  
Identify Features, including

- Grass
- Trees & Shrubs
- Non-Irrigated/Bare Earth
- Man-Made Surfaces
- Pools
- Natural Water Bodies
- Artificial Turf

Then Layers Parcel Boundary and/or  
Proprietary Customer Data Over Region of  
Interest



# Water Resource Management

OmniEarth separately classifies building/roof foot-prints from surface level impervious surface measurements enabling a broader range of storm-water and recycling applications, and improved water budgets

The screenshot displays the OmniEarth web application interface. At the top, the browser address bar shows the URL: <https://demo.omniearth.net/omni/root.en?conversationId=2106>. The application header includes the OmniEarth logo, user name 'OE User', and a 'Help' link. Below the header, the main content area is titled 'Water Budget by Parcel'. On the left, a 'MAP' section shows a satellite view of a residential area with a parcel highlighted in green. A search bar and navigation controls are visible. A legend and layers panel on the right of the map shows checked options for 'Parcels (CCF)', 'Land Cover', and 'Satellite Imagery'. A tooltip for the selected parcel provides the following details:

- Address: 104 ONEILL CT FOLSOM 95630
- Parcel Area: 18,765.3
- Land Use: Single Family
- [Aerial Image](#)

Below the map, a 'PARCEL INFORMATION (CCF)' table lists nearby addresses and their irrigated 2015 CCF values:

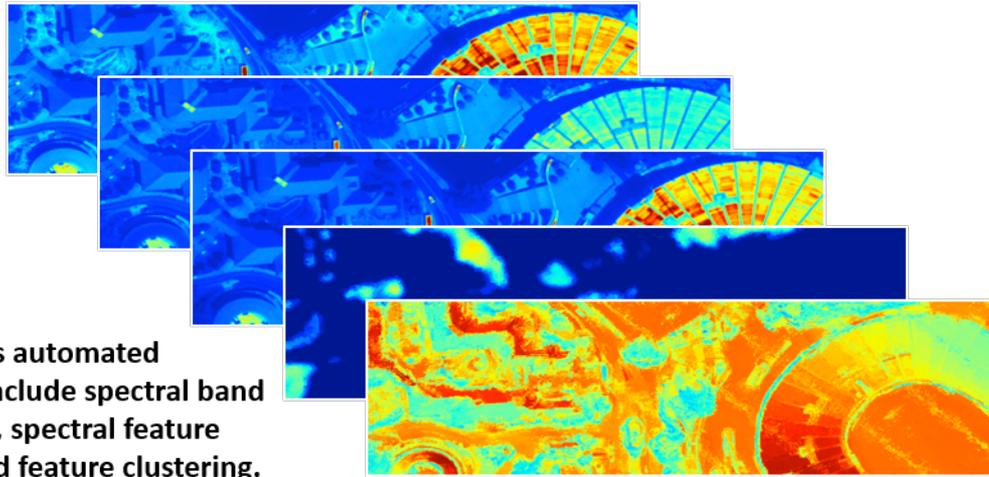
Address	Irrigated 2015 ...
104 ONEILL CT...	321.2
106 ONEILL CT...	323.2
107 ONEILL CT...	542.3

Below this table is a 'WATER BUDGET (CCF) BY PARCEL' table showing monthly data for 2013 and 2014:

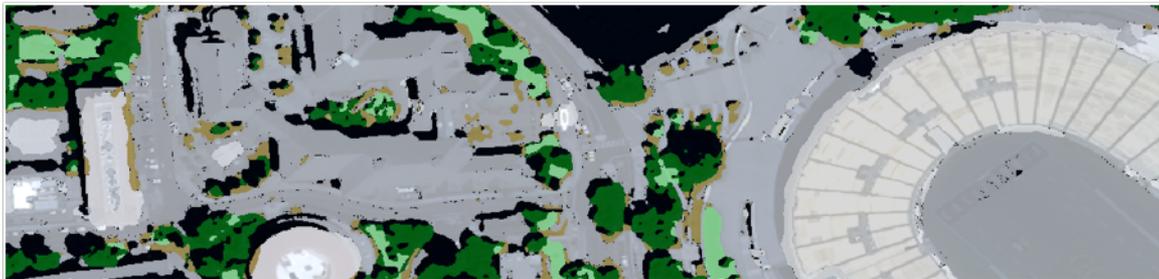
Year - Month	Indoor Bud...	Irrig...
2013-01	7.8	
2013-02	7.0	
2013-03	7.0	
2013-04	8.8	
2014-01	16.8	17.8
2014-02	17.8	28.9
2014-03	17.8	48.0
2014-04	20.1	

An 'AERIAL IMAGE' overlay shows a top-down view of the selected parcel, highlighting a swimming pool and surrounding landscaping. Below the map and tables, a 'WATER BUDGET (CCF) BY PARCEL' bar chart displays monthly CCF values for three categories: Indoor Budget (green), Irrigated Outdoor Budget (blue), and Irrigable Outdoor Budget (red). The chart shows a seasonal peak in outdoor budgets during the summer months (2013-07 to 2014-07). A legend on the right identifies the colors for each budget type.

At the bottom of the interface, the footer includes the text: © Mapbox © OpenStreetMap Improve this map © DigitalGlobe and © OmniEarth, Inc. 2010.



OmniEarth's automated processes include spectral band assessment, spectral feature masking and feature clustering.

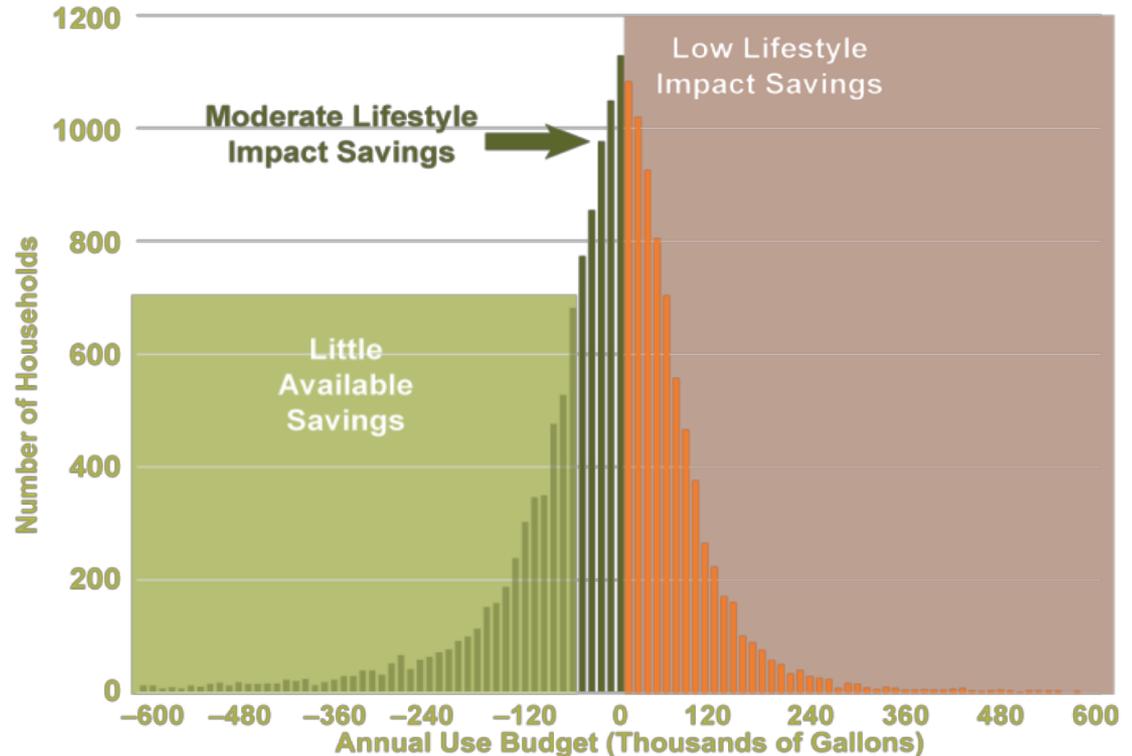


# The Where of Water Efficiency



*In this example water district, 15% annual water savings could be achieved with minimal impact on consumers' lives.*

*10% revenue recovery was identified due to customers that were metered far less than actual budgeted usage.*



**Likely non-revenue water due to aging or other**

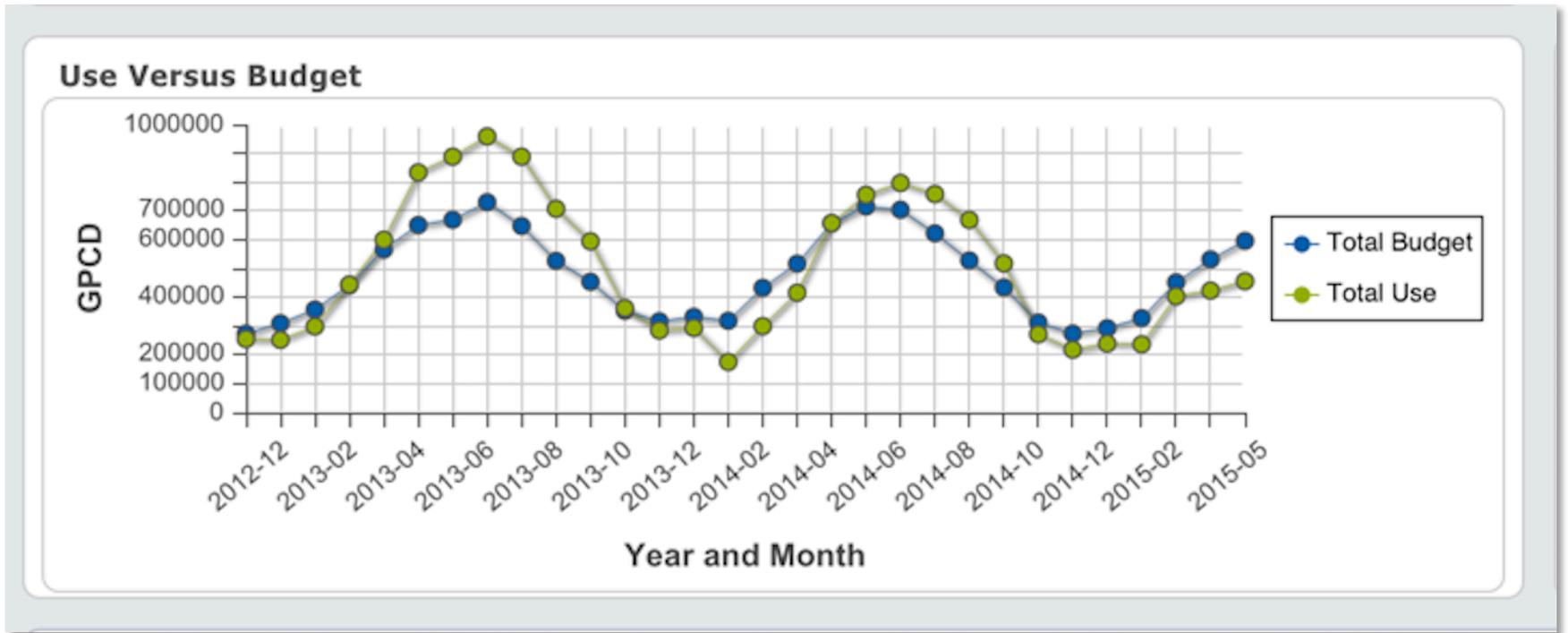


**Likely household or irrigation leak**



**15% savings if conservation efforts can bring these households within budget without lifestyle changes**

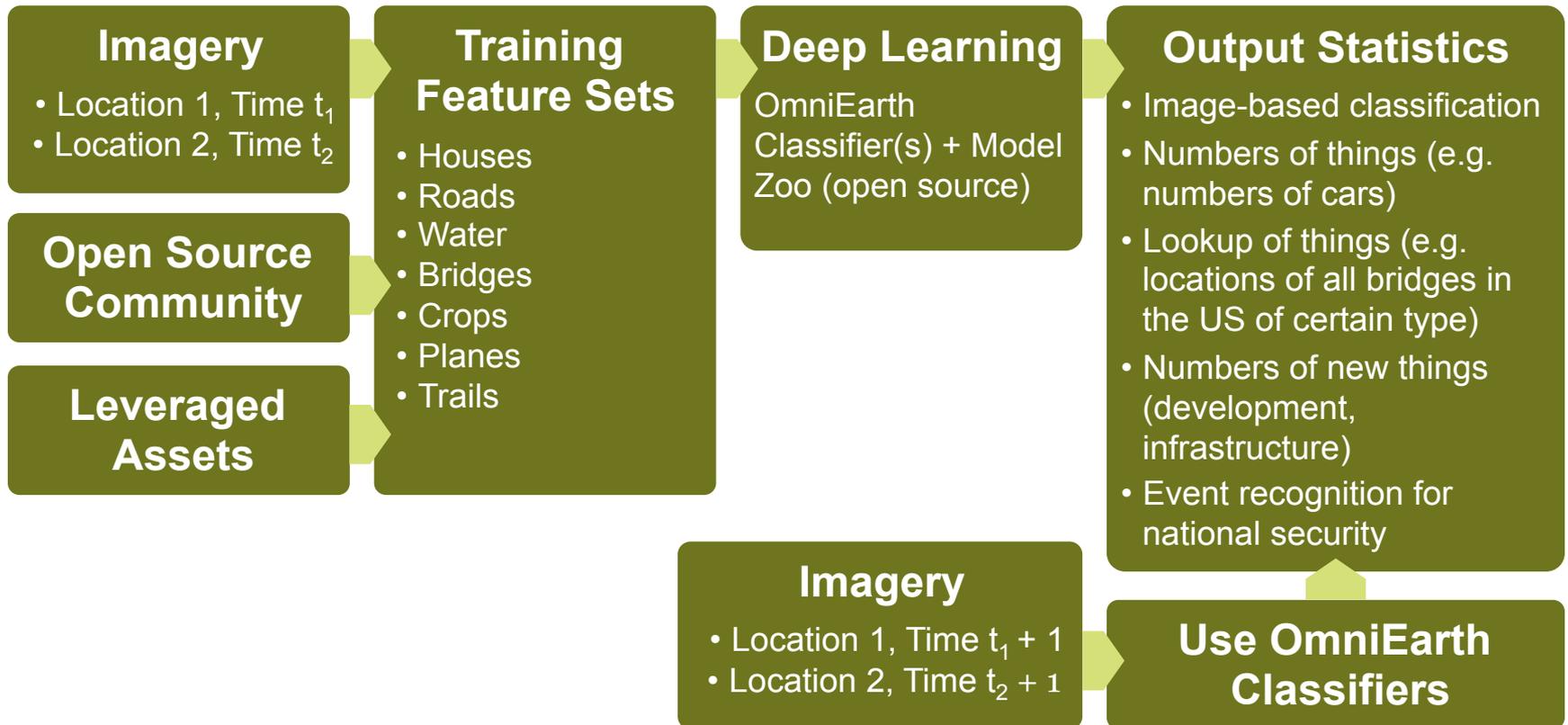
# The When of Water Efficiency



# Imagery + Machine Learning



Actionable Intelligence for Customers Who Are Not Data Scientists, Analysts or Engineers



# Application of Artificial Intelligence



Roof type identification to lower risk of fire and hurricane damage for Insurance applications



# OmniParcels-Nationwide property database

*Automatically detects property features, and monitors condition and change. Feature sets are searchable and filterable, and can be accessed via OmniEarth's online platform or through APIs.*

## Measurement Attributes

- Turf, trees, shrubs, impervious surface
- Irrigated area
- Pools and standing water
- Building footprints
- Roof Area

## Feature Identification (type, yes/no)

- Solar panels, trampolines, decks,
- Roof and driveway material types
- Roof Style
- Custom and on-demand

## Hyperindices (custom attribute/data combinations)

- Water budget, CO2 budget
- Overhanging vegetation
- Disrepair
- Risk scenarios





# Application of Artificial Intelligence

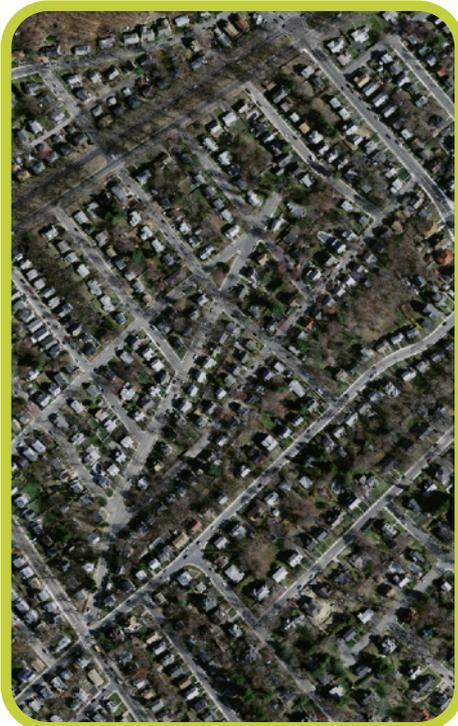


*Dis-repair index, predicting un-occupancy and foreclosure*



*Note disappearance of lawn furniture and cars in the driveway, then the appearance of lifted shingles (far right).*

# Using AI for Building Detection



Multispectral Image

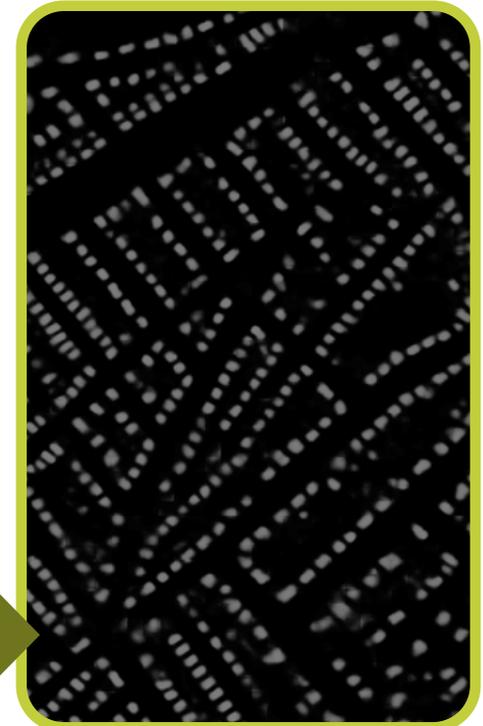
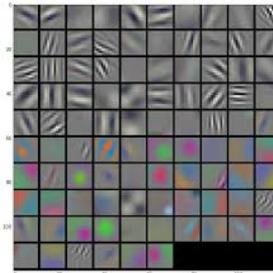
**1** Label data with desired features: 'What are buildings?'



**2** Many different types of buildings: varies w/ region, country, population density. Common feature set established.



**3** Neural Network Feature Set

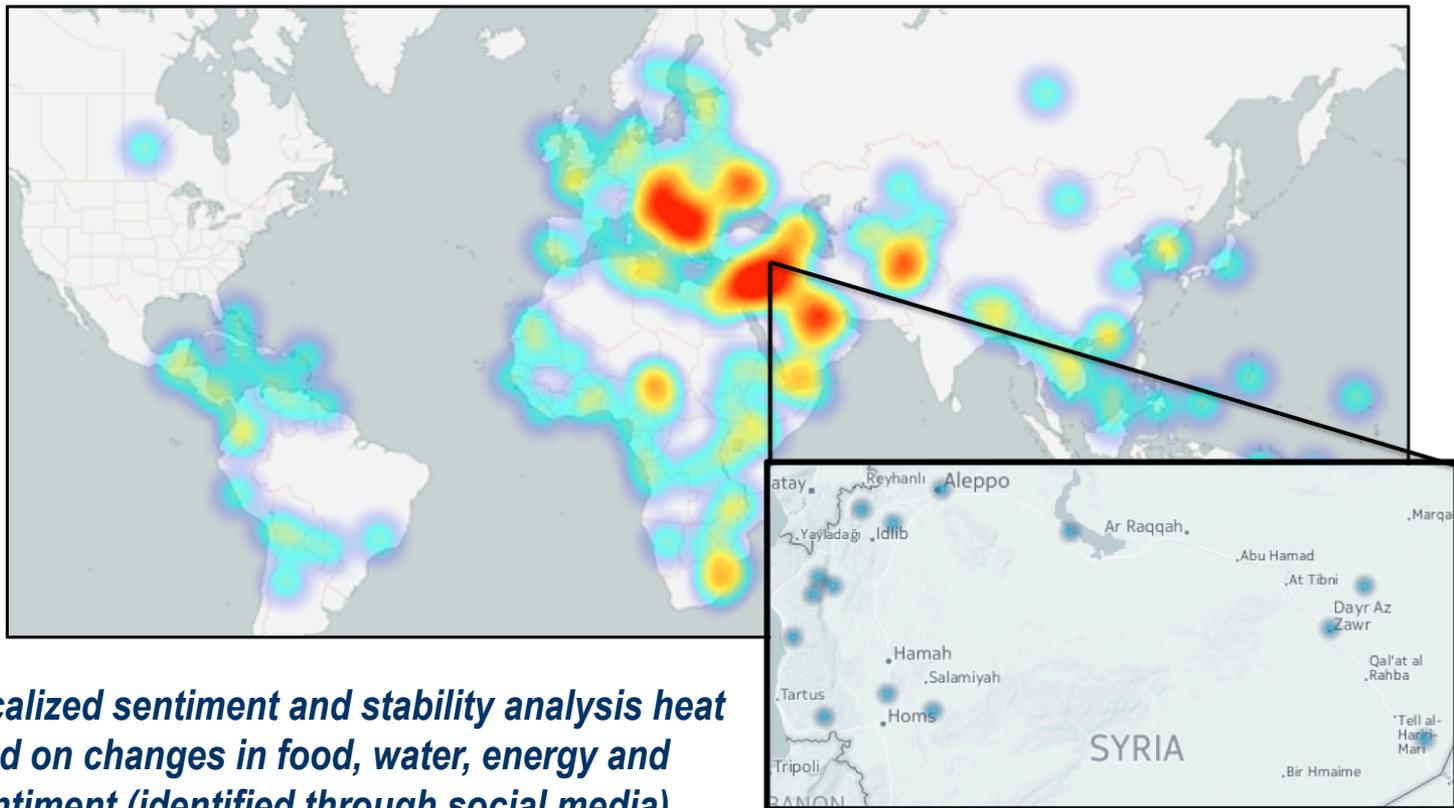


Neural Network Building Footprints

# Defense/Intelligence



Proven Change-Detection Analytics + Fusion of Social Media and Other Geospatial Information



*Highly localized sentiment and stability analysis heat map based on changes in food, water, energy and public sentiment (identified through social media)*

# Contact

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