



**“Farm to Fork
Global Food Security Supply
Chain”**

James Madison University

April 17, 2017

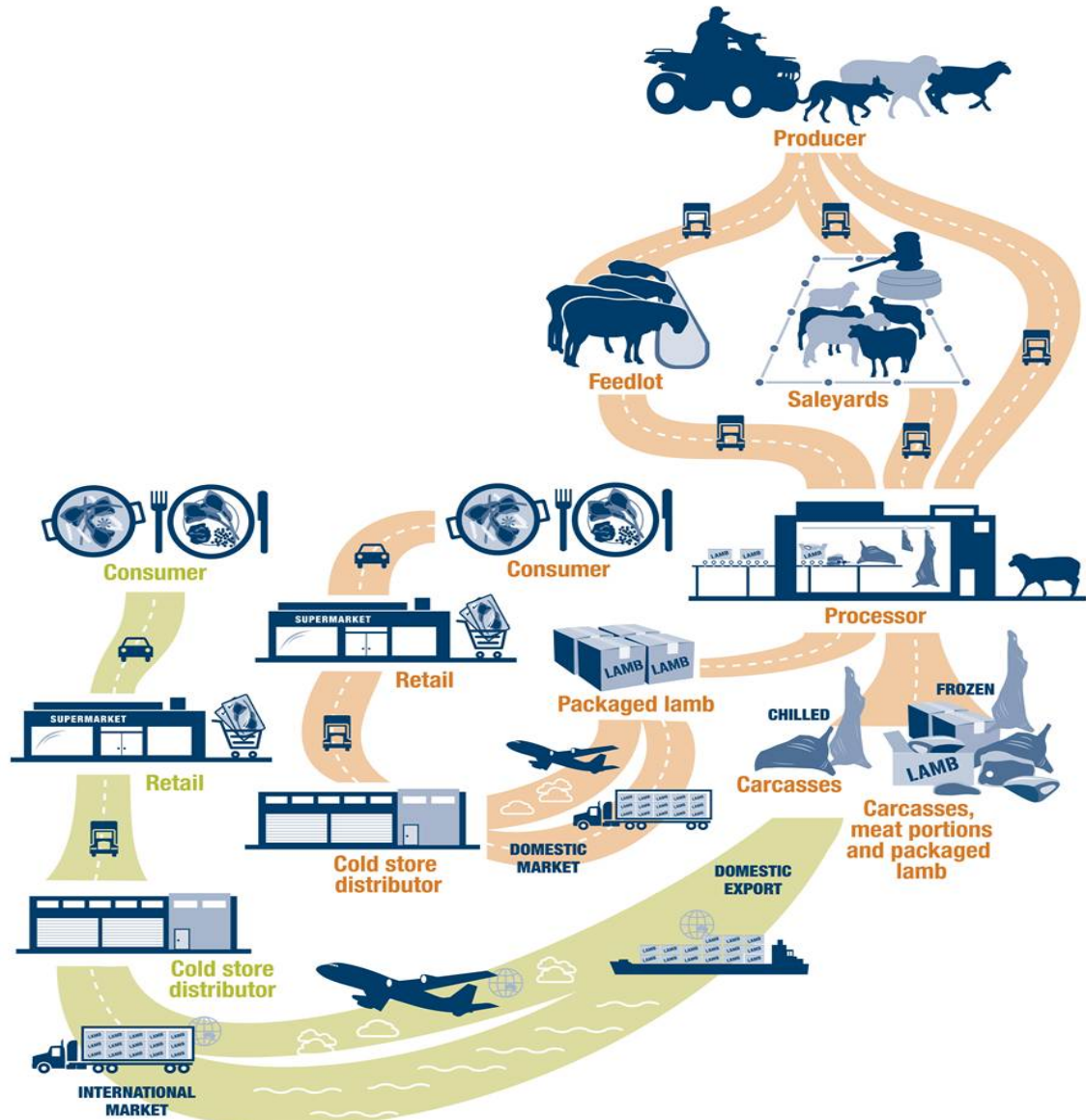
TODAY.....

1. Agriculture Supply Chain
2. Brief History Remote Sensing
3. Supply Chain Remote Sensing Solutions
4. Results

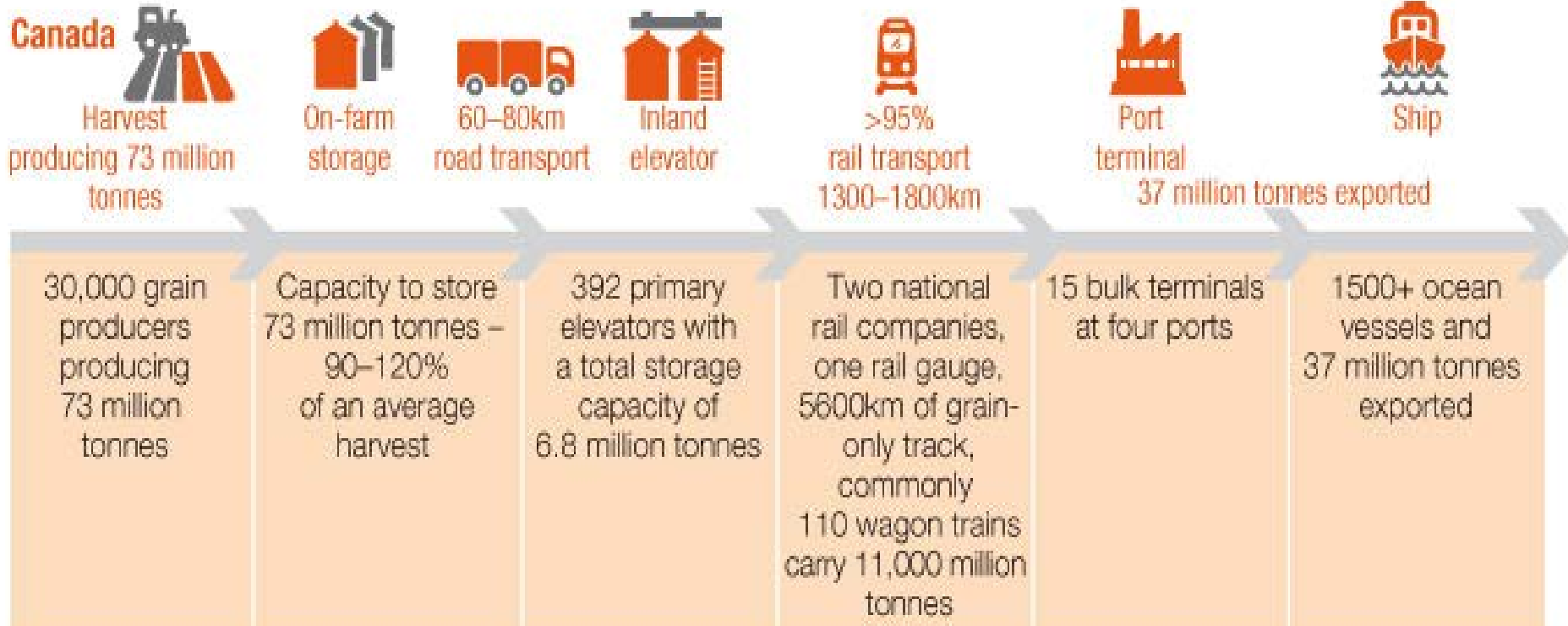
Agriculture Supply Chain

Major players in Agriculture Supply Chain

- 1 • Farmers
- 2 • Traders
- 3 • Commission agents
- 4 • Wholesalers
- 5 • Retailers
- 6 • Consumers



Agriculture Supply Chain Security and Logistics



Agriculture Supply Chain Definition for this Session

- Global Food Security
 1. Assuring global commodities economic stability
 2. Monitoring global commodities logistics
 3. Monitoring global food supply

Remote Sensing History

Use of Hot Air Balloons With Film Cameras Operated By Photographer:

- *Began in America During The Civil War*



Balloon Intrepid Used For Aerial Photography By Union Army (1863)



San Francisco 1906 After The Great Earthquake

Remote Sensing History

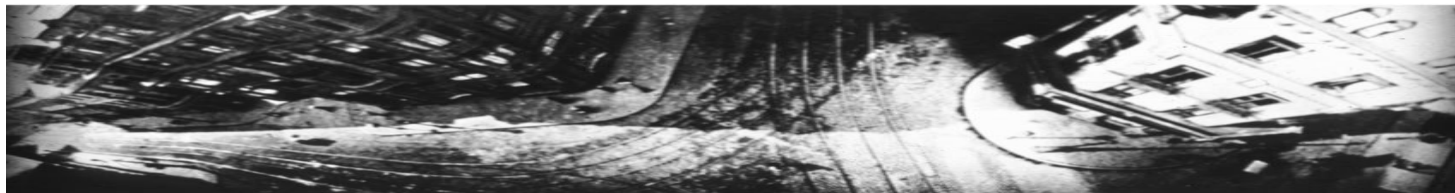
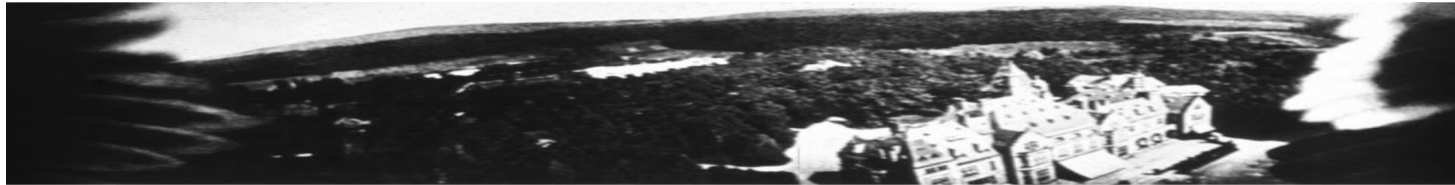
Use of Pigeons With Cameras Attached

- *DRONES of the DAY*
- *Began in Germany circa 1900*
 - *Pigeons Easily Available*
 - *Could Be Trained To Return*
 - *Very Minimal Cost*
 - *No Risk To Humans*



Carrier Pigeon With Camera Attached

Bavarian Pigeon Corps 1903



Pigeon Camera Imagery Obscured
By Wings (Upper Image)

Remote Sensing History

Use of Aircraft With Film Cameras Operated By Photographer:

- *Began in Europe; Grew Greatly in WWI*



Aerial Photograph Showing Trenches
In France (1917)



WWII Era P-38 Lightning High
Altitude Photo Reconnaissance Plane

Remote Sensing History

Extra Atmosphere Military/Intelligence

Corona (1960's – Early 1970's)

- *First Effective US "Spy Satellite"*
- *Film Based Camera*
- *Program Ran For Over a Decade*
- *No Threats of Human Interference*
- *No Danger To Humans (Pilot)*
- *High Resolution (~1 meter)*
- *Treaty Compliance*
- *Military/Economic Intelligence*



Corona Image of The Pentagon in The
Late 1960's



Mid-Air Capture of Corona Film Canister

Remote Sensing History

Military Use of Aircraft With Film Cameras:

- *Grew Greatly During Cold War*
 - *Could Provide Treaty Compliance Data*
 - *Nuclear Deterrence*
 - *Military Intelligence*
 - *Battle Damage Assessment*
 - *Automatic Cameras Large Image Swath*
 - *Ultra High Flights/Great Speed*

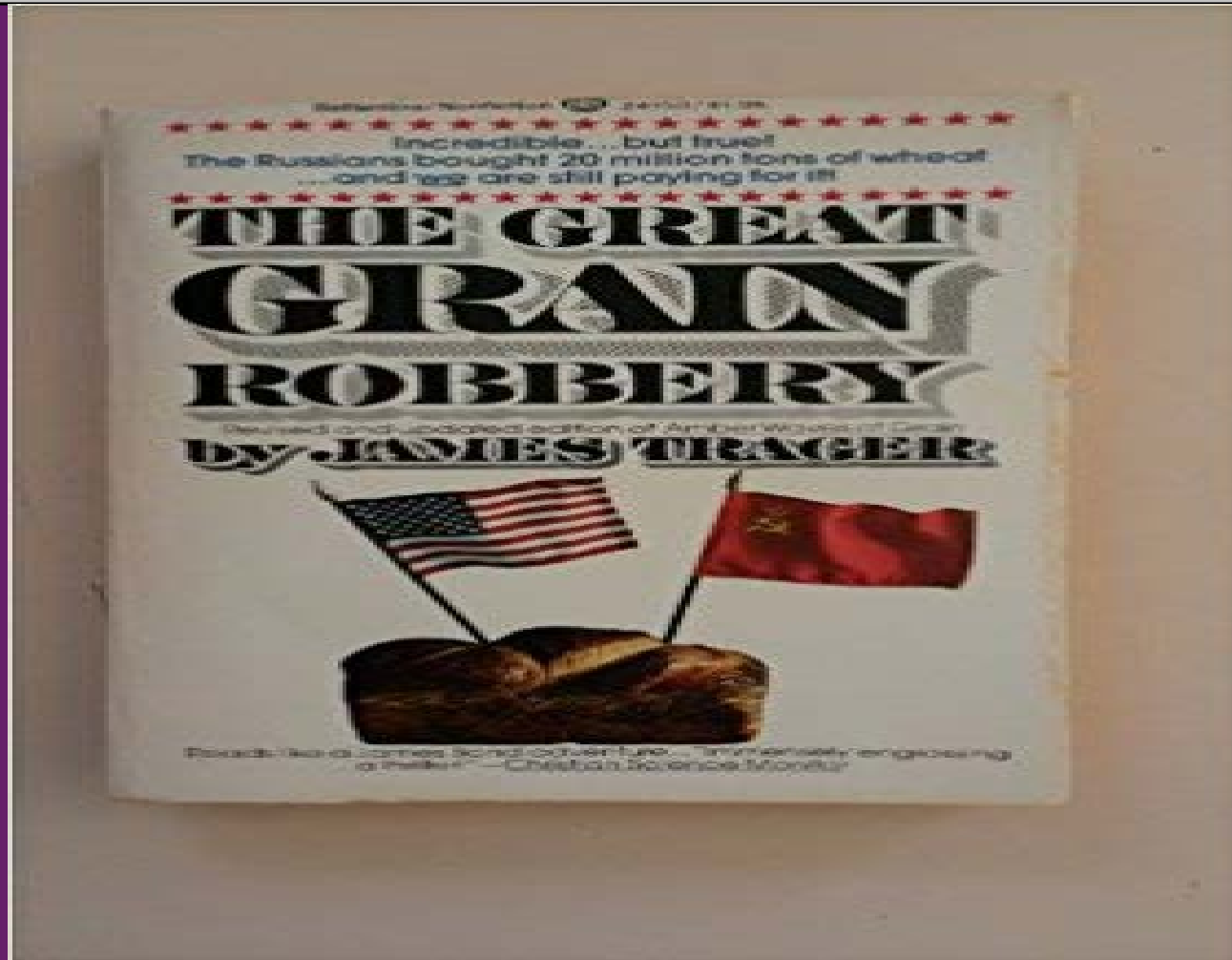


SR-71 Blackbird Capable of Speeds
> 2,000 mph at > 70,000'



U-2 Aircraft Similar to Plane flown by
F. Gary Powers Flown Shot Down in 1960

Global Food Security Mgt. The Reason



Global Food Security Mgt. The Reason



Global Food Security Mgt. The Reason



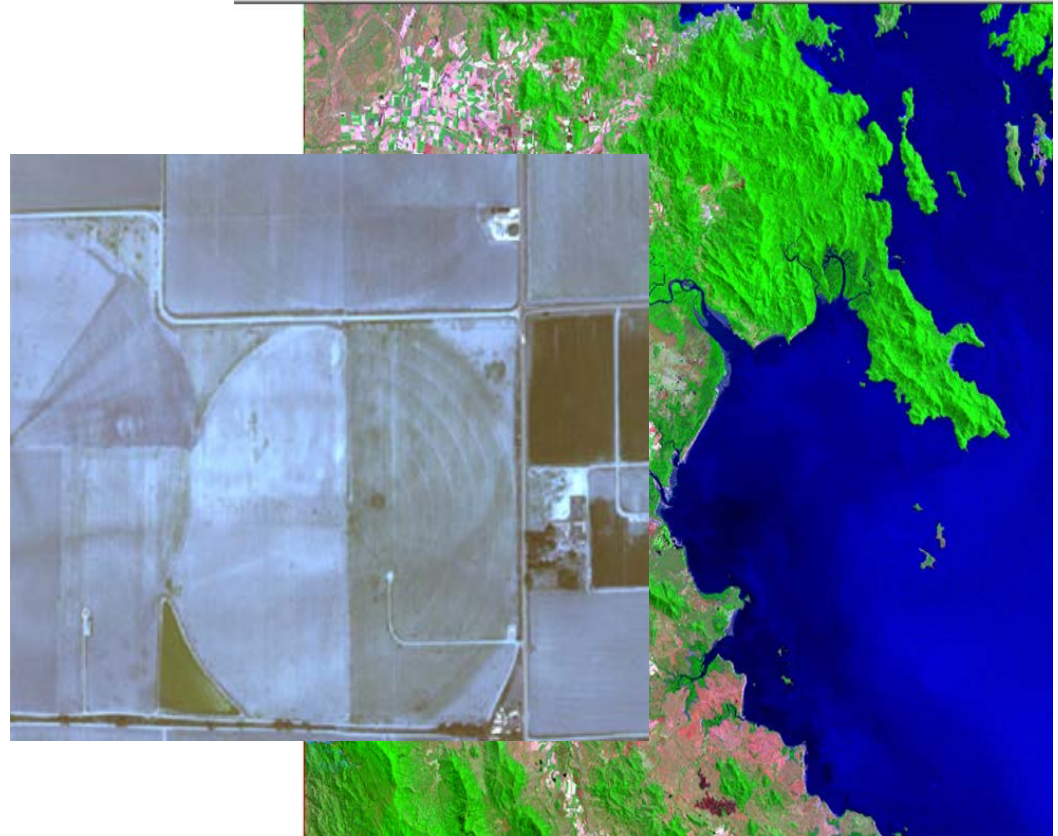
Global Food Security Mgt. The Result – Pre Harvest

- **US Landsat (1972 - Present) Longest Operating Commercial Satellite in History**

- First “Commercial Satellite”
- Digital Sensors
- 7-band Multi Spectral Sensors
- Thermal Sensors
- Medium Resolution (30)meter
- Landuse/Landcover
- Agriculture Monitoring
- Natural Resources Planning

- **Limitations**

- Resolution (15-30 meter)
- Ground Stations Required



Global Food Security Mgt. The Result - WAOB

1973

The World Agricultural Outlook Board is created and the first Agricultural Supply and Demand Estimates report is issued on September 17.



Global Food Security Mgt. The Result – FARM



Global Food Security Mgt. The Result – Food Dist. Mgt.

Taking Stock

Foodgrain
procured by
Punjab govt worth
₹20,000 cr
is missing

The state accounts
for 40%, or

₹40,000 cr
of total food
credit from banks

**Banks will stop
lending to Punjab
govt for procure-
ment of foodgrain
if the state and
Centre do not
resolve issue**

**Over 30 lenders
will meet on
Monday to discuss
the issue**

The decision could disrupt
an agricultural economy
already on its knees after
two consecutive droughts

RBI had asked the lenders
to set aside money against
loans of ₹12,000 crore or
more, treating these as
non-performing assets

With provisioning at 15%, the
banks may have to set aside
₹1,800-3,000 CRORE
at a time when an RBI-directed
cleanup of books has been taking
a toll on earnings

Global Food Security Mgt. Road Transport to Silo/Grain Elevators



Global Food Security Mgt. Rail Transport



Global Food Security Mgt. Rail Transport

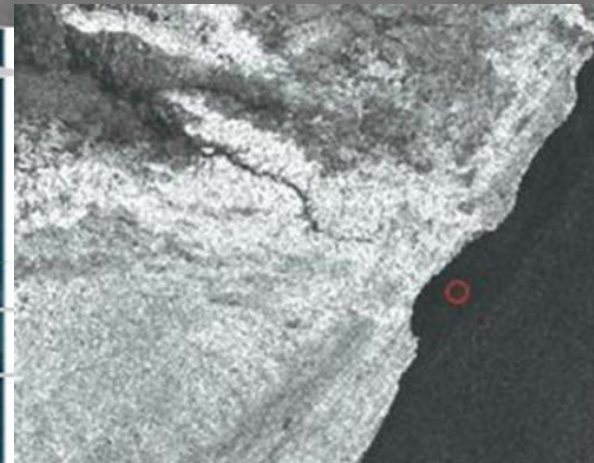


Global Food Security Mgt. Port Terminals & Shipping



Global Food Security Mgt. Port Terminals & Shipping

Cross Cueing Timeline



Vessel detected by
satellite SAR only



Vessel detected by both
satellite SAR and AIS



Global Food Security Mgt. Port Terminals & Shipping

Rhine River Cargo Shipping

Grains
Minerals
Coal, Oil

Barges

Motorized Cargo

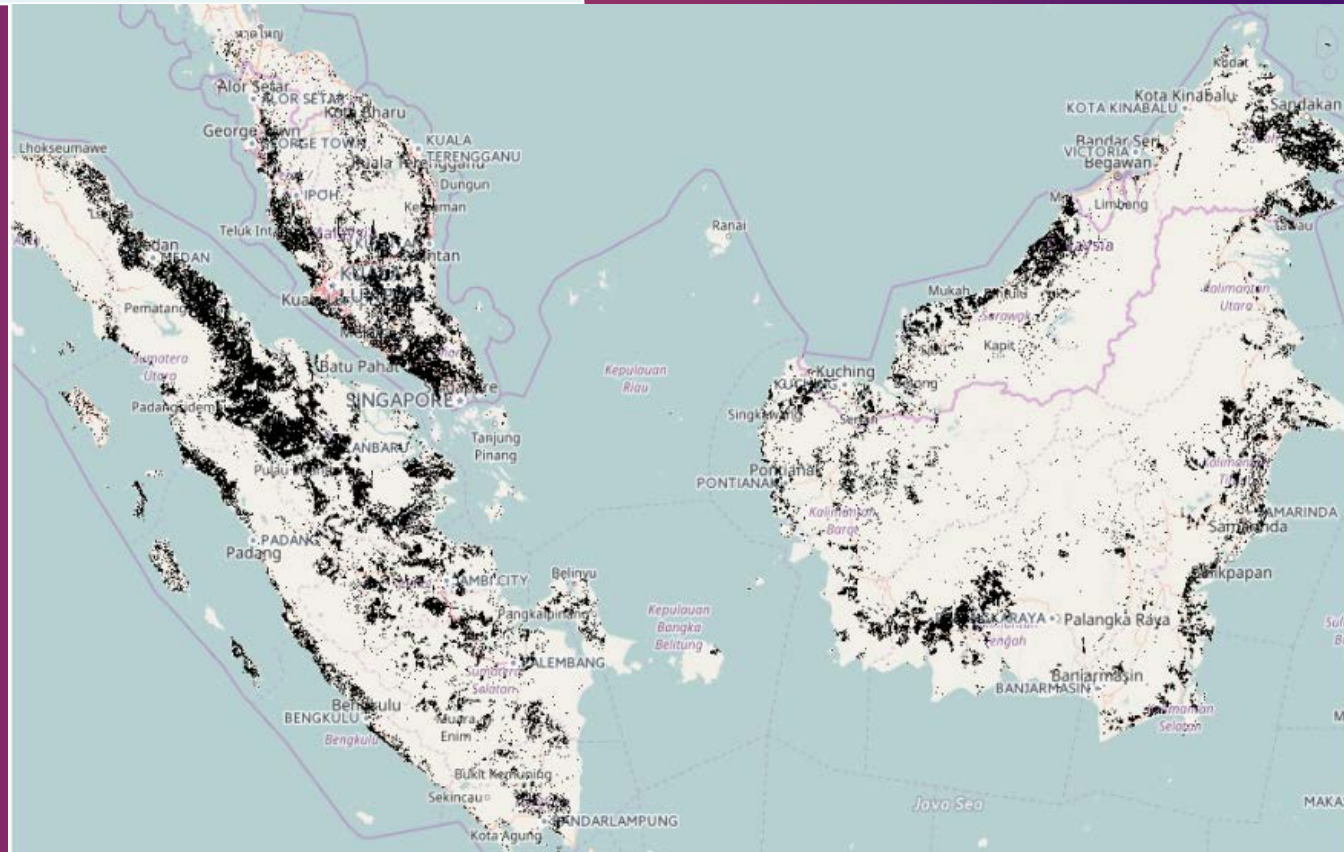
Tankers

1200 ships

4400 ships

1300 ships

300+ Million Tonnes Annually



4 systems for Global Agricultural Monitoring with Earth Observation Data

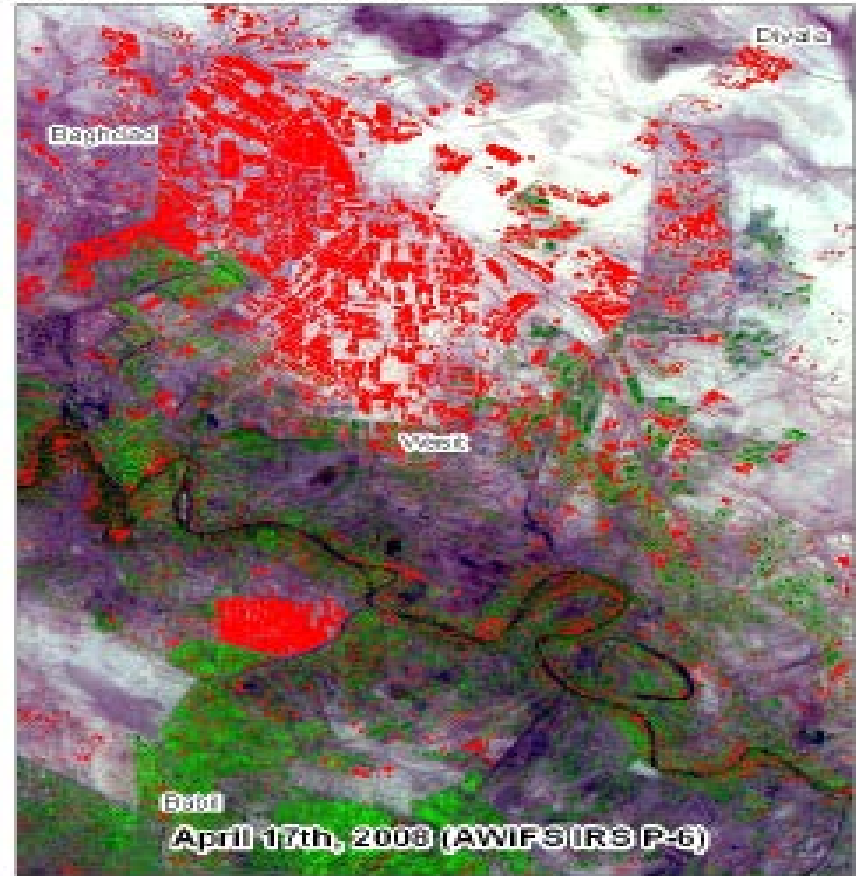
1. The USDA Foreign Agricultural Service's Crop Explorer.
2. The European Commission's Monitoring of Agriculture with Remote Sensing.
3. CropWatch, developed by the Chinese Academy of Sciences' Institute for Remote Sensing Applications.
4. The U.N. Food and Agriculture Organization's Global Information and Early Warning System.

Monitoring Global Food Supply Chains – Saves Lives!

Multi-temporal Change Detection: Comparison of Current and Archived Data



Spectral Bands 3, 4 and 5



Spectral Bands 2, 3 and 4

Data Source: Landsat ETM+/AWIFS IRS P-6
Data Provided by: Archive Explorer/NSA
Supporting: US DAFAB/USDA
International Production Assessment Division



Global Food Security Mgt. The Result – FORK

www.pecad.fas.usda.gov/cropexplorer/

www.descarteslabs.com



Thank You!

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