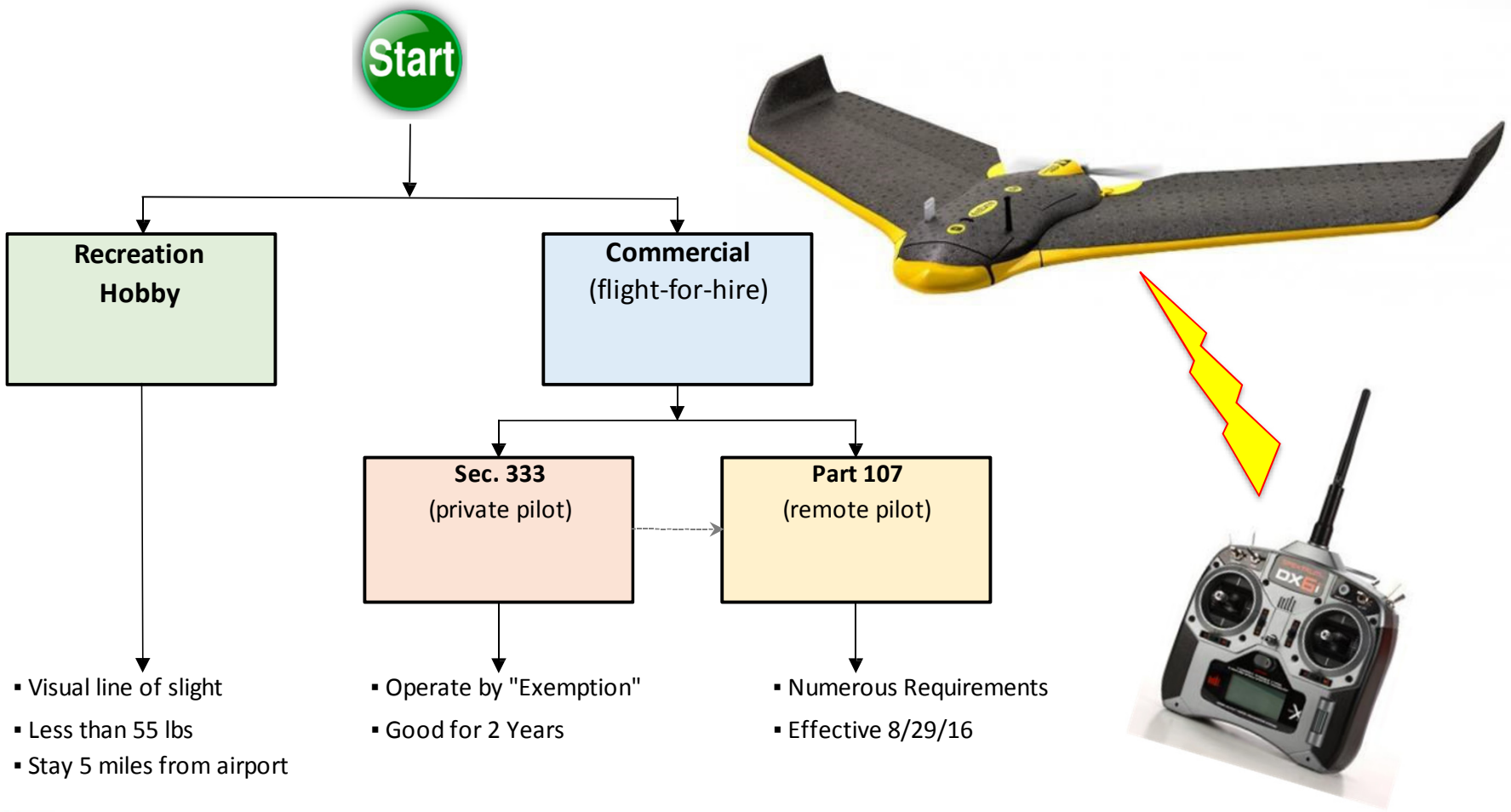


Drones for Environmental Assessment

Luncheon Presentation A&WMA New England Section

October 11, 2017

What is a Drone (aka Small Unmanned Aircraft System)



Remote Pilot in Command (rPIC) Requirements

- Must Hold Remote Pilot Airman Certification with Drone Rating
- To Get Certification
  - Demonstrate Aeronautical Knowledge
    - Pass Knowledge Test, or
    - Hold Current Pilot Certification and Complete Online Training
  - Complete Successful TSA Vetting
  - Be at Least 16 Years Old
- Other
  - No Alcohol Use or Alcohol/Drug Convictions
  - No Interfering Physical or Mental Conditions
  - Use English Language

Source: www.fanpop.com

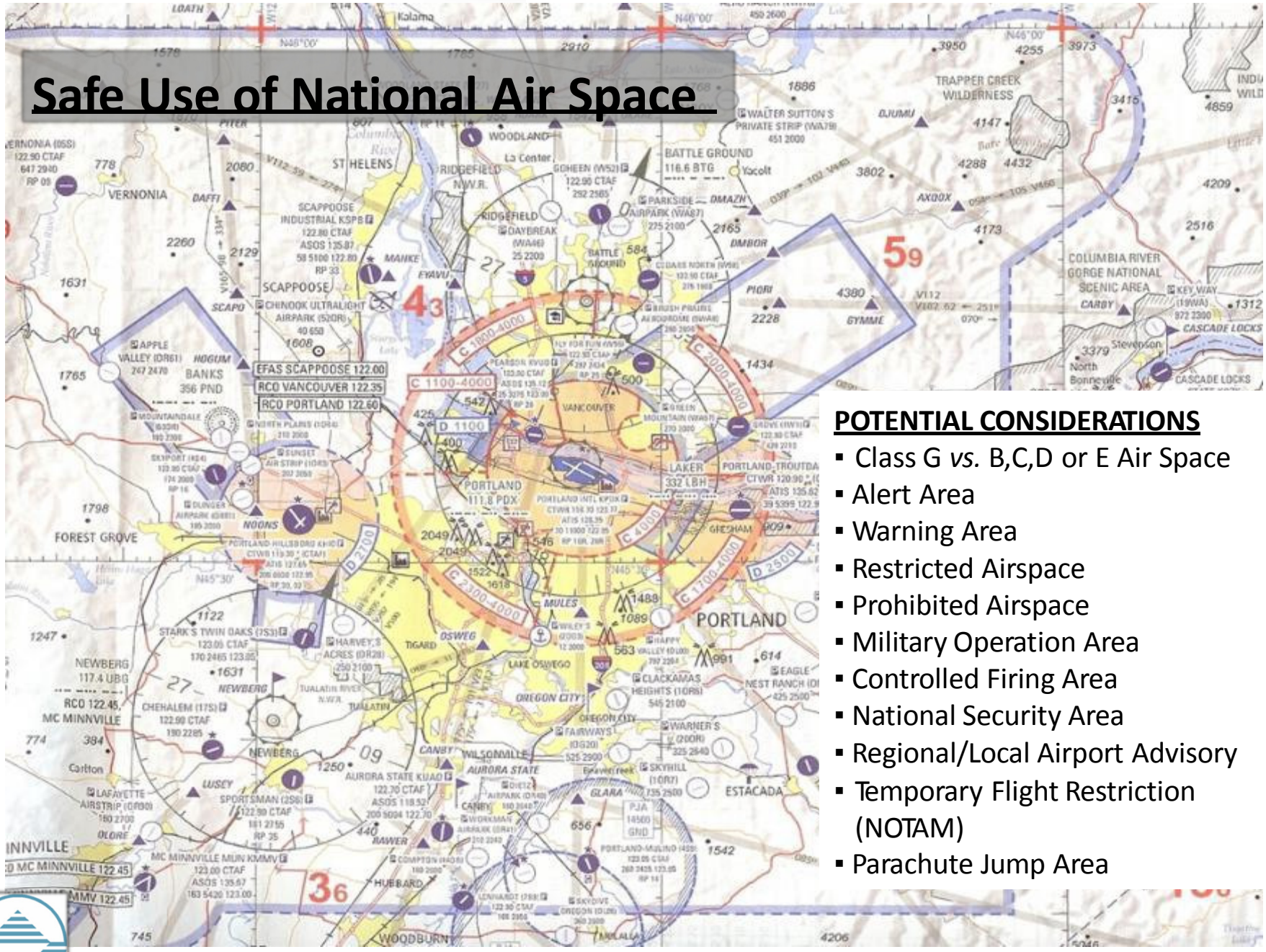
Remote Pilot in Command (rPIC) Responsibilities

- Operate within Part 107 Rule, etc.
- Comply with Drone Registration Requirements
- Conduct Preflight Inspection
- May "Daisy-Chain" Flights
  - Inflight Handoff to Another rPIC
- Upon Request Provide Drone, Documents, and Records for Testing or Inspection
- Report Injury, Loss of Consciousness or Property Damage
- May Deviate from Part 107 Rule in Emergency

Summary of Operating Limitations

Remote Pilot in Command; Optional Visual Observer and/or Control-Manipulator	Fly < 100 mph Ground Speed,
Drone Registration	Stay < 400 ft Above Ground Level, or w/i 400 ft of Structure
Pre-Flight Checklist and Maintenance	Minimum Visibility 3 miles
Suitable Medical Condition, No Impairment, and Carless or Reckless Operations	Stay Away from Clouds (< 500 ft vertically and 2,000 ft horizontally)
Maintain Visual Line of Sight (VLOS)	Prohibited Operation Over People
Class G National Air Space Limitation (no Class B, C, D, or E w/o ATC approval; TFR/NOTAMS, etc.)	Operations from Moving Vehicles in Sparsely-populated Area Only
Daylight Operations	Can Transport Property (no Haz Mats) w/ Limitations
Total Take-off Weight < 55 lbs	Can Deviate from FAA Rules in Emergency
Report Accidents w/i 10 Days	See also: FAA Summary of sUAS, 6/21/16

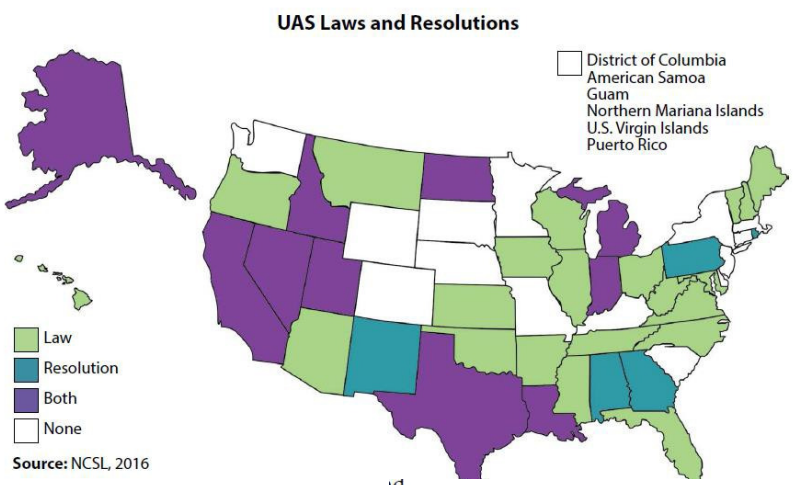
Safe Use of National Air Space

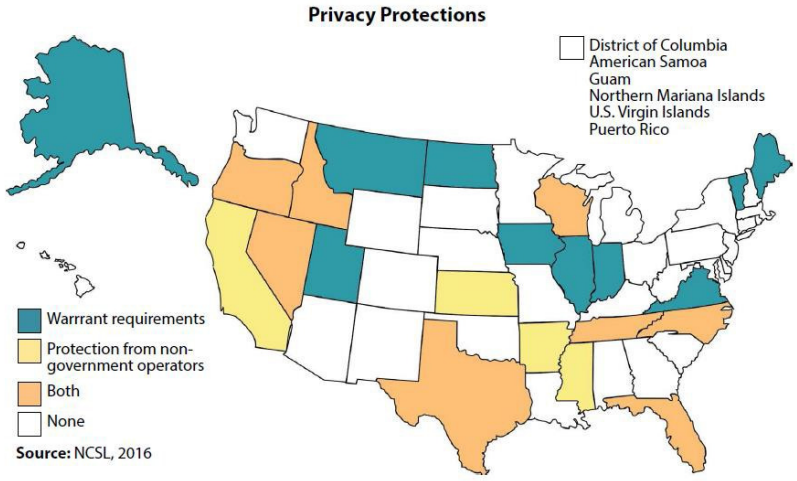


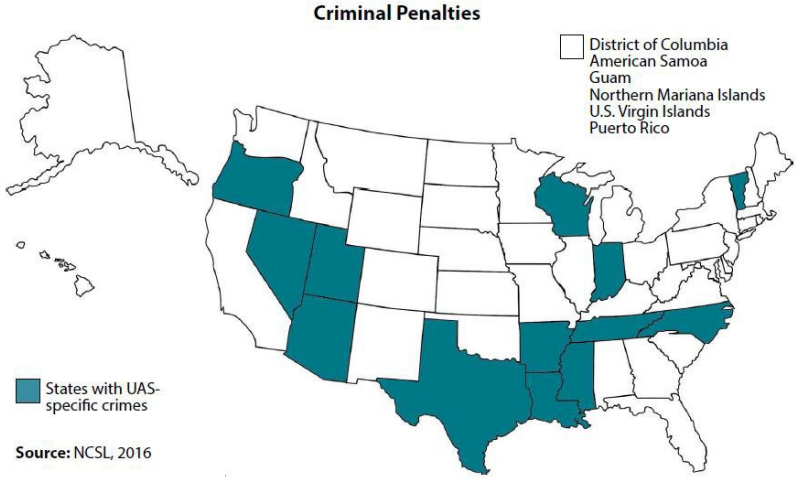
POTENTIAL CONSIDERATIONS

- Class G *vs.* B,C,D or E Air Space
- Alert Area
- Warning Area
- Restricted Airspace
- Prohibited Airspace
- Military Operation Area
- Controlled Firing Area
- National Security Area
- Regional/Local Airport Advisory
- Temporary Flight Restriction (NOTAM)
- Parachute Jump Area

Range of State-Specific Requirements

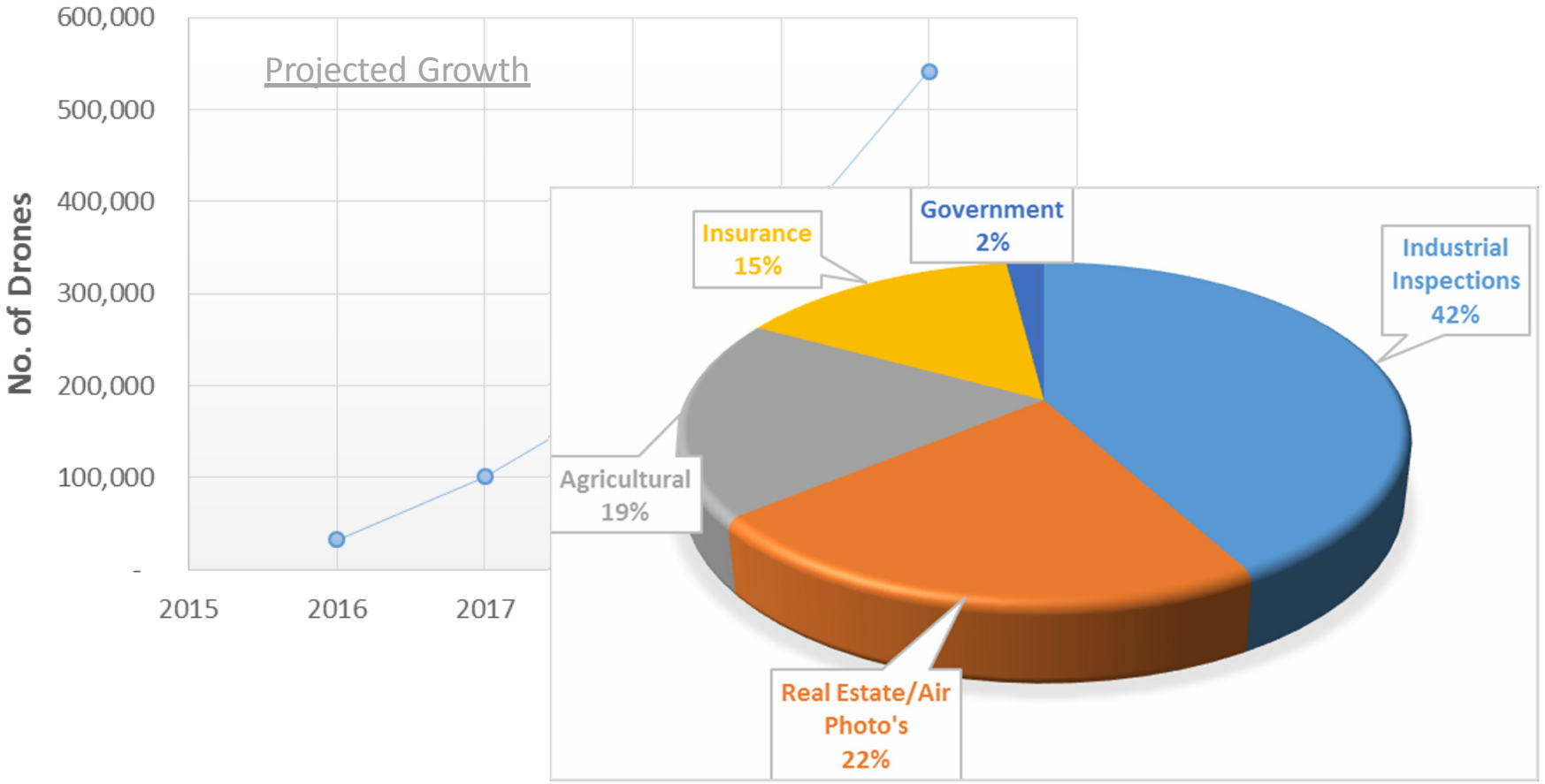






Source: http://www.ncsl.org

Projected Drone Market Growth and Use



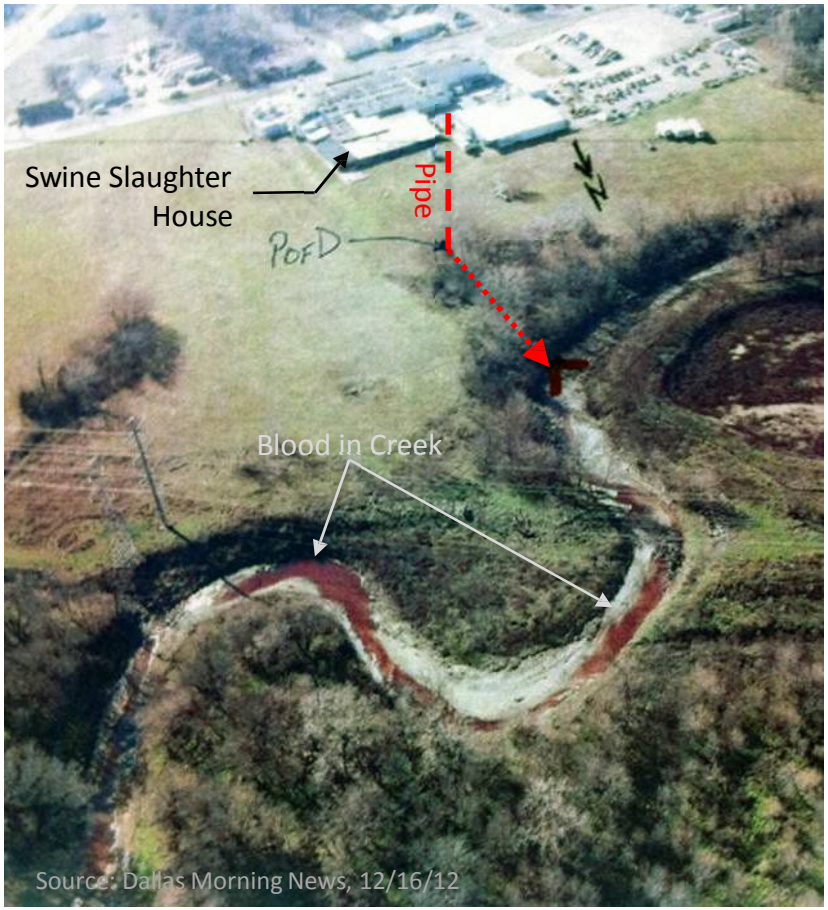
Top Five Markets

Source: FAA Aerospace Forecast, FY16-36

Data and Sample Gathering Capabilities

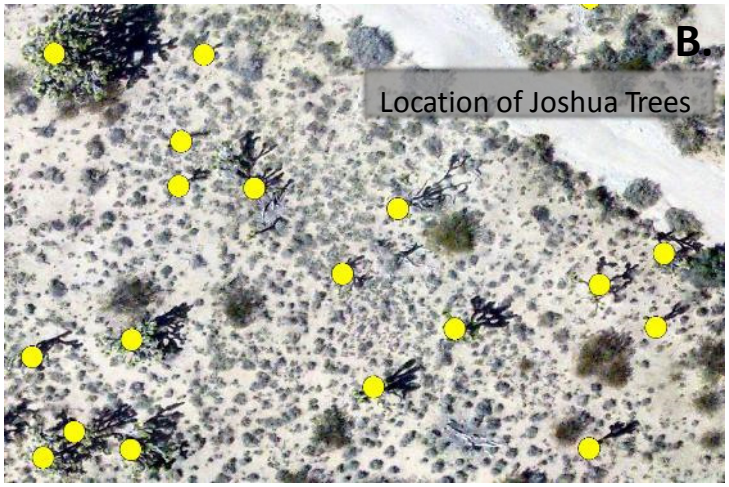
Sensor Type	Typical Uses
Optical Camera (visible light)	Photography, photogrammetry, mapping 3D-modeling
Thermal Imaging [infrared (IR)]	Building heat leaks, broken solar panels, animals, search and rescue
Multispectral (visible, IR and some ultra violet)	Precision agricultural, crop health monitoring
Laser (LiDAR, LADAR)	Surveying, high-resolution mapping
Other Sensors/Equipment	Emissions, radiation, gas, electromagnetic, vapor
Sampling Equipment	Air (summa canisters, Tedlar® bags), water, etc.

Drone Finds *"River of Blood"* In Texas



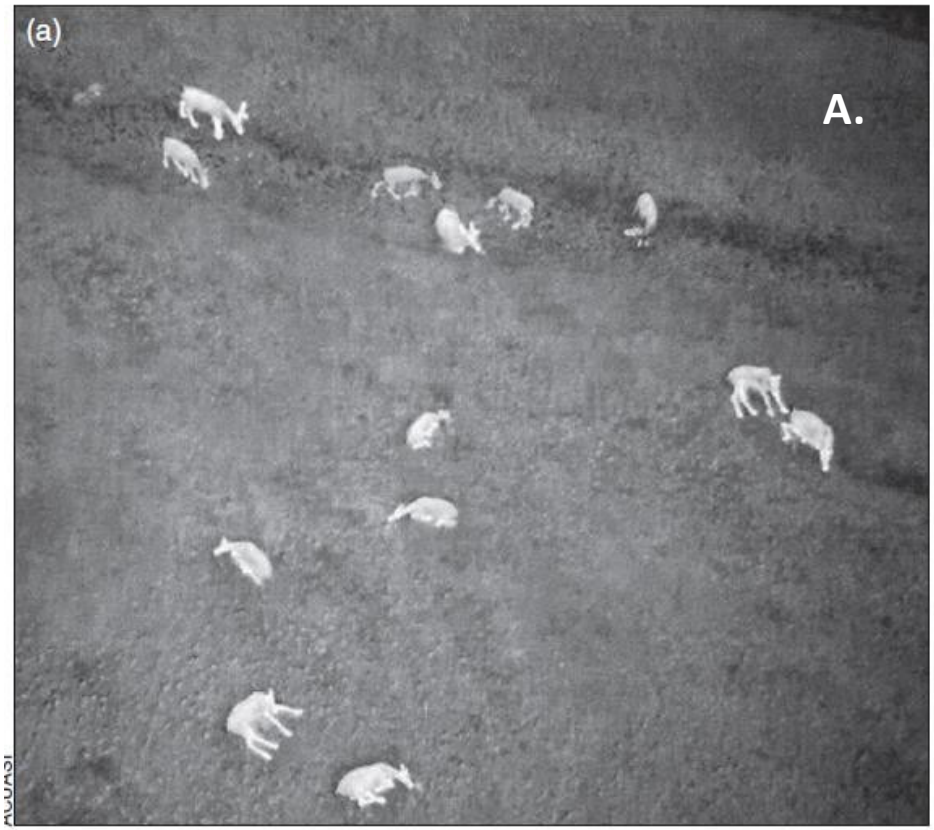
- Recreational Drone Pilot Testing Camera
  - Found Blood in Creek Downstream of Slaughter House
  - Called National Response Center
- Began Investigation of Slaughter House
  - County District Attorney, TX Parks & Wildlife, TCEQ and USEPA
  - Found Underground Pipe Flowing to Creek
  - Eighteen-count Indictment Against Company and Two VPs

Drone Finds Waste Sites in Mojave Preserve

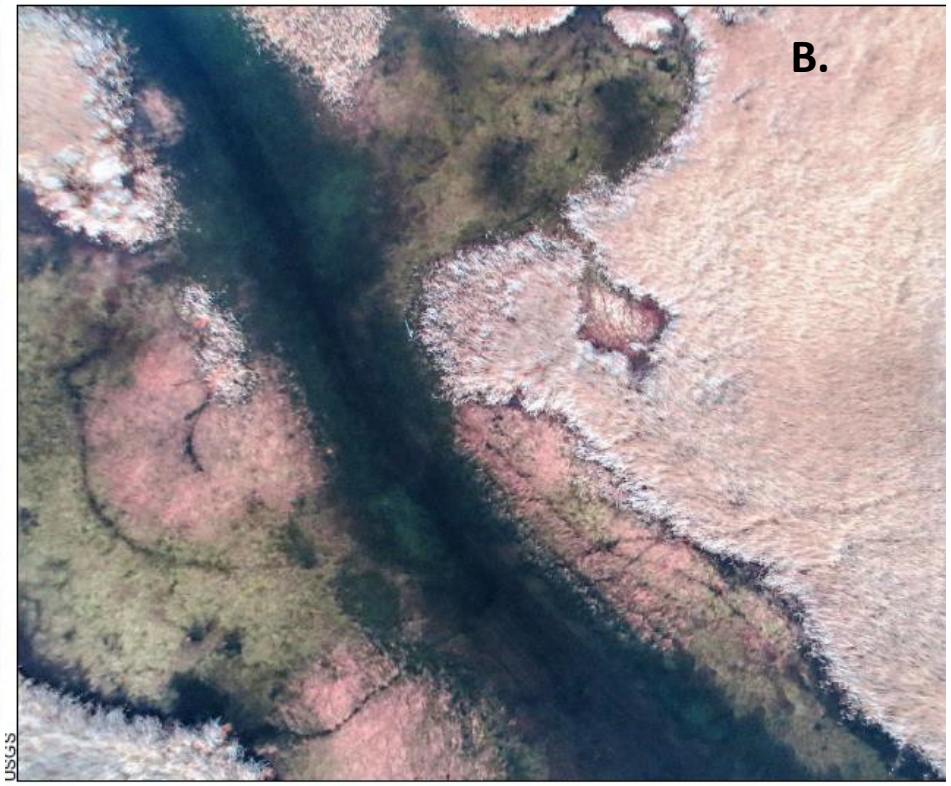


Source: U.S. Geological Survey, UAS Project Office

Drones for Wildlife Research



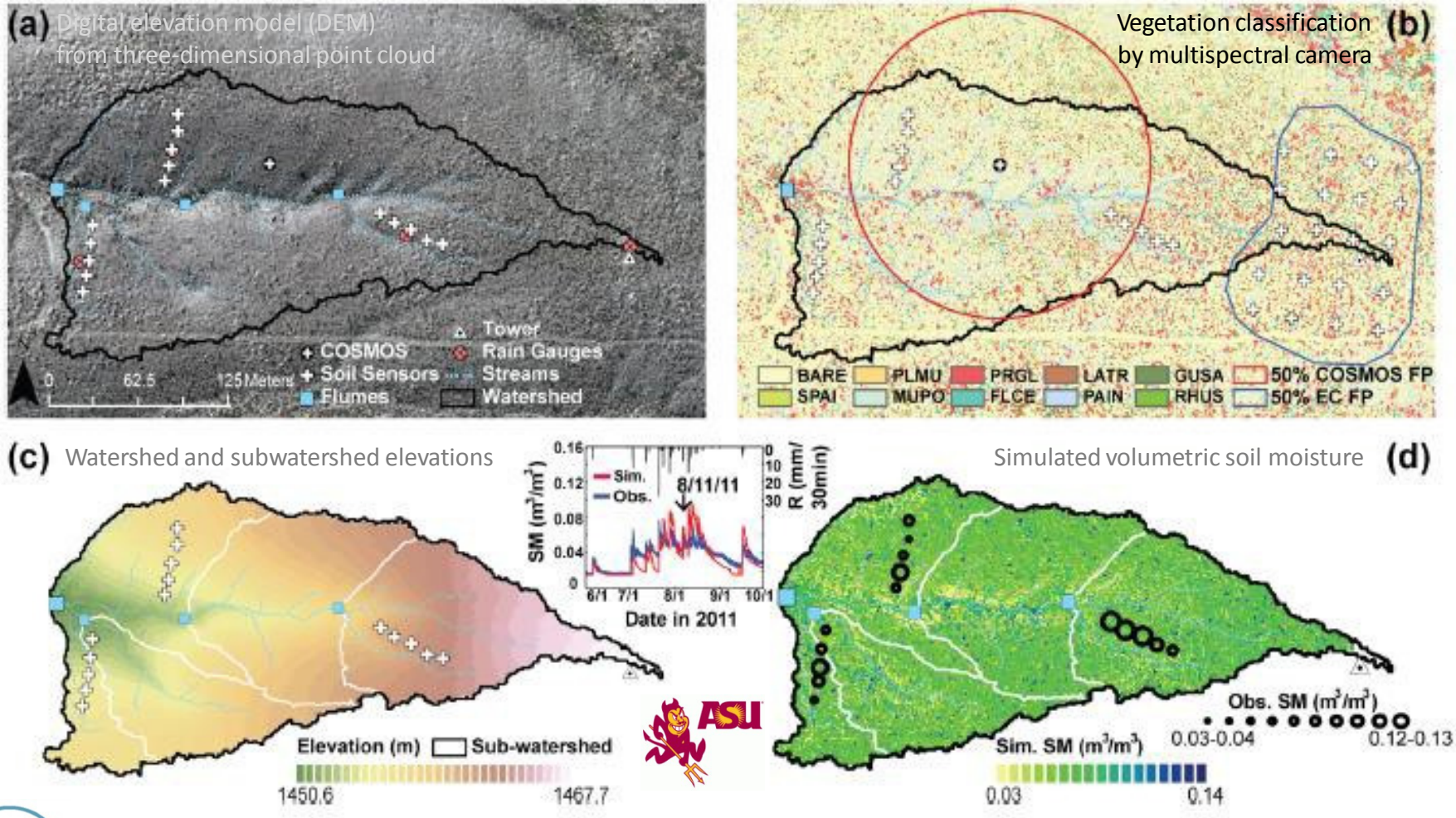
Infrared image of caribou



Normalized difference vegetation index (NDVI) of wetlands

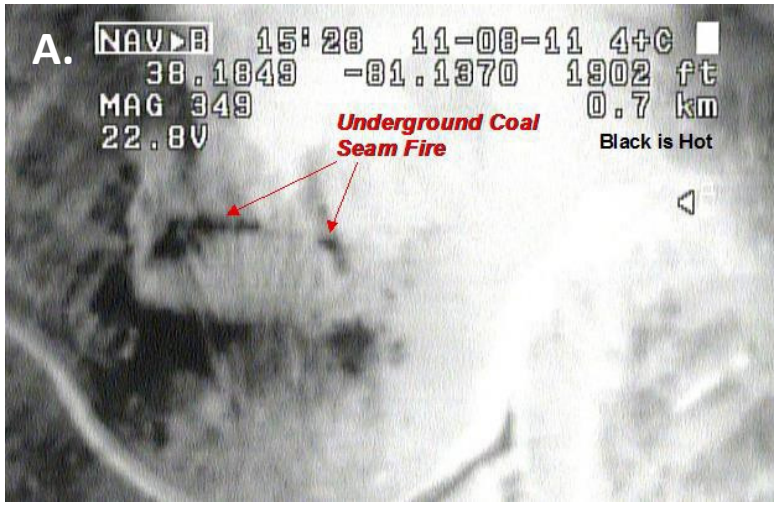
Source: Christie *et al.*, Front Ecol. Environ., 2016, 14(5): 241-251

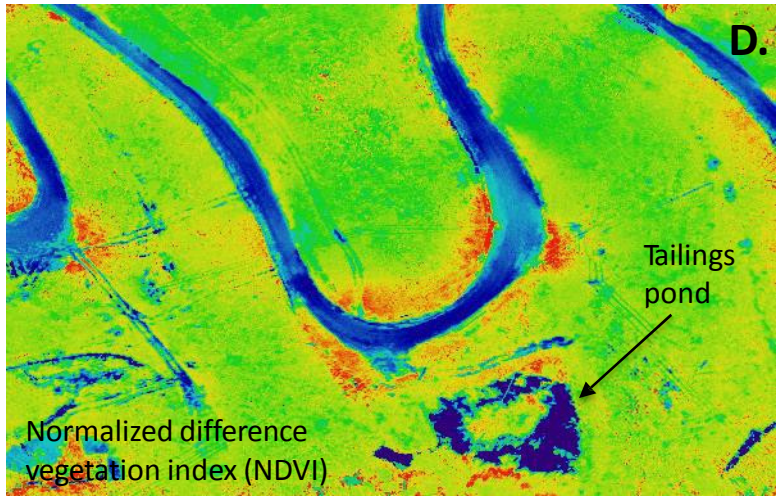
Ecohydrology of Arid Watersheds



Source: Vivoni, *et al.*, Ecosphere, Oct'14, Vol. 5(10), Article 130

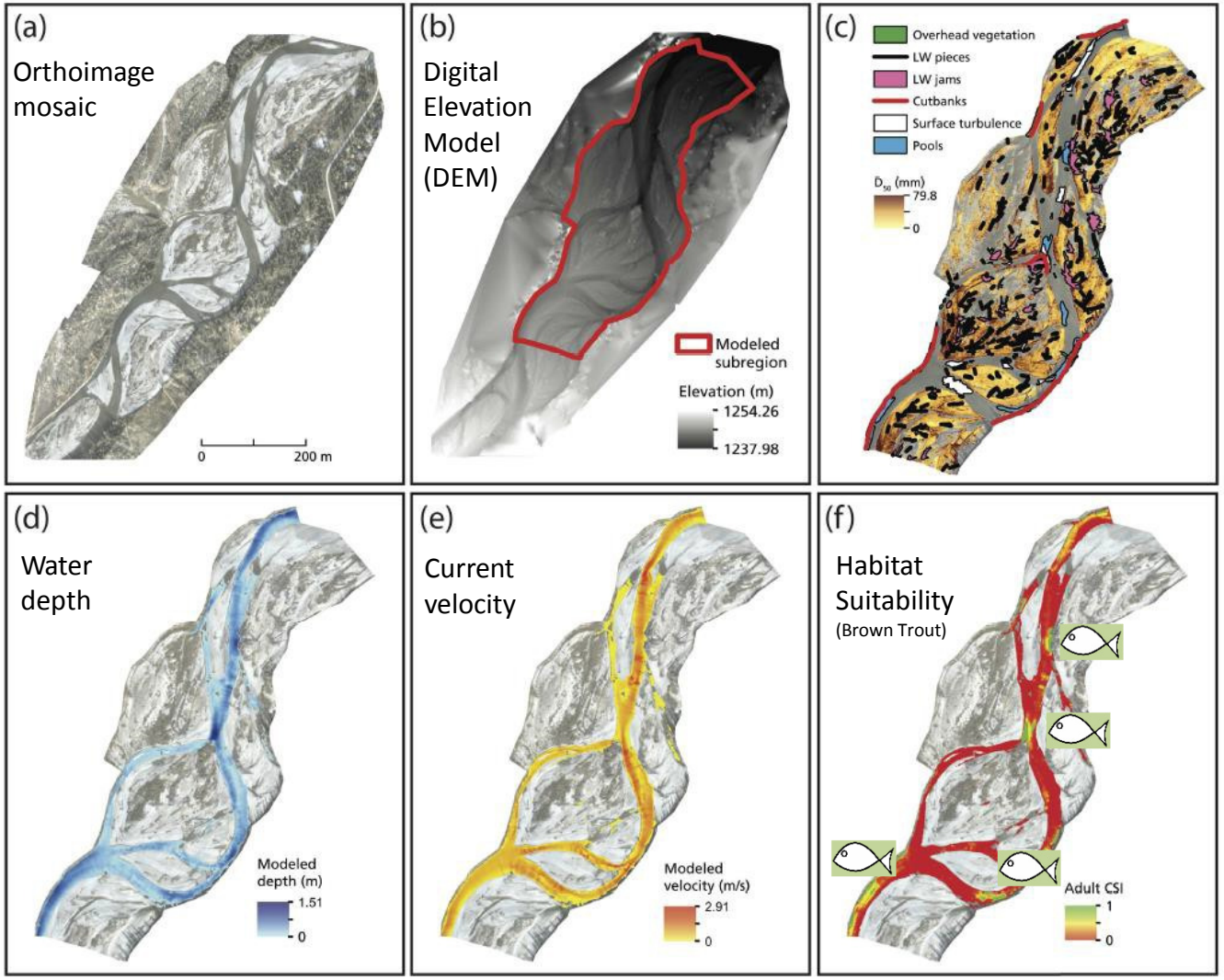
Drones Monitoring Mining Sites





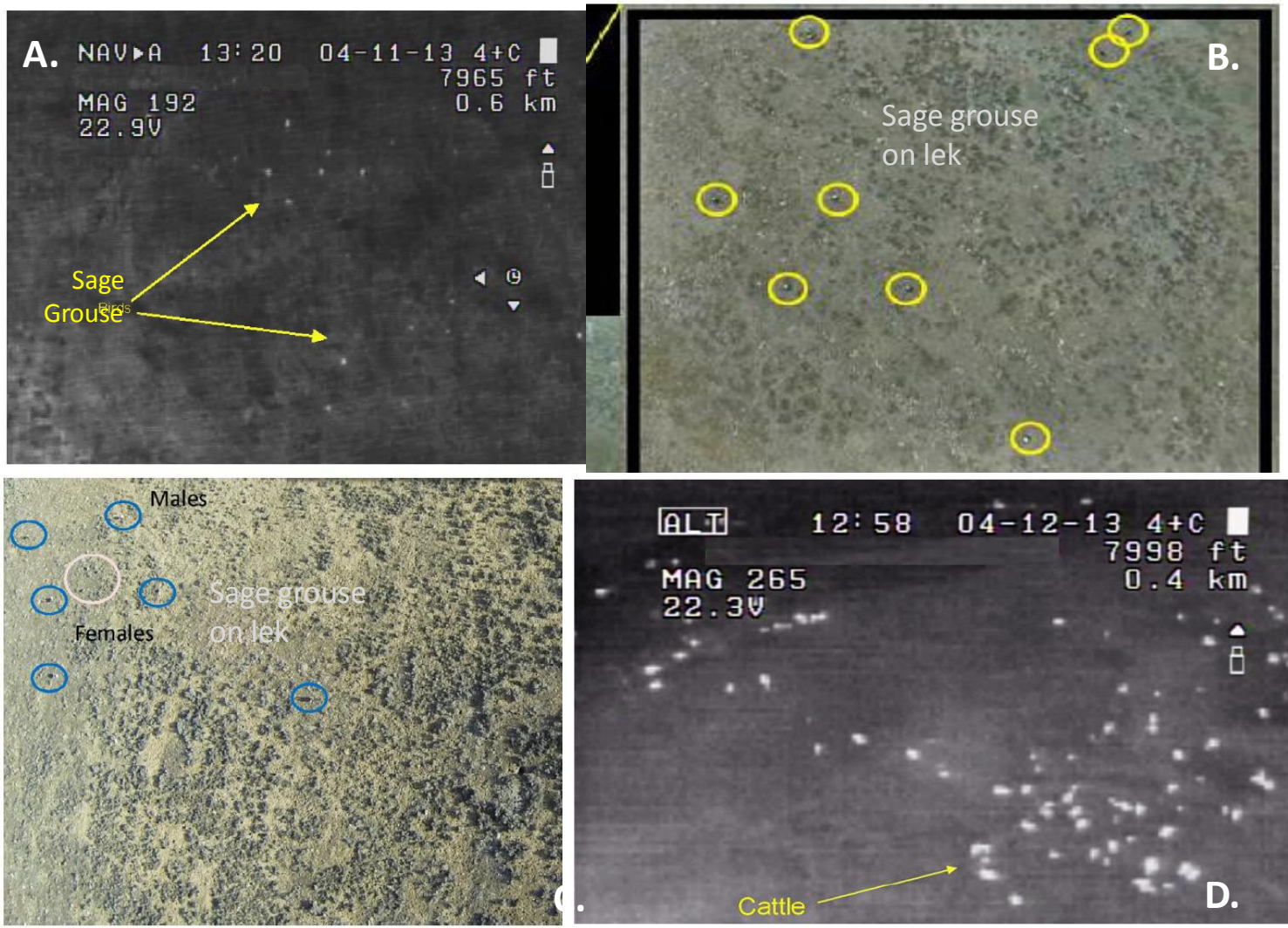
Source: U.S. Geological Survey, UAS Project Office

River Habitat Mapping by Drones



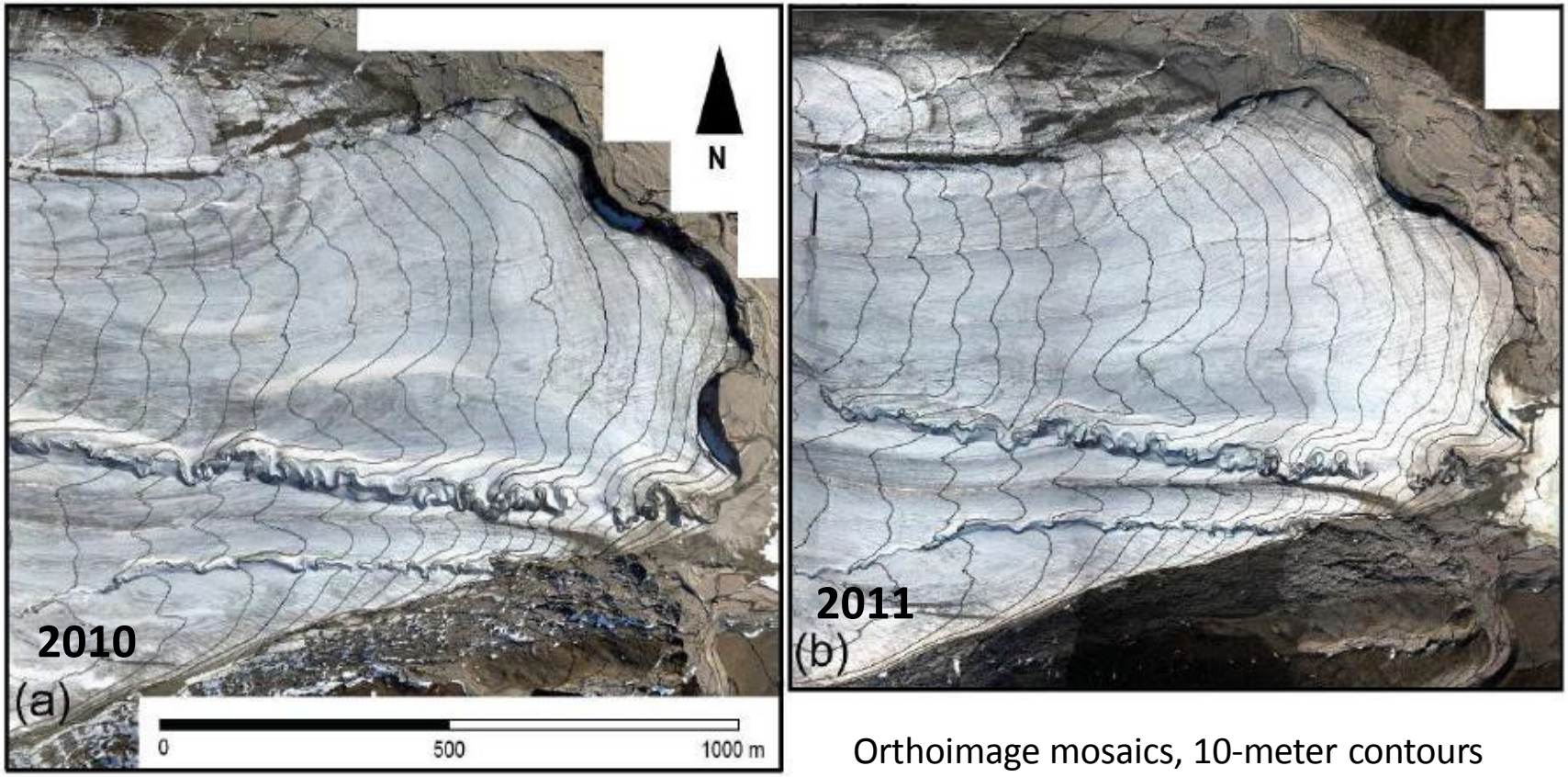
Source: Whitehead *et al.*

Drones Monitoring Sage Grouse Leks



Source: USGS Open-File Report 2104-1205

Drone to Monitor Glaciers



Orthoimage mosaics, 10-meter contours

Source: Whitehead *et al.*

Drones Collecting Water Samples

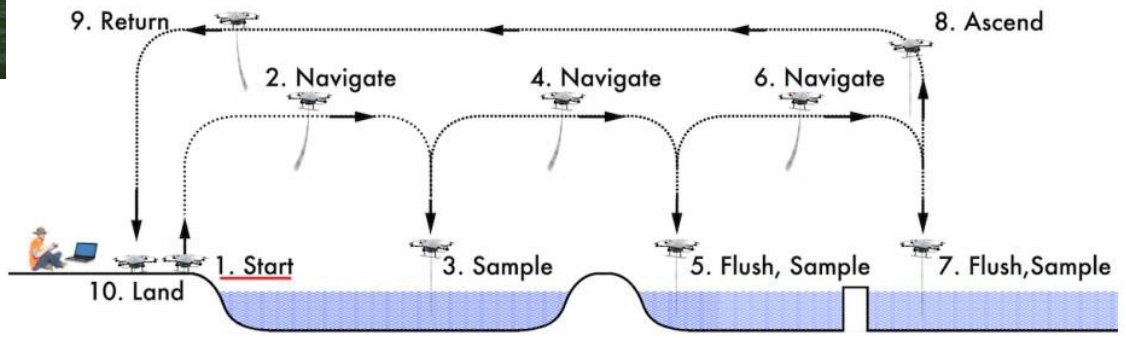
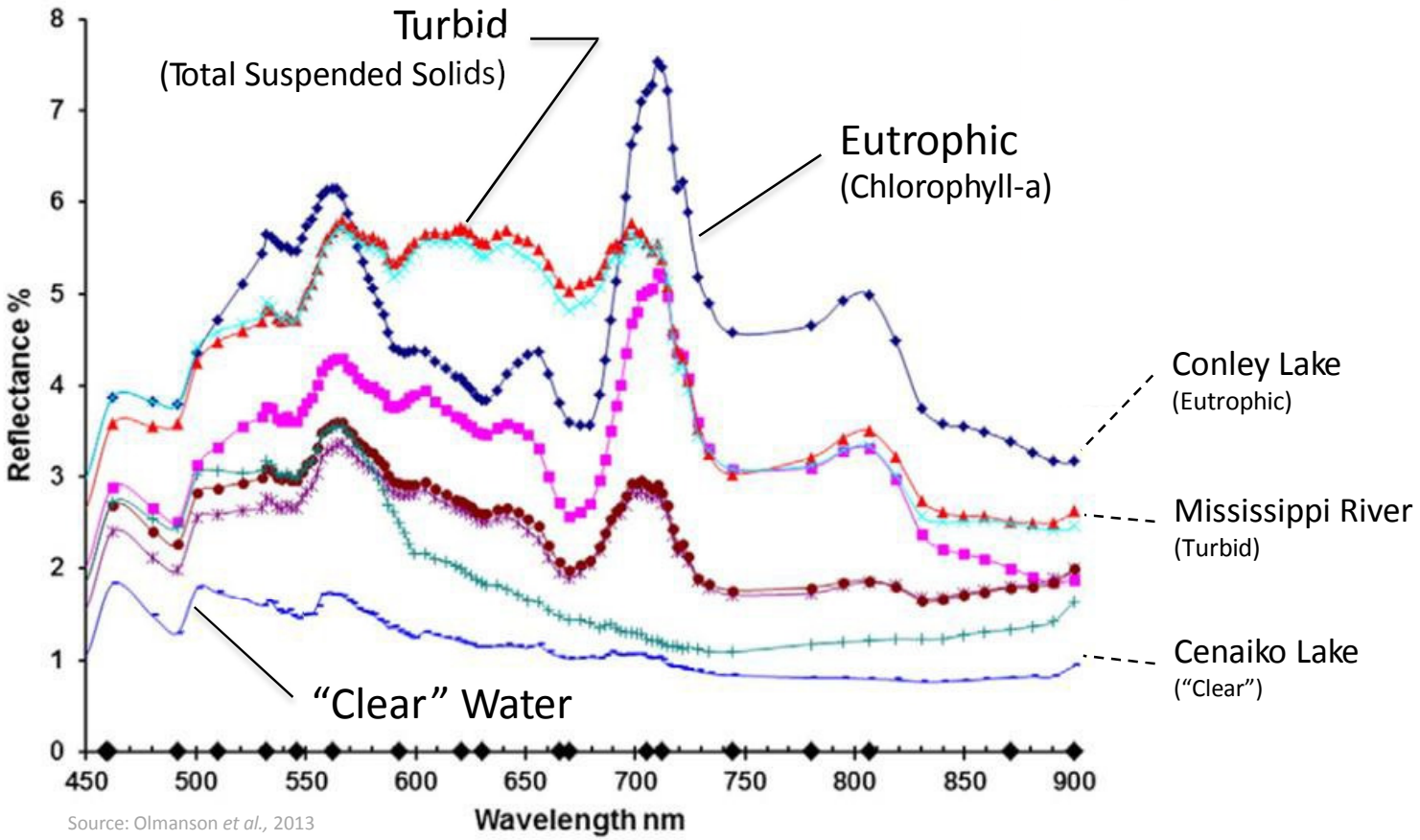


Figure 3: Overview of Proposed Method.

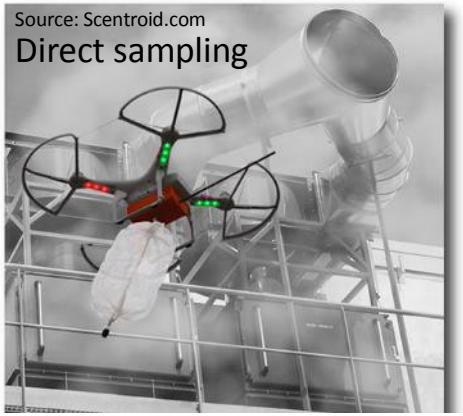
Source: http://research.unl.edu/annualreport/2014/water-slurping-drones-have-broad-potential/

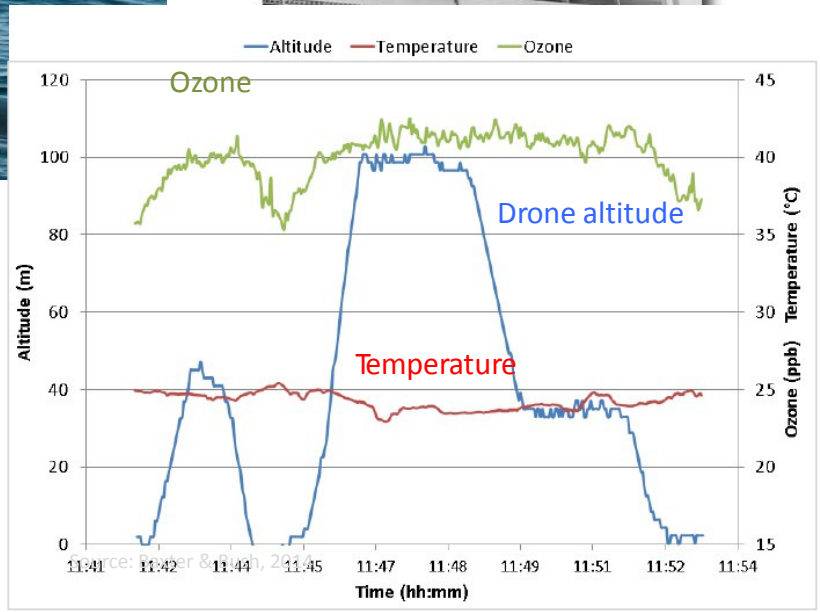
Multispectral Scanning of Waterbodies



Source: Olmanson *et al.*, 2013

Air Sampling Using Drones





Site Assessment Capabilities

- Phase I for <u>Forestland or Rural</u> (Undeveloped) Property
  - Properties More 120 Acres
  - Streamlined Site Reconnaissance
- Real-Time Data Collection with Mobile Devices
  - Photographs, Checklists and Notes, and Location Information
- Aerial Flyovers Using Small Drones
  - Suspect Areas Flagged for Later “Ground Truthing”
  - Estimate Extraction and Stockpile Volumes

Thank you

Questions?

Gale Hoffnagle
GHoffnagle@trcsolutions.com
O: 860-298-6247 ▪ C: 860-559-7910