Applications of UAV in forest monitoring: a regeneration survey case and an ice damage case

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Forest Monitoring

IUFRO: "***the regular and periodic measurement of certain parameters of forests (physical, chemical, and biological)***"

- Specifics:
  - Constant
  - Multiple objective

Constant & multi-objective measurements

- Key factor → Procedure

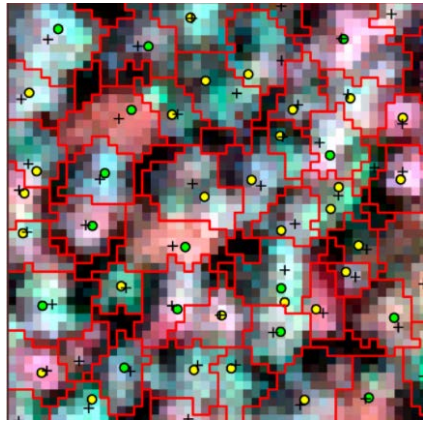
Field vs. Remote Sensing

- Field: Slow & Sample

  Accurate

- Remote Sensing: Fast & Population

  Relatively accurate

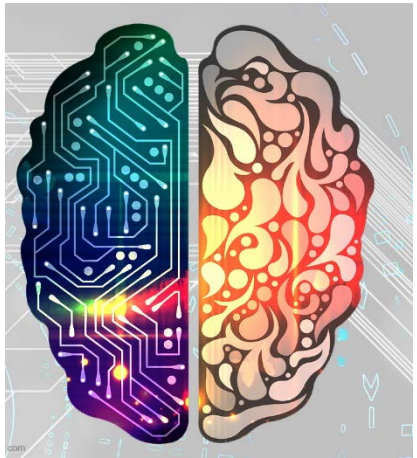


Winning Team

1. Unmanned Aerial Vehicles

2. Sensors

3. Computer Vision / Machine Learning



UAV

- Combination of two worlds: Remote Sensing & Field
  - Requires field visit
  - Provide population estimates

- High accuracy at affordable prices
- Best case: forester with RS expertise

Sensors

Machine Learning

- Algorithms for processing
  - Large amount of data
  - Low quality data

Objective

- Reduce costs in forest monitoring
- Timely intervention
- Assess damage or success

Regeneration survey

- Western Oregon

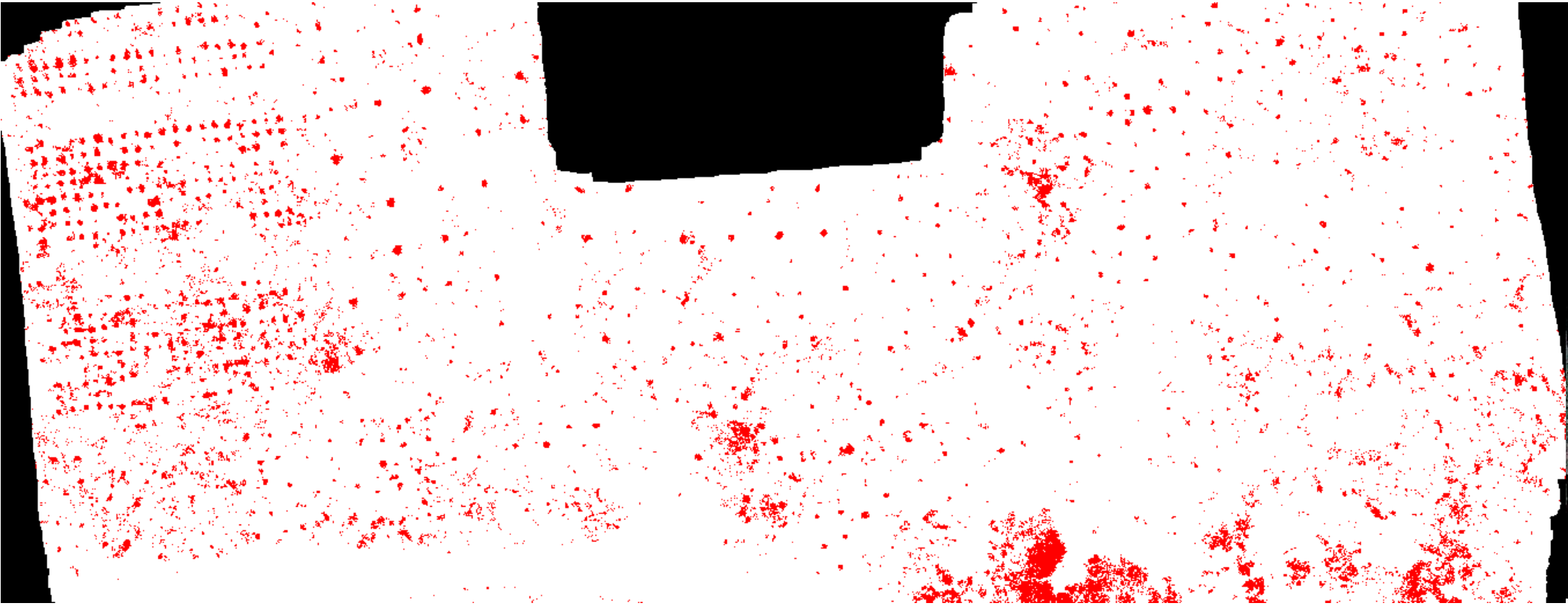
Regeneration survey

UAV – RBG - Machine Learning

- Western Oregon

Detail

Only Remote Sensing



Results

- 2 people (could be only one)
- Remote Sensing not the perfect solution
  - Lack of appropriate sensor (IR)
- Human intervention - crucial for accuracy
- <1/2 day the entire process

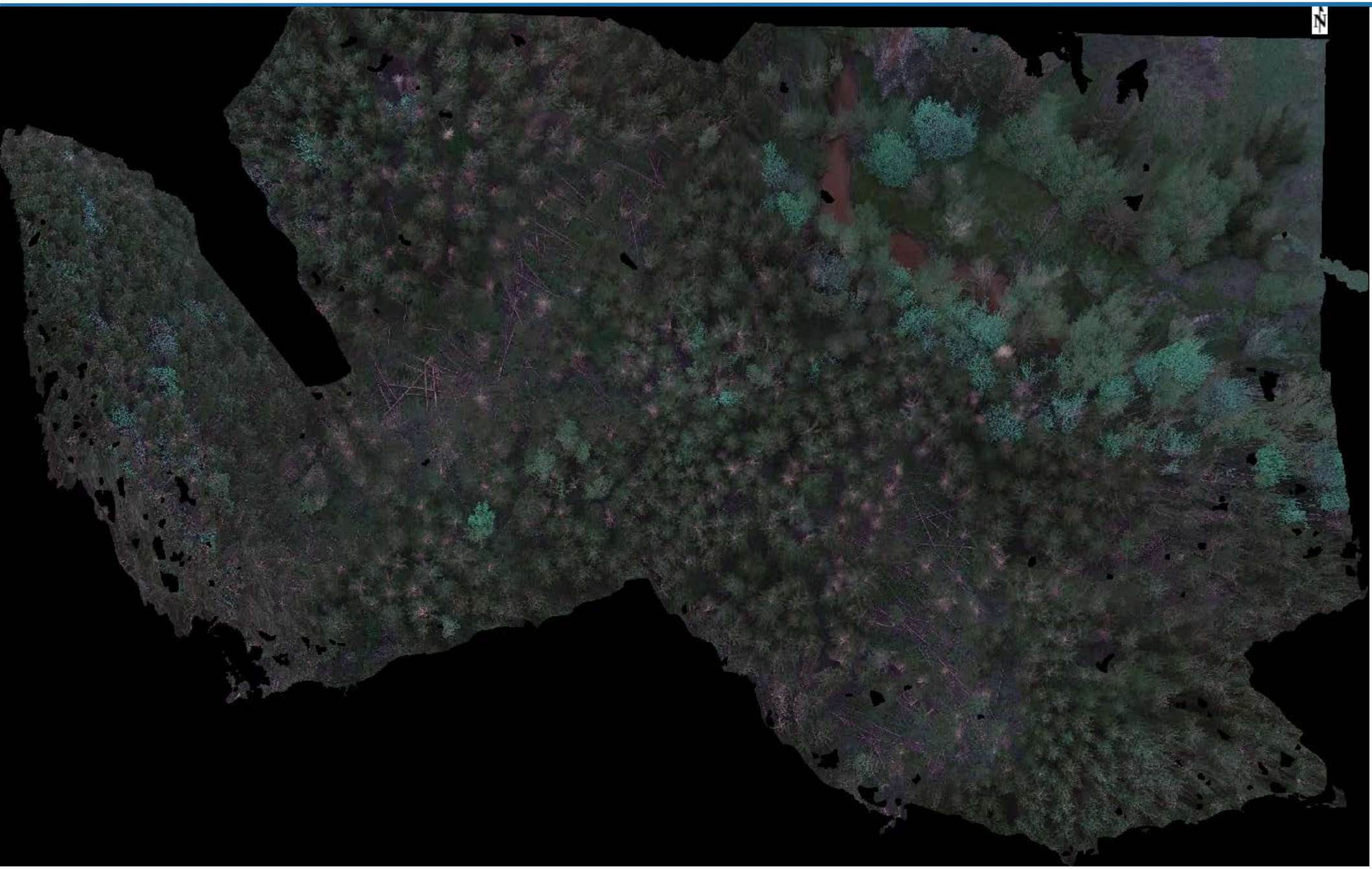
Ice Damages

- Western Oregon
- Winter 2015

Ice Damage (2)

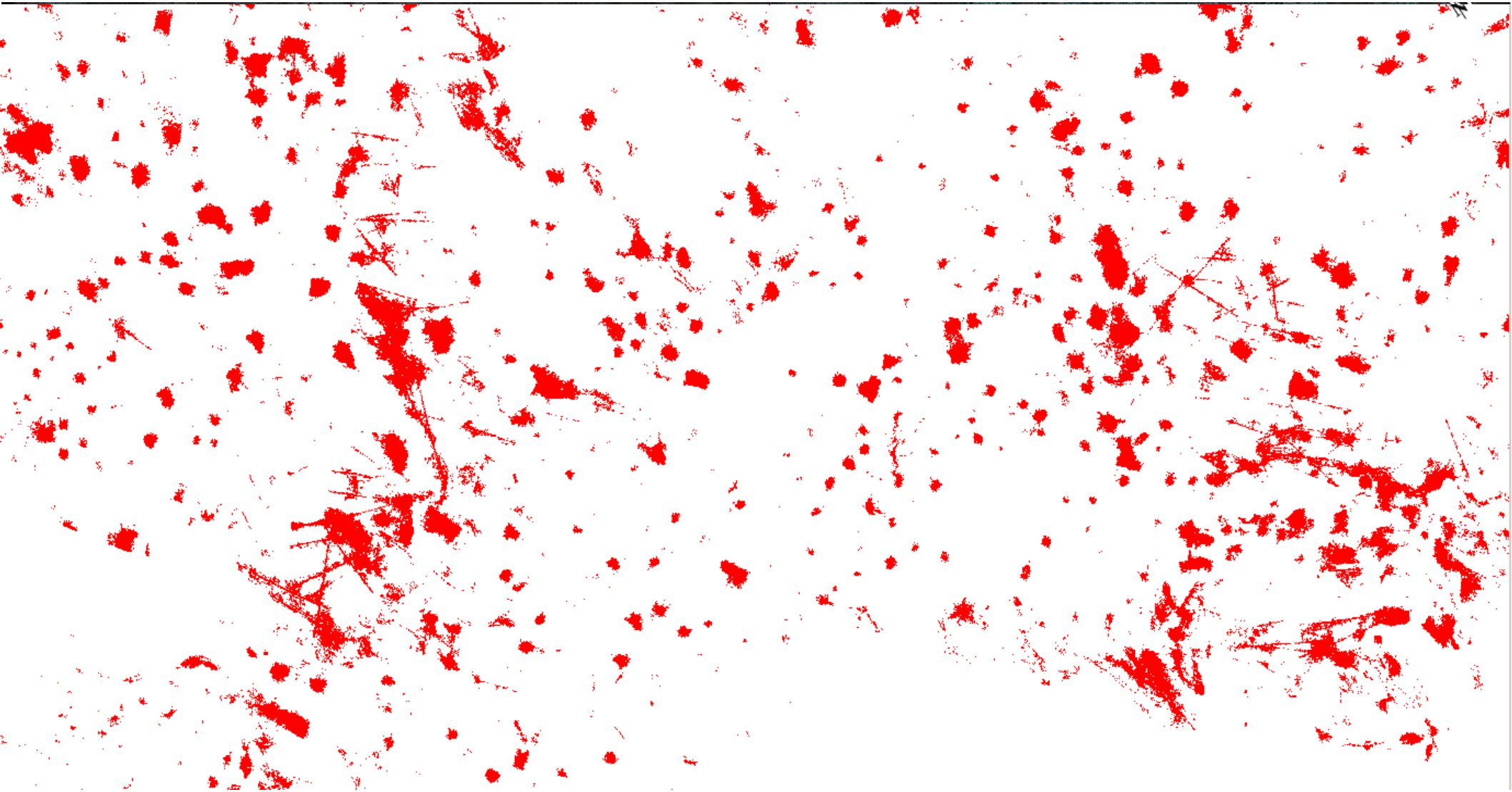
Ice Damage (3)

UAV – RBG - Machine Learning



UAV-RBG-Machine Learning

Broken tops and fallen trees



Results

- 2 people (could be only one)
- <1/2 day work
- $1500 equipment
- Remote Sensing → Accuracy > 95%
- **Why? High resolution RGB orthophoto ~ 1 inch**

Conclusion

- UAV useful tool
  - Price
  - Quality
- Remote sensing
  - Accurate
  - Fast
  - Other attributes – growth, health, composition, etc
- Snapshot of history