DoD Natural Resources Program

Enabling the Mission, Defending the Resources

Integrating Drones into DoD Natural Resource Management

Susan Cohen

April 21, 2022

Please mute your phones.

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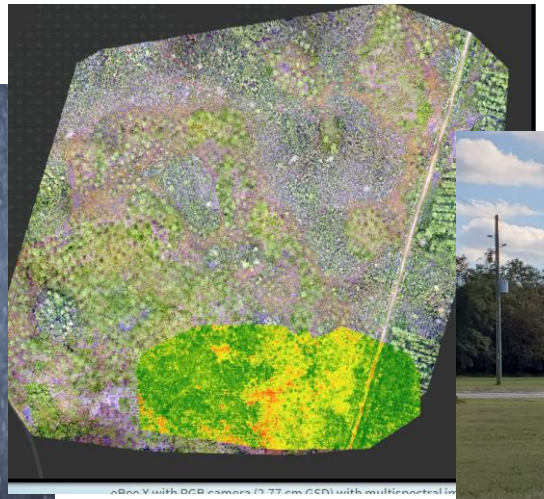
Agenda

- Structure and approach of the ESTCP project that launched a regional USMC drone program (Regional Drone Demonstration for Installations and Environment, REDDIE; RC19-5218)
- Natural resource applications
- Opportunities for DoD civilians



(L to R: Vesper, Blue UAS; Westervelt LLC, FL; MCLB Albany)

REDDIE Project Team

- Salinda Bachelor, Duke University Marine Lab
- Susan Cohen, UNC Institute for the Environment
- David Johnston, Duke University Marine Lab
- Jonathan Putney, Attollo LLC
- Justin Ridge, Duke University Marine Lab
- Antonio Rodriguez, UNC Institute for Marine Science
- Joey Trotsky, NAVFAC EXWC
- Troy Walton, Attollo LLC

REDDIE

Problem

➢ Lack of strategic UAS protocols result in one-off approvals or none at all, no real time capabilities, and no process for incorporating the capabilities, efficiency, and safety of UASs into DoD natural resources management.

Why we care

➢ Having the capability to collect, process, & interpret on-demand, high-resolution remotely-sensed data can transform DoD land-management by providing the latest information for optimizing decision-making.

Solution

➢ Demonstrate and deploy a unified, strategic, and operational framework of training, mission kits, protocols, and demonstrations on a regional level to incorporate sUAS into the civilian workflow.

MCIEAST Demonstration Sites share climate and resilience challenges due their coastal setting.

Operational Framework – training, gear, protocols, demos

Development of a mobile **training** platform to facilitate adoption of the technology across MCIEAST installations (Part 107 FAA standard compliant and BUQ II Level DoD standard compliant)

Photos:
MCLB
Albany

Creation of a sUAS **mission kit** for regional dissemination to installations.
A comprehensive suite of multi-platform/multi-sensor missions to answer a wide array of environmental management questions.

Parrot Anafi Thermal

senseFly eBee X

Vantage Robotics Vesper

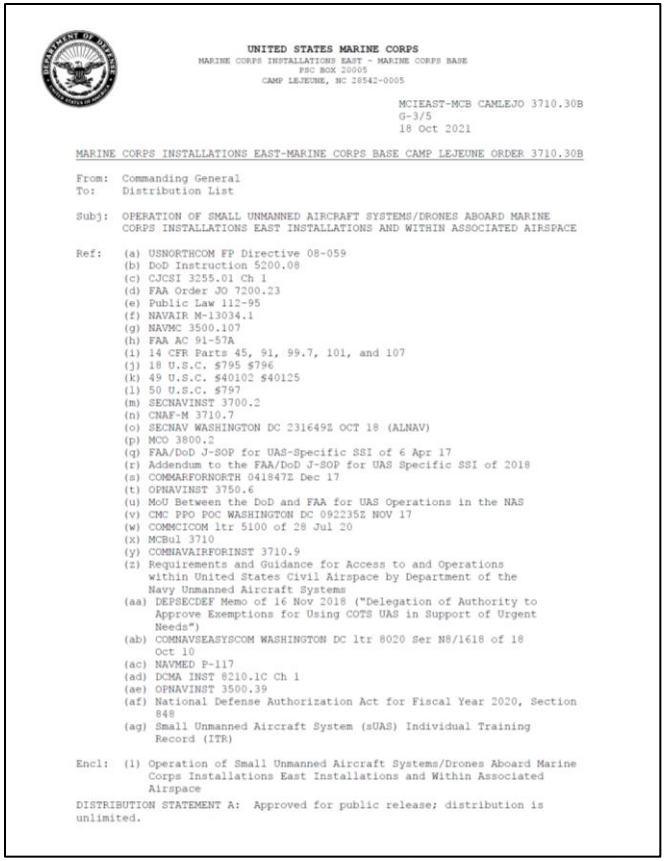
Operational Framework

Develop and codify sUAS **protocols** and program framework. Integrate with MCIEAST leadership, installation staff, airspace managers, etc…to develop pathways.

The USMC MCIEAST order provides a formal pathway for the non-POR program.

The first version (Sept 2020) was a collaboration between MCIEAST leadership and REDDIE.

The order was revised and updated Fall 2021!



UNITED STATES MARINE CORPS
MARINE CORPS INSTALLATIONS EAST - MARINE CORPS BASE
PSC BOX 20005
CAMP LEJEUNE, NC 28542-0005

MCIEAST-MCB CAMLEJO 3710.30B
G-3/5
18 Oct 2021

MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE CAMP LEJEUNE ORDER 3710.30B

From: Commanding General
To: Distribution List

Subj: OPERATION OF SMALL UNMANNED AIRCRAFT SYSTEMS/DRONES ABOARD MARINE CORPS INSTALLATIONS EAST INSTALLATIONS AND WITHIN ASSOCIATED AIRSPACE

Ref: (a) USNORTHCOM FP Directive 08-059
(b) DoD Instruction 5200.08
(c) CJCSI 3255.01 Ch 1
(d) FAA Order JO 7200.23
(e) Public Law 112-95
(f) NAVAIR M-13034.1
(g) NAVMC 3500.107
(h) FAA AC 91-57A
(i) 14 CFR Parts 45, 91, 99.7, 101, and 107
(j) 18 U.S.C. §795 §796
(k) 49 U.S.C. §40102 §40125
(l) 50 U.S.C. §797
(m) SECNAVINST 3700.2
(n) CNAF-M 3710.7
(o) SECNAV WASHINGTON DC 231649Z OCT 18 (ALNAV)
(p) MCO 3800.2
(q) FAA/DoD J-SOP for UAS-Specific SSI of 6 Apr 17
(r) Addendum to the FAA/DoD J-SOP for UAS Specific SSI of 2018
(s) COMMARFORNORTH 041847Z Dec 17
(t) OPNAVINST 3750.6
(u) MoU Between the DoD and FAA for UAS Operations in the NAS
(v) CMC PPO POC WASHINGTON DC 092235Z NOV 17
(w) COMMCICOM ltr 5100 of 28 Jul 20
(x) MCBul 3710
(y) COMNAVAIRFORINST 3710.9
(z) Requirements and Guidance for Access to and Operations within United States Civil Airspace by Department of the Navy Unmanned Aircraft Systems
(aa) DEPSECDEF Memo of 16 Nov 2018 ("Delegation of Authority to Approve Exemptions for Using COTS UAS in Support of Urgent Needs")
(ab) COMNAVSEASYSCOM WASHINGTON DC ltr 8020 Ser N8/1618 of 18 Oct 10
(ac) NAVMED P-117
(ad) DCMA INST 8210.1C Ch 1
(ae) OPNAVINST 3500.39
(af) National Defense Authorization Act for Fiscal Year 2020, Section 848
(ag) Small Unmanned Aircraft System (sUAS) Individual Training Record (ITR)

Encl: (1) Operation of Small Unmanned Aircraft Systems/Drones Aboard Marine Corps Installations East Installations and Within Associated Airspace

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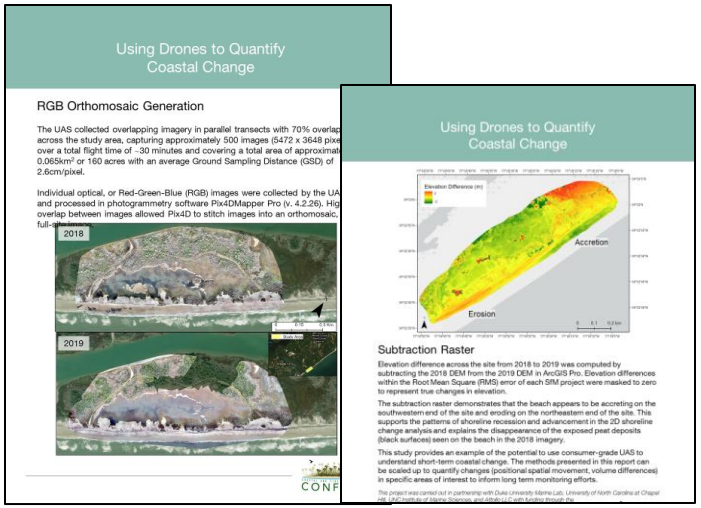
Institutionalize civilian drone use, longevity beyond revolving door…

SOPs and Guidance

- Demonstration reports
- Remote sensing user guides
- Practical application templates

Operational Framework



Use demonstrations to teach and highlight applications

Photos: UNC Institute of Marine Science

12/5/14; Saltmarsh = 0 m^2

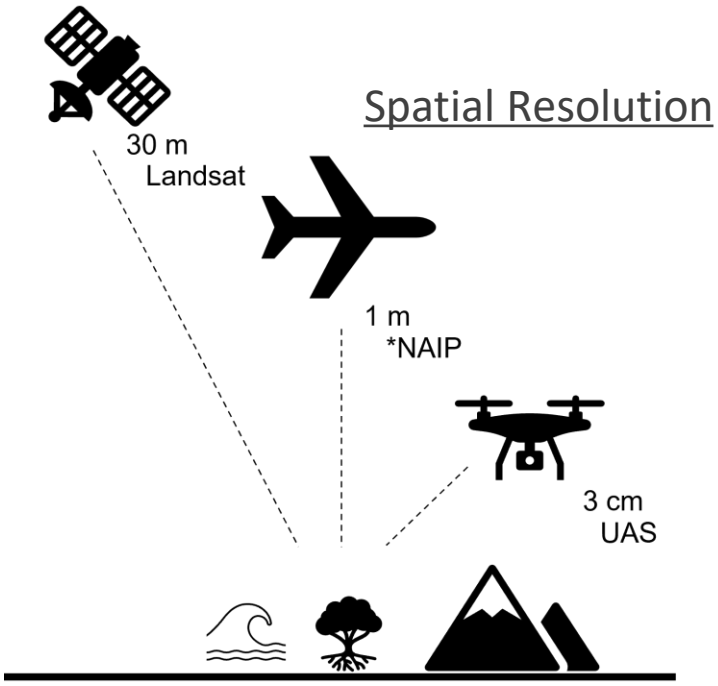
5/29/19; Saltmarsh = 203 m^2

Progress (and lessons learned)

- If you want to fly drones on your installation, you have to be the expert on rules and educate leadership, one person at a time.
- Success relies on leadership and staff, engage early – a change can move you back several steps each time or an obstacle can retire.
- Socializing civilian flown drones and incorporation into workflows requires continuous communications, briefs, and outreach
- Each installation's implementation is different with its own set of sensitivities.
- But the training, gear, and basic protocols can be codified.
- Continuous changes in DoD policy (e.g. NDAA) can stop or challenge a UAS program without strong advocates; remain flexible!
- Nothing guarantees the Bases will figure out some of the remaining pieces, but they are going to be set-up to finish strong!

Natural resource applications

UAS systems allow for high-resolution mapping (~3cm/pixel) on a user defined temporal scale



Long-term monitoring

- Invasive species detection/ monitoring
- Herbicide applications
- Coastal habitat resilience
  - Sea level rise/beach erosion
  - Marsh mitigation
- Pre/post major storm event
- Habitat restoration mapping
- T&E habitat monitoring
- Forest health and growth monitoring

Situational Awareness

- Forestry
- Prescribed fire
  - Hotspot detection
  - Live personnel tracking
- Post storm assessment

Natural resource applications

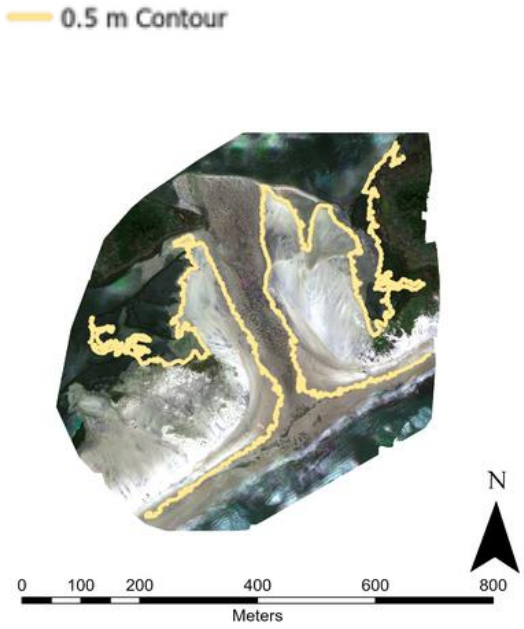
- Safety of personnel
- Inexpensive when compared to the logistics tied with occupied aircraft or satellite imagery
- Increased efficiency over ground methods
- Increased spatial and temporal resolution
- Accessibility - impact areas, rough terrain, limiting disturbance, etc.

Benefits of UAS

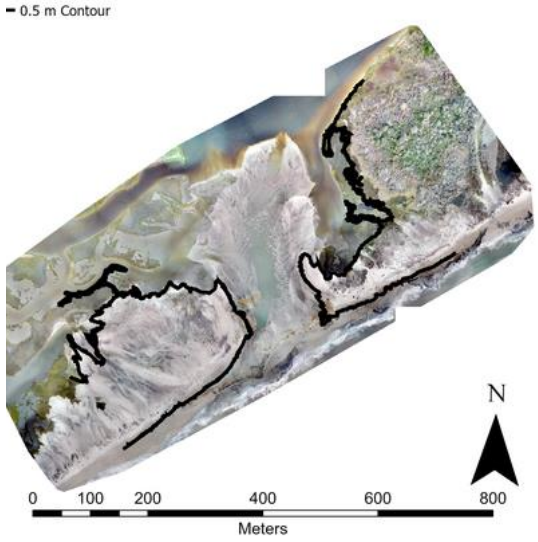
Onslow Beach, MCBCL

Natural resource applications

Pre-Hurricane Florence



Post-Hurricane Florence



Dr. Tony Rodriguez, UNC Institute for Marine Science

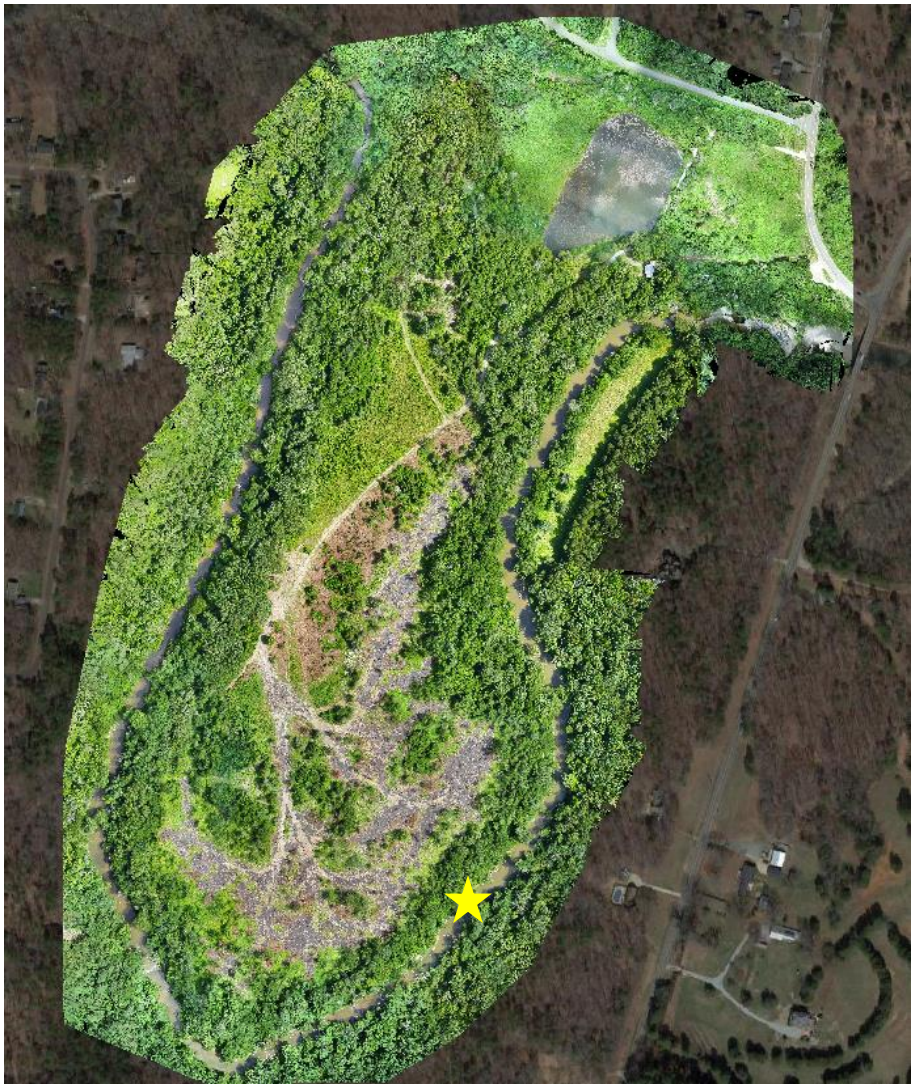
Onslow Beach, MCB Camp Lejeune

Infrastructure (training areas, facilities), ecosystem benefits, and T&E threatened by sea level rise and extreme events

Natural resource applications

Natural resource applications

Penny's Bend at Falls Lake, NC

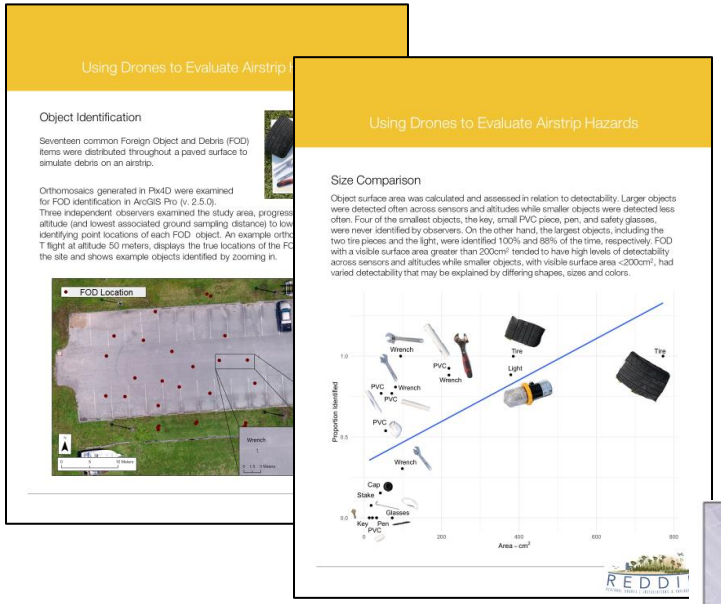


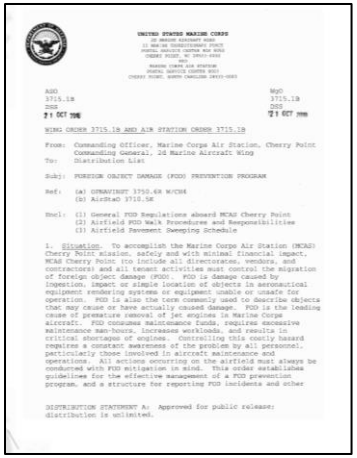
Natural resource applications

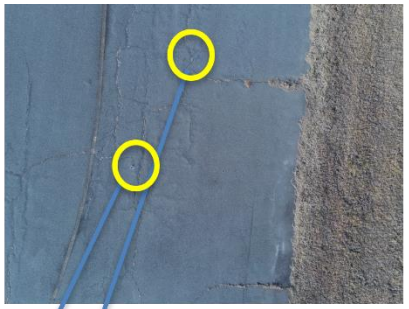
Natural resource applications - Fire

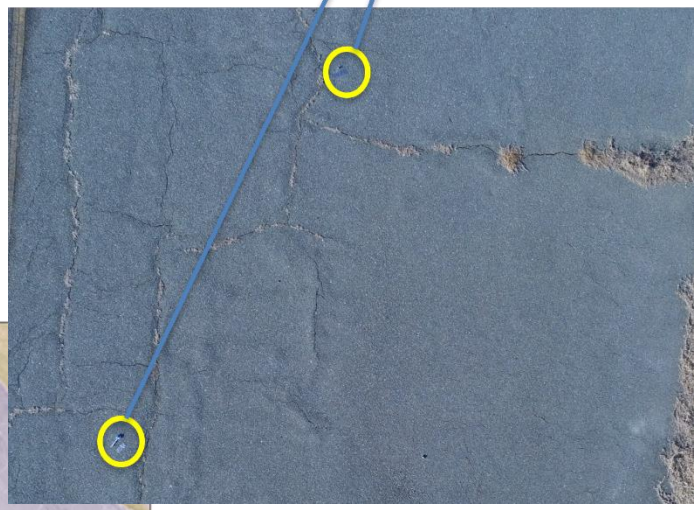
- Assess burn effectiveness by mapping pre and post burn
- Fuel assessment
- Provide assistance to burn boss in tracking progress of prescribed fire
- Wildland firefighter tracking
- Hotspot detection
- Infrastructure checks

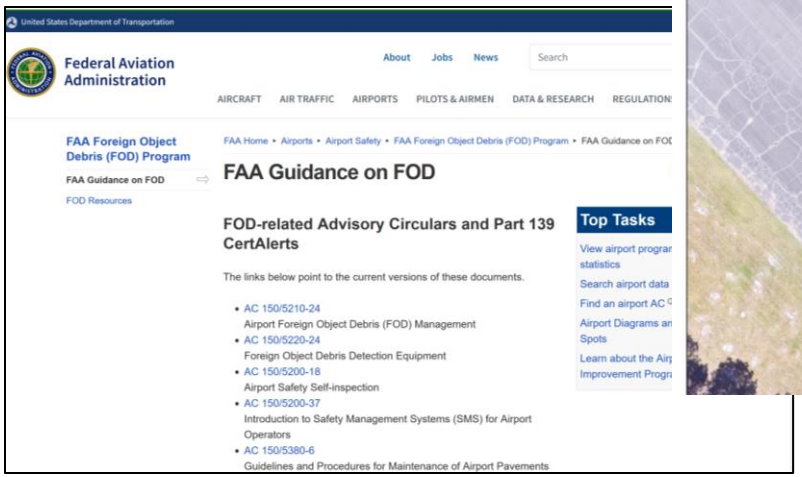
Natural resource applications?
FOD/Runway Condition





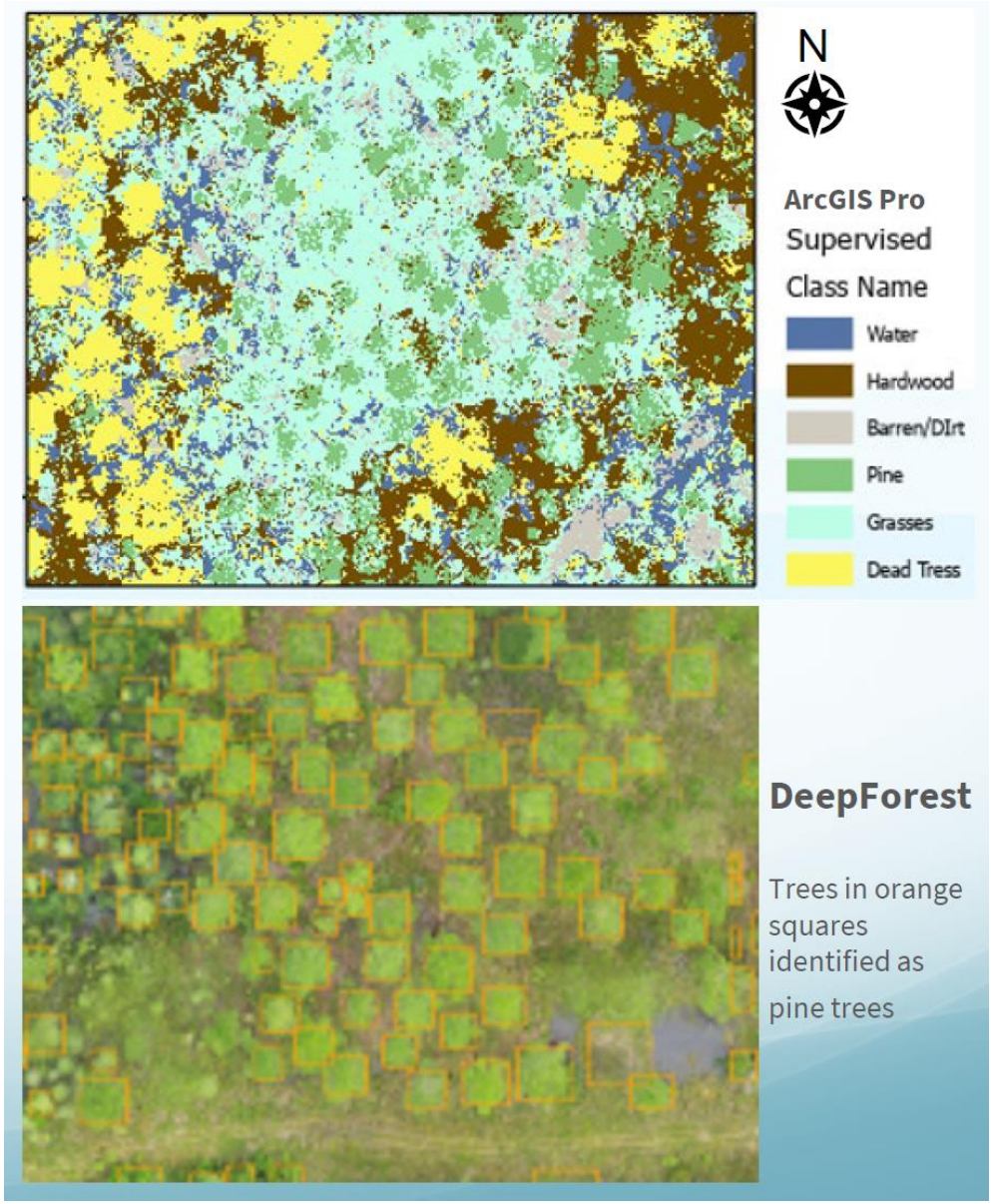






Marine Corps Outlying Field Atlantic
Atlantic, NC

Natural resource applications



Machine Learning

Supervised Classification
- an expedited supervised
- classification via ArcGIS Pro using the RGB imagery for accurate classification of pine trees

Python machine learning via DeepForest to identify trees (https://doi.org10.1111/2041-210X.13472)

Untrained model using National Ecological Observatory Network

Opportunities for DoD civilians

The Basics

1. Become an expert

2. There are **NO** DoD memorandum or orders that prevent federal civilians from flying drones on installations

3. Get to know range control!

4. Two avenues to flying a UAS on an installation
   - BlueUAS
   - Receive cyber waiver for Commercial-off-the-shelf system

5. Cyber waivers do not give permission to fly on installation, it simply starts the process

6. The process to fly varies by service and installation, Installations/Services largely set their own requirements for flying. But the process is discoverable!

7. Allow plenty of time to accomplish one piece at a time.

Opportunities - DoD Concerns and Mitigations

- Cybersecurity and data leakage is a top concern for all DoD entities
- Contractors do not get to bypass the rules.
- National Defense Authorization Act (NDAA) 2020, Sect 848

  "Prohibition on Operation or Procurement of Foreign-Made Unmanned Aircraft Systems"
  - Main components cannot be manufactured in China and other covered countries
  - Batteries and non-computing equipment still allowed to be manufactured in China
  - Approvals required by service waiver board
- Enter "BlueUAS" by Defense Innovation Unit

1. Freefly Alta X
2. Sensefly eBee TAC
3. Skydio X2D
4. FLIR ION M440
5. Parrot Anafi USA GOV
6. Teal Golden Eagle
7. Vantage Robotics Vesper

Opportunities - Waiver Process

Freefly Atla X

- You can still fly Commercial-Off-The-Shelf drones on installations that are not on the BlueUAS list!

- Naval (Navy & Marine Corps) Waiver Board
  - Guidance for the operations of DON Group 1 and 2 UAS
    < COMNAVFORINST 3710.9 Nov 17 (Ref: ALNAV074)
  - Interim Flight Clearance (IFC) required for non BlueUAS
  - Flag Officer/SES endorsement required

- Army Board
  - Consolidated DoD – Army COTS UAS Cyber Security Waiver Business Rules ALARACT 039/2020
  - Flag Officer/SES endorsement required

Opportunities for DoD civilians
Waiver Process

- Air Force Board
  - MANUAL 11-50229. Flying operations sUAS Air Force Acquisition, Technology and Logistics (SAF/AQ) and AF Deputy, Chief Information Officer (SAF/CN) approval is required
- USACE
  - Engineering Research & Development Center (ERDC) developed “S-UAS Cyber Threat Management – FY21” to address mitigation strategies

- **<u>Common Practices By All</u>**
  - No internet connection
  - No bluetooth
  - Dedicated ground control station (GCS)
  - “Air gap” firmware updates

Inspiration….