UAS APPLICATIONS FOR INVASIVE PLANT MONITORING

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BACKGROUND

Traditional methods for monitoring and mapping invasive plant populations have severe limitations in some habitats associated with California's bays, estuaries, and river deltas due to:

- tidal influence
- soft sediments in mudflats
- dense emergent vegetation
- diffuse channel networks

To improve field data quality and extrapolation accuracy, Stillwater Sciences developed a habitat classification mapping methodology using remotely sensed UAS (unmanned aircraft system) imagery collection and interpretation.

METHODS

Methods vary by site based on access challenges, resolution desired, and site conditions:

- set georeferenced ground-control points
- collect oblique and nadir-perspective photographs
  - vehicle: multicopter or fixed-wing
  - sensor: multispectral camera, or LiDAR sensor
  - resolution as high as 0.3cm/pixel
- field verification of vegetation signatures
- post-process with photogrammetry to generate:
  - dense point clouds
  - orthomosaic basemaps to interpret via heads-up digitizing
  - 3D topographic surfaces (DEM and/or Meshs) compatible with GIS and CAD
- GIS analysis

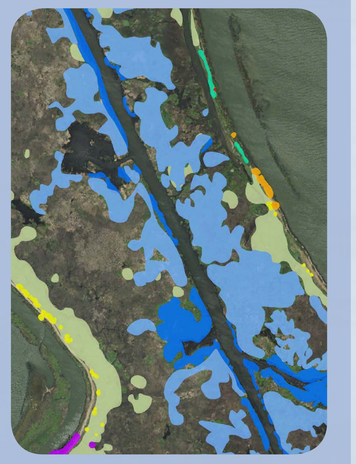
RESULTS

Invasive plant mapping with up-to-date, high-resolution imagery allows aids effective site restoration by informing invasive species extent prior to removal and measuring restoration success post-implementation.

WINTER ISLAND & CHIPPS ISLAND TIDAL HABITAT RESTORATION PROJECTS: PLANNING AND IMPLEMENTATION

450 ACRES & 850 ACRES

Application: invasive weed removal (focus on aquatic invasives and their impact on fish populations)
Approach: fly pre-selected locations targeting specific plant signatures, conduct simultaneous ground surveys to collect plant species signature data, map using available imagery



Challenges:

- large island with challenging access, difficult to establish ground control points and for pilot to launch and land the UAS
- windy conditions and risk to equipment over water
- capturing certain species phenology (to differentiate *Ludwigia* spp. from *Alternanthera philoxeroides*)

LOWER BERRYESSA CREEK: MITIGATION MONITORING

7 ACRES

Application: species-specific mapping, monitoring for cover of invasive species and mitigation performance goals
Approach: fly entire project area, examine signatures in office, perform field-based vegetation mapping with post-processed imagery as mapping base

Challenges:

- overhead powerlines
- restricted airspace over road

CONCLUSIONS

COST EFFECTIVE, EASILY REPEATABLE, WITH MULTIPLE APPLICATIONS

- detailed habitat mapping
- alliance-level vegetation typing
- species-specific invasive weed mapping
- planning for and monitoring restoration success

APPROPRIATE USES

- projects that require up-to-date or seasonal imagery, or high resolution
- areas with access challenges
- scale: river-reach to thousands of acres

LIMITATIONS

- resolution: gathering sub-centimeter resolution imagery requires lower and longer flights
- environmental factors: tidal fluctuations, strong winds, precipitation, ground reflectivity, and extreme temperatures
- large study areas must balance cost-effectiveness with resolution

BENEFITS OF USE

- rapid: provides real-time imagery
- cost-effective: efficient & comprehensive data gathering
- repeatable: successive sampling is quick to mobilize and expedites analysis
- precise: comprehensive data informs management decisions across entire study area, rather than extrapolating from a sampling subset

ACKNOWLEDGEMENTS
Dan Riordan and Ling Chu, DWR
Zooey Diggory, Valley Water