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Inventory methods for sea asparagus in the Salish Sea: working with indigenous communities to integrate UAV technology and aquatic plant management

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INTRODUCTION

- Licences for the harvesting of sea asparagus (*Salicornia maritima*, *Salicornia rubra*, and *Sarcocornia pacifica*) are issued annually on the west coast of British Columbia.
- Traditional inventory methods are too expensive to employ throughout the Salish Sea.



- We developed and tested a cost-effective approach using:

- predictive habitat mapping;
- ground surveys; and
- small unmanned aerial vehicle (UAV) technology.

BACKGROUND

- Sea asparagus is a salt tolerant plant common to saltwater marshes.
- Marketed as 'sea asparagus' 'sea beans' or 'samphire greens', these salty succulents have become a popular culinary product.
- Previous inventories of sea asparagus distribution and biomass have been conducted in Boundary Bay and Cowichan Bay¹, but are lacking for the rest of Vancouver Island.



OBJECTIVES

- Develop a sound and cost-effective methodology to inventory the biomass, density, and distribution of sea asparagus;
- Test this inventory methodology between Union Bay and Qualicum Bay; a location of interest on the east coast of Vancouver Island with no previous inventory data;
- Produce a final report documenting the methodology as well as field inventory findings for the pilot area.

METHODS

1. Predictive habitat mapping

- The Canadian Wetland Inventory (CWI) was used to identify saltwater marsh sites in the pilot area (Figure 1).

2. Ground verification surveys

- Sea asparagus % cover and biomass was recorded in at least 15 quadrats per site.

3. UAV surveys

- The UAV was flown at an altitude of ≤ 50 m in parallel transects.
- An orthomosaic and a digital surface model were produced from the aerial photos.
- Field data and orthomosaics were used to verify supervised ground classifications, mapping the distribution of sea asparagus (Figure 2).
- Total sea asparagus biomass was estimated by multiplying the total area of sea asparagus by the average biomass from field surveys.

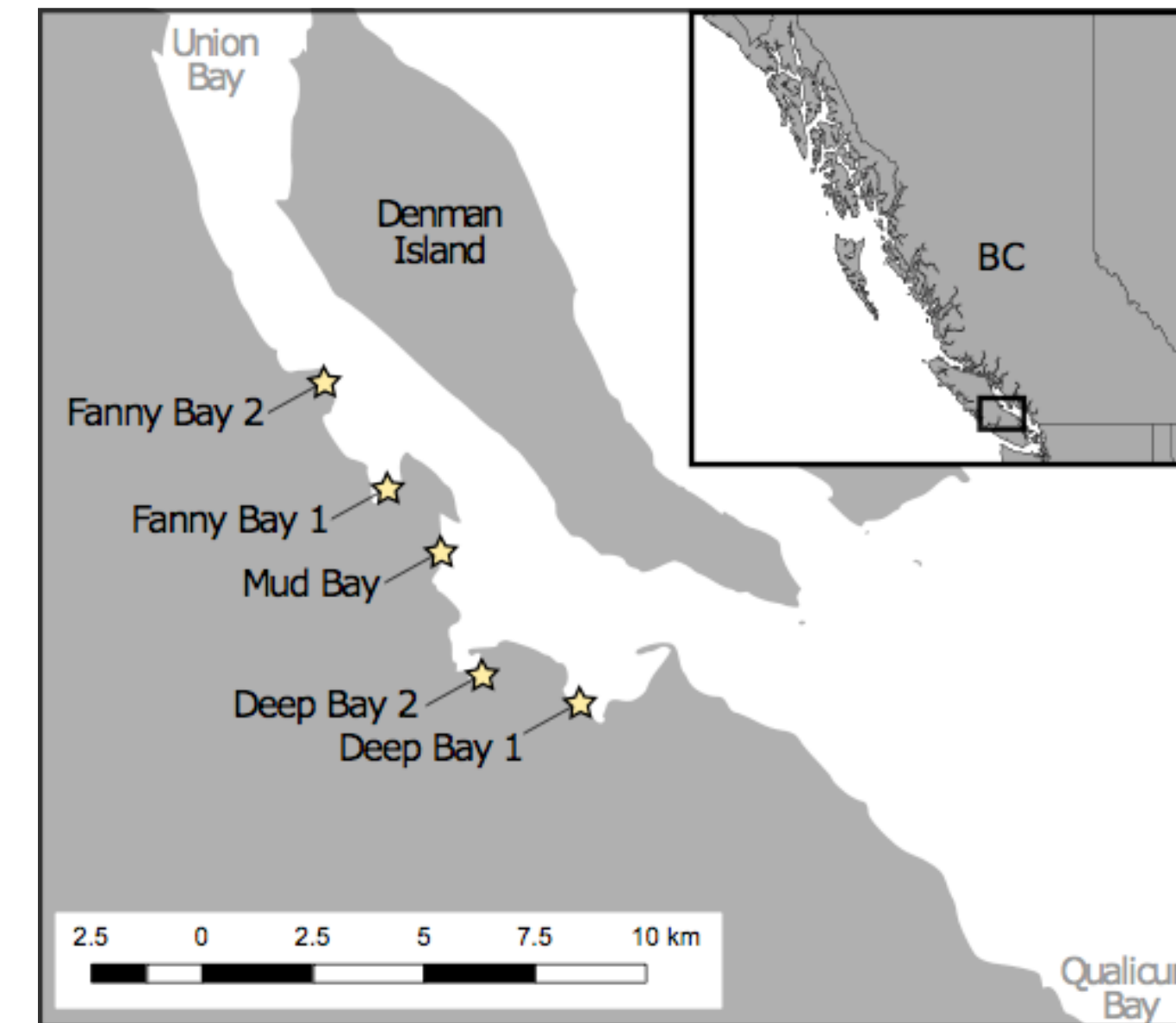


Figure 1. Map of inventory sites (★) between Union Bay and Qualicum Bay.

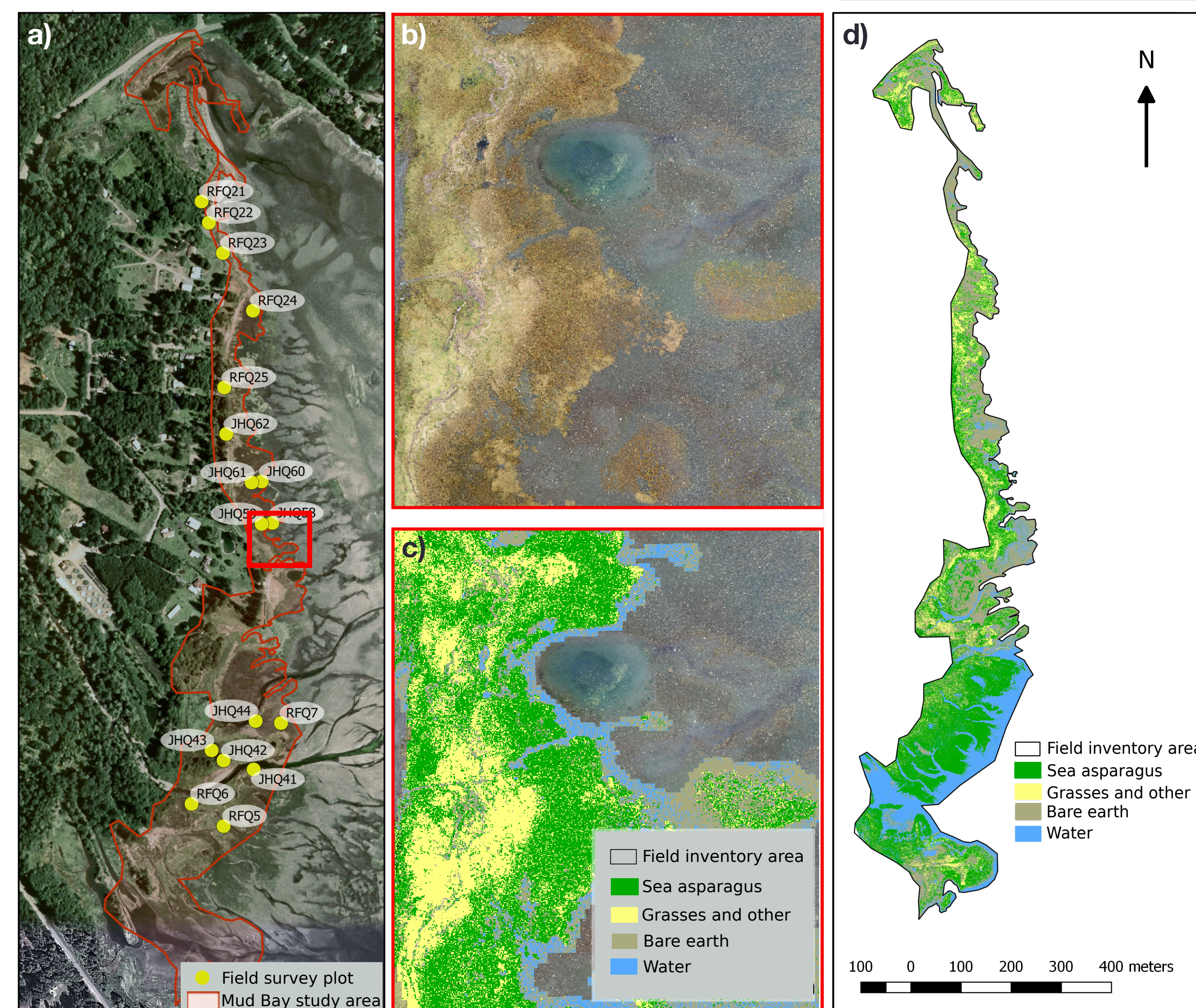


Figure 2. a) Satellite imagery of the Mud Bay study area with the locations of field survey plots. b) Sample orthomosaic created from the UAV aerial imagery, and c) supervised ground classification. d) Final ground classification for the Mud Bay study area

RESULTS

- Sea asparagus covered a total estimated area of 285,178 m², with an estimated biomass of 1,056.4 tonnes (Table 1)
- Sea asparagus biomass varied greatly among and within sites.
- Some sea asparagus was observed on very sheltered shorelines outside of the saltwater marsh habitat identified by the CWI.

Table 1. Sea asparagus area and biomass estimates across the five inventory sites. (SD = standard deviation)

Site	No. of field quadrats	Total area (m ²)	Biomass (g) per 0.01 m ²	Total biomass (tonnes)
Deep Bay 1	26	82,478.80	40.1 (± 24.3 SD)	330.7
Deep Bay 2	15	44,806.85	31.7 (± 21.4 SD)	142.0
Mud Bay	22	71,547.56	38.9 (± 32.5 SD)	278.3
Fanny Bay 1	15	49,688.43	27.6 (± 19.3 SD)	137.1
Fanny Bay 2	25	36,656.40	45.9 (± 40.1 SD)	168.3
Total	114	285,178.04	-	1,056.4

RECOMMENDATIONS

- Management of sea asparagus should be precautionary. Expansion of the field inventory areas to include sheltered shorelines would provide a more complete inventory of sea asparagus biomass.
- Multi-year contracts would support planning, earlier initiation of inventory work, and promote consistency across years.
- Future work should incorporate Indigenous ecological knowledge.



REFERENCES

- Hutchinson I, and Smythe SR. 1998. Impact of Commercial Harvesting of Sea-Asparagus on the Productivity of Coastal Salt Marshes in B.C. British Columbia Ministry of Agriculture and Fisheries. Contract No. 06024. 30 pp.