Invasive Plant Management on the Farallon Islands National Wildlife Refuge

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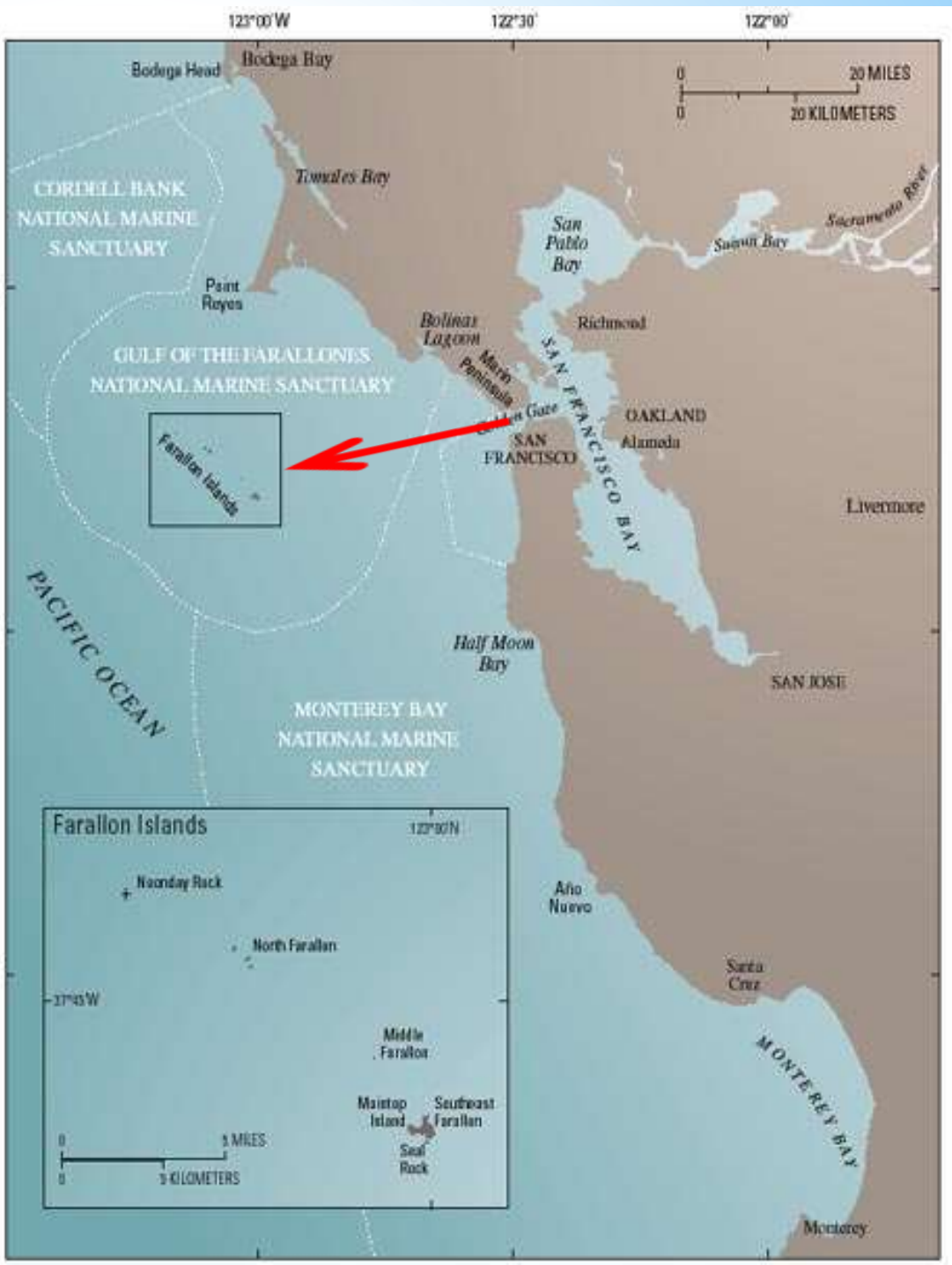
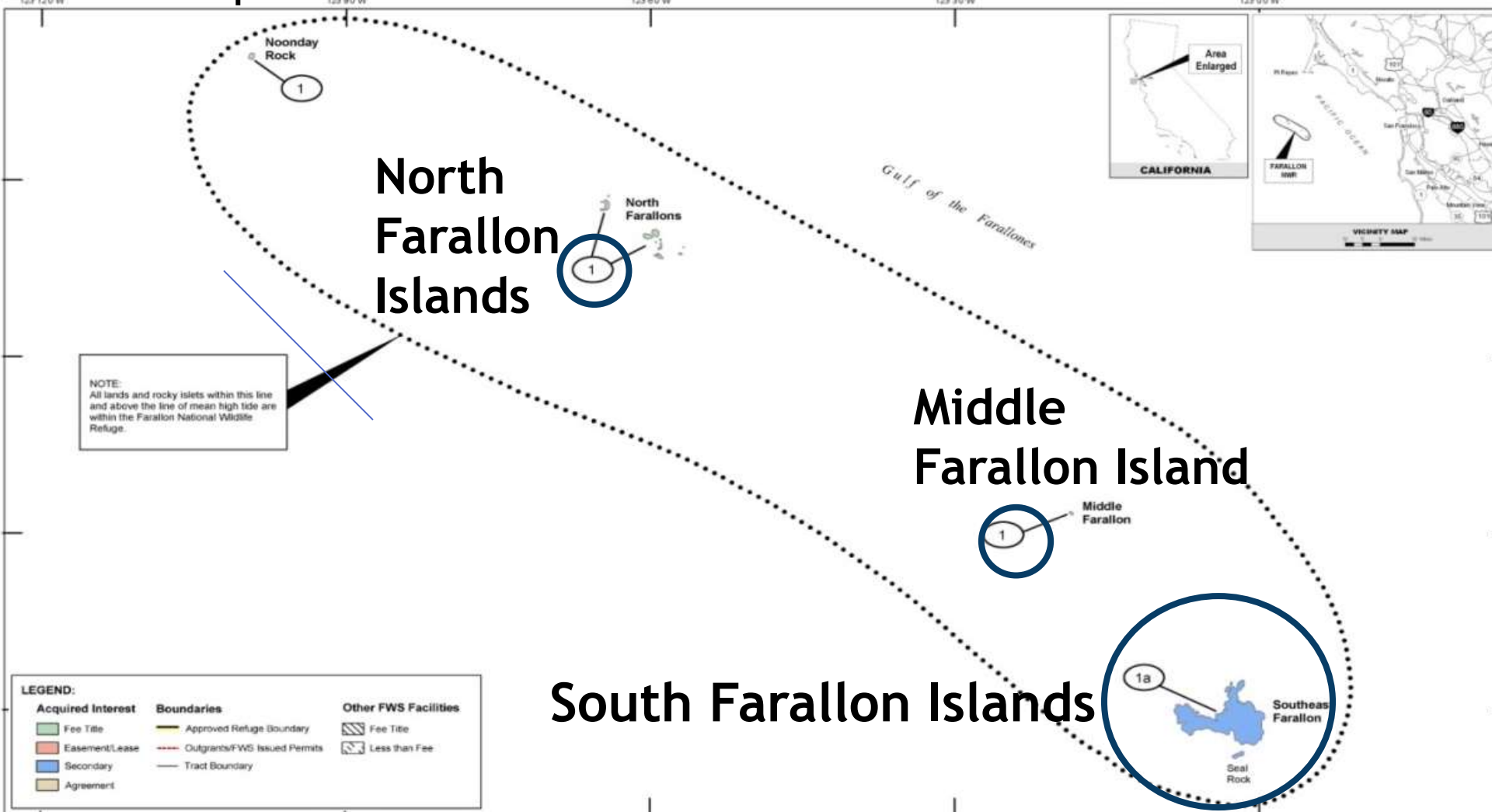
Farallon Islands NWR-Orientation

- 30 miles from the Golden Gate Bridge, San Francisco, California
- Managed by the U.S. Fish and Wildlife Service
- Administered by the San Francisco Bay National Wildlife Refuge Complex in Fremont, CA



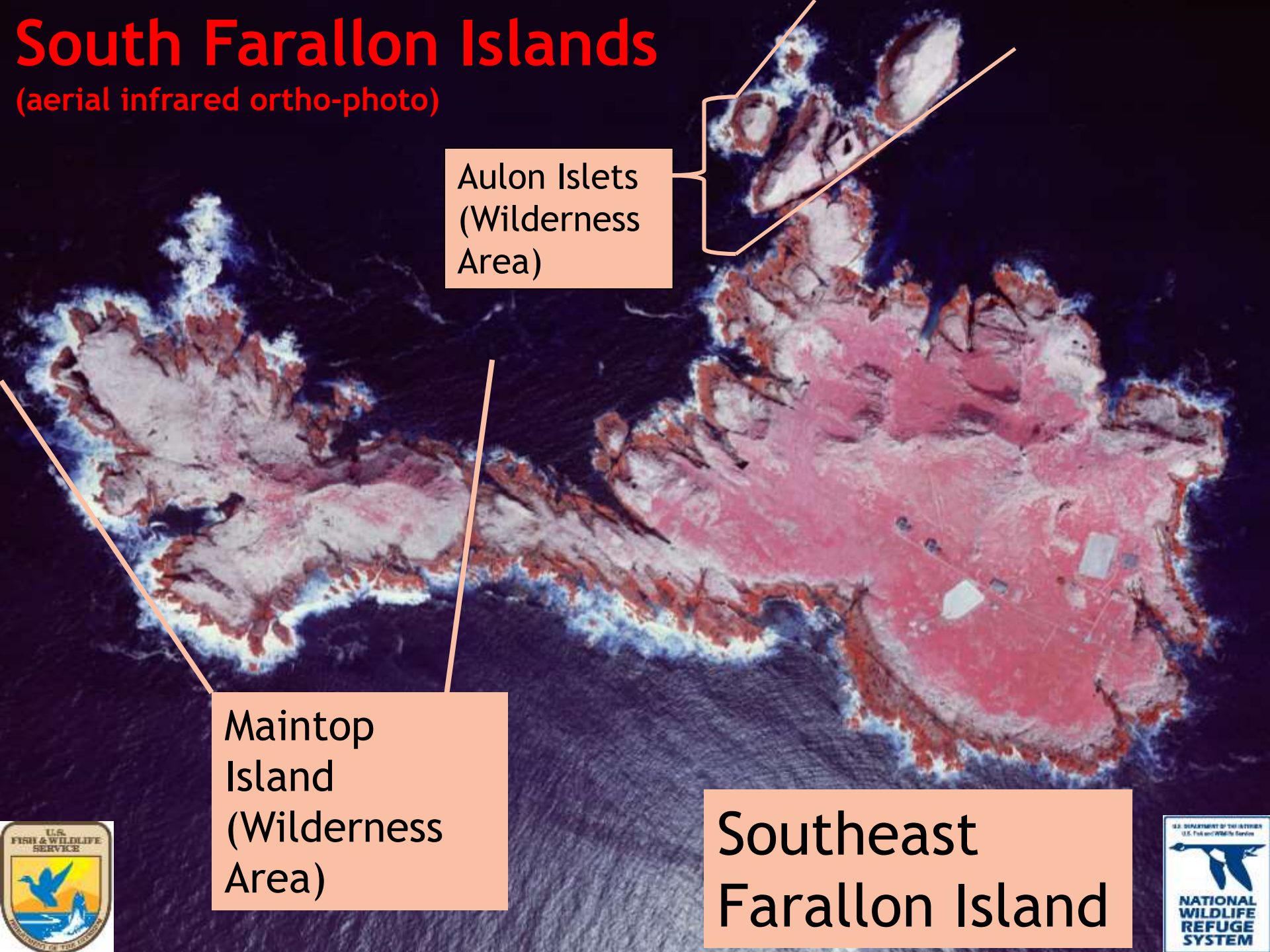
Farallon Islands NWR- Land Area

- Total Refuge area is: **211 acres**
- Invasive plants only on the South Farallon Islands: **120 acres**
- Primary management occurs on Southeast Farallon which is largest island at: **70 acres**
- **Closed to public access**



South Farallon Islands

(aerial infrared ortho-photo)



Human History

- Russian fur sealers
  1812 to 1842

- Common murre egging
  1848 to 1881
  (Introduction of mice and rabbits)

Human History

- U.S. Army Corps of Engineers, Weather Bureau, U.S. Navy, Lighthouse Service and U.S. Coast Guard 1858-1972

Cooperator Staffing

Point Blue Conservation Science (founded as Point Reyes Bird Observatory or PRBO)

- Point Blue Biologists have staffed the biological field station since 1968.
- In 1971, Point Blue and USFWS began joint protection, monitoring, research, and management of the Refuge through a cooperative agreement.

50 YEARS 1965-2015 Point Blue℠ Conservation science for a healthy planet.℠ www.pointblue.org

Natural Resources

300,000 Breeding Seabirds
12 Species

Brandt's Cormorant

Ashy Storm-Petrel

Western Gull

Tufted Puffin

Common Murre

Pigeon Guillemot

Rhinoceros Auklet

Cassin's Auklet

Natural Resources

Five Species of Pinnipeds
~3,000 - 6,000 Animals

California Sea Lion

Harbor Seal

Steller Sea Lion

Northern Elephant Seal

Northern Fur Seal

Native Plant Community

- *Spergularia macrotheca* (Sticky sandspurry)
- *Lasthenia maratima (*Maritime goldfields)

Native Plant Community

- Most natives are annuals

Farallon Islands NWR- Invasive Plants

- Focal species

Scientific Name ITIS	Common Name
Chenopodium murale	nettle-leaf goosefoot, nettleleaf goosefoot
Coprosma repens	creeping mirrorplant
Ehrharta erecta	panic veldt grass, panic veldtgrass, erect veldtgrass
Malva arborea	tree mallow
Oxalis pes-caprae	African woodsorrel, Bermuda buttercup, buttercup oxalis
Plantago coronopus	Plantain
Rubus bifrons	Himalayan berry, Himalaya blackberry
Senecio vulgaris	old-man-in-the-spring, common groundsel
Sisymbrium orientale	Indian hedge-mustard
Tetragonia tetragonioides	New Zealand-spinach, New Zealand spinach

Holzman et al. 2016

Farallon Islands NWR- Invasive Plants

- Focal species groups

SPECIES GROUPS	Common name
Annual Grasses	
Avena fatua	wild oat, wild oats, flaxgrass, oatgrass, wheat oats
Avena barbata	slender oat, slender oats, slender wildoat
Bromus diandrus	ripgut brome
Hordeum murinum	mouse barley, bulbous barley
Vulpia bromoides	brome fescue
Rumex Species	
Rumex acetosella	sheep sorrel, field sorrel, red sorrel, common sheep sorrel
Rumex crispus	curly dock, narrowleaf dock, sour dock, yellow dock
Sonchus Species	
Sonchus asper	spiny sowthistle, prickly sow thistle, prickly sowthistle, , perennial sowthistle
Sonchus oleraceus	common sowthistle, sow-thistle, common sow-thistle, annual sowthistle, pualele, sow thistle
Malva Species	
Malva neglecta	buttonweed, cheeseplant, cheeseweed, common mallow, dwarf mallow, roundleaf mallow
Malva parviflora	small-whorl mallow, cheeseweed, cheeseweed mallow, little mallow

Holzman et al. 2016

Invasive Plants

Tetragonia tetragonioides (New Zealand spinach)

- Potential impacts to seabird crevice nesting habitat

New Zealand spinach

- Competes with natives
- Behaves perennially

New Zealand spinach

- Abundant seed bank

Malva species

- *M. neglecta and M. parviflora*

Plantago coronopus

- Competes with natives

Plantago coronopus

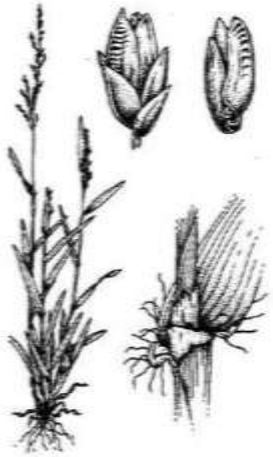
- Potential impacts to seabird burrow nesting habitat

Ehrharta erecta

- Recent invasion
- Potential to spread

BE ON THE LOOKOUT FOR THIS PLANT

Ehrharta grass or Veldt Grass (*Ehrharta erecta*)



Description: Stems: culms erect or ascending from a base along the ground, branching, 12-24 in (30-60 cm) tall. Leaves are flat blades 2-5 in (5-12 cm) long, 0.2-0.4 in (4-9 mm) wide. Inflorescence (grass flower): 2-6 in (6-15 cm) long, contracted to open panicle. Laterally compressed attached directed to flower stem or with small stalk, 0.1 in (3-3.5 mm), falling as one unit. Glumes 0.06-0.1 in (1.5-3 mm), about equal, longer than sterile florets. Three florets per spikelet, lower two sterile and without palea; upper floret fertile with palea. Sterile lemmas awnless, glabrous (Hickman 1993).

Ehrharta (Ehrharta erecta) is a perennial grass, with a crabgrass-like habit with decumbent as well as ascending jointed stems. The sterile lemmas of E. erecta are without awns. Ehrharta grass is a **very invasive** plant on SEFI. If you see it take care to remove it along with its roots.

Last seen: on South slope on trail to lighthouse. If you see this species please remove it and please report it to Refuge Manager.

Holzman et al. 2016

Annual grasses

- Concern over impacts but no resources to address at this time

Research and Monitoring

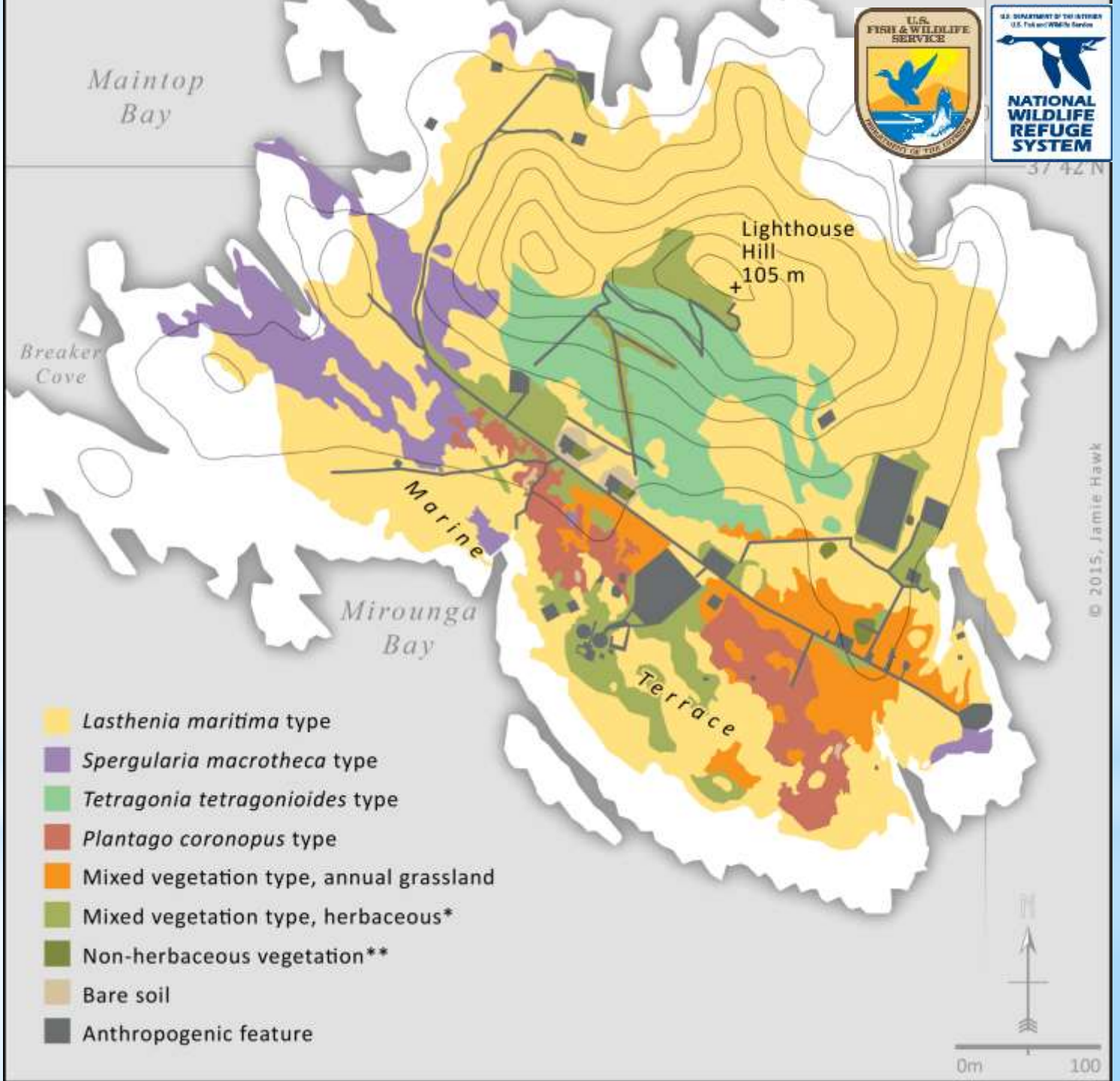
- 1972, Malcolm Coulter, first comprehensive plant inventory and monitoring, repeated with same methods until 2005. Did not effectively gauge trends.
- 2012, Barbara A. Holzman and Point Blue established vegetation monitoring plots to develop baseline data prior to a proposed mouse eradication.
- 2015, Jamie Hawk, San Francisco State University thesis showed high proportion of non-native (80%) and Cal-IPC ranked (25%) invasive plant species.
- 2016, Richard Chasey, (SFSU) Seed Bank Characterization showed native seeds in >92% of samples.
- 2016, Barbara A. Holzman and Quentin Clark (SFSU), Invasive Plant Inventory report and Clark et al. thesis 2017 (Modeling the Spatial Distribution of Invasive Plant Species.
- 2018 - Planning for the development of a protocol to detect changes in invasive and native plant composition and distribution over time, with Barbara A. Holzman, Santa Barbara Botanic Garden.

Research and Monitoring

- 2012-2014 Control plots

Research and Monitoring Products

- Reports, theses, and maps
- Hawk 2015



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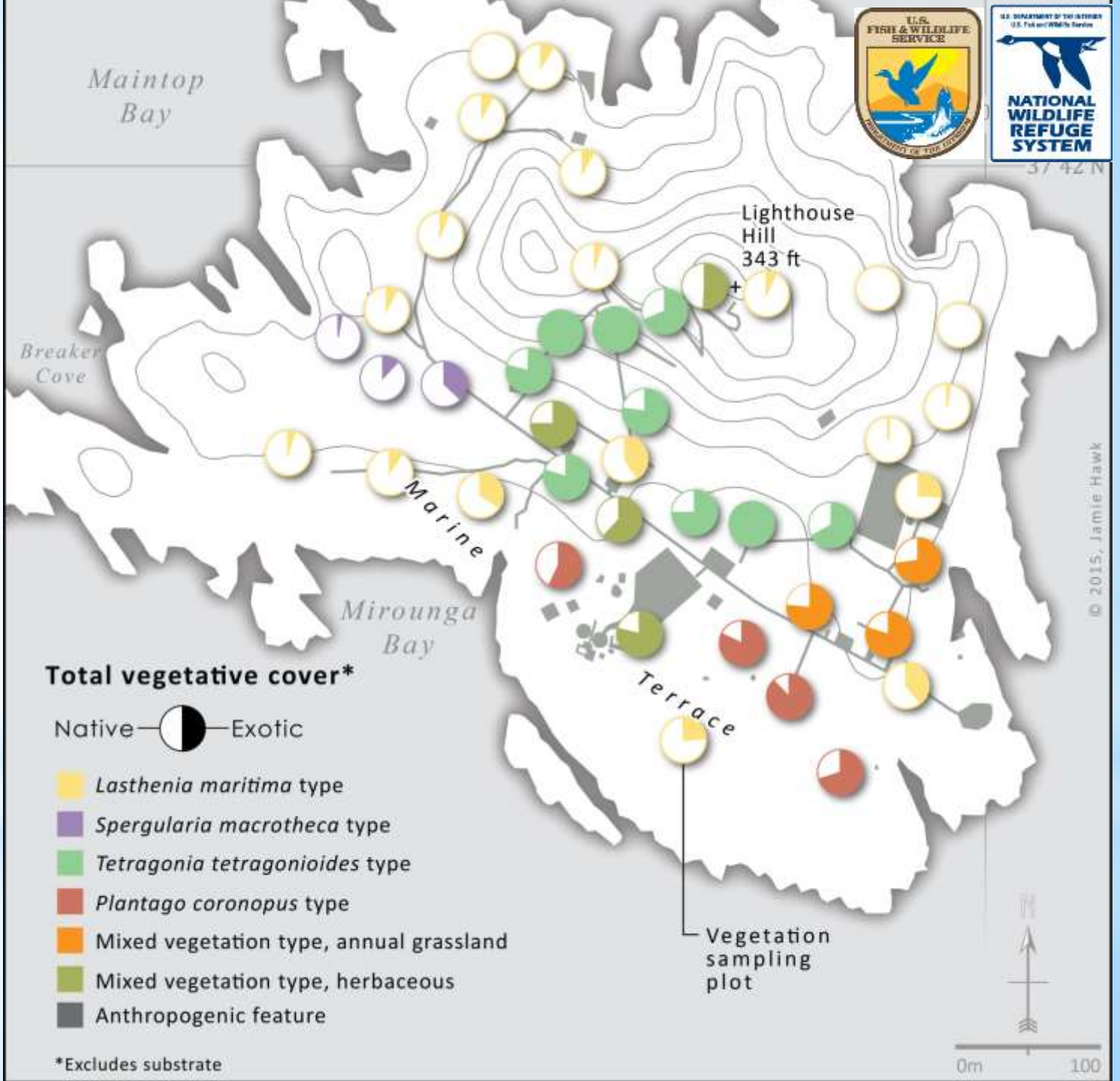
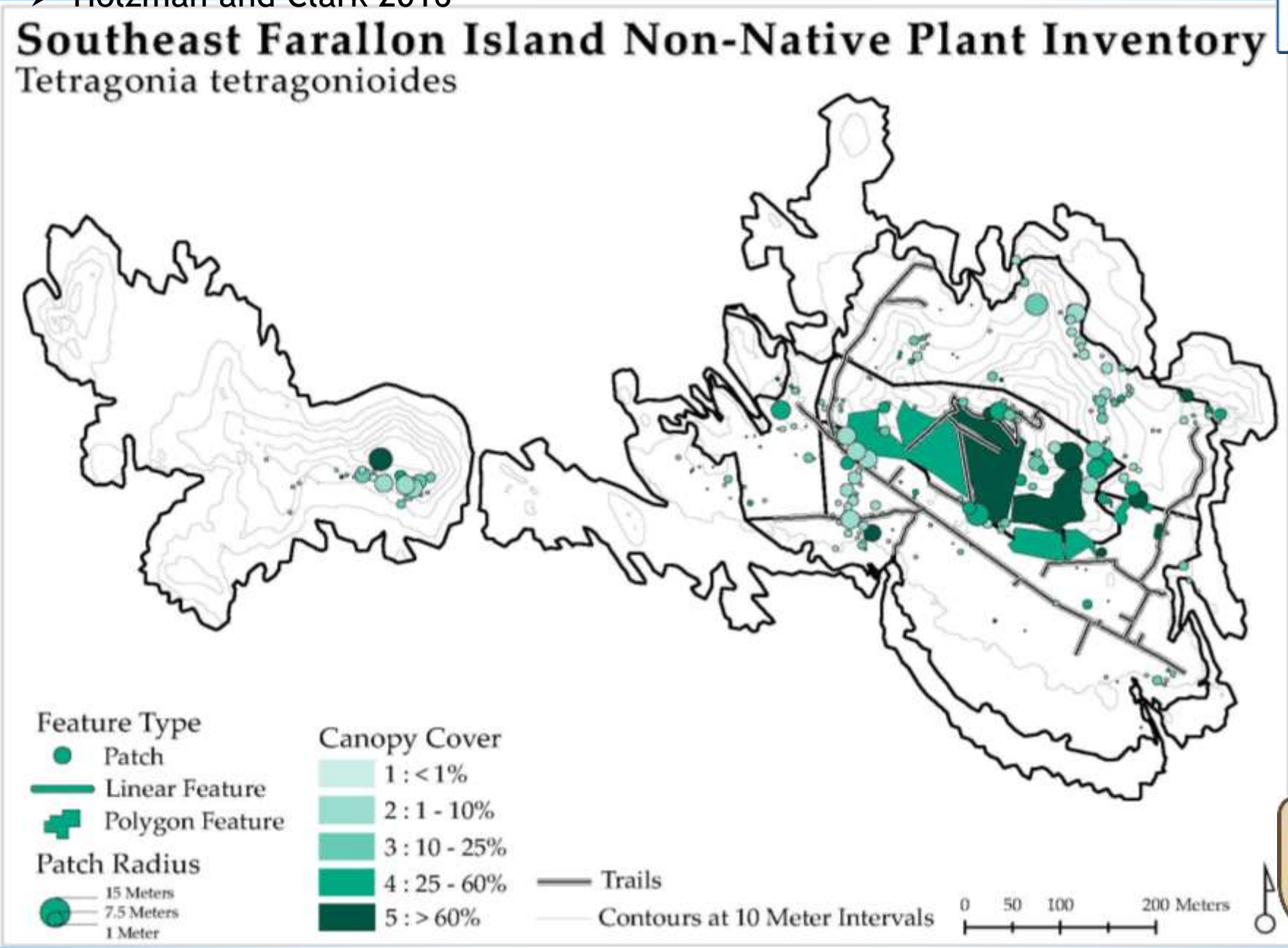


Research and Monitoring Products

- Holzman and Clark 2016



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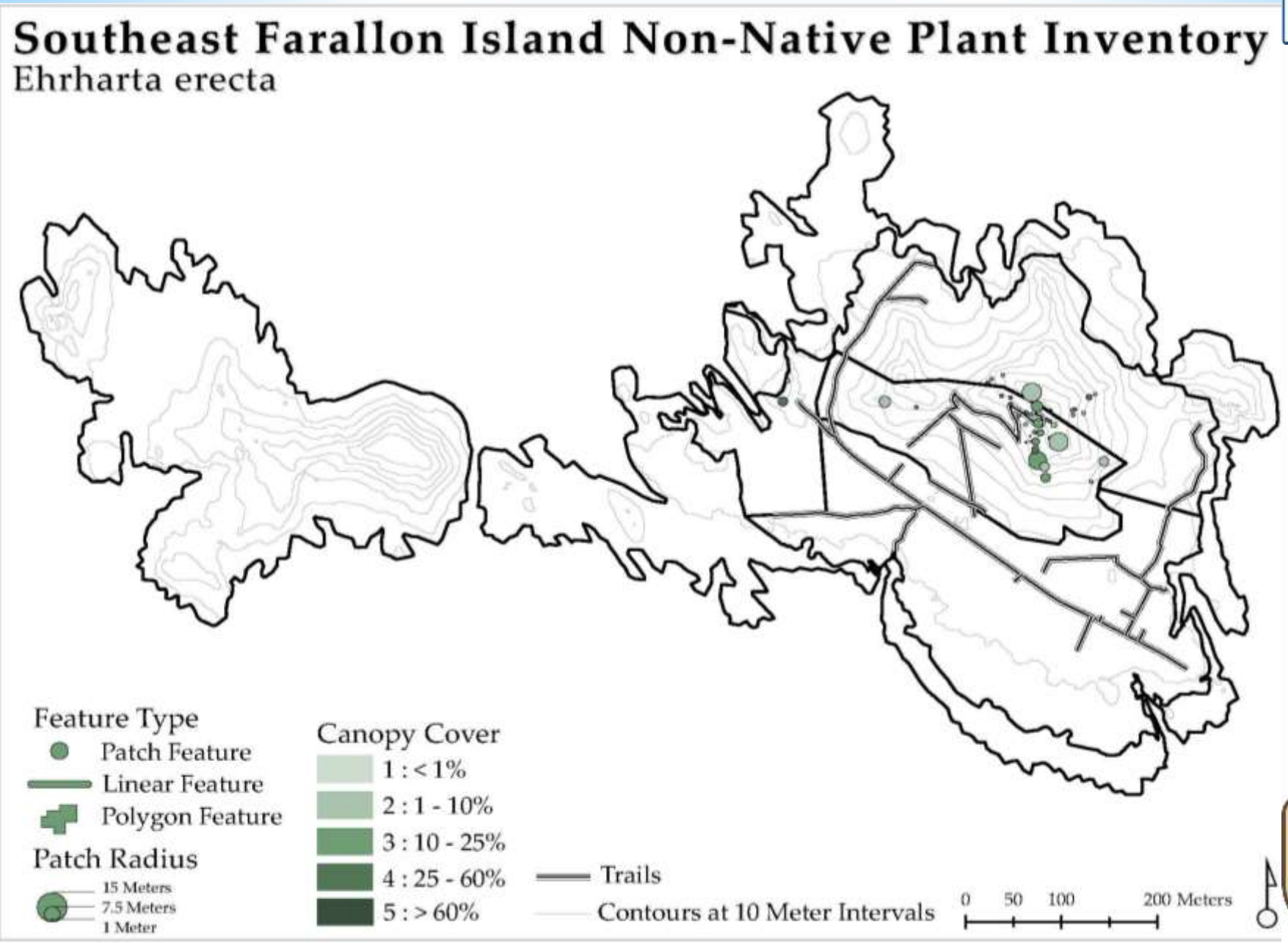

Invasive Plant Management

Herbicide Application

- Treat the entire island in ~8 days (weather and staffing permitted)
- Labor is mostly volunteers (~800 hours per year)

- 2-3 treatments per year
- Primary herbicide is glyphosate (RoundUp Custom)

Invasive Plant Management

Herbicide Application

- Steep terrain

Invasive Plant Management

Herbicide Application

- Extension wands for inaccessible plants

Invasive Plant Management

- Challenging logistics (supplies for the week)

Invasive Plant Management

- Preventing spread, boot brushes around island

Biosecurity and Prevention Plan

- 2013 Draft Biosecurity plan in Revised Draft Environmental Impact Statement for the South Farallon Islands Invasive House Mouse Eradication Project.

- Plan to incorporate plants and complete final version in 2018

BIOSECURITY MEASURES

PATHWAY	BIOSECURITY MEASURE
CARGO TRANSPORTED ON VESSELS OR HELICOPTERS (PRBO Farallon Patrol and charters; FWS charters and contractors; NOAA and NOAA charters; Special Use Permit or cooperator charters; fishing and sightseeing charters; U.S. Coast Guard or other military; Other not listed)	PRE-DEPARTURE QUARANTINE: a) Requirement for everyone coming ashore to reduce off-the-shelf packaging and re-pack in thoroughly cleaned rodent-proof containers. • All cargo must be in sealed duffel bags, suitcases or other sealed containers. • Bulky items that cannot be packed in containers, such as pipes or other items with hollow portions will need to be assessed, and if possible sealed to prevent rodent entry. b) Visually assess all cargo for signs of rodents or potential rodent entry points, especially containers of foodstuffs and large equipment before loading on to long-haul vessel or aircraft. • Recommend that all items loaded onto vessels or aircraft be self-inspected for holes, cracks or other signs of potential rodent entryways. • If any deficiency is found, cargo must be re-packed prior to arrival or it will not be permitted on the island.
CARGO TRANSPORTED ON VESSELS OR HELICOPTERS (PRBO Farallon Patrol and charters; FWS charters and	POST-ARRIVAL QUARANTINE: a) Visually assess all cargo as it is being loaded on to landing vessel or unloaded off of aircraft. • Island staff supervisor and/or assistant will visually assess all cargo to ascertain if it is packaged in required

Challenges

- Annual grasses
- Developing and implementing new techniques (technical climbing and herbicide ballistic technology)
- Facilities management
- Logistics on accessing an off-shore island
- Safety of personnel
- Invasive house mouse (proposed eradication project is controversial)
- Property transfer from U.S. Coast Guard (contaminants issues)

Acknowledgements and References

- Barbara A. Holzman, PhD
- San Francisco State University, Department of Geography & Environment
- Giselle Block, U.S. Fish and Wildlife Service, Inventory and Monitoring

- Hawk, J. and Holzman, B.A. 2015. Classification, Vegetation-Environment Relationships, and Distribution of Plant Communities on Southeast Farallon Island, California. MA thesis, San Francisco State University.
- Chasey, R.A. and Holzman, B.A. 2016. *Southeast Farallon Island Seed Bank Characterization*. MA Thesis. San Francisco State University.
- Holzman, B.A., Q.J. Clark, G.J. McChesney, and G. Block. Farallon Islands 2016 invasive plant inventory. Unpublished report, San Francisco State University, San Francisco, CA, and U.S. Fish and Wildlife Service, Fremont, CA.
- Clark, Q.J., B.A. Holzman, E. Hines. 2017. Modeling the Spatial Distribution of Invasive Plant Species on Southeast Farallon Island. MA. Thesis, San Francisco State University.

- Too many volunteers to name!

THANK YOU!!! Questions?

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