Seascape photography: use of aerial remote sensing to quantify landscape-scale patterns of eelgrass (*Zostera marina*) in Halifax Harbour

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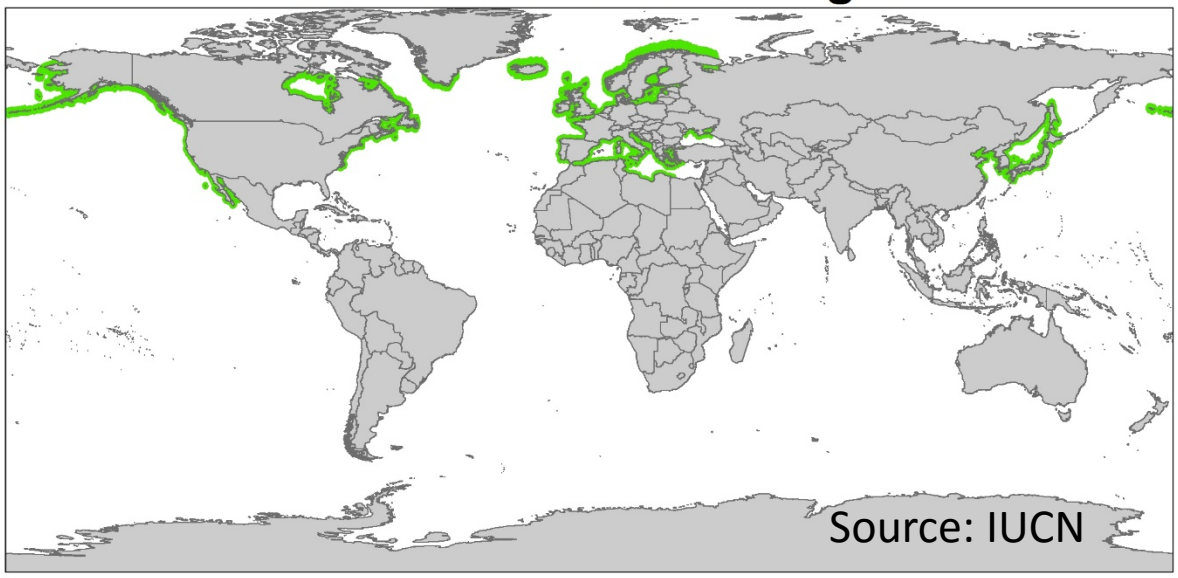
Global Distribution of Eelgrass



- Eelgrass (*Zostera marina*): widespread in Atlantic Canada
- Rooted flowering plant
- Moved from land -> sea ~100 million years ago
- Both clonal & sexual reproduction
- Perennial/annual forms

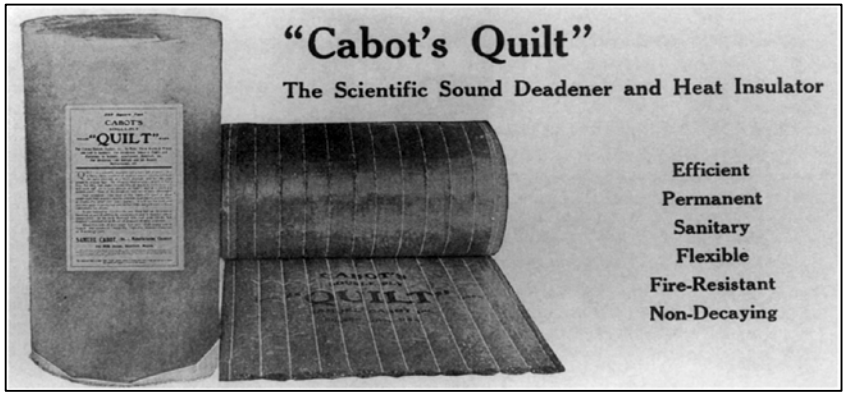
Why is it important?

"Ecosystem engineer"

- Primary production
- Food web
- Habitat
- Alters currents
- Sediments/erosion
- Nutrient cycling
- Ecosystem services

In Nova Scotia:

- Harvested along South Shore NS for insulation, sound-deadening
- Exported to Boston: >400t/year in 1920s
- Later produced as “Seafelt” until early 1960s in Sable River, NS
- Used in Radio City Music Hall, Rockefeller Center in NYC



Sensitivity and Threats

- Decline in distribution
  - Coastal development
  - Eutrophication, pollution
  - Climate change
  - Invasive species (e.g. green crab)
  - Disease
- Management*
  - Ecosystem health indicator
  - Monitoring
  - Prediction
  - Habitat restoration

***Need to know where it occurs!**

A Global Crisis for Seagrass Ecosystems

ROBERT J. ORTH, TIM J. B. CARRUTHERS, WILLIAM C. DENNISON, CARLOS M. DUARTE, JAMES W. FOURQUREAN, KENNETH L. HECK JR., A. RANDALL HUGHES, GARY A. KENDRICK, W. JUDSON KENWORTHY, SUZANNE OLYARNIK, FREDERICK T. SHORT, MICHELLE WAYCOTT, AND SUSAN L. WILLIAMS

Fisheries and Oceans Canada / Pêches et Océans Canada
Science / Sciences
Gulf Region
Canadian Science Advisory Secretariat
Science Advisory Report 2009/018

DOES EELGRASS (*Zostera marina*) MEET THE CRITERIA AS AN ECOLOGICALLY SIGNIFICANT SPECIES?

Associations of concern: declining seagrasses and threatened dependent species

A Randall Hughes[1,2*], Susan L Williams[1], Carlos M Duarte[3], Kenneth L Heck Jr[4], and Michelle Waycott[5]

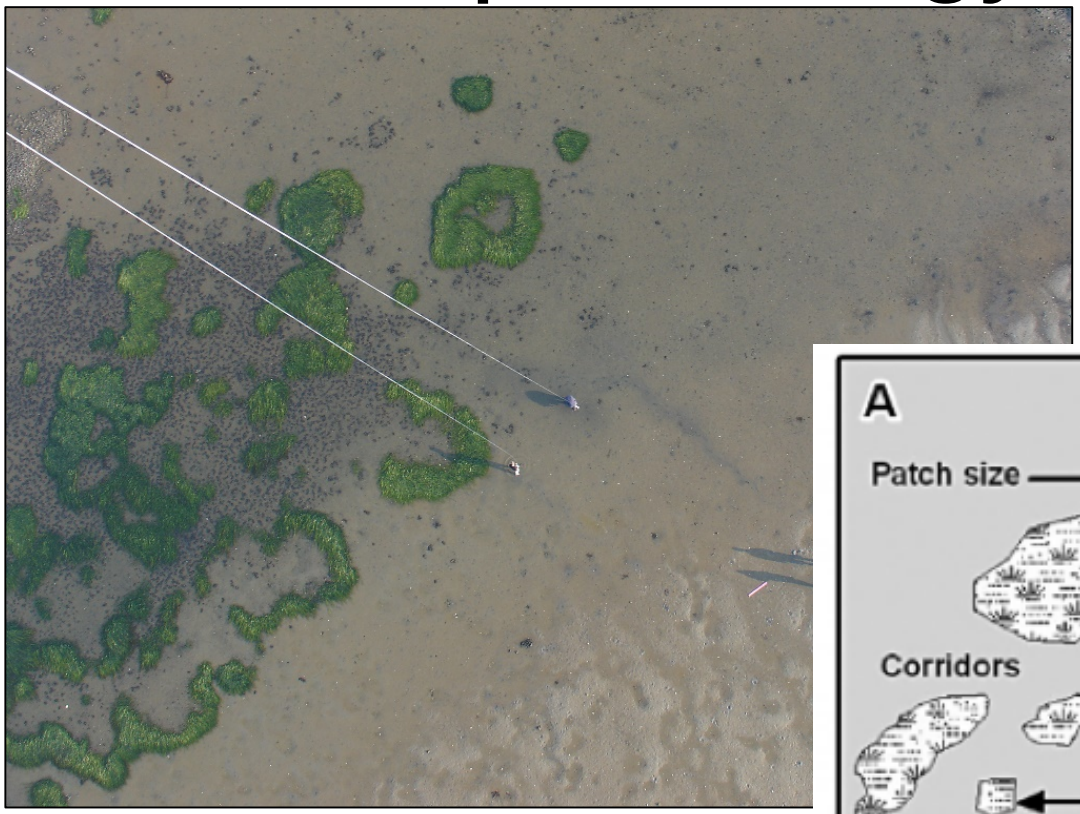
Accelerating loss of seagrasses across the globe threatens coastal ecosystems

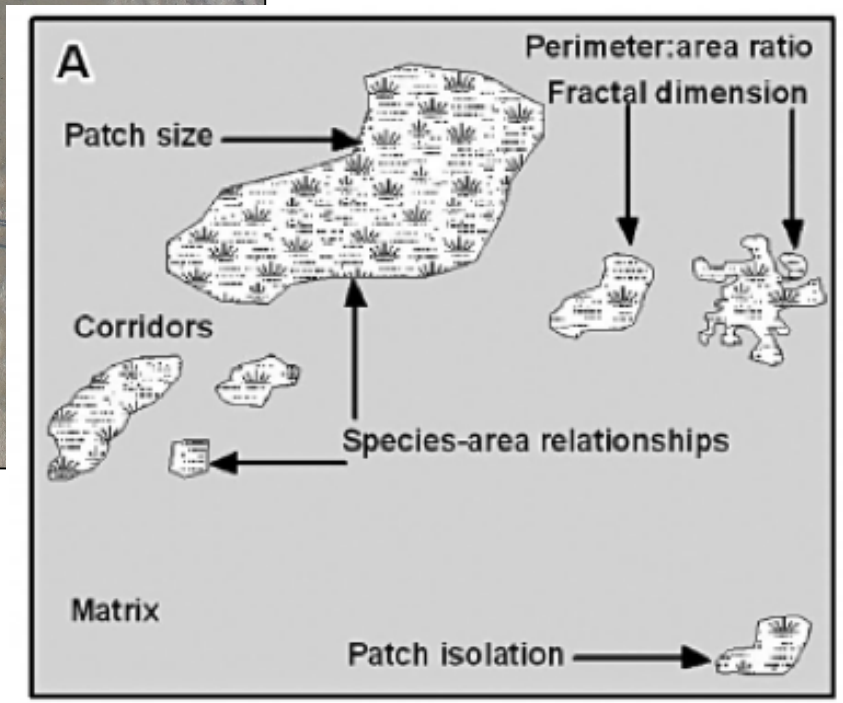
Michelle Waycott[a,1], Carlos M. Duarte[b], Tim J. B. Carruthers[c], Robert J. Orth[d], William C. Dennison[c], Suzanne Olyarnik[e], Ainsley Calladine[a], James W. Fourqurean[f], Kenneth L. Heck, Jr.[g,h], A. Randall Hughes[e], Gary A. Kendrick[i], W. Judson Kenworthy[j], Frederick T. Short[k], and Susan L. Williams[e]

Extinction risk assessment of the world's seagrass species

Frederick T. Short[a,*], Beth Polidoro[b], Suzanne R. Livingstone[b,1], Kent E. Carpenter[b], Salomão Bandeira[c], Japar Sidik Bujang[d], Hilconida P. Calumpong[e], Tim J.B. Carruthers[f], Robert G. Coles[g], William C. Dennison[f], Paul L.A. Erftemeijer[h], Miguel D. Fortes[i], Aaren S. Freeman[a,2], T.G. Jagtap[j], Abu Hena M. Kamal[k,3], Gary A. Kendrick[l], W. Judson Kenworthy[m], Yayu A. La Nafie[n], Ichwan M. Nasution[o], Robert J. Orth[p], Anchana Prathep[q], Jonnell C. Sanciangco[b], Brigitta van Tussenbroek[r], Sheila G. Vergara[s], Michelle Waycott[t], Joseph C. Zieman[u]

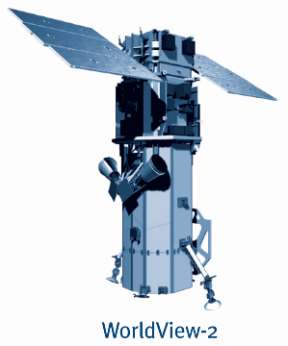
Landscape ecology

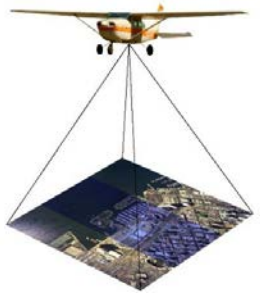




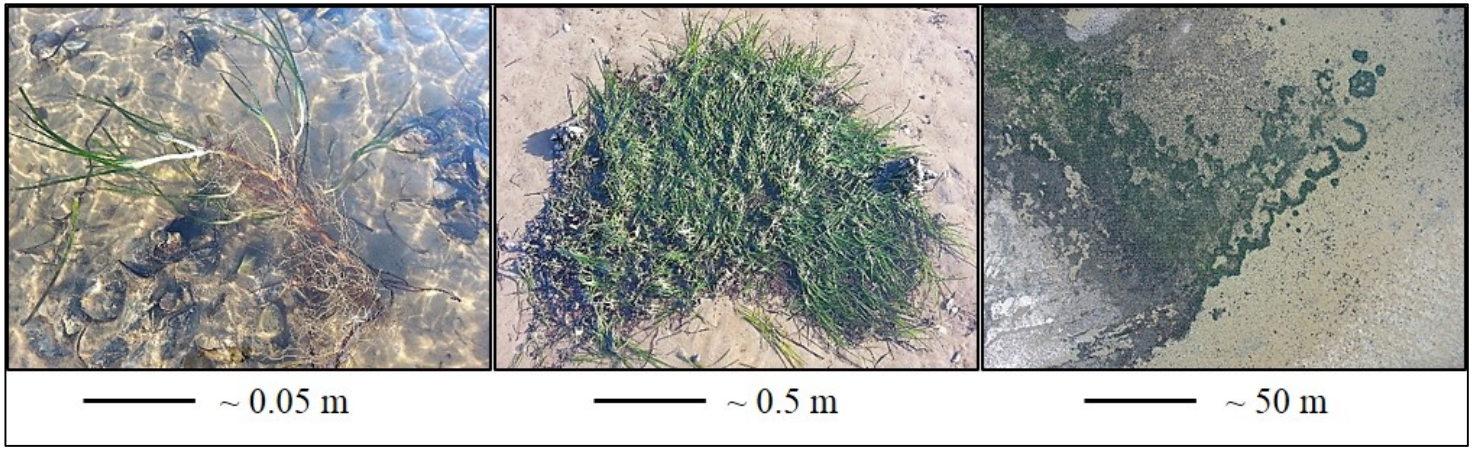
Wedding et al. 2011

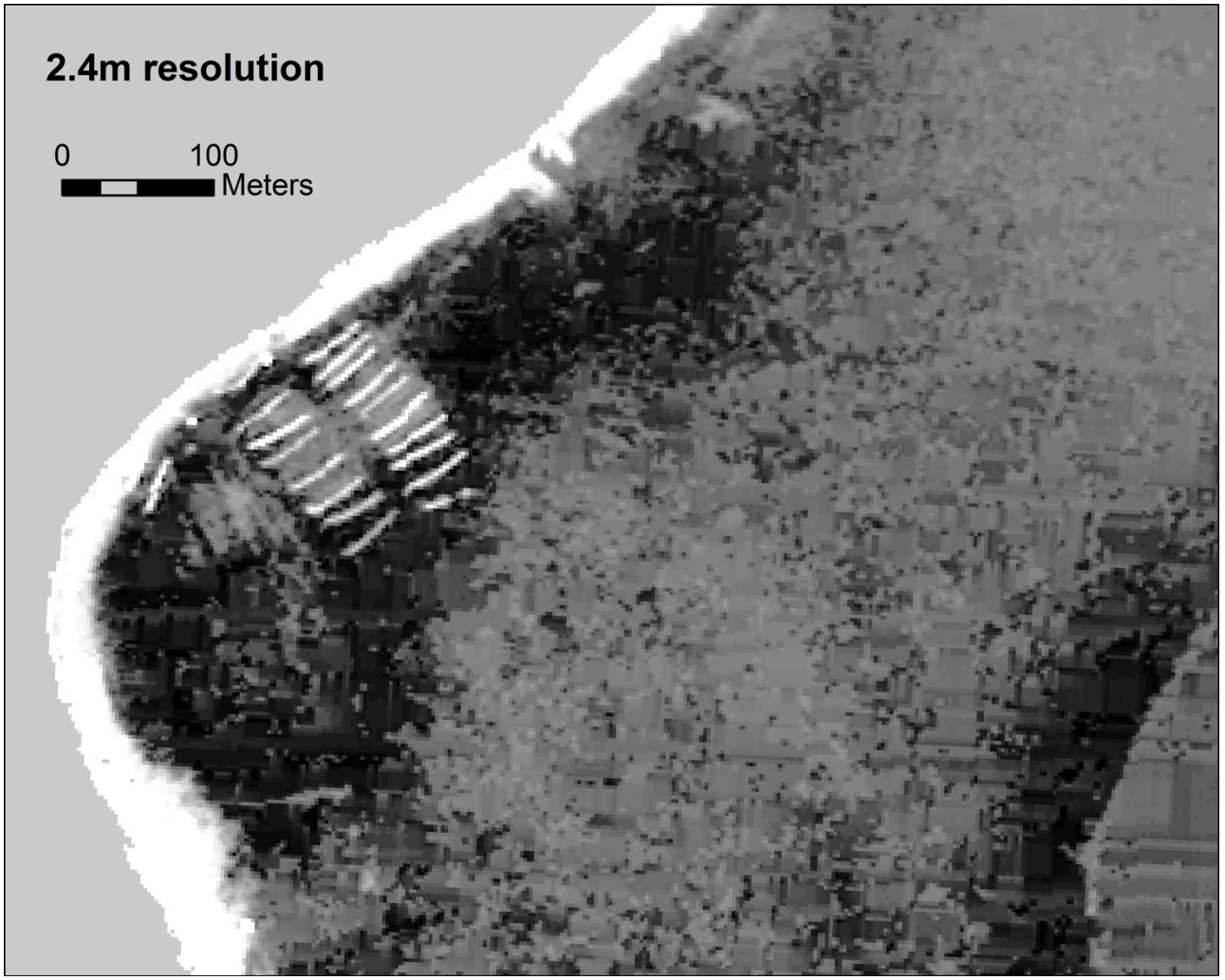
Zostera “landscapes”

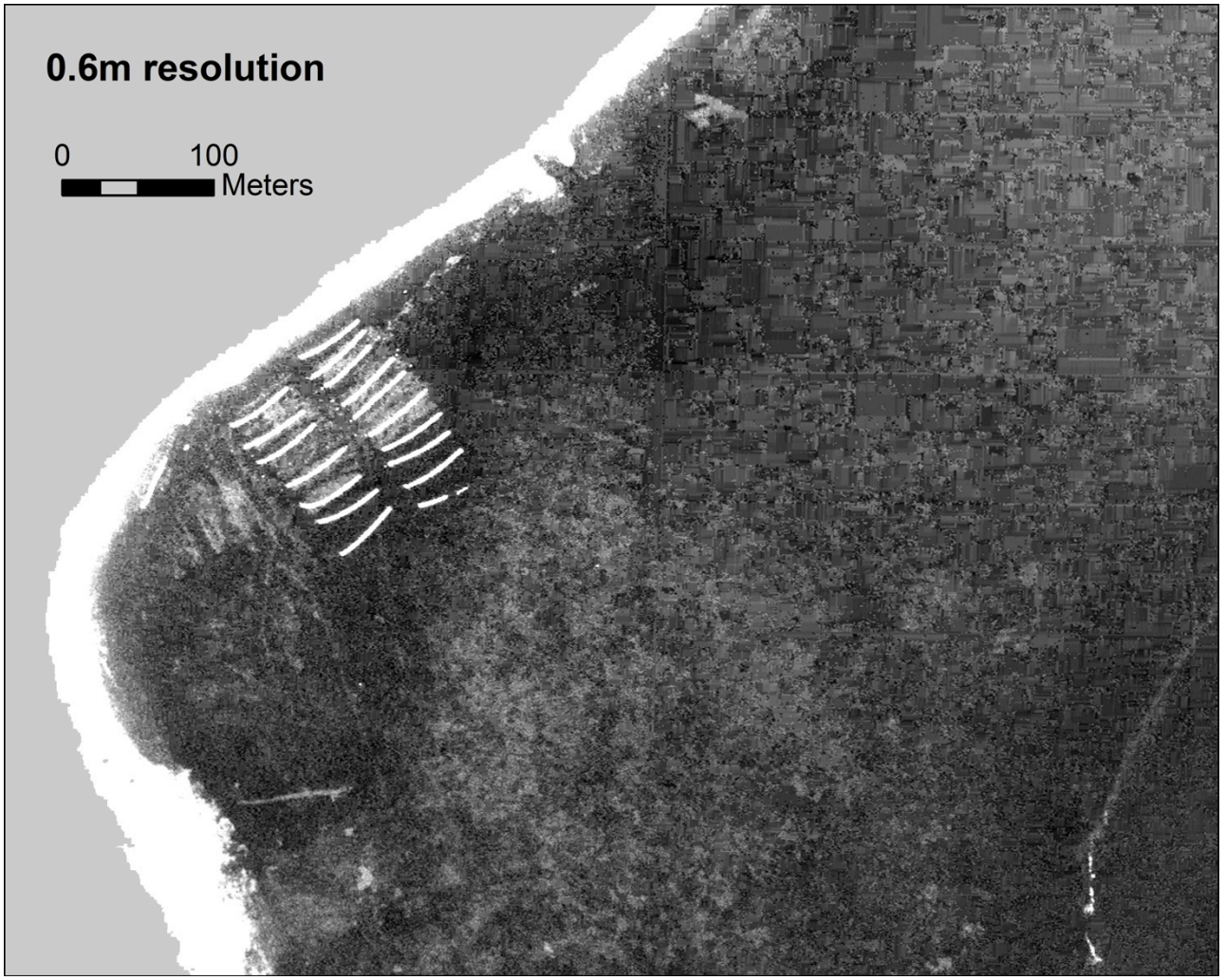




- Multi-scale hierarchical spatial structure
  - Landscape ecology models
  - Shoot < Patch < Landscape
  - Characterize & quantify landscape structure
- Difficulty of collecting fine-scale, broad-extent data
  - Direct sampling?
  - Remote sensing?
  - Remote sensing?




2.4m resolution
0
100
Meters


0.6m resolution
0
100
Meters

- *“Landscape photography is the supreme test of the photographer – and often the supreme disappointment.”* – Ansel Adams

Birds on a Beach – Ansel Adams

Seascape

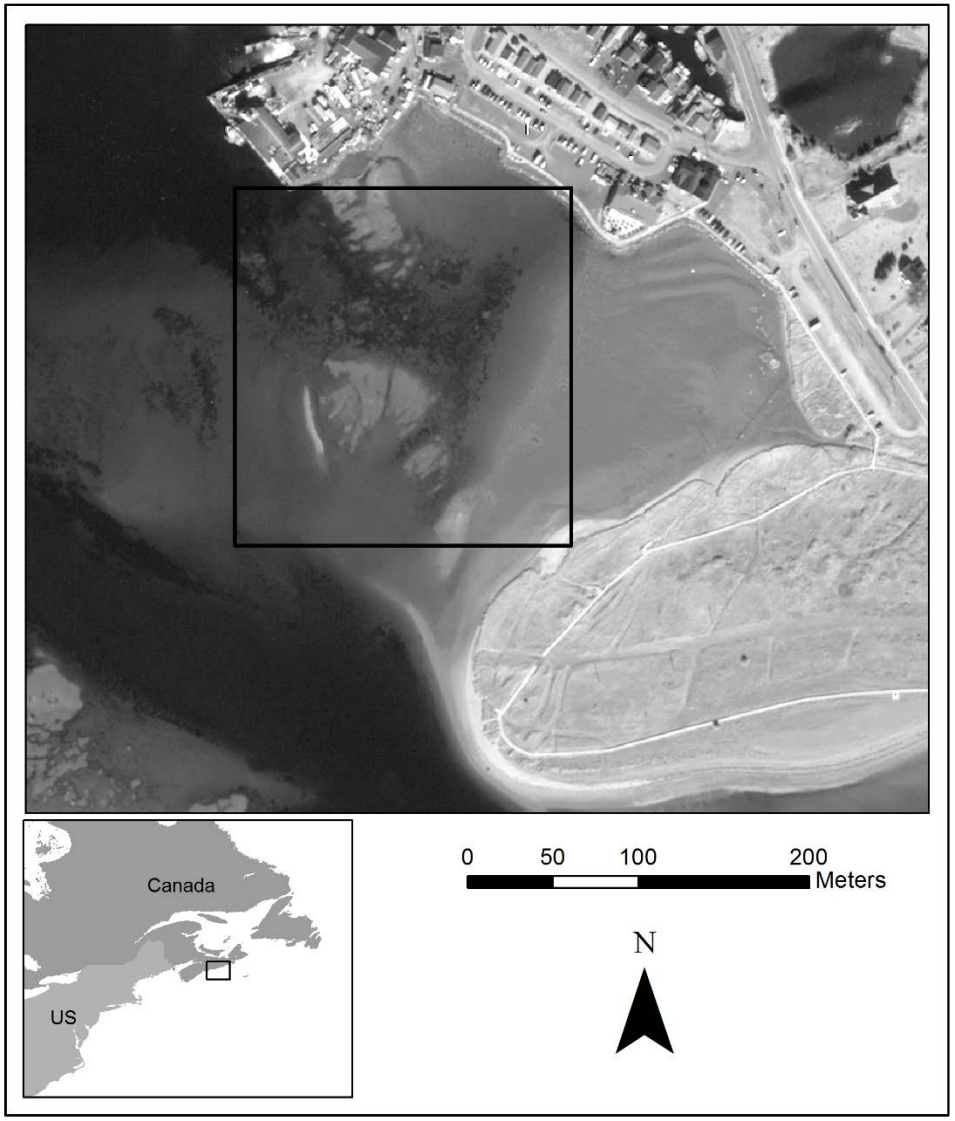
- *"~~Landscape~~ photography is the supreme test of the photographer – and often the supreme disappointment."* – Ansel Adams

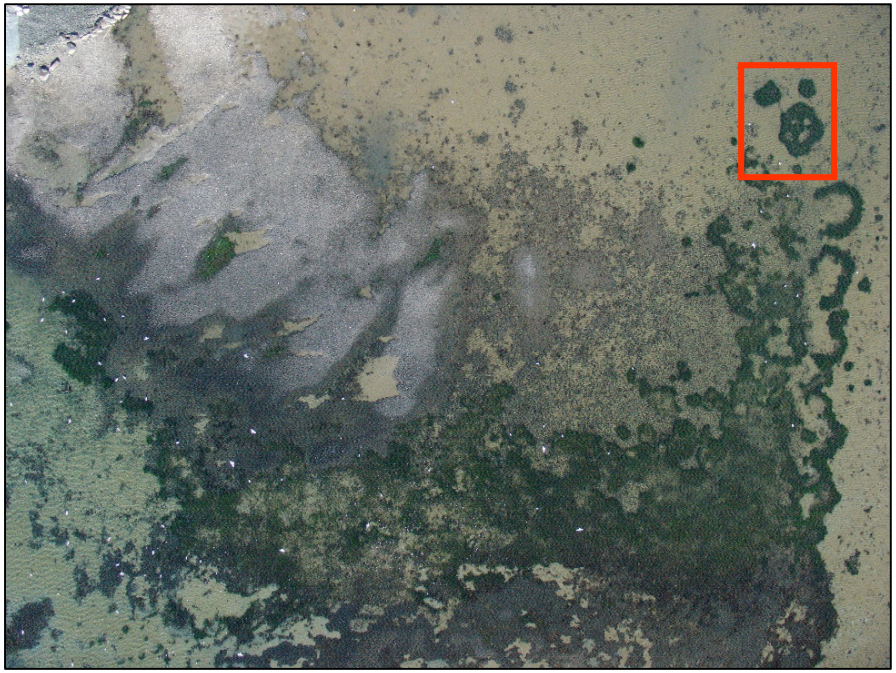
Birds on a Beach – Ansel Adams

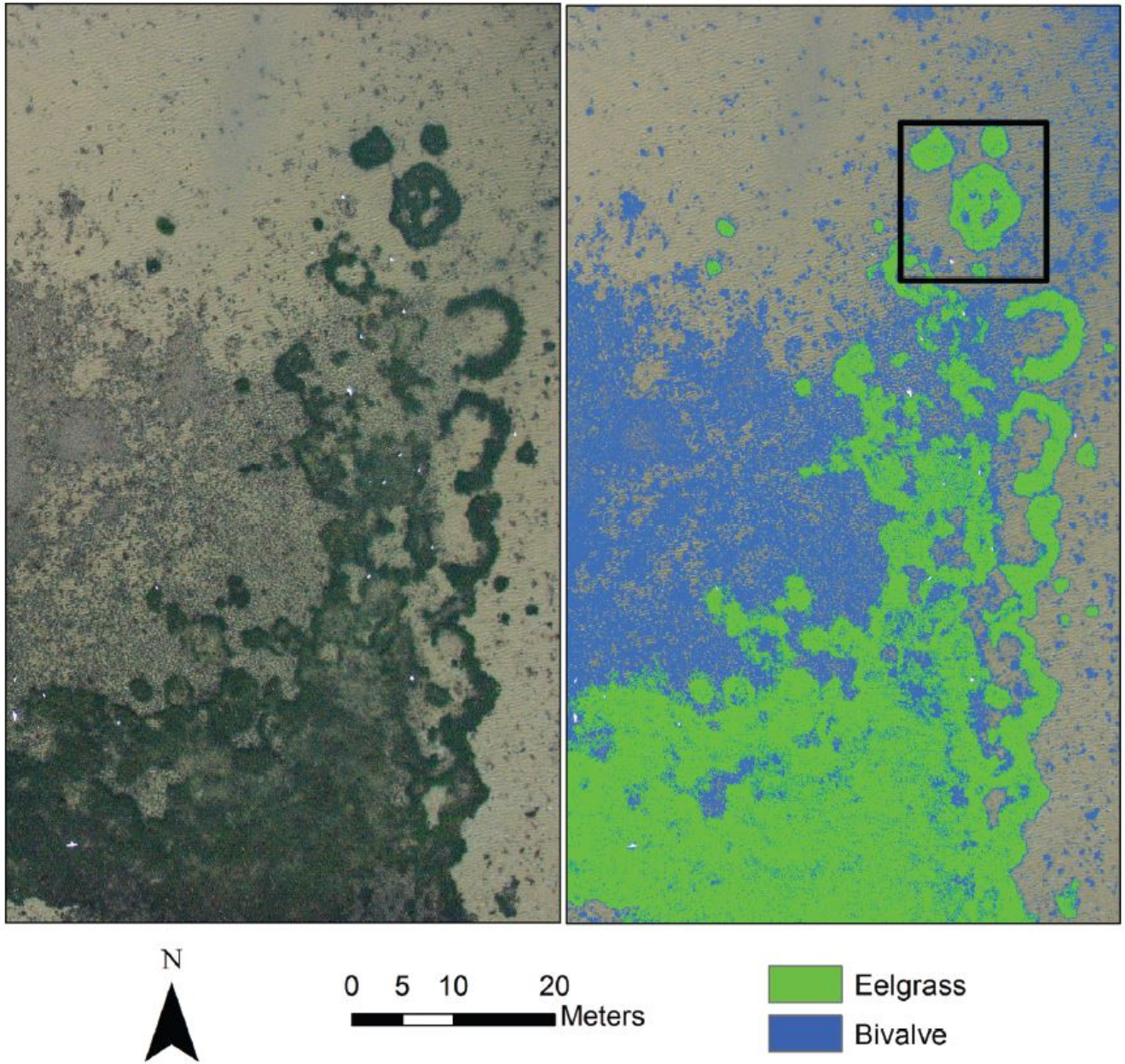
Aerial photography: DalBlimp

Case Study: Eastern Passage, NS

- McCormacks Beach
- Shallow subtidal eelgrass/mussel landscape







Landscape:

27.9% Eelgrass
29 patches

25.1% Bivalve
29,000 patches

47% Sediments

Figure 2. Map showing the raw unclassified imagery (*left*) with classified bivalve and eelgrass patches superimposed (*right*). The area of interest for patch-scale analysis is outlined at right. The spatial resolution of the imagery is 0.045 m.

Barrell & Grant 2015

Patch-level landscape metrics

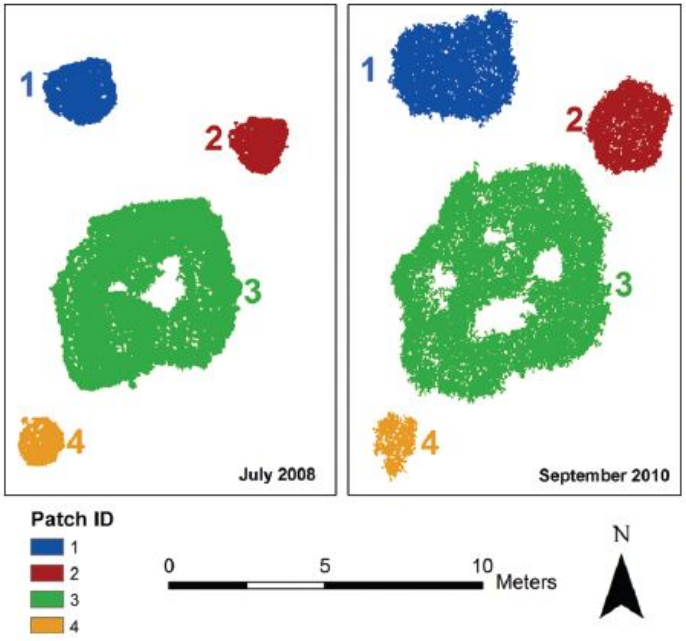
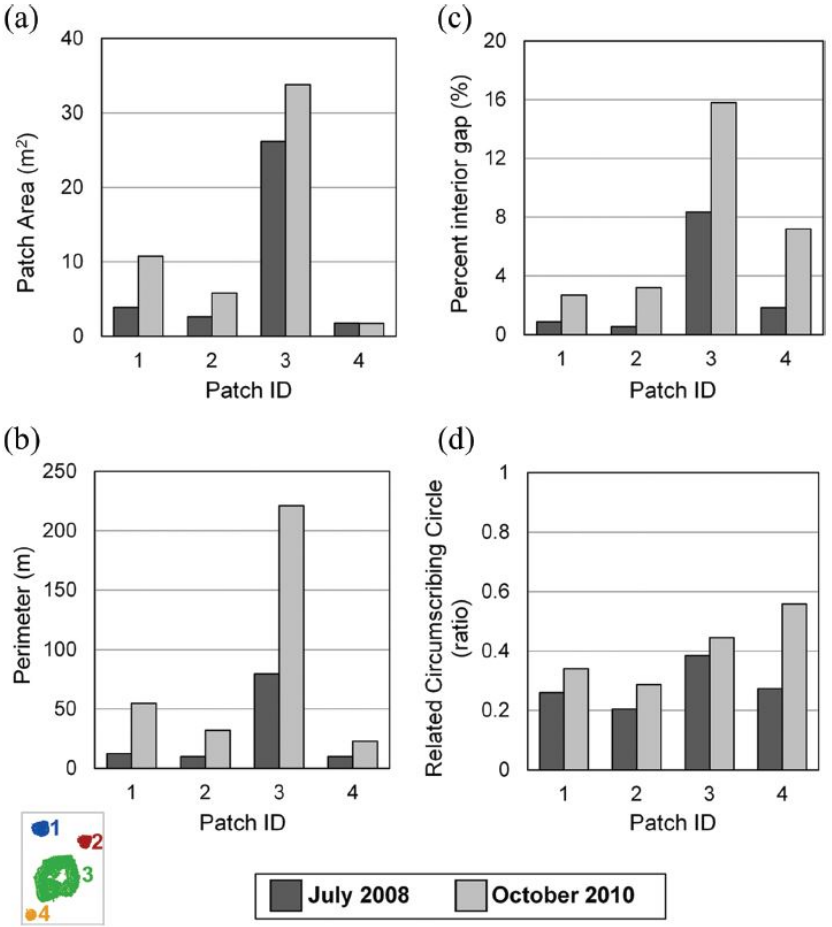
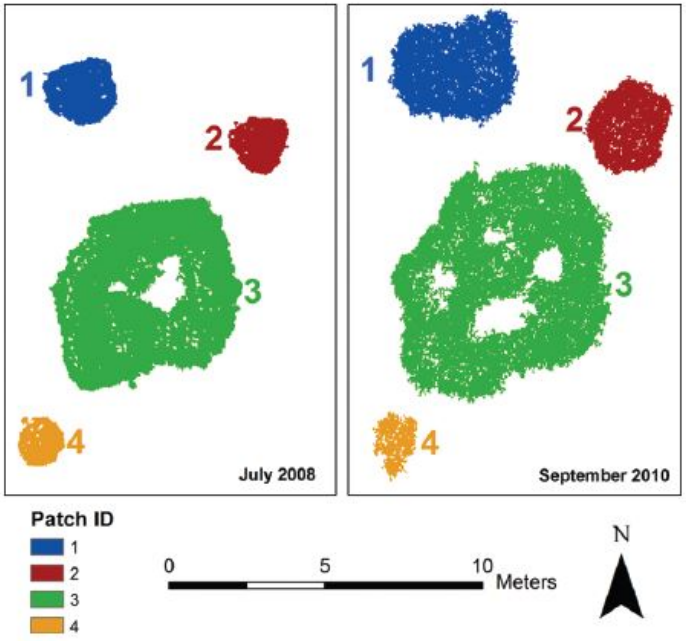


Figure 3. Depiction of the temporal change in four selected patches from imagery collected on 8 July 2008 (*left*) to 20 September 2010 (*right*). The spatial resolution (i.e. pixel edge length) of the 2008 and 2010 images are 0.0353 m and 0.0368 m, respectively.



Barrell & Grant 2015

Patch-level landscape metrics



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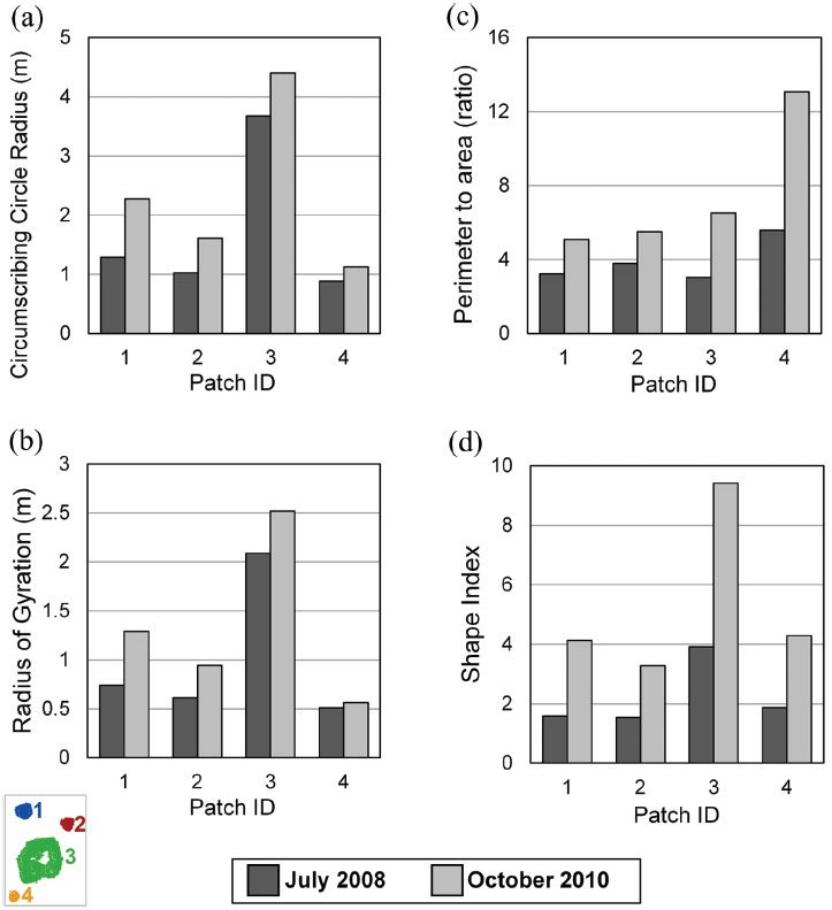
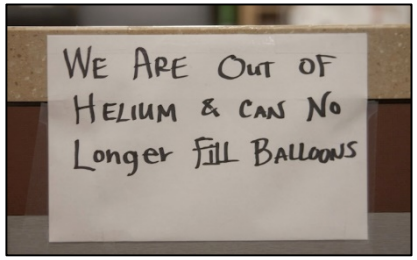
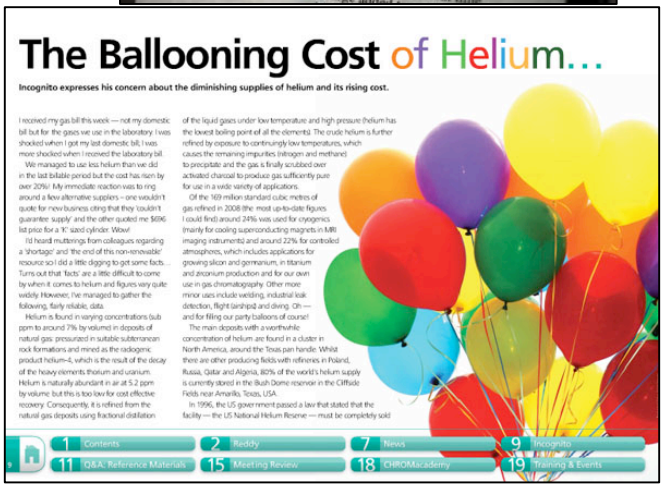
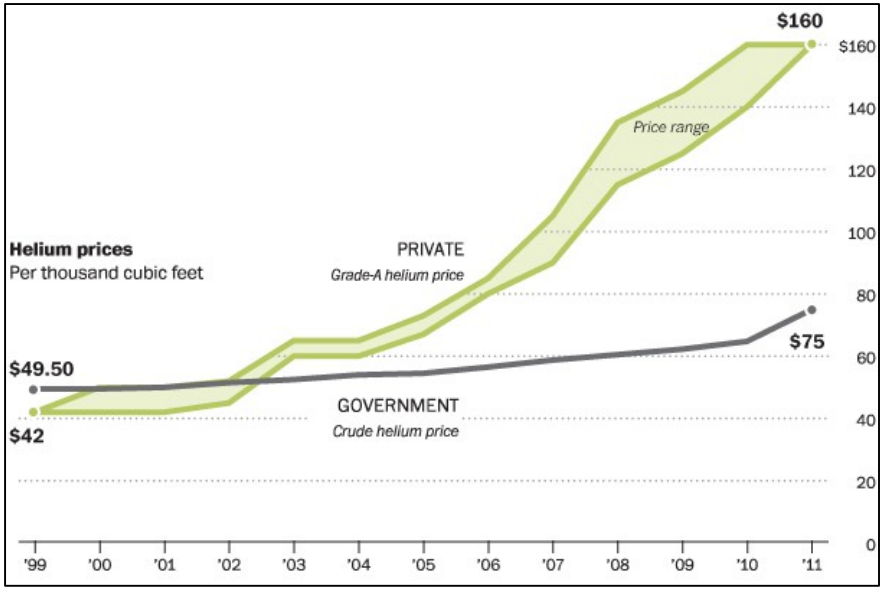


Barrell & Grant 2015

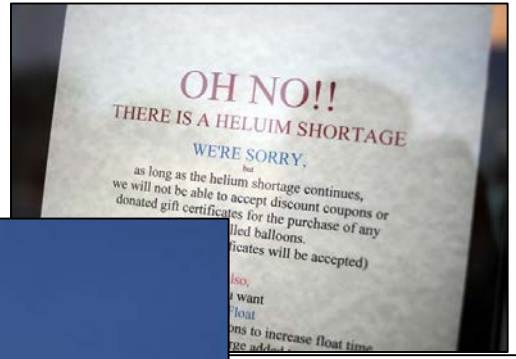
Helium shortage = rising prices

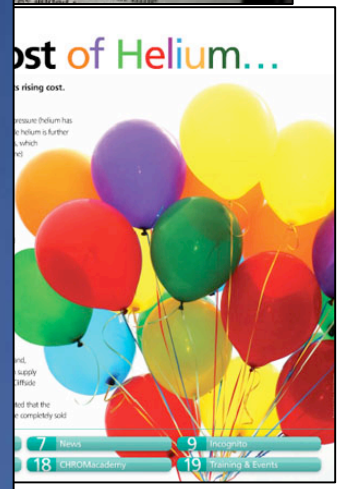






Helium shortage = rising prices





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Resources: Stop squandering helium

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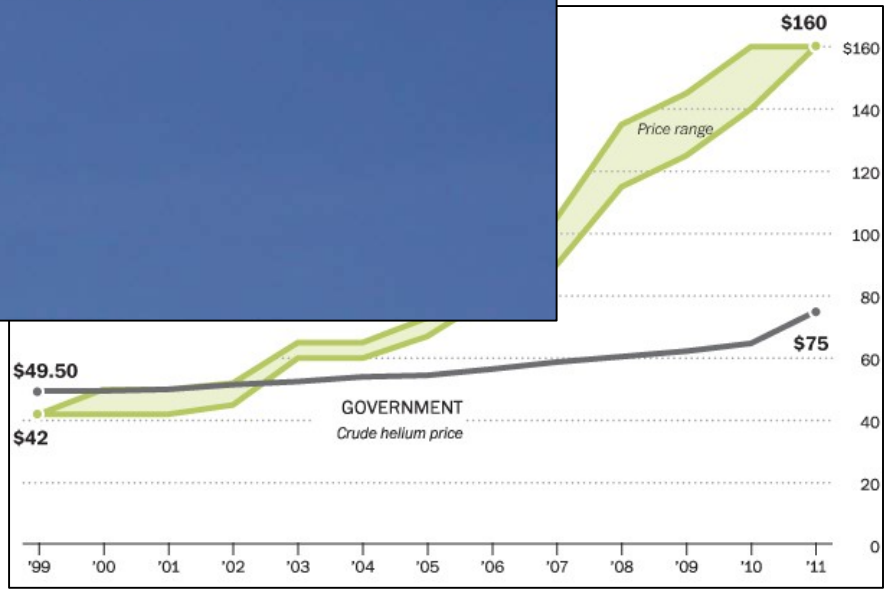

Thanks!

Questions?

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