

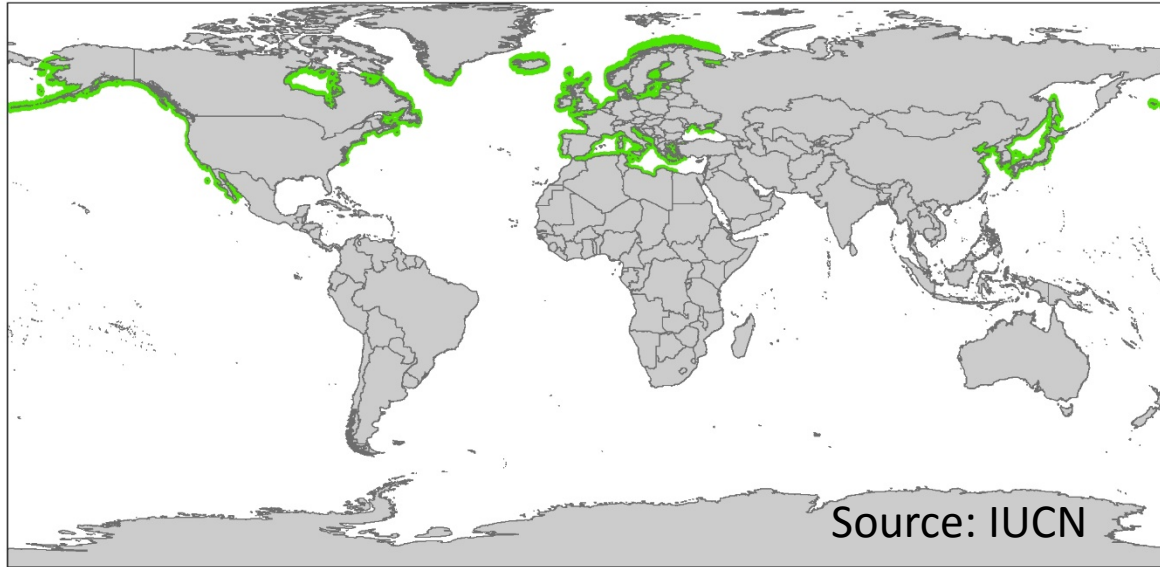
# Seascape photography: use of aerial remote sensing to quantify landscape-scale patterns of eelgrass (*Zostera marina*) in Halifax Harbour

Jeff Barrell  
Dept. of Oceanography  
Dalhousie University  
[jeffbarrell@dal.ca](mailto:jeffbarrell@dal.ca)



DALHOUSIE  
UNIVERSITY

## 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

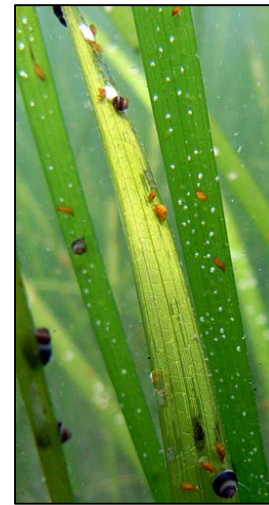




# Why is it important?

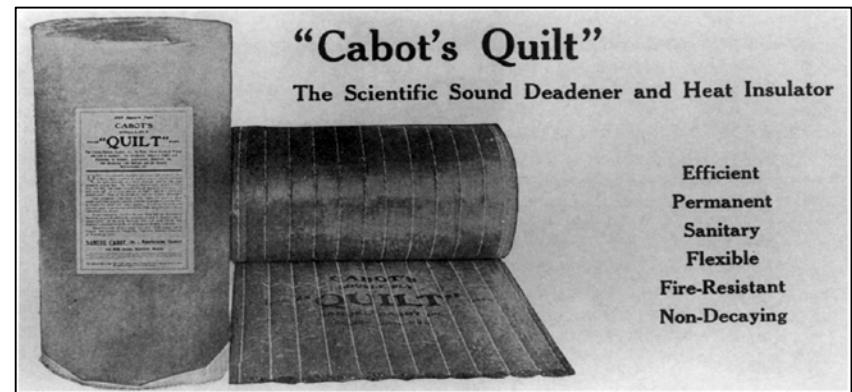
## “Ecosystem engineer”

- 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<sup>1,2\*</sup>, Susan L Williams<sup>1</sup>, Carlos M Duarte<sup>3</sup>, Kenneth L Heck Jr<sup>4</sup>, and Michelle Waycott<sup>5</sup>

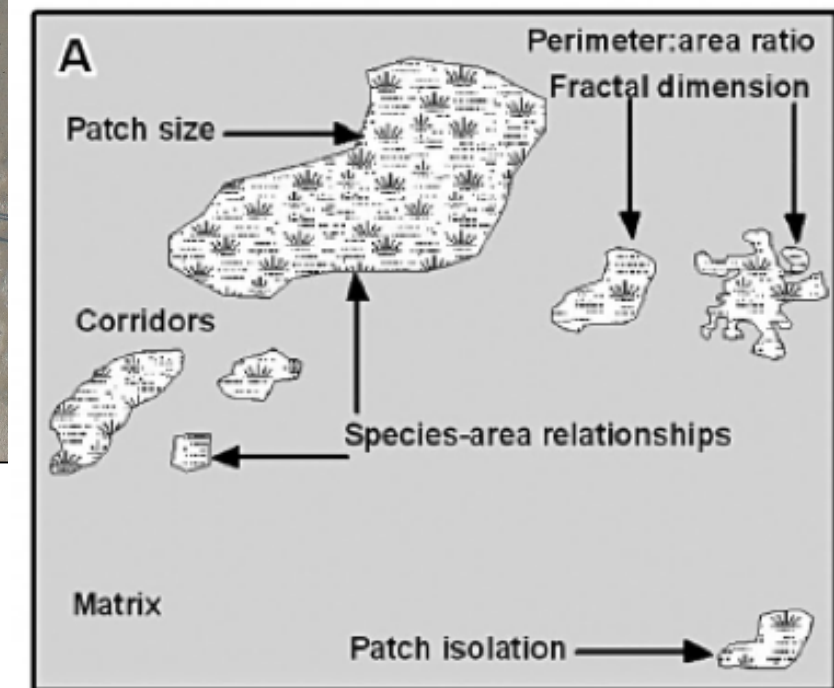
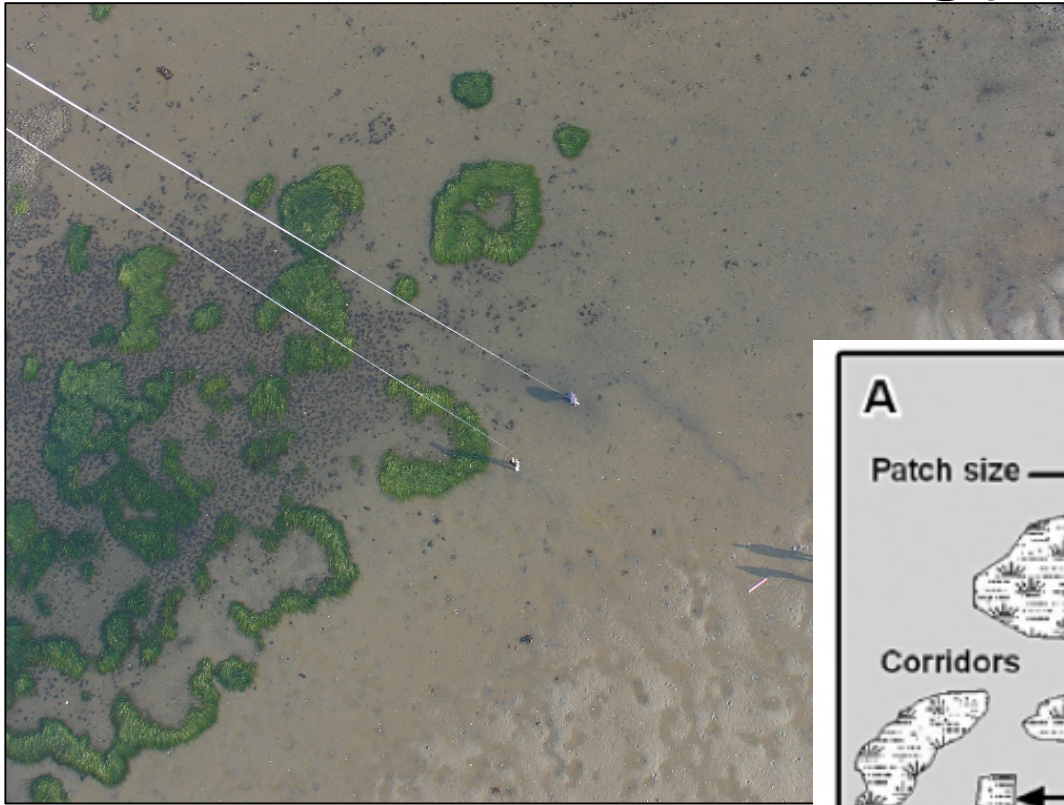
## Accelerating loss of seagrasses across the globe threatens coastal ecosystems

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

## Extinction risk assessment of the world's seagrass species

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

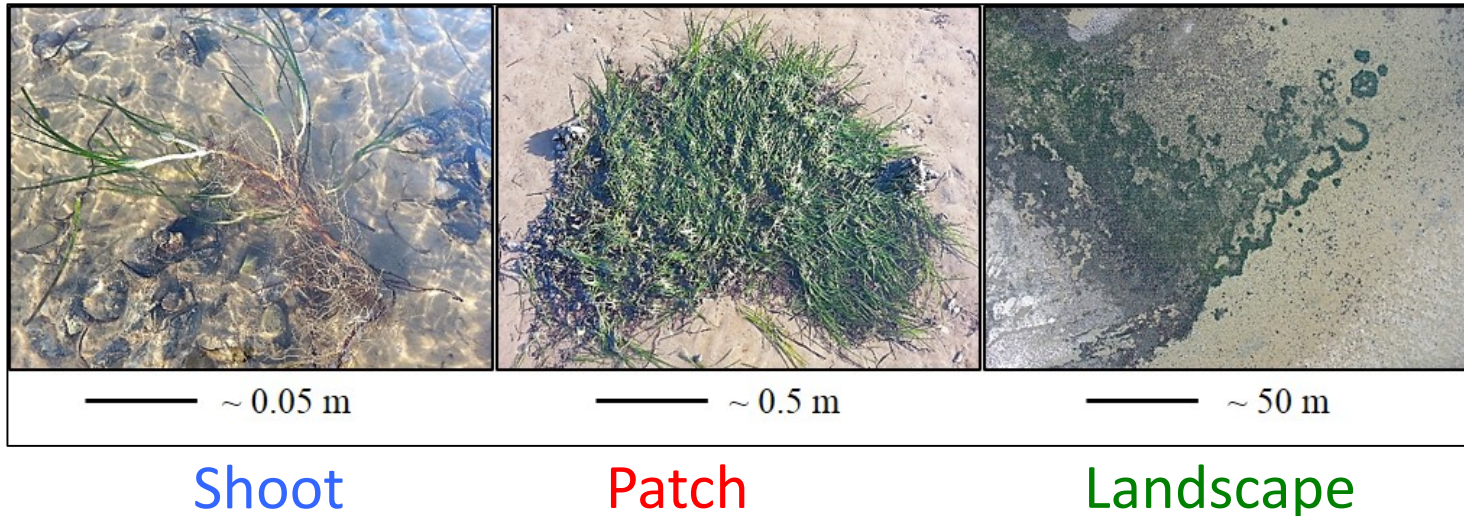
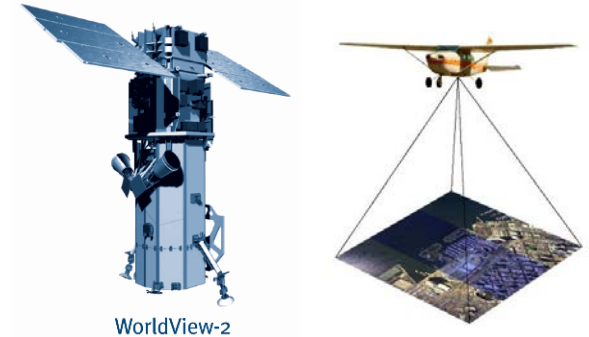
# Landscape ecology



Wedding et al. 2011

# *Zostera* “landscapes”

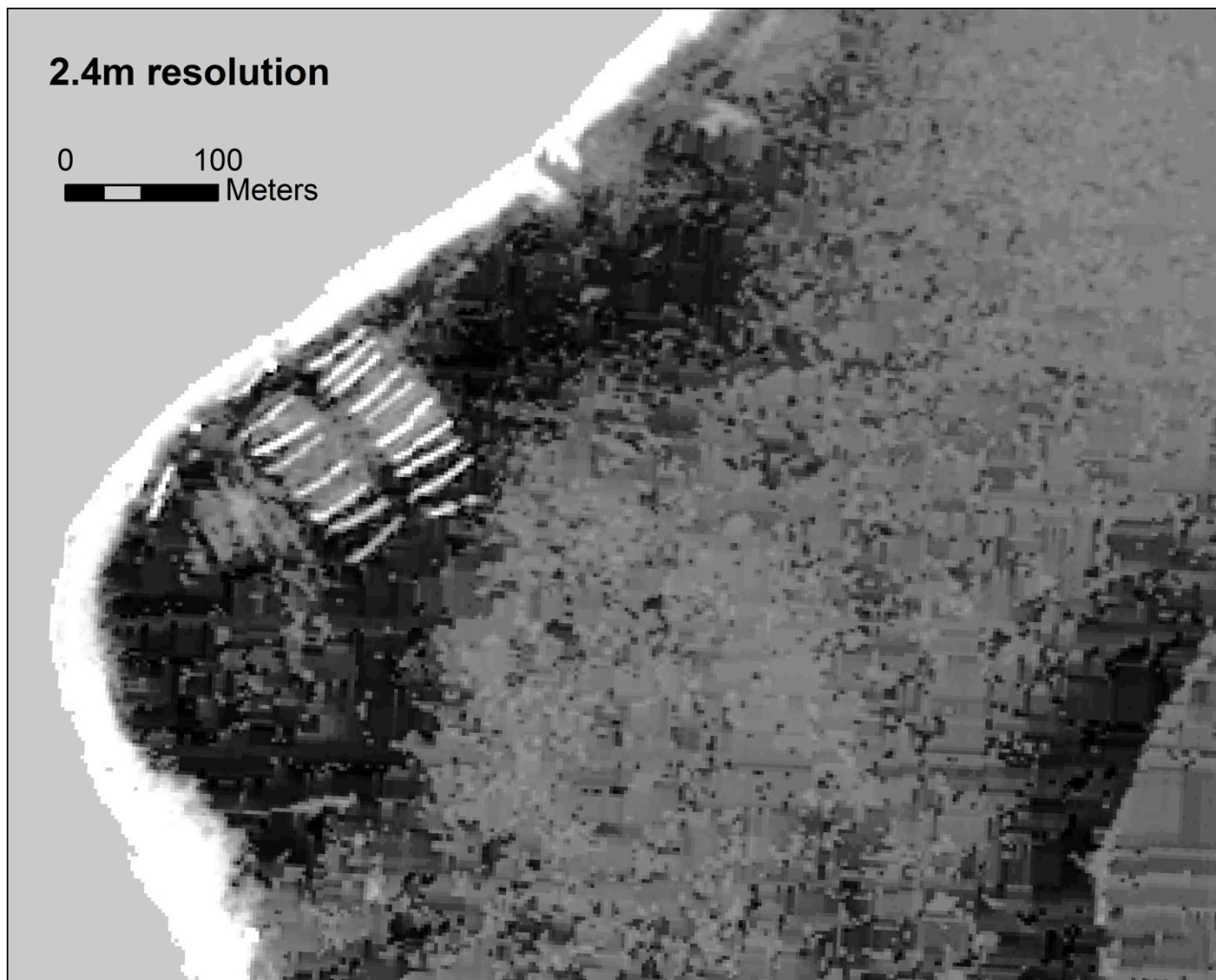
- Multi-scale hierarchical spatial structure
  - Landscape ecology models
  - Shoot < Patch < Landscape
  - Characterize & quantify landscape structure
- Difficulty of collecting fine-scale, broad-extent data
  - Direct sampling?
  - Remote sensing?
  - Remote sensing?





**2.4m resolution**

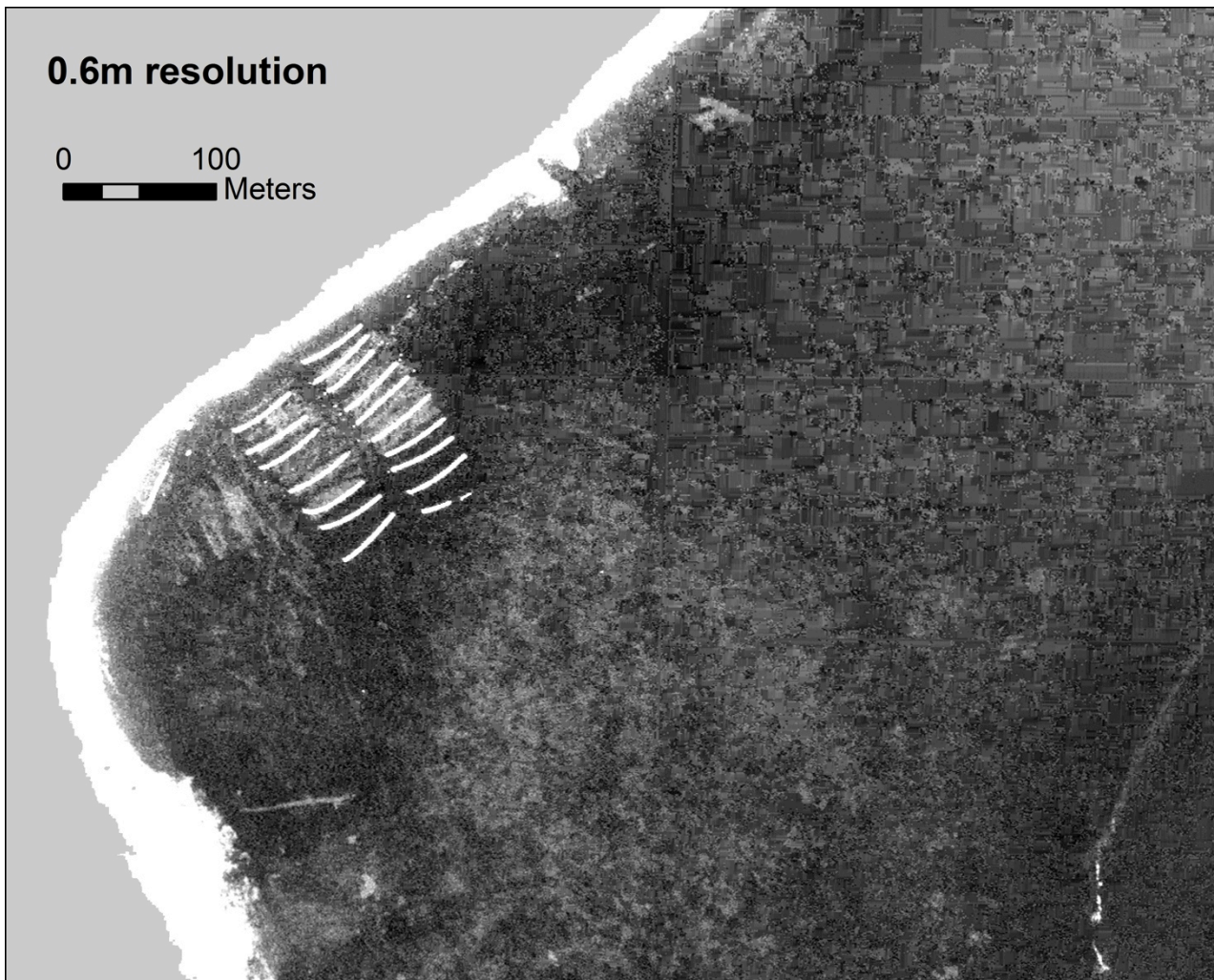
0 100  
Meters





**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

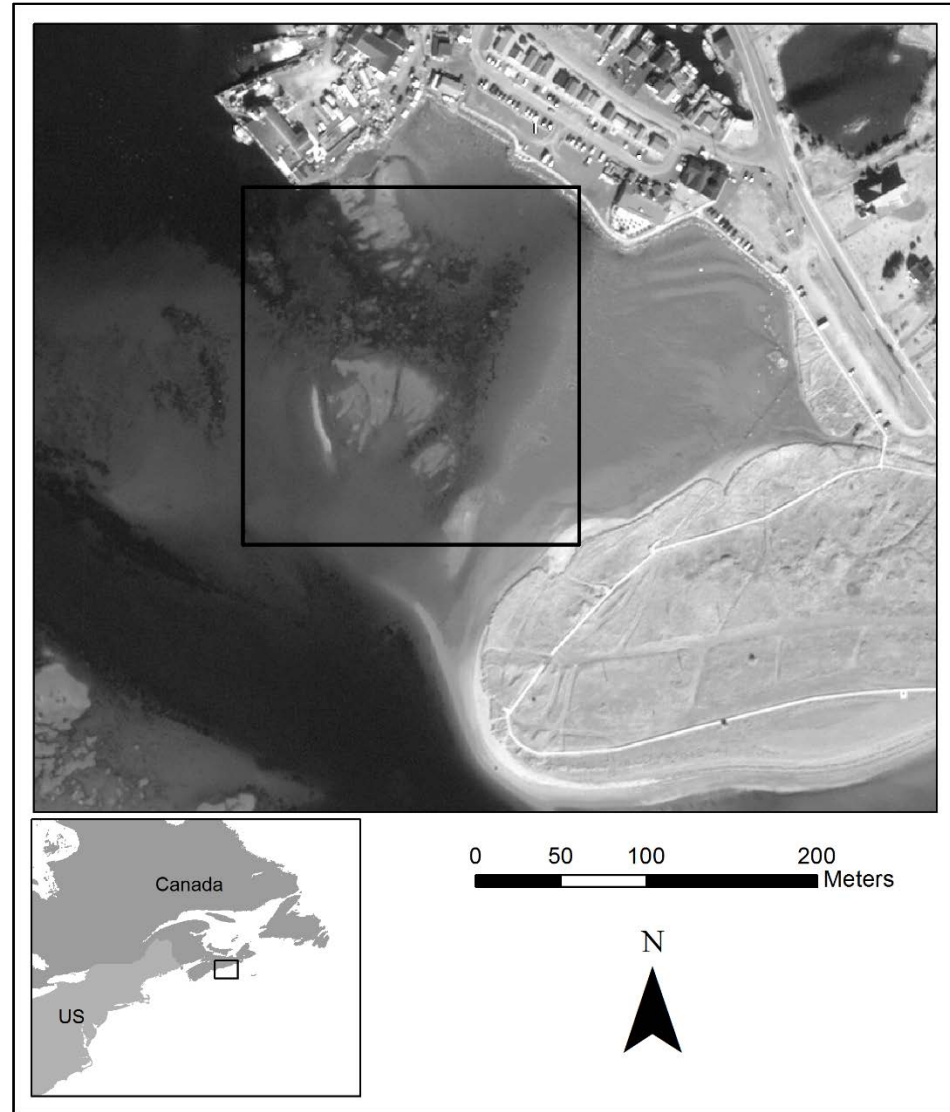
# Aerial photography: DalBlimp



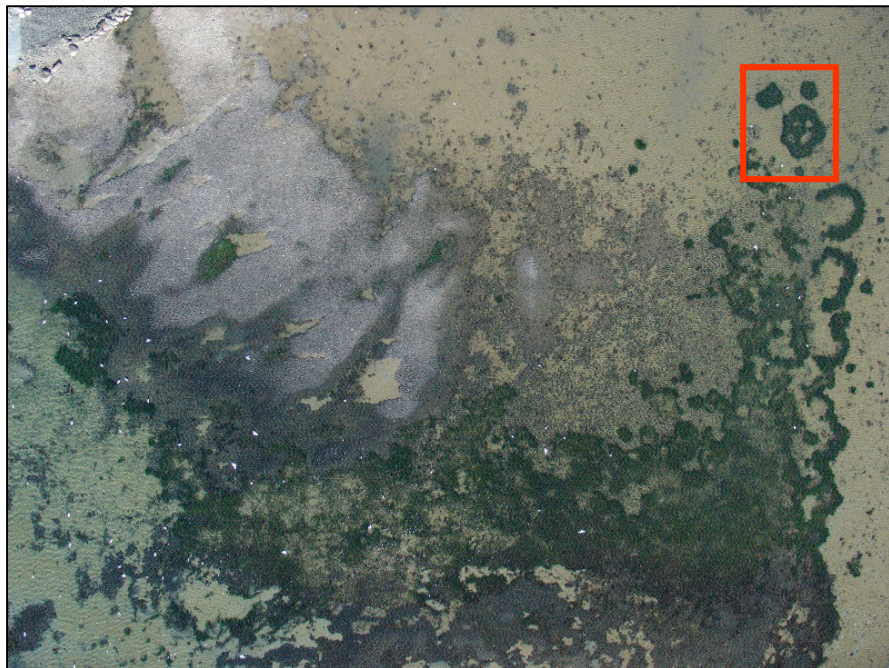


# Case Study: Eastern Passage, NS

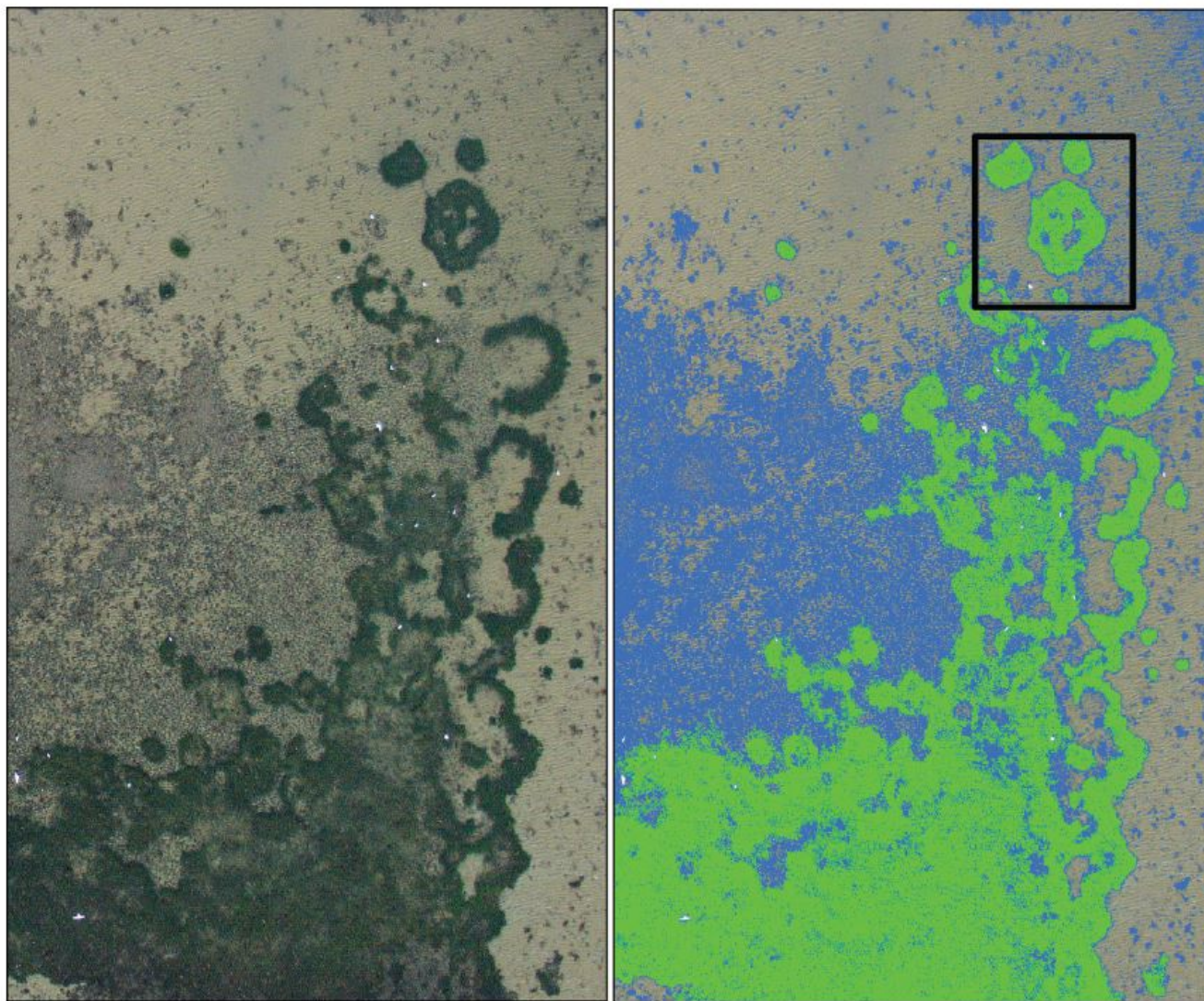
- McCormacks Beach
- Shallow subtidal  
eelgrass/mussel  
landscape











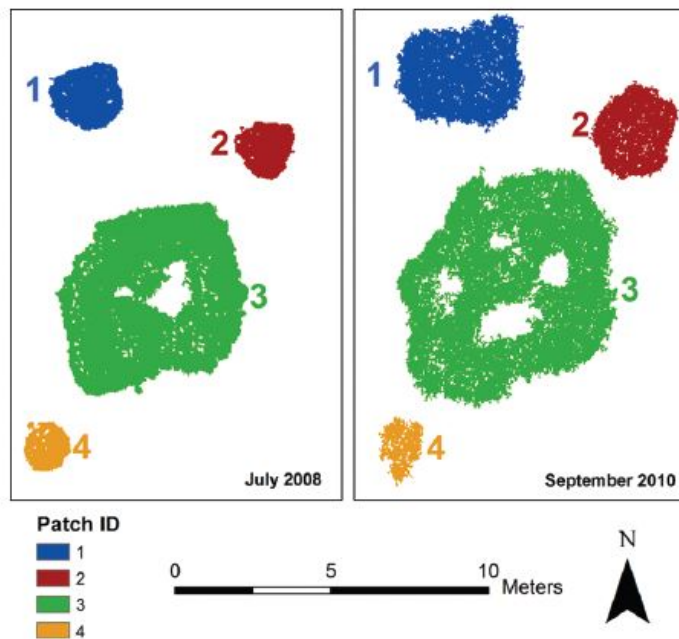
**Landscape:**  
**27.9% Eelgrass**  
**29 patches**

**25.1% Bivalve**  
**29,000 patches**

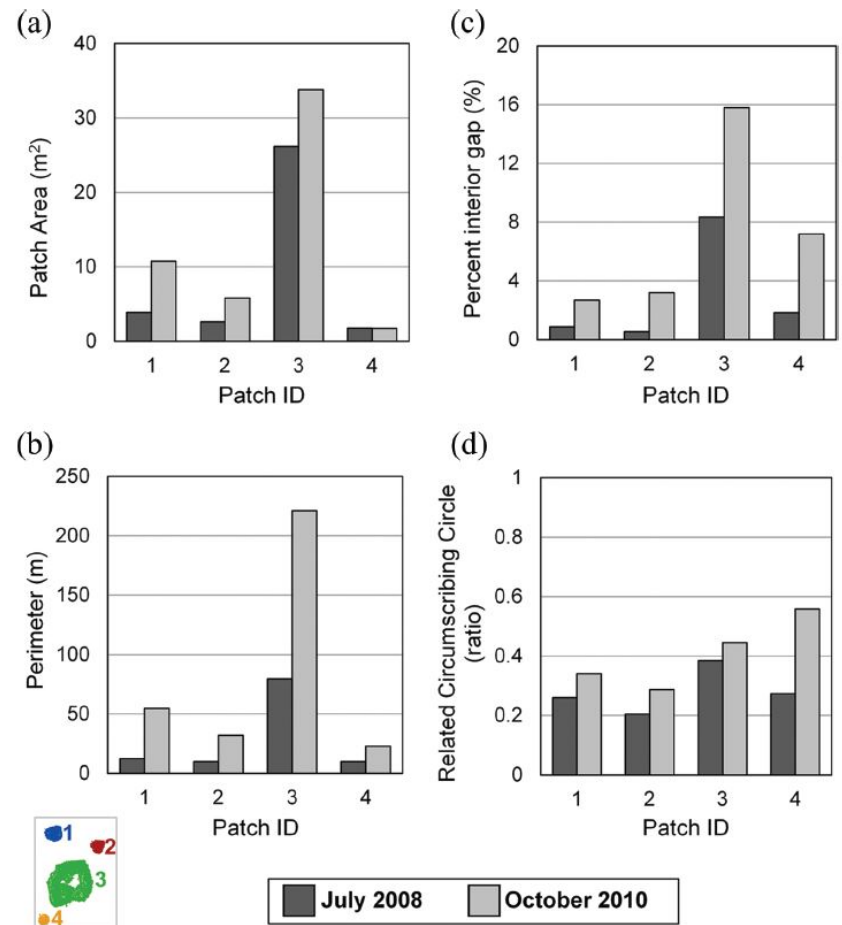
**47% Sediments**

**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.

# Patch-level landscape metrics

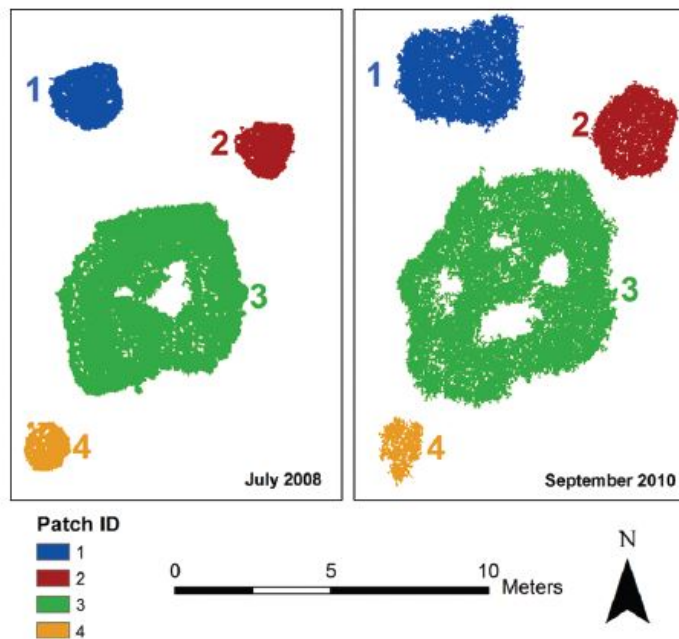


**Figure 3.** Depiction of the temporal change in four selected patches from imagery collected on 8 July 2008 (*left*) to 20 September 2010 (*right*). The spatial resolution (i.e. pixel edge length) of the 2008 and 2010 images are 0.0353 m and 0.0368 m, respectively.

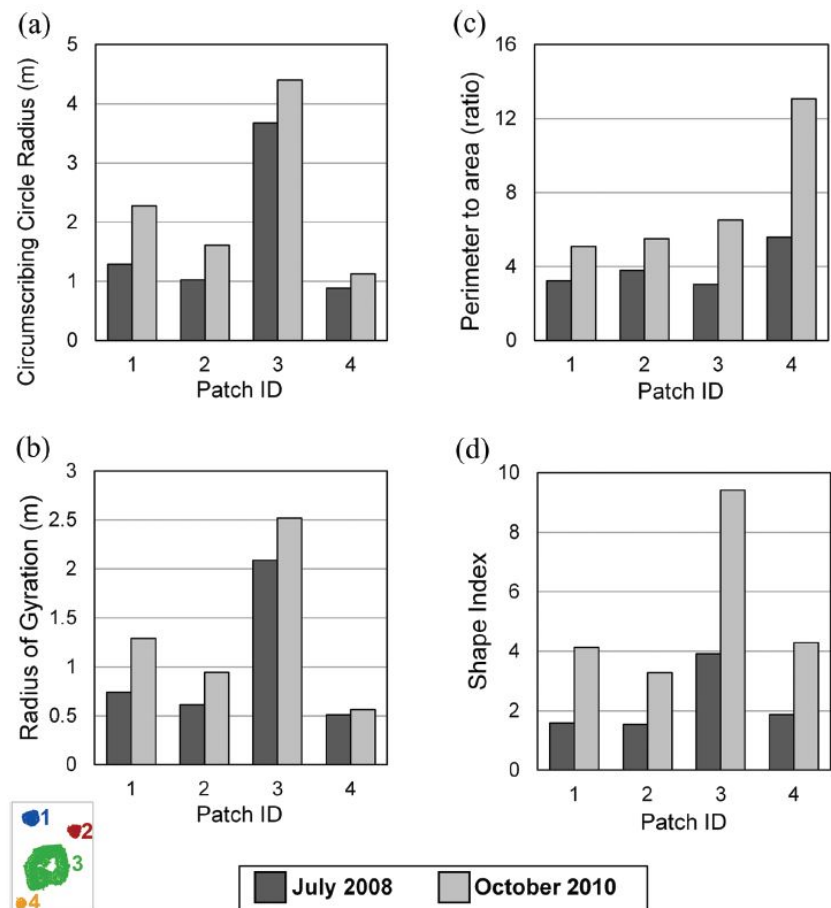




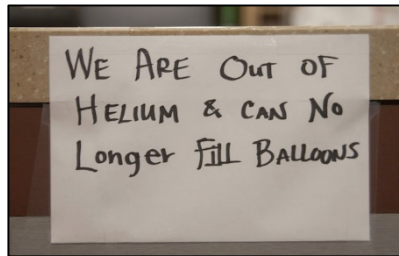
# Patch-level landscape metrics



**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.



# Helium shortage = rising prices



## The Ballooning Cost of Helium...

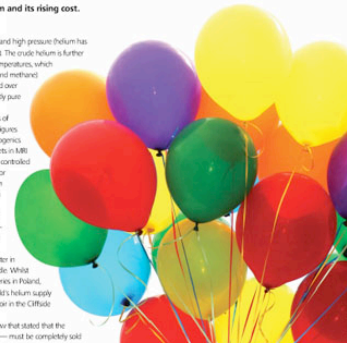
Incognito expresses his concern about the diminishing supplies of helium and its rising cost.

I received my gas bill this week — not my domestic bill but for the gases we use in the laboratory. I was shocked when I got my last domestic bill. I was more shocked when I received the laboratory bill. We managed to use too little helium than we did in the last billable period but the cost has risen by over 20%! My immediate reaction was to ring around a few alternative suppliers — one wouldn't quote for new business (saying that they couldn't guarantee supply) and the other quoted me \$806 for a 100 cubic foot cylinder. (Wow!)

I heard nothing from colleagues regarding a 'shortage' and the end of this non-renewable resource so I did a little digging to get some facts. Turns out that facts are a little difficult to come by when it comes to helium and figures vary quite widely. However, we managed to gather the following, fairly reliable, data.

Helium is found in varying concentrations (but generally around 7%) by volume in deposits of natural gas. It is produced in suitable subterranean rock formations and mixed as the radioactive product Helium-4, which is the result of the decay of the heavy elements thorium and uranium. Helium is naturally abundant in air at 5.2 ppm by volume but this is too low for cost effective recovery. Consequently it is refined from the natural gas deposits using fractional distillation.

Of the 100 million standard cubic metres of gas refined in 2008 the most up-to-date figures I could find around 24% was used for cryogenics (mainly for cooling superconducting magnets in MRI imaging instruments) and around 20% for controlled atmospheres, which includes applications for growing silicon and germanium, in titanium and zirconium production and for our own use in gas chromatography. Other more minor uses include welding, industrial leak detection, flight control and diving. Oh — and for filling our party balloons of course!



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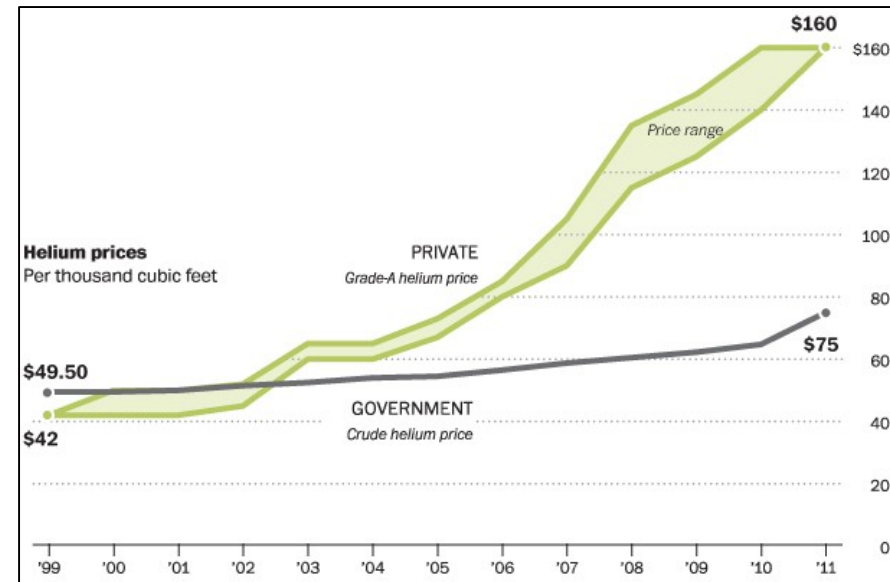
Resources: Stop squandering helium

William J. Nuttall, Richard H. Clarke & Bartek A. Glowacki

Affiliations | Corresponding author

Nature 485, 573–575 (31 May 2012) | doi:10.1038/485573a

Published online 30 May 2012

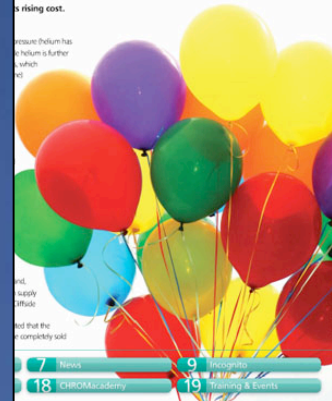




# Helium shortage = rising prices

**OH NO!!**  
**THERE IS A HELIUM SHORTAGE**  
**WE'RE SORRY,**  
as long as the helium shortage continues,  
we will not be able to accept discount coupons or  
donated gift certificates for the purchase of any  
filled balloons.  
(Gift certificates will be accepted)

## Cost of Helium...



## Resources: Stop squandering helium

William J. Nuttall, Richard H. Clarke & Bartek A. Glowacki

Affiliations | Corresponding author

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# Thanks!



Questions?  
[jeffbarrell@dal.ca](mailto:jeffbarrell@dal.ca)