Eelgrass restoration and its potential to counteract ocean acidification in South Puget Sound

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Restoration

- Eelgrass (*Zostera marina*) recovery goal established by the Puget Sound Partnership

- 20% more eelgrass by 2020
  - 4,400 ha (relative to baseline of 22,000 ha)

- Recovery Strategy
  - Stressor reduction
  - Restoration

- Multi-step adaptive process
  - model
  - test-transplants
  - evaluate
  - large-scale transplants
Restoration Sites 2013 - 2018

- Eelgrass Transplant Sites
  - Large - Zm present
  - Large - Zm absent
  - Test - Zm present
  - Test - Zm absent
  - Donor site

- Key Peninsula
- Case Inlet
- Carr Inlet

- Seattle
- Olympia

- CAN
- USA
Joemma Beach State Park
Joemma Beach State Park

1 – 2015
– staples w/ 4-5 shoots, 80 shoots m$^{-2}$

2 – 2016
– burlap w/ 21 shoots, 504 shoots m$^{-2}$

3-5 – 2017
– staples w/ 10-15 shoots, 160 shoots m$^{-2}$
SITE 1

Planted in 2015
- 5 transects
- 80 shoots m\(^{-2}\)
- 125 m\(^2\)
- 10,000 shoots
Site 1 - Transect 4

Average Density (m$^2$ ± SE)

- 2015
- 2016
- 2017
- 2018

Site 1 - Transect 5

Average Density (m$^2$ ± SE)

- 2015
- 2016
- 2017
- 2018
Total Eelgrass Area (m²)

- Total Area
- Total Shoots

Year:
- 2015
- 2016
- 2017
- 2018

Total Eelgrass Shoots

0 25,000 50,000 75,000 100,000

Total Area

0 100 200 300 400 500
Planted in 2016
- 504 shoots m\(^{-2}\)
- 40 m\(^2\) planted
- 20,160 shoots
SITE 2

Average Density (# m$^{-2}$ ± SE)

- **2016**: 500
- **2017**: 1,000
- **2018**: 1,500
SITES 3 – 5

Planted in 2017

- ~ 160 shoots m\(^{-2}\)
- ~ 22,000 shoots
ANeMoNe sensors measure eelgrass effects on water quality.
Heat and low oxygen levels cause fish kills in South Sound.
Photosynthesis produces $O_2$. 
Can eelgrass restoration improve oxygen levels?
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Can eelgrass restoration improve oxygen levels?

Oxygen (mg*L⁻¹ ± SD)

Bare
Can eelgrass restoration improve oxygen levels?

![Graph showing oxygen levels over time with data points for bare and 1-year-old eelgrass conditions.](image-url)
Can eelgrass restoration improve oxygen levels?
Can eelgrass restoration improve oxygen levels?

**Oxygen (mg L\(^{-1}\) ± SD)**

- Bare
Can eelgrass restoration improve oxygen levels?
Can eelgrass restoration improve oxygen levels?

Mature eelgrass improved daytime oxygen; new grass did not.
CO₂ emissions cause ocean acidification, which could harm shellfish and other animals in South Sound.

Day 4

pHₜ: 8.0

pHₜ: 7.5

Barton et al. 2015
Photosynthesis consumes \( \text{CO}_2 \).
Can eelgrass restoration counteract acidification?
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Can eelgrass restoration counteract acidification?

1-year-old eelgrass

Bare

\[ \text{pH}_{\text{T}} (\pm SE) \]

\begin{align*}
12am & \quad 6am & \quad 12pm & \quad 6pm & \quad 12am \\
7.7 & \quad 7.8 & \quad 7.9 & \quad 8.0 & \quad 8.1
\end{align*}
Can eelgrass restoration counteract acidification?
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Mature and new eelgrass appear to improve daytime pH.
Acidification Nearshore Monitoring Network - ANeMoNe

ANeMoNe measures acidification and ocean warming, and tests practical solutions.
ANeMoNe Site Guardians participate in research, maintain data quality and assess ecosystem response.

Interested in becoming a Guardian? Contact Micah Horwith

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