



REGIONAL FLYWAY INITIATIVE TRAINING SERIES:

Workshop on Wetland Ecosystem Services and Nature-based Solutions

THAILAND

27-29 November 2023

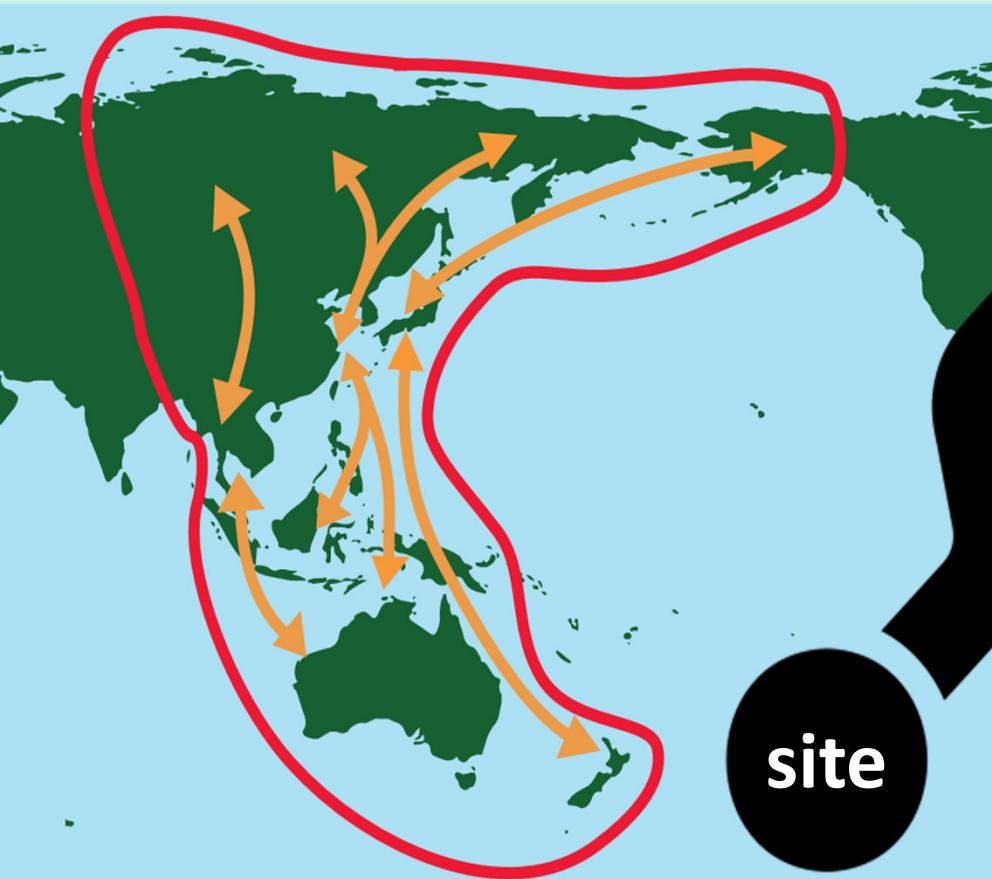


Coastal protection and water-related services of RFI sites in Thailand

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The two-pronged approach of the Regional Flyway Initiative



regulating ES

provisioning ES

High-level, modelling-based assessment

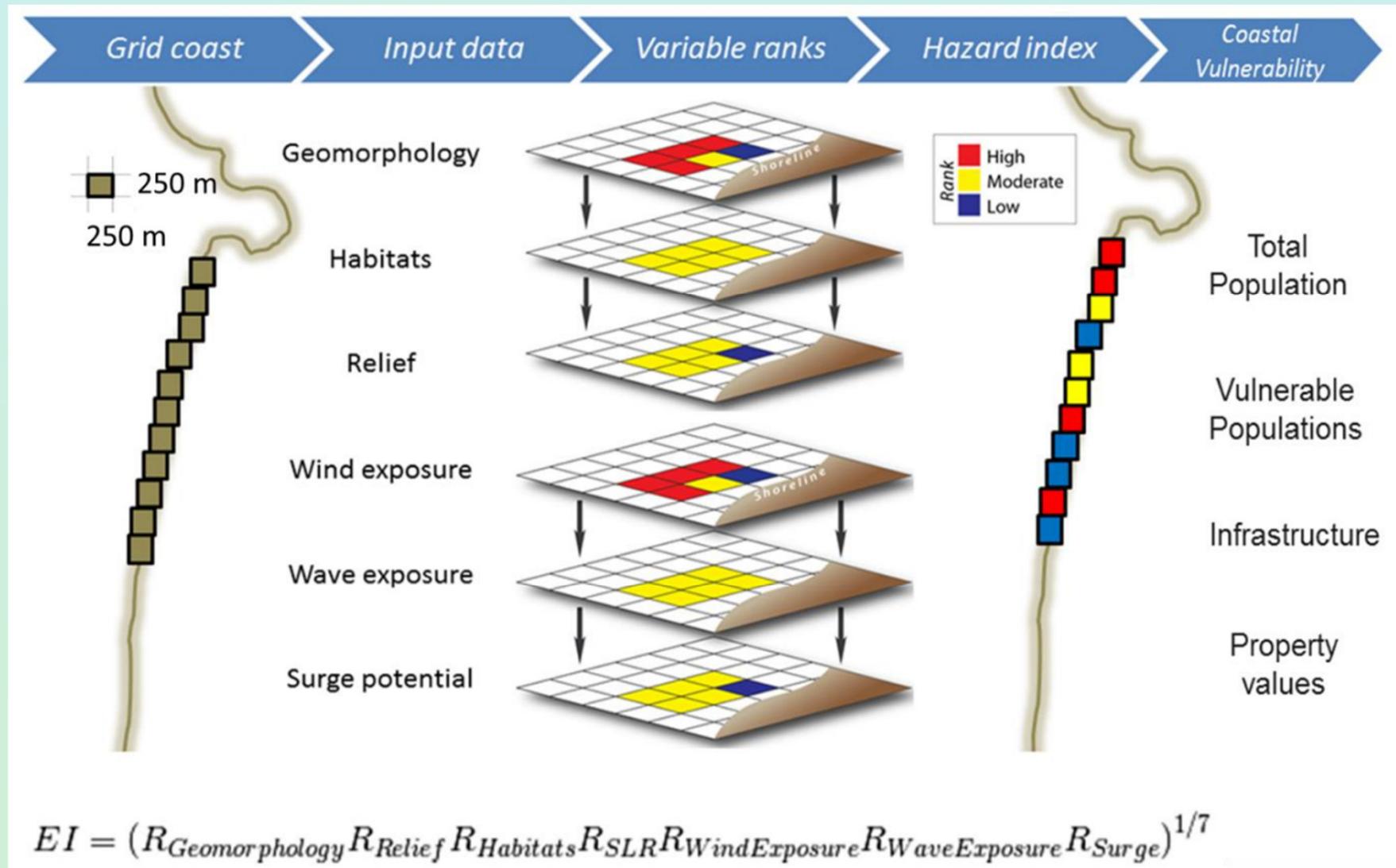


Site-level, participatory assessment



Source: East Asian-Australasian Flyway Partnership & Asian Development Bank

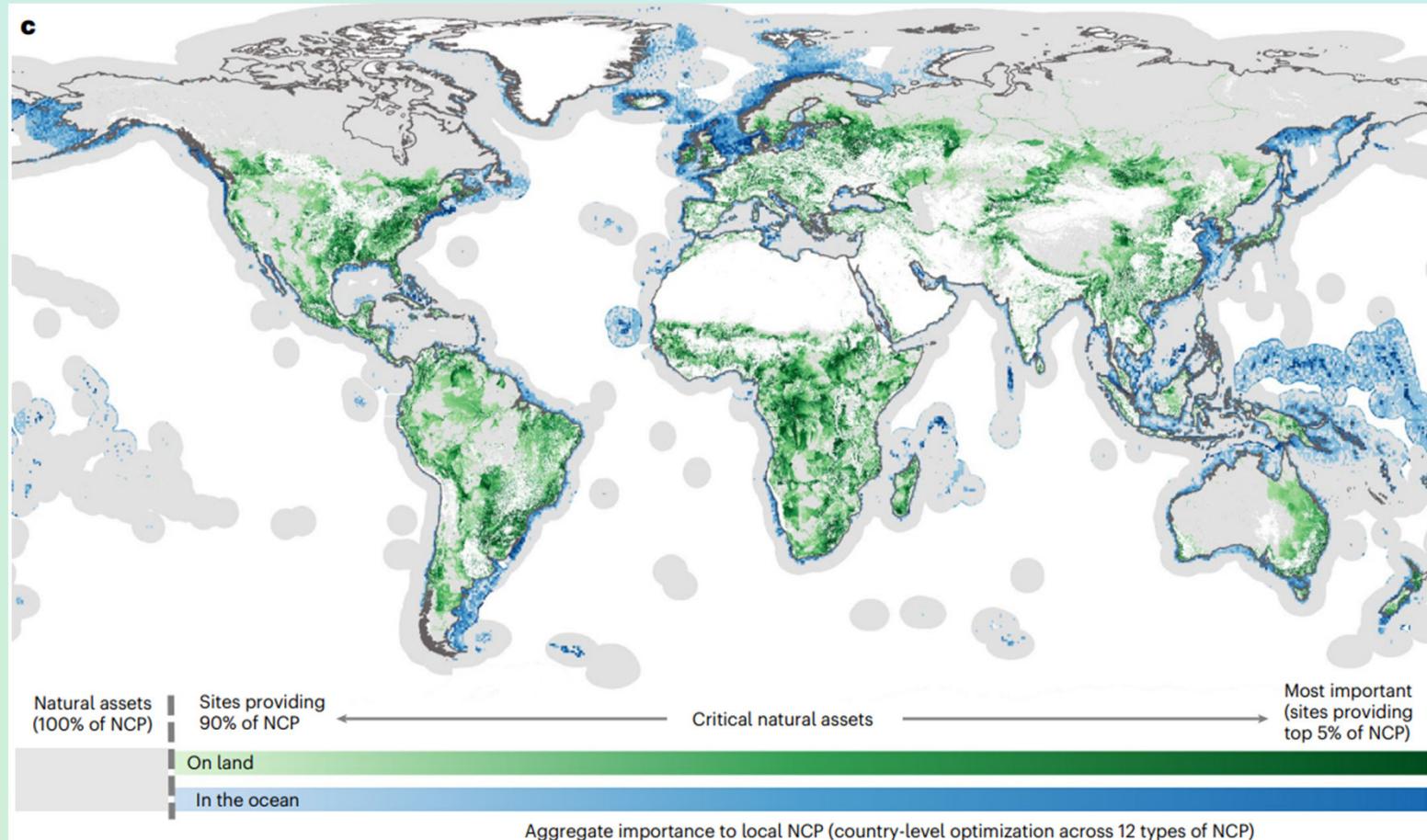
Modelling-based assessment: Coastal protection (biophysical)



Silver et al., 2019: A National Coastal Hazard and Social Vulnerability Analysis for The Bahamas

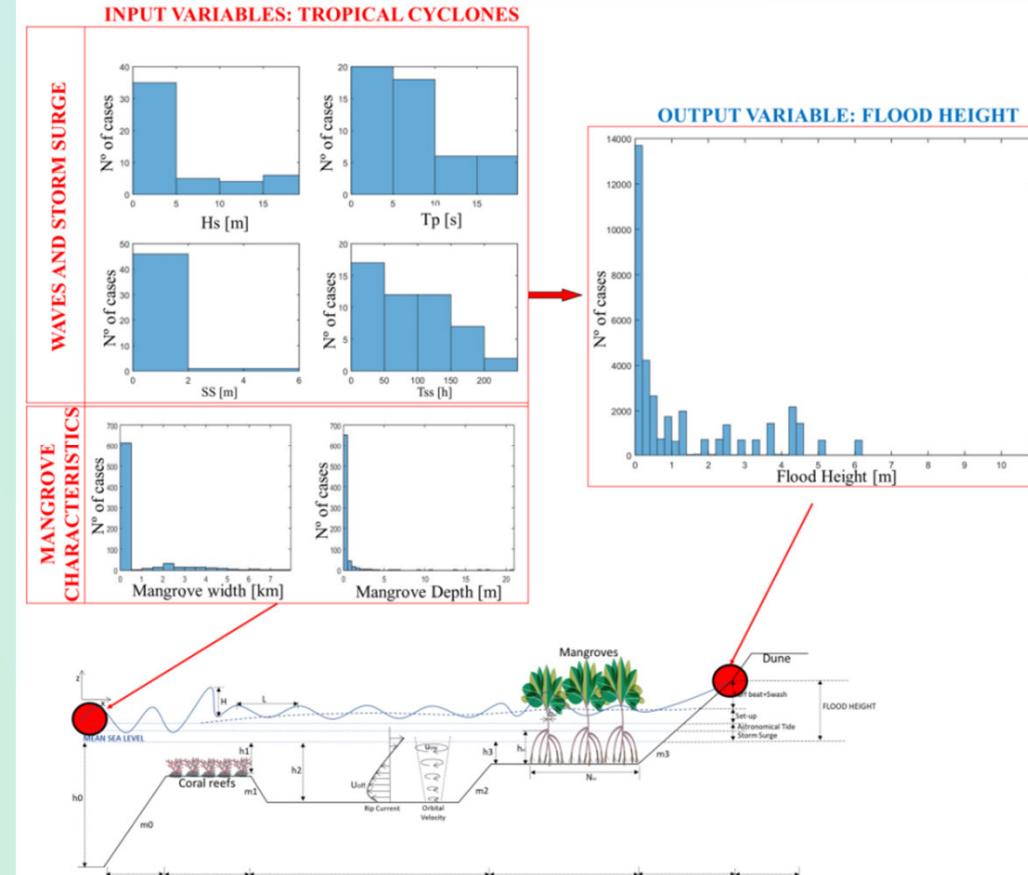
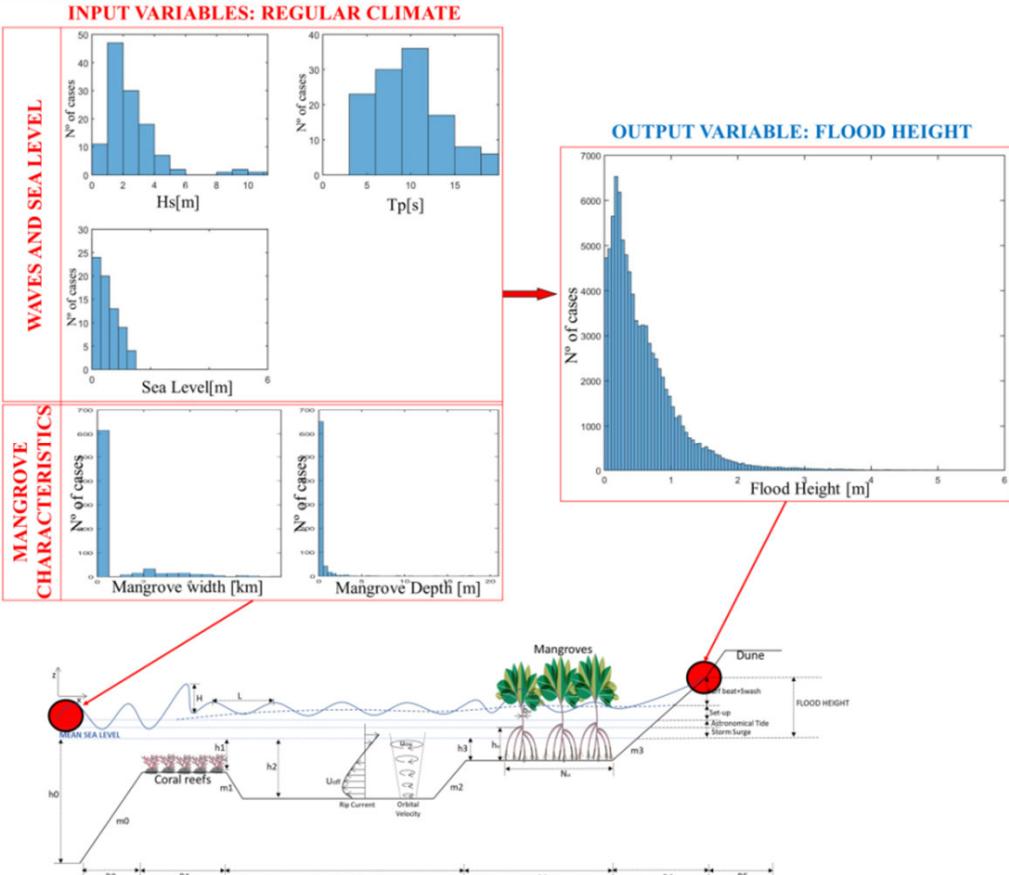
Modelling-based assessment: Coastal protection (biophysical)

a
List of local NCP modelled
Nitrogen retention for water quality regulation
Sediment retention for water quality regulation
Pollinator habitat sufficiency for pollination-dependent crops
Fodder for livestock
Timber production
Fuelwood production
Flood regulation
Riverine fish harvest
Access to terrestrial nature (for local recreation and gathering)
Coastal risk reduction (terrestrial and marine) (highlighted)
Marine fish harvest
Marine recreation (coral-reef tourism and associated livelihoods)



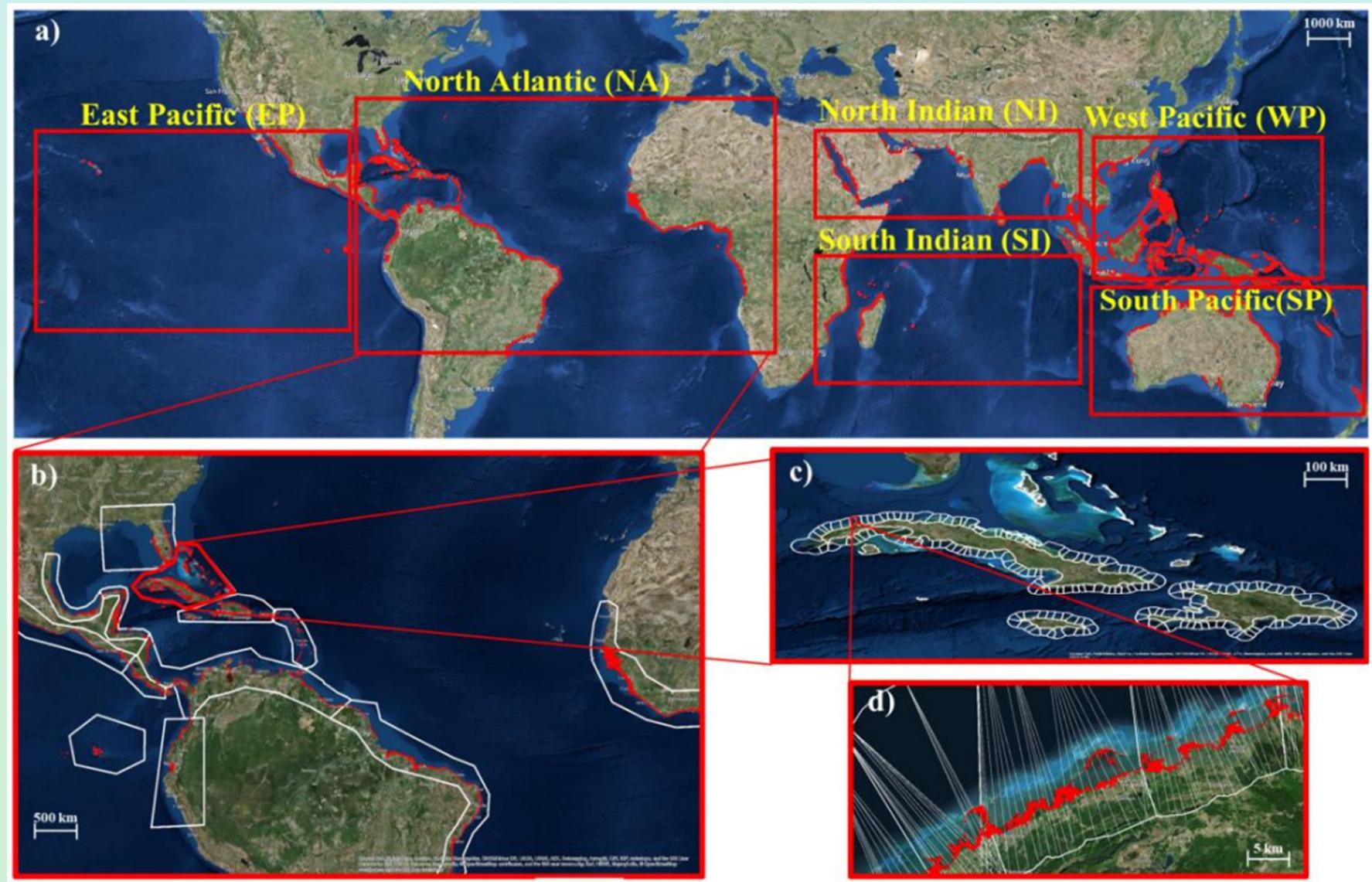
Chaplin-Kramer et al., 2022: Mapping the planet's critical natural assets

Modelling-based assessment: Coastal protection (economic)

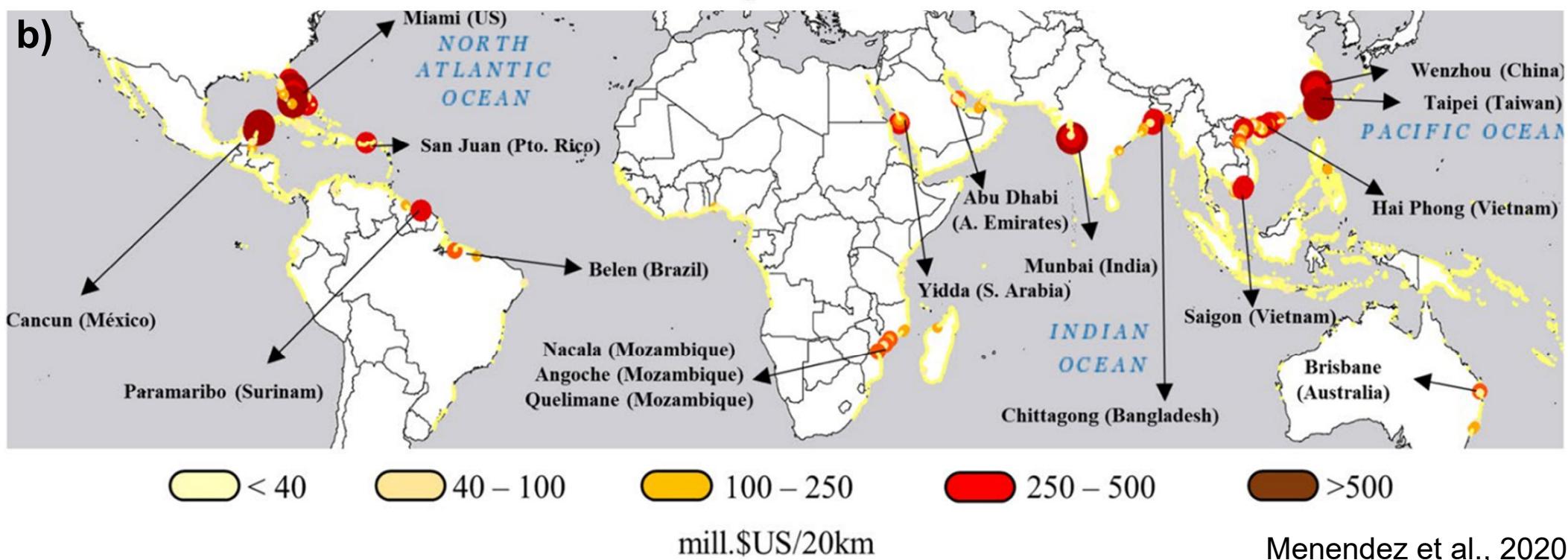
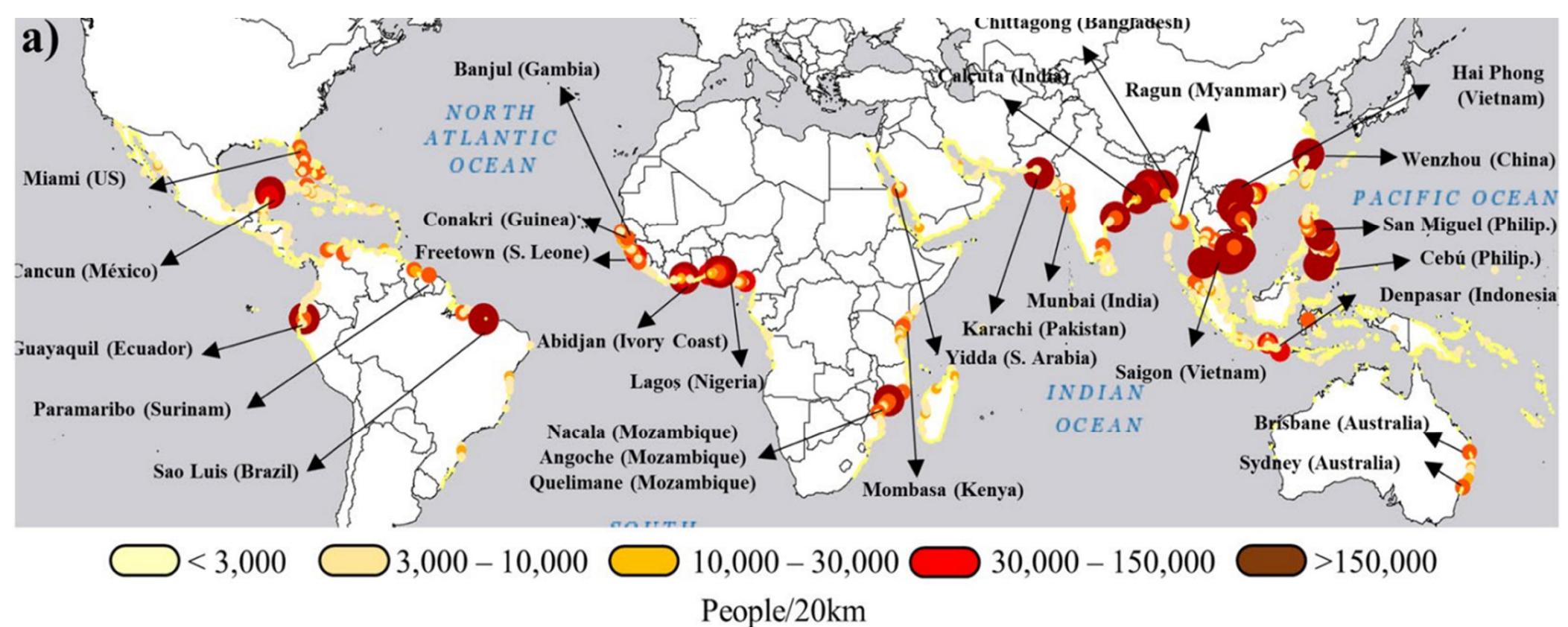


Menendez et al., 2020: The Global Benefits of Mangroves

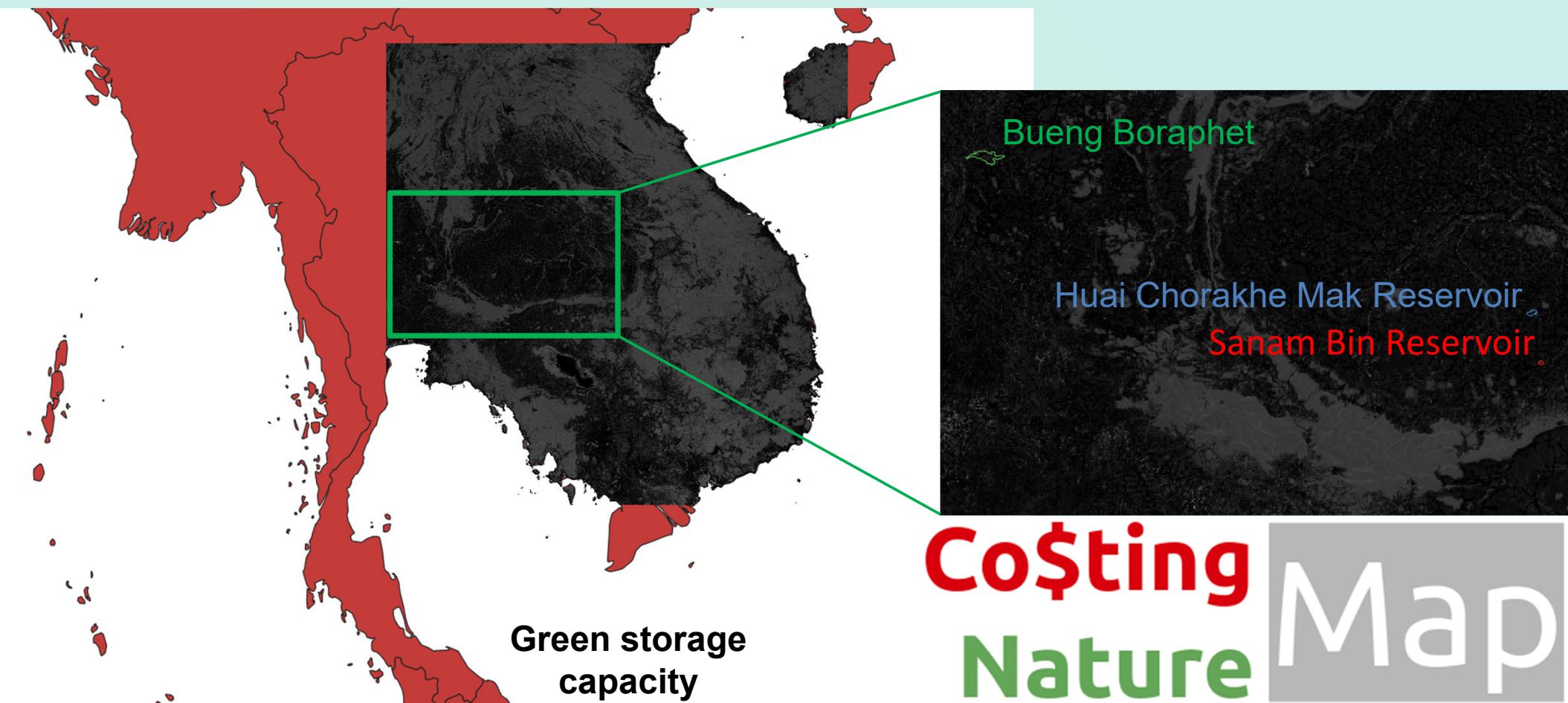
Modelling-based assessment: Coastal protection (economic)



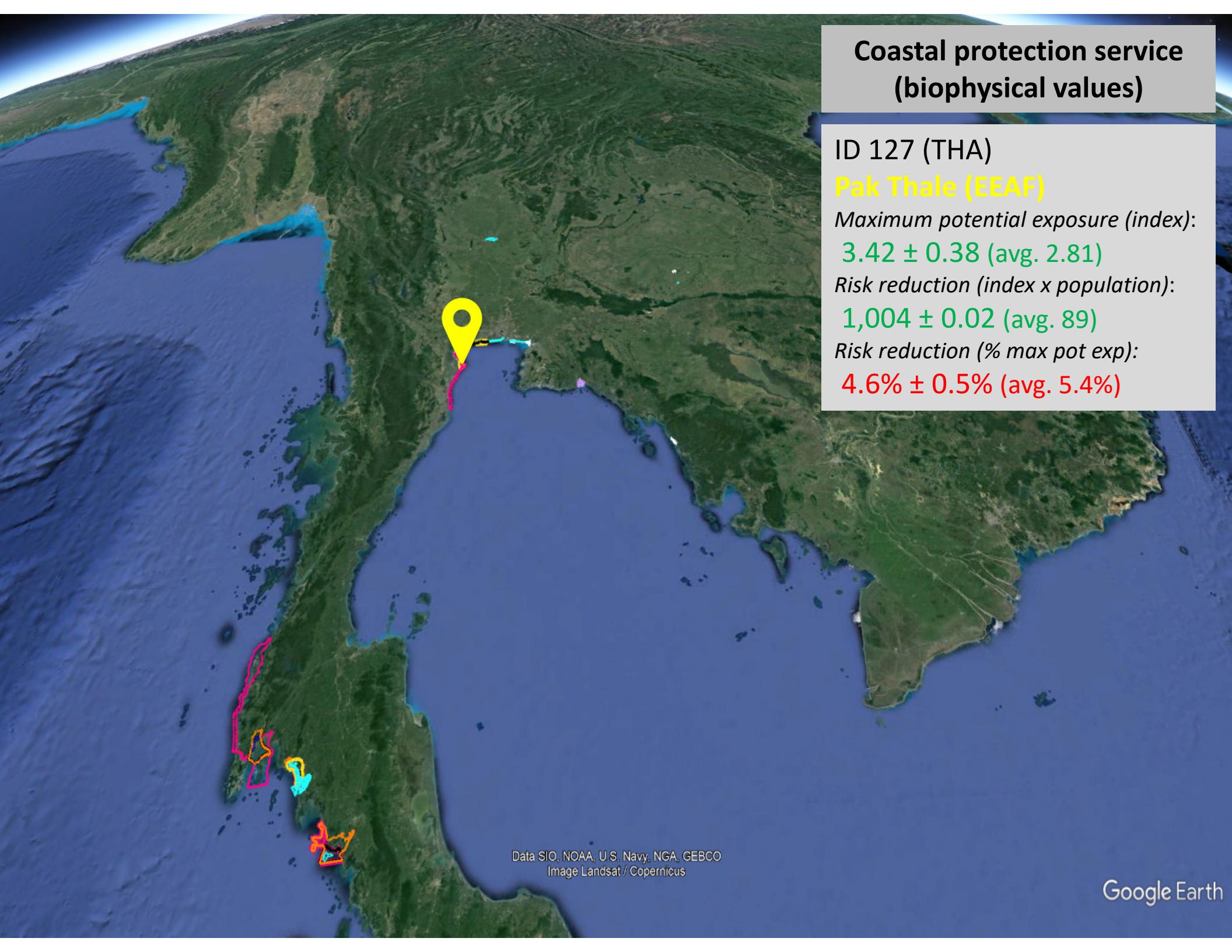
Menendez et al., 2020: The Global Benefits of Mangroves



Modelling-based assessment: Flood Mitigation (biophysical)



Mulligan, M. 2022: Co\$tingNature Model V3.



Coastal protection service (biophysical values)

ID 127 (THA)

Pak Thale (EEAF)

Maximum potential exposure (index):

3.42 ± 0.38 (avg. 2.81)

Risk reduction (index x population):

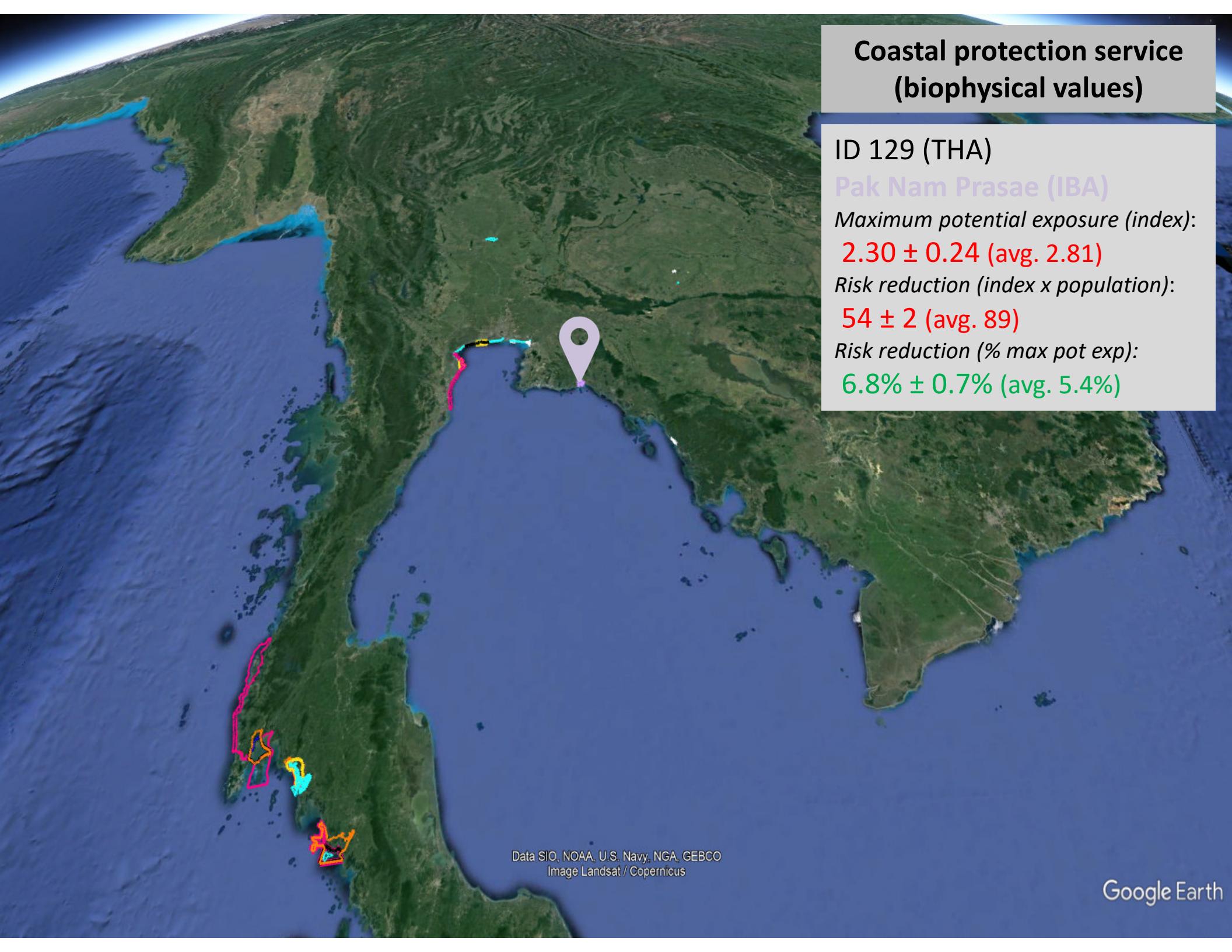
$1,004 \pm 0.02$ (avg. 89)

Risk reduction (% max pot exp):

$4.6\% \pm 0.5\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 129 (THA)

Pak Nam Prasae (IBA)

Maximum potential exposure (index):

2.30 ± 0.24 (avg. 2.81)

Risk reduction (index x population):

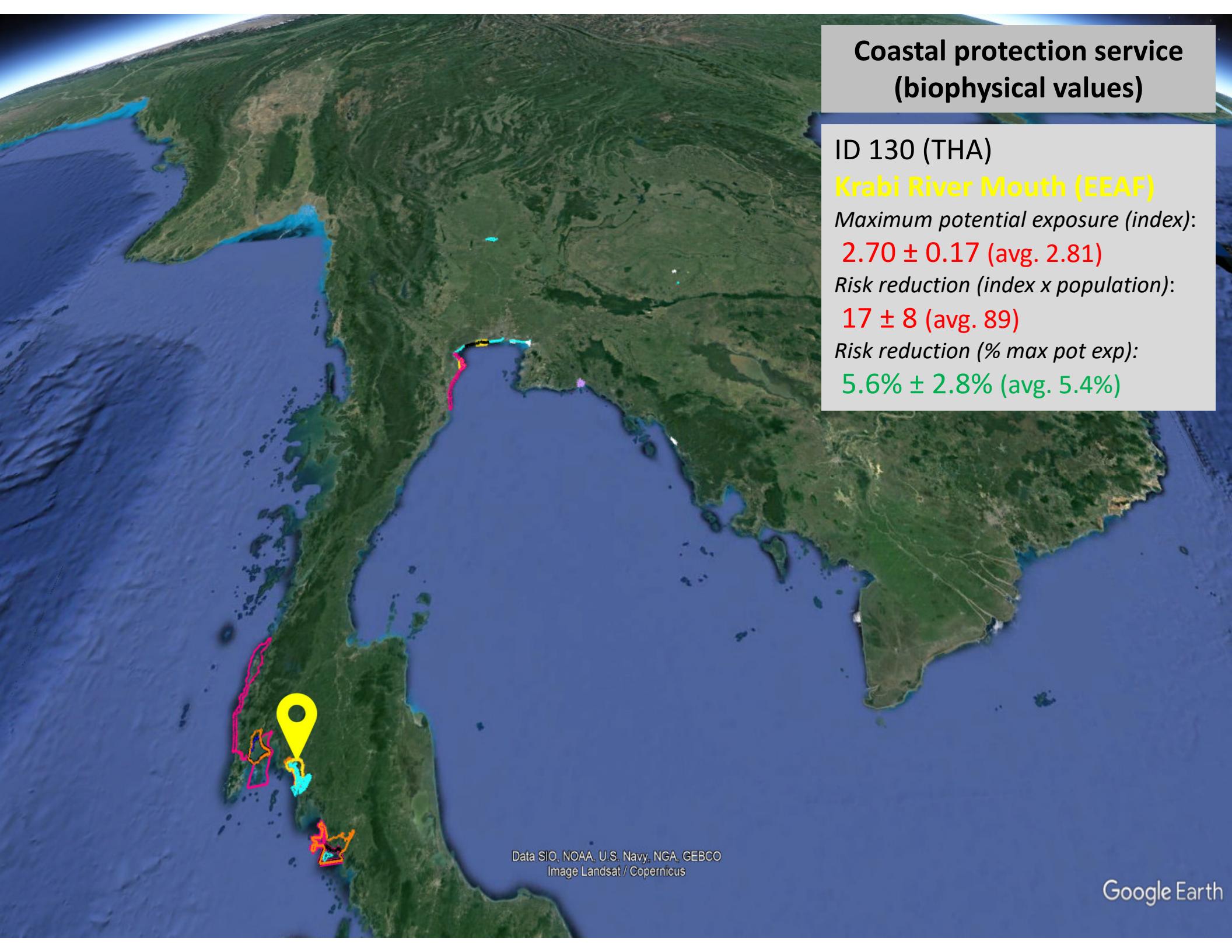
54 ± 2 (avg. 89)

Risk reduction (% max pot exp):

$6.8\% \pm 0.7\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 130 (THA)

Krabi River Mouth (EEAF)

Maximum potential exposure (index):

2.70 ± 0.17 (avg. 2.81)

Risk reduction (index x population):

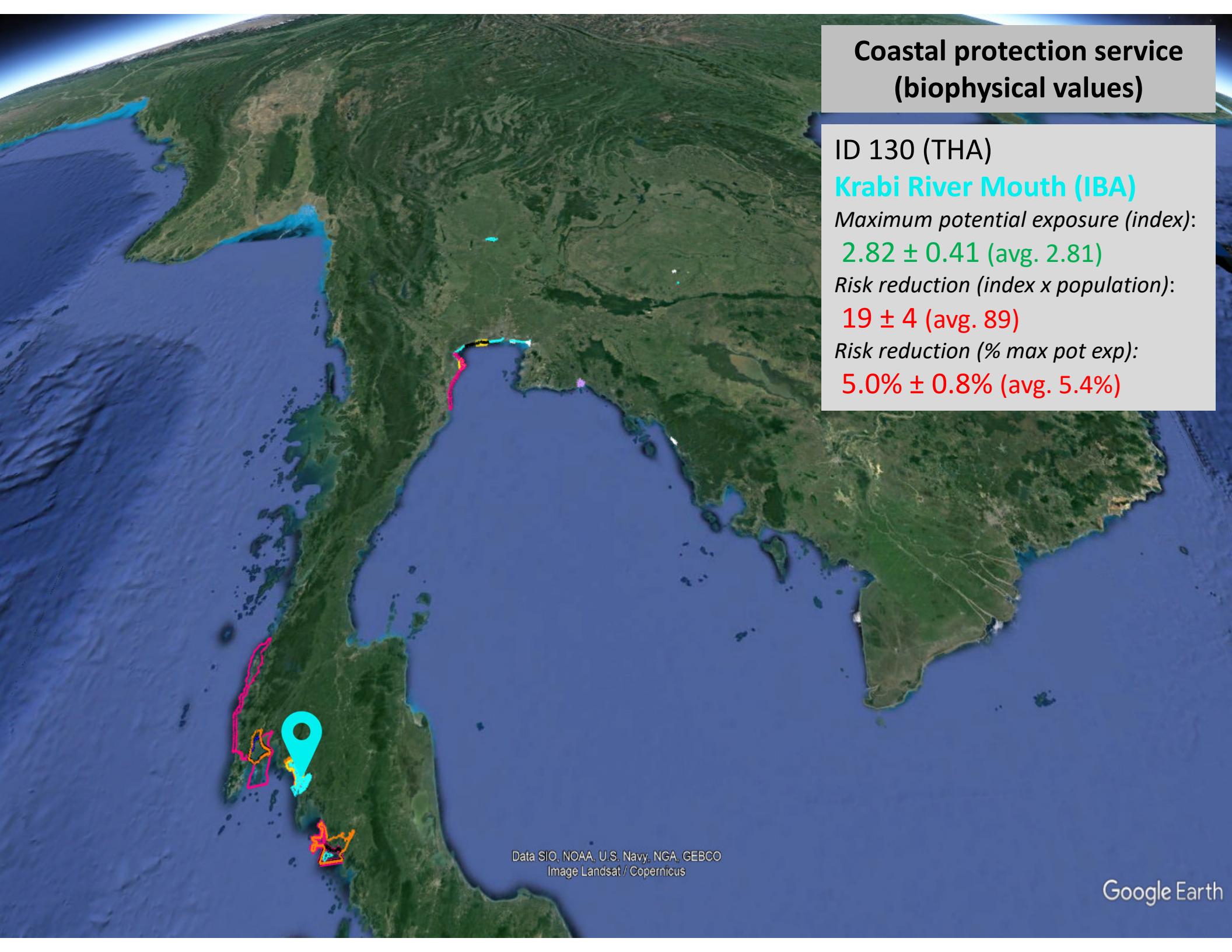
17 ± 8 (avg. 89)

Risk reduction (% max pot exp):

$5.6\% \pm 2.8\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 130 (THA)

Krabi River Mouth (IBA)

Maximum potential exposure (index):

2.82 ± 0.41 (avg. 2.81)

Risk reduction (index x population):

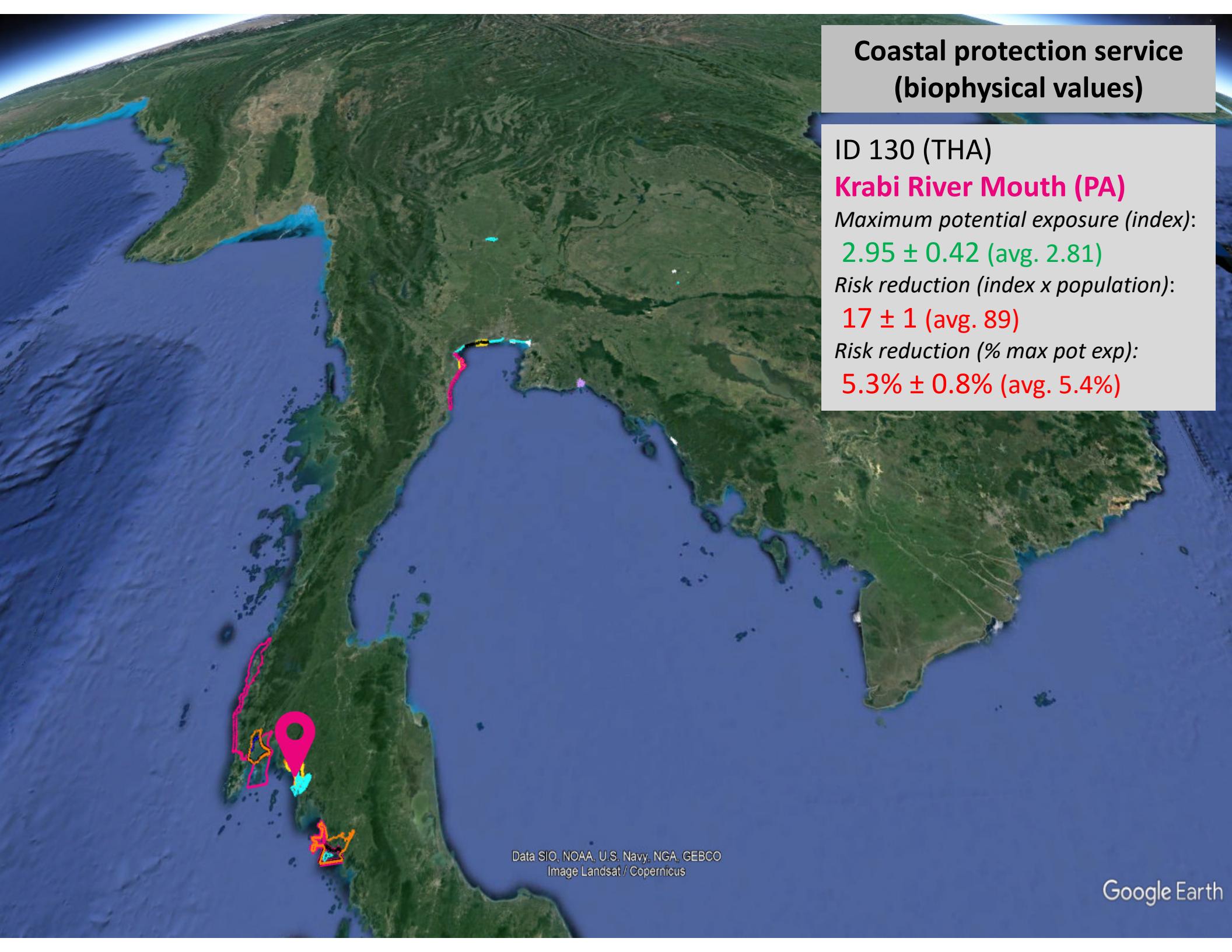
19 ± 4 (avg. 89)

Risk reduction (% max pot exp):

$5.0\% \pm 0.8\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 130 (THA)

Krabi River Mouth (PA)

Maximum potential exposure (index):

2.95 ± 0.42 (avg. 2.81)

Risk reduction (index x population):

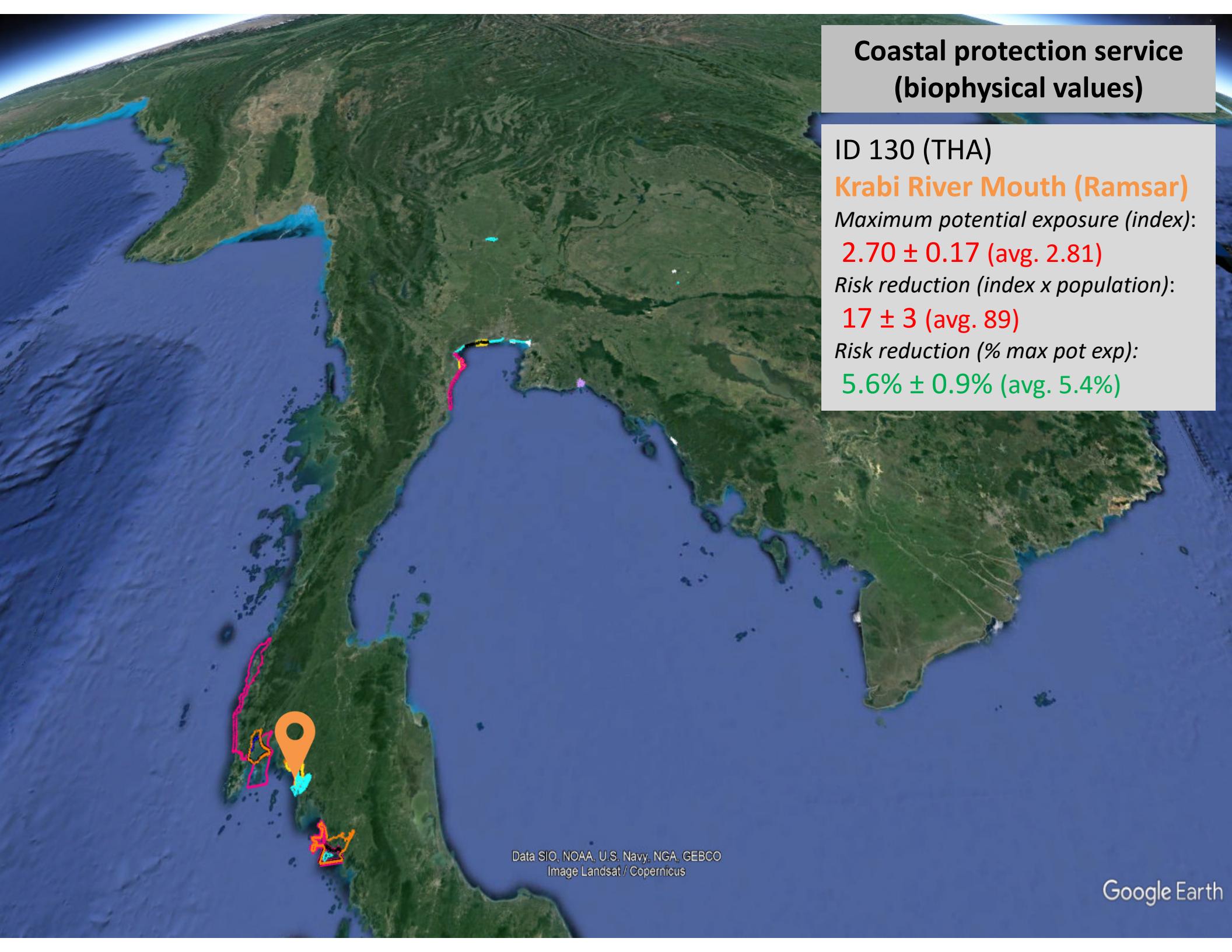
17 ± 1 (avg. 89)

Risk reduction (% max pot exp):

$5.3\% \pm 0.8\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 130 (THA)

Krabi River Mouth (Ramsar)

Maximum potential exposure (index):

2.70 ± 0.17 (avg. 2.81)

Risk reduction (index x population):

17 ± 3 (avg. 89)

Risk reduction (% max pot exp):

$5.6\% \pm 0.9\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth

Coastal protection service (biophysical values)

ID 132 (THA)

Khlong Tamru (estimated)

Maximum potential exposure (index):

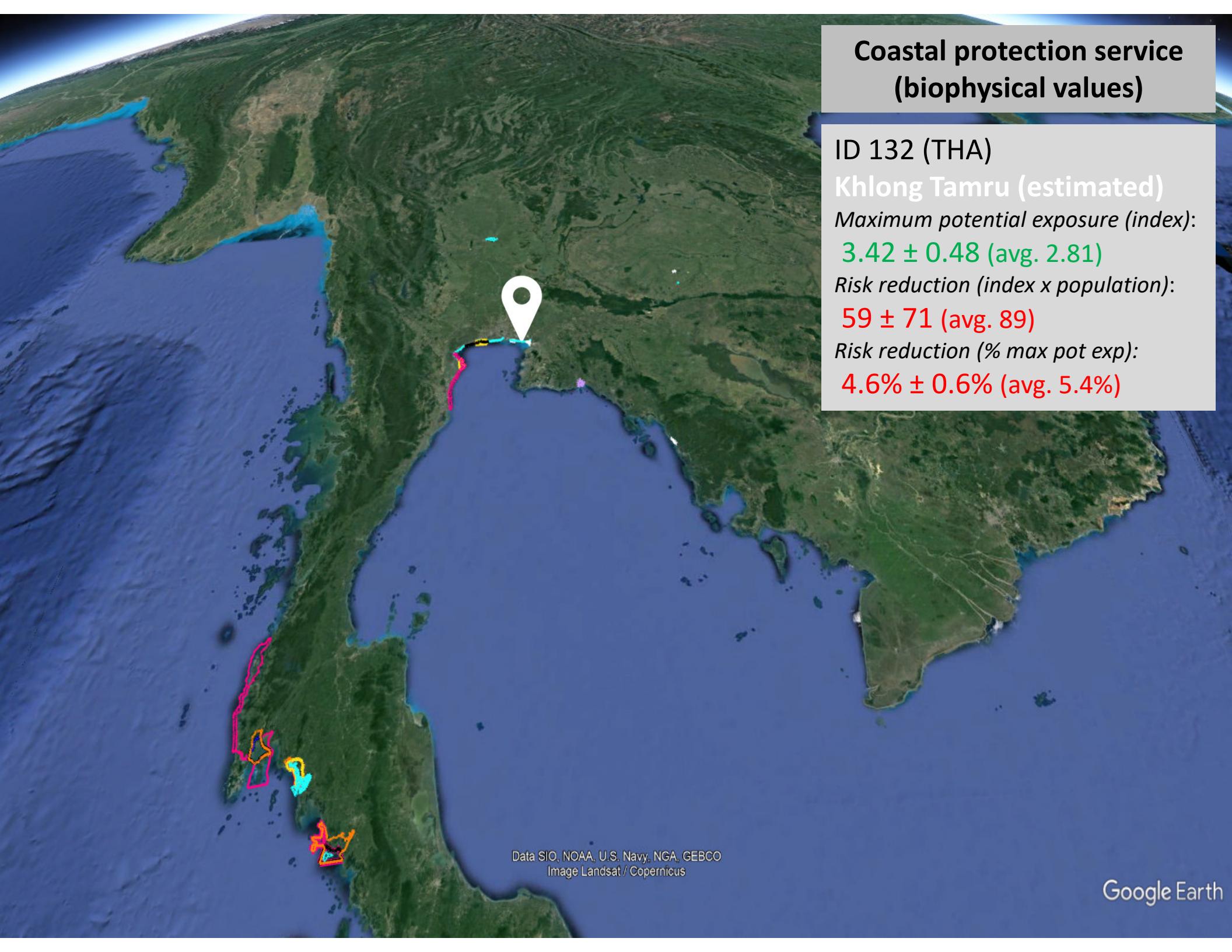
3.42 ± 0.48 (avg. 2.81)

Risk reduction (index x population):

59 ± 71 (avg. 89)

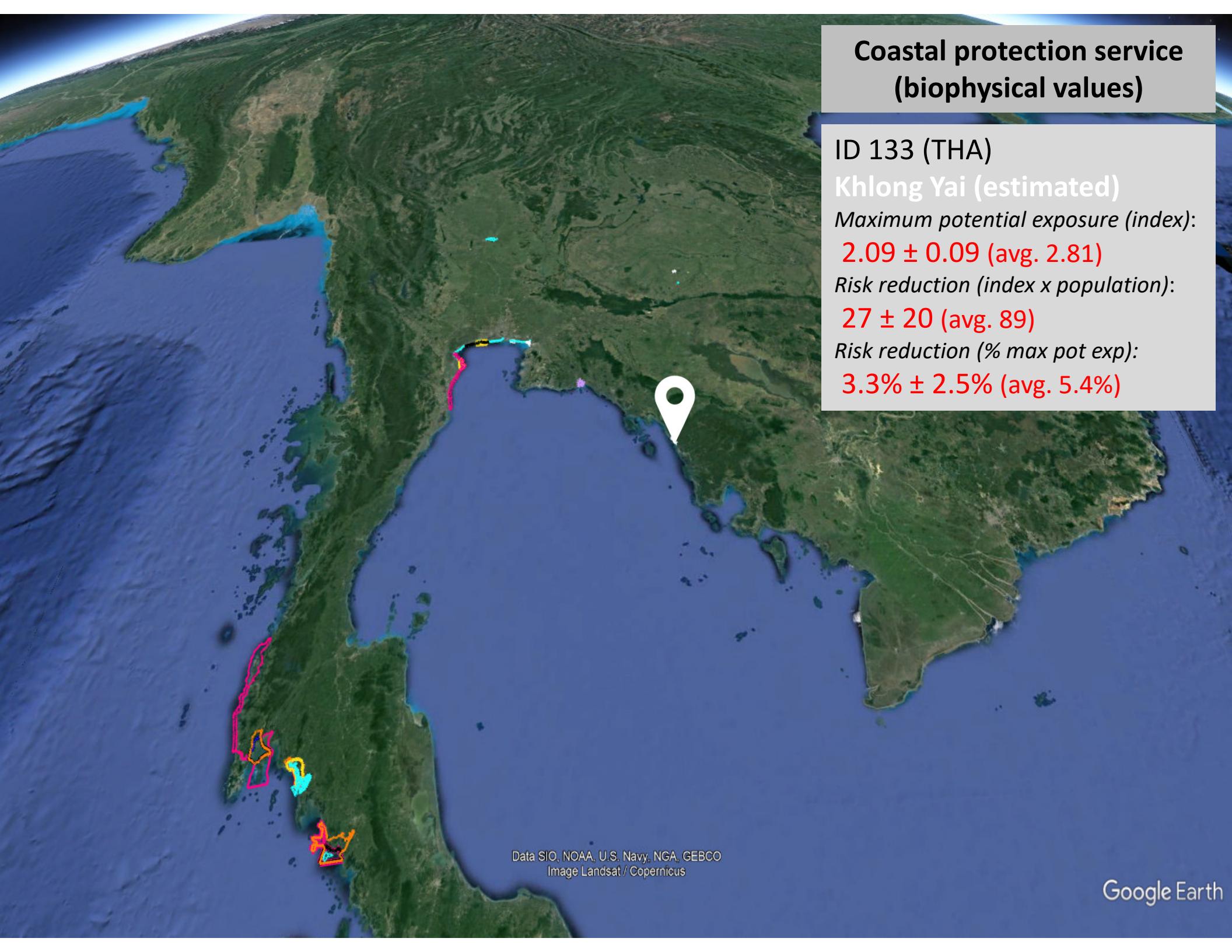
Risk reduction (% max pot exp):

$4.6\% \pm 0.6\%$ (avg. 5.4%)



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 133 (THA)

Khlong Yai (estimated)

Maximum potential exposure (index):

2.09 ± 0.09 (avg. 2.81)

Risk reduction (index x population):

27 ± 20 (avg. 89)

Risk reduction (% max pot exp):

$3.3\% \pm 2.5\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth

Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong/HatChaoMai (IBA)

Maximum potential exposure (index):

2.91 ± 0.17 (avg. 2.81)

Risk reduction (index x population):

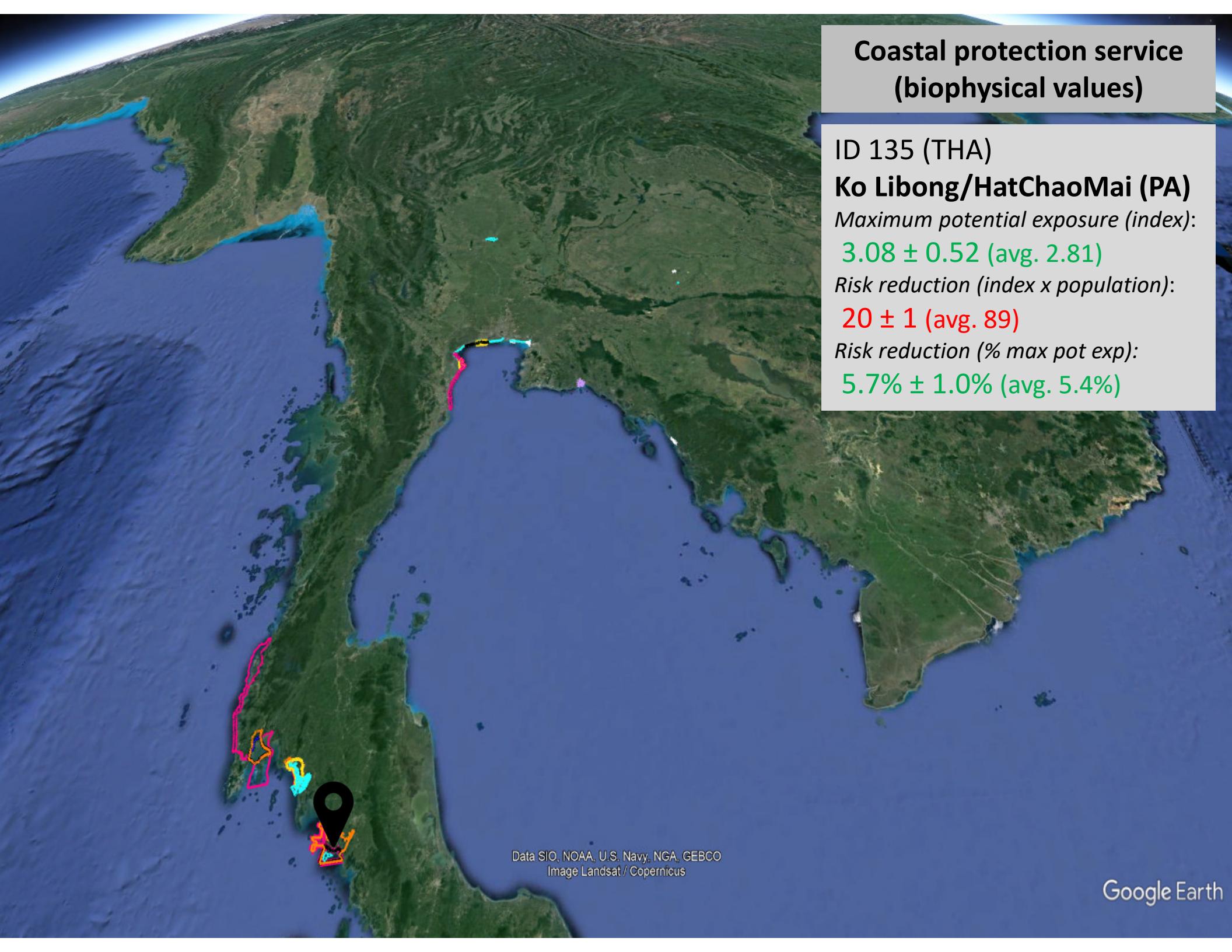
23 ± 3 (avg. 89)

Risk reduction (% max pot exp):

$6.2\% \pm 0.5\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong/HatChaoMai (PA)

Maximum potential exposure (index):

3.08 ± 0.52 (avg. 2.81)

Risk reduction (index x population):

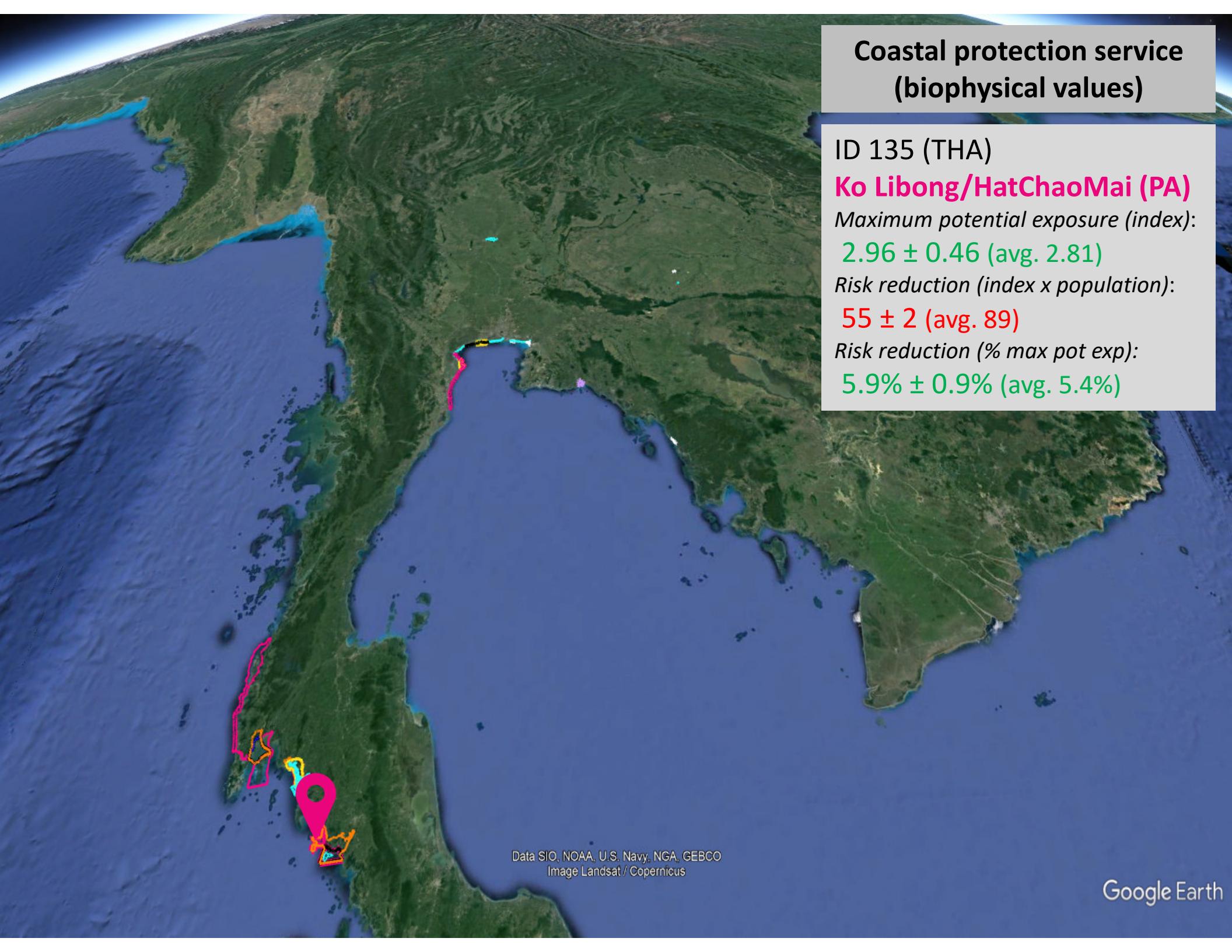
20 ± 1 (avg. 89)

Risk reduction (% max pot exp):

$5.7\% \pm 1.0\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong/HatChaoMai (PA)

Maximum potential exposure (index):

2.96 ± 0.46 (avg. 2.81)

Risk reduction (index x population):

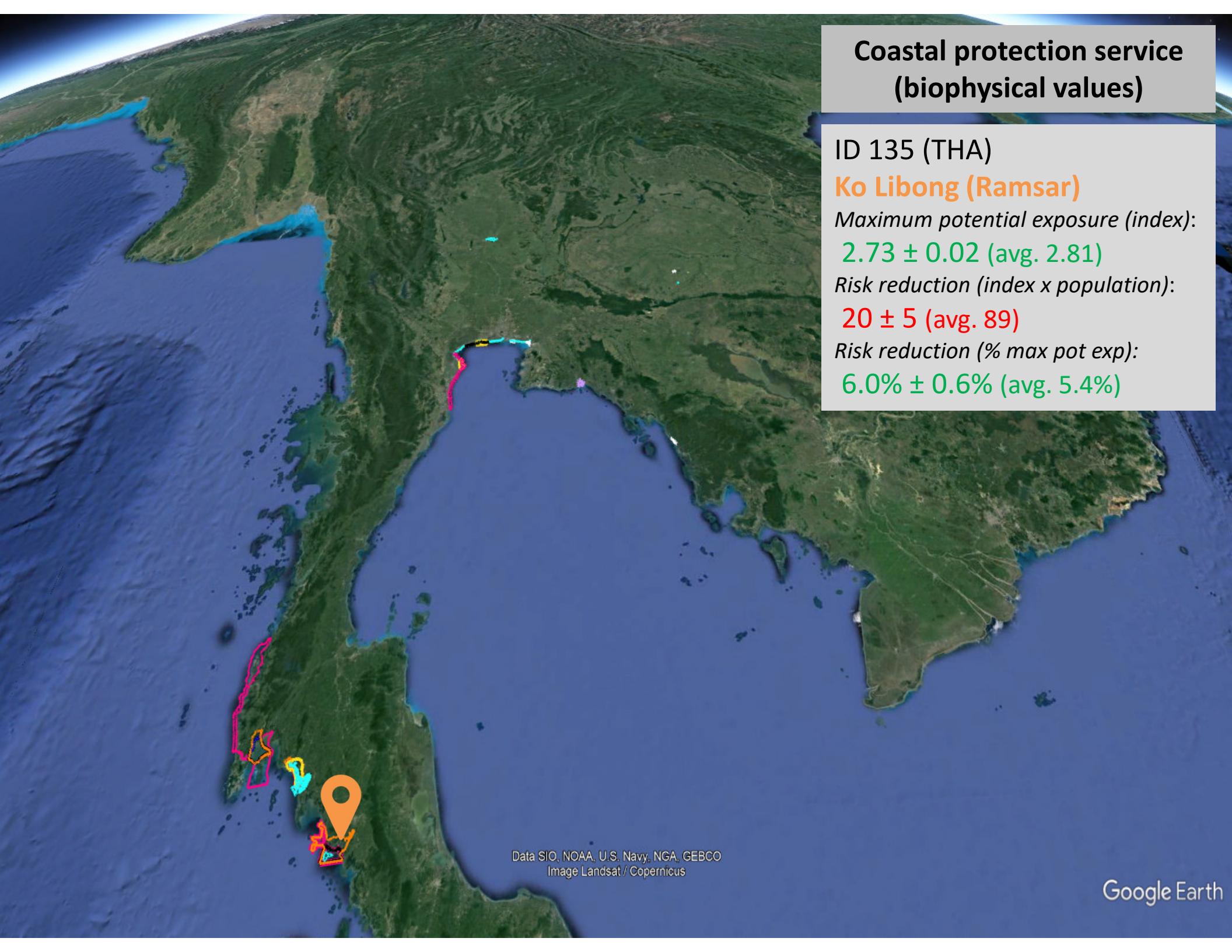
55 ± 2 (avg. 89)

Risk reduction (% max pot exp):

$5.9\% \pm 0.9\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong (Ramsar)

Maximum potential exposure (index):

2.73 ± 0.02 (avg. 2.81)

Risk reduction (index x population):

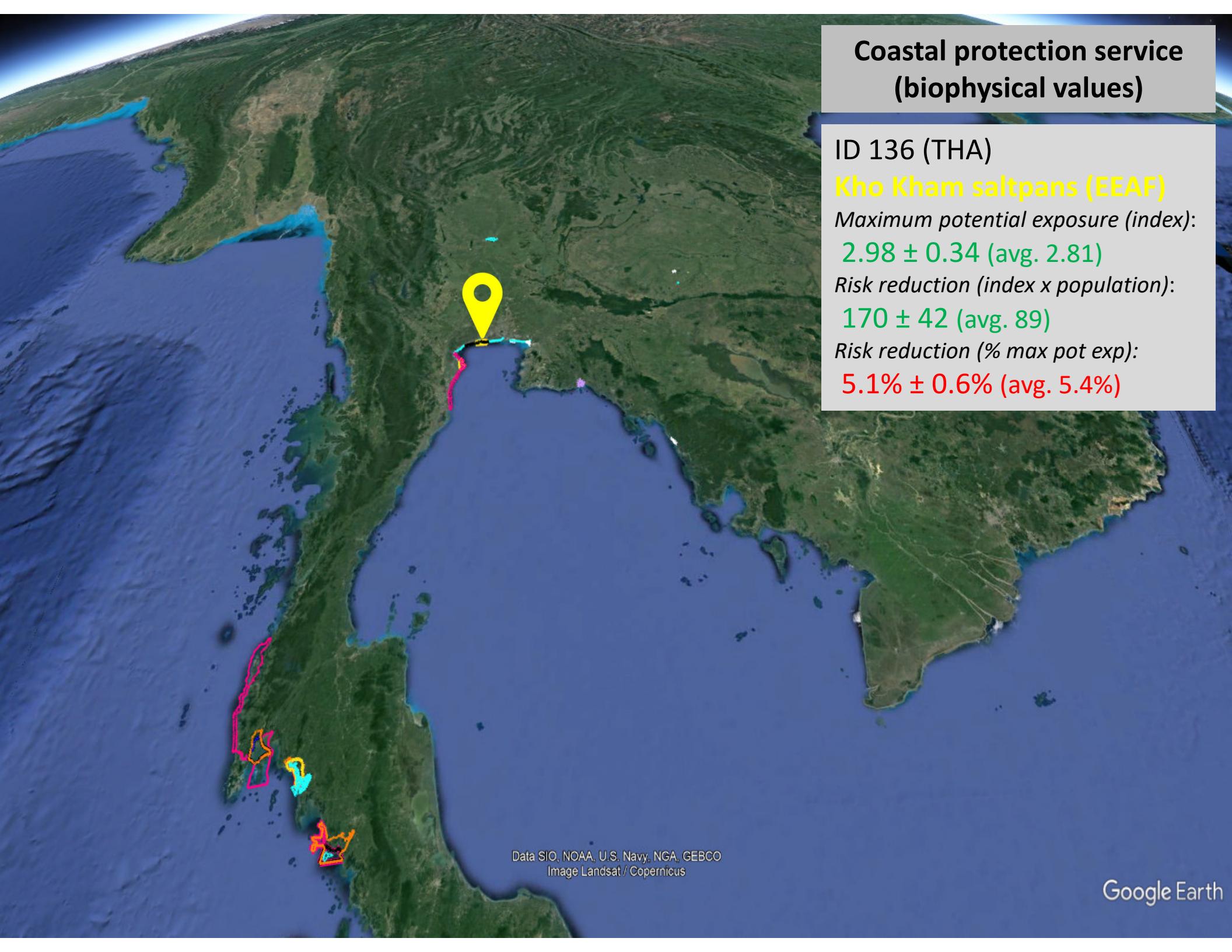
20 ± 5 (avg. 89)

Risk reduction (% max pot exp):

$6.0\% \pm 0.6\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 136 (THA)

Kho Kham saltpans (EEAF)

Maximum potential exposure (index):

2.98 ± 0.34 (avg. 2.81)

Risk reduction (index x population):

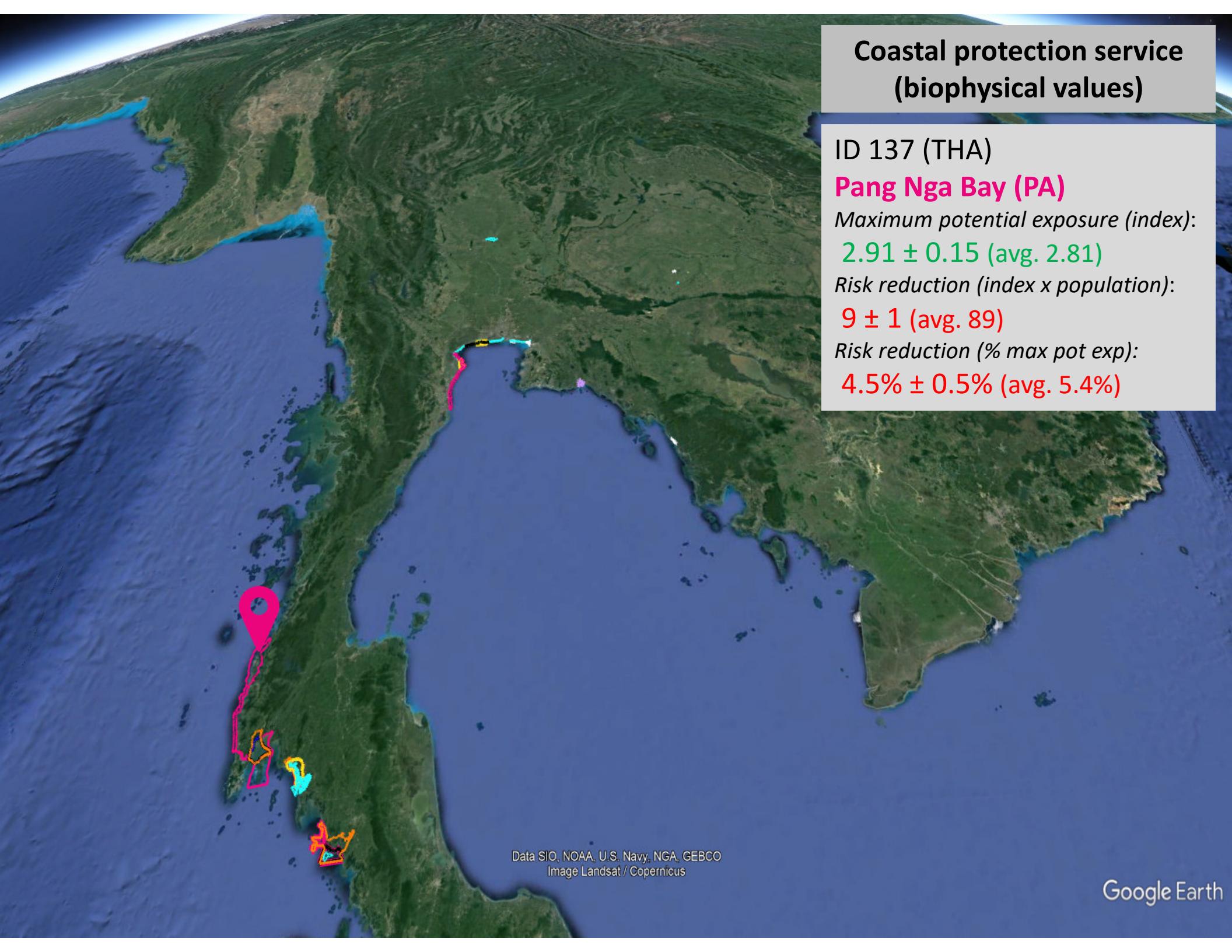
170 ± 42 (avg. 89)

Risk reduction (% max pot exp):

$5.1\% \pm 0.6\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (PA)

Maximum potential exposure (index):

2.91 ± 0.15 (avg. 2.81)

Risk reduction (index x population):

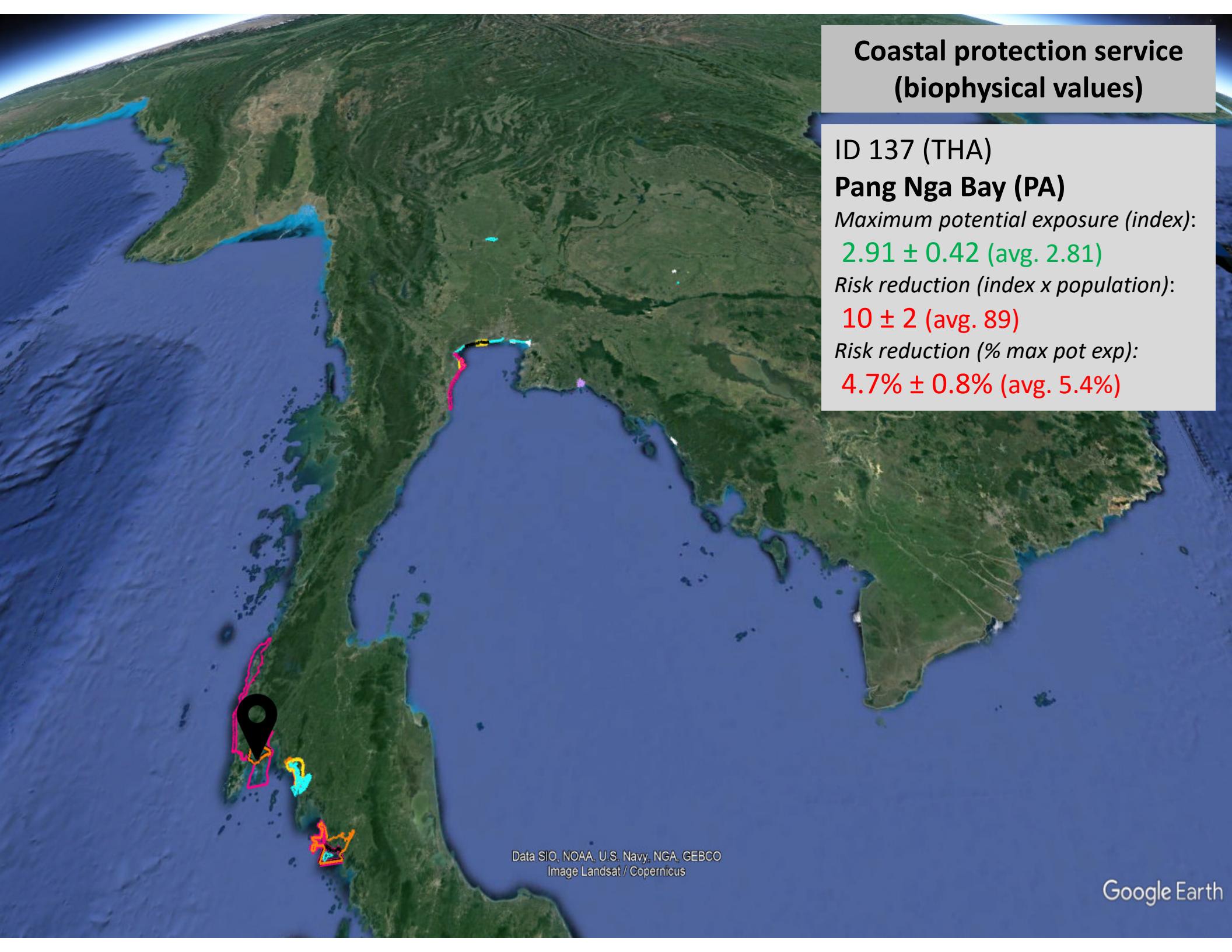
9 ± 1 (avg. 89)

Risk reduction (% max pot exp):

$4.5\% \pm 0.5\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (PA)

Maximum potential exposure (index):

2.91 ± 0.42 (avg. 2.81)

Risk reduction (index x population):

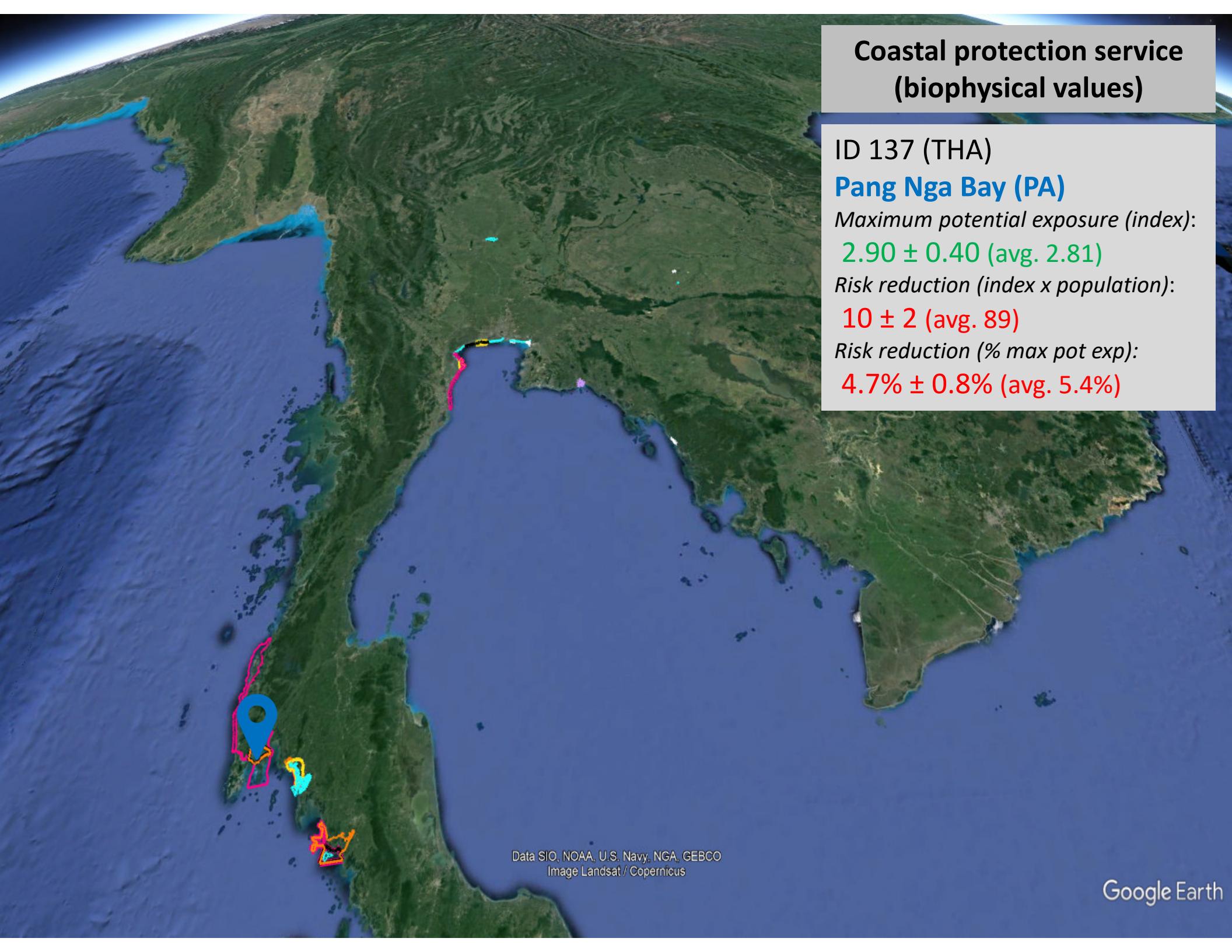
10 ± 2 (avg. 89)

Risk reduction (% max pot exp):

$4.7\% \pm 0.8\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (PA)

Maximum potential exposure (index):

2.90 ± 0.40 (avg. 2.81)

Risk reduction (index x population):

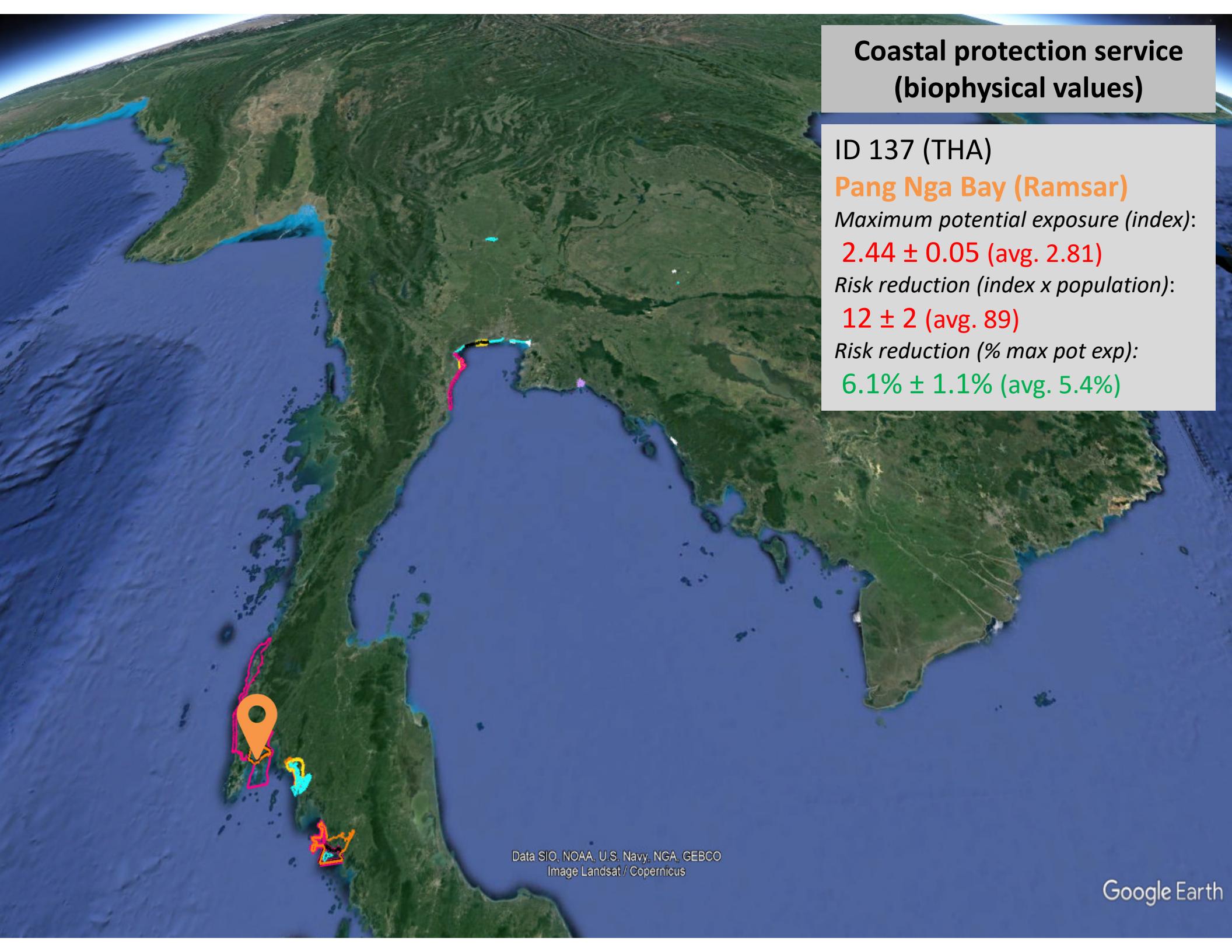
10 ± 2 (avg. 89)

Risk reduction (% max pot exp):

$4.7\% \pm 0.8\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (Ramsar)

Maximum potential exposure (index):

2.44 ± 0.05 (avg. 2.81)

Risk reduction (index x population):

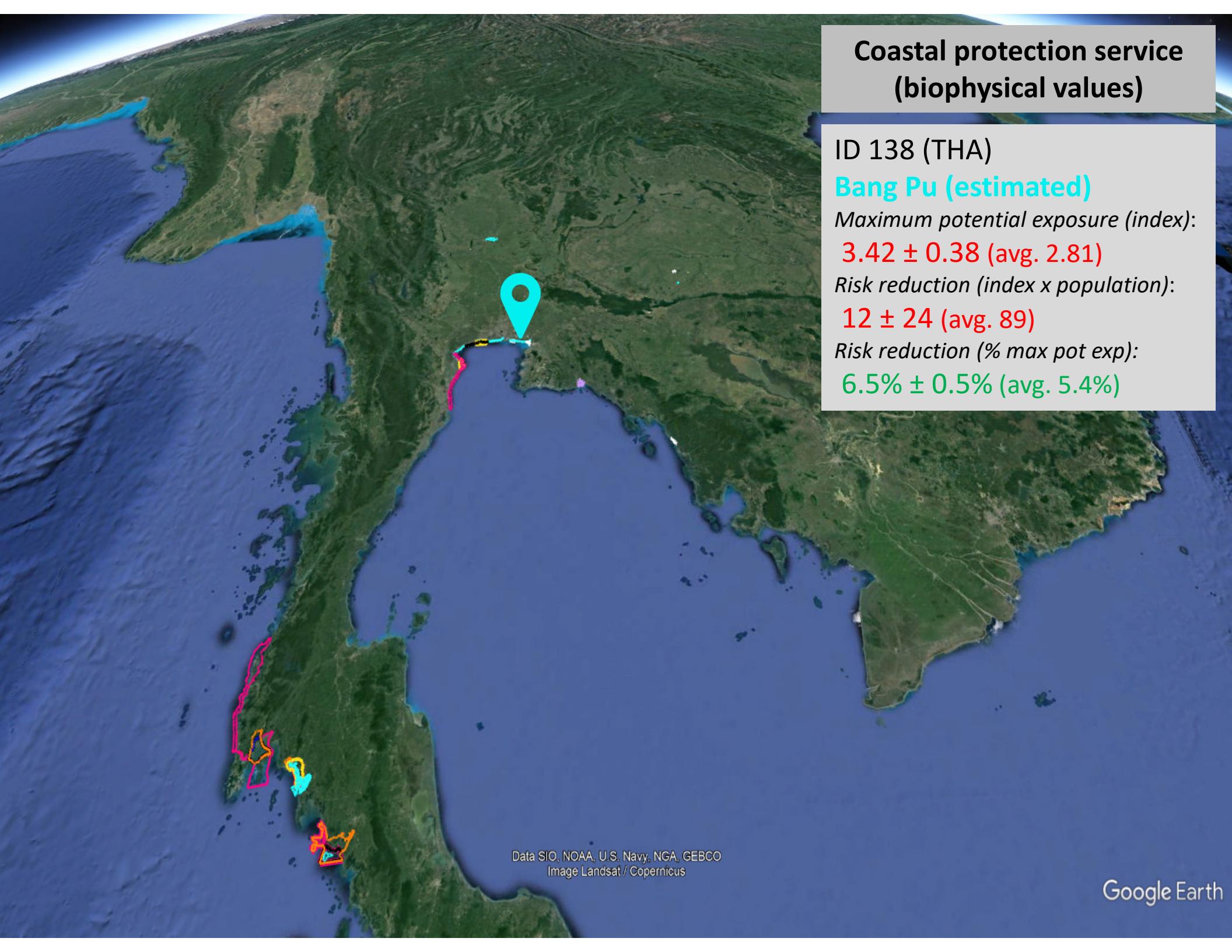
12 ± 2 (avg. 89)

Risk reduction (% max pot exp):

$6.1\% \pm 1.1\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



A Google Earth map of Thailand and surrounding regions. A blue location pin is placed on the eastern coast of Thailand, specifically near the city of Bangkok. The map shows land in green and water in blue. Several areas along the coast are highlighted with colored outlines: pink, yellow, and orange. These likely represent different coastal zones or buffer areas used for risk analysis.

Coastal protection service (biophysical values)

ID 138 (THA)

Bang Pu (estimated)

Maximum potential exposure (index):

3.42 ± 0.38 (avg. 2.81)

Risk reduction (index x population):

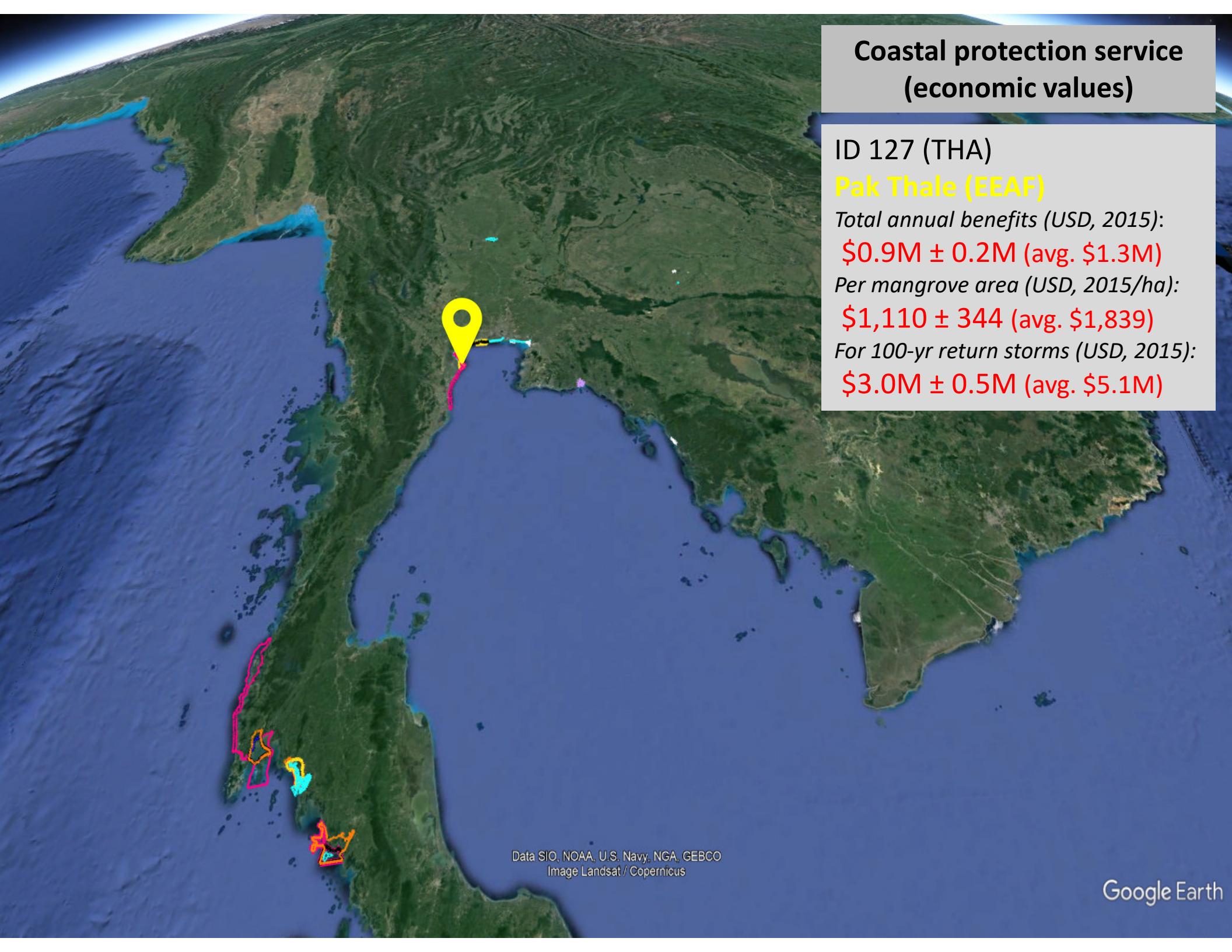
12 ± 24 (avg. 89)

Risk reduction (% max pot exp):

$6.5\% \pm 0.5\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 127 (THA)

Pak Thale (EEAF)

Total annual benefits (USD, 2015):

\$0.9M ± 0.2M (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

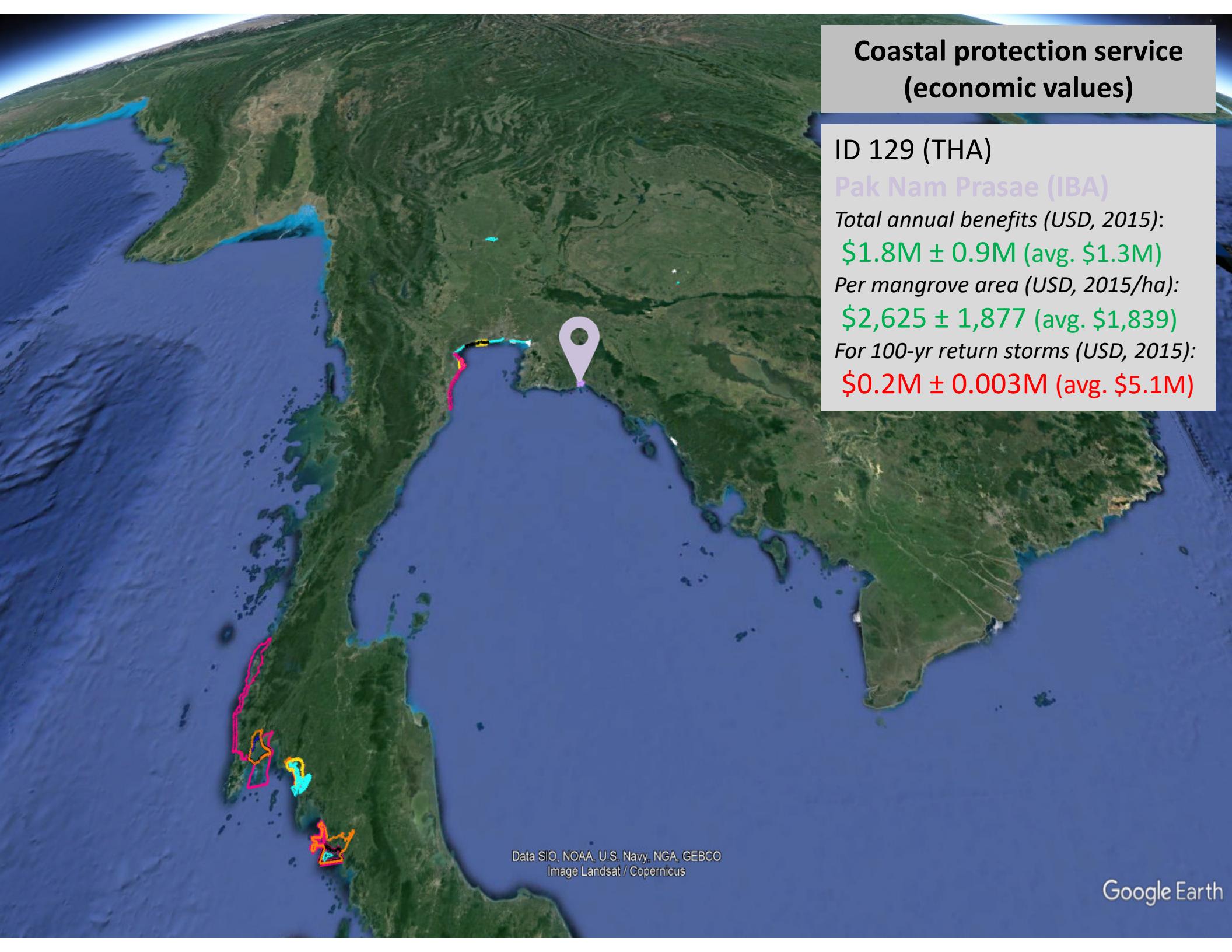
\$1,110 ± 344 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$3.0M ± 0.5M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 129 (THA)

Pak Nam Prasae (IBA)

Total annual benefits (USD, 2015):

\$1.8M ± 0.9M (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

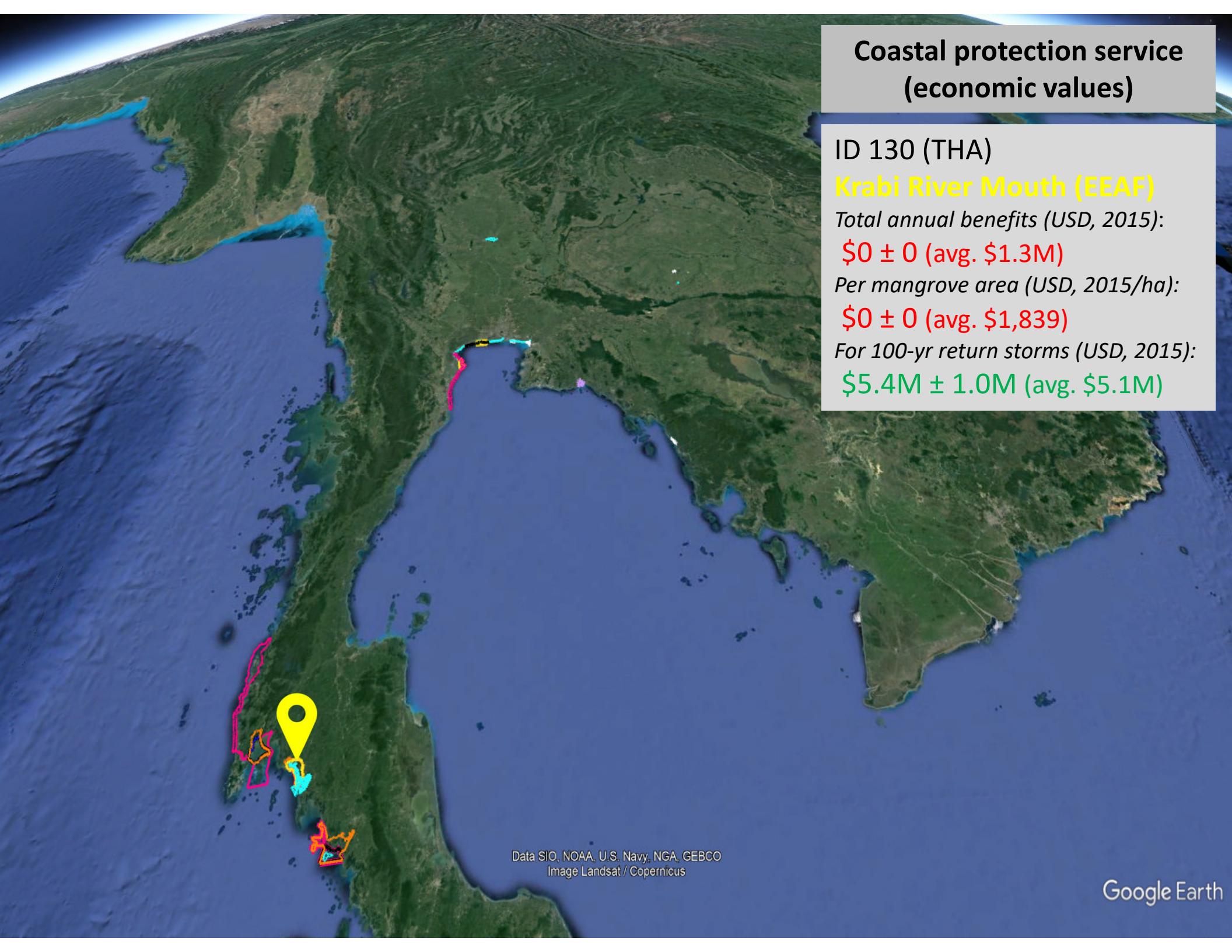
\$2,625 ± 1,877 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$0.2M ± 0.003M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 130 (THA)

Krabi River Mouth (EEAF)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

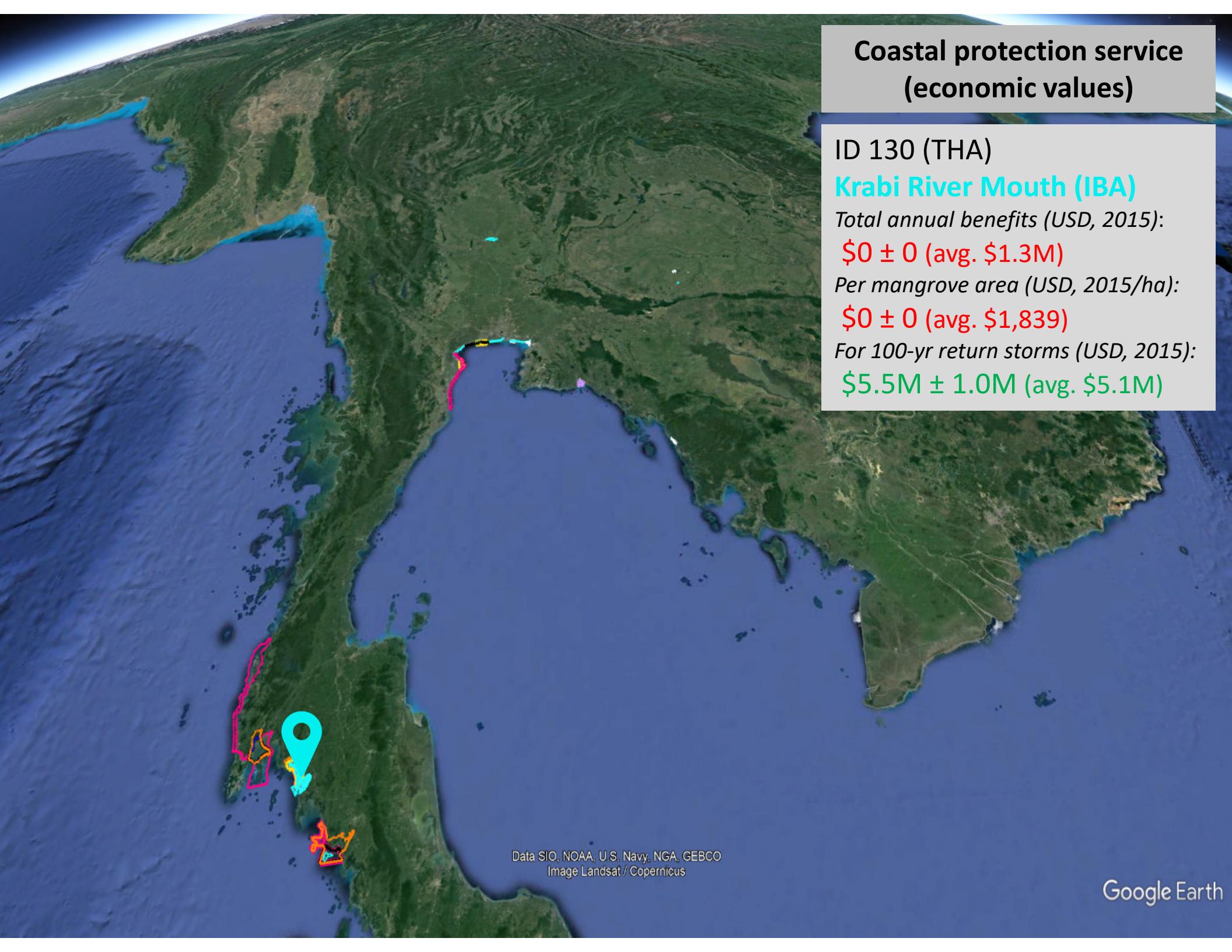
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$5.4M ± 1.0M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 130 (THA)

Krabi River Mouth (IBA)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

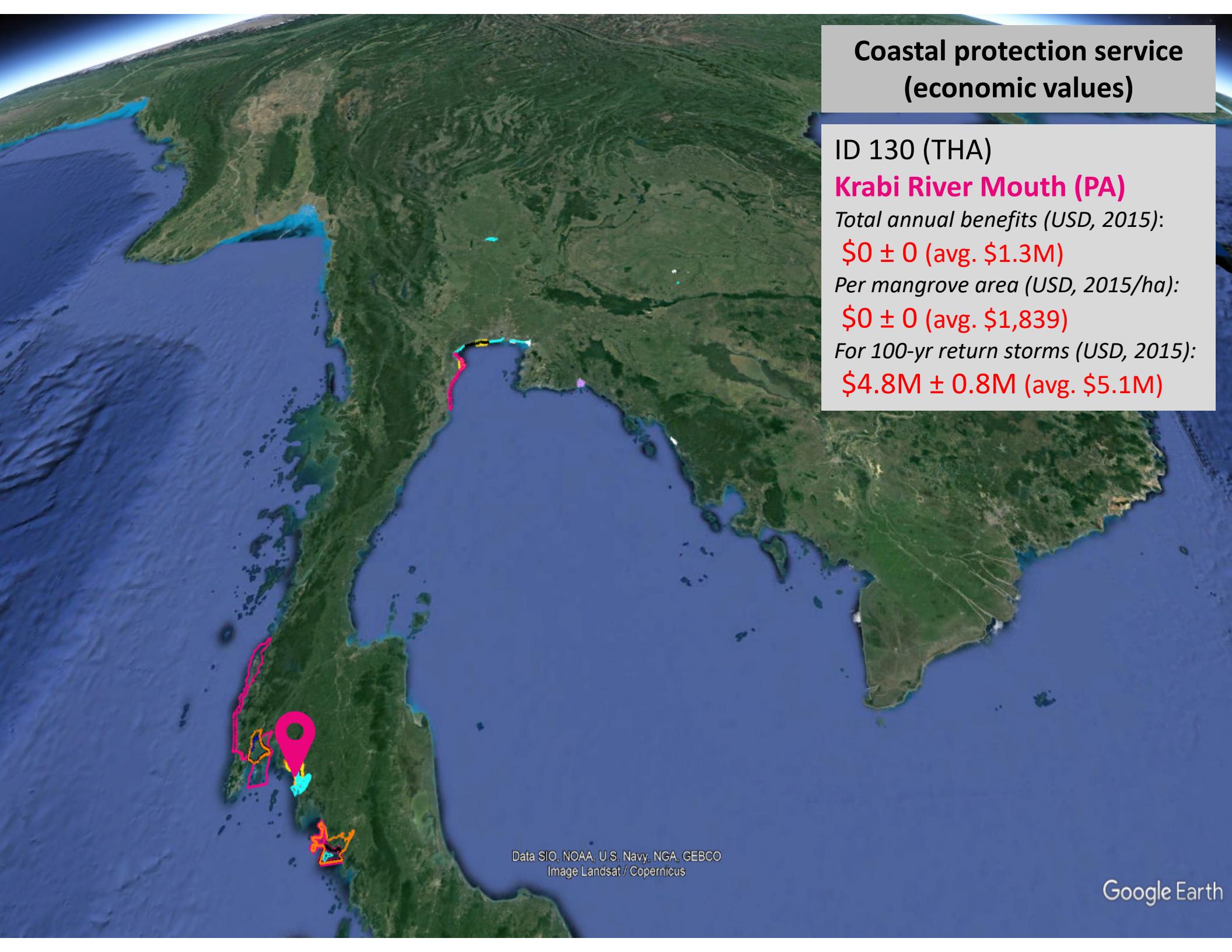
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$5.5M ± 1.0M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 130 (THA)

Krabi River Mouth (PA)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

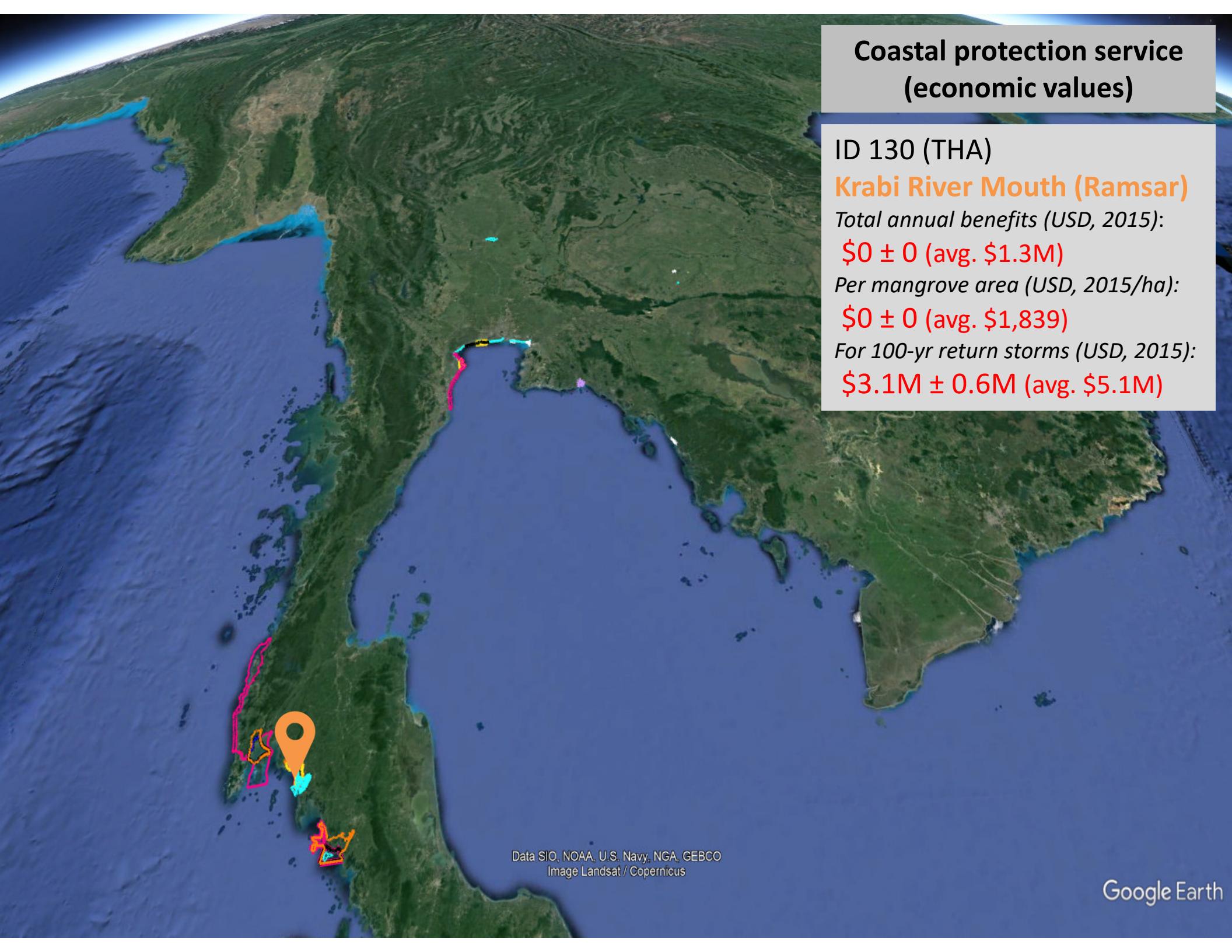
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$4.8M ± 0.8M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 130 (THA)

Krabi River Mouth (Ramsar)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

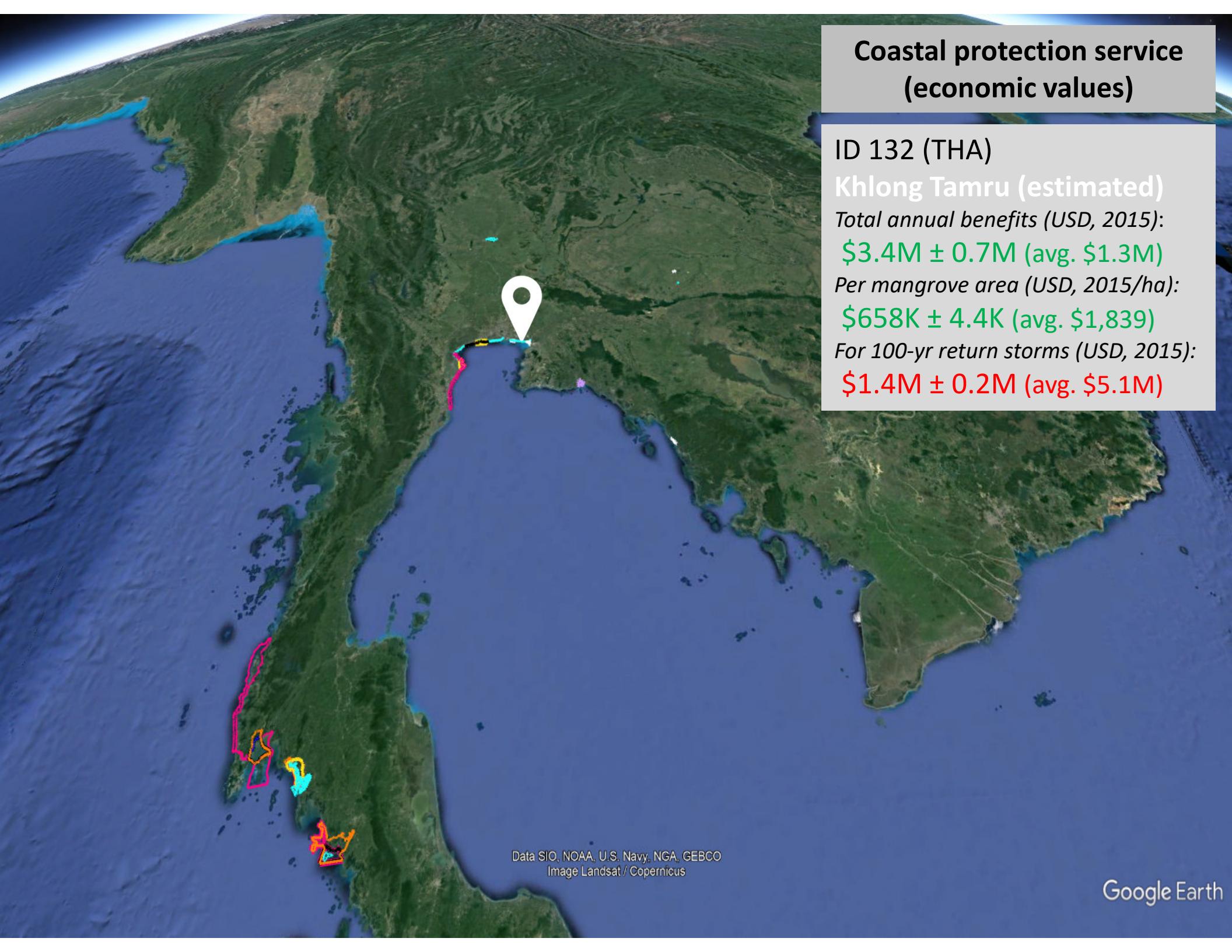
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$3.1M ± 0.6M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 132 (THA)

Khlong Tamru (estimated)

Total annual benefits (USD, 2015):

\$3.4M ± 0.7M (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

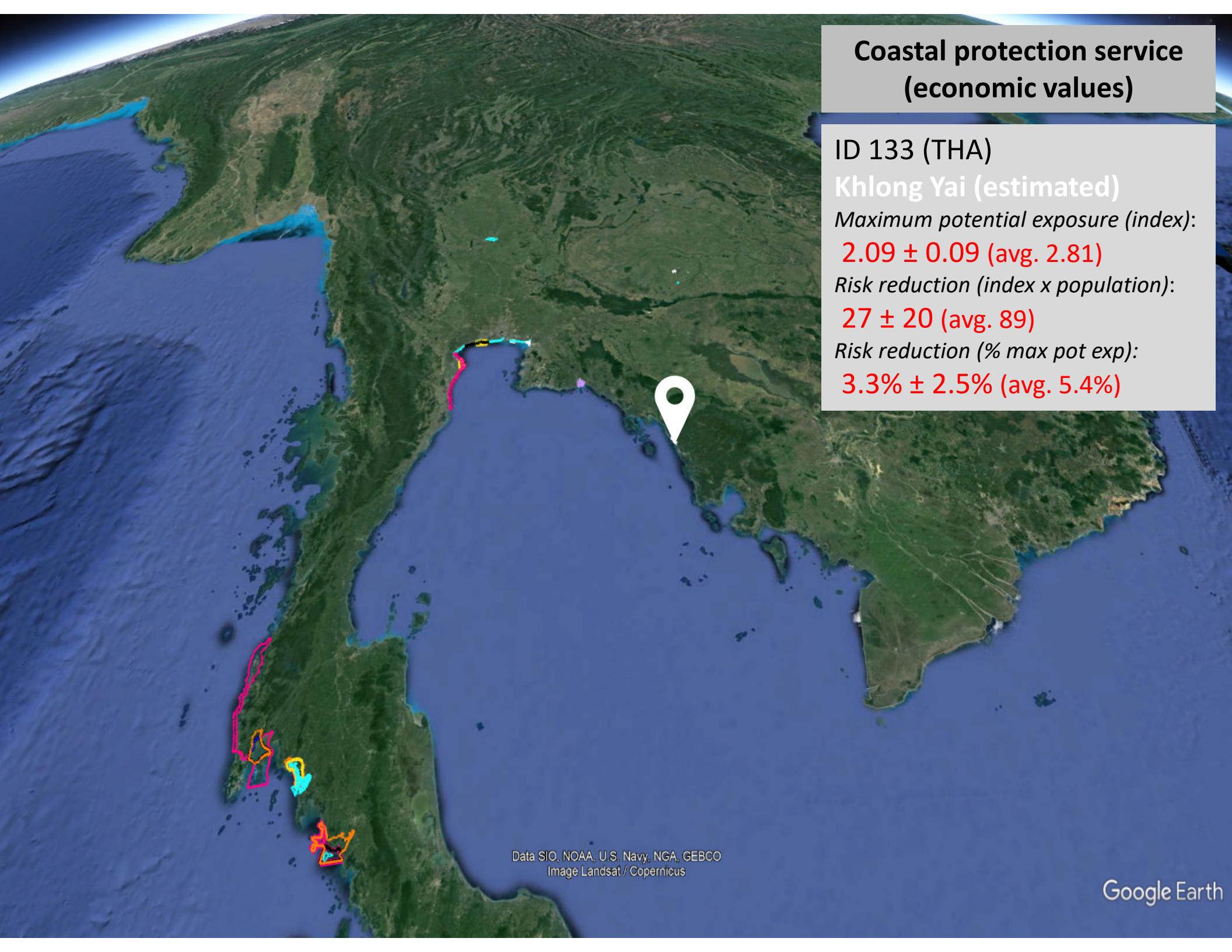
\$658K ± 4.4K (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$1.4M ± 0.2M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (economic values)

ID 133 (THA)

Khlong Yai (estimated)

Maximum potential exposure (index):

2.09 ± 0.09 (avg. 2.81)

Risk reduction (index x population):

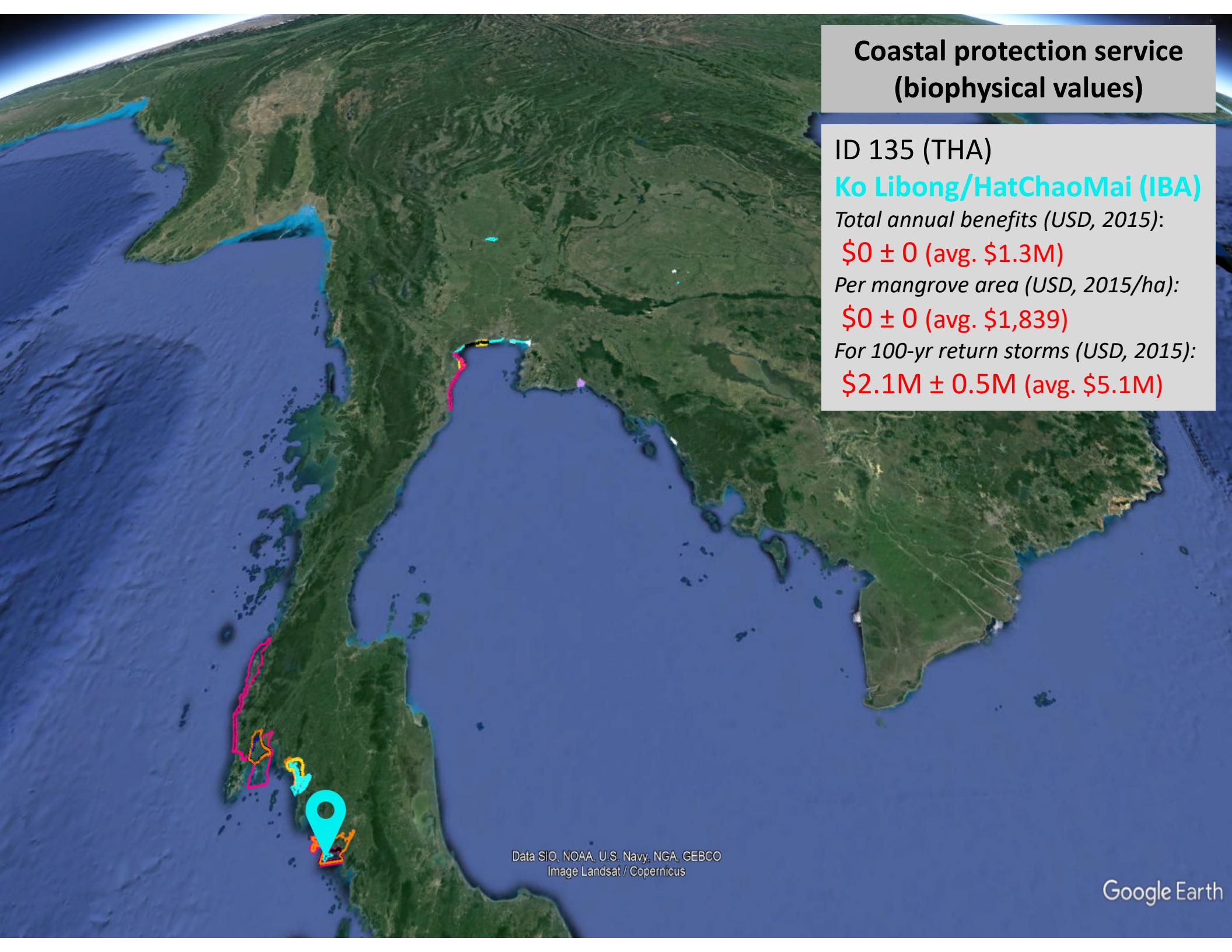
27 ± 20 (avg. 89)

Risk reduction (% max pot exp):

$3.3\% \pm 2.5\%$ (avg. 5.4%)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong/HatChaoMai (IBA)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

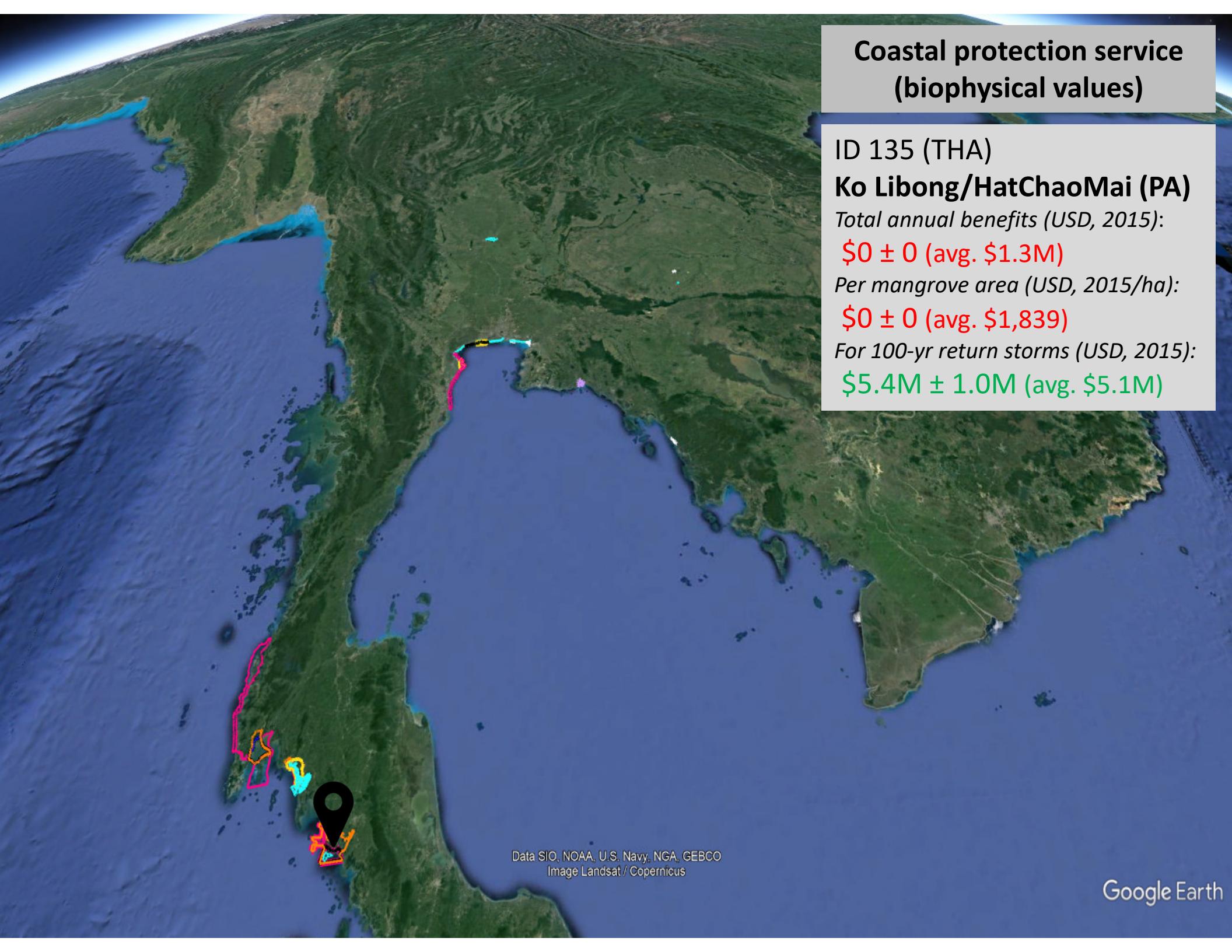
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$2.1M ± 0.5M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong/HatChaoMai (PA)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

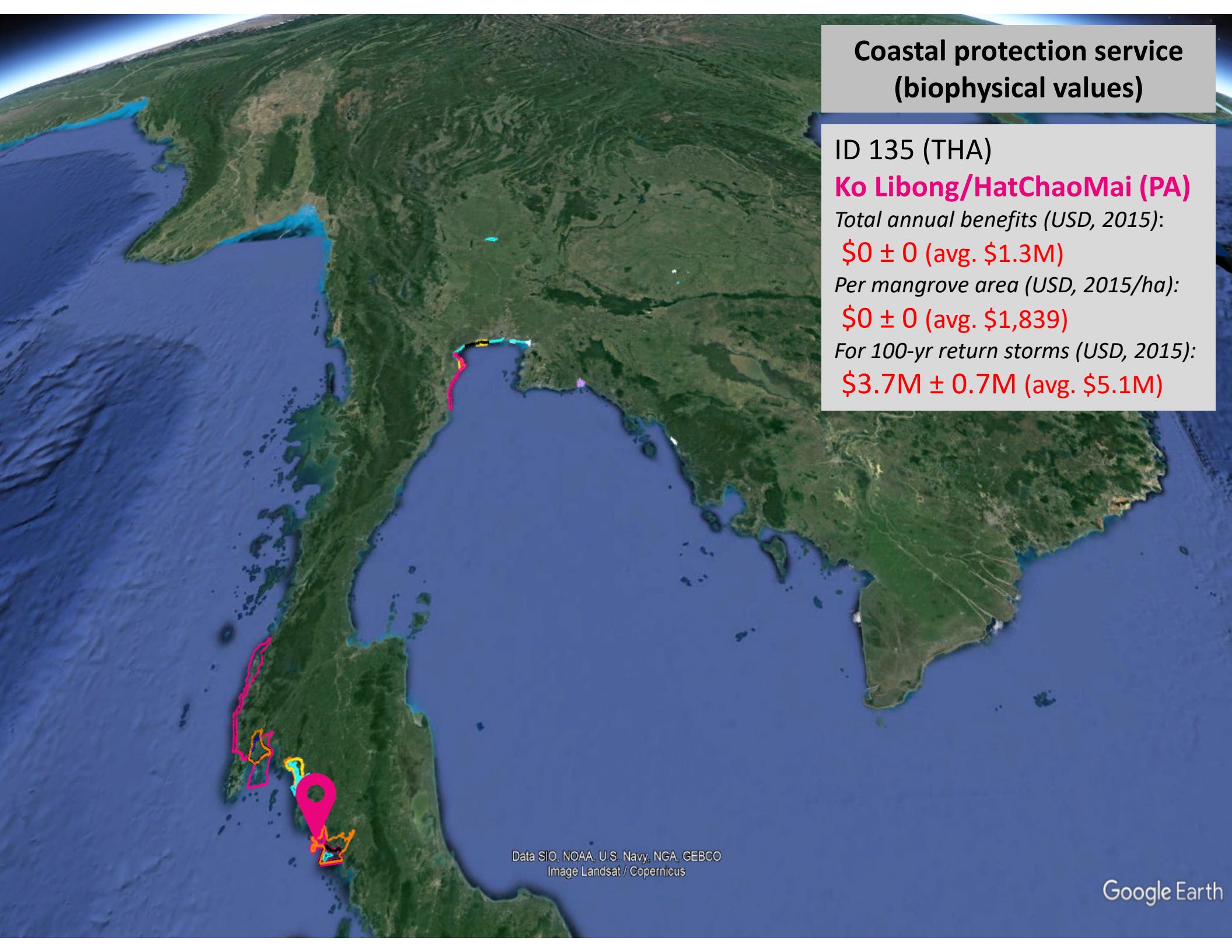
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$5.4M ± 1.0M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong/HatChaoMai (PA)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

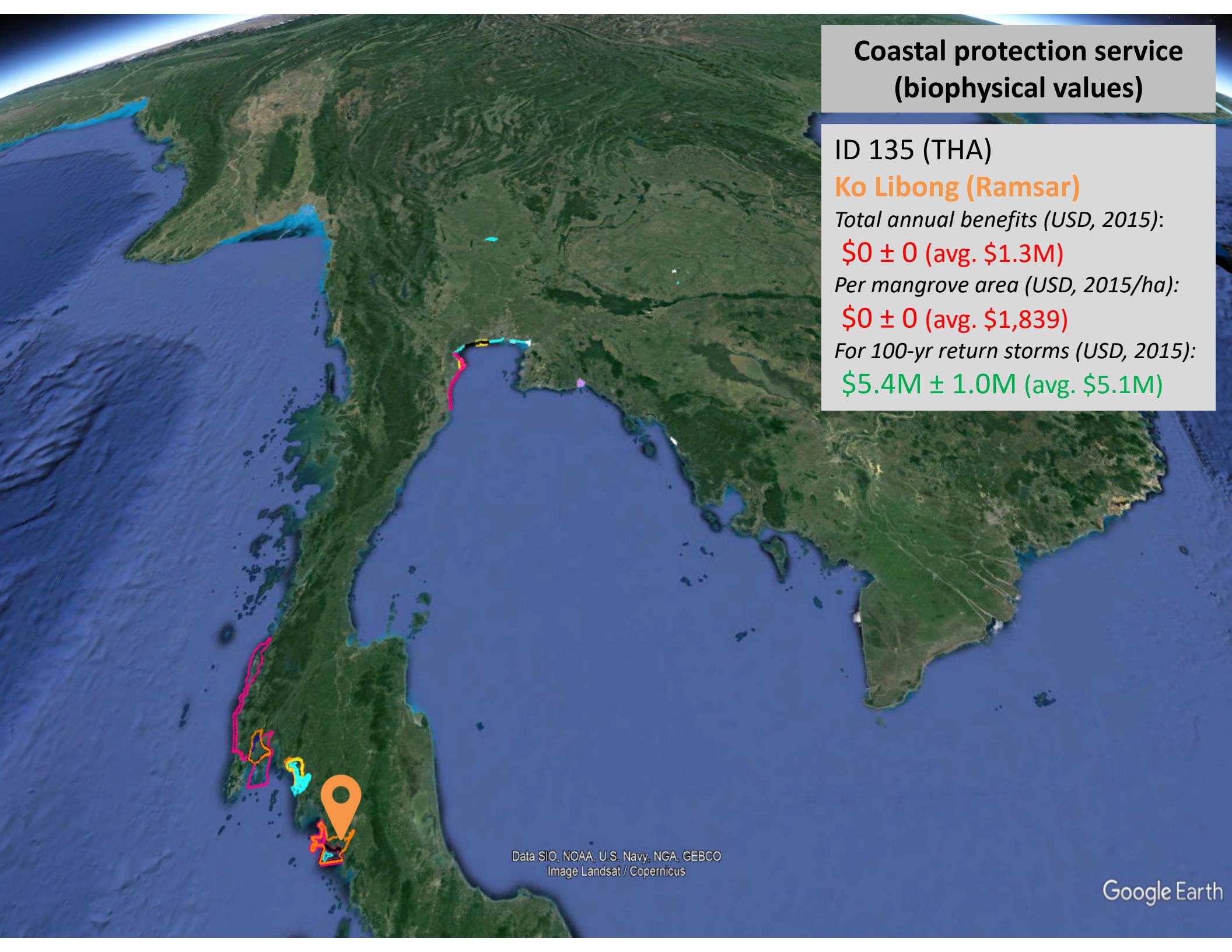
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$3.7M ± 0.7M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 135 (THA)

Ko Libong (Ramsar)

Total annual benefits (USD, 2015):

$\$0 \pm 0$ (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

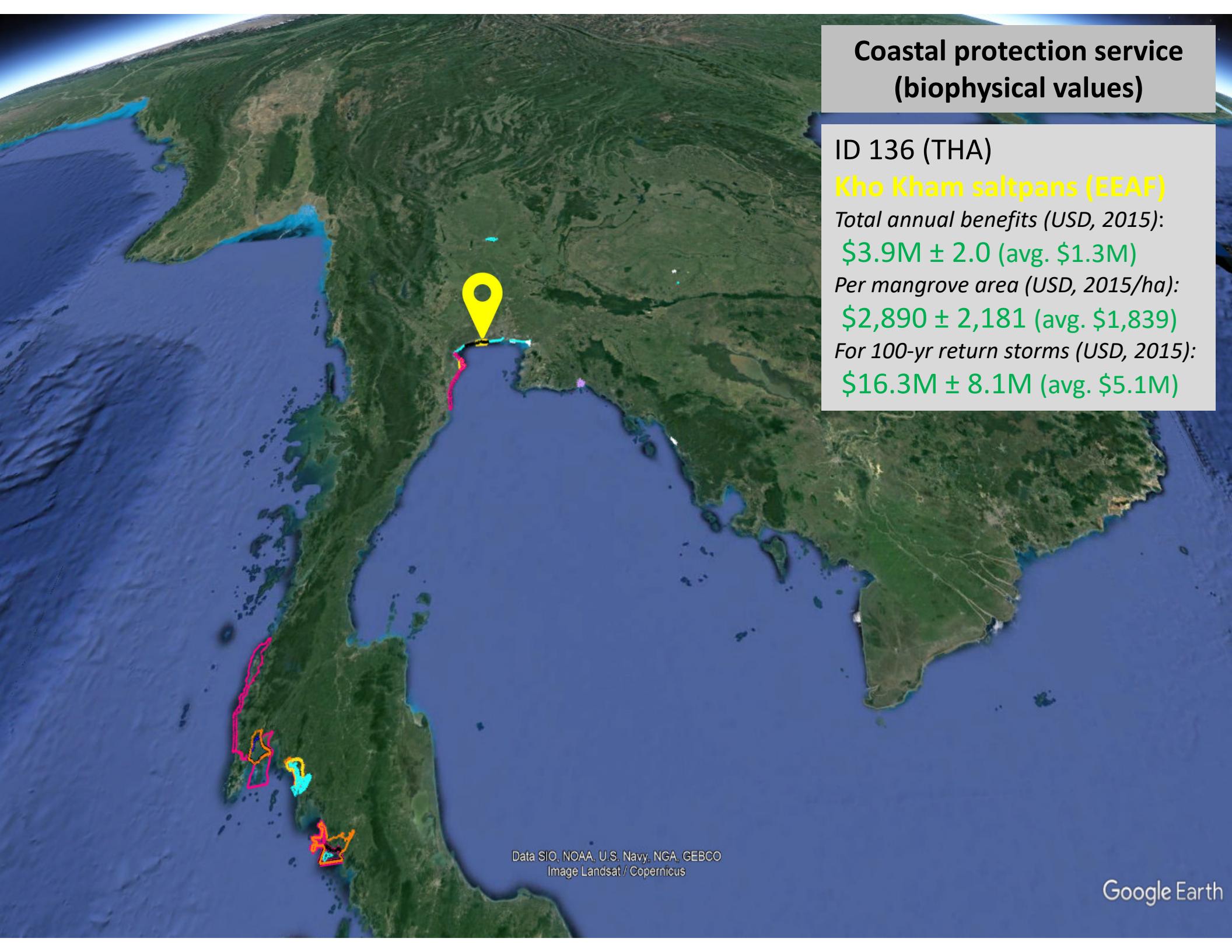
$\$0 \pm 0$ (avg. \$1,839)

For 100-yr return storms (USD, 2015):

$\$5.4M \pm 1.0M$ (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 136 (THA)

Kho Kham saltpans (EEAF)

Total annual benefits (USD, 2015):

\$3.9M ± 2.0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

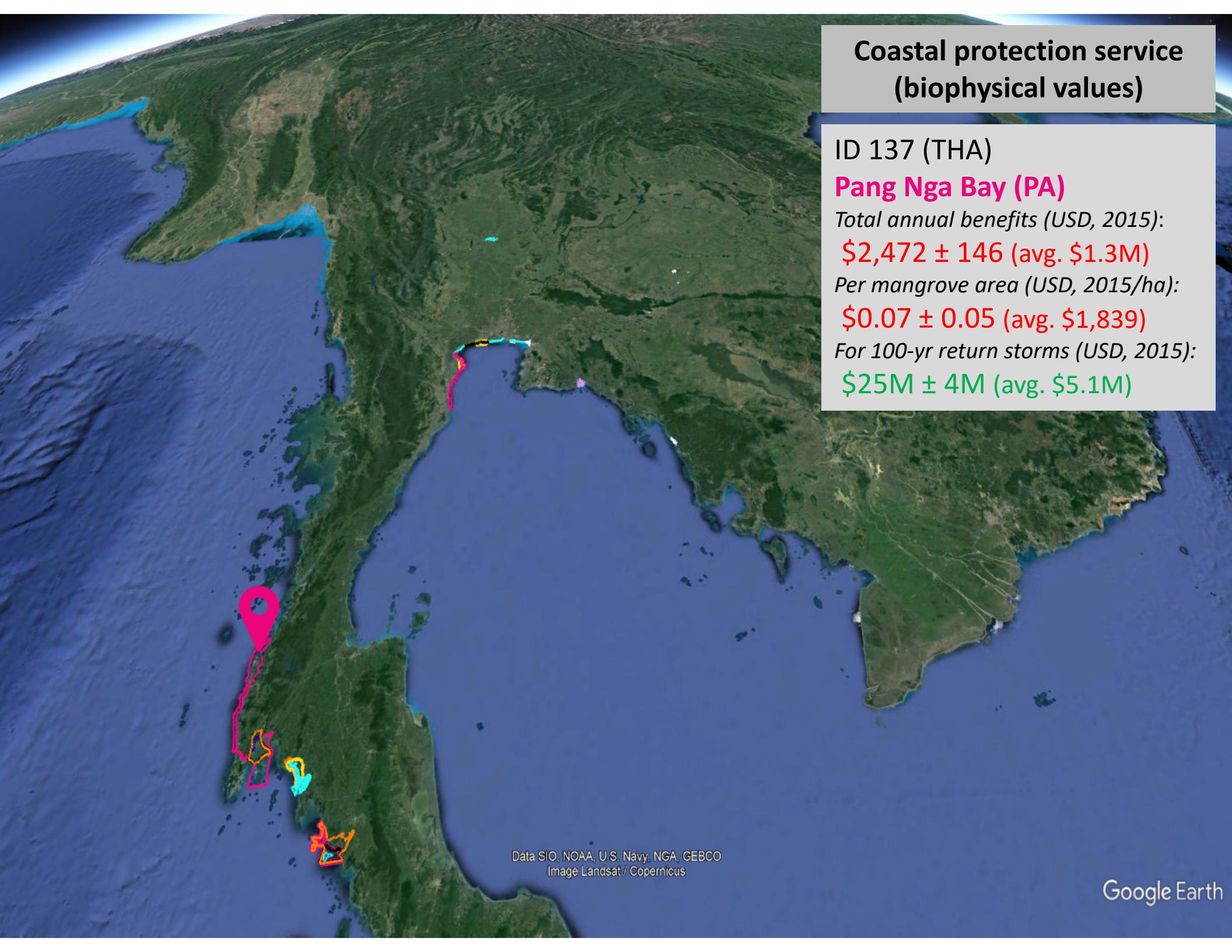
\$2,890 ± 2,181 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$16.3M ± 8.1M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (PA)

Total annual benefits (USD, 2015):

\$2,472 ± 146 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

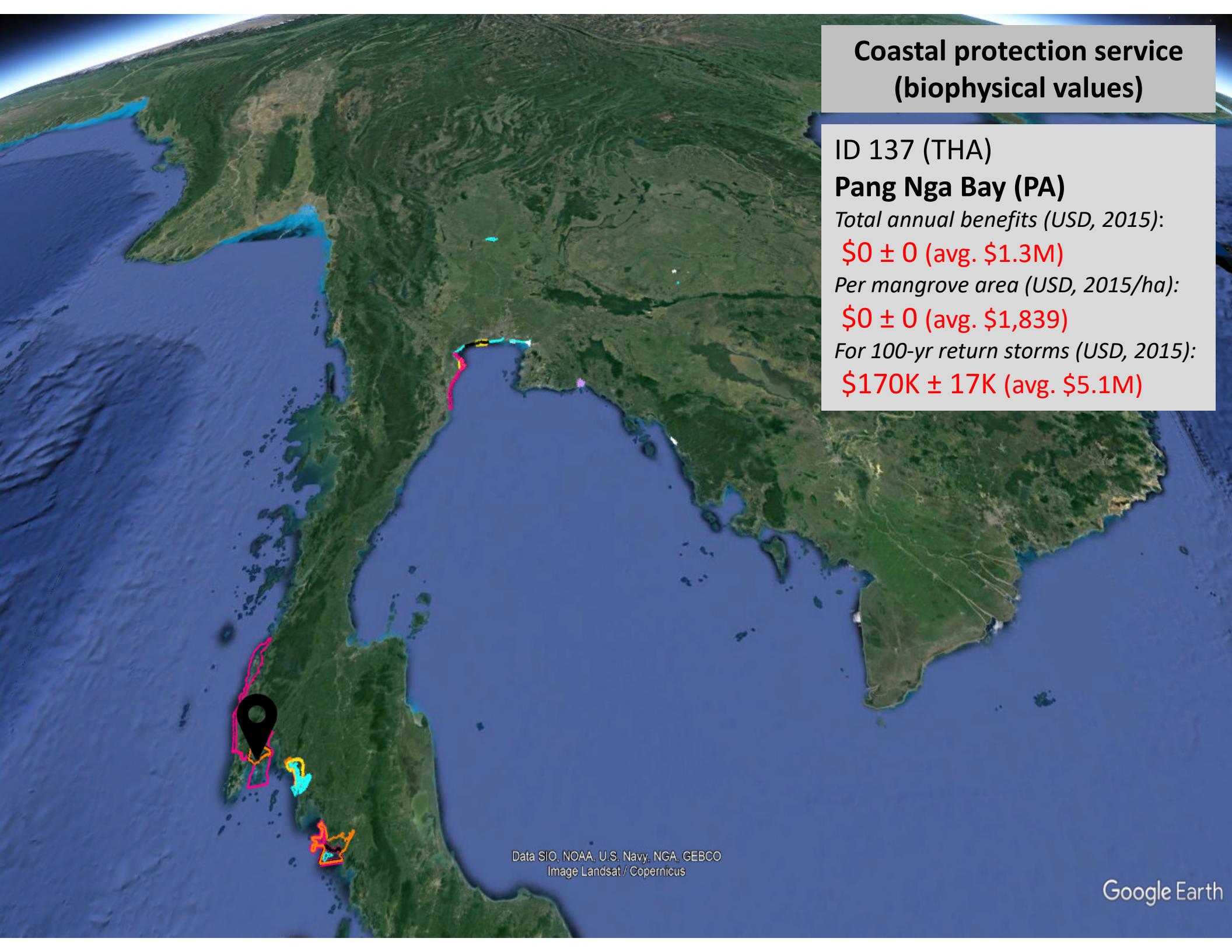
\$0.07 ± 0.05 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$25M ± 4M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (PA)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

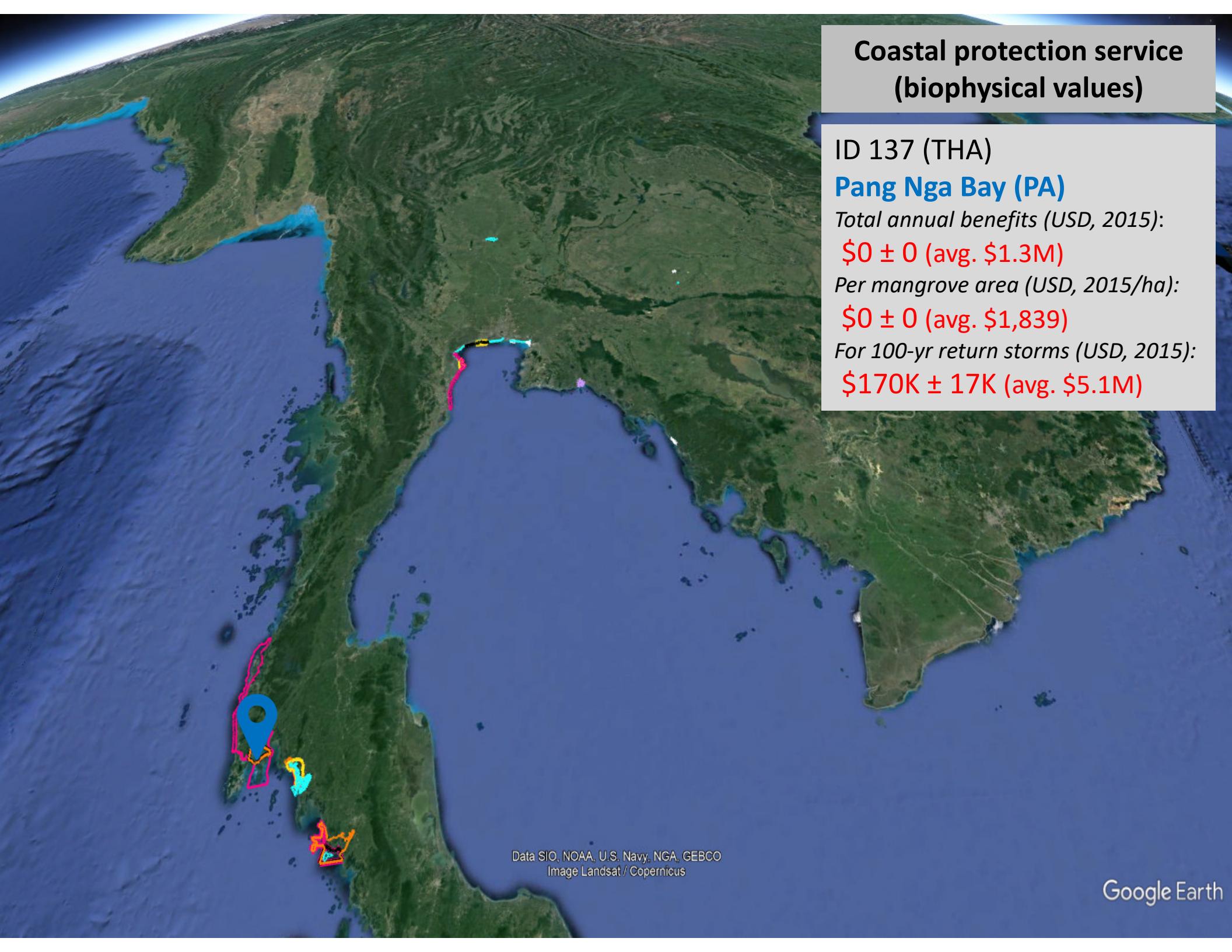
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$170K ± 17K (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (PA)

Total annual benefits (USD, 2015):

$\$0 \pm 0$ (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

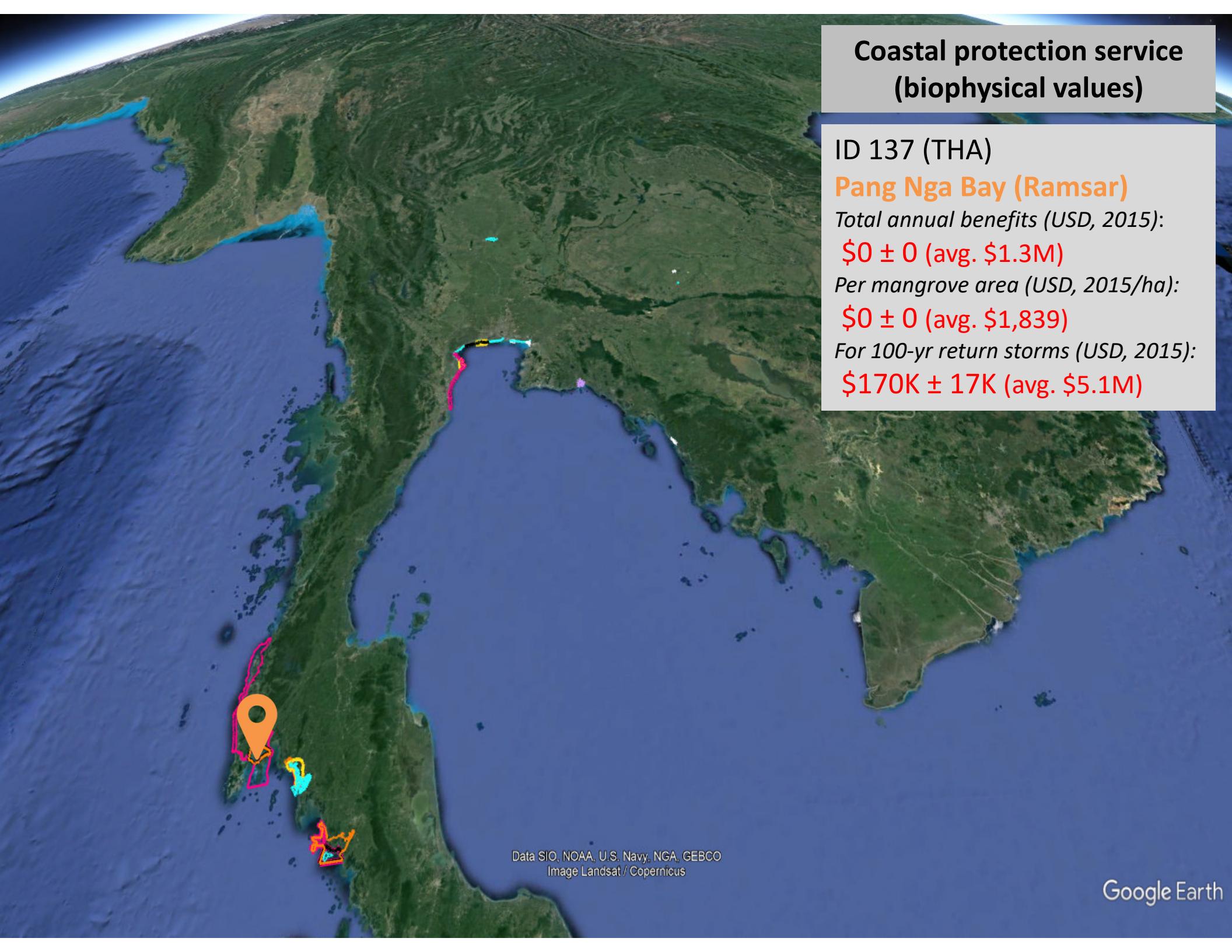
$\$0 \pm 0$ (avg. \$1,839)

For 100-yr return storms (USD, 2015):

$\$170K \pm 17K$ (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 137 (THA)

Pang Nga Bay (Ramsar)

Total annual benefits (USD, 2015):

\$0 ± 0 (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

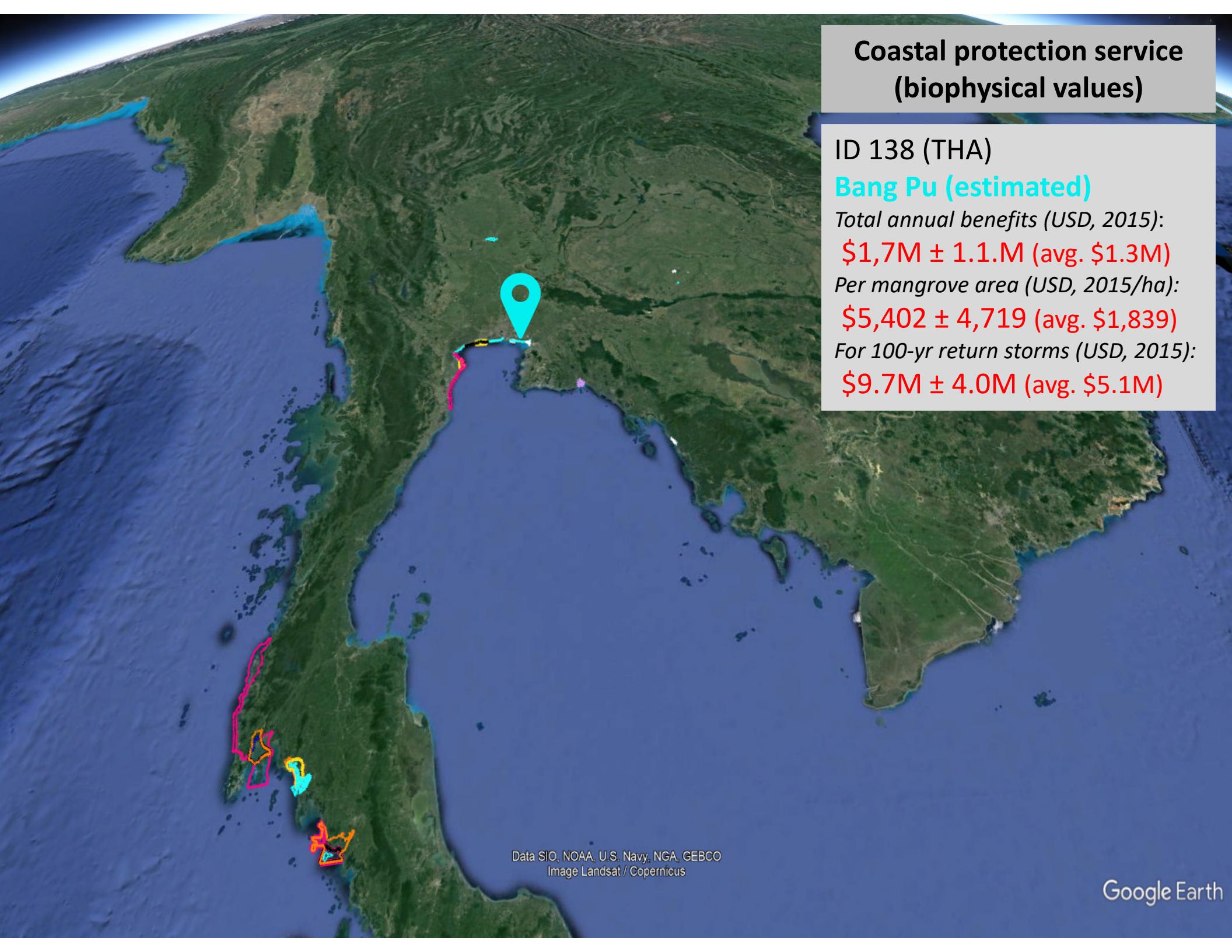
\$0 ± 0 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$170K ± 17K (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Coastal protection service (biophysical values)

ID 138 (THA)

Bang Pu (estimated)

Total annual benefits (USD, 2015):

\$1,7M ± 1.1.M (avg. \$1.3M)

Per mangrove area (USD, 2015/ha):

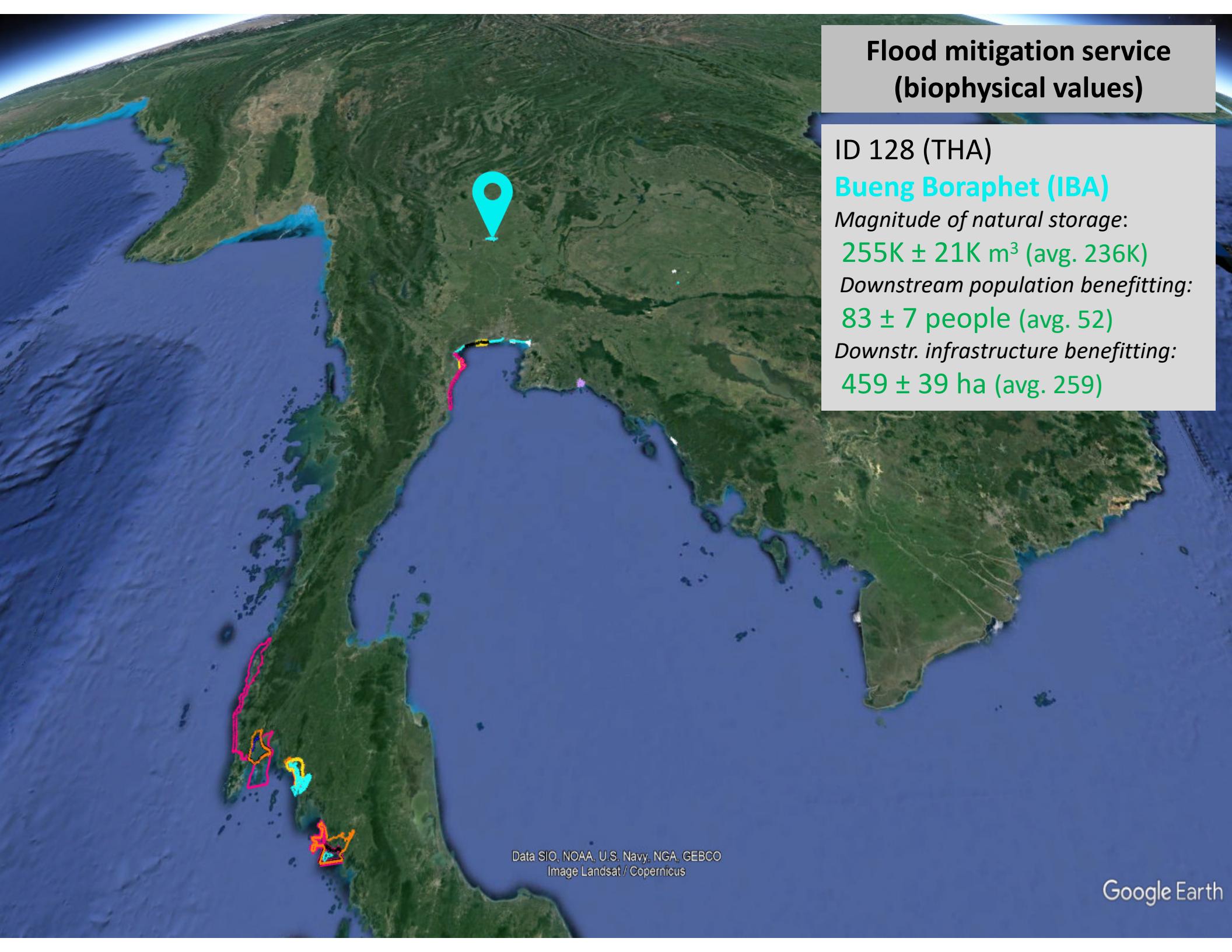
\$5,402 ± 4,719 (avg. \$1,839)

For 100-yr return storms (USD, 2015):

\$9.7M ± 4.0M (avg. \$5.1M)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Flood mitigation service (biophysical values)

ID 128 (THA)

Bueng Boraphet (IBA)

Magnitude of natural storage:

$255K \pm 21K \text{ m}^3$ (avg. 236K)

Downstream population benefitting:

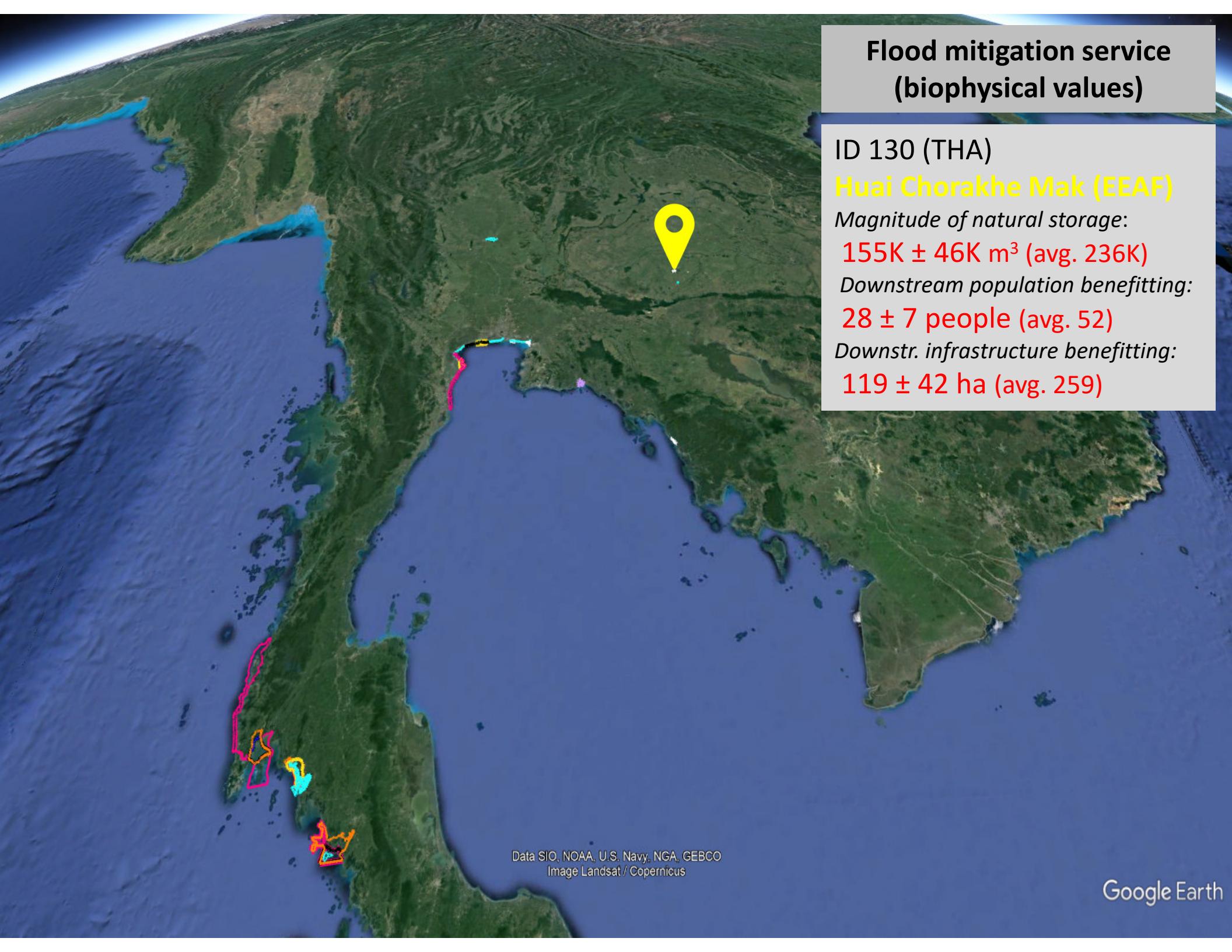
83 ± 7 people (avg. 52)

Downstr. infrastructure benefitting:

459 ± 39 ha (avg. 259)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



Flood mitigation service (biophysical values)

ID 130 (THA)

Huai Chorakhe Mak (EEAF)

Magnitude of natural storage:

$155K \pm 46K \text{ m}^3$ (avg. 236K)

Downstream population benefitting:

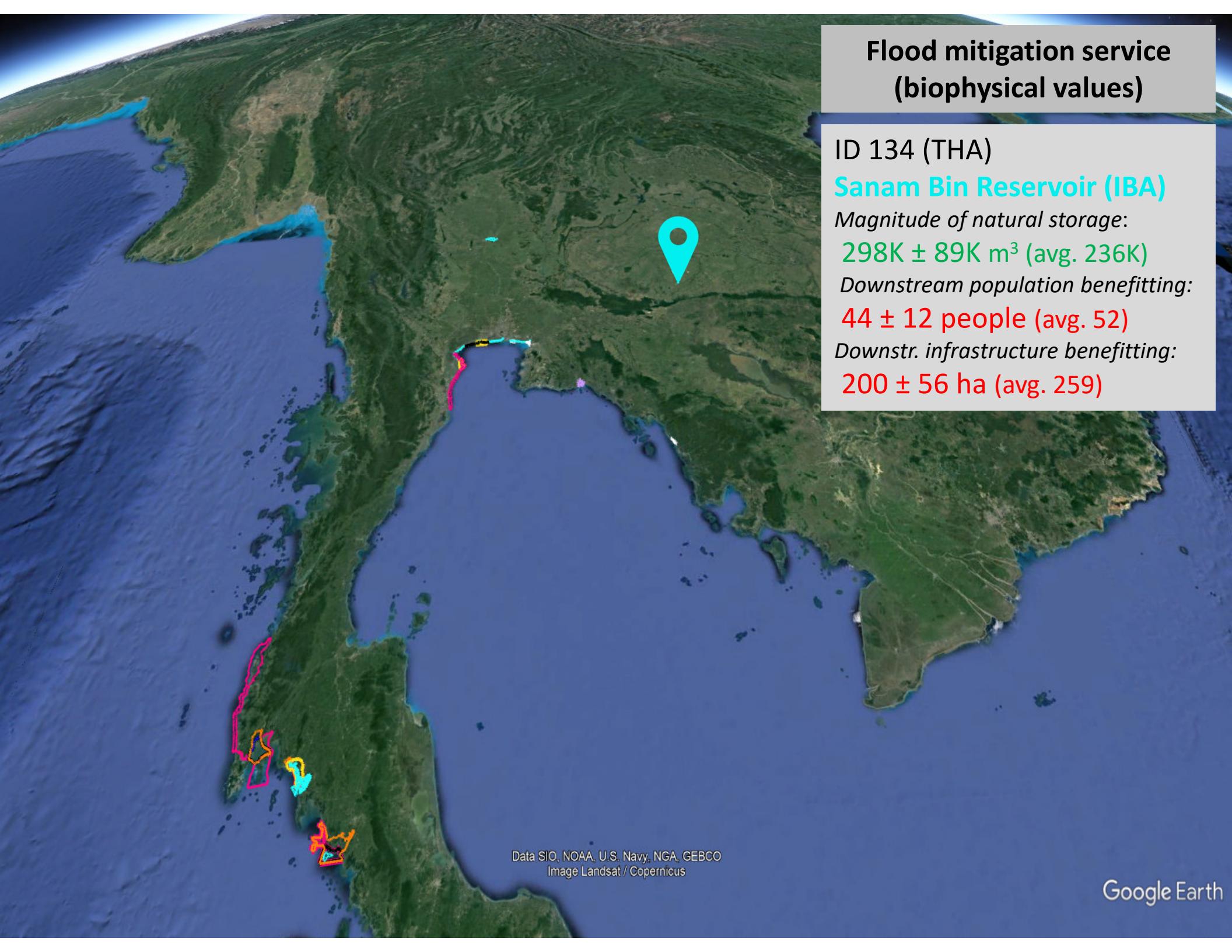
28 ± 7 people (avg. 52)

Downstr. infrastructure benefitting:

119 ± 42 ha (avg. 259)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



A Google Earth map of Thailand and surrounding regions. A cyan location marker is placed near the northern part of the country, specifically over the Sanam Bin Reservoir area. The map shows green landmasses and blue bodies of water.

Flood mitigation service (biophysical values)

ID 134 (THA)

Sanam Bin Reservoir (IBA)

Magnitude of natural storage:

$298K \pm 89K \text{ m}^3$ (avg. 236K)

Downstream population benefitting:

44 ± 12 people (avg. 52)

Downstr. infrastructure benefitting:

200 ± 56 ha (avg. 259)

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Google Earth



ANY QUESTIONS?

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