CHANGING WHAT'S POSSIBLE

Seaweed 2.0 - Farming the Oceans for Fuels & Chemicals

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- 70% more food needed
- much higher demand for biofuels & biobased products
- Need to greatly increase biomass production capacity

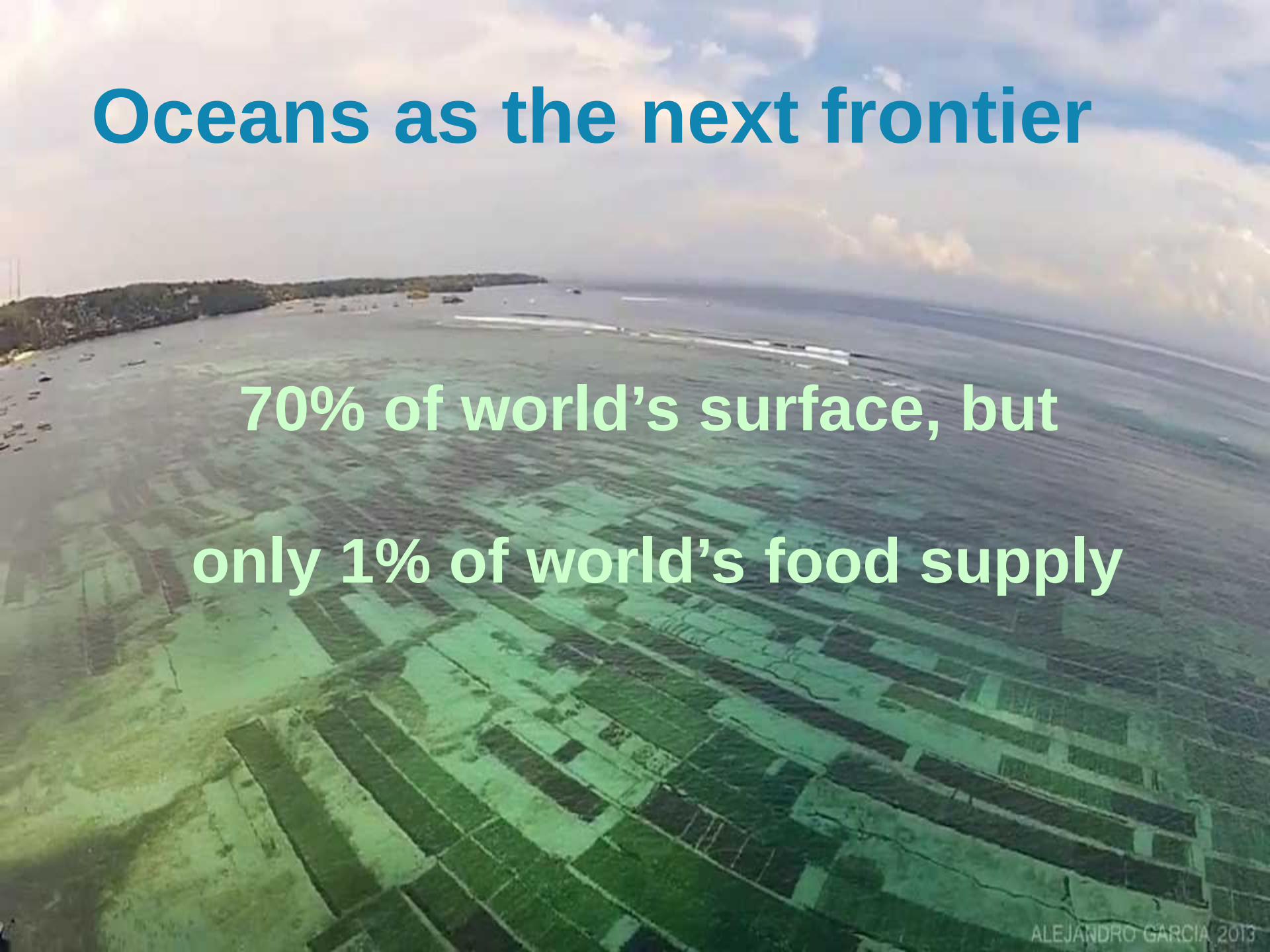

Where and how
will we grow
our additional
biomass?

Peak Farmland

Peak Freshwater

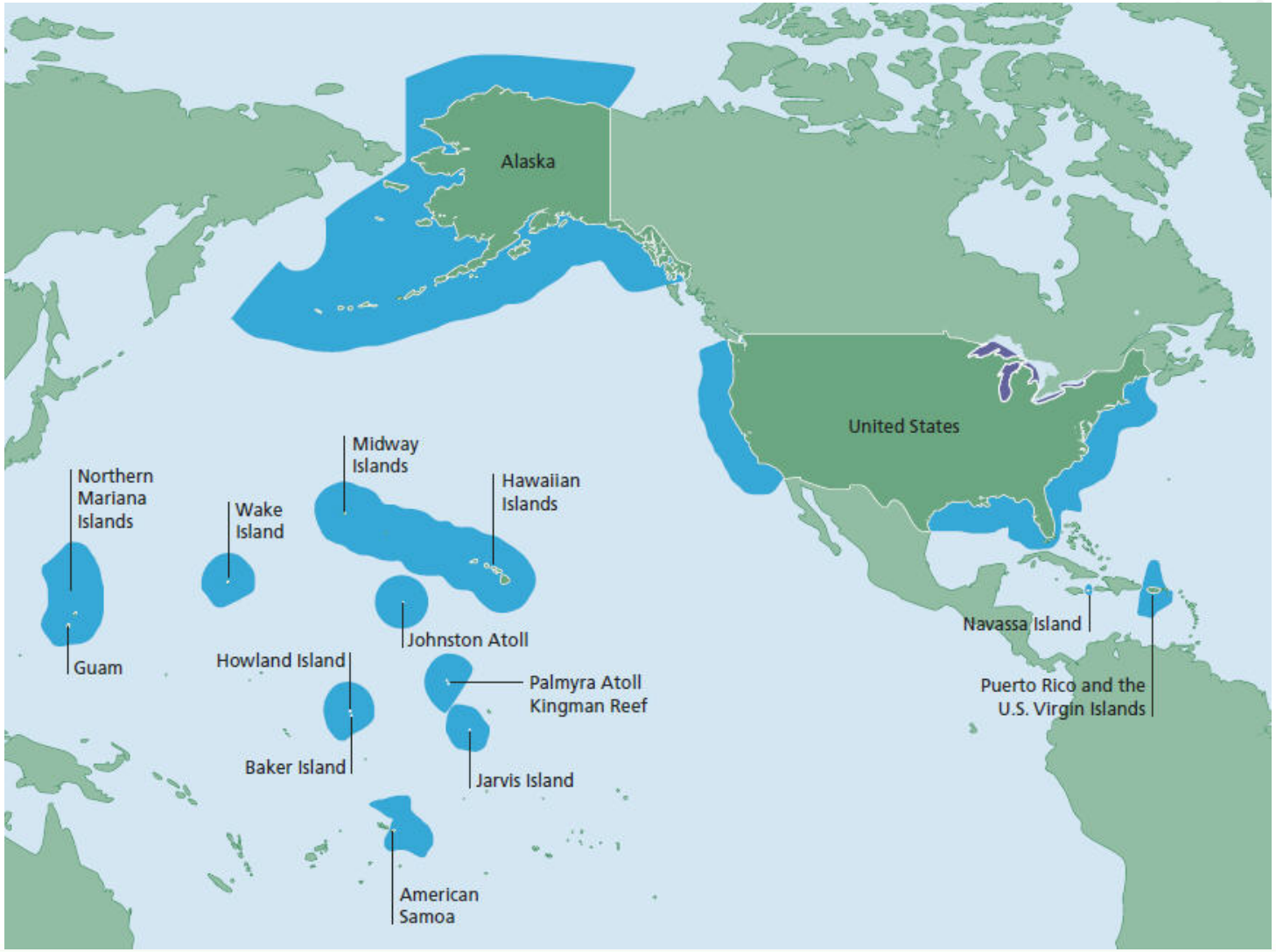

All eggs in
increased yield basket?
Photo: National Geographic

Oceans as the next frontier



Oceans as the next frontier

U.S. Exclusive Economic Zone (EEZ): Larger than total U.S. land area



Crop for the Ocean Farm - Macroalgae

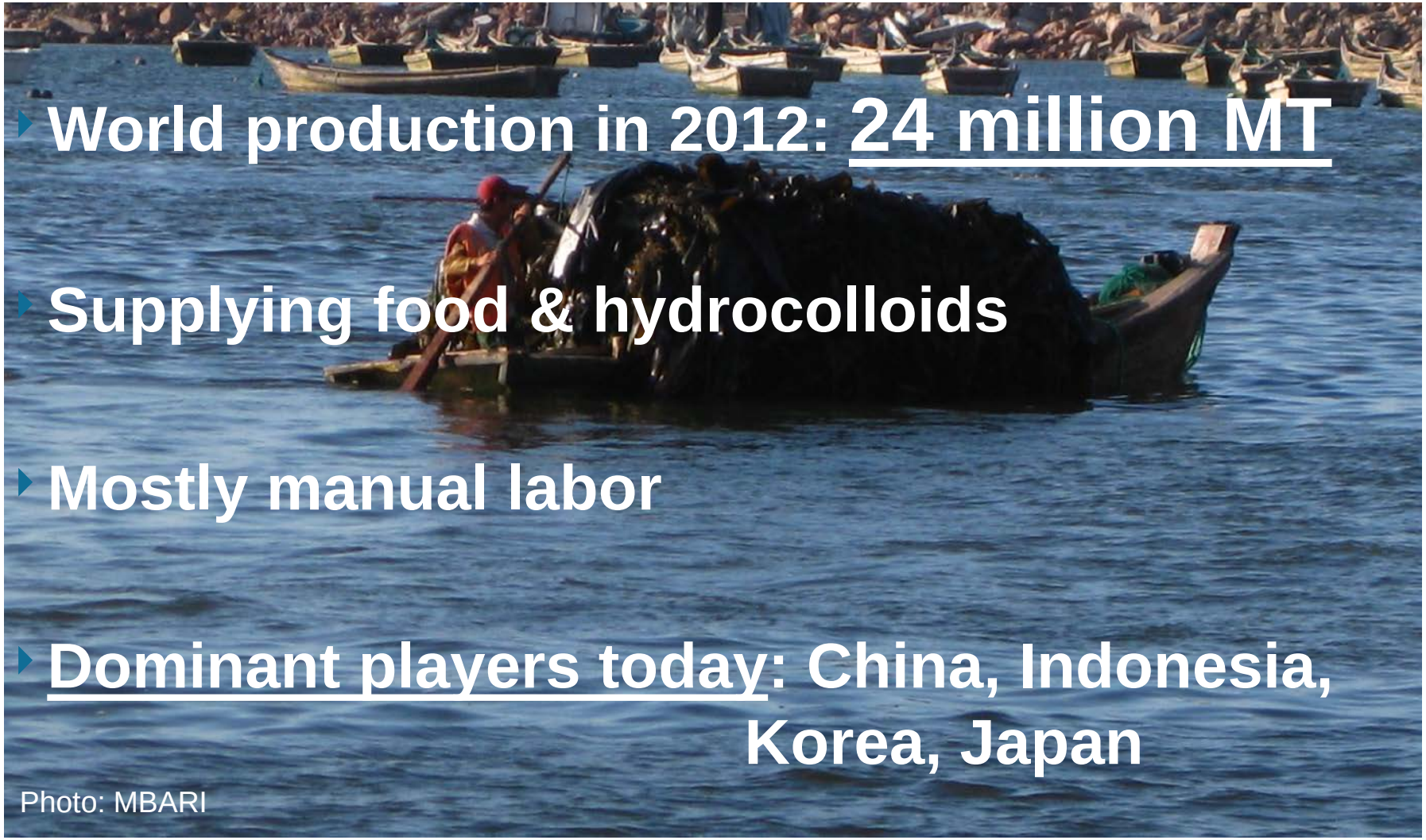
Fast growing

Easy to harvest

Many different species

Mostly carbohydrate & some protein

An Existing Industry



- World production in 2012: 24 million MT
- Supplying food & hydrocolloids
- Mostly manual labor
- Dominant players today: China, Indonesia, Korea, Japan

Photo: MBARI

Can we make it Energy-Relevant ?

- **Back of the envelope calculation:**
  - **1 Quad (10^{15} BTU) Ethanol (~13 billion gal)**
  - **210 million MT of dry seaweed** (~2.1 billion MT wet)*
  - **18 million acres** (~28,000 square miles)*

- **Increase volume of production ~100x**
  above current world level

- **Drive down cost of production ~10x**
  to get within range of terrestrial biomass

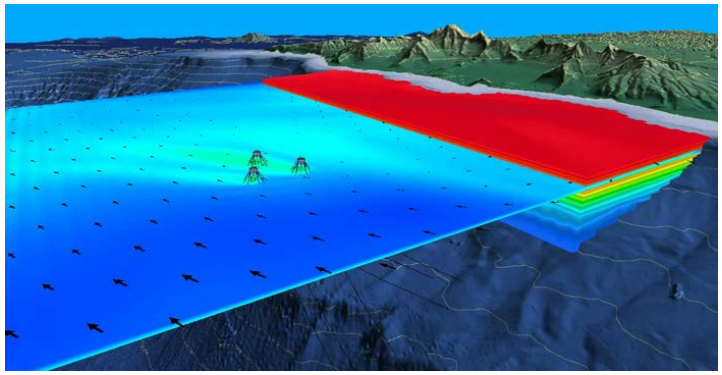
Photo: MBARI

Scale-up Challenges

Leveraging new tools to leap forward

Satellite Imaging & Remote Sensing

Robotics & Automation



Computational Modeling

Advanced Breeding & Genetics

One idea: Seaweed “Ranching”

Stepping Stones to Commercialization

Price per unit

Food

Feed

Fuel

Volume

Innovative Approaches to Ocean Cultivation of Macroalgae for Production of Fuels & Chemicals

ARPA-E Workshop

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Thank you !

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