Coral Reef Restoration: Viable Way to Respond to Coral Loss?

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Transplanting coral restoration method. Image from Pol Bosch

Executive Summary

- Corals are threatened by human activity: pollution, ocean warming, ocean acidification, coral bleaching, climate change, nutrient runoff, habitat destruction, etc.
- We rely on resources from coral reefs: protection from storms, medical discoveries, economic value, ecological needs for fisheries, but could lose 70-90% of coral reefs by 2050.[5]
- Coral restoration is a form of re-building coral reefs by supplementing reefs with more corals and/or more resilient corals. It is likely to be most effective when combined with climate change mitigation efforts.

National Geographic

What are Corals?

Coral are unique animals related to jellyfish & anemones. They are made up of colonies of individual polyps. They have a symbiotic relationship with photosynthetic algae which live in their tissues and provide food to the coral.

Act Now: Corals are rapidly declining, the IPCC projects we could lose 70-90% of tropical corals by 2050.[5]

Importance of Corals

Social

- Reefs act as a **speed bump** to protect coastal communities from storms and intense weather.
- Contain chemicals potentially useful in drugs & **medicines**.

Economic

- Support livelihoods via employment from tourism and fishing.
- Reefs support economically valuable species i.e. fisheries. **($200M** commercial value)[1]

Ecological

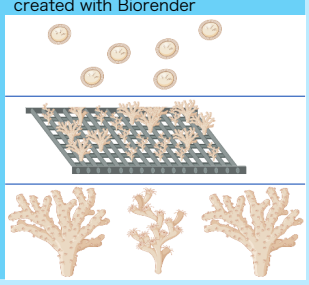
- Reefs are a nursery for growing fish and invertebrates.
- Corals support **¼** of all marine species.[1]

What is Coral Restoration?

Active methods to assist recovery of degraded coral reef ecosystems to improve reef habitats and maintain ecosystem function.[2]

- Larval Enhancement: baby coral are grown until they are mature enough to attach to the reef.
- Coral Gardening & Micro-fragmentation: small fragments of corals are reared in a nursery then brought to a reef.
- Transplantation: directly attaching corals to a reef.

Image of each restoration technique created with Biorender




Bleached corals, image from The Verge

Protective vs. Reactive Measures for Coral Conservation

Protective (before damage)	Reactive (after damage)
• Limitation of anthropogenic/climate change pressures: CO_2 emissions, pollution, habitat destruction. • Fisheries management measures. • Marine Protected Areas.	• Coral transplantation. • Coral gardening. • Increasing coral resilience through genetic enhancement of heat tolerance.

How do we measure effectiveness of restoration?

- Restored ecosystems are considered restored once they contain enough biotic & abiotic resources to survive with no assistance after restorative activities.[2]
- **Metric**: monitoring how much live coral tissue is present in each colony of coral as a percentage. If the area scores above a mean of 80% live tissue per coral, this region receives a passing score.[3]
- Restoration can encourage community involvement providing social benefits.

Conclusions

Example: restoration program in Indonesia[4]

Pros	Cons
• Higher coral density. • More coral diversity. • Supported higher diversity of fish species.	• Water temperature increased and killed almost the whole reef after restoration.

1. **Protect**
   - Proactive actions like marine protected areas, fisheries management and reducing anthropogenic/climate change pressures should be top priority to mitigate coral declines.
2. **Restore**
   - Restoration activities have benefits, but do not replace the need for climate change action. [2]
   - Boosting coral resilience via genetically enhancing heat tolerance may be beneficial on a smaller scale but is more difficult to match the large scale of climate change. [2]

Recommendations

- Mitigate anthropogenic pressures by establishing policies to reduce CO_2 emissions, enhance renewable energy, and reduce nutrient runoff to limit overall coral damage.
- Integrate the importance of climate change in reef restoration efforts.
- Encourage individuals to support restoration & coral protection via social media. Collaborate with stakeholders to increase community engagement involving coral restoration programs.
- Integrate data from various restoration sites to get a fuller picture of how well restoration is working!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