Ocean Iron Fertilization and the Iron Hypothesis

In 1988, oceanographer John Martin first suggested the idea of dumping iron into the ocean to lower temperatures and draw down atmospheric CO₂. His idea, now known as the **Iron Hypothesis**, is that certain areas of the ocean are high-nutrient, low-chlorophyll (HNLC) zones that have low phytoplankton levels in spite of high macro-nutrient concentrations, e.g., nitrates, phosphates, silicic acid. Martin believed that the absence of the micronutrient iron, in particular, was a limiting factor for phytoplankton growth, since they need it to make chlorophyll. Martin hypothesizes that the addition of iron to the water as a fertilizer will stimulate phytoplankton growth and the uptake of carbon dioxide through photosynthesis. Further, when phytoplankton die and fall to the ocean floor, they will take the sequestered carbon dioxide with them, thus locking it up deep in our oceans.

Besides sequestering carbon, iron fertilization could potentially restore former phytoplankton levels in areas where they have declined, revive fisheries, and restore ecosystems where whales once fed on abundant levels of krill. Moreover, the process would cost $20 billion; proponents claim that this is relatively affordable, as it represents less than 0.3% of the (2011) global economy. Moreover, phytoplankton release dimethyl sulfide (DMS) into the atmosphere, which could have an aerosol effect and reflect some of the sun’s incoming rays, subsequently counteracting warming.

However, new evidence indicates that iron fertilization carries many risks, and its beneficial effects may not last as long as previously believed. It could create toxic algal blooms, and create subsequent dead zones as decomposition depletes oxygen in the water.

![Harmful algal blooms (Red Tides, Dead Zones) are a possible unintended negative consequence of iron fertilization.](http://oceanservice.noaa.gov/hazards/hab/hab.jpg)

Iron dumping is hard to detect, control, and study, and could also produce nitrous oxide, a potent greenhouse gas. Finally, a recent discovery shows that diatoms compete with phytoplankton for iron and store extra iron in their silica skeletons and shells; this would reduce phytoplankton’s long-term CO₂ trapping capabilities.

<table>
<thead>
<tr>
<th>PROS (+)</th>
<th>CONS (-)</th>
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<tr>
<td>• Removes carbon from the atmosphere</td>
<td>• May only remove carbon for short periods of time.</td>
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<td>• May revive fisheries</td>
<td>• Could cause toxic algal blooms and dead zones, destroying fisheries</td>
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<tr>
<td>• Relatively affordable</td>
<td>• Phytoplankton release of DMS could act</td>
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as aerosol that reduces warming

- Hard to detect/control/study
- Could produce nitrous oxide

Works Cited

