Can Science Get Ahead of Commercialization of Ocean Iron Fertilization (OIF) to Evaluate its Climate Benefits and Ecological and Environmental Consequences?

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Decarbonization of anthropogenic activities is progressing too slowly, creating an urgent need to actively remove carbon dioxide (CO2) from our atmosphere if we are to prevent the most severe consequences of a disrupted climate system. The marine environment offers several potential approaches for sequestering carbon. Iron-enhanced biological productivity has been the most extensively studied, and there is commercial interest in moving ahead with its implementation. However, past OIF studies were not designed to quantify the efficacy and durability of carbon storage, nor did they evaluate what the potential broader ecological consequences would be over longer term implementation for marine carbon dioxide removal (mCDR). Assessing whether or not OIF should, or should not, move forward for mCDR depends on a new generation of field studies to address critical knowledge gaps regarding the effectiveness, scalability, reproducibility, and environmental costs. Tackling these needs requires new field experiments conducted on significantly larger spatial scales (over ten times larger) and longer in duration (multi-seasonal rather than the typical one-month studies) compared to previous mesoscale iron addition studies. Core measurements are required to quantify key factors, including but not limited to CO2 drawdown in the surface ocean, the re-equilibration timescales of atmospheric CO2 with the surface ocean, the sinking transport of carbon to depth, and the portion of this flux that results in carbon sequestration for 100 years or more (a centennial tonne). Also essential will be measurements that can inform on the ecological and environmental consequences of OIF, necessitating a combination of remote sensing, in-situ observations, and modeling. Initial field trials are proposed for the iron-limited high seas of the NE Pacific, chosen for specific reasons outlined in this presentation. These field trials must be co-developed and conducted in collaboration with social science and governance experts to ensure they encompass community engagement in an equitable, just, and ethical manner. This presentation reflects the contributions of a diverse group of international and multidisciplinary experts, all of whom are committed to a responsible code of conduct as part of the Exploring Ocean Iron Solutions (ExOIS) consortium. Now is the time for actionable studies to begin. https://oceaniron.org/