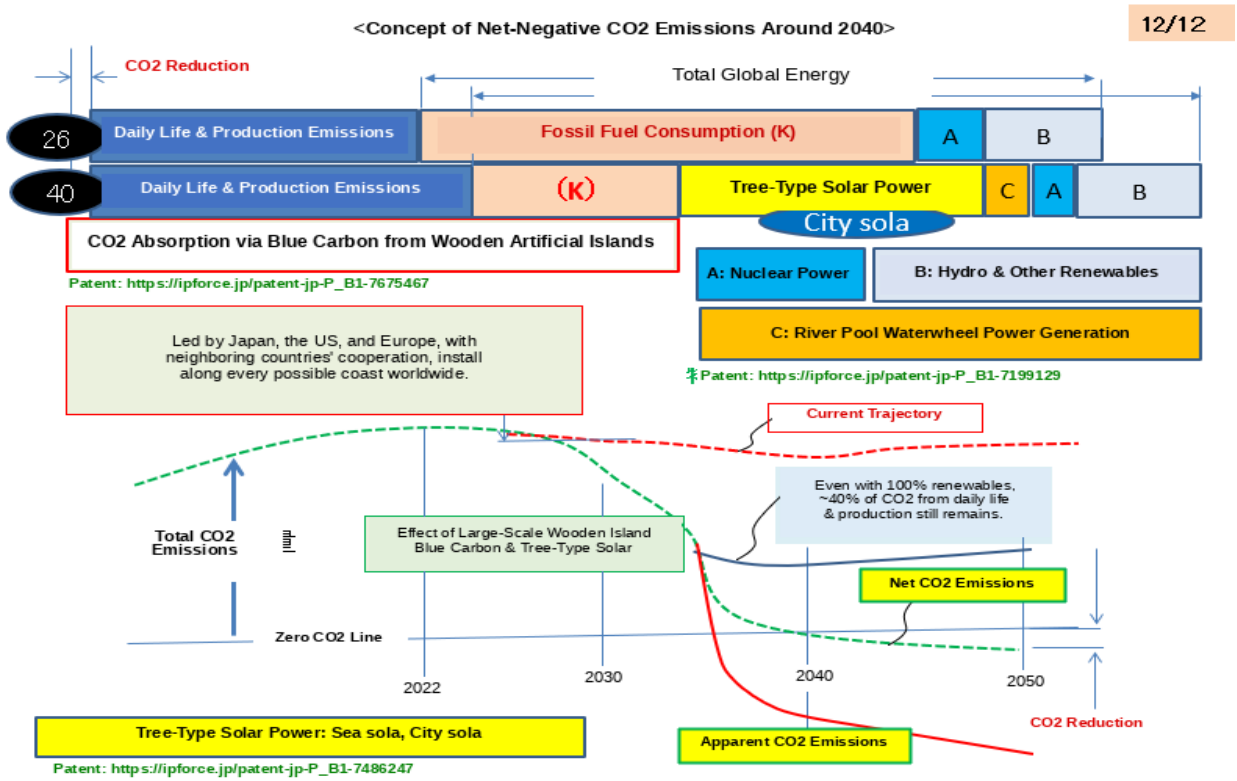
International Standardization of Blue Carbon and the Seaweed Food Industry Using Movable Wooden Artificial Islands
(Early Achievement of Carbon Neutrality Around 2040 and Overcoming the Global Food Crisis)

[Overview]

Conventional blue carbon initiatives in shallow coastal waters face inherent limitations: there is little prospect for rapid area expansion, seaweed is consumed by fish and sea urchins, and even once carbonized, it is decomposed by aerobic microorganisms and re-released into the atmosphere as carbon dioxide (CO2) within several decades.

To fundamentally solve these issues, we aim to rapidly expand—as an international standard—the cultivation and harvesting of seaweed using "Movable Wooden Artificial Islands" equipped with fish-protection nets and capable of being towed by vessels, combined with deep-sea sequestration at depths of 100 meters or more (permanent fixation in carbon form). Through this reliable carbon fixation and the rapid global expansion of the seaweed food industry, we declare the simultaneous resolution of global warming and the food crisis.

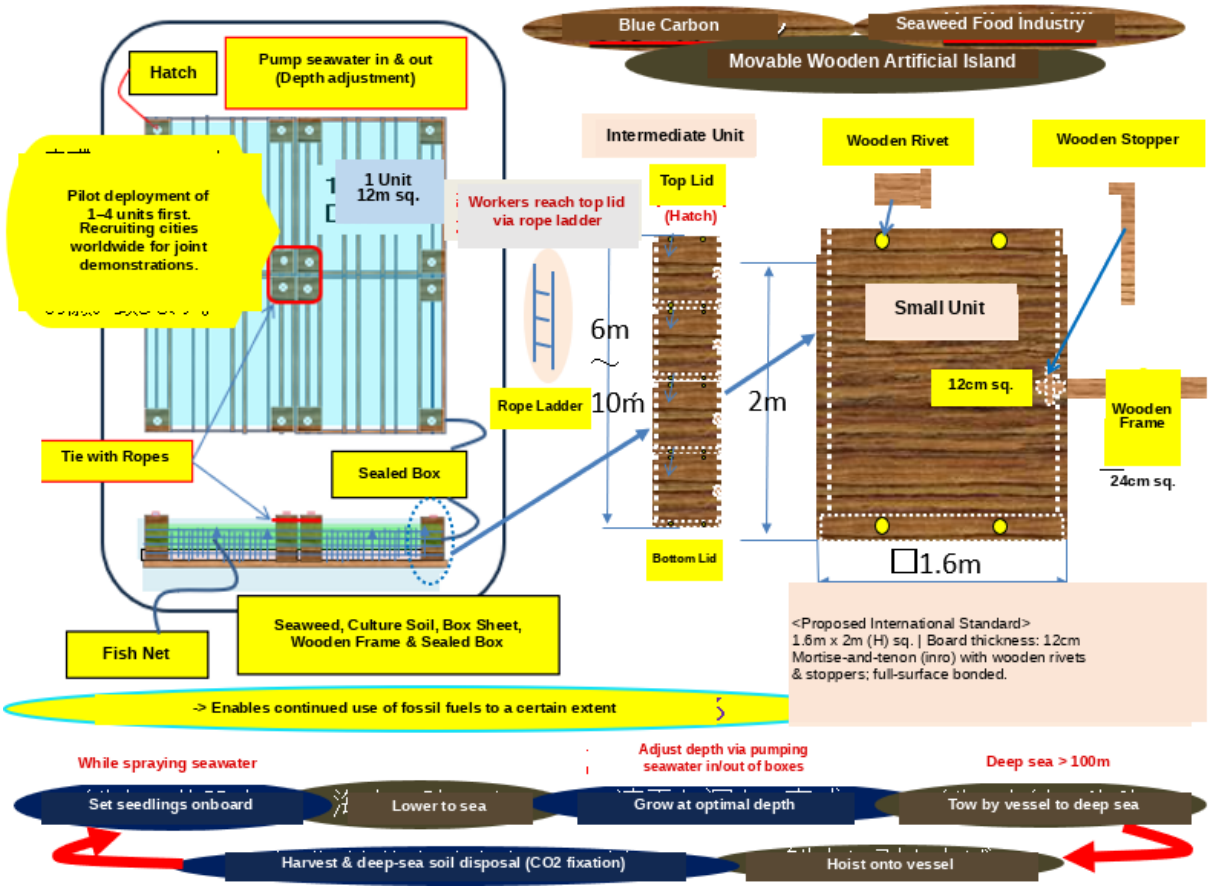
Meanwhile, to achieve carbon neutrality early around 2040, the global proliferation of "City sola," which coexists harmoniously with urban areas, is also indispensable. Please refer to the following URL:
https://www.garden-field.com/_files/ugd/954e39_7ceffcce5e18408c8100f4d3870516b5.pdf



[Detailed Explanation]

Although "blue carbon" utilizing coastal ecosystems is attracting worldwide attention as a climate change countermeasure, conventional nature-reliant blue carbon cultivation methods suffer from serious flaws. In shallow waters less than 20 meters deep, where water temperatures are high and oxygen is abundant, the vast majority of carbon absorbed by seaweed through photosynthesis is returned to CO2 and re-released into the atmosphere and ocean within a short period of just a few years to a few decades due to predation by fish and sea urchins or active decomposition by microorganisms. Relying solely on natural ecosystem cycles makes it difficult to guarantee long-term, reliable carbon fixation. In other words, while the intentions and efforts behind conventional blue carbon activities are valuable, their substantive impact has been virtually negligible.

An innovative solution that overcomes this limitation and simultaneously resolves global warming and the global food crisis is the international deployment of "Blue Carbon and the Seaweed Food Industry Using Movable Wooden Artificial Islands." The basic configuration of this system is a 12-meter unit (proposed international standard) combining sealed wooden boxes—assembled from 12 cm thick timber using full-surface bonding, wooden rivets, and anti-slip stopper structures—with wooden frames, box-shaped sheets, and fish-protection nets.



Work Preparation and Procedures

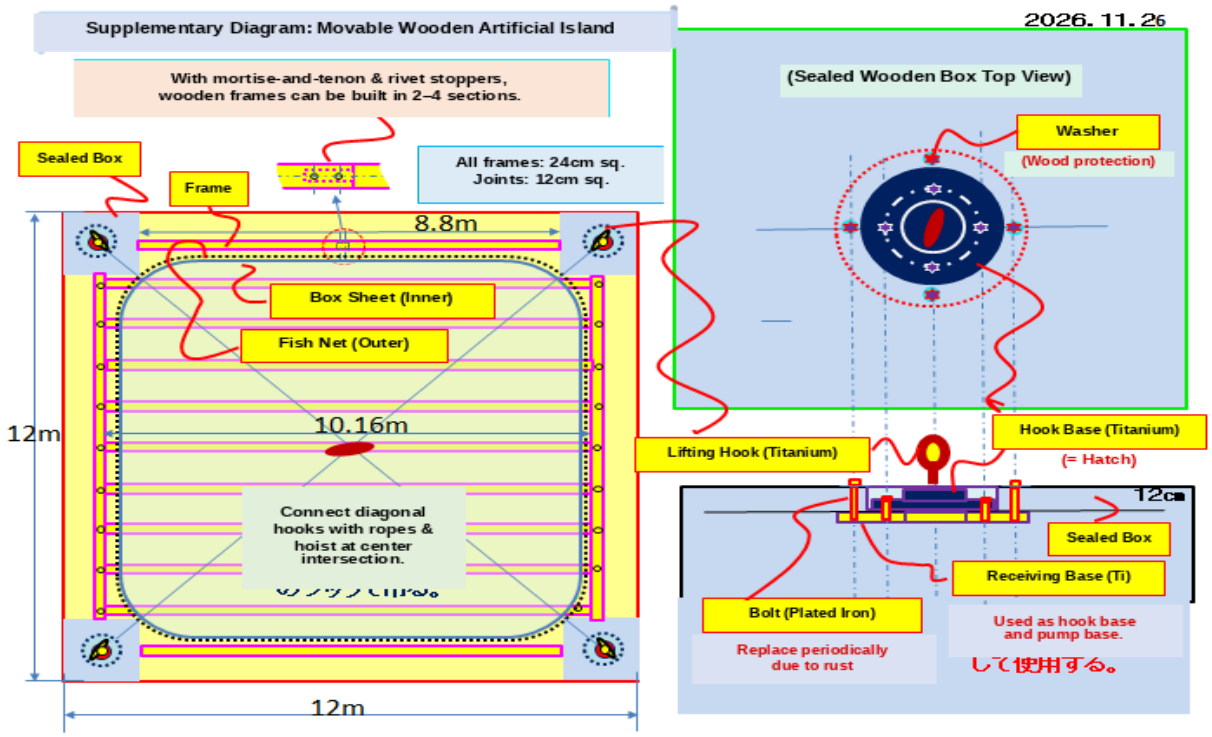
1. Unit Assembly at Factories and Seedling Cultivation in Tanks

(1) Manufacturing of Small Sealed Wooden Box Units (1.6 m x 2 m) and Wooden Frames (240 mm x 1,016 mm & 880 mm):

The system is designed so that even in remote rural areas without electricity—as long as there is a road accessible to large delivery trucks—a couple, even in old age, or a single energetic worker can process the parts in a workspace of about 10 tatami mats (approx. 16.5 m2) using a portable simple hoist (costing around 100,000 JPY). (Combined with City sola, City car, and City HUB, anyone can live happily until the end of life, even when living alone.) Standardized small sealed wooden box units (1.6 m x 2 m), wooden frames (0.24 m x 10.16 m with 0.12 m x 0.24 m mortise-and-tenon joints + rivets to prevent slipping; and 0.24 m x 8.8 m with 0.12 m x 0.36 m mortise-and-tenon joints + anti-slip structures; frames can be split into 2 to 4 sections), wooden rivets, and wooden anti-slip stoppers are primarily manufactured at small-scale woodworking shops (e.g., operated by a married couple). Each wooden part is coated with liquid glass. While the small woodworking shops do not perform full assembly, they pre-fit the mortise-and-tenon joints, verify the fit after liquid glass coating, and mark matching pairs with identification numbers (such as 7-7) so that assembly workers at dedicated coastal factories can easily identify the exact combinations.

(2) Assembly at Dedicated Coastal Factories:

At dedicated coastal factories, the parts are assembled into intermediate units and then into full units.



(3) Production of Seaweed Seedlings

Seaweed research centers (established within universities, fisheries cooperatives, or as private enterprises) are set up to carefully cultivate seedlings of seaweed species suited to each region—and capable of becoming local specialty products—in seawater tanks at the spacing required for growth.

2. Loading Units and Seedlings onto Vessels and Departure

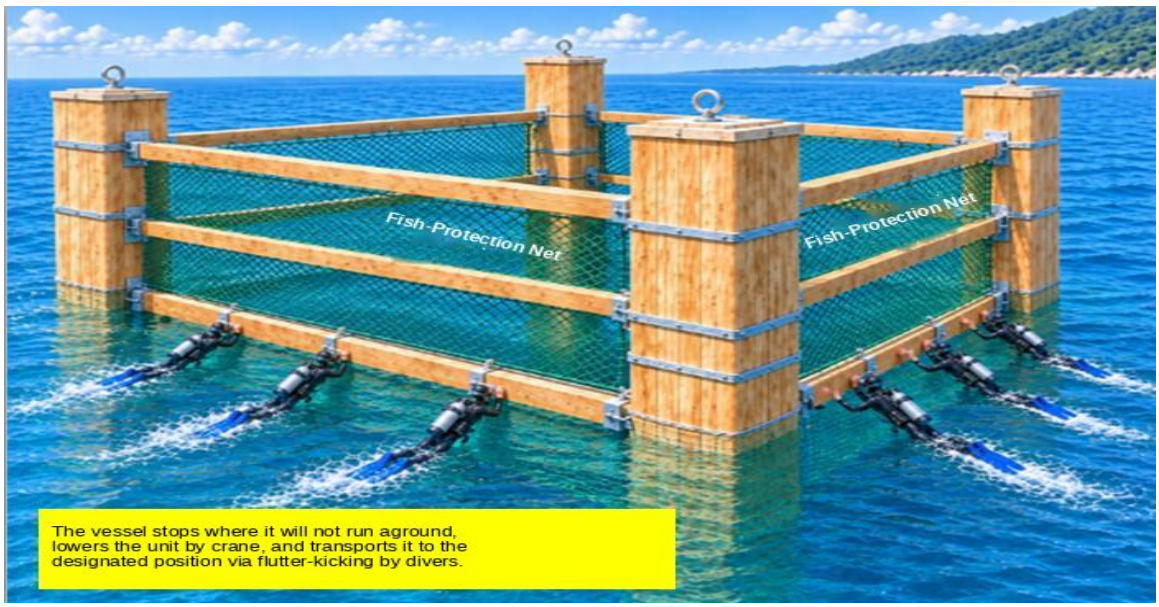
Completed 12-meter units and seedlings from the cultivation tanks are safely loaded onto the deck of a work vessel using a large crane. Once all equipment and personnel are prepared, the vessel departs for the blue carbon installation sea area and offshore operational base.

3. Placement and Securing of Seedlings and Installation of Fish-Protection Nets in Coastal Waters

The vessel stops in safe, shallow coastal waters near the planned installation site where the ship will not run aground. While continuously spraying seawater on the seedlings to prevent them from withering due to dryness or heat, workers arrange and firmly secure the seedlings—together with their seedling culture soil—onto the culture soil bed of the unit. Afterward, a sturdy fish-protection net is stretched around the outer perimeter of the unit to completely prevent feeding damage by fish, sea urchins, and other marine organisms.

4. Lowering onto the Sea Surface, Transport Corner-First by Six Divers, and Mooring

The 10-meter (12-meter) unit equipped with seedlings and the fish-protection net is gently lowered onto the sea using a crane. To minimize water resistance during movement, one corner of the sealed wooden boxes is pointed forward, and a total of six divers—three on the left side and three on the right—work together to propel the unit by flutter-kicking, steadily guiding it to a designated location pre-arranged with seabed anchors (weights) and buoys. Upon arrival, the buoy ropes are untied and securely fastened to the sealed wooden boxes of the unit.



5. Installation of a Rope Ladder by Throwing a Weighted Rope

To ensure safe access from the sea surface to the tall unit, a guide rope attached to a weight is thrown toward the top of the wooden frame. The rope is securely fastened and draped over, and a dedicated "rope ladder" connected to it is set in place. This secures a safe and reliable foothold for workers to climb onto the top of the sealed wooden boxes.

6. Fine Depth Adjustment via Frequent Seawater Injection

The unit is initially set at a depth where seaweed can perform photosynthesis most efficiently during the seedling stage. Thereafter, as the seaweed grows, seawater is gradually added to the sealed wooden boxes (for example, once a week). To prevent the unit from tilting, four workers are stationed at the four sealed wooden boxes, and once ready, they call out to one another to inject or drain seawater simultaneously.

• Water Injection Workflow: A worker carries a dedicated waterproof backpack containing a three-piece set—a reversible pump, two hoses, and a battery—approaches by motorboat, climbs the rope ladder hanging from the hatch, and stands atop the wooden box. They remove the bolts from the four "hatch-and-hook" sections, connect the pump and hoses, attach the battery, set the flow rate (equipped with an automatic stop function), and operate the pump to adjust the unit to the proper depth.



7. Growth Inspection, Determination of Harvest Date, and Towing Preparation

As seaweed cultivation progresses and the harvest season approaches, divers submerge to inspect the growth status and the condition of the nets to determine the optimal harvest date and time. On the harvest day, workers untie the anchor ropes securing the unit or the ropes connecting adjacent units to prepare for towing.

8. Towing by Vessel to the Harvesting Area and Deep-Sea Sequestration Point

Workers verify that the towing hook units on the hatches are firmly bolted in place, connect a

heavy-duty towing rope from the work vessel, and safely tow the unit to the destination where harvesting and deep-sea sequestration will be carried out.

9. Weight Reduction of the Unit via Simultaneous Drainage at Four Points in Deep Waters

Once the vessel reaches a deep-sea area with a water depth of 100 meters or more, the ship stops. Four workers simultaneously open the four "hatch-and-hook" sections and use pumps to drain the seawater from inside the sealed wooden boxes at the same time. This significantly reduces the overall weight of the unit, making it easy to lift with a crane.

10. Hook Attachment and Hoisting onto the Vessel by Crane

For the unit lightened by drainage, workers firmly re-tighten and secure the bolts on the four hatch-and-hook sections. Ropes are crossed diagonally between opposite hooks, and a crane hook is attached at their intersection (the center of the unit) to safely hoist the unit from the sea surface onto the vessel deck.

11. Seaweed Harvesting and Supply to the "Seaweed Food Industry"

Once the unit is hoisted onto the vessel, the fish-protection net is removed and the carefully cultivated seaweed is harvested. This harvest is supplied to the "seaweed food industry" as a new source of protein and nutrition for humanity, directly contributing to averting food crises driven by global population growth.

12. Disposal and Permanent Fixation of Carbon-Rich Culture Soil at Depths of 100 m or More and Global Deployment Toward COP31

After harvesting the seaweed, the culture soil and unused biomass—which have accumulated large amounts of carbon (derived from CO2) through photosynthesis—are shoveled onto a conveyor belt and discharged directly into the deep sea at depths of 100 meters or more. This completely cuts off microbial decomposition and re-conversion into CO2 in shallow waters, achieving reliable and semi-permanent CO2 fixation.

<Implementation Strategy: Roadmap for Global Deployment and International Cooperation Framework>

To simultaneously and fundamentally resolve worsening global climate change, ocean acidification, and the food crisis driven by global population growth, this "Blue Carbon and Seaweed Food Industry Using Movable Wooden Artificial Islands" project cannot remain the effort of a single nation or region; it must be promoted under an international cooperative framework uniting coastal cities worldwide. We plan to advance its concrete implementation and proliferation along the following two phases (while welcoming diverse feedback and making refinements accordingly):

Phase 1: Pilot Introduction and Technical Verification in Model Regions (Years 1–2)

• Launch of Pilot Deployment: Implement trial introductions of 1 to 4 units initially in major coastal cities and regions worldwide heavily impacted by climate change, starting with

Abashiri City, Yokohama City, and Ishigaki Island City in Japan, as well as the Melbourne–Tasmania sea area in Australia.
• Collaboration with Local Communities and Research Institutions: Work closely with local fisheries cooperatives, universities, and marine research centers in each city to select indigenous seaweed species, collect cultivation efficiency data, and optimize local operational protocols. We will also demonstrate the end-to-end supply chain, from component processing at small woodworking shops to local assembly and marine operation.

Phase 2: Building an Inter-City Network and International Joint Demonstration (Years 3–5)

• Formation of a Mutually Cooperative City Network: Recruit cities worldwide that have succeeded in pilot deployments to build an "International City Cooperation Network" for sharing knowledge and data through open innovation. Cities will mutually verify environmental data and carbon fixation volumes in real time to enhance system reliability.
• Standardization of Supply Chains and Establishment of Local Production Systems: Globally deploy standardized specifications easily manufacturable even by small woodworking shops (1.6 m x 2 m wooden boxes, wooden frame specifications, etc.) along with liquid glass coating technology, establishing self-sustaining production and operational bases utilizing local materials and labor.
• Mass Deployment on a Global Scale: Simultaneously deploy thousands to tens of thousands of movable wooden artificial island units along coastlines and coastal waters worldwide. This will ensure the early achievement of carbon neutrality around 2040 and reverse the trend of global warming.
• Establishment of a New Food and Resource Supply Ecosystem: Alongside climate stabilization through permanent deep-sea carbon fixation, continuously supply large volumes of harvested high-quality seaweed to the global "seaweed food industry," establishing the foundation of a new marine civilization that permanently averts humanity's food crisis.

<Patent Information & Contact>

Patent Publication: https://ipforce.jp/patent-jp-P_A1-2026-6721?apn=79255

Yuji Hirota, Representative Director, Garden Field Co., Ltd.
Address: 1-33-503 Keyakidaira, Miyamae-ku, Kawasaki-shi, Kanagawa 216-0023, Japan
Website: https://www.garden-field.com/
Phone: +81-90-5203-8627 (090-5203-8627)
Email: hirota.yuji@garden-field.com
Secondary Email: tarou177jp@yahoo.co.jp

We welcome inquiries and questions of any kind, no matter how small, from anyone. Please feel free to contact us anytime. We look forward to hearing from you.