Practicality of industrial-scale marine agronomy as a major source of food, feeds and biofuels

Bally's Casino, Palace #1

Monday, 27 February, 1:00 to 5:00 PM

A round-table discussion to plan for the future

Attendees

Mark Drawbridge	David Tze	Mike Rubino
Mike Rust	Cheng-Sheng Lee	Kevin Fitzsimmons
Jordanna Schatz	Mark Capron	Randy Brummett
Hillary Egna	Jim Diana	Alyson Myers
Kevin Hopkins	John Forster	Paul Dobbins
Charles Yarish		

Yuki Kashiyama gave a mini-presentation on Thursday, 1 March

Discussion of Terminolgy

Even though most people do not know what MARINE AGRONOMY is, it accurately describes what we are talking about and all of the alternatives suggest to date are inferior re: accuracy of description. As a note of historical perspective, Max Doty championed the term Marine Agronomy almost 40 years ago. Further, Marine Agronomy does not have the negative connotations associated (unfairly in most cases) with the term marine aquaculture = cage culture.

Operational Definition of Marine Agronomy

Marine Agronomy is the farming of plants in the oceans for food, feed, fiber, energy, and organic chemicals.

Note: Although the initial emphasis will probably be macroalgae because of the current state of technology, microalgae may become a very important component of Marine Agronomy.

Visions of Marine Agronomy

Our visions need to be "Big and Grand" if we are to grab the attention of the public, political and financial leaders, and coastal communities.

Other concepts to be included in the vision:
Long-term (decades) focus; sustainability; Marine Agronomy is good for the environment

An example – By 2050, we will farm 6% of the oceans' surface to sustainably provide the plant materials required for the production of food and energy needed by 9 billion people.

Note: The group did not decided upon a formal vision at this preliminary meeting.

Current Status of Marine Agronomy

Details in papers in Dropbox folder

World - $7 billion annually, kelps & Porphyra in cool water, Eucheuma & Gracilaria in subtropics & tropics, mature technologies that could be made much more efficient

USA - $7.5 million annually, 2 kelps, 5 companies, constrained by lack of seed supply networks

Observations on the markets - Direct competition with Far East difficult. Regional markets differ. Emphasize environmental quality and biosecurity

How to Sell Marine Agronomy

- Renewable resource system
- Extracts nutrients from environment, particularly excess nutrients
- CO2 sequestration
- Source of biological materials for use in production of
    - Food

    - Fiber
    - Feeds (substiture for fish meal)
    - Chemical
    - Plastics
    - Fuels (methane and liquid biofuels)
- Enhances natural fisheries by providing substrate and cover
- USA has comparative advantage in its technological expertise in bio-product engineering
- Illustrate the costs (economic and environmental) of NOT implementing marine agronomy
- Well-paying jobs

Constraints

- Lack of a reliable seed network outside of Far East
- Uncertain regulatory environment, particularly in nearshore areas of the USA but there are also concerns about regulation in open waters
- Very little research has been conducted upon potentials for using seaweeds as feed stock for value-added products
- Lack of mechanization including cleaning, sensor technologies, harvesting and dewatering at sea
- Little commercial effort to date re: integration with other activities (IMTA, marine afforestation, etc).
- Current efforts have looked focused on the near-shore because of economics and regulation while off-shore is where the main potential will be realized.
- There is a perceived conflict with marine mammals although evidence of such conflict is lacking.

- Considerable effort is needed to educate the coastal communities that, with proper siting, marine agronomy will not interfere with existing resource usages such as
    - Navigation
    - Fishing
    - View planes
    - Shading on reef faces
    - Bird habitat
- Effects of bioaccumulation, both positive and negative
- The financial community must be an active participant even though it is difficult to meet the venture capital goals of profitability in 3 years, $5-20 million in capitalization and greater than 20% return on investment:

First Steps towards the Vision

1. We need to have a two-pronged approach – both large vision and incremental to show immediate success.

2. We need to develop a constituency for both bottom-up and top-down action.

- Academia will have to take a major role, at least initially
- Join with environmental groups emphasizing bio-remediation
- Consider the Alternative Feedstock group as a model
- Involve foundations and think tanks – e.g. Packard and Gates
- Comment on the ARPA-E solicitation to include marine systems
- Explore options for cooperation with the microalgae industry

2. Although our group will has a particular interest on US coastal environments, we must consider the entire world emphasizing developing countries if we are to gain the active support of the large development organizations and banks.

3. Where are the knowledge gaps? What short-term studies, possibly funded as part of the World Bank's New Oceans initiative, should be conducted immediately

- Which macroalgae are best suited for large-scale cultivation?
- What is the future of marine agronomy in the Far East?
- What products can be made from marine plants?
- Case studies of successful marine plant farms looking for commonalities re: technology, regulation, markets, environment. For example, the Long Island Sound communities.
- What are the opportunities for increasing the scale and efficiency of current marine agronomy practices?
- Spatial requirements vs. availability in both near-shore and off-shore environments
- Options for facilitating permits to sustainable farms including out-sourcing of permits, certification programs, etc.
- What ecosystem services can be provide by marine agronomy?
- Develop a preliminary "business plan" for the WB

4. Start the public education:

- Article for Scientific American – Mark Capron will take lead
    - Relate the large scale needs for food and fuel to spatial requirements
    - Include information on seaweed farming is already done
    - Much of the information is already in Charles Yarish's papers (see drop box) and was discussed here.
- Letter to Science commenting on the need to expand the view of seaweeds as a biofuel to the much larger opportunity
- When dealing with USA communities and decision makers, emphasize
    - Healthy local food
    - Jobs

    - Cleaner water

- Start the discussion with NSF as soon as possible

Discussion Participants' titles and affiliations

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