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# ENVIS NEWSLETTER

## Centre for Environmental Studies (CES)

## Dept. of Forest & Environment, Govt. of Odisha

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## AQUA FARMING TO COMBAT $CO_2$ SEQUESTRATION & GLOBAL WARMING

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## *From the Coordinator's Desk...*

Odisha ENVIS Centre is always trying to bring out environmental issues those are most vital in the State in newsletters. We have covered many issues of environment of the State in our previous publications. The objective is to disseminate information to the users and bring awareness among the society and policy makers.

This time we are covering an issue of **Aqua Farming to Combat $CO_2$ Sequestration & Global Warming**. I hope the information contained in the issue will be useful to users.

**Dr. Sailabala Padhi**, M.Phil, Ph.D., D.Sc.
Director, CES-cum- ENVIS Coordinator

## Aqua Farming to Combat $CO_2$ Sequestration & Global Warming:

### Aquaculture:

India is bestowed with large aquatic resources and a long coast line. The aquaculture sector has grown well and has attained the status of a viable vocation today. India has greatly emerged as a major aquaculture nation in the world with several new technologies available; the scope for further development in aquaculture during the 21st century is bright. Man is still primarily a hunter and a gather of the food resources of the ocean. With the decline in agricultural productivity coupled with the phenomenon of climate change the global community is looking for new and alternate resource utilization for sustainable development. Algae, which are being traditionally used as food, feed, fertilizer, chemicals etc can be now used for carbon dioxide capture, biofuel production, paper manufacturing etc. a major concern today is the distinct possibility that planet Earth may not be able to produce enough food for its burgeoning population. Particularly controversial are the varied estimates of the potential productivity of the sea. The oceans, on the basis of their areas, receive twice as much solar energy as the land, but most of the sea's a biological desert, without sufficient chemical nutrients to convert these energy in to living species. High productivity is found only along the near-shore environment where coastal runoff provides nutrients or in ocean areas where upwelling currents, forced by wind and bottom topography, bring nutrients up from the sea floor.

### Prawn farming:

With an annual landing of over 300 thousand tones of shrimp, India has occupied a prominent place in the top shrimp producing countries of the world. The attraction of prawn culture to entrepreneurs and big industrial concerns and the availability of vast areas of inland water spread suitable for prawn farming points to substantial increase in our shrimp production. Shrimp farming

is a growing industry with adoption of modern scientific technologies.

## Cooling the planet with micro algae and seaweeds:

Human activity in the modern world has disturbed the composition of the atmosphere. This has led to some of the major environmental issues such as ozone depletion, acid-rain and Global warming/climate change which is potentially the most serious threat for the environment and human health system. The use of fossil fuels and practice of deforestation to meet the world's energy demands has led to increasing concentration of carbon dioxide and other green house gases in the atmosphere. Increased CO2 and the green house gases is such a serious problem for the mankind that many research and development approaches are


implemented to reduce $CO_2$ emissions. Various processes to reduce $CO_2$ emission have been used and photosynthetic technology using algae, both microalgae and seaweeds is widely discussed as a feasible technology. Prime Minister Shri Narendra Modi who participated in the International summit said climate change is a major global challenge and is the result of global warming that came from the prosperity and progress of an Industrial age powered by fossil fuels and developing nations are not responsible for it.

India is also actively pursuing farming activities not only for microalgae but also for large scale cultivation of seaweeds such as *Porphyra*, *Gracilaria, Kappaphycus* and *Sargassum* through an All India Co-ordinate project funded by Department of Science and Technology, Govt. of India.

## Algal farming:

Algae which are being traditionally used as food, feed, fertilizer, chemicals can be now used for carbon dioxide capture, bio-fuel production, paper manufacturing etc. The unprecedented population growth, unchecked industrial expansion and urbanization have diverted the human attention for ocean exploitation. Among its vast living resources, seaweeds are one of the best sources of food, fodder, fertilizer, medicine and chemicals. Although fish and prawns have been fully exploited and successfully farmed, seaweed farming has been restricted to a few countries only. Today it is a multibillion dollar industry and according to FAO report the current seaweed gel industry alone is worth over US $ 1 billion. There are nearly 24 million tones of wet seaweeds worth hundreds of millions of dollars which have been produced annually in the four major oriental countries namely China, Japan, Korea and Philippines involving nearly 6,70,000 people. This figure is increasing every year. Other

countries like Indonesia, Brazil, Chile, Namibia, New Zealand, Norway, USA, U.K. France, Spain and others have many seaweed industries. Recently Thailand, Vietnam and Tanzania have come up as new seaweed production centers.

The socio-economic impact of the development of the seaweeds cultivation and exploitation in the developing countries can be seen and appreciated by first looking at the present status and the quality of life, resources and livelihood of the people living in coastal areas. A large portion of the Asian population lives along coastal areas and are intimately associated with the sea and its resources. Being in the tropics, the coastal areas of Asian countries are characterized by well developed coral reefs, shallow bays and suitable agro-climatic conditions which are ideal for seaweed cultivation. Many oriental countries have taken advantage of this nature's gift.

The world's most successful country in seaweed farming is Philippines. In 1966, Philippines exported only 800 tons of *Euchema* and this figure rose to 400,000 tons during 1990. Today, seaweed farming has directly employed nearly 80,000 people and its related industries have given employment to nearly 350,000 people in Philippines. Seaweed farming has become the alternate source of income for many fishermen. It ranks third in foreign exchange earnings for Philippines. Inspired by the Philippine model, Indonesia started *Eucheuma* cultivation with the help of some multinational companies and today it is a major producer of seaweeds, employing thousands of people. More recently Tanzania successfully introduced *Eucheuma* seedlings were brought from Philippines and introduced in Tanzania coast; by 1993 it exported 2044 tonnes of seaweeds employing nearly 10,000 people. Thrilled by such success stories, many countries in Asia-Africa regions ventured in to *Eucheuma* cultivation. The latest player in the field is Vietnam. Besides *Eucheuma*, many other seaweeds have been successfully farmed and have become major industries in the respective countries. For example, *Gracilaria* cultivation in Brazil, Chile, Thailand and Morocco. *Porphyra, Laminaria* and *Undaria* cultivation in Japan, Korea and China.

About 20,000 marine algal species are distributed throughout the world. India has a coastline of nearly 7000km and an Exclusive Economic Zone (EEZ) over 2 million square km. Till today a total of 806 species of marine algae have been reported from Indian coast which includes 487 species of Red, 186 species of Brown and 133 species of Green seaweeds. In spite of its rich seaweed resources, strategic location, tropical climate and other favorable conditions nothing substantial has been done in the field of seaweeds production and utilization.

Andaman & Nicobar having 325 islands in Bay of Bengal, Lakshadweep having 36 Islands in Arabian sea and some other parts of Indian coasts are ideal locations for seaweed cultivation due to several factors, especially ready availability of manpower who are familiar with the sea. Since these remote areas have very little employment opportunities and malnutrition problems, seaweed cultivation will not only create thousands of jobs but also solve malnutrition problems in these areas. Seaweed farming will give an alternate source of income to the fisher types of cottage industries and other industries based on seaweed utilization unemployed. This will not only solve some of our unemployment problems but also earn valuable foreign exchange for the country.

## Marine algae : Importance and Future perspectives

Among the three major habitats of the biosphere, the marine realm which covers 70% of the earth surface provide the largest in habitable space for the living organism, particularly marine algae. They thrive not only in the upper surface of the sea, but also in the lower and abyssal depth from coast to the offshore regions and from the general oceanic to the specials and niches like blue water of coral reefs to black smokers of hot thermal vents at the sea floor ( Quasim, 1999). Exploration of algal diversity is a topic of considerable importance and interest. The study of marine algal diversity is important in order to understand the community structure and pattern of distribution. Histologically the macrophyte algae have been sources of food, as well as valuable chemicals, such as iodine, agar, carragenan and other hydrocolloides. They are also important source of a range of valuable fine chemicals including carotene ( Dunaliella ), astaxanthin (Porphyridium, Rhodella) and fatty acids, antibiotics and anti-neoplastic agents and other pharmaceutical compounds. Marine macro algae (seaweed) cultivation can contribute in a major way can save the environment as it has great capacity to absorb carbon dioxide. Seaweeds refer to any large marine macro-algae inhabiting in the seas and oceans which from an important renewable resource in the marine environment and contribute around 35% of coastal primary production worldwide. The application aspects of the seaweeds have been realized during 1960. In a recent review the seaweed resource have been arrived at 6.77 to 6.83 tons and from 3.5% of the world resources. The seaweed Kappaphycus alvarezii is an important seaweed whose technology has been commercialized generating huge coastal rural employment on the coast of Tamilnadu earning Rs. 5000 to 7000/- per head per month. Future research should be oriented to thoroughly investigate the entire flora for taxonomic identification. Along the 7500 km coastline, harboring a maritime states and this is a prerequisite for further progress in all desired directions like biotechnological works including molecular characteristics, gene cloning and field cultivation for their industrial applications viz , manufacture of value addition products for human nutrition.

Seaweed mariculture is an important and profitable livelihood option for the coastal fishing community especially for fisherwomen who with little effort can earn a substantial increase for the

household. India possesses 434 species of red seaweeds, 194 species of brown seaweeds and 216 species of green seaweeds, ( Modoayil,2004) comprising 250,000t in Gujurat 250,000t in Tamilnadu, 100,000t in Kerala, 100,000t in Andhra Pradesh, 5000t in Maharastra and 300,000t in Andaman Nicobar Island. The commercial scale of the red seaweed *Kappaphycus alvarezii* began when PepsiCo India Holding Ltd ( Pepsico) initiated as a pilot scale investment. Commercial cultivation of macro-algae is being carried out in India. *Kappaphycus alvarezii*, that originated in Philippines in 1960 ( Doty & Alvarazii , 1975) is now being cultivated in Mandapam, South India (Eswaran et al, 2002). It is also cultivated on a large scale in countries such as Japan, Indonesia, Tanzania, Fiji, Kiribati, Hawaii, South Africa and India (Subba Rao et al, 2008). Today its cultivation is gradually increasing around Rameswaram and other coastal areas where *Kappaphycus alvarezii* is being conventionally grown on bamboo raft system in calm and shelter waters of the Indian coast. The feasibility study for the cultivation of *Kappaphycus alvarezii* in Odisha was done by Padhi et al (2008). In the RKVY Project of Fisheries and Animal Department, Govt. of Odisha Kappaphycus alvarezii cultivation was implemented by Centre for Environmental Studies, Dept. of Forest and Environment, Govt. of Odisha in the Ganjam Districts of Odisha for improving the livelihoods as a part of coastal community empowerment seaweed cultivation was developed within the participation of local SHG ( Self Help Groups) of women, local communities , NGO (UAA), Fisheries Department ( Ganjam circle). Seaweed farming will help the coastal fisheries community to develop skills in seaweed cultivation, harvesting, processing on seaweed biomass production, particularly when fishing is becoming uneconomic.

The red alga *Gracilaria verrucosa* is a source of the phycocolloid agar and is among the most important commercial seaweeds (Santelices and Doty 1989). This genus is widely distributed in tropical and temperate seas with more than a hundred species. In terms of the production of economically valuable phycocolloides, the most important genera of macroalgae are *Gracilaria, Eucheuma* and *Hypnea* (Dawes, 1998). Chlika lake, a highly productive lagoon ecosystem with rich fisheries resources, sustains the livelihood of more than 0.2 million fisher folk and 0.8 million people who live in the catchments of the lagoon. It is the largest lagoon system of Asia and Gracilaria verrucosa grown in different sectors of the lake. The pear shaped brakish water lagoon is situated on the east coast of Indian peninsula between latitude 19°28'N and longitude 85°06' and 85°35'E in the districts of Puri, Ganjam and Khurda in Odisha. Submerged rocks and rockey shores offer a very good substrate for the luxuriant growth of various form of marine algae and Gracilaria verrucosa is the most conspicuous component of the flora in summer month. The pilot study on cultivation of *Gracilaria verrucosa* in Chilika lake was carried out at Langaleswar in a DST (Dept. of Science and Technology) project, Govt. of India. The coastal women (SHG Group) have acquired basic knowledge about the cultivation, uses of *Gracilaria verrucosa* and handling of the harvested crop. These activities will definitely improve the socioeconomic standard of the coastal villages through their involvement in seaweed farming.

The other marine macroalgae of Chilika lake are Grateloupia filicina, G. lithophyta, Enteromorpha intestinalis, E.linza, E.clathrata, Chaetomorpha linum and C.antennina. Demand for seaweed raw materials has required management and harvesting from natural rocks and intensive and extensive cultivation of algae for the large biomass required for industrial application and large scale reduction of $CO_2$ to cool planet effectively, the decision which has been taken in the International Summit on Climate change COP21 at Paris.

## ECO-ACTIVITIES: CELEBRATION OF "NATIONAL ENERGY CONSERVATION DAY-2015"

Centre for Environmental Studies (CES) organized Written Quiz Competition, Rally & Awareness Meeting at Block, District & State level with the support of Engineer-in-chief (Electricity)-cum-Principal Chief Electrical Inspector & State Designated Agency (SDA) under the Department of Energy, Govt. of Odisha on the occasion of Energy Conservation Day 2015.

More than 44000 school children participated in the competition. Selected students from district level followed by block level competition participated in the State level competition held in Regional Museum of Natural History (RMNH), Acharya Vihar, Bhubaneswar at 3.30 pm on 13th December 2015. After valuation 5 no. of students awarded with Platinum trophy along with cash prize of Rs.5000/-, 10 no. of students awarded with Gold trophy along with cash prize of Rs.3000/ and 25 no. of students awarded with Silver trophy along with cash prize of Rs.2000/-.

State level function on Energy Conservation Day was organized on 14 December 2015 at Jayadev Bhawan, Bhubaneswar. The objective of commemorating this day is to propagate the message of Energy Conservation among the general public as well as all sectors of the economy.

On the occasion a mass rally was organized in the morning which was flagged off by Chief Guest Hon'ble Minister Energy, Shri Pranab Prakash Das in the presence of Member, OERC, Shri A.K. Das; EIC(E)-cum-PCEI, Shri S.S. Pati; Director CES, Dr. Sailabala Padhi besides other dignitaries and officials. The rally was participated in large number by students from all 30 districts of the State from Kalinga Stadium to Power House square, Bhubaneswar. Participants wearing T-shirt & Caps participated in rally holding placards of various slogans on Conservation of Energy to save the nation.

A state level function was organized at Jaydev Bhawan, Bhubaneswar. Platinum, Gold and Silver awards, cash prizes and LED bulbs were given to the selected state level participants during this state level function. All the participants were felicitated with mementoes and certificates and LED bulbs during this function. Shri Pranab Prakash Das, Hon'ble Minister, Deptt. of Energy, Govt. of Odisha and Shri Sanjay Ku Das Burma, Hon'ble Minister, Food Supplies & Consumer Welfare Deptt., Govt. of Odisha inaugurated the function in presence of Shri Rajesh Verma, IAS, Principal Secretary to Govt., Deptt. of Energy; Shri S.S. Pati, EIC(E)-cum-PCEI; Shri R.N. Patra, Chief Engineer, EC, PP&M-cum-CEI; Dr. Sailabala Padhi, Director, CES and gave away the prizes. More than 500 people participated in this state level function.

## Awareness Programme by Rally & Meeting on the occasion of World Wetland Day 2016

On 02.02.2016, CES had conducted an awareness programme at Tangi Girls High School nearby Chilika Lake to raise public awareness about the importance and value of wetlands. To make awareness among the people residing nearby Chilika on Bird Protection, CES organized a student's rally programme in which about 150 students participated.

After that, a meeting was organized in Tangi Girls High School with all participants along with their guardians & teachers. In this meeting, Dr. Sailabala Padhi, Director-cum-ENVIS Coordinator told that wetlands are essential for human health and prosperity. They provide us fresh water supply, food and building materials, biodiversity, to flood control, ground water recharge and climate change mitigation by storing carbon dioxide. Odisha is endowed with very rich and diverse wetlands. Chilika is the great example for us. So we have to protect Chilika Lake as well as our other water bodies. Sri Pravat Mohan Dash, Programme Officer was present on the meeting & he stressed about the importance of wetland, nature's beauty & how to save birds. Sri Santosh Kumar Kar, Asst. Teacher, Tangi Girls High School, Tangi, Khurda gave a brief outline about the programme implementation in this meeting.

Drawing & painting competitions is conducted among the students in the schools in and around Chilika on the theme "Wetlands for our Future" to generate awareness on wetland conservation and selected students were received certificates during the meeting.


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