WATER MANAGEMENT IN HOMES AND VILLAGES

Dr. Felix Ryan

author of
Survival by Sea Water,
Pumps without Water, etc.

Published by

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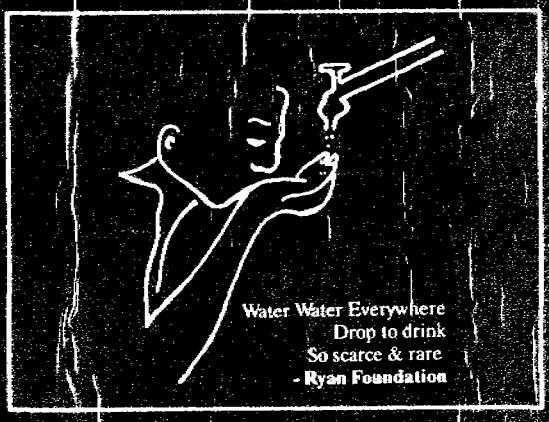

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P.A. Ryan

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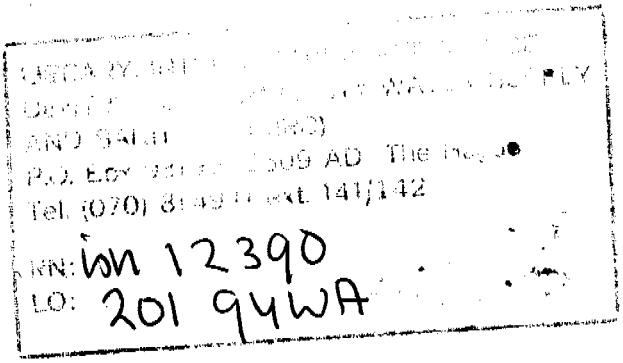

Water Management
In Homes & Villages
(a practical guide)

By
Dr. Felix A.Ryan
United Nations Global 500 Laureate
(for outstanding environmental achievements
in Third World Countries)

*"Thousands of water pumps
remain unrepaired due to
lack of funds, expertise,
capability or spare parts."*

- ASIAN DEVELOPMENT BANK
(Water supply & Sanitation
- beyond the Decade.
Proceedings 1990)

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PREFACE

Enough has been researched and written about the worsening water situation in the World, water-related diseases and calamities caused by drought and famine. Water scarcity is the most acute problem of humanity and of generations to come and not of Governments alone. Every individual, every town and country has to conserve water and manage the scarce commodity carefully. This book is meant to educate and guide common men and women, especially the uneducated village people, in managing the little water available to them carefully and sensibly.

The author hopes to add on more ideas and methods in the next edition and welcomes new ideas and suggestions for improvement from the readers.

F.A.RYAN.

DEDICATED
to my mother, CLARE,
who shaped me to be
the man that I am.

CONTENTS

When the mother and her daughter in every rural home plant and care for atleast three useful drought-resistant saline soil trees in their frontage and backyard, nourish them with home-mixed organic manure, water them with waste water from the bath room (without soap) and care for them like three other members of their family, they will be sowing the seed for the much needed peaceful rural revolution, for self-help and self sustaining community health and economic growth of their village for posterity to prosper.

- Author

1

WATER - A MAJOR THREAT SAYS STUDY.

According to a World Watch Institute report released in Dec 1989, a creeping water scarcity threatens the world and scarcity will be acute in North Africa, major parts of India and China, Mexico, Soviet Union, USA and West Asia by the end of the century.

The bounties of river Nile are dwindling and Egypt will be the worst hit by the year 2000, says the report.

Ms. Sandra Patel, Vice President of the World Watch Institute and her team of experts studied field situations and prepared the report . The main reasons for the threatening water scarcity is said to be precarious fall in water tables, worsening environmental damage caused by greenhouse effect, poor water management and salination of soil.

As the world population grew over 3 billions during the past century and as the population is still growing fast, water shortage is bound to result in food shortage.

India faces the worst salinity problem in the world and about 30 million hectares of land have been declared uncultivable wasteland. China has about 7 million hectares of saline and alkaline agricultural land. The report says that the situation regarding the drop in the level of water table is also serious in India and China. Over-pumping in parts of Tamilnadu had reduced water tables to about 30 metres within a decade, and in Gujarat area, over-pumping by agriculturists in coastal districts has caused salt water to invade the aquifer and contaminate drinking supplies.

Some sixty million people of Egypt are almost entirely dependent on the Nile. Its burgeoning population, food, and water needs are rising rapidly. The water problem of Egypt will be very acute when 80 percent of the flow from the Nile is controlled by Ethiopia to divert the water to meet the needs of her own people.

There is no quick-fix solution to the world water problem, says the report. This book has the solution and it is reasonably a "Quick fix".

"And with water, we made all living beings"
(The Koran - Sura 33 - verse 7)

2

WHY DROUGHT, DEATH AND DISASTER

In Kenya's arid North, the district called Marsabit covers 75,000 sq.metres, but has only 165 water wells and 35 boreholes to serve the 1,85,000 people and the wells are mostly unreliable during summer. They break down frequently and at any given time 50 to 60 percent of them don't function. When there is prolonged drought, the water crisis worsens considerably. In extreme cases, thirsty humans resort to drinking camel urine - from a report which appeared in FEMNET Vol 1 No.10, reproduced in DROPLETS, Newsletter of the African Water Network, issue No.1 of 1993.

Ryan Foundation asks "why don't the Government or some NGOs make sea water available to the people which they can easily and without investing money desalinate by the RYFO methods?" When the Britishers who ruled India dug the 420 km. long Buckingham canal connecting Nellore to Madras in peninsular India and saved people from drought, death and disaster, why don't self-governed democratic Governments resort to this method?

The World Health Organization (WHO) of the United Nations recommends a total dissolved salts (TDS) concentration in water upto 1500 milligrams per litre. But people in Botswana drink water with upto 4000 mg/L TDS and their poor health reflects the high ingestion of salt. There are many parts in several Third Countries where people drink water with much more than 2000 mg/L TDS. Many bore wells installed by the World Bank and UNICEF are sucking saline or sea water with high salt content.

Ryan Foundation reasserts that the solution for water scarcity is not ground water but desalination of water. Sea water desalination on a domestic scale is a must for survival and progress.

Madras in Peninsular India has had severe water shortages in 1982, in 1987 and in 1993. The pre-monsoon rains of March, April and May 1993 were almost nil. A drought was declared in Tamil Nadu (- 52 percent) and the taps, tanks and wells were totally dry. This sort of climatic change is bound to repeat itself frequently in the future, not only in Madras but all over the world.

3

WATER MANAGEMENT BY GOVERNMENTS

In the Orissa state, India, the Potteru project was planned to irrigate 65 percent of the cultivable land of the state at a total cost of Rs. 14.81 crores and was approved by the Planning Commission of India in 1973. The project should have been completed in March 1977, but in 1993, i.e., 16 years after the targetted time, the project was still in the initial stages. In the meantime, the Government of Orissa revised cost estimates several times and the last estimate it furnished to the Planning Commission in May 1992 was Rs.102.19 crores, i.e., more than seven times the original estimate. Officials and ministers give lame excuses and stories for the delay and cost. In the meantime, obviously, much money has been misappropriated down the pipeline, and many people have died due to famine and water-borne diseases. The State of Orissa has the highest starvation and mal-nutrition deaths in India, as per Government reports and statistics. This is but one out of a thousand cases of mis-management of water by Third World Governments.

Of the 2840 villages in Malahandi, Orissa, 754 habitations are waterless. In Bolangir, out of 2741 villages, 311 are waterless habitations and in Koraput, out of 6294 villages, 4054 habitations are waterless. More than 800 drinking water wells in these districts have dried up. About 3300 tubewells in these districts have become defunct and 1750 tubewells yield water with high iron content. Besides, 30 percent of the tubewells in the area are not functioning (Hindu 16.5.93).

Orissa State has a long coast-line. If from somewhere near Puri, the sea water is taken inland by man-made canals, like the canal cutting across Dubai, people can desalinate the sea water as they now brew country (illicit) liquor in Orissa and elsewhere and they can survive by sea water, fish culture and saline agriculture.

Hundreds of trees such as the coconut tree, palmyrah, casaurina, Alexandria laurrel, pugamia Globra, plants and creepers like melon and various types of beans grow well on the sea shore without fresh water and produce raw materials for several livelihood projects (Ryan Foundation specializes in such projects). The National Academy of Science, USA, has published a book (report) on Saline Agriculture.

Why can't the Government of Orissa and other Governments and countries, where water is scarce, exploit the sea for people to live with basic necessities ?

As on date (20.7.93), Tamil Nadu and its Headquarters, Madras, has no water, wells have dried up and borewells are sunk deeper and deeper to suck saline water or air. Tankers are bringing water from Neyveli some 300 kms. away, but how much water can be brought by trucks and tankers to supply 5 million people of the Madras City and at what cost?

The Chief Minister of Tamil Nadu, sat in the Marina beach (20.7.93) on an indefinite hunger strike. Her demand was that the neighbouring state, Karnataka, must give water to Tamil Nadu. But Karnataka itself is short of water and people are suffering(see page 22). Environmentalists wonder if there is really no water or no political will to convert sea water into drinking water by the various inexpensive methods advocated by the Ryan Foundation and its "Survival By Sea Water" Global Movement, which was part of the UN Secretariat Document for the Rio Summit. Some Governments seem to believe that it is easier to eradicate the poor by starvation deaths than to eradicate poverty.

Addressing the Third World Academy of Sciences in Trieste, Italy, on the occasion of its 10th anniversary, World Bank's Environment Department Director, Mohamed T. El Ashay, told an international panel of water management experts, that it takes about 1000 tons of water to grow one ton of grains and 200 tons to grow one ton of rice. But despite the priority and massive resources invested in water resources development, he said, the performance of large public irrigation systems has been disappointing.

Untouchability in Contemporary India
Worse than Apartheid

Diagram taken from" THE WOUNDED SOCIETY: DALITS Of India - A review by the Human Rights Education Movement of India. 161, TTK Rd Madras-6000018 INDIA

4

WATER, ENVIRONMENT AND PUBLIC HEALTH

Everybody knows that water problem which affects environment, health and livelihood of people is critical, but it is necessary to point out two aspects of the problem which has not drawn the attention of international conferences on Water, Environment or Health. Problems that are frequently discussed are climatic change, loss of forests, over-exploitation of ground water, fall of ground water table, mismanagement of water distribution and excessive flow of rain and river water into sea. No doubt all these are correct and real, but the crux of the problem, in most urban centres, is the fact that the little water available for an over-grown and still growing population is lost to a large extent in storage and leakage in pipelines, which were laid about a century ago.

Most of the Developing Countries were under colonial rulers whose method was to store water in catchment areas and to take the water mains underground, along the highways and by-lanes. Every house owner was asked to lay pipe line fittings inside his or her house upto the mains in the road, and then get connection to the main pipe after paying a prescribed fee. The rates were very low and the price of pipes and cost of labour were cheap. But all this happened 100 to 200 years ago.

Today, in these former colonial countries, most of the pipes are leaking with rust perfuration , cracks or breakage. People are not willing to remove the entire underground pipes which were laid by the house owner or the owner's grandparents and lay new pipes, as the cost now is 100 times more and they have to bribe several people working on the pipe line and bribe the government to fix the new connection. With the cost of living and inflation so high, homes are unable to re-lay the pipes. They ask their governments to provide water for them, which is a basic necessity and the opposition parties encourage the people not to help themselves but demand water (and everything) from the Government. Moreover, because of foreign aid and World Bank loans, the spirit of self-help of the developing countries has been lost and they want everything to be given to them with foreign aid, while the governments swindle the aid or waste the money. We have a million cases of waste and swindling to cite from several countries.

Now in 1993, a network of pipelines about 3000 km. long supplies potable water to the citizens of Ahmedabad, capital of Gujarat state in India, which has about 2 lakh domestic connections. More than 70 percent of these connections are rusted and punctured by corrosion, according to Mr. P.U. Asnani, Deputy Municipal Commissioner of the Municipal Corporation of Ahmedabad, who is also in charge of the Health Department of the Corporation. The life of these galvanised pipes is 10 to 15 years and the households are required to change them thereafter. The residents have seldom bothered to do so. Most of the pipes are several decades old.

Also, where the colonial rulers laid the water mains to cater to a population of one million, now the population has risen to about 5 million, and the underground water mains don't have the capacity to take more water. As a result, homes and institutions near the supply centres get some water and those in the other end suck air in their hand pumps. In many cities, water is supplied on alternative days for an hour or two, during which time people must pump and store water.

What is worse, the sewerage mains on the highways and connections inside residential colonies are also leaking, and the drinking water and sewerage water mix. When people pump, they get muddy or dirty water with a bad odour, leading to cholera and diarrhoea and several other diseases.

Contrary to a popular belief, it is not necessary for a leaking drain and the corroded pipelines to be closely located for the drinking water to get contaminated. They can be apart and still the water can get contaminated, if the corroded pipe is passing through the underground spillings. The risk of the ingress of the pollutants goes up many times if the residents have installed motor-pumpsets on their connections to draw more water at higher pressure. Little do they realise that the pump also draws on contaminants from the underground spillage.

Private hand pumps are fixed to the corporation mains and the water supplied without pressure does not flow into the sump in the homes by itself. While the Government helplessly permits sucking through hand pumps, they prohibit fixing motors to the pipes but the rich secretly fix powerful one HP motors, concealed somewhere in their houses, and suck water by force, depriving the handpumpers, usually women, of their share of water, while the

majority of the poor and slum dwellers walk several miles to find a pot of water which is usually contaminated. Quarrels and clashes occur in the process of fetching water.

To solve the grave water problem, Governments have sunk millions of deep bore well pumps, like the Mark II pump. But instead of mitigating the problem, these pumps have reduced water tables, rendered open wells and tanks dry and made the water problem more acute. In several coastal areas, the deep pumps are sucking sea water which seeps in due to over-exploitation of ground water and forcible sucking with electric motors or oil engines. In several locations, borewater has substantial mineral contamination. The Centre for Water Resources of the Government Anna University at Madras, South India, tested hundreds of drinking water samples drawn from different areas of the city in 1993 and declared that underground water was unfit for human consumption, as per WHO standards and can cause several diseases as they contained a high percentage of arsenic and selenium. This finding necessitates the exploitation of the sea and desalination methods on a domestic, rural and commercial scale, as demonstrated by the Ryan Foundation. These technologies are so simple and inexpensive that NGOs and under graduate students of Science could take them to the common man and the rural poor.

The point to be emphasised is that in over-populated and widespread urban centres, it is not possible to centralise water distribution. Nor is it proper to ask people to pay for their drinking water when 99 percent of our planet is made of water. No amount of good water management will solve the problem, rather it would only increase scarcity, bribery, corruption, water-related diseases and starvation deaths, as we witness today. As a proof, we may cite that, at the end of the World Bank water decade, water problem became doubly acute. The UN system recognises this fact, which is staring them on their face, but they refuse to accept their policy mistake and insist on sucking the earth dry without minding the dire consequences. Their medicine is worse than the disease.

In the thinly populated rural areas, the problem is totally different. The colonial rulers did not lay water mains in villages and villagers did not lay metal pipe connections. Local Governments or people's committees regularly deepened ponds, catchment areas and wells and ensured adequate water for their settlements. But now the

local self-governments and people's own efforts are all gone. Politics has penetrated rural areas in a big and ugly way and the opposition parties are playing their part. Villagers are asked by the opposition not to deepen wells and catchment areas but to demand water from the ruling Governments. (There are such political parties and opposition parties in countries like India, Pakistan, Bangladesh, in Gulf countries and even in Africa).

It is a tragedy that the ruling Governments have taken bribes and allotted common land and Government land to their party men to raise residental colonies, schools or cinema theaters for their personal gains. As a result, thousands of catchment areas are no more catchment areas but residential or commercial complexes or industrial estates. Some large scale undertakings, such as the Neyveli Lignite Corporation, a Govt. of India undertaking, in peninsular India, suck millions of gallons of sub-soil water everyday to keep their thermal plant going, rendering about 1000 formerly fertile villages all around dry, and destroying farmers and families by famine.

One major ongoing scheme which was launched in 1990 has gobbled up a vast stretch of over 37 hectares of wetland in Nolambur in Ambattur municipality, Madras, India. Ironically, a Public Corporation like the TNEB is so unconcerned about the obliteration of one of the few remaining green and wet patches around Madras city, that it has blankly named the scheme as "Nolambur and Magappair Eri Scheme", "eri" being the Tamil word for lake.

In the past, villagers who regularly removed silt and clay from lakes, ponds, and catchment areas used them to make bricks and built their own low-cost houses. This is no more a prevalent practice. Multinational and large-scale cement factories (many of them owned by Governments) sell cement to the poor at exorbitant prices and all along the delivery lines, there is corruption and the poor are going without proper shelter. The price of cement in India has risen ten-fold during the past 3 decades.

Ryan Foundation's solution to the water problem, and several other water-related problems, such as health and environment, is to exploit the sea. There are several sane and sensible ways of converting sea water into potable water without using renewable energy, political power, or money power but only by using brain power and muscle power.

In the Gulf Countries, expensive projects have been functioning to desalinate sea water. Among very many methods, the reverse Osmosis method is popular in rich countries, but this is too costly for poor countries and cannot be introduced. In the developing countries, nothing from outside, even a table pin, really reaches the poor directly or at fixed prices, as there are brokers and middlemen, bribery and corruption all along the pipelines.

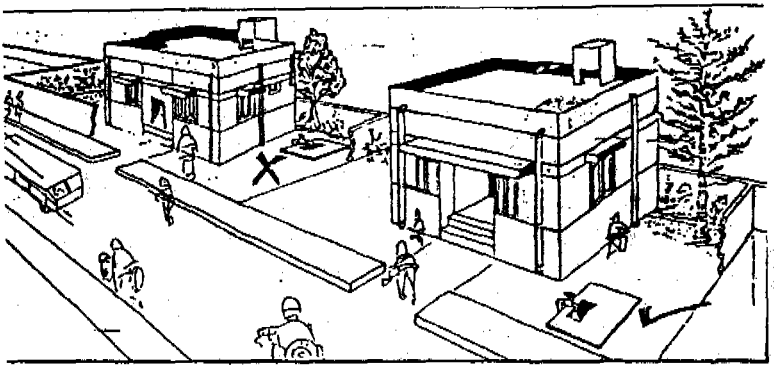
Taking sea water through a network of man-made canals and open-cut water ways and asking people to draw and desalinate the sea water is probably the only practical solution to the water problem.

Ryan Foundation has innovated several simple and inexpensive desalination methods (not plants) by which the poorest of the poor in God-forsaken villages can help themselves. The simplest method requires only 2 buckets and one sq.meter transparent plastic sheet. By another method, as a woman cooks food in her hut, she automatically converts sea water in an oil drum, or a brick and mortar tank of the size of a drum, into drinking water enough for the family and enough for the day, utilizing heat around the pot. Conversion by the solar-cum-thermal method is our best system. It is not possible to explain details of these methods here, but the methods with drawings have already been published in booklet form and they were declared part of UN Secretariat official document for the UNCED summit and the booklets are available with the Ryan Foundation. All the methods are explained in the following pages of this book.

But to follow these methods sea water must be made available to people, as the British rulers made it available to drought affected people of peninsular India by digging the 420 km. Buckingham Canal which was also navigable. Then, the rural poor were promoting saline agriculture, kitchen gardens, fish and fish-based industries, cattle, ducks, etc. But this canal has been neglected and polluted after the foreign rulers left the country.

Domestic desalination is not a difficult science or process. Almost in all poor countries and in every village, the poor brew their own alcohol (illicit liquor). The principle is evaporation and condensation. Since the rural poor all over the World know and practice the method, we must give them the sea water to be evaporated and condensed. It is for the Government to dig a network of sea-water canals and open cut channels to take the water into interior rural

parts. Given the main canals, people will dig their own tributaries with free labour. The sea and the tree holds the key to many problems relating to environment and health.



The length of the supply pipe is needlessly lengthened, by the installation of the Sump at the rear side of the house. In course of time, the chances of the pipe getting rusted and causing pollution are higher.
Moreover, it is difficult to attend to problems, if any arise.

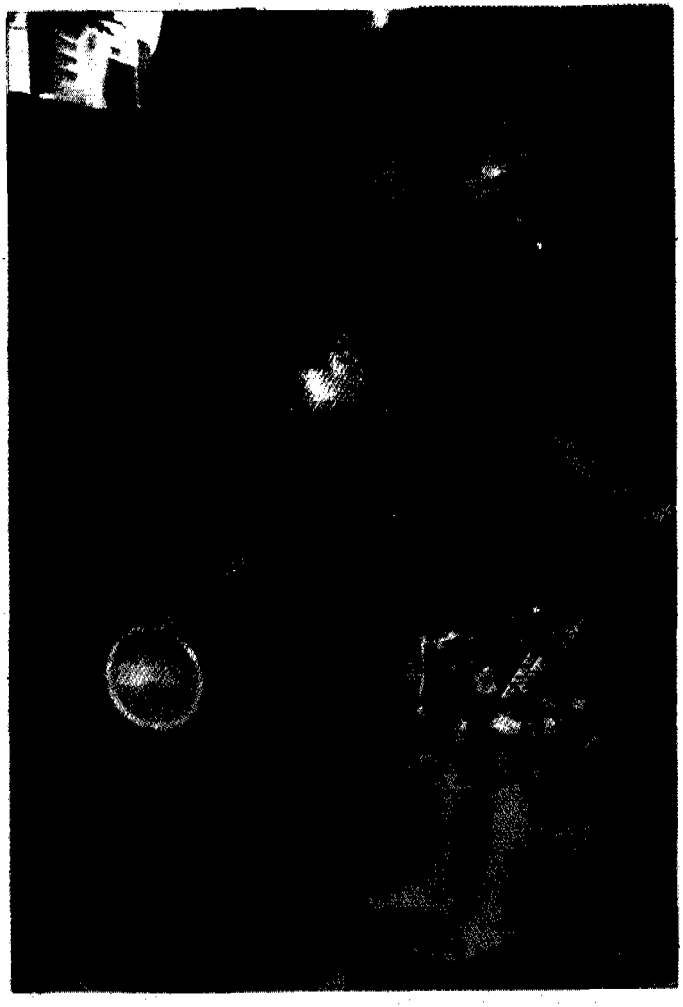
Managing Director
METRO WATER
Madras 600 002.

Therefore -

*Kindly instal the Sump at the front portion of your house,

*As far as possible - locate sump near the supply point from the road.

" Teach them when they are young"



Baby environmentalist, Rajiv, aged two, has learnt careful management of scarce water and to care for the Sapota (fruit) tree and insists that only he should water it.

(Grandson of the author. Photo by his mother).

5

ARE HANDPUMPS REALLY WORKING?

UNDP journal SOURCE, Dec.1990, reports, "Zimbabwe has produced 18,000 Bush pumps. Some water engineers are critical about the Bush pump because its design leans too heavily towards durability as opposed to simplicity in repair. This results in an expensive Government maintenance system. Other experts question the high levels of Govt. subsidy to new sanitation and water supply installations, insisting that more of the burden must be borne by the beneficiaries to endure sustainability. Still others are concerned about the programmes' increasing dependency on concessional foreign finance.

The bucket pumps and the Blair pumps which Zimbabwe has been installing are more troublesome and expensive in terms of maintenance and less reliable than the Bush pump. This writer has the same opinion about the African Afridev pump, the Nira pump, manufactured in Finland, the Kardia pump developed in West Germany and the Mark II pump which was pioneered in India. The TARA pump developed in Bangladesh is no better.

In the same issue of SOURCE, Sid Kane, water expert of China talks about the handpumps installed in Xinjiang, China and states, "There have been clashes in the region before, and the Government doesn't want to see water turn into a large political problem."

These are some R & D and discouraging reports about different types of handpumps installed in different parts of the world. One has to go into the ground as deep as these borepumps to find the real truth about their performance, utility and cost. German, Swedish, UN and other water experts who visit remote areas and villages where these pumps are installed often echo surface reports of those who invented the pumps named above, those who manufactured them or those of the Government field staff, career men who had them installed spending much time, money and energy. Frequently, the reports recorded and published are those of the village community which is briefed (even bribed) by interested parties about the type of reports and statistics to be given to foreign visitors, engineers, journalists and donor agencies. Having been a government official for well over 30 years and most of the time engaged in rural development, this writer knows for sure how these reports are manipulated over a cup of tea or a tot of whisky in a Five Star Hotel or in the house of a tribal after a tribal dance.

For an exhaustive and critical report about the true situation in the water front in almost all Third Countries, refer to the booklet, 'Pumps without Water' published in 1988, in which this author emphasises that only the open system can give water to the poor in remote villages of poor countries and recommends several ways of taking water by the open system.

When reading encouraging reports about handpumps and supply of bore water for the poor, one is reminded of the saying, "the operation was successful but the patient died.'

6

WATER TAPPING

Struggle for survival knows no law. The main underground water pipes in the Gandhi Nagar village near Madurantakam of the Chingleput district of Tamil Nadu is being illegally tapped by the water starved people of the area, despite the cholera outbreak in 1994. People have no other go. It is better to take the risk of being affected by cholera than to die of thirst and dehydration.

There is indiscriminate tapping of water pipes in many water starved areas of several countries. Illegal water tapping has become a way of life and various methods of tapping is widely practised, mindless of health hazards and risks. Sucking the pipelines with electric motors or oil engines is done in urban areas by the rich.

The tappers illegally remove pipes joints or couplings from nearby points and connect cycle tubes for drawing the water. After taking water required for their survival, they remove the cycle tubes, cap the openings and replace the joint fittings. This develops cracks and leaks in the joints through which scarce water goes underground throughout the day and night. As the pipes are underground, the illegal practice goes unnoticed by the municipal authorities or village administration.

During the last rains prior to the cholera epidemic in Madurantakam in 1994, water coming in from the nearby fields, where people defecate in open places, entered the pipes through these drawing spots, and contaminated the drinking water.

Another illegal method which people are forced to resort to is "pit collecting", which can be commonly seen in many parts of India. By this method, the pipe is punctured, just cut with an hacksaw blade, and a pit is dug below the punctured spot. Water fills this pit and people collect the water from it in buckets. In many places, this method is followed in an organised manner and the pits are enlarged and paved with cement or mortar. In other places, empty asphalt (tar) drums, abandoned on the road side, are rolled to the spot and buried underground to collect the water.

It is impossible to stop these illegal practices because water is essential for human survival. The only solution to the problem is to bring in the sea water in open man made canals and teach people to desalinate the water in their homes by the very simple methods recommended by the Ryan Foundation.

7

THE AFRIDEV PUMP

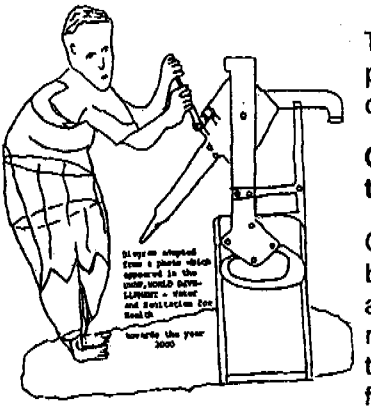


Diagram adopted from a photo which appeared in the UNDP, WORLD DEVELOPMENT - Water and Sanitation for Health towards the year 2000

Caption of UN photo

The Kenyan-made AFRIDEV pump is simple to repair and cheap to maintain.

Comment of Ryan foundation:

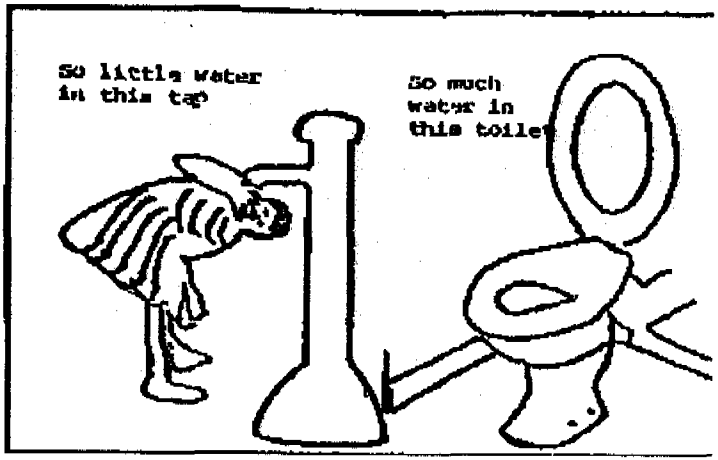
Great expectation. Millions of bicycles owned by men are abandoned in rural parts of most Third countries, since there are no materials and facilities to patch a puncture in the tube, or to set right a dislocation of ball bearings and for want of bolts and nuts and hand-tools for repairs and replacements.....

Millions of sewing machines owned by women are rusting for want of needles and bobbins. Poor villagers don't have tools, techniques or money for maintenance and there is no ' Maintenance culture'

in poverty stricken Third countries. Where tools and spare parts are made available, Government agents and private distributors black market them at a price which rural communities can never afford. It is wishful thinking that most backward and illiterate women who will not even appear before men, especially in many muslim countries, can find washers and tools and maintain pumps and remove bolts and nuts which are usually rusted and hard to remove even by men and mechanics. Moreover, throughout the Third World, women believe and say that machine maintenance-work is a man's job and women's job is in the kitchen. If the UN wants to change their culture, it has to bring about a change in civilization and expedite evolution, (author's recording on Labour Day 1st May 1989).

8

SEA WATER FOR TOILETS RYFO Handout 674



It is very wrong to use about 40 percent of scarce and costly fresh water in toilets both in rural and urban homes. The idea of using sea water for flushing toilets and washing floors and cattle was advocated by Sir Viswaseriah, when he was Devan of Mysore nearly a century ago. But those were the days when there were no rigid PVC pipes to withstand sea water corrosion and sea water could be used only in a limited way where earthernware pipes were laid. Now that practically in every home rigid PVC pipes are laid or are replacing GI (metal) pipes, it is time to use sea water wherever it can be used.

Overhead tanks must be built along the sea shore to lift sea water in canvas buckets, as explained elsewhere in this book. Underground earthernware pipes must be laid to take sea water to residential areas and to farms, factories, hospitals, airports and railway stations to clean and swab floors. To a certain extent, sea water is a disinfectant and will keep away mosquitoes and flies. Ryan Foundation recommends a public limited company to supply sea water to homes and institutions.

9

THE BAREFOOT MECHANIC

BY

BUNKER ROY

REFLECTIONS AND COMMENTS

BY

Felix Ryan

I have reproduced below with permission the article by Bunker Roy of the Social and Research Centre of Tilonia-305816, India, from ECOFORUM of September 1990 with courtesy to Bunker Roy and ECOFORUM. Roy should have captioned this true-to-facts article, "Why barefoot mechanics fail." His article underlines the well-known fact that nothing works or will ever work in the hands of the Governments which are not able to enforce basic law or order, especially when it comes to delivering goods and services to the helpless rural poor. The article supports this author's firm conviction and message in several papers and publications which say that the closed system of drawing ground water will not deliver water to the rural poor but only increase corruption, make the middlemen richer and the poor man poorer and bring about other socio-economic complications, including black money inflation in rural pockets. "Survival by Sea Water", the movement launched by the Ryan Foundation to mark Earth Day 1990 recommends only the open system. There is no other way to get out of the clutches of the Government, who, under the pretext of helping their people, swindle money down the pipe line and exploit the poor. In every field of livelihood, the poor must be told, taught and helped to help themselves with local resources and appropriate technology. That

community or family is most progressive which is least dependent on the government. UNESCO has stated "Development must be designed even at the humblest level as a process of ensuring the advancement of man through his own endeavours". But it is not enough for Governments and International Governments to make statements and pass resolutions in international conferences and produce public documents; they should implement their pronouncements for the good of the people.

Under the order of the day, it is futile to expect Governments of Third Countries to deliver goods and services, fuel and water, to the rural poor or even to the urban rich for that matter. Third World politicians are not interested in people's welfare but only in their own welfare. They are more concerned about their own position and power and projects to make money than about the plight and poverty of the people; not in a welfare state but in a state of self-welfare.

The bare-foot revolution by extension personnel which was gaining importance a decade ago is failing now in the early nineties, as revealed by Roy's article but people's do-it-yourself revolution is picking up courage and force and it is bound to succeed. Succeed it must for there is no survival without success. Governments must make this new bloodless revolution possible to avoid a bloody revolution.

For the reasons explained above, Ryan Foundation discourages Government pipe lines and encourages self-help projects independent of government machinery.

COMMUNITY INDEPENDENCE

THE BAREFOOT MECHANIC

by

BUNKER ROY

It was a simple illiterate villager in a tea shop who actually managed to put the finger in the problem. He said, "If we can repair our own tractors, diesel and electric pump sets, agricultural implements and all these without paper degrees, what is so difficult about repairing our own hand pumps ?" This simple question started the process that culminated in the introduction and acceptance of what is now known all over India as the Hand Pump Mistry (mechanic in Hindi): the HPM.

Since 1984 more than 500 HPMS have been trained and are looking after 40,000 Indian made India Mark II hand pumps. From the UNICEF designed engineer-based urban-oriented model costing US $50/ hand pump/ year to repair and maintain, the HPM village based model has brought the cost down to US $ 10/hand pump /year.

The effectiveness of any idea is in its simplicity. If it has to be absorbed into the system, then the last man in the delivery system of Government at the village level must first understand and then accept it - not the engineer sitting in a city who has no idea of rural realities and whose solution in many cases is expensive and wasteful.

If the ultimate beneficiary is supposed to be the rural community, it stands to reason that they must be taken into confidence from the very beginning. The simplest of innovations have known to fail because the community has always been taken for granted or grossly under-estimated.

The outcome, therefore was predictable when in 1979 the 3 Tier System of repairing hand pumps was introduced. This involved a caretaker (1st Tier) who did very simple maintenance free-of-charge identified by the local community; a Block Mechanic (2nd Tier) a paid government employee looking after 100 villages with little or no tools; a District Maintenence Unit (3rd Tier) with trucks, jeeps, special tools, equipments and engineers all paid government employees of the Public Health Department located 60 to 70 miles away from hand pumps installed on inaccessible areas.

This absurdly expensive system proved to be wasteful and designed to suit the convenience of the engineers concerned.

In contrast the Barefoot Mechanic scheme introduced into the government system in the desert state of Rajasthan (India) is simple. Here the government was facing an acute problem of repairing and maintaining over 50,000 India Mark II hand pumps drawing water from depths varying from 100 to 250 ft.

Under the scheme, an unemployed rural youth, barely literate, is selected by the community for a 3 month government sponsored programme called TRYSEM (Training of Rural Youth for Self Employment). He is given a stipend while under training to meet the basic needs. While under training, he is taught how to dismantle

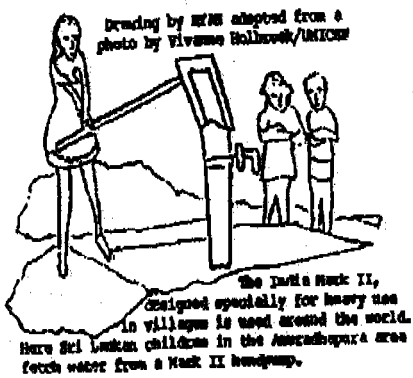
the entire Mark II hand pump and put it back again. He is taught the names of the running spares. No theory, just the extensive use of the special tools needed to pull the hand pump apart which he will be using in any case after training is over and he goes back to the village. The special tools can be carried on a bicycle. After the 3 months practical training is over, he is allocated 30-40 hand pumps by the government within a radius of 5 kms. from the village he lives in. He has been trained to carry out all the minor repairs above the ground as well as the major repairs below the ground thus replacing the caretaker, the Block Mechanic and District Maintenance Unit all at once.

The community no longer has to send post cards and wait for the unit to come and repair the hand pump. They go to the HPM who is one of them and the HPM is in a position to carry out the repairs. The government gives US $2/hand pump /year for spares. Once the headman of the village certifies that the hand pumps in his village are in working order, payment is made by the government to the Hand Pump Mechanic.

The beauty of the scheme is that the Barefoot Mechanic is selected by the community (ensures accountability) and with proper training upgrades his knowledge and skills to provide a vital service at low cost to his own community. No importance or preferences are given to the paper degrees. On the contrary, more emphasis is given in the selection to mechanical aptitude, practical experience, his economic status and his rural roots. It just shows if you trust the community how self reliant they can be but even more important is the feeling they have developed as a result that no economic programme can instill a feeling of self respect.

Potential Weakness

Unfortunately one of the biggest weakness in this simple scheme is the deep rooted mistrust of the engineer in the capability of the community to look after themselves. The engineer is totally hostile to the idea of demystifying technology to the extent of handing over the responsibility of repairing and maintaining -



The India Mark II, designed specially for heavy use in villages is used around the world. Here Sri Lankan children in the Anuradhapura area fetch water from a Mark II handpump.

what he believes is sophisticated technology. It is inconceivable and totally beyond his comprehension that a semi-literate can do the job of an engineer, perhaps more competently, without back up equipment and other support. The engineer cannot imagine a person he has always considered socially and intellectually inferior coming from the village to be as technically competent as he is. Every opportunity is thus taken to sabotage the scheme in the eyes of the politicians.

Another major threat to the HPM scheme is the Literate man. Though the bare foot mechanic keeps the hand pump in order, the government official invariably takes time to hand over payment. Sometimes the mechanic may have to wait for months. This has led to drop outs in many villages.

In a similar fashion many engineers ensure the mechanics are poorly trained in Industrial Training institutes. They are not issued the proper special tools with which they can carry out major and minor repairs. In turn this is cited as yet another indication of why hand pumps should not be handed over to the community.

Bank managers are not prepared to give loans even though there is a policy to support the self employed. Engineers have whispered in their ears that they are likely to run off with the loans and use it elsewhere. Thus special tools are not available to repair the pumps though the HPMs have been allocated the 40 hand pumps.

Often too, the selection by the political leaders is poor. Relations of the leaders who see quick money in becoming a HPM are selected and as a result money is released but the pumps are not maintained in working order - another black mark against the scheme.

It is interesting that the capability of the illiterate villager to repair and maintain hand pumps has never been questioned. It is the supporting systems that should encourage this decentralisation. And certainly on paper, in any case, the government says the community actually owns the pump. They should, therefore have the right to maintain it.

Certain schemes like this have the capacity to reduce the dependence of the community on government. In many countries, such as India, the government is trying to encourage such self-reliance and decentralisation. But while such moves are resisted by local technocrats whose word is law, low-cost community based schemes like the barefoot mechanic scheme remain in jeopardy.

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THE MAD RIVER

The excellent article by Allan Thompson on the Great Manmade River (D + C No.6/1991) ought to wake up the people of Libya from their decade old slumber and make them protest against the removal of billions of cubic metres of fresh water now trapped in limestone caverns beneath the southern sands of their country. The already degraded Libyan earth mass will not stand in its right position if its bowels are sucked and emptied but will simply collapse and crumble.

There are reports to show that in several cities, land subsidence is taking place due to large scale extraction of ground water. Among them are Milan, Pisa and Venice in Italy, Bangkok in Thailand and Nagoya in Japan and yet in these countries, groundwater is not being extracted in such a massive scale as is now being done in Libya. Reports reveal that what is now happening in Libya is only the beginning of the project.

In the City of Calcutta and elsewhere in India, several multi-storied buildings have developed cracks due to over- extraction of ground water. Can we remove the layer of underground support for the earth and then put up multistorey buildings on top?

A recent study indicates that in Bangkok, excessive exploitation of ground water in the past 30 years has caused alarming land subsidence, resulting in flooding, waterlogging, damage to buildings and to the very infrastructure of the city. Wherever the pumping was cut down, the subsidence has stopped and in some cases, the surface has been rebonded. Where it is not possible to ban ground water pumping, artificial recharging is being done to save the land from caving in.

One wonders if the semi-desert of Libya will tolerate or withstand the removal of billions of cubic metres of water which is now holding the land mass of the country at a certain level above the sea. If over-pumping is done, the coastal land between Tripoli and Kutra is bound to cave in and let in the Mediterranean Sea to flood and millions of people will perish. Such a disaster can happen slowly in stages or suddenly overnight.

The solution to the water problem of Libya is to leave the deep lying sub-soil water and lead the Mediterranean water by canals from Beida to Ghat and from Misurata to Ellauf. Desalinating sea water is so easy and cheap now.

As a water expert and an environmentalist, this author can assert that the open (surface) method of providing water is always safer, cleaner, quicker and cheaper than the closed (underground) method.

Author's letter to the editor reproduced from D + C Development and Co-operation of the German Foundation of International Development No. 2 of 1992.

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HOODWINKING THE SOUTH

The excellently got up book, "Rural Water Supplies and Sanitation" by Peter Morgan, Blair Research Institute, Zimbabwe, a complimentary copy of which was sent to this author by the Swedish International Development Agency (SIDA) which has sponsored the publication and distribution of the book, is the provocation to write what follows:

Almost everything that is recommended in the book is made of, or requires the use of, items (machines, components, tools etc.) made of iron, steel, brass, plastic, or cement which are made by capitalists and multinationals in advanced countries. The North keeps pushing its methods and products on the South for a market.

The special issue of the UNDP Centre on Small Energy Resources, No.12 of August 1988, reveals that it costs US $ 5740 to install one windpump in a country like Cape Verde out of which US $ 2240 is spent on imported parts. What a fine "market" - for the North. For US $ 5740, a poor country will dig about 1000 open wells but the West will lose so much market and so much exports. We may explain this as the Trade and Development exploitation Tragedy of a self-destroying civilization.

When the South cannot afford to buy these goods, the North presents or loans them (gives on credit) and records it as aid given to the South to relieve poverty, hunger and drought. But the rich man's charity does not really begin or end in the poor man's home.

Fact remains that the Western approach to water problem in the poor countries has lowered water tables and promoted multipoint corruption, inflation and conflict. The end of the UN Water decade saw the poor world facing more acute water problems than the beginning. Water position is getting bad to worse day by day but the "good Samaritans of the West" keep harping on the same string and repeating the same methods.

Have the advanced countries not realised that their method is making the water problem more and more acute and the poor countries more and more indebted to them? Certainly, they have. But that is exactly what they want to achieve - keeping the poor countries perpetually indebted to them. They know that the poor cannot progress if they depend on the rich. Gandhiji made this very clear in his teachings. Even recent history of Nation- building has proved it. China and India, for instance, started on their development process about the same time, both large countries with about the same population and similar natural resources. But India took foreign aid from many countries while China relied on self-help. Result? China is far ahead of India today in so many fields while India is moving from poverty to more poverty and is locked up in a debt trap of unimaginable magnitude. Our Western aid-givers know fully well the relationship between "external aid" and "internal development", correctly, "internal destruction".

I have said it in some of my publications on water and I say it again that machines and machine-made items or components and the closed system of giving water to the poor in remote villages of poor countries will not work, except in stray cases here and there which are magnified and publicised by those pursuing these wrong methods and policies. The remote poor will have to be given the open system (wells, canals, ponds, lakes, channels, streamlets, etc.) and will have to be helped in their traditional methods of finding water and introduced to appropriate technologies.

An African or Indian villager or aborigine of Papua New Guinea for that matter knows much better than Americans or Europeans about digging open wells and it is ridiculous for SIDA or any Western agency to tell them about digging wells using technology of the West. but the very poor are under such acute starvation and malnutrition due to structural adjustments, invented and imposed by armchair development exploiters that the poor countries are now not even in a position to dig their ground for water as they did for thousands of years. Their local governments also come in their way of practising traditionnal methods followed for thousands of years because they are tempted by foreign agencies with money and machines, contracts and consignments which fill the pockets

of local governments and politicians. It is very clear to any sensible man that the North is in the South for its own advantage and that the local Governments of poor countries ask for foreign aid also for their own advantage. To hell with Aid! (The author is now the chief monitor of the Global Movement - SURVIVAL BY SEA WATER).

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WATER PROBLEM IN CAPE VERDE

Problem number one of Cape Verde is water. Almost every room in the hotels of the country say, "Water is a precious commodity in Cape Verde. Please do not waste it ".

The only natural source of water in the island is the scant rainfall and there are no permanent sources of water. The Island has a short rainy season twice yearly, but the water quickly flows into the ocean. However, the people try to collect the rain water in several ways and help themselves. The country has built huge storage tanks in which they collect and store water during the rainy season and sell them during summer. In 1991 the price per can of 25 litres was 2.5 escudos. Sale of water is well organised and managed at the foot of Fogo Volcano.

The people themselves have contributed and financed several water storage projects, especially around Santiago to help meet the ever increasing demand of Praia, the capital. Sometimes the people transport water from Santo Antao where there is little more water, to Sao Vincente, where water is always scarce. As the distance between these two islands is short, shifting water thus seems to be economical and worthwhile. Lorry tubes are filled with water and shifted on donkey backs.

The country cannot help having several seawater desalination plants which are very expensive especially because they use imported oil. Some wind mills are also used but they are very unproductive.

Countries such as this, must introduce the most inexpensive solar stills innovated by Ryan Foundation, both for domestic desalination and for commercial desalination. The RYFO 4 pots desalination method can be given to every home and the government can

put up massive stainless steel tanks to work on the same principle. People can survive through the 21st century only if they turn to low-cost desalination of sea water.

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SURVIVAL BY SEA WATER : PART - 1

At the end of the much publicised UN water decade during which billions of dollars were spent, water position all over the world was much worse than what it was before the decade was launched and by the end of this century the water problem will be atleast twice as acute as now. The annual rainfall is falling in many parts of the world.

Mostafa Tolba, Executive Director UNEP, stated in the International Conference on Water and Environment at Dublin, end of January 1992, "There is no longer an unlimited supply of fresh water, and international competition will grow more fierce, more violent. And with no clear consensus on how best to use shared water resources for the benefit of all riparian states, that competition will become conflict".

Today, drinking water is rationed in Sri Lanka and Libya and scarce almost in all countries . In several parts of India, water is sold by the Government and black marketed by private contractors. In Brazil where the UNCED Earth summit took place in June 1992, there is very acute shortage of drinking water. More than 24 million people in Brazil are living without access to water even to wash and bathe. The cholera epidemic is ravaging South America at present due to lack of even sea water which is not made available to them for bathing, cleaning and washing in man-made canals as done in some countries like Dubai. It is a pity that the UN has been pursuing totally a wrong policy of over-exploiting the scarce subsoil water, reducing water tables, and causing land subsidence in several countries instead of exploiting the abundant sea for water. UN has to chalk out new pathways of development which will be environmentally sustainable. The marine environment - including the oceans and the adjacent Coastal areas - forms an integrated whole that is an essential component of the Global life support system and a positive asset presenting opportunities for sustainable development.

It is a great pity that the very basic fact is being ignored by Governments and water experts. The real problem, is not, as the Dublin statement says, mis-management of rainwater flow, or ground-water sources, but inadequate rains for the evergrowing population, that has multiplied several million fold ever since Adam, and non-availability of already over-exploited underground potable water, besides climatic change.

There has been so much climatic change during the past two decades in particular, that Cherrapunj, Mehalya, India, which had the heaviest rainfall in the world, where for centuries it used to rain all the 24 hours of the day and all the 365 days of the year, is now totally drought-ridden and people are walking several miles to fetch a pitcher of unhealthy water. Singapore which once enjoyed plenty of water is now drawing millions of gallons of water from the Riau Province under a long term agreement signed between Singapore and Indonesia in July 1991.

However, it is simply madness to say that there is no drinking water in this planet when more than 99 percent of the planet is made of water and solar desalination is so easy and inexpensive.

The quickest, easiest, safest, cheapest and sane solution to the water problem is in exploiting the sea in different ways as reported and explained in the booklet "Survival by Sea Water" published by the Ryan Foundation, India, referring to the research findings and published reports of the UN, USAID, countries like Israel, and many authorities on environment and water.

USAID team of experts had researched in several countries and published a report on Saline Agriculture explaining very many plants and trees that can be cultivated by sea water or sea water mixed with potable water to provide food and employment for billions of people and the thousands of sea-based livelihood projects that can be promoted in every Coastal country.

An important point to be emphasised is that, gone are the days when rain water could be collected in big lakes and catchment areas and pumped by motors and taken to cities and towns and supplied to homes by pipes. Now the cities, towns and villages are wide spread and over-crowded. Population has multiplied many times over but the natural water available remains constant, from time immemorial. Also, terrorism and sabotage is rampant around water works and all along pipe lines. In the coming years, water blocking is feared to be a major problem.

Ground water table is falling day by day and water subsidence is taking place in several countries. In certain parts of Bangkok in Thailand, Nagoya in Japan and Milan, Pisa and Venice in Italy, land is sinking and sea is moving in. On the other hand, due to green-house effect sea-level is rising and many Coastal countries like Guyana are fighting the sea to keep it at bay when it is easier and wiser to lead the water into the land under controlled system.

We cannot perform the distribution miracle which Christ performed with wine at Cana with our inadequate fresh water and the ground water table falling lower and lower year after year but will have to turn to the sea. It is in the plan of the Almighty that people should exploit the sea for their survival. There is no use talking about expensive reverse Osmosis process, centralising potable water and then transporting or piping it to interior villages but we must resort to the Saudi method of using wind, wave and solar energy to purify sea water and let them flow in open cut canals.

The sea has to be brought into land by man-made canals like the 420 km. long Buckingham canal which connects Nellore to Kovalam. Aquaculture, pisiculture and saline agriculture must be promoted and people taught to desalinate sea water right in their homes with domestic utensils, as explained by Ryan Foundation in its booklet,"Simple Stills for the Rural Poor", which was distributed free at the Earth Summit at Brazil. Time is critical now for governments, NGOs and peoples of the world to exploit the sea for their survival.

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SURVIVAL BY SEA WATER : Part - II

The very acute water problem in the Middle East is getting more and more acute year after year. Be it repeated that at the end of the UN water decade the problem was more than twice as bad than what it was before the water decade was declared. International Conferences on water have been stating the problems and possible solutions over and over again without bringing relief to people without water.

Ryan Foundation's positive solution to the problem is to exploit the sea for survival. The Foundation published three booklets and several papers explaining many simple and inexpensive ways of

desalinating water which can be followed both on a domestic scale and national or international scale. The booklet "Survival By Sea Water" released by the Foundation in 1990 was declared part of UN Secretariat document for the RIO summit but there was no follow-up. The methods advocated by the Foundation are briefly explained here with detailed supporting documents and diagrams appended.

Saudi Method

Sea Water is being converted into fresh water on a large scale by solar power north of Jeddah, Saudi Arabia, by American technology. The desalination process uses heat from the sun to produce steam. Powerful lenses are used to intensify sunlight by 40 times, and the steam is used to work machines to freeze sea water. When sea water freezes, the salt in the water collects on the outside of the ice crystals, and the salt can be separated by washing the ice crystals in fresh water. Then the crystals are melted into fresh water. This is a method which uses wave energy, wind energy and solar energy (all abundant renewable energies) to convert sea water into potable water and the plant is producing millions of gallons of water some 30 kms. from Jeddah.

Further research is bound to simplify this technology to make it even more economical than now. Windmills with canvas bucket lifters on the sea shore can be used to lift the sea water into stainless steel boilers and freezers. By installing a row of these units, a large extent of land can be brought under fresh water irrigation and perhaps organic fertilizers can be mixed in the water flowing to the fields to promote food, employment and income for the people besides giving them water to drink, bathe and wash.

Direct Application

Man-made sea water canals, such as the canal cutting across Dubai or the Buckingham Canal running parallel to the East Coast of Peninsular India, are to be commissioned for direct use of sea water by the people.

The 420 km. long Buckingham Canal which was dug by the British Rulers 200 years ago connecting Nellore in Andhra Pradesh to Madras was a green belt of Peninsular India when this author was a boy. It was used for navigation, desalination and saline agriculture and for promoting sea food and rearing Kaki Cambel ducks which take to sea water if pots of potable water were provided on the banks for the ducks to dip their heads.

Hundreds of plants and trees have been identified by the USAID and their book on "Saline Agriculture" is now available. The Ben Gurion University has identified several halopytes (salt loving plants and trees) and demonstrated them in the Israeli town of Askelon. Oil and medicinal plants are already growing on saline water in gardens near the Ultra-salty Dead Sea and the port city of Eilat on Red Sea. Dr.Pasternak of the University believes that the growing of field crops from the sea is the key to the future desert agriculture and points out that cotton has so taken to salt water that its yield has been increased by 20 percent.

Scientists are finding new crops grown on salty soil irrigated with sea water that may be useful in the Middle East with long ocean shorelines and scarce fresh water. The US National Research Council published in 1990 the results of a four-year study of hundreds of plants that can tolerate salt and sea water. The report was prepared by a panel set up by the Council's Board on Science and Technology.

Among the several trees and plants that grow on sea shores without the application of fresh water that have been identified by the Ryan Foundation are Alexandria Laurrel, Pongamia Glabra, Acacia Holoseriea, Capparis decidua, coconut, palmirah, casaurina, teak, bamboo, Ailanthies, posiperous Juliflora, Eucalyptus, Subabool, Neem, etc.

Domestic Desalination

When sea water is made available in open cut canals within walkable reach of the people, they will take the water and desalinate it in their homes by the RYFO method which needs only 2 buckets and a meter of HDPP (plastic) transparent sheet. Desalination is done by simple evaporation and condensation. Full explanation with diagram is given in this book.

In the Middle East semi-desert countries where day temperature is very high and comparatively night temperature is very low, this method works very well. The RYFO pit desalination method which requires only a meter of plastic sheet can also be used in these countries. In fact, they are being used already where sea water is available and the day temperature is high.

The domestic desalination methods is nothing new to the rural poor. In almost all villages in India, Africa and several poor countries, people have been brewing country liquor (illicit alcohol)

by this method. Even the most backward tribals of India and Africa are masters of this method.

For swimming and washing

The rural poor have no water to bathe and wash their cattle and to keep their toilets clean. Sea water canals will give them plenty of water to meet these needs.

40 percent of potable water is used in toilets these days in urban centers almost all over the world. With earthern-ware and rigid PVC pipes, sea water can be used to flush toilets.

Conclusion

These, in short, are Ryan Foundation projections to harness sea water for human progress. Water experts agree to this solution to solve the global water problem. What is wanting is political will to provide sea water and to bring about sustainable development. There is no political will because these are Do-It-Yourself methods for the people with negligible or no investment and no capital intensive spectacular high technology. Most governments seem to be interested only in large capital and high technology and not in people, water, environment and progress.

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Happy is the woman who finds copious and healthy water in her tap right in her kitchen. And a happy woman makes a happy home and family. This is a message which Ryan Foundation likes to drive home during the UN declared International Year of the Family (1994). Copious water can be made available only by desalinating sea water by tapping natural, priceless and renewable wind, wave and solar energy.

Governments should promote rather than provide, water and sanitation facilities.

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SEA WATER CANALS

(Letter to the editors of dailies)

Ms. Althea Pompey of Guyana stated in her talk at the Dr. M.S. Swaminathan Research Foundation in Madras on 22.05.92 that the major threat to the mangrove eco system in her country came not from human settlement but from sea erosion.

The thousand mile coastline of Guyana is below sea level, the sea is eroding the land and the country is building up sea defence. Will it not be a great contribution to the development of Guyana and South America if Guyana takes the sea into the land by navigable man-made canals like the man-made sea water canal that cuts across Dubai? Perhaps the countries neighbouring Guyana can prolong the canal across their countries and take it miles across between Buenos Aires in Argentina and Montevideo in Uruguay and connect the canal to the Bay of Rio de la Plata.

If the canal is made broad and deep like the English Channel, many land-locked countries and cities of South America will get a sea port to improve their trade, commerce and exports. The sea water can be desalinated for human consumption by so many economical ways now known and sea water plants and trees, birds and fish can be promoted in the land-locked parts of South America. Millions of people can be given fish, food and income generation activities, besides water to wash to wash and swim. The Britishers who ruled India bull such a navigable sea water canal connecting Nellore and Madras which is 420 kms. long.

Similarly a canal may be dug across South American Countries to connect, let us say, Bogota with Rio de Janerio. Whether one likes it or not, these sea-based developments have to take place in many countries and continents, if not in this century then in the next for humanity to survive in this planet and to keep the balance of ecology and environment for a self-sustaining growth.

Dr. Felix A. Ryan
Chief Monitor
Global Movement for
Survival By Sea Water

Madras
22.05.92

This is how the Buckingham Canal in Madras used to be between Ennore and Kovalam. The 420 km. canal connects the Nellore town with the city of Madras. When this author was in school in the forties, he used to travel in this canal by motor boats and steam launches to parts of present Andhra. The sea water in it was clean and transportation was brisk.

Salt Bushes and saline plants and trees flourished all along the banks. In the quieter stretches, there were patridges, quails and pigeons and rabbits used to play about by night. Women bathed by dawn, boys swam by noon and cattle were washed by dusk.

The poor used to fetch water from the canal and desalinate it in home-made contraptions (the ones used even today to brew and distill country alcohol).

Why was all this given up? Let the people of the city demand an answer from the ruling government.

16

FOREST ISLANDS

One of the worst incidents of terrorism happened in Terai region of Uttar Pradesh, on 1st August 1992, when 29 innocent villagers entered the forest to collect a wild edible fruit and were ruthlessly murdered in the Puranpur forests of Pilbhit district. It was reported that the terrorists hiding in the forest there with arms and ammunitions were suspicious of anyone entering the forests and discovering their hiding places and therefore murdered the intruders.

Terrorists hiding in the dense forest and waging a guerilla warfare in Malaysia, Korea, Mayanmar (Burma) and many other countries is common knowledge. The LTTE militants of Sri Lanka were also trained in their hiding places in the dense forests of India. Undoubtedly, terrorism and guerilla warfare and coup threats are on the increase all over the world because of forests, besides other reasons. Most of the drug producing plants are cultivated in dense forests and illicit (poisonous) alcohol is brewed behind bushes.

Nevertheless, we need more and more forests and trees and better ecology and environment and rain forests to save our planet. We also need more forest bushes to give habitat to birds and animals.

The solution to the problem is better and clever forest management free of guerillas, terrorists, drugs and poachers and the following module for developing and managing forests may be considered.

The conventional stone marking of forest boundaries or barbed wire methods have failed to produce results and in fact, in many countries, they have been counter productive. After spending billions annually, third world countries will be poorer by a few hundred thousand trees cut to make the uprights for barbed wire fencing.

Strictly speaking, under the order of the day the social forestry projects of most parts of the globe have no social challenge, no social action, no social change, the resources are not being utilised for the welfare of the people, not for the community but only to fill pockets of poachers and politicians. They have no element of permanent resource creation.

In most of the social forestry projects in India, the rich grow eucalyptus paying a pittance to the forest labourers. They sell the timber to paper and board factories and get richer. They even shoot the animals and sell the skin.

Forestry needs a radical change and therefore some unconventional and rationale methods have to be introduced. The Ryan Foundation module explained below is based on (or linked to) the "Survival by Sea Water" movement of the Foundation.

* To make a beginning, dense forests within a distance of 100 kms. from the coastline in countries like Guinea, Somalia, India, Kampuchea, Malaysia or Mayanmar may be declared as "Forest Islands".

* 100 mts. broad and 3 mts. deep man-made canals may be dug round the forests, making the forests like Islands with lock (sluice) arrangement to regulate the flow of sea water into the land like the canal cutting across Dubai.

* There shall be only two jettys on the circular canal, one to enter into the Island forest and the other to exit.

* Authorised country boats may ply in the canal to transport forest products, fish and sea water plants and plant and tree products.

* Two or three or more speed boats depending on the circumference of the canal may be on guard to prevent unauthorised people entering in or out.

* Watch towers may be built on the banks of the canal and also in the islands and search lights provided.

* These forest islands may be made permanent headquarters of army companies or batallions and the army may be given the responsibility of keeping law and order in the forests as their peace time operations.

* Hundreds of trees have been identified to grow well in sea water by the Ryan Foundation in the book "Plants and trees that Generate Employment" and several of them identified, explained and published in the book entitled "Saline Agriculture: Salt Tolerant Plants for Developing Countries" published by the National Academy Press, Washington DC in 1990. These trees may be planted on the tanks of the ring canal. Several of them yield edible fruits, oil, fibre, dye, medicines, gum, nuts, fodder, fertilizers, chemicals, etc. and generate employment.

* The commercial planting and exploitation and replanting may be regulated by the army as part of their peace time operation and the army men and women will love to engage themselves in such useful and purposeful work during peace time.

* On the outside of the ring canal the army may build their quarters and settlements and habitation may spread from the periphery of the forests outward. This will develop new habitations, homes, villages and towns and prevent over congestion in already congested cities and towns and retard the growth of slums and squatter settlements in urban centres. Barren lands will become water sheds.

* Sea water fish such as sardine and the milk fish (chanos chanos) may be introduced into the canals and fish based industries such as chicken feed, cattle feed, organic fertilizers, fish oil, fish gum, etc. may be promoted based on appropriate rural technology as advocated by Ryan Foundation.

* The sand from the sea that comes into the canal may be manually lifted and shifted to fill low lying areas and this will provide employment to hundreds of women in each of the surrounding villages.

* Small rails with open wagons may be provided upto a distance and hand drawn carts,donkey drawn trucks and pack horses employed from where the rails end.

* With sand thus lifted, pits and pot holes in the villages and towns may be filled, low lying areas raised, and sand mountains raised along the coast lines in countries like Guinea or Maldives for sea defence. Raising such sand mountains will cost much less than erection of tetrapods as now done in Maldives, Bombay and many coastal towns.

* Administration of these forest islands may be entrusted also to the navy and air-force for peace time operations but should not be given to the forest department or civil administration.

* For this matter the projects may first be tried in two or three party democracies and not in countries under one party rulers.

* If the forests enclosed by the canal is too vast, diagonal canals may also be dug across the forests for better transportation, communication and administration.

* When work is in progress the animal, bird and plant life of the area shall not be disturbed in any way but regulated and protected.

* Wild animals may be confined inside pockets in the island surrounded by water so that forest workers can move about without fear of being attacked. By this arrangement forest islands will become natural zoos in natural settings.

* Nurseries and saw mills may be provided outside the island in which the locals may be employed.

* Fish canning factories and foliage briquette factories may also be established.

* Sea tortoise and crabs and sea weeds may be introduced in the canals and weed based industries to make products such as coragrenan may be promoted.

* Medicinal herbs may be grown, gathered, processed and exported where possible.

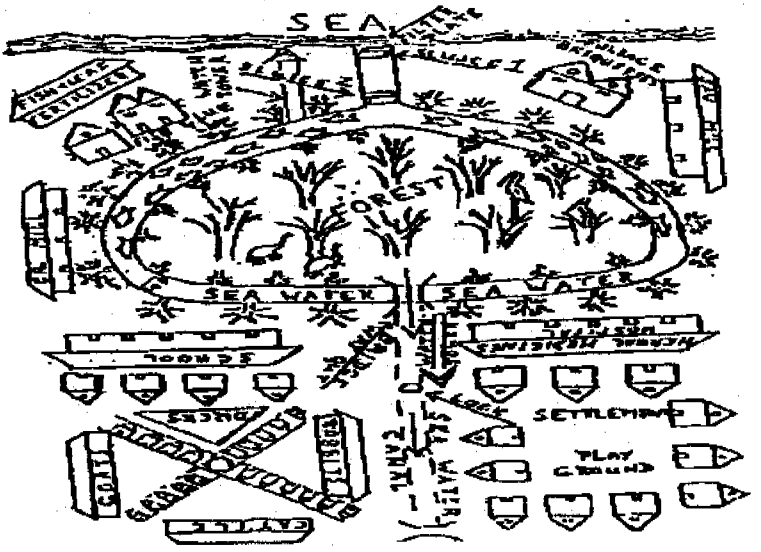
* The nuts may be collected and crushed for oil and that oil may be used for making soaps.

* Fruits may be collected dehydrated and sold in local and foreign markets.

There are indeed thousands of employment possibilities based on plants and trees that generate employment and thousands of employment possibilities to generate power fuel and employment using sea water. For further information, see the book "Plants and Trees that Generate Employment" and the booklet "Survival By Sea Water" published by the Ryan Foundation. Also, see the 3 volumes on "Better life Technologies for the Poor" by the Foundation. Three more volumes of the book will soon be in the market.

First published in CAPART. Vol.7 No 5 of 1992

Author's concept of a Forest Island



17

STATEMENT OF PRINCIPLES ON FORESTS

By the time of the June 1992 Earth Summit, countries had developed a series of principles for sustainable forest use. This, the first global consensus on forests, deals with the needs of people who want to protect forests for environmental and cultural reasons and with the needs of people who use trees and other forest life for economic development. The Rio forest principles may harm the basis of further negotiations towards a binding agreement.

The Rio statement says that forests, with their complex ecological processes, are essential to economic development and the maintenance of all forms of life. They are the source of wood, food and medicine, and are rich storehouses of many biological products yet to be discovered. They act as reservoirs for water and for carbon, that would otherwise get into the atmosphere and act as a greenhouse gas. Forests are home to many species of wildlife and, with their peaceful greenery and sense of history, fulfil human cultural and spiritual needs.

Among the forestry principles:

- All countries should take part in "the greening of the world" through forest planting and conservation.
- Countries have the right to use forests for social and economic development needs. Such use should be based on national policies consistent with sustainable development.
- The sustainable use of forests will require sustainable patterns of production and consumption at a global level.
- Forests should be managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations.
- The profits from biotechnology products and genetic materials taken from forests should be shared, on mutually agreed terms, with countries where the forests are located.
- Planted forests are environmentally sound sources of renewable energy and industrial raw materials. The use of wood for fuel is particularly important in developing countries. Such needs should be met through the sustainable use of forests and replanting. The plantations will provide employment and reduce the pressure to cut old-growth forests.
- National plans should protect unique examples of forests, including old forests and forests with cultural, spiritual, historical, religious or other values.
- International financial support including some from the private sector should be provided to developing nations to help protect their forests.
- Countries need sustainable forestry plans based on environmentally sound guidelines. This includes managing the areas around forests in an ecologically sound manner.
- Forestry plans should count both the economic and non-economic values of forests, and the environmental costs and benefits of harvesting or protecting forests. Policies that encourage forest degradation should be avoided.
- The planning and implementation of national forest policies should involve a wide variety of people, including women, forests dwellers, indigenous people, industries, workers and non-governmental organizations.

- Forest policies should support the identity, culture and rights of indigenous people and forest dwellers. Their knowledge of conservation and sustainable forest use should be respected and used in developing forestry programmes. They should be offered forms of economic activity and land tenure that encourage sustainable forest use and provide them with an adequate livelihood and level of well-being.

- Trade in forest products should be based on non-discriminatory rules, agreed on by nations. Unilateral measures should not be used to restrict or ban international trade in timber and other forest products.

- Trade measures should encourage local processing and higher prices for processed products. tariffs and other barriers to markets for such goods should be reduced or removed.

- There should be controls on pollutants, such as acidic fallout, that harm forests.

■ Taken from the booklet " A PLAIN LANGUAGE VERSION OF AGENDA 21 AND OTHER RIO AGREEMENTS" which the Prime Minister of Norway Hon. HARLEM BRUNDTLAND calls, "THE ESSENCE OF EARTH SUMMIT".

■ Written by Michael Keating published by The Centre for our Common Future, Switzerland.

"All countries should take part in the greening of the world"

18

COCONUTS CAN SAVE LIFE

Botanical - COCOS NUCIFERA

There are 83 coconut growing countries in the world (see list in the next page) and coconuts grow very well constantly washed by sea waves (roots submerged in sea water) as seen in this picture. It is commonly seen in Kerala, Sri Lanka, Seychelles, Fiji and many other countries.

All coastal areas in the tropics should promote coconuts all along their sea shore for sea defence and for food and water for drinking. The tree provides food, drink, oil, oil-cake, fibre, fuel, timber, husk, shells, sugar, roof for houses and a million jobs.

The colourless water inside the coconut, tender or ripe, is very tasty and nutritious. It is an excellent substitute for drinking water where safe water is not available and it need not be boiled. It can also be used for cooking in the place of ground or tap water and also for washing wounds in hospitals. Indeed, coconut water can save millions of lives. It can be solar evaporated and condensed into pure water if necessary but it is sensible to directly evaporate and condense sea water where sea water is available.

Along with coconuts, barley, melons and several other plants and trees that grow well in sea water can sustain lives and settlements in coastal areas.

"Nearly 70 percent of the world's population lives in or within 80 kilometres of a sea-coast", says Fiscal 1992 report of the World Bank and Environment. ... Coconut trees can and should be grown for the benefit of these populations... A good and tender coconut gives a full glass of sweet and healthy water which is a good substitute for pure drinking water.

The Buddhist economic and social thinker Sulak Sivaraksa advocates coconuts and saline agriculture in his book "Seeds of Peace" (published by Parallax Press P.Box 7355, Berkeley, California - 96707 in 1992). He gives the example of a Thai Buddhist Abbot who succeeded in transforming an impoverished province, where the rice crops were regularly destroyed by inundations of sea water. The abbot persuaded the inhabitants to switch to coconut trees and to make coconut sugar using traditional technologies. They are now selling their sugar all over the country.

83 Countries where coconuts grow

Benin	Barbados
Cameroon	Belize
Comoro Islands	Costa Rica
Equitorial Guinea	Cuba
Ghana	Dominica
Guinea Bissau	Dominican Republic
Ivory Coast	El Salvador
Kenya	Grenada
Liberia	Guadeloupe
Madagascar	Gautemala
Mauritius	Haiti
Mozambique	Honduras
Nigeria	Jamaica
Sao Tome St Principe	Martinique
Senegal	Mexico
Seychelles	Nicaragua
Sierra Leone	Panama
Somalia	Puerto Rico
Tanzania	St.Kitts etc.
Tago	St Lucia
Trinidad & Tobago	St. Vincent
Bangladesh	American Samoa
Brunei	Cocos Islands
Burma	Cook Islands
Cambodia	Fiji
China	French Polynesia
India	Gilbert Islands
Indonesia	Guam
Malaysia	Nauru
Maldives	New Caledonia
Oman	New Hebrides (vanuatu)
Philippines	Niue Islands
Singapore	Pacific Islands
Sri Lanka	Papua New Guinea
Thailand	Solomon Islands
Timor	Tokelau Islands
Vietnam	Tonga
Wallis etc.	West Samoa
Brazil	Peru
Colombia	Surinam
Ecuador	Venezuela
Guyana	

19

RESEARCH ON HALOPHYTES
RYFO Handout 695

EPRI Journal (1994) published by the University of Arizona reports after several years of research on Halophytes (sea water plants), conducted by the Environmental Research Laboratory (ERL) of the University and the Salt River Project, on the Sonoran Coastal farm in the Gulf of California owned by Genesis Inc. of Mexico, which grows halophytes on a commercial scale that:

1. Some halophytes, such as Salicornia bigelovii, can even be grown as food crops - producing seeds that compare favourably with soyabeans in oil and protein content - using only sea water for irrigation.

2. Halophytes are able to accumulate salt to more than six percent in their cell vacuoles, more than enough to offset the osmotic pressure generated by pure sea water, which contains on an average 3.2 percent salt.

3. However, the seeds of halophytes do not accumulate salt, so they can be used as food or fodder without processing while the leaves may have to be processed.

4. There are 720 hectares of coastal desertlands which will not support conventional plant life. In addition irrigated cropland have been degraded by salinisation. An estimated 130 million hectares of these salt affected drylands could be used to grow halophytes, according to the Arizona Researchers.

5. An important reason to consider the cultivation of halophytes on a commercial scale is their potential for removing carbon from the atmosphere. This method promises several advantages over approaches known so far for controlling carbon in the atmosphere.

6. Halophyte plantations on salinised drylands would not compete with other agricultural uses or suck scarce fresh water resources but on the contrary increase rainfall in the area.

7. Although the heat content of halophyte bio-mass varies by species,it generally falls in the same range as that of lignite coal and give a high calorie of heat. Thus, briquettes made out of halophytes can be used in boilers.

8. It is possible to blend refined halophyte oil with diesel fuel to power vehicles and reduce the price of motor fuel.

9. Yields of 14 halophyte species were measured over two growing seasons at the Mexican farm using sea water for irrigation (rainfall in the area is less than four inches per year). Even under these harsh conditions, the five most productive species had annual dry biomass yields in a range from about 17 to 34 tonnes per hectare - about the same as for conventional crops irrigated with fresh water.

10. ERI has announced that measurements of water consumption showed that halophytes require 1-3 cubic metres of sea water per sq. metre of soil each year, depending on the species and growing season. This range is about the same as that required for cotton and alfalfa irrigated with fresh water under similar conditions.

11. Salicornia which grows fast is very easy to harvest. It looks like green jointed pencils with seed spikes on the top portion of the plant.

12. Three halophytes, namely, Atriplex nummularia, a shrub suitable for land scaping, as turf grass, and Sesuvium portulacasstium a flowering ground cover are all very promising for commercial cultivation. They can be cultivated in dry and desert land watered by sea water canals.

Ryan Foundation is awaiting more research findings on Halophytes.

Water, pollution and scarcities are not God-made problems but problems made by politicians and bureaucrats for their advantage.

20

WORSE THAN THE BHOPAL TRAGEDY

Open letter to the Secretary General of the UNCED Conference (Earth Summit) Brazil, June 1992 and to humanity at large

By the author

Dear Mr.Maurice Strong,

With the facts and figures, truth and false reports available regarding the Narmada Dam Project, one is convinced that the Dam is going to kill many more people than the Bhopal tragedy did. Thousands of villagers are now ready to die by drowning themselves with a moment's suffocation and pain, in preference to dying by sickness, starvation and prolonged agony hundred miles away from their home. The concerned Governments have been giving false hopes to them regarding their resettlement and false figures and reports to the World Bank authorities only to get a big aid at the expense of 3,000,000 lives, according to the prime group of activists, the Narmada Bachao Andolan which is spearheading the agitation against the Dam. Even if thousands don't die by drowning as threatened, certainly several thousands of tribals, very poor and the sick who keep their body and soul together by their livelihood, based on forests, are bound to die, out of starvation and sickness, and the toll will be three to four times more than in Bhopal.

Half the forests they have been living on have already been cut and the other half is fast coming under axe and water. Small patches of their land which were under cultivation for their daily bread have been taken away. According to official sources, the displacement is going to be more than 100,000 people in 237 villages, in 3 states and over 14,000 hectares of forest lands. The government is not really going to settle the uprooted families which is implied in their undertaking, viz., that they will not take any more forest lands, especially to replace the uprooted people and they have no lands acceptable to the uprooted to resettle them. Nevertheless, the Shoolpaneswar sanctuary has recently been notified as part of the land meant for the Dam project, which means another 35,000

people will soon be evicted. But people of all the affected villages now say, "come what may we will stay where we are and die where we are".

All those involved in the Dam Project stand guilty before God and humanity, for inventing or introducing a new type of what may be called killing people by killing their environment. Since the concerned Governments refuse to look into these realities, reveal the facts, admit the policy mistakes committed regarding the dam and take corrective measures, but consider only the attractive aid from the World Bank, on behalf of forests, the tribals and the environment, I appeal to the delegates of the UNICED Conference, to look into this case of ruthless, mass massacre and destruction of forests, of full grown useful trees and the eco system there.

The Swedish and Finnish parliaments have already passed a resolution advising the World Bank to desist from financing the project, and in reaction to their appeal, the World Bank ordered an independent review of the project. But did the team that reviewed, get the facts and the truth, most of which have already gone under water? It is everybody's guess!.

My suggestion is that the half built dam should be left like that as a monument of the tribals who are dead or almost dead so far by starvation, sickness and neglect; save the remaining tribals, forests, ecology and the predicament in which the World Bank has been placed, let the semi finished dam be a tribute to environment. The very concept of the project should now be changed radically. As an appropriate solution, man made tributaries and broad canals, should be dug in several places, all along the river's course for the water to reach many parts of Gujarat, Maharashtra and Madhya Pradesh. These tributaries or canals should be dammed in suitable places and small turbines erected at various points to generate electricity. In doing so, care ahould be taken not to destroy forests, submerge lands under cultivation, and disturb and dislocate the downtrodden tribals. There is no need at all for a huge centralized capital intensive dam. Surely small is safe, sustainable and agreeable.

As matters stand today, only the Global UNCED Conference can pass a resolution to implement this suggestion and avert greater tradegy than the one at Bhopal. Let UNCED save environmental refugees from environmental death.

With respectful regards.

Yours sincerely

F.A.Ryan

All those who agree with the solution suggested in this paper may enter their name, address, sign below and post the paper (reproduce it) and send it to Mr.Maurice Strong, Secretary General, UN Conference on Environment and Development (UNCED), Post Box-80, CH-1231, Conches, Switzerland.

Name Signature

Address Date

Copy to residents and Prime Ministers, UN Agencies, Global Environmental Agencies, Nobel Laureates, UN Global 500 Laureates, leading environmental journals and daily paper.

(This open letter is reproduced from the Scandinavian Journal of Development Alternatives - June 92).

Some other journal reports:

1. "The World Bank Fiscal 1992 report on Environment says in para 106 "Supervision inputs in the Narmada Projects have been about ten times the Bank's average and yet deficiencies have persisted".

2. "Dams have displaced eleven million people in India. Of these 8.5 million still have not been resettled and remain landless. Narmada Dam scheme in India is already 4 years behind schedule. It may be made economically unviable by the build up of silt even before it is finished" - OXFAM NEWS Summer 1992.

3. "Peter Bosshard reports in the Berne Declaration (Dec. 1992 No.3). As a member of the International Network on the Narmada Project, the Berne Declaration has protested the Bank's decision to continue funding the scandalous dam project in India and has started lobbying the Swiss authorities for supporting a reversal of this decision".

4. "The decision of the directorate of the World Bank to continue disbursing the loan of 450 million US dollars for the dam project in Narmada Valley of India is deplorable. The CDU / CSU Bundestag group thanks the Federal Minister for economic Co-operation, Carl-Dieter Spranger, that he asked the German Executive Director in the World Bank to vote to stop the disbursements. With this, Minister Spranger followed a unanimous decision by the committee for economic co-operation. He was in agreement with the USA, Japan, Canada, Australia and Scandinavian countries. It must now be feared that uncorrected implementation of the Sardar Sarovar project will cause severe environmental damage and that the human rights of scores of thousands of people who are to be resettled by force will be violated. The decision of the World Bank is all the more impossible to understand as it simply ignores the findings of a commission of enquiry it appointed itself". -L + C No1.1993

5. "Never in the Bank's history have so many Executive Directors opposed a project - Earthaction Alert" (GEF) No.2, 1993.

21

ENVIRONMENTAL BULLETIN, WORLD BANK,

Fall 1993 states:

BANK URGES WATER-RELATED INVESTMENTS BY DEVELOPING COUNTRIES

Providing a guide for the World Bank's future involvement in water activities, a new "Water Resource Management" policy paper urges countries with water management problems to adopt a comprehensive approach to water management, while highlighting the intersectoral aspects of water use.

The paper, which suggests that upto $ 700 billions may be needed for water related investments by developing countries over the next decade, concludes that people affected by water projects in developing countries should participate in designing and managing those programs. It emphasizes the benefits of decentralization while acknowledging the role of central governments, and outlines a role for both public and private entities.

"Water is an increasingly scarce resource requiring carefull economic and environmental management", the report says. "The

situation is exacerbated by rapid population growth and urbanization in developing countries. As the demand for water for human and industrial use escalates, so has the competition for water used for irrigated agriculture. At the same time, the engineering and environmental cost are much higher for new water supplies than for sources already tapped. New challenges call for a new approach."

Noting the countries have generally paid little attention to water quality and pollution control, the paper says that in many developing countries, water quality is poor and often unsafe for human consumption. For instance, it observes, polluted water is the principal cause of many health problems, such as diarrhoeal diseases which kill more than three million people - mostly children - around the world each year and sicken more than a billion more. In addition to the human suffering, the economic and environmental damages from water pollution are devastating, resulting in billions of dollars spent to clean up and prevent degradation of waterways and surrounding land.

The Bank's Role

In defining its role in helping to provide water and improve its quality worldwide, the Bank plans to: (a) incorporate water resources policy and management issues in its country policy dialogue and in formulating country assistance strategies where water issues are significant; (b) help governments formulate laws and regulations for dealing with pricing, monopoly organizations, environmental protection, and other aspects of water management; (c) support measures for more efficient use of water by providing incentives for utilities and users through pricing and other demand management strategies; (d) support government efforts to decentralize water administration and encourage the private sector, financially autonomous public corporations, and community water user associations to participate in delivering water to users; (e) encourage water users to participate in planning, designing, implementing and managing the projects it supports including the collection of user fees; (f) focus on protection, enhancement and restoration of water quality and on the abatement of water pollution through such approaches as "the-polluter-pays" principle; (g) ensure that investments involving resettlement be avoided or minimized, but, where resettlement is necessary, farmer incomes should be restored or improved; and (h) support training to upgrade skills in handling water reforms.

For a copy of the policy paper, write to the World Bank's Publications, P.O. Box 7247-8619, Philadelphia, PA 19170-8619, USA, Price $6.95.

22

IN QUEST OF WATER

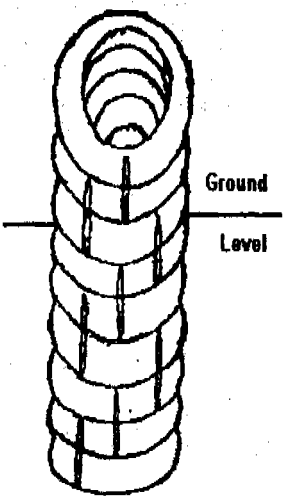
These are drawings adopted from photos that appeared in the popular HINDU daily on Friday April 1987.

This lad on a bullock amidst dry and parched land is proof of wide spread drought and acute drinking water scarcity in Karnataka. As the bullock cannot be used to plough dry and dead land the lad uses the family bullock to hunt for water. Whether he will find a pitcher of water he himself does not know.

The picture shows water starved men and women of MOOLAKULAM village close to the Vaigai river. They resort to all improvisations in a desperate attempt to find water. In the Ramanatha puram district in South India more and more wells are sunk every year to relieve water scarcity. Picture shows a poor woman trying to scoop out water from a pit with a spoon with a long handle made of coconut shell in the summer of 1993. Others in the picture await their turn while thousands have left the village to urban slums.

If sea water is made available to these people in man-made canals they will desalinate the water by the simple RYFO methods. But where is the political will to provide sea water?

TYRE-WALLED WELLS RYFO Handout 138



Traditional village wells, open type, are explained in RYFO Handout 134. With cheap or free village labour, digging a well does not cost much. But the brick and cement work inside the well to prevent the sides from sliding into the well are expensive. Moreover, cement is not readily available in villages and have to be bought and carried from outside, paying transportation charges. Mild steel reinforced cement rings that are placed inside wells in the place of brick walls are even more expensive than the brick walls.

In tyre walled wells, used and discarded lorry tyres are used in the same way as cement rings are used. As the tyres are mounted one on top of the other they may be tied one with the other as shown in the diagram so that they stay in position. The tying may be done either with nylon or fibre ropes or with aluminium or copper wires.

Binding with copper wires will be very good and durable but copper wires are costly and difficult to get. If old electric wires ripped out from building walls are available, they may be obtained and the copper wire may be taken out from inside the plastic coating and used. Sisal fibre which is commonly available in villages may also be used. This fibre gains strength when soaked in water.

No plastering of the tyres is required and the underground water will flow into the well between the heap of tyres which will have crevices because of the binding wire or fibre running inbetween them.

If wells of larger diameter are required, tractor or bulldozer tyres may be used.

Tyre walled wells are excellent for breeding inland water fish, as the fish lay eggs inside the tyres and when the eggs hatch, the

young ones hide inside the tyres from big fish. (Japan increased its coastal fish population ten fold by throwing the used tyres into the sea for fish to breed).

Small cloth bundles containing some leaves, fruits, seeds, barks, etc. which have insecticidal properties may be packed into the tyres to make the water safe for human consumption. For plant materials that purify water, see RYFO Handout 120.

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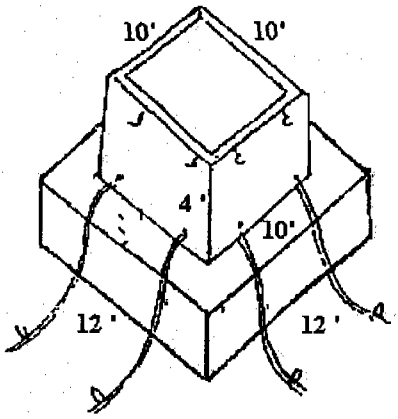
RYFO WATER TANK

RYFO Handout 6



Water, both for drinking and for washing, remains a major problem in almost all Third World countries. The taps are blocked or broken, the hand pumps installed by the UNICEF and so many other Aid Agencies are not maintained and in many places, children have filled them with sand and stones. Some wind-mills stand here and there like skeletons of giants for want of spare parts and for birds to build their nests and washermen to dry their clothes and water remains an eternal problem. It is common knowledge that a good majority of Third World people do not have water close by and have to walk several miles to fetch water.

The Water tank built out of mud bricks, clay and plaster is a reasonable solution to this problem, provided drinking water is available in the village. The RYFO Water tank can be given to the people without much expenditure and for trouble free maintenance.

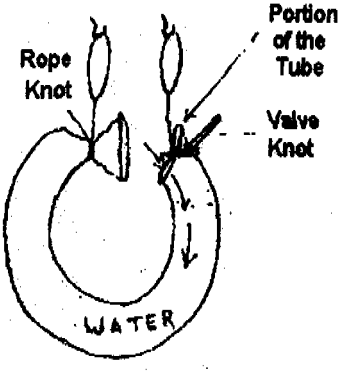
As seen in the diagram, it is a simple tub-like construction (cistern) raised about a foot from ground level. A standard tank can be of inner size 10' x 10' x 4'(height). Dimensions may be bigger if necessary but the height may be restricted to four feet so that water can be poured into it without difficulty.

Flexible PVC tubes may be fixed to leak proof holes made at the bottom of the tank so that, when filled, water will flow out automatically through the tubes. Curved hooks may be fixed on all sides along the upper end of the tub as shown in the diagram and rope or wire loops tied to the delivery end of the PVC tubes as shown. The delivery end will always be lifted and hung on the hook on the top end of the tank and when removed and brought down to the bucket or vessel on the ground, water will flow into it.

Metal barrels or wooden barrels mounted on small carts with two wheels and drawn by a man or by an animal may fetch water from the nearest available source and have the tub filled every day. If there is a well in the middle of the village, the tub may be built adjoining the well.

25

AUTO TUBES FOR STORING WATER
RYFO Handout 56



Poor families do not always have metal or PVC containers to store water. Many families cannot afford to buy containers to store scarce water which they fetch from distant places. Not all rural craftsmen make earthern pots or wooden barrels for want of raw materials or knowhow. Therefore, many families store water in rusted tin cans or broken mud pots or in dirty leather bags or in open pits near their dwelling. The containers they use are prone to contamination leading to several diseases.

RYFO recommends storing water in discarded automobile tubes of all sizes, especially in heavy vehicle tubes which are most suited for the purpose. Punctures, if any must be patched before use. (America and Europe would do well to send their discarded tubes to Africa instead of sending them to Automobile dumping yards).

Two nails may be fixed on the wall at a height of 4 feet from the floor with a distance of one foot between them. The tube may be cut open near the metal valve and the two cut ends of the tube tied as shown in the diagram. Loops in the rope may be provided to hang the tube conveniently. Half the opening of the tube near the valve end must be free to take in water and therefore must be tied as shown in the diagram. The tube may always be kept hanging on the wall and removed only for cleaning. Clean and filtered water may be filled into the tube every day or every second day. To draw water from the tube the loop at the opening end may be brought down to fill the pot placed on the floor beneath the tube and returned to its place.

Two or three such tubes will hold enough water for the family and solve water problem in the kitchen considerably to relieve the burden of the woman of the house. Clean water kept in clean closed tubes will reduce contamination and reduce sickness in rural communities and refugee settlements.

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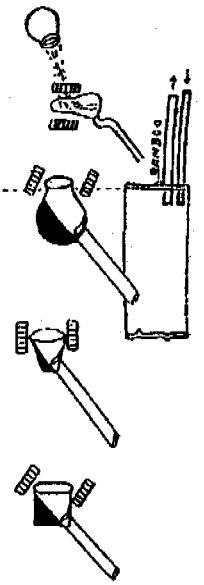
RYFO FLUSH TOILET RYFO Handout 278



RYFO flush toilets can be built in backward rural areas using traditional village earthern pots, plastic or metal buckets or biscuit tins. Half the pot or container is blocked with cement, and the sloping surface made smooth and slippery as shown in the diagram. If cement is not available, mortar may be prepared mixing 4 kgs. of sieved sand, one kg. of burnt and powdered lime stone, or gypsum, roasted and powdered sea or egg shells along with quarter kg. of jaggery, sugar or any gum tapped from a gum tree (see Handout 110). This mixture will bind as good as cement. For finding good quality clay or for mixing sand and other materials to make clay, see Handouts 109 and 184.

A hole of 10 cm. diameter may be made in the container and at one end a two Meter long pipe inserted, plastered and the other end let into the pit as shown. If pipes are not available, bamboo which runs smooth inside may be used and if not smooth inside, the bamboo may be sawed into parts along the joints and uniformly joined outside by plastering to get a free flowing inner surface. Another method is to take two long glass bottles, lay them on the ground, their bottom touching each other and to use them as a mould to shape the mortar mixture like a pipe (cyclinder). Ten such mortar cylinders may be joined by outside sleeve plastering while laying the connection as usually done in sanitary masonary work.

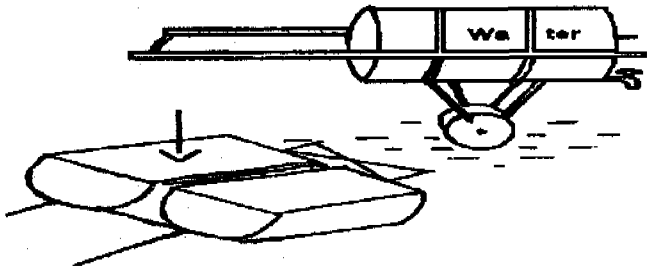
This toilet may be laid in any convenient open space in the village and for privacy the Gandhian lavatory frame, shown in Handout 47, may be used.

To get an idea of the principle behind a soak pit, see Handout 175.

If a long hollow bamboo is available, an air outlet from the soaking pit may be provided. A bamboo air inlet may also be provided as shown.

27

RYFO DRUM CART RYFO Handout 32



Wheels and water are two major problems in rural parts of the Third World. RYFO Hand-out No.27 explains, with the help of diagrams, appropriate wheels for village carts. This diagram shows an empty oil drum mounted on a simple wooden frame-work and on RYFO Wheels to supply water to people from wells and tanks. The drum cart can be pulled either by an animal (a donkey is most suited) or a man. As it is so light and easy to move, women and grown-up children can also pull it conveniently. (Wheel assembly is not shown in this booklet).

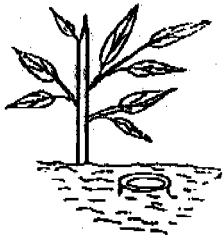
If possible a metal tap may be fixed to the drum, as shown, to draw the water out. If welding is not possible in the area of operation, just a round hole may be made and a wooden plug used as a stopper. A bigger opening is required on top of the drum to fill water.

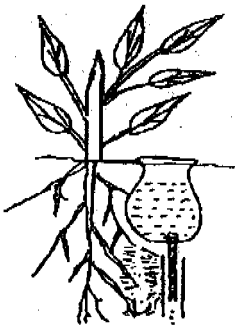
For vending vegetables and grains, an empty drum may be cut into two halves and fixed on the frame as shown in the diagram.

28

DRIP IRRIGATION SAVES WATER AND TIME
RYFO Handout 52

During summer plants do not get enough water and so often fade and die. To a certain extent, plants can be saved by drip watering (drip irrigation).





A clay pot or tin of plastic container with a narrow neck that would hold three to four litres of water may be buried a foot away from the plant. At the bottom of the container, a hole of half inch diameter may be made and a foot long rope made of fibre and knotted at one end may be passed through it so that the knot almost blocks the hole, while the other end of the rope comes out of the pot like a tail.

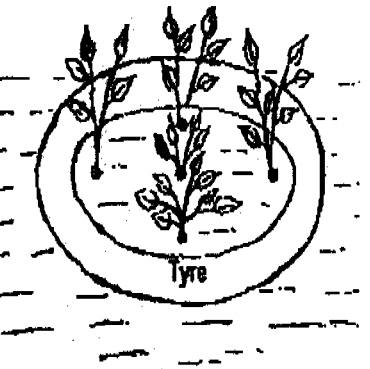
A small pit to fully bury the container at a distance of about a foot from the plant may be dug and at the bottom of this pit, a foot deep vertical hole about an inch in diameter may be made to let the rope that hangs out of the pot go into it.

With this preparation, the device is ready. And then every second or third day the pot may be filled with water and the water will trickle down through the rope to wet the roots of the plant and there will be no wastage of water while the roots will always be damp. To prevent evaporation, the container should be kept closed. This method saves labour on watering plants every day.

29

VEGETABLE GROWING INSIDE AUTOMOBILE TYRES

RYFO Handout 58



Discarded car and lorry tyres are buried flat in the ground about one inch below surface level. The inside of the tyre is filled with sand free of small stones and pebbles. The sand used for filling may be mixed with poultry or cattle yard sweepings. Alternatively, different types of dried leaves may be mixed with the sand. Delicate vegetable plants such as tomatoes, garden eggs (brinjals), Okra (lady's fingers), and spinach may be grown inside the tyre.

The advantage:

When the plants are watered, the manure-mixed sand inside the tyre absorbs and retains the water or moisture for two to three days and keeps the bed of the plant wet. Therefore it will be enough to water the plants on alternative days during summer and once in three or four days in winter. Thus, there will be considerable saving in water and labour. The plant fertility will be greater and the plants will yield more and better vegetables in a shorter period. Weed problem will be less inside the tyre and labour spent on weeding will also be less.

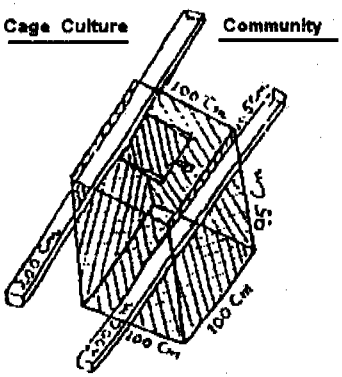
With the growing of vegetables in about ten tyres (four to five plants inside each tyre as shown in the diagram), a family can have vegetables all through the year. It should be noted that vegetables grow better when the plants are clustered together and support one another.

If two or three tyres are buried one on top of the other, their water holding capacity will be greater and the plants will also yield better and quicker. When layers are made with two or three tyres, watering may be done even once a week provided a good flow of water is ensured everytime watering is done.

The tyre system works well in flower gardens also, particularly in urban homes and roof-gardens. To grow plants to a height of three or four feet, it is necessary to have three tyres in layers. On roof gardens, the tyres need not be buried.

30

CAGE CULTURE IN COMMUNITY WELLS
RYFO Handout 186



Fish culture is easier to manage in community wells than in rain-water ponds. Hardy fish such as milkfish, cutla, silver carp, Tilapia and Chinese white Amur are suitable for cage culture. It is advisable to start with SG (stunted growth) fingerlings if available. If Tilapia is cultured, other fish should not be mixed.

Bottom soil of many wells contains acid sulphate, unsuitable for fish. To remove this, during summer, as much water as possible is removed from the well and lime stones thrown in. Harrowing can quicken oxidation of the acids present. Tilling, liming and flushing may be repeated thrice with an interval of 5 days between each operation. Finally, lime may be spread as a layer and left to stay. Oxidation must be done every year.

A wire mesh cage (0.4 cm. mesh) of the size 100 cm. x 100 cm. x 100 cm. with a lid on the top side fixed on two wooden arms (floats) as shown in the diagram may be used as the cage. To the 4 ends of the 2 arms, nylon or fibre ropes may be tied (hooks may be used) and the cage may be lowered into the well to float. The other ends of the ropes may be joined and tied to a post or hook in the wall of the well.

Feed mix may be prepared out of farm-yard manure, soaked oil-cake, rice-bran, boiled corn or maize, ground Soya bean, coconut flesh after the extraction of the milk, manioc leaves, pressed peanuts, soaked bread etc. Algae and daphnia may be

grown in shallow ponds separately and mixed. About a kg. of the mixture may be filled into perforated transparent plastic bags (like milk bags), heat-sealed and placed into the cage. Three or four bags may be placed at a time and the fish will draw the feed through the perforations.

The fish named above reach harvestable size in about three months and the big ones must be removed first by lifting the cage out of the well. After culturing for three months, a family can harvest enough fish every week for the family from one well.

31

FRESHWATER POLYCULTURE
RYFO Handout 692

Ponds of fields which hold rain water to a depth of about 1.5 m. can be profitably used for fresh water fish breeding if the water stays for more than 3 months in a year. Rainwater of the surrounding areas may be collected at a central pool and where necessary and feasible, some well water may be lifted into the pool.

Many herbivorous fishes feed on aquatic weeds and they mostly belong to the family cyprinidae. Among the carps most suited for this type of pond culture are (1) Catla (catla catla) (2) Mrigal (cirrhimus mrigala) (3) Rohu (Labco rohita) (4) Silver Carp (Hypophthal michlthys molitrix) and common carp (cyprinus carpio).

Catla is the fast growing fish among the Indian major carps. It grows to a length of 0.8 m. and attains a weight of 6.5 kg. at the end of 3 years. It is mainly a surface and column (middle) feeder and consumes a lot of vegetation. Rohu attains a length of 0.9 m. and weight of 5.5 kg. and it is a columfeeder. It feeds on decomposing vegetation such as kitchen and table vegetable waste and plants and algae that grow inside the pond.

Mrigal and Calbasu (Labeo Culbasu) are both bottom feeders. They attain 3.5 kgs. at the end of 3 years. The common carp, one of the easily domesticated fish is a bottom feeder and it is omnivorous. The Silver Carp or Chinese Carp is mainly a surface and phytoplankton feeder and it also feeds on micro plants and vegetable waste. The grass carp is really a fast growing exotic fish.

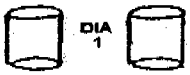
Feed supplement with oilseed cakes and rice-bran cakes is very necessary for quicker growth while the natural feed stuff in the ponds sustain the culture.

In an hectare about 5000 to 8000 fingerlings of each type may be stocked to get 2000 to 5000 kg. of fish per year. The 3 Indian major carps, Catla, Rohu and Mrigal can be combined with the 3 exotic Chinese type such as grass carp, silver carp and common carp to get best production and profits.

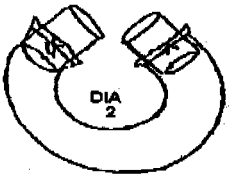
Chicken, duck and cow manure may be thrown to the fish for nourishment and growth.

32

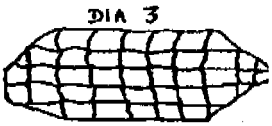
RYFO TUBE BUCKETS



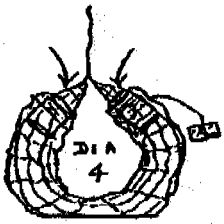
Two uniform empty tin cans of 1 or 2 kg. capacity are taken and the top and bottom completely removed to get two cyclinders as shown in diagram 1.



A foot long bit is cut out from a discarded automobile tube and is removed so that the metal valve of the tube comes away with that cut piece. Then the two tin cylinders are inserted on either end of the bigger portion of the tube and tied in that position as shown in diagram 2.



Any village made fibre rope having the thickness of one's little finger may be tied to make a net as shown in diagram 3. Then the tube with the two ends is wrapped with the net and tied all around as shown in diagram 4. The two tapering ends of the net are joined to a long rope and the tube which now serves as a bucket is dropped into the well by the long rope. To a separate rope tied around one tin end is a stone weighing about one kg. to pull the tube bucket into the water to make it fill quickly.

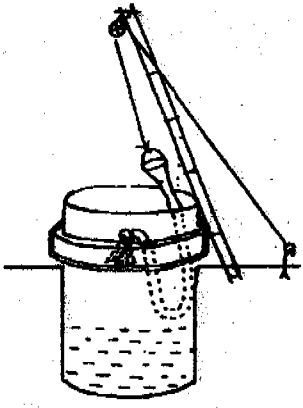


The advantage of the tube bucket is that it can be assembled by village families with locally available materials. It is flexible, light and trouble free for women and children to use. It will also lift more water from the well than the traditional bucket.

In least developed countries and even in many developed countries, not only is water scarce but also buckets or pails to fetch the available water are scarce. One can see groups of families using the same bucket in turns as buckets are neither made in their countries by factories nor imported for want of foreign exchange. Hence the idea of using automobile tubes as buckets.

33

COMMUNITY WATER SERVICE
RYFO Handout 218



Bore wells are inoperative and often give saline water. However, there are some good open wells here and there and the village women gather around these wells and wait for their turn. The waiting is long and often the queue is broken resulting in quarrels.

Diagram shows an arrangement in which a water tank is built around the wall of the well. A hole is made on the existing wall of the well just above the tank as shown.

A pair of Casaurina poles may be tied like a ladder 10 to 12 metres long. Two or three poles may be joined and tied together. One end of the ladder must be buried half a foot into the ground slanting on the well wall as shown. The other end must come almost in line with the middle of the well and on the very top cross bar (rung) a pulley may be tied or hooked.

Water-proof canvas cloth (rain coat cloth) may be cut and stitched in the form of a long tube of 15 cm. diameter. Out of the same material a bucket may be stitched without the bottom. The bucket may be 40 cm. long, 30 cm. in top diameter and 15 cm. in bottom diameter. The open bottom end may be attached to one end of the long canvas tube as shown. A metal rim of 18 cm. diameter may

be fixed to the delivery end of the canvas tube so that the delivery end does not fall back into the well.

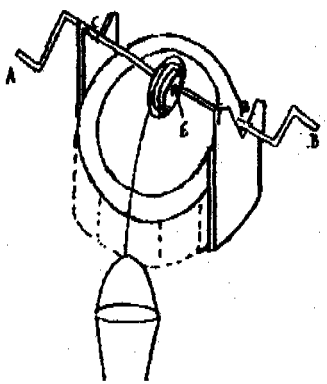
The total length of the canvas tube should be equal to the length between the delivery hole in the wall and the water level in the well (plus 1½ mts. in case the water level goes down).

A quarter cm. thick metal ring is fixed to the opening end of the bucket and a semi circular ring attached to that ring as shown. When the two cm. thick nylon rope or fibre rope tied to the bucket and taken round the pulley is let loose, the bucket dips into the water and picks up water and when the rope is pulled back, the water in the tube gets emptied into the storage tank around the well.

Every day the families may fill the tank in turns and the others asked to take three buckets of water from the tank. This will save time, trouble and labour for the village and there will be happy community participation. The system can very well be introduced as a first step in community co-operation and people's participation in rural areas.

34

AUTO-HUB WINDLASS RYFO Handout 70



Women and children find it hard to lift water from open wells and usually the buckets they use are of a large size.

A windlass constructed with one large size auto hub (preferably a truck hub) and handles on either end for two people to work the windlass at the same time can reduce the burden considerably. The handle can also be turned from one end by one person but the lifting will be easy if two people at either ends turn the handles.

The axle and handles, ie. A to B in the diagram must be a single long rod and it may be a mild steel round of one inch thickness. Simple bush bearing or metal sleeves may be fixed at O and D for the handles to turn without much friction. A wooden or metal tube may be inserted into A and B to make the rotating more easy.

One end of the rope must be tied to the hub to prevent the loose end falling into the well. The rope should not be tied to the axle rod. The axle must be welded to the hub at E.

The advantage of this system is that the rope will not fray and children can lift water without the danger of falling into the well. Lifting water will become a play for children and it will be a good exercise for them as well.

35

HOME TREATMENT FOR POTABILITY
RYFO Handout 221

RYFO Handout 40 explains with diagrams how drinking water can be filtered to an extent in 3 pots arranged as shown in the diagram. Handout 120 gives details about 8 commonly available plants and trees, the leaves of which can be thrown into small wells to purify and disinfect the water to a certain extent.

Intensive research in Germany has revealed that seeds of raw drum sticks (MORINGA OLEIFERA) clarify water of low and medium turbidities with a 98.99 percent reduction in faecal coliforms. When the seeds are broken to bits and stirred vigorously in a pot of drinking water, the dangerous microbes don't die but settle down in the bottom of the pot in about an hour. After an hour 3/4 of the water in the pot may be gently (without shaking) cloth filtered into another clean pot and the 1/4 sediment remaining in the first pot may be thrown out.

Indian time-worn experience based on several experiments is that neem seeds dried and broken and gooseberry seeds dried and broken have the same effect. These seeds may also be used in the process explained above. If all these three seeds are easily available, they may all be mixed and used.

Where these seeds are not available some of the common leaves listed in Handout 120 may be put into pots 1 & 2 as shown in Handout 40. They should be washed well, dipped in boiling water if possible and then used. Old leaves must be removed everyday and replaced by fresh leaves. To make the removing easy, the leaves may be bundled in thin cloth and thrown in as a bundle. Seeds and leaves may all be mixed if available for better effect.

The water must be boiled before being filled into the top most pot. If fuelwood is scarce and costly, the water may be solar heated as shown in RYFO Handout No 2 or No 166.

Villagers will do well to grow all the trees mentioned in their neighbourhood. All of them have several uses other than what is mentioned here. Some are medicinal and produce oil bearing nuts and others can be used as fodder and fertilizers too. Drum stick tree for instance, is medicinal and honey yielding and the leaves are eaten by people and animals; they are a rich source of vitamin A and prevent eye ailments.

36

WATER FOR CONSTRUCTION
RYFO Handout 201

Food for work project going on in the province of TIGRAY in Ethiopia. Efforts are being made to complete 12 dams before the arrival of the next rains. Over 1000 men and women are working on each dam. Report from AFRICA RECOVERY March 1988.

Employing people for manual labour and giving them food for their work is a good idea in poverty stricken and drought ridden areas. But they should be taught to do work without strain and suffering. The diagram above shows women (probably mothers with several children) sweating it out and breaking their backs.

Drawing by Ryan adopted from a photo by Edith Simmons/UNICEF

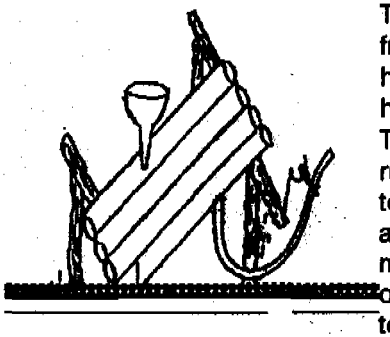
The diagram below shows AT method of carrying water to such construction sites. The idea is simple and costs almost nothing. Two women walking one behind the other as seen in the photo should carry a pole on their shoulders one end resting on the shoulder of each woman. A piece of cloth or towel may be folded and used as a shoulder pad.

An old automobile tube, preferably a tube of a lorry (4 wheelers that shift sand, stone and cement to the site) may be put on the pole, half of it hanging on either side as shown in the diagram below. The brass valve in the tube must be on top of the poles as shown. Two holes, of 10 cm. diameter each,

may be cut out from the tube on either side of the valve (on one wall only) and the two holes may each be at a distance of 10 cm. from the valve. The cut and removed circular piece of the tube may be stuck or stitched at one end of the hole to serve as a flap to close the hole. This is to prevent the water from spilling while being carried on the pole. Care should be taken to fill the water through both the holes. One tube can hold more than what four pots of the type seen in the picture can hold.

37

RYFO SOLAR HEATER — RYFO Hand-out 2



The RYFO solar heater is different from the many solar heaters that have been introduced to provide hot water at no recurring cost. Two galvanised (rustless) corrugated zinc sheets are welded together one on top of the other as shown in the diagram and mounted on four pillars made out of tree branches. The sheet on top will have a funnel-feed opening and the bottom sheet will have a PVC tube delivery end. Under broad sun light, water that is contained between the sheets gets heated quickly to a high degree of temperature. Under bright sun light, the temperature can reach upto 80 degrees Centigrade and several evil bacteria present in the water can be destroyed. It is the most appropriate alternative to boiling drinking water.

Two RYFO heaters may be mounted side by side and water may be drawn from them on alternative days so that water drawn from a heater would have been solar heated throughout the previous day. However, if hot water is required, it has to be drawn before dusk.

The height of the heaters must be atleast 6 feet or else children may be tempted to sit on them. As an alternative to mounting the heaters on pillars, if a suitable brick building is available, the heaters may be mounted on the building. If one pillar or one side of the wall is made a foot higher than the other, and the heater mounted on a tilted position, the heating will be a bit quicker and all the water can be drained out easily when necessary.

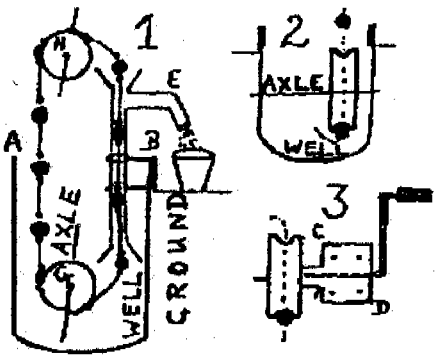
The side welding and the delivery end must be absolutely leak-proof. Here and there some dents have to be made on the ribs in both the sheets to make water enter all the channels of the heater easily.

It is safe to wash fruits and vegetables that are to be preserved with the water drawn from this heater in the absence of boiled water.

38

TENNIS BALL PUMP

RYFO Handout 106



This is a modified version of the Chinese rope pump and can lift about 30 litres of water per minute from a depth of about 20 mts.

Requirements :

1) A plastic pipe 10 mts. long broad enough for a tennis ball to pass through; 2) One metre long delivery pipe; 3) Two cms. diameter axle rods (2 Nos.) - one atleast 30 cms. longer than the diameter of the well and the other about 2 metres longer; 4) Two wooden pulleys made like a scooter wheel rim; 5) One cm. thick nylon rope about 20 mts. long; 6) 30 used tennis balls and 7) A wooden block 30 cms. x 30 cms. x 15 cms.

Assembly:

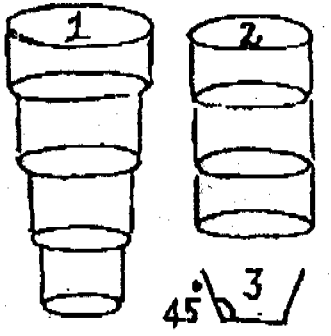
The plastic pipe is fixed to the wall of the well with two strong clamps as shown at B in diagram. The two ends of the pipe should have conical opening made out of tin and fixed as shown. E is the delivery pipe fixed to the main pipe as shown. G & H are two wooden pulleys. The bottom pulley is fixed to the smaller axle which is fixed a metre above the bottom of the well. If the well is narrow this axle may be cutting the middle of the well and if broad, it may be fixed towards one side.

In diagram 1, for clarity, the top pulley is shown much above the ground level, but in actual position the top axle should be on the existing wall A-B of the well. In all the tennis balls, two holes may be made opposite to each other for the rope to pass through. All the balls may be fixed at equal distance from one another and knots made above and below each ball to keep in position. CD is the wooden block fixed at A, opposite the delivery end. The top axle which passes through the middle of the wooden block should be bent to make the turning handle as shown in diagram 3. When the handle is turned, the nylon rope will move round the two pulleys and the tennis balls lift the water and deliver at E. Washers cut out of car tubes may be inserted above and below the balls.

This pump is easy to operate and more efficient than the traditional hand pump and is also trouble-free. If something goes wrong, the village people can quickly set it right with local skill and materials. The cost of constructing a tennis ball pump should not exceed US $ 100. The whole system can be mounted on a MS rod ladder and made portable(MS - Mild Steal).

39

WELL DIMENSIONS AND REINFORCEMENT
RYFO Handout 134



The width and diameter of a well should be in relation to its capacity to recupercate, i.e., regain the water that was drawn out during the day. Villagers have the wrong idea that bigger the well more the water. This is not always true. If the ground does not run enough water, a large well will not regain during the night the water that was drawn out during the day.

In hard rocky ground, shallow wells with a large diameter are good to tap ground water. An open well that is about four meters broad and six meters deep may be considered optimum in size in rocky areas. When wells are cleared and deepened periodically, the optimum depth should be kept.

If water level goes down in summer, vertical, horizontal or inclined bore pipes may be driven inside the well to collect more water. Such boring will cost less than deepening the entire wall by excavation.

The best way to prevent side sliding inside the well is to place reinforced cement rings one on top of the other as shown in diagrams 1 & 2. It may be noted that the very bottom ring is the smallest and the size of each ring is bigger as they rise. A well built with cement rings this way will usually be narrow at the bottom and broad at the top. This is to ensure more fresh air and sun light in the well. Also, going down to clean or deepen is easier when the well is shaped as shown in diagram 1. In diagram 2, uniform rings are used.

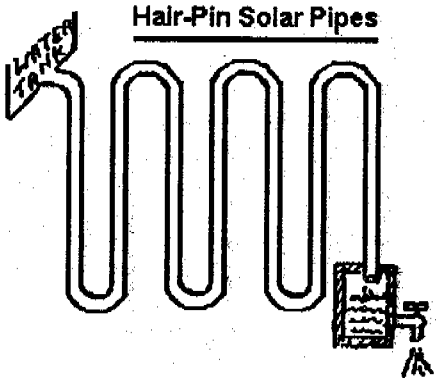
When cement rings are not available, regular brick walls may be built and plastered to prevent side sliding. If the village is very poor and cannot afford rings or bricks, construction of the well may take the shape of a broad pit as shown in diagram 3, where the slant of the sides will be about 45 degrees as shown. The disadvantage in this type of well is that during summer when more water is required much of it will evaporate and sometimes the well can go totally dry.

The fourth type of open well is the tyre walled well which is ideally suited for poor villages and this is explained in RYFO Handout 138.

40

HAIR-PIN SOLAR PIPES

RYFO Handout 156



From the water tank on top of your house, the pipes are usually laid on the parapet wall and led to toilets inside the house. Sometimes the pipes are buried inside the wall. But to have a hair-pin solar pipe heater, the pipe leading the water from the tank to the tap should be laid flat on the roof of the terrace.

When the sun is hot, only the water which is inside the pipe gets heated and therefore,the supply of warm water to the taps is short. To get more water heated almost for a continuous flow of hot water, long pipes may be taken and bent in a pipe bending machine with hair-pin bends as shown in the diagram. Alternatively, about 20 pipe lengths, each one meter long may be taken and with 'U' bends and couplings joined together. But if a pipe bending machine is available, it is easier, quicker and cheaper to have the pipes bent. Couplings and joints may be used to make the length of the pipe as long as required. The length is to depend on the amount of warm water and the duration of time for which the warm water is required by the family.

If necessary, under the tap in the toilet a double walled water tank or container packed inbetween with cotton rags, sisal pith or fibre may be used to retain the heat in the container for a longer time.

On a normal warm day, the temperature of the water that comes out of the pipe will be about 60 degrees and on hot sunny days, it can go upto 75 degrees and kill several evil bacteria.

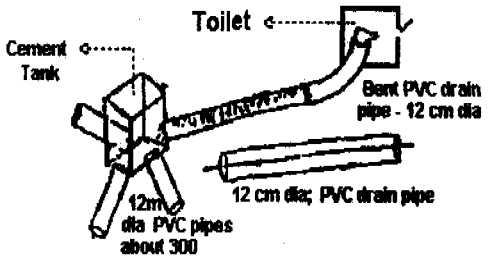
Note that the bending, joining and laying the pipes is so simple and easy that two members of the family can have it laid with domestic tools. The pipe may be painted black with mat finish to help absorption of heat. There is nothing to go wrong in bent pipes laid as explained and one can have adequate supply of warm water all through the year in countries where the sun always shines. Of course, the temperature will fall during the night but will not be cold in the morning like the water flowing through taps without the heating arrangement. It is an excellent appropriate technology method to provide warm water for domestic use.

41

RYFO RURAL HOME SEWER RYFO Handout 175

Villages in poor countries do not have a sewerage system - for that matter even towns and cities in many Third World Countries do not have proper sewerage and drainage. Governments of these countries which are not able to give their village people food to eat are not going to give them sewerage in their life time. The UNICEF, HABITAT and other UN agencies and many NGOs have been developing and introducing different types of toilets and sewer

systems but have not touched the fringe of the iceberg. Self-help and appropriate technology can take rural communities a long way in this field of development to make life of the rural poor less burden-some.



18 mts long each buried about 60 cms under ground to empty the tank under the soil for kitchen garden

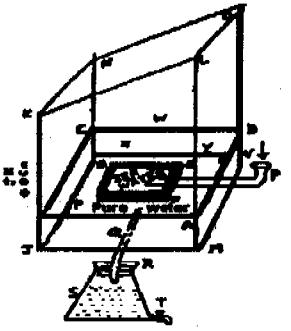
RYFO rural home sewer system is a simple and inexpensive way of connecting the domestic toilet to an open air disposal tank at a distance of about 50 feet. PVC pipes are recommended to connect the toilet pit to the tank because they are cheap and durable, can be easily transported and they are easy to lay and maintain. However, earthern-ware or metal pipes may also be used or lead channels may be built with brick and cement. The open channel system is to be preferred for villages because it is easy to notice obstacles in the flow, and to clean and maintain them. (However, closed bamboo pipes may also be used).

When water from the bath room is let out through the lavatory pit, the channel will be washed and cleaned every day and once in a fortnight, clogging if any, may be cleared with a broom or a stick. Cleaning windows may be provided.

The slant of the clearing channel must make about 60 degrees to the ground so that what moves out of the lavatory rolls down the channel into the tank. The tank may be about 4 feet deep out of which 3 feet should be underground. The ground may be prepared to slope away from the tank. The 3 outlet lead tubes may be on level with the bottom of the tank. What collects in the tank will go into the soil and spread and fertilise an area big enough to make an excellent kitchen garden for the family. Being exposed to sun and rain, and 50 feet away from the home, there will be no foul smell. It is better to build the huts in a row and lead all the sewerage towards the same direction. Perhaps this is the most appropriate sewerage system for villages under the order of the day.

FAMILY SIZE SOLAR STILL RYFO Handout 198

Maximum cost US $ 40 only



Solar stills are now becoming popular in countries with bright sun. There are very cheap and small bachelor size stills like the one invented and displayed for demonstration by the Murugappa Chettiar AT Research centre at Taramani, Madras and large scale village community types, like the one installed with UN aid in Somalia. The diagram here is of a still designed specially to meet family requirements of pure and potable water.

Instructions for construction : ABCD is a one sq.metre galvanised tin tray 16 cm. deep EFGH is a smaller galvanised tin tray of the size 80 sq.cm, 15cm. deep. JK, GN,OV,&IM are 0.5 cm. rounds welded to the 4 corners of the larger tray. KL,LO,& ON are all 0.5 cm. rounds welded to the 4 pillars shown. Rod KN may be a PVC coated electric wire. Rods on one side may be 15 cm. longer than the rods on the other side as shown. A high density transparent PVC cloth may be cut to size and stuck with rubber glue to cover sides ABKL, KNOL & CDON. Another similar sheet may be cut to size to cover the side BCKN, LONK & LODA. The sheets must be pulled and fixed as stiff as possible (should not sag) and the chamber thus covered must be air-tight. If necessary, stitches may be put here and there to make the fixing stiff. All the sheets should be stuck on the inside walls of the big tray and not on the outside walls. Side JBCG must be a shutter, either with sliding arrangement or with hinges so that the small tray can be removed and cleaned every week. If sea water is used, salt will collect in the small tray which can be scraped and used in the kitchen. If impure and brownish, the salt may be cleaned and purified as explained in RYFO Handout 64. If the roof KNOL alone can be of glass, there will be quicker evaporation and more condensed water will come out of the still every day. The glass must be 1¼ x 1¼ mts. If the two rods JK and ON are made to project an inch or two on top, the projection will hold the glass

placed on the frame KLON. If the glass is in two parts the joint must be sealed by a cellophane tape or hand-made paper.

Operation: The still may be kept permanently in one's backyard, frontage or terrace. It can even be kept in the balcony of residential flats provided sun enters there. Trees or buildings should not obstruct the fall of the sun. Four buckets of sea water or brackish well water may be poured into funnel P to fill the small tray. By evening most of the water which evaporates and condenses will roll down the smallest side in beads and fill the bigger tray and from there flow into container SRT. The lid of this container must be tight to prevent further evaporation. The water that can be drawn out through tap T will be absolutely pure and fit for human consumption without boiling. For more water, two stills are the answer.

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RURAL LIGHTING BY SEA WATER
RYFO Handout 214

(for diagram see Handout 215)

This is a simple idea of connecting a dry lake or catchment area of coastal villages by cement or metal or fibre-glass water pipes of about 60 cm. diameter to let sea water in. The lake or catchment area may be at a distance of one to ten kms. from the sea. At the outlet end in the lake or catchment area, one or two mini generators may be installed. The entry of the sea into the pipes may be controlled and regulated by lock and sluice arrangement. For safety sake, an additional locking arrangement may be made somewhere in the middle of the pipe-line. In case the head-lock gets stuck or breaks, the middle lock can stop the water from flooding into the land.

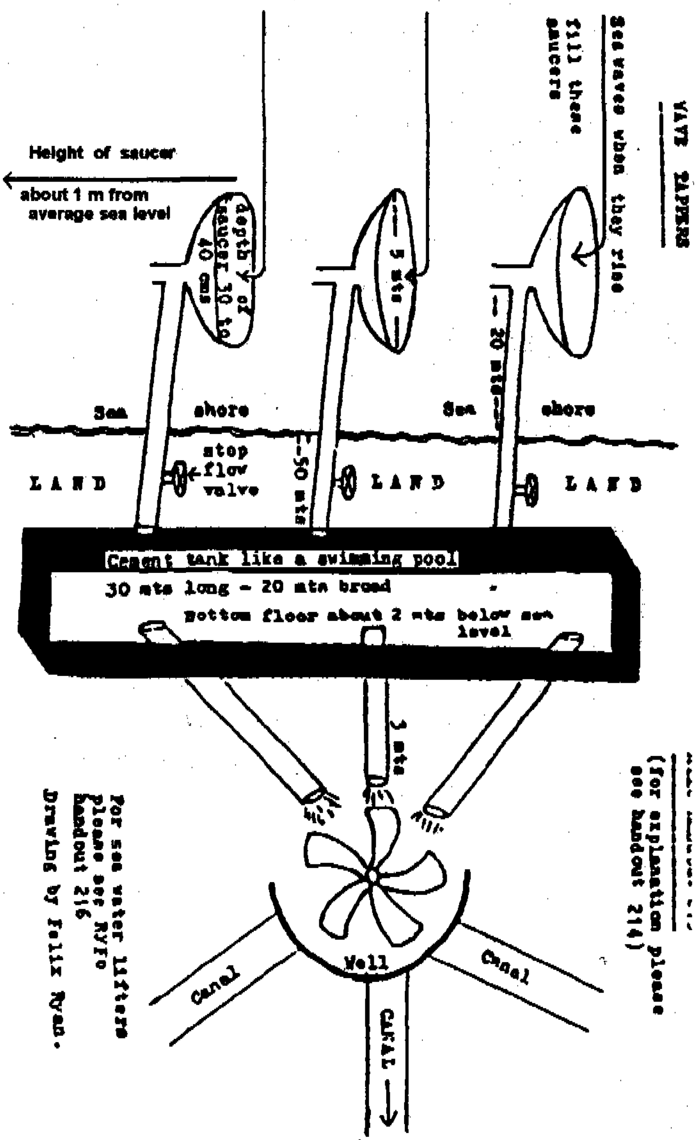
The lock may be lifted at 6 PM and closed at 6 AM and throughout the night, the flowing water will generate electricity. If the receiving capacity of the tank or catchment area is small, the flow may be allowed only from 6 PM to 10 PM every day when people really need light. From the lake or catchment area, the water may be led by small canals into interior villages and connected to lakes and catchment areas in those villages. Mini generators may be installed also at the end of these canals.

This scheme will not only provide street lights for the poor villages but also make their barren dry lands wet. There can be inland sea water fishing and growing of saline soil trees, shrubs and fuel wood. Names of some saline soil and sea water plants and trees are given elsewhere. Land-locked interior villages will have atleast sea water to cool their surroundings and to wash their cattle, clean their clothes and to soak their fibre plants for fibre extraction. They can also have salt pans and make salt for their domestic needs. Fodder for cattle can be grown.

When drinking water becomes scarce in summer, they can use the solar still shown in RYFO Handout 198 and convert the sea water into potable water. People who have no water to bathe and keep clean can take a dip in sea water ponds and pools and there will be less disease and more cheer.

For more ways of using sea water, see Handouts No. 213 & 216.

The World Health Organization recommends a total dissolved salts (TDS) concentration in water upto 1500 milligrams per litre. People from BOTSWANA drink water with upto 4000 mg/l TDS and their poor health reflects the high ingestion of salt.


WAVE TAPPERS
Sea waves when they rise
fill these saucers
5 mts
depth of saucer 30 to 40 cms
Height of saucer
about 1 m from average sea level
20 mts
50 mts
Sea
shore
Sea
shore
LAND
LAND
LAND
stop flow valve
Cement tank like a swimming pool
30 mts long - 20 mts broad
Bottom floor about 2 mts below sea level
3 mts
Well
Canal
Canal
CANAL
(for explanation please see handout 214)
For sea water lifters please see RYFO handout 216
Drawing by Felix Ryan.

44

FISH PONDS IN FOOD GROWING FIELDS
RYFO Handout 375

It is quite profitable to have small fish ponds in the middle of paddy or sugar cane fields which are watered regularly and liberally. Small ponds can also be had in the middle of fields growing other food grains or vegetables, provided adequate water is available to flow into and out of the pond. Fish rearing in fields has many advantages - the main being that fish eating up many insects and pests and unwanted weeds which attack the roots of grain plants. Fish provide rich organic manure for the plants. Fish such as Cyprirus Sp burrow into the fields and loosen the soil causing the water to penetrate for the roots to spread out.

Ponds of the size 3 mt. x 3 mt. may be located in the 4 corners, so that cultivation can be carried out conveniently in the middle portion. Alternatively, there may be one big pond in the middle of the plot and cultivation done all around it. If the pond is in the middle, there should be a single file path leading to the pond. Each pond may be about one metre deep. The entire bottom (floor) and the sides upto a height of 1.5 mts. may be paved to prevent seepage and waste of water. The water level in the pond should be above the paved portion of the side walls.

Common carp, silver carp and grass carp are good and sturdy varieties to be introduced and they may be introduced all together. Thilapia, catla and Rohu may also be put together.

If the fingerlings are too small when obtained from government or private ponds, they should first be kept in a separate small pond to attain size and then transferred into the bigger ponds after a month or two. If very small fingerlings are directly put into the big ponds along with big fish, the big ones will eat the small ones.

Predatory fishes such as Murrel, Wallago, Channa marulius etc. and frogs and snakes should be prevented from getting into the fish ponds by raising a steep bund around the pond/ponds.

Since the pond is paved, the fish must be fed regularly with crushed oilcakes (coconut, groundnut or any other edible oil cake). Rice bran may also be given. Ready mix chicken feed may be thrown. The feed may be spread on the surface of the water and also given

in plastic bags as explained in Handout 186. If well fed and looked after, nearly 5 tons of fish can be harvested in a year from a pond of total carpet area of about one acre. Fish rearing is done usually from June to June. Fish that die and float may be removed as soon as it is noticed, and buried in the field to a depth of about ten cms. to fertilize the soil.

When plenty of fish is available in a village, several fish based industries may be started. Drying or smoking fish, making chicken feed with dried and powdered fish, fish oil, fish meal, fertilizers, etc. are all possibilities. Coal stores may be opened in nearby commercial centres to store the fish for the market. From one hectare of land it is possible for a farmer to make as much money as he makes from selling his grains from one hectare.

45

WATER PURIFICATION IN SMALL WELLS
RYFO Handout 120

Chlorine and bleaching powder and other chemical agents are not easily available in villages and they are expensive. Moreover, use of these machine-made chemicals should be avoided as far as possible. Rural communities should find their own appropriate methods to purify drinking water to the extent possible. This can be done without difficulty in small community wells from which upto 1000 litres of water are drawn every day. Some of the traditional and scientifically proven native methods are :-

1. By throwing a small log (or parts of) the Nelli tree into the well (very commonly and traditionally done in India). Botanical name of this tree is Phyllanthus Embelika. Sanskrit name is Dhatriphala. This tree is very commonly available in tropical countries and can be grown easily. The fruits are edible and medicinal.

2. By throwing ground seeds of Drumstick (after removing the outer skin of the seed) into the well. Botanical name of Drumstick tree is Moringa Oleifera Adans. This very common tree has properties of water purification as reported by Samia John of Care German Agency (cited in the book Science and Technology for Women, Dept. of Science & Technology, Govt. of India). Other researchers have confirmed this finding.

3. By throwing Tulsi leaves into the well. Botanical name of Tulsi is Cocimum Basilium Linn. It has insecticidal properties and repels mosquitoes and flies as reported in Science for Villages, India No. 77, Feb. 1984. Tulsi is a very common plant and can be propagated easily.

4. By throwing neem leaves into the well. For chemical and insecticidal properties of Neem, see RYFO Handout No. 33.

5. By throwing dried and burnt banana peel ash. This ash contains antifungal and antibacterial substances. (Source: Useful plants of India & Pakistan by J.F. Dastur, page 22; Published by Taraporevalas, Bombay).

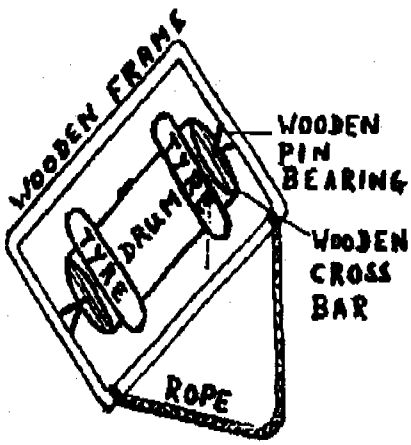
6. By throwing leaves of Adhatodal (botanical - Adhatoda Vasica Nees). These leaves have properties of weedicide, fungicide and insecticide. As an insecticide, they have the same use as the tobacco leaves. (Source: Useful Plants of India and Pakistan by Dastur).

7. By dropping burnt lime stones or roasted river or sea shells into the well. This is commonly done in India since time immemorial.

8. By throwing Papaya leaves (Popos). This is done in some parts of Africa. Papaya smell is said to repell mosquitoes and prevent mosquito larvae in the water. (In Sierra Leone, people boil Papaya leaves and bathe in the water to prevent mosquito bite and malaria).

Atleast 4 out of these 8 items may be pound to granules in dry form and filled in equal parts by volume into a perforated 5 kg. plastic container and reduced into the well with a fibre rope and the contents replenished every month (3 small holes at the bottom and 3 at the top will do). The 8 items can be pound or ground and the mixture made readily available in 5 kg. packets and may be distributed free by aid agencies. Village communities can mix and market the mixture.

ROLLING WATER DRUM RYFO Handout 377



The diagram is self explanatory. Materials required to assemble are two large size used automobile tyres, an empty oil drum which can fit into the tyres as shown in the diagram, two wooden pieces to be used as cross bars, a large wooden frame and a rope to pull.

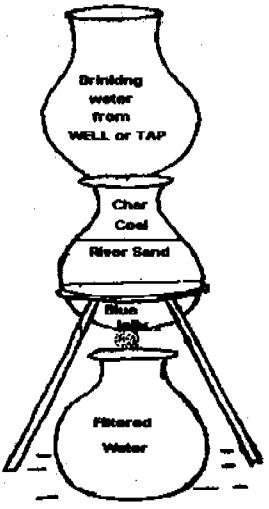
After filling the drum from the source of water, a woman or little girl can drag the drum without strain and take it to her hut. Both the tyres may be filled tight with straw or used gunny or woven sacks used for packing cement or fertilizers.

If a family has two drums, they can be used alternatively to collect water, and water can be stored in one drum when the other is in use. In other words, the drum can be drawn and left inside the hut until the water is consumed.

If left under open sun in hot countries, the water will be heated to a certain degree of temperature and atleast some evil water borne germs will die. But it is better to transfer water meant for drinking into a village pot filter explained in Handout 40.

In very poor villages where many families cannot afford to own a water drum with tyres, one or two unemployed youth may be commissioned to supply water to families for a payment or in exchange for a cup of rice or cereals. Thus supplying water can provide employment or food to some unemployed youth or additional income for families who don't have adequate means to live.

VILLAGE POT FILTER RYFO Handout 40



Good drinking water remains a major problem in most Third World Countries. The poor have no fuel to boil the water and they don't bother to filter the water.

A very simple and inexpensive solar heater for rural communities is explained in RYFO Handout No. 2. The water drawn from these heaters may be filtered and purified in this village pot filter which is also simple and inexpensive. While a group of ten families can collectively own the open solar heater shown in RYFO Handout No. 2, every home can have its own pot filter shown in this page.

A stool with a ring top as shown in the diagram is required. If such a stool cannot be made, an old scooter or car tyre may be mounted on three legs. Three uniform branches of a tree may be used to make the legs.

The bottom 1/3 portion of the middle pot may contain blue jelly or hard gravel or large size pebbles, whichever is easily available. The middle 1/3 portion may have clean river sand washed in clean water, dried and sieved. The top 1/3 portion will have charcoal.

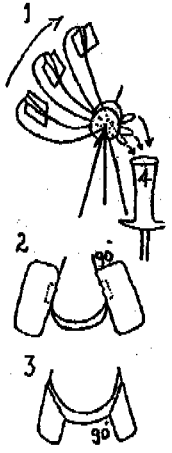
The first and the second pot will have a one inch hole at the bottom. To have this hole made, the pot may be filled with wet mud and then inverted and gently dented and punctured with a sharp nail. At the bottom of the first two pots, a clean piece of cloth may be placed to serve as filter and to prevent the river sand from dropping into the bottom pot.

Every morning a bucket of water drawn from the RYFO Solar Heater or Drum Roller may be poured into the top pot. This water will keep trickling down into the bottom pot for several hours. The water that collects in the bottom pot will not only be free of impurities but will also be cool and tasty.

If available, a wire guaze lid may be used to keep the bottom pot covered. A clean mug may be kept separately to collect water from the bottom pot.

WAVE LIFTERS

RYFO Handout 216



While Handout 215 explains how to tap waves in the sea, this Handout explains how to lift the waves to an overhead tank.

The buckets and the collapsible flaps are the special features of the windmill designed for the purpose. Each bucket wing seen in diagram one is 2 m. long and each wing has 30 cm. x 15 cm. flaps on either side fixed on hinges to work like butterfly wings. When folded towards the axle of the mill, the flaps will fold only to a certain extent (to form about 90 degrees with the bucket wing as shown in diagram 2) as there is a block (stop) in the rear of the flap to prevent it from folding further. Thus, when the wind blows, the flaps will be in open position as shown in diagram 2. But this will happen only when the buckets with water move upwards and make the buckets move faster.

After the buckets empty the water in the receiving tank as shown in diagram 4 and move downward empty, the flaps will collapse and hang downward as shown in diagram 3. In other words, when the buckets pick up waves (water) and move upwards, the opened out flaps will face more of blowing wind and move faster and when they return empty downwards, the collapsed flaps will not offer wind resistance. By this arrangement the mill will operate efficiently.

The buckets and the collapsible flaps may be made of aluminium or fibre glass. The mill may be installed 30 to 50 mts. away from the shore and in such a position that the bucket wings dip 15 to 30 cms. into the water at normal water level in the sea.

Receiver (diagram 4) built on Saucer collectors which are explained in Handout 215 should also be positioned to collect the water dropping from the buckets. The site for installing the mill must be selected with care. There must be enough wind in the area and the shore level should not be more than two meters above the sea level.

DUCK-CUM-FISH FARMING RYFO Handout 340

Farming ducks together with Tilapia, Catfish, or Cutla is profitable where ducks are allowed to wander freely in fish ponds. Three months and older ducklings can be reared at the rate of ten per 100 sq. mts. in ponds into which 2 fish, each weighing about 10 gms. are introduced. Ducks don't eat or kill fish and when ducks are a year old, they can be harvested and sold. In a year, about 2000 kgs. of fish can also be harvested and they will be of the size the market wants. The advantage of duck-cum-fish mixed farming is that the ducks clear the ponds by uprooting aquatic weeds and eat the worms, snails, insects and fish parasites.

Duck and fish farms may be developed in existing all-season ponds or rainy-season ponds or developed adjoining big lakes as shown in RYFO Handout 312. Alternatively, they may be built like a swimming pool, provided circulation of water can be ensured. Coastal villages can easily develop sea water ponds by leading sea water through man-made canals with sluice arrangement. If canals are dug by rural communities by their free labour every day, the water can be taken far into the interior. For safety one sluice (lock) arrangement should be near the sea outlet and another near the pond inlet.

If the ponds are large, fish may be kept in floating cages as shown in Handout 186. The ponds need not be deep and a depth of 3 or 4 feet would be quite adequate. If kept in cages, the fish may be fed as explained in the same handout.

Ducks may be sold as live birds or dressed ready for the kitchen. Out of duck feathers, shuttle corks may be made for children to play in rural community play-ground. Feathers may also be dyed and sent to cities for flower arrangements and florists will buy them. Being very light, they may also be exported with low freight charges, either as feather or as shuttle corks.

Bird feathers when crushed and mixed with pig-meal and boiled make excellent and nutritious feed for pigs. Pigs like to eat bird feathers and scales of fish. Out of fish-waste, fish-meal may be prepared in a crude way as explained in Handout. Fish-meal may be mixed to chicken feed, cattle-feed and organic (leaf) fertilizers for village use and for outside market.

When duck herds are allowed to wander freely in paddy or grain fields, they eat up insects and caterpillars that are harmful for plants without destroying the crop. Thus, they are non-chemical pest controllers in grain fields.

Two or three duck-cum-fish farms in a village can provide food, employment and a living wage for a hundred families. Feed for ducks and fish can be found in villages and they need not be purchased from factories and multinationals. Kaki cambel ducks can be kept in sea water ponds provided fresh water in large pots is provided on the bank for the ducks to dip their heads.

50

SOLAR DISINFECTION OF DRINKING WATER
RYFO Handout 239

The American University of Beirut in Collaboration with UNICEF had conducted intensive research on solar disinfection of drinking water and published its findings and recommendations for the benefit of rural families of Third Countries who don't get safe drinking water.

The recommendation is merely to expose cloth filtered drinking water in transparent glass or plastic bottles preferably glass) in bright hot sun for atleast 6 to 8 hours. The bottles must have the lids or corks fixed and should not have paper or plastic labels. They should be kept in upright position as tilting them at an angle towards the sun (as is commonly recommended for other solar appliances) may diminish the disinfection efficiency.

A family should ov[illegible]20 empty bottles so that about 10 may be filled and exp[illegible]y day as a matter of routine.

It is claimed that during the exposure to hot sunlight, some evil bacteria die but many of them settle in the bottom of the bottle. When the bottles are removed from the sun, they should not be tilted or shaken but the water should be gently transferred into a clean container or jug with a lid. Only 3/4 of the contents should be poured into the jug as the remaining 1/4 in the bottles will be contaminated with germs and impurities.

RYFO Handout No. 40 explains how drinking water can be passed through 3 pots containing sand, pebbles and charcoal to purify it and Handout 221 explains how crushed drumstick and some other seeds make evil bacteria settle to the bottom. Experiments carried out in Germany have proved that crushed drumstick seeds are very effective in settling bacteria and the method is now widely advocated.

All the 3 methods are so simple, inexpensive and easy to follow that RYFO (International) recommends that rural families should follow all the 3 methods together. In other words, after cloth filtering water, they should filter it again through the row of 3 pots, further filter it through crushed drumstick seeds and finally expose the water in bottles in hot sun. Alternatively, crushed drumstick seeds may be added to the charcoal or sand in the pots.

Even though this process requires constant and regular attention of the family, it is worth following to be free of water-borne diseases. Teenage children can be assigned this job in the family.

Perhaps one family in the village or an NGO may take up the work as a full-time job and prepare the water for drinking for the rest of the village and that family may be remunerated by the families benefitting by the service. This will bring in closer bonds in the village community. During rainy season, in the absence of hot sun, rain water may be used without any filtering or boiling.

51

POND LINING WITH AGRIFILM- I
RYFO Handout 209

The problem of rain water ponds in rural areas in which potable water seeps out or saline water seeps in, especially, in coastal areas, can be solved by lining the ponds with agrifilm (plastic sheets). The storage can be preserved and used for small cultivation, human and cattle consumption.

The slope of the pond must be made smooth and even, so that the agrifilm can be spread out uniformly, without ups and downs. A lining may be given to the slopes with flat bricks and tiles before spreading the sheets. The lining may be plastered not with scarce and costly cement but with mortar mixture explained in RYFO

Handout 294. The soil removed from the slopes may be used to build the lip or bank of the pond.

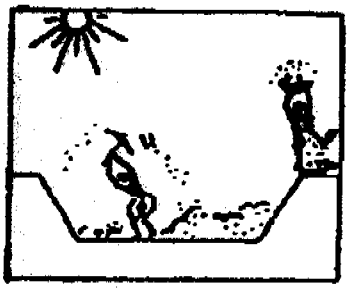
Toe Wall : A toe wall 60 cm. deep and 30 cm. broad with brick and mortar masonary should be constructed all around the bed to provide strength to the bank and to grip the agrifilm which should be tucked into the toe wall and covered with sand to prevent sliding. Joining of agrifilm sheets may be done either by heat sealing, adhesive tapes or by using molten bitumen. Further, 30 cm. x 30 cm. brick mortar ribs, like umbrella ribs, may be built all around the pond (inside) for reinforcement. These ribs may be joined to the brick wall built around the pond to anchor the outer end of the sheets.

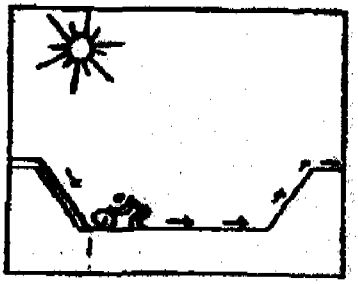
Inlet-Outlet : Arrangements may be made for rain water inlet and outlet with small sluice arrangement which can also be built of brick and mortar. The door may be made of one inch thick mild steel sheet. The top of the embankment should be made one metre broad and flat so that people can walk over it and see the water in store. Steps may be provided to go up the embankment and catchment canals built all along the pond to lead the water to the inlet gate.

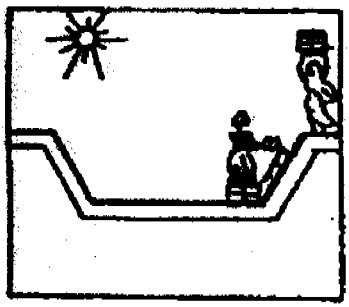
Filtering through Outlet : The water that flows out through the sluice when lifted should be passed through a brick and mortar honey-comb filter as a first stage filtering and then passed through stones and pebbles as a second stage filtering and lastly through sand, charcoal and neem leaves for final filtering. The final outflow may be received in a cement tank at ground level and from there lifted to an overhead tank by a windmill with canvas buckets as shown in Handout 210. From the overhead tank, water may be taken to family settlements in PVC pipes or gardenhose as shown in diagram. (For detailed explanation, see booklet RYAN'S WATER GATE which may be obtained from RYFO International).

For cultivation and cattle, it is enough to pass the water through the first honey-comb filter. The filters must be cleaned atleast once a month.

POND LINING WITH AGRIFILM - II
RYFO Handout 219



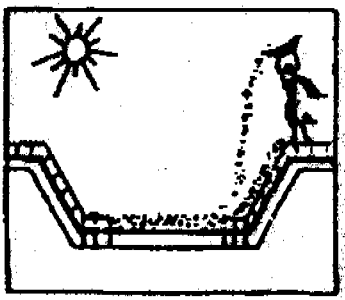


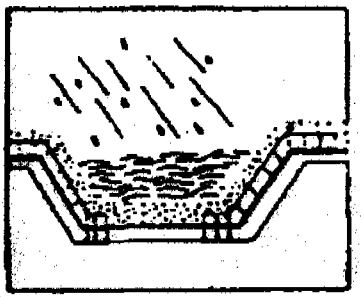


POND LINING

First the bed of the village pond or catchment area is dug and levelled. A plastic sheet called Agri film, specially designed for such applications, is spread along the floor and sides and attached to the surface by a toe wall. The film is then covered with a brick lining followed by soil for protection to the film. When run-off water is collected in the pond, the loss due to seepage and unpotability due to salinity is eliminated.

WITH AGRIFILM





Quotation For Agrifilm

Indian PetroChemicals Corporation Limited
(A Government of India Undertaking)
Regional Office Ralla Ram Bulding
30 Mission Road Bangalore 560 027

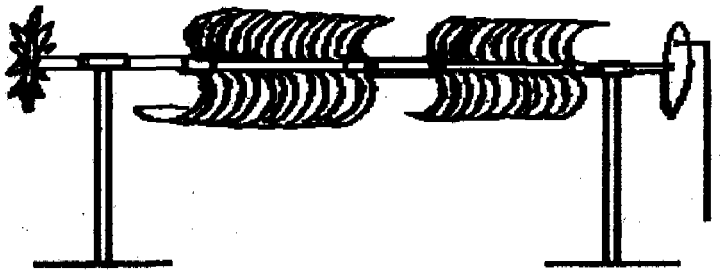
BG:MR:PC:28th Feb. 1989

Ryan Foundation
8, West Mada Street
Srinagar Colony
Madras 600 015 (TN)

The selling price of Agrifilm effective from 1.4.88 has been fixed at Rs.38,000/- per tonne in Thaan Form and Rs.38,500 /- per tonne in Roll Form. The above prices are inclusive of excise duty of 26.25% for films upto 250 microns (1000 guage) thickness and are subject to following terms and conditions.

1. Taxes:	4% Sales Tax against 'C' form or 10 % without 'C' form.
2. Delivery Time:	15 to 20 days after receipt of the confirmed order by us.
3. Minimum Quantity:	1 mt. and above is preferable. However, for small quantities schedule will not be as promised.
4. Specification of Film:	We can supply seemless wide- width film upto 12 metres, the thickness ranging from 400 gauge (100 micron) to 1000 - gauge (250 micron).
5.Price Escalation:	Our price is the price prevailing on the date/day of supply/delivery. Any change in the basic price of granules, excise duty and other statutory levies shall be charged accordingly.
6.Payment:	Advance payment by way of Demand Draft drawn in favour of Indian Petrochemical Corporation Limited, payable at Bangalore.
7.Despatch Point:	Hubli (Karnataka) and Salem (T.N)

RYFO RIVULET LIFTERS RYFO Handout 235



Streams and rivulets with water flowing in streaks are common. If barrier walls are built across them to regulate the flow of water towards one side and a small flow gate is built, there, the water will gush through that gate. Mini generators or turn wheels or turn drums as shown in the diagram may be erected. Alternatively from an always-flowing river, several small canals may be led into the bank to a distance of about a mile, two, or three, and at the end of the canals, mini generators may be installed.

Two oil drums may be cut, erected and welded on a long axle as shown and the axle rod may pass through two bush bearings mounted on two vertical pillars as shown.

A sprocket wheel attached to one end of the axle rod may be connected to the sprocket wheel of a wind mill built close to, and in line with, the axle rod. By this arrangement, the turning will be done by water power or wind power or by both. Next to the wind mill, an overhead tank and an open well may be built with canvas bucket lifters to lift the water from the well on to the over-head tank. Fixing of canvas bucket lifters is explained elsewhere.

On the other end of the axle, a disc and arm may be fixed as shown, attached to a tube well in the river. When the drum wings on the axle rod are turned the bore pump will also lift water into the tank.

Thus RYFO rivulet lifters will lift water both from the open well and from the sub-soil. The bore pump may be connected to the windmill only when there is not enough flow in the river to turn the drum wing.

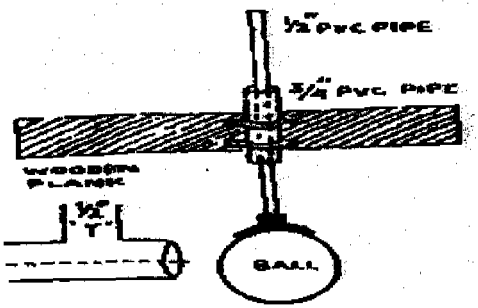
If the flow of water and blow of wind are steady and regular in the area, and if the lifters work non-stop, a mini generator may also be turned simultaneously and some power may also be generated. Fishing nets cast near the flow gate will net a big catch.

54

WATER LEVEL GAUGE RYFO Handout 250

Measuring Water level in overhead tanks

This is a simple method of measuring the amount of water present in overhead tanks. The system mainly consists of a plastic ball, a 1/2" - T (used for electrical wiring) and two PVC pipes, one 8 inches long of 3/4" diameter and the other of 1/2" diameter but of a length depending upon the height of the tank.



First the 1/2" PVC pipe is fitted into the "T" which is then cut along the dotted line as shown in the diagram. It is then fixed on the ball with the help of screws to make a float. The 3/4" pipe is fixed on a wooden plank with clamps, which is laid across the tank.

The float should move freely through the 3/4" pipe. As the tank is filled, the float rises upward. The 1/2" pipe may be suitably calibrated to indicate the quantity of water in the tank. The cost of this arrangement would be less than Rs.10.

- Innovation of : M.P. Prasanth, Murali Krishna, P.O.Chalad, Cannonore 14.
- Courtesy: Invention Intelligence, Govt. of India. (Reproduced with the permission of Mr.Prasanth).

BIO-DYNAMIC GARDENING RYFO Handout 256

SOIL PREPARATION
DOUBLE-DIG
PROCESS CONSERVES WATER

1. After soil is lightly moistened, pre-loosened and weeded, dig the entire area 12 inches deep with spading fork.

2. Spread 1-inch to 3-inch layer of compost over entire area.

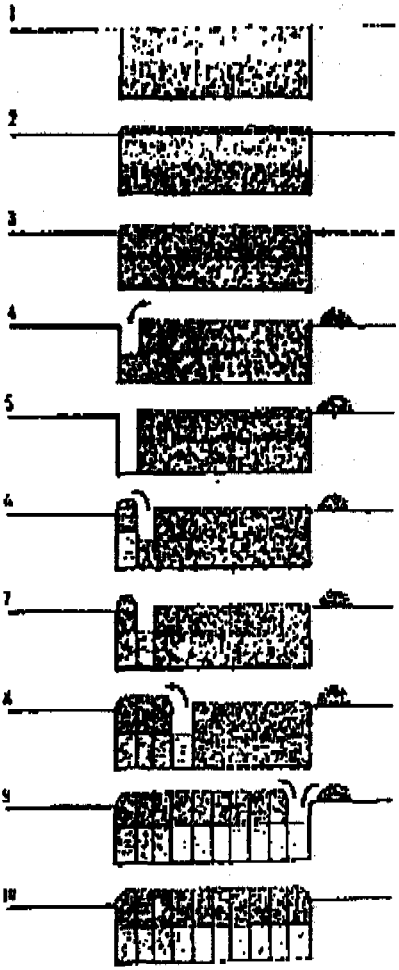
3. Throughly mix in compost 12 inches deep.

4. Remove soil from upper part of first trench and place at far end of bed.

5. Loosen soil further, 12 inches deep.

6. Dig out upper part of second trench and throw forward into upper, open part of first trench.

7. Loosen lower part of second trench.



8. Continue "double-digging" process (repeating steps 4 and 5) for remaining trenches.

9. Place soil in mound at end of bed into open , upper part of last trench.

10. Shape bed. Then spread any fertilizers needed evenly over entire area and sift in 2-3 inches deep with a spading fork: the completed "double-dug" bed.

(HOW TO GROW MORE VEGETABLES; BY JOHN JEAVONS : SOURCE)

Reproduced from Science for Villages - Feb. Mar. 1988.

Tomatoes grown on salty soil
Washington May 28

Scientists are finding new crops grown on salty soil and irrigated with salt water that may be useful in Third countries with long ocean shorelines and scarce fresh water.

The US National Research Council has just published the results of a four-year study of hundreds of plants that can tolerate salt. The report was prepared by a panel set up by the council's board on science and technology.

Seeds from a wild tomato found on the sea shore of Ecuador's Galapagos islands produced small and bitter tomatoes. But when crossed with commercial tomatoes, tasty fruits were obtained in 70 percent sea water. AP.

A.T. FOR LOCATING GROUND WATER
RYFO Handout 260

Reproduced with courtesy to the magazine
Science for Villages - April 1988

Varahamihira's treatise helps locate groundwater

New Delhi, April 18 (PTI)

Armed only with a sixth century manuscript, an Indian geologist is discovering groundwater reserviors with amazing success, using trees and termite hills as clues.

Dr.E.A.V.Prasad, a professor at Sri Venkateswara University in Tirupathi says his technique "may be unorthodox but it works'.

The challenge came four months ago when the Gujarat State's Water Supply and Sewerage Board (GWSSB) asked him to locate water in Jamnagar, A chronically drought-stricken district.

Surveying the surface vegetation in village Kamballa, he asked the GWSSB to drill a borehole 15 feet north of the tree.

Water gushed out of the well at the rate of 2000 gallons per hour (GPH).

In village Haripur, Prasad identified a termite mound colonised with vegetation and had a hole drilled 10 feet north of it. Its yield was even higher : 3000 GHP.

Within 10 days, Prasad located 51 well sites in 30 villages that had been classified as "no source" villages. Drilling has been completed on 15 sites.

While modern scientists depend on costly equipment and satellite pictures to detect groundwater, Prasad says he depends on "bio-indicators" listed in "Brihat Samhita" written by Varahamihira, a philosopher and sage who lived 1500 years ago.

According to Varahamihira, presence of termite mounds indicates water below. His clues also include half a dozen animals and some 30 different trees, important among them being a species called "phreatotypes", whose roots penetrate to reach the water table no matter how deep.

While surveying for bio-indicators, Prasad also looks for trees with knots in their trunks, two different trees united into one, abnormal palm trees with two crowns instead of one and absence of thorns in a normally thorn-bearing tree. According to Prasad, Varahamihira's "Brihat Samhita" is the essence of ancient Indian wisdom on tropical groundwater hydrology. "It not only gives the clues but also tells where to dig and how deep".

Prasad says Indian geologists, trained in the West, simply do not believe in Varahamihira's technique on a scientific footing.

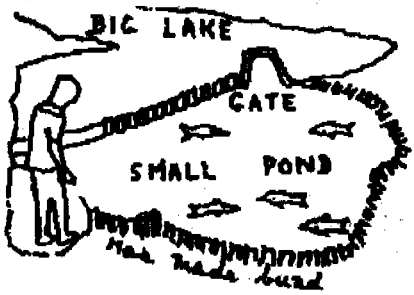
In 1981, when his native Andhra Pradesh was reeling under drought, Prasad using Varahamihira's clues identified 300 well sites in Rayalaseema, the driest region of the State.

Prasad says his success in Gujarat during the current drought has convinced him that the ancient technique also works in hard-rock terrain where conventional techniques have a high failure rate.

57

INLAND FISH CULTURE

RYFO Handout 312



A fine way of promoting inland water fish culture is following the method shown in the picture. A pond or big pit with a diameter of 10 metres and depth of one metre may be dug 4 or 5 metres away from a lake or rain water pond which always has water. The pond may be connected to the lake with an earthernware sewage or drainage pipe (plastic pipe or several hollow bamboos may be used if easily available) to let the lake water flow into the fish pond. Foul-house net with very small holes may be tied at either end of the connecting channel to serve as filter and to prevent the fish from going into the lake.

Under this arrangement, there will be a regular flow of water between the lake and the pond and a supply of fresh oxygen for the fish. Natural fish feed from the lake will also flow into the pond to supplement the prepared meal put into the pond. Since the size and depth of the pond is small, it is easy to fish the fish out of the pond.

Please note that all along the periphery of the pond, poles may be planted to reinforce the bund of the pond, which, without the reinforcement is likely to erode during rainy season and break open. The reinforcement also prevents the bund from sliding inward when people do the fishing.

Fishing in this type of pond can be done either by angling, netting or setting basket traps like those used in Seychelles and many other countries. This trap can be made of bamboo, tree branches or metal wire.

RYFO recommends that village families who like to have fish may pay a nominal monthly fee to the pond administration and leave their family basket trap in the pond every night and remove it the next morning. The number of fish they get in the morning depends entirely on their luck.

To avoid disputes, all trap baskets must be of uniform design and size. The pond administration will be responsible for preparing the fish feed and feeding the fish every day and for the cleaning and maintenance of the pond.

58

SHRIMPS IN COASTLANDS RYFO Handout 693

From Khulna to Cox Bazaar in Southern Bangladesh, unscrupulous men in shrimp business grabbed private plots of rice farmers, as shrimp export became big business in the eighties. They breached protective embankment illegally with sea water to raise shrimps. Land level in most parts of coastal Bangladesh is only about a meter higher than the mean sea level. City people owning lands in the coastal belt willingly leased out their lands for money, but many small holders who depended on their holdings, lost their lands or plots to the saline sea, shrimps and business sharks. Consequently, paddy harvest has fallen by about 30

percent in the Khulna area since the shrimp business picked up, says Dr. Atiur Rahman of the Bangladesh Institute of Development Institute. He also says that the cattle population of the area has fallen by 47 percent as grazing lands are also lost to the shrimp farmers. Dr. Rahman says that dense mangrove forests along the coast have been cleared and turned into sea water ponds to culture and cultivate shrimps.

Shrimps earn export money for Bangladesh. Exports shot up from USD 19 million in 1977-78 to USD 170 million in 1992-93, with 40 percent exports going to Europe, 38 percent to USA and 10 percent to Japan. The World Bank which usually backs up only macro and mega projects is providing International Development Assistance to Shrimp farms on 6000 ha. in Cox Bazaar and 1400 ha. in Khulna. From 20,000 ha. in 1980, shrimp farms now cover 120,000 ha. The owners of these farms grab private lands with political influence and to quell resistance to their encroachment, neither the police nor the Government interfere.

In Khulna, the Jewel Fisheries took over a wide canal for farming shrimps where villagers had fished from time immemorial and suddenly found that they were treated as intruders. Some local people sneak to the canal to fish at night in desperation but they are caught and beaten by armed guards of the exporters. A young villager was once beaten to death. A case was filed but no action was taken. A common story in India for the Amnesty International to take note of.

At present, a very gloomy situation of threat and fear prevails in the area and the Bangladesh Government is more interested in earning foreign exchange than in guarding the property and rights of the poor. What does it matter if a thousand people are killed in an overpopulated poor country!

Ryan Foundation's solution to the problem is to bring the sea water in through organised man-made canals, extending to hundreds of miles like the 420 km. Buckingham canal of Peninsular India or the canal cutting across Dubai, and to lease out different stretches of the canals to different shrimp farmers with suitable dam-walls or bridges to earmark different tenancy rights. If this is not done, Bangladesh shrimps and sharks will wipe out the helpless poor from the Coastal belt. For more light on tenancy rights, see "The View from Airlie (community-based) Conservation in Perspective" report of the Liz Clairborne and Art Ortenberg Foundation, 650 Fifty Avenue, New York, NY 10019, USA.

Trouble, similar to what is being reported from Bangladesh is also reported from Pakistan and Srilanka Coastal belts. In my own state, Tamil Nadu, in peninsular India, similar reports came from Pulikadu between Madras and Andhra, from the Cuddalore coast and, worst of all, from the Tuticorin Coast where there are several large investment shrimp farms (where this author has worked).

The ITC (Multinational) has resorted to the method advocated by Ryan Foundation. They have made long parallel man-made sea water canals within the land area that they have purchased and the campus is well-guarded. This is the only system that will produce results; any other system will cause trouble anywhere in the world under the order of the day.

59

BAMBOO PIPES — RYFO Handout 323

Bamboo, of the grass family, grows fast and high under hazardous conditions of soil and climate. It is a highly drought-resistant forest shrub-tree, offering several livelihood possibilities and yet neglected. Bamboos make excellent sewerage pipes in remote rural areas where they can be grown and processed.

RYAN Foundation recommends standardisation on bamboo pipes to lengths of 3 mts. and 8 cms. internal diameter. Mature bamboos may be cut at either end uniformly with a saw and projections outside may be chopped with a chisel and hammer and then the inner cavity cleaned and broadened. To do this, a long iron rod 1½ mts. long, sharpened at one end like a chisel, may be used. The bamboo may be placed on two 'Y' stands, as shown in the diagram, and chiselled from either end. Only in this position, one can see through easily and knock out internal projections and smoothen ruggedness. Whether used above ground or under, all bamboos have to be treated. The best rural technology for treating is to boil castor oil with neem, vasaka, datura leaves (3 parts) and turmeric, chilli powder and wood ash (one part) and paint the bamboos with the solution inside and outside.

On a commercial scale, the solution may be prepared in a long concrete pit-tub and the bamboos put into it and soaked for about a week. This treatment prevents bamboos from cracking or being attacked by white ants. If bitumen (tar) is available, it may be melted and painted outside (not inside). Inside must be as smooth as possible. If tar is not available, used cement or fertilizer bags (plastic or fibre) or locally woven crude fibre cloth may be wrapped around the bamboo and tied.

Bamboos, which are 30 cms. long and 10 cms. in inner diameter, may be similarly prepared and used as sleeves to join the pipes where required. Mortar mixture, explained in Handout 294, may be used as the binder to plaster the joints. These bamboo pipes may also be used to take water to fields and for domestic supply of drinking water.

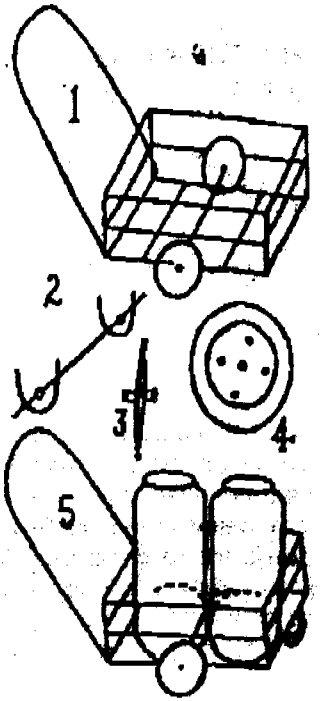
In Tanzania region of Arusha, Rukwa, Morogoro and Dar-es-Salaam, several bamboo processing and installing units have been established, financed by the Dutch government (US $ 140,000), NORAD (US $ 196,000), SIDA (US $ 280,000) and the EEC. The processing method is different in Tanzania from what is recommended by the RYAN Foundation. For RF processing, only local materials available in the village need be used and nothing need be imported.

Raw materials being free, each 3 metre long pipe may be sold for Rs.10/- or US $ 1 (one) and the industry can provide full employment for atleast a dozen families of the village in the cultivation, processing, laying, repairing, replacement and maintenance. This is an ideal industry for rural women. For Castor, see Handout 228.

60

WATER TROLLEY — RYFO Handout 320

Water scarcity is acute in several regions. Governments, local bodies and non-Government organizations provide water in taps or tankers in selected centres and people gather there to fetch their rationed water. Sometimes, only one or two wells or taps give good water. One can commonly see respectable women, old and sickly women collecting water. Servants don't report early when water is available and they are busy at that time collecting water for their own family. The water trolley in the diagram is designed to help women to shift water to their residence conveniently.



How to make the trolley

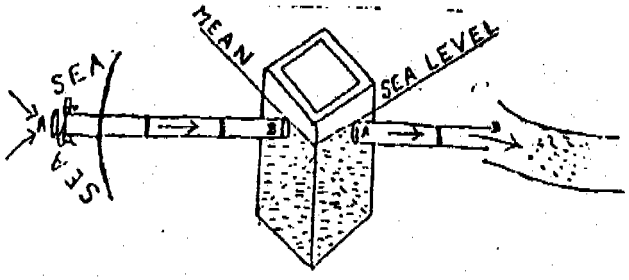
1) Take two used and discarded scooter tyres of uniform size and pack them tight with used gunny or HDPP cement or fertilizer bags. 2) Make 4 mild steel discs out of 12 gauge sheet, (like gramaphone records) and make 5 holes in each as shown in diagram 4. The centre hole may be of 3 cm. diameter and the four side holes each 1½ cm. in diameter. 3) Cut 4 bits of GI water pipe, each about 4 cm. long and 4 cm. in diameter and weld one each on one side of the 4 discs, as shown in diagram 3. 4) Make a mild steel trolley as shown in diagram 1 and fix the axle in two U-plates welded to the frame of the trolley as shown in diagram 2. The box of the trolley must be just big enough to take in two plastic containers, each of 40 cms. in diameter. It is better to purchase the two empty containers first and then make the trolley frame to size. The containers must have wide opening so that filling and removing water can be easy. Screw type lid will be the best but there must be some lid to prevent the water from spilling when the trolley is pushed.

Have a folding support in front of the trolley, as shown in diagram 5, or in the rear to park the trolley while filling. The trolley can be used for other purposes too.

In India, the total cost of this trolley, including the two containers, works out to be Rs. 500/- after leaving a profit of Rs. 50/- for the welder. A welder can easily make two trolleys a day and make Rs. 100/- every day. As he gains experience and gets orders, he can buy, cut and store in bulk and can make even three trolleys a day.

There is a very good demand for these trolleys and they can also be made with 4 wheels to shift heavy loads.

SEA WATER PIPE AND CHAMBER INLET
RYFO Handout 579



Where Governments are not coming forward to build sluice gates or locks to let sea water flow into nearby villages, people may take the initiative and lay bamboo pipes or earthernware pipes one or two metres below ground (about 15 cm. below mean sea level) and take the sea water to fill dry lakes, ponds and catchment areas. The pipe connection is to be laid only to a distance of about 50 mts. in all (about 50 bamboo poles) and connected to a brick and mortar chamber as shown. About ten mts. of the pipe will be submerged in the water and about 40 mts. buried under the ground. The chamber will have a bamboo outlet pipe which will drop the water into narrow open channels and the water can be led and taken wherever it is required.

This is an easy, safe and cheap way of letting (tapping) sea water with control system. The dimensions of the brick and mortar chamber may be about one or two cms. Depth will depend on the height of ground above mean sea level.

There will be a continuous flow of water and to stop the flow when necessary, one has only to walk knee-deep into the sea and insert a wooden stopper (plug) or stuff cotton rags inside the bamboo at point 'A'. For that matter, even a bottle can be inserted into the bamboo at point 'B'.

The chamber may be built without cement using RYFO Mortar Mix, explained in Handout 170, and the bamboo pipes may be prepared, as explained in RYFO Handout 323. The chamber may be either raised a metre above ground level or kept closed with a wooden plank or fenced to prevent children or cattle falling into it.

Point 'A' where the sea water enters must be given a cloth or mesh filter - tied round with a fibre rope or wire as shown. This is necessary to prevent the entry of foreign matter and sea sand. Since there is absolutely no danger of opening out the sea and marooning the village by this system, no government permission is required to build it. As the chamber can be constructed with village-made bricks and free community labour, no external technical or monetary aid is required and the project can be entirely a community initiative devoid of Government interference and red tape.

The water may be led into open channels, dry ponds, lakes and catchment areas for rearing fish, cultivating plants, trees and weeds that grow in sea and saline water and for desalinating the water for human consumption in RYFO mud stills, explained elsewhere.

62

REPORT OF SHOICHI NAKATA

(Following is an excerpt from an article captioned "The School of the Wind" written by Isagani S. de Castro, in the Development Forum, Journal of the UN Secretariat dated March-April 1990).

"The drought-aggravated food crisis in Africa in the early 1980s prompted many donor nations to fund water supply projects. Thousands of wells were dug and many were equipped with diesel pumps throughout Sub-Saharan Africa.

When Nakata visited Africa in late 1986 as part of a United Nations Environmental Programme (UNEP) survey team, he discovered that only one third of the wells were in running condition. The broken pumps and wells were not repaired due to either lack of funds, non-availability of spare parts or lack of skills to repair the pumps.

But Nakata points to a deeper reason behind these failures -ignorance on the part of the donor agencies of the need of Africa's villagers. "Many big, mechanised water projects are suited to the condition of donor nations. There must be appropriate technology for the unique conditions of poor countries", he explains.

The solution, he believes, is first to send volunteers to carefully ascertain the needs of rural dwellers. "Development Cooperation

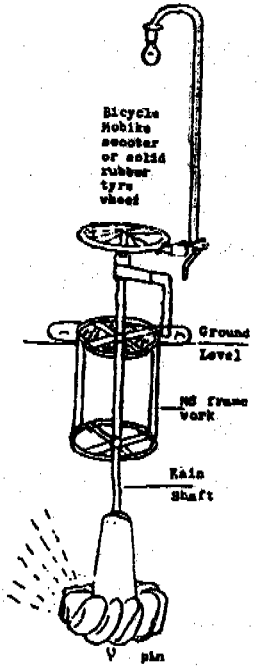
is human cooperation, human exchange ", says Nakata. "Sending money or materials is charity, not cooperation".

Nakata is critical of his country's aid projects, which he says are often too big, unwieldy and inappropriate for Third World conditions and "vested economic interests" of suppliers and traders to thrive.

He says sophisticated mechanical water systems should not be promoted unless the recipient agency has the funds and the know-how to maintain them.

63

RYFO SEWERAGE LAMP RYFO Handout 213



There are many underground drainages and sewerage channels in several towns and cities which have a good flow of waste water. At certain junction points, water keeps flowing fast and to a good level. The flow is particularly full and fast between 6 PM and 9 PM when people returning from work bathe and women cook or clean clothes. There are several points where water keeps gushing night and day. Tapping the running force of this underground sewerage water is the basic idea behind the RYFO Sewerage lamp.

The diagram is clear and self explanatory. The whole unit as seen in the diagram can be fabricated in a welding shop and fitted into a selected man-hole. The man-hole cover that is removed is closed by the middle wheel (lid) seen in the diagram. The two arms welded to the wheel will rest on the road or pavement and may be locked to prevent theft. The entire unit will cost as much as a bicycle. Installed lamps may be guarded like road-side trees are guarded with tree guards.

The man-hole in which the lamp mechanism is to be installed should be first identified and the length of the main shaft determined as the depth of man-holes can vary from point to point.

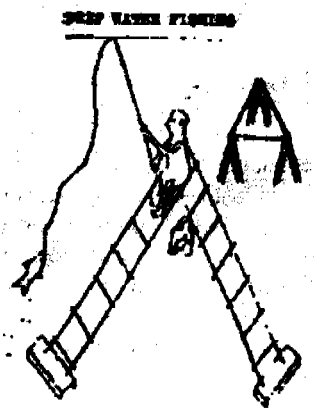
Where sewerage water is inadequate, sea water may be let into the sewerage mains with lock and sluice arrangement. Using sea water will not only keep the sewerage clean and flowing full but will also prevent mosquitoes, cockroaches and give a continuous and steady supply of current for street lighting.

The turning bucket unit (portion) may be made of fibre-glass to prevent corrosion by salty sea water. If sea water is used, car dynamos may be used for brighter light. And if the flow of water is fast and strong, even two or three dynamos may be used in each unit.

For lighting coastal village streets by using sea water, see RYFO Handout 214.

64

DEEP WATER FISHING RYFO Handout 197



Small-scale fishing by individuals and families is going on in traditional unproductive methods in Third countries. Frequently, one can see anglers sitting on banks of rivers, ponds and lakes for hours together waiting to hook fish. Anglers sitting on banks can only catch small fish and after long intervals. For more and bigger fish, they must go atleast 2 mts. deep into the water and this is difficult without a boat and the poor cannot afford a boat.

The diagram gives a simple idea for productivity in 'bank fishing' but it is recommended only for those who know to swim. Two ladders made of bamboo or casaurina of almost equal size, say, 3 mts. long, may be tied together at one end as shown. At the other end, blocks of wood, or tree branches about a meter long may be tied horizontally to prevent the bottom of the ladders from sinking into the soil.

The top ends are tied in such a way that the inverted 'v' can be folded to get the bottom ends of the ladders together and spread out when required. The angler may drag the ladders and swim and mount them in a convenient spot at a depth of about 2 to 3 mts., climb and sit comfortably on top as shown and angle from there. Baits and bags to put the angled fish must be tied to the upper end of the ladder.

What is seen in the diagram is one pair of fishing ladders. If three pairs are planted as in the three corners of a triangle, the three top ends being in equal distance from one another, and if the three top ends are connected and tied with casaurina poles or bamboos, the three pairs will stand strong and steady as one unit and can be left to stay in the water. Three anglers may swim to the structure and sit on top of the ladders as shown and angle from up there and thus make sure that they get a profitable catch.

If the anglers are good swimmers, they may follow the same system to catch from the sea but should not go beyond 3 mts. deep. As a safety measure, one end of a strong rope may be tied to the ladders and the other end tied to a strong tree or a firm peg on the shore. Catching by nets or baskets may also be tried from this position.

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WIND PUMPS FAIL — RYFO Handout 337

While it is very necessary to harness wind energy wherever possible for several uses, it should be realised that bore pumps connected to windmills are short-lived. It is not because the wind does not turn the blades (the blow and direction and speed of wind in the area of location is usually taken care of) but because the pumps don't work. Either there is blockage or breakage in the pump or the worn-out washer is not replaced. Remote villagers have neither the money nor the knowledge to maintain windmills or bore pumps. Therefore, it is that millions of windmills all over the world stand like skeletons of dead giants.

The Energy Development Corporation of the Govt. of Tamil Nadu gives free windmills costing Rs. 20,000/- each to farmers. Scores of them can be seen along the sea shore to Mahabalipuram from Madras. An indepth investigation by this author reveals that almost all of them are defunct or most unproductive. Most of the blades go round and round without pumping water.

The Special Issue of the UNDP Centre on Small Energy Resources (No. 12 of Aug 1988) reports the performance of windmill pumps as under, based on the information provided by D. Lovejoy, Inter-regional Adviser, United Nations Department of Technical Cooperation for Development, USA.

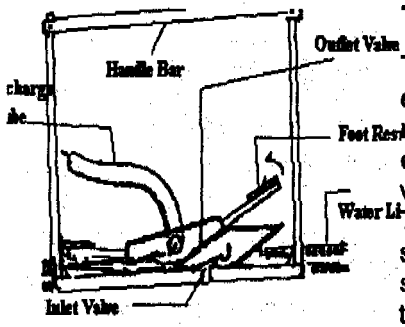
1. "Egypt - some 2000 windpumpers were installed in the 1960s along the Mediterranean Coast, West of Alexandria, mostly imported but with some local manufacture. They have been largely displaced by rural electrification".
2. "Kenya - Some hundreds of imported windpumpers were formerly in use".
3. "Mauritania - Many Windpumpers were installed in the past but most are no longer functioning".
4. "Morocco - Some 5000 equipments were installed from 1930 to 1960, mostly imported but with some local manufacturing. Most have fallen into disuse, being replaced by gasoline and diesel pumps".
5. "Nigeria - Some Windpumpers were formerly installed in the North but most have fallen into disuse".
6. "Senegal - Many machines were installed in the past but they have largely fallen into disuse".
7. "Somalia - With very favourable wind conditions, some 2000 imported machines were installed before 1940. They have virtually all ceased to function through lack of maintenance".
8. "Sudan - More than 100 windpumpers were installed in former times, although most have fallen into disuse".
9. "Tunisia - Some 1200 equipment were formerly installed. Most have fallen into disuse".

The report also reveals that it costs about US $ 5740 to install one windpump in a country like Cape Verde, out of which US $ 2240 are spent on imported parts.

The Ryan Foundation's comment is that the costly closed system of providing water to the Third World poor will just not work and this has been sufficiently explained in the booklet "Pumps Without Water" by this author. Ryan Foundation recommends only windlifters, i.e., canvas buckets lifting water from open wells, as explained in Handout No. 312. Windlifters are very cheap, trouble-free and very poor rural communities can maintain them without importing metal and machined parts from Europe or USA.

IRRI BELLOWS PUMP RYFO Handout 125

For irrigation, drainage, and other low lift applications



The Pump :

The foot pump is made of two canvas bellows reinforced with metal inserts. The entire unit, equipped with a handle for convenient carrying, weighs 20 kg. The design is rugged for long service and easy repair yet simple enough to be manufactured by small machine shops.

How it works :

The operator stands on the two foot-rests and shifts his weight from one foot to the other. This compresses a bellows, forcing water from the outlet valve. By alternately shifting his weight in a rhythmic manner, the operator pumps a continuous flow of water.

What it does :

This low-cost pump can lift 50 to 60 gallons of water per minute to a height of 1 to 2 metres.

The IRRI bellows pump is well-suited for pumping water from irrigation ditches, open channels, river banks, and shallow wells. Unlike most pumps, it can handle muddy water with small stones or other solid impurities.

It was developed at the Agricultural Engineering Department, International Rice Research Institute, Los Banos, Laguna, Philippines, under a research contract with the U.S. agency for International Development, Washington, D.C.

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AGRIFILM FRAME FLOATS RYFO Handout 316

In several regions in many Third Countries, one can see valleys besides mountains and mole-hills or low-lying catchment areas. During rainy season, water collects in these places but for want of conservation management, the water evaporates or drains into the soil. Potentialities are good in such areas to conserve and supply water to meet community needs. One good way of conserving water in ponds and catchment areas is to line the water basin (catchment area) with agrifilm. (For details, see Ryan Foundation Project Report). Another way is to dig a well 200 mts. deep and 20 mts. in diameter in the middle of the pond. Valleys and catchment areas usually have plenty of sub-soil water and wells dug in their basin usually do not go dry during summer.

The third way is to make wooden frames of the size 3 mts. x 3 mts. (may be tied out of dried casaurina, bamboo or eucalyptus poles), fix sheets of agrifilm on the frames (small nails may be used) and let many of these agriframes float on the water to prevent evaporation.

A fourth way is to dig small channels from a distance of 3 or 4 kms., all leading into the catchment area.

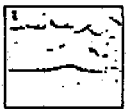
If all these arrangements are done and managed properly, there will always be water in the well in the middle of the valley and, from there, water may be lifted to overhead tanks by bucket lifters, as explained in Ryan Foundation report on conserving and using water by the use of agrifilm. What is explained above is an ideal way of building watersheds.

In a valley called Veerapalli in the Cuddapah district of Andhra Pradesh, India, where a thousand families live around the valley, one end of the valley has been deepened into a large pond and people fetch water from there. They have also sunk several bore wells and erected pump sets and find enough water for cultivation and human consumption.

The large scale manufacturer and supplier of agrifilm is the Indian Petrochemicals Corporation Ltd., Ralla Ram Building, 30 Mission Road, Bangalore - 560 027. In April 1988, the selling price of one tonne of Agrifilm was Rs. 38,500/- in roll form inclusive of taxes. For complete information about Agrifilm, see Ryan Foundation Report.

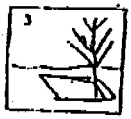
In places where agrifilm is not available, laminated woven sacks or used woven sacks in which cement, fertilizer, food grains, etc. are packed may be stitched together to make a carpet and spread out on the basin. The same sack carpets may be used also to make frame floats.

WATER TRAPS

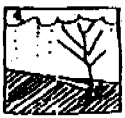


1. In regions where rain is scarce

2. There can be water enough for a tree but you have to catch the run-off of a large area.



3. you can do this by digging a large & shallow bowl & having the tree in its deepest spot.



4. The scarce rain collected in the bowl might suffice for your tree

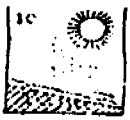
5. In regions where there is no rain there is some humidity in the air.

6. The moisture condenses on stones as dew during nights.

7. If you make a heap of stones on plastic sheets you can collect the dew.

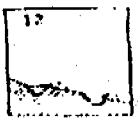
8. This can be easy if you dig a bowl and make your dew collecting device.

9. Rain water is good water but often it is difficult to keep it for a long time after rain fall.



10. A part of it seeps away. Another part evaporates and the rest flows to the river or sea.

11. You can stop rainwater by digging a hole where it runs off to the river.



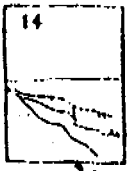
12. You can do such traps in a string one below the other which will fill up with rain water.

Reproduced with courtesy for mass communication by the RYAN FOUNDATION, INDIA

from Fritsche's ENERGY ALTERNATIVES, Ed. Sangles, Paris, 1982
Organization, APPROPRIATE TECHNOLOGY FOR HEALTH & WATER
Spring-Summer 1984, 00-10-11

(continuation of handout 345) RF Handout No 346

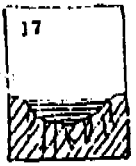
13. You can trap water by building a small dam in a creek.



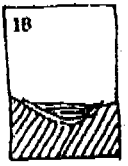
14. You can choose a site for the dam where the creek is narrow.

15. And when the water runs down the creek, you will have a basin up stream.

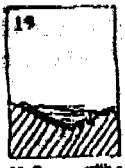
16. You can do as well a series of such dams creating a series of basins.



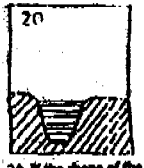
17. If you store the collected rain water often the water seeps away into the soil.



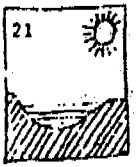
18. Against seepage you can line the burrow of the pond with plastic rolls.



19. Or even with a thick layer of clay.

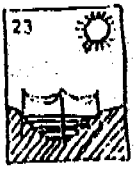


20. If the shape of the pond is half of a sphere, the seeping surface can be kept as small as possible.

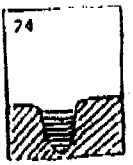


21. Under the sun your water tries to evaporate fast.

22. If you keep in shade of plants the water seepage will slow down to evaporation.



23. You can create shadow on the water by mats fixed on poles too.



24. If your pond is deep and narrow, the evaporating surface is less and so is evaporation.

From Friedman's ENERGY ALTERNATIVES, ED. Dangles, Paris, 1982. Source: World Health Organization, APPROPRIATE TECHNOLOGY FOR HEALTH & WATER Spring-Summer 1984, 00-10-11

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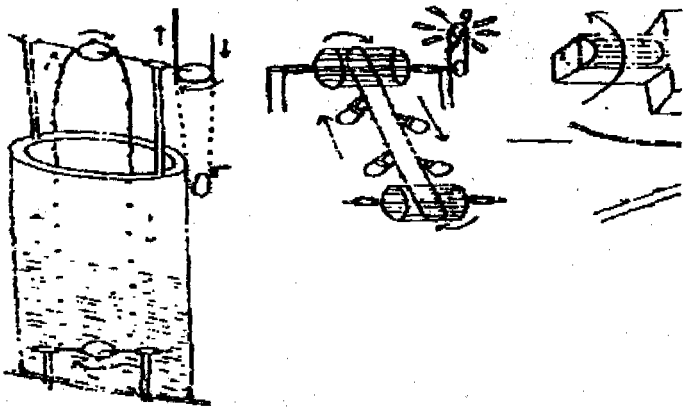
RYFO WATER LIFT

RYFO Handout 312



RYFO water lift is a simple and easy-to-maintain village mechanism to lift water from open wells, tanks and ponds on to over-head tanks. A windlass is fixed at the bottom of the well and another 3 mts. above the wall of the well on pillars, as shown in diagram one. Position and fixing arrangement of windlass is shown in diagram 2. The axles of both are 3 cm. in diameter and pass through bush bearings. The top axle attached to a pulley is connected to a windmill, as shown in diagram 2.

A long fibre rope with several knots made in it with gaps of 30 cms. between knots is passed round the windlass, as shown in diagrams 1 and 2. Ten leak-proof canvas or car tube bag buckets, each having two handles (flaps), are tied to the knots at equal distances. The tail of the T-shaped water tank (diagram 3) projects over the well and under the top windlass. When the top axle turns by wind, water fills the tank. A vertical pipe brings water to the ground and a 'L' joint leads it into a horizontal pipe laid flat on the ground. From the nipples of this pipe, flexible hose pipes take water to convenient locations. By folding the delivery end of the hose pipe, the flow of water is stopped.

A small pulley attached to the top pulley, which is bigger in size, is connected with a thin knotted rope to a pulley on the wall of the well with a turning handle to be used when the mill does not move by wind.

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SEA WATER FOR LIVELIHOOD
RYFO Handout 379

In many Third Countries, want of water is the problem for initiating development. Coastal villages 20 to 30 kms. from the sea may exploit sea water for their livelihood activities by leading sea water into their villages with the help of 2 or 3 inch flexible PVC pipes like the garden hose or bamboo poles or by digging narrow channels and creating an artificial pond or lake in the village. If an open channel is cut, there must be lock and sluice arrangement to regulate and control the flow of water or else the village will be marooned and lives will be lost. Flow through flexible tubes will be easy, practical, more economical and convenient to manage and maintain. By folding the outlet end of the tube or lifting the flowing end one foot above the sea level, the flow can be stopped and even a child or illiterate woman can stop the flow. By this system, water can be taken from one village to another.

When sea water ponds or lakes are made available in the midst of rural settlements, several activities become possible. Solar stills may be built to convert the water into potable water and the hundreds of plants and trees that have been identified to be growing well in saline soil and sea water may be introduced and cultivated. Some such plants and trees are : Allanthus (botanical -Allanthus excelstia); salt bushes such as Atripoliex Nummularia; sea water plants botanically known as Zostera Marina which grow fully submerged in sea water. (The grains which float to the shore are edible). Mangroves, Casaurina, Accacia, Palmyrah, the dry zone wonder tree called Prosopis Juliflora, Pongamia Glabra (Karanj in Hindi) which gives rich oil used in soaps and medicines etc. can all be promoted.

When sea water ponds or lakes with regular inflow and outflow of water are available, people will take to fishing and rearing crabs and turtles and growing sea weeds for making agar agar and preparing rabbit feed (rabbits and their by-products can give millions of jobs and food for billions of people. See author's book on rabbits). All water-based raw materials can be exploited in one way or the other for processing and manufacturing industries and generating employment. For instance, if plenty of fish is available, besides eating fresh fish, people can dry, smoke and preserve fish and also make fish meal by the village method, explained by the

Ryan Foundation. Fish-oil, chicken and cattle feed and fertilizers out of the non-edible fish can also be made.

Inexpensive village community-scale desalination plants may be built to provide drinking water for kitchen use and domestic gardens (Handout 198).

When sea water is allowed to flow into waste lands in certain soils, over a period of time they lose their salinity or atleast salinity is reduced and certain types of crops and trees can be cultivated and mangroves may be promoted. Water is the most basic necessity of life and it is getting more and more scarce in most parts of the world. Coastal villages must exploit this God-given natural and renewable resource, the sea water, for their livelihood and survival. For a detailed explanation of various ways of using sea water for survival, see booklet, "Pumps Without Water" by the author.

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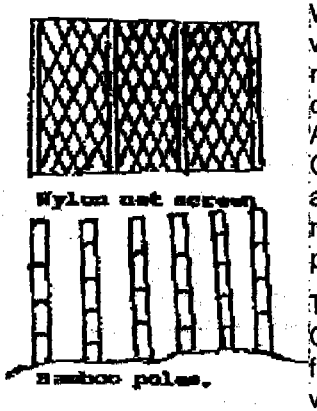
TRAPPING MIST FOR DRINKING WATER
RYFO Handout 506



When the cold sea currents meet the warm land mass, fog is formed. In many parts of the world, particularly on the South West Coast of South America, and more particularly in Chile, the conditions that produce fog are almost constant year round. The method of trapping the mist is explained below.

The poor and dirty Chilean village, Chungungo, with 300 inhabitants, all fisherfolk, is the only place in the world where the supply of drinking water is harvested from the fog floating over the mountain top of El Tofo at an altitude of 400 to 1200 metres.

78 nylon mesh nets are tied to 5 or 6 parallel poles or pillars, each about 6 metres high, to trap the floating mist and harvest drops of water. Each square metre of the net traps about 35 litres of water and the average annual yield has been 10,580 litres a day. The project was inaugurated on May 15, 1992 and since then, each home connected to the system is providing about 120 litres of water every day.

As the water collects on the net, droplets join together forming streaks of water which is collected in gutters or troughs beneath the panel soreen and led to the central storage tank.The system relies totally on gravity and no energy or man power is used. Since the tank is high up in the mountain, water flows down to the village and from a receiving tank at a lower level, rubber hose pipes (garden hose) or bamboo poles can lead the water into the homes and no metal or tap connections are necessary. (It is not known if house-to-house connections have been given so far but it is easy to do so as suggested).

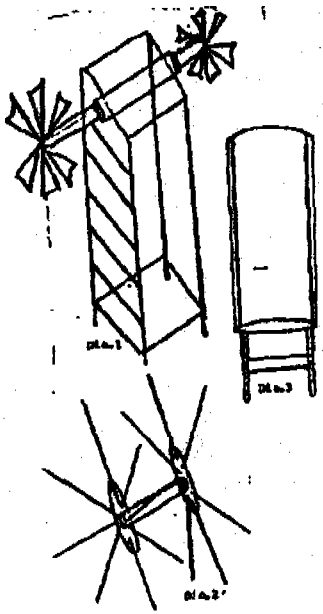
The ropes used to make the nets may be about 3 to 5 cm. thick. (Nets made of broad ropes trap more mist but they are heavy to transport and handle). The design of the net is shown in the diagram. Where nylon ropes or nets are not available, fibre nets may be made and coated with tar (bitumen). In the net, knots must be avoided and the cross joints must be tied with twine, strong thread or sisal fibre which gains strength as it soaks in water.

If the wind is not forcible in the area, bamboo poles, slit lengthwise into two halves, may be planted in a row like pillars to trap the mist, as shown in the diagram. There should be a gap of about 30 cm. between the poles so that strong winds do not uproot them but enter inbetween the poles.

Another way of trapping mist is by planting two poles like pillars and tying a rope, top to top, like linen lines, and hanging strips of automobile tubes from the rope. The strips (ribbons) must be straight, about one metre long and six cm. broad. The tank below may be 15 cm. deep but broad enough to receive the droplets from the rubber ribbons which may be fluttering in the wind. Whichever side they rise in the wind, the water drops must fall into the receiving tank.

Only 3 percent of world's water is fresh water and less than one percent is accessible. The fog water collection system does not involve large capital and local communities can erect them out of contributed funds. The water trapped as explained is healthy and need not be boiled. Maintenance is easy and inexpensive.

RYAN FOUNDATION WIND MILL
RYFO Handout 410



The traditional windmills attached to bore pumps have failed all over the world (see Handout 337). Reasons for failure have been explained in the Ryan Foundation booklet, "Pumps Without Water" and "Agrifilm for better Storage and Use of water". Nevertheless, wind power has to be harnessed for energy and Ryan Foundation recommends the trouble-free open-ground system where the maintenance can be done by villagers without training or expenditure.

A rural wind-mill must be built of poles and canvas with minimum of metal parts for the axle and the ribs to fix the sails. Parts may be of galvanised iron (water pipes) of 5 cm. diameter and the metal axle rod of 4¾ cm. in diameter. Two large metal spools with welded arms on either ends of the axle are also necessary. Diagram 2 shows construction of metal parts (spools with arms) on one side of the axle rod. Two similar units are required like what is shown in diagram 2. Alternatively, axle may be mounted on two brick pillars.

Discs on either side of each spool should be as big as a long-playing gramaphone record made of 12 gauge metal sheet. One cm. diameter arms (ribs) may be welded to them in parallel position as shown. HDPP woven cloth of the type used for packing cement, fertilizers or food grains may be stitched like pillow cases and put like a case between two parallel arms as shown in diagram 3 and tied or stitched to stay in position.

Water lifting arrangements from open wells and tanks are explained in Handout 312. The axle need not revolve to take the direction of the wind but the pole structure should be so built that one end of the axle points to the South and the other to the North.

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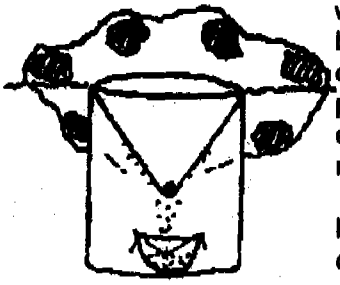
DRINKING WATER FROM NOWHERE
RYFO Handout 418



Wherever human beings live, some water can be produced from the earth but the quantity obtained will depend on the soil, the climate and the atmospheric air. Water can be produced even in the middle of deserts by the method explained here.

In a Third World village, a pit of one cubic metre is enough to produce a cup of water but in a desert a pit of the same size will give only about an ounce of water because there is less water in the atmospheric air in a desert.

All that is required is a bowl or basin to be placed in the middle of the pit and a thin transparent plastic sheet as big as a bed sheet. The sheet is spread to cover the pit and then stones (weights) are put all around the pit on the sheet to hold it. Before the sheet is stretched, the middle portion of it should be made to sag into the middle of the pit. This is easily done by placing a stone in the middle of the sheet as shown. Sand or dug-out earth may be heaped all around the pit on the plastic sheet to close gaps and prevent outside air entering the pit.

During night, the hot air inside the pit hits the plastic sheet shaped like a funnel and the cool atmospheric air of the night above the plastic sheet, and the moisture in the air inside the pit condenses and drips into the basin.

If the soil is wet, more condensed water can be obtained. On the banks or bunds of sea-water canals and channels, the poor can have enough and more water for family consumption and this water obtained by condensation need not be boiled. Thus, there will be saving on fuel-wood or cooking fuel. Therefore, sea waterways, canals and channels must be led into drought-ridden areas to give water for people to survive. For taste, they may mix a little of salt, herbal essence, Basil or cummin seeds.

If sea water is made available in a village, several families will cultivate kitchen gardens and they can be taught to process and preserve fruits and vegetables. Live stock and by-products based on vegetation can be promoted to generate employment for the people. Fish and fish products can also be developed and sea water plants and saline soil trees may be introduced.

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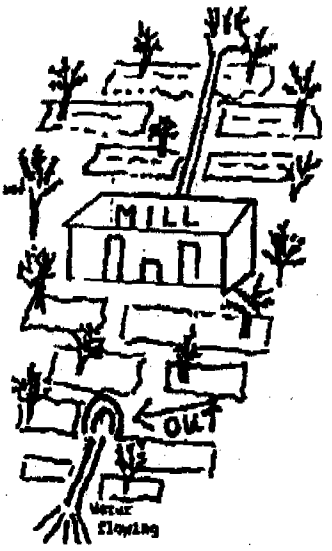
MICRO HYDRO-POWER RYFO Handout 424



People of Nepal have made a mark in the world for deriving motor power for turning various machines to meet domestic needs. Most of the Micro hydro-power units of Nepal are owned and managed by individual villagers in their neighbourhood. People use water-powered mills to hull rice, press oil seeds, grind flour and even to operate a band saw in some places. The journal Hydronet from Germany, dated March 1989, reported that atleast 600 such hydro-powered water wheels were in existence in Nepal in 1989 and indicated that they were getting more and more popular.

Water to turn the turbine is diverted from a streamlet or rivulet by piling a row of rocks or poles to make a barrier. The diverted water is led into a pipe to flow on the turbine. A simple hut or shed is built around the turbine to call it a mill. The water filling the pit below the turbine inside the hut is led to a lower level through a gutter as shown in the diagram and out into the open to join other rivulets or to form new streamlets, take its course and flow away.

Cost of a micro hydro power unit depends on the length of the lead-pipe, the size of the turbine, the number and size of machines attached and the installation of additional attachments such as generators, bandsaws or grinding wheels.

Water wheels/generators can be erected on slopes of mole hills, slopes of lake or pond bunds or catchment areas. A distance of three metres between the water level and the bottom level of the receiving slope or pit is adequate to make the system work efficiently. If depth is not adequate, the length of the lead may be increased so that the water flowing through it gains force.

- On the spot investigation by the author.

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SURPRISES FROM SALT WATER

RYFO Handout 403

Courtesy - DEVELOPMENT FORUM 5 : (Jan-Feb 1990)

Today, thirsty plants are not only drinking, but thriving on seawater at an experimental farm near the Israeli town of Ashkelon on the Mediterranean Sea.

The seawater-irrigated plants, which have been proven nutritious as well as edible for sheep and camels, are the first of many which Dr. Dov Pasternak, the head of the project, hopes to grow on water from the sea.

"I am trying to make people see that salt is beautiful", says Dr. Pasternak, head of the Boyko Institute for Agriculture and Applied Biology of the Ben Gurion University. Dr. Pasternak oversees studies of 150 species of plants irrigated by seawater. So far, he and his team of five scientists have screened 20 species for salt tolerance.

"We are concentrating on the raising of plants for fodder", he explains, carrying out nutritional studies of animals to see if these plants are suitable for them. One salt bush Buja of California for example, successfully grown in salt marshes, has been found to be palatable to both sheep and camels.

The team is also giving its attention to grains, oil and medicinal plants. Ornamental plants are already growing on saline water in gardens near the ultra-salty Dead Sea and the port city of Eilat on the Red Sea.

Dr. Pasternak says that the Universities of Arizona and Delaware in the US are carrying out similar experiments; the University of Delaware is concentrating on grain and fodder, while scientists at Arizona are interested in oil plants.

The research into seawater for irrigation is directly related to the successful efforts of Dr. Samuel Mendlinger, also from the Boyko Institute, to produce a special strain of sweet, high quality autumn melon grown on brackish water using drip and sprinkler irrigation.

"Stress induces sweetness", explains Dr. Pasternak, obviously referring to fruits and vegetables. But, he adds, like people, each plant possesses a personality and has individual needs. Some young plants are sensitive and must be irrigated with fresh water at an early stage; others get sensitive to salt as they mature.

Other fruits and vegetables being successfully irrigated by saline water from underground acquifers, commonly found in many desert areas, are asparagus broccoli, sorghum, olives, pears and pomegranates.

Dr. Pasternak believes that the growing of field crops from salty water is the key to the future of desert agriculture and he points out that cotton has so taken to salt water that its yield has been increased by 20 per cent.

A major effort is also being invested in the development of salt tolerant medicinal plants, like the evening primrose, and the buffalo gourd for starch production. The cashew, jujube, papaya, jack fruit tree and some cactus species are among lesser known fruits which are the concern of a long-term project being carried out at the Boyko Institute aimed at the selection and development of a wide range of subtropical high quality fruits.

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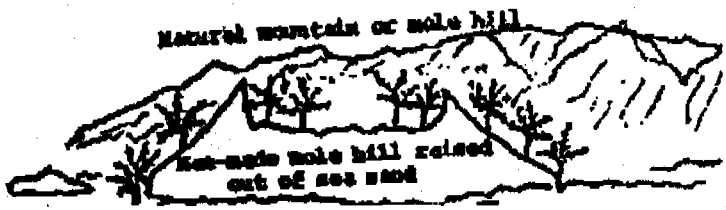
MOLE-HILL CATCHMENT PONDS - A CONCEPT
RYFO Handout 553

Picture shows a man-made mole hill raised out of the sea sand brought into the land by pipes to flush inland dry rivers and rivulets, streams, canals and nullas, for inland navigation, saline agriculture and desalination, as explained in Ryan Foundation booklet "Survival By Sea Water" (call for action) which was part of UN Secretariat document for the UNCED Summit.

In the picture, the sand heap is made against an existing natural mole hill forming a basin inbetween. Such basins are excellent for creating rain water catchment areas and storing water for regulated supply during summer.



Broken clay bricks, stones and pebbles available nearby may be mixed to make the mole hill strong and firm and vetriver, cactus, casuarina, mopane, acasia holisercia etc. may be planted initially to prevent land sliding. After 2 or 3 monsoon rains, the salinity of the top soil will fall.

Now and again sea shells may be roasted, powdered and sprinkled on the mole hill for soil binding and to make the soil alkaline. The mole-hill may be raised to a height of 1000 feet and the basin that is formed may be dug to a depth of 50 feet. The earth (soil) removed by the digging may also be thrown to raise the mole hill. The area of the basin (catchment area) made by the mole hill may be one to two square kilometers. A sea water canal of 4 mt. width and 4 mt. depth may be dug all around the mole hill and the sand removed to make the canal may also be used to raise the mole hill. On the slopes of the inner side of the basin, eucalyptus and casuarina poles may be laid in parallel rows for soil consolidation and reinforcement.

PVC pipes, hose pipes or bamboos, may take the water down to homes in the surrounding areas and the rain water need not be treated. When rain water is thus stored and released, fresh water agriculture and kitchen garderns will come up. Farm yard birds and animals may be kept and people will have good water to wash, keep clean and healthy. Most of the diseases in the world today are due to non-availability of water and water-borne diseases. With the availability of sufficient water, income generation activities may be started based on appropriate technology and raw materials available from plants, trees, birds and farm yard animals. (This author has a book entitled "Plants and Trees that Generate Employment" which explains hundreds of rural enterprises based on organic raw materials). Also, fresh water fish, the Pink Thilapia, in particular, may be introduced in the rain water pond and sea water fish commonly called "Milk fish" (chanos chanos), in the sea water canal surrounding the mole hill. After the fish are harvested and eaten, out of the unwanted parts of the fish and dead and non-edible fish in the catch, chicken feed, fertilizers, table gum etc. may be made for urban markets.

This module of converting waste land into water sheds may be tried to meet demand for food, water and social forestry.

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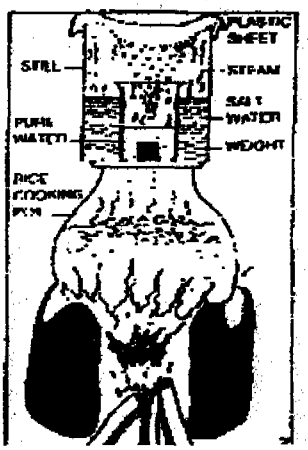
LOW-COST DESALINATION RYFO Handout 655

(Reproduced from the Hindu, dated 1.12.1993)



"A simple, inexpensive method to desalinate sea water at home, using just two pots and a plastic sheet has been suggested by Dr. Felix Ryan, former United Nations adviser and environmentalist from Madras.

The technique uses the principles of evaporation and condensation to get potable water from salt water. Two pots - any kitchen utensil is suitable - are taken, one pot four times the size of the other. The smaller pot is put inside the larger one and weighed down with a stone.

Sea water is then poured into the outer container upto the brim of the inner one. The contraption is closed using a plastic sheet and string, so that the sheet sags in the middle. The "still" is then placed on any heat source like a stove or a wood fire, at low temperature. In a few minutes, the water in the container evaporates. As the plastic prevents its escape, the droplets condense into the smaller vessel. Residual salt is left behind in the other container.

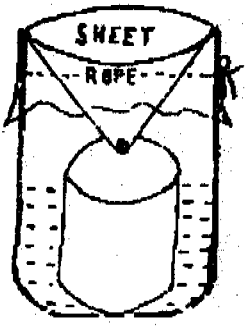
Demonstrating the device, Dr. Ryan said if some cold sea water was poured on the plastic sheet, the whole process could be speeded up. The required heat being low, the "still" could be left in the open, using solar energy. Only, it would take the whole day. To save fuel, the containers could be placed on top of the rice pot which is used everyday. As the pot boils, the waste heat is harnessed usefully, says Dr. Ryan.

Field tests have shown that a pot of rice for four people yields three glasses of safe water from three and a half glasses of sea water, Dr. Ryan says". - OUR SCIENCE CORRESPONDENT.

RYFO DOMESTIC STILL RYFO Handout 584

(The same method explained further)

Requirements :



1. One large tub or bucket, preferably, made of metal and roughly 40 cm. deep and 40 cm. in top diameter.
2. One small tub or bucket of the size 20 cm. x 20 cm. (top diameter). (Many homes will have containers about this size to suit the purpose).
3. A thin transparent plastic cloth of the size 80 cm. x 80 cm. (bits may be heat sealed to get the required size).
4. Sea water or brackish water.

Method : The small container is placed inside the big one and the water poured into the big container upto the brim of the small container. A weight is placed inside the small container to prevent it from lifting due to buoyancy. The plastic sheet is spread over the buckets (setting) and the middle portion of the sheet depressed to make the sheet sag like a funnel in the middle above the small bucket as shown in the diagram. The funnel should not touch the small bucket. When the plastic sheet takes the shape of a funnel or an inverted cone, the ends of the sheet are pressed against the big container and a rope or ribbon is tied round the top end (rim) of the big container to hold the plastic sheet in that position.

The setting is done under the open sun in the morning and left there throughout the day. The water in the larger container vaporises and in the night when the atmosphere cools down, it condenses, rolls down along the outer side of the funnel and fills the small container placed inside the big container. Every morning, the condensed water is removed and the still reset with more water.

The condensed water need not be boiled. A pinch of sugar, salt, or a drop of some herbal essence may be added to the condensed water for taste and flavour. Cummin seed, basil leaf (thulasi), curry leaf, etc. may also be added.

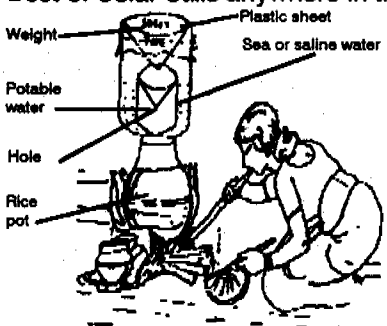
In countries where the sun does not shine to vaporise and condense water, the following is done:

1. The sea water or brackish water is brought almost to a boiling point and poured into the still to cool and condense, (or),
2. The still is set on three stones and fuelled underneath as campers do to prepare food, (or),
3. A portable electric room heater is reflected on the still to heat the water (or)
4. All the methods explained above are combined.
5. After setting the still as shown, it is put on top of the rice pot set on the stove to boil, (in the place of a lid). The steaming water in the pot evaporates and condenses the sea water into the small container. In about 30 minutes, about 3 glasses of water are collected. More cooking, more water. If you put the still straight away on the fire without the rice pot, there is more evaporation and more condensation in a quicker time. Direct heating on a stove consumes cooking fuel. Home made foliage briquettes may be used.

RYFO RICE POT STILL — RYFO Handout 667

(Same principle, different style)

Best of Solar Stills anywhere in the world take a long time to yield a small quantity of water. And if rows of them are built to get more water, the project becomes centralised, the cost goes up, and maintenance becomes difficult and expensive.



After innovating different designs of solar stills and field testing them, Ryan Foundation concludes that Solar-cum-Thermal Stills, utilizing waste energy (heat), from kitchen stoves or factory

boilers are the most productive, economical and suitable for the poorest of the poor. The Foundation believes that centralising a desalination plant and trying to distribute water to thousands of homes and villages scattered far and wide is not only expensive but also troublesome and the agency behind such centralised water distribution takes bribes which is a common practice in Third World Countries.. Therefore, the Foundation strongly advocates house-to-house desalination of sea water. RYFO Domestic Still (Handout 584) satisfies this need very well and it is being used in homes and villages in several countries. However, stove or boiler energy, in one form or the other, is needed to operate a RYFO Domestic still effectively.

The RYFO Pot Still showed in the diagram here avoids additional cooking energy but utillizes the heat escaping from cooking vessels on the flaming oven. RYFO Domestic still (Handout 584) is simply to be mounted on top of the rice pot on the boil. In other words, the bottom of the still is used as the lid for the pot boiling the rice. The steam coming out of the pot heats the sea water, evaporates and condenses it.

When cold water is filled into the funnel-shaped plastic sheet, the condensation is quick and more. As the water in the funnel gets warm, 2 or 3 cups of water may be removed from it and cold water added to it. Only if the funnel water is cold, condensation will take place quickly. With ice, the condensation is immediate.

While cooking the rice, the Still may be lifted and put down to check if the rice has boiled and put back on top of the pot. Removing and replacing the Still this way does not reduce condensation but frequent lifting must be avoided.

Field tests have proved that a pot of rice for 4 people, if cooked for 30 minutes, yields 3 tumblers of safe water. If 3 dishes are cooked, the yield will be about 9 glasses. If more water is required, the Still must be put directly on the stove without the cooking pot inbetween. The Still may be placed also on top of the glass in the middle of a solar box cooker. There is only a marginal reduction of yield on a solar box. Field tests are most encouraging. For more information, see RYFO Handout 668.

Drinking water is no problem provided Governments make sea water available for the poor in man-made sea water canals as Water explained in Ryan Foundation booklet, "SURVIVAL BY SEA WATER'.

RYFO RICE POT STILL (OBSERVATIONS)
RYFO Handout 668

Gives best results when:-

1. The size of the still (bigger vessel, ie, the one into which sea or saline water is poured) is 30 cm. high and 20 cm. in diameter.
2. The bigger vessel is made of aluminium or stainless steel. (Aluminium is slightly better, lighter and cheaper).
3. Both the vessels are painted black except for the inner side of the small one.
4. Only a little sea water is poured in. For Eg: to get 4 glasses of good water only 4 1/2 glasses of sea water must be poured and to get 5 glasses, 5 1/1 glasses of sea water must be poured. Too much water takes more time to get heated for evaporation.
5. Flaming fire is used and the water must boil with a noise.
6. The small vessel is mounted on a flat stone or building block so that the already condensed water in it does not get heated and evaporates again. Heat on the small vessel gives less yield. If the small vessel is closed with a saucer-like lid with 3 or 4 holes, the yield will be better.
7. The plastic sheet takes the shape of a funnel - folds in it help the water beads to roll down the folds and drip into the small vessel through the lid.
8. Cold water is filled into the "V" shaped funnel. Ice water gives excellent and immediate results.
9. Cold water that gets warm is removed by a cup and replaced with fresh cold water.
10. It is better to have more stills when more water is required and not to increase the size of the still.

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RYFO DOMESTIC STILL (Observations)

RYFO Domestic still gives best results when:-

1. The big drum is of the size 45 cm. x 45 cm.
2. The small drum is of the size 30 cm. x 30 cm.
3. Placed under a tree on 4 flat stones (bricks or building blocks) 15 cm. above ground level.
4. Both the drums are painted black excepting the inside of the small drum.
5. 18 or 20 mm. galvanised sheets or mild steel sheets are used to make the drums (galvanised sheets are costlier).
6. A readily available full-size empty petroleum drum is used.
7. When the plastic sheet takes the shape of a funnel - folds in the sheet help the water drops drip fast.
8. When 3 buckets of condensed water is required, only 3½ buckets of sea water is poured.
9. It is better to have more drums when more water is required and not to increase the size of the drums. Alternatively, condensation process may be repeated 3 or 4 times.
10. Thin high density Polythene sheet is used.
11. When the water is allowed to boil with the boiling sound for 2 hrs and allowed to cool and condense over night.

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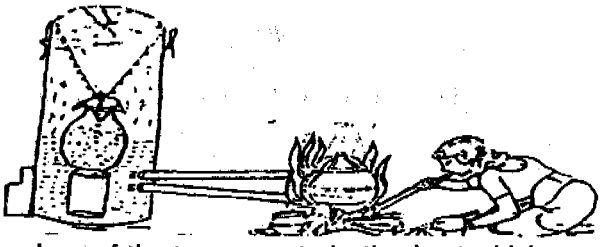
THERMAL-CUM-SOLAR STILL (Domestic model) RYFO Handout 629

If the tank is built out of self-made RYFO mortar (adobe bricks and plaster), only the two pipes and the plastic sheet will have to be purchased and the whole construction will cost about Indian Rs.100 or US $ 4/- and everyday, the family can have a full pot of about 20 litres of water for drinking and cooking.

Dimensions

1. Height of tank 150 cms. Diameter - 100 cms.
2. Height of pillar inside the tank - 30 cms.
3. Diameter of pillar - 15 cms.
4. Height of pot about 30 cms. (may be village mud pot).
5. Depth of inverted plastic cone from the circular top-90 cms.
6. Depth of sea or saline water inside the tank - 50 cms.



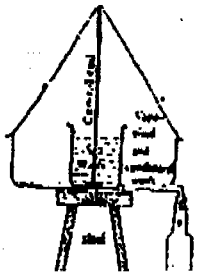
7. Dimensions of the transparent plastic sheet which covers the opening of the tank - about 150 cm. x 150 cm. (bits may be welded together).
8. Height of steps 80 to 90 cms.
9. The two metal water pipes resting on the stove (may be fuel wood stove) at one end, going into the tank at the other end, may be one or half-inch thick and the length depends on the distance between the stove and the still (say 200 cms.).
10. Cement should not be used to build the tank as it will put up the cost but RYFO Mortar should be used. (See RYAN Foundation Booklet on mortar).
11. A large size oil drum if available may be used and the water pipes may be welded to it.
12. Cotton or fibre rope may be used to tie the sheet. The still must be out in the open and every hut can have a still.

Explanation :-

The two metal pipes run parallel to the ground. Height of the stove and the still are adjusted (built) accordingly. When a woman cooks her daily meal in her hut, the water in the pipes gets heated and transmits the heat to the water in the tank. Rays of the sun also heat the water. The water evaporates during the day time, hits the plastic sheet and gets condensed during night because the night air outside is cold. The "V"-shaped plastic sheet above the pot is filled with cold sea or saline water. Water particles (beads) trickle down the inverted cone and drip into the pot during night and every morning before the sun comes up, the sheet is removed, the pot of condensed water taken out and the still reset. If the day temperature is 30 to 35 degrees celcius and a woman cooks for about two hours, the output of drinking water is about ten litres. Longer cooking gives more water. Outside of the big tank must be painted black. Tar or bitumen may be used. A solar box cooker or cookers may be attached to transmit more heat into the tank and to get more drinking water. Governments should make sea water available to people to solve drinking water problem.

RYAN FOUNDATION STILL (Table model)
RYFO Handout 391

Instructions for construction



- Take a large flat basin or tray-like vessel 60 cm. in diameter. It may be made of mud, metal or plastic but nothing like having it in aluminium which will not rust. If made of mud or plastic, use small mirrors or plain glass sheets at the bottom of the basin and some pieces to line the side wall. Fix a small outlet pipe or tube at the bottom of the basin as shown.

- Place a slightly smaller basin (about 30 cms. in diameter) inside the big vessel but this vessel must be longish (deep) so that it can hold more sea or saline water. If not made of metal, this may also be lined with suitable pieces of glass or mirror.
- Place a wooden, non-corrosive or painted metal stand fixed to a base-plate in the middle of the smaller basin as shown. Length/height of stand may be 60 cms. and one cm. thick.
- Take a thin circular transparent polythene sheet two metres in diameter and put it on top of the stand which will have a nob or ring on top and allow the sheet to fall like a cone into the bigger basin touching the side wall uniformly.
- Place a ring inside the cone and tuck the sheet (bottom of the cone) under the ring to close all gaps and air getting into the cone.
- Paint the outside of the big basin and both sides of the small container black as black colour absorbs heat faster.
- Before setting the still thus, fill the middle container with sea or saline water. Place the still on a stool or elevated place in the open sun and connect a rubber or plastic tube to load the condensed water into a bottle as shown. To prevent air entering in, place the other ring (59 cms. in diameter) outside the cone to sit on top of the ring inside the cone. The two rings should be of the same size.

- Water from the small basin will evaporate, hit the plastic cone, get condensed and drip into the big basin and flow into the receiver.
- One still is enough to give pure water for a small family which need not be boiled. Two buckets of sea water will give nearly one bucket of pure water in about 2 days. This system works well in desert areas where the author worked.
- Diameter of the big basin may be 60 cms. and that of the small may be 50 cms. Height of the big basin may be 15 cms. and that of the small may be 30 cms. Diameter of the outlet pipe may be 3 metres. This may be a metal pipe welded to the basin or a plastic tube drawn through a hole made in the basin.

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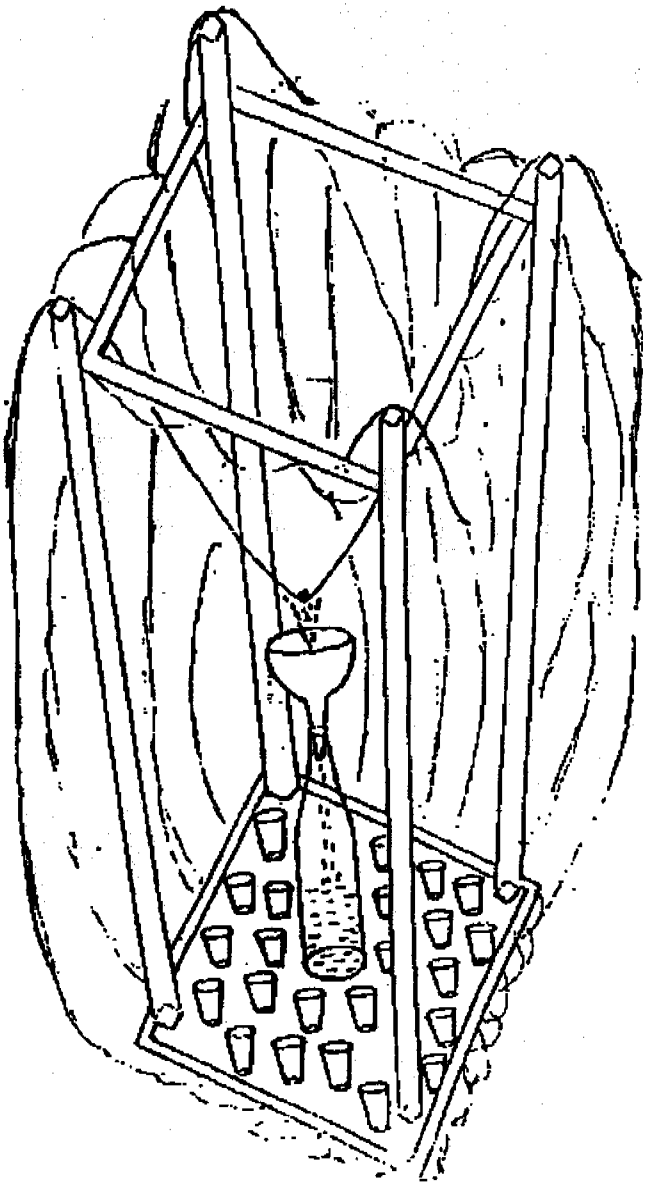
RYFO STOOL STILL RYFO Handout 530

In the pamphlet on "Simple Stills" (Ryan Foundation Do-it-Yourself Series No.20), the construction of a domestic still and the construction of a pit still are explained in detail with diagrams. A more recent innovation of the Foundation called the "RYFO Stool Still" is also simple, low-cost and easy to assemble by village women. The principle is the same as those explained in the pamphlet.

The materials required to assemble a stool still is a big stool, 3 mts. of transparent polythene (plastic) sheet and a dozen or more glass tumblers. The stool is inverted and glass tumblers filled with sea or saline water are arranged as shown in the diagram. A two-metre bit of Poly sheet is wrapped round the 4 legs of the stool like wrapping a bath towel around the hip of a man and tied to stay (like a belt round the hip). Then, a one metre bit of poly sheet is spread on the 4 legs of the stool and allowed to sag in the middle to take the form of a funnel or inverted cone. It is tied to stay in that position. Care must be taken to ensure that there is no hole or opening anywhere for air to enter the stool. When the sun shines, the rays penetrate not only from the top but also through the sides of the stool and the glass tumblers. Thus, the evaporation and condensation is much quicker and the still is more productive than the domestic or the pit still. The condensed water fills the bottle kept in the middle as shown in the diagram. Every morning only the top poly sheet may be removed to take the bottle out and the still reset with the tumblers filled again. A single sheet, big as a bed-sheet used as a wrap and sag in the middle gives excellent results.



In cold countries, where the sun does not give enough heat, a metal stool and metal tumblers may be used and the plate of the stool put on a stove with low fire.

The four sides of the stool may be blocked also with glass sheets used for framing pictures. Glass sheets may be framed and the frames screwed on to the stool with proper packing to prevent air leakage.

Under bright sun, 15 glasses of sea water filled in the morning give 5 glasses of drinking water the next morning. If more water is needed more stools must be set. About six stools will be adequate to provide water for a small family.

Without the bottle and the glass tumblers the setting may also be used to dry grains free from pests and dust and also to dehydrate vegetables, flesh, fish or mushrooms. It is an excellent device for drying and dehydrating food stuffs in rural areas free of contamination.

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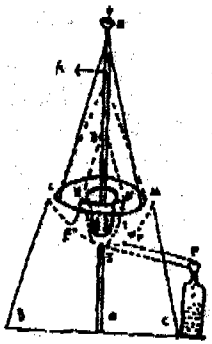
RYFO CLAY STILL

This is not as complicated as it looks in the diagram. Even an aborigine can see a model functioning and build one for herself or himself without any help. Every poor hut all over the world can build one in the frontage or backyard to convert the sea or saline water into drinking water.



Materials required

1. About 100 kgs. of clay. (If clay is not available, mix earth with other materials and make clay as explained in RYFO Handout 110. Alternatively, prepare mortar mixture as explained in Handout 270).

2. One and a half metre long bamboo of 6 to 10 cm. diameter. It must be like a pipe without blocks in the middle.

3. Another bamboo pipe of the same length almost but 3 to 6 cm. diameter (smaller diameter).

4. A large empty glass bottle, preferably colourless.

5. 4 to 5 metres of thin colourless transparent polythene (plastic) sheet. (Used cement, fertilizer or milk powder bags may be opened out and heat welded into sheets and used for lining the clay basins. The bags used must be laminated bags and usually they are). Instead of lining the clay basins with such plastic sheets, they may be painted with RYFO glaze paint to prevent seepage.

How to Construct

1. Build a clay or mortar-mix cone (ABC in diagram).

2. Before it dries, cut half the cone with a big knife at LM and discard portion ALM.

3. Make (scoop) cavity (bowl) like LFJEM as deep as point J and make the diameter of the bowl as long as possible without weakening the side wall of the bowl.

4. Before the bowl dries, drive the big bamboo pipe 'ON' in the middle upto point ' O ' as shown. The bamboo should have one centimetre perforations above ' J ' to a length of 10 cms. and completely blocked at J. Before the bowl dries, drive the bamboo JP also in position.

5. Line the inside of the bowl with the plastic sheet cut to size. Tree gum, fish gum, tamarind seed or cluster bean gum may be used for pasting. (For fish gum see RYFO Handout 501). Build small cone EDF in the middle of the big bowl, cut it into half and make bowl HJK as shown. The height of this narrow bowl should be about the same as the big bowl and the gap between the circular side walls of the two basins should be only 10 to 15 cms.

6. Cut transparent plastic sheet into a round piece of one and a half diameter. For joining bits if necessary heat seal. If it is hard to find thin plastic sheets in villages, opaque or transparent, to line the basins as already explained, paint the basins with village-made "RYFO paint for glaze effect".

For details regarding glaze paint see page 3 in the Ryan Foundation booklet on "Do-It-Yourself Rural Toilets". Add some charcoal powdered to fine mesh to the paint to make it pitch black. Black container quickens evaporation.

7. Fold and stitch or heat seal the border end of the transparent plastic sheet like the ends of a handkerchief but the folding should be 5 to 6 cms. broad to be loaded (inserted) with weights and closed. The weights may be pebbles or stones.

8. Place the central point of the circular transparent sheet at point 'N' and tuck the hanging circumference around LM into the bigger bowl.

9. When in position, the sheet going into the big bowl should not touch the small bowl. This is very important.

10. To prevent air getting in, pack clay between the big bowl and the sheet all around or pack with cotton or rags.

11. Make a small hole in the plastic sheet at point 'N' and insert a small funnel as shown and always keep the hole in this funnel closed with a piece of cloth or cotton.

12. Pour sea or saline water into the funnel and fill the small bowl HJK and close the funnel.

13. Hot sun falling on the conical plastic sheet during the day will evaporate the water which will rise, hit the plastic sheet, get condensed and roll down the sheet along NL & NM, drop into the big bowl and find it's way out through the bamboo pipe FP and fill the bottle.

14. A small rubber tube, long balloon, cycle tube bit or a tube made out of canvas or umbrella cloth may be used to connect the pipe to the bottle at point 'P'.

15. When the bottle gets filled, another bottle may be replaced.

16. As the water in the small bowl evaporates, more water may be poured into it.

17. If saline or unclean water is poured, after it evaporates, a dirty residue will be seen in the small bowl. Remove the plastic sheet, clean the bowl and set it again every fortnight.

18. If sea water is used, salt deposit will be found which can be recovered and used for cooking. If the salt is dirty, dissolve it in clean water, filter and evaporate again to get clean salt (see Handout 64).

19. The base BC may be one meter and the still should be built in an elevated place or on a platform.

20. It is very important to enclose the still with a thorny fence to prevent children and stray cattle pulling it down as it happened in Somalia when a model unit was constructed at Jalalaqsi by this author.

21. The water collected in the bottle need not be boiled and for taste a bit of salt or sugar may be added to it.

22. If a little flavour is desired, cummin seeds, basil leaves, curry leaf or any aromatic leaf or root including lemon grass or Khus-Khus may be added.

23. Though each family can make its own still, in every village one or two women, youth and unemployed in particular may be asked to specialize in constructing these clay stills and they may be paid Rs. 10/-for constructing a still if materials are provided and Rs. 50/- if materials are not provided.

24. If big mirrors or large shiny metal sheets are available, they may be set high on a table or wall to reflect the rays of the sun on the water in the middle basin to expedite evaporation.

25. NGOS may organise the supply of plastic sheets and bamboo pipes for the village community and dealers may be named in each village.

26. NGOS may construct one model cum demonstration unit in every water scarce village for the village community to copy.

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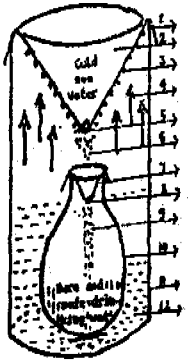
RYFO DRUM & SOLAR STILL — Handout 670

(simple & efficient)



1. Transparent plastic sheet.
2. Sea water inside the plastic sheet.
3. Condensed water beads falling.
4. Water vapour rising.
5. Weight to keep the plastic in position.
6. Potable water dropping.
7. Transparent, with half cm. hole.
8. The hole in the sheet.
9. Condensed water filling the pot.
10. Mud, metal or plastic pot.
11. Tar (asphalt) or oil drum.
12. Sea water or saline water.

This is an improvement over all other domestic model solar desalination methods so far innovated by the Ryan Foundation to reach the poor in remote parts of God forsaken villages anywhere in the world. The salient features of this still are:-

1. Locally available containers may be used.
2. Different types and size of containers may be used, metal or mud as long as the principle behind the system is adhered to. The drum must be painted black inside and outside.
3. Can be done on a large scale under the open sky, or on top of a kitchen rice-pot while cooking rice or gravy. In both cases renewable energy only is used.
4. When done in an oil drum under the open sky, foliage or twig briquettes, or waste paper briquettes (as in Germany) may be used to heat the sea water. The drum is mounted on three stones (campers cook stove).
5. When the sun is bright and hot, fuel is not required and hence it is ideal for warm countries and more ideal for semi-desert countries.
6. A family can set as many units as it wants and produce even 100 litres of fresh water provided sea water is close by.
7. The drums can be set on one's terrace or roof, even if the roof is slanting.
8. Any flexible plastic sheet or rubber sheet cut out of an automobile tube can be used to close the pot inside the drum. Used cement or fertilizer plastic bags may also be used.
9. This covering over the inside pot is the additional innovation in this method. The water that drips from the sides of the big inverted cone falls into the small inverted cone and then into the collecting pot. As the collecting pot is closed the already condensed water in it does not evaporate and therefore more potable water is available by this method.
10. The plastic sheet may be tied around to stay in position with fibre strings.

87

CULTIVATION BY SALINE & POTABLE WATER
RYFO Handout 509

There are several plants and trees that grow only in sea water and others that grow only in potable water. There are yet others like the Mangroves which grow where the seawater and river waters mingle. Recent research reveals that several plants and trees can be watered by saline and potable water alternatively. But how much

of this, and how much of that and when (at what stage)this, and when that, is opening out as a big science to be researched into. Many plants seem to need potable water only as a starter ie. until the stage of germination.

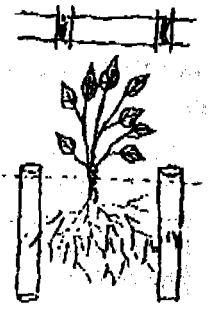
Plant and soil scientists of Ben-Gurion University in Israel have been researching on this new science. They have already announced that tomatoes and melons grow well in saline soil under dry conditions and that the quality of the fruits are rich when watered with saline water. They have also established that cotton, a major crop of Israel, has higher yields when irrigated with brakish water and produce fewer leaves and branches but more and better pods.

Scientists of the Ben-Gurion University however caution that some fresh water has to be introduced at the appropriate stage in the growth of a plant depending on the species, the soil and the climate. For example, sugar beet is highly sensitive to saline water at the time of germination, but very tolerant thereafter. Lettuce and peanuts, are tolerant at the time of germination but very sensitive as the nuts are formed. Maize is tolerant during germination, sensitive after germination but very tolerant as they grow up. Since humanity has to depend more and more on growing plants and trees on saline and sea water more research is needed in this science. Source: BBC. also reported by Development Forum of the United Nations.

88

WATERING ROOTS THROUGH BAMBOOS
RYFO Handout 397

In water scarce areas, Bamboo pipe irrigation is considered better than drip irrigation. Under this method, water directly reaches the roots of plants. This method can be adopted for watering kitchen gardens and dry crops in fields.



Nodes of bamboos which have an inner diameter of 6 to 8 cms. may be cut out as shown in the diagram and the length of each piece (cylinder) may not be less than 30 cm. and more than 60 cm. Then, 20 cm. diameter pits may be dug inbetween

the plants. The cylinders may be planted in them like pillars. The dug out mud is pushed back to fill the pits and trampled to make the cylinders stand straight and strong.

The little water that is available may be poured into the cylinders to reach the roots of the plants directly preventing or giving no room for top soil absorption.

Plants watered by this method grow much healthier than those under traditional watering system or drip irrigation.

Where bamboo is not available, bottoms of full size glass bottles may be removed and used instead of the bamboos. The broken bottom side should be above the ground. The method of removing the bottom of a glass bottle more or less uniformly is explained in RYFO Handout 699. The same handout also explains the method of making the sharp end of the broken bottle blunt. The sharp broken ends must be blunted to prevent cutting the ankle of people who walk around the garden to collect the vegetables or grains.

Bottle watering produces excellent results in kitchen gardens especially in gardens that grow tomatoes, okra (lady's finger), garden eggs (brinjals) and plants of similar size, the roots of which are 20 to 30 cms. below ground.

89

WASTE WATER FISH PONDS RYFO Handout 516

The ideal fish pond for poor rural homes is waste water fish pond (tank) of the size 2mt x 1mt x 1mt. There may be two ponds side by side with a distance of one metre between them. They may be built of bricks compressed in a Cinva ram (Handouts 231 & 353). The mud/clay for the bricks may be composed as explained in Handout 184. Glaze finish to the tank may be given as explained in Handout 474. Four brick pillars may be built on the 4 Corners of the tub and fenced. Thorny branches or ropes made of fibre may be used for the fencing. Where necessary to protect the fish from thieves, the top may also be closed by a fibre net. The tubs may be commissioned for use alternatively. If the tanks are built with unfired clay bricks, after building dried leaves and twigs may be filled into them and set fire to.

Waste water from the bath and kitchen may first be connected to one tank and Thilapia introduced. After the harvesting of the fish the tank is dried and the other tank is connected to take the waste water. The left over small fishlinks may be transferred from the 1st to the 2nd tank. Repairs and maintenance may be done to the first tank, if necessary, when it is dry. Soap water should not be allowed to go into the tank. There must be a different outlet for soap water.

By this arrangement the flow of fresh water and oxygen into the tank every day will be automatic and assured but may not be adequate. If inadequate all the fish will die and this frequently happens in Thilapia Ponds. To overcome this, in addition to the flow from the bath and kitchen, a bucket or two of water may be removed from the tank every day and fresh water introduced. The leftover kitchen and food waste other than flesh and bones may be thrown to the fish as feed. They may also be bundled in perforated plastic sachets and suspended as explained in Handout 186 or in Handout 482.

Groundnut cake (residue after extracting oil from ground nut) and cow dung or chicken excreta can be an important supplement feed for fish. Once in six months the pond may be changed.

The dead fish and the unwanted parts of fish from the kitchen may be steamed and converted into gum (glue) as explained in Handout 501. They may also be chopped and minced and buried in a pit and left for a month or two and thereafter dug out and used as manure. Alternatively, they may be straightaway thrown into kitchen/vegetable gardens to serve as manure.

If several families in the village have family fish ponds as explained above and make glue out of the unwanted parts, the gum may be collected for bulk supply to commercial markets or packeted in one or half or quarter kg. sachets for consumer market. The odourless gum industry can bring considerable money to the villages as this gum is wanted by several industries and consumers for several purposes and does not solidify unless exposed to air.

90

SOLAR RAYS PURIFY WATER
RYFO Handout 490

Small amounts of highly polluted water can be purified by solar rays and the water so purified can be used for preparing diarrheol rehydration salts (ORS) to avert child death from dehydration as researched and announced by the Brace Research Institute in Canada.

The process is simple; a litre or two of water taken in a glass or plastic bottle or even in a plastic pouch (sachet) is exposed for about 5 hours in bright sunlight.

The research, funded by the UN University in Tokyo was done in Asia, Africa and Latin America by the Brace Institute and declared to be most effective when the intensity of solar radiation is atleast 500 watts per square metre of surface area. "The method does not require specific temperature as the purification process is related to ultra violet light intensity", says the report. But the technique does not produce acceptable results with water polluted by faecal coliform bacteria or chemicals. Solar rays is said to destroy almost all pathogenic bacteria in slightly polluted water taken from rivers, ponds and streams.

Mr. Ayouh of the Brace Research Institute says that in about 5 hours of exposure almost 100 percent of the harmful bacteria are rendered harmless and that in some countries good results were recorded with only about two hours exposure to sunlight.

The International Development Research Centre (IRDC) and the UNICEF first sponsored the research in 1984 at the American University in Beirut and then the Brace Research University joined the research.

The World Health Organisation and the UNICEF recommend boiled or otherwise germs and bacteria free water for the preparation of ORS and when such good water is not available to use the solar heated water.

If villagers can purify the water they drink merely by exposing it to sunlight during the day and storing it by night, they can save so much time, energy, cooking fuel and cutting of trees, and lives of babies.

91

DRUMSTICK SEEDS CLARIFY WATER
RYFO Handout 461

The seeds of Moringa Oleifera, the common drumstick, which is a drought-resistant tree growing in almost all tropical countries is found to have excellent use in water treatment. In Sudan, people have been purifying water by using Moringa from time immemorial and scientists at the University of Leicester, UK have confirmed the science behind it.

The light yellowish white kernel inside the winged seeds are removed crushed and mixed with a small quantity of pure water and stirred for about 5 minutes. This suspension is then strained and mixed to a pot of turbid water and stirred again for 10 minutes with a wooden stick. To clarify 40 litres of water some 40 seeds are required.

When mixed with river water, the pulped seeds, according to scientists, give water-soluble proteins that bind finer particles of sediments in the water and form what is known as floc. Viruses and bacteria get enmeshed in the floc and after some 15 minutes, the colloidal particles settle down at the bottom of the pot. The action of the seed pulp is similar to the result produced when alum (aluminium sulphate) is mixed with water to purify water.

There are several leaf, root, bark and seed (organic) methods of purifying water practiced by tribals of India and Africa. In India, people use the wiry roots of Vettriver (Vetiveria Zizanoides) for filtering muddy water. When water is filtered through Vettriver in a pot, the water not only gets clarified but also gains a pleasant smell.

Another seed used is Kataka (Strychanos Potatorum) and it is used in a similar way. Ryan Foundation experiments show that when crushed Moringa (drumstick) seeds and (Vettriver) are both mixed and used, the filtered water is much purer and safer. An effort is being made by the Foundation to make available to the rural poor ready mix packets of powder of Moringa seeds and Vettriver roots which are easily available. The collection, drying, powdering and packeting these 2 raw materials is a very good income generation activity for the rural poor and there should be one unit (family) in every village to prepare this powder (mixture) hygienically. Done well, they can be sold also to urban communities. Upto six months, the powder has good shelf-life.

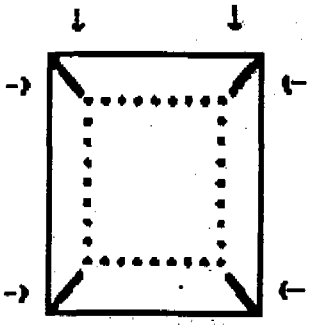
TECHNOLOGIES FOR WATER MANAGEMENT
RYFO Handout 456

Anti-evaporation floats

Plenty of scarce water seeps into the soil and evaporates from open wells, ponds, lakes and catchment areas in warm countries. It is estimated that about 15 to 30 percent of water seeps into the soil depending on soil conditions and another 15 to 30 percent evaporates depending on climatic conditions.

Evaporation can be minimized by simply floating plastic sheets on the surface of the water to be conserved. Many rural communities get into their village, cement, rice, sugar, fertilizers, etc. packed in HDPP woven sacks. These used sacks can be opened out and stitched like large handkerchiefs in square or rectangular shape. The fold on all the 4 sides must be about 6 cm. broad and the ends of the folds should be open on all sides as shown in the diagram. The size of the opened out sack may determine the size of the sheet float to be stitched. More or less it may be of one Square meter.

Sticks and twigs of Eucalyptus, Casaurina, Subabool, Allanthus, Julliflora or any unwanted shrub at least one inch thick may be cut to straight bits each atleast 15 cm. long, dried well, and inserted into the folds on all sides. Each fold must be filled with sticks and twigs and if they are thin 2 or 3 sticks may be inserted side by side. The idea is to fill or tightly pack all the 4 folds with well dried sticks. Stems of corn, millet or Sorgum may be used. When filled, the floats are ready and hundreds and thousands of them may be floated on the water and this will reduce evaporation by about 85 percent on full coverage.



Stitching the floats is an excellent rural industry and they can be hand-stitched by women and children for local use. To commercialize the item it is better to have them machine-stitched and there are so many women today in the Third World villages who wait for work after learning to sew. Stitched ones may be

folded like small towels and sold in bulk to wholesale buyers. The Ryan Foundation is now organizing buyers and users for this product on the one side while organizing production on the other. The users will insert the sticks at their end (in their village).

Therefore used woven sacks and plastic sheets which can be used the same way should not be thrown away. They can conserve water, cultivate more land and arrest the flow of environmental refugees into urban slums.

93

TETRAPODS ALONE WON'T DO
RYFO Handout 576

The picture shows tetrapod barrier (wall) built as sea defence in Maldives. The same type of tetrapods are lined along the "Queen's Necklace" in Marine Drive in Bombay. In the Kulmadapam-Ennore area of Madras, large reinforced cement concrete water pipes are used to keep the invading sea at bay. Land erosion and subsidence is taking place in many countries due to green house effect and rising sea-level. Bangladesh which is on an average just a metre above sea-level, is under the danger of sea sweeping in and a poor country like Bangladesh cannot afford to place tetrapod barriers.

The best alternative for low-lying countries is to plant saline soil trees all along their coast. The better known saline soil trees which grow luxuriously washed by sea waves are Alexandria Laurrel, Pungamia Pinnate, Acacia Holoseriea, Capparis decidua, Coconut, palmyrah, casaurina, bamboo, Allanthus, Posiperious Juliflora, etc. In the Besant Nagar beach in Madras, the Corporation has planted a row of Globra which is in the right direction.

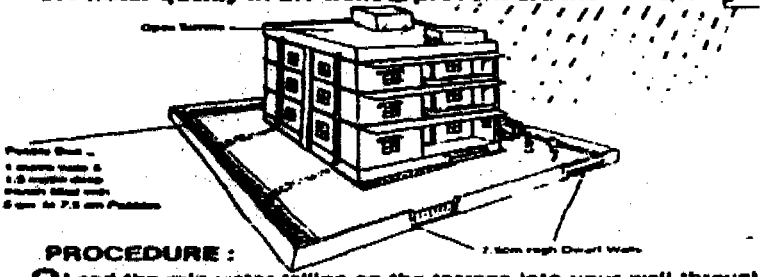
But these are planted on the sea sand about 100 mts. away from the sea water. The best way to plant them is at a distance where the trees will be almost touched by the waves during high tide. Then the roots of the tree will bind the soil and arrest the advance of the sea. Vetriver grass should be promoted between the trees, and Anti-erosion Setaria should be grown.

Such an effort will also promote social forestry along the coastline as in Kerala in peninsular India. Fifty years ago there was a dense growth of Casaurina in Besant Nagar beach and the British rulers used to go there for bird shooting. (This writer has also shot pigeons, cacoos and rabbits in that coastline jungle as a student). These coastline jungles have to be restored and new jungles have to be created wherever possible to gain so many advantages and to create employment for the people living in those coastal belts. The earlier we do so, the better it will be for our environment and health.

94

DOWN TO EARTH WAYS TO CONSERVE RAIN WATER!

On an average, Madras City gets 110cms of rain annually. B preventing its runoff into sea and saving it, we could ,
Orecharge our wells and improve their water level O enhanc the water quality in the wells Oprevent cracks in buildings



PROCEDURE :

O Lead the rain water falling on the terrace into your well throug drain pipe. If there is no open well, let the rain water flow into th metre wide pebble beds as shown here.

O Dig a number of 3 metre deep and 30cm dia percolation pits a metre intervals around the plinth. Fill them up with metal and bro bricks and pack the top 15cm with river sand.

O Erect 7.5cm high dwarf walls at entrance and exit gates to retain water into the compound so that it will flow into the pebble beds.

ISSUED IN PUBLIC INTEREST BY

MANAGING DIRECTOR
MADRAS METROPOLITA
WATER SUPPLY AND
SEWERAGE BOARD

95

TAKE WOMEN ALONG

1. Don't pay a woman less wages when she does the same work as a man.

2. See that projects don't by-pass women and women don't by-pass projects.

3. Accept the fact that often the best person for a job is a woman.

4. Create balanced opportunities for men and women and reasonable profits for their respective labour.

5. Reduce drudgery in women's work; give them a helping hand.

6. Encourage grass-root participation of women as there can be no development without women.

7. Prevent loss of women's income to middlemen, and middlemen exploiting women.

8. Encourage women's right to land ownership and joint ownership.

9. Teach women to reduce post-harvest losses as most of the post-harvest work is done by them.

10. Encourage NGOs to design/innovate appropriate technologies for women to lighten their burden.

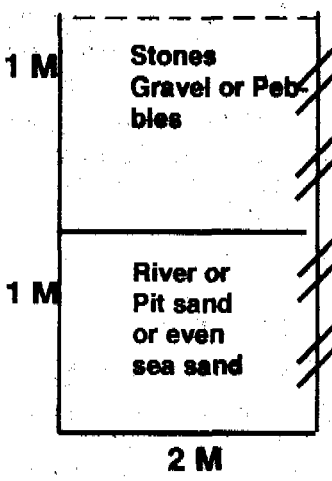
11. Disseminate information to women on their rights, duties and entitlements.

12. Be sure that women are better money savers than men.

13. Most important of all, give women plenty of fresh and healthy water for their domestic use and use in fields and factories.

SOAK PITS STORE WATER RYFO Handout 652

Ryan Foundation recommends two easy ways of tapping and storing run-away rain water. If you have an open well which usually dries out in summer, lead the rain water from the roof-top into the well. Cement or PVC pipes may be used or a simple open cut channel may be dug for the collecting water to fall into the well.



If you do not have an open well, dig a soak pit 2 m. x 2 m. x 2 m. Fill the lower half of the pit with river sand, pit sand or sea sand or all mixed. On top of it, fill small stone gravel or pebbles or all mixed. Ram the top to ground level.

If the place you select for the soak pit is so located that cars and carts and scooters must run over it, then the top must be rammed well with big stones. But if it is secluded, it need not be rammed hard.

If you have enough open space around your house, have as many pits as possible, you may even have them dug inside your car-shed, chicken shed or porch and the collecting rain water to enter the pits through pipes provided on the sides of the pit at an angle of 45°. The broad angular pipes may be filled and closed with mud as water will still enter them and go into the pit. In rural areas where people cannot afford cement or plastic pipes, bamboo pipes may be used. Alternatively, about 6 or 7 casaurina or eucalyptus poles each one metre long and about 6 cm. in diameter may be bundled together and buried in the same position as one will place the pipes. Water enters the gaps inbetween the poles and falls into the pit. The pole bundle arrangement is as effective as a pipe and this method has been successfully introduced in several African countries by Ryan Foundation.

If about a dozen of these soak pits are made all around a big well, it is most likely that the well receives and yields water all through the year, even during drought.

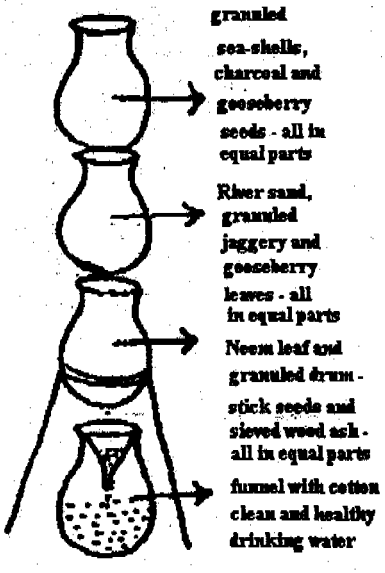
Ensure that all the ground around your well that belongs to you is made to slope towards the well so that when it rains the running water automatically flows towards and into the well. Keep your well always closed to prevent evaporation but provide small holes on two sides for air circulation. In warm countries where the temperature averages around 35 degrees celcius in summer about 25 percent of water evaporates from open wells. By keeping the well closed, evaporation can be minimised to about 5 percent.

Don't pave the ground around the well and don't grow big trees near the well as they will absorb some water. Specifically, don't have an Eucalyptus tree near the well. Good water management is an integral part of family life.

97

MAKING SEA WATER POTABLE

RYFO Handout 669



For domestic consumption, sea or saline water can be purified and made potable by this method shown in the diagram. Only 4 mud pots and a wooden stand are required to mount the system.

In the topmost pot, equal parts of sea shells, charcoal and gooseberry seeds granuled or broken to bits are put to fill one third of the pot. The granule bits may be as big as tamarind or soyabean seeds or smaller. (equal parts by volume)

In the second pot, equal parts of washed and dried river sand, crushed jaggery and fresh gooseberry leaves are put.

In the third pot, equal parts of fresh neem leaves and granuled (semi-powdered) drumstick seeds and sieved wood ash are put.

In the fourth pot below the stand (the collecting pot), a funnel is fixed and half the funnel is filled with cotton or tailor's waste bits (only cotton).

The first 3 pots have a 1 cm. hole at the bottom and cotton cloth bits (tailor's waste) placed on top of the hole to serve as a filter.

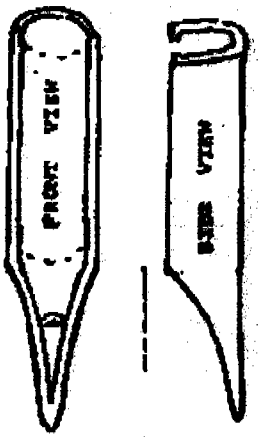
Sea or saline water is poured into the topmost pot before going to bed and closed (a dining plate may be used as a lid). The water percolates through the pots ready for drinking the next morning.

The pot on the ground may be shifted out away from the stand, the funnel lifted, the water in the pot taken with a mug or cup, and the pot put back in position. The capacity of each pot may be 10 to 20 litres. If more water is required, another row of pots may be set. The water collected from the bottom pot need not be boiled.

Once a fortnight, all the pots must be emptied, washed and reset again with fresh materials. The said materials may be gathered, granuled and kept ready and all the materials are readily available at no cost for the rural poor. The said materials may be made readily available in bags for the consumer market.

98

TRAPPING FOG/DEW FOR WATER
RYFO Handout 532



Cut 10 cm.dia. bamboo poles into lengths of 50 cms. pieces. Take about 10 pieces (cylinders) and slit each into two equal halves and shape them with a knife like a 'dip-and-write' nib as shown in the diagram. Insert the sharp end into the bottles arranged as shown in the diagram in handout 99 when the lamp is set for light. During night, when there is plenty of fog or dew fall or mist, the semi-circular bamboo poles standing on the bottles trap the water in the atmosphere. The heat of the burning oil-lamp on the stool condenses the water and water drips into the bottles.

While setting, the cavity side of the bamboo pieces must face away from the fire. In other words, the curved outside of the bamboo

should get the heat. Only then, a large amount of fog/dew will be trapped by the bamboos and the warm side of the bamboos will melt the water particles. By about 7 or 8 in the morning, the water in all the bottles may be collected and stored. On a foggy night, the bottles can be full of water. Near the sea or sea water canals, the collection will be more.

Oil lamps may be made in different ways and they are explained in Handour 57. Non-edible oil can be extracted from various nuts and leaves. For extracting oil from nuts, see Handouts 72, 165, 209, 212, 217 and 281 and for extracting oil from leaves, see diagram and explanation in Handout no. 7 (in Vol.I of the book "Better Life Technologies for the Poor", published by CARITAS (India) CBCI Centre, Ashok Place, New Delhi).

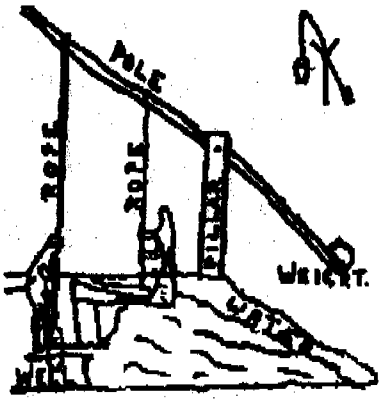
Fuel for steam distillation can be found as explained in Handouts 103, 104, 148, 206, 284, 287,319, 344, 356, and 357. Some non-edible oil yielding plants and trees are explained in Handouts 310, 228, 230 and 332.

During warm summer months, water from the atmosphere cannot be tapped by this method. But during cold months by setting several trapping units in the frontage or backyard of a village hut, it is possible for a family to collect nearly a bucket of water for drinking and cooking. In high altitudes the collection is good - higher the altitude more the collection.

In Chile, reports UNDP journal SOURCE of Dec. 1990, on a two -year period from 1987 - 1989, the 50 fog collectors in El Tofo, 780 Km. above sea level yielded 10,000 litres of water per day. But in plains one can have only about a bucket of water even during winter.

While planning for water, we have to balance what is technically sound, environmentally friendly, legally possible, economically viable, socially acceptable and politically possible.

SEE-SAW WATER LIFTERS RYFO Handout 361



Perhaps Adam and Eve used this system to lift water shown in the diagram in the garden of Eden. Though the system is anclent, it is very appropriate even today in many Godforsaken villages where one cannot think of a better alternative. The technique followed here is simple. The weight of the stone is half the weight of the bucket of water. When a full bucket of water is lifted from a pond or well it comes up easily upto the surface of the water in the well due to buoyancy. Thereafter the lifter has to apply only little manpower to lift the bucket upto the mouth of the channel as the weight of the stone helps him in lifting the bucket. Nearly half the lifting power is provided by the stone. However, when he pulls the empty bucket back into the water he has to lift the stone but because of the long pole acting on a fulcrum the lifter gets a mechanical advantage both while lifting the bucket of water and while lifting the stone.

In villages where the ground level is much higher than the sea level this system is helpful to shift water.

Ryan Foundation recommends sea fish culture in sea water ponds. Large community scale sea water ponds can be made in low--lying areas of villages but from that pond water may be shifted by rural families to the frontage or backyard of their homes if their settlement is in high ground. If their settlement is on land which is more or less on level with the community sea water pond they may cut small channels and take water to different places. See booklet "Survival By Sea Water" published by the Ryan Foundation. Given the sea water, hundreds of income generating activities can be promoted in rural settlements based on fish, plants, trees, sea weeds, crabs etc. These are discussed in other handouts of the Ryan Foundation.

100

BOREPUMPS - A TOOL FOR CORRUPTION

(Excerpts from front page article (report) which appeared in the popular daily of India, The Hindu dated March 11 1991)

"The State Government has taken in sinking of over 5000 deep bore wells in chronically shortage zones, particularly in the central and western parts of the state.

"Over the years the Tamil Nadu Water Supply and Drainage Board (TWAD) alone has sunk nearly 1.15 lakh borewells in the state in addition to several thousands put up by different agencies, such as Department of Social Forestry, Slum Clearance Board, municipalities and panchayats.

"Maintenance of assets (borewells) already created now vests with the local bodies left much to be desired, leading to repeated expenditure in the same localities.

"A recent study in Coimbatore district reveals that owing to over exploitation of ground water the water table is going down by 25.3 mm every year.

"Although the financial allocation provides for deepening of the existing open wells, experience in recent years has indicated an all round clamour for sinking of bore wells and so much of political pressure used to be brought on the officials that often the basic rules and norms were given the go-by."

For detailed and revealing information on borepumps read the booklet 'Pumps without Water' by Dr. Felix A. Ryan which is now in circulation in most English speaking countries and in the hands of agencies which give aid for handpumps and borewells.

101

WATER RACKET

(A letter published by the author)

In some Third World countries, India in particular, drinking water drawn from underground is being commercialized and black-marketed by middlemen and politicians to the detriment of the poor and lower middle-classes and the environment (see "Creating Water Markets: solution or threat for farmers?" by John Colmey in the November-December issue of Development Forum of the United Nations).

We cannot say drawing ground water unscrupulously is illegal, as there is no legislation in these countries preventing people from boring the ground and drawing water. In several areas like Cuddalore and Saurashtra in India, for instance, available potable water has been sucked out and machines in borewells are now pouring out saline and sea water.

Local authorities take commission from water supply contractors for every tanker load of water drawn from these aquifers or government land leased out to them. Exploiters are making capital out of this scarce drinking water situation. It is time that the United Nations, World Bank or UNICEF brings out a draft legislation on the use of ground water and insists that the member countries introduce and enforce the legislation to qualify for any United Nations aid for water-related development - Felix Ryan.

Reproduced from the Development Forum - March -April 1991. (Journal of the UN Secretariat published by the United Nations Department of Public Information for the Joint Nations Information Committee).

102

BEAST OF BURDEN RYFO Handout 672

This donkey in Sudan is loaded with water that will sell for 50 piastres (USD 20) (India Rs.600) per four gallon tin in El Obeid. Usually 2 or 3 automobile tubes (lorry tubes) are filled with water as shown in RYFO Handout 201 and supplied to homes and institutions.

The lost animal power is being restored again all over the world, particularly in Italy and Spain. Wealthy people in Europe are promoting and using donkey transport and pack horses to avoid pollution and non-renewable energy.

Donkeys are drought animals and beasts of burden. They eat leaves, straw, waste paper, cardboard etc. and make themselves comfortable in all sorts of climatic and environmental conditions. In Egypt and Sudan small children are taken to school on donkey backs and children enjoy the ride.

Farms and centres to breed and upgrade donkeys, mules and horses are becoming a necessity in certain parts of the world. A mule is born out of a sexual cross between a pair of parents(horse & donkey) but it is possible to produce hybrid mules by genetic engineering(recombinant technology).

Genetic engineers are at present concentrating on the application of gene technology mostly to edible items -birds, animals or vegetables which human beings eat and genetically engineered and produced eats are harmful to human metabolism. One school of thought has it that such eats cause cancer, asthma, allergies and many diseases.

Ryan Foundation favours hybrid donkeys, horses, mules, the king crow (farmers friend which eats away several pests) and anything that serves men and women and helps humanity to progress. Donkeys are very good for transporting water filled into automobile tubes.

NGOs should pay special attention to the promotion of beasts of burden. Third world countries have bright prospects of exporting them to advanced countries where they are being increasingly used to draw carts and coaches and to carry water.

BOTTLED WATER UNSAFE RYFO Handout 678

The renowned Shriram Institute for Industrial Research (SIIR) did a research in 1993 to assess the purity and safety of the bottled mineral water which was capturing an expanding commercial market of the urban rich and which is being supplied wholesale to hospitals, hotels and other institutions.

The results announced say that more than 65 percent of the bottled and the so called safe mineral water is neither really safe or atleast upto the mark. The research was undertaken to find out the chemical composition and impurities in the different brands of bottled water in the market. 65 percent of the bottles scientifically examined did not conform to the requirements of standards prescribed by India or the WHO. Out of 14 well known and fast moving brands, 6 brands did not mention the composition but only made general statements and claims about the quality on the label. Some labels merely claimed that the water was free from bacteria.

The SIIR report warns, by and large, that no bottled water in the market can be accepted as pure and safe. The consumers concern for health is being exploited by those who bottle the water and different gimmicks are adopted for selling the water. Some of them use names of holy rivers, pilgrim centres and religious places to attract or lure the customers. Moreover, the report points out that many well-to-do people are beginning to use bottled water more as a status sysmbol than for health reasons.

The findings of this reputed and reliable analytical laboratory reports that in the Indian market, it is rare to find mineral water free from organic, inorganic and other impurities to be consumed without risk. The report advises the public to drink plain tap or well water filtered, boiled and filtered again.

However, there are some very small units like "SUJAL" promoted by highly specialised groups in Madras which bottle water for a limited clientele, strictly conforming to WHO standards and their motive seems to be quality, purity and service. But with such high ideals, they are not able to grow, in fact, they don't want to grow. Ryan Foundation tested their water with the C. P.R Foundation water testing kit and found the quality excellent. Other brands like "SUJAL" are to be identified.

Various standards for the quality of drinking water are known. In the Third World, generally the WHO standards are adopted. These standards are related to physical, chemical, bacteriological and toxic factors. It is generally assumed that good drinking water should be free from pathogenic matter. To be acceptable, it should be colourless, odourless, tasteless and free from turbidity. It should contain sufficient oxygen and have a suitable temperature.

104

W.H.O. QUALITY STANDARDS RYFO Handout 682

SOME PHYSICAL, CHEMICAL AND BACTERIOLOGICAL QUALITY STANDARDS. (W.H.O. 1984)

Quality Aspect	Symbol	Guideline Values	Undesirable Effects And Disease Symptoms
Bacteriological quality		10 Coliforms/100ml O E - coli/100 ml	Chance of infective diseases via faecal contamination
Total dissolved Solids		1000 mg/l	Taste;stomach and intestinal irritation with overdose $MgSO_4$ (laxative action)
PH		6.5 - 8.5	Taste; corrosion
Hardness		500 mg/l $CaCO_3$	Deposit in pipes and equipment
Iron	Fe	0.3 mg/l	Taste; colour; growth of iron bacteria
Manganese	Mn	0.1 mg/l	Taste; colour; turbidity
Copper	Cu	1.0 mg/l	Taste; colour; corrosion
Fluoride	F	1.5 mg/l	Fluorosis (teeth and bones)
Nitrate	NO^3	10 mg/l	Methaemoglobine am--ia; Cyanosis (Blue Babies)
Chloride	Cl	23 mg/l	Taste; corrosion
Sulphate	$SO^{2-}{}_4$	400 mg/l	Stomach and intestinal irritations ($MgSO_4$ Na_2SO_4)

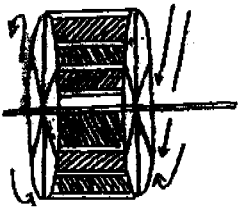
Coagulation is a chemical process which causes small suspended particles to adhere together to form large silt particles which sink readily. This process can be achieved in a simple way with materials such as starch, milk protein, some types of clay, certain seeds, roots, fruit juices etc. If such materials are mixed quickly and thoroughly with water and then allowed to come almost to a standstill while stirring slowly, particles are formed which sink quickly when stirring stops.

Aeration is a process in which water is brought into contact with air as intensively as possible with the purpose of increasing the oxygen level or to force certain gases out of the water (carbon-dioxide, methane, H_2S).

By removing ammonia, nitrate, iron, manganese, oxidisation of dissolved organic material, the chemical composition of water can be changed.

105

RYFO CART WHEEL TURBINE
RYFO Handout 680



RYFO Cart Wheel turbines is simple and inexpensive and can be assembled and mounted by village communities with the help of a carpenter, mason or handyman. Two wooden wheels of an old cart are taken and held parallel to each other at a distance of 90 cms. using 4 wooden crossbars nailed in that position as shown in the diagram. 8 wooden planks each less than 5 cms. thick are cut to size and fixed between the parallel spokes of the 2 wheels to serve as blades of the turbine as shown. A two meter long half inch metal water pipe is passed through the middle of the two wheels to serve as the axle. Bush bearings (not ball bearings) are used in the wheels for smooth rotation.

The axle is mounted on two brick pillars built on the stream or streamlet and the distance between the pillars should be just enough to accomodate the turbine.

The flowing water turns the turbine anti-clockwise or against the flow direction of the stream. While fixing, care should be taken to

ensure that the stream when in full flow, does not rise above the level of the axle rod. Side outlets may be provided to regulate the level. The axle rod is directly connected (coupled, welded, or pullied) to a mini-generator,if the purpose is to generate electric power, or to a canvas bucket wind-mill, if the purpose is to lift water on to an overhead tank, as explained in RYFO Handout 312.

If the flow of the stream is too weak, two strong walls are built across the streamlet from the bank to the pillar on either side leaving only a small opening in the wall where the turbine is set. Then, the flowing water is arrested and accumulated at the wall and made to flow out fast through the turbine gate (principle of a regular hydro-electric dam applied on a small village scale).

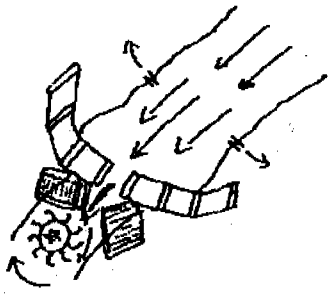
The entire turbine is painted with tar (bitumen) to increase its service life. At the other end of the axle, wind mill sails may be fixed so that when the wind blows along the flow of the river, the turbine moves faster.

At the outflow side of the turbine, small fish traps may be set. Hundreds of such stream generators can be seen in Nepal and thousands in China. Why not other countries have them?

For more diagrams and explanation, see RYFO Handouts 68, 312, 410, 424 and 235.

106

STREAMLET MINI GENERATOR
RYFO Handout 684



Electricity can be generated from small rivulets about 2 mts. broad and one mt. deep by the system showed in this diagram. During summer, when the rivulet is dry, a small semi-circular wall is built with 2 mt. deep foundation with a gate-like opening in the middle as shown. Two other walls, each about one mt. long are built behind the semi-circular wall to direct the water towards one side to fill the "cups" of the turbine as shown. The gap between these two walls must be very narrow.

The turbine is mounted on a vertical pillar built of brick and mortar and there is a sprocket wheel on the top face of the turbine as shown.

On the other side of the semi-circular wall (dam), water will accumulate and form a catchment area. Side openings or sluices are provided to let out the surplus water during heavy rains. Alternatively, the catchment area is widened to increase its holding capacity and the area may also be deepened.

Ways of generating electricity or lifting the water to a storage tank is explained in other RYFO Handouts (see handout 680).

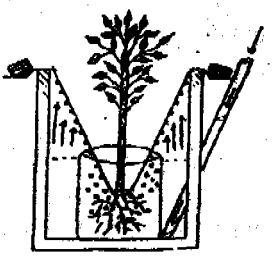
Empty oil or tar (asphalt) drums may be cut open and mounted as turbines as shown in Handout 235. The axle rod in the middle of the turbine pillar should be a one-inch thick galvanised iron water pipe.

If the rivulet is small, holding water only during the rainy season, it may be dammed as explained and halted in one village and prevented from flowing further. This is done by turning the flow back into the catchment areas.

By this arrangement, a village can always have water and generate some electricity. The sluices may be opened only when the water level rises and the excess flow is used either for cultivation or taken to other catchment areas.

107

SEA WATER KITCHEN GARDENS
RYFO Handout 676



Plants and trees that cannot stand saline soil or brackish water can be raised by this method innovated by the Ryan Foundation. Experiments conducted in some African countries have proved very successful.

Materials required are 3 sq. metres of thin transparent plastic sheet, 200 hand-compressed and sun-dried bricks, a 20 litre garden or kitchen mud pot, RYFO mortar (no cement) and a hollow bamboo with 6 cm. diameter and about 120 cm. long.

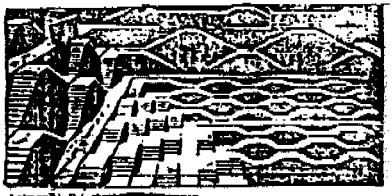
First, a 1 mt. x 1 mt. pit is dug and the floor and sides are lined with bricks and plastered with mortar. While building a side wall, the bamboo is placed slanting as shown in the diagram. The mud pot is placed in the middle of the pit as shown and filled with good earth mixed with organic manure. (RYFO manure is recommended). The pit built of adobe bricks may be fired after it is built.

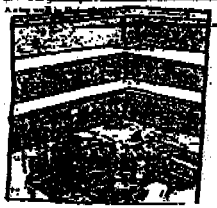
In the middle of the plastic sheet, a circular hole of 10 cm. diameter is cut. The pit is covered with the sheet and the central portion of the sheet taken down into the mud in the middle pot as shown. Weights are placed on the flap of the sheet around the pit as shown and sand heaped around the pit on the plastic to prevent air entering the pit.

The required vegetable, say, the quick growing Okara (lady's finger) is sowed or planted in the middle of the central pot as shown. Sea water is poured through the top end of the bamboo and the mouth of the bamboo is plugged.

During the day, sea water evaporates, hits the sides of the plastic sheet, gets condensed and rolls down the sheet to the roots of the plant. Thus, the plant gets something like pure rain water and flourishes. The method can be adapted also to growing trees in the middle of deserts, provided man-made sea water canals are taken into the deserts. The sea and the tree hold the key for human progress. Fused out tubes of tube light, metal ends removed, may be used in the place of bamboos.

108
TUBES REDUCE EVAPORATION
RYFO Handout 669





Picture one is a common community tank in Rajasthan (India) and picture two is a traditional well in Nepal of which the country has hundreds. Open community wells, tanks, and ponds are common in poor countries and it is the basic source of supply of drinking water especially in the rural parts.

The major problem with these community wells and tanks is seepage and evaporation. By and large, in open storage, 25 percent of the stored water seeps into the ground and another 25 percent evaporates during a given period of time.

RYFO solution is to inflate discarded automobile tubes of all sizes and float them in the community open water storages. Large size truck and bus tubes are the best as they spread out and cover the water sheet. As compressed air is not available in poor villages, they may be inflated with a hand pump or even blown in the mouth like a balloon. Tubes may be thrown one on top of the other to cover the water if the well or pond is small. By completely protecting the water from direct sunlight and atmospheric air, about 20 percent of the total evaporation can be arrested.

Moreover, in a well or pond so laden with tubes, the fish population multiplies fast. The small fish hide under the tubes or inside or outside the circular edge and escape from the big fish.

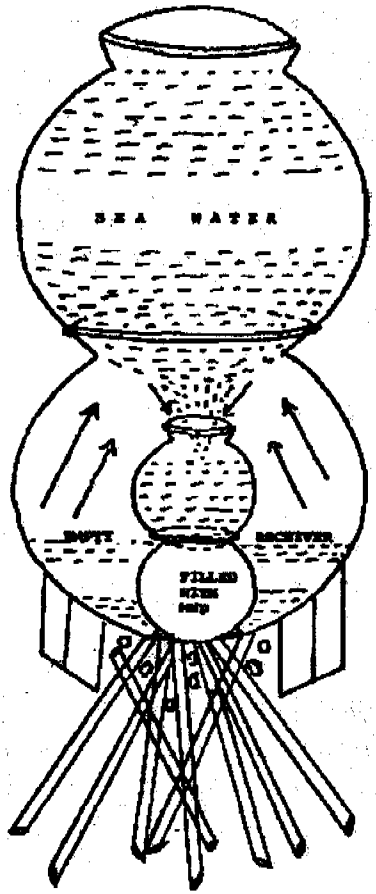
Cleaning and reinflating the tubes may be done once a month.

FOREST

is a peculiar organism of unlimited kindness and benevolence that makes no demand for its sustenance and extends protection to all beings, offering shade even to the axeman who destroys it...

- GAUTAMA BUDDHA

RYFO 4 POTS STILL **RYFO Handout 682**



POSTER PRODUCTION AND MASS COMMUNICATION
REQUESTED BY RYAN FOUNDATION.
PLEASE RENDER IN LOCAL LANGUAGES TO
REACH THE RURAL POOR.

RYFO 4 POTS STILL RYFO Handout 682

1. Ryan Foundation has innovated several stills to give drinking water to the rural poor but some of them require the use of metal containers and plastic sheets which are not easily available in remote villages. Even if available, the poor cannot afford them.

2. The 4 pots still does not require metal or plastic. It is easily assembled with earthern pots readily available with rural poor. Two large size pots and two small ones are taken. The small pots should go into atleast one of the large pots.

3. They are set, preferably in the open, on a 3 stone stove (campers stove). Sea water is poured into the big bottom pot upto the brim of the small bottom pot, which is filled with mud as insulation. To prevent it from lifting due to buoyancy, sea or saline water is filled into the big pot on top and the stove is fired from below. Water evaporates even in room temperature but with some heating, evaporation is quicker.

4. Since fuel wood is scarce and costly, briquettes made of foliage (dried leaf sweepings), crushed like tea leaves and made into lumps with locally available tree gum to bind are used for heating. (Tamarind seed, roasted, crushed and boiled yields good gum or glue). For details on alternative stove fuel, see RYFO handouts 48, 103, 319, 491 and 654.

5. How does it work? Sea or saline water is poured into the bottom pot upto the brim of the small pot as already stated. The big pot on top is fully filled with sea or saline water. When heated, the water in the big bottom pot evaporates, the vapours hit the cold bottom of the big pot above, condenses, drips and fills the small pot. It is pure healthy water which need not be boiled. Some salt, sugar, curry leaf or cummin seeds may be added for taste and smell.

6. As the water in the big pot on top gets warm, it is removed with a cup in small quantities and is filled with fresh cold water. The colder the water in the top big pot, quicker the condensation.

7. In between the 2 big pots, there may be pin holes through which the vapour can escape. To prevent this, a thin cloth as big as a towel is twisted and wrapped around, like a bandage, between the two big pots and tied.

8. The two big pots may have a holding capacity of about 20 litres each and the two small pots, about 5 litres each. Small variation in size will not matter. The small pot filled with sand prevents the condensed water getting heated and evaporating again. It takes about 30 minutes to yield 5 litres of potable water, if opened early morning. For more, the process may be repeated or more stills may be set.

9. The most backward and poor people in almost all third world countries follow this principle in different methods and use different contraptions to distill country liquor(alcohol). If sea water is made available, they know how to distill and desalinate it.

[Innovation, R&D and field tests done by Dr. Ryan and his project associates, Mrs. Girija Sinnas, social worker and Dr. A.D. Monteiro, Chief Technical Advisor, UNIDO (United Nations)].

110

JULIFLORA BRIQUETTES (Mesquite)
(for heating the sea water)

RYFO Handout 319

There are absolutely dry and drought prone villages in some Third Countries where, people believe, income generating activities cannot be promoted. This is a wrong notion as humanity cannot survive there if nothing can be done and people live there only because there are ways of living.

Briquette-making is one thing that can certainly be done. The thorny bush called PROSOPIS JULIFLORA which grows into a tree now commonly seen in many Third Countries (belonging to the family P- CHILENSIS), popularly known in English as the MAD TREE because it grows on rocky mountains, on river beds, on saline sea shore, in areas where there is plenty of rain and places where there is no rain at all and in any type of soil or climate, uncared for, is a boon to dry and drought-ridden areas and should be introduced and propagated in dry areas. In peninsular India, this shrub tree is called 'VAELI KAATHAN' meaning fence-protector as it is thorny and human beings and animals keep away from it. Ryan Foundation has been promoting Juliflora briquettes and providing employment and a living for the poor in many Third Countries. This is how briquettes are made:

After removing the leaves and thorns, fairly straight twigs are cut to the length and thickness of a standard size lead-pencil. Three such twigs are first tied together with any fibre available in the village. There is no Third World barren village including semi-deserts which do not have or cannot grow atleast a dozen fibre-giving plants and trees. Then, five of these twig bundles are put together and tied into a bigger bundle consisting of 15 twigs. Each bundle is a briquette and burns for a long time almost like charcoal. If not in bundle form, they burn out quickly. If unwanted leaves and foliage are ground to paste in traditional village oil crushers (Ghani in Hindi and Shekku in Tamil), then the ground leaves made into a semi-liquid by adding water and the briquettes dipped into it, they burn for a much longer time. The idea is to block crevices and make the briquettes into solid blocks. (Cattle eat the pods of this tree but not the leaves).

There are several other desert plants and shrubs which give high thermal energy and can also be used. Among them are Acacia, Acacia spp, Pitecellabium dulce, Zizyphus Spp, Sesbania Spp, Dichrostachys glomeruta, Chlorophospermum mopane, Crytostgia grandiflora, Datura (Voomatham in Tamil), Ipomoea fistula, Vasaka (Adathoda in Tamil) and the croton-like plant called in Tamil KATAMANI. (Semi-liquid clay fill crevices better and burnt clay (surki) is excellent for brick-making. See handout 184).

Villagers may use these bundle briquettes for their domestic cooking and also send them to nearby urban markets. For cooking one simple routine meal for a family of four, ten briquettes may be required. If the price per bundle is fixed low as low as 5 paise (in India), a household will have to spend only 50 paise on fuel per meal which is about one-fourth the price of cooking gas, electricity, coal or kerosene. A family of four can make 500 bundles in one day in their spare time, ie. Rs.25 per day. If Rs. 5 is set apart to meet the cost of transportation to nearby urban markets, there will be a net profit of Rs. 20 per day or Rs. 600/-per month which is a good family living wage. Transporting may be done by several families jointly by animal drawn carts. Care must be taken to replant what is cut. Other commercial uses for the shrubs are explained in other RYFO handouts. These briquettes are recommended to heat and evaporate sea water for condensation and potability. Families can prepare briquettes to meet their own domestic requirements and for heating sea water.

111

CRUSHING THE SMALL HOLDER

The World Bank granted USD 80 Million in 1993 to Brazilian companies to enable them to cultivate 25,000 ha. for tropical fruit juice production. Land and labour are over-exploited by transnationals in Brazil and elsewhere with chemicals and bio-technology. The Bank wants everything mega and magnificent and does not believe that small is beautiful, possible or sustainable. The gap between what the Bank says and does is wider than the gap between the North and the South. In fact the gap between the North and the South is widening year after year because of massive aid by the World Bank which merely results in mass destruction of development and the developing people.

"The vast loans which were made at the end of 70s and the beginning of 80s seldom resulted in any sustainable development which was meant to benefit the poor of the Third World, but now it is precisely they who have to pay the price". (Editorial of Development Mirror of Sweden, Issue one of 1990).

Falling incomes, rising price of food and all baasic needs have caused women to work longer hours and change their consumption patterns. Economic adjustment policies resulting in cutbacks in expenditure on education and health have only made women's role as mothers more difficult and lives of children still more difficult and insecure.

The solution to all these socio-economic and eco-environment problems of the world and of humanity is not loans and aids, macro and mega dams and projects but in providing the people with healthy and abundant water. This is possible only by exploiting the sea in various ways as advocated by the Survival By Sea Water Movement of Ryan Foundation International. Water Management in Homes and Villages is a book to be read by planners and policy makers. Everything is explained in this book in simple language for the common man.

112

WASTE-OIL COOKING FUEL
(for heating the sea water)

RYFO Handout 48

Waste oil is not commonly used as cooking fuel in rural homes and yet locally available waste oil can serve as an ideal cooking energy at no or negligible cost.

Given below are botanical and common Indian names of non-edible oil-bearing nuts found in many tropical countries from which oil can be extracted to be used as fuel. Indian names are given in brackets:

Bassia Latifelia (Mohwa); Azardirachta Indica (Neem); Hevea Brasiliensie (rubber); Pongamia Glabra (Karanja); Mosus Ferrea (naher); Schleichera trijuga (Kusum); Calophyllum Inophyllum (undi); Carcinia Indica (kokum); Veteria Indica (dhupa); Actinedaphne hookeri (pisa); Salvadora Oleoides (pilu); Hydnocarpus Wightiana (Marotl); Jatrapha Ourcas (ratanjyet); Circulus Colocynthis (tumba); Shorea Robusta (sal); Tictonia Grandis (teak); Mangifera Indica (Mango); Butea frendesa (polash); Neolitsea umbresa (chirandl).

Oil bearing nuts available in the African continent especially in Gambia and Senegal (Source: UN Environment Programme, Ref INFOTERRA/ISRQ 1364/RG/UO dated 3-12-81 - letter to Ryan) with their botanical, English and local African names are given.

Azederchtu Indica (B) Neem tree (E) local not given. Anacardium Occidentale (B) Cashew (E) Darkassu (L) Butyrespermum patkir (B) Sheer Butter (E) Junigelam (L) Morungu Obelfera (B) Ben oil (E) Nebbadays - (L) Ocimum Viride (B) Tea Bush (E) local name not given. Lippa Herabera (B) Sisil Yame (E) local name not given.

Nuts available particularly in the Rwanda region - Ref: Inferra OPS/D/480-ISRQ 1364 & RG/UO Dt.11-12-81 - letter to Ryan.

Ricinus (Eupherblaees) (B) Ricin (E) Partout en Afrique noire (L) Malvacees (B) Kapatier (E) Afrique Occidentale (L) Botanical-not given Karite (E) Region Soundanaise (L)

Also from the African continent, mostly in the Congo region - Ref: INFOTERRA/OPS/D/480-IRSQ/RG/rs dated 22-12-81 letter to Ryan.

Ongekea (B) available in large quantities.
Owala (L) also available in large quantities.
Pentadesma Burtyrasea (B) large quantities.
Pentaclethila (B) large quantities.
Pega Oleesa (B) small quantity.
Penda Oleesa (B) Small quantity.
Courges(French local name-small quantity).
Irvigvia Gabounenais (B)
Tetracorpidium Conopherum (B) Small quantity.
Baillenella Texispesma(B) Small quantity.

The crushing of the nuts may be done either by a cow drawn "Seku" as done in India or by a hand press. Different nuts may be mixed for crushing. The collection and crushing activity may be organised centrally by the village community or by any external service or promotional agency. Unemployed people and children may be employed in the activity.

An empty tin, earthern pot or even a motor car hub cap can be used as a stove with cotton wicks and waste oil. The burning wicks in oil may be pushed under the pot of sea water to evaporate it.

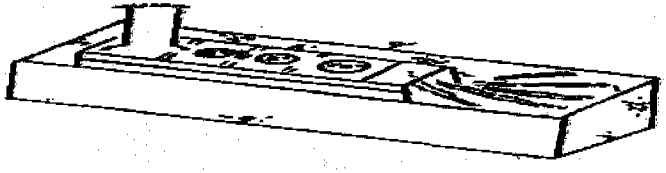
Ryan Foundation See-Saw Crushers are ideal for extracting non-edible oil for cook stoves.

113

OPEN AIR COOKING PLATFORM

(for boiling the sea water)

RYFO Handout 29



In rural areas of the Third World, cooking is almost always carried on inside the small low hut which has scanty accomodation and ventilation and the whole family lives in the same smoky room where the cooking is done. Rural communities should be advised to cook, as far as possible, out in the open before the sun sets in or after sun set. They should also get into the habit of cooking in a standing position instead of squatting near a low fire.

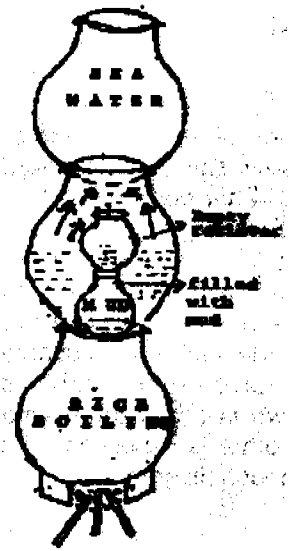
The open air cooking platform may be built out of brick mud or cement or clay building-blocks. To form the top of the platform, quarter inch thick mild steel rounds or squares may be laid across the two long parallel walls and the bricks or slabs may be arranged on them and plastered. Alternatively, a reinforced cement slab may be pre-cast and put on top. A small second platform, with circular openings to hold pots as shown in the diagram may also be hollow inside with side opening and firewood or briquettes may be stored in it.

Families that can afford to put up this construction in front of their hut may do so. Three or four families may do well to join together and put up a common platform for their common use.

Aid agencies would do well to build open air community kitchens for collective use of selected families. Different times may be assigned to each family to use the platform to prepare their meals. Such open air kitchens will not only make life inside huts liveable but also save time, labour and fuel for the rural poor. These open air cooking platforms can be used very conveniently by village communities to desalinate sea or saline water.

114

RYFO 5 POTS STILL — RYFO Handout 686



The RYFO 5 pots still is about the same as the RYFO 4 Pots still and works on the same principle. The main difference between the two are 1) the size and 2) the heating energy used.

The 4 pots still is placed on a cook stove and fired from the bottom and therefore requires fuel wood, oil or briquettes, which are scarce and costly. But in the 5 Pots method, the 4 pots still is placed right on top of the pot which cooks rice (or anything), and the sea or saline water in the middle pot is heated by the steam that comes out of the cooking pot. Thus, to use this still, additional fuel is not required but the energy going waste is used.

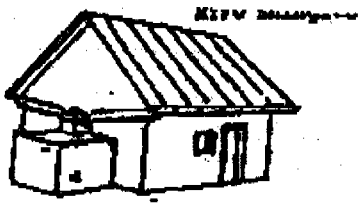
As the still is placed on top of the rice pot, the two pots that stand on the rice pot should be about the same size as the rice pot, if not smaller. If they are bigger, they may tilt. The two small pots going into the big middle pot will also reduce in size proportionately, and the collecting capacity of the still will be small. The pots desalinating the water should be opened only on the following day. Give time to cool and condense.

During a day's normal cooking, an average family of five members will be able to collect about one litre water only over a pot of rice and perhaps one more over a pot of gravy. However, a village housewife finds this still more convenient and suitable to collect drinking water for the family as the process becomes part of her daily cooking, without any special effort.

The advantage of these pot cookers (stills) are that they don't have any metal or plastic components like handpumps and they don't reduce the level of the water table. They save the trouble of transporting and long distance walking, if sea or saline water is available, or made available, close by. The required pots are readily available in most of the rural poor people's homes. Even if they are not available, they can be easily made by the village potter with the clay available in nearby ponds and lakes.

RYFO WATER TANKS

RYFO Handout 687



Gutter made of bamboo or RYFO mortar

"GALA TANK" - BRICK model (details elsewhere)

Inlet opening on top of the tank has cloth filter.

On the roof of thatched huts and on sloping roofs built of tiles or shingles (Handout 192) water tanks cannot be built. Underground tanks are expensive and it is difficult to make them seepage-proof. However, two types of water storage tanks are suitable for rural homes. One is shown in this diagram and the other is explained here without a diagram.

The materials required are sun-dried bricks made of RYFO mixture for mortars (Handout 270) with tree gum such as BARNA (Handout 654). Alternatively, jaggery and mineral calcium (chunam) is mixed to the mortar in equal portion and the mixture gives excellent pores-free tank walls. The tank may also be built like a GALA TANK, recommended by the UNICEF (Handout 688). The tank may be built with double walls and a concentrated solution of mortar mixture and tree gum may be poured inbetween for reinforcement and strength.

Abutting the hut, a solid platform of the size 1 mt. x 1 mt. x 1/2 mt. is built. Then the tank, of the size one cubic metre is built on top of it. Inlet and outlet pipes and air-vent are provided as shown in the diagram. Since the tap is 1/2 mt. above the ground level, it is easy to put a bucket under the tap to draw the water. A motor or handpump is not used.

The second design has the solid platform, as big as the floor of the hut, right under the hut and the tank has the same floor area as the hut. The tank is built two meters high above the platform and the hut is built on top of the water tank. In this case, steps made out of casuarina or Eucalyptus poles are provided as shown in RYFO Handout No.6.

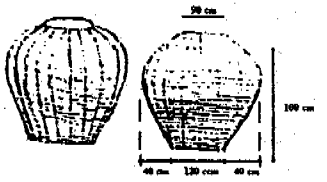
In this design, the water holding capacity is large and the house being high can be kept clean and free from reptiles and creeping insects. The hut can be kept dry during rains.

Before the top slab (lid) of the tank is fixed, man-hole openings are provided for inspection and cleaning. Also, the tank is filled with dried leaves and twigs and burnt (fired) for strength and durability. Heat expands body and the pores in the tank walls, if any, get blocked when fired. Pillars may be built inside the tank to support the top slab of the tank.

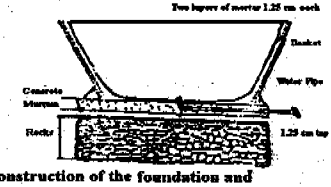
For further information, see Ryan Foundation pamphlet on Building Blocks and Roofing tiles.

THE GALLANT GALA TANK by UNICEF
(for catching and storing rain water)

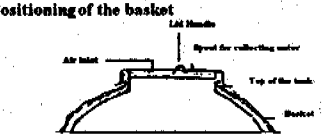
RYFO Handout 688



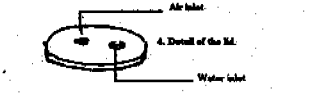
1. Ghala basket constructed without a base



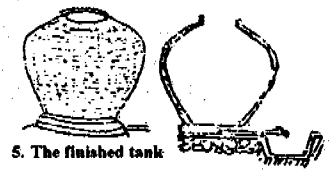
2. Construction of the foundation and Positioning of the basket



3. Construction of the lid



4. Detail of the lid



5. The finished tank

Murram - a naturally found mixture of clays, sands and pebbles which is commonly used in road surfacing

The idea originated from Thailand where UNICEF discovered rural people carrying water in baskets covered with an impermeable layer of tree resin. This concept was enlarged to meet the needs in Kenya, where more long-term water storage is required, by modifying a traditional Ghala or granary basket shape and plastering it, inside and outside, with a 2:1 sand/cement mixture. In Kenya, the basket frame is made from sticks cut from a woody shrub which grows throughout the country. In Rwanda and Burundi, the frame is made from bamboo. Presumably, provided that the material is strong, the basket could be made from any number of shrubs or sticks which can be woven into basket form. The basket is constructed on the ground by weaving the sticks into round shapes. The actual shape does not seem very important, but it is recommended that the bottom be omitted so that the sides can bond with the base.

Rougher weaves are better for the application of the cement which should saturate the basket as much as possible.

It has been observed that the baskets will deteriorate if allowed to weather. Thus the outside should be plastered with a thin layer of cement in order to protect it.

The baskets or tanks were first introduced in a self-help pilot project location called Karai outside Nairobi in 1978. After training local masons in the methods of building, the participants of the project embarked on a construction programme which is still ongoing. To date, over 300 tanks have been built in Karai, and a large number of privately-contracted tanks are under construction in satellite locations nearby.

The Ghala tank is ideal for small community projects where perhaps only 10 tanks are produced each month. UNICEF has successfully adapted the Ghala tanks to other countries in the region including Burundi, where over 100 tanks have been constructed and Lesotho, Rwanda, Swaziland, Tanzania and Zambia. To make very large tanks, the design can be further reinforced by simply banding the basket with wire or mesh. Several tanks of up to 2000 gallons have been successfully constructed in this manner.

For more details, read Appropriate Technology, Vol 8, No. 4, March 1982 - 9 King Street, Covent Garden, London WC_2E 8HN, UK or ask UNICEF, Eastern Africa Regional Office, PO Box 44145, Nairobi, Kenya. (Reproduced with permission).

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ECONOMICS OF REVERSE OSMOSIS

It is sheer madness to convert sea water into potable water by the reverse osmosis process, using costly Japanese machines, gulf oil, and Italian diaphram; then filling the water in plastic bottles each costing about Rs. 2 made in large scale factories; using heavy machines, scarce and costly electricity, inorganic chemicals, raw materials which cannot be easily disposed of in the form of bottles or pouches, and on top of it all, spending Rs. 5/- or more to transport the bottles of potable water to a distance of 5 km. or less, in road polluting vehicles, and selling the water to the urban rich at Rs.15/- per bottle, which includes publicity, promotional expenses and profit.

One cannot understand why governments are not converting sea water for farm and factory use by the successful Saudi method using wind, wave and solar energy (explained elsewhere by the Ryan Foundation) and also make sea water available to people in man-made canals and streams, especially in remote drought areas for domestic desalination in RYFO DO-IT-YOURSELF stills which are assembled with mud pots. From time immemorial villagers

have been using crude, unproductive stills for distilling country alcohol and they certainly know the principles of evaporation and condensation. RYFO stills are very productive and practical.

A down-to-earth water revolution is the need of the day and it has to be a sea water revolution of the people, by the people, for the people. Governments cannot usher a peaceful revolution and they have never done it before. They can only keep revolving round problems the way they have been revolving over the years and keep saying that water table is falling year after year. They will spend a billion dollars to install bore pumps to suck air or saline water but will not spend Rs.100/- to get down to brass tacks. Third World governments like scarcities and problems to stay in power and to make their money. They derive their strength as rulers, from poverty, problems and scarcity.

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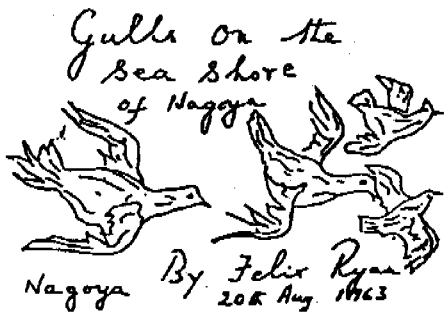
GULLS ARE USEFUL — RYFO Handout 691

(in building water storage tanks)



Millions of sea gulls are seen in thousands of places all over the world in coastal areas. They live in a kingdom of their own and multiply very fast and they are not edible.

From his study room the author used to watch them on the shores of Nagoya in Japan. He used to see them also in thousands every morning during the fifties in the Mahalakshmi area in Bombay, around the mosque on the sea shore. He found them in many other countries during his career travels.

The white of the egg of gulls (albumen) when mixed with mortar without cement makes excellent wall plaster for buildings. If made available in large quantities, they can be used for binding sun-dried bricks in the place of gum (glue) made out of tamarind seed powder.

The technology is ancient but people have been using chicken eggs for the purpose which are edible, nutritious and costly. Builders must be told and taught to switch over to eggs of gulls. The feathers of gulls are used for making shuttle cocks and also to make pig meal in China.

Gulls may be promoted in mangroves, estuaries and man-made sea water canals. Other uses can be found for the bird and possibilities appear to be many. When the white of the egg is added to mortar mixture, the binding property enhances.

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STATE-WISE DISTRIBUTION OF DAMS IN INDIA

Water is life, and sound management of a country's water resources represents an integral, if not the key component of the new paradigm for sustainable development - one that allows the steady improvement in living standards without destroying the fragile natural capital of river and groundwater system.

STATE WISE DISTRIBUTION OF DAMS IN INDIA

01. Andhra Pradesh	-74	09. Maharashtra	-
02. Bihar	-31		631
03. Himachal Pradesh	-3	10. Meghalaya	-6
04. Gujarat	-	11. Orissa	-39
	276	12. Punjab	-67
05. Jammu and Kashmir	-7	13. Rajasthan	-67
06. Karnataka	-63	14. Tamil Nadu	-77
07. Kerala	-44	15. Uttar Pradesh	-84
08. Madhya Pradesh	-	16. West Bengal	-17
	131	17. Goa, Daman & Diu	-2

Source : Registrar of Large Dams in India (1979)

RISE IN ESTIMATED COSTS OF SOME DAMS

DAM (NAME)	ESTIMATED COST(crores)	FINAL COST (crores)	% RISE
1. Thungabhadra	20.19	79.51	69.46
2. Bhakara	79.42	176.30	121.98
3. Barna	5.56	14.60	162.59
4. Tawa	27.50	91.40	232.36
5. Aliyar	24.87	85.76	244.83
6. Koyna	45.60	187.90	312.06
7. Dimbhe	27.51	120.38	337.59
8. Sidheshwar	2.57	18.57	622.57
9. Sriram Sagar	40.10	308.00	668.08

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FACTS ABOUT WATER

1. The presence of mercury above 500 nanograms in one kg. of fish is fatal to those who consume it. It has been found that fish caught from the coastal waters off North Bombay contain mercury above the level.
2. The variety of fish in and around the sea polluted by the effluents of Travancore Titanium Products, Thiruvanandhapuram, have now been reduced by 68 percent. The total loss to the fishermen in the last 20 years in the area is estimated at Rs.1006 crores. The Oxygen content in the sea water is being reduced at an alarming rate. If this is allowed to continue unabated the area cannot sustain any aquatic life in the near future.
3. Many decades ago when lakes and tanks existed and were maintained by the rural people without political interference, about 150 of them emptied their surplus in the Cooum river in Madras City, India which runs a course of 75 kms. and drains an area of 287 sq. km. The Cooum originates from the Bangaru channel in the Kesavaram anicut and joins the Bay of Bengal.
4. A survey conducted by the Govt. of Tamil Nadu in 1988 revealed that about 8100 families were residing along the banks of the Cooum in huts, within Madras city limits and any programme to cleanse the river must also include their resettlement. In 1991, about 15,000 families were estimated to be living on the banks. In 1994, about 25,000 families are estimated to live on the banks.

5. Beginning as two streams, the Adyar river joins near Chembarambakkam and flows into the city of Madras as a large river. It runs through St.Thomas Mount and enters the city from Nandambakkam and runs to a length of 40 km. The Adyar river drains an area of 847 sq.km. and used to take on the surplus of 450 tanks and lakes.

6. The United Nations Development Programme (UNDP) has approved a $ 732000 project to promote seaweed farming in Sorsogon province in the Bicol region in Southern Luzon, Phillippines.

7. In parts of Chile, there hasn't been a drop of rain for four centuries. Source : Severn Trent Water Ltd. Information service (quoted by Tamil Nadu Pollution Control Board, July 1991).

8. Water shortages have combined with soil erosion and desertification to degrade farm and grazing lands and reduce food production.

9. Instead of digging deeper and deeper and sucking the earth to leave it dry and sick and then declaring that potable water is getting more and more scarce, Governments should take sea water into the land by open cut man-made canals, and also connect them to dry rivers to help people, the rural poor in particular, to help themselves with adequate and safe water without making them depend on Government pipelines and supply system which are always expensive and troublesome.

10. According to the World Bank and the UNEP, 67 percent of Africa's non-desert lands, 34 percent of Asia's non-desert lands, 20 percent of Latin America's non-desert lands may turn into non-productive deserts in the near future. As many as six million hectares world-wide become deserts annually and an additional 21 million lose their productive potential each year.

11. Americans withdraw about 400 billion gallons of water each day for residential, industrial and agricultural purposes. This figure translates into 1600 gallons for each person each day. Prrolifigate use of water is begining to show in many parts of the country. Henry La Rose of the US Geological Survey predicts that the supply of underground drinking water in

South West Florida will be completely exhausted in ten years (zero population growth Nov. 1991).

12. Health depends on water and sustainable development depends on health. Goods and services cannot be produced by families, farms and factories without water. The national income, standard of living and export earnings of any country is bound to fall if there isn't adequate usable water.

13. "According to UN figures, 20 million more Africans lacked safe water, and 30 million more Africans lacked adequate sanitation at the end of the International Drinking Water Supply and Sanitation Decade than at the beginning" : Africa Recovery (UN) September, 1991.

14. One-tenth of China's territory is below sea level and concentration of population, agriculture and industries is in these areas.

15. While Global Water recharge has remained almost constant over the centuries, withdrawals are believed to have grown more than 35 fold during the past three centuries and are projected to increase by an additional 30 to 35 percent by 2000.

16. The degree of acidity is expressed in a scale of numbers known as the PH value (PH stands for the potential of hydrogen) and is a measure of the activity of hydrogen. Pure water with PH 7 is neutral. PH ranges from 1 to 14. The lower the PH, the higher the acidity.

17. "Looking back at the International Drinking Water Supply and Sanitation Decade (IDWSSD), we are all disappointed that the primary goal of providing safe drinking water for all by 1990 was not achieved. Over one billion people remain without access to good quality potable water while nearly two billion people have no sanitary means of disposing of human waste" - G.Arthur Brown, Chairman of the Steering Committee for Co-operative Action for the International Drinking Water Supply and Sanitation Decade in (UNDP) SOURCE, December 1991.

18. "Dams have displaced eleven million people in India. Of these 8.5 million still have not been resettled and remain landless. Narmada Dam scheme in India is already 4 years

behind schedule. It may be made economically unviable by the build-up of silt even before it is finished" - Oxfam News Summer 1992.

19. Cheerapunj in Mehalya, India, where it used to rain all the 24 hours of the day, all the 365 days of the year is now totally drought-ridden and people are walking several miles to fetch a pot of unhealthy water.

20. Water, pollution and scarcities are not God-made problems but problems made by politicians and bureaucrats for their advantage.

21. Development of water resources is the surest and shortest path towards poverty alleviation and improvement of the quality of life of the people.

22. The proposition that the non-monsoon flow of rivers can be increased appreciably by afforestation is not true either scientifically or on the basis of available flow of data.

23. Moreover, pumping of ground-water requires energy which is woefully short. Many tube wells can operate for no more than two to four hours a day for want of electricity.

24. The Cooum originates at Kaveripakkam in North Arcot District and was designed by the British to carry the surplus waters of the local tank at the Kesavaram Anaicut (dam). The canal branches out into two, one to link the Poondi reservoir and the other as the extension of the Cooum. Within the city limits of Madras, the Cooum stretches 17.6 kms.

25. Improving basic water and sanitation services is an important first step in the alleviation of poverty, protection of the environment and promotion of human development.

26. Nearly 70 percent of the world's population lives in or within 80 kilometres of a sea-coast - says a report on "The World Bank and the Environment - Fiscal 1992".

27. A study conducted by the Indian Market Research Bureau for the UNICEF and published by the National Drinking Water Mission of the Govt. of India in 1990 indicates that faced with a choice between a handpump and an open well, people often opt for the well water for drinking and cooking.

28. In India, the tug-of-war between the states and between the Centre and the states over water sources and supply highlights political manoeuvring and characterises water management policies which have not produced any good results for the past 2 decades. On the contrary, due to bad water management in several areas in the city of Madras, such as Minjur and Mylapore, saline water has intruded and made once potable water of the area now unpotable. In some places the water-table has fallen from ten to twenty feet and in other places the surface land is visibly sinking. The problem of sea water intrusion was observed by some UNDP agencies and the Metro-water Board as early as 1984. It is reported that in the Mylapore and Minjur areas, sea water intruded into the coast by some 8 km. in 1983, 5 km. in 1984, and 9 km. in 1987. Perhaps it reached 15 km. in 1992 and this is the evil of over-extraction of ground water. But our planners and politicians seem to go by the Keynes Philosophy that we will all be dead in the long run and therefore such problems should not worry us.

29. While planning for water, we have to balance what is technically sound, environmentally friendly, legally permissible, economically viable, socially acceptable, and politically possible.

30. In Titlagarh, which is reeling under acute water crisis, the water table plummets to 330 feet during the summer months when the mercury touches 52^0C. Despite the Tel river at a distance of 8 km., there is no piped water supply here and water is being sold to the poor at Rs. 2 to 4 a pitcher.

31. According to a report which was published in the Hindu on 16.05.1993 in Orissa, of the 2840 villages in Kalahandi, 754 habitations are waterless. In Bolangir, of the 2741 villages, 311 are waterless habitations and in Koraput, out of 6294 villages, 4056 habitations are waterless. More than 800 drinking water wells in these districts have dried up. About 3300 tubewells in these districts have become defunct and 1750 tubewells yield water with high iron content. Besides, 30 percent of the tubewells in the area are not functioning.

CONCLUDING APPEAL OF RYAN FOUNDATION - FOLLOW EXAMPLE OF DUBAI & ISRAEL

A desert is defined as an area receiving less than 25 cm. rain in a year. Dubai, which was once a desert or a semi-desert will not be a prosperous and an inviting commercial oasis today had not the wise rulers of the country of the past taken the sea water from one side of the country to the other in a broad man-made canal for small ships and boats to navigate and built several bridges across the canal to connect the two parts of the country, split by the canal. They dug the fine sea water lake in the track of the canal which now serves as a beach and amusement park for the people of the country and the very many tourists. The seawater canal which cuts the country into Bur Dubai and Deira Dubai brought progress and plenty to the country, of course, backed by oil. The hot deserts or semi-deserts of the world are not enemies of life. On the contrary, they are inhabited by diverse and fascinating creatures which have adapted wonderfully to the environment. Some day they may become the last region to be colonised by humanity. Israel has successfully reclaimed a million acres of desert. 60 percent of fresh water in Saudi Arabia is obtained from the sea.

Dubai can now promote inland sea water fish, fish based industries and promote saline and desert agriculture when the oil boom fades down which is bound to happen as solar power, electric cars and alternative sources of energy are picking up.

Much research has been done already by Global organisations like the FAO, USAID, Arizona University, the Ben Gurion University of Israel and several NGOs such as the Ryan Foundation International and successful results have been published and also demonstrated for other countries to follow. The drought resisters and perennial trees and shrubs can store water or trap it underground or reduce their need for water. Cactus, for instance, stores water in its stems, Creosote bushes have widespread roots to get ground water. Besides, plants and trees several birds, animals and reptiles exist and survive in desert conditions. With the introduction of sea water and increase in moisture all living beings in deserts can multiply and conquer desert conditons. Why don't dry countries quickly resort to this method when over 70 percent of the world's population lives within 100 kms. from the sea?

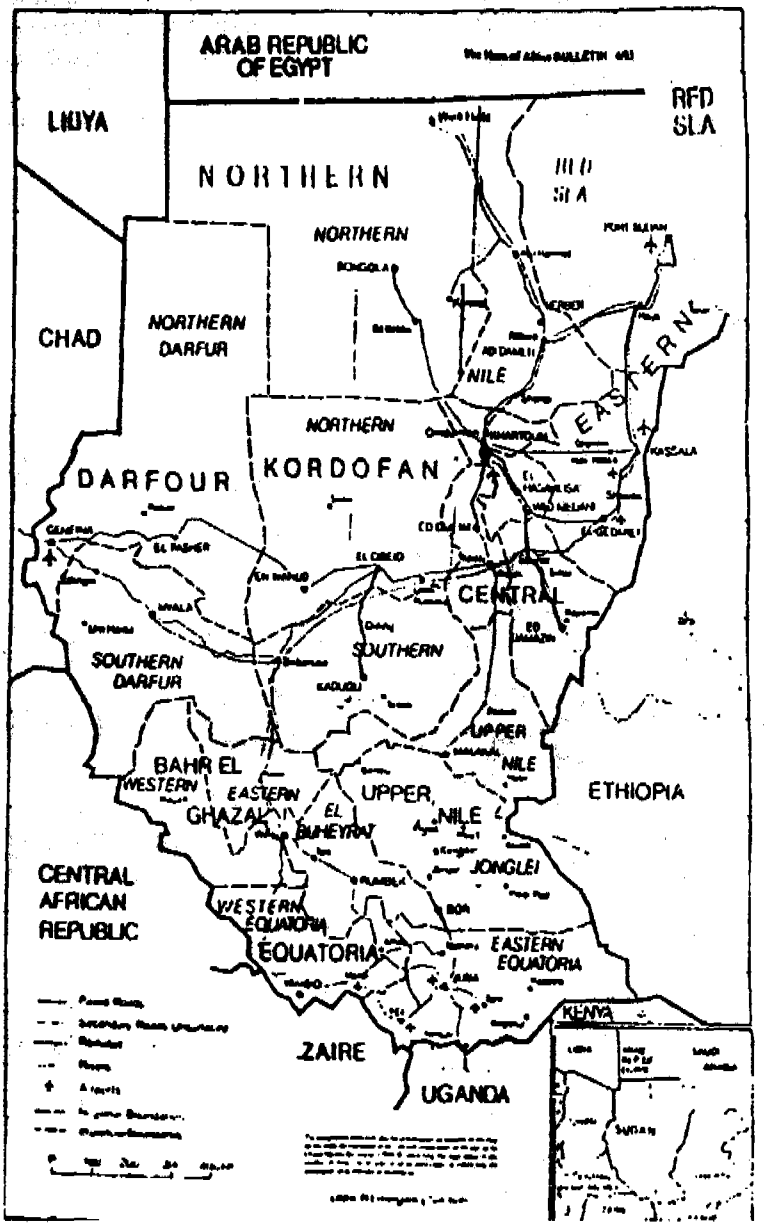
If seawater is taken in, domestic desalination by the easy RYFO methods will automatically be taken up by the people without aid or outside help to get healthy water to drink and cook and large scale desalination in stainless steel containers can be done by NGOs and private companies for cultivation and commercial use as now being done some 22 kms. from Jeddah in Saudi Arabia (the method is explained elsewhere in this book).

The approach of the United Nations, World Bank and UNICEF in particular, will not solve or mitigate the global water problem. African Recovery (UN) September 1991 reports "According to UN figures, 20 million more Africans lacked safe water, and 30 million more Africans lacked adequate sanitation at the end of the International Water Supply and sanitation Decade than at the beginning". The alarming global water situation has already been explained in the initial chapters of this book.

Large-scale development projects almost always erode basic human rights as many mega dams funded by the World Bank in India and elsewhere have demonstrated. Material development resulting in human destruction is not development. Let there be a stop to funding mega dams and let there be funding for the sea to be brought in. Countries like Bangladesh, India and Maldives and many island-nations should break away from wrong old ways and take to new innovative methods and give a lead to save the world from a water catastrophe. Let methods of Dubai, Saudi Arabia and Israel be copied by all developing countries and improved upon. This is the appeal of Ryan Foundation to the nations of the World. The sea and the tree hold the key for the safe survival of humanity.

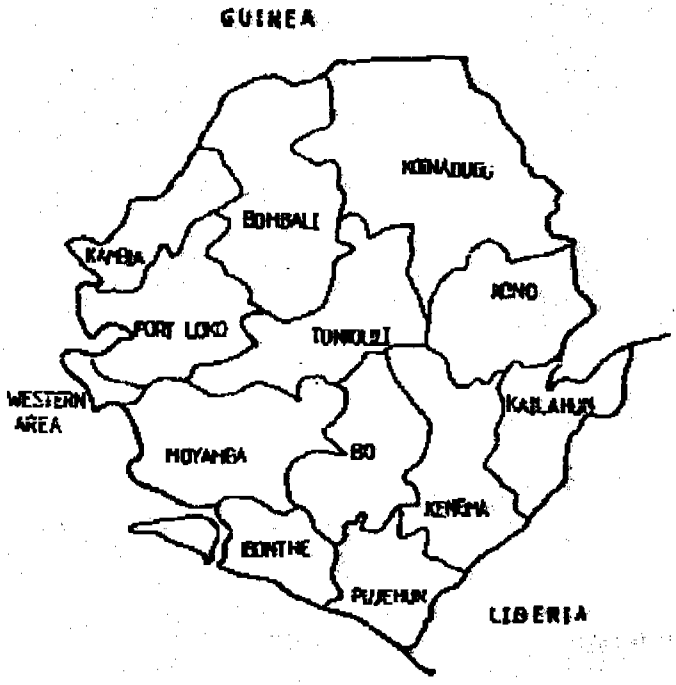
Appendix

1. MAP OF AFRICA (PARTIAL)



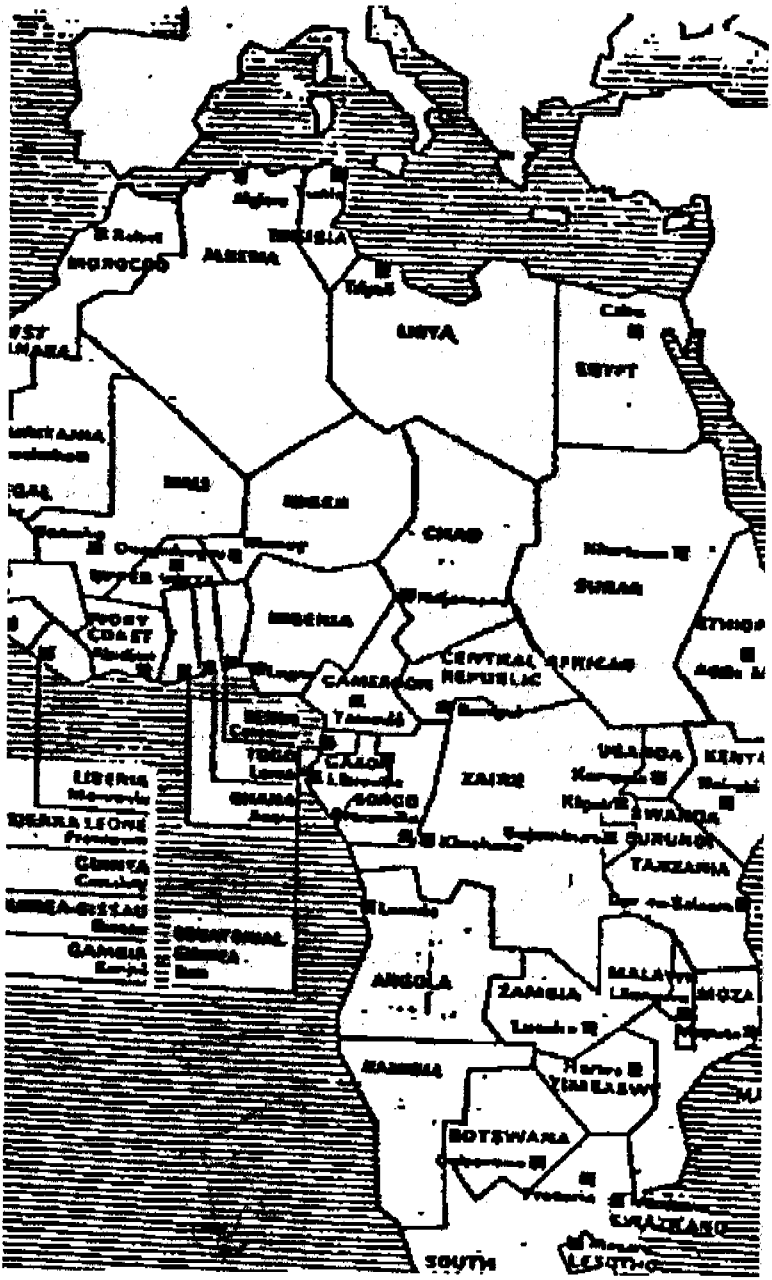
2. DISTRICTS OF SIERRA LEONE

Sierra Leone in the West Coast of Africa is badly neglected but the potentialities for development are great. The country has no oil and shortage of electricity is a very big problem. Industries and agriculture have not developed and people are poor. Eventhough rainfall is adequate water storage and distribution is mismanaged. Sewerage is badly neglected and Free Town, the capital, is highly polluted.



However, this country can progress fast if sea water is brought in and exploited for development and progress by the various ways explained in this book. The author spent the best part of his stay in Africa in this country. It is one of the leading diamond producing countries of the world but foreign businessmen take away the diamonds. Sea water can turn the tide and promote trade, commerce and industry for the local people.

3. MAP OF AFRICA

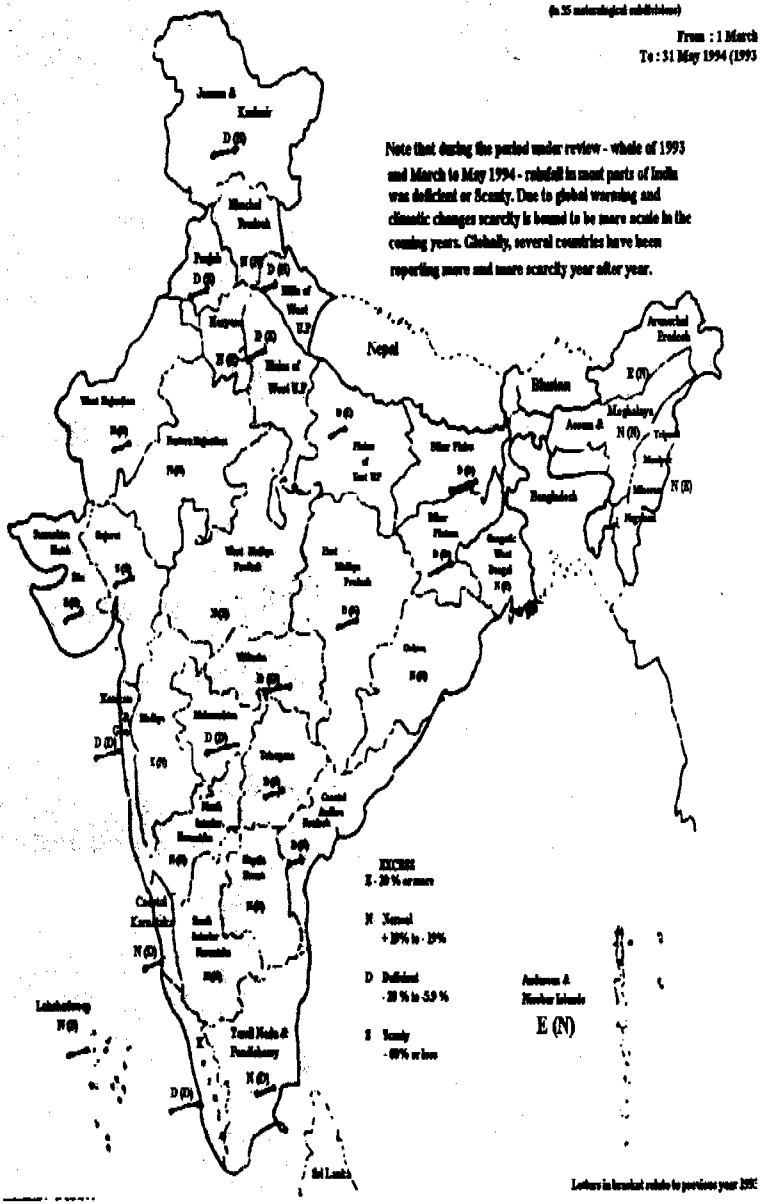


4. MAP OF SOUTH AMERICA (PARTIAL)

5. PRE-MONSOON SEASON RAINFALL IN INDIA

(in 35 meteorological subdivisions)

NATIONAL Source Hindu 18-6-94



For more than half the world there is no shelter, no water, no work, no education and no future. The only solution to the problem is to take sea water through pipes like this into man-made canals for low-cost domestic desalination, for saline agriculture, sea food, for people to bathe and swim, wash their cattle and for promoting sea based industries and inland transportation. This is already being done in some parts of the world. The sea and the tree can provide basic human needs and relieve poverty, hunger, disease and distress. - Dr. Felix Ryan, Chief Monitor, SURVIVAL BY SEA WATER Global Movement.

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REVIEWS OF OTHER PUBLICATIONS

1. SURVIVAL BY SEA WATER

Felix A. Ryan, Survival by Sea Water 56 pp., illustrations, Ryan Foundation International (8 West Mada st., Srinagar colony, Saidapet, Madras 600 015, India) rev.ed. October 1990, Rs.20(India), $ US 5 (elsewhere)

The author, a Global 500 Laureate launched a "Survival by Sea Water" movement to mark Earth Day 1990. This document and call for action is addressed to governments, NGOs and church agencies and the peoples of the world. On the very first page, he warns,"if governments do not let in sea water expeditiously to save humanity from peril, the scramble for ground water will increase, water tables will fall further and drought, disease, destruction and death will increase by the turn of the century."

Ryan's thesis is that the closed system of water supply has failed to take water to the poor. Thus the appeal to exploit sea water, involving women and children in the provision of safe drinking water through what he defines as the "Self-help open system". "Our progress towards health for all by the year 2000 can be made possible only if rural people take over the responsibility of water supply and sanitation as in the past". He especially recommends the RYFO pit is still as "perhaps the best, the cheapest, the easiest, the safest and sane[st] method of converting sea and saline water into drinking water". The materials required are 2 metres of plastic sheeting, tin cans, and access to nearby sea water. It operates on the principles of evaporation/condensation.

United Nations Centre For Human Settlements
HABITAT NEWS
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2. BETTER LIFE TECHNOLOGIES FOR THE POOR

Efforts at improving the lot of the rural poor have more often thrown up technologies that the poor can ill-afford. And when low-cost technologies do happen to see the light of day, very few of these manage to reach the poor. Meanwhile experiences of several workers at the grassroots level repeatedly dwell on the eagerness with which the poor await such low-cost easy-to-adapt, and remunerative technologies.

Such technologies are necessarily those that utilize locally obtainable and inexpensive materials and skills to meet community needs. Instead of technologies that are capital-intensive and time-consuming, yet hardly remunerative, the poor would be much better off if they were taught ways of utilizing their meagre resources optimally. By exploiting the living matter around them (plants, trees, birds, bees, livestock, etc.), they can generate substantial incomes. They can put to use the enormous quantity of waste materials around them. Indeed, the waste of the rich could be turned into the wealth of the poor.

The author of the volumes under review has come up with several such technologies that not only make use of locally available raw materials but also exploit waste materials to the fullest advantage. Drawing on his vast practical experiences, during which he actually faced and overcame several problems, Felix Ryan describes a vast array of what he calls the 'better life technologies for the poor' that are sure to be appreciated in many parts of the world. These technologies deal with such very primary needs as water storage, food storage and preservation, cooking, wheel making and the utilization of sun's energy for heating and drying. Besides, there are technologies for making cheap buffalo cart, tennis ball pump, groundnut sheller, oil distiller, baby weigher, solar cookers, pot coolers, etc.

The author has devoted considerable space to obtaining medicines, insecticides, gums, fodder and many other items from common trees. Then there are several remunerative practices like rabbit and pig rearing, integrated farming, horticulture, paper making, tilapia farming and fish farming. There are even a couple of plans for building low-cost houses. There are many technologies that use waste items like car tubes and moped tyres.

These volumes contain a wealth of information on innumerable technologies that the poor can easily adapt and be much better off. And they are a worthy addition to development literature that can be of much help to grassroot workers and all those concerned with direct application of appropriate technology for poverty alleviation.

Better Life Technologies for the Poor by F.A. Ryan (CARITAS India, C.B.C.I. Centre, Ashok Place, Near Gole Dakhana, New Delhi 110001): Volume 1(1987) pp.100, Price Rs.10;Volume II & III (Combined,1990),pp.200,Price Rs.50. All three volumes together USD 15.

3. PUMPS WITHOUT WATER

This book which exposes tall claims, utter failures and fraud in the water front with convincing facts and figures has been disturbing national and international governments, planners, policy makers, water experts and environmentalists. The author, United Nations Global Laureate, Dr.Felix Ryan, predicts a troublesome water revolution and warns:-

1. That by the end of the 20th century humanity will be sucking the earth dry and drinking water will become a rationed and taxed commodity as it is already so in several countries, including India, the land of rivers.

2. That boundaries of drinking water, like sea-water, will come under national and international control everywhere and wars will be fought between nations and within nations for water.

3. That conflicts and quarrels will increase between states, districts, villages, groups, families and individuals, not for land, gold or power but for plain drinking water.

4. That village-to-village, family-to-family and woman-to-woman clashes will increases and rural law and order will go out of control.

5. That water is bound to become as costly as oil and many nations that erect rigs and drill for oil will soon be drilling multi-billion projects in and off-shore for water, if they do not open out sea water canals and channels and teach homes and villages to desalinate sea water by the simple process of solar evaporation, advocated by the Ryan Foundation.

6. That licensing of private drilling operations will lead to corruption and the cost of transporting water will be more than the cost of the water transported.

7. That the greatest threat of the 21st century is not war but water.

The author, an environmentalist, who surveyed several drought hit countries in Asia and Africa asserts that thousands of sea water canals/channels is the positive answer, and these, moreover, will also arrest the rising sea level due to acid rain and greenhouse effect and with sea water made available, thousands of sea-water plants and saline-soil trees, and employment based on them and their derivatives, can be promoted for billions of people.

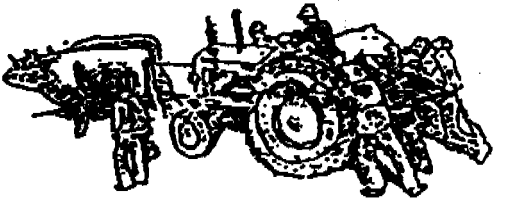
The booklet may be ordered for cost plus postage for Rs.30/-within India from the RYAN FOUNDATION INTERNATIONAL No.8,West Mada Street, Srinagar Colony, Madras-600 015, India. Those abroad may please make a bank-to-bank direct tranfer of US$ 5 into "ATIC a/c No.3354." in Vijaya Bank, 192, Mount Road, Madras-600 002 and intimate the Ryan Foundation for despatching the booklet.

4. MUSHROOM CULTIVATION UNDER YOUR ROOF

Obtaining fresh spawns (seeds) is the usual difficulty in mushroom cultivation. This do-it-yourself detailed guide by Dr.Ryan explains how spawns can be prepared out of common grains in a domestic pressure cooker or a double walled drum cooker. Cultivation methods done in boxes, plastic bags, under a staircase or a thatched shed are explained in simple language. Harvesting, dehydrating, pricing, packing etc. are also explained. By preparing mushrooms on a kitchen scale during spare time, the poor can earn a living wage and have a better diet, health and home. Price

in India Rs.20 including postage and US $ 3 including postage if sent outside India. Order from Ryan Foundation.

5. IS THIS APPROPRIATE TECHNOLOGY ?



FINDING NEW ROUTES IN OLD PATHS:
CULTURAL NEEDS TO TECHNICAL KNOWLEDGE:
APPROPRIATE TECHNOLOGY INSPIRES DEVELOPING SOCIETIES CONCEPT,CONTROVERSY AND CLARIFICATION

By

Felix Ryan

and

Franklin Vivekananda

with an introduction by
P.C.Mathew, I.C.S.(Rtd)
Former Asian Chief of the
International Labour Organization (ILO)
of the UNITED NATIONS

There is much difference between "appropriate technology", "alternative technology" and "intermediate technology" and yet these terms are often wrongly used one for the other. This book explains the difference with right and wrong illustrations.

Appropriate technology has strong attachment to cultural needs and what is appropriate to a rural community in Canada will not be appropriate to a rural community in India or Bangladesh.

The innovators of appropriate technology take it for granted that glass sheets, nuts, bolts or springs are easily available anywhere in the world but this is not true. Half the poor world cannot buy them from their local market even if they pay a big price.

There is a serious question for discussion about technology transfer. Contradictions are to be clarified. Third World Countries have to redesign today's appropriate technology from past practices into new patterns. Custom designed skill-making approaches are required for a multiculture world to enhance quality of rural life.

Felix Ryan spent several decades in innovating and spreading the right technologies for the rural poor in several countries for which he has been rightly rewarded (Global 500 Laureate) by the United Nations. Ryan is the author of "Appropriate Management Technology For the Third World", "Better Life Technologies for the Poor", "Pumps Without Water". "Survival By Sea Water" etc. For the past 40 years, Ryan has been promoting income-generating projects for the poor, based on rural raw materials, waste and appropriate technology in Asia and Africa. The three volumes of his popular book, "Better Life Technologies for the Poor" is a good reference book for rural extension workers. Ryan has succeeded in desalinating sea or saline water into drinking water at almost no cost and also in planting trees that grow in sea water to create employment. He was advisor of UNIDO and ILO of the United Nations.

Franklin Vivekananda has written number of books on Third World Countries especially in technology transfer, economic development, agriculture and political economy.

ORDER YOUR COPY FROM :

Outside India	Within India
Bethany Books *10391 Stockholm* SWEDEN (Price USD 10/- including postage)	R.L. Samaraj 782 C Vivekananda Nagar Guntakel 515 801 (Price Rs. 250/- including postage)

6. APPROPRIATE TECHNOLOGY FOR THE POOR

This book written by UN Global 500 Laureate Dr.Felix Ryan contains 200 grassroot development ideas to help the very poor to help themselves and their neighbours to live better economically, socially and hygienically. All ideas can be implemented even in remote villages with local raw materials with their own resources and without any financial or technical help from outside. Some of

the ideas don't require any money at all to be put into practice, and many can be implemented with about ten to twenty Indian rupees on material cost. Usage of metal parts, even simple items such as bolts, nuts, washers, nails, screws and binding wire are avoided as far as possible because they are not easily available in most Third World countries which do not manufacture but import them. If an NGO takes up the implementation, US $ 2000 would be more than adequate, including transportation, supervisory charges and contingencies to implement all the 200 ideas in a selected village. But they may give direct employment or additional income to at least 2000 families. In the book, every detail is explained in simple language with diagrams, and it is an ideal guidebook for grassroot workers to bring about development without dependence. The book is particularly suited for refugee settlements, villages in remote areas, small underdeveloped islands, tribal areas and the urban informal sector.

Review reproduced from D + C (Development and Co-operation, Government of Germany) No. 5 of 1991

Title: Better Life Technologies for the Poor by Dr.Felix Ryan. Vols: 1, 2 and 3 together available with : Ryan Foundation International 8, West Mada St., Srinagar Colony, Madras -600015,India.

Price in India for all 3 Vols Rs.100/- and US $ 15/- for orders from outside India. Cheques or bank drafts may be sent to Ryan Foundation favouring Ryan Foundation. Books will be despatched only on receipt of payment.

7. BOON FOR EMPLOYMENT GENERATORS

"PLANTS AND TREES THAT GENERATE EMPLOYMENT" is not only to help students and researchers in botany but also NGOs, social workers, public and private institutions and church organisations to generate employment in rural areas by planting, promoting, exploiting and replanting local vegetation.

About 300 under-utilized or commercially unexploited or under-exploited tropical plants, trees. shrubs, grass and weeds are described in the book, alloting about one page for each of them with diagrams or photos where necessary. Their marks of identification, soil, oil, climatic conditions, physical, chemical and medicinal properties are explained in clear and simple language avoiding technical jargon other than botanical names. Information on plants and trees that grow in saline soil and sea water is of

particular interest and authentic sources of research are mentioned where necessary.

The author, Dr. Felix Ryan, United Nations Global 500 Laureate, who has been an Adviser to the U.N. on employment generation attached to the UNIDO and the ILO, explains the various uses the leaves, barks, roots, stems, oils, starch, gum, dye, nuts, fruits and shells can be put to ; the very many rural industries that can be promoted using these as raw materials; and the millions of jobs they can generate in poor Third Countries, with negligible investment and by the application of appropriate rural technology. (In his booklet "Survival by Sea Water", he indicates plants and trees that can be cultivated using sea water).

Ryan emphasises that the only way to promote rural livelihood activities with strong and lasting roots is by helping the illiterate rural poor to generate their own vegetation-based raw materials and by promoting fish live-stock and live-stock related raw materials and he explains several leaves to feed livestock.

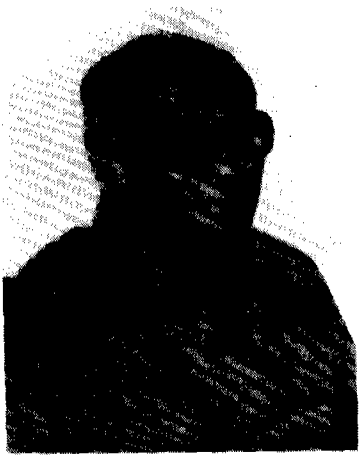
He recommends only a three figure investment on all his projects ideas, in Indian currency, to plough back profits for growth and development to get a family living wage within a year or two. He also points out that for many raw materials, urban factories and commercial centres should be made to depend on rural supplies and the village communities should bring about this situation. That is almost the only way for them to come up economically, socially and out of starvation. He identifies several plant-based raw materials that can be exported as raw materials or as semi-processed or fully processed raw materials and also as manufactured finished products from the developing countries to the developed.

Ryan does not recommend power-operated machines but only hand- cutters and crushers. Plants and trees that give oil such as the highly drought-resistant Castor, Jujube, neem and Soya are recommended. The mere collection of seeds and supply to nearby crushing centres, the author claims, can generate employment for millions in Third Countries, especially, for women, children and the handicapped.

The book is a boon to employment generators and those interested in trees, ecology and environment and in bringing about a rural revolution. The book will be in the market shortly. The price of it is US$ 20/- including postage. Within India, the price is Rs.200 including postage.

Printed at
INTEGRA
148, II Floor, Mission St.,
PONDICHERRY-1.

ABOUT THE AUTHOR



Dr. Felix Ryan, appropriate technologist, who worked as senior adviser to UNIDO and ILO and some international NGOs in Africa and other countries, now heads the Ryan Foundation International, registered Public Charity, dedicated to promoting income-generation activities, based on plants, trees, fish, live-stock etc. and their derivatives. In his controversial book, "Pumps Without Water", Ryan warns that, by the turn of the century, wars will be fought between nations and within nations for drinking water and appeals to the World Governments to channelise sea water into lands for human survival. He explains solar desalinization and hundreds of livelihood activities that can be promoted for the poor, based on sea water and saline soil.

The United Nations conferred on Ryan the UN Global 500 Honour in 1989 for his outstanding environmental achievements in Third countries, especially, in the field of cooking energy.

Ryan's books of innovative ideas on better Life Technologies for the Poor and on income-generation using village materials are now followed by NGOs in Third Countries.

Water management in homes and villages explains several sane alternatives for conserving and consuming scarce water. This book is the first of its kind on the subject for the use of common people, villagers and extension workers.

ABOUT THE BOOK

Instead of digging deeper and deeper and sucking the earth to leave it dry and sick and then declaring that potable water is getting more and more scarce, Governments should take sea water into the land by open cut man-made canals and connect them to dry rivers to enable people, the rural poor, in particular, to provide themselves with adequate and safe water without making them depend on Government pipelines and supply systems which are always expensive and troublesome.

Several methods of exploiting the sea for transportation, sewerage disposal, saline agriculture, no-investment and DO-IT-Yourself domestic desalination methods and very low investment desalination methods for farm and factory uses are vividly explained in this book of revolutionary original ideas. Is there any better solution for the water problem than what is explained in this book ?