Media Campaign
for climate justice

a Pipal Tree publication
Media campaign for climate justice
Compilation of monographs from the 2012-13 media project of Pipal Tree

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Executive summary

In the next fifteen years, as we hurtle towards a major climate change scenario, about 100 million people will perish due to climate change related factors in the absence of serious mitigation and adaptation measures. The numbers will only increase in the years that follow. Unprecedented climate change events such as flooding, drought, ocean acidification and the emergence of new pests, along with land-use change and over exploitation of natural resources are likely to reduce the ability of ecosystems to naturally adapt to changes in climate over the next century.

Although the ecological footprint of a poor farmer in South Asia is very small, these impoverished and vulnerable communities of the global south, and indeed, entire nations, will face the consequences of climate change for no fault of their own, their economies and welfare destroyed because they lack technologies, social protection mechanisms (such as benefits, insurance and savings) and adequate protection for their crops and animals.

Countries like Bangladesh and Maldives will have to pay a heavy price as their landmass goes under water and yet there is little mention of climate justice. Climate justice must squarely face up to the unequal burdens created by climate change, and find urgent ways to redress them. Policy options on how to fairly share the benefits and burdens of climate change need to be the subject of both national and international debate and action.

To that end, the print media in India, especially the Indian languages print media which has a mass readership, has a vital role in creating awareness among the general public and in engaging policy makers on aspects related to climate justice, low carbon farming, alternative energy and other mitigation and adaptation strategies.
In this context, Pipal Tree, a Bangalore based NGO, facilitated an alliance of freelance writers, journalists, social researchers and activists in 2012-13 to make use of the space available in the print media for stories and articles aimed at putting into place effective adaptation measures, particularly in the context of the rural poor who rightfully deserve a consideration for climate justice.

This magazine is a compilation of articles written and published by eight freelance writers from the three South Indian states of Karnataka, Tamil Nadu and Kerala for the campaign on climate justice during the programme year 2012 and 2013. Here is a synopsis of the articles presented:

In the article ‘Borewells that drains groundwater’, M.N. Kulkarni from Karnataka cites the crisis with dry land agriculture due to overexploitation of ground water resources. “Agricultural scenario in the country changed after 1950”, he writes and refers to how intensive agricultural practices entered farmers’ fields with the objective of increasing yields. High yielding varieties dependent on chemical fertilizers demanded more water and soon borewells replaced open wells. “Borewell drilling machines initiated the saga of groundwater exploitation and today the damage is irrevocable”, he notes. He recommends that people should be collectively involved in water conservation activities by building percolation structures like trenches, farm ponds, desilting of tanks and check dams and revert to traditional methods of farming.

Anitha Pailoor, in her article ‘Sustaining through drought and beyond’ describes jowar, little millet, foxtail millet, pearl millet, finger millet and proso millet as crops of hope since they grow easily under rainfed conditions. “Once sown, they grow with available natural resources and minimum water. They hardly require any fertilizer or pesticide”, she writes and states that, though small in size, millets surpass wheat and rice in terms of nutrition value. Needing very low or no external inputs at all, she says that millets offer multiple securities to the farmers: food, fodder, health and nutrition, and have the capacity to respond to the latest challenges such as climate change. On a positive note, she writes, “The crops that offer independence and dignity to small and marginal farmers are finally getting due recognition. Farmers and several organizations are now acting towards safeguarding remaining varieties”.

In the article ‘Disappearing flora, tradition, culture, vocation and language with climate change’ Poornaprajna Belur looks at climate change from a different perspective. With a changing climate, he states that along with medicines and food, tradition, culture and vocabulary linked to them are disappearing. He points out that, “Every language, food habit, culture, society and polity has been exposed to drastic changes. But these changes do not facilitate sustainability. Will it be possible to sustain life and culture by rejuvenating traditional agricultural practices, time-honored lifestyles and food habits?”

Depicting the scenario in Kerala, Ranjith Kavumkara remarks that climate change is no more a fallacy of romantic environmentalists. In his article ‘Forest communities, climate and ecosystems; conflicting reciprocities’, he reflects that, although the newspapers and television channels have started discussing climate change, not much has been done to understand the ways in which various sects of society are going to face the disastrous consequences of climate change. “The Intergovernmental Panel on Climate Change explicitly says that communities whose livelihood is dependent on natural resources will be the primary victims of climate change. The Kadars, one among the five Primitive Tribal Groups (PTG) of Kerala who live in the Chalakkudi River Basin in the Nelliyampathi and Parambikklam regions will be one such community”, he warns.

Maju Puthenkandam contributes with ‘Unscientific development practices and its adverse impact on local environment’ and writes, “Mining is now happening in Kerala without any control. Impact studies and protests by real environmentalists are ignored by the government and the mining mafia who say that there is no alternative for laterite and granite.
Our developmental priorities are turning suicidal. They are not taking into account the changing climate condition and the needs of local communities” and urges that a stand has to be taken to change the situation and protect our mountains, lands and water bodies to save ourselves and the future generations. He also writes emotively in ‘Rivers where boats ply no more’ the death of the Meenachil River which had once many tributaries. “Each was perennial and fed many a rice field. Country boats from Alappuzha and Changanassery had carried essential commodities to villages of these localities through the tributaries. Inland water ways were so active in those days and they also carried coconuts and pepper to the outer markets. Even during hot summers, water transport did not face any challenge”, he recounts and cites soil erosion and erection of check dams on the river which prevent the smooth navigation of the boats as the reason for the death of this once magnificent river.

On the coastal situation, Oamjie John in his ‘The burning sea and the vanishing coast’ describes how the uncontrolled and unscientific measures applied to several developmental projects all along the coast have in fact made a deep impact on the ecosystem of the sea and the coastal environment. “The Kerala coast is, in effect, undergoing unprecedented changes and has been facing acute ecological crisis over the past five decades. Both natural and man-made causes are behind this crisis”, he writes and draws attention to the rise in sea water temperatures causing fish like Sardine and Mackerel of the Pelagic species to migrate either to other areas or move to the bottom of the sea and threaten the livelihoods of fisher folk. The article also deals with sea level rise. “Traditional paddy fields and 90,000 hectare shrimp/fish hatcheries will be completely ruined, endangering job and food security of the people living along the Kerala coast. The foundations of rural economy will be adversely affected, causing its complete destruction”, he states.

From Tamil Nadu, Nakkeeran, in his ‘Virtual water - the blue gold’ delves into the dynamics of commodity production causing pollution of water bodies and the economics of water in favour of importing countries. “Many developed countries import goods from developing countries like India leaving us to pollute our water bodies by running all the industries. This has resulted in the dying of the Noyyal River in Tamil Nadu in addition to the Palar River”, he writes. On the economics of water, Nakkeeran explains, “Many developed nations see the importing of goods in terms of virtual water saved by not producing them locally. These importing nations only pay for the products and not for the water consumed for producing them in India. Water experts argue that increasing our exports would only mean spending more water to produce those goods and helping the importing countries save their precious blue gold”.

Renuga Kasi’s contribution ‘Climatic changes due to urbanization and deforestation’ dwells on factors contributing to global warming and human induced climate change. Renuga points out at indiscriminate deforestation and unchecked urbanization as twin evils committed by humans is spurring on climate change. “Forests are natural carbon sinks and destruction of trees results in increased levels of unabsorbed carbon dioxide in the atmosphere. Yet humans have set out to plunder the earth’s forests which has contributed towards damaging climatic conditions and global warming”, she writes. Prolific with statistics, she has detailed the identifiable sources of carbon emissions in the process of urban development. “Mankind makes abundant use of fossil fuel nowadays due to urbanization and the earth will face disastrous consequences if the carbon dioxide concentration level in the atmosphere is not decreased to 350 ppm (parts per million) from the present level of 400 ppm”, she states.

It is hoped that the efforts of these eight freelance journalists will cause a wider dissemination among the readers and policy makers and harness local, national and international cooperation. On a larger platform, it is hoped that these articles enhance awareness on the implications of climate change in India and provoke concrete actions.
Agriculture is not just an occupation in India. It is embedded in our culture and tradition. Farming is the backbone of our country. Over 70 percent of the population in the country is dependent on agriculture. In the early years after India's independence, agriculture and agriculturists commanded great respect from society. It was the period when traditional agriculture was practiced. Crop diversity was the characteristic of every farm. Grains including millets and sorghum, pulses and oil seeds were all grown in rainfed conditions.

Agricultural scenario in the country changed after 1950. Intensive agricultural practices entered farmers' fields with an objective to increase the yield. Providing food for the rising population was the reason cited for the entry of these heavy input - high yield methods. Chemical fertilizers and pesticides became vital to agriculture. They were easy to procure, handle and their effect was immediate and impressive. There was no reason for the farmers to continue with traditional methods. Their dependency on cattle for agricultural purpose reduced due to mechanization of agriculture. Traditional methods of compost making no longer interested farmers. Moreover, chemical farming was introduced and popularized by State-run agencies like the Department of Agriculture and Agricultural Universities.

Mechanisation followed chemical farming. High yielding varieties and chemical fertilizers demanded more water. Borewells replaced open wells. Borewell digging machines initiated the saga of groundwater exploitation and today the damage is irrevocable. Earlier crops were selected based on the availability of water in the open wells and rainfall pattern. Most of the crops were rainfed, while very few like areca, banana, coconut and beetle leaves were irrigated from the open well. The trend changed with the introduction of market-oriented agriculture.

Groundwater exploitation has become a serious concern in recent years. Groundwater abuse continues in spite of strict prohibitory measures undertaken by the government. Mallikarjunaiah of Belagerahalli in Tiptur Taluk has a coconut farm. Monsoon was the major source of water for the plants in the initial years. Open wells and tanks were also used when necessary. Gradually groundwater depleted. Open wells went dry. He had no other option but to dig a borewell. He says that irrigation using borewell requires an initial investment of Rs.2 lakhs. Only those who can afford that much money can opt for borewells and prosper. He says, 'Rich people become richer and provide good education to their children. Agriculture is no more a common

92 Borewells in a village with 120 households

Upparahalli is a small village in Chikkanayakana halli in Tumkur District with 120 households. The concept of borewell was introduced to the village in 1980. Now the village has 92 borewells. Coconut and vegetables are the major crops. Water level which was at 60 feet in the beginning has gone down to 800 feet. Farmer Parameshwaraiah believes that borewell companies are the ones who have made huge profit with the farmers' increased dependence on borewells.

Use of chemical inputs:

Traditional method of mixed cropping by which grains, pulses, vegetables and oil seeds were grown together lost its relevance with the introduction of advanced method of cultivation.

Three quintals of chemical fertilizers and a large quantity of pesticides are used for growing vegetables in half an acre. More than 40 farmers grow vegetables on a total of 10 acres. Three tractors and 40 motor cycles commute on the roads regularly. Farmers are not aware of the damage caused by these developments on the environment. Recently Organic Village Project is getting implemented in the village and farmers have shown interest in growing vegetables using organic inputs.
person’s occupation.’

Irrigated farms yield more crops than rainfed farms. Farmers who possess 80-100 coconut plants own a motorbike. Farmers who have 500 plants own a four-wheeler. Electronic gadgets are commonly found in all the houses. All these oﬀshoots of chemical farming have indirectly added to the problems of climate change.

In Karnataka, 95 percent of the rural population is dependent on groundwater for household purposes. According to the statistics provided by Mines and Geology Department, groundwater usage has increased from 35.6 percent to 82.33 percent between 1991 and 2001. Seventy-one taluks in the state are identiﬁed as groundwater scarce regions. Tumkur District is categorized as ‘Dark Zone’ with respect to groundwater status. In most of the taluks of the district, groundwater level has gone down to 600-800 feet. As per the rules, new borewells are not given electric connection. But this decree is not properly followed. Borewells are excavated unremittingly and ground water exploitation is continuing.

Coconut is the major commercial crop of Tumkur district. Tiptur, Gubbi, Chikkanayakanahalli, Turuvekere, Kunigal and Koratagere are popular coconut growing taluks. Earlier to the introduction of borewells, open wells were the major source of water for the crops. Though open wells still exist near coconut plantations, these water sources remain dry even during monsoon. Irrational excavation of borewells has led to many problems. Coconut plantation, which was earlier rainfed or limited to lowland, is now spread to upper catchments also. Borewells increased proportionately. All this has led to the depletion of groundwater.

Details of wells in Tumkur district as per 2001 census:

<table>
<thead>
<tr>
<th>Type of Well</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Open wells</td>
<td>14,764</td>
</tr>
<tr>
<td>Borewells</td>
<td>78,750</td>
</tr>
<tr>
<td>Borewells meant for drinking water</td>
<td>15,870</td>
</tr>
<tr>
<td>Total</td>
<td>1,09,348</td>
</tr>
</tbody>
</table>

**Eta irrigation** (Manual lifting of water using bullocks) method ensured conjunctive use of water. Moreover, in a day, only one acre of land could be irrigated. This system lost its relevance with the entry of borewells. They also had techniques by which moisture level would be maintained even in summer. “Water exploitation has reached its peak as there is a sharp increase in the number of borewells. In Halkurike village, more than 200 borewells exist. Rich people exhume more borewells and convert bare lands into coconut plantations. “This will pose problems in the future,” opines Naganna of Halkurike village.

Since coconut was aﬀected by a couple of diseases in recent years, people are shifting to areca cultivation. Areca requires more water than coconut. So water exploitation and water shortage is high. This has aﬀected crops also. Modern agriculture requires high investment but the income has been ﬂuctuating signiﬁcantly. As a result, farmers have lost hope in their occupation. Some could not come out of the vicious cycle of loan-chemical fertilizers-pesticides-borewells and therefore started committing suicide.

**Kalyani**

In Karnataka, particularly in parts of South Karnataka, life revolves around ‘Kalyani’, a traditional water source. Its history runs parallel to the evolution of agriculture around tanks. There are 2,022 tanks in Tumkur district. Temples are usually constructed close to this water source and sometimes we also ﬁnd a Kalyani in the temple’s surroundings. Holy water pond, Pushkarini, is another name for Kalyani.

Groundwater is the major source for 90 percent of the Kalyanis. Water is used for drinking purpose and for temple poojas. Size of the Kalyani ranges from a few feet to many acres. Every Kalyani has historic or mythological signiﬁcance attached to it. Pushkaranis at Hampi, Badami and a series of Pushkarinis at Melkote are some of the Kalyanis that could be cited. Most of the Kalyanis, particularly smaller ones, have become victims of groundwater shortage and have become garbage tanks.

**Threat to food security**

Finger millet and groundnut are the major
field crops of the district. In the last few decades, farmers are finding commercial crops more profitable than finger millets. A range of native finger millet varieties along with other millet types are on the verge of extinction. Horticulture crops have replaced millet and groundnut fields. Marigold and gherkin cultivation has attracted farmers. A marigold processing plant has been set-up near Halkurike in Tiptur Taluk. Gherkin processing plant is functioning near Koratagere. Both crops require huge amounts of chemical fertilizers and lethal pesticides. Waste produced at the processing units also has a negative impact on the environment. Most of the farmers are not aware of these consequences.

<table>
<thead>
<tr>
<th>Crop</th>
<th>2002 (Ha)</th>
<th>2012 (Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger Millet</td>
<td>199872</td>
<td>192046</td>
</tr>
<tr>
<td>Ground nut</td>
<td>171639</td>
<td>84599</td>
</tr>
<tr>
<td>Red gram</td>
<td>11220</td>
<td>9931</td>
</tr>
<tr>
<td>Field bean</td>
<td>11437</td>
<td>9025</td>
</tr>
<tr>
<td>Horse gram</td>
<td>22490</td>
<td>6544</td>
</tr>
<tr>
<td>Horticulture</td>
<td>151000</td>
<td>255000</td>
</tr>
</tbody>
</table>

Lack of labourers for agricultural activities is another problem faced by farmers. Consequently, farmers are shifting to horticulture and monocrops. Dhanajay of Toremavinahalli in Turuvekere Taluka who has 20 acres of land says, “Earlier we used to grow 80 quintals of finger millet. Now the area has reduced and we grow only four quintals. The number of coconut plants has increased from 200 to 800 and an areca plantation with 1800 plants has been added.” Since farmers are showing interest in horticulture and perennial crops, cultivation areas under food crops has been reduced considerably. This is drastically affecting food security.

Impact on health

Drinking water problem is looming large with the depletion of ground water level. This has led to water contamination. The level of certain chemicals has crossed the safety margin. Fluoride contamination is a major problem. The maximum permissible limit of fluoride in drinking water in India is 0.5 to 1.5 mg/liter and the government has been obliged to install fluoride removal plants of various technologies to reduce fluoride levels from industrial waste and mineral deposits.

More than 14,000 borewells in the district have higher levels of fluoride. Having no other option, villagers drink this water and suffer from severe health problems. As the water level goes down, fluoride contamination becomes greater. Flurosis cripples people with bone related ailments. If the patient fails to recognize the symptoms at an early stage and gets proper medication, he will have to suffer lifelong.

The way ahead

If exploitation of water resources continues at this pace, the country will have to face acute shortage of water by 2070. Former President of India Dr. A.P.J. Abdul Kalam has foreseen the problems and cautioned people about the consequences of unscientific use of water. Proper utilization of water, rain water harvesting, ground water recharging, desilting the tanks and drip irrigation are some of the ways to ease the pressure on groundwater exploitation.

People should be collectively involved in water conservation activities. Water conservation and percolation structures like trenches, farm ponds, desilting of tanks, check dams etc. should be encouraged. It has been estimated that 3000 litres of water get collected in a trench of 5 metre length, 1 metre depth and 1 metre breadth. This has been established through watershed development projects implemented by the watershed development department.
Roof top rain water harvesting is another activity which should be given more importance and has the potential to solve drinking water problem sustainably. A law that compels roof top water harvesting will act as a catalyst. Rainwater collected scientifically is portable and safe. A family with 4 - 5 members needs 6000 liters of water for drinking. In cities, 15 to 20 percent of water gets wasted in the supply chain due to seepage. Leaking taps and damaged pipes are some of the reasons for water losses and wastage.

Farmers have to employ advanced irrigation methods. Drip irrigation and sprinkler irrigation reduce the quantity of water used. System of Rice Intensification (SRI) method of paddy cultivation will reduce use water by 50 percent. Proper mulching is very important for horticulture plants. A properly mulched plant requires water only once a week. Use of organic manure, green manure, construction of water percolating structures help in reducing water requirement.

Many organizations, government agencies and enthusiastic individuals are actively campaigning for water conservation practices. The State Government has repaired and desilted many tanks under its Community Based Tank Management Project. Check dams, trenches, farm ponds, sunken ponds have been constructed under Integrated Watershed Management Projects. However, maintenance and desilting of water harvesting units at regular intervals is the need of the hour. Communities need to be trained and motivated in this direction.

BAIF Institute for Rural Development, an NGO based in Tiptur, is encouraging water harvesting activities like roof top rain water harvesting,
excavation of farm ponds, borewell recharging, open well recharging etc. The department of Rural Development and Panchayat Raj (RDPR) sponsored Sachetana project for rain water harvesting for drinking purpose has become a model in the State. Over 5700 Rain Water Harvesting (RWH) units have been constructed in 115 villages in the districts of Tumkur, Gadag and Chikkaballapura under this project. The second phase of this project is under progress in 26 villages around Y.N. Hosakote hobli, Pavagada taluka, to construct RWH units for 4000 households.

Dhanya, an NGO based in Tumkur, has organized awareness programmes about the need to conserve traditional water resources called ‘Talaparige’. Arghyam Trust in Bangalore has been involved in different water conservation activities apart from supporting efforts in this direction. Shivakumara Swamiji of Nandiveri Matha in Gadag District has been successful in constructing water harvesting structures in thousands of acres in Kappatha Gudda hill ranges. Editor of Adike Patrike, Shree Padre, Devaraja Reddy of Chitradurga, Ayyappa Masagi, Chanabasappa Kombali of Ranebennur, Vishwanath of Rain Water Club, Bangalore and Shivakumar, a scientist at Indian Institute of Science, Bangalore, are involved in creating public awareness about water harvesting and conservation.

Ground water should become a possession of the community. A law pertaining to the use and management of ground water should be strictly implemented. If water harvesting programmes are put into practice with people’s participation, we could gradually overcome the looming water crisis.

Reference:
Groundwater information booklet (2008), Tumkur District, Central Ground Water Board, Government of India.

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*Translated from Kannada by Anitha Pailoor*
In 2004, North Karnataka was facing drought for the third consecutive year. Unable to get a good crop, farmers of Kamadhenu and Kamplikoppa villages in Dharwad district decided to petition the Deputy Commissioner for help. The group sat together and drafted a letter. As the letter reached farmer Nagappa Adaragunchi's hand for signature, he thought for a while before passing the unsigned sheet to the next person. His farm had survived the scarce rainfall and he was confident of a reasonable crop. He felt no point in appealing for support. 'I am assured of good harvest even when there is minimum rainfall,' says Nagappa.

Tree-based farming has given him the confidence to sustain livelihood in drought conditions. He has grown need-based crops on his two and a half acre farm. Mixed cropping has made farming sustainable and helped him to achieve a self-reliant livelihood. Sapota, mango, lemon, cashew, drumstick, tamarind, custard apple, jackfruit and cattle fodder is grown together on one and a half acre land. Nagappa has created a micro catchment area for all sapota plants. There is a farm pond to store water. Over 2000 plants grown on the borders of the land which include sandal wood, bamboo, teak, silver oak and neem act as a live fence and offer timber. Trees enhance bio-diversity and percolate water into the earth. Dairy and vermicompost are complimentary to farming activities.

First step towards sustainability was abandoning the use of chemicals on the farm. This was crucial to maintain the quality of the soil and sustain ecological balance on the farm. Manure and vermicompost were used to enhance fertility of the soil and its productivity. Mulching had helped to maintain moisture level thus reducing water requirement. Regenerative organic farming, focused on enhancing long-term biological interactions, turns the soil into a carbon reservoir. Organic management also changes the structure of the soil, improving its ability to store water and deliver nutrients to plants over time as the soil carbon levels continue to increase.

Water conservation models like farm ponds and trenches facilitate rainwater percolation. He believes that soil and water conservation can effectively protect agriculture from impending drought situations.

**Tree-based farming**

The couple Kallavva Haklad and Malleshappa Haklad has set an example in self-reliant farming in Kamplikoppa village of Dharwad district (Karnataka). Recurring drought-like situations have not deterred them since the last one decade.

Fifteen years ago Kallavva used to get only one quintal sorghum from her 3.5 acre dry land. Her trials with vegetable didn't help much. Earning a decent livelihood was difficult for this farming family. Her sons started working either in the nearby city of Hubli, or
on others’ farm. At this stage, when Kallavva was trying hard to enhance the productivity of her farm, BAIF Institute for Rural Development in Karnataka assisted her to opt for a different farming method.

She opted for tree based farming (agro-forestry) and planted various tree saplings of forest species on the borders to act as a live fence. Ten different varieties of fodder meet the needs of cattle in her shed. She has intercropped grains, pulses and horticultural plants with sorghum. Mixed cropping was a firm step towards achieving food security. Additional advantage is that fluctuating markets does not affect her much.

Shifting from chemical to organic farming has helped her family monetarily. Expenditure on fertilizers and other inputs has reduced. In-situ vermicompost is the major nutrient to their farm. Pest attack and other plant diseases have reduced gradually.

Structures like trenches, bunds and a farm pond help rainwater to percolate there itself. This has enhanced water level in the farm. Kallavva and Malleshappa have dug structures called ring trench biomass (RTB) of one-and-a-half feet length and width circling the plants which would be filled with biomass. This helps to increase the moisture level of the soil near the plant. To water plants in summer she uses a pot with a small hole at the bottom. Water drips to the soil through a coir rope inserted in the hole, thus helping to retain moisture level of the plant. A pot full of water lasts for five days.

Kallavva has achieved food security by carefully choosing the crops to be grown in the tree based farm, which is also known as wadi. She also grows most of the produces that she consumes. Since she practices organic farming, expenses have gone down while productivity of the farm has increased.

Crops of hope

Jowar, little millet, foxtail millet, pearl millet, finger millet and proso millet were part of agriculture in Dharwad district till late eighties. Millets grow easily in rainfed regions. Once sown, they grow with available natural resources and minimum water. They hardly require any fertilizer or pesticide. Farmers preferred growing millets as a second crop.

Even if other crops failed, millets sustained livelihood. Even cattle liked eating nutritious millet straw. As the concept of high input and high yield became popular, agriculture got transformed to agribusiness. Water intensive cash crops replaced food crops. Rice and wheat entered kitchen shelves via the Public Distribution System. Gangamma of Chinnikatte in Haveri district says, “In spite of their consistent growth and assured yield, millets are rooted out of the fields.”

The non-chemical farming trend that has spread in the state in the last decade and the network of community seed banks helped farmers realise the crucial role millets play in sustainable farming. Many farmers have made up their minds to return to a millet diet. Some farmers take up processing at home to sell at organic markets. But processing large quantities is a constraint due to the low acceptability of the grain.

When cash crops like maize, improved variety cotton and soya bean were introduced, tricky and laborious post-cultivation processes of millets appeared tiresome for farmers. Farmer Basavanneppa Angadi says, “When we got a month’s ration with a day’s wage we almost forgot millets in our daily food. Cooking rice was easy and quick. Now we

Trees produce more bio-mass than surface crops. Trees encourage water percolation and help in recharging ground water, and thus check soil and water erosion. Trees provide food, fodder, fibre along with biomass. They also create micro-climate by their continuous evapo-transpiration helping better crop production.

Trees contribute a lot in increasing humus by dropping their dry leaves which act as mulch and later on they are converted into humus. Humus is very important in improving the soil’s capacity to hold water and improving the biological activity in the soil, thus helping in yield improvement. Trees play an important role in providing fodder for animals even during the drought situations.

Trees provide shelter and host predators and birds, which are useful in controlling insect damage in the crops. Since droughts and untimely rains are very common, it is much safer for farmers, particularly small and rainfed farming communities, to adapt to the agro-forestry system to be safe and risk free. Since they have trees and regular supply of fodder from trees they can opt for dairy or sheep/goat farming to get additional income. Horticulture plants also provide food in the form of fruits which also become major sources of income for farmers.
have understood that the time saved gets spent in the waiting lounges of hospitals.”

Cash crops do not cater to the fodder needs of the cattle. “At the end, cultivating one acre of little millet is equivalent to growing ten acres of maize.” Basavaraj, a farmer from Naganur compares the fodder produced and also cost of cultivation. It took a couple of decades for farmers to understand this vicious circle, which also snatched away their food security.

**Coarse grains become miracle millets**

Farmers observe that between 1950 and 1975, 23 varieties of jowar were grown in the fields, which have reduced to 11 in the last one decade. Similarly little millet lost its three varieties. Area under cultivation of all millets has been reduced.

Though small in size, millets surpass wheat and rice in terms of nutrition value. These crops grow in very harsh environment under rainfed conditions. It needs very low or no external inputs. Millets offer multiple securities to the farmers: food, fodder, health and nutrition, livelihood and ecological. They have the capacity to respond to challenges of climate change. The crops that offer independence and dignity to small and marginal farmers are finally getting due recognition. Farmers and several organizations are now acting towards safeguarding remaining varieties.

Finger millet, one of the staple grains in Southern Karnataka, grows in poor soil under harsh weather conditions. Mustard, sesame, pigeon pea and Bengal gram are intercropped with finger millet. Mixed cropping improves the yield from the farm and thus the farmer’s income. Soon after harvest, finger millet field gets filled with pulses like green gram. Certain pulses like local variety of green gram grow by absorbing moisture from the atmosphere. These pulses also fix nitrogen in the soil. ‘Netti Ragi’ a unique finger millet cultivation method developed by farmers is popular in Haveri and Shimoga districts. In this method, tender plants are planted at regular distances. One kilogram of seed is sufficient for one acre. Though rainfed, this method yields 15 to 20 quintals per acre. Native variety of finger millet is suitable for this method. Locally available cattle manure is used as fertilizer.

Adequate distance is maintained between pits and lines in this method. This helps the plant to absorb sufficient sunlight and the roots spread deep in the soil. Due to this the plant survives through scanty rainfall. Organic fertilizer is applied directly to the pit.

The area under millet cultivation is reducing despite its ecological and nutritional significance. In taluks like Navalgund (Dharwad District) where soil and climatic conditions are ideal for millet cultivation, maize and BT cotton have occupied the farms. Area under millets has shrunk by more than 75 percent. The older generation is particular about this farmer-friendly crop. Even when their children show interest towards cash crops, they ensure that millets are grown at least in a small patch of land. Mookappa Poojar of Chinnikatte in Haveri district is one such farmer who grows millets to meet the family’s requirements.

In certain places the millet farm naturally nurtures twenty varieties of crops under natural circumstances. This combination meets food and nutrition requirements of the family even during a drought situation. Sorghum and pearl millet provides...
one tonne fodder per acre which is sufficient for two cattle. Babu, a farmer from Harohalli in Kanakapura Taluk has grown high yielding variety finger millet organically under rainfed conditions.

As climate change and global warming hit the agricultural sector badly, it may not be possible to cultivate wheat and paddy for long. Millet cultivation will be the only hope and organizations and farmers who have realised this are working towards popularizing millet cultivation.

System of Rice Intensification

The System of Rice Intensification (SRI) is an improved method of rice cultivation developed in the highlands of Madagascar. SRI method of cultivation aims at producing higher yields with less seed and less water. In this method, the paddy field is kept moist but not continuously saturated. This has given better results, both agronomically and economically, than flooding rice throughout its crop cycle. SRI method helps farmers to grow paddy with less water, thus becoming beneficial even in drought conditions.

At the same time it is also environment friendly, reducing methane emission. Reduction in flooding intensity results in reduction of up to 60-70% of methane emissions. SRI was introduced in India in the early years of the 21st century and has been widely adopted in the southern states and the Indo-Gangetic Plain. The technology is fast gaining acceptance among the farming community.

In Karnataka, depending on the climatic conditions different types of cultivations are used. Fifteen day old seedlings are used for transplantation under this method. A distance of 9” x 9” between the plant and the demarcation of the row is maintained. One or two seedlings are planted in a pit.

The seedlings are irrigated lightly once in five days. Fifteen days after transplantation, the healthy seedling in each pit is retained and the other is removed. Weed-incidence will be high due to less flooding. Positively, there will be an increase in the soil aeration and the soil microbial activity which enhances soil fertility. As a result of this there will be a significant increase in productivity.

Water wisdom helps Hungund withstand drought

“No farmer in our village has purchased sorghum from the market even during continuous drought years,” Mallanna Nagaral says with pride. Drought proofing techniques implemented and popularised by the Nagaral family in the last one century has helped hundreds of farmers to live through drought seasons in the sorghum growing belt of Hungund Taluk in Bagalkote district in Karnataka.

Sanganabasappa Nagaral, Mallanna’s grandfather, was an inquisitive farmer. He wanted to do something that would make agriculture sustainable. The turning point came when saint Ghanamatha Shivayogivisited Hungund in the first decade of the last century. He was not an ordinary saint. He had studied various dimensions of agriculture in different agro-climatic conditions and was writing a book based on his observation. When Sanganabasappa Nagaral saw the draft of ‘Krishi Jnana Pradeepike’, he copied the entire book manually. He has even copied the revised edition a few years later. The Nagaral family has preserved the book as a prized possession.

Soon Sanganabasappa started experimenting on methods of soil and water conservation following the guidelines in the book. Though he drew inspiration from the book, most of the methods followed were on a trial and error method. He chose the 28-acre Ramavadagi farm to start with. The field was visibly infertile. According to Mallanna, it was very tough to plough the field as hard soil would chip off farmer’s legs and also hurt buffaloes. Sanganabasappa thought that this farm was best suited to experiment his activities. He first concentrated on constructing bunds to stop soil degradation. The intention was to give each and every patch of land the shape of a palm, with high borders on all the four sides. Borders check water inside the farm. The shape helps the soil to maintain moisture on all sides.

The skilful Sanganabasappa realised black cotton vertisoil doesn’t make the boundary strong. He tried and found that red soil and sand was best suited for constructing the bund. Red soil allows percolation of the soil and hence remains strong for decades. Initially he cut all the high points (remba) in the farm and put the soil near the boundary to form a slope. This structure called edi, serves two purposes. It conserves the boundary from sudden force of flowing water during monsoon and also increases the growing space of the farm.

To send excess water out, Sanganabasappa
constructed a shielded water outlet called Gundavarti. It is a classic example of the workmanship and craft of construction that existed a hundred years ago. This water weir can be used for blocking water or letting excess water out. Gundavarti looks like a well and is a clear indicator of the toil involved in leveling the ground. The base of Gundavarti is the original height of the farm while the top is a foot or two above the present farm level. It is constructed using carved boulder stones. The twin Gundavartis constructed to let water from this sizable farm are a special attraction for farmers. The height on Gundavartis in this farm is about seven feet. Whenever the level of the field changes, the height of Gundavarti also alters. One single boulder acts as a water valve. These structures constructed a hundred years back are in good condition without any repair in the Ramavadagi farm. A careful observation of Gundavarti explains the effort gone into transforming the field and the foresight of Sanganabasappa Nagaral.

Krishi Jnana Pradeepike: Source of inspiration

Initially people laughed at him saying that instead of reforming the farm, he could have purchased another patch of land for cultivation. The suggestion seemed very apt considering labour and money involved in the process. Farmers thought that leveling the farm which had high elevations and steep run downs is impossible. Hay-stack produced from the land was not enough to feed two buffaloes that plough the farm. But ‘Krishi Jnana Pradeepike’ was a constant source of inspiration for Sanganabasappa.

Sanganabasappa’s son Shankranna Nagaral continued the work under his father’s guidance. He leveled the entire land by cutting the elevation three times. Leveling the elevation is very laborious, hard and an expensive task. The soil obtained from cutting the elevation was spread on the depletions and thus the farm was leveled. After constant efforts, the farm was restructured properly so that rainwater soaked the entire land equally. It enhanced the water holding capacity of the soil. He applied all the scientific knowledge available at that time to improve the land.

The soil structure in Hungund is unique. Even if the farm looks wet and ready for sowing, water doesn’t percolate inside. Two inches down the ground level, the soil will be dry. In such a condition, holding water in the field when needed helps in getting a good crop. Proper maintenance has helped the Ramavadagi farm to reap the harvest even during a poor monsoon.

The lower bund in the Ramavadagi farm is at a height of about nine feet from the adjacent farm. Length of the bund is 1947 feet and width six to seven feet. Such a huge bund withstands water flowing from 50-60 acres. Of course, intensity of the flow has gone down as many farmers on the upper side have constructed bunds on their farms.

The Ramavadagi farm now doesn't possess any symptoms of degraded soil of a century back. The yield is equal to any other good farm. This did not happen in one or two years. Three generations of workmanship has gone into this transformation.

Along with restructuring the field for soil and water conservation, importance was also given to enrich the soil by providing green manure; farmyard manure and cow dung. Herding the sheep in the field on a contract basis also proved to be useful. Continuous and constant effort by investing both money and hard work has proved to be effective for the family.
Once he successfully applied these soil and water conservation techniques on his field, Shankranna Nagaral started spreading the awareness. He traveled place to place to guide interested farmers. He composed and sang vachanas (a unique folk poetry tradition in Kannada which carries some social message) to popularise sustainable concept of farming, soil and water conservation. Simultaneously, he motivated his labourers to purchase land and improvise them.

**Extending the good work**

One such person is Hanumathappa Chandannavar. He is seventy-five years old now. Though Hanumathappa had a patch of land he had to work as a labourer since his land was infertile. When Shankranna Nagaral observed this he encouraged him to improve the land and construct a bund. He was also given financial assistance. In the last four decades, Chandannavar never went looking for work outside. He is a content farmer. He says, “If we survived during three continuous drought years, the credit goes to the checks and bunds that maintain moisture.” According to him drought hits only those who have not cared for this basic principle of constructing bund or talagatti in the farm. When someone suggested him to apply for drought relief fund he rejected saying, “When our family didn’t sleep hungry even a single day during drought, how can I say that I am drought affected?” Many more farmers have survived through the drought due to this bund (talagatti). The lesson of subsistence during drought was spread in Hungund and other taluks in this region from Ramavadagi farm through the Nagaral family.

After Ramavadagi farm, the Nagaral family improved their other two farms - Goputai and Madi. Shankranna’s son Mallanna Nagaral has inherited the qualities of his father and grandfather. Shankranna had made three patches in four acres on the Madi farm while leveling it. Mallanna continued the work and divided the remaining three acres into four patches. According to him the farm should resemble a tank. Only then it will be fertile. Farm labour like Hanumakka and Lakshmavva who have been working for the Nagaral family say that they spent their life constructing bunds and levelling the field. They also remember how Mallanna Nagaral used to toil to the tune of his workers.

Mallanna is not yet satisfied with this transformation process. He says that it is never ending. Along with that he also leads the way for improving the land of many others. He has traveled hundreds of kilometres to suggest and guide farmers to enrich their land. For all these efforts he does not even take travel cost or consultation charge. Mallanna spends around twenty thousand every year towards maintenance of the farm. He believes that, “If we care for the land, she blesses us with good yield.”

Mallanna Nagaral recites a vachana composed by his father Shankranna Nagaral. The vachana underlines the significance of soil and water conservation.

‘Hola nodu ilukali, mannella savakali
Ilakaligadda odda haku, savakali aagada haage
Mannu savakali aagadamge, mannu neeru hidiya hange
Mannu hodare raitana kannu hodamte
Dehake hunnu aadamte, naadina punya teeridante
Mannu kamadhenu tamma, mannu kalpavruksha’

(If the farm is uneven, the soil would degrade. To avoid that the farmer has to construct bunds against the
water flow. Structures like checks and bunds help in the soil and water conservation. Vachana relates the health of the soil to that of the health of the farmer. Soil and water are the soul of farming.

Mallanna assesses the condition of the soil in a few minutes and suggests that the farmer take necessary steps to improve it. The University of Agriculture Sciences, Dharwad, has been observing Mallanna's farming activities since the last two decades. After much observation and research, they have found that the soil and water conservation structures in the farms have a scientific basis. Scientists say that this process can be successfully practiced in at least eight districts in North Karnataka where similar agro-climatic conditions exist.

“Leveling the ground to form the shape of palm requires more money. So many farmers cannot afford to do it. But constructing talagatti or bund will definitely bring some returns to the family”, says Mallanna.

Borewells cannot be dug in Hungund as the groundwater is saline. Agriculture is totally dependent on the monsoon. Tanks in the villages supplied water earlier but with water becoming scarce these days, tank water is used only for household purpose. Utilising available rainwater by enhancing water holding capacity of the farm is the only way to sustain agriculture. Accordingly the soil responds fast to the monsoon. Many farmers in this part and in areas with similar geographic condition are following Nagaral family’s farming techniques to sustain through unpredictable monsoons.

The effort of three generations of a farming family was honoured by the University of Agricultural Sciences, Dharwad. Considering their effort in enhancing the quality of the soil by applying indigenous technology and spreading the knowledge with their own initiative, the university awarded Mallanna Nagaral an honourary doctorate. Nagaral says that this is the tribute to his ancestors and the entire farming community.

**Basics of sustainable farming**

Like most people of his age, seventy-five year old Sadashivaiah in Maragondanahalli village in Tumkur District has passed through different stages in agriculture. Kannada rendering of ‘One Straw Revolution’ by Masanobu Fukuoka changed his inclination from chemical to non-chemical pattern. He has been practicing organic farming since 1991. Over the years he has experimented with his land and crops and evolved strategies to make agriculture comfortable and sustainable.

He has twelve acres of irrigated land in four different patches. A seven acre dry patch where finger millet, jowar, oil seeds, chilly, pulses, drum stick and other wild vegetables are grown meets the food needs of the family. Susheelamma claims that the family has to buy only four items - rice, jaggery, salt and kerosene for their kitchen. One block of the irrigated land spread over two and a half acres consists of five varieties of areca, four varieties of banana, pepper, turmeric, ginger, and coconut. Cocoa, cardamom and coffee are other crops which he has successfully tried on the farm. “I ensured that the market was stable before opting for new crops”, says Sadashivaih.

He spends most of his time on the farm, observing the plants and working along with agricultural
laborers. The farm is designed in such a way that every plant draws maximum natural nutrients. Sadashivaiah says that 25 percent of the nutrients should come naturally through nitrogen fixing, sun rays, the monsoon and wind. Each plant should get 50 percent of the nutrients from its biomass. Bio-waste of the farm is utilised in-situ. External inputs like vermicompost, cow manure, and manual labour should amount to the rest 25 percent.

Sadashivaiah strongly feels that at least ten gunta of forest species should be grown per acre. This provides proper raw material for composting and ensures supportive biodiversity. Colourful crotons and flowering plants in the farm create a refreshing environment and also act as moisture indicators. When the sensitive crotons turn dull, he waters that particular region for three hours through drip irrigation.

The farm is covered by a live fence with teak, gooseberry plants in the southern direction, hebbevu (Melia Composita) and silver oak in the north, mango, jackfruit and pongamia towards east and tamarind and wild mango towards west. The plants are chosen to get maximum advantage of nature.

In tune with nature

“I had feared a bad monsoon in this area early enough. Crows had hinted the situation by positioning their nests on the tip of the tree branches.” This observation helped Lakshmi Lokur to plan her crops and withstand scanty rainfall in Belavadi village in Belgaum district.

When Lakshmi took charge of the seven acre farm, her first activity was to trace the rainwater flow in the land. She recalls her first monsoon in the farm when she walked along the water flow with her father. Soon, there were structures to percolate water in the farm. Along the border saplings were planted which have become a live fence.

Cropping pattern is seasonal. By the time a crop is harvested another crop starts yielding. This cultivation design helps to produce more in a cycle. Also the crops are intercropped in such a way that watering one crop helps the growth of a couple of other crops. For example: Along the ladies’ finger row she planted greens and groundnut. She opted for hard crops like mustard, millets, toor dal that grow well in scarce rainfall. Sufficient mulching helps the land to retain moisture. Drip irrigation helped justified use of water and she could extend irrigation from two to ten acres with the available water. Preference was given to short term crops. Water intensive crops like paddy, turmeric, cotton and sugarcane were left out from the list. In certain parts of the farm where irrigation was not possible she opted for one crop instead of two. All these wise decisions have helped her to sail through the drought like situation with sufficient seeds in hand for next year’s sowing.

When she entered into farming she had certain goals. The most important among them were:

1. To prove that agriculture can be self-sustainable and profitable.
2. To work towards convincing farmers the advantages of village life.

Mixed cropping, farming in line with nature’s laws, labour management, producing organic manure, bio-pesticides within the farm, survey of the market needs are the basics which Lakshmi Lokur has followed to make farming sustainable.

She gives preference to crops that are suitable to the agro-climatic conditions of the area. Apart from grains, pulses and fruits, her farm grows 30 vegetable varieties including 10 types of greens. She agrees that agriculture has its own difficulties. “When we learn to live with nature, we device our own ways to cope with problems.”

She opts for barter system to obtain certain produces that she couldn’t grow in her farm. In Belgaum district where organic farming has a strong hold, barter system is practiced since many years. Local exchange of produces is also a positive step towards reducing the negative effects of climate change.
Grain Preservation

Farmer Jayanthnath B.R of Goshala in Koppala says that only millets had survived in places where there was little shower of rain. Still, his objective of obtaining all food requirements of the farm has not been defeated. Grain storage which was sufficient for another year made him independent of the market in spite of poor harvest. Since the last six years he has not brought grains from outside. His storage always has grains and pulses sufficient for another year. He feels that embracing age-old processing and preservation methods would help us to face drought situations. Drought would have been a recurring phenomenon even in earlier times but grains stored in underground storage units like Hagevu would serve their nutrition needs, thus helping them to sustain the enthusiasm for the next season.

The strong link between biodiversity and food security is made evident by human dependence on natural resources for survival. Veteran organic farmer L. Narayana Reddy says that the best way to face climate change is to modify present farming practices and food habits. He says, “Food habits in a region have developed along with the growth of civilization based on the climatic conditions and social structure of that particular region. For example, the coastal population uses coconut oil for cooking, the upper part of Deccan Plateau uses groundnut oil, people in the northern part of the Deccan Plateau use Safflower and Sun-flower oil. In most of the Northern States people use mustard oil which grows well in these areas. Communities in every region have been depending on the principal food crop grown in their regions. For instance, people in the coastal areas and in hilly tracks cultivate paddy and hence rice is their staple food. In most of the northern plains where the temperatures go below 10°C during winter, people have got used to wheat as their main food. People in the northern parts of Deccan Plateau grow bajra, jowar and legumes like red gram, Bengal gram, green gram and feed on them. Communities in middle Deccan Plateau are confined to cultivation of millets and their consumption. As a thumb rule, food cultivated and consumed within local geographic regions and seasons are ideal for a healthy living.”

Along with consuming locally grown food, Narayana Reddy also gives preference to tubers which are drought and flood resistant. About ten varieties of tubers grow on his farm and he feels that tuber based food habits will help us to cope with the changing climate. He precisely focuses on crops that require less water and can be grown in high temperature. When he learnt that grape cultivation is not feasible on his farm in Doddaballapur, he planted jackfruit on the border of the farm signaling the change in cropping pattern. He also cautions about the dangers of mono cropping.

Attitudes, however, are changing and there is a growing awareness and acceptance of the importance of biological diversity in reinforcing sustainable development and human welfare. Well-managed natural resources foster peaceful communities, promote balanced economic growth, and contribute to poverty reduction. Healthy biodiversity is essential to help us adapt to shifting conditions, including a changing climate. This recognition must be urgently translated into conservation action.

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* Translated from Kannada by the author
Disappearing flora, tradition, culture, vocation and language with climate change

Poornaprajna Belur

The harvest was over. Bhagya of Belur in Sagar Taluk in Shimoga District was searching for neer madarangi (Lawsonia Inermis) leaves, a native medicinal plant that grows all over; in the kitchen gardens, farms and banks of streams. However, although the plants that grow now in the paddy fields look similar, she noted the change in the features of the leaves.

Hurala Gurige (Ageratum Conyconyzoidus) is another native medicinal plant that has disappeared from our surroundings. The widespread plant which grew uncontrolled a few decades back was valued for its healing properties. It was useful for children and elders alike. At times when first-aid kits were not easily available in the villages, leaves of this plant helped in clotting a bleeding wound. Whenever there was a swelling in the neck, a paste made by mixing the juice of Hurala Gurige leaves with jaggery and lime was applied on the neck for quick healing. Panchapatre (Artemisia Vulgaris), another plant of a leafy variety was used to clean the stomach from worms. But these plants have inexplicably disappeared from the human habitat.

Likewise, many plants which were wildly grown cannot be found in the kitchen gardens, farms, hills and forests. Is it because they are extinct or is it because we have lost the ability to recognize as we no longer use these plants? For better or worse, allopathic tablets have successfully replaced them even in rural areas. As a result, everyone prefers medical shops instead of searching for remedy in the kitchen garden - the traditional medicinal storehouse.

Fifteen years ago, there was an effort to document the different types of tamblis (buttermilk and coconut based recipe with ingredients ranging from wild leaves to flowers and seeds) and their method of preparation. This recipe known for its cooling properties is popular in the region. High school students recorded methods of preparation with the help of their parents. At the end, a list of six hundred tamblis was prepared. Strangely enough, 500 among them were not in use. Many had stopped preparing this recipe since many basic ingredients had been destroyed due to deforestation. The present generation has no knowledge about leaves and vegetables that could be used. Even traditional medicine has lost its source of many of its raw materials owing to negligence and change of climate.

Along with medicines and food, tradition, culture and vocabulary linked to them are disappearing. Traditional medicine practitioners like Haregoppa Anantharamu, Anegoli Subbanna and Bilagunji Gangabhavanamma list over exploitation of forest land, climate change and change in lifestyle as the major reasons for the extinction of native varieties. The life cycle of most of the plants has altered while many weeds have become extinct.

In the Malnad region, it is customary to offer ‘phalavalige’ to Lord Ganesha on the day of Ganesha Chaturthi festival. Phalavalige is a combination of assorted vegetables, wild fruits, seeds and nuts that are seasonal. They decorate the Ganesha kiosk by hanging this phalavalige as a festoon. In the present times, there are no traces of wild produce like Jummana kaayi (Zanthoxylum Alatum), Maddale kaayi (Apocynaceae) Kanganaharalu (Celatrus Paniculatus) and Majjige kaayi (Reggium Kottum). Traditional medicine practitioner Halemane Ramachandra in Belur village shares his experience, saying that collecting flowers and leaves like Uttarane (Achyranthes Aspara), Vishnu kranthi (Evolvulus Alsinoides), Bellatte (Mussaenda Frondosa) and the Kalla flower (Carissa Carandus) demands an entire day. Proportionate rainfall at right time is essential for the growth of these plants. But as the rainfall has become scarce, these plants have ceased to exist.

Compared to the quantity of the Uttarane (Achyranthes Aspara) leaf grown in 1995, the measure has considerably decreased in 2010. Poor monsoon is the main reason for this development. With the decrease in the growth of Uttarane incidents of uterus related diseases have increased among the Amrutmahal cattle breed in the recent
years. This leaf has been a natural remedy for the Amrutmahal breed’s health problems during pregnancy and calving. Dr. Ranganath, veterinary officer at Amrutmahal Kaval in Ajjampura, has documented that growth of this medicinal plant in the six hundred acre fodder growing area has decreased significantly. He feels that since many such medicinal plants are getting destroyed due to climate change, it is becoming difficult for animals to self-medicate with naturally available resources.

A few years ago Channabasappa Shivappa Kombali of Ranebennur in Haveri district had organized a competition for school children in his village Kakol. The objective was to collect information about millet recipes, medicinal properties of millets and its other life-saving aspects. He realized that while cultivation of millets has decreased, its consumption had also almost stopped and even if millets are grown in some farms, it does not form an integral part of their food habits. As a result of the Green Revolution, millets which can withstand problems arising out of climate change have disappeared from the farms. The region is now facing extreme climatic conditions.

Likewise, open wells have also become victims of climate change. Open wells have facilitated development of civilization as rivers did. We have learnt that the prosperity of states depended on the availability of open wells and thus underground water. If wells in the residential area provided water for domestic purpose, open water resources in the agricultural land provided water for the crops. But open wells have dried up and have become dysfunctional owing to irregular rainfall and increase in temperature and now only certain festivities which hail the significance of open wells are symbolically held devoid of a cultural tradition. Traditional methods of drawing water using bullocks like Kapali (a north Karnataka expression) and Etha (a south Karnataka expression) for irrigation are no longer practiced and the techniques of digging open wells and cleaning them have been forgotten. Equipment used in this method along with various proverbs, songs and words associated with them have faded away.

Borewells have replaced open wells. Crops have changed. Agricultural practices have also changed, in some cases detrimental to commerce and traditional vocations. The death of the beetle leaf export business is an instance. Kurubara Nagappa of Asundi observed that the decrease in the numbers of finger millet growers has resulted in the decline in the cultivation of the once popular beetle leaves at Ranebennur for export. Finger millets were essential to the ‘Cheluve’ type of packing, ‘Cheluve’ meaning ‘beautiful’ in English. It is the name given to the process of packing a layer of beetle leaves over which a layer of finger millets are sprinkled and sealed. The finger millet is known to contain excess of calcium which facilitates a certain degree of temperature that keeps the container cool and the leaves fresh for a month after packing. Due to the death of the export business, ‘Ubbe Hakkuvudu’, a word that denotes the process which conditions the air to maintain the freshness and enhance durability has almost disappeared.

As a result of climate change, duration of the monsoon has decreased. In spite of this development, farmers have opted for water intensive crops like paddy instead of millets. As farmers’ preference of commercial crops increased, borewell digging became common and as a result water tables dropped. On the one hand farmers lost native crops and seeds which survived even in hard conditions and on the other hand, there was insufficient water for the new crops. Farmer suicides are an indirect consequence of climate change.

Huge irrigation projects like Tunga Upper Basin Project and Varada Lift Irrigation Project were implemented in Haveri. Excess of chemical fertilizers used for commercial crops degraded the quality of soil.

Most of the traditional agricultural practices have also been forgotten. ‘Netti Ragi’, a farmer developed method of growing finger millet has lost its relevance as finger millet is not a major crop any more. Mookappa Poojar of Chinnikatte has been growing finger millet in a small patch while his sons grow BT cotton and other high yielding varieties in the remaining part of the land. Chemical inputs demanded intense irrigation. As money spent on borewell construction and watering the
agricultural land increased, agricultural expenses also increased. Harmony that existed in the villages has also become a victim of new age agriculture due to conflicting farming practices between generations and the economic dynamics resulting from it.

The ecosystem’s imbalance led by erratic rainfall has made farming insecure. Shrenikaraju of Chinnikatte in Byadagi Taluk says “Monsoon is highly uncertain and rainfed agriculture has become a nightmare. Harsh weather conditions compel us to abandon agriculture posing a looming labour problem in the agricultural sector.”

In Haveri town, foxtail millet is priced at Rs. 40 per kilogram but even if there is a rise in prices, farmers are not keen to grow them due to the insecurity. The younger generation which could not cope with the problems due to insecurity, started working in the nearby towns and cities. Some opened fertilizer shops. Statistics say that 196 seed and fertilizer companies operate in Ranebennur alone.

Some trees that are suitable for farm implements have disappeared. Trees like Benteak (Lagerstoemia Parviflora), J a m b u l (Syzygium Cumini), Neem (Azadirachtya Indica) and Hunalu (Terminalia Paniculata), which were used for making ploughs, Palm used for the block and rosewood and Goddalu trees (unclassified native tree) used for the wooden harrow (for tilling) are scarcely found in the Malnad region. Eucalyptus and Acacia are used instead of these forest species. This change in the raw material used has adversely affected the health of bullocks that are tied to the plough while tilling the field. Earlier whenever there was some stiffening/swelling on the neck or back of bullocks certain juice of a weed grown on the edge of the field was used as a medicine.

Naganna Adaramani of Kurtakoti village says that the weed has also disappeared.

Blacksmiths in Haranahalli of Shimoga District are expert cart manufacturers. Earlier they used to construct over 100 carts every year. Now they have stopped manufacturing. Wheels of the bullock cart can now be seen only in folk museums or as props and sets for the theatre. One such expert Basavarajappa attributes the trend to the rising cost of the timber that is suitable for cart manufacturing. After tillers, tractors and harvesting machinery entered the fields, bullock carts are not preferred by farmers either.

Carpentry tools like the vice, hammer, chisel, drill, rule and set square are locked away in the tool box. Words associated with the making and use of the cart like gumbha (Axle), keelu, kalu, kali, halage, mooku (local traditional Kannada expressions) are unknown to Basavarajappa’s grandson Aruna. The situation is similar in the entire village. They do not seem to be enthusiastic to learn and continue the tradition. Carts lie abandoned in the cattle shed. Earlier, bullock carts were used in marriage ceremonies where bullocks and carts were decorated for the purpose, giving an aesthetic and grand look to the wedding entourage.

This was also a prelude to the flourishing relationships between people and families. Various competitions connected to carts and the joy it would bring about has also disappeared along with the carts. They are not even used for

![The gadiya gumbha, once widely used can be seen only in museums today](image)
transportation now. Halle Rangappa of the village says that the next generation has no incentive to continue the family profession of preparing the bullocks for these competitions because of the disappearing traditional competitions.

During Diwali festival, bullocks were decorated using varieties of artifacts and ornaments that were available in the series of shops in the streets of towns. In 2009 there were three shops in Sagar, five in Hirekerur, nine in Byadagi and ten in Ranebennur. Raju Kati who has inherited one such shop in Ranebennur says that locally available materials have been replaced by plastic ones which have adverse impact on bullocks. Jute ropes though looked and sounded harsh didn’t hurt the bullock. But plastic ones leave a wound on the back of the bullock. Sangajja of Bidirukonda says that they have stopped using them as it is very painful for the bullocks.

Every language, food habit, culture, society, polity has been exposed to drastic changes. But these changes do not facilitate sustainability. Will it be possible to sustain life and culture by rejuvenating traditional agricultural practices, time-honored lifestyles and food habits? Time may have to rotate backwards...

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*Translated from Kannada by Anitha Pailoor
It is hot sir, really hot. This burning temperature may not be an issue to an outsider. But that is not the case for a Kadan. It is unbearable for us. That’s why we prefer to live in the forest.”

This was the response of Balankutti Maman when asked about climate change. Balankutti Maman who is of an approximate age of 75 is the oldest member of the Kadar tribal community of the Vazhachal Tribal settlement. At first he was quite reluctant to talk and it took a long time for him to get rid of the innate shyness typical of every tribal member. But after the initial hesitation, he was eloquently outspoken and his words articulated the ways in which a very primitive community which has been living as gently as possible on the planet without leaving any carbon footprint for generations, is being victimized by the consequences of climate change.

Climate change is no more a fallacy of romantic environmentalists. Each day we hear news of the impact of climate change in our region be it the changing seasons or the appearance of new viruses killing many hundreds. Although the newspapers and television channels have started discussing climate change not much has been done to understand the ways in which various sects of society are going to face the disastrous consequences of climate change. The Intergovernmental Panel on Climate Change (IPCC) explicitly says that communities whose livelihood is dependent on natural resources will be the primary victims of climate change.

The Kadors, who live in the Chalakkudi River Basin in the Nelliampathi and Parambikklam regions which are the on the southern side of Sahyadri will be one such community. They are one among the five Primitive Tribal Groups (PTG) of Kerala. Throughout history, their population has been somewhere around 2000.

The Kadors are basically a rainforest tribe. Earlier they were seen only deep inside the rainforests. They have been displaced many times from their habitat for construction of dams on the river Chalakkudi. They were then settled on the river banks near the Vazhachal waterfalls. But after 1980 they were again displaced to areas such as Kayarivachumaram, pokalappara etc. and started living in settlements (ooru) directed by the then legal statutes. Evidences are available that the Kadors were settled near the Aathirappally waterfalls during 1940.

A living interdependent with forest and river ecosystems

The Kadors possess invaluable bio-wealth and a treasure of knowledge since generations. The rivers emerge from their innocence. A river flowing from hillocks to the plains is not just water flowing; it is an interaction between the mountains and the oceans; it is the transmission of love by people living in its ecosystem. The Kadors, as any other indigenous communities in the world, preserve the mysteries, myths and uniqueness of the wilderness and pass it over to the following generations. They never say that the forest belongs to them. Instead, they live with the consciousness that they belong to the forest. It is quite common for a Kadar to see wild animals or be trapped among a herd of elephants without being attacked.

Livelihood

The traditional livelihood activities of Kadors include collection of non-timber forest produce (NTFP) and fishing. The life of the Kadors is hence highly dependent on the forest and the river, and around these revolves all affairs in their life such as birth, death, wedding, worship, entertainment, etc. In short, decrease in the availability of fish in the river or any change in the availability of honey and other forest produces will severely affect the life of the Kadors.

Honey is the main forest produce the Kadors depend on for their livelihood. They have great knowledge about honey, honeybees, the methods of honey collection, etc. There are a number of sayings and popular tales among the Kadors which is related to honey. Taking a few drops of honey in hand and examining it, the Kadors can tell from which flower species the honey has been extracted. If asked about
the aroma of honey, the Kadars recite an old saying, “If churuli has flowered, the honey will have its fragrance because bees will collect honey from it.” “If the white pine (Pinus strobus) has flowered, small bees will sting” is another saying which is prevalent among the Kadars. The Kadars know that honey production is part of an organic cycle. There should be an accord between honeybees, flowers, flowering plants, proper and timely rain, etc. and if this synergy is lost, the entire system will collapse.

“The south western monsoon was delayed this year and it didn't rain when it was supposed to. As a result, many wild plants didn't flower. So this season honey was much lesser,” narrated Suresh of the Vazhachal Kadar settlement. Disappointment and helplessness were evident in his voice. The honey of Vazhachal has good demand in the market but forest dependent communities are at stake due to the changing weather pattern.

Reduced flowering and honey yield are not the only issues the Kadars have with the delayed monsoon. Whatever little honey there was in the forest was soaked with the rain and became useless. All the honey waxes were drenched and the honey had flowed out. “When it starts raining, the honeybees will drink the honey to prevent energy loss and the Kadars can't collect honey after that”, says Dr. Amita Bachan who has been working among the Kadars for years.

Besides honey, the Kadars collect various other minor forest produce such as tubers, fruits, berries, flowers and gum. “If there is no honey or fish, we’ll collect forest produce like manjakkuva”, says Geetha of the Vazhachal tribal Colony. “There are many wild tubers and palms in this area. Climate change normally doesn’t affect them. So we consider these foods to resist consequences of climate change in the future”, says Dr. Amita Bachan. “Plants like manjakkuva are not endemic in the evergreen forests. But this plant is now found common in Kadars’ region. This shows that the forest is losing its evergreen status”.

Rivers are as important as forest to the Kadars. On examining the history of the Kadars, one can see that the Kadars always selected river banks to inhabit. If there is no water in the river when it is required or if the available water is not pure, the life of the Kadars will become tougher. The river Chalakudi has six dams. The water flow in this river is now dictated by all these dams. The Kadars get only the surplus water. If there is not enough rain to fill all these dams, the Kadars will face water scarcity.

Fishing

Fishing is another livelihood activity they are engaged in. The Kadars go fishing as a whole family. They follow traditional methods and use manually made rafts for fishing. They mainly depend on almost 30 varieties of fish such as Aral (Masacembelus sp),

Decrease in the availability of honey and other forest produce will severely affect the life of the Kadars.
Chengani (Puntius denisonii), Chura (Tor khudree), Eettappachila (Puntius carnaticus), etc. Uthal fishing is a special method of fishing which is prevalent among the Kadars. Uthal is a process where during the propagation period, fish move upstream to the emerging points of rivulets and streams, swimming against the flow. The fish rub the egg-sacs against the grass at the bottom of the streams and hatch. Pure water and minerals are essential for the growth of the fingerlings. Eating Uthal fish ensures nutrition which helps them in maintaining good health. Larger fish like the njezhu are caught with normal nets and sacks when the fish arrive at the rivulets for spawning after the rain. Huge quantities of fish are caught during this time. The excess fish will be kept dried for consumption during the monsoons or the non fishing season. Besides njezhu, kanayanparal (Rasbora dandia), poovalipparal (Puntius sp), pavay paral (Barilius sp) etc. are also caught.

Because of the change in the rain pattern, the water flow in the rivulets has become a trickle, drastically reducing the availability of uthal fish. The health of the Kadars will be severely affected with diminishing supply of this natural source of nutrition. Women who were once involved in uthal fishing have now been alienated from this activity and it marks a gap in their relationship with nature. “Uthal fishing is not only a livelihood activity for the Kadar women. There is an emotional content associated with it. It was an opportunity to bring out their emotions.” says Ms. Divya, an independent researcher working with the Kadars.

Fish species like muzhi (Clarias sp), chura, pachilavetti (Puntius carnaticus), malinjeel (Anguilla sp) etc. are available in plenty during heavy rains. But the reduction in the rainfall and the water flow controlled by the upstream dams has reduced their availability. The Vazhachal River had completely dried up in the first two weeks of October 2012 and this had resulted in the disappearance of many varieties of fish.

The Kadars used to collect the varameen or kottan thavala, which comes out of the soil in the beginning of the monsoon, dry it by the kitchen fire and keep it for medicinal use to treat suffocation, chickenpox, etc. The Kadars lament that varameen has totally disappeared. Itta is yet another fish species disappearing due to the decreased rains.

Tens of thousands of fish have perished this year because mud flowing from the dams penetrates the operculum of the fish. According to a study by Kerala Biodiversity Board, many fish species are on the verge of extinction with drying up of rivers and fresh water sources. The change in the river ecosystem will affect communities living downstream as well.

River systems are an integral part of the kadars life.
There will be intrusion into the resource area of the Kadars and this will disturb the peaceful life of the Kadars.

Almost all the nutritious food in the menu of a Kadar family such as river fish, wild edible fruits, plants and tubers, honey, etc. are climate dependent. As these are becoming scarce, the community will be forced to depend entirely on the white rice which is given to them through the public distribution system.

Other livelihood options

The Kadars have tremendous knowledge of the medicinal properties of various plants found in the forest. They include such plants in their diet as a preventive care. They say that many plants which were common earlier are now hard to spot. This worries them as their healthcare is entirely dependent on these medicinal plants. They have started a medicinal plant nursery adjacent to the Vazhachal Tourist Centre in order to protect these plants.

The present day Kadars depend on the Forest Department for their livelihood. Since the Kadars are familiar with the forest, the Forest Department engages them in the forest management activities such as planting of saplings, preventing forest fire, tourism, etc.

The places where the Kadars reside are the most biodiverse forest areas of Kerala. Climate is very much related with their dwelling places as they change their place of stay according to the changing seasons. During the honey season, the entire Kadar family goes into the deep forest and stay in temporary huts. During the rainy season, they go to the riverside for fishing. The nature of the places of habitation of the community is also changing because of the changing climate. “In olden times we had a lot of reason to stay in the forest. But now we don’t have much. The streams have dried. The forest cover has reduced. I have heard people speaking about large trees dying and hornbills losing their habitat because of the changing climate. I think we will also lose our habitat just as other living things in the forest.” says Mr. Senthil of the Malakkappara Kadar Colony.

As per the tradition of the Kadars, there are many sacred areas in the forest where entry is restricted. The Kadars normally don’t go there as they believe that entering such places will bring them bad luck. Scientists like Dr. Amita Bachan say that such entry-restricted areas of the forest are ecologically sensitive zones. The fact that the Kadars restrict themselves from entering into such areas signifies the ecological wisdom of the community. It is unjust that a community which is living as simply as possible and in total harmony with nature, doing great services to humanity is the first to suffer because of the vice of others.

Footnotes
1Those belonging to the Kadar tribal community
3Koragar in Kasargod district, Cholanaykkar in the Nilambur forest of Malappuram district, Kurumbar in Attapadi of Palakkad district, Kattunaykkar in Wayanad, Kozhikode and Malappuram district also the other PTGs of Kerala
5Ehrenfels d.R, 1952; Kadars of Kochin
6Honey, Thelly (Canarium strictum), Pathri (Myristica bactyloides), Cheenikkayi (Acasia sinuate), Marottikkayi (Hyduocarpus tentandra), Kattumanjal (Curcuma longa), Kattinchi (Zingiber officinalis), Manjakkuva etc.
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*Translated from Malayalam by the author
Unscientific Development Practices and its Adverse Impact on Local Environment

Maju Puthenkandam

The popular perception of a true environmentalist always remains deceptive. Those who regularly organize casual street corner meetings or platform speeches on the need of tree plantation and engage in mere sloganeering for the sake of publicity on the need of tree plantation are often misconceived as environmentalists by society in general. At the same time, some of the most eligible segments of society are failing to obtain such a tag mainly because of the insensitivity of opinion makers and authorities. The case of farmers who cultivate in a way without causing any damage to the soil, water and biodiversity is one such example. What farmers apply on the soil is the traditional wisdom inherited through generations. Traditional forest dwellers and fisher folk also come under this category. The way they live and engage in day to day activities would not breach any law of nature and the equilibrium of the climate. Biodiversity faces no challenge from such people. Their initiatives go very well with the balance of nature and they are never enticed by greed.

But the situation is now fast changing. Tribals who used to go deep inside the forests to collect minor forest produces by smelling the movement of wild elephants and gaurs are finding it difficult to continue with the tradition. Gone are the days when fishermen ventured into the sea by observing the smell of the saline water, direction of winds and the changing colour of the sky. Traditional wisdom is no longer helping farmers to create success stories on agricultural land.

Here lies the question of survival. Climate change has now become a reality. In order to coexist with the changes, nature itself has started genetic modification in both flora and fauna. During the harvest festival of Onam this year, Kerala witnessed severe natural calamities. Climate change has started turning Kerala’s agricultural and social heritages upside down.

Changes in the Farming Culture

Agriculture across the world involves traditional knowledge that is transferred through generations. Humankind started gathering knowledge and expertise since the primitive days of hunting and living in the wild. There was a time when farming was in perfect harmony with the environment as farmers worshipped the climate and the surroundings and engaged in due protection of them. Seed gathering itself was a huge process in perfect harmony with nature. Irrigation during the non rainy seasons also did not pose any threat to water security. Farming was highly dependent on rains those days. Organic fertilisers always enriched the fertility of the soil. Most of Kerala’s traditional festivals are related to the bygone era of agriculture in perfect harmony with nature. Traditional Kerala festivities like Onam, Vishu, Njattu Vela, Pathamudayam, Kumbha Bharani, Amavasi and Pournami are part of that rich tradition. Any disruption to that chain and tradition will result in a severe catastrophe on Kerala’s environment and climate. Moving away from that rich past means Keralites would start living a life of conflict with nature.

In the beginning of the eighties, paddy cultivation was spread on 400 acres of green fields in Kadanad panchayat, on the borders of Kottayam and Idukki districts.1 It was a watershed area blessed with the proximity of hillocks of the Western Ghats like Kayyur, Perumkunnu, Nadukani, Ilaveezha, Poonchira, etc. There were streams and rivulets in the village which ensured water availability throughout the year. Now, farmers in the panchayat are fast retreating from paddy cultivation. The reasons are many which include lack of enough farm hands, accumulating losses and lack
of government support. Now the paddy cultivation is limited to just 10 acres\(^2\). Reduction in paddy cultivation has also started reflecting in land use patterns, changing the balance of nature. Availability of rain too started dwindling, affecting water availability in the streams and rivulets. All the water bodies get dried up by November every year and the situation would continue till the onset of the South West Monsoon in June. Water deficit of the once surplus panchayat now stands at 35 percent. During every summer, panchayat authorities supply drinking water using lorry tankers, spending crores of rupees.

Fortunately, the panchayat and its residents have understood the reason behind the adverse impact though a little late. Several conservation efforts aimed at protecting water and soil were undertaken. Drinking water schemes were implemented with the objective of meeting water needs of at least 90 percent of the residents. Now the panchayat has succeeded hugely in rain water harvesting. Check dams and storage pits have been built across the region apart from massive tree plantation. Ground water has been recharged as a result. Wells are now having water. It was an example of a local community initiative to ensure water needs of a region. There are several communities across India that is known for effective utilization of their minimal water resources. The water they use for hand washing, bathing and cleaning of crockery is being collected to use again for watering plants and to use in toilets. Reuse of waste water after filtering is now rampant across India. However, the once water surplus Kerala is now largely depending on packaged drinking water and its price is similar to that of the market price of milk.

**Uncontrolled quarrying in the mountains of Kerala**

Kerala is now on a development spree with projects to build sea walls, railway lines, roads and buildings and the immediate casualty are the mountains on the Western frontiers. Each of the mighty projects costing crores of rupees are being undertaken, using political influence. The natural wealth is exploited flouting provisions of the Panchayathi raj laws and bypassing elected members of the local bodies. The exploiting elites are also throwing to the wind laws pertaining to mining, geology, environment, pollution and handling explosives. For example, the borders of Kottayam and Idukki districts, which are part of the highly sensitive Western Ghats, are being leased out by the local panchayats for granite and laterite mining and crushing units. At least 3000 acres of such crucial land is being misused by over 100 crushing and mining units across the region.

Other than steel and timber, ninety percent of the raw materials used for house construction, like granite, laterite, hollow bricks, cement, crushed stones, marble come from the hills and mountains. Hills are being destroyed for meeting the needs of constructions which will last for just 30 to 50 years. Each exploited mountain is turning into a heap of rubbish within the life span of an average person. Then the land mafia uses rice fields and wetlands to dump the concrete waste. Mindless and unscientific constructions are badly affecting our survival in this world.

The growing clout of mining and construction mafias over Kerala society is a topic to be studied with accuracy and concern. Thirty percent of the big mansions across the state remain locked with nobody staying inside. Almost all affluent class people are now competing with each other to construct summer homes in tourism locations like Munnar and Wagamon. They include politicians, professionals, businessmen and religious heads. Instead of small houses, they construct big mansions displaying their money power. While people in Western countries show how a family can live in a 100 sq.ft. house, in Kerala 10,000 sq. ft. mansions are being constructed for owners or visitors to stay for very brief periods in a year. Those who are settled in Gulf countries also build palatial bungalows in Kerala, just to keep it locked forever. The number of people owning more than one house is on the incline.

Mining is now happening in Kerala without any control. Tipper lorries move across the state with plundered natural resources of the hilly region and those who protest against this kind of day light robbery are treated as enemies of development. Impact studies and protests by real environmentalists are ignored by the government and the mining mafia who say that there is no alternative for laterite and granite.

Each mountain area of the region protects its own watersheds and rivulets. Ninety percent of the herbs mentioned in Ayurveda are grown on the Western Ghats. The biodiversity is so rich that it can sustain human generations for long and in a healthy way. But stone crushers are badly affecting the growth of medicinal plants and herbs apart from causing respiratory ailments to human beings. Even domestic
animals face danger. The Madav Gadgil committee report on conservation of these sensitive regions is facing strong resistance from vested interests.

**Unscientific aspects of mining**

The mining act passed in 1961, meant for small scale explosions to ensure the immediate needs of housing, allow mining only up to 20 feet below the earth’s surface. However, instead these laws are being flouted by the powerful.¹ Now, technology equipped mafias are conducting large scale mining, misusing the same law and explosions happen under the surface of the earth even at a depth 400 feet and sometimes even 900 feet. Bombs are being used as explosives and the impact of explosion is so severe that the stability of houses and buildings is often affected. Tremors caused by explosions¹ are creating an earth quake like situation in the hill areas, posing a threat to wildlife and survival of human beings.

Mining is being regulated using an act passed 50 years ago. In Kerala's context, it is unscientific. Here goes the statutory distance from mining quarries with regular explosions from human settlements.

<table>
<thead>
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<th>State</th>
<th>Distance (metres)</th>
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<tr>
<td>Karnataka</td>
<td>200</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>300</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>500</td>
</tr>
<tr>
<td>Goa</td>
<td>200</td>
</tr>
<tr>
<td>Kerala</td>
<td>100</td>
</tr>
</tbody>
</table>

It is astonishing that a state like Kerala with a high density of population is having a mere distance of 100 metres between mining sites and human settlements. It was based on an act that came into existence when there was no large scale and indiscriminate blasting of mountains to get granite and laterite. While the law⁵ insisting to limit mining up to a maximum of 20 feet, Kerala is allowing it up to 400 feet below the ground level.

Noise pollution is another aspect. The Pollution Control Board’s regulations are also violated. Kerala has many stringent laws against collecting river sand and reclaiming paddy fields but there is no stringent rule to prevent the demolition of mountains. No statistic is available on how many quarries are operating in Kerala and how many loads of stone are being taken out of them per day.

It is easy to build roads, buildings and railway lines by taking away resources from mountain ranges. But it is not easy to rebuild the damaged mountains. We are badly in need of construction concepts which can facilitate reuse of the once applied resources. New technologies can help evolve construction methods which can withstand the vagaries of time. Safe and judicious use of resources is the need of the hour. Housing must be an essential priority but it must not be an excuse to build multiple mansions for a single person. Roads must be laid with new technologies for quality and long years of use. Natural fences can be made for streams and rivers by planting bamboo and reed. The construction sector must apply new technology to minimize use of natural resources.

**Encroachment of land resources**

During the nineties, the government had prompted farmers to occupy Idukki, Palakkad and Wayanad districts under ‘A grow more food plan’ to fight hunger. Now these farmers who engage in agriculture, causing bare minimum damage to land and the environment are in a crisis because of the incursion from the industrial lobby. There is massive encroachment on land and resources by external entities such as stone crushers, granite quarries, large scale plantations and holiday homes causing huge negative impacts on the ecology and environment. It is continuing unabated as government and locals remain mere spectators.

Food security of Kerala is also facing a crisis as a result. The natural cycle of nature is being disturbed here. Greed for profit is now visualizing a world without earth worms, chirping birds, reptiles and animals. Their world of profit lacks butterflies and bees.

The Gadgil committee had in fact recommended empowering grama sabhas and other village bodies to decide on their own survival and future but small scale farmers are worried about the unavailability of patta for the lands they have occupied for many generations.⁶ Just as tribals inhabit forests, fisher folk have freedom over the sea. Land is meant for the farmers because agriculture is after all a way of life. However, some vested interests are creating fear in the minds of these farmers by unleashing propaganda that there would be restrictions on agricultural work. There are rumours that all constructions would be regulated in the sensitive areas. Vested interests term the efforts to protect the balance of the ecology in the region as a part of a dubious global agenda to make the entire Kerala a forest and to evict people from their land and resources. Attempts by the Gadgil committee to empower local
communities with the right to decide on their future are now being resisted.

**Lack of proper tourism plans**

We claim that Kerala is God’s own country but the flawed perceptions on tourism development have made it a Devil’s own country. No tourism project was implemented in Kerala in the right spirit. No such project was implemented after taking to account its impact on the environment. Tourism master plans have never been comprehensive and reflect the interests of local communities.

The famous tourism station of Munnar is now in shambles because resort mafias and land mafias are on a construction spree causing huge destruction. Soil erosion is the order of the day in Munnar. All other sensitive regions of Kerala like Idukki, Kottayam, Pathanamthitta and Wayanad are under the tight grip of land mafia, which buy traditional agricultural lands and destroy the land pattern and biodiversity. It is easy for anyone to encroach upon pristine Kerala villages to construct resorts; individual priorities often out way the larger interests of the country. While developed countries have planned tourism in a way protecting their environment and the climate, here there is no such concern. Even the sensitive grasslands of Wagamon are facing threat from resort lobbies which lay access roads for their clients. Concrete structures in Munnar have degraded tourism to just merry making. Concrete mansions have affected the climate in these areas and now the chillness is vanishing fast. Mountains with scenic appeal are being bought by education lobbies to start self financing schools and colleges. Lack of a tourism master plan on the part of Kerala government has created such a difficult situation.

We have to prioritize our tourism. What would be the attraction of Wagamon without its grasslands, winds, salubrious climate, fresh air, chillness and captivating views? Tourism must be a facility to introduce these features to those who love them. It must not be an attempt to destroy the grass lands to construct golf courses. Mushrooming constructions in Munnar and Wagamon will ultimately ruin these destinations and tourists will move away. Sooner, these locations will turn into abandoned concrete jungles.

Reforestation is the solution. We can plant multiple saplings in the space of a tree axed for construction. Vacant lands must be used for planting trees suitable for building houses and establishments. Tourism must be eco-friendly and the natural gifts of the state must be retained.

**Conclusion**

Kerala is spending crores of rupees every year on water conservation. National Rural Employment Guarantee Act, Hariyali and Western Ghats Development Project are all focusing on water conservation. They also focus on hill areas where water easily moves out to the plains to finally join the sea. While such conservation efforts are progressing at one level, huge destruction of mountains is taking place on another level.

We have rules aplenty. Quarries are to be sanctioned after environmental impact studies. Mining is also to be restricted to 1 km radius. Tops of mountains and slopes are to be exempted from mining. But all these rules are only resting in papers and no such rule is being implemented at the practical level. Quarry owners are not even ready to fill the huge pits with soil to enable agriculture in such areas.

To sum up, our developmental priorities are turning suicidal. They are not taking into account the changing climate condition and the needs of local communities. Those who voice their concerns against environmental destruction are being termed as enemies of development. This situation must change. We must stand up and fight to protect our mountains, lands and water bodies to save ourselves and the future generations.

**Footnotes:**

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3. The Metalliferous Mines Regulations Act, 1961
5. The Metalliferous Mines Regulations Act, 1961
6. www.westernghatindia.org
7. According to recommendations of Center for Earth Science Studies (CESS)

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*Translated from Malayalam by K.A. Shaji*
Rivers where boats ply no more
Maju Puthankandam

Most of the rivers in Kerala are going dry during the summer months between January and May largely because of the rampant deforestation at the points of their origin. Previously, the trees and plants of these areas had helped absorb and conserve rain water in the soil for the post monsoon periods. It was this stored water that kept the rivers alive during the summer months. Destruction of forests has also resulted in increased levels of soil erosion, which in turn has raised the floor levels of dam reservoirs, thus reducing their capacity.

Kerala has a total of 44 rivers. Their length ranges between 15 km to 244 km. Due to deforestation, rain water in the hilly regions reach the sea within 48 hours through all these rivers. A small change in the monsoon pattern would affect water flow in Kerala rivers by the beginning of November itself. A state which gets up to 10 feet of rain water a year is facing drought twice a year. There has been no visible change in the case of rain water availability in the last 50 years but the rivers remain perennially shallow in the summer months. What happened to Kerala’s environmental balance and climatic conditions? The answer lies in the life of Kunjavarachan, who was born in central Travancore before independence and lived there all these years witnessing the changes sweeping across his country side.

Agriculture in the region was primarily rain fed. Agricultural activities were taken up twice a year depending on the availability of rains and nobody tried a third attempt. During one such year, Kunjavarachan’s father cultivated sesame, beans and a few pulses during the first season. After harvesting, the residues of the crop along with cow dung and green leaves of Arjun tree would be laid out in different parts of the field. This acted as the basic manure for the next crop. In the second season, paddy was cultivated on this land.

The family used to sow seeds of two different kinds of paddy together. The variety called Cherumani was harvested after 110 days. The second variety was called Mundakan and it was harvested after 200 days. The first harvesting was in the Malayalam month of Chingam while the
second one was in the month of Makaram. In the local language, it was called Iruppoo cultivation.

Seeds are especially collected from the first batch of grains thrashed after the harvesting. There was a traditional way of keeping them safe by exposing them to day light for seven days and mist for seven nights. Then they would be kept near the fireplace in the kitchen. During the Malayalam month of Idavom, there would be heavy rains. All the rice fields would turn water logged. Then farmers would prepare the fields for cultivation using ploughs and bulls.

Kunjavarachan’s father was an expert farmer who used indigenous technologies in conducting his agricultural activities. He handled climatic changes at ease as he had clear knowledge about the rhythm of the climate. Three days before sowing the seeds, they would be tied in a jute sack and soaked overnight in water. On the next day the seeds are tied tightly in the jute sack and big stones are kept above it as weight. After a day the sprouted seeds would be sprinkled with water and spread on the floor for air circulation. There would be tremendous heat from the sprouting seeds. In adverse conditions of weather, Kunjavarachan’s father knew how to delay or accelerate the sprouting of the seed. The secret lies in the quantity of water that is given to the seed ‘to drink’.

During his childhood, Kunjaravachan thought that it was his father who decided the order of seasons, climate, rain and wind. His father had accurately predicted rains, winds and drought. He had experimented with different seeds on the agricultural land predicting correctly the changes in climate conditions. After attaining adolescence, Kunjavarachan too started working in the field along with his father. He also learned climate prediction skills of his father by observing the blooming of kanikonna, colour of the sky and the sail of the clouds, the high and low flying of Narayana Pakshi, arrival of certain birds and the way in which the wind blew. They were the laws of nature.

Although Kunjavarachan studied only up to third standard, he can read and write. Other than paddy, the main stay of his family was growing coconut. The family also cultivated some cereals and pulses along with tapioca, pepper and sugarcane.

The eastern border of Meenachil is the panoramic Western Ghats Mountains. Its valleys are dotted with wet lands and paddy fields. Central Travancore’s food security is highly dependent on the cultivation on these agricultural lands.

The paddy fields, kandam, with its mud bunds of about half a foot height had played a crucial role in harvesting rain water. Each paddy field had a stream flowing nearby. Bunds were built across the streams so that water flows into the fields. The water level of fields was regulated by kammas built by adjusting the heights of the bunds. During the rainy season the bunds were removed and in the summer they were built again. The water stored in the paddy fields had enriched the streams around. The paddy fields, along with streams, rivulets and check dams, had preserved precious water resources of the region.

The farm lands were tilled with kalappa, using the bulls. After tilling the field is leveled by using njavari. Bullock carts were used for transporting grains and bio-fertilisers. Bulls were also used to run oil extraction units. Gobber was used as the main fertilizer.

The agricultural activities of that time had their own aesthetics. Special folk songs were sung during sowing seeds and harvesting. Songs were also sung when the weeds were removed and the tender saplings were replanted. A portion of the yield, one for six para harvested, was given as wages to the agricultural workers. Dalits of the locality, the Pulayas, worked on the farm lands and they were experts in handling rice varieties.

Six Pulaya families had helped Kunjavarachan’s family those days in agricultural activities. The family had a dozen bulls to till the agriculture land. The health of the bulls was crucial for better performance of the rice fields. Kunjavarachan used to graze the bulls on the Western Ghats hills for which he used to seek the help of Malayarayas.

During each harvesting season, Kunjavarachan’s father was able to generate grains ten times higher than what he sowed. He was a rare kind of farmer who survived poverty during his entire life time. Poverty was prevalent those days but his family was an exception. Lying on an armchair and chewing betel leaves, he was proud that he had enough food in his store, ara, for next three years to overcome...
the poverty in the month of ‘Karkidakam’.

The area in which the bulls of Kunjavarachan grazed was known as Vazhikadavu. It was a point from where roads to Mundakkayam, Kootrikkal, Elappara, Erattupetta and Arakalam began. No trees were in sight in that area. There were only grass lands. The chill was at its peak. The mountains were always engulfed in mist. The main feeder of the Meenachil River originated in the grass lands of Vazhikadavu. The river fed the entire rice economy of Central Travancore. Its watershed area had large tracts of agricultural land and they were in villages like Thalapulam, Bhrananganam, Meenachil, Kadanad, Ramapuram and Karur. The Meenachil River had many tributaries. Each was perennial and fed many a rice fields. Country boats from Alapuzha and Changanassery had carried essential commodities to villages of these localities through the tributaries. Inland water ways were so active in those days and they also carried coconuts and pepper to the outer markets. Even during hot summer, water transport did not face any challenge.

Sand beds would form on both shores of Meenachil in Arivuthura during each summer. These sand beds witnessed many mammoth meetings. During post monsoon days, these sand beds would wear a festive look. Many a rural trade fair had taken place on these beds. Both Jawaharlal Nehru and Sree Narayana Guru had addressed huge gatherings on these river shores. The area was known for amity among different religious groups. There was a peaceful coexistence of workers and farmers.

It was between Erattupetta and Thikkoyi that three feeders of Meenachil joined. Theekoyi had big tea and rubber plantations of the British. The area had a sizable population of the Malayaraya tribe who cultivated a variety of cereals and pulses.

Kunjavarachan used to be enthralled about the secret of the perennial form of the Meenachil River even during years in which the area witnessed poor monsoons. The river was protected by a variety of trees grown on both sides. Fish resources of the river were also extremely rich. Big boulders in the river had decided the flow of water in the river. Whenever the river flow got slow, its water would be absorbed by the local soil. According to Kunjavarachan, it was the trees, shrubs and the grasslands of the region which stored rain water to feed the river during summer days.

During an agricultural season, Kunajavarachan climbed the grass hills of Wagamon via Vazhikadavu. There were lots of unoccupied lands on top of the hills. He took his bulls to graze on the hills. The hills and their beauty attracted Kunjavarachan. He decided to stay there forever. Mingling with the local Araya community, he spent seven decades of his life on the top of the hills doing agriculture.

After the seven eventful decades he returned to the shores of Meenachilar. His eyes turned wet, witnessing the changes that have taken place in the Meenachil River in the last seventy five years. The paddy fields have almost vanished and Cranes which used to move around the paddy fields were hardly in sight. These paddy fields had played a crucial role in ensuring food security for lacks of human beings in the past centuries. The traditional rain water harvesting methods are no more in existence. The tribe of agricultural workers has vanished. Rice fields have been reclaimed to construct huge concrete mansions. Agricultural patterns also changed a lot and rice was replaced with coconut and aracanut trees, rubber and other cash crops. Now there is another set of agricultural workers who speak another language. Their way of cultivation is also different. The local dalits are no longer in the field. The paddy fields are now converted to brick kilns. The paddy fields are now dried up. Kunjavarachan was irritated on seeing the changes. “Have you stopped eating rice and started drinking what the rubber trees are providing?” he asks.

The new generation seemed practical while answering his queries. They said the rice fields have made way for cash crops because of the lack of required farm hands. According to them, rubber was more profitable and that Rubber would ensure earnings to buy rice from the shop. Hence, there was no need of spending the whole day on the farm land. Kunjavarachan asked from where the rice would come. It would come from Tamilnadu and Andhra, the new generation replied, “What would happen to you if they too think on the similar lines?” Kunjavarachan asked.
Gone are the days when boats from Alappuzha reached Theekkoyi with essential commodities. Many a check dams have been erected on the river Meenachil preventing the smooth navigation of the boats. Soil erosion also made movement of boats difficult. Encroachments are severe on most of the areas. The trees and shrubs which ensured natural protection to the river were removed to construct stone walls. Sand mafias took away the vast river beds. The clay once available in the river is extracted to make bricks for construction works. Whenever there was water scarcity, new check dams were constructed but the experiments were futile. Now the government is thinking about diverting water of Idukki hydel project from Moolamattam to Meenachil using tunnels. When the water level in Meenachil decreased, saline water from Vembanad backwaters entered the river reaching up to Kottayam. To prevent it, concrete bunds were constructed. The fish also face mass destruction due to this turn of events. With the intrusion of saline water fresh water fish like prawns and pomfrets migrated further up on the stream. Massive check dams hindered easy movement of fish species resulting in the decrease of fish population in the village streams. Traditional fishing was totally abandoned and electric rods and poison were used to catch the fish. The jetties where the boats docked have also disappeared. Concrete buildings and industries now stood on the river banks instead of trees which rendered shade to the river. Waste disposal is another issue killing Meenanchil. The river now looks more like a drainage canal. The check dams are causing stagnation of the polluted water and that is resulting in contamination of water in the wells of the locality. The highly contaminated water of Meenachil is quenching the thirst of thousands through drinking water schemes of the government. The boulders which had controlled the flow of the river and served as check dams have been turned into decorative items in the courtyards of rich people.

Massive deforestation on the eastern mountains has also affected water availability in Meenachil. Trees which stored water were axed and in their place rubber trees which demand huge consumption of water are being grown. Now tanker Lorries are supplying water even on the hill tops. Packaged drinking water is now the favourite product at the village bazaars. Stone crushers are also contributing to the pathetic state of affairs. The water which reached the house from the cliffs of mountains through gravitation force reaches today by having it pumped from the valleys to the top of the hills. Bulls which were once an integral part of activity are nowhere in sight. Soil erosion and landslides have become common phenomena. Bio-fertilizers have been replaced with chemical fertilizers. Tourist resorts have started occupying the grass lands of Vagamon.

The younger generation is teaching Kunjavaranach about the advancements they have achieved in life. They boast about the fortunes reaped through mechanisation and industrialization. Now every village has power, roads and vehicles. All are educated and employed. Population also has increased and that is why the environment is getting affected. But Kunjavaranachan is knowledgeable enough to see all these advantages as temporary. His advice to the new generation about the need of a coexistence with nature is in vain. The young generation is least concerned about their future.

“"For how long will these all last? This earth is not just for you alone. It is for all the living and non-living beings. In their coexistence one perishes and becomes manure for the other. When you eat your food you never remember that someone else has toiled for you in the fields. If he would have laboured only for profits like you, he would have added poison to your food and adulterated it. He is also a pleasure seeker like you. He also wants to make money the easy way. Human beings have lived on the earth for centuries and multiplied but no species were eliminated by this. But the creatures which I have seen in my lifetime have all but disappeared and your ‘development’ will yet exterminates more of them. For a blade of grass to grow it requires only a fist full of soil. The cow that eats it needs only a pasture but a tiger which eats the cow needs the whole forest. Ten acres of land was more than enough for me and my dependants but you need the whole earth to live and your next generation needs another earth! When the rhythm of nature is disturbed temperature will increase,
ice will melt, soil will be washed away into the sea and the sea will rise. On that day I hope that Parasuraman\textsuperscript{12} will come again to create Kerala that has disappeared into the sea”.

It is not a question of the generation gap. Even after independence, we have poor development policies. We have no control on exploiting natural resources. The much hyped land reforms also had a negative impact on food security. Agriculture has never been profitable and the government has done nothing to bail out the farmers from any crisis. Populist policies of right and left governments lacked foresight. They have never taken care of the sustenance of rivers, hills and forests. Farmers lacked institutional and bank support which has also contributed to the present situation. Developmental projects are being implemented without looking into the environmental impacts they cause threatening all our forty four rivers and their watershed areas with imminent death. The death of River Meenachil is the indication of the end of a centuries old agrarian culture of Kerala.

Meenachil also had a civilization of its own. The local community evolved an agricultural methodology in conformity with climate changes. The area had commercial links with Rome and China in the past\textsuperscript{13}. The Meenachil experiment and its success have prompted many a farmer of the region to migrate to other parts of Kerala after the Second World War under the Grow More Food programme. The British style of plantation economy with estates having rubber, tea, cardamom and coffee have turned detrimental to the environment and ecology of Kerala.

The huge capital flow that happened in Kerala in the last two decades affected the environmental balance heavily. In the name of infrastructure development and entertainment, deforestation happened across the state. Eighty percent of Meenachil watershed has been converted into rubber plantations. Concrete check dams have killed the river. Before independence the average rainfall in Meenachil was 180 inches as per Travancore State Manual\textsuperscript{14}. Now it has decreased drastically.

The area has a long and chequered history. It witnessed migrations from Tamilnadu long back. The Poonjar royal family has the linagenge of the Pandya kingdom in Madurai. The name Meenachil itself is derived from Madurai Meenakshi. Gold coins of Rome and silver coins of Magadha have been excavated from here. The area has a history dating several centuries back to Christ\textsuperscript{15}.

St. Thomas, the disciple of Christ, climbed these hills to reach Tamilnadu to spread his message. The Arya invasion and religions like Islam and Buddhism also came in the same way. Sadly, River Meenachil now looks more like a stinking garbage canal. It indicates a difficult future for Kerala. Along with the river, its agricultural traditions are also dying. Boats are no more plying on the River Meenachil.

Footnotes:
\textsuperscript{1} Cassia fistula; a tree with yellow flowers
\textsuperscript{2} Grey Heron
\textsuperscript{3} The segregated paddy fields constructed raising mud bunds so that rain water is harvested and preserved for farming
\textsuperscript{4} A drainage system in the mud bunds for regulating the water level
\textsuperscript{5} A piece of gear to till the paddy field
\textsuperscript{6} A wooden frame to level the tilled farm
\textsuperscript{7} A measurement utensil to measure the harvested paddy; it can contain over 10 kgs of paddy
\textsuperscript{8} The agricultural labourer community in Kerala
\textsuperscript{9} The tribal community lives on the hills
\textsuperscript{10} A special wooden box for storing to preserve paddy
\textsuperscript{11} Last month in the Malayalam calendar
\textsuperscript{12} The incarnation of Vishnu who is believed to have restored Kerala from the sea god Varuna by throwing an axe from Gokarna to Kanyakumari
\textsuperscript{13} T. K Velu Pillai, The Travancore State Manual, Vol. III, 1940
\textsuperscript{14} T. K Velu Pillai, The Travancore State Manual, Vol. III, 1940
\textsuperscript{15} From the Preface of Panchayat Project Documents of Meenachil Taluka

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*Translated from Malayalam by K.A. Shaji
Oamjie John

“A few decades ago, we used to go fishing by observing the direction of the wind, the movement of the waves and the sight of the flock of birds. We were almost sure where we could get the type of fish we wanted. Today everything has changed; the untimely rain, unpredicted cyclones and vanishing coasts and houses. Some species of fish have disappeared for ever. Instead, some new species started migrating into our sea. In short, there is no certainty at all with our livelihood”, lamented Ravikumar, a fisherman from Kozhikode. His helplessness is shared also by almost all the fishing folk all across the Indian coast. About fifty years ago fisherfolk normally planned their work on the sea by observing the changes in nature and its admonitions. These observations were found to be accurate in most of the occasions. This traditional and local knowledge has built a strong foundation for the sustainability of their livelihoods.

However the last five decades have witnessed unprecedented changes in the sea and all along the coast. The major changes among these are man-made. Moreover, the complexity of the problem has been enhanced due to the unpredicted and ever growing impacts of climate change as well. The uncontrolled and unscientific measures applied to several developmental projects all along the coast have in fact made a deep impact on the ecosystem of the sea and the coastal environment. Even globally, the coast and the adjoining areas have been converted as major hot spots for industrial and tourism development. The case of India and Kerala is no exception.

Global warming and climate change

Studies about the impact of global warming and climate change on the coast and on life and livelihoods of coastal communities are only in the preliminary stage. In Kerala, hardly any study has been done in this direction but it can be directly understood that the consequences of global warming and climate change are increasing on a day-to-day basis. It is a daily experience for the coastal inhabitants that sea temperature is on the increase, fish species disappear, sea-level rises, coasts vanish due to erosion, flood is a common phenomenon and houses are being washed away. If this condition persists, scientists predict that by 2026 global warming will deal a death blow for most of world’s coastal countries and communities.

The Kerala coast is, in effect, undergoing unprecedented changes and has been facing acute ecological crisis over the past five decades. Both natural and man-made causes are behind this crisis. Temperature rise due to the emission of greenhouse gases has in fact started affecting the Arabian Sea and its eco system on a large scale. The emerging modern lifestyle and the way in which we deal with nature also have indeed aggravated the present crisis. Uncontrolled thirst for consumerism has become the culture and lifestyle of the majority of Malayalees. The messy increase in transportation, the criminal destruction of forests, hills, rivers and other water sources in the name of infrastructural development, the pollution of air and water due to unscientific industrialization, the carbon emission created by domestic activities, etc. are causing rise in the temperature and chaotic changes in the climate.

“Sea water has a great capacity to absorb carbon dioxide in the atmosphere. But this ability is considerably
reduced as a result of increase in acidity in sea water. Studies show that acidity of sea water at the surface level has increased by 30 percent. This is due to the increased carbon dioxide level in the atmosphere. Marine species with shells and coral reef are perishing alarmingly. Due to rise in sea temperature, cyclones such as El Nino lose its direction and create havoc on unpredicted areas on the coast. These destructive cyclones are nightmares for sea travelers.\textsuperscript{1}

Uncontrolled and unscientific mode of fishing affects adversely even the seabed. Nuclear tests in deep sea, developmental activities along the coast, sand mining, tourism projects, etc. cause extensive destruction to coastal environment and the ecosystem of the sea. Human interventions of this sort both in the sea and along the coast lead to climatic changes and its resultant environmental problems. For example, the indiscriminate sand mining and destruction of mangroves on the Kolavipalam beach have resulted in the disappearance of the Olive Ridley tortoise which used to seasonally visit the beach for procreation since centuries.\textsuperscript{2}

A survey conducted by the State of the Environment Report through Kerala State Council for Science, Technology and Environment shows that sea and the coastal environment are being systematically exploited by tourism industry, waste disposal, excessive land use, coastal engineering works and sand mining. The coastal areas of Kochi Lake, Alappuzha, Kayamkulam, Paravur, Veli and Kollam are considered places of importance for tourism. Waste disposal from tourism houseboats adds to pollution in these areas. Residues of plastic wastes also cause environmental destruction of the lakes and backwaters.

**Kerala- the land of diversity**

Kerala, a small stretch of land along the south-western coast of India, is situated between 8°18'-12°48' northern latitude and 74°52'-77°24' eastern latitude along the northern side of the equator. Kerala has a total land area of 38,863 sq.km constituting 1.03 percent of the total land area of India. It has a coastal stretch of 590 km. Although the land is in close proximity to the equator, the climate is considerably influenced by the Western Ghats situated along the eastern border. The normal temperature of Kerala is 28-32 degree Celsius and the south-western and north-eastern monsoons are the major rainy seasons. Geographical diversity of Kerala also accounts for the diversity in climatic conditions of the area.

Human (social) development index disproportionate to economic development makes Kerala a unique development model compared to that of other parts of the world. According to UNDP ranking, Kerala stands first in human development index among Indian states. Advances in education and health sectors, low infant and maternal mortality rates, population control, and increased longevity are the major factors behind this unique positioning. Though Kerala stands fifth in per capita income, it has the first place in per capita consumption. As a consumer state, its fast changing lifestyles, extensive developmental activities and high energy consumption cause excessive emission of greenhouse gases. For example, per capita emission of carbon dioxide in Thiruvananthapuram city is 0.205 tones and that of Kochi is 0.40 tones.\textsuperscript{3}

**Rising temperature; falling rainfall**

Studies show that the Arabian Sea on the western border of Kerala is highly affected by global
warming. During the period 1904 - 1994, an increase of temperature by about 0.5 degree Celsius was observed on the surface of the Arabian Sea. In the period 1960 to 1995, only a very low increase in temperature was recorded in the Arabian Sea which is situated between 0.25° northern latitude and 45°-80° eastern latitude. (ICOADS, NOAA, KAPLAN). However it was observed that after 1995 the surface temperature of the sea started increasing. Post 1995 recorded unprecedented changes in temperature levels. Even when the temperature from the sun was low, the surface temperature of the sea remained high. Carbon dioxide level also increased excessively during this time while the same was negligible before that. During the decade from 1995 to 2005, there was a 20 percent increase in carbon dioxide level which the highest recorded in the last 200 years. From this observation it can be inferred that the increase in surface level temperature of the Arabian sea is due to the influence of carbon related global warming and climatic change.5

Indian Institute of Tropical Meteorology based at Pune conducted a study on the increase in temperature from 1901 to 2007 at Calicut in north Kerala and Thiruvananthapuram in south Kerala. According to the report, the average annual temperature in north Kerala has increased by 1.02 degree Celsius and that of south Kerala by 1 degree Celsius in 100 years. The increase in temperature during the last three and a half decades is 0.4 degree Celsius.

As per the temperature statistics/data collected from 7 centers in Kerala during the last 50 years by the National Data Centre of Indian Meteorological Department (I.M.D) at Pune, there is an increase in temperature by 0.64 degree Celsius. Reports show an increase in global temperature by 0.7 degree Celsius since 1950 thus validating the relation between increase in carbon dioxide in the atmosphere due to excessive use of fuels like petroleum and coal and acceleration in global warming. I.M.D. statistics also shows further increase in the surface level temperature of Kerala.

It is observed that a substantial decline in rainfall happened during the period 1901 to 2007 according to available statistical data on monsoon rain in Kerala. Availability of underground water is also decreasing and the State Ground Water Department has observed that in certain areas of Kerala like Palakkad, the amount of underground water has alarmingly decreased. As per reports, changes in rainfall availability along the western coast of Kerala is from 965+185.33 mm to 1794+247 mm; an increase by 6% to 8%. Compared to the 1970 average, an 8% increase can be expected in rainfall availability in the months of June, July and August by 2030. At the same time a decrease of 19% in rainfall during the months of November, December and January is also expected. The report also predicts a decrease in rainfall during March, April and May as compared to that of 1970.

Rise in sea level
Impacts of climatic change will be excruciating in Kerala, a State having a lengthy coast line. As a result of the rise of sea level, salt water enters into low level terrains along the coast and thus the sources of agriculture, underground water and drinking water become contaminated and useless. Excessive amount of salt water is seen in Kadalundikkadavu and Chaliyam in the southern part of Kozhikode coastal area and in Beyapore, Korapuzha and Morappuzha areas. A report prepared by the Ministry of Environment and Forest of the Central government for the Framework Convention on Climate Change of the UN shows that Kerala is facing severe threats due to sea level rise. “It is estimated that there can be a rise in sea level from 8.8 cm to 87.8 cm during the period from 2000 to 2100. This will result in contamination of coastal underground water with salt water, deterioration of marshland and intermittent flooding making valuable coastal land useless.” the report warns.6

“There is recorded evidence showing that the changes in sea level have been examined since the 19th century. Today, with the advancement of technology, any area can be assessed accurately by satellite. During the 20th century the average sea level rise was 1.7 mm per annum. In the decade 1993-2003 it became 3.1 mm. After 2003 there was a slight decrease to 2.5 mm. Excessive water flow caused by the melting of glaciers is the major reason behind the current rise in sea level. If this melting continues, by 2200 the glaciers will completely disappear and it is beyond doubt that the consequent sea level rise will be a great threat to coastal areas and especially low laying areas along the coast. Gradually the sea will engulf the shore and the coast will vanish into the sea. Rare species of plants along the coast will disappear forever. It will be catastrophic if the sea decides to take back the stretch of land once originated through the retraction of the sea.”
Observation of the Indian coast over the last two decades reveals that an average 1.3 mm rise in sea level has been happening every year. As per available data of the last 54 years, average sea level rise along the coast of Cochin is 1.75 mm per annum. An area of 169 sq. km adjacent to the Cochin coast is affected by the dangers of flash floods due to sea level rise. A study conducted by Thrivikramaji in 2008 corroborated that trickling of salt water into underground water sources and filling of marshland with salt water are among the major and severe impacts of global climatic change on the Kerala coast.

In a publication of the Central Marine Fisheries Research Institute, Mr. K.S. Purushan of Panangad Fisheries College opines, “It is assumed that the sea level rises 8-9 mm per year due to climatic change. If this continues, there will be a rise in sea level by 30-40 cm by the end of the next 50 years. This will result in severe environmental and human disaster along the Indian coast and especially in Kerala.” Traditional paddy fields and 90,000 hectare shrimp/fish hatcheries will be completely ruined, endangering job and food security of the people living along the Kerala coast. The foundations of rural economy will be adversely affected, causing its complete destruction.

1.3% of total coastal area of Kerala is affected by soil erosion. Protective structures like sea walls have been constructed in almost a 310 km area. Following are statistics relating to the Kerala coast:

<table>
<thead>
<tr>
<th>Type of Erosion</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>High soil erosion-affected area</td>
<td>2.3km (0.40%)</td>
</tr>
<tr>
<td>Moderate soil erosion</td>
<td>9.2km (1.57%)</td>
</tr>
<tr>
<td>Less soil erosion</td>
<td>49.2km (8.37%)</td>
</tr>
<tr>
<td>Artificial/man-made beach</td>
<td>309.7km (52.09%)</td>
</tr>
<tr>
<td>Permanent/ unaffected coast</td>
<td>46.3km (7.87%)</td>
</tr>
</tbody>
</table>

Demise of bio-diversity of the sea and coast

The Arabian Sea and the coast of Kerala are rich in precious bio-diversity. It is really startling that the mangrove forests in Kerala, once extending over an area of 700 sq km, has been reduced to a tiny stretch of 17 sq. km on account of ignorance and greed of Man. Traditionally, the creepers that grow on the coast, sand-dunes covered with green, tiny coastal forests and sacred groves have all acted as efficient organic defenses that indeed protected the valuable bio-diversity of the coast. The planktons in the sea and the innumerable species of fish are to be seen as the dynamic presence of this ever vibrant bio-diversity.

District-wise distribution of mangroves in Kerala is as follows (in hectares)

<table>
<thead>
<tr>
<th>District</th>
<th>Area (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiruvananthapuram</td>
<td>23</td>
</tr>
<tr>
<td>Kollam</td>
<td>58</td>
</tr>
<tr>
<td>Alappuzha</td>
<td>90</td>
</tr>
<tr>
<td>Ernakulam</td>
<td>260</td>
</tr>
<tr>
<td>Thrissur</td>
<td>21</td>
</tr>
<tr>
<td>Malappuram</td>
<td>12</td>
</tr>
<tr>
<td>Kozhikode</td>
<td>293</td>
</tr>
<tr>
<td>Kannur</td>
<td>755</td>
</tr>
<tr>
<td>Kasaragod</td>
<td>79</td>
</tr>
<tr>
<td>Total area</td>
<td>1671</td>
</tr>
</tbody>
</table>

Geographically, the northern coastal belt of Kerala was richer in mangroves and was considered as a living network of sustainable eco-links between sea, coast and inland areas. It was protected and revered as the organic body of a landscape because of its ability for sustainable productivity, coastal protection, for procreation of
fishery species, housing a variety of animals and birds. Hence, any damage to these mangrove forests can lead to severe environmental impacts and climatic problems having far-reaching consequences. Almost 88% of mangroves in Kerala are owned by private individuals and it is being systematically destroyed in the name of house construction, uncontrolled collection of firewood, fish farming and other agricultural as well as developmental activities. Hence, controlling the destruction of mangroves is quite impossible. Moreover, private owners are motivated by financial profits and other vested interests over and above crucial concerns like environmental equilibrium.

Along with human encroachments, the rise of sea level also threatens the existence of mangroves. Mangroves play an important role in maintaining carbon dioxide equilibrium in the atmosphere. It is certain that the destruction of mangroves along the Kerala coast will damage its bio-diversity and result in climatic changes having far-reaching consequences. However, rays of hope can be seen as some NGOs and individuals are actively working for the protection of mangroves in certain parts of the State. Mr. Pokkudan from north Kerala is one such example.

Declining employment opportunities

The coast of Kerala having a length of 590 km is thickly populated. Undoubtedly, climate change will adversely affect employment opportunities of people of this coastal area. Although the Kerala coast accounts for only 10% of the total Indian coastal area, 25% of the total population of Indian fishing community inhabit here. Fishery production is also proportionate to the density of population.

Climate change will affect employment opportunities in the fisheries sector in a number of ways. Sea level rise and unexpected sea encroachment aggravate erosion of the coast through which the safe places to stock fishing equipment are being eroded almost completely. Most of the fish landing centers of earlier days have disappeared over the past few decades. The villages of Mukadar and Nainamvalappu in Kozhikode are victims of ferocious sea encroachments and resulting in the loss of job opportunities. Veli, a village in Thiruvanathapuram, is another example of this situation. In a violent sea encroachment that happened here a few years back, about 60 houses that stood for more than 30 years were completely destroyed in three days.

Discrepancy in the availability and types of fish species also have contributed to the decrease in employment opportunities in this sector. According to scientific observations and experience of fisherfolk, fish like Sardine and Mackerel of the Pelagic species which are in plenty on the Kerala coast, have started moving either to other areas or to the bottom of the sea due to variation in the temperature of the sea. It is observed that over the last couple of year, Oil Sardine has moved from the western coast to the eastern and north-western coasts. This uncertainty in the availability of fish causes problems both in employment and market sectors. The entry of new species and exit of traditional ones is quite a new phenomenon and therefore fisher folk are learning how to cope with this situation. Scientists warn that as unpredicted climate variations occur, temperature of the sea will rise and will rapidly increase the uncertainty in the availability of fish.

Production and distribution of pelagic fishes like Sardine and Mackerel which are of high commercial importance, have been very badly affected by climatic changes. Historically, Sardine and other similar fish species were found in the Malabar sea region located at the south-western part of India in 80-160° latitudinal area. But ever since 1989, there had been a definite change observed in the distribution of these fish. Oil Sardine became a major species of the south-eastern sea and Mackerel moved to the north-western part. As in the case of other tropical pelagic species, irregular increase and decrease in production can be noticed as well. Experiences of fisher folk on the Malabar Coast corroborate this.

Basheer, a fisherman from Kozhikode beach complains, “There is no certainty as to the availability of fish as before. Frequent changes are noticed in the quantity of fish catch. Hence uncertainty prevails in fish sale also.”

Many studies show that pelagic fish have only a very short life span. Climatic changes cause irregular temperature variation in pelagic coastal sea which is the living place of Sardine, Mackerel, etc., resulting in mass migration or destruction of such fish. It is observed that such unprecedented, irregular variations in sea temperature as experienced today also affects El Nino and La Nina winds. Scientists have found that the average rainfall during the 2012 monsoon was very less since El Nino wind was not properly formed. These phenomena also cause variations in the quantity of fish...
Disease-hit Kerala

Several studies highlight that climate change leads to severe health problems. Untimely rainfall, extreme temperature and cyclonic winds set a favorable atmosphere for the spread of epidemics. Increase in mosquito breeding, generations of new disease-causing viruses/bacteria and emergence of new types of diseases and epidemics have become a common experience of day-to-day life. Kerala, especially its coastal area, is currently facing the threat of this disaster.

Globally 2.5-3 billion people (40% of the total world population) live in constant threat of infection. Every year 5 crore cases of infection and 24,000 deaths are reported from about 100 epidemic-hit countries all over the world. 90% of victims are children and 52% of the total cases are reported from south Asian countries annually. India is one among the 7 countries from where Dengue fever cases are continuously reported. Experts from the health sector have already predicted that India will be placed as the capital of the epidemic Dengue fever in the near future.

It was in the year 1997 that Dengue fever cases and consequent deaths were reported from Kerala for the first time. Viruses Den-1, Den-2 and Den-4 were detected among the inhabitants in many parts of Kerala. Experiments show that in the year 1979 itself, Dengue anti-bodies were found in human blood in Kozhikode, Kannur, Palakkad, Thrissur and Thiruvananthapuram districts. There are recent reports that Den-2 and Den-3 viruses have been found both in mosquitoes and human blood. The statistics provided by the Kerala Public Health Department shows that in the year 2011 there were 1304 reported cases of Dengue fever, which increased to 1396 in 2012. In addition to Dengue fever, epidemics such as Japan fever, Chikungunya and Filariasis also have hit many parts of Kerala, especially the coastal areas, and claimed many lives. On the basis of observations and experiments, experts and health workers strongly assert that all these epidemics have to be understood as the after-effects of climate change.

In the year 2008, WHO warned that Chikungunya has been widespread in Kerala since 2006 and observed that it was the after effect of unprecedented climate change.

“Climate change is one of the key factors of the Chikungunya outbreak in Kerala during 2006 and 2007. Global warming is a major cause of surge in Chikungunya, dengue and malaria. These vector borne diseases will intensify with climate change and more people and new areas will fall prey to it”, according to Poonam Khetrapal Singh, deputy regional director (Southeast Asia) of WHO.

Intermix climatic conditions of heat and dampness caused by increased atmospheric temperature and untimely rainfall is favorable for the growth of a number of microbes; moreover, such germs actively exist for a long time under such conditions. Environmental pollution and waste water deposits result in excessive procreation of germ-carrier mosquitoes. All these enabling conditions have made the coastal areas of Kerala a fertile land for a number of epidemics.

How to combat this disaster?

Two things are essential for facing such a challenge: first one is devising steps for reducing the impact of such disasters and secondly, developing sufficient capacity to cope with this calamity. The coast of Kerala and the communities residing there are facing the consequences of climate change and global warming for no fault of theirs. With whatever preventive measures that have been taken so far or planned to be implemented, the unavoidable reality is that this disaster is at their door steps. If timely initiatives to prevent the catastrophe are not taken immediately, impacts of the disaster may be unbearable. It is a historic truth that where modern technology and unscientific plans failed, traditional knowledge systems and techniques succeeded. It is remarkable that such initiatives are being experimented in the coastal environment and communities of Kerala.

Strengthening of such attempts and giving maximum propaganda and enhancing awareness among the public about these initiatives are most desirable in the present time. A few suggestions helpful in reducing the impacts of the disaster are given below:

1. Plant mangroves extensively especially in areas adjacent to estuaries and other marshlands.
2. Plant creepers such as Adampuvalli on the beach
3. Protect natural coastal forests and sand-dunes
4. Develop a bio-shield all over the coast of Kerala.
5. Strictly implement the CRZ notification; ban all illegal constructions in areas near the sea.
6. Fisher folk should be advised to construct their houses at safe places away from the coast.

Some suggestions also are put forth for developing
disaster preparedness to creatively cope with situations caused by climate change:

1. As a first step, identify the threat of irregular and uncertain fishery production.
2. Make attempts to creatively intervene in market activities by forming social management institutions in the changed scenario.
3. Take proper precautions and preventive measures with the help of modern technology while going for fishing.
4. Get training in the production of value-added fish products. Co-ordinate marketing and sale through cooperative societies and women organizations such as Kudumbasree.
5. Start resource/information centers and set up effective communication networks using community radio, T.V., etc. to give prior information regarding unexpected disasters.
6. Start initiatives both in family and at Panchayath level to procure food, drinking water, etc. for disaster-affected times.
7. Acquire technological knowledge in methods of processing/disposing of waste at the source itself; strongly oppose and prevent waste disposal in the sea.
8. Reduce fuel consumption to the minimum level; use more of non-conventional energy like solar and bio-gas.

Governments need to be pressurized to show political will to effectively implement these suggestions in order to address the unavoidable disaster due to global warming and climate change. Attempts for disaster preparedness are to be started from school level itself. It is high time that proper actions need to be initiated by society as a whole to combat such unavoidable calamities keeping apart all blind political, caste or religious rivalries.

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*Translated from Malayalam by the author
Virtual Water - The Blue Gold

Nakkeeran

The lovely T-shirt on the hanger in the mall beckons you. It has got there after consuming—hold your breath—256 gallons of water (one gallon = 3.78 litres) for the dyeing of its threads, stitching and packaging! All consumer goods consume huge amounts of water during production. For instance, one kilogram of polished sugar needs 1,653 litres of water, one slice of bread is prepared after utilising 40 liters and making of one mug of beer consumes 75 litres. A burger would have taken 2,500 litres before landing on your plate. The quantity of water used in the production of a product through various stages, which is not seen by the customer, is known as ‘virtual water’.

London based geologist Tony Allan introduced the concept of ‘virtual water’ in late 1990s. He was awarded the Stockholm water prize for this innovative concept. Explaining ‘virtual water’ he says that all of us know that water is needed to produce wheat. But we do not see the water used in producing the grain after the harvest. In reality, several liters of water are spent for raising the crop. In a nutshell, this huge amount of water used in various steps in the production chain but cannot be seen by our naked eye is known as virtual water. Allan also says that when countries start importing goods which they need, they can save water in addition to saving money.

Based on Allan’s concept, water experts Hoekstra and Chapagain have defined the virtual-water content in a product. A cup of coffee is produced by using 140 liters of water. This means that the coffee seeds are sowed, watered, harvested, ground, powdered and finally packed and exported to a country. During this process, the amount of water utilized for a cup of coffee comes out to 140 litres. Hence, a cup of coffee consumed by an individual in England is gulping 140 liters of virtual water. Apart from gulping that cup of coffee, he would use up 140 liters of water for all his needs including bathing, drinking and cooking whereas in developing countries like Africa, an individual finds it tough to get 20 liters of water for his one day’s consumption.

Countries like the US, UK, Italy and Israel conserve huge amounts of their water resources by importing water-intensive goods. Italy makes its famous footwear by importing processed leather from India, where in
towns like Ambur, Vaniyambadi and Ranipet, the leather factories have over-exploited the Palar River and also ruined groundwater by contamination. The Italians can make more profits by processing the leather themselves but they don’t do that in order to protect their waterways and their environment.

Israel, famous for its advanced irrigation methods that save huge amount of water, has stopped exporting its delicious oranges because harvesting one fruit would consume 50 litres of water. The secret behind the developed world importing clothes and cars from India and other developing countries is to preserve their own water resources and also to prevent pollution of this elixir of life.

Many thinkers have already predicted that the next world war would be fought for water. Already we are witnessing many signs of it. Even then, why are these no signs of war in the water scare countries like the Gulf nations?

Now, let us look for answers why the water starved Gulf countries do not fight for water. Ground water was the only water source for the farmers in food production in Saudi Arabia. In early 1990’s, Saudi Arabia increased the cultivation of wheat to earn more foreign exchange reserves through exports. As a result, Saudi Arabia became a country most deplete of the ground water resources compared with any other country in the world. Suffering severe water shortage, Saudi Arabia now imports wheat. This virtual water concept is well understood by the Gulf countries and thus they handle their water carefully. When a country imports a tonne of wheat, that country will be able to save 1,300 cubic metres of its water. The importing of wheat costs much less in terms of water than producing the crop and harvesting it. Being able to import essential goods is perhaps a good reason for the Gulf countries not to fight for water.

Namakkal district in Tamil Nadu is known as the egg city in India and is the biggest producer of eggs in India. Production of one egg consumes at least 200 litres of water and Namakkal exports several lakh eggs every day to the Gulf countries along with huge loads of precious water.

Several tonnes of meat products are imported by the US and UK alone for their hamburgers and other food items. The global average water footprint of beef is 15,400 litre per kg, says the water footprint network.

Hence, one can imagine the water we are spending and the quantity the importers are saving. The irony is that after exporting such amounts of water, we buy packaged water sold by MNC firms for Rs.15 per litre. The Tamil Nadu state municipal administration and water supply department promises supply of 40 litres of water per day to each individual in villages and 140 litres to city cousin. But the sad truth is that while the government is not keeping its word, the rural households are now spending large sums of money every month to buy water. Why do we have to pay for water? Who is stealing our glass of water?

While every country is working on trade plans to conserve water and reduce the water footprints, in our country we are inking new export deals and inviting several foreign firms to open their industries here. Chennai is known as the ‘Detroit of India’. A car manufacturing unit in Chennai will spend almost four lakh litres of virtual water to produce a 1.1 tonne car. This amount of water equals a day’s consumption of water in five villages, wherein each village has close to 5,000 residents. So the car firm produces lakhs of vehicles every year using huge amounts of water which should have been actually supplied to villages. Just think about the water shortage which prevails in Chennai and the number of cars we export every year. Why the foreign countries do not manufacture cars in their own countries? They are very much informed and careful in using water resources.

The captains of Tirupur hosiery industry in Tamil Nadu must be proud that they are earning Rs.12,000 crores annually by exporting global brands made in their units. But then, point out water experts; it would be imprudent to draw such growth maps by merely speaking about the export earnings from products made in our factories. Many developed nations see the importing of goods in terms of virtual water saved by not producing them locally. These importing nations only pay for the products and not for the water consumed for producing them in India. Water experts argue that increasing our exports would only mean spending more water to produce those goods and helping the importing countries save their precious blue gold.

The amount of water which is present now is the same amount of water which existed when the
earth was formed. Not even a drop has increased or decreased on earth. This is a scientific fact. Then why do we suffer with water shortage and scarcity. 97 percent of the total water on earth is sea water. In the rest of the three percent of water, almost 68.7 percent of water is in the form of frozen icebergs. 30.1 percent remains in the underground in unusable form. Just 0.3 percent of water is found on the surface level of the earth. Even in this 0.3 percent of water 87 percent of water is found in lakes and ponds. 11 percent of water remains in marshlands and barely two percent of water run as rivers. Water in the marshlands cannot be used as fresh water.

So, very less amount of water is left for the daily consumption for every life form in the entire world. The life form includes not just human beings but also plants, animals and everything living on the planet. It is essential that we understand that every living being has the right to water.

Of the surface water left on our earth we utilize 70 percent of water for agriculture, 22 percent for industries and the rest eight percent for consumption. So every living being is dependent on this scarce water resource for its consumption. Actually 200 years ago, we did not have any issue in using the water resources. Industrial revolution initiated water famine and allied problems.

Virtual water can be classified into three types. They are: green, blue and grey. Green-rain water, blue-surface ground water and grey-effluent water which was polluted at the end of a production process. In this green and blue water evaporates when water is used for agricultural purposes. We will get back the evaporated water as rains. In case of polluted grey water, we have no clue of reusing it. This remains the root cause of many water problems.

The fresh water bodies and ground water are affected when the grey water gets mixed up with the resources. Noyyal and Palar rivers in Tamil Nadu are the best examples of how grey water pollutes water bodies. The Noyyal River had once flowed across the western districts with 34 tributaries and 120 check-dams. The Noyyal River now remains a dump yard for the knitting industry to flush out effluents from their mills. The untreated effluents contain unbelievable amounts of chromium, cyanide and many other hazardous chemicals. For e.g., 500 grams of wetting oil, four kilograms of caustic soda, four kilograms of sodium peroxide, eight kilograms of hydrochloric acid, 8 kilometers of soda ash, 3 kilograms of acidic acid, 10 kilograms of salt and 2 kilograms of petroleum oil mixed with 40,000 liters of water is used to produce 100 kilograms of knitted cloth. When these effluents are discharged into the Noyyal river at the end of the process, the water resource is damaged and if the effluents are discharged every day it will lead to the death of the river.

While farmers are pleading with the government not to release the water from the Orathupalyam dam which stores the polluted water from the Noyyal River, the knitting mills continue to discharge their effluents into the river with impunity uncaring of the plight of the farmers. The pollution has even seeped into the ground to such an extent that even the tender coconut water looks reddish in colour. When tender coconut water itself turns reddish, there is no need to explain the quality of drinking water in the Orathupalayam villages.

According to the standards prescribed for drinking water by the World Health Organisation, TDS (Total Dissolved Salts) should range between 500-1500 in the water whereas the district administration has found out that water samples from Orathupalayam have 6,000 TDS in them. Sometimes the TDS levels were recorded as high as 17,000 in the dam water. In general, TDS levels in the effluents released from the tanneries would be really high. In 100 kilograms of leather only 20 to 30 kilograms would be retained and the rest would be lost during the processing in the tannery and ends up as solid waste. These wastes were discharged into the Palar River by the tanneries and now almost 35,000 hectares of agricultural land has become unfertile. In Australia, cleaning a car using freshwater is considered a crime but when we look at the flourishing trade in the hosiery capital of Tirupur and Vaniyambadi dotted with leather tanneries, we see how this trade is unmindful of the conditions of water, resulting in Tamil Nadu losing one of its major rivers.

On the assurance that the local population would get employment in the tanneries or knitting mills, the government permits the operation of tanneries and knitting mills. The irony is that, as little as five percent of people will get employment in these firms whereas the effluents released by these firms affect the water bodies and as many as 85 percent of people would lose their livelihoods.
It’s our responsibility to protect our environment for the future generations than accumulating wealth and saving money for their welfare. According to a study the water consumption would rise by more than 57 percent of the present consumption rate in the next 25 years. India has also been found to be on the list of countries which would face severe water shortages in the future. Even at present almost 20 crore people still struggle for good quality of drinking water. The fact is that against this alarming scenario, we are polluting 80 percent of our water resources. Moreover the situation in Tamil Nadu is worse than other states. Next to Rajasthan, Tamil Nadu is the second state in India which receives very less rains. Even the Tamil Nadu public works department has announced that 72 percent of water resources in Tamil Nadu is unfit for consumption.

Sweden based doctor Malin, water expert, says that an individual needs 2,000 cubic metres of water in a day. If the water consumption reduces to 1,700 cubic metres it would indicate that there is drought in the neighbourhood where the person lives. If the water usage comes down to 1,000 cubic metres per person that would severely affect the country’s economic growth and also the welfare of the people. Now, an individual in Tamil Nadu receives just 900 cubic metres of water. Going by Malin’s scale, residents here are in effect going through a water famine.

Rivers are the main sources of water in Tamil Nadu. It receives 36,000 million cubic metres of water in which 24,000 million cubic metres of water is received through rains in the state. Neighbouring states contribute the rest of 12,000 million cubic metres of water. Due to conflict for water with the neighboring states, the government is forced to provide less amount of water. The water supply per person is going down to almost 700 cubic metres as against the recommended level of 2,000 cubic metres. Though Tamil Nadu state might look prosperous with its huge industries and economic growth, in reality it suffers severe water shortage. The development scene is a mirage. The state has to learn lessons from other countries on how to save water and what would happen if we fail to do that.

Africa had exported several tonnes of lemon and vegetables to European countries once and was known to be the leader in exporting water. Now, one third of the African population faces the adverse impacts of water shortage. People in Sahara desert slog for several hours to bring water for their consumption and the people in the Sahara desert do not have enough water for their living. The scene across Africa is devastating. The water falls in Angola in Africa is polluted and it could be seen with our naked eyes. Yet the people have no choice but to consume the contaminated water. This can be related to the scene in Vellore district in Tamil Nadu. People in Vellore are forced to use the poor quality water in their neighbourhoods. In Sudan, worms have infested the lake water. But the people are forced to drink the contaminated water. The voluntary organizations in developed nations have provided them a pipe for free, which would filter those worms! The question is whether we want a similar situation to occur in Tamil Nadu.

3

During his speech on ‘Virtual water and geopolitics’ at the global level conference on water held in Japan in 2003, Danniel Zimmer, director of World Water Forum, gave the message that usage of virtual water of an individual in Asia is 1,400 litres per day whereas a consumer in America uses up to 6,800 litres and those in European countries use up to 4,000 litres of virtual water in a day. According to Zimmer, developed countries export just one part of water and import three parts of water or save the same amount of water. There is a misconception that Japan exports and earns more returns. In reality, Japan imports products from other countries which amount to 15 times higher than the exports in terms of virtual water.

Export and import business happens in every country. But what we export and import matters. We have to understand how the developed countries are very particular about importing water-intensive goods and export products which would be produced only with very less amount of water. Our government publishes reports on the profits we reaped through exports every year. Why the foreign countries are saving their money by importing our goods. They are particular about saving in terms of water and not in terms of money whereas, we fill our treasuries with money and exploit all our water reserves. Export business is encouraged only to gain foreign exchange reserves from the international markets. This is promoted by the World Bank and other private financial firms. There are chances of a big fall in the future of the global markets and foreign countries
might stop importing goods like leather, clothes and almost all the products from our countries. At that point of time, the demand for Tirupur clothes or Ambur, Vaniyambadi leather products would not exist or if the developed countries get to find some other ‘innocent’ country which might provide goods at a cheaper price, our goods would be unnecessary for them.

So far in the history of the world, it has been learnt that any country which fails to protect its natural resources and its people by continuing its business would witness a big fall in the economy. These countries would ‘gift’ famine and poverty to its citizens. Africa is the country which worked in the above said model and is now facing severe famine. While an American utilizes 6,800 litres of virtual water, a resident of Zambia in Africa has to struggle for four litres of water.

It’s not just water which is hidden in the export goods but also the cheap labour of the country. Foreign countries import water which is the gift of nature and also labour for a much lesser price. Several multinational firms fill their kitty by importing goods from developing countries whereas poverty and shortage of water and food are ubiquitous in the third world nations.

You may say that people in the third world nations also get job opportunities given by the foreign firms and cite that thousands of our youth are employed in information technology firms and BPOs run by foreign firms. When you calculate the profits in terms of virtual water you will be depressed to know how ingenious the developing nations are. The Current Science magazine published an article on how the developed countries save water by outsourcing jobs to developing nations. For instance, direct consumption of water for a resident in America is marked at 700 litres and virtual water consumption works out to 6,800 litres. In toto, an American consumes close to 7,500 litres of water. So by outsourcing a job to an Indian, an American firm could save up to 7,500 litres of precious water. It will be unbelievable when we multiply the amount of water saved and number of jobs offered to Indians and see the result in the amount of water saved in America. If an American firm provides a job to a person in its country, it will be forced to spend water for its employee and also for the family members of that person whereas if the jobs are routed to India, America could save huge loads of water and virtual water. The American government is particular about conserving its water resources and involved in protecting the existing water bodies. So, by providing jobs to people in developing nations, developed nations save their water resource which is precious and cannot be priced, the Current Science magazine said in its article.

48,000 cubic metres of water is available in the form of rain water on the earth. Of the total population on earth, Tamil Nadu contributes to one percent of that population. Going by this calculation, just one out of 100 percent of water is available for the people in Tamil Nadu and even of this one percent of water, we are wasting almost 90 percent of water by using it in industries. At least we should wake up now.

The US government has spent close to 1.5 billion dollars to protect a lake in New York City. The government which spent so much money to protect its resource did not bother to encroach and exploit the water bodies in developing nations. It is well known that the food consumption pattern of an American citizen affects many others in developing nations. It is common knowledge that American food habits deny adequate food for the rest in the world. The meat industry in the US consumes much more water than agriculture. The water used to produce meat is much higher than in the production of vegetables and grains. For instance if we use one glass of water to produce ten grams of fat from food grains, production of the same amount of fat from meat would consume five glasses of water. The meat industry consumes 38 percent of total amount of water spent for food production in the world. If an American switches to consuming vegetarian food like an Asian, he would cut down the water usage to a dramatic level.

The Chinese love pork but recently their government brought out regulations for households raising pigs, the reason being that a kilo of pork needs 4,810 litres of virtual water which is twice the quantity needed for mutton and chicken or fish for that matter. This is the reason why the Chinese government has regulated the rearing of pigs. The Chinese contribute 21 percent of the total population of the world but the country has just seven percent of fresh water resources. Hence, the Chinese government has started producing food grains and other goods, which consume less amount of water.

It is said that the American population will surge
up to 35 crores in 2025. If all of them convert to consuming vegetarian food, the water saved could be used to produce food grains for almost 20 crore people in other countries. Statistics show that 20 crore people go to bed without food every night in India.

Not just Americans, even Indians who belong to high income groups have also changed their food habits which consume large amounts of virtual water. They empty water resources in their own country and forcing the poor to remain hungry. A young man who takes a glass of beer and a burger in a restaurant would gulp almost 2575 litres of virtual water. A glass of beer needs 75 litres and a burger consumes 2,500 litres of virtual water. His previous generations had just a cup of tea and a snack as refreshment and the tea they had, consumed only 30 litres of virtual water. Though milk was produced with so much virtual water, the milk was not originally produced by adding additives and packing it in plastic sachets. The cow gave the milk and it was fed by the farmer whereas, in the present form, one jug of processed milk uses up 208 litres of virtual water from its starting process in the milk firm to the end consumer.

Our forefathers had tea with palm jaggery. The palm tree grew without needing watering. Now we are using white sugar which is refined several times. One kilogram of such refined sugar contains 1653 litres of virtual water. On the same lines, our ancestors prepared sweets using palm jaggery but we spend 26,450 litres of virtual water to produce one kilogram of chocolate. These days almost in every house a snack is prepared within minutes with breads. One litre of cola and bread sandwiches find their place on the dining table in many homes. It is a shocker that one slice of bread needs 40 litres of virtual water. So, some 15 slices of bread in a packet would have been prepared after utilizing nearly 600 litres of virtual water. Not just that, but almost 56 litres of water would be released in the environment at the end of producing one litre of cola.

It is the responsibility of every country to provide safe drinking water to its citizen whereas not even one state in India is seen to owning up the responsibility. They are into guiding the private firms to rake in the money in the water business. Instead of raising our voices against commercializing water, we are immersed in the modern life and do not mind buying water at high prices even when that one litre of packaged drinking water is produced after processing three litres of fresh water.

Water scarcity will not just create drought but also result in climate change. The term climate change is misunderstood by many of us. It doesn't happen naturally. We humans pollute the environment and disturb nature and as a result we face climate change. The export-import trades consume huge amounts of virtual water thereby causing severe water shortage and this contributes towards global warming. The export business can be well be termed as ‘red economy’ which means trading goods using huge amounts of fuel and exploiting the natural resources. A celebrated green writer Nagesh Hegde says, “When you question whether we have to shut down all the export trades and force ourselves to work using an earthen lamp, the real answer is yes.”

If we consider using the earthen lamp now, again we have to understand that at this juncture, we have to outsource lamp which is produced in a firm far away from our town, the oil should be exported from Malaysian firm and the cotton twig has to come from Maharashtra. And finally the match stick will be brought from Sivakasi in Tamil Nadu. But the same earthen lamp was produced by a potter in our neighbourhoods. The farmer harvested cotton and the oil was purchased from the local grocery store. So, this transaction is called as green economy according to Nagesh Hegde.

When you use the lamp or any other item produced in your neighbourhood, the water used up to produce the product was not exported. It was consumed in the local area and the village did not lose its resources. This applies to all countries. When we consume the local goods, the green economy will grow and flourish and save water. Only if we find solutions to cut down virtual water trade, we would be able to save up our water resources.

The Noyyal River in western Tamil Nadu stands as a live example of the red economy. Archeologists say that the Noyyal River and its neighbourhood used to be a bustling export town known as ‘Kodumanal’ during 200 BC to 400 AD. Close to 600 years, gems were traded from Kodumanal through Kesari highway and reached to the Thondi port and sent off to Rome.
We have to understand that during those years, the export trade was carried without contaminating the water bodies but the amount of trade carried out by the Tirupur knitting mills is in no way comparable to the ancient day exports.

The developed countries follow environmentally friendly trade practices these days and we have now been forced to do the same. The main reason is the impact of climate change would be felt in developing countries like ours. Particularly, water scarcity would haunt us and the countries which are gulping our water would not come to our rescue. That apart, they would not even shed a tear for us.

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*Translated from Tamil by Pramila Krishnan
The earth is home to innumerable number of living species. From the evolution of mankind, humans have been living in unity with nature but since the time they started getting obsessed with private property and wealth, they have been manipulating nature and its resources for their personal gains. For a long time, mankind has been regarding nature as a mere depository of resources to be exploited for industrial production. As a result, natural resources like water, land and air were polluted excessively. Eventually, these self destructive actions of man have resulted in global warming which portends catastrophes of an unprecedented nature.

Weather patterns are changing all over the world. We get unusual heavy rainfall in the wrong season. Sea levels have risen, posing danger to many cities and villages situated along the sea shores the world over. On the other hand, this very global warming is responsible for the drying up of rivers, affecting the livelihood of crores of people depending on them for drinking water and irrigation. Consequently, this also poses a serious threat to food production and food security.

What is the reason for global warming resulting in climate change?

Scientific studies have proven that heavy and uncontrolled emission of greenhouse gases into the atmosphere is the main reason for global warming. The main greenhouse gases are carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFC). Developed back in the 1930s as a safe, non-toxic, non-flammable alternative to dangerous substances like ammonia for purposes of refrigeration and spray can propellants, it turned out that CFCs were responsible for introducing chlorine into the ozone layer which has the potential to destroy large amounts of ozone.

French mathematician and physicist Joseph Fourier discovered greenhouse gases in 1824. It was he who discovered that these gases absorb sunlight and turn it into infra red rays, resulting in an increase in heat of the earth.

There has been a steady increase in temperature since 2001 all over the world. According to scientists, it will take many years to measure the real impact of global warming. They warn that the earth will face many climatic catastrophes if the increase in global temperature is not contained at 2 degree Celsius by 2020. “The earth is about to face a tremendous climatic change which was unheard of in the last 8,00,000 years. Dangerous changes are seen in the climate the world over due to global warming. The world witnessed the highest level of global warming in the year 2007”, says Dr. R. K. Pachauri, Chairman of the Intergovernmental Panel on Climate Change (IPCC).

The concentration of Carbon dioxide in the atmosphere has increased by more than 30% since post industrialisation. It was marked at 280 parts per million in the pre-industrialisation era, whereas in the post industrialisation era it was above 392 parts per million. Humans’ continuing anti-ecological actions such as massive industrialisation, indiscriminate deforestation and unchecked urbanisation have exacerbated the damages to even more dangerous levels. Industrialisation demands urbanisation to support it and deforestation facilitates setting up of industries and urban development.

Consequences of deforestation

Forests play a vital role in controlling the level of carbon dioxide in the atmosphere and in maintaining a climatic equilibrium. Forests are natural carbon sinks just as seas and oceans are and when trees in the forests are destroyed to make way for industries and housing, the amount of carbon emitted by these industries and housing results in increased levels of unabsorbed carbon dioxide in the atmosphere. When compared with the past, we have only 11% of forest coverage left in the country now and this is decreasing gradually. When more and more deforestation happen, it makes a considerable and undesirable change in the weather and climatic conditions such as lesser rainfall. Rainfall of 3700mm was recorded in 1920s and 1930s in the plains of Kerala but these plains received only 2800mm of rainfall in 1960s. Studies from 1990 to 2003 record a further decrease by 14% in rainfall. In addition, deforestation does not mean mere destruction of trees. Entire species
living in the forest are also destroyed during the process unbalancing the ecology leading to an array of environmental problems, mainly the pollution of air and water in addition to forced displacement of habitat.

Pollution of air and water bodies due to urbanisation and migration

What is pollution? Pollution is explained as the undesirable changes in the chemical composition of air, water and land. The equilibrium of air and water resources is affected by changes in the equation of land use.

There has been an unimaginable increase in urban population in the last 30 years. In a 2007 report, United Nations has opined that 50% of world population live in cities. 60% of village population was understood to have migrated to urban areas.

Urban population is expected to reach 2 billion by 2030 due to urbanisation and urban development. This will understandably bring vast climatic and environmental hazards along with it. We can understand the intensity of environmental pollution by studying our cities. The level of carbon dioxide emission is vastly increasing due to expansion of urban areas. An estimate of 2007-08 says that Kolkata, which is one of the metropolis of the country, emits 9.33 metric tonnes of carbon; Visakhapatnam 7.36, Ahmadabad 6.78 and Bangalore 6.36. Chennai, the capital city of Tamil Nadu, emits 3.82 metric tonnes of carbon.

When metros like Chennai are expanding and its population ever increasing, it pollutes the surroundings. Outskirts of such metros are fast expanding. Industrial and manufacturing units are mushrooming in Kanchipuram and Chengalpattu areas since the government has given ‘No Objection Certificates’ to many foreign companies. All these industries are set up on agricultural lands which the government has procured and handed over to these foreign industrial giants.

Industries and urban development

The development of urban areas affects the environment adversely. Since these urban areas contain industrial units and factories, more carbon dioxide is being emitted to the atmosphere. This causes global warming. Raw materials used for constructing buildings such as sand, wood and cement are produced by exploiting nature. In a nutshell, huge skyscrapers are the main villains of nature.

Surveys find that different activities by various sources have been emitted more and more carbon dioxide to the atmosphere in India. Based on 2007 statistics, industries contribute to 33 percent of the carbon dioxide emission from the country, followed by houses (28%) and transport (24%).

Buildings emit most amounts of greenhouse gases. Among greenhouse gases, carbon dioxide constitutes the major portion (76%) followed by Methane (13%), Nitrous Oxide (6%) and chlorofluorocarbon (5%). Among these gases, carbon dioxide is the main agent causing global warming.

Power houses (21.3%), industrial activities (16.8%), fuel used for transportation (14%), industrial production (12.5%), other trade bodies (10.3%), land usage and burning various objects (10%) and waste management and purification (3.4%) are the main sources from where carbon dioxide is emitted.

Among them, construction and industrial activities together constitute 80% of the carbon dioxide emitted in the country. Millions of new buildings are mushrooming in the country every year. Carbon
dioxide is emitted through the production and processing of raw materials used in construction industry. Here is a breakup of which material emits how much of carbon dioxide into the atmosphere:

The concreting process itself emits large amounts of carbon dioxide. When calcium carbide is turned into calcium oxide through a chemical process to produce cement, it also causes extensive emission of carbon dioxide. Modern day architects use glass widely while building structures. The fact is, glass absorbs more heat. 1000 metric tonnes of newly manufactured glass emits an excess amount of 315 kilogram carbon dioxide than the same amount of recycled glass.

**Pollution of water and diminishing water resources**

India can in no way claim that we lack in water resources. Only 2.5 percent of the total water deposit of the world is consumable. India holds 4 percent of this consumable water. Present water bodies can no longer cater to the need for water because, instead of preserving and making the best use of it, it is being polluted: The results of urban expansion. The Declaration of Human Rights of 1948 and The International Covenant on Economic, Social and Cultural Rights have declared water as one of the basic needs of humans but till date, the Indian Government has not passed legislation declaring water as a basic need.

Urbanisation demands for many facilities such as office buildings, recreational areas and waste dump yards and in order to provide them, agricultural lands are snatched away from the farmers, bringing an end to village life. Real estate brokers and building contractors buy agricultural lands at meagre prices and resell them as residential plots for huge profits.

Large profits are made from constructing multi level apartments on ponds and other water bodies. Many small lakes, tanks and rivers have disappeared due to various developmental activities. As a result, during rainy season, floods are reported everywhere as there are no longer lakes and tanks to contain rain water, which poses health hazards for the people.

“A survey map we have prepared shows that water bodies covered 35 to 40 percent of Chennai city till the last century. But as for now, the presence of water bodies has shrunk to just 5 percent”, says Professor Ramalingam, head of Department of Remote Sensing, Anna University.

Meteorological Department Director Selvaraghavan also said that the lake near Velachery is shrinking day by day. The marshland in Pallikkaranai also has shrunk from 225 acres to 75 acres. The government has encroached upon this site over the years and established many industrial estates there.

While speaking on the subject, G. Nammalvar, the famous organic farming scientist has blamed the government for encroaching and destroying many water bodies in order to facilitate industrial development. In a clear anti-ecological policy, the government actively promotes urbanisation by procuring and converting agricultural lands, ponds and canals and converting them into Special Economic Zones (SEZs).

**Increased use of fossil fuel due to urban transportation**

People use more and more cars and two wheelers for convenience in their day-to-day mechanical life, rather than depending upon public transportation. There were 0.3 million motor vehicles in India in 1951. The figure rose to 37.2 million by 1997. 32% of these vehicles operate in 23 cities alone. A vehicle using petrol emits 8000 grams of carbon dioxide every day. That means, a petrol vehicle produces 1.92 tonne carbon dioxide a year.

In recent years concern about exhaust emissions from motor vehicles has been increasing. Now petrol driven catalyst cars have much lower CO, HC and NOx emissions, at the expense of CO₂ emissions, but despite these improvements, petrol cars with catalysts still produce more CO and HC than diesel cars. Hence, the motor industry has been promoting the diesel car as cleaner than petrol cars. However, diesel
cars have very different emission characteristics, and an increase in diesel cars at the expense of petrol cars could have important implications on urban air quality, smog formation, global warming and other environmental issues. Although diesel fuel contains no lead and emissions of the regulated pollutants (carbon monoxide, hydrocarbons and nitrogen oxides) are lower than those from petrol cars without a catalyst, when compared to petrol cars with a catalyst, diesels have higher emissions of NOx and much higher emissions of particulate matter.¹

The smoke emitted from aeroplanes mainly constitutes vapour, carbon oxide, hydrogen oxide, sulphur dioxide and hydro carbon. These pollutants may stay in the atmosphere for 3 to 100 years. In that way, the pollutants emitted in one part of the world can pollute the atmosphere around the globe.

Provided below are the permitted level of emission of gases:

<table>
<thead>
<tr>
<th>Carbon Oxide</th>
<th>Carbon Monoxide</th>
<th>Nitrogen Oxide</th>
<th>Sulphur Dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 ppm</td>
<td>50 ppm</td>
<td>5 ppm</td>
<td>5 ppm</td>
</tr>
</tbody>
</table>

Technology is developing various measures to prevent carbon dioxide from entering the atmosphere. Carbon Capture System (CCS) is one such technology. Carbon capture means trapping the carbon emissions from industrial units and storing them away from the atmosphere to prevent global warming but there are chances of many adverse effects when this technology is applied.

### Increasing demand for electricity

In India, only 1.7 thousand megawatt electricity was produced in 1950-51. But in 2000, it rose to 93.3 thousand mega Watts, an increase by 55 percent, in order to meet the increasing need for electricity in urban areas. Coal is mainly used as a raw material. Half kilogram coal has to be burnt to produce one unit of electricity. India is the third largest producer of coal in the world. Coal is responsible for the emission of 40 percent of greenhouse gases the world over. India plans to produce 4,00,000 megawatt electricity in the next 20 years. This will cause large scale emission of carbon dioxide into atmosphere.

There is an increase of 20 percent in the use of air conditioners among the middle classes of India and China. Chlorofluorocarbon emitted from air conditioners and refrigerants are detrimental to the ozone layer and equally hazardous for the environment. A report states that 1500 kilogram of carbon dioxide is emitted by every air conditioner used in America. Many household articles like grinders, fans and air conditioners consume large amounts of electricity.

These are the adverse effects of toxic carbon in human beings:

<table>
<thead>
<tr>
<th>Carbon concentration (ppm)</th>
<th>Health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>vision impairment</td>
</tr>
<tr>
<td>100</td>
<td>headache, fatigue, dizziness</td>
</tr>
<tr>
<td>250</td>
<td>memory loss, psychological problems</td>
</tr>
<tr>
<td>300</td>
<td>anxiety</td>
</tr>
<tr>
<td>500</td>
<td>vomiting</td>
</tr>
<tr>
<td>750</td>
<td>death within hours</td>
</tr>
<tr>
<td>1000</td>
<td>sudden death</td>
</tr>
</tbody>
</table>

The impact of global warming is directed at the poorest section of the people. The grass root level people including hill tribes, people living in coastal areas, agricultural labourers and the like will receive its worst impacts. Every human being emits carbon dioxide intentionally or unintentionally while using electronic equipments, while cooking or while using vehicles. Hence every individual becomes responsible for global warming.

The main problems of the present age are environmental pollution, population explosion, extensive urbanisation, technological development, the profit motivated capitalist society and the lack of education suited to the modern era. Natural resources of the earth are depreciating day by day due to modernisation and development-oriented projects taken up over the years. The earth will face disastrous consequence if the carbon dioxide concentration level in the atmosphere is not decreased to 350 ppm from the present level of 400 ppm.

### Recommendations

A professor of Michigan State University has said that 55,000 tonne carbon dioxide can be decreased
from the atmosphere every year if every house has smoke free fire places.

Professors of Los Angeles University, California have discovered that a liquid gas called Isobutane which has negligible ozone depletion and very low global warming potential can be produced by making a few changes in the genetic properties of Cyanobacteria (photosynthetic bacteria). This can be a good alternative for the liquid gas fuel being used at present.

In order to decrease the atmospheric heat level, it is enough if every man grows three bamboo trees each in his lifetime. Each bamboo tree absorbs 500 kilograms of carbon dioxide every year.

We should also decrease the usage of vehicles to a considerable level. If we want to go to the nearby shop, we can always walk or use a bicycle instead of going by motor vehicles. Petrol can be replaced with biodiesel. We should decrease the concentration of hydro carbon in the atmosphere by decreasing the usage of two wheelers and four wheelers.

Clean air and sunlight will enter the house if we keep the doors open. In this way, usage of electricity in the form of fans and lights can be decreased. Usage of air conditioners should be avoided as far as possible. Economic usage of electricity is always advisable. Decorative lights and other such wastage of power should be avoided. We should make use of recyclable products as far as possible.

We should practice saving electricity by switching the unused fans and lights off. Replacing the age old bulbs and tubes with CFL lamps also will help saving electricity to a large extent. We could limit the production of electricity if power can be conserved by minimum usage. Recycling of electronic goods means only that the metal parts of these items will be removed and recycled. Other than disposing the electronic equipments with minimum faults, we can protect nature by repairing them and using them for a longer period.

Gardening in the houses and planting trees in the compound will nurture the environment. Other than thermal and nuclear power, we should use more energy produced from hydro and wind power units as well as ensuring apt tapping of solar energy.

A love for nature should be instilled in the young minds from school level itself by teaching them lessons on nature and nature conservation. College students should study more on conserving nature and should engage in activities related to it.

Of the nine planets in our solar system, only earth has a favourable climate for nurturing life. This indeed is a blessing of Mother Nature. The atmosphere which provides life breath to the innumerable number of living species on the face of the earth often balances between weather conditions like heavy rains and storms. However, it seems to have lost this equilibrium of late, mainly due to the destructive actions of mankind. It is incumbent upon us to reverse this.

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*Translated from Tamil by S.M. Arun
Tumkur sinks deeper into a water crisis

DEVELOPMENT

Tumkur, the second-largest district in Karnataka, is facing a severe water crisis. The district's water tables have hit all-time lows, posing a major challenge to the district's water needs.

Many organizations are working on water conservation projects in the district, but the situation remains grave. The district administration is taking steps to address the crisis, including the construction of new water reservoirs.

Water conservation has become a priority in the area, with residents urged to conserve water and use it efficiently.

The situation is expected to worsen in the coming months as the monsoon season approaches, highlighting the need for effective water management strategies.