Global Environmental Change and Human Security
The Need for a New Vision for Science Policy and Leadership
(Climate Change as an opportunity)

National Council for Climate Change,
Sustainable Development and Public Leadership

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Presented by
Dr. Kirit Shelat – I.A.S. (Retd.)
Executive Chairman - National Council for Climate Change,
Sustainable Development & Public Leadership
Email ID: drkiritshelat@gmail.com

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SUSTAINABLE DEVELOPMENT AND AGRICULTURE

- . Sustainable development is a pattern of natural resource use that aims to meet human needs while protecting the environment simultaneously. This ensures that the need for resources can be met not only in the present, but also in the indefinite future.

- The word “Sustainable development” has well-known implications. It is a long-term activity. It involves the use of natural resources. It implies economic growth with socio and economic content.

- It means to provide enough of what one needs in order to live or exist and implies its gradual growth in size, quantity and quality without diminution.

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SUSTAINABLE DEVELOPMENT

- Common definition: Pattern of natural resource use to meet human needs while preserving the environment so that these needs can be met not only in the present, but also in the indefinite future.
- Context of developing nations: Specific meaning with well known implications.
- It is a long term activity; with significant socio - economic relevance; involves use of natural resources and implies economic growth.
- Provide enough for one's needs to live / exist.

Continued.....

- Continue to have the essential resource without becoming less.
- Includes gradual growth in income for a better quality of life to all with focus on families below poverty line and remote areas.
- It provides safety- net in time of unforeseen climatic change with adverse impact by way of re-capturing losses and providing employment.

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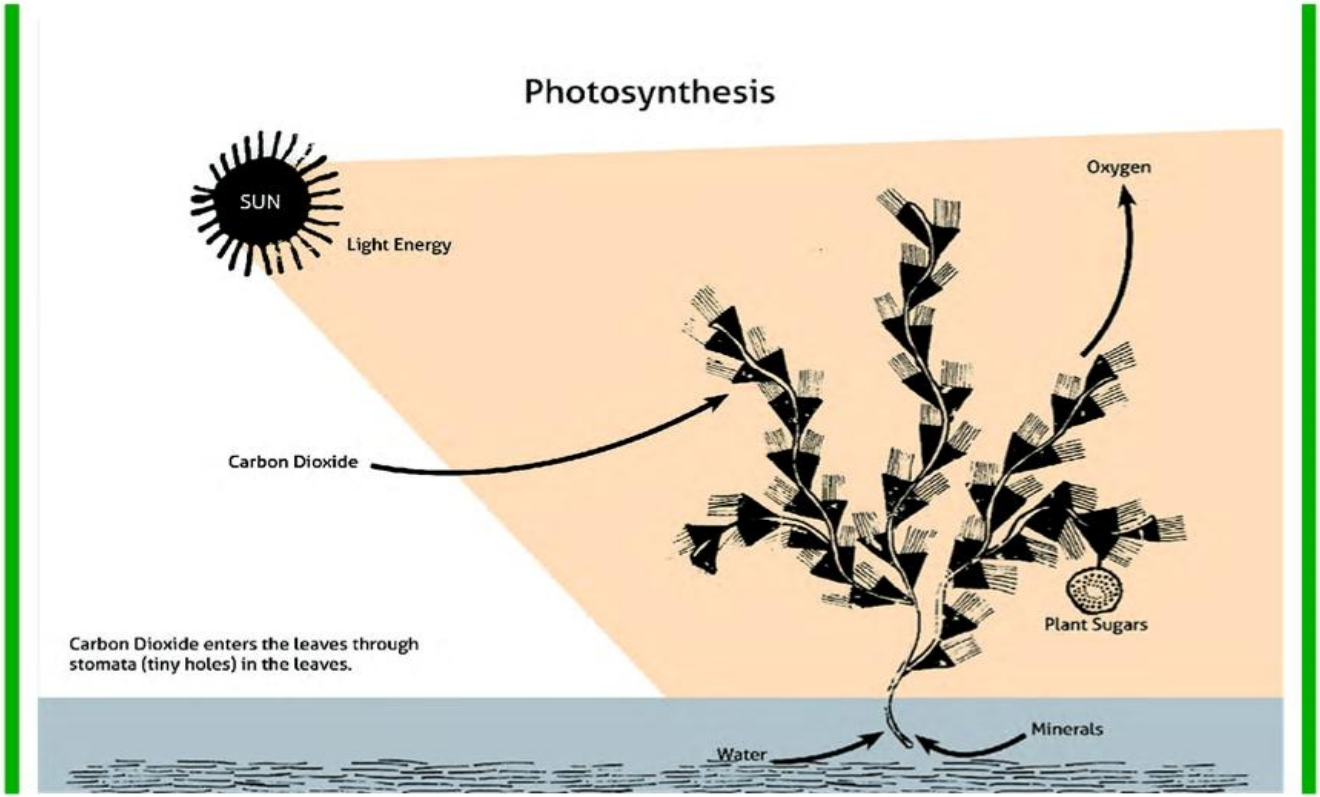
Photosynthesis



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SUSTAINABLE DEVELOPMENT: NATURE'S FORCES

- The sustainable development is centered on nature's principles. Nature has five important forces - Sky (atmosphere), Sun, Earth, Water and Vegetation. These forces are inter-dependent and maintain equilibrium in nature. They are also responsible for different seasons round the year - including weather cycles and climate.
- Appropriate use of these forces of nature to generate basic resources for livelihood is important, which in turn helps sustain the habitat and promote sustainable development.
- Improper use and reckless exploitation of these resources disturbs the balance of nature and affects sustainable development. For example, overdrawing of underground water leads to salinity ingress and advancement of desert while excessive use of fossil fuel leads to excess of gases in the atmosphere disturb heat balances. Inequitable use of resources leads to social turmoil and political instability.

HOW NATURE OPERATES ITS SYSTEM

- It is well known that the water vapor mobilized by sun's heat generate clouds. They are moved by winds in the sky and influence rain on earth - land. Due to moisture in land, the seeds germinate into plants, which in turn grow through the process of Photosynthesis.
- Photosynthesis is a process by which green plants use sunlight to make their food. They use sunlight along with carbon dioxide and water to create simple sugar or glucose. Plants absorb CO2 from the atmosphere and release oxygen.
- Plants produce millions of new glucose molecules per second. They use these to build leaves, flowers and fruits and seeds to convert glucose into cellulose - the structural material in their cell walls. Most plants produce more glucose than they can use. Hence, they store it in the form of starch and other carbohydrates in roots, stem and leaves. Nutrients are also transferred by plants into the soil, which increases its fertility. This is a part of the process of carbon assimilation by plants.

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HOW NATURE OPERATES ITS SYSTEM

- Humans and other animals too depend on glucose as an energy sources, but they are not capable of producing it on their own. They are dependent on plants for glucose.

- Thus, virtually all life on earth, directly or indirectly, depends on photosynthesis - the process of interaction between the five forces of nature.

- Whenever nature's balance or equilibrium of its forces is disturbed, the weather cycle is adversely affected, resulting in climate change. The normal cycle of atmosphere is affected and this includes changes in weather, un-timely or excess or no rain, sea level changes etc. This increases the vulnerability of our systems including agriculture to impacts of other natural calamities like earthquake or Tsunami so on so forth. In present times, this is called 'Global Warming' due to 'Greenhouse Effect'. Climate change often enhances natural calamities and has a direct impact on sustainable development.

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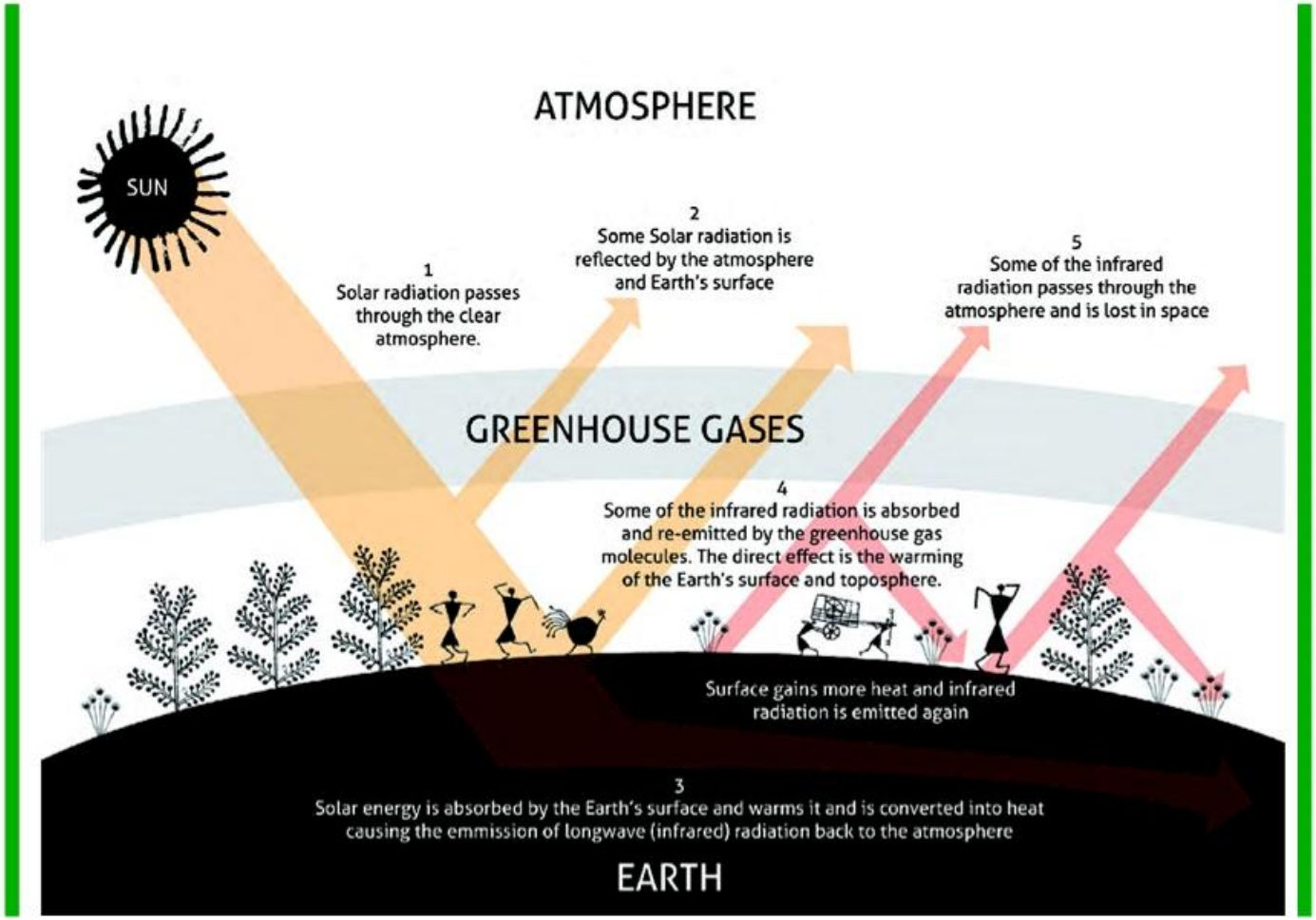
ATMOSPHERE



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IMPACT OF GLOBAL WARMING

THE GREEN HOUSE EFFECT - The discrimination against agriculture

The interface of global warming, climate change & agriculture:

- We are familiar with the fact that our earth is heated by sunlight. Most of the sun's energy passes through the atmosphere, to warm the earth's surface, oceans and atmosphere. However, in order to keep the atmosphere's energy budget in balance, the warmed earth also emits heat energy back to space as infrared radiation. A natural system known as the "greenhouse effect" regulates temperature on Earth. Just as glass in a greenhouse keeps heat in, our atmosphere traps the sun's heat near earth's surface, primarily through heat-trapping properties of certain "greenhouse gases".

- Over the past thousands of years the amount of greenhouse gases in our atmosphere has been relatively stable. A few centuries ago, their concentrations began to increase due to the growing demand for energy caused by industrialization and rising populations, and due to changing land use and human settlement patterns.

- The greenhouse effect refers to the change in the steady state temperature by the presence of gases that absorbs and emits infrared radiation. The greenhouse gases trap heat within the troposphere. The gases are water vapor, carbon dioxide, ozone, methane, nitrous oxide and chlorofluorocarbons

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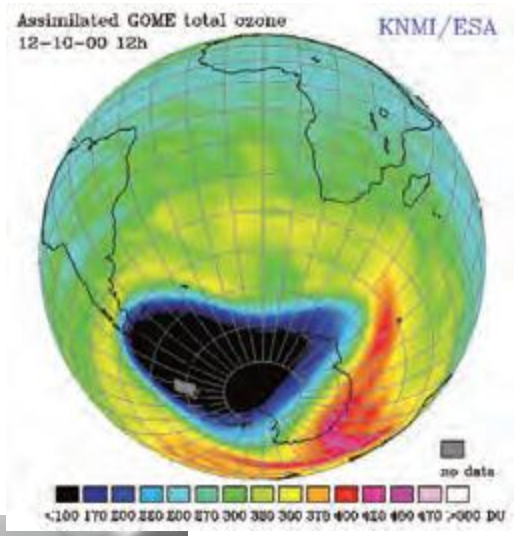
IMPACT OF GLOBAL WARMING

- Nitrogen, oxygen and argon make up 98 percent of the Earth's atmosphere. But they do not absorb significant amounts of infrared radiation and thus do not contribute to the greenhouse effect.

- Carbon dioxide (CO_2) constitutes about 72% of total GHG and contributes the bulk of radioactive forcing. Increase of burning of fossil fuel like coal, oil, gas, wood etc caused by industrial activities and deforestation have increased its concentration in the atmosphere. The concentration of carbon dioxide (CO_2) in the atmosphere has increased from 285 ppm at the end of the nineteenth century before the industrial revolution, to about 385 ppm in the new millennium.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IMPACT OF GLOBAL WARMING

- Methane is produced when vegetation is burned, digested or decayed with no oxygen present. Garbage dumps, rice paddies, and grazing cows and other livestock release methane. It is about 18% of total GHG.
- Nitrous oxide is released when chemical fertilizers and manure are used in agriculture. It is about 9% of total GHG.
- Other gas is SF-6.
- Most interesting part of these major emitters is CFC12 ¸ 1 unit = 7000 CO2), SF6 (1 SF = 23900 CO2) are largely from industrialized nationals.
- One of the most important issues relating agriculture to climate change impacts and greenhouse gas releases is the apparently iniquitous treatment meted out to it in international deliberations. While there is no debate that industrial establishments are responsible in a major way for the net high levels of emissions, it is important to recognize that agriculture absorbs CO2 and releases oxygen through photosynthesis. It is also true that some fertilizer - centered releases of CO2 occur due to related agriculture practices. Nevertheless while calculating the overall scenario it is essential to examine and highlight the CO2 absorbed in soil, stem, leaves and grains or fruit for appropriate apportionment.

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IMPACT OF GLOBAL WARMING

Our present understanding is that it is not adequately represented and there are significant gaps in our understanding of related dynamics in different systems of production across the globe. Agriculture, therefore, tends to be targeted through a biased perspective and in simple terms also inappropriately blamed. Importantly a significant part of international and national policies provide market based opportunities / incentives to large scale polluters instead of strictly regulating them and overlook the need to support agriculture with suitable incentives. Going further, it is important to also ask if the net impact of agriculture can be positive considering the links it has with sustainable livelihood especially in the developing countries. It even appears less prudent to place industry and agriculture on similar emission terms, considering the apparent anomaly. If agriculture is given due weightage for its capacity to absorb CO2 from atmosphere and considered as a prime tool for integrated mitigation and adaptation, the entire international policy and dialogue could be on a different platform.

THE IMPACT

- Unpredictable Climate is a threat to sustainable development: Every single day, there is breaking news about natural calamities hitting some region in the world. This unpredictable climate is creating havoc around the world, destroying habitats and disturbing people's livelihood. Some of the recent natural disasters related to this phenomena in India are narrate below. It must be noted that our country is not new to drought, cyclones etc., but its frequency and intensity have increased abnormally in the new millennium. India like other countries in the world had its share of natural disasters.

Gujarat Earthquake, 2001

The Kutch earthquake that shook Gujarat was one of the deadliest earthquakes to strike India.
The region continues to simmer and has experienced several mild earthquakes and tremors since 2001.

Trail of Destruction

- The death toll : 19,727
- Injured : 166,000
- Homeless : 6 lakhs
- Houses destroyed : 3,48,000
- Cattle killed : 20,000
- Estimated losses at : 1.3 billion

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THE IMPACT

Tsunami December 2004 - affected the Andaman & Nicobar, Pondicherry, Kerala and Andhra Pradesh causing loss of Agri crops, cattle wealth, housing and livelihood.

Mumbai Floods - 26th July 2005 -city was paralyzed and floods in Maharashtra

Surat Floods (2006) - Estimated loss of Rs.22,000 crore. City's infrastructure affected, high individual losses and crops like sugarcane (Rs. 4,000 crore)

Heavy rains in 2007 in Rajasthan with flooding and consequent breakout of diseases, loss of crops and cattle wealth.

Bihar - 2008 - Koshi river overflow with dam in Nepal giving way and large areas of Bihar - UP got affected.

Droughts 2009: Delayed monsoon caused drought in some states.

2010 : Heavy floods in Northern India & Un-seasonal showers and snow falling in some parts of India like Gujarat in 2010, the most important is that weather has become totally unpredictable

Some consider impact on climate change is only related to increase in temperature -but as mentioned, it is due to disturbance of equilibrium of nature's forces, that tsunami or earthquakes have increased or sea-water level is increasing hence this impact have to be understood in two ways - first is the actual increase in natural disasters as mentioned above. Second is the concurrent impact due to change in weather as low or heavy or no rain or impact of increased temperature on productivity of crops, animal or fish catch. For the first case we have Disaster Management post disaster -for the second we need to take preventive steps and it can certainly be managed by timely action, convergence of efforts and with involvement of local level leadership. By leadership, we do mean only political or elected leaders. It includes all members of Public governance System - at the village level Sarpanch, Chairman of Cooperative or Self Help Group, village level worker, teacher similarly at taluka & district level. It also includes non-Government organizations involved Voluntary assistance, Entrepreneurs even Judges.

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Effect of Climate Change

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Effect of Climate Change

ADAPTING TO A WARMER,WILDER WORLD

The worldwide impact is equally grave.

- In the U.S. alone, nearly 1,000 tornadoes have killed many people and inflicted $9 billion in damage.
- The 2010 heat wave in Russia killed hundred of people and led to a 40% fall in the harvest of food grains.
- Floods in Australia and Pakistan killed thousands of people and devastated agricultural lands.
- Re-current droughts in China have eroded millions of acres of farmland.
- Tsunami in Japan - Nuclear plant affected & played havoc to the local habitat
- Recurrent and continuous famines in Ethiopia - Somalia and riots for Food by hungry millions.
- Recurrent floods in South East Asia, Philippines, Indonesia, Thailand.
- Almost all nations small or big are affected, one way or another
- This is continuously happening with increasing intensity.

CLIMATE CHANGE ENHANCE IMPACTS OF NATURAL DISASTERS

Such Disasters creates:

- Severe famine or heavy floods
- Loss of life
- Loss of Agriculture crops and animals
- Loss of livelihood
- Increased risk of diseases outbreak
- Damage to infrastructure and communication particularly in rural areas.
- Setback to social and economic development and emergence of social turmoil with increased rural urban divide.
- Pushing farmers in rural areas again back below poverty line.
- Impact in productivity of various crops, thereby creating a challenge to food security. Recent research carried out at the Anand Agricultural University provides clues on the deficits that may arise.

Anand Agricultural University – Research on impact:

Sensitivity of CERES-Peanut (Groundnut) model to ambient temperature under optimal condition (cv. JL-24)

Change in mean ambient temperature (°C)	Simulated grain yield ($kgha^{-1}$)	% Change from base ($2200\ kgha^{-1}$) yield
1	2152	2.1
2	1888	14.2
3	1514	31.2

The area under groundnut crop in Gujarat is 19 lac ha.
Therefore, due to increase in temperature by 3°C, reduction in groundnut yield would be around 31.2% i. e. 13.2 lac ton per year.

Source: Dr. A.M. Shekh, V.C. Anand Agricultural University, Gujarat

Anand Agricultural University – Research on impact:

Sensitivity of CERES-wheat model to ambient temperature under optimal condition (cv. GW-496)

Change in mean ambient temperature (°C)	Simulated grain yield ($kgha^{-1}$)	% Change from base ($5825\ kgha^{-1}$) yield
1	4078	- 30
2	3675	- 37
3	3266	- 44

The area under wheat crop in Gujarat is 4.89 lac ha.
Therefore, due to increase in temperature by 3°C, reduction in wheat yield would be around 44% i. e. 12.5 lac ton per year.

Source: Dr. A.M. Shekh, V.C. Anand Agricultural University, Gujarat

HOPE TO MAINSTREAM AGRICULTURE IN INTERANTIONAL NEGOTIATIONS

International community has taken up global warming seriously. United Nations initiated series of meeting of all the countries to come for certain common policies to adopt by all nations. This is known as "United Nations Conference of Parties (COP).

- The Montreal Protocol (1987) was considered to be landmark in International Agreement designed to protect stratospheric Ozone Layer.
- In Kyoto (Japan) had COP in December 1997 which formally adopted binding targets for GHG emissions reduction by member countries under what is known "Kyoto Protocol".
- Thereafter this was been followed up every year like in Nairobi, Bali, Pozhan, Copenhagen, Cancun in last December COP 17 in Durban.
- There are formal discussions with representatives of National Governments. Simultaneously interested parties also hold dialogue with civil society members.

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Hope to mainstream agriculture in International negotiations

- At Durban in 2011 world leaders agreed on some provisions for adaptation, a green climate fund, and a deadline for governments to adopt a legal agreement on climate change by 2015. Some of these may eventually help poor farmers deal with climate change that threatens food security among the most vulnerable.

- COP's Ad Hoc Working Group on Long-term Cooperative Action (LCA) concluded that a decision on agriculture will be made at COP18 which takes place November 2012 in Qatar.

- Agriculture is an important part of the Reduction of emission from de-forestation and degradation of forest (REDD+) discussions in the UNFCCC negotiations because emissions reductions cannot be done without addressing agricultural productivity. However, agriculture could get sidelined should the negotiations in Qatar fail.

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Hope to mainstream agriculture in International negotiations

- This slows progress on agriculture in the negotiations reinforces the need for action on the ground. It's important to strengthen the confidence and capacity of nationally and community-led efforts to address food security, development, natural resource management and climate change together, as interlinked issues. We need the creativity, leadership, resources, expertise and solidarity to find solutions to the common challenge of food security and livelihood of millions of hungry families across the world in the context of climate change. As someone predicted that unless Carbon cuts are made effective, there will be collapsing iceburgs, melting frost, displaced ocean currents with disappearing coastlines, sizzling atmosphere and, ofcourse, recurrent and devastating tornedos, heavy rain, drought and temperature variations - all these which can not be predicted easily.

AGRICULTURE VEGETATION HAS THE SUCCESFUL TECHNOLOGY TO ABSORB CO2

The only known technology, which can absorb CO_2 is "agriculture" through photosynthesis process. While no data are available about reduction in vegetative cover and related reduction in absorption of Carbon dioxide and release of Oxygen, the agriculture -vegetative cover - both as agriculture land and forest areas are reducing rapidly due to increasing.

- Urbanization,
- Industrialization & infrastructure and mining.
- Fallow agriculture land due to farmers' migration to urban centers for better and assured income.
- Soil salinity and soil erosion along with un-timely or reduced rainfall or floods resulting in crop failures.
- Large scale purchase of agricultural lands by land developers - attracted by phenomenal increase in land prices.

AGRICULTURE VEGETATION HAS THE SUCCESFUL TECHNOLOGY TO ABSORB CO2

This is also the main reason for decline in production of food crops; posing a challenge to food security in many parts of the world. Some related reasons for Global Warming and disturbance to nature's balance of forces include

- Increasing global population,
- Increase in the proportion of middle income people of developing world, who have increased demand, for equipment using energy and consequently release greenhouse gases
- Increase in transport vehicles and transportation due to better infrastructure and increase in industrialization, mining and urbanization.

The factors which increase Global Warming will continue to grow with a multiplier effect in the future. In many countries of the world like India, energy needs in rural area and poor families are yet to be met with. This requires further setting up of power plants and rural industrialization to add wealth in rural areas and people residing there.

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THE WIN-WIN SITUATION

One solid way to meet all these challenge is to promote and mainstream agriculture – the vegetation cover

- This has been lost sight off in development and efforts are focused elsewhere - but not looking back at nature that provides solutions.
- Says Shri. Kantisen Shroff "the Veteran NGO", In our sunlit tropical areas all our natural resources are through the process of photosynthesis which is natural process of each and every plant cum grass. That means the CO_2 from the atmosphere forms the basis of all resources absorbed through this process and we get back oxygen which is released as its consequence. We have measured these conversions and seen the positive changes in the environment at local level". The case studies of this vision are in the following pages.

The interesting aspects of carbon assimilation by plants are:

- The atmospheric CO2 stimulates the process of photosynthesis and consequently plant growth, as extensive experimental research has shown (IPCC, 2000)*
- The extent of this stimulation varies for forest (up to 60 percent), for pastures, and crops (about 14 percent).

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THE WIN-WIN SITUATION

- There are three basic types of photosynthesis: C3, C4, and CAM. Each type has its own advantages and disadvantages. Approximately, 35 % of the terrestrial plants are C3 species, while 1 % are C4 and 4% use CAM pathway of photosynthesis. (Bowes, 1993).

(Bowes G. 1993: Facing the Inevitable: plants and Increasing Atmospheric CO2. Annula Reviews of Plant Physiology and Plant Molecular Biology, 44:309-332)

(IPCC 2000: Land use, land use change and forestry. A special report ofV the IPCC Cambridge, UK, Cambridge University Press:)

- According to one estimate, a single row of trees with or without shrubs can reduce particulate matter by 25% and each hectare (2.471 acres), of plantation can produce enough oxygen for about 45 persons.

- The foliage of a single mature beech tree(Fagus sylvatica), for example, can extract more than 2.5kg of CO2 from the atmosphere, and produce 1.7kg (3.7lb) of oxygen in one hour, which in theory is enough for the needs of ten people in a year

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CARBON SEQUESTRATION

- Action taken to sequester Carbon in biomass and soils increase the organic matter content of soils.
- This has a positive impact on environment and biodiversity.
- The increase in soil carbon storage increases the soil fertility, land productivity and prevents soil degradation.

Therefore, this constitutes a win - win situation, but we need to notice it and make it happen. In fact we have gone through such adversities due to change in climate or otherwise over last centuries and in many places, we have overcome such difficult situation by persistent efforts by balancing management and use of soil, water and vegetation in sun-lit areas of our own country India. Let us look at some experiences:

KUTCH STORY

- In the 19th century, a devastating earthquake struck Kutch on June 1`6, 1819. Before the earthquake, Sindhu River flowed in the region. Kutch was a green land which produced paddy. Agriculture and livestock flourished.
- After the earthquake, the Sindhu River changed its course and disappeared from Kutch. The earthquake caused a nine-meter vertical displacement, which came to be known as the Allah Bund. Sea water made huge ingress into the land through this displacement, converting the entire area into a huge saline desert which came to be known as the little and great Rann of Kutch. The vegetation cover was slowly lost with high occurrence of famines.
- Crops failed, drinking and irrigation water became scarce, health and sanitation was affected. Survival became difficult in this arid land. Farmers left agriculture and land soon became fallow. This resulted in large-scale human and cattle migration over the years, a trend which continued in the last century. In fact happened here is what we visualize this will happen in many parts of the world due to climate change. But the situation was changed in Kutch with persistent efforts by the people who were determined to make the desert green again.

THE SHROFF INITIATIVES

- Shri Kantisen Shroff came to his motherland Kutch in the early seventies from Mumbai. He was the Chairman of the agrochemical firm Excel Industries Ltd in Mumbai. He has been now staying at Bhujodi - Kutch since last two decades with his wife Chandaben. They are popularly known as Pujya Kaka and Pujya Kaki.
- The Shroff's were the first to work for rural development in Kutch as a voluntary group. When Shroff started visiting Kutch, the region was facing recurrent droughts that led to scarcity of water and huge cattle and human migration. The government was running a few relief projects to provide livelihood and create community assets such as ponds, roads etc. The villagers remained occupied in such projects whenever monsoon failed - from September till the beginning of monsoon next year. The most severe droughts occurred between 1968-70 and 1973-75. This was when Shroff thought of a solution to the problem on a long term basis.

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The shroff's initiatives

- Shroff set up a number of voluntary organizations to involve people in sustainable development projects. These included the Vivekananda Research Training Institute (VRTI) at Mandvi in Kutch, Shrujan - Bhujodi-Bhuj and Shroff Foundation Trust in Vadodara.
- Shrujan was developed by Chandaben for promoting assured livelihood and self-respect amount rural women of Kutch, who were highly skilled in traditional embroidery work.
- Pujya Kaka developed a participative approach which involved people as well as government agencies. This, in turn, created a local committee of participants who implemented the programmes. All these were done with convergences of efforts and active involvement of Government agencies and by taking up development programmes initiated under different government schemes.
- A clinical approach was taken, which involved the diagnosis of a problem, a prescription for its solution and its implementation. The programmes were planned taking into consideration the local requirement and involved the use of modern technology. Some of the success story replicating above of Mundra, Lakhpat and Mandvi block of Kutch district are as follows.

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THE STORY OF KUTCHH

- In 19th century, a sever earthquake struck in Kutchh.
- Before earthquake, Sindhu River was flowing on. It was a green land. It used to produce paddy.
- After earthquake the Sindhu River disappeared by changing its course. Seawater made huge ingress on land and the entire area became saline – the vegetation cover was lost – there were frequent famines.
- This made life difficult for survival and for livelihood. Life had become difficult – livelihood was not assured, Agriculture – the crops were failing, drinking water was scare, health and sanitation were affected so and so forth.
- This resulted into large-scale human and cattle migration over years even up to 20th century.
- But the situation changed with determined and will thought out and persistent human efforts. Let us have some examples.

CASE STUDY – 1

WATERSHED APPROACH –VRTI-MANDVI

- **37 projects in 34 villages of 3 blocks, covering 20300 ha.**
- **Implemented as ridge to valley concept with cluster & participatory approach.**
- **Case study of Hamla and Manjal villages of Mandvi block**
- **Area covered 1000 ha.**
- **120 families**

CASE STUDY – 1

WATERSHED APPROACH –VRTI-MANDVI

Activity carried out

- Trainings and awareness generation
- 4 Storage tank
- 31 Farm pond
- 26 Nalaplug
- 17751 Staggered trenches
- 64 Pakka waste wear
- 113 loose boulders
- 68 Contur bounding
- 8 acre plantation

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WATERSHED APPROACH –VRTI-MANDVI

Impact

- Increase cultivated area - 100 acre
- Increase irrigated area - 250 acre
- Waste land developed
- Women empowerment and sustainable economic activity started.
- Easy availability of drinking water for human being and cattle
- Biannual and Triannual cropping started.
- Farmers adopted scientific agriculture practices
- Capacity building

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CASE STUDY - IV
STORY OF LAKHPAT

Watershed Approach:

- 2000 acre, two villages of Lakhpat Taluka.
- Chuger village farmers have first time sown crop in their field. It created income of more than 3 to 4 lacs.
- Created employment of 15,970 Man-Days.
- Soil erosion reduced. It improved productivity.
- Shri Khengarji started taking two crops from stored water and realized income of Rs. 3 lacs.
- Water table and quality of water improved in the wells of surrounding area.
- Animals from surrounding five villages got water for drinking
- Treated area taken up for plantation under joint forest management

AGRO FORESTRY

- Treated Area: 500 Acres
- Cost –Rs.27,000,00
- Storage and recharge of Water-30 Cr Lts
- Lush Green Grass Area- 250 Acres

No. of plants-

1 to 2 Meter Canopy- 3500

Less than 1 Meter Canopy- 9500

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VEGETATION DETAILS

Plants	2005	2006	2007
Khijado	25	70	267
Kher	440	2305	3347
Pilu	110	710	1810
Vingo	10	220	269
Kerad	67	110	467
Boradi	2170	2760	4275
Kundher	20	510	567
Luva	200	320	355
Gugar	110	450	630
Gangni	370	560	690
Liyar	20	425	467
TOTAL	3542	8450	13144

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Socio-economic- ecological impact

- Food security
- Nutritional security
- Financial security
- Fodder and timber available in their vicinity
- Availability of drinking water in their vicinity
- Reduction of pressure on forest
- Reduction in drop out in school
- Higher education in girl child
- Healthier life
- Stable/ pucca house
- Drastically change in number and days of migration
- Empowered and confident community

Results of proven capability of Sadguru Foundation and above all, total involvement and participation of community

Real empowerment of people, particularly of women groups, has been achieved through constant training and capacity building as well as managing successfully their programmes

Case Study 6: COMMUNITY BIOGAS PROJECT – CHHOTA UDEPUR

- Individual biogas scheme failed due to low cattle holding with individual farmer
- Community biogas plan set up after interaction with village community. State Government provided financial assistance.
- Production of 3 Ton of slurry per day and network of gas pipeline for village household.
- Animal holder paid price for cow dung per kg.
- Per month Rs.200/- for gas connection - 70 householders.
- Vermicompost bed set up and slurry used for it
- Liquid slurry not marketable but once converted into vermicompost, it can be transported to urban centers in bags after meeting local demand. Thus it becomes marketable product, which is the key to success of the project.
- The gobar and Agri waste emanates mythen gases which affect environment but converted in Biogas has different value addition to environment and is a solution to problem

CASE STUDY – VIII

Climate Resistant & Sustainable Agriculture - Rajasthan & Andhra Pradesh

Prof. M S Swaminathan, the veteran scientist has set up Swaminathan Research Foundation which is working on climate resilient agriculture in many parts of our country. Dr. R R Nambi Director of the Institute describes its approach as under for its projects in Rajasthan and Andhra Pradesh.

Catalytic Interventions

Design of Cropping system based on appropriate Promotion of locally suitable best practices

Learning Hypothesis – Land Use: Updated village level land use maps and a basket of option sets for different rainfall scenarios (drought, normal, excessive) can provide information for appropriate agronomic practices that can stabilize yields from rain fed farming thereby providing greater food and/or economic security

Activity	Output	Outcome
Best practice – System Rice Intensification (SRI)	• 30% Reduction in water usage as compared to conventional method • 20% Increased productivity	• 52 Rice farmers (60 acres) adopted SRI against 150 rice growers
	Output indicator	**Outcome Indicator**
	• Quantity of water used for crop duration • No. of productive tillers / hill, no. of grains / panicle and test weight.	No. of acres and farmers under SRI

Benchmark	Conventional submergence rice was practiced

Learning Hypothesis – Water: Community's access to weather monitoring and prediction data combined with community managed water resource systems can lead to greater water use efficiency and improve adaptive capacities

Activity

Lining of Harren, awareness & capacity building

Output

Year - 2007
- 780m lined channel (Harren) constructed
- 24 acre area brought under irrigation
- 41 farmers irrigated wheat crop, 6 times/crop

Output indicator

- Length of water channel lined
- Area brought under irrigation and No of irrigation provided

Outcome

- Group of farmers evolved norms for efficient water use

Outcome Indicator

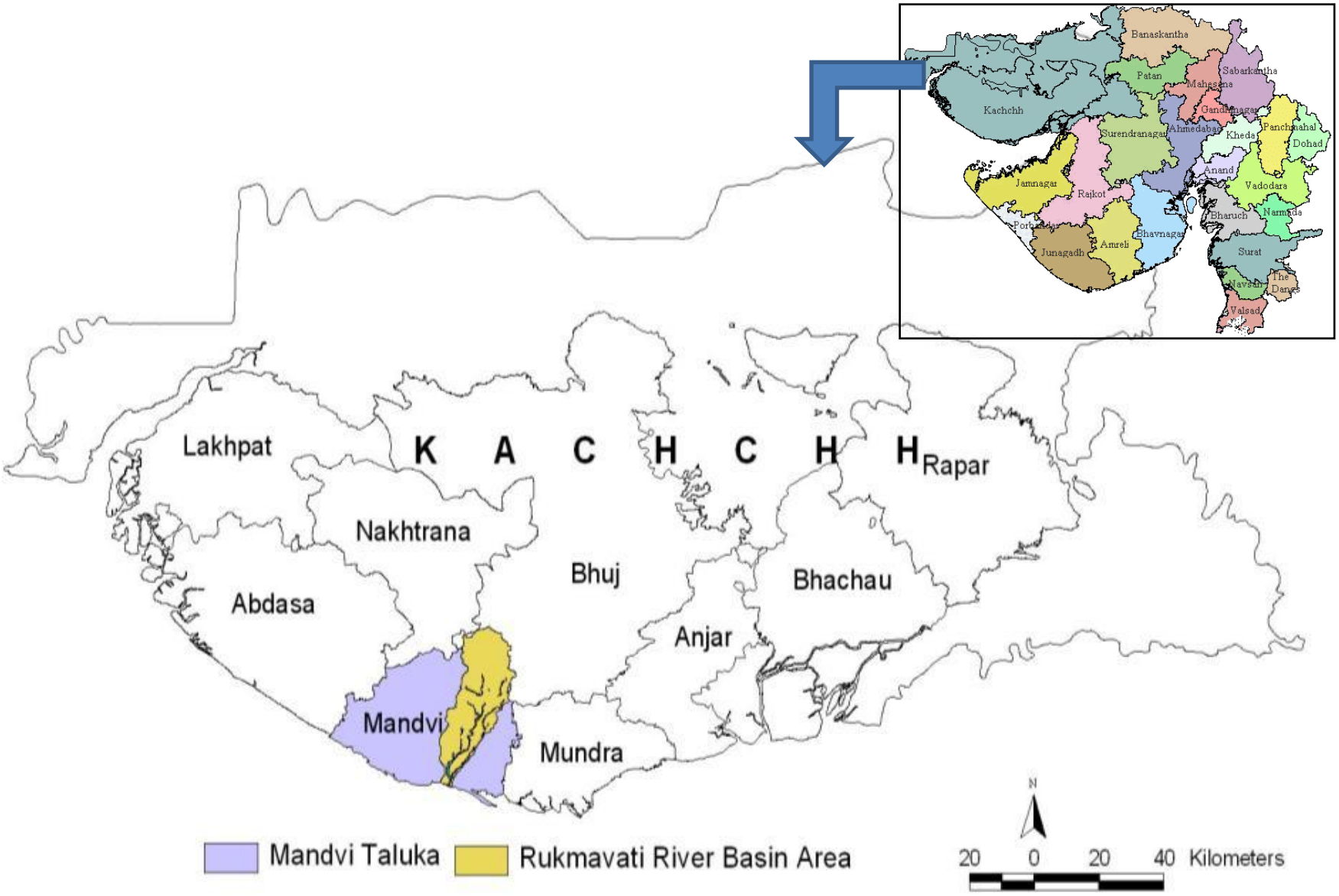
- Ability to manage the irrigation channel by functional group
- Increase in water productivity
- Time saved for irrigation

Benchmark

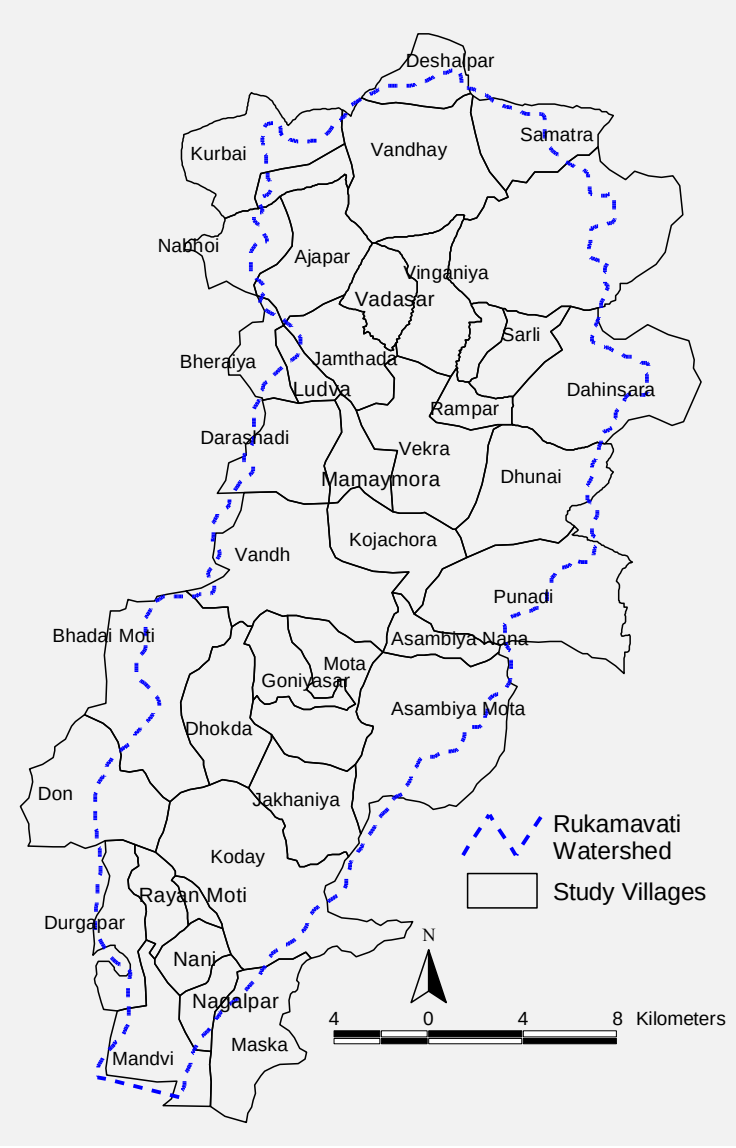
During 2006, 0 m lining, 39 farmers irrigated wheat crop in 20 acre area by using 6 irrigation

Rainfall 2006 – 1158mm
2007 - 566mm
2008 - 672mm

Rukmavati River Basin water conservation approach



BASIN AREA PROFILE



No of Villages	46
Total population	108033
Total Area	59075 Hac.
Total Agricultural Land	33477 Hac.
Irrigates Land	10268 Hac.
Cultivable Wasteland	5649 Hac.
Forest Area	4282 Hac.
Other Land	15671 Hac.

NCCSD
National Council for Climate Change, Sustainable Development and Public Leadership

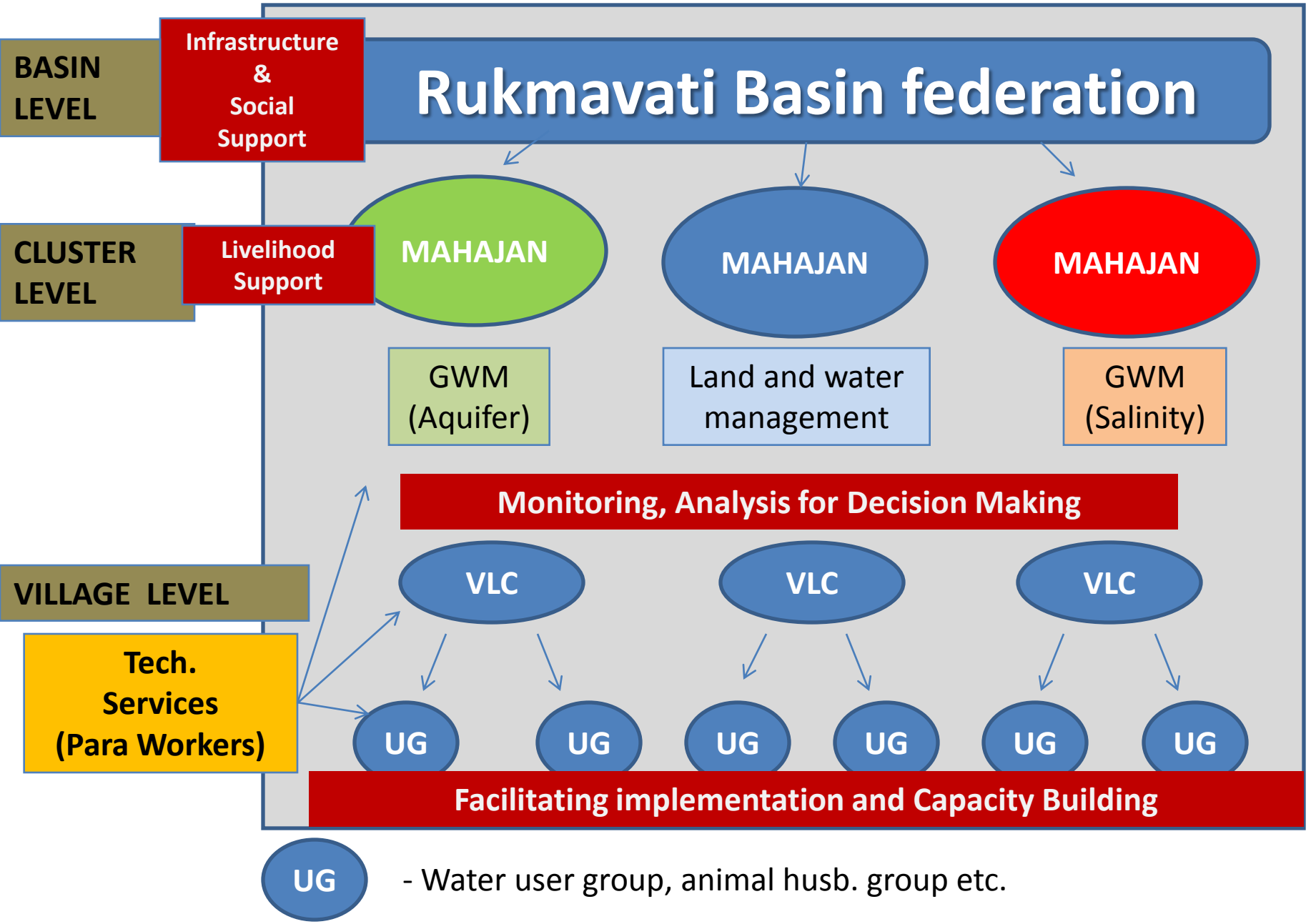
RIVER BASIN MANAGEMENT

One of the Approaches :

The important area which causes concern is depletion of water resources. We have depleting water resources. Hence, major initiatives are necessary to combat this issue.

The Integrated River Basin Management can be one such approach. It is bigger step from existing watershed approach and its process of coordinating conservation, management and development of water, land and related resources and agro industries across sectors within a given river basin."

An integrated approach using the whole River Basin as a basis for holistic & sustainable planning, can provide a good solution to ensure Economic, Social and Environmental sustainability and ensure Food & Water security and generate wealth in rural areas through value addition by local processing of Agri-produce and remove disparity


BASIN LEVEL
Infrastructure & Social Support
Rukmavati Basin federation
CLUSTER LEVEL
Livelihood Support
MAHAJAN
MAHAJAN
MAHAJAN
GWM (Aquifer)
Land and water management
GWM (Salinity)
Monitoring, Analysis for Decision Making
VILLAGE LEVEL
VLC
VLC
VLC
Tech. Services (Para Workers)
UG
UG
UG
UG
UG
UG
Facilitating implementation and Capacity Building
UG
- Water user group, animal husb. group etc.

BASIN MANAGEMENT
Rukmavati River Basin

Aim:

- Create an integrated and sustainable development model on Rukmavati river basin

Objectives:

- Understand potential of various natural resources like water, land, vegetation etc. within the basin.
- Educate the stakeholders about the situation
- Understand issues and challenges of the river basin management
- Institutionalize decentralized and people centered resource management mechanism
- Generate economic well being along with human well being and environmental well being
- Manage micro climate in the basin area

Over flowing check dam in basin area

BASIN MANAGEMENT
Rukmavati River Basin

Approach & Methodology

There are four phases of the entire project: -

- Community Awareness
- Planning
- Implementation
- Management

However there is overlapping of activities of these phases

Major problems

- Due to over exploitation of ground water, Mandvi block is declared as dark zone
- Ground water quality is degraded i.e. TDS - 3000 to 10000 ppm
- Degradation of agricultural land and reduced productivity
- Soil erosion in basin area due to mining activity
- Due to unequal allocation of resources like water and land, difference in socio economic condition

BASIN MANAGEMENT
Rukmavati River Basin

Activities

- Water Harvesting
- Check dam
- Renovation of old structure
- Desilting
- Soil moisture conservation
- Continuous Contour Trench
  Staggered Trench
- Silt Trap
- Farm pond
- Agriculture/ Horticulture
- Farm bunding
- Land leveling
- New Plantation
- Drip irrigation

Contd…

BASIN MANAGEMENT
Rukmavati River Basin

- Forest area development
- Animal Husbandry

- Grass land development
- Cattle feed units
- Milk collection units
- Veterinary services

Training and awareness

- Farmers training
- Women - Self Help Groups (SHG) - Workshop/Seminar
- Exposure visits
- Rural industrialization
- Promoting locally & Marketing
- Promoting young educated farmers to set up micro-enterprise.

BASIN MANAGEMENT
Rukmavati River Basin

Impact

Improvement in Agriculture

- Improvement in crop productivity due to improved water quality.
- About 250 hectares of land benefited and there is about 10-15% increase in crop productivity (cotton)

Achievements

- Implementation Phase:
  - Desilting - In 9 structures, 2.8 MCFT water storage. 200 hectares of land benefited from this fertile soil.
  - Roof Top Rain Water Harvesting Structures – 1
  - Distribution of Kitchen Garden kits - 100
  - Compost preparation using 'Madhyam' - 13
  - Animal vaccination - 1691 animals
  - Formation of SHGs - 21 (301 members)
  - Exposure tour - 6

BASIN MANAGEMENT
Rukmavati River Basin

Forward & Backward linkages for A&H

- CFC - 6 - 273 members
- Average monthly cattle feed sale - 750 bags
- About 5 to 8 % reduction in cattle feed cost
- Linkage with dairy for milk collection
  - Villages - 12
  - Members - 522
  - Milk collection - 4050 lit /day
- Increase in milk price - 20 to 30%

Improvement in water quality

- 54 bore wells were set for monitoring around 18 structures
- Water samples here collected from monitoring wells show the following result

TDS (ppm)	Minimum	Maximum
Pre monsoon	882	9080
Post monsoon	326	4180

- TDS (ppm) value reduced due to ground recharge from

pH	Minimum	Maximum
Pre monsoon	7.14	9.14
Post monsoon	7.06	8.81

- pH value reduced due to ground recharge from 0.11 to 1.21

BASIN MANAGEMENT
Rukmavati River Basin

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