

# **INTEGRATION OF CLIMATE CHANGE ADAPTATION STRATEGY WITH THE WATERSHED BASED SUSTAINABLE RURAL LIVELIHOOD APPROACH**

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## **ABSTRACT**

Climate change is a fundamental challenge to the way we live on this planet. The poor and the rural communities surviving on the climate sensitive activities and resources are first to suffer and are more vulnerable. Watershed management as a means to manage common property resource and to ensure sustainable livelihoods for rural communities is a challenge. Integrating adaptation and mitigation strategies within in the watershed management model shall ensure livelihoods for the rural communities and prepare them for the impact of climate change. Per unit geographical area emissions in a country could be another way of taking responsibility by global citizens in addition to the per capita and unit GDP production emissions. This ensures climate-friendly development pathway for future and involves every stakeholder contribution for climate improvement on planet.

**Key words:** *Climate change – watershed - rural communities - sustainable livelihoods - adaptation and mitigation - per unit geographical area emissions.*

## **About Author**

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## **CLIMATE CHANGE AND WATERSHED PROGRAMMES**

Climate change<sup>1</sup> has intensified greatly during the last century due to anthropogenic reasons. It has emerged as one of the biggest environmental challenges facing the world and changes in climate have significant implications for present lives, for future generations and for ecosystems on which humanity depends. While climate change is a global phenomenon<sup>2</sup>, its impact on countries and communities will be very different, with developing countries likely to be the most adversely affected.

Unfortunately, it is the poor and marginalized people who have not contributed to climate change they are and will be the most affected by climate change. The possible outcomes and impacts of climate change are complex and unpredictable and climate change is widely perceived as a threat rather than as an opportunity. Some communities will be affected very strongly and very negatively within the next two to three decades. While stress resulting from climate variability is evident, rain-fed areas have become even more vulnerable.

Watershed programmes<sup>3</sup> have been implemented since 1990s in rain-fed areas to conserve soil and water, use natural resources productively and improve natural resource-based livelihoods. While it lays emphasis on ecological restoration and on strengthening rural livelihoods, it may not be possible to address climate change concerns in the present framework. Therefore, the watershed development programmes now need to examine climate change and the diverse risks the phenomenon poses to rural communities. Therefore, the integration of climate change concerns in watershed programmes becomes important in order to make rural communities more resilient.

## **WATERSHED APPROACH**

A watershed is a hydrological unit and can be defined as an area from which the run-off drains and flows through a common point in the drainage system. Due to human interventions for agricultural purposes, changed ecology and management practices have had negative effects on the well-equilibrated natural watersheds. There is thus a reduction in water availability, land productivity, and rural livelihoods have become threatened. In view of the above, the watershed approach has graduated from natural resource conservation to productivity enhancement and sustainable rural livelihoods. In a way, the watershed approach not only focuses on improving land, water, vegetation and livestock, but also on the people whose livelihoods depend on these resources. The key components of watershed development thus include:

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<sup>1</sup> Emission of green house gases (carbon dioxide, methane etc) into atmosphere- both natural and man made - reflects more heat back to earth. This results in an increase in temperature, change in precipitation and storm activity, widespread runoff, reduction of first water availability, droughts, changes in pest distributions, rise in sea levels, etc.

<sup>2</sup> The environment does not have national geographical boundaries; therefore, it is imperative for global citizens to take on adaptation and mitigation measures at the local level for survival of humankind on the planet.

<sup>3</sup> Natural resource management on ridge to valley basis is an important aspect of the sustainable rural livelihood strategy.

- Carrying out area treatment (e.g., contour/farm bunds and farm ponds) and drainage-line treatment (e.g., check dams, percolation tanks) measures to conserve soil and moisture and to harvest run-off water, respectively to ensure drought proofing
- Enhancing productivity in agriculture, livestock and forestry sector; and also supplementary income activities.
- Improving livelihoods of poorest of the poor, with emphasis on women, landless and disadvantaged groups.

There is evidence to suggest that watershed interventions have contributed towards improving natural resources, productivity of land, water and livestock, as well as enriching rural livelihoods. The watershed management practices certainly added to existing drought proofing practices and improved rural livelihoods to some extent, especially in the following way:

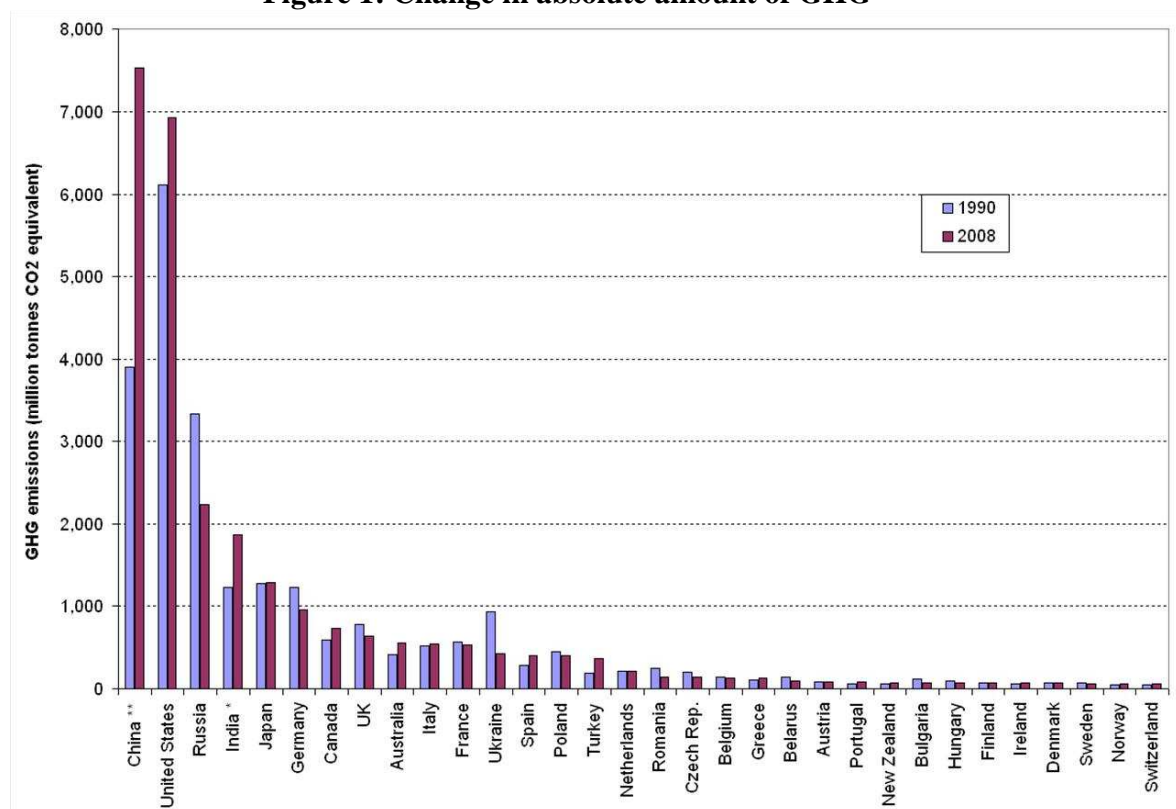
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| 1. Greenery development in homesteads, institutions, farm bunds etc.         | 2. Productive use of wasteland in village                               |
| 3. Improved fodder availability: Fodder trees, Fodder plots, dry fodder etc. | 4. Commercial crop replacing water intensive paddy & sugarcane.         |
| 5. Improved breed of livestock.  | 6. Increasing area under micro-irrigation; and Horticultural plantation |
| 7. Increase in milk production and Milk cooperatives.                        | 8. Organic farming.   |
| 9. Ground water availability improvement                                     | 10. Participatory decision-making approach                              |
| 11. Enhanced credit flow to the village.                                     | 12. Reduction in distress migration.                                    |

Besides improvement in the status of resources and adoption of better management practices, the communities in watershed villages are well organized and in a position to make informed decisions. Watershed interventions have also created enabling conditions for nurturing adaptive capabilities of rural communities to climate variability. There are, however, many gaps in the current watershed approach in so far as dealing with mitigation and adaptation aspects of climate change. And it is an opportune time to include climate change concerns in its agenda. Hence, watershed projects now need to examine the same issues with another lens, namely that of climate change and the diverse risks the phenomenon poses.

## WATERSHED AND EMISSION PER HECTARE AREA

The UNFCCC conducted a series of global conventions and involved national governments to evolve a consensus on mitigation measures<sup>4</sup>. So far, sixteen conventions have been held, with the most recent convention held at Mexico in 2010. The reduction of greenhouse gas (GHG) emissions is considered important for climate change mitigation: Figure 1 shows the net change in GHG emissions from 1990 to 2008 for the top 30 emitting countries that report to the United Nations Framework Convention on Climate Change and estimates for China and India from 1990 to 2005.

**Figure 1: Change in absolute amount of GHG**



The Kyoto Protocol, an international agreement linked to the United Nations Framework Convention on Climate Change, sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. This reduction amounts to an average of five per cent against 1990 levels over the five-year period 2008-2012. Recognising that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of “common but differentiated responsibilities.” Proportionate allocation of responsibilities for reducing emissions has been debated for decades now. Yet there is no consensus on the subject among nations. The dilemma is as follows:

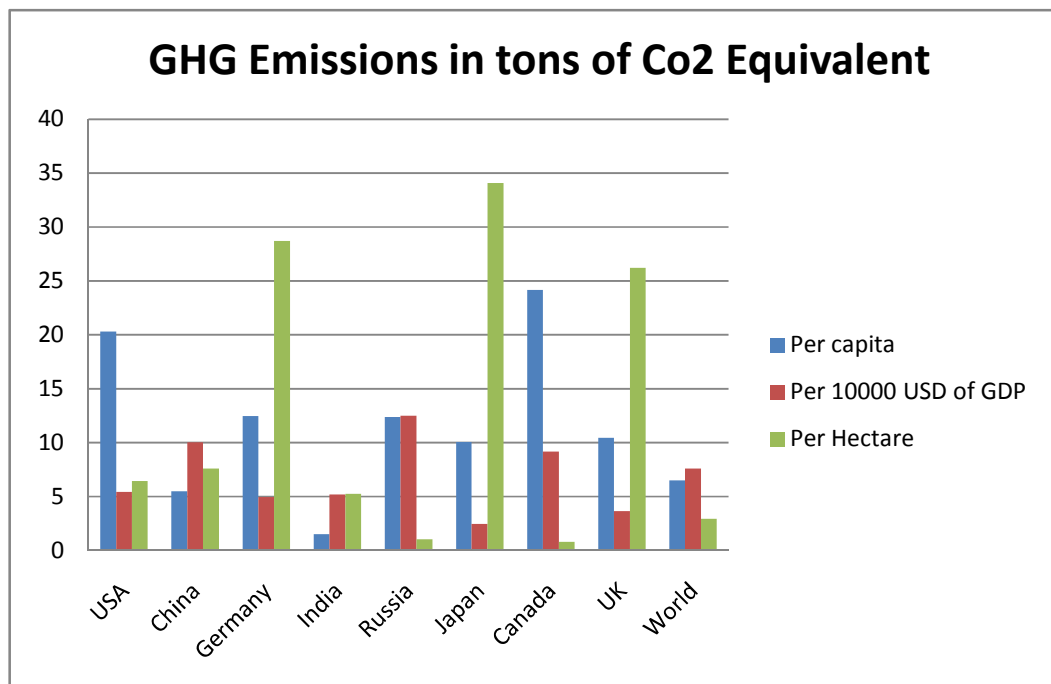
<sup>4</sup> The UN Framework Convention on Climate Change (UNFCCC) presents a global and democratic platform to voice concerns where all countries can discuss this particular issue on equal terms.

- When the criterion is country-wise per capita emissions, then some of the leading contributing nations demonstrate lower per capita emissions than the global average per capita emission. The argument could be the equal opportunity for the people on the planet

**Table 1: Comparison of per-capita emissions, per unit GDP emissions and per Unit area emissions**

Name of the country	Population in Millions	GDP in Billion USD	Geographical area of the country in Million Hectare	GHG emissions in Million tons Co2 equivalent	Per capita	Per 10000 USD of GDP	Per Hectare
USA	305.92	1,14,68	963.14	6,212.67	20.31	5.42	6.45
China	1,330.04	72,62	959.7	7,282.00	5.48	10.03	7.59
Germany	82.26	20,65	35.7	1,024.73	12.46	4.96	28.70
India	1,147.99	33,19	328.76	1,727.71	1.50	5.21	5.25
Russia	142.22	14,07	1707.52	1,757.84	12.36	12.49	1.03
Japan	127.77	52,02	37.78	1,287.23	10.07	2.47	34.07
Canada	32.93	8,69	998.47	795.87	24.17	9.16	0.80
UK	61.36	17,65	24.48	641.87	10.46	3.64	26.22
World	6,790.06	5,80,70	14894.0	44,153.00	6.50	7.60	2.96

**Figure 2: Per Unit GHG emissions in tons**



- When the criteria are fixed with respect to the carbon emissions per unit of GDP (Gross Domestic Product) all developing nations which are leading emitters of green house gases shall be demonstrating lower emissions per unit GDP. Developed countries would present that their emissions are from exports consumption.
- When carbon emissions are calculated per unit area, then a different scenario altogether emerges. All most all countries will have to take measures. By following this criterion, it is possible to ensure actions at the global as well as the local level. Russia and Canada per hectare emissions may be less and this could be corrected by ice covered area sun energy reflectance. Communities living in each of the geographical unit areas can explore actions for adaptation and mitigation. Since climate change mitigation involves natural resources management and their sustainable use, the watershed as a geographical unit could provide a platform for initiating climate-friendly measures.

## **FRAMEWORK FOR INTEGRATING CLIMATE CHANGE CONCERNS IN WATERSHED PROGRAMMES**

A comprehensive approach for adaptation and mitigation is possible on the watershed platform<sup>5</sup>. To address climate change issues, two-dimensional action is required. First is the *mitigation* effort to reduce carbon emissions which is being addressed all over the world as an important environmental concern. Second are the *adaptation*<sup>6</sup> measures to combat the vulnerability of adverse impacts of climate change.

Although adaptation to climate change is a relatively new issue, there are some innovative practices such as IWRM, source protection, watershed management and disaster preparedness and response, which can build community resilience to climate change impact. The watershed projects can facilitate autonomous adaptations by communities<sup>7</sup> by putting systematic mechanisms in place (e.g., communication, credit, finance, social network, alternative services livelihoods, etc.).

The capacity to adapt depends on socio-economic status, environmental circumstances, and available information and technology, etc. For example, an intensification of the hydrological cycle means less number of rainy days with heavy rainfall. This necessitates the implementation of measures that improve soil moisture content and conserve water. In other words, it is possible to minimise the adverse impact of climate

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<sup>5</sup> Watershed being a hydro-geological unit of the geographical location has significance in terms of actions relating to the mitigation of climate change, based on the communities living in it and the opportunities they can take up for adaptation.

<sup>6</sup> Capacity to switch strategy and able to do well: It is an action that people/households /individuals taken in response to stress, including that due to climate change.

<sup>7</sup> It is assumed that people respond to stress or risk in different ways; while planned adaptation is extremely limited and can be considered as the tip of an iceberg, a larger part of adaptation observed today is autonomous.

**Table 2: Climate change agenda in watershed programs**

<b>Thematic area</b>	<b>Scope for interventions</b>	<b>Potential for Mitigation/ Adaptation</b>
Agriculture	Cultivation of green manure crops and ploughing into soil.	Soil moisture retention - drought proofing. Reduced chemical fertilizer consumption. Soil carbon improvement.
	Soil amendments to correct soil nutrient deficiencies.	Crop specific nutrient requirement and soil specific deficiencies application only to be applied Avoiding pollution from unnecessary application of fertilizers.
	Avoid burning of agricultural waste.	Soil carbon improvement.
	Vermi-compost application.	Reduction of dependence on fertilizers based on fossil fuels
Water resources	Crop water budgeting	Water use efficiency Less release of GHG from paddy fields
	Micro irrigation	Water use efficiency
	Recharge structures in the influence zone of bore wells	Avoiding bore well drying up
Energy	Capacitors for Ground water pumping efficiency	Energy saving
	Energy efficient stoves for cooking	Energy saving, avoided tree felling
	Promoting Gobar gas	Energy saving, avoided tree felling
	Energy efficient lamps	Energy saving
	Energy awareness and audit	Energy saving
	LPG for cooking	Energy saving, avoided tree felling
Fodder and Livestock	Efficient use of fodder by using chaff cutters	Reducing wastage in fodder
	Increasing area under fodder plots	Ensuring fodder availability for cattle
	Cattle breed improvement	Productive cattle
	Stall feeding	Prevention of top-soil erosion and Greenery development
Greenery Development on waste lands	Bund planting	Carbon fixation
	Tank foreshore plantations	Carbon fixation
	Energy plantations	Carbon fixation
	Horticulture promotion	Carbon fixation
	Bamboo plantation	Carbon fixation
	Natural regeneration protection	Carbon fixation

variability on crops by improving the micro climate (i.e., by conserving moisture and developing green cover).

Another action possible is improving access to meteorological information. There is no doubt that farmers will be in better a position to respond to climate variability if they have access to historical data as well as day-to-day, reliable weather forecast specifically targeted to farming practices.<sup>8</sup> This is the most critical aspect of climate change adaptation. Table 2, presents a number of actions possible to integrate climate change concerns in watershed programs. The information and awareness leads to sense of urgency and urgency leads to responsibility and responsibility leads to action.

Capacity building of communities with respect to the crop, cattle and health insurance is equally important. Convergence with programs like National Rural Employment Guarantee Program for drought proofing works also ensures everyone's participation towards reducing adverse impacts of climate change on communities.

## **OTHER OPPORTUNITIES TO INTEGRATE CLIMATE CHANGE AGENDA IN WATERSHED DEVELOPMENT PROGRAMMES**

As discussed earlier, changes in climate will have considerable implications for future generations and for ecosystems on which humanity depends. The time is running out as emissions already accumulated in the atmosphere will have lasting effects. It is important that we focus on the changes in consumption patterns and resource-use efficiency, and introduce technologies for carbon-neutral life-styles. Irrespective of the global process, it is time to focus on community-level action also. For this to happen, the following aspects must be addressed:

***Watershed as a strategy for the ecosystem management:*** The carrying capacity of the geographical unit area has to be managed in a sustainable manner; for instance, the limited water resources that are available in the area must be used efficiently in order to fulfil people's aspirations. So, watershed is a platform for creation of awareness and initiate suitable action on climate change. Better-organized and informed watershed communities could play the role of pressure groups in climate-sensitive matters.

***Proactive Policies:*** What concerns us about climate change is the survival of people, in particular vulnerable groups. Therefore, Government programs and policies must proactively identify specific impacts of climate change and take carefully-targeted actions to enable autonomous adaptations. In this respect, watershed development policy must take into consideration climate change concerns. There is a need to apportion resources for capacity building and specific actions related to climate change mitigation and adaptation. For example, the focus must be on ensuring plant survival. Another next generation issue is capitalizing on carbon credits and mobilising more resources. The processes involved in this must be modified to suit to community-based initiatives.

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<sup>8</sup> Correct prediction of weather for tomorrow is of high significance to the farmers. Though cost involved in this may appear higher, but will be small if we compute its benefits in the long run.



***Watershed and National Action Plan on Climate Change (NAPCC):*** The carrying capacity of certain areas given the current carbon foot print levels is unsustainable. While the tertiary sector is less carbon intensive, primary sector is becoming more and more energy intensive. To improve, we need to bring in resource use efficiency and introduce technologies for carbon neutral life styles. There is a vast scope for spreading awareness at community and individual levels on carbon free economy in watershed villages. For example, we can reduce power consumption by promoting CLF bulbs. There is also a need to reduce activities that release carbon, if not avoid such activities altogether. Thus, a minimum common programme on climate change can be developed based on NAPCC in watershed villages.

***Social adaptation:*** Time taken for social adaptation is long, in particular when uncertainty exists about the type and magnitude of climate-induced changes. The delay is also due to lack of awareness and greater interest in immediate survival needs. Yet, there is a need to promote socio-cultural adaptations in watershed villages as a response to climate change.

***Technology:*** Affordable, accessible and appropriate technology no doubt plays a highly significant role in carbon emission reduction. We need to transfer technologies to the community level. In this respect, there should greater effort to ensure carbon proofing the new developmental projects.

***Mechanisms:*** CDM and carbon finance are important mechanisms emerged from international consultations. It may be noted that carbon finance is a design to help developing countries meet their targets and achieve sustainable development (the process is, however, complex and favors large polluters). Greater awareness should be created about these mechanisms in order to ensure more widespread use.

***Capacity Building:*** While the communities in watershed villages are organized, their capacities are to be nurtured to respond to climate mitigation. Information and awareness leads to responsibility, which in turn results in action. Climate change can be addressed by empowering people to manage the ecosystems that support their livelihoods.

***Documentation:*** The community itself will respond on its own or with support from development program. There is a need to not only document communities' coping mechanisms and adaptations, but also disseminate them on a large scale.

Everyone on the planet has a responsibility to save humankind on the planet the blame game is over. Watershed management practices, ensures everyone on the planet to participate in mitigation and adaptation strategies. Especially it is a good model for adaption to the changing climate by the rural communities

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