

## Economic Impact Assessment of Rehabilitation Schemes of Tsunami Affected Farmers of Bay Islands in India

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### ABSTRACT

*The giant tsunami of December 2004 not only damaged the physical infrastructure of the islands but devastated the agriculture and allied sectors along with the associated livelihood opportunities. An investigation was carried out to assess the damage caused by tsunami to the farming community of Andaman and Nicobar Islands and the impact of the schemes implemented by the A&N Administration. Totally 136 respondents from selected eight villages were interviewed for the study, which revealed that agriculture land affected (which remains dry) per family was to the extent of 0.1-.53ha. The land affected from high tides varies between 0.37 and 0.19 ha per family and the inundated land per family from 0.74 to 0.49 ha, during 2005-08. The agriculture crop loss per family was estimated to be Rs. 50,472. Agriculture inputs and farm implement losses were Rs. 15,775. The loss following damage of livestock inputs and assets was also very high with the loss of poultry alone contributing to about Rs. 19,242 per family. To revive the agriculture and allied sector of Tsunami affected families, Rajiv Gandhi Rehabilitation Programme (RGRP) has been implemented by the Andaman and Nicobar Administrations with total outlay of Rs. 821.88 crores. The study shows that the project has benefited the farming community of these islands by improving their income and through employment generation. The project has also led to the increase in cropping intensity to the extent of 155%. Overall impact of the programme was estimated to be 68%, which is considered as very good.*

**Key words:** Tsunami; impact analysis; RGRP; Employment; Opportunity;

The high intensity earthquake followed by a powerful tsunami, which occurred in the early morning on the 26th December 2004 brought about death and devastation along large parts of east coast and Andaman & Nicobar Islands in India. The tsunami generated by the Indian Ocean earthquake is recognized as the deadliest tsunami in recorded history. Natural disasters always have devastating effects on the economy; they cause huge human and economic losses, and significantly hinder the economic development of a region or a country (Ganesh-Kumar *et al*, 2009). Their resilience to bounce back to pre-disaster level is highly limited. For the planet Earth, the imminent threat, however, is from a vicious spiral among environmental degradation, poverty and climate change-related natural disasters interacting in a mutually reinforcing manner which in turn, retard sustainable development and also wipe out any small gains made thereof (Kesavan and Swaminathan, 2006). The earthquake resulted in

seduction of the landmass in South Andaman to the extent of over 1m due to which the agricultural lands and coconut plantations in several parts of Andaman continue to remain inundated during high tide. Hence, there has been a considerable damage / loss to the islands in general and to agriculture in particular, which is the mainstay for the sustenance of the rural and tribal farmers for many decades. Majority of these resource-poor farmers have become landless and lost their sources of livelihoods and live in intermediate shelters provided by the local administration. It must be understood that such crises hit the poor, especially small and marginal farmers, landless labourers, land-poor peasants, socially underprivileged sections and women the hardest (Swaminathan, 2009). A study was conducted to assess the changes in socio-economic status of farmers and entrepreneurs deriving livelihood from agriculture, animal husbandry and aquaculture. The impact of the rehabilitation schemes introduced by the

local administration was assessed as to analyse the course of change in their livelihood options in order to suggest suitable policy measures / initiatives to the relevant development departments for better and sustained agricultural productivity in these islands.

**METHODOLOGY**

The tsunami affected areas of A&N Island were selected for the study. Totally 136 affected farmers were selected randomly from eight villages selected for study. The selected villages were Chouldari (17), Mithakhari (17), Guptapara (17), Wandoor (17), Stewartgunj (17), Subhash Nagar, Diglipur (17), Govind Nagar, Campbell Bay (17), Sawai, Nicobar (17) and the number of sample households from each village is given above in parentheses. The data were collected in three phases as immediately after tsunami i.e. 2004-05 and then during 2005-06 and 2007-08. The data were collected with respect to loss of land and crops, experience in agricultural activities and other livelihood enterprises, educational status, type of households and family size. The strategies adopted by the different development departments were taken from the official records and validated from the field survey. The impact rating of RGRP was analysed using 0-3 point scale and weights were assigned based on the extent of correctness of answers. The calculation procedure is given below.

$$\text{Impact rating of an intervention (\%)} = \frac{(\sum x_{ij})}{(\sum X_{ijs})} \times 100$$

Where,

$x_{ij}$  = score assigned by  $i$ th respondent to  $j$ th impact  
 $X_{ijs}$  = Maximum attainable score of  $j$ st attributes of impacts for  $i$ th response.

Twenty open ended questions were asked to the beneficiaries, Project Implementation Agency (PIA) officials and the NGOs operating in the study area. Further data were analysed using statistical tools and conclusions were drawn.

**RESULTS AND DISCUSSION**

*Damage caused by tsunami :* On 26<sup>th</sup> December 2004, a massive earthquake followed by tsunami occurred in the bay islands. The villages across the ANI were affected severely. The Government of India launched the Rajiv Gandhi Tsunami Rehabilitation programme (RGRP) during 2005-06 in order to revive the livelihood

of the people. The extent of damage to agricultural sector was 8722 ha (Table 1). The damage to field crop was estimated about 25% while that of plantation crops was 68%. Car Nicobar Island was badly hit in terms of total number of farmers affected followed by South Andaman (23%). Under field crops South Andaman was most affected (67%) followed by Campbell Bay (24%). Under plantation crops, Katchal was most affected with an area of 78% followed by Car Nicobar (16%), Campbell Bay (13%), Teressa (13%) and other islands also were reported the damage in the field and plantation crops

**Table 1. Island wise damaged agriculture area due to tsunami / earthquake (ha.)**

Name of Island	Paddy and other field crops			Plantation crops			No. of
	SA	RA	TDA	SA	RA	TDA	
S. Andaman	1148	319	1467	131	69	200	1448
L. Andaman	0	43	43	0	74	74	48
Rangat	11	73	84	0	0	0	181
Mayabunder	5	39	44	7	7	14	19
Diglipur	0	27	27	0	0	0	47
Car Nicobar	0	0	0	213	756	969	2378
Kamorta	0	0	0	527	110	637	341
Nancowrie	0	0	0	244	13	257	251
Trinket	0	0	0	289	40	329	140
Teressa	0	0	0	343	401	744	268
Chowra	0	0	0	58	173	230	340
Bambooka	0	0	0	20	10	30	15
Katchal	0	0	0	331	1297	1629	317
Campbell Bay	211	301	513	669	110	779	525
Total	1375	803	2178	2831	3060	5891	6324

(Source: Digal et.al., 2006, Development Commissioner A & N Administrations)

SA = Submerged area RA = Reclaimable area  
 TDA = Total damaged area AF = Affected farmers

(Digal, 2006). Thus, an area about 8700 ha was damaged due to tsunami which is about 17% of the total cultivated area in the islands.

*Damage to animal husbandry :* The livestock population in the islands consists of non-descript cattle, buffaloes, pigs, and goats. The livestock supports the agriculture in the form of Draught Animal Power (DAP). Majority of farmers are following the concept of integrated farming in these islands. As per the 1997 census, total livestock population on the islands was 188311 including 29% crossbred. The total milk production was 25 lakh litres in year 2010. The average

per day yield is about 1.5 litres for cows and 1.5-2.0 litres for buffaloes. The total poultry population was 800950 in year 1997 and it further increased to 930878 (14%) in the year 2010. Common feature of people in the A & N Islands to have some poultry birds in the backyard along with milch animals, goats and pigs (Table 2). The total 3786 no of cattle were lost which is about 46% were from Campbell Bay alone. The goat also called poor mans' live ATM. Thus loss of goats is a direct loss to the affected families. Totally 16623 no of goats were lost due to tsunami out of which 41% were Car Nicobar itself followed by Teressa (20%), Katchal (14%) and 25% from other affected islands. Hence, majority of farmers affected followed the similar trend. However, 6188 families were affected due to tsunami and they lost cattle, goat, pigs and poultry. Since, these

**Table 2. Loss of livestock due to tsunami**

Name of Island	No of livestock lost				No. AF	Major loss
	Cattle	Goat	Pig	Poultry		
S. Andaman	166	843	102	18523	635	G&P
L. Andaman	397	1146	503	9119	779	G&P
Car Nicobar	426	6791	16616	26517	2408	Pig
Chowra	Nil	31	4245	7620	328	Pig
Teressa	13	3387	8767	5140	382	G&P
Katchal	476	2342	3860	12000	317	G&P
Nancowry	12	97	325	1006	137	Pig
Kamorta	345	872	1600	4684	156	G&P
Trinket	220	120	700	1550	83	Pig
L. Nicobar	-	-	300	1967	82	Pig
Campbell bay	1724	750	749	9075	761	Cattle
Kondul	-	-	36	300	34	Pig
Pilomillow	1	25	239	558	25	Pig
Bambooka	4	163	403	-	22	Goat
Mayabunder	2	56	1	663	39	Goat
Grand Total	3786	16623	38446	98722	6188	

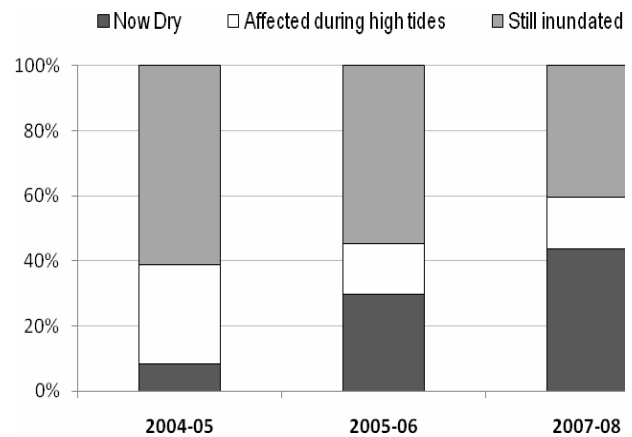
AF = No. of families affected

G&P = Goat & pig

livestock species were their bread earners; tsunami has completely fractured their livelihood (*Sahani and Prasad, 2005*).

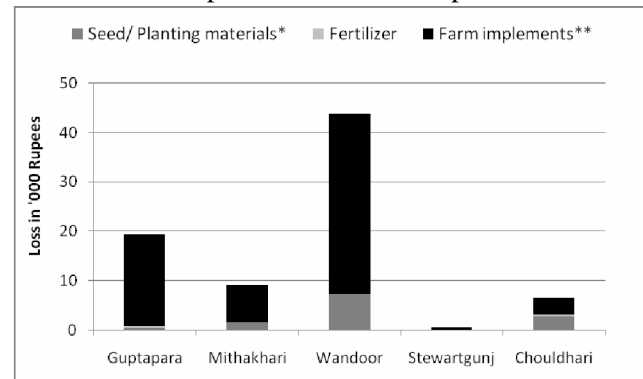
**Damage to land resources:** The earthquake / tsunami has left three different scenarios in these islands viz., (i) area in which seawater entered and receded subsequently (ii) seawater enters even now during high tide due to land subduction and (iii) area permanently inundated with seawater. The data on the extent of

land under different scenario are provided in Fig. 1 for three years since tsunami. It is evident that there is significant increase ( $P < 0.01$ ) in the area which has dried up since the tsunami in the subsequent years. Both the extent of land affected during high tide as well as permanently inundated has decreased over time, which could be attributed to the resettlement of plates during aftershocks and earthquakes (*Rao, 2005*). There was significant increase to assess the status and damage caused to the land resources by tsunami, data were collected from the affected farmers (Fig.1). It was observed that land remain dry after tsunami was to the extent of 0.1 ha. to 0.5 ha., (2004-05 to 2007-08) respectively.



**Fig. 1. Status of Tsunami affected land (In ha)**

**Damage to standing crops, agriculture inputs and infrastructure:** The loss was not only in terms of cultivable land alone but loss of standing crops also. The study revealed that on an average there was loss of Rs. 50472/- to the affected farmers. Maximum loss was observed in Wandoor (Rs. 79417/-) and Chouldhari (Rs. 65023/-). In Stewartgunj village, the maximum damage was caused to the paddy with an average loss of Rs. 25600/- per farmer. The crop wise loss was



**Fig 2. Damage of agricultural inputs due to tsunami**

maximum among those who cultivated coconut followed by paddy, arecanut, vegetable, fruits and pulses. The assessment of damage of inputs and agriculture infrastructure of the respondents was made and same is presented in the Fig 2. The study on loss of agricultural inputs indicated that the major loss in the form of Farm implements (Rs. 13120/-) consisted of pump sets, motors, tractors, rice mill, plough, fishing boat and fishing nets etc. followed by seeds / planting materials and fertilizer Rs. 2514/- and Rs. 142/- respectively. Similar findings were reported by *Ganesh Kumar et al (2009)*.

Village wise comparison indicates Wandoor village accrued maximum loss of Rs. 43858/- of which Rs. 36667 was from implements, fishing boats and nets. This has indicated that major farm assets were lost and farmers became handicap due to tsunami.

*Effect of tsunami on animal husbandry:* Based on sample survey it was observed that there was considerable reduction in livestock holding due to tsunami. This was accounted for cattle 3.27 to 0.73, buffalo 0.92 to 0.25, goat 2.85 to 0.68 and for poultry birds 86.49 to 32.49 per family after tsunami. There

**Table 3. Average loss of livestock related inputs and infrastructure (in Rs)**

Village	Feeds	Feeding trough	Utensils	Shed	Poultry equipments	Dung/ Manure
Guptapara	150	40	75	7000	70	50
Mithakhari	133	57	112	7767	47	0
Wandoor	93	71	95	7517	0	0
Stewartgunj	90	25	60	3200	0	600
Chouldari	2068	347	149	17538	719	119
Subhash Nagar	459	280	85	9500	250	150
Govind Nagar	1855	450	145	10550	1525	350
Sawai	250	100	50	1500	25	0

**Table 4. Impact on cropping intensity and Power tiller use**

Crops	Animal power (pre- tsunami)		Power tiller (post tsunami)		Saving in time/ha (%)
	Area (ha.)	Time Taken (in hr.)	Area (ha)	Time taken (h)	
Paddy	2.0	312 (ploughing four times)	2.0	60.00	80.76
Vegetable (post-paddy)	0.3	52.5 (ploughing three times)	0.5	11.25	87.12
Pulses (post-paddy)	0.3	52.5 (ploughing three times)	0.6	13.50	87.12
Cropping intensity (%)	130		155	-	-

was significant drop in the production of milk (4.48 to 0.98 litters) and egg production (from 18.20 to 7.23) per day per farmer in the study area. This was also observed that livestock sector is improving slowly. The loss to the livestock related infrastructure was too high especially on sheds followed by feeding troughs and equipments (Table 3).

*Impact of rehabilitation programme:* The Government of India has approved a total package of Rs. 821.88 Cr. for A & N Islands under "Rajiv Gandhi Rehabilitation package (RGRP) for Tsunami affected areas" which includes Rs. 239.54 Cr for Agriculture Sector. The rehabilitation and rebuilding of infrastructure is given special emphasis with a view to achieve the physical and financial targets. The Govt. of India has approved RGRP for tsunami affected areas. The programme was

aimed to rehabilitate the affected farming families in terms of agriculture, animal husbandry and other allied activities with technological and inputs subsidiaries interventions. Under the RGRP package mechanical power improving U Power tiller and pump sets distribution) was made. The essential hand tools were also supplied to the affected people. The detailed data on socio economic and biophysical aspects were collected from entire Islands for impact assessment and logical conclusions were drawn for future strategies in such event. The improving of the programme is given as under.

*Impact on cropping intensity and utilization of power tillers:* The data on mechanical power for agriculture operations v/s manual/ traditional power were collected. It was observed that in paddy crop a net time saving

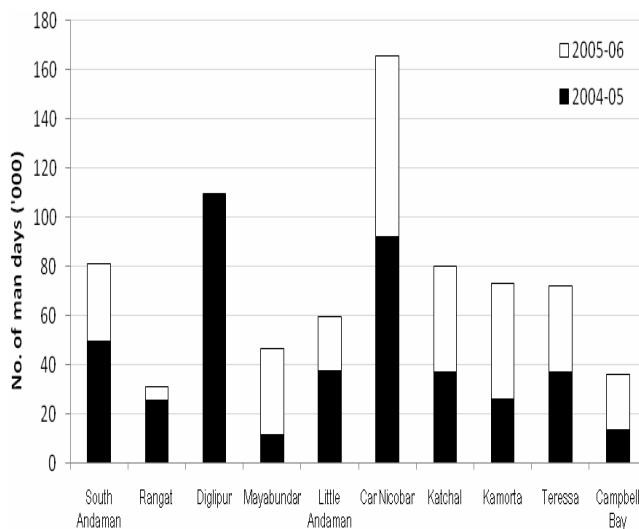
was 81% and in the case of vegetable and pulses it was still higher about 87% (Table 4). This has resulted in increase in the cropping intensity which was 130 to 155%. This is positive contribution of the programme. Hence, RGRP has increased the cropping intensity.

*Increase in mechanical power availability in Islands*  
: To assess the improvement in mechanical power availability during post tsunami, data on available power tiller, diesel engine and other source were collected.

It was observed that mechanical power available before tsunami was 0.18 KW/Ha and was increased to the extent of 0.55 KW/ha. This indicated highly positive impact of the programme and reflected about 272% increase in mechanical power. This further has resulted in the improvement of cropping intensity from 130 to 155% (Table 5). This is considerably significant contribution. Thus, the RGRP has improved the agriculture and allied sectors.

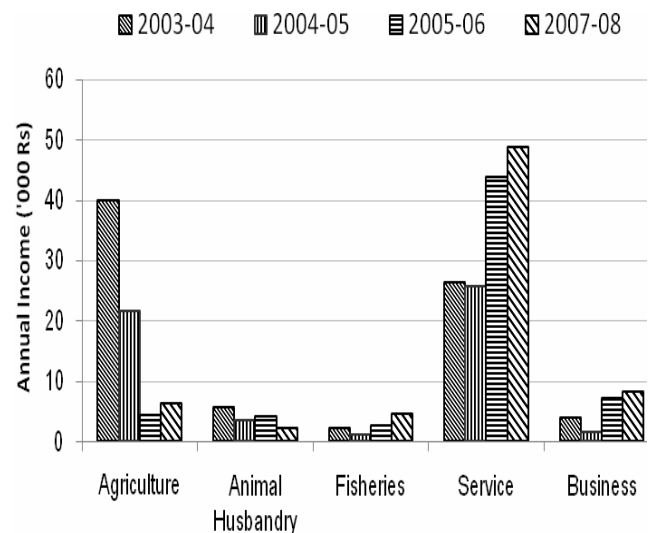
**Table 5. Improvement in mechanical power in A&N Islands**

Mechanical power	Pre tsunami (2004)			Post tsunami (2006)		
	No.	Avg. Unit Power, (KW)	Total Power, (KW)	No.	Avg. Unit Power, (KW)	Total Power, (KW)
<i>Tractor</i>						
Deptt. of Agriculture	65	33.57	2182.05	65	33.57	2182.05
Farmer owned	58	22.38	1298.04	61	22.38	1365.18
<i>Power tiller</i>						
Deptt of agriculture	4	8.952	35.81	4	8.952	35.81
Farmers owned	35	8.952	313.32	591	9.405	5558.36
<i>Diesel Engine</i>	919	3.73	3427.87	3174	3.342	10607.51
<i>Electric motor</i>	36	0.746	26.86	36	0.746	26.86
Total available power, kW			7283.95			19775.77
Net cropped area, ha			40382			36176
Mechanical power available, kW/ha			0.18			0.55



**Fig. 3. Zone wise employment generation through RGRP activities**

*Employment generation:* The RGRP programme not only has revived the agriculture and allied sector by providing the inputs but also has provided the employment to the affected families directly through cash and food for work. More than three lakh mandays were generated through project activities (Fig 3). These



**Fig 4. Change in Income pattern Pre & Post Tsunami**

mandays were not concentrated at one place but also in different islands. Since project activities have covered entire islands, local people got employment which has resulted in hope for survive.

*Improvement in income pattern of tsunami affected farmers:* The impact of tsunami on the pattern of income

**Table 6. Overall impact ratings of RGRP (Impact rating table (0-3) point scale)**

Name of activity	IIA	WAI	ULU	IPC	SHI	IG	LVI	FPI	II	EG	AC	NBW	IV	BS	CA	CB	TS
Water resource development	2.5	2.5	1.5	-	-	-	2.5	-	2.0	2.4	2	1.5	-	1.5	-	-	18.4(68.2)
Crop improvement	-	-	2.0	1.5	1.5	2.0	1.0	-	1.0	1.2	1.5	1.0	1.2	11.5	-	-	15.9(48.1)
Horticulture prog.	-	-	1.5	1.0	1.0	2.0	1.0	1.2	1.0	1.3	1.0	1.0	1.0	1.0	-	-	14.0(38.9)
Inputs distribution	-	-		1.4	1.6	0.5	-	-	2.5	2.5	2.2	2.4	-	2.5	-	-	15.6(65.0)
Community institution building	-	-	-	-	-	-	-	-	-	-	1.0	1.0	-	1.0	1.5	1.3	5.8(38.7)

IIA = Increased irrigation area

WAI = Water availability increased

ULU = Unutilised land used

IPC = Insect pest controlled

SHI = Soil health improved

IG = Increased greenery

LVI = Land value increased

FPI = Fodder production Increased

II = Income improved

EG = Employment generation

AC = Assets creation

NBW = Need based work

IV = Increased vegetable

BS = Beneficiaries satisfaction

CA = Change in attitude

CB = Confidence building

TS = Total score

has been depicted in Fig 4. The result revealed that, in the pre-tsunami period (2003-04) the average annual income of affected farmer was Rs. 78067/- of which farming sector was contributing about 60% but in the year of tsunami i.e. 2004-05 the annual income was reduced to Rs. 53763/- of which the contribution from farming sector was 49%. The 11% reduction in income from farm may be attributed to the loss of standing crops. In the subsequent years i.e. 2005-06 and 2007-08 the farm sector contributed only 18% and 19% respectively of the annual income which shows the shift of livelihood of tsunami affected farmers to non farming sectors.

*Overall impact ratings of RGRP:* The overall impact rating was prepared using three point scale Table 6). It was observed that highest ranking emerged for water resource development (68.2%) followed by input distribution (65%), crop improvement (48.1%). The ranking for other activities was also more than 30%. This has indicated that project has deliver intended benefits and able to achieve its objective to the considerable extent.

## CONCLUSION

The tsunami has made a great loss to agriculture and allied sectors. The situation prevailing is grave for agriculture in these islands especially the tsunami

affected areas. This situation should be taken as a challenge as well as an opportunity for reviving agriculture in these islands. By introducing certain innovative methods such as Integrated Farming system, high value agriculture, development of silvi-pasture, organic farming etc. has to be spread to attract the younger generation to adopt agriculture as livelihood option. The technological interventions in the farmer's field and refinement of the same to suit the area specific demand with farmer's participation will build up the confidence level of the farmer to adopt and to innovate new technologies. Providing the affected farmers with permanent shelter and some surrounding space will encourage them to keep different livestock component as backyard farming. It is imperative that farmers have acquired reasonable support to enable them succeed in their farming business. This will certainly rejuvenate the agriculture sector much better than before. Practicing better management viz. insect and pest management, integrated farming system and livestock feeding and breeding technologies will increase the production and productivity of agriculture and allied sectors. It is suggested that component wise study may be carried out to assess the real impact.

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