Rohmoria's Challenge: Natural Disasters, Popular Protests and State Apathy

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Rohmoria, in the upper reaches of the Brahmaputra river in Assam, is severely affected by river-borne erosion. Efforts to get government help in combating this erosion passed through different stages of peaceful agitation and ultimately took a political character. People's resistance used oil blockade as an effective means of getting government attention. Unfortunately, the state's response has mostly been ad hoc and geared towards temporary measures to lift the oil blockade. This article has two objectives: to portray the nature of the problem of erosion in Rohmoria and to show the history of the peoples' movement and the state's response.

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Before landing at the Dibrugarh airport, if you look below, a few big pythons seem to guard majestically a huge tract of lush greenery. The pythons are the interwoven channels of the Brahmaputra river and the widespread green stretches having exceptionally high degree of geometric consistency maintaining almost uniform hues are, of course, the tea gardens. A number of famous tea gardens of Assam, still bearing the brand of old colonial heritage, were developed by the side of the Brahmaputra due to the cheaper navigability and the typical growth promoting climate – tropical and temperate – necessary for various plants belonging to the tea family. The commonly available tea species is *Camellia sinensis*. Kudos to blending, if Darjeeling tea is famous for its flavour, the Assam tea remained equally famous for its strength and colour for the last one hundred and more years. Along with green tea bushes at the top are to be found some of the oldest oil pools in the depth of the soil, manifested on the surface by the tall oil rigs. Sulphur rich high quality coal reserves are there in the shallow subsurface which is very effective for converting into oil by hydrogenation. Unfortunately, it is, at present, wasted due to lopsided policies by making coke out of it. Estimated hydroelectricity potential around the Brahmaputra valley is more than 60,000 megawatts (MW), whereas, at the current level of industrialisation, the peak hour need for all the seven states of north-east India is less than 2,500 MW.

Brahmaputra River Dynamics

The Brahmaputra is an international river which passes through three most populous countries – China, India and Bangladesh. It acts as a conduit through which a massive transfer of sediments takes place into the Bay of Bengal from its source, which broadly represents the active zone of collision between the Indian and the Eurasian plate. On a global scale, the sediment yield of the Brahmaputra (Goswami 1985) within the Indian territory alone (804 tonnes/km^2 every year) is $\sim$ 5.5 times higher than that of the Amazon ($\sim$ 146 tonnes/km^2 every year), the longest river on this planet.

The mighty Brahmaputra channel belt is highly dynamic due to the ongoing structural changes (Molnar and Tapponnier 1975) in the basin part and the basin margin areas as well as the sediment load dumping patterns. The word *basin* stands for a large size depression on the surface of the earth formed due to structural changes or erosion providing accommodation space for sediment deposition. Basin margins are usually mountainous ranges where the rate of erosion is much higher than deposition. Rivers and other channels act as the agencies to bring sediments from mountains to deposit in the basins. The sense of fluvial dynamism is related to the temporal path consistency of a channel on the surface relief. Higher consistency means lesser dynamism. The catchment processes responsible for supplying vast quantities of sediment include erosion of actively uplifting mountains of the Himalayas, slope erosion of the Himalayan foothills and movement of alluvial deposits stored in the Assam valley (Thorne et al 1993). Besides this, sediment supply from the Naga-Patkai hills (Figure 1, p 33) also contributes substantially to the ongoing sediment architecture of the valley. The rise of the Himalayas and influx of the eroded materials from the mountainous reach to the valley have greatly influenced the fluvial dynamics of the Brahmaputra.

The river gets its name "Brahmaputra" from the old confluence place called Kobo where three major rivers – the Lohit, the Dibang and the Siang – used to meet each other. The Brahmaputra can be divided, broadly, into three reaches – upper Assam reach, lower Assam reach and the Bangladesh reach. Each of the reaches can be subdivided into segments. In the present study, we are going to focus our attention on the uppermost segment of

the upper Assam reach. Let us call it Dibru-Saikhoa segment (Figure 1).

Why Riverbank Erodes So Fast?

The place Rohmoria, a *mouza* in the Dibrugarh district is shown inside the location map (Figure 1) for the upper reach of the Brahmaputra. It is believed (Sarma and Phukan 2006) that in the aftermath of the great Assam earthquake of 1950, the rate of erosion in the south bank of the Dibru-Saikhoa segment of the upper reach of the Brahmaputra channel belt witnessed a sudden surge. So far, all over Assam, this segment had gone through maximum erosion (Kotoky et al 2005; Sarma 2008). But till today we do not have very clear explanations about how this earthquake could cause the spatial enlargement of the overall channel belt.

A careful measurement of some simple parameters like average channel belt widths, areas of the channel belts, channels, interfluves and the ratios of channel and channel belt areas as well as interfluve areas and channel areas shows very clearly (Table 1) that the upper reach of the Brahmaputra channel belt (includes channels as well as interfluves) experienced about 90% positive stretching in 1975 from its status during 1915. The same tendency attained a whopping 230% in 2005 with respect to the base year 1915. The ratio of actual channel areas and the channel belt areas witnessed a fall whereas the same for interfluves had a spectacular rise. Its direct implication is a very high rate of sediment dumping in the catchment areas. This may happen even if the average annual rainfall remains constant or had a slight increase. In Table 1, the term interfluve includes all the land areas within the channel belt. That also includes later deposits like sandbars as well as the earlier open lands now encircled by the channels and thereby becoming islands. The Dibru-Saikhoa Reserve Forest is such a place (Figure 2, p 33) having an area of approximately 300 sq km which has come into the map as an island very recently, after 1998. Even when we subtract the area of the Dibru-Saikhoa island, the net sand bar area within the Brahmaputra channel belt shows a remarkable increase. In this context, it may be added that a drastic rise in the sediment influx in the valley-fill zones might be due to post-earthquake instability in the mountains or perhaps the instability caused due to the anthropogenic intervention in the form of rapid deforestation and loosening of the soil binding materials. There might be a kind of overlapping too. But, either way, it emphasises the increased instability in the further upstream mountainous reach, the increased rate of sediment influx and a rapid increase in the overall width of the channel belt. Thus, the tendency of the channel-belt to increase its width caused rapid erosion and bank line migration, bringing the Brahmaputra river closer to Rohmoria. This is the first important observation.

Table 1: Temporal Variation in the Upper Reach of the Brahmaputra Valley

Geomorphological Parameters	1915	1975	2005
Average channel belt width (in km)	5. 28	10. 65 (+102%)	18. 48 (+250%)
Channel belt area (in sq km)	358. 71	678. 39 (+89. 12%)	1186. 27 (+230. 7%)
Channel area (in sq km)	122. 04	144. 13 (+18. 1%)	270. 24 (+121. 4%)
Interfluve area (in sq km)	234. 08	534. 26 (+128. 24%)	916. 03 (+291. 32%)
Channel area/channel belt area	0. 35	0. 21 (-40%)	0. 23 (-34. 3%)
Interfluve area/channel area	1. 92	3. 71 (+93. 2%)	3. 39 (+76. 6%)

Variation in the parameters like average channel belt widths, areas of the channel belts, channels, interfluves and the ratios of channel and channel belt areas as well as interfluve areas and channel areas are shown for the Dibru-Saikhoa segment of the upper reach of the Brahmaputra valley during 1915, 1977 and 2005. Positive numbers inside the brackets indicate growth over the 1915 status.

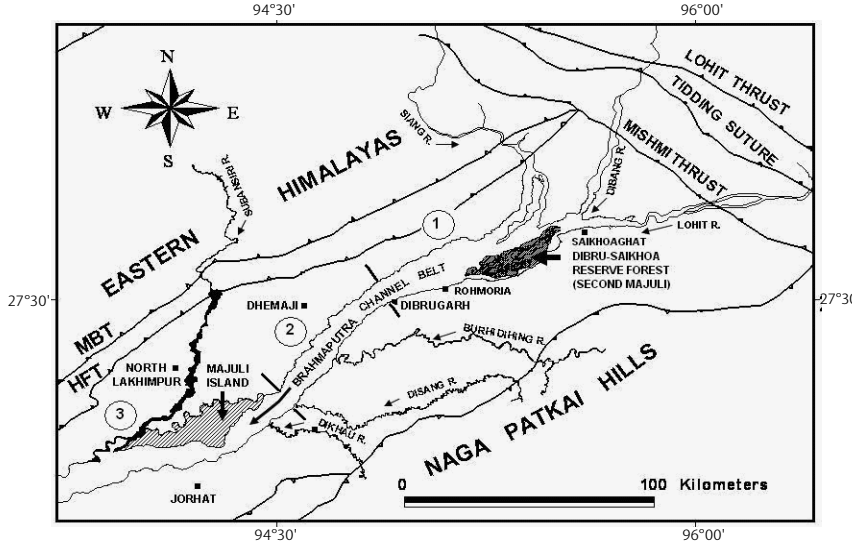
Second, a major cause behind the Brahmaputra channel belt widening is the avulsion of the Lohit river through the Ananta Nallah (Figure 2) that in turn gave rise to the formation of the Dibru-Saikhoa island. The drastic shift of the Lohit from its earlier course along the western side of the Dibru-Saikhoa Reserve Forest to its eastern flank, resulted in a shift of the confluence further and closer to Rohmoria. According to the older topographic maps, the confluence point used to be located near a place called Kobo during 1915. It shifted around 16 kms in the downstream direction to a place near Laikaghat by 1975. By 2005, as observed in the satellite imagery, a further downward shift of 19 kms took place, bringing it close to the upper tip of the Rohmoria area. This increased the pressure tremendously on the riverbank at Rohmoria.

Third, the intra channel belt flow characteristics keep on changing, the major channel becoming minor and vice versa. This is most probably due to the unevenness of the sediment dispersal as well as locally raised flow diversionary means of the state departments. Presently, an advancing frontier of the main channel, in the form of a "bow" (Figure 2) is directed towards Rohmoria making it highly hazard-prone, whereas the next half cycle of the main channel belt is directed towards the north bank, reducing considerably the erosion-borne hazard intensity for Dibrugarh town and its adjoining areas. The fourth factor is the presence of very loose sands of older flood plain deposits, just below the clayey topsoil. This causes rapid toe-cutting of the banks and its consequent slumping. Visibly, these are the four major factors responsible for the rapid bank erosion at and near Rohmoria. However, a very fundamental question that still remains unresolved is, why does the median course of the Brahmaputra channel belt show a remarkable eastward shift in the Dibru-Saikhoa segment? Is it principally sedimentological or structural?

The Rohmoria Struggle

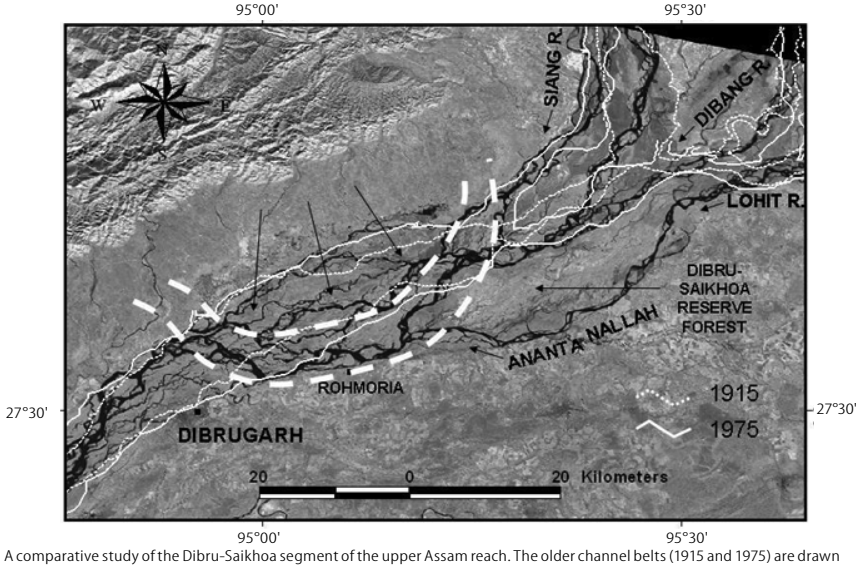
In the aftermath of the great earthquake in 1950, the Brahmaputra channel belt started inflating in the Dibru-Saikhoa segment causing rapid bank line migration in both the north and the south banks. By 1979, a significant portion of the Dibrugarh, Rongagorah, Tinsukia metalled road, the main link that used to connect Rohmoria with the two important townships of Dibrugarh and Tinsukia, was cut heavily due to this erosion. All of a sudden, the lifeline for business and general transportation was snapped and the earlier well-connected Rohmoria was reduced, almost in one go, to a hinterland, a very interior

Figure 1: Prominent Geological Features of Upper Assam



The reach is divided into three segments. 1- Dibru-Saikhoa or the new Majuli segment; 2- Inter-Majuli segment: 3-Old Majuli Segment Rohmoria comes within the Segment-1. The map has been redrawn in the GIS environment from the 23m resolution IRS-P6-LISS-3 image, taken on 15 December 2005. MBT-Main Boundary Thrust; HFT-Himalayan Frontal Thrust.

Figure 2: Brahmaputra Channel Belt from 1915-2005



A comparative study of the Dibru-Saikhoa segment of the upper Assam reach. The older channel belts (1915 and 1975) are drawn on IRS-P6-LISS-3 image, taken on 15 December 2005 after going through proper georeferencing. A bow-like morphological change is distinctly observed in the main channel of the Brahmaputra river which was approximately straight earlier. The diverging nature of the bow brings new land areas within the fold of the river by causing massive erosion.

place to which most of the town-based doctors would refuse go even in an emergency. Peoples' anger built up over the years as the administration did little to check this erosion. This resulted in the formation of an amorphous body called the "Rohmoria, Lahoal, Rongapara, Bokdung Baan Protirodh Samity" in 1979. The years from 1979 to 1985 can be seen as a period when the slow process of submitting memoranda to the district authorities, sending delegations to meet state government ministers, organising visits to the affected area by some of these ministers, getting election time assurances from candidates and parties, etc, was witnessed. The period 1985 to 1997 was a phase of peoples' disillusionment (Lahiri 2008) at the non-action of the state departments.

In September 1997, in a big public meeting, the earlier body was dissolved and a new body named the "Rohmoria Khahaniya-O-Baan Protirodh Samity" was formed. This body was much stronger in its determination. This was proved by its resolve to take some anti-erosion measures of its own. Mainly mobilising people from the highly hazard-prone areas of 15 villages and three tea gardens, the voluntary body took the task of constructing six wooden spurs to divert the course of the Brahmaputra river. Some technical know-how was provided by the erstwhile embankment and development department of the government. Other than that, the entire work was based on local resources and voluntary labour and took more than four months to complete. However, during the peak flood of 1998, all the spurs gave way and practically nothing remained. The setback was immense.

Gradually, a simple idea was building up among these suffering people – if a state refuses to address the basic problems of the people, it too forfeits its rights to the natural resources of the land where these people live. It should be kept in mind that the older idea as of nationality struggle were always present and provided a catalyst to comprehend state apathy in terms of a semi-colonial legacy.

Coincidentally, in 1998 itself, Oil India Limited (OIL) discovered a big oilfield at Khagorijan within the Rohmoria area. The "Oil Blockade" started from 16 August 1999. This day onward the struggle took on a political character. Cycle rallies, more frequent protest meetings, big rallies and mass gatherings as well as technical and political workshops resulted in a rapid expansion of the support base of the movement. On 23 January 2000, a state-level organisation – "Sadau Asom Baan Khahoniya Protirodh Sangram Mancha" – was formed at the end of a three-day workshop attended by representatives from different voluntary organisations all over the Brahmaputra valley engaged in their own struggles against flood and erosion. On 31 March 2000, Bolo Gohain, a schoolteacher, died under the heap of slumped soil while raising a spur. He was the first "martyr" for the cause of resisting flood and erosion.

The State Response

On the basis of the report submitted by R A Oak of the Central Water and Power Research Station (CWPRS) Pune to find a long-term solution to the problem (based on a site visit on 9 August 2000), the 31st technical advisory committee meeting of the state water resources department recommended a project to the Central

Water Commission (CWC) on 24 September 2002. This proposed project, with an estimated amount of Rs 404.72 crore, included construction of nine concrete spurs, raising of tie-bund, provision of RCC porcupine with other palliative measures. In October 2003, 10 iron pipe-based dampeners were raised by OIL as a pilot project.

On 3 January 2004, the Dibrugarh district administration convened a meeting of the representatives of different organisations as well as OIL. A consensus was reached that OIL would raise 360 iron pipe-based dampeners within a stretch of nine kilometres (from the Oakland Tea Estate to Bogoritoli village) in a phased manner. Based on this assurance, the oil blockade which had been in place for about four and half years, was lifted. In 2005, Kanak Sen Deka, the then President of Asom Sahitya Sabha, a highly influential and prestigious literary body, visited Rohmoria and took a resolution that if within 45 days, the prime minister did not visit Rohmoria, the Sabha would lead an economic blockade. In the meantime, OIL did not take any initiative according to the promises it had made in the multiparty meet convened by the district administration. From 13 December 2005, oil blockade in the Khagorijan oil field was reimposed.

Prime Minister Manmohan Singh visited Rohmoria on 17 January 2006. During the period April to August 2007, OIL raised 24 more scrap oil pipe-based dampeners with the help of the District Rural Development Agency, Dibrugarh. On 4 September 2007 the oil blockade was again lifted on the basis of the assurance that the phase-wise implementation of the promised plan would be expedited. On 13 November 2007, the Union Water Resources Minister, Saifuddin Soz, visited the erosion-affected places and declared that the Rohmoria issue would be incorporated in the next five-year plan. He also said that for immediate remedial measures, a short-term package would be declared very soon.

As the oil production ran smoothly OIL backtracked from its promises. From 20 November 2007, the oil blockade started again. On 20 December 2007, the Central Reserve Police Force (CRPF) tear-gassed and lathi-charged about 1,500 protestors who were trying to impose a blockade on national highway 37 near Chabua airport. On 24 December 2007, a daylong Dibrugarh district bandh call was given by the "Rohmoria Gora Khahoniya Protirodhi Mancha" against the CRPF atrocities. Other participants of the bandh were various students and youth organisations like the All Assam Students Union, All Assam Tea Tribe Students Association, Assam Jatiyatabadi Yuba Chhatra Parishad, All Assam Tai Ahom Students' Union and the Motok Yuva Chatra Sammilan. During and in the aftermath of the floods of 2008, the Rohmoria area experienced intensified erosion. On 8 September 2008, a procession of 6,000 people with much broader representation from many more organisations submitted a memorandum to the prime minister and the president of India through the district collector. The 45 technical advisory committee (TAC) meeting held in November 2008 recommended another scheme based on the pre-feasibility report of the Brahmaputra Board and the model study report on Hatighuli to Nagaghuli-Maijan reach prepared by the CWPRS. This proposal, costing an estimated amount of Rs 292 crore, was approved by the Assam government.

In summary, the alarming rate of erosion due to the Brahmaputra around Rohmoria for the past 50 years only led to various plans to check bank erosion by various state agencies but all these remained confined only to paper. Until the oil blockade started, nothing happened that can be said to be tangible in real terms.

'Palliative' Measures

The CWC, through a letter dated 16 July 2009, suggested some immediate "palliative" measures costing about Rs 60 crore for Rohmoria. All of a sudden they scrapped, on the late realisation that a project was already going on under the aegis of the Brahmaputra Board to close the Ananta Nallah in the further upstream direction, most of the earlier recommendations for stopping the erosion of the riverbank at Rohmoria. The state government was informed that if the diversion of the Lohit river through the Ananta Nallah could be closed, then the additional pressure and subsequent slumping of the riverbank near Rohmoria would also

Table 2: Comparison of 'New Proposals', 'Suggested Changes', and Redrafted 'Sanctioned Proposals'

Proposal by CWC, New Delhi vide letter no. 59/ Rohmoria/01/FM-II 328 dated 16 July, 2009	Modified proposal after multi party meeting vide letter no. WR(ED)/ Tech/5567/09/18 dated 10/09/09	Observation from CWC, New Delhi vide letter no. 59/ Rohmoria/01/FM-II/362 dated 13/10/09
1. Nine numbers of RCC porcupine spurs with apron of 39m and shank length of 60m. The RCC porcupine is proposed to be launched in five layers in the shank portion in phased manner to achieve the required siltation. The width of upstream apron is 15m and downstream apron is 24m.	1. Construction of RCC porcupine screens to choke up all the southern incoming channels towards Rohmoria in order to reduce pressure on the bank. Total nos of screen provided are nine.	1. For the protection of 2,600m of severely erosion-affected reach of Brahmaputra at Rohmoria, provision of apron with sand filled Geobags inside polypropy lene gabion of size 2m×1m×0.5m in two layers and pitching with sand filled Geobags 0.45m thickness in w/m cage laid over geofabric filter mats.
2. RCC porcupine bars at 50m intervals. The length of the bars is 27m below LWL and above LWL is 15m. The porcupine below LWL is proposed to be launched in three layers.	2. Providing geo-synthetic mattress in the trimmed bank slope of 1:3 above LWL and provide empty cement bags filled with sand cement mix in synthetic crates of size 2m×2m×0.45m.	2. Provide RCC porcupine screens in three layers to choke up all the southern incoming channels towards Rohmoria in order to reduce pressure on the bank. Moreover, to protect the reaches of 6,400m provision for RCC porcupine rows (five rows below LWL and three rows above LWL.)
3. Maintenance of the approach road for smooth supply of the construction materials. Other ancillary works as per the CWC guidelines.	3. Excavation of pilot channels (Guide channel) at two locations by Berge Mounted Excavator. Channel lengths 4,900m and 4,875m, respectively.	3. A pilot channel by engaging Berge Mounted Excavator to maintain a mid regime channel guiding the flow to the main stream is proposed at suitable locations.

stop. The CWC recommendations were:

(1) Choking up of all the southern incoming channels towards Rohmoria. This implies closing down Ananta Nallah, which presently should be called Ananta *river*) since it has now become the joint flow of the Lohit, the Noa Dihing and a part of the Dibang river discharge.

(2) Channel guiding programme by excavating strategic paths to pursue the channels to retreat towards the middle path.

(3) Bank stabilisation to check high degree of scouring or toe-cutting of the bankline due to the loose sandy soil below the top soil.

In a nutshell, the project intends to revert the Brahmaputra morphology back to its old status as of 1915. Additionally, the river banks are proposed to be made erosion resistant.

So far, all small-scale channel guiding programmes, by dredging sands from the Brahmaputra riverbed, have failed miserably, yet planners seem to resort frequently to identical kinds of fruitless prescriptions. A comparative study of the "New Proposals", "Suggested Changes" and the "Sanctioned Proposals" (Table 2) within a span of four months (16 July to 13 October 2009) clearly shows the absence of scientific research and a preponderance of an ad hoc decision-making approach within the authorities of the state.

Interestingly, even the meagre "palliative" measures, green signalled by the planners, were not initiated for implementation in time. Massive erosion has already started engulfing huge tracts of land in the lower part of Rohmoria, called Nogaghuli as well as Mohanabari ghat adjacent to Dibrugarh town, in the summer of 2010. Local newspapers are buzzing as usual with the imminent threat to the very existence of Dibrugarh town and the fate of the hapless people of Rohmoria. The administration, in this "climax" of the drama is showing that it is trying to do anything and everything possible. Even more ambitious analysts are trying to put the "China factor" behind the overall aggravation of the problem. In a highly confusing situation, the victims and the would-be-victims are fast losing all hopes in the capability and credibility of the state.

Conclusions

Erosion-borne hazard in the Brahmaputra valley is much more serious than many of the other natural disasters, especially floods, that the country faces. In floods, the magnitude of losses might be great, but mostly it is temporary. Erosion, on the other hand, makes peasants landless overnight. One of the most important causes behind the recent social disturbances of agrarian origin in Assam is rooted in the massive rate of river-borne erosion which opens up a Pandora's box of related issues. These are encroachment of forests by the uprooted people from the erosion-affected places, subsequent eviction of these displaced peoples by the state, pauperisation of these affected people and then rapid rate of internal migration and overpopulation of the urban centres with "unauthorised" people who lose the right to claim even the basic amenities of a civil society.

The problem of erosion at a small place, Rohmoria, in the upper reach of the Brahmaputra valley of Assam, the peoples' struggle and the pathetic state response is a typical sample that might be fitted to many other places of the valley. It shows clearly how in certain situations ecological issues may constitute the core of socio-political instability.

The energy and speed with which the state is implementing the massive hydro-electricity projects in the mountains surrounding the upper reach of the Brahmaputra valley is only seen in war-like situations. In comparison to that, even a bare minimum interest is not shown in understanding and addressing the problem of erosion and its connection to the instability of agrarian society. It is high time for the state to understand that prejudiced models of progress and social negligence piling up for decades may boomerang at unexpected moments with unpredictable intensities unless a really sincere effort is shown to comprehend the science behind the core issues of a place and the people therein. Moreover, implementation of all large-scale projects having questions related to ecological balance should be based on healthy, wide-ranging debates at different levels of the society.

Unfortunately, the people of Rohmoria may serve as an example of how not to deal with such natural disasters, they still have not found the state to be an enabler in providing a solution.

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