

# Planning for Vulnerability

The Hazards and Setbacks in Coastal Legislation



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**Aarthi Sridhar**

Dakshin Foundation

Email: [arthi77@gmail.com](mailto:arthi77@gmail.com)

Website: [www.dakshin.org](http://www.dakshin.org)

**Cover photo:** Photograph of the heavily eroded Puri coast line in Orissa, India. July 2010.

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## Abbreviations

CMZ	Coastal Management Zone
CRZ	Coastal Regulation Zone
MoEF	Ministry of Environment and Forests
NFF	National Fishworkers' Forum



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# Reconstructing fragility

The Indian state has accumulated a veritable smorgasbord of legal lexicon to govern a range of human activities. Nearly all ecosystems in India have seen enough destruction to warrant visible efforts from the state to reverse and prevent such an occurrence or recurrence. Laws pertaining to specific ecosystems and their use made an appearance over the last three decades and the law pertaining to coastal spaces – the Coastal Regulation Zone (CRZ) Notification, 1991 specifically decides what people can and cannot do on the coastal stretches of the country. This mainly includes where people can live, where establishments can be set up and the nature of activities permissible on the coast. The basis for each of these regulations is ascribed to certain concerns, principles and concepts and coastal management has seen several shifts and changes in these. The concern around ‘vulnerability’ has seen the emergence of ideas and responses such as introducing ‘setbacks’ for development and establishing ‘hazard lines’.

More than 10,000 people in India lost their lives to the Indian Ocean tsunami that struck the region on December 26, 2004 and the damage to property was computed at about one billion USD (World Bank 2005). Rehabilitation and reconstruction efforts were all extremely conscious of the fact that building close to the seafront was fraught with danger. As a parallel, a great deal of concern was also raised about fisher houses being located in the hinterland where they would not have quick access to the coast and visibility of the sea (Rodriguez et al. 2008). In fact in many areas, fishing communities in Tamil Nadu accepted the new rehabilitation sites in the hinterland but also attempted to occupy their earlier lands on the shore, particularly the community lands (Menon et al. 2008). Questions about the legality of building on the coast arose and the complications involved in existing CRZ regulations also became apparent to aid agencies (Sridhar 2005). It was around this time that the CRZ, 1991 became a subject of intense public debate – beginning as concerns around the massive rehabilitation efforts in the southern Indian states, but thereafter focusing on the inconspicuous

process of coastal legislation reform that the Ministry of Environment and Forests (MoEF) had initiated in July 2004, just prior to the tsunami.

The Swaminathan Committee, set up by the MoEF to review and revise the CRZ Notification, 1991, submitted its report in February 2005, with new ‘scientific’ constructs for a revised legislation. Coming in the wake of the tsunami, the most significant aspect of this review report was that it dropped the earlier system of ‘coastal regulation’ and advocated ‘coastal management’ instead, based on vulnerability of coastal areas to natural hazards. This report examines the application of the key concepts related to vulnerability that the Swaminathan report of 2005 and the subsequent draft notifications introduced.

The evolution of law is continuous, and it often keeps time with changes in government. This report explains how these ideas around coastal vulnerabilities found their way into the debates on coastal management and the implications of its proposed formulation in legislation. In doing so, this report also evaluates how government authorities and committees have articulated these concepts and whether the present efforts towards incorporating these ideas into legislation will actually result in enhanced protection for coastal communities and ecosystems.

# Re-forming the CRZ Notification

The CRZ Notification was officially declared by the Ministry of Environment and Forests (MoEF) on February 19<sup>th</sup>, 1991, under the provisions of the Environment (Protection) Act of 1986 and the Environment (Protection) Rules, 1986. The idea behind the 1991 CRZ Notification was to:

- i. Arrive at a balance between development needs and protection of natural resources in coastal areas
- ii. Prohibition and regulation of activities that are harmful to both coastal communities and their environment.
- iii. Sustainable management of coastal ecosystems thereby ensuring the protection and survival of millions of livelihoods.

Although the CRZ Notification was very well-known and its implementation was prompted by the active participation of several environmental organisations and judicial action, its overall achievements in terms of the above objectives have been extremely poor. The original notification was amended about 25 times with each amendment diluting it further (Menon & Sridhar 2007). The committee headed by Prof. M.S. Swaminathan to review it and make necessary changes to strengthen it had the following terms of reference:

- a) To review the reports of various committees appointed by the MoEF on coastal zone management, international practices and to suggest scientific principles for an integrated coastal zone management that would best suit the country
- (b) To define and enlist various coastal and marine resources and recommend the methodology for their identification and the extent of safeguards required for conservation and protection;
- (c) To revisit the CRZ Notification, 1991 in the light of above and recommend necessary amendments to make the regulatory framework consistent with recommendations on (a) and (b) above, and the Environment (Protection) Act, 1986.

The final chapter and annexes of the Swaminathan Committee report suggested a new legislative framework for coastal management, albeit quite contradictory in tenor and design from the main

text of the report (Sridhar et al. 2005). It was from this suggested framework that the Coastal Zone Management (CZM) Draft Notification, 2007 was developed by the MoEF (Menon et al. 2007). This new framework for the management of coasts spoke of a 'setback line' that permitted commercial activities on the seaward side of the setback line and pushed back all dwelling units of fisher communities to the landward side of the line. It proposed a dangerous situation of transferring the traditional ownership of and access to beach-fronts from fisher communities to non-coastal agencies with commercial interests. Furthermore, the framework had no mention of rights and protecting the livelihood of fisherfolk (Menon et al. 2007; Rodriguez 2010). This draft met with tremendous opposition from various quarters.

Later the same year (2007) a concept note was introduced by the MoEF which was similar to the earlier draft but contained a few modifications particularly on the subject of setbacks and vulnerability assessments. The note was shrouded in controversy because the meeting conducted by the MoEF to discuss the concept note was held without key fishworker leaders and environmentalists (MoEF 2007). The subsequent draft Coastal Management Zone (CMZ) Notification, 2008, (S.O. 1070 (E)), raised the hackles of citizens once again. A number of aspects in the draft CMZ Notification 2008 like its premise, objectives, monitoring mechanisms, jurisdiction and the concept of the setback line have come under scrutiny (Sridhar et al. 2008).

After the 15<sup>th</sup> Lok Sabha elections in May 2009, the new minister Jairam Ramesh sought to undo the damage caused by the earlier notification drafting attempts. Another committee again chaired by Prof. Swaminathan, produced a new report, popularly referred to as the 'Final Frontier Report'<sup>1</sup> on July 16, 2009 (MoEF 2009). It recommended, among other things, the following:

- It noted that coastal areas were doubly vulnerable, particularly to climate change related devastation.

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<sup>1</sup> The full title of the report is 'Report of the Expert Committee on the draft Coastal Management Zone (CMZ) Notification – The Final Frontier'

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- The CMZ Notification, 2008 should be allowed to lapse.
  - Amendments are incorporated in the existing CRZ Notification, 1991 for better coastal management.
  - Protection to fishing communities and families for habitat and livelihood security is enhanced through amendments in the CRZ Notification.
  - It also recommended that policies should be introduced to cope with and adapt to the future dangers from sea level rise and increased vulnerability of the coasts.

After the MoEF allowed the CMZ 2008 Notification to lapse, it undertook another series of public consultations to gather opinions about recommendations of the 'Final Frontier' report and incorporating appropriate suggestions before bringing in further amendments to strengthen the existing CRZ 1991. The Centre for Environment Education (CEE) was commissioned by the MoEF to hold public consultations on the subject, taking a total number of public consultations held on this subject to 35. Despite the limited scope these consultations provided for discussion and substantive debate on the provisions of the report or ideas to strengthen the CRZ (NCPC 2010a), the MoEF announced its decision to promulgate a new notification. In April 2010, the MoEF introduced a pre-draft CRZ Notification, 2010. Despite the time, effort and concern expressed about the entire process of reform, the MoEF had really not incorporated any of the public opinions. This pre-draft was met with a significant amount of protest mainly on account of the fact that it did not incorporate any of the suggestions made during public meetings, on account of permitted non-coastal activities that did not require the waterfront or foreshore and finally for not really providing a safeguard for fishing communities over their homes, settlements and coastal commons (*ibid*).

Despite the public resentment and disappointment expressed by environmentalists and fisherfolk over the pre-draft the MoEF announced the draft CRZ

2010 in September 2010 containing more or less the very same clauses as the pre-draft. Fisherfolk and environmentalists pronounced this as the 'last straw' and on 29<sup>th</sup> October 2010, the entire country witnessed mass agitations by fisherfolk across each coastal state, rejecting the notification and demanding that earlier regulations as per the original 1991 notification be reinstated (NCPC 2010b).

# Vulnerability, Setback and Hazard

## Vulnerability: the early days...

While the present debates on vulnerability of coasts and setbacks for activities are all concerned with the Coastal Regulation Zone (CRZ) Notification, 1991, there were state-level regulations which dealt with these ideas preceding this. Antecedents for protection of coasts through legal provisions can be traced back to building rules (under local town and country planning laws) or the land revenue code (NST, 2000). Section 15 of the Karnataka Land Grant Rules, 1969, prohibited the granting of lands near the coast upto 200 mts from the high water mark. The attempt was to regulate the kind of factories and vegetation encouraged in the area. On May 11, 1993, Rule 15 was amended to extend the area of no grants of land upto five hundred metres (*ibid*). Goa already had a legislation related to building near coastal stretches (Matanhy Saldanha, pers. Comm, August, 2010).

Environmentalists regard the year 1981 as a landmark for coastal protection, when Mrs. Indira Gandhi, the Late Prime Minister issued a directive expressing her concern at the high degree of pollution of India's 'fragile coasts' and the need to safeguard these spaces from pollution. Various citizen environmental groups are to be credited with having raised this concern are said to have brought this to her notice (Chainani 2007). This letter is said to have prompted the Beach Protection Guidelines – which later evolved into the Coastal Regulation Zone Notification rolled out in 1991. Mrs. Gandhi's letter to all chief ministers expressed distress at the degradation and 'mis-utilisation' of beaches. In the letter, Mrs. Gandhi suggested that upto 500 mts from water level at maximum tide be kept clear of all activity. This could be considered one of the first attempts at issuing setbacks.

Following this, working groups were set up in 1982, and in July 1983, the MoEF issued the Environmental Guidelines for the Development of Beaches. These guidelines required that the state governments

prepare status reports on the respective coastal area, which were then to be followed by a master plan identifying the areas required for conservation/preservation and areas where infrastructure development was possible. In 1986, an inter-ministerial committee was formed to scrutinise proposals for setting up of tourist resorts along the west coast. However, all these efforts stopped short of being the law<sup>2</sup>(NST 2000).

The legislation that finally emerged from Mrs. Gandhi's directive was the Coastal Zone Regulation (CRZ) Notification, introduced in 1991 by the MoEF, with the idea of preventing unregulated development in coastal zone areas. However, over the years, due to a lack of regulation and implementation of the CRZ Notification, many items initially prohibited in this area were permitted. The CRZ definitely contained a component of setbacks but this did not apply to all kinds of activities. The 1991 notification also did not use the actual terms vulnerability, hazards or setbacks.

The 1991 notification employed a system of differential setbacks for various activities. The notification mostly deals with regulating development on the coast and is not based solely on the idea of its vulnerability to natural hazards alone. It has more of a focus on man-made vulnerabilities due to over-industrialisation and pollution. The only natural hazard mentioned is sea level rise, for which the notification requires such areas to be declared CRZ -I or no development areas.

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<sup>2</sup> Shyam Divan and Armin Rosencranz, in their book Environmental Law And Policy, mention the case of Sergio Carvalho v. State of Goa 1989 (1) when a PIL sought to enforce Mrs. Gandhi directive against a hotel resort in Goa. It was rejected by the Bombay High Court on the grounds that the directive was just an "executive fiat" without authority of law (NST 2002).

## Post-tsunami ideas of vulnerability

One concept that has undergone change from its introduction in the Swaminathan report of 2005 to the present draft 2010 notification is that of the 'vulnerability or setback line.' The Swaminathan Committee proposed a 'scientific approach' towards the development of coastal land-use management using a form of vulnerability or hazard mapping that would define the spatial distribution of activity in the coastal zone (Pethick 2005). The setback line clearly was to decide how, what and where development activity could be located along the coast, and this decision was to be based on the idea of vulnerabilities of coastal populations and ecosystems to both man-made and natural hazards.

The report paid a great deal of attention to the problems of coastal erosion. It therefore recommended that coastal construction activities which could potentially interfere with beach processes do not initiate or aggravate beach erosion. However, it was acknowledged that it may not always be possible or successful to avoid such activities because the location of structures such as ports and harbours are often determined by economic or geographic needs, which may override the risks involved. The report suggested that the consequences of such activities would therefore have to be 'managed'. Such activities which were considered a 'necessity', were to be allowed beyond the setback line.

The report also recommended that buildings and investments, e.g. housing, roads or plantations, could be protected by locating them away from the zone of probable worst-case erosion. This particular idea was considered to be the primary objective of the setback line. The report exhibited a general bias towards shoreline erosion narrowing down the definition of vulnerability as largely being driven by the problem of erosion. It however mentioned the need to redefine areas of the coast where development could put people and property at risk. The report also recommended that a coastal map be developed to show hazard lines based on a 100 year return interval.

Although the Swaminathan Report, 2005 suggests that the ideas of vulnerability also include man-made hazards, the report failed to illustrate a methodology for actually doing so, and its final recommended legal scheme completely ignored this aspect.

As a follow up to the Swaminathan CRZ Review Report of 2005, an expert advisory committee was formed comprising of Dr. M. Baba (Director, Centre for Earth Science Studies), Dr. Shailesh Nayak (Director, Space Application Centre), Prof. Pethick, J. (Advisor, Government of United Kingdom) and a representative from the Ministry of Environment and Forests (MoEF). In order to map the vulnerability of different coastal stretches to natural hazards and to replace the original 'arbitrary' concept of the 500 m differential setbacks that the CRZ imposed on coastal activities, in 2005, the MoEF set up the *Expert Committee for Evolving the Methodology for Demarcation of the Vulnerability Line*. The setback line was defined in the presentations made at these meetings as a line demarcated along the coast based on its vulnerability to natural and man-made hazards (Pethick 2005).

Prof. Pethick, a member of the committee noted in his report that it was the role of the government to supply coastal communities with sufficient scientific information to allow them to make a decision as to whether the disadvantages of living in high risk areas far outweigh the advantages and locate themselves and their infrastructures accordingly. He however noted that this by itself was a complex task and therefore it was imperative that, initially, central government provide the factual basis for decision-making in a simple manner, and combine this with an education programme.

An important point to note from the Committee's recommendations was that there was shift from the term vulnerability line, employed by the Swaminathan Committee to the use of hazard lines or hazard mapping as a means to decide on activities

on the coast such as the location of settlements and infrastructure. The idea of vulnerability in the Swaminathan Report was broad enough to include even man-made hazards. This concept was modified in subsequent draft notifications and eventually the idea of mapping vulnerability to man-made hazards has been completely dropped. In fact the entire idea of mapping a vulnerability line has given way

to the mapping of a hazard line thereby only emphasizing the need to assess the impacts of natural hazards and not man-made ones.

The important recommendation of the committee, that the MoEF provide sufficient factual basis for decision-making has not yet been attended to, as seen in the subsequent draft notifications.

### Planning for vulnerability through years of reform

One of the concepts introduced in the Swaminathan committee report of 2005 was that of the setback line, to be demarcated to based on vulnerability to natural and manmade hazards. The setback line in the Swaminathan review was to be based on 7 parameters and was applicable only for the CMZ II and CMZ-III areas, based on vulnerability to both manmade and natural hazards. However, the setback line in the subsequent 2007 draft notification was based on 6 of those parameters while the 2007 concept note and 2008 draft notification considered only 4 parameters.

With subsequent draft notifications that marked the reform process, the concept of the setback line has been replaced by the hazard line, as suggested by the MoEF's Expert Committee and its application has become hazy, with the number of relevant parameters in defining and demarcating the line also having undergone changes. A brief summary of the changes in the various parameters considered to map the setback line within the Swaminathan Review, 2007 CMZ Draft Notification, 2007 Concept note and the 2008 CMZ Draft notification are given in Table I.

*Table I: Comparison of parameters used for defining the setback / hazard line in key reports and draft notifications of the CRZ reform process.*

Swaminathan Report 2005	CZM 2007 Draft Notification	Concept Note 2007	CMZ 2008 Draft Notification	Pre-draft CRZ 2010 & the CRZ 2010 Draft Notification
<p>Appendix –I SETBACK LINE The setback lines in the zones categorized as CMZ –II and III will be based on vulnerability of the coast to natural and manmade hazards. For the purpose of mapping the vulnerability of the coast, seven parameters are taken into account: elevation, geomorphology, geology, sea level trends, horizontal shoreline displacement (erosion/accretion), tidal ranges and wave heights</p>	<p>Appendix –I SETBACK LINE The setback line can be defined as “a line demarcated along the coast based on its vulnerability along the coast.” For the purpose of mapping the vulnerability of the coast, six parameters are taken into account: elevation, geomorphology, sea level trends, horizontal shoreline displacement (erosion/accretion), tidal ranges and wave heights</p>	<p>Appendix-I SETBACK LINE Definition remained the same as in the CRZ 2007. However, for the purpose of mapping the vulnerability of the coast, four parameters are taken into account: elevation, geomorphology, sea level trends and horizontal shoreline displacement (erosion/accretion).</p>	<p>Appendix-I SETBACK LINE For the purpose of mapping the vulnerability of the coast, four parameters are taken into account: elevation, geomorphology, sea level trends and horizontal shoreline displacement (erosion or accretion).</p>	<p>The term setback line is dropped altogether in this pre-draft CRZ 2010, in favour of the terms hazard line and hazard mapping. Para 5.1 states that (i) Hazard mapping – The hazard line shall be mapped by MoEF through Survey of India all along the coastline of the country. The hazard line shall be demarcated taking into account 4 parameters - tide, waves, sea level rise and shoreline changes.</p>

With regard to vulnerability mapping, the term 'vulnerability' was not defined in the original draft and the usage in Appendix (i) of the CZM 2007 draft notification was fairly narrow (Menon et al., 2007).

On the whole, the entire process of CRZ reform and the development of the concept of the setback line appears rather arbitrary since many of the decisions regarding the development of the parameters or their methodologies are still unclear. The process right from the Swaminathan report of 2005 leading upto the CMZ 2008 draft was in fact marked by a lack of transparency and public participation (Menon et al. 2007) .

At no time in any of the notifications, has there been any indication as to whether the setback / hazard line developed would be constant or dynamic. A reliable time frame also seems to be absent from any of the notifications, which is of concern since the line is to act as a regulatory line. While the Swaminathan review had 7 parameters for 'vulnerability mapping', important parameters like data on wind speeds and previous extreme weather events till date are lacking, which are also directly indicative of coastal hazards. The subsequent CMZ 2007 draft notification, in addition to wind speed and prior weather anomalies, also excluded geology as a parameter. Geology 'identifies the rock types for all coastal segments' (Annexure I Swaminathan Committee Report) and plays a vital role, along with bathymetry, in determining the impact of certain hazards such as tsunamis (Menon et al. 2007). While the setback line was to be demarcated based on vulnerability to both natural and manmade hazards, the Concept Note and 2008 CMZ Draft Notification further reduced the number of parameters to four. These 2 notifications removed tidal range and wave heights from the list of parameters, and the alteration of these parameters according to a report of the Inter Governmental Panel on Climate Change (IPCC) would be the main effects of climate change with sea level rise (Nicholls et al. 2007). Also, according to the Initial National Communication of the Government of India as part of its requirement to the United Nations Framework Convention on Climate Change, areas with maximum vulnerability along the Indian coastline were identified based on the integration of physiographic evaluations, site

specific sea level changes, tidal environment, tectonics, hydrography and physiography of the areas (MoEF 2004). While the setback line was to be based on vulnerability to manmade and natural hazards, ultimately parameters relating to manmade hazards were excluded from all the notifications.

With the costs for vulnerability line demarcation using satellite imagery reaching an astronomical figure of 150 crore rupees (MoEF 2008), the feasibility of the mapping exercise was being questioned. In addition, obtaining data for parameters like sea level rise, tidal range and wave heights was acknowledged by the MoEF's Expert Committee to be a 'Herculean task' because the data could not be uniformly obtained (MoEF 2008).

Despite the numerous consultations that took place from 2008 till 2010, and despite the fact that the 2008 CMZ notification was withdrawn, the idea of the hazard line remains although in a much indistinct shape and form. The draft CRZ 2010 notification does not give any detail of the justification and objective of the use/ purpose of the hazard line. The provisions on the same are ambiguous and seem to imply that it takes precedence over the 500 m line in determining what sort of development can take place. The Ministry has also not given any clear explanation as to how the hazard line fits into the CRZ framework and what sort of regulations will emanate from this inclusion.

Interestingly, the scientific methodology for the determination of the hazard line is not clarified and instead, only some basic parameters are listed. Only 4 parameters (tide, waves, sea level rise and shoreline changes) are to be considered for this, as against 7 which were contained in the Swaminathan Committee Report on the CRZ (elevation, geology, geomorphology, sea level trends, and horizontal shoreline displacement, tidal ranges and wave heights). Through the removal of key parameters of bathymetry, geology, wave heights and tidal ranges for hazard line determination, the MoEF has invited criticism over the rigour of the science it employs. In fact the entire section on the methodology of the preparation of the hazard line has been omitted.

Table 2: Comparison of premise and approach to vulnerability in key reports and draft notifications of the CRZ reform process.

CRZ Notification, 1991	Swaminathan Report – 2005	Final Frontier Report 2009	Pre-draft CRZ 2010, April 2010	Draft CRZ 2010, September 2010
<b>Premise</b>				
The 1991 notification employed a system of differential setbacks for various activities. However, this was not based on vulnerability to natural hazards alone.	The report brought focus towards the vulnerability of the coasts due to natural hazards in the wake of the 2004 Indian Ocean tsunami and its devastating impacts. It introduced the idea of vulnerability, a hazard line and setbacks. Mainly it recommended regulating development through the demarcation of a 'Vulnerability Line' or a Setback Line	It noted that coastal areas were doubly vulnerable, particularly to climate change related devastation. It also recommended that policies should be introduced to cope with and adapt to the future dangers from sea level rise and increased vulnerability of the coasts.	The notification states in its preamble that it draws extensively from the recommendations of the Final Frontier and earlier reports - one of which is the concern related to sea level rise and increasing coastal hazards.	The notification states in its preamble that the purpose of the CRZ is to ensure protection to coastal populations and structures from risk of inundation from extreme weather and geological events.
The 1991 notification mostly deals with regulating development on the coast and is not based solely on the idea of its vulnerability to natural hazards alone. It has more of a focus on man-made vulnerabilities due to over-industrialisation and pollution. The only natural hazard mentioned is sea level rise, for which the notification requires such areas to be declared CRZ - I or no development areas.	The report mentions a few natural hazards such as coastal erosion, sea level rise due to greenhouse effect, cyclones and storm surges, flooding, salt water intrusion and tsunamis.		Para 2(iii) of the pre-draft states that the CRZ shall include the land area falling between the hazard line and 500mts from HTL on the seaward side. In case of hazard line as meaning the line demarcated by Ministry of Environment and Forests (MoEF) through Survey of India (Sol) taking into account tides, waves and sea level rise and shoreline changes.	Para 2(iii) of the pre-draft states that the CRZ shall include the land area falling between the hazard line and 500mts from HTL on the seaward side. In case of hazard line as meaning the line demarcated by Ministry of Environment and Forests (MoEF) through Survey of India (Sol) taking into account tides, waves and sea level rise and shoreline changes.

*Table 3: Comparison of the overall design and application of the idea of vulnerability in key reports and draft notifications of the CRZ reform process.*

<b>CRZ Notification, 1991</b>	<b>Swaminathan Report – 2005</b>	<b>Final Frontier Report 2009</b>	<b>Pre-draft CRZ 2010, April 2010</b>	<b>Draft CRZ 2010, September 2010</b>
<b>General design</b>				
For prohibited activities, the distance of the CRZ line was considered a setback line	Vulnerability maps in the U.S are prepared according to 7 parametres and this is the basis on which even the vulnerability line proposed here shall be based. (page 25).	The report notes that it is imperative that the Ministry undertake a project to demarcate the vulnerability and hazard line along the coast. This will take into account present and future risks because of projected sea level rise and other threats. Once done, the demarcated vulnerability and hazard line must be incorporated into the CRZ 1991. This will initiate steps to improve protection of critical infrastructure and thickly populated areas. The study would also provide policy directions for adaptation strategies in coastal areas.	There is absolutely no mention of the vulnerability line in this notification. Instead the entire notification talks only about the hazard line and its mapping.	Same as the CRZ pre-draft of April 2010
	The setback lines in the zones categorized as CMZ –II and III will be based on vulnerability of the coast to natural and manmade hazards. This procedure is followed in many countries including USA where the coast has been mapped for vulnerability to coastal hazards.		The idea of a setback line was dropped altogether. Instead the earlier 1991 principle of regulating activities within the 500 m mark was resorted to. However, many more non-foreshore and waterfront requiring activities were permitted. The idea of a hazard line was introduced although nothing was clarified about its role in restricting development.	Same as pre-draft CRZ, April 2010

*Table 4 Comparison of the overall design and application of the idea of vulnerability in key reports and draft notifications of the CRZ reform process.*

<b>Swaminathan Report – 2005</b>	<b>Draft CMZ Notification 2008</b>	<b>Pre-draft CRZ 2010, April 2010</b>	<b>Draft CRZ 2010, September 2010</b>
<b>Parameters</b>			
Elevation: - The elevation data shall be obtained from the available coastal toposheets satellite data surveys.	Elevation: - The elevation data shall be obtained from the available coastal toposheets satellite data surveys.	For the purpose of depicting the flooding due to tide, waves and sea level rise in the next fifty/hundred years, the contour mapping of the coastline shall be carried out at 0.5m interval upto 7km from HTL.	Para 5(iii) states that For the purpose of depicting the flooding due to tides, waves and sea level rise in the next fifty and hundred years, the contour mapping of the coastline shall be carried out at 0.5m interval upto 7km from HTL on the landward side.
Geology: - The geology identifies the rock types for all coastal segments.			
Geomorphology:- the land forms will be identified on the maps based on the available toposheet and remote sensing data. Bathymetry to be derived from naval Hydrographic Charts on location specific surveys	Geomorphology:- the land forms will be identified on the maps based on the available toposheet and remote sensing data. Bathymetry to be derived from naval Hydrographic Charts on location specific surveys		
Sea level trends: - The sea level trend data shall be obtained from the data available in the Ministry prepared based on primary data published by Survey of India.	Sea level trends: - The sea level trend data shall be obtained from the data available in the Ministry prepared based on primary data published by Survey of India		
Horizontal shoreline displacement: - The erosion/accretion data used for horizontal shoreline displacement shall be obtained from long term information derived from Survey of India Topographic maps (1967) and the latest satellite data.	Horizontal shoreline displacement: - The erosion/accretion data used for horizontal shoreline displacement shall be obtained from long term information derived from Survey of India Topographic maps (1967) and the latest satellite data.		Para 5(iii) Shoreline changes shall be demarcated based on historical data by comparing the previous satellite imageries with the recent satellite imageries.
Tidal ranges: - Tide table published by the Survey of India.			

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# CONCLUSION

Vulnerability is variously defined. The MoEF's expert committee on demarcating the vulnerability line defined vulnerability as *"the potential for adverse consequences caused by a hazard and includes the potential to suffer harm, loss or detriment from a human perspective"* (Pethick 2005), which could be measured both quantitatively (e.g. using economic methods) or qualitatively (e.g. using relative indices).

The focus of vulnerability assessment in coastal zones as seen in the Swaminathan Committee report of 2005 appeared to be largely on erosion and land loss due to sea-level rise. Present day methodologies of addressing vulnerability now increasingly consider the wide range of climate and impact variables that play a part in determining coastal vulnerability, as well as non-climatic developments. As Klein and Nicholls (1998) have stated, vulnerability to impacts is a multi-dimensional concept, encompassing biogeophysical, economic, institutional and socio-cultural factors.

Although the entire basis of a revised coastal regulation as suggested by the Swaminathan Report, 2005 was to be based on responding to the vulnerability of coastal populations and ecosystems, in actuality, it really only focused on natural hazards. The MoEF's Expert Committee's suggestion that a shift be made in terminology from mapping a 'vulnerability line' to the idea of mapping the 'hazard line' found support as seen in the subsequent draft notifications.

The MoEF expert committee defined this line stating that *"the term 'hazard' refers to the potential for future events (natural) to adversely affect humans or things valued by humans. Hazards are normally considered to be episodic and therefore their frequency of occurrence is expressed as a probability. Risk is expressed as the product of the likelihood of a hazard and its adverse consequences. The MoEF's expert committee defined risk as being "based on coastal hazards with a one percent (1%) probability of occurrence in any given year, after accounting for the median estimates of mean sea level rise and horizontal shoreline displacement in the next one hundred (100) years"* (Pethick 2005).

That the hazard line would then define all development alone was evident but how it would do so was certainly not clear. For instance, in the CMZ-II areas (developed areas) as defined by the CMZ Notification, 2008, it was not clear how the setback line would apply to 'Areas of Particular Concern'. In this zone while 'new houses and settlements' were only permitted on the landward side, 'new constructions' or 'new developments' which are not settlements and houses, would be allowed on the seaward side. Fisherfolk require access to the coast for their day to day livelihood activities (Bharathi 1999; Praxis 2005; Salagrama 2006), and the building of new houses on the landward side of the setback line is likely to lead to clashes dealing with caste and with non-fishing communities (Sridhar 2008). It also became evident that this setback line did not apply new constructions or developments such as hotels, resorts and industries. This only served to heighten the suspicion that fisherfolk were being alienated from coastal spaces.

While the setback line was introduced with the idea of protecting the coasts and the people living along it, so far little good seems to have come of this concept. With a reduction in the number of key parameters in determining the vulnerability of an area, from 6 to 4, the MoEF's draft CMZ notification 2008 faced a lot of criticism. Further in the present notification, it is not clear what methodologies are being employed to address not just the challenge of mapping natural hazards, but also measuring shoreline displacement.

Questions about the availability of accurate data to study the various parameters involved in demarcation of the hazard mapping suggested in the present Draft 2010 remain unanswered.

Clear monitoring mechanisms and specific deadlines by which the data on the various parameters should be available do not exist. The setback line was originally thought of with lofty aims and solid scientific backing, but the subsequent lack of implementation seems to have derailed the entire purpose.

Despite the services of an expert advisory committee from around the world, a majority of the suggestions originally made seem to have been left out from the current notification. The rationale behind these exclusions has not been explained to the public and without proper justification public skepticism is bound to increase. An increased public participation, especially from the fishing communities, should be high on the priority list. The government also needs to be more transparent regarding its rationale to allow development by non-coastal agencies. Without rethinking the entire concept of vulnerability, from both the scientific and social angle, the idea seems doomed to failure.

Several coastal processes such as shoreline displacement, cyclones and storm surges are dynamic and although scientific advances have made it possible to predict these, the timeframes and costs involved make it difficult to base a regulatory framework for coastal areas purely on these facts. The CRZ Notification of 1991 required that the High Tide Line be demarcated all along the coast, both by means of a map as well as on the ground, to enable the implementation of this law. This has not been undertaken successfully in a single coastal state and the reason for the same can hardly be ascribed to the lack of funds.

The CRZ Notification in its original version was not alien either to the idea of 'setbacks' nor to the concern around the vulnerability of coastal ecosystems and coastal populations. But its entire history is replete with evidence of poor implementation and the vested interests that caused this. Almost all of the 25 amendments of the notification diluted it and permitted more non-coastal activities on the coast. Coastal spaces are today highly coveted lands. While climate change scenarios indicate that most of these coastal spaces might be high risk areas, business today is moving towards these spaces at a rate that has concerned the fishing community whose common lands and sources of livelihood are being targeted. Against this backdrop, the battle for settling disputes over development on the coast has both gained and suffered from the CRZ Notification 1991,

depending on how legal cases were fought and how clauses were interpreted.

The reports, draft notifications, the expert committees and indeed the myriad projects that will constitute the coastal regulation reform process however has not been based on an assessment on why the CRZ 1991 was not allowed to perform in the first place. The present draft contains the same amendments and dilutions made to the 1991 law. It also does not address coastal vulnerability concerns in a fully comprehensible or transparent manner.

There have been several committees and public consultations and of course nearly 6 years have passed since the Swaminathan report was introduced. Having examined the script and the plot of active legal reform that began in 2004, it is hard to imagine that the current draft CRZ 2010, actually represents an improvement over the arbitrariness of the 1991 Notification's design.

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The basis for many legal regulations is often ascribed to certain concerns, principles and concepts. Coastal regulation legislations has seen several shifts and changes in these ideas. The concern around 'vulnerability' has seen the emergence of ideas and responses such as introducing 'setbacks' for development and establishing 'hazard lines' within coastal regulation law. This report explains how these ideas around coastal vulnerabilities found their way into the debates on coastal management and the implications of its proposed formulation in legislation. In doing so, this report evaluates how government authorities and committees have articulated these concepts and whether the present efforts towards incorporating these ideas into legislation will actually result in enhanced protection for coastal communities and ecosystems.