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Environmental assessment after the 2004 tsunami: a case study, lessons and prospects

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Humanitarian aid projects carried out after the Southeast Asia tsunami must protect, conserve and manage environmental resources for sustained household and community recovery. This paper explores the role and contributions of environmental assessment (EA) in assessing and managing the impacts of these projects. The focus is on community-based EA of small, village-level rehabilitation and reconstruction projects typically implemented by nongovernmental organizations for long-term recovery. Lessons from an EA case study of housing reconstruction in Indonesia show that community EA can provide timely information for protecting water supply and reducing risk of slope movement, and that community participation can provide useful input for site planning, rehabilitating farmland and securing land title for women-headed households. These contributions are useful for sustainable project design, local resource management, and facilitating the transition from temporary to permanent housing. Future prospects for community EA include strengthening linkages among strategic and rapid forms of EA, compliance with EA requirements increasingly reinstated after the emergency phase, and greater use of supplementary or alternative EA approaches such as class assessments.

Keywords: community environmental assessment, post-disaster EIA, tsunami, reconstruction, housing, Indonesia

THE MASSIVE Sumatra–Andaman earthquake on December 26, 2004, measuring 9.3 on the Richter scale, generated enormous tsunamis that inundated coastal areas of the Indian Ocean (Lay *et al*, 2005). The magnitude of this natural event and low disaster preparedness resulted in a high death toll, large numbers of displaced persons, and extensive destruction and damage to infrastructure, settlements and livelihoods. Recovery may take ten years and cost more than US$10 billion (Burke, 2005).

Environmental resources were also affected. Seawater contaminated drinking water in thousands of open wells, and salinized large tracts of farmland. Sewage spilled from flooded septic systems, and petroleum and chemical products were released from damaged production or storage sites (refineries, retail shops), posing a risk to human health and wildlife.

Safe disposal of huge volumes of debris and rubble from collapsed structures is also a significant environmental challenge. Further, the tsunami damaged ecological assets such as coral reefs, mangroves and protected areas. Where these systems were largely intact, impacts on human systems were generally not as great as those areas where reefs and mangroves were destroyed by years of coastal development (UNEP, 2005).

For the first six months, the emergency humanitarian response emphasized meeting basic human needs of water, food and shelter. The response then

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shifted to medium- and long-term rehabilitation and reconstruction initiatives, which will continue for several years. These initiatives include: repairing major infrastructure such as roads, ports and power plants; rebuilding community assets including schools, clinics and markets; and rehabilitating agriculture and fisheries. One of the highest priorities during this phase is providing permanent housing and related household needs of potable water, sanitation and livelihoods.

An emerging challenge of the rehabilitation and reconstruction phase is the protection, conservation and sustained use of those resources upon which long-term recovery depends. For example, water quality may be at risk of contamination from land clearing and erosion on new housing sites, poorly designed septic systems or leaching of fertilizers and pesticides used for agricultural rehabilitation.

Similarly, provision of potable water from new wells or rehabilitated municipal systems requires careful allocation of scarce freshwater, especially in coastal areas where industry, irrigation and tourism also compete for the same supply. Rehabilitation of irrigation schemes damaged by seawater requires removal and safe disposal of saline silt from canals, and preventing further increases in soil salinity from the same irrigation practices as before the tsunami. The impacts of these projects on environmental resources must be considered in project design if beneficiaries are to receive full and continued project benefits.

The purpose of this paper is to demonstrate the role and utility of environmental assessment (EA) in the design and implementation of proposed rehabilitation and reconstruction projects that are part of the tsunami response. The EA process is challenging because of urgent human need and because environmental resources degraded by the tsunami need to be protected from additional impairment that could result from reconstruction and rehabilitation projects.

By identifying and mitigating adverse effects of these projects on environmental resources, EA can make effective and timely contributions to the sustainability of those resources that are critical for long-term recovery. When these contributions are integrated into project design and implemented, revival of livelihoods, households and communities are more likely to be environmentally sustainable.

The paper is focused on rehabilitation and reconstruction projects at the community level. These are typically smaller initiatives aimed at household recovery and involve the beneficiaries in project design and implementation. Examples include constructing family houses, drilling wells, repairing schools, building fishing boats and rehabilitating small irrigation schemes. These projects are usually managed by nongovernmental organizations (NGOs) that facilitate local involvement through participatory processes such as community meetings and consulting women's groups. The participatory nature of these projects necessitates a community approach to EA. A case study demonstrates how community EA of rehabilitation and reconstruction projects can make a difference in the tsunami response.

The paper first describes the concept and approach of community EA for post-tsunami projects, distinguishing it from other types of EA. An application of community EA is then demonstrated using a case study of a proposed housing project in a coastal village of Indonesia. Lessons learned and prospects for community EA in post-tsunami recovery conclude the paper.

Community EA of post-tsunami projects

Communities are increasingly viewed as essential partners with government and the private sector for sustainability governance, and community-based approaches are advocated widely in resource and environmental management (Dorcey, 2004; Wismer and Mitchell, 2005; Wismer *et al*, 2005). Similarly, community-centered processes are promoted for environmental assessment (Hunsberger *et al*, 2005; O'Rourke, 2004). These processes also are being adapted and tested for EA of international development projects (CIDA, 2005a; Pallen, 1996; Spaling *et al*, 2001). An EA that uses community-centered processes for assessing the environmental sustainability of small development projects is referred to as community EA (Spaling, 2003).

Community EA is characterized by (Spaling, 2003; Spaling *et al*, 2001):

1. a rapid appraisal guided by scoping of key potential impacts and issues,
2. analysis of available documented information and observations from site visits (rather than exhaustive field work or comprehensive scientific studies),
3. participation of affected communities with specific attention to ensure equitable participation of women and men, local resource users (fishermen, hunters, medicine women) and other stakeholders in the project area, and
4. professional opinion of consulted experts and EA team members.

This approach is distinct from conventional EA in several ways. In EA generally, the scale and complexity of a proposed project, or the environmental sensitivity of its location, determines the corresponding level of effort and detail required for the assessment. Large projects, or those in environmentally sensitive areas, are usually subject to comprehensive assessment, requiring more detailed scientific investigation.

Community EA is generally applied to smaller projects and is less detailed because of rapid identification and assessment of potential impacts. Many proposed rehabilitation and reconstruction projects are small household or community-level undertakings focused on water supply, shelter and livelihoods. The nature and scale of these projects imply that community EA is an appropriate approach. A community EA may still recommend a comprehensive EA, if more detailed assessment is needed.

Participation of project beneficiaries and other stakeholders is also a central feature of community EA. However, unlike most conventional EA, participation is neither a separate step nor a public review phase. Instead, community views and concerns largely drive the assessment. This input is particularly important for scoping key concerns and impacts early in the EA. Post-tsunami participants typically focus on issues of resource quality, particularly as these relate to basic and livelihood needs (contaminated water, salinized farmland). Impacts identified at the scoping stage are then analyzed, and those assessed as significant are mitigated in subsequent steps.

Another distinction is the mode of community participation. Methods of public involvement common to conventional EA are mostly replaced by techniques of participatory rural appraisal (PRA). PRA, and its variants, such as participatory learning and action, are a semi-structured but systematic process for involving communities in the gathering, analysis and use of information for their own benefit (Chambers, 1994; Beebe, 1995). PRA tools that are useful for gathering traditional environmental knowledge and identifying locally valued resources include community mapping, transect walks, informal interviews, ecological histories, among others (CIDA, 2005a; Wiltshire, 2005; NES *et al*, 1991). The utility of PRA tools for community EA is demonstrated in the case study.

Special attention is given to gender in community EA. Given differences in environmental resource use and inequalities between women and men, it is important to understand how resource use and priorities differ by gender during disaster recovery. PRA tools may also exhibit gender bias. Sometimes specific consultations with women alone may be required. Views and concerns from women should be identified through the EA and, where necessary, mitigated specifically for them.

A further consideration is disaster risk reduction. This involves increasing the capacity of communities and households to prevent, prepare for and respond to disasters. Community EA can help mitigate risk by assessing and managing both the effects of a disaster on the project, particularly natural hazards, and the impact that a project may have on natural events or processes (for instance, leveling coastal dunes for housing may increase exposure to future tsunamis). Means of disaster risk reduction are considered under mitigation measures.

Finally, community EA is distinct from the rapid environmental assessments that were conducted after the tsunami (Ministry of the Environment, 2005; UNEP, 2005; UNEP/OCHA, 2005a; 2005b). Rapid EA is carried out immediately after disasters to identify the extent and severity of environmental damage and assess risk to human health, contamination of critical resources such as water supply and farmland, and damage to sensitive ecosystems and protected areas (for instance, coral reefs, wildlife reserves) (Kelly, 2001).

Community EA and rapid EA are both quick and participatory, but community EA differs by focusing on project-related impacts rather than cataloging the effects of a disaster. Rapid EA reports for the tsunami concluded that there were no life-threatening environmental emergencies, but did identify urgent environmental problems related to debris, sewage and sanitation, and urged EA of proposed rehabilitation and reconstruction projects (Ministry of the Environment, 2005).

Case study: rebuilding Layeun village

Survivors from four coastal villages that were completely destroyed by the tsunami have come together to rebuild at Layeun village in Aceh Besar District on the northwest tip of Sumatra, Indonesia (Figure 1). The 710 surviving residents selected this site because of land availability, water supply, proximity of resources for livelihoods (farming, fishing, forestry) and road access. The proposed project will construct 183 houses, a health clinic, village office and three community wells, and also assist with recovery of agriculture and fishing livelihoods, and sewing income for women. The community's NGO partner is World Vision and the project is funded, in part, by the Canadian International Development Agency.

A community EA of this housing project was carried out in May 2005 and is among the first to be completed after the tsunami. This project was selected for the case study because housing is the priority need in tsunami-affected areas, estimated at

Figure 1. Layeun in geographical context of Southeast Asia

100,000 new homes in Indonesia alone, and is a major focus of reconstruction (HFH, 2005). The EA case describes the types of impacts and issues associated with housing projects in a post-tsunami environment, and it explains how these were identified, assessed and mitigated.

The case is divided into three parts. Part one describes the project and its environmental context; it briefly identifies EA policies affecting the project and the overall EA approach. Particulars of the community approach used to identify and rank issues and concerns during the scoping stage are demonstrated in part two. Part three explains how impacts were assessed for significance, and then mitigated.

Project background

Layeun village is located in a U-shaped coastal valley. Slopes have thin, poorly developed soils and rock outcrops; they are covered with secondary bush with some old growth forest on the ridges. Spring seepage is evident on some lower slopes. The valley bottom is flat, poorly drained and used for farming. Surrounding the entire valley up to 25 metres is a tsunami scar — a ring of stripped forest, exposed soils and outcrops.

A causeway separates farmland from the shoreline, which the tsunami moved inland about 100 metres, completely destroying the original village. The survivors built temporary shelters upslope and further inland. Water supply and sanitation are major challenges at this site. Wells were flooded by seawater and latrines were constructed in zones with shallow groundwater, further threatening supply.

Recovery of resource-based livelihoods is another challenge. About 75% of the residents were fishermen before the tsunami, collectively owning 15 catamarans, none of which survived. The remaining residents are farmers, growing rice, corn and vegetables on the valley bottom, which is now saline. Women also maintained small ‘kitchen’ gardens near the house and used sewing to supplement their livelihood, but their seeds, tools and sewing machines were all destroyed.

Residents are eager to rebuild their homes and livelihoods. The community appointed a resident with some technical education to prepare a general layout for the housing project (Figure 2). A technical survey and site plan have also been prepared by a contractor. These plans will be reviewed through a community consultation process, and consensus reached on the final site plan.

Both plans reflect a strong desire among tsunami survivors for their new homes and community facilities to be located on higher ground. For this reason, houses will be located along both sides of an existing access road that is 3–5 metres above sea level. This road follows the perimetre of the valley, forming a loop off the main Banda Aceh–Meulaboh Road. Above the road, where slopes are generally steeper, plots include a five-metre buffer upslope.

Site preparation will involve cut and fill. Soil from plots above the road will be excavated to level

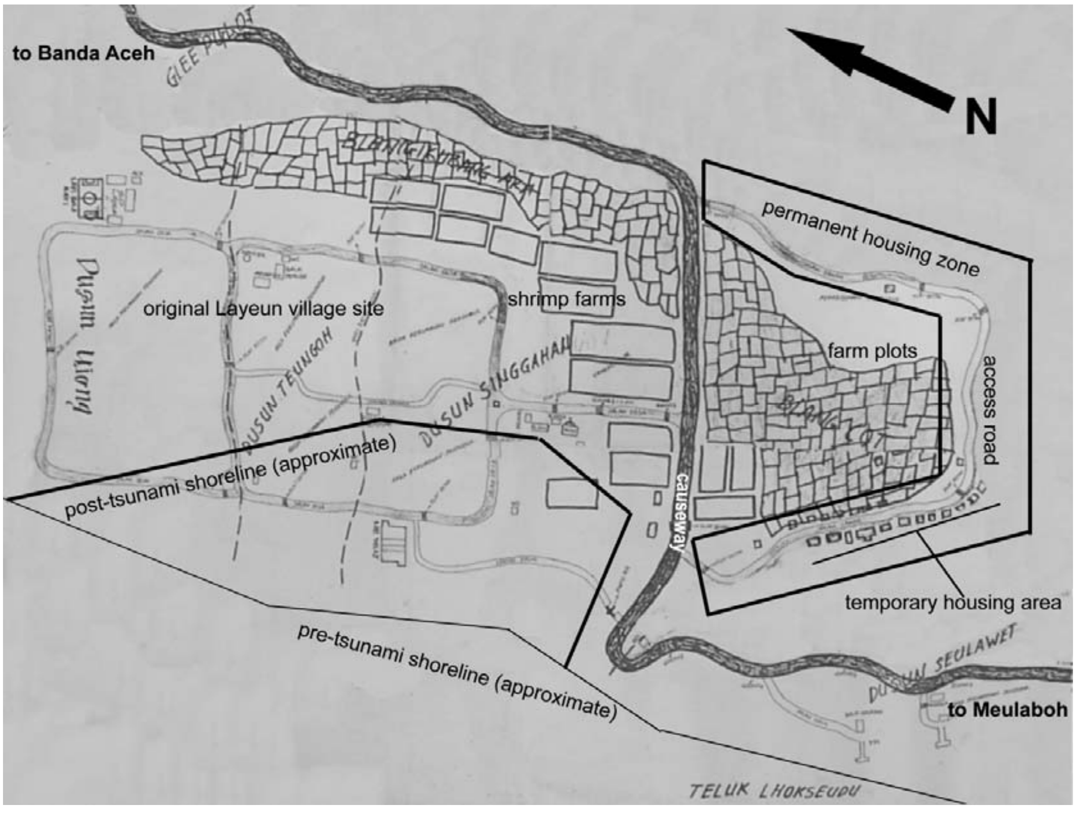

Figure 2. Community’s layout of Layeun housing project
Note: Shorelines and typed labels added by authors
Source: Photo credit: Andrew Bingeman

and deposited on plots below the road, raising their elevation. Higher plots will be contoured for site drainage into the roadside ditch, which enters perimeter channels along farmland. Lower plots drain directly into these channels. The main outlet for the entire valley is a culvert under the causeway of the Banda Aceh–Meulabon Road. The culvert is near sea level, allowing some tidal flow, which sustains a small area of mangrove that was replanted by the community after the tsunami.

Three deep wells will be drilled for a community water supply. During the site visit, it was observed that one such well was being drilled at the toe of the slope and on farmland. A 'bucket-flush' latrine, including a septic tank, will be constructed for each house. Home owners are to build their own bathing and laundry area (about 2 metres × 2 metres) in the backyard. Grey water will drain into ditches or farm channels.

Private land was donated free to the community for its resettlement. Each home owner is to receive legal land title for their individual plot.

EA requirements and approach

Indonesian EA legislation was suspended after the tsunami but may apply to future rehabilitation and reconstruction projects (discussed later). However, Canadian environmental policy applies to this project at two levels. First, federal funding guidelines require that projects exceeding CAN$5 million be subject to a strategic environmental assessment. The Canadian International Development Agency conducted a strategic EA of World Vision's proposal for humanitarian aid in response to the tsunami (CIDA, 2005b). The strategic EA generally identified potential environmental impacts of, and mitigation measures for, shelter, water, sanitation and livelihood initiatives, and committed World Vision to conduct more detailed assessments of each project.

Second, projects were exempt from formal EA requirements of the Canadian Environmental Assessment Act because of the humanitarian emergency, but the Agency does require all funded projects to adhere to its *Policy for Environmental Sustainability* (CIDA, 1992). The Agency recently prepared an *Environmental Handbook for Community Projects* to help NGOs implement this policy (CIDA, 2005a). Its guidelines informed the community EA of the Layeun housing project.

A standard practice in EA is to explore alternatives to the project. This was not done for the housing case because permanent housing is the preferred alternative for tsunami survivors living in temporary shelters, and considered a priority by the Indonesian Government and among humanitarian aid agencies. The community EA for the proposed Layeun housing project was organized around the generic steps of scoping, impact analysis, significance assessment, mitigation and follow up, but these were implemented in a somewhat fluid and iterative fashion to facilitate community input using PRA tools. These tools consisted of a community meeting, focus groups consisting of women and farmers, household interviews, a transect walk, and a site sketch or footprint analysis.

Gathered information was used to scope key impacts and issues for further analysis and assessment (discussed further below). A multidisciplinary team (ten people) comprised of Canadian (five) and Indonesian (five) contingents conducted the community EA. Team members also consulted local experts (hydrology, soils), other humanitarian aid organizations, an interagency working group on water and sanitation, and a consortium of environmental NGOs. Training, field work, meetings and report writing took about five days.

Scoping community issues

Scoping is a critical phase that determines the content for the remainder of the EA. In community EA, scoping is driven by participation. Participatory methods and PRA tools used during scoping to identify community views and concerns for this project included:

- a community meeting with 30 participants (12 men, 18 women);
- focus groups with 29 women to solicit gender-specific resource issues;
- transect walks accompanied by residents through the temporary shelter area and along the access road proposed for permanent housing;
- informal interviews with farmers and fishermen during the transect walks;
- review of the community's site plan with local leaders;
- observations of the landscape and land use.

Sample views and concerns from the Layeun community are listed in Table 1. Those expressed by women are identified as such. Community issues were supplemented by input from the EA team based on site observations, debriefing sessions or document review.

A consultation-intensive process usually results in myriad views and concerns. Since it is impractical for an EA to consider each in detail, these must be ranked to identify priority issues or impacts. This was done through basic risk analysis (Table 1). The assumptions are that all views and concerns are not equally important or relevant, and that their exposure level and probability of occurrence can differentiate these.

Exposure refers to the number of people potentially affected over time in an area. Probability is the likelihood of an impact occurring over time. Exposure and probability are appraised qualitatively as low, medium or high. Issues with the highest risk are selected for further assessment in the EA process. The fact that other views and concerns are rated lower does not diminish their importance, such as

Table 1. Sample of scoping issues for the Layeun housing project, Indonesia

Women	Community views and concerns, and EA team input	Exposure			Probability		
		low	medium	high	low	medium	high
	Community views and concerns						
√	No clear rule for land ownership when the housing is done, especially for widows			•			•
	Lack of space for a garden in front of the new house may affect family self-sufficiency		•		•		
√	Difficult access to house plots on steep slopes, especially for women, children and the elderly		•			•	
	Existing well water is not good for drinking or cooking, but can be used for washing, bathing, etc			•			•
√	New drilled wells may be salty because of proximity to the ocean			•			•
	Loss of cooking utensils and farm tools for household recovery		•			•	
	Latrines should not be too close to the kitchen in the new house (odour)		•		•		
	Need training in sewing to earn extra money		•			•	
	EA team input						
	The site plan shows that:						
	- 76 plots are on steep slopes on the west side of the site with potential slope instability			•			•
	- 16 plots are at low elevation with risk of flooding, even after cut and fill (1-2 m above sea level)			•			•
	- 25 plots are on farmland			•			•
	The project may be affected by natural hazards: tsunamis, earthquakes, flooding, slope movement			•		•	
	Military presence (checkpoint ~1 km from site)		•				•

the need for training in sewing or nearby military presence (Table 1). These are still included in the EA report for subsequent consideration.

In community EA, risk analysis is a scoping tool for rapid ranking and grouping of environmental impacts with greatest potential risk so that these may be assessed further, and mitigated as needed. The remainder of the case study summarizes these steps.

Assessing and mitigating impacts

The EA grouped the issues with highest risk into four impact categories:

Contamination of water supplies In the temporary shelter area constructed during the emergency phase, hand-dug wells, already saline from seawater, are at risk of further contamination from public latrines that do not meet minimum standards of separation (30 metres) or depth to water table (1.5 metres) (Sphere Project, 2004). However, the design and location of latrines for the permanent houses should minimize contamination risk. Latrines will be upslope, or on elevated plots, with sufficient depth to water table, and dispersed along the valley road (one latrine per house), which should reduce septic loading at any one site.

Women were concerned about saltwater intrusion in the newly drilled wells, as a result of shoreline regression; however, this is unlikely to happen since well depth (>100 metres) should be below the saltwater interface. However, the well located on farmland is at significant risk of contamination from fertilizer and pesticides, and from plot and road drainage above the well, all of which may enter the well directly. This may be mitigated by sealing and protecting the well head, constructing a drainage apron, and avoiding fertilizer or pesticide use within 10 metres of the well.

Risk of natural hazards Seismological evidence suggests strong potential for other earthquakes along the Sumatra Fault line (Lay *et al*, 2005). While the probability of another earthquake-induced tsunami in the near future is considered to be low, but not negligible, the potential of a major earthquake on land is thought to be quite high. However, the potential impact of tsunamis and earthquakes on this project is deemed insignificant because of high community awareness, relocation to higher ground and single-storey housing.

Another risk is flooding in low-lying areas because of restricted outflow from only one culvert under the causeway, especially after prolonged, heavy rainfall combined with high tide. Sixteen house plots are below the height of the causeway, which means that rising water may flood them before flowing over the causeway. Overall, flooding hazard is rated as insignificant because of the small magnitude, low frequency, short duration (one tide cycle) and limited area of any flood.

An additional hazard is slope movement, which may be affected by cut-and-fill construction, especially at the toe of steep inclines. Further, unconsolidated fill may become saturated from rain or seepage, resulting in unstable soil that may weaken foundational support. Risk of slope movement and unstable soils are significant impacts that can be mitigated through construction techniques (caissons for buildings, retaining walls), contouring plots for proper drainage and replanting slopes.

Conversion of farmland According to the site plan, about 25 houses will be located on farmland, representing about 6% of the total farmland area. This loss of farmland is considered insignificant because of the small proportion of total farmland converted. Farmers who loose their land will be compensated with other land nearby, according to the community. Farmers also stated that seawater affected soil salinity but think that rainfall will dilute it. The tsunami deposited some sand in the rice paddies, which will be ploughed in with the cover crop. Thus, long-term effects on soil quality are regarded as insignificant.

Secure land title Women expressed concern about securing land title, especially for women-headed households. They felt uneasy about the project's plan to settle land title after occupancy. This significant issue emanates from land inheritance customs that may result in land claims against a plot that is not legally owned by the occupant. It should be mitigated by transferring land title as soon as possible, and providing access to legal services for women.

These mitigation measures should help protect water quality, manage risk from natural hazards and acquire land tenure. Responsibility for mitigation, follow up and monitoring were assigned to specific programs (departments) within World Vision (proponent). For example, water from the new wells, especially the well located on farmland, should be tested by the Water and Sanitation Program for drinking parametres immediately after drilling, after 30 days and, if potable, every six months.

The Shelter program should provide technical advice to contractors on constructing caissons for houses located on steep slopes, and monitor slopes seasonally for any movement. In addition, the General Protection Program should resolve land title for three to five test cases, including for women-headed households, and then monitor progress every four months until all homeowners have title.

This case study demonstrates how an EA approach, driven by community views and concerns, including consideration of gender, can effectively identify and manage key impacts of a housing project in a tsunami-affected area. Incorporating these findings into project design should help protect, conserve and manage environmental resources needed for sustained household recovery, and also prepare better against future disasters.

Lessons learned

Several lessons for community EA of post-disaster projects can be gleaned from the case study. First, the spatial and temporal scales of rehabilitation and reconstruction projects facilitate rapid community-level assessment. The EA case of the Layeun housing project, with a footprint of 4.2 hectares, demonstrated that community EA can contribute to the sustainability of water supply and farmland, mitigate risk of natural hazards and secure land tenure, even for small projects. The anticipated reconstruction of some 100,000 houses in Indonesia is likely to be comprised of numerous small projects such as at Layeun. Community EA is best suited for assessing and managing the impacts of these projects without causing undue delay in meeting urgent human needs.

Second, the transition from emergency humanitarian aid to rehabilitation and reconstruction projects for the rapid recovery of households and communities is a particular challenge in post-disaster projects. This transition is characterized, in part, by uncertainty about, and sometimes conflicting views on, when EA regulations suspended for the emergency phase should be reinstated. An emphasis in community EA on rapid assessment, and early scoping of priority issues, implies that EA findings can facilitate this transition.

Community EA can also generate timely and relevant input for prompt project delivery to meet recovery needs. In the case study, public latrines constructed during the emergency phase were observed to pose a further risk to shallow wells already saline, confirming the project's plan to drill deep wells. However, the EA observed that one of these wells was at risk of contamination because of its location on farmland and below a roadside ditch. This information proved timely for protecting water supplies during the transition from emergency shelter to permanent housing, and demonstrated the importance of conducting EA before project implementation.

Third, meaningful participation in community EA provides an opportunity for project beneficiaries to participate in decisions in which they otherwise may not have had a say. Views and concerns expressed during scoping drive the EA process with special consideration given to gender. An example from the case study is the anxiety among women about securing legal title for the housing plots, especially for women-headed households. The EA also responded to women's concern about the salinity of deep wells by explaining the difference between shallow (saline) and deep groundwater, and the importance of well depth for securing new supply.

Further, farmer knowledge about climate and soils proved useful for determining that soil salinity would decrease through rainfall, thus avoiding technical and expensive mitigation measures for agricultural rehabilitation. The community EA showed that meaningful input from women and men, and open exchange of traditional and scientific knowledge, were important factors for protecting, conserving and managing resources needed for household and livelihood recovery.

Community EA also faces several challenges in the post-tsunami reconstruction process. Many development NGOs lack EA capacity, although this is changing through increased awareness of the importance of environmental sustainability in ensuring continued project outcomes. NGOs already have considerable capacity in community development and PRA techniques, which are readily adapted for community EA. In the case study, training in community EA included a one-day workshop, field application and daily debriefing sessions.

Another challenge relates to community input. In post-disaster contexts, this input may be skewed in favour of urgent human needs. For example, concerns from Layeun residents focused exclusively on resources essential for household recovery, such as water and farmland, but did not mention wildlife, old growth forests or coral reefs. A single-minded focus on participation may also ignore or downplay scientific information (sources for this information may also be destroyed or damaged during disasters). Further, post-disaster communities may lack strong leadership and social organization for some time. For these reasons, the EA team supplemented community input in the case study.

Perhaps the biggest challenge is the disaster context itself. Sophisticated analysis of digital data, field work in idyllic settings or public involvement governed by timely notices and held in comfortable venues are the luxuries of conventional EA. Community EA of rehabilitation and reconstruction projects is confronted by devastated natural environments, communication and logistical difficulties, destroyed information records (data, reports, maps), personnel shortages and, most strikingly, direct interaction with people experiencing personal and family tragedies. All these take their toll on a team.

Yet, tsunami survivors are amazingly resilient, having elected leaders, established local governing structures, selected a site for reconstruction, prepared a basic development plan and worked with aid agencies in clearing debris, providing water and sanitation, and replanting mangrove trees. They are eager to rebuild their livelihoods and communities, and very willing to participate in a community EA, especially in addressing environmental concerns such as contaminated water, salinized farmland and sustained availability of local resources (timber, sand, fish) as these are critical for recovery of basic and livelihood needs. Conducting EA in a post-disaster context entails a compassionate character, exceptional listening skills, confidence in a community approach and an optimistic sense of purpose (Buranakul *et al*, 2005).

Prospects

Three prospects for community EA of post-tsunami projects are: strengthened links with strategic and rapid EA; increasing compliance with EA requirements; and developing supplementary or alternative means of assessment.

The links among rapid EA, strategic EA and community EA should be strengthened in future disaster responses. Rapid EA carried out immediately after a disaster provides information about the effects of the disaster on the environment, and their risk to human health and resource-based livelihoods. It can also quickly assess NGO capacity for EA. This information is especially useful for a strategic EA of disaster-response plans.

Strategic EA can identify the broad scope of potential impacts, and possible mitigation measures, for these plans, and integrate community EA into specific projects (Alshuwaikhat, 2005). It can also help identify human and budget resources required for project-level assessments, and incorporate this into the response plan.

Findings from both strategic EA and rapid EA can inform community EA. Over time, community EA could inform strategic EA about unique conditions in disaster contexts such as weak EA capacity among humanitarian NGOs, and advocate more community participation in rapid EA. This tiered approach provides each type of EA with a distinct but related role in disaster situations.

Community EA can satisfy donor requirements for EA even if host country requirements are suspended during the emergency phase, as the case study showed. However, these requirements are likely to be steadily reinstated for rehabilitation and reconstruction projects. Indonesian EA legislation, known as AMDAL (law 23/1997) and administered by BAPEDAL (Environmental Impact Management Agency) (MacAndrews, 1994), was suspended during the emergency response but may apply to subsequent phases. Scale criteria are used to determine whether or not a proposed activity is subject to EA (ERM, no date). For example, an EA is required for farming projects greater than 50 hectares and housing projects occupying more than 100 hectares. The Layeun housing project has an estimated footprint of 4.2 hectares and thus would not be subject to AMDAL.

A secondary level of environmental management, known as UKL/UPL, applies to activities that do not require a formal EA under AMDAL (ERM, no date).

An environmental study, akin to a community EA, is still required and submitted to BAPEDAL for review. A permit may specify mitigations and monitoring requirements for a project. UKL/UPL requirements are more likely than AMDAL to apply to community-level rehabilitation and reconstruction projects in tsunami-affected areas.

Furthermore, governance of UKL/UPL has been decentralized to provincial counterpart agencies known as BAPEDALDA, and further to regional and district levels (KABUPATEN/KOTA). Lower levels of government may overrule higher ones on resource use and environmental management, in recognition of diversity in local resources and needs. While some lower-level institutions have been incapacitated during the emergency phase, they may play an increasing role in regulating environmental assessment in subsequent phases.

The sheer number of rehabilitation and reconstruction projects distributed across tsunami-affected areas may overwhelm the limited capacity for community EA, causing delay or circumventing it altogether in some locations. Also, repeated findings from numerous assessments of the same type of projects (for instance, housing) in similar environments may be redundant, wasting time and money.

Class assessment is an alternative for routine projects. Under class assessment, projects of the same type (such as housing, latrines) may be grouped and assessed together if the projects are unlikely to have significant effects when the design standards and mitigation measures are applied to each individual project. EA of selected individual projects must still be completed, but these may be declared a class assessment for all projects of the same type. Criteria for selecting the individual assessments are generally based on environmental representation such as ecoregions, watersheds or other ecological classification.

Another alternative is exercising regulatory discretion so that EA requirements are imposed selectively such as on larger projects, or those in environmentally sensitive areas, and guidelines for self-assessment are used for other projects. This approach is used by the Central Environmental Authority in Sri Lanka. Recognizing the urgent need for housing, the Authority is using its discretion in deciding which projects require a formal EA. Only one housing project located in a flood zone was subject to a formal EA at the time of writing. Self-assessment guidelines have been issued specifically for housing reconstruction projects, which can be quickly reviewed by regional or local offices of the Authority for environmental clearance (CEA, 2005).

A discretionary approach supported by self-assessments, or use of class assessments, can streamline the community EA process considerably for numerous rehabilitation and reconstruction projects, facilitating timely implementation in the face of urgent human need.

Conclusion

Community EA is an emerging approach for rapid assessment of the environmental impacts of NGO humanitarian aid projects. This paper has shown that community EA can contribute to the environmental sustainability of small rehabilitation and reconstruction projects proposed for disaster recovery. Community EA can especially help to protect, conserve and manage critical environmental resources needed for household and community recovery.

The practice of community EA was broadly demonstrated in a case study of a housing reconstruction project. Its local scale and rapid assessment are important aspects when assessing small and urgent rehabilitation and reconstruction projects in post-disaster contexts. Another essential feature is meaningful participation of beneficiaries, including gender consideration, which can contribute valuable information for sustainable project design and local resource management (Rianse and Widayati, 2005; Wismer, 2005). For example, women's concerns about land tenure were deemed to be significant in the community EA analysis, whereas their concern for saline water contamination of deep wells was not.

Community EA in post-disaster situations is multi-faceted, which creates distinct challenges. It may operate in a policy and regulatory context where the host jurisdiction has suspended EA requirements but international aid agencies have not. Instead of a coordinated process following common standards, in post-disaster contexts community EA is regularly confronted by poor coordination, duplicated effort and surplus funding.

Also, aid agencies often perceive environmental concerns to be of secondary importance. Investment of money, personnel and time in EA needs justification and demonstrated results for humanitarian organizations addressing basic and livelihood needs, even long after the emergency phase. Furthermore, a particular challenge is that community EA must deal with not only project impacts but also the environmental and social effects of the disaster itself, and the large number of projects required for recovery.

The paper identified several prospects of community EA including strengthening linkages with rapid EA and strategic EA, increasing compliance with government or donor EA requirements, and developing supplementary or alternative approaches, such as class assessment or regulatory discretion to deal with the sheer number of projects that need to be assessed. These prospects have implications for humanitarian aid NGOs.

Most NGOs already have some capacity for EA, usually in reaction to regulatory or funding requirements, but this will have to become more mature and sophisticated. Governments and donors will increasingly expect NGOs to use appropriate types of EA at various decision levels such as rapid EA as part of disaster assessments, strategic EA for programs and plans, and community EA for site-specific projects.

NGOs should also be proactive in adapting and testing approaches such as class assessment in order to realize savings of time and money. It is likely that savvy NGOs will even use their emerging EA capacity for development education, advocacy and fund raising.

Recovery of households and communities affected by the tsunami is intertwined with the protection, conservation and sustained use of environmental resources. NGOs play an important role in integrating these considerations into the design of rehabilitation and reconstruction projects. Community EA provides a framework and process for this integration. As the tsunami response shifts toward long-term recovery, this integration will become increasingly important for humans and the environment.

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