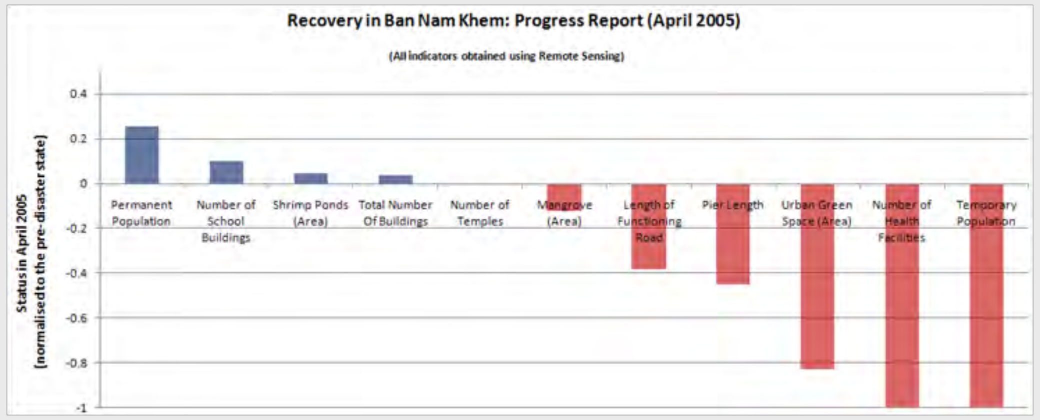
MULTI-SECTOR RECOVERY - A COMPREHENSIVE EVALUATION



Evaluation: The Indicators adopted by the Recovery Project encompass a range of physical, environmental, social and economic factors, which combine to give a true picture of the reconstruction process at agreed intervals. Both the *speed* and *quality* of recovery can be monitored and evaluated by comparing key indicators to base-line statistics also acquired with satellite imagery. In our Thai case study, roads were cleared within several months and 70 % of the buildings were constructed within the first year. Key facilities and services including Schools and Health Facilities were also restored within a year, along with key sources of livelihood such as Piers and Factories.

	Pre-disaster	*Apr-05*	*Feb-09*
Temporary Population	N/A	3,200	192
Total Number of Buildings	1,170	1,212	1,723
Length of Functioning Road (Km)	45.7	28.3	53.7
Number of School Buildings	10	11	27
Number of Health Facilities	1	0	2
Number of Temples	1	1	2
Shrimp Ponds (Area, Km²)	609.2	635.9	708.7
Pier Length (m)	539	296.1	452.1
Mangrove (Area, Km²)	787.3	689.8	866.2
Urban Green Space (Area, Km²)	15.4	2.6	15.1

Questions about Implementing Remote Sensing M&E?

- **HOW DOES SATELLITE IMAGERY COMPARE WITH OTHER RECOVERY MONITORING TECHNIQUES?** Satellite imagery offers a systematic, independent and replicable framework for recovery monitoring and evaluation. You can build up a comprehensive picture of recovery, or pick and choose specific indicators of interest. Satellites can access hard-to-reach or high risk locations avoiding security risks to field teams.
- **HOW DOES REMOTE SENSING DATA FEED INTO MY EXISTING M&E WORKFLOW?** Yes, our data are developed using satellite imagery, but the resulting data can be delivered as a database, table, graph, graphic — depending on your preference.
- **WHAT DOES IT COST**? The cost is made up of two components: (1) satellite imagery; (2) time required for processing. The cost is dependent on the data needs of the user, but are considerably cheaper than ground survey techniques by avoiding travel and translation costs.
- **IS SATELLITE IMAGERY EXPENSIVE?** In today's competitive market, imagery is cheaper than you might think ($15-25 sq km). Imagery costs are determined by the size of the study area and the time period across which recovery is being monitored and evaluated.
- **CAN WE ANALYSE IT OURSELVES?** Developing in-house capabilities for monitoring and evaluating recovery with remote sensing requires technical expertise in satellite image acquisition, processing and interpretation. Specialist GIS and image analysis software is needed, which may cost up to $10,000.
- **HOW LONG DOES THE ANALYSIS TAKE?** This depends on the number of performance indicators being monitored. There is some economy of scale, where multiple indicators are analysed.
- **CAN I HIRE CONSULTANTS TO DO THIS ANALYSIS FOR ME?** If you are interested in using satellite imagery for recovery monitoring and evaluation, please consider the Recovery Project Team. We are a unit of highly trained and experienced project managers, analysts, and scientists who can be deployed at your request to formulate and then deliver a recovery M&E program. Team members currently work with the World Bank, using remote sensing for post-disaster damage assessment.

Through the World Bank's role on The Recovery Project's steering committee, they have helped to steer this work. Our tools and methods complement the advice and approaches covered by the World Bank's *Handbook on Reconstruction*.

This Knowledge Note is produced by The Recovery Project Team, which includes Cambridge University, ImageCat (www.imagecatinc.com) and Cambridge Architectural Research (www.carl.co.uk). Funded by the EPSRC, the project team developed indicators for monitoring and evaluating recovery using the Indian Ocean tsunami and 2005 Pakistan earthquake as case study examples. Imagery was sourced from commercial high-resolution satellites. QA comprised independent verification of the remote sensing results through Social Auditing Techniques including Household Surveys, Focus Group Discussion and Key Informant Surveys conducted in Thailand and Pakistan. Ground verification was captured during street-view deployments using ImageCat's VIEWS field data collection system. **For further details contact : info@recovery-aid.com**

Contact the Recovery Project Team today for more information, or to set up a trial info@recovery-aid.com

Disaster Recovery Monitoring & Evaluation

Achieving Systematic, Comprehensive and Independent M&E using Remote Sensing

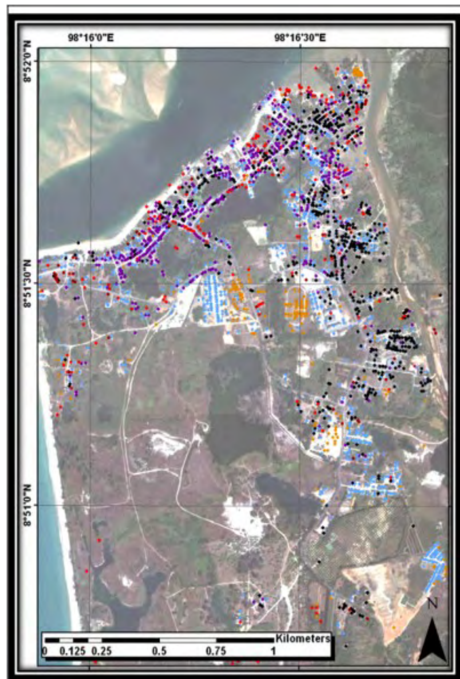
This paper introduces new scientifically-based techniques to help Donors and Governments answer key challenges in effectively monitoring and evaluating post-disaster recovery and reconstruction.

THE CHALLENGE: That there is a pressing need for a systematic approach to monitoring and evaluating the recovery and reconstruction process following a disaster becomes clearer with every passing event. A need, moreover, for a framework that promotes transparency and that gives early warning if the reconstruction is not going to plan. A system that, according to the World Bank's GFDRR, *'allows all parties to track the progress of reconstruction – who is doing what and where - is essential to coordinating an effective response, and good for public morale'* (Wielinga, 2009).

Operationally, effective M&E is also necessary to improve coordination, situational understanding and decision making, which ultimately improves reconstruction outcomes through assessing as early as possible whether objectives are likely to be met, enabling more efficient agency intervention. It may also lead to a better understanding of both good practise and bad, so that future recovery activities may learn from previous projects. Strategically, it visibly demonstrates best practise and accountability to Ministers, Boards of Directors, and the Public.

REMOTE SENSING: Remote sensing-based performance indicators offer National Governments and Donor Agencies a systematic and independent framework for accomplishing these goals, through accurately and comprehensively monitoring and evaluating recovery and reconstruction. From a time-series of satellite images acquired every 6-12 months, a comprehensive set of 12 indicators independently and efficiently bring together pieces of the recovery jigsaw that would otherwise take considerable time and resources to assemble.

Monitoring and evaluating the removal and construction of buildings in Ban Nam Khem, Thailand following the devastating 2004 tsunami. Housing performance indicators are obtained from analysing a time-series of satellite images, collected before the tsunami, immediately afterwards and in the the months and years following. As recovery takes place, progress is evaluated by tracking the year-by-year increase, and comparing the total number of dwellings with the pre-disaster state.

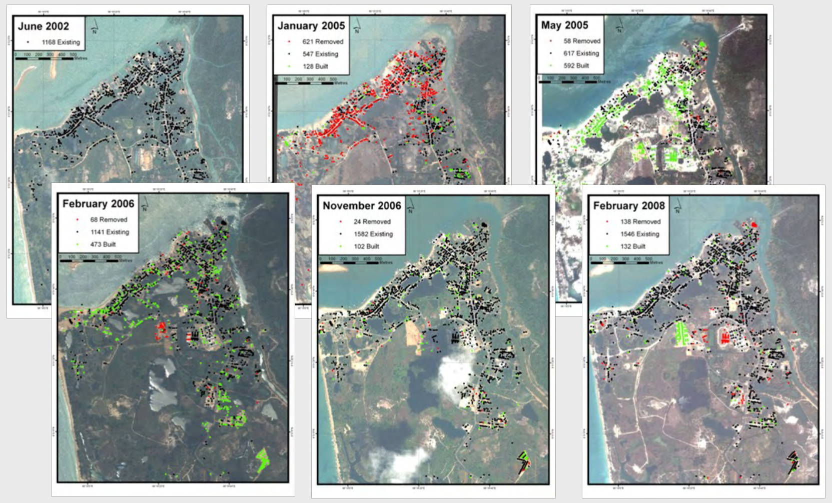


June 2002	Jan 2005	Feb 2009	Category	Number
Y	Y	Y	Still Standing or Unaffected	544
Y	N	N	Destroyed by tsunami and not built back	183
Y	Y	N	Demolished (present before)	30
N	Y	N	Demolished (not present before tsunami)	22
N	N	N	Temporary Jan 2005 and Feb 2009	201
Y	N	Y	Rebuild	458
N	Y	Y	New build (immediately after tsunami)	125
N	Y	Y	New build (later)	1,128

- Destroyed and Not Built Back
- Demolished after the tsunami
- New-Build
- Re-Build
- Temporary Building
- Still-Standing/Unaffected

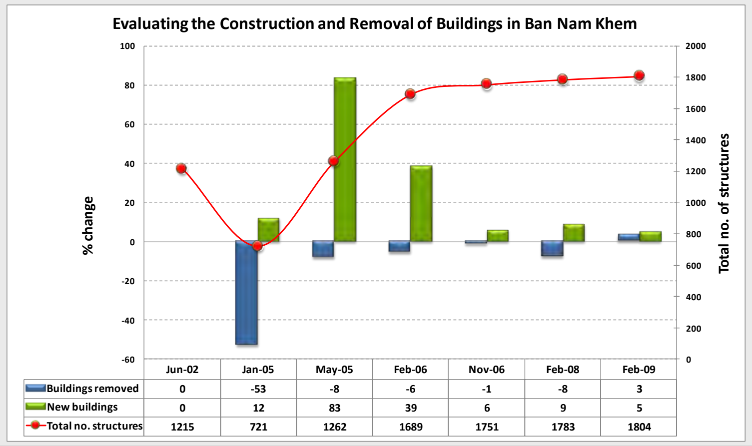
Build up a comprehensive picture of recovery, or pick and choose which aspects interest you. Here are some examples....

SHELTER



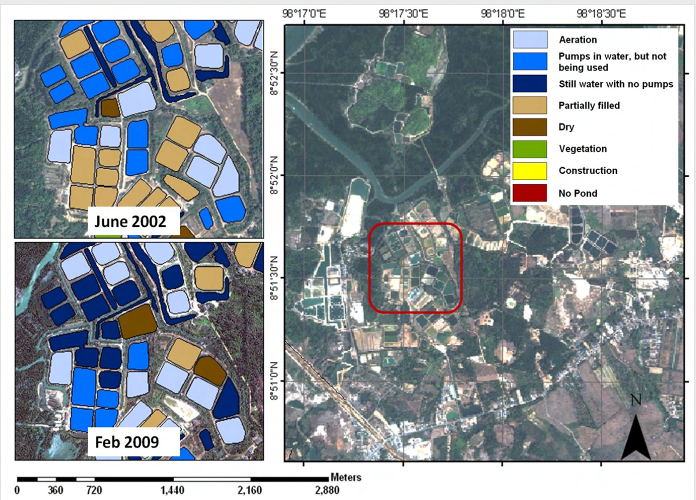
In the above images, reconstructed buildings are monitored in green; demolished or destroyed buildings are shown in red. Total numbers are recorded in the graph below.

Evaluation: Except in the coastal 30m non-construction zone, most areas in the centre of Ban Nam Khem were reconstructed to pre-tsunami levels within 1 year. The number of buildings in these dense central areas is similar to the number of buildings present before the tsunami. In all, 544 buildings were unaffected or repaired, 455 were rebuilt and 1,128 were new build. Most of the 1,128 new builds are in clusters outside of Ban Nam Khem, which has led to a significant extension of the town. The total number of buildings present is Ban Nam Khem increased by 48% from 1,170 to 1,727.



	Jun-02	Jan-05	May-05	Feb-06	Nov-06	Feb-08	Feb-09
Buildings removed	0	-53	-8	-6	-1	-8	3
New buildings	0	12	83	39	6	9	5
Total no. structures	1215	721	1262	1689	1751	1783	1804

LIVELIHOOD



Evaluation: Aquaculture was an important source of employment prior to the tsunami. Small-scale shrimp hatcheries in Ban Nam Khem were all totally destroyed by the waves and either demolished or left derelict. In contrast, grow-out ponds were protected by swaths of Mangrove Forest and the productivity was unaffected by the tsunami. In fact, 20 new pools were added to the site between February 2006 and February 2008.

☑ **12 Performance Indicators**

☑ **Cross-sector, including shelter, transport, environment and livelihood**

☑ **Independent, objective and transparent data**

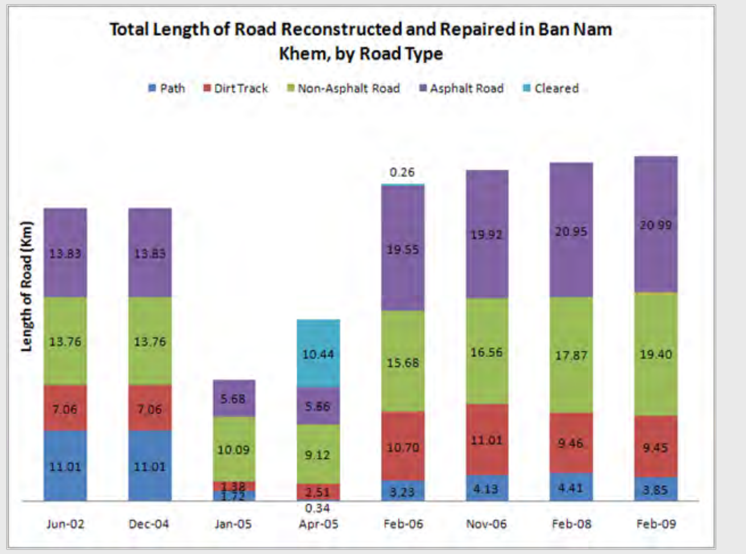
☑ **Data sources readily available and cost effective**

Sector	Performance indicator	Monitoring data produced	Evaluation examples
Transport	1. Accessibility analysis	Travel time distance, length of transport network	• How quickly was access reinstated?
	2. Reconstruction of bridges and transport facilities	Number and date of bridges reconstructed	• How does the number of facilities compare with the pre-disaster state?
	3. Presence of vehicles	Traffic activity	• Are roads being used? • When did services (e.g. schools) start being used?
Buildings/ shelter	4.Removal and construction of buildings	Number of buildings, location of buildings, new build versus rebuild	• How quickly are buildings being constructed (increase per year)? • How does the number of buildings compare with the pre-disaster state? • Has reconstruction caused households to relocate?
	5.Change in urban land use and morphology	Building density, total built area	• How does people's quality of life (building density, location) compare with the pre-disaster state?
	6. Quality of dwelling reconstruction	Changes in size, shape, arrangement, location, context with rebuild	• How does the quality of people's homes (household contentment) compare with the pre-disaster state?
Population	7. Temporary dwellings and shelters	Camp longevity, number of temporary and emergency structures, building use, layout, service provision	• How quickly are refugees being re-housed? • Are living/housing standards acceptable?
	8. Location of population	Number or % of people in temporary and permanent accommodation	• How many people were affected by the disaster? • How many refugees are living in temporary and emergency camps? • Is overcrowding a risk?
Services	9. Administration, education, healthcare and religious facilities	Number and location of schools, hospitals, places of worship	• How quickly are functioning services being reinstated? • How does the number of services compare with the pre-disaster state?
	10. Power, WATSAN (water and sanitation)	Evidence of facility reinstatement e.g. utility poles and sub stations	• How quickly are functioning utilities being reinstated?
Environment	11. Change in landcover and public open space	Area of urban and non-urban land cover classes Evidence of environmental degradation, erosion etc.	• How does the amount and location of urban green space (quality of life) compare with the pre-disaster state? • Are there local amenities (e.g. parks)?
Livelihood	12. Reconstruction of livelihoods	Evidence of farming, fishing, industry, commerce Number of fishing boats, piers, area of crops	• How quickly is employment reinstated? • How does the type of employment compare with the pre-disaster state

Worldwide independent and systematic evaluation **Our monitoring and evaluation techniques are non-country or disaster specific. While they have already been applied to earthquakes and tsunami, our systematic, replicable approach may be applied to all recovery projects. Examples of other areas that would surely benefit from such a system include Burma after the 2004 tsunami and 2008 Cyclone Nargis, when access was denied and donors not welcome; Sri Lanka, due to conflict and access issues; and Bangladesh, an area repeatedly hit by disasters.**

Better Information = Better Decisions

TRANSPORT



Evaluation: Before the tsunami the total length of roads in Ban Nam Khem was 46 km. The tsunami destroyed or made impassable 27 km. Remote sensing analysis shows that most of the permanent repair and reconstruction work (21 km) was completed in one year by February 2006 and that the total length of road in February 2009 was 8.01 km longer than it was before the disaster.

EDUCATION

Evaluation: Prior to the tsunami, Ban Nam Khem School contained 8 buildings—all of which were flooded and received major damage. A new main building was constructed in 7 months and consisted of 3-storeys. In February 2009, the school contained 29 buildings (7,959 m²), representing an increase in building area of 210%.