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PARTICIPATORY 3-DIMENSIONAL MAPPING FOR DISASTER RISK REDUCTION:
A Field Manual for Practitioners

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ACRONYMS

CBDRR – Community-based disaster risk reduction

DEM – Digital Elevation Model

DRR – Disaster risk reduction

GIS – Geographic Information System

GPS – Global Positioning System

NGOs – Non-government organizations

PLA – Participatory learning and action

P3DM – Participatory 3-dimensional mapping

VCA – Vulnerability and capacity analysis

3D map – Three-dimensional map

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RECOMMENDATIONS TO THE USERS OF THIS MANUAL

There has been a recent impetus towards the use of Participatory 3-Dimensional Mapping for Disaster Risk Reduction (DRR). This has created a demand for appropriate skills to conduct P3DM for DRR among practitioners, including staffs from community-based organizations, NGOs, local government offices and scientific organizations. This manual aims, in response to such a need, to assist those practitioners in facilitating disaster risk assessment and in planning activities geared towards reducing that risk.

However, the present manual is not meant to provide a rigid step-by-step methodology which works everywhere at any time. It rather provides a framework which is flexible and which should therefore be adjusted to local needs and conditions. Some activities spur momentums amongst participants in mapping diverse information. It is crucial that the facilitator draws on these momentums and adjust her/his plan in accordance. P3DM is a really flexible tool which enables people to express their knowledge and creativity. Most of the ideas which have led to the framing of the following methodology were indeed suggested by participants to P3DM activities.

So let people do and innovate!

Any feedback from the field on this manual or on P3DM for DRR is much welcome. Please send comments to jc.gaillard@auckland.ac.nz and jrdcadag@yahoo.com.

AN INTRODUCTION TO PARTICIPATORY 3-DIMENSIONAL MAPPING FOR DISASTER RISK REDUCTION

Participatory 3-Dimensional Mapping (P3DM) for Disaster Risk Reduction (DRR) in a nutshell

Objective: P3DM fosters the participation of a large array of stakeholders and the integration of local and scientific knowledge as well as bottom-up and top-down actions in DRR.

Suggested stakeholders:

- Local communities
- Local governments
- NGOs
- Scientists
- School communities
- Faith groups
- Business sectors
- Others

Key resources:

- Local people, their knowledge and skills;
- A venue to conduct mapping activities and store the map
- A strong table made of local materials
- A base (topographic) map
- Mapping materials, e.g. carton/Styrofoam/cork, paint, yarns, pushpins, glue, nails or local equivalents
- Training materials, e.g. markers, flip charts, masking tape, scissors

Duration:

- Three to seven days (depending on the terrain and population density) if

Disaster Risk Reduction as an integrative process

Disaster risk reduction (DRR) should be an integrative process which considers a wide array of knowledge and stakeholders. (Figure 1) Integration of local and scientific knowledge and collaboration between stakeholders are both essential for sustainable DRR. Local communities, government authorities, Non-Government Organizations (NGOs), scientists, school

communities, and faith groups all have a role to play. Communities (including citizen-based organizations, pupils and teachers, and faith groups) are an important resource and constitute the frontline of action since they are most severely affected by, and the first to respond to, disasters (Delica-Willison, 2004). In coping with hazards, communities are often assisted by NGOs, toh conduct community-based DRR. Community-based and people-led actions emerge from the bottom up. From the top down, scientists and government authorities should provide support and facilitate access to sustainable livelihoods and means of protection (Gaillard, 2010). Both sets of stakeholders should also share knowledge. Local knowledge is invaluable in understanding and responding to historical hazard events while scientific knowledge has been proven to be of great importance when dealing with rare or unknown events (Mercer et al., 2007).

Achieving such a blending of knowledge and action in DRR, however, proves difficult. Many scientists and government officials often underestimate – if not dismiss – the value of local knowledge and community activities (Mercer et al., 2007; Shaw et al., 2009). Similarly, local communities rarely have a detailed understanding of scientific knowledge and NGO workers often claim that science is disconnected from reality. Such a gap between stakeholders, in terms of actions and knowledge, is considered a major obstacle for reducing the risk of disasters in a sustainable manner and on a large scale (Wisner, 1995).

Instead, integrating knowledge and actions in DRR should be premised on a relationship based on trust and communication. Fostering communication and building confidence require tools mutually trusted by all stakeholders and which make all forms of knowledge tangible to all. As of now, however, most tools used by scientists and government officials to assess hazards and vulnerability and to foster DRR are geared towards appraising the alleged extra-ordinary dimension of hazards and disasters. Hazard assessment particularly focuses on reducing the uncertainty pertaining to the occurrence of natural events, thus relying on the latest available technological devices, e.g. probabilistic models, seismographs, extensometers, radars, Global Positioning System (GPS), remote sensing (Saito et al., 2001). In parallel, social scientists provide evaluations of vulnerability and risk perception based on tools and methods such as questionnaire-based survey and Geographic Information Systems analysis. All these tools are quantitative and non-contextual as well as selected and designed by outsiders to local communities.

In parallel, there are a lot of tools which are used by NGOs for facilitating the participation of local communities for CBDRR. These are loaned from the usual participatory learning and action (PLA) toolkits and refer to ranking, scoring, calendar sand timelines, problem trees, Venn diagrams, transect, participatory mapping, etc. Practitioners have also developed more specific tools and toolkits such as the Vulnerability and Capacity Analysis (VCA) matrixes which have become widespread (e.g. Anderson and Woodrow, 1989; Davis et al., 2004; CARE, 2009). Unfortunately, if these tools prove very useful for achieving their primary goal, i.e. identifying local knowledge and issues, and planning actions at the community level, they remain insufficient to integrate stakeholders from beyond local communities and NGO partners. Local government institutions and scientists have indeed been reluctant to seriously consider both the tools themselves and the knowledge they produce for improving policies. This is because participatory tools are not primarily geared towards producing quantitative data which are of primary importance for government decision makers and scientists.

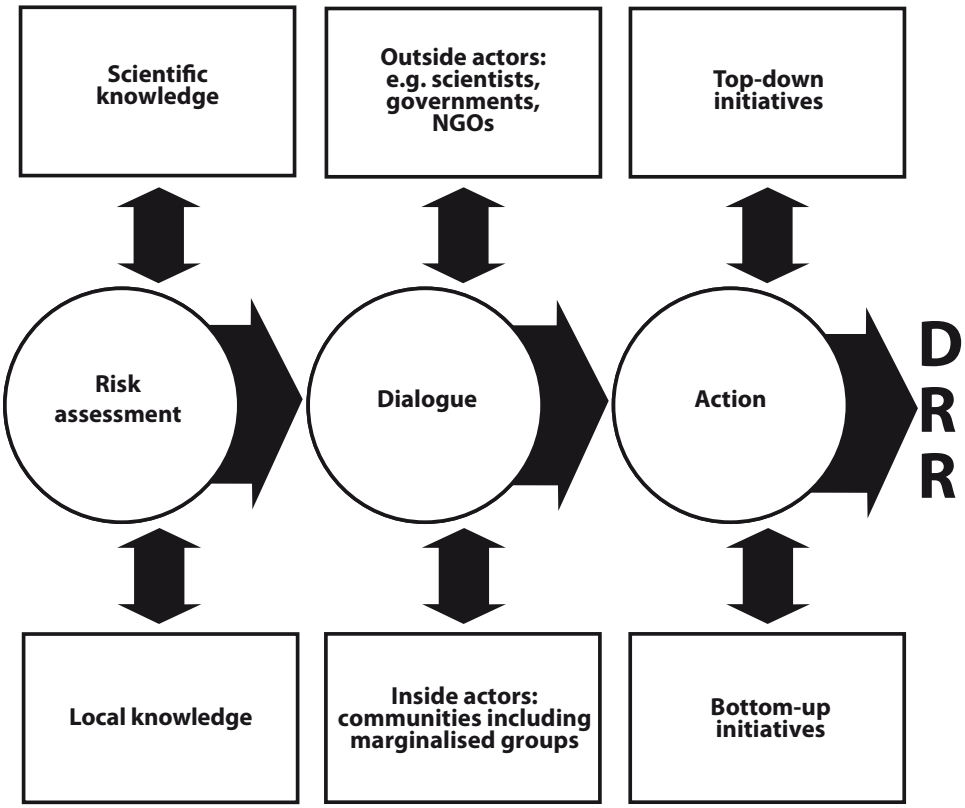


Figure 1: An integrated framework for disaster risk reduction

Mapping for disaster risk reduction

Maps and mapping provide a very good example of the gap between different actors when it comes to the tools most often used for emphasising knowledge and fostering DRR. Maps are powerful instruments which give visual expression to realities which are perceived, desired, or considered useful (Chambers, 2008).

On the one hand, however, scientists supported by governments and sometimes international organizations usually provide very useful, highly detailed and scientifically accurate hazard maps. Unfortunately these maps often require particular skill to decipher. Hazard maps are crafted after Western guidelines and semiologies, e.g. language, technical jargon, color coding of the legend, orientation towards the north, which frequently make little sense to people threatened by the same hazards.

On the other hand, local communities assisted by NGOs are able to draw very insightful participatory maps of their territory which feature people's perception of natural hazards and their vulnerability and capacities. These maps are usually culturally embedded and thus reflect local needs and resources. Different forms of participatory mapping are being used for DRR (Table 1). These include ground mapping, 'stone mapping', sketch mapping, 2D scaled mapping, GPS mapping, and Web-based and interoperable Geographic Information System (GIS) mapping – from the least to the most demanding in terms of resources. On the one hand, the less demanding and most accessible types of mapping (ground and stone mapping) are short-term activities, often dismissed by government officials and scientists. On the other hand, the very sophisticated GPS and web-based GIS mapping require training and resources, and may be easily manipulated by community outsiders despite being credible to government officials and scientists. Drawing sketch maps (which occupies the middle ground in terms of advantages and disadvantages) is a form of participatory mapping that is most frequently used for DRR. Although some attempts have been made (Cronin et al., 2004), it remains poorly capable of integrating local and scientific knowledge, and bottom-up and top-down actions. Since sketch maps are not scaled or geo-referenced, they are often dismissed by government officials and scientists who struggle to overlap their hazard and land-use maps and challenge the veracity of the data.

Type of participatory mapping	Principles	Advantages	Disadvantages
Ground mapping	People draw the map in the sand/ground with a stick or their fingers	- Very easy to set up and cheap - Familiar to most people - Less eye contact - Flexible (easy correction and adjustment)	- Temporary - Limited signs and symbols - Neither scaled, nor georeferenced - Value often dismissed by government officials and scientists
Stone mapping	People draw the map using stones, branches, paper and other locally available materials	- Easy to set up and cheap - Familiar to most people - Less eye contact - Flexible (easy correction and adjustment)	- Temporary - Neither scaled, nor georeferenced - Value often dismissed by government officials and scientists
Sketch mapping	People draw the map on a sheet of paper with colored marker pens	- Relatively easy to set up and cheap - Permanent - Large semiology - Most often stored locally	- Unfamiliar to many people - Rigid (difficult to correct and adjust) - Neither scaled, nor georeferenced - Value often dismissed by government officials and scientists
GPS Mapping	People walk around the area to be mapped and plot features with GPS. Data are eventually included into a GIS	- Permanent - Large semiology - Scaled and georeferenced - Reliable to government officials and scientists	- Unfamiliar to most people - Costly and difficult to set up - Require an external facilitator to train the participants - People seldom include the data themselves into the GIS - Flexible only to those who master the technology - May be manipulated by facilitators - Most often stored externally

Web-based and interoperable GIS mapping	People contribute to a web-based GIS database from their own computer	- Permanent - Scaled and georeferenced - Flexible for correction and adjustment - Credible to government officials and scientists	- Unfamiliar to most people - Costly and difficult to set up - Signs and symbols controlled by facilitators - May be manipulated by facilitators - Stored externally

Table 1 – Advantages and disadvantages of the most common forms of participatory mapping

Participatory 3-Dimensional Mapping

In the wider field of natural resource management, attempts to overcome these limitations have been made through Participatory 3-Dimensional Mapping (P3DM) (see http://www.iapad.org/). P3DM basically comprises the building of stand-alone scaled relief maps made of locally available materials (e.g. carton, paper) which are overlapped with thematic layers of geographical information (Rambaldi and Callosa-Tarr, 2002). It enables the plotting of landforms and topographic landmarks, land cover and usage, and anthropogenic features, which are depicted using push-pins, yarn, and paint. P3DM thus facilitates the interpretation, assimilation, and understanding of geo-referenced information by making it visible and tangible to everyone. P3DM raises local awareness of territories, provides stakeholders with powerful mediums for land-use management, and serves as an effective community-organizing tool (Rambaldi and Callosa-Tarr 2002). It si noteworthy that most of the P3DM initiatives for natural resource management and land conflict resolution use a relatively small scale – often 1:10 000 – and, as such, rarely include details at the household level. Some initiatives have applied similarly small-scale P3DM to DRR but with an applicability limited to land-use and hazard mapping (Capelao ,2007).

The present manual provides a step-by-step methodology for using large-scale (1:500 to 1:2000) P3DM in the context of DRR. However P3DM alone cannot solve all issues pertaining to DRR. It should be combined with calendars, ranking and scoring, and other tools of VCA and Participatory Learning and Action (Gaillard and Maceda, 2009). A combination of tools is particularly important to assess those dimensions of disaster risk which are poorly addressed by P3DM such as client-patron relationships, gender-related inequalities, social networks, and temporal variations in vulnerabilities and capacities.

References

Anderson M., Woodrow P. (1989) *Rising from the ashes: development strategies in times of disasters.* Westview Press, Boulder.

Capelao P. (2007) *Raumoco watershed vulnerability mapping East Timor.* Concern Timor Leste, Lospalos. Available from: http://www.iapad.org/publications/ppgis/timor%20vulnerability%20mapping%20report.pdf (accessed 16 January 2012).

CARE (2009) *Climate vulnerability and capacity analysis: handbook.* CARE, Chatelaine. Available from: http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf (accessed 16 January 2012).

Chambers R. (2008) *Revolutions in development inquiry.* Earthscan, London.

Cronin S. J., Petterson M.J., Taylor M.W., and Biliki R. (2004) Maximising multistakeholder participation in government and community volcanic hazard management programs; a case study from Savo, Solomon Islands. *Natural Hazards,* 33: 105–36.

Davis I., Haghebaert B., and Peppiatt D. (2004) *Social vulnerability and capacity analysis.* Workshop Discussion paper prepared for the ProVention Consortium Workshop at IFRC Geneva on May 25-26, 2004. Available from: http://www.drm-china.com/documentation/pdf/Workshop_%20Social%20Vulnerability%20and%20Capacity%20Analysis.pdf (accessed 16 January 2012).

Delica-Willison Z. (2004) Vulnerability reduction: a task for the vulnerable people themselves in Bankoff G, Frerks G and Hilhorst D (eds) Mapping vulnerability: disasters, development and people. Earthscan, London, pp. 145-58.

Gaillard J.-C. et Maceda E.A. (2009) Participatory 3-dimensional mapping for disaster risk reduction. *Participatory Learning and Action,* 60: 10. Available from: http://pubs.iied.org/pdfs/G02818.pdf (accessed 16 January 2012).

Gaillard JC (2010) Vulnerability, capacity, and resilience: perspectives for climate and development policy *Journal of International Development,* 22: 218-232.

Mercer, J., Dominey-Howes, D., Kelman, I., and Lloyd, K. (2007) The potential for combining indigenous and western knowledge in reducing vulnerability to environmental hazards in small island developing states. *Environmental Hazards, 7: 245–256.*

Rambaldi G., Callosa-Tarr J. (2002) *Participatory 3-dimensional modelling: Guiding principles and applications.* ASEAN Regional Centre for Biodiversity Conservation (ARCBC), Los Baños. Available from: http://www.iapad.org/publications/ppgis/p3dm_arcbc_lr.pdf (accessed 16 January 2012).

Saito T., Eguchib T., Takayamaa K., and Taniguchic H. (2011) Hazard predictions for volcanic explosions. *Journal of Volcanology and Geothermal Research,* 106: 39-51.

Shaw R., Sharma A., and Takeuchi Y. (eds) (2009) *Indigenous knowledge and disaster risk reduction: from practice to policy.* Nova Science Publishers, New York.

Wisner B. (1995) Bridging 'expert' and 'local' knowledge for counter-disaster planning in urban south Africa. *GeoJournal,* 37: 335-348

Ka Noli, community leader, San Mateo, Philippines

"In order to come up with a realistic capacity building pursuit for our community, there ought to be a tool where in one glance our location, situation, resources and vulnerabilities are depicted. The roving satellites above our heads and the interlinked GPS instruments cannot provide home grown information for us."

Aivin, government official, Camarines Norte, Philippines

"At first, I thought it was a complicated task to conduct P3DM for DRR. It actually wasn't."

STEP 1.

SELECTING A SITE

STEP 1 IN A NUTSHELL

Objective: Identifying an appropriate site to conduct P3DM for DRR

Suggested stakeholders:

- Facilitator(s)
- Local communities
- Local stakeholders

Key resources:

- Open mind
- Trust

Duration:

- Variable

There are two main possible scenarios when selecting a site for a P3DM project.

1. The facilitator is asked to introduce P3DM upon the request of a local community or local stakeholders, e.g. NGO, government authorities. This is the best case scenario as it is likely that a local stakeholder will take the lead in implementing the project and the long-term monitoring of the tool.
2. In the second scenario, the facilitator, as an outside stakeholder, picks a site which seems relevant and in need of such a methodology for improving local DRR practices. In that case a long period of consultation and rapport building (see Step 2) is required to evaluate whether there really is a need and commitment on the side of the local community and stakeholders.

In any case, selecting a site for a P3DM project should conduct a baseline survey and consider the following issues:

1. The community has to be vulnerable in facing one or more hazards. NGOs (as well as government authorities and academic researchers) should try to make initial disaster risk assessment using tools such as key information interviews, focus group discussion, and ethnographic research methods such as participant observation and life story. These tools would provide initial assessment of the current situation in the community.

2. The P3DM should benefit the local people, particularly the most marginalized sectors.
3. The project must be accepted and desired by the community. It is necessary to conduct community immersion and in the process encourage the local people to participate. Otherwise, you are risking not having participants on the day of the activity.

Such a baseline survey is essential for eventually monitoring the participation process and outcomes of the project. It provides both the rationale for the activities and an initial reference-point in terms of disaster risk in the community, which the project should aim at reducing.

To learn more, see Chamber (2007), Cook and Kothari (2001) and Delica-Willison and Gaillard (2012).

Warning:

Security of both the outside stakeholders such as NGOs as well as of the communities should always be considered. NGO must not endanger communities by its presence especially in the case of actual or potential conflict. In areas with histories of armed conflicts, activities that involve community organizing and people's participation might trigger suspicions on conflicting parties. Both NGO workers and the local communities may be put in danger. It is thus important to properly coordinate with appropriate authorities keeping in mind the security of all stakeholders involved.

Mas, NGO staff, Yogyakarta, Indonesia

"I was surprised that the community could make a map and fill with the complete information of their village. They could present to others about their village. This is my house, this is the road for evacuation, this is my land, and this is my water resource. My house is 8 Km from the peak of the mountain. Surely, through this map the people know their village and their potentials."

References

Chambers R. (2007) *Poverty research: methodologies, mindsets and multidimensionality.* Working Paper No 293, Institute of Development Studies, Brighton. Available from http://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/399/Wp293%20web.pdf?sequence=1 (accessed 16 January 2012).

Cook B., Kothari U. (2001) *Participation: the new tyranny?* Zed Books, London.

Delica-Willison Z., Gaillard JC. (2012) Community-based disaster risk reduction and management. In Wisner B., Gaillard J.-C., Kelman I. (eds.) *Handbook of hazards and disaster risk reduction.* Routledge, London, 711-722.

STEP 2.

BUILDING RAPPORT WITH THE COMMUNITY

STEP 2 IN A NUTSHELL

Objective: Building trust with local stakeholders and levelling down power relationships

Suggested stakeholders:

- Local communities
- Local governments
- NGOs
- Scientists
- School communities
- Faith groups
- Business sectors

Key resources:

- Open mind and trust
- Time
- Training materials to conduct preliminary interactive group discussions, e.g. markers, flip charts, masking tape, scissors

Duration:

- From a few days to several years depending on pre-existing relationships

2.1 Building rapport and trust with the community

Building rapport and trust with the community is considered an invaluable part of the P3DM process. In the first place, the commitment and dedication of the local people to participate in the activity could depend on this relationship. Thus, community immersion and integration of the outside stakeholders such as the scientists and NGO workers to gain the trust of the local people is a must. Until a relationship based on trust between stakeholders outside and within the community has been achieved, it is not an ideal time for conducting P3DM.

Building rapport with the community requires time. In some cases, it requires living within the community for a period of time especially in areas where local people are not used to visitors from the outside. Learning local language and culture is also necessary to communicate easily with the local people. To show to the local people the sincerity of the purpose of the activity, they should be implicated in the entire process. The local people should understand

that they are the key actors of the activity who should not just be involved but should also participate in the decision making process. To foster this process it is important to work in partnership with local organizations who have long term relationships with communities.

2.2 Identifying key stakeholders

This is also the ideal time to identify key stakeholders of the activity. Aside from local officials within the community, there could be other important persons who do not hold official designation but are trusted and respected by the local people for cultural and economic reasons (e.g. clan head, indigenous tribal chieftain, landowner, church or faith leaders, professionals, people's organization leaders). The participation of these key persons within the community could convince the local people to participate in the activity without hesitations and suspicions. On the other hand, in some instances, the heavy involvement of leaders may also cause a barrier for equal participation amongst marginalized groups in the community so great care should be taken. In some other contexts, the facilitators may need to gain government permission to work with local communities, which proves particularly important to ensure both government and community buy in and participation in the activities.

2.3 Getting to know the community

The initial rapport-building stage also provides room for better understanding the community, its needs and priorities, as well as for collecting secondary data which often proves useful afterwards when conducting the actual mapping activities. Those include historical chronicles, censuses, local government records (across a wide array of sectors, e.g. housing, education, health, agriculture, fisheries, industry, politics), project reports and academic publications. This data collection process should cover a wide range of stakeholders (e.g. local community, government, NGOs, scientists, private sector) at different scales (local but also provincial/regional and national). It is particularly important to focus on past disasters to be aware of the potential impact of hazardous events and predict issues which may arise during the mapping activities and therefore anticipate appropriate facilitation. This baseline survey often constitutes a key factor of success in conducting P3DM for DRR activities.

At this stage, several participatory methodologies can be used to gather data, consult the local people while identifying key stakeholders and

preparing them to get involved in decision making. Key-informant interview, focus group discussions, Venn diagrams, and participatory observation methods are just a few of the participatory methods that can be used. Venn diagrams, for instance, can be used to understand the relationship between the local people and the key persons and organizations (Figure 1).

Figure 1 – Left: Venn diagram for stakeholders analysis conducted by the participants of a P3DM training in Josefina, Philippines (JC Gaillard, January 2010); Right: informal group discussion initiated by the participants of a P3DM training in Yubo, Philippines (JC Gaillard, June 2011)

To learn more, see International HIV/AIDS Alliance (2006), Chambers (2002, 2007) and Geilfus (2008).

References

Chambers R. (2002) Participatory workshops: a sourcebook of 21 sets of ideas and activities. Earthscan, London.

Chambers R. (2007) *Poverty research: methodologies, mindsets and multidimensionality.* Working Paper No 293, Institute of Development Studies, Brighton. Available from http://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/399/Wp293%20web.pdf?sequence=1 (accessed 16 January 2012).

Geilfus F. (2008) *80 tools for participatory development: appraisal, planning, follow-up and evaluation.* Inter-American Institute for Cooperation on Agriculture, San Jose. Available from: http://www.iica.int/Esp/regiones/central/cr/Publicaciones%20Oficina%20Costa%20Rica/80tools.pdf (accessed 10 December 2012).

International HIV/AIDS Alliance (2006) *Tools together now! 100 participatory tools to mobilise communities for HIV/AIDS.* International HIV/AIDS Alliance, Brighton. Available from: http://www.aidsalliance.org/includes/Publication/Tools_Together_Now_2009.pdf (accessed 10 December 2012).

STEP 3.

PREPARING FOR THE TRAINING

STEP 3 IN A NUTSHELL

Objective:

- Identify the venue and participants
- Prepare the base map
- Prepare the table
- Prepare the materials
- Anticipate the logistics

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- A venue to conduct mapping activities and store the map
- A strong table made of local materials
- A base (topographic) map
- Mapping materials, e.g. carton/Styrofoam/cork, paint, yarns, pushpins, glue, nails or local equivalents
- Training materials, e.g. markers, flip charts, masking tape, scissors

Duration:

- A few days to several weeks

3.1 Identifying the venue and the storage area

The venue of the actual P3DM and the storage area of the 3D map should be properly identified. This is crucial in order to avoid mistakes in choosing the scale and dimension of the 3D map. Based on several experiences, it also determines who will be in charge of looking after the map once the training is finished and the facilitator gone. This is sometimes a problematic issue which has to be carefully anticipated.

The venue for the actual P3DM and the storage area of the 3D map are not necessarily the same. The training venue of the actual P3DM is normally conducted in a huge space to accommodate the participants and to properly facilitate the activities. On the other hand, the final storage area is normally smaller than the training venue. If the scale and dimension of the 3D map is calculated based on the size of the training venue, there is a risk that it would be too large for the storage area. Therfore, the scale and

dimension of the 3D map should always depend on the dimension of the storage area.

In addition, if the training venue and the storage area are not the same, the facilitator has to anticipate how to move the map out of the training venue to its final storage area (Figure 2). Considering the height and width of doorways, a whole 3D map might need to be divided into two or four parts (see section 3.4). Although these reminders and considerations are quite commonsensical, they should not be mistaken otherwise the next tasks would not go smoothly as planned.

Figure 2 – Moving a 3D map from the training venue to the storage area in Masantol, Philippines (JC Gaillard, August 2008)

Identifying the space available for storage will also determine the scale of the 3D map (as well as its actual dimension and the size of the support table) and ultimately the level of details of the data to be depicted on the 3D map (see section 3.2). Table 2 enumerates some of the issues and critical considerations in identifying the venue and the storage area:

Issues	Critical considerations
Space available for storing the map	Should be wide enough to allow people to move around easily.
Space for training	Anticipate that there needs to be more space for the construction of the map than for it storage. Assembling materials and preparing the legend require space. Consider also the space needed to organize discussion with a significant group of participants around the map.
Space for meals and snack	Always consider reserving a table or space for eating, snack or coffee break. In most cases, participants would be too excited to the extent that they bring their food or coffee near the 3D map. Though this is a good sign of their commitment, it might damage the 3D map.
Type of structure	Open structures are good for lighting and ventilation (see below) but they usually poorly protect from rain and other climatic hazards. Similarly be careful at animals which could approach the area and alter information plotted on the map.
Lighting	Should be strong enough to have a clear view of the map.
Ventilation	Should be enough to avoid participants' sweat dripping on the map and dilute the paint. But be careful of windy places where materials may be blown away by gusts.
Access to water	It is good to have an access to water nearby for painting and other cleaning activities.
Cabinets and other storage facilities	Useful for storing legend (push pins, yarns and paints) and other construction materials so that these are immediately available for updating activities.

Table 2 – Issues and critical considerations in identifying the venue of the training and storage area for the 3D map

3.2 Choosing the scale and size of the map

Scales can be differentiated as horizontal or vertical scale. The horizontal scale (or simply scale) is the ratio of a distance on the map to a corresponding ratio on the ground. On the other hand, vertical scale is actually the contour interval or the difference in elevation between successive contour lines on a topographic map, which ultimately is the ratio to actual elevation on the ground.

Ideally, horizontal scale should be the same as vertical scale (or contour interval). If the horizontal scale of the map is 1:1000 which means 1 cm on the map is equal to 10 meters on the ground, the ideal vertical scale (contour interval) is also 10 meters or equivalent to 1cm thickness of each layer of polystyrene or carton. The 1:1 ratio of the vertical and horizontal scale gives the best representation of the reality in a 3D map. However, the vertical scale could be higher or lower than the horizontal scale especially if there is a need to emphasize or de-emphasize important landforms based on the preferences and priorities of the participants. Should the 3D map be eventually hung on a wall it may be relevant to adjust the vertical scale so that the map be not too heavy or that the pushpins do not fall on the ground. In any case the entire map should easily be accessible. In very mountainous areas, it may also be appropriate to adjust the vertical scale so that the participants do not need a ladder to access some parts of the 3D map.

TIPS AND TRICKS: *Remember to note the thickness of the carton / polystyrene / cardboard / cork to fit the vertical scale. If the chosen vertical scale or contour interval is 10 meters, then the thickness of each layer (polystyrene or carton) should be 1cm.*

As a general rule in P3DM for DRR, the larger is the scale the better. The larger scale is translated to more space on the actual 3D map and thus more information can be depicted. Since the information on the map is intended at the household level, the ideal scale is from 1:500 to 1:1000. In rural areas where houses and settlements are generally scattered, the scale can be smaller than 1:1000 as long as the necessary information can still be depicted without congesting the pushpins, yarns and paints in the 3D map (Figure 3). In urban areas, however, where houses and structures

are usually overcrowded and concentrated, it is advisable that scale is at least 1:500 or much larger (Figure 3).

Figure 3 – Left: Details of a P3DM conducted in a rural area at a scale of 1:1500 in Mondulkiri, Cambodia (JC Gaillard, January 2011); Right: Details of a P3DM conducted in an informal urban settlement at a scale of 1:750 in San Mateo, Philippines (JC Gaillard, February 2011)

However, a large scale would also mean a large size of the actual 3D map especially if the target land area is large.

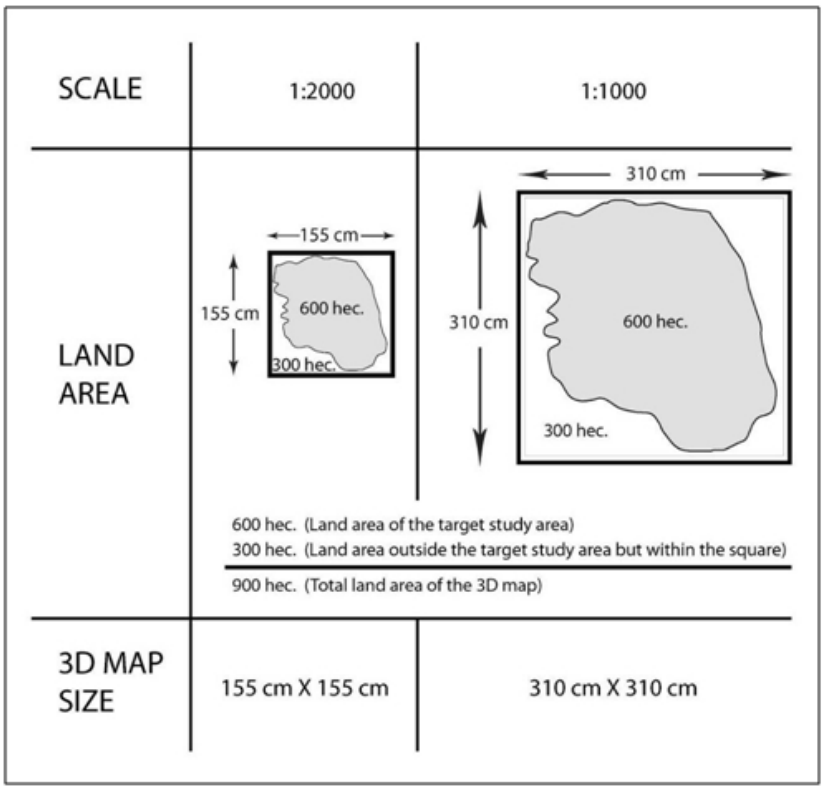


Figure 4 – Illustration showing the relationship between scale and size of the 3D map and the space requirements for the chosen scales and size

From Figure 4, with the same size of the target land area (900 hectares), choosing a larger scale (1:1000) over a smaller scale (e.g. 1:2000) would mean a larger size of the actual 3D map (310 cm X 310 cm). This requires a large space for storage at least double the size of the 3D map so that there is enough space for people to discuss around it. If there is no space for such size of the 3D map (310 cm X 310 cm), then the scale should be smaller than 1:1000 in order to fit it to the available size for storage.

Thus, it is clear that before choosing the scale and size of the 3D map, it is always necessary to first verify if there is an available space for storage. This is one of the most common difficulties based on past experiences wherein there is not always available space for storage of a large 3D map. Several examples, however, have shown how the local people and facilitator turned this difficulty into their advantage (Box 1).

The most common difficulty in P3DM is the fact that the 3D map occupies a large space. There are, however, plenty of techniques to save and optimize space in storing the 3D map. For example, the map can be covered with a glass case which may serve as a session table or a display material in the storage area. Alternatively, a map with little relief may be hung on the wall but this should be done with care because pushpins and other elements of the legends may fall down. The map may also be towed up to the ceiling with a pulley. Or different parts of the map may be arranged like a Russian doll, one under the other.

In the village of Mangin, Dagupan, Philippines, the local people and officials covered the 3D map with glass and use it as a showcase for visitors (Figure 5). Further, in the village of Macawayan, Irosin, Philippines, the 3D map was affixed in the wall inside the village hall thus making it more visible but occupying lesser space. The 3D map covered by glass can also be used as session table by local public officials and workers as planned in the two villages of Negros Island, Philippines.

Box 1 – Some ways to overcome limits on storage space

Figure 5 – 3D map covered with a glass scale and displayed in the village hall of Mangin, Dagupan, Philippines (JC Gaillard, July 2009)

3.3 Preparing the base map

The base map is a scaled map of the target area containing information that can be used as basis of the construction of the relief model. The following map elements should be present in the base map (Figure 6):

Mandatory

1. Contour lines and labels based on desired contour interval (vertical scale)
2. Basic elements of a map such as title, scale (horizontal scale), north arrow, and legend for the contour lines (with labels in local language)

Optional

3. Points representing landmarks (preferably based on GPS survey)
4. Political boundary
5. Rivers and roads
6. If there are too many contour lines, the color of subsequent lines can be differentiated into two (black or orange)

The contour lines are the most essential elements of the base map. A contour line is a line of which any point along it has the same elevation. A contour line should be accompanied by a contour label or a number that indicates the elevation. The contour lines serve as guides for the participants to define each layer of polystyrene or cartons to be superimposed later to produce the blank relief model. The contour lines may be obtained using the following methods (see Annex 1 for the detailed instructions on how to produce the base map using the different methods below):

1. Direct enlargement of the latest topographic map (Figure 7)
2. Tracing of the latest topographic map, which has been initially enlarged, using carbon paper
3. Digitizing of the latest topographic map using GIS
4. Extraction of the contours from an existing Digital Elevation Model (DEM) using a GIS

The first three methods are quite laborious as they normally require time, patience, and sometimes lucky chances to get the right size and scale (when using photocopier) or to trace each contour lines one at a time (when using carbon paper or GIS). On the other hand, the fourth method can be used to automatically generate contours using a DEM. With proper skills on GIS (which may also be required on the second method), the contour lines can be generated much easier and in a shorter period of time. If a DEM is not available locally, a high resolution worldwide DEM can be easily accessed and is freely available for download in the internet (http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp). Rivers, mountains, watersheds and other prominent landforms can also be automatically generated in the DEM and can be included in the base map.

Despite the practicality of the fourth method in terms of time and precision, it requires skilled personnel who understand the know-how of GIS. It is very seldom, however, to find GIS personnel in rural areas where we usually conduct P3DM, making the third and fourth methods sometimes impractical at all.

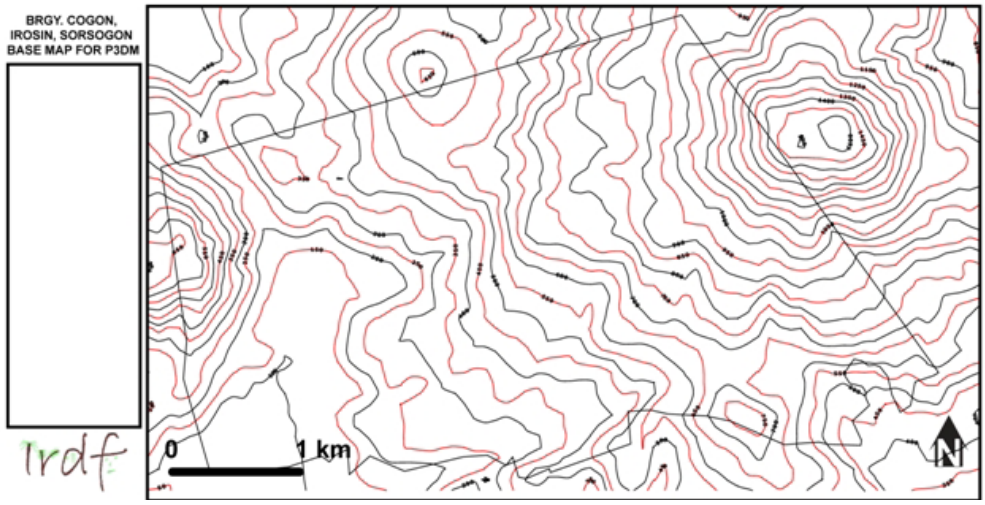


Figure 6 – A sample of a base map with the basic elements required such as contours, scale and orientation (pointing to the north when relevant). Contours are portrayed using two different colors to better differentiate them.

Figure 7 – Base map enlarged from a topographic map in Borongan, Philippines (JC Gaillard, August 2007)

If there are only few contours on the study area, the base map should contain at least the boundary of the study area (should it follow administrative borders) and few references such as roads, river, and landmarks that are preferably based on GPS or other mapping techniques.

In some cases, maps of the target area might not exist or might be too difficult to obtain especially in rural remote areas. Thus there would be no basis for the boundary of the base map. GPS then can be used to obtain the boundaries through GPS mapping of the boundary which require some technical skills and knowledge on that technology.

To learn more, see Rambaldi and Callosa-Tarr (2000, 2002).

3.3.1 Who prepares the base map?

Preferably, the preparation of the base map is a task of the local government unit (or the concerned partner government agency) and local NGO (Figure 8). Thus the method of preparing the base map and obtaining the contour should depend on their preferences and capacities. This is one way to ensure that replication of the tool can be done without the necessity to ask for experts or technical personnel. However, in most cases, there are no GIS specialists or technical persons even among the members of NGOs. It is more likely, however, that government authorities and agencies have the capacity to produce the base map with their technical expertise on the matter. Thus, it is advisable that there is a partner government authority (or academic institution) involved in a P3DM project. In fact, this is an opportunity to build partnership and start the collaboration between local people, NGO, government authority and academic institution.

Figure 8 – Staff of a local NGO preparing a base map in view of a P3DM in Phnom Penh, Cambodia (JC Gaillard, January 2011)

3.3.2 Materials for the base map

The base map can be printed on either paper or tarpaulin depending on the cost and practicality of the materials in the locality. Table 3 enumerates the advantages and disadvantages of the materials for base map.

Material	Advantage	Disadvantages	Cost
Paper	Easy to cut Lighter	Fragile Sensitive to wind, humidity and scratches	The cost of the materials depends on the locality, e.g. in the Philippines, Cambodia, and Indonesia base maps printed on tarpaulin are cheaper than if printed on paper. On the other hand, in France, tarpaulin printing is much more expensive than paper printing.
Tarpaulin	Water-proof Flexible and not sensitive to wind Easy to move from time to time without erasing the content	Heavier than paper but can be carried easily	

Table 3 – Advantages and disadvantages of paper and tarpaulin as base map material

Warning:

The base map may contain mistakes. Check carefully especially the contours and contour label before printing and allot time for correction, otherwise there is a risk that the base map would not be useful at all.

3.4 Preparing the support table

The support table is used as the underlying support to the 3D map. The size of the support table is dependent on the chosen scale and size of the 3D map and the storage area. The size of the support table must be of the same size or a bit larger than the size of the 3D map (the edges of the table may be used to hold elements of the map such as legend, north arrow, title, etc. or as support for glass cover).

The strength and stability of the support table should be carefully considered (Figure 9). The table should be strong enough to withstand the actual weight of the 3D map as well as the vertical pressure that will be exerted by the participants during the construction of the 3D map. During the plotting of pushpins, for example, you would expect participants clinging or holding on the table, and in some case sitting or standing on the table (Figure 10).

At this stage, it is essential to foster the participation of local craftsmen to gather the required materials and actually build the support table. On the long run, such early participation in the activities ensures ownership as locals are usually very keen to look after the map they have built with their own hands.

Figure 9 – Preparation of support table by the local participants in Masantol, Pampanga, Philippines (JC Gaillard, August 2008)

Tips and tricks: *Make the support table very strong and stable. If not, it might suddenly collapse together with your 3D map.*

Figure 10 – Participants sitting and standing on the table supporting a 3D map in Josefina, Philippines (JC Gaillard, January 2010)

The 3D map is normally huge in size (with a dimension of least 1.5 x 1.5 m for a 1000 hectare land area). For several reasons, it is sometimes necessary that the 3D map (thus the support table and the base map) be divided into two or more parts. Also, if the 3D map is huge in size, it might be inconvenient for the participants to put information (pushpin, paint or yarn) on the map as they have to stretch their arms to reach the center or distant part of the 3D map. Thus the 3D map including the support table and the base should be divided into two or four parts in order for the participants to easily circulate on each part of the 3D map (Figure 11).

Figure 11 – A 3D map with a dimension of 2x2 meters were divided into 4-parts in order for the participants to easily access any part of it, Macawayan, Irosin, Sorsogon, Philippines (J. Cadag, January 2010)

Also, if the storage area or room is not the same as the venue of the actual P3DM, it is easier to transport 3D map piece by piece. Thus, it is also necessary to check the size of the door to ensure that the 3D map (or the divided parts) can be brought inside the room (Figure 12). All of these considerations while making the support table should be anticipated.

Figure 12 – Participants try to get a 3D map into its storage room in Masantol, Pampanga (JC Gaillard, August 2008)

3.5 Collecting some GPS points

This is not a compulsory task and P3DM may well proceed without using GPS. However, GPS points could serve as guides for participants to locate other community information. It is to make sure that information (in the form of pushpin, yarn and paint) is properly located on the 3D map. Usually, on where and which information to start is a bit tricky especially for participants who are not familiar with maps. In many marginalized communities especially in rural areas, the 3D map might be the first map the participants could have ever seen.

GPS points are extremely important especially if the blank model is relatively plain and there are no prominent features such as mountains, rivers, and other landforms that could guide the participants to locate other information. With GPS points already located on the 3D map, it would be easier for the participants to identify adjacent information (Figure 13).

Figure 13 – GPS points plotted in the 3D map using popsicle sticks to facilitate the plotting of other information, La Carlota City, Negros Occidental, Philippines (J. Cadag, January 2010)

Collecting GPS requires some technical skills on both GPS and GIS mapping. After collecting the GPS points, they need to be transferred into a GIS. The GPS points could be printed on the base map or could be depicted directly on the blank model using any local materials such as stick or pushpin. GPS points could also help to verify the accuracy of the base map in terms of the boundary, elevation and scale (both vertical and horizontal).

Warning:

It is important to properly explain to the participants the purpose of the GPS points and why they are important. The participants must not misunderstand that the P3DM would not be completed without collecting GPS points. If necessary, the local officials or anyone from the community who understand the technology explains it to the participants in order to avoid possible misconceptions that it is a very sophisticated technology that could only be used by "experts" from the outside (Box 2). Once again, P3DM may well proceed without the use of GPS points.

3.6 Preparing the training materials

It is important that all the materials are ready before the actual P3DM activities in order to avoid delays. Based on previous P3DM experiences, it is always better to prepare the materials in collaboration with the community. Local people always have the ideas and alternatives to replace missing items with what they have in the community. It is also the best time to explain to the participants why those materials are needed. Consider the following stages of P3DM in preparing the materials:

3.6.1 Registration

Prepare attendance sheet for the participants. This is also useful to count the actual number of meals to be prepared for the participants. Try to provide a kit for the participants containing at least a pen and a paper. It should also contain some brochures, nametag, and other necessary materials. In some cultural contexts, however, kits and name tags may be irrelevant.

3.6.2 Group discussion and activities

Anticipate as much as possible the different activities that shall be conducted as part of the actual P3DM. Mostly, there will be some discussion before or in-between the P3DM activities and thus large pieces of paper and pens would be needed. There might also be some games or 'energizers' in between, and some materials might also be needed like a ball. Take note of those complementary activities and list the required materials.

Also, consider the number of participants to better estimate the quantity of the materials to be provided. During the discussion, for instance, each person might need a pen so that each can write at the same time and thus unnecessary time for waiting will be avoided.

3.6.3 Materials for the P3DM

In preparing the materials for P3DM, always consider the accessibility for the local people and environmental impact and sustainability of those materials. This is particularly important during the updating process on which additional supply of same materials will be needed. It is also crucial should similar mapping activities are to be reproduced eventually by local stakeholders in neighboring areas. In case the identified materials are not accessible for the people or a lot of time, effort and money are required to obtain them, consult the local people immediately for the possible alternatives. Certainly, you will not be disappointed! In fact, it is best to encourage the participation of prospective participants in identifying and collecting the materials required to conduct subsequent activities. Table 4 is a suggested list of materials to be prepared in view of P3DM:

Suggested materials for each stage of P3DM	Suggested quantity	Illustrations/photos	Some considerations
Construction of the blank relief model			
Base map	Depending on the number of 3D map to be built	Refer to Figures 6 and 7 for examples of base maps	See section 3.3 for the base map preparation
Scotch tape	At least 10 rolls with varying widths from 1-2 cm		Test the scotch tape if it works on polystyrene or the chosen building materials for the base map

Brown tape	At least 5 rolls depending on the relief of the 3D map		Will be used to affix the layer of materials needed to build the blank model. Test it beforehand
Building materials of the base map: Polystyrene Carton Crepe sole Rubber mat Cork	Depending on the size and terrain of the map		See Table 5 for the advantages and pitfalls of these materials
Cutter and spare blades	At least 10 pieces		Reserve some extra blades
Scissor	At least 10 pieces		Reserve extra scissors
Polystyrene cutter	6-8 pieces		Needs extra batteries and blades

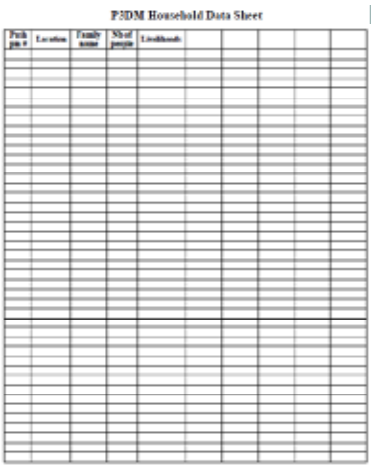
Glue made from cassava starch, commercial glue or whatever local materials	At least 2 kilos		When available locally, glue made from cassava starch is highly recommended since it is cheap and easy to prepare Cook the cassava starch with boiling water with a ratio of 1:2. A small amount of vinegar can be added to prolong the affectivity of the glue
Carbon papers	The quantity should be enough to cover the whole base map		Check beforehand that the carbon paper you have purchased works with either tarpaulin or paper base maps
Double clip	At least 10		Should be big enough to clip the base map, the carbon paper and one layer of either carton / polystyrene / crepe sole / rubber mat / cork
Thin nail	One kilo		Will be used to strengthen the blank model. Should be appropriate to the kind of materials chosen for the model.
Hammer	2-3		

Old disposed newspapers or whatever available scratch paper	Large quantity depending on the size and relief of the map		Will be used to make paper mâché
White paint	At least 2 liters		You can add mixing compound such as thinner and gasoline to dry the paint faster
Paint brush	At least 5		The width of the paint brushes should be at least 2-3 cm
Group Discussion			
Computer	1		Not to be recommended if locals are not used to see technological devices as it may bring a divide between the facilitator and the participants
Overhead Projector	1		

Large sheets of paper	At least 30 pieces with a dimension of at least 1x1 meter		
Small pieces of colorful papers	Hundreds		
Markers	At least 30 pieces		Select different colors
Masking tape	At least 5 rolls		Test the masking tape if it can fasten the huge papers to the wall
Scotch / cellophane tape	At least 3 rolls		Will be used to affix the sheets of carbon paper

Energizers or games			
Ball, dance music, chart, etc. Depending on the games	Depending on the number of games		Try to conduct energizers before the start of each activity
Plotting of map features			
Pushpin	The quantity of pushpin to be prepared should base on the estimated number of data to be plotted on the 3D map and their quantity. For example, if there are 30 kinds of data (houses, vulnerable people, landmarks, etc.), then there should be at least 30 kinds of pushpins. Also, if there are 300 houses in the village, then there should be a type of pushpin which is at least 300 in quantity.		It is suggested to obtain the most number of pushpins with different shapes, colors and sizes since they can be used for updating later

Yarn	At least 20 colors Consider obtaining yarns in the same color theme (ex. light red, red, dark red)		It is suggested to obtain the most number of yarns with different colors since they can be used for updating later
	5000 pieces		
Thimble	A dozen depending on the number of participants		This is a helpful gadget for the comfort of the participants which may have to plot thousands of dressmaker's pins
Paints	At least 2 liters of white and black, 1 liter of other basic colors, and ½ liter of ready-mixed colors		Other colors can be mixed using the basic colors

Paint brush	At least 15 paint brushes with width of 2-4 cm At least 10 artist brushes with width of 3-10mm		Prepare mixing compound such as thinner and gasoline to clean the paint brushes
Scale guide	At least 5		The length depends on the chosen scale For a scale of 1:1000, Make a 10 cm long carton or polystyrene (to represent 100 m) and shade each centimeter with black and white as illustrated below.
Household data sheet	Based on the number of households		The facilitator may provide a blank household data sheet if the community has no existing records See step 8 for the household data sheet

Small-pointed markers	At least 20		These small-pointed markers will be used to mark the top of the pushpins There should be white and dark colored markers to ensure Also a small piece of paper marked by number can be glued at the top of the pushpin
Global Positioning System (GPS) – Non-compulsory.	1		The simplest models usually suffice and prove more accessible to locals whom should be engaged in the collection of reference points

Table 4 – List of materials to be prepared for each stage of P3DM

The usual problem is the limited variety of pushpins especially in the rural provinces. One of the easiest ways to cope with the shortage in the number of pushpins of a particular color is to paint some of another color (Figure 14). In addition, Figure 15 shows other locally-invented alternatives to make for an insufficient diversity or numbers of pushpins. Locally available materials can always be used as replacements.

Figure 14 – Pushpins painting workshop in Masantol, Pampanga (JC Gaillard, August 2008)

 Popsicle stick and hand-made flags made up for the shortage of pushpins in Josefina, Philippines – Jan. 2010	 Different kinds of beads were used instead of pushpins which are quite limited in Ngargamulyo, Indonesia – Jul. 2011	 Sponge were cut into small pieces and replaced the pushpin usually used for houses in Fogo, Cape Verde – May 2011	 Corks used in replacement of pushpins to depict large buildings in Bourg Saint-Maurice, France – May 2010
 Ear ring used instead of pushpins to depict boat accident-prone areas in Mercede, Philippines – Dec. 2012	 A yarn tied to the pushpin provides another information or give another meaning in La Carlota, Philippines – Jan. 2011	 Matches may serve as additional items for the legend, notably to depict lifelines as in Odraha, Nepal – May 2012	 Decorative flowers replaced pushpins in Odraha, Nepal – May 2012

Figure 15 – Examples on how to cope with limited shapes and colors of pushpin

There are several base materials that can be used to build the blank relief model. Table 5 compares the advantages and disadvantages of different base materials.

Kind of materials	Advantages	Disadvantages	Cost
Polystyrene 	- Easy to assemble and cut - Available in different thickness - Resistant to water - Last for over 10 years if properly stored	- Fragile and may easily be damaged by wind - Pollutant	- Normally less expensive than crepe sole, rubber mat and cork
Carton 	Always available locally - Environment friendly	- Difficult to assemble - Not available in volume with the same thickness - Sensitive to water and high humidity - Risk of booklice even with insecticide - Limited lifetime	- Free or cheap

Crepe sole 	- Resistant to water and wind - Last for over 10 years if properly stored	- Heavy - Not usually available especially in the rural areas - Difficult to assemble and cut	- Generally expensive
Rubber mat 	- Resistant to water and wind - Easy to assemble and cut - Advantageous in relatively plain 3D map with 1-3 layers - Last for over 10 years if properly stored	- Heavy - Not usually available especially in the rural areas - Difficult to find in volume	- Generally expensive
Cork 	- Available in different thickness - Easy to assemble and cut - Estimated lifetime of 3 years	- Heavy - Fragile and might be damaged on its way to the venue - Difficult to find in volume - Not usually available especially in the rural areas - Risk of booklice - Sensitive to water and high humidity	- Generally expensive

Table 5 – Comparison of possible base materials for a 3D map

The facilitator and participants should consider balancing the advantages and disadvantages of the base materials and choose according to suitability to local context. For instance, in relatively dry places where humidity is low and booklice is not a common problem, the carton might be the best choice over other materials not to mention that it is relatively cheap if not free. On the other hand, considering available locally, polystyrene might be the best material as it guarantees the same durability as crepe sole and rubber mat at relatively cheaper price although it is not eco-friendly and should be use with care.

3.6.4 Transportation of materials

The facilitator should also anticipate the difficulties during the transportation of the materials. In some cases, materials must be transported to communities where roads are poorly maintained or not passable by cars and other 4-wheel vehicles. A large truck or 4x4 vehicles can be used or perhaps the facilitator and the local people themselves could carry the materials by foot if vehicles are not allowed in the area.

Tips and tricks: *Prepare the list of materials needed. Ask the help of the local people in preparing the materials and ensure the right transportation means to carry everything safely.*

3.7 Identifying the participants

P3DM is a tool and method which facilitates people's participation in consensual decision making with a large array of stakeholders. Ensuring a large, representative and fair participation of the local community is therefore essential.

First, there needs to be a core group of participants who will follow the activities from the start up to the end of the training and beyond, i.e. they should also be involved in the monitoring and upgrading of the map. This core group should be large enough to include several people from all places covered by the map so that enough knowledge is available for the entire area. Most often this core group is composed of 15 to 30 people, but there is no definite figure as the number varies with the size and population of the local community.

This core group must also cover all sectors of the community. It should involve the most and less affluent people, the young, adults and elderly, men, women and non-heterosexuals, farmers, fishermen, factory workers and office employees, people with different disabilities, different ethnic and religious groups, etc., depending on the local context. P3DM is a tool which usually works very well with people who are usually marginalised within their community or amidst the larger society because it makes knowledge and issues tangible and scales down power relationships. Emphasis should therefore be placed on those usually neglected (Figure 16).

Figure 16 – People of different castes, livelihood groups, age and gender participating in a P3DM activity in Odraha, Nepal (JC Gaillard, April 2012)

Finally, the core group should consider power relationship within the local community. Its composition should therefore draw upon a fine knowledge of the context and involve local stakeholders in the decision making process. Participants must be committed volunteers. Transportation fares to reach the training area may be covered by the facilitator but no allowances or per diems should be distributed as power relationships between outsiders and insiders should be leveled down as much as possible.

Beyond the core group, no one should be prevented to participate at all stage of the training activities. It is always better to have more participants

than too few as it reflects a sense of dedication and interest on the side of the local community. It is the task of the facilitator to find a way to accommodate an unexpected large number of participants.

In some instances, it may be good to organize special session with specific groups to discuss particular issues upon the map, e.g. women and gender minorities to discuss gender-related issues, children and elderly to address age-related concerns, farmers for problems pertaining to agriculture, and fishermen to tackle hazards which form off shore (Figure 17).

Figure 17 – Children plotting school-related data on a 3D map in Irosin, Philippines (JC Gaillard, January 2010). The tangibility of data available on a 3D map facilitates the involvement of kids in DRR.

Beyond members of the local community, P3DM activities should also involve from the beginning of the training representatives of other crucial stakeholders of DRR, e.g. NGO staffs, local government officials, scientists, faith group leaders, representative of the business sector. The sooner they are involved in the activities, the better the dialogue is afterwards as rapport and trust are built along the construction process. Such a large array of stakeholders also eventually facilitates the reproduction of the methods in neighboring areas.

3.8 Anticipating the logistics

Logistic are an important element to achieve a smooth flow in conducting P3DM activities, to work in better conditions and to avoid unnecessary delays. Planning the logistics, however, should always take into account its suitability to the local context.

3.8.1 Schedule of the activities

Ideally, the schedule of activities should be defined by the participants according to their own needs and availability. Some participants might be too generous to the extent that they would suspend their daily activities just to please the outside facilitator. The facilitator should always keep in mind that for some participants, a day lost is equivalent to a day or days without food on the family's table. Prayer time, community feasts and celebrations, and other community's occasion should not be disturbed.

The facilitator should then be flexible enough with regards to the schedule and should propose two or three schedules for the participants to choose so that there is not a need for them to sacrifice their daily activities. For example, a focus group discussion with women can be organized during the day if they are free while men can have the same activity late in the afternoon after their work.

In some cases, some participants could not participate simply because of the distance from their home to the venue especially in remote rural areas. This should be taken into account by the facilitator in think of a strategy to make them participate.

There are basically two main options for scheduling P3DM activities. The first consists in organizing all activities within a week or several consecutive days. The second scenario includes activities on a regular basis, e.g. once a week, over a longer period. The second option usually fits best Western context where people attend formal jobs which require presence at work on a daily basis. In more flexible contexts, the first option is often best as it creates a momentum amongst participants.

During the 3D mapping activities, it is preferred that the participants from the first day could also attend the remaining days until the map is finished. This way, there is no need for the facilitator to explain again the process on the second or third day for the newcomers. However, it is again a question of availability of time of the participants and the facilitator should anticipate it. In the Philippines, sustainability of participation of the participants is ensured through the village chief or the village council who arrange the schedule on behalf of the members of the community.

3.8.3 Facilitator

The role of the facilitator is instrumental. It is actually recommended that there be a tandem of two facilitators to orient a P3DM activity as there often many parallel tasks which demand attention on several sides. Too many facilitators may, on the other hand, out weight the power relationships with the participants.

Most often the facilitator is an outsider (i.e. from beyond the local community) and has to be very careful about their overall behavior when interacting with locals. To level down power relationships it is strongly recommended that the facilitator be careful at her/his attire and do not show obvious (pseudo-) signs of power, i.e. wealth and knowledge (e.g. devices and gadgets such as fancy mobile phones, GPS, voice recorders, cameras). Language should also be gentle and encouraging and it is obviously best if the facilitator speaks the vernacular. The facilitator should never teach participants or show them that they are wrong in locating a feature on the map. Because the map is scaled, a wrongly located feature will lead to all other features being misallocated and ultimately people will realize that not all fit in the map. By themselves, they will look back at potential errors and eventually correct the entire map. The more marginalized the community is, the more careful the facilitator needs to be.

The facilitator, however, is not always necessarily the outside stakeholders who have initiated or funded the activities; any participant can be a facilitator as long as he/she understands the purpose and objective of the activity. In most cases, there is always a local leader or facilitator that comes out and is highly recommended by the local people. If there is no one, maybe that is a chance to look for someone and develop local leaders!

Tips and tricks: *It is also very useful and recommended that the facilitator documents and takes note of the P3DM activities, notably the participation process. This often proves instrumental in identifying issues (e.g. dominant behavior, facilitation mistakes, technical difficulties), understanding the reasons for failures or successes and finding solutions to problems. Ultimately, it also helps the facilitator to learn about his/her own successes and mistakes and improve for subsequent projects.*

3.8.4 Role of the participants

P3DM is usually a fun activity which involves the entire community. For example, children may sort pushpins and cut papers while men prepare the table and women assemble the blank model.

Many preparatory activities such as sorting of small materials (e.g. pushpins, yarns, paints), preparation of the support table and the polystyrenes (or cartons), arrangement of presentation materials such as the markers and huge papers (or data projector and computer), etc., actually have to be done subsequently. The facilitator should not attempt to do all these activities by themselves. Instead, the participants should be encouraged to participate at all times. In fact, it is more ideal that facilitator work less while the local people accomplish the activities they can do by themselves.

For instance, during the construction of the 3D map, some of the laborious activities are cutting, gluing, painting, putting of pushpins, etc. Always encourage the local participants to do all those activities and, if possible, do not intervene to the extent that local participants become intimidated. Always consider that there are many communities which do not have much exposure to the outside and that local people are usually timid in front of outsiders. It is for this very reason that the outside facilitator should try not to dominate the activity as local people would always try to avoid mistakes in their every action making them hesitant to do many things. In other words, skills and time of the participants should be maximized through proper distribution of tasks.

Tips and tricks: *Try to balance the participants' participation. Some might be too keen to participate while others might be too timid or intimidated for many reasons. The facilitator should try to balance out the dominance of some participants over the others.*

3.8.5 Arrangement of meals for the staff and the participants

Preparation of decent meals is very important as it can be the only consolation for the participants during the whole activities. Always overestimate the number of meals to be prepared in order to ensure that every participant will be served with food.

It is always better that the local people prepare the food for themselves. There should always be someone from the community who would be willing to perform the role as a cook. The local cooks know better than anyone the food preferences of the local people – ditto for the refreshments. Also, it is preferred that the same venue of the activity is to be used during lunchtime so that the participants need not to leave the area. This is also a good chance to hear some feedback from the participants and to assess their interests in the activity.

However, there are some cases that meals have to be delayed especially if the participants are too busy or too focused on the map or discussing important matters related to the activity. This is to avoid interrupting the momentum of the participants which might not happen again because of the meal. This is not to say that meals will not be served until the discussion or certain activity is finished but the facilitator should be observable.

Warning:

Participants may suddenly approach the 3D map while eating their lunch or having break, this shows how interested they are and should not be stopped. Ask someone from the participants to remind those participants to be careful not to spill food or drinks in the 3D map.

3.8.6 Accommodation for staff

To save time and to be fully integrated into the community, the facilitator should try sleeping or staying in the community during the whole duration of the activity. Late-afternoon informal conversations with the local people or neighbors would allow the facilitator to better understand the community. Customs, taboos, traditions and other community issues that are invaluable in understanding the community but cannot be discussed formally during the day may be revealed at night.

Also, keep in mind that the living and working conditions within the community may be full of constraints. For example, there might be no electricity and thus debriefing at night is almost impossible. However, do not impose the desire to sleep in the community if it is uncomfortable to the local people. At the very least, the place where you will stay or sleep at night is near the village and that there is not much time to spend travelling every day.

To learn more, see Gaillard and Maceda (2009).

Mayfourth, NGO project leader, Quezon City, Philippines

"Participatory 3DMapping involves a lot of people in the community (from different sectors, members of the disaster risk reduction and management committees, other stakeholders and duty bearers) in studying their risks, vulnerabilities and capacities, thus making risk assessment more reliable."

Rosalyn, woman leader, San Mateo, Philippines

"In 3D mapping, it is very important that there are participants who know well the whole village and the people in the village. It is also important that the presidents of the organizations are present because they make the activity easier knowing that there are data and information of which they are the most knowledgeable."

Ka Noli, community leader, San Mateo, Philippines

"Participatory 3- Dimensional Resource Mapping (P3DRM) is a convergence of people wanting to create for themselves that version of terra firma which they call 'home sweet home'. It is that one slice of planet Earth where they live, move and have their being."

References

Rambaldi G., Callosa-Tarr J. (2002) *Participatory 3-dimensional modelling: guiding principles and applications.* ASEAN Regional Centre for Biodiversity Conservation (ARCBC), Los Baños. Available from: http://www.iapad.org/publications/ppgis/p3dm_arcbc_lr.pdf (accessed 16 January 2012).

Rambaldi G., Callosa-Tarr J. (2000) *Manual on participatory 3-dimensional modeling for natural resource management.* Department of Environment and Natural Resources, Quezon City. Available from: http://www.iapad.org/publications/ppgis/p3dm_nipap.pdf (accessed 16 January 2012).

Gaillard J.-C. et Maceda E.A. (2009) Participatory 3-dimensional mapping for disaster risk reduction. *Participatory Learning and Action,* 60: 10. Available from: http://pubs.iied.org/pdfs/G02818.pdf (accessed 16 January 2012).

STEP 4.

INTRODUCING THE TRAINING

STEP 4 IN A NUTSHELL

Objective:

- Introduce the objectives of the activities
- Expectation check
- Introduce the base map

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Flip charts, small pieces of paper, markers and masking tape, stones/beans or equivalent
- Base map

Duration:

- One to two hours

4.1 Formal start of the activity

Depending on the local context, there may be a formal protocol of activities to start off with. These activities may be very important as a first step to earn the trust of the participants. These might include:

- Registration of the participants
- Opening prayer
- National or local anthem
- Opening or welcome remarks
- Introduction of the participants

Do not hesitate to use games for the introduction of the participants. For example, the facilitator and participants may introduce themselves through passing a ball from each other. Whoever gets the ball introduces himself/herself. This simple game provides a friendly atmosphere eliminating the barrier between participants and facilitator.

To learn more, see Chambers (2002).

Tips and tricks: *Providing name tags to the participants is very practical for the facilitator to easily recognize the participants. Also, a name tag gives participants a sort of confidence that they are really part of the project. On the other hand, others who may not have nametags might feel excluded. Thus, make sure to prepare extra nametags especially for the newcomers.*

4.2 Rationales and objectives

The training formally starts with the presentation of rationales and objectives. The facilitator should explain to the participants why the training is being initiated in the community and what would be their participation. The facilitator should emphasize to the participants the benefits of the activity to the community without promising of solving all the problems. In other words, the facilitator should clearly explain that the success of the activity greatly depends on the cooperation of the participants.

In explaining the rationales and objectives, the following guide questions are worth considering:

1. What is the project? Whose project is it?
2. Why is it important for the community?
3. What are the tools/methods that will be used in the community?
4. Who are the key actors? What is their role before, during and after the training?
5. What are the expected benefits for the community? Who will benefit from the project?

For the outside facilitator, language barrier, achieving people's trust, and understanding the humor of the local people are some of the difficulties that might hinder communication with the participants. If the outside facilitator is not so confident to overcome all these difficulties, one of the best ways is to ask someone from the community to play the role as facilitator. The following are some of the advantages of having local facilitator:

1. People are more comfortable to talk
2. There is no language barrier

3. The local facilitator has already an idea of the community issues and thus he/she can anticipate the answers and ask more relevant questions
4. The activity becomes self-sustainable in a sense that it is the local people themselves who facilitate and participate with less intervention from the outside
5. The outside facilitator can focus on participant observation and understand the power play between the participants of which they are not aware of

Using technological devices such as data projector and computer is very useful for presentation purposes and other documentation procedures on the side of the facilitators. However, some communities are not familiar with these devices, which might cause them to be hesitant in many ways. The facilitator should not give the impression that in order to conduct P3DM, technological devices are always required. The facilitator should always consider that P3DM is a methodology and tool that adapt to the local context and not the other way around (the local people adapting to the tool). Facilitators should find a way to provide materials that replace those technological devices without causing hesitations on the part of the local people to participate. For instance, a simple paper and a marker can be used to replace data projector and computers for presentations. For documentation procedure, local people can participate in documenting the activities using pen and paper instead of video cameras or voice recorders.

Box 2 – Issues with the use of technology

Another smart way to proceed for introducing the training to the participants is to invite people from other villages who have been involved in building and using a 3D map in the past. Those may share their experience in words which often speak to the participants (figure 18). It further facilitates a horizontal transfer of experience instead of relying on the sole outsiders' knowledge of the facilitator.

Figure 18 – A community leader from Dagupan shares their previous experience with the member of a community of San Mateo, Philippines, at the start of a P3DM training in January 2011

4.3 Expectations check and training needs assessment

This step is aimed at identifying everyone's expectations and see whether there are gaps with the facilitator's expectations. In this activity, the facilitator should be clear enough of what is doable or not. It might disappoint the participants at the start but it prevents them from false expectations.

Perhaps the simplest way to conduct an expectation check is to ask the participants directly of what they expect from the activity. If the participants are quite timid to speak, a pen and a paper may be distributed so that participants can just write and give their expectations anonymously. The pieces of paper containing the expectations may be posted on the board and the facilitator can just directly indicate to the participants whether those expectations are achievable or not.

In some cases, DRR may not be identified or listed as the priority or urgent problems in the community. Poverty, unsustainable livelihood, food security, and health problems are more likely to be the priority problems.

However, this does not mean that we should not continue the P3DM activity that is intended primarily for DRR. This only means that the development of DRR plans and strategies during the training should be widened to include those community issues as part of the DRR efforts.

One particular way to conduct an expectation check is training needs assessment through a scoring/ranking activity. This method allows the facilitator to understand what are the most important or urgent problems in the community that affect people the most. The following simple steps can be done to accomplish this training needs assessment:

1. Ask the participants of the three most important issues or problems in the community
2. Ask them to write them on a piece of paper (if you think some could not write, group them with other participants – if this might offend them, the participants can just give their answers orally)
3. Display the answers on the ground and group similar answers
4. Give a certain number of pebbles, stones, beans or whatever materials is locally available to the participants
5. Instruct the participants to distribute pebbles/stones/beans over the issues/problems they have indicated earlier. The more pebbles/stones/beans, the more important the problem is to the community
6. Rank the issues/problems according to the number of pebbles/stones/beans
7. Summarize the results using Table 6 below

Issues/Problems	Number of stones	Priority order
Example 1 – Landslide	OOOOOOO	2
Example 2 – Illegal fishing	OOOOO	3
Example 3 – Flood	OOOOOOOO	1
Example 4 – Malaria	OOO	4

Table 6 – Table of scoring issues

To learn more, see for example von Kotze and Holloway (1996), Abarquez and Murshed (2004), International Federation of Red Cross and Red Crescent Societies (2008) and CARE (2009).

4.4 What is disaster risk reduction?

It is important to provide the participants with a rationale for building a 3D map in planning for DRR. It should draw upon a discussion on the causes of disasters and the potential measures to prevent their occurrence or at least mitigate their impact.

One common option for engaging in such a discussion with the participants is to resort to the mnemonic:

Disaster Risk = Hazard x Vulnerability / Capacity

It should be made clear that the purpose of this formula is not to come up with any quantitative computations but rather to understand the interactions between natural events and the community. In that context, simple definitions of the crucial concepts which appear in the formula include:

DISASTER: a situation involving a natural hazard which has consequences in terms of damage, livelihoods/ economic disruption, and/or casualties that are too great for the affected area and people to deal with properly on their own (Wisner *et al.*, 2011).

HAZARD: a natural phenomenon which is of potential danger for people and properties in a given area at a given period of time.

VULNERABILITY: susceptibility to suffer from damage in the event of a hazardous phenomenon or the "condition of a society which makes it possible for a hazard to become a disaster" (Cannon, 1994).

CAPACITY: the set of knowledge, skills and resources people resort to in dealing with hazards and disasters.

RISK: a compound function of a natural hazard and threatened people, characterized by their varying degree of vulnerability and capacities, who

occupy the space and time of exposure (adapted from Wisner *et al.*, 2004).

Obviously, these terms may not exist in many local languages and it is pointless for the facilitator to impose Western concepts to local participants. The aim here should be for the participants to realize that people are unequally fragile in facing natural events but that all possess resources to cope with such phenomena. It is equally important for the participants to appreciate that the root causes of their vulnerability are often, not always, exogenous and anchored in structural constraints (e.g. unequal distribution of wealth and resources within the society, unfair gender relationship, poor governance). On the other hand, their capacities to face natural hazards are largely, not exclusively, endogenous as these reflect local knowledge, social network, traditional medicine, etc. Figure 19 provides a diagram which summarizes these issues.

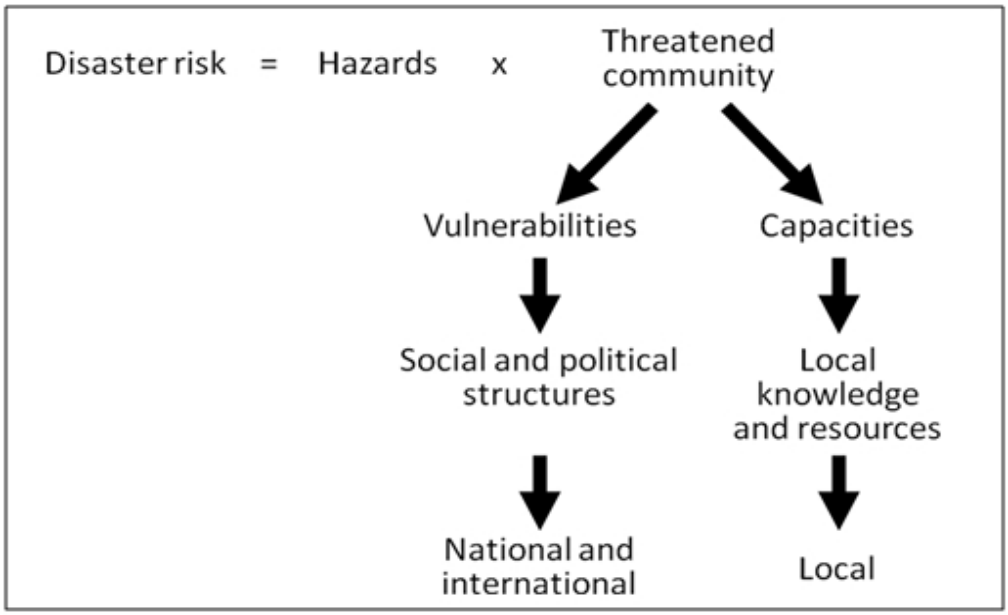


Figure 19 – Root causes and interaction between hazards, vulnerabilities and capacities

From there, the facilitator should foster a short discussion around the potential actions for reducing the risk of disaster in the community, which is to be expanded at Step 12. It should be underlined that preventing hazards is often costly and never provides total safety. Mitigating vulnerabilities is similarly difficult because often beyond the reach of the community. On the other hand, it is frequently easier to enhance capacities because they are locally available. Figure 20 may help in debating these issues should the concepts make sense in the local context.

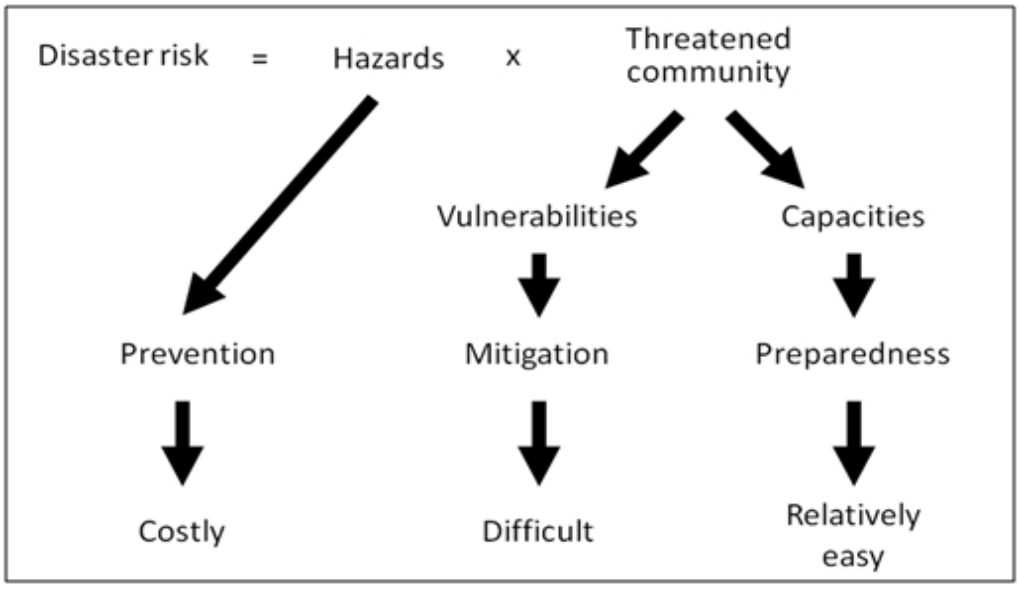


Figure 20 – Potential disaster risk reduction measures

It should be emphasized that the P3DM training and the 3D map are intended to enhance local capacities and facilitate their mobilization in time of disaster, as well as to identify potential local hazard prevention measures and ways forward in mitigating vulnerabilities.

Marcelo, high school student, Masantol, Philippines

"When we made the 3D map, I have seen the unity of the people who participated. They came from different barangays (i.e. villages) and yet they worked as one and had only one vision, that is, to finish and complete the map because it will be for the benefit of the community. When we were hit by the recent flash flood that was when I realized the importance of the project. The project has been very useful because people were able to identify the areas where they will evacuate in times of calamities."

4.5 Presenting P3DM

P3DM should be introduced as one of the tools that can be used to reduce people's vulnerability and enhance their capacities. The following questions can be used as guides to explain the tool and method briefly (refer to the introductory part of the manual for some explanations and answers on the following questions):

1. What is P3DM?
2. How does it help in enhancing local capacities and addressing vulnerabilities?
3. Why is it useful for facilitating the integration of knowledge and actions in DRR?
4. How does it foster dialogue between stakeholders?

To learn more, see Gaillard and Maceda (2009) and Cadag and Gaillard (2012).

Afterwards, the steps and materials needed to build the 3D map should be presented. Give participants a brief orientation on the step-by-step process that should be accomplished in order to build the 3D map. The materials listed in Table 4 can be presented to the participants. It should be emphasized that materials to be used are preferably local materials. This is to facilitate the updating process or even replication of the 3D map in other communities that require the same materials.

Some pictures of the major activities (preparation of the relief map, depiction of information using pushpin, yarn and paint, preparation of the legend, etc.) may also be shown to the participants in order for them to have a general picture of the upcoming activities (refer to section 5 for detailed information on the step-by-step procedure on building the 3D map).

4.6 Introducing the base map

A base map is difficult to decipher and interpret especially for people who have never encountered such a tool before. It is thus necessary to discuss the different elements it contains such as the contour lines, few elements

of legends, scale, etc. First, gather the participants around the map and let them observe it and share their interpretation. This is important in order to have an initial assessment of the know-how of the people when it comes to map. Afterward, the facilitator may discuss and clarify the nature and purpose of the base map and its main components.

The most noticeable feature of the base map is the contour line. So it is often the case that participants ask first about them. Try to avoid using very technical definition of the contour line. Explain to them that contour lines are lines that have the same elevation and the numbers indicated along them represent its elevation. The contour lines will serve as the guide to define each layer of whatever material is used to build the 3D map.

If there are few elements of legend on the map, such as rivers and roads, introduce them. It should help participants in orienting the map, which is a crucial issue. In Western contexts, the north is an obvious reference so the map may be oriented in that way. In most cases however, Western sense of orientation does not make sense as people rely on stars, wind patterns or actual landforms. In that case, the map simply has to be oriented according to the actual location of the training venue. For example, let people orient the map so that the hill or river they see outside is in the same direction on the base map.

Eventually the facilitator may discuss the scale of the map. A small piece of carton or polystyrene can be used as scale guide to explain scales and how are they used in the map. For instance, for a scale of 1:1000 (1 cm is equal to 1000 cm or 10 m on the ground) that is indicated on the base map, a 10 cm long piece of carton can be made to represent 100 m on the ground. This way, participants would easily understand that if their house is only 10 m away from their neighbor in reality, it should be represented on the map only as 1 cm.

The best way to proceed is often to discuss with a community leader beforehand and eventually let her/him introduce the base map with her/his own words (Figures 21 and 22). Explanation from outside facilitator might be hard to understand for the local people due to usage of technical words that are sometimes difficult to avoid or perhaps simply because of language barriers.

Figure 21 – Facilitators discussing a base map with local community leaders in advance of a P3DM training in Mercedes, Philippines (Kristine Marie Sadac, December 2012)

Figure 22 – Local community leader introducing the base of the 3D map built in La Carlota, Philippines (JC Gaillard, January 2011)

Before the actual activity, a small workshop can be conducted with key individuals such as local public officials to orient them about the method. A small group is easier to facilitate and technical questions could be answered and explained. During the actual activity, the participants of that small workshop can be asked to introduce to the participants the base map and later facilitate other activities.

Warning:

Do not forget to explain to the participants how the base map was produced. The base map is somehow complicated at first sight because of the contours and map elements and the participants might think that it requires a very sophisticated technology and skills. Explain to them that there are many ways to produce the base map.

Rosalyn, woman leader, San Mateo, Philippines

"When the map of the village (printed in tarpaulin) was taken out and divided into four parts, the participants who grouped themselves according to their organizations and associations eagerly searched for their areas of settlements."

References

Abarquez I., Murshed Z. (2004) *Community-based disaster risk management: field practitioners' handbook.* Asian Disaster Preparedness Center, Bangkok. Available from: http://www.adpc.net/pdr-sea/publications/12handbk.pdf (accessed 16 January 2012).

Cadag J.R.C., Gaillard JC. (2012) Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area*: in press.

Cannon T. (1994) Vulnerability analysis and the explanation of 'natural' disasters. In Varley A (ed.) *Disasters, development and environment.* J. Wiley & Sons, Chichester, 13-30.

CARE (2009) *Climate vulnerability and capacity analysis: handbook.* CARE, Chatelaine. Available from: http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf (accessed 16 January 2012).

Chambers R. (2002) *Participatory workshops: a sourcebook of 21 sets of ideas & activities.* Earthscan, London.

Gaillard JC., Maceda E.A. (2009) Participatory 3-dimensional mapping for disaster risk reduction. *Participatory Learning and Action,* 60: 10. Available from: http://pubs.iied.org/pdfs/G02818.pdf (accessed 16 January 2012).

International Federation of Red Cross and Red Crescent Societies (2008) *VCA toolbox with reference sheets.* International Federation of Red Cross and Red Crescent Societies, Geneva. Available from: http://www.ifrc.org/Global/Publications/disasters/vca/vca-toolbox-en.pdf (accessed 16 January 2012).

von Kotse A., Holloway A. (1996) *Reducing risk: participatory learning activities for disaster mitigation in Southern Africa.* International Federation of Red Cross and Red Crescent Societies, Durban.

Wisner B., Blaikie P., Cannon T., Davis I. (2004) *At Risk: Natural Hazards, People's Vulnerability, and Disasters.* 2nd edition, Routledge, London. Available from: http://www.preventionweb.net/files/670_72351.pdf (accessed 23 January 2012).

Wisner B., Gaillard JC., Kelman I. (2012) Framing disaster: theories, models and stories seeking to understand hazards, vulnerability and risk. In Wisner B., Gaillard JC., Kelman I. (eds.) *Handbook of hazards and disaster risk reduction.* Routledge, London, 18-33.

STEP 5.

PREPARING THE BLANK MODEL

STEP 5 IN A NUTSHELL

Objective:

- Build the blank model

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Base map
- Carton/polystyrene/crepe sole/rubber mat/cork
- Carbon, brown tape, double clips, paper and pens
- Glue, thin nail, newspaper, white paint

Duration:

- One to two days depending on the terrain of the area covered by the map

Once the base map is properly introduced to the participants, the building of the blank relief model may now commence. The blank relief model is basically the 3-dimensional representation of the topography of the community.

Table 7 shows the step-by-step procedure to build the blank relief model. For the purpose of illustration, we will be using polystyrene as the base material of the blank relief model.

Step-by-step process	Materials	Illustration
1. Divide participants into four groups with particular tasks to: a. 1st-group – Attach pieces of polystyrene b. 2nd group – Affix the carbon paper and then later to trace the contour line from the base map to the polystyrene c. 3rd group – Cut the polystyrene d. 4th group – Superimpose layers of polystyrene using glue and a few nails		
2. The 1st and 2nd group should begin affixing the polystyrene and carbon paper with the same size as the base map while the third and fourth groups are on standby.	Polysterene Carbon paper Brown tape Scotch tape	 

3. The 1st and 2nd group then may superimpose the base map, carbon paper and the polystyrene in the following order: Top – Base map Middle - Carbon paper Bottom - Polystyrene Fix them by using double clip to ensure that they will not move	Double clips	 
4. The 2nd group should start tracing the contour line of the base map one at a time starting from the lowest number (which implies the lowest elevation). The contour line will be transferred to the polystyrene through the carbon paper.	Pen or any sharp object than can used to trace the line	
5. Once the tracing is done, the polystyrene at the bottom should be remove and transferred to the 3rd group. The 3rd group may then cut the polystyrene along the traced line. Take the part of polystyrene which corresponds to the given elevation (i.e. within the contour line). Remove the other parts and keep it for later small layers.	Cutters	
6. The 4th group should receive the polystyrene from the 3rd group and start putting glue on its surface.	Glue made from starch or commercial glue	

7. Step 2-6 should be repeated with the following conditions to produce the second layer: Step 2 – The same carbon paper can be used until the last contour line, there is no need to affix another one. Step 4 – The second lowest elevation should be traced.	Same materials as step 1-6	
8. The 4th group should receive the 2nd layer of polystyrene and overlay it on top of the 1st layer. The 1st and 2nd layers of polystyrene should be well fastened by the glue and potentially with a few thin nails.	Glue made from starch or commercial glue and nails	
9. Step 2-9 should be repeated until the last contour line with the following condition: Step 4 – trace 3rd lowest elevation to produce the 3rd layer of polystyrene, 4th lowest elevation to produce the 4th layer, and so on.	Same materials as step 1-9	
Remarks: After finishing the last contour line, mountains, river channels and plains should be evident despite the ladder-like appearance of the slope.		

10. To eliminate the ladder-like appearance of the slopes of the blank relief model, the next activity is to cover them by paper mâché using newspaper and glue. Holes or cracks might appear if the newspapers are not fully layered with or soaked in glue. It is thus recommended to cut the newspaper into small pieces before applying glue and pasting them on the edges of the polystyrene layers. Two layers of paper mâché are recommended to fully cover the 3D map.	Newspaper, glue made from starch or commercial glue, scissor	
11. Finally, the relief modem should be painted with white paint to remove the different colors of the newspaper and provide a relatively smooth surface for subsequent mapping activity. Use fans or hair dryers to fasten drying. The blank relief model should then be ready for plotting anthropogenic features.	White paint, paint brush	

Table 7 – An example of step-by-step procedure for building a blank relief model

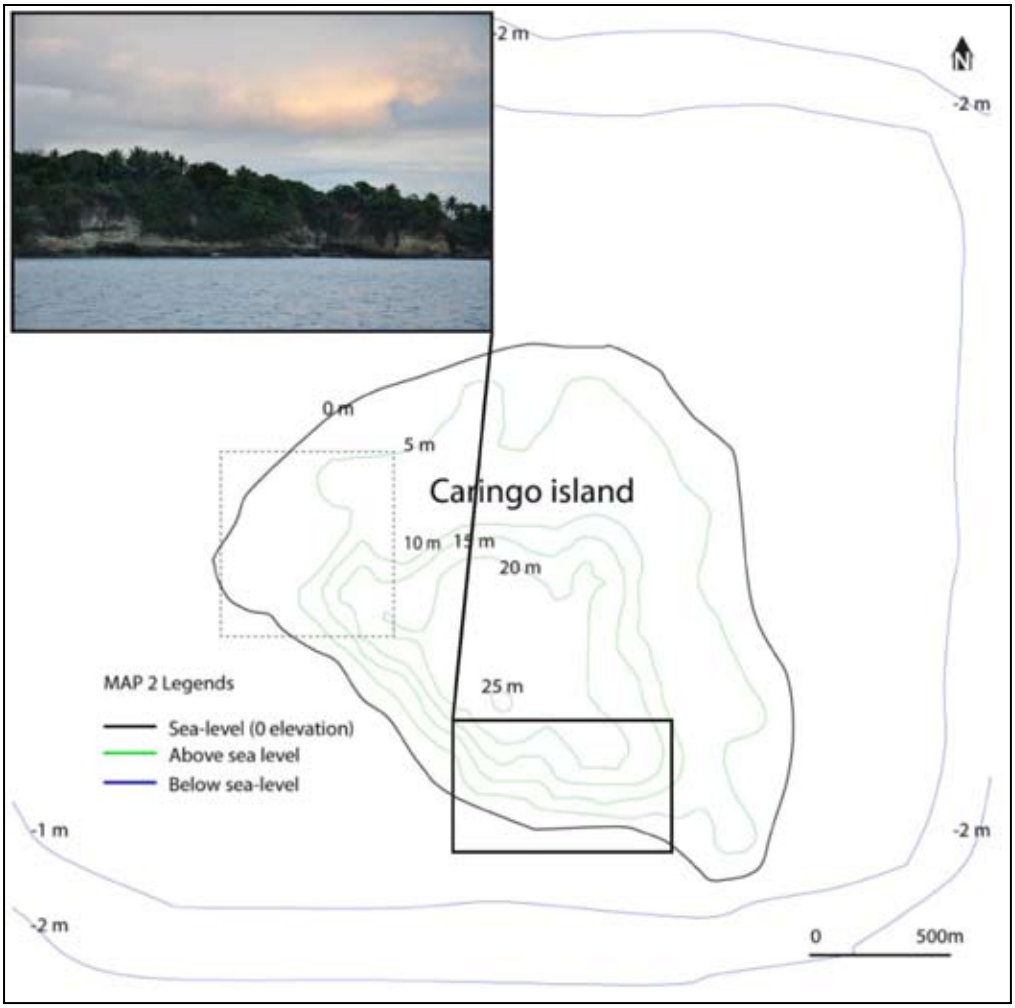


Figure 23 – Discrepancy between the slopes depicted on the base map of Caringo Island, Mercedes, Philippines, and the reality of the field (Kristine Marie Sadac, December 2012)

Warning:

It is essential for the participants to reflect how real the model looks compared with the landscape. In many instances data provided by GIS database or topographic maps prove to be wrong (Figure 23).

To learn more see, Rambaldi and Callosa-Tarr (2000, 2002).

References

Rambaldi G., Callosa-Tarr J. (2002) *Participatory 3-dimensional modelling: guiding principles and applications.* ASEAN Regional Centre for Biodiversity Conservation (ARCBC), Los Baños. Available from: http://www.iapad.org/publications/ppgis/p3dm_arcbc_lr.pdf (accessed 16 January 2012).

Rambaldi G., Callosa-Tarr J. (2000) *Manual on participatory 3-dimensional modeling for natural resource management.* Department of Environment and Natural Resources, Quezon City. Available from: http://www.iapad.org/publications/ppgis/p3dm_nipap.pdf (accessed 16 January 2012).

STEP 6.

DEFINING THE LEGEND

STEP 6 IN A NUTSHELL

Objective:

- Identify the key features to appear on the map and assign specific symbols to each of them

Key stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Base map
- Flip charts, masking tape, markers
- Paints, yarns, pushpins, dressmaker's pins
- Small pieces of carton, polystyrene, crepe sole, cork

Duration:

- Three to four hours

6.1 Community history of disaster events

Before proceeding with the mapping of community information, the prerequisite task is to generate and identify the data that should be plotted on the 3D map. This task basically consists in defining the legend. A legend consists of a series of symbols represented by lines (yarns), points (pushpins of different shapes and colors) and polygons (paints). The points symbolize individual features such as houses, health centers, schools, public buildings, and other important landmarks. The lines represent linear features such as rivers, roads, trails and political borders. Finally, polygons depict land-uses and landforms.

As much as possible it is important to anchor such data in people's life and experiences so that the information to be plotted on the 3D map is tangible. Table 8 provides an example of table summarizing community disaster history which may be used to collect such data amongst participants to the P3DM training.

Event	Where did they occur?	Date/ Season	Who was affected?	What was affected?	How did the community / people cope (short-term)?	How did the community / people recover (long-term)?
Example 1 – Landslide						
Example 2 – Flood						
Example 3 – Malaria						

Table 8 – Community history of disaster events

Such table is expected to produce information on hazards and their specific locations (1st and 2nd column) as well as the most vulnerable people – e.g. women, children, elderly, sick individuals, people with disabilities – and resources which make up livelihoods (4th and 5th columns). Columns 6 and 7 should point to the resources and stakeholders upon which/whom the community relied to cope with and recover from the disaster (Figure 24). The facilitator should make clear that this table emphasizes strengths (capacities) and weaknesses (vulnerabilities) of the community and that this is essential to understand these to eventually proceed with the planning of any actions to reduce disaster risk. Therefore, these data will be the basis of all eventual activities to be conducted as part of the training, including those to be displayed on the 3D map using different shapes, colors and sizes of pushpin, yarns, and paints. The table should also be hung near the map as it will serve as a permanent reference throughout the next activities.

Figure 24 – An example of disaster history drawn by a community of La Carlota, Philippines – it is being facilitated by two locals (JC Gaillard, January 2011)

This activity may be conducted as a carousel and/or community drama to make it faster, more dynamic and lively. In the former, each column of the table provides the basis for a station of the carousel. In the latter, some members of the community act as in a real disaster situation to emphasize the impact of different natural hazards and the way people cope and recover (Figure 25).

Figure 25 – Drama performed by members of a community of Mercedes, Philippines, in view of informing a disaster history table (Kristine Marie Sadac, December 2012)

Again, a participant should serve as facilitator or moderator of the discussion. A local facilitator is much more knowledgeable when it comes to local history, context, language, and effective methods of communicating with the local people. This also emphasizes the capacity of the local people to discuss by themselves and learn through their own skills.

6.2 Classifying the data into general categories

The different data identified in the previous table should be organized into general categories. It makes the plotting of information more systematic and faster. For instance, a group of participants may plot all the map features associated to one general category while the other groups may do the same for the other categories. In addition, these categories help map readers later to easily search in the legend the meaning (or label) of certain pushpin, yarn or paint plotted on the 3D map.

Hazards also need to be differentiated in terms of magnitude and probability of occurrence to define high, medium and low levels of danger. Depending upon the local context, there may be one, two, three or more categories.

To come up with such categories the participants need to reflect upon the occurrence of disasters associated with these different hazards in the foregoing history of events in the community.

Warning:

The participants should classify the information according to their own needs and references. It is pointless for a facilitator to try to impose any categorizations which do not speak to local communities. Such practice actually endangers the sustainability of the tool, which should be totally appropriated by the participants. For example, be careful while using the usual livelihood framework and its Western classification of resources into natural, physical, human, social, financial and political assets, as these do not often make any sense to the locals.

Table 9 provides an example of categorization as defined by some communities in the Philippines.

General categories	Examples
Political Boundaries	Political boundaries of the village, political boundaries of the quarters, hamlets, or zones within the village, etc.
Natural resources	Rivers, waterfalls, springs, ocean, mountains, forests, etc.
Land uses	Residential, commercial, agriculture, etc.
Landmarks and public buildings (or government owned facilities)	Village hall or community's meeting point, church or temple and other religious, cultural, or sacred places, schools, market place, boundary markers, health centers, sports fields, shops and stores, etc.
Lifelines and infrastructures	Roads, electric networks, water system, sewage system, irrigation facilities, water tanks, weighting posts, driers, bridges, fire extinguishers, etc.

Houses and other buildings		Differentiated based on type building materials or structure such as: - Palm or wood - Light materials - Semi concrete - Concrete - One-storey - 2-storey - > 2-storey
Vulnerable people		Vulnerable people such as children, malnourished children, pregnant women, older people, People with disabilities and long term illness, gender minorities, as well as marginalized ethnic, religious and caste groups depending on local cultures.
People with particular capacities		Local leaders such village officials, village police officers, forest rangers, health workers, volunteers, midwives, nurses, doctors, firemen, etc.
Other household information		Vehicles (trucks, 4x4, cars, motorcycles, etc.), number of people leaving in each house, main source of incomes, animals (cows, buffalos, horses, piggeries, poultries, etc.)
Organizations within the community		NGOs, people's organization, government agencies, and other associations within the community
Land tenure and exploitation		Ownership, tenancy, rental, wage labor, etc.
Hazards (these may be further classified into natural or man-made hazards)	High level of danger	Earthquakes, volcanic hazards, floods, tsunamis, cyclones, droughts, landslides, etc. Fires, epidemics and other health related issues, road accident prone areas, hunger, etc.
	Medium level of danger	
	Low level of danger	

Table 9 – Possible categories of data

6.3 Assigning symbols to each kind of data (Table 10)

Symbols (pushpin, paint and yarn) need to be assigned to each kind of data that will be plotted on the 3D map (Figure 26). If the facilitator may orient and suggest potential choices the ultimate decision for selecting the symbols to be assigned to each category of data must be that of the participants. It may be influenced by local culture (e.g. meaning of colors) and preferences, which the facilitator has to appreciate and respect.

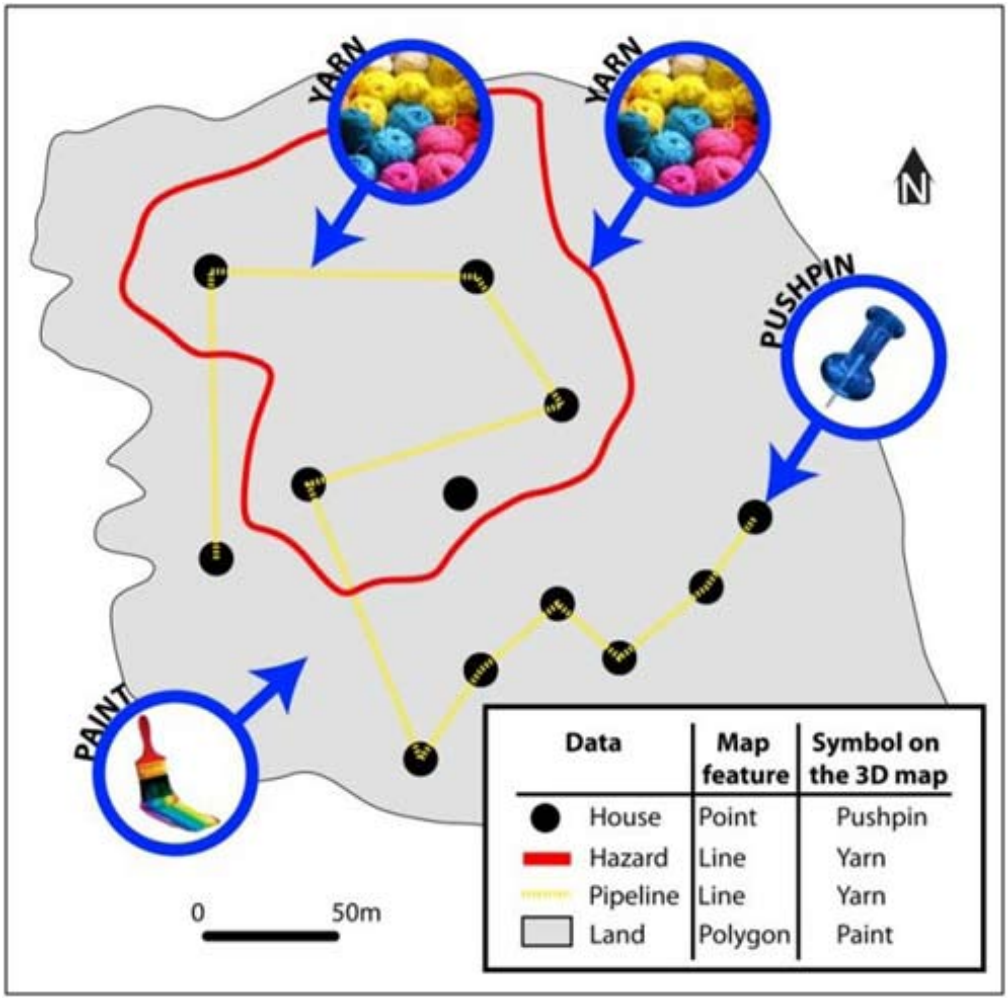


Figure 26 – Different data represented by line, point and polyogn are normally depicted in 3D map by pushpin, yarn and paints.

The followings are some suggestion in assigning symbols for each kind of data.

1.1.1 Pushpins

Pushpins are used for features that may be represented by single point reference such as houses, buildings, location of vulnerable people (Figure 27).

Large and distinct pushpins are usually picked for public buildings and major infrastructures such as village halls, community centers, schools, churches, etc. This enables to easily locate those major landmarks on the 3D map, especially when they stand amidst hundreds of other pushpins.

Different colors of pushpins are normally used to differentiate houses based on type of structures or building materials, number of storey/ floor, or even structural design. The participants might have mentioned in the community history of disaster events that particular types of houses are often damaged by particular types of hazards. For instance, concrete houses are much prone to earthquakes while houses made of light materials are easily damaged by cyclones and strong winds. Also, houses with second floor are important during flood events. This should be pointed by the facilitator as important information that needs to be depicted on the 3D map using different types and colors of pushpins.

The smallest pushpins are usually kept for vulnerable people and those with particular capacities. Since there often are many of them to associate to a particular house they need to be tiny enough to fit between different houses, especially in densely populated urban areas (Figure 27).

In addition, some pushpin may be marked using a fine marker pen to associate additional information to a particular house or building. This is often used to indicate the number of people living in each house or the main source of financial income or the religion of the household (Figure 27).

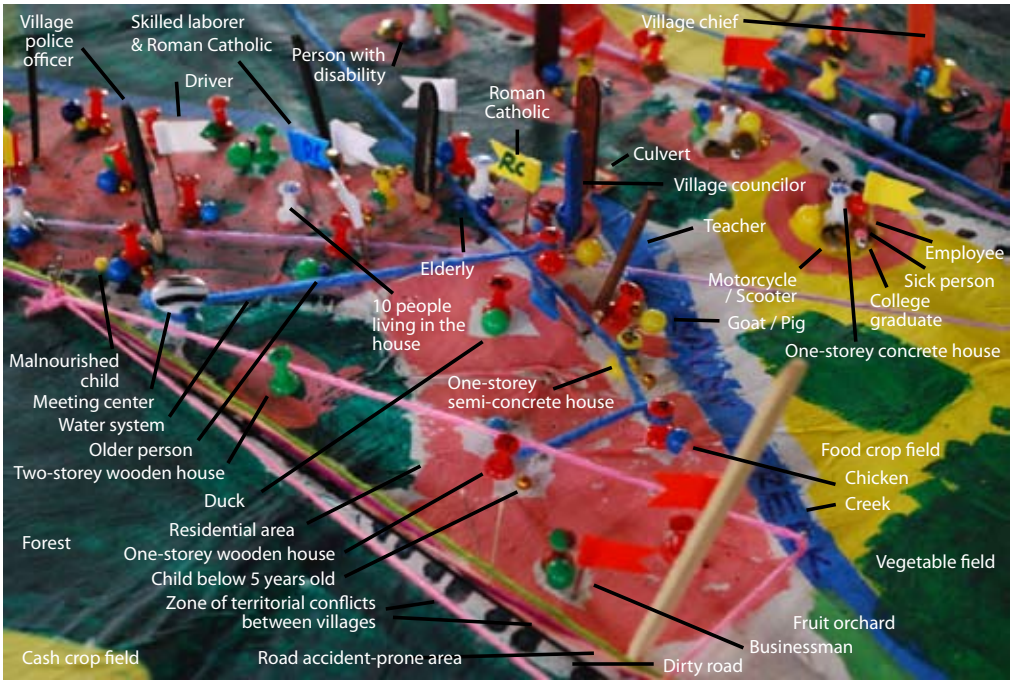


Figure 27 – Pushpins and alternative symbols used in a 3D map in Josefina, Philippines (JC Gaillard, January 2010)

However, some color, shape and size of pushpins may be limited in terms of quantity. In that case, the facilitator may suggest using the kind of pushpin which is available in greatest quantity for the kind of data which is to be plotted in highest number. If pushpins are lacking, the facilitator should ask the participants for possible alternatives (refer to figure 7 for some of the examples on how to cope with lack of shapes and colors of pushpins). It is thus important at the beginning of the activity to make assumption of what data to be depicted and their quantity especially the point features.

Popsicle or similar sticks / pieces of base map materials may be particularly useful to describe flows, migrations and directions as shown in Figure 28. These may be carved to form arrows and make the map more dynamic.

Figure 28 – Labor migration routes, remittance and relief good flows and other spatial dynamics depicted on a 3D map in Mercedes, Philippines (JC Gaillard, December 2012)

1.1.2 Yarns

Yarns are intended generally for linear features such as political boundaries, rivers, roads, lifelines, etc. (Figure 29). Yarns, however, can be replaced by paint as more permanent symbol for that data depending on the preference of the participants. For instance, rivers may be plotted first using yarns for the purpose of discussion and obtaining everyone's agreement about their location. Yarns can also be used to plot polygon data on top of other aerial features, such as land use. This is to allow overlaying of different information. For instance, a parcel of green paint in the 3D map may depict a rice farm. To show that this farm is prone to flood participants need to overlap a yarn of a particular color (Figure 29).

Yarns are also used for delineating hazard-prone areas (Figure 29). Different colors should be used for distinct hazards. In addition different shades of the same color should be utilized to differentiate the different level of danger. For example, areas highly prone to floods may be delineated using a dark red yarn, while locations of medium danger enclosed with light red yarns and low danger places encircled with orange yarns.

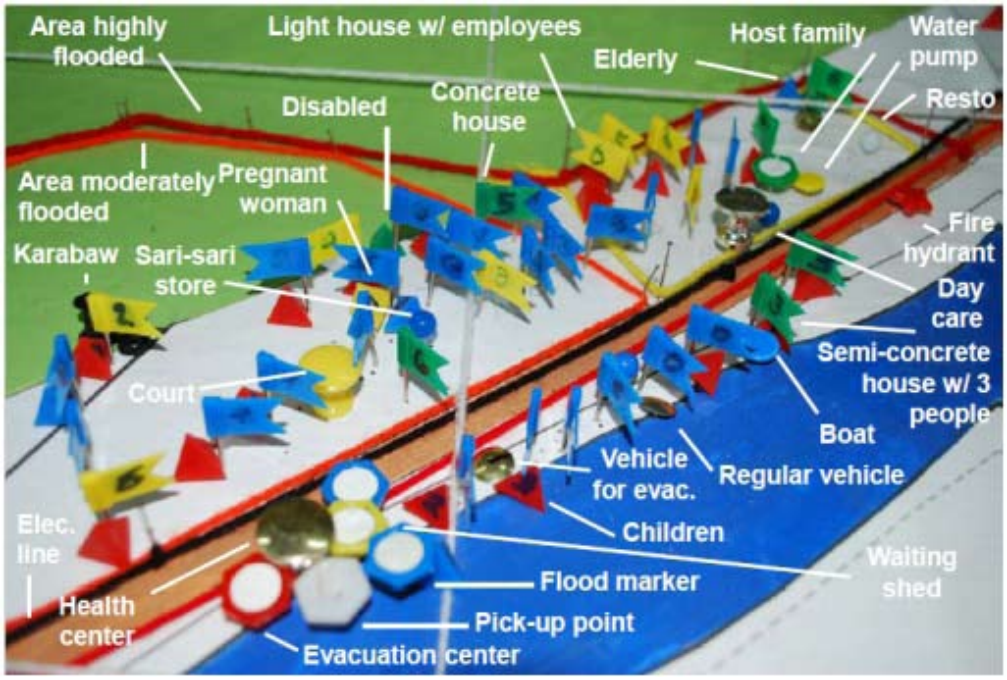


Figure 29 – Yarns used to depict hazard-prone areas in a 3D map in Dagupan, Philippines (JC Gaillard, July 2009)

1.1.3 Paints

Paints are used to plot polygon features which cover a particular area on the 3D map (Figure 30). It fits best to depict patterns of land-uses and features which are too big to be showed with a pushpins (large sports fields, major buildings, etc.). To depict two overlapping aerial information, it is possible to use shadings (patterns of straight or intersecting lines, small crosses or whatever other symbols) drawn using paints (or marker pens) (Figure 31a).

The color of paint should be defined by the participants according to their own preferences and cultural references. Sometimes, existing norms in mapping should also be considered, not necessarily preferred, especially if the purpose is to integrate knowledge from outsiders such as government officials who are used to deal with official topographic maps. If some of the participants are those government officials, then initiate a debate amongst all participants. Government officials may explain, for instance, that they have already been using green and blue for agricultural farms and rivers, respectively, in official maps. For the purpose of integrating the 3D map into existing government maps, it may be useful that the colors be more or less the same. The important point is that everyone agrees without unbalanced power relationships.

Figure 30 – Painting forested area on a 3D map in La Carlota, Philippines (JC Gaillard, January 2010)

Figure 31a – Marker-pen shading used to depict land tenure of top land use on a 3D map in Josefina, Philippines (JC Gaillard, January 2010)

General categories	Specific data	Symbol	Remark
Political boundaries	Political boundaries of the village		Yarn may be replaced by paints for more diversity (e.g. straight or dash lines of different colors)
	Political boundaries of the quarters or hamlets within the village		
Natural resources	Mountains, forests, oceans/ seas/ lakes/ swamps/ other bodies of water		Use different colors
	Rivers		Depending upon people's preference
Land uses	Residential / Institutional / Recreational / Commercial / Industrial / Open or vacant spaces		Use different colors
	Agricultural		Crops are usually differentiated
Landmarks and public buildings (or government owned facilities)	Village hall or community's meeting point / Boundary markers		Use different kind of pushpins
	Church or temple and other religious, cultural, or sacred places		A mark to the pushpin may differentiate religions
	Schools		Different levels are usually differentiated
	Market place		May be differentiated
	Health centers		May be differentiated
	Sports fields		May be differentiated
	Shops and stores		If the store is within a house, a mark to the pushpin saves space

Lifelines and infrastructures	Roads		Width and surface are usually differentiated
	Electric lines / Water and irrigation systems / Sewage systems		Use different colors
	Other facilities (e.g. water tanks, weighting posts, driers, bridges, fire extinguishers)		Width and surface of bridges are usually differentiated
Houses and other building infrastructures	Houses		Differentiate according to the number of storey and building material
	Other buildings		Use paint if it covers a large area
Vulnerable people	Older people / Children / People with disabilities / Pregnant women / People with permanent illness / Etc.		Use different colors
People with particular capacities	Local leaders / Police officers / Forest rangers / Health workers / Nurses / Etc.		Use different colors
Other household information	Vehicles (Trucks / 4x4 / Cars / Motorcycles / Etc.)		Use different colors
	Number of people leaving in each house	Indicated on the house pushpin using a marker pen	
	Main source of incomes		Or mark the house pushpin if too crowded
	Animals (Cows / Buffalos / Horses / Piggeries / Poultries / Etc.)		Use different colors
Organizations within the community	NGOs / People's organization / Government agencies / Other associations within the community		Use different colors
Land tenure and exploitation	Ownership / Tenancy / Rental / Wage labor / Etc.		Use shade on top of land-use

Natural Hazards	Earthquakes / Volcanic hazards / Floods / Tsunamis / Cyclones / Landslides / Etc.		Use different colors for different levels of danger
Man-made hazards	Fires / Epidemics and other health related issues / Road accident prone areas / Hunger / Etc.		Use different colors for different levels of danger
Flows / migrations / directions	Evacuation routes / Origins and destinations of remittances / Labor migrations / Assistance / Etc.		Use different colors for different kinds of flows

Table 10 – Suggested symbols for a particular categorization of data

6.4 Integrating time into the legend

Integrating time and temporal patterns is a difficult task on every map and P3DM is not different. A map is by definition a picture of one place at a certain point of time and creativity is needed to incorporate daily and seasonal patterns as well as long trends.

For daily and seasonal variations in hazards, vulnerability and capacities both push pins and yarns can be used. Push pins may be used to locate particular features or resources which vary over time, e.g. fishing grounds, trees. Then, a series of yarns may be tied around the push pins to identify harvest seasons or vulnerable periods. For example, twelve yarns of different colors may be selected to depict the twelve months of the Western calendar. The yarns of the corresponding colors may be tied around the pin of a tree to indicate that fruits are harvested in particular months of the year (Figure 31b). Similarly, yarns of different colors may delineate farm lands which harvests are due in particular months. A common approach may be used too to identify features which are particularly vulnerable during daytime or at night.

Long-term trends should be monitored through detailed records of the map and regular updates (see step 16). These records may be photographic or written if a camera is not available locally. Keeping record of every update helps members of local communities in reflecting upon continuity and changes in their village. These changes pertain to hazards but also to vulnerability and capacities.

Figure 31b – Yarns tied around push pins to indicate harvesting months for different crops in Mercedes, Philippines (JC Gaillard, January 2013)

6.5 Crafting the legend

It is essential that each symbol is clearly indicated on a legend which is agreed upon by all participants. Temporary, 'working' legends can be made using spare pieces of polystyrene, carton or whatever material was used for the blank model (Figure 32). Each data to be plotted through pushpin, yarn or paint should be on the legend and clearly labeled using markers or paints (Figure 33). For instance, a black yarn is chosen to plot the political boundary of the village. Before putting the black yarn onto the 3D map, first cut a small piece of yarn and affix it to the legend board and label it accordingly. It must be intelligible to everyone so local language should be preferred. The same procedure should be followed for pushpins and paints. This way, all the pushpins, yarns, and paints are certainly indicated on the legend.

Ideally, the legend should be complete before proceeding with the plotting activity. However, creating the legend is often a fastidious activity which may prove boring for some participants. In that case, the participants may be invited to plot each kind of data after symbols have been assigned to it. This procedure allows to work back and forth between the map and the legend.

Tips and tricks: *Take photos of the legend regularly as it often changes. The photos become useful in the event the legend is damaged or lost.*

Figure 32 – Preparing a 'working' legend for a 3D map in Josefina, Philippines (JC Gaillard, January 2010).

Figure 33 – Representation of data and legend of a 3D map drawn by a community of Josefina, Philippines (JC Gaillard, January 2010)

STEP 7.

PLOTTING DATA ON THE 3D MAP

STEP 7 IN A NUTSHELL

Objective:

- Plot data on the map

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Paints, yarns, pushpins, dressmaker's pins
- Small pieces of carton, polystyrene, crepe sole, cork
- Brushes and markers

Duration:

- One to three days depending on the number of households and size of the area covered by the map

Once the legend is ready data may be plotted on the 3D map. The following paragraphs provide suggestions on how to proceed with the plotting of data on the 3D map. This is an activity which is usually very lively and enjoyed by the participants whose knowledge is emphasized. Therefore, the facilitator must be very careful in respecting momemtums and participants' initiatives as to how to sequence and organise the plotting of the different data. At any time, however, the facilitator should monitor the legend and make sure that the participants use the correct symbols.

Plotting data needs to be a collective activity which involves everyone in the community, young and old, men and women, farmers and employees. All collaborate and contribute their own knowledge to the map together. However as indicated in 7.4 some specific sessions may be required for specific groups of people or when schedule of daily activities does not allow gathering all participants at the same time.

Building a 3D map is a collective learning experience which stimulates the exchange of information through the continual search for consensus among the participants about the type and location of information to be plotted on the 3D map. P3DM thus facilitates the exchange of information and dialogue within and between members of the local community, especially those who are usually excluded from policy planning because they are marginalized, e.g. children, elderly, women, people with disabilities, etc (Figure 34).

Figure 34 – Member of a lower caste (wearing a red shirt) collaborating in a P3DM activity with participants of an upper caste (wearing grey and orange and white shirts) in Odraha, Nepal (JC Gaillard, April 2012)

7.1 Plotting pushpins for punctual features

Placing pushpins to depict point features is one of the most laborious tasks of P3DM (Figure 35). The sequence of plotting may be suggested by the facilitator but ultimately must up to the participants.

Figure 35 – Plotting pushpins on a 3D map in San Mateo, Philippines (JC Gaillard, January 2011)

Often it starts with major landmarks in the community such as the village hall (or community's meeting point), church or temple (and other religious or sacred places), schools, marker place, boundary markers, etc. The precision of the location of this first information is crucial since the location of the next information (other types of pushpins) will depend on it. If the participants struggle to plot these landmarks, the facilitator may step in the discussion and refer to GPS points (see step 3.5). However, this is always an unsatisfying strategy as it tends to induce a bias towards the facilitator's knowledge and technology.

After plotting landmarks, the participants often proceed with their houses and then the vulnerable members of the different households. At that stage, the participants often gather according the hamlets or areas they live in. To facilitate the plotting process it is therefore recommended to distribute small sets of pushpins at different locations around the 3D map so that small groups of participants can plot on their own (Figure 36).

Figure 36 – Simultaneous plotting of pushpins on a 3D map in Josefina, Philippines (JC Gaillard, January 2010)

Participants eventually proceed with other man-made and natural features such as vehicles, animals, springs, waterfalls, etc.

When the 3D map becomes too crowded it is possible to resort to small pieces of carton / polystyrene to gather specific information for a particular area of the map. For example, plotting all vulnerable people is often difficult, especially in densely populated urban areas. In that context, a small piece of carton / polystyrene may be used to list the number of children, pregnant women, elderly, etc., for a particular ward (Figure 37).

Figure 37 – Piece of carton compiling some data (elderly, children, people with disabilities, sick persons and pregnant women) for a crowded area of a 3D map in San Mateo, Philippines (J. Cadag, Dec. 2010)

At that stage too, participants often decide to identify their hamlet or wards on the 3D map. If need arises, they may use small pieces of carton / polystyrene / crepe sole to make small sign board indicating the name of the places (Figure 38). This usually helps in enhancing the appropriation of the 3D map by the participants.

Figure 38 – Place name (Durian) indicated with a small piece of carton on a 3D map in Josefina, Philippines (JC Gaillard, January 2010)

7.2 Defining land-use through yarns and paints

Plotting land-use follows a two-step process. It first necessitates delineating the extent of the area covered by a specific land-use. Then, only, the paint may be applied on the 3D map. Do not apply the paint directly to the 3D map. There are always chances of mistake and disagreement among the participants whether the information is properly located or not.

Yarns, affixed on the map using dressmaker pins, should therefore be used first to trace or to enclose the area covered by a particular feature (Figure 39). For instance, instead of directly painting blue paint to represent a river, a blue yarn can be used to trace it. It makes it easy to locate and relocate each feature in order to find a consensus amongst participants.

Figure 39 – Delineating land-use on a 3D map in Borongan, Philippines (JC Gaillard, August 2007)

Once everyone agrees that the river is indeed in such location, then that is the right time to apply the blue paint. Remove the yarn after the application of paint (Figure 40). The reason for this is to facilitate the discussion between the participants in finalizing the location of the information and to serve as guide during the application of the paint. Ideally the entire map is painted to provide the overall land-use pattern.

Figure 40 – Marginalized women doing painting for the first time in their life during a P3DM activity in Mondulkiri, Cambodia (JC Gaillard, January 2011)

Painting areas which have been already plotted with pushpins may require to carefully removing those pushpins first to facilitate the process. Conversely, it is obviously better to wait for the paint to dry before proceeding with the plotting of pushpins.

Tips and tricks: *If available locally, use electric fans or hair dryers to fasten the drying of the paint.*

7.3 Stretching yarns for linear features and additional areal features

Major linear features such as rivers and roads are usually plotted early in the mapping process as they often help in locating further pushpins and land-use. Yarns are stretched and affixed on the map using dressmaker pins. They are easy to move and are often readjusted throughout the activity.

Other linear data such as electricity lines, pipelines, telephone lines, etc. are frequently plotted later in the process, often after houses and other punctual infrastructure (Figure 41).

Figure 41 – Plotting electric lines on a 3D map in Irosin, Philippines (JC Gaillard, January 2010)

Defining hazard-prone locations usually comes last in the process of plotting data on the 3D map as people often need other features to identify areas which have been affected in the past or may be affected in the future. In addition, scientists may step in the process at that stage (see step 8) or alternatively the participants may resort to available scientific hazard maps and confront outsiders' knowledge to their own awareness of hazard-prone areas. This may prove important in facing rare phenomena or the potential effects of future changes in the climate patterns.

Tips and tricks: *Thimbles prove useful at that stage if there are thousands of dressmaker pins to be plotted.*

7.4 Special sessions

As mentioned in step 3, on top of the collective sessions which facilitate dialogue between members of the community (Figure 42), it is suggested to carry out particular sessions for specific groups within the community, e.g. children, women, elderly, farmers, fishermen, to make sure that all needs and viewpoints are covered in the map. Sometimes, some people feel more comfortable to speak out when only in presence of their fellow villagers. In that case it is often best to have a regular participant who is a member of the said group to facilitate the discussion to avoid unbalanced power relationships between insiders and outsiders.

Figure 42 – Young *bakla* plotting information which matters to them on a 3D in Irosin, Philippines (JC Gaillard, January 2010)

To learn more, see Gaillard and Maceda (2009) and Cadag and Gaillard (2012).

7.5 Important issues arising while plotting data on a 3D map

7.5.1 Overcoming territorial conflicts through P3DM

The plotting of features on the 3D map is likely to trigger intense discussions which sometimes may lead to potential conflicts. P3DM is believed to be a powerful tool for solving such conflicts as it facilitates debate between participants based upon tangible data (Rambaldi and Callosa-Tarr, 2002).

Such conflicts may arise in the case of political or territorial boundaries. In many rural areas, technical descriptions of political boundaries do not exist or are not accessible even to the local officials. In such case, the facilitator has to be very cautious. Inviting authorities and local officials and resorting to existing legal documents may useful depending on the

context (Figures 43 and 44). This might cause some delay but consider it as one of the purposes of the 3D map – to solve conflicting interests.

On the side of the facilitator, it is suggested to always consult available official or legal documents such as local land use and cadastral plans before the P3DM activity starts.

Figure 43 – Village head (with the cap) discussing conflicting political boundaries in Josefina, Philippines – Areas encircled with violet and pink yarns were places where people did not vote in the correct village – see figure 18 (JC Gaillard, January 2010)

Figure 44 – Local official reading a municipal resolution defining the boundary between villages in Josefina, Philippines (JC Gaillard, January 2010)

7.5.2 Confidentiality of the information

Another issue which arises when plotting data on the 3D map is that the nature of tool makes that household information is not anonymous since they are obviously associated with a particular house in a given place. In some countries, there may laws which prevent the divulgation of such data. In other settings, it may be culturally or socially dangerous to indicate certain information on the map, e.g. women who suffer from domestic violence or people with disability. This is a major issue which may render those marginalized even more vulnerable in facing natural and other hazards.

The easiest way forward to include them on the 3D map without breaching any cultural, social or legal rules is to gather the information at the scale of a neighborhood or hamlet so that it is not anymore associated with a particular home. Participants may resort to small pieces or carton / polystyrene, as described in 7.1, to indicate a list of data for a given area.

7.5.3 Waste management

Waste management is critical to an effective and environment-friendly P3DM activity. This is particularly important when using materials which may harm the environment such as polystyrene or any sort of crepe sole or rubber mat. In that context, it is essential to anticipate how small pieces of waste materials will be cleaned, collected, temporarily stored and then thrown away in an appropriate place/container.

Waste management very much depends on the type of venue and materials selected for the activities. It is often much more challenging when working outdoors or in windy places. Sandy grounds also prove tricky to clean. When using polystyrene, specific cutters (instead of scissors or regular cutters) help in limiting the amount of waste (see table 4).

To learn more, see Gaillard and Maceda (2009) and Cadag and Gaillard (2012).

7.6 Process and outcomes

Throughout the plotting of data on the 3D map mistakes or errors on the part of the participants are inevitable. Although it is necessary to correct those errors, there is a risk that the facilitator, as an outsider, intimidate the participants or worse end up humiliating them in front of others. To level down power relationships between outsiders and members of the community and to avoid disempowering participants, the facilitator must never teach nor correct participants. Instead, he/she should foster discussion and spur reflection amongst participants.

Along that line there are two ways for dealing with errors in the plotting of data: (1) just let the participants uncover the mistakes by themselves at the end. For example if participants start plotting pushpins two far from each other's they are likely to lack space for further data at one point ; or (2) ask someone amongst the participants to raise the issue with his/her fellow participants. In the first strategy, the participants will eventually find and correct their own mistakes. However, re-plotting 500 pushpins because of a mistake at the start is not an easy task. The second strategy, on the other hand, encourages discussions among participants and mistakes can be corrected as early as possible.

The ultimate rule in using P3DM for DRR is that both the process and the outcomes should be considered. The objective of a P3DM activity is not to come up with a stunning and perfectly accurate map if this is through disempowering the participants. Tangible outcomes should not overcome the process through which these outcomes are achieved. Therefore, it is sometimes better to end up with a poorly finished map because for example the participants discovered painting for the first time in their life. If the use of the 3D map is solely for the community and depending upon the context, minor inaccuracies in the plotting of data may be acceptable. It may cause more harm if the facilitator tries to correct such errors, leading participants to feel disempowered.

To learn more, see Chambers (2002, 2007).

Mayfourth, NGO project leader, Quezon City, Philippines

"It helps a lot in consensus building (because the participants can see together the real situation in their communities), especially if crucial issues are tackled (like which houses are in the high risk, medium risk and low risk areas)."

Rosalyn, woman leader, San Mateo, Philippines

"We were like children who enjoyed a lot the painting and the putting of pushpins with different colors, sizes and shapes (pushpins here, pushpins there). The first day of the activity has ended and I felt like everyone does not want to go home because they have not yet finish the putting of pushpins for houses. What was really fascinating is that the participants themselves have already put the pushpins to represent the houses of their neighbours and not just their own information."

Nanette, NGO coordinator, Iligan, Philippines

"The community mapping participants were then able to effectively identify and analyze the vulnerabilities and capacities and the disasters risks of the community including individual households. The 3D map then became an effective tool in identifying actions for risk reductions by the people and community leaders themselves. Having a more accurate visual presentation of risk data, options to address identified underlying causes are then more effectively addressed during land use and development planning."

References

Cadag J.R.C., Gaillard JC. (2012) Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area*: in press.

Chambers R. (2002) *Participatory workshops: a sourcebook of 21 sets of ideas & activities.* Earthscan, London.

Chambers R. (2007) *Poverty research: methodologies, mindsets and multidimensionality.* Working Paper No 293, Institute of Development Studies, Brighton. Available from http://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/399/Wp293%20web.pdf?sequence=1 (accessed 16 January 2012).

Gaillard JC., Maceda E.A. (2009) Participatory 3-dimensional mapping for disaster risk reduction. *Participatory Learning and Action,* 60: 10. Available from: http://pubs.iied.org/pdfs/G02818.pdf (accessed 16 January 2012).

STEP 8.

INTEGRATING LOCAL AND OUSTIDERS' KNOWLEDGE

STEP 8 IN A NUTSHELL

Objective:

- Integrate outsiders' knowledge on the map

Suggested stakeholders:

- Local communities
- Local governments
- Scientists
- NGOs

Key resources:

- Paints, yarns, pushpins, dressmaker's pins
- Small pieces of carton, polystyrene, crepe sole, cork
- Markers

Duration:

- One day

8.1 Integrating local and outsiders' knowledge

One of the main assets and advantages of using P3DM for disaster risk assessment is that it allows for the integration of local and outsiders' knowledge. Indeed, P3DM makes local knowledge credible to scientists and government officials. In contrast to most other forms of participatory mapping, the exact scale of a 3D map through P3DM allows scientists to delineate threatened zones in their expected extent as they usually do on topographic maps or computer-based tools. Because the map is scaled and geo-referenced, scientists are able to rigorously integrate their own knowledge with local people's data.

It is therefore suggested that P3DM involve stakeholders beyond the community, especially scientists and local officials, so that it builds upon a large and integrated set of knowledge. P3DM enables marginalized people, including the illiterate who may have a limited grasp of scientific concepts, to discuss DRR with scientists who, on the other hand, may have a poor understanding of the local context. P3DM is often acceptable to both local people who built the map and plotted most of the information, and to

scientists who could easily overlap their own data. P3DM thus contributes to the empowerment of the most marginalized individuals by granting them access to scientific knowledge and by rendering credible their own knowledge in the eyes of local officials and scientists. It therefore balances the power relationship between local people and scientists.

8.2 Facilitating the dialogue between members of the community and outsiders

Ideally, outsiders, whether they are scientists or local government officials, participate throughout the P3DM activities. This fosters rapport building and facilitates the reproduction of the methodology by local government officials in neighboring villages afterwards (Figures 45 and 46). In certain cases, however, such a strategy may intimidate the local participants who may be out powered by outsiders. In that case the facilitator has to be very careful and try to limit the contribution of outsiders while raising the confidence of the local participants by emphasising their knowledge.

Figure 45 – Climatologists plotting hazard-prone areas on a 3D map in Bourg Saint-Maurice, France (JC Gaillard, May 2010)

In other instances, it is impossible to get outside stakeholders involved for the entire duration of the activities, as their schedules limit their involvement. In this case, specific sessions during their available time. In that context, specific sessions should be organised to facilitate dialogue between members of the local community and scientists or local government officials. Such specific sessions have to be carefully facilitated to avoid unbalanced power relationships.

Figure 46 – Specific session conducted for facilitating dialogue between the local community and the municipal planning officer (in red shirt on the right) and a volcanologist (in yellow shirt on center right) who are all discussing potential lahar hazard on a 3D map in Irosin, Philippines (JC Gaillard, January 2010)

If properly moderated such multi-stakeholder sessions prove powerful and enable the integration of both local and outsiders' knowledge into disaster risk assessment.

To learn more, see Gaillard and Maceda (2009) and Cadag and Gaillard (2012).

Nanette, NGO coordinator, Iligan, Philippines

"Recognizing that DRR and CCA would only become more effective if science and local knowledge are balanced, the P3DM is certainly a powerful tool for realizing this. And with the fact that hazards are location specific, community's resilience would only be enhanced if risk reduction measures is owned and managed by the local communities based on local analysis aided by data combining science and indigenous/local knowledge. Unlike conventional maps that are mainly produced by scientists, P3DM is mainly a product of the people with technical experts only aiding and facilitating."

References

Cadag J.R.C., Gaillard JC. (2012) Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area*: in press.

Gaillard JC., Maceda E.A. (2009) Participatory 3-dimensional mapping for disaster risk reduction. *Participatory Learning and Action*, 60: 10. Available from: http://pubs.iied.org/pdfs/G02818.pdf (accessed 16 January 2012).

STEP 9.

HOUSEHOLD DATA SHEETS

STEP 9 IN A NUTSHELL

Objective:

- Prepare household data sheets to integrate more information

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Sheets of paper and pens

Duration:

- Two to four hours depending on the number of households

9.1 Rationale for using household data sheets

Household data sheets are an add-on feature of P3DM for DRR that gives communities an entire GIS made of spatial and tabular data. This is without requiring any computer hardware and software, which are most often beyond the reach of marginalized communities.

The rationale for using household data sheets is that, in most cases, not all household information can be plotted on a 3D map. This is for two reasons. Firstly, there is not enough space for the pushpins, yarns, and paints to depict all household information especially in the case of large-scale 3D map or if the households are concentrated in a particular part of the 3D map. For instance, it is often hardly possible to plot all children in the community using pushpin but only those children that are malnourished or below a certain age. Yet, for DRR and in facing an actual disaster, a comprehensive set of data is essential.

Secondly, there are some household data that cannot be shown in the 3D map but are equally important information. For instance, data pertaining for example to single parenthood, gender minorities or household violence,

are pertinent data but those persons might be ashamed to be pinpointed on the 3D map. In some context, the law also prevents private and individual data being revealed to the larger public.

Whatever the reason is for not plotting particular information on the 3D map, it can still be stored on a household data sheet. The primary objective of the household data sheet is therefore to associate more data to a single household.

9.2 Using household data sheets

Household data sheets compile and list data for each household which is plotted on the map through the use of pushpins. A number is assigned to each household on the 3D map and written on the top / side of the pushpin or on a small piece of paper affixed on the pushpin (Figures 47 and 48). This number is eventually reported on the data sheet (Box 3). Additional information for that household is then listed and available when needs arise, for example, in time of action planning (Table 11).

In some countries such as the Philippines, household data sheet may already be available as part of the community data management effort. Local officials, especially the Barangay (village) health workers or BHW, keep detailed household data using columnar books for the primary purpose of health monitoring. In numerous P3DM activities already conducted in the Philippines, these household data were successfully synchronized with the 3D map (Figure 49). In the columnar table, a household number is assigned to each household. The household number is further associated with information such as family name, number of household members, birth date of each member and other health related data. Disaster-related data in each household can be easily added.

Box 3 – Synchronizing the existing household datasheet of the village to the 3D map

Figure 47 – Small pieces of paper with a number glued on top of each pushpin depicting houses in Odraha, Nepal (JC Gaillard, May 2012)

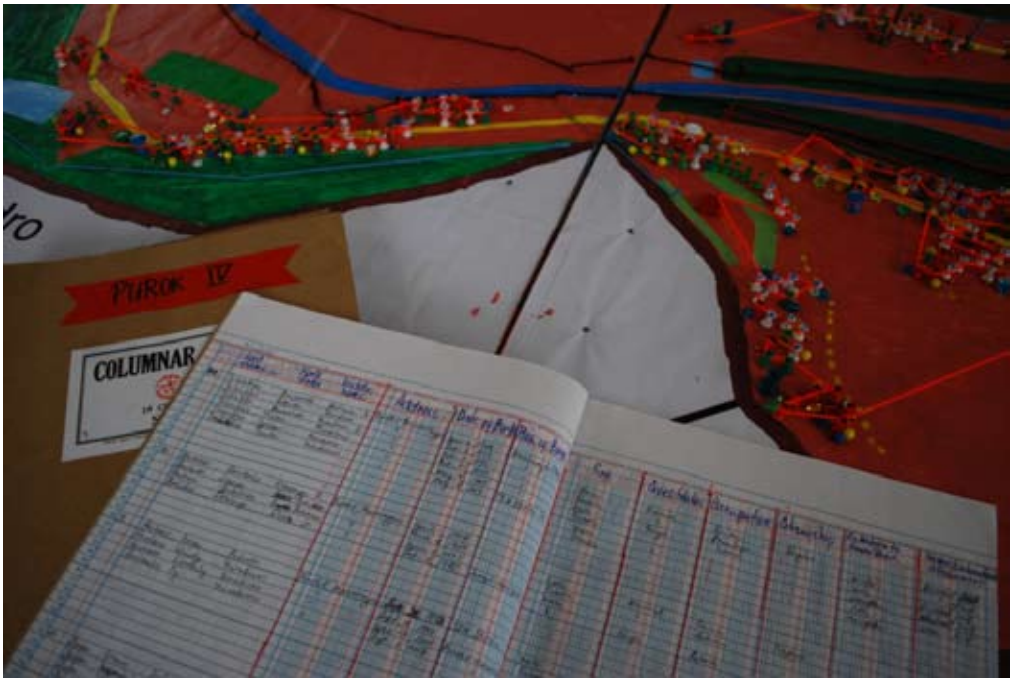


Figure 48 – Columnar data serving as household data sheets in Irosin, Philippines – The number on top of the pushpins correspond to the number on the leftmost column of the notebook (JC Gaillard, January 2010)

Household No.	Household name	Location (hamlets, quarters, zones)	No. of household member	Name of household members	Birth date of household members	Sex of Household Member	Employment Status	Job	Other household information
1	Family Surname	Hamlet 1	4	Name	Birth date	M	Self-employed	Farmer	-
				Name	Birth date	F	Unemployed	n/a	-
				Name	Birth date	M	Retired	n/a	-
				Name	Birth date	F	Studying	n/a	-
2	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-
X number of households	-	-	-	-	-	-	-	-	-

Table 11 – A sample household datasheet

Figure 49 – Adding data to household datasheets in Josefina, Philippines (JC Gaillard, January 2010)

STEP 10.

FIELD VERIFICATION AND COMMUNITY VALIDATION

STEP 10 IN A NUTSHELL

Objective:

- Verify the accuracy of data plotted on the map

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Cameras or printed copies of the map
- Notebooks and pens
- GPS device if relevant

Duration:

- Two hours to one day depending on the size and terrain of the area covered by the map

Once all the relevant data are plotted on the 3D map, field verification and community validation may be conducted. This step is primarily to verify the precision or correctness of the data plotted on the 3D map and seek the validation of the larger community. These give the participants a sort of confidence that the data they have generated is correct and verified.

10.1 Field verification

The following steps are suggested in conducting the field verification:

1. Identify the data on the 3D map that needs to be verified (e.g. extent of low-risk, medium-risk and high-risk areas, location of houses, number of vulnerable people in a particular house).
2. Identify the locations or zones for the data that needs to be verified (e.g. hamlets or quarters of the village, rivers, mountains).
3. Take photographs of these areas and either store the pictures on the camera or print them out if printer is available
4. Divide the participants into small groups according to the number of

locations or zones identified in step 2 and attribute to each group a camera with the photographs or a printed copy of the area they will cover for the field verification. For instance, if there are five places to be visited for field verification and there are 20 participants, then there should be five groups each composed of four participants.

5. Suggest different tasks to each member of the group:
    - Data collectors – to document the results of field verification using cameras, pen and paper and other means of documentation – including GPS if relevant
    - Guide – to guide the group on its way during the entire field verification
    - Time keeper – to keep the group updated of the agreed time to finish the field verification
6. Conduct the field verification. Each group reports on a note book or on their printed photograph of the map the discrepancy they observe between the 3D map and the reality of the ground (Figure 50).

At the end of the field verifications, the corrections should immediately be done on the 3D map. In most cases, not all participants need to participate in the field verifications especially if there are only few data to be verified. Other participants can then proceed to other necessary activities retouching of paints, verification of household database, cleaning up of the training area, preparation of the 3D map elements such as scale, title etc. The purpose is to maximize the time of the participants (see step 13).

Figure 50 – Field verification conducted using printed map and digital cameras in Mondulkiri, Cambodia (JC Gaillard, January 2011)

10.2 Community validation

Community validation is usually conducted after the P3DM training during a community assembly or larger event which involves the larger community. The purpose of a community validation is to seek the approval of people who have not participated in the construction of the 3D map but who are concerned by both the map and the DRR action plan. This is also a chance for the other members of the community to verify the accuracy and location of the symbols that concern them (e.g. location of house and neighbors).

To learn more, see Rambaldi and Callosa-Tarr (2000, 2002).

References

Rambaldi G., Callosa-Tarr J. (2002) *Participatory 3-dimensional modelling: guiding principles and applications.* ASEAN Regional Centre for Biodiversity Conservation (ARCBC), Los Baños. Available from: http://www.iapad.org/publications/ppgis/p3dm_arcbc_lr.pdf (accessed 16 January 2012).

Rambaldi G., Callosa-Tarr J. (2000) *Manual on participatory 3-dimensional modeling for natural resource management.* Department of Environment and Natural Resources, Quezon City. Available from: http://www.iapad.org/publications/ppgis/p3dm_nipap.pdf (accessed 16 January 2012).

STEP 11.

DISASTER RISK ASSESSMENT

STEP 11 IN A NUTSHELL

Objective:

- Assess disaster risk

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Flip charts, masking tape and markers

Duration:

- One to two hours depending on the number of households and the size of the area covered by the map

11.1 P3DM for disaster risk assessment

Vulnerability and capacity are abstract concepts even when disasters have previously occurred in the area. To make vulnerability and capacity tangible, it is essential to relate them to the potential threat of natural hazards. For instance, dangerous areas with a large number of houses made of wood and palm, and with many children, pregnant women, elderly, and people with a disability or permanent illness can be readily considered at high risk. On the other hand, areas with lower hazards, less vulnerable people and more local resources may be considered at low risk. The 3D map clearly portrays vulnerabilities, capacities and hazards represented by pushpins, yarns and pins.

Therefore, one of the purposes of P3DM for DRR is to make these issues tangible and to lay the foundations for assessing disaster risk. After plotting the map features, a disaster risk assessment can easily and quickly be conducted by the participants themselves.

This assessment of disaster risk therefore reflects the perspective of the local community supported by outside stakeholders, not that of the sole scientists or government officials based upon data extracted from locals. In that sense, it does not require any sophisticated equations, formula or computations.

11.2 Steps in conducting disaster risk assessment through P3DM

The disaster risk assessment table also provides quantitative data. P3DM thus generates what Chambers (2007) has called 'participatory numbers' or numbers created through participatory methods and approaches, not just through survey questionnaires or other statistical methods driven by outsiders and external interests. Participatory numbers are often essential to make local knowledge, skills and resources tangible to outside stakeholders who often request for quantitative data to make policy decision. Assessing disaster risk through P3DM is one way of generating such numbers through the counting of pushpins and other symbols on the 3D map by both the members of local communities as well as scientists and local government officials.

Consider the following steps in conducting disaster risk assessment using the 3D map:

1. Using large pieces of paper, prepare a blank disaster risk assessment table (Table 12) and hang it on the wall. The table should be context specific.
2. Divide the participants into groups, preferably according to the area / village where they live;
3. Divide each group again into two sub-groups: one assigned to the 3D map and the other to the disaster risk assessment table.
4. Ask the participants to list the different areas / villages on the leftmost column of the table.
5. The different groups complete the table by identifying the hazards threatening their area / village and counting the pushpins and other symbols of the legend (e.g. vulnerable houses, vulnerable people, vehicles) which are within each hazard-prone areas (Figure 51).
6. Identify the issues and problems faced by the local community based on the hazards, vulnerabilities and capacities;
7. Elaborate the reasons / root causes of these issues and problems;
8. They eventually assign a certain level of risk to their village according to the hazard, vulnerabilities and capacities.

Both the map and table provide a tangible basis for assessing disaster risk. It makes it quick and easy to assess, for example, how many people are vulnerable in each area of the village to particular hazards and what the resources in facing such hazards are. In other words, the disaster risk assessment table provides the participants with an overview summary of the risks being faced by the community (Figure 52).

Figure 51 – Assessment of disaster risk based on a 3D map built in La Carlota, Philippines (JC Gaillard, January 2011)

Figure 52 – Disaster risk assessment table compiling data extracted from a 3D map built in Josefina, Philippines (JC Gaillard, January 2010)

11.3 Combining P3DM with other tools

Obviously, P3DM must be combined with other methods and tools for appraising issues which are not covered in the 3D map but which are yet very important, e.g. client-patron relationships, gender-related inequalities, social networks, and temporal variations in vulnerabilities and capacities. P3DM must therefore be associated with calendars, ranking and scoring, problem trees, Venn diagrams, and other tools of vulnerability and capacity analysis (VCA). See for example von Kotze and Holloway (1996), Abarquez and Murshed (2004), International Federation of Red Cross and Red Crescent Societies (2008) and CARE (2009).

Tips and tricks: *Disaster risk assessment through the 3D map and the disaster risk table should be updated whenever necessary.*

To learn more, see Kotze and Holloway (1996), Abarquez and Murshed (2004), International Federation of Red Cross and Red Crescent Societies (2008) and CARE (2009).

Celdre, NGO staff, Limay, Philippines

"By using the 3D map, the community identified their risk about disaster. The community was very participative about the workshop because they are the one who made the 3d map and input information about their community."

Rosalyn, woman leader, San Mateo, Philippines

"We were able to really understand the situation in our village. We realized that we are not fully aware of many things we thought we knew about our village. Thanks to the map, we see now the situation in every part of the village."

References

Abarquez I., Murshed Z. (2004) *Community-based disaster risk management: field practitioners' handbook.* Asian Disaster Preparedness Center, Bangkok. Available from: http://www.adpc.net/pdr-sea/publications/12handbk.pdf (accessed 16 January 2012).

CARE (2009) *Climate vulnerability and capacity analysis: handbook.* CARE, Chatelaine. Available from: http://www.careclimatechange.org/cvca/CARE_CVCAHandbook.pdf (accessed 16 January 2012).

International Federation of Red Cross and Red Crescent Societies (2008) *VCA toolbox with reference sheets.* International Federation of Red Cross and Red Crescent Societies, Geneva. Available from: http://www.ifrc.org/Global/Publications/disasters/vca/vca-toolbox-en.pdf (accessed 16 January 2012).

von Kotse A., Holloway A. (1996) *Reducing risk: participatory learning activities for disaster mitigation in Southern Africa.* International Federation of Red Cross and Red Crescent Societies, Durban.

Area	Hazard			Vulnerabilities												Capacities												Issues	Causes	Risk		
				Houses and buildings				People				Animals				Vehicles				Shelters				People								
	Type	Probability of occurrence	Magnitude	Light materials	Semi concrete	Concrete	Etc.	Children	Pregnant women	Older people	Etc.	Horses	Buffalos	Pigs	Etc.	Trucks	4X4	Cars	Etc.	Gymnasiums	Caves	Hills	Etc.	Doctors	Nurses	Fireman	Etc.			High	Medium	Low
Zone 1	Flooding	Low	High	7	3	4		9	3	4		2	2	7		1	1	0		1	0	1		0	2	0		Lack of vehicles to evacuate an important number of dependent people in time of flooding	Lack of financial resources to purchase vehicles and political neglect	X		
	Erratic weather	High	Medium	5	6	2		8	1	2		4	2	9		0	0	1		0	0	2		0	0	0		High number of malnourished children who prove vulnerable in time of poor harvest and lingering limited financial incomes	Single source of financial incomes and erratic weather	X		

Table 12 – An example of disaster risk assessment table

STEP 12.

DISASTER RISK REDUCTION PLANNING

STEP 12 IN A NUTSHELL

Objective:

- Design an action plan for disaster risk reduction

Suggested stakeholders:

- Local communities
- Local governments
- Scientists
- NGOs

Key resources:

- Flip charts, masking tape, markers
- Pushpins, dressmaker's pins, yarns

Duration:

- Four hours to one day depending on local issues

12.1 Integrative action planning for DRR

The previous assessment of disaster risk paves the way for the planning of actions for reducing that risk through preventing the hazards, reducing the vulnerabilities or enhancing the capacities – or most often a combination of all strategies (see also Step 4). Although important, preventing hazards is often costly (in money, labor and time) and never ensures total safety as a dike may breach or be overtopped. Mitigating vulnerabilities is of crucial importance to address the root causes of disasters. However vulnerabilities are frequently, not exclusively, anchored in structural issues (unequal distribution of wealth within the society, ethnic or gender discrimination, unfair access to resources, etc.) which are beyond the reach of the locals. In that context it is often, not always, a utopia to promise participants that the training will address these issues although it may lead to advocacy actions to emphasize local needs. As a consequence, it is usually easier and more realistic to give a prime, not sole, focus on enhancing capacities. Capacities are indeed most often intrinsic to the local community as they refer to local knowledge, social networks, traditional medicine, etc.

As mentioned in the previous sections, P3DM facilitates dialogue between members of the local communities and scientists, local government officials, and NGOs (Figure 53). It serves as a common and credible tool that allows all stakeholders to collaborate. P3DM enables them to plan

internally what can and should be done at the community level. The same tool enables NGOs and local government officials to plan and plot, in collaboration with the community, top-down actions intended to meet local needs. Both a mutually acceptable tool and collaboration are essential to integrate bottom-up and top-down disaster risk reduction measures. These measures and actions appear more legitimate to stakeholders since they are ones who conceptualized and endorsed them using a common tool that is acceptable to everyone.

It is therefore recommended that the action planning stage of P3DM for DRR involves the largest possible array of stakeholders, including the participants who built the map but also staffs from the NGO, representatives from the local government, school communities, faith groups, scientists and the business sector.

Figure 53 – P3DM activity involving a representative from a community-based organization, a local indigenous people leader, a staff from a local NGO, an indigenous people, a municipal planning officer and an elected public official (from right to left at foreground) in Josefina, Philippines (JC Gaillard, January 2010)

12.2 Planning actions for DRR based on a 3D map

P3DM provides a powerful tool for planning a combination of actions for DRR. Based on the table drawn at the previous stage and on the 3D map it is possible to identify the major issues which lead a particular area to be at high risk in facing natural or other hazards, and plan remedial measures

according to available local resources (Figure 54). Such action planning necessitates not only the 3D map but also tools and methods which are not specific to P3DM. It is therefore highly recommended that facilitator refer to handbooks and manuals such as those authored by von Kotze and Holloway (1996) and Abarquez and Murshed (2004) amongst many others.

Figure 54 – Debating hazard-prone areas on a 3D map in San Mateo, Philippines (JC Gaillard, February 2011)

In line with the previous activities which aimed at making disaster risk tangible to the locals it is suggested to continue to resort upon tables which draw upon the data and outcomes of the disaster risk assessment. Table 13 proposes a template which needs to be adjusted to the local context. Such tables should list areas identified during the disaster risk assessment from those at highest risk to those at lowest risk. For each area, it is suggested to:

1. Remind the issues and problems faced by the local community based on the hazards, vulnerabilities and capacities identified in the disaster risk assessment table;
2. Remind the reasons / root causes of these issues and problems;
3. Identify the needs to address / overcome such issues in the context of the prevailing causes;
4. Enumerate specific actions to be conducted to meet these needs given available resources and capacities as listed in the disaster risk assessment table. Draw upon the 3D map to assess the relevance

and pertinence of these actions and plot them if possible;

5. Define a target date for the implementation of the aforementioned actions. Specify the hour, date and month if possible.
6. Identify the specific persons / organizations who / which will be responsible in implementing and monitoring the activities. Locate them on the map to see whether they are the best located people / organizations.

It is often appropriate to conduct this activity through gathering the participants from each area so that different groups look at the places they know best and for which they are most concerned (Figure 55). It is however essential to eventually collate all actions into a community-based action plans to avoid redundancy and pool resources together. When collating all information and local suggested actions it is also instrumental to discuss with outside stakeholders such as NGOs, local government officials and representatives from faith groups and school communities.

Planning for DRR was conducted in the small village of Sagrada, Philippines, in following a P3DM activity. Sagrada is a small coastal village which is isolated from the center of the municipality of Masantol by the Pampanga River. People dominantly make a living from aquaculture and small-scale river and sea fishing. P3DM was conducted in January 2013 with the objectives to come up with an action plan as mandated by the Philippine legal framework for DRR. The 3D map helped the local community in identifying key issues such as the unequal spatial distribution of deep wells, key drivers of land subsidence but essential to provide water resources, and boats, crucial to evacuation, amongst the different households of the village. The 3D map eventually provided the basis to plan location-specific actions such as organizing the use of boats in time of evacuation, installing early warning devices made of multi-colored bamboo posts in the river to monitor the level of water, distributing two-way radio in appropriate places and setting up evacuation facilities and resources in the vicinity. All these actions were eventually integrated in the local government template for DRR which includes scheduling of activities and identification of funding opportunities.

Box 4 – P3DM-based DRR planning in Sagrada, Philippines

Level of risk	Area	Issues (reminder)	Causes (reminder)	Needs	Actions	Timing	Actors	Funding
High risk	Zone 1	Lack of vehicles to evacuate an important number of dependent people in time of flooding	Lack of financial resources to purchase vehicles	Alternatives means of transportation	Identify and assign horses and buffalos for each household in need	Before the rainy season	Farmers and households in need	None
				Vehicles from neighboring zones	Identify and assign vehicles from the next zone for each household in need	Before the rainy season	Vehicle owners and households in need	None
		High number of malnourished children who prove vulnerable in time of poor harvest and lingering limited financial incomes	Single source of financial incomes and erratic weather	Micro-insurance to buffer for poor harvests	Implement a community-based insurance scheme where every household contribute every month a small amount of money	April. 2012	All households	Cooperative
				Early warning system for droughts and cyclones which damage crops	Develop an early warning system using local knowledge of precursory signs for cyclones and locally made rain gauges	March 2012	The local high-school community and its science class	Government
	Zone 2	Evacuation proves difficult for those households located near the hills in time of landslide and flooding	Poor access to land which prevents the poor to relocate in hazard-safe areas	Footbridge or rope that can be used to facilitate evacuation across the river during landslide	Five-day volunteer labor from the community to build a footbridge using local materials (e.g. bamboo, timber)	May 2012	Volunteer villagers	NGO
Medium risk								
Low risk								

Table 13 – A sample table for DRR action planning

Figure 55 – Groups of participants from different hamlets of La Carlota, Philippines, working on their action plan near their 3D map (JC Gaillard, January 2011)

The 3D map provides a tangible and solid basis for the planning process. It is therefore best to conduct the action planning around or near the 3D map. Normally, both the facilitator and the participants have to look back and forth at the 3D map while conducting the action planning. For example, planning for evacuation in facing a pending hazardous event requires identifying the safest and fastest routes as well as locating hazard-free evacuation spots / centers. The vertical dimension is most useful as it provides a tangible basis for identify such routes and evacuation spots / centers (Figure 56).

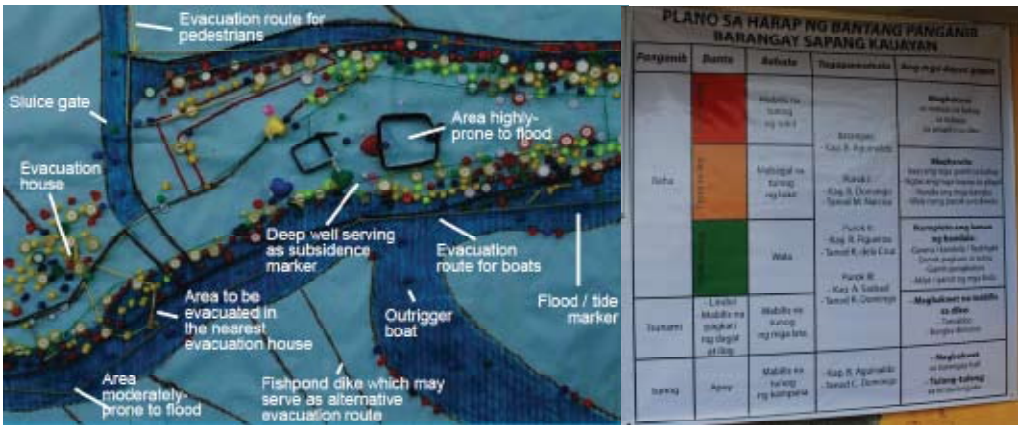


Figure 56 – DRR actions identified over a 3D map (left) and associated community-based DRR plan hung on the wall of the village hall in Masantol, Philippines (JC Gaillard, September 2009)

12.3 Prioritising actions and time shortage

The 3D map usually enables the identification of many issues which underpin disaster risk within the community. It is often impossible during a single, short training to address all issues and plan actions in facing all hazards. It is therefore essential to focus in priority on the areas which have been considered at highest risk during the disaster risk assessment. Because P3DM provides local communities with a tangible, cheap and easy to reproduce methodology for assessing and reducing disaster risk it is expected that the participants will eventually take the lead in reproducing the activities on their own. In that view, the initial training should provide the momentum and the basic skills and knowledge for sustainable community-based DRR.

In the long term, the 3D map can be used to mainstream DRR and other development issues at the municipal / city level. It is easy to reproduce in other villages and is very affordable in terms of financial requirement. It should also be noted that the 3D map is a holistic tool and can be used in many ways (e.g. health survey, land use planning, zoning). The flexibility of the 3D map in terms of usefulness could give the village infinite benefits regarding several issues and problems, at any time providing a common tool among villages to produce data and knowledge needed at the municipal/ city level.

To learn more, see Gaillard and Maceda (2009) and Cadag and Gaillard (2012).

Tips and tricks: *When relevant and possible, P3DM facilitates the integration of CBDRR within government frameworks for reducing the risk of disasters. This stems from the ability to foster dialogue between government officials and the members of local communities. Therefore, if there is an existing appropriate and progressive government template for planning DRR it is highly recommended that P3DM activities draw upon such document for planning actions.*

Nanette, NGO coordinator, Iligan, Philippines

"P3DM is indeed an effective tool for empowering people and communities. It is a powerful tool for linking local knowledge and science; community and local government; community action and policy making; community-managed and government-mandated disaster risk reduction and sustainable development efforts."

Mamerto, elected local government leader, Canlaon, Philippines

"We can never know when the volcano is going to erupt. The more reason we need to plan. With this 3D map, we can make plans with basis. Like in this part (pointing the village center) which has large concentration of settlement, with one burst of lahar, all is gone. In Sitio Matagbak (an upland hamlet) with almost 200 households and more than 600 people, what if the footbridge fell, how do we rescue them? Those questions and the answers to them are input to our DRR plans."

Aivin, government official, Camarines Norte, Philippines

"I realised that P3DM is not only for DRR but that we can use it for many other purposes and effective planning."

References

Abarquez I., Murshed Z. (2004) *Community-based disaster risk management: field practitioners' handbook.* Asian Disaster Preparedness Center, Bangkok. Available from: http://www.adpc.net/pdr-sea/publications/12handbk.pdf (accessed 16 January 2012).

Cadag J.R.C., Gaillard JC. (2012) Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area*: in press.

Gaillard JC., Maceda E.A. (2009) Participatory 3-dimensional mapping for disaster risk reduction. *Participatory Learning and Action*, 60: 10. Available from: http://pubs.iied.org/pdfs/G02818.pdf (accessed 16 January 2012).

von Kotse A., Holloway A. (1996) *Reducing risk: participatory learning activities for disaster mitigation in Southern Africa.* International Federation of Red Cross and Red Crescent Societies, Durban.

STEP 13.

POLISHING THE MAP

STEP 13 IN A NUTSHELL

Objective:

- Polish the P3DM

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Paints, pushpins, dressmaker's pins, yarns
- Small pieces of carton, polystyrene, crepe sole, cork
- Brushes and markers
- Plastic sheets / glass cover

Duration:

- Four hours to one day depending on local issues

The 3D map may now be polished (see step 15 for subsequent updating the map). This requires adding key components of all maps on the P3DM and protecting it.

13.1 Map components

The 3D map should include the following components so that reading is easy, especially for members of the community which have not participated in the P3DM activities. These component are also essential for eventually integrating scientific knowledge and supporting integration of the community-based DRR plan into municipal activities.

Title – this is the chosen title of the 3D map with the name of the village. It may be painted or designed by the participants on a piece of wood or polystyrene. It should be visible and large enough to be seen at first sight (Figure 57).

Figure 57 – Participants carving the name of their village for 3D map in Mondulkiri, Cambodia (JC Gaillard, January, 2011)

Legend – the temporary pieces of cartons or polystyrene which have been used during the mapping activities (see step 7) should be replaced by a clean and integrated list of symbols which appear on the 3D map (Figure 58).

The legend may be written or painted directly onto the map with the appropriate push pins, yarns and paints. Alternatively, a picture of the actual legend may be used to make sure than no symbols get lost during transport or final set up. The legend should be in the local language and may include drawings or pictures for those who can not read.

Figure 58 – Polishing the legend of a 3D map in Borongan, Philippines (JC Gaillard, August 2007)

Scale – the scale should be represented as a graphic scale, meaning a line marked with distance on the ground (Figure 59). A numeral scale such as 1:1000 may not really be understandable for the participants. A scale of 1:1000 cm means 1 cm is equivalent to 1000 cm or 10 m. This means that a line with a length of 10 cm is equivalent 100 m. This 10 cm line (equivalent to 100 m on the ground) can be painted on the 3D map in a sequence of black and white (or other culturally relevant colored) 1 cm blocks (equivalent to 10 m). In some non-Western context, the scale may not be metric and refer to time or other references.

Orientation – as mentioned in step 4 the orientation may follow the Western system of cardinal points or any other locally relevant pattern. In any case the orientation of the 3D map has to be clearly indicated to make sure that the map is properly oriented even if it is moved from one place to another. This can be through an arrow pointing to the north or whatever other symbol (Figure 59).

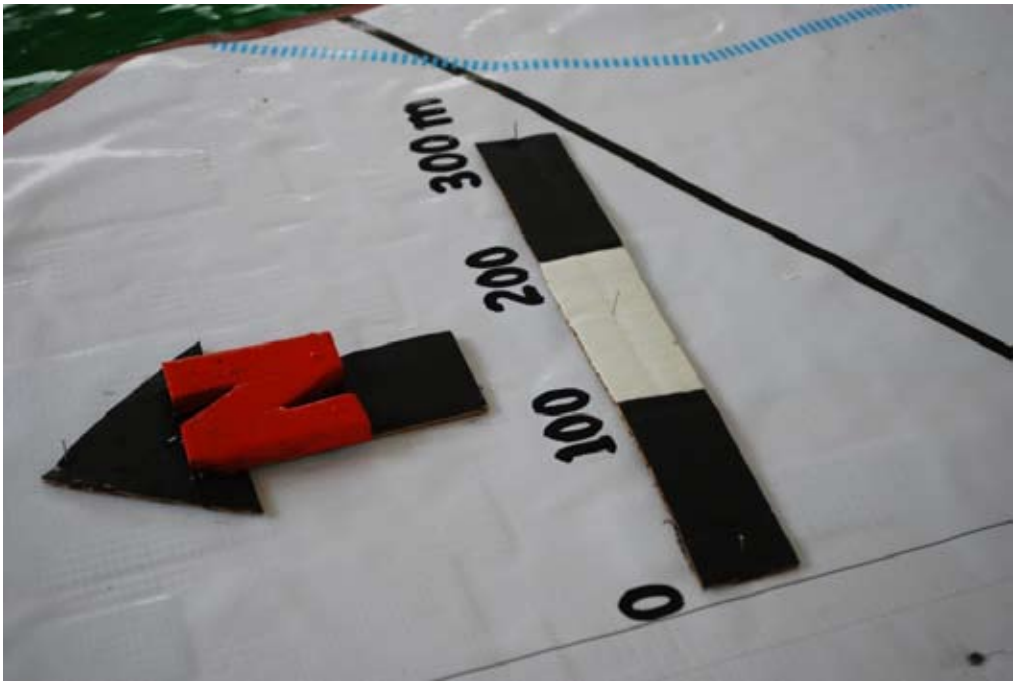


Figure 59 – Scale and orientation of a 3D map in Irosin, Philippines (JC Gaillard, January 2010)

Grid and coordinates – this is optional and may only serve a purpose if there is a future plan to integrate the data on the 3D map into a GIS (see step 14). The grid is placed on top of the 3D map using distinct yarns stretched across the map (Figure 60). Obviously this proves difficult of the terrain is mountainous. In that case, the yarns have to carefully follow the relief while maintaining the proper direction.

Figure 60 – Grid affixed on top of a 3D map in Borongan, Philippines (JC Gaillard, August 2007)

In addition to these cartographic musts it is suggested to include the names and group photograph of the participants in order to enhance their sense of ownership. It also often raises pride amongst those who built the map so that they care for it afterwards.

13.2 Protection measures for the 3D map

In order to ensure the safety of the information on the 3D map, it has to be properly covered. Depending on the resources of the community (or the source of funding), the following materials can be used as a cover:

1. Plastic cover – this can be an immediate and cheap material to cover the map (Figure 61). However, this may have to be replaced from time to time depending on the local conditions.

Figure 61 – 3D map covered with plastic sheets in Mercedes, Philippines (JC Gaillard, December 2012)

2. Glass or fiberglass cover – this is a much more expensive and a bit fragile (for glass) option but the beauty of the 3D map is certainly enhanced and display is easy (Figure 62). The map may further serve as table.

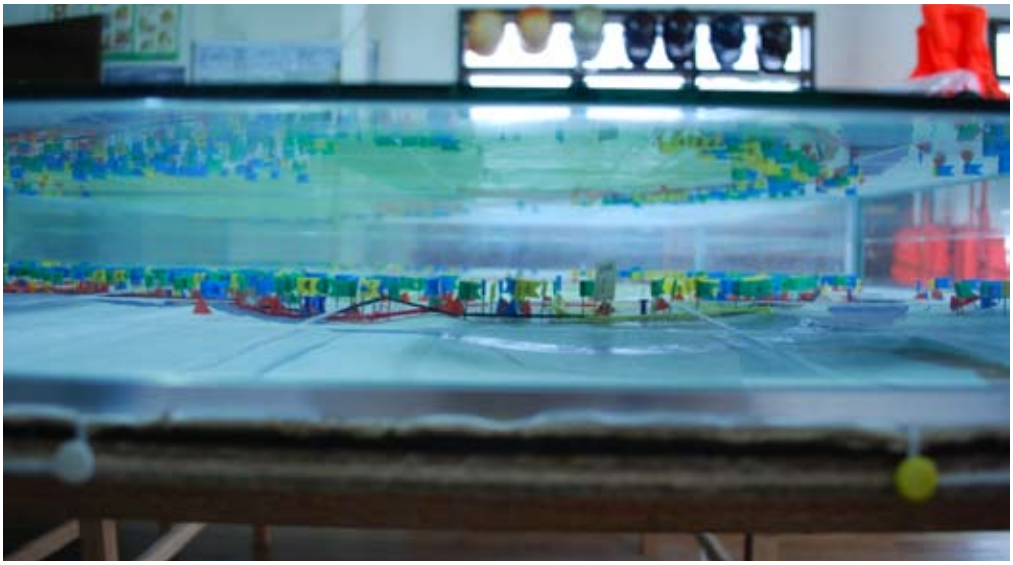


Figure 62 – Glass case covering a 3D map in Dagupan, Philippines (JC Gaillard, July 2009)

STEP 14.

CLOSING CEREMONY

STEP 14 IN A NUTSHELL

Objective:

- Turn over the map to the local community

Key stakeholders:

- Local communities
- Local governments
- Scientists
- NGOs

Key resources:

- Certificates and camera

Duration:

- Two hours

14.1 Distribution of certificates to the participants and group photograph

Depending on local culture and context, it may be appropriate to organize a closing ceremony. Such an activity usually formalizes the contribution of the participants and increases their sense of pride in having participated in the building of the 3D map. A closing ceremony may involve the distribution of a certificate of appreciation to each participant and a souvenir group photograph. For some people, this may be their first experience of this kind of activity that appreciates their knowledge and skills, and therefore a certificate of appreciation and a picture are great consolations.

The certificate of appreciation should be prepared on the last day of the training in order to confirm all the names of the participants. Even though some participants have not attended the whole duration of the activity, they still deserve the certificate of appreciation. The certificate should include the logos of the organizations involved, title of the project, date of the project implementation, name of the awardees/participant, venue of the activity, date the certificate is awarded, and the names, titles and signatures of the facilitator (Figures 63 and 64).

COMMUNITY-MANAGED/BASED
DISASTER RISK REDUCTION

CERTIFICATE OF PARTICIPATION

Is hereby given to

For attending the

PARTICIPATORY 3-DIMENSIONAL MAPPING AND COMMUNITY-BASED DISASTER RISK REDUCTION AND MANAGEMENT TRAINING

9-10 August, 2011
Brgy. Masulog, Canlaon City

HON. MAMERTO S. BERMIL
Brgy. Captain/ABC President
Brgy. Masulog/City of Canlaon

JAKE ROM D. CADAG
Field Coordinator/Researcher
MIA-VITA Project

Figure 63 – A sample layout of certificate being awarded to all the participants of the P3DM activity

Figure 64 – Distribution of certificate of appreciation at the end of a P3DM training in San Mateo, Philippines (J. Cadag, January 2011)

The group photograph is usually taken in front of the 3D map and eventually posted on the map (Figure 65).

Figure 65 – Photograph gathering the participants in a P3DM training in Irosin, Philippines (JC Gaillard, January 2010)

14.2 Turnover of the 3D map to the local caretaker

The closing ceremony may also be the occasion for a formal turnover of the 3D map to its caretaker. As mentioned in step 3, the caretaker is often the owner of the place where the map is to be stored. The caretaker should be tasked with maintaining the map in good shape through regular cleaning. It should also store the spare materials, such pushpins, dressmaker pins, yarns and paints, as well as other materials associated with the construction of the 3D map.

The caretaker may also be in charge of organizing the subsequent regular activities for updating the 3D map (see step 16). Depending upon the context, it may be the local government, a people's or community-based organization, a local NGO, a school or a faith group.

Tips and tricks: *Changes in government agencies staff or local elected officials is often an issue for ensuring the sustainability of a 3D map. Newly appointed or elected leaders may have no knowledge of the 3D map, which in turn may not be maintained or updated. It is therefore essential that the caretaker ensure the future use and transfer of knowledge to future local government or decision makers, and children or community members.*

Ed, high school teacher, Masantol, Philippines

"As an individual, I find it very helpful. I felt the unity of the village folks including the students and this motivated me to actively participate in the 3D mapping activity. In school, the students learned to apply social investigation. For the community, the project made the community leaders see their significant role in ensuring the safety of the inhabitants in times of calamities."

Vincent, think tank project leader, France

"We started the project with elderly and went on with kids, members of the larger community and shop owners. People were engaged. Every day they came to plot new information. It was a project which gathered people across generations as children were able to understand what their grand-parents said."

STEP 15.

INTEGRATING P3DM DATA INTO A GIS

STEP 15 IN A NUTSHELL

Objective:

- Extract data from the P3DM and integrate them into a GIS

Suggested stakeholders:

- Local communities
- Local governments
- NGOs

Key resources:

- Camera and tripod
- Plumb line, set square and level
- Computer hardware and GIS software

Duration:

- Two to three days depending on the number of households and size of the area covered by the map

15.1 P3DM, GIS and ethical concerns

Integrating data into a Geographic Information System (GIS) is an optional add-on feature of P3DM for DRR which requires technical, most often external (to the community) expertise. It is applicable only when local knowledge may be thoughtfully integrated into larger DRR policies on the side of local authorities or NGO programs. In that case, it may be a powerful tool for broadcasting local resources beyond the local community.

Integrating P3DM data into a GIS requires that the skills, the hardware and the software and the resources for maintaining these in good shape are all available either in the community or within the hands of proximate outside stakeholder, e.g. local government or NGO. It is also possible that the NGO facilitator consider a GIS training component as part of a DRR project. In that case, it is recommended that great attention be given to the principles of Participatory GIS training as exposed on the IAPAD website: www.iapad.org

In any case, the use of GIS has to be carefully planned as it endangers local people's ownership over their data. GIS data are indeed almost always manipulated beyond the community and there is therefore a danger that local knowledge is misinterpreted or transformed without the prior agreement of those who own the said data. Integrating P3DM data into GIS thus requires the highest ethics and dedication to participatory values.

15.2 Transferring data from the 3D map to the GIS database

The methodology for transferring data from the 3D map to the GIS database follows a simple four-step process, which includes:

1. Preparing the map;
2. Photographing the 3D map;
3. Digitizing and classifying the data;
4. Processing and valorizing the data.

15.2.1 Preparing the map

Before integrating P3DM data into a GIS, it is compulsory to set a rigorous grid of perpendicular yarns stretched at equal distance across the map as described in step 12 (Figure 66). This is essential to provide references for eventually georeferencing each photograph to be taken and digitized in the GIS. It is obviously similarly important to know the exact location in latitude, longitude and elevation of each corner of the 3D map and hopefully of a few more landmarks.

Figure 66 – Grid stretched across a 3D map in Borongan, Philippines (JC Gaillard, August 2007)

15.2.2 Photographing the 3D map

Photographing the 3D map is the most difficult part of the process as it must avoid any distortions between the actual map and the digital data. The reference Participatory GIS manual by Rambaldi Callosa-Tarr (2002) recommends the Parallel Camera Movement shooting method.

This method consists of taking a series of photographs along a straight line traced on the floor at a constant distance from the 3D map. The map is titled to facilitate the process. A set square is required to respect a perfect perpendicularity between the 3D map and the floor.

The camera is eventually set on a tripod at a given distance from the 3D map. A plumb line is useful to make sure that the axis of the tripod is exactly aligned with the line traced on the floor (Figure 67). A level is also required to verify that the body of the camera is perfectly perpendicular to the floor. That way every photograph to be taken will be perpendicular to the 3D map. The initial height of the camera depends on the size of the map. Usually several series of photographs at different heights are necessary to cover the entire 3D map. It is important to ensure that there is a slight overlap between photographs to facilitate stitching afterwards (Figure 68).

Figure 67 – Setting up a digital camera on a tripod before taking photographs of a 3D map in Dagupan, Philippines (JC Gaillard, July 2009)

Figure 68 – Photographing a 3D map in preparation for the integration of data into a GIS in Dagupan, Philippines (JC Gaillard, July 2009)

15.2.3 Digitizing and classifying the data

The third step of the process for integrating P3DM data into a GIS consists of digitizing the photographs using any GIS software. Digitizing has to carefully respect the data plotted by the local community. The digitizer has to permanently refer to the legend of the 3D map which may be very long and complex.

At that time it is best for the digitizer to classify the data by respecting the categories provided in the legend and by sticking to the local knowledge and interpretation of those who built the map. It is recommended that different layers of information are generated for every section of the legend so that the manipulation of the GIS database is eventually easy.

Note that digitizing data from a 3D map is difficult if overlapping beads have been used to replace pushpins – unless they have been piled up from the largest, at the bottom, to the smallest, on top.

15.2.4 Classifying, processing and making use of the data

Once the data are integrated in the GIS database it is henceforth possible to integrate them with existing data produced by other stakeholders. In addition, it is also possible to juxtapose data from different neighboring 3D maps to form a large, for example municipal, depository of participatory data and local knowledge.

Such spatial databases advantageously replace satellite images which are usually very expensive (if updated) and often require additional skills to decipher, which are often absent in marginal and/or poor locations. In addition, GIS databases fueled by P3DM are easily updatable and do not require the purchase of any more digital data. If a farmer has decided to till a new crop and if the 3D map is updated shortly afterwards it just requires on the side of the authorities or NGO which manages the database to take a new set of photographs to update the GIS. Similarly if a pushpin is removed, relocated or replaced it is very easily transferable into the GIS without any additional cost.

Thematic maps may be produced out of the GIS to assist land-use or development planning through drawing upon people's knowledge (Figure 69). Obviously, this requires the highest ethics on the side of the planners and actions require discussion and prior approval of those who own the data and are first concerned by the measures to be taken, i.e. members of the local community.

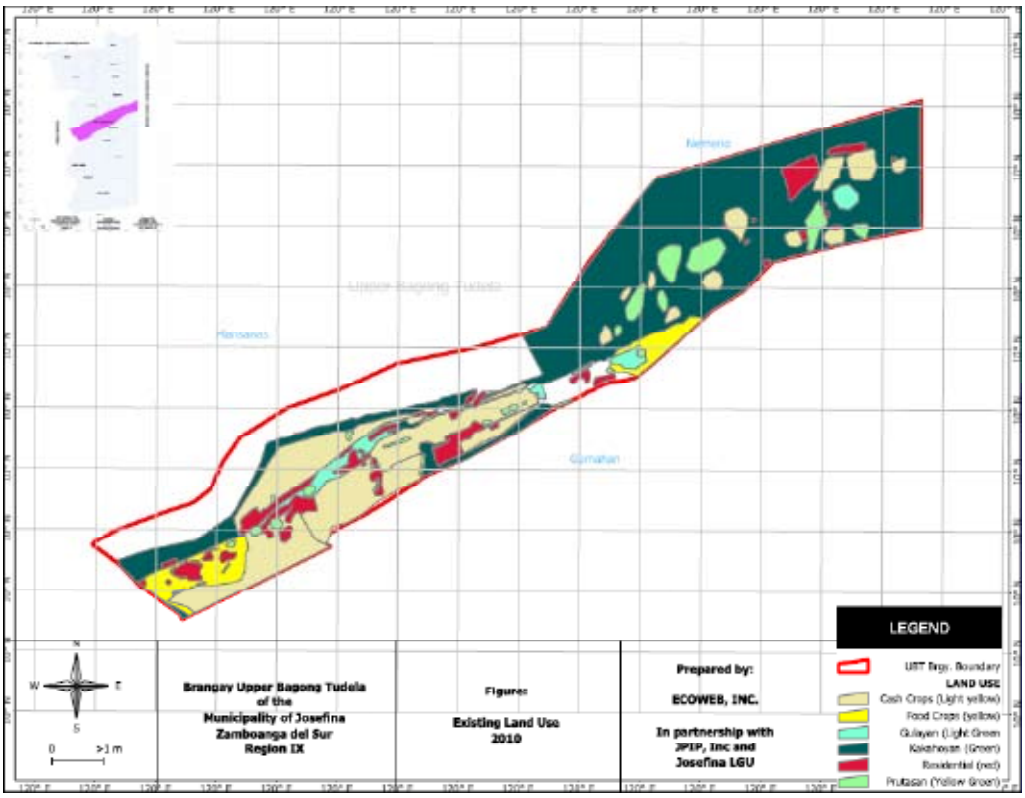


Figure 69 – GIS map extracted from a 3D map in Josefina, Philippines (Ecoweb, Inc.)

GIS databases are also useful to monitor the evolution of the data in the 3D map, an issue which is difficult to integrate into the actual map. Storing images and digitized versions of the 3D maps at different periods of time may be useful to understand past, current and future trends in hazards, vulnerabilities and capacities – trends which are important in planning for DRR.

To learn more, see Rambaldi and Callosa-Tarr (2000, 2002) and www.iapad.org

References

Rambaldi G., Callosa-Tarr J. (2002) *Participatory 3-dimensional modelling: guiding principles and applications.* ASEAN Regional Centre for Biodiversity Conservation (ARCBC), Los Baños. Available from: http://www.iapad.org/publications/ppgis/p3dm_arcbc_lr.pdf (accessed 16 January 2012).

Rambaldi G., Callosa-Tarr J. (2000) *Manual on participatory 3-dimensional modeling for natural resource management.* Department of Environment and Natural Resources, Quezon City. Available from: http://www.iapad.org/publications/ppgis/p3dm_nipap.pdf (accessed 16 January 2012).

STEP 16.

UPDATING THE 3D MAP

STEP 16 IN A NUTSHELL

Objective:

- Update the P3DM

Suggested stakeholders:

- Local communities
- Local governments
- Scientists
- NGOs

Key resources:

- Paints, yarns, pushpins, dressmaker's pins
- Small pieces of carton, polystyrene, crepe sole, cork
- Flip charts and markers

Duration:

- One day

If a P3DM training has an end, P3DM activities do not. It is indeed one strength of P3DM to enable permanent and detailed updating of the 3D map. Pushpins and yarns are easily movable and replaceable should need arises while a certain paint may be covered by other colors. For example, if a woman gives birth, the pushpin which indicated that she was pregnant should be replaced by the pushpin showing that there is a young child in the household. Such a fine-tuned updating of the 3D map on a regular basis enables the upgrading of the disaster risk assessment and lingering action plan on a continuous basis. In time of disaster updated information proves to be crucial.

Updating the 3D map may take place on a continuous basis or at regular schedules agreed upon by the community. In the first case, the stakeholder in charge of looking after the 3D map takes charge of updating the data and eventually have it validated by the larger community, for example during community meetings.

In the second case scenario, regular meetings, e.g. quarterly or yearly, are organized with the participants who built the 3D map. They should gather during a day or two to update the entire data at once (Figure 70).

Associated data, such as the household data sheets, the disaster risk assessment table and DRR plans must be updated simultaneously.

Figure 70 – Updating of the 3D map and household data sheets in San Mateo, Philippines (JC Gaillard, December 2011)

Ka Noli, community leader, San Mateo, Philippines

"It is indeed a work in progress. It is a map that is alive in its fullness. And this P3D Map's fullness will be our daily tool and compass towards the attainment of a more disaster resilient community."

ANNEX

ANNEX 1: BASE MAP PREPARATION

Base map preparation is one of the critical steps in P3DM. Without a base map, it is practically impossible to make the 3D map or to conduct the P3DM activities. The following methods are the three ways to produce the base map:

- Direct enlargement of the latest topographic map
- Base map preparation using GIS

The facilitator or the organizers should consider the practicality of each method in terms of the capacity of the stakeholders especially the local authorities to produce the base map. If the local stakeholders could not produce the base map by themselves, replication of the tool in the future would not also be possible.

1. Direct enlargement of the latest topographic map

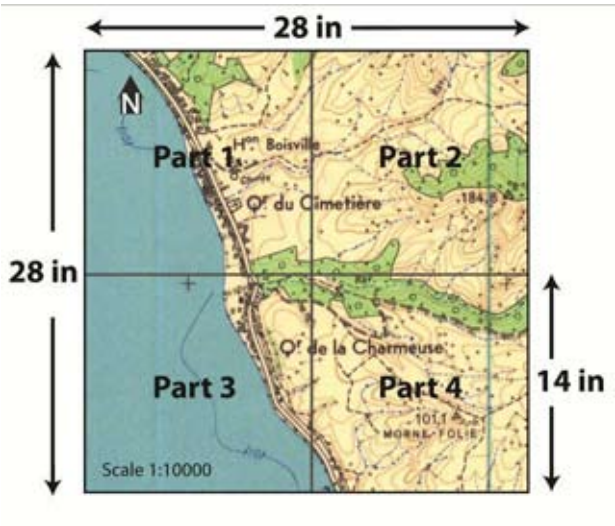
Direct enlargement of the latest topographic map seems to be the easiest way and most probably the most accessible method especially in the rural areas. This method has the minimum requirements:

Requirements

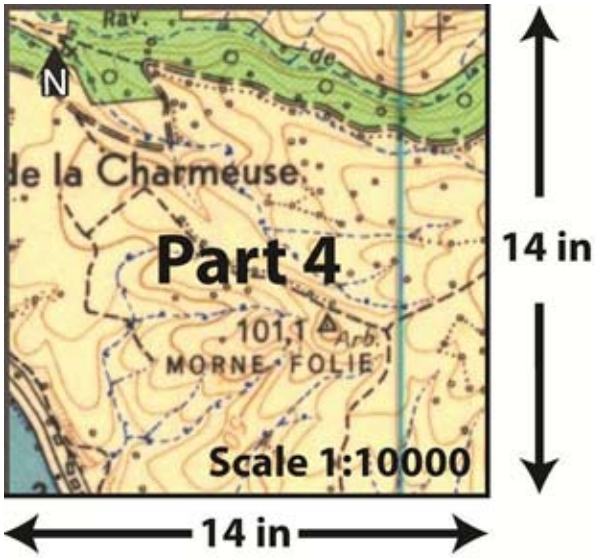
1. Topographic map preferably with a scale of 1:10,000
2. Photocopier with enlargement function

1.1. Horizontal scale ('scale')

Considering that we have the topographic map below with a scale of 1:10,000 and a dimension of 28 x 28in. And our target area for the base map is located in Part 4 of the topographic map. How can we obtain a base map with a scale of 1:000 and what should be the actual dimension (in inch or centimeter)? Follow the instructions below:

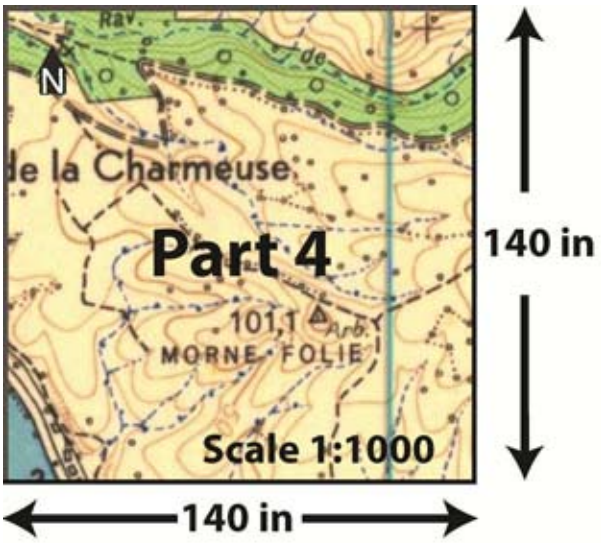


1. Obtain the part 4 of the topographic map (you can simply fold it or cut it).
2. The topographic map you have should have a dimension of 14 x 14 in as shown below:



3. Divide the current scale (1:10,000) by the desired scale (1:1,000). The result is 10.
4. To obtain the actual dimension of the topographic map at 1:1000 scale, enlarge the topographic map 10 times (from step 3). The resulting dimension should be 140x140 in. This is the size of your base map at the scale of 1:1000. Consider the illustration below.

5.



1.2. Vertical scale (contour interval)

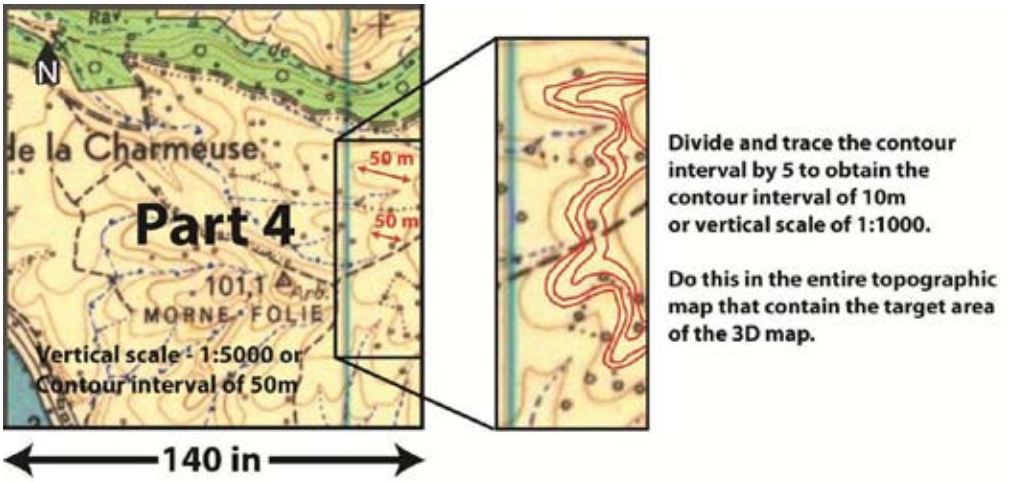
The vertical scale is the contour interval. If the contour interval is 50m, then the vertical scale is 1:5000 (1cm=5000cm or 50m). Similarly, if the contour interval is 10m, then the vertical scale is 1:000 (1cm=1000cm or 10m). In the 3D map, each contour line is represented by layer of carton or polystyrene. If the scale is 1:1000, a layer of carton or polystyrene with 1cm thickness is equivalent to 10m. Likewise, in a scale of 1:5000, a layer of carton or polystyrene with 1cm thickness is equivalent to 50m.

Vertical scale	Contour interval	Thickness of carton or polystyrene in the 3D map
1:10000	100m	1cm
1:5000	50m	1cm
1:2500	25m	1cm
1:2000	20m	1cm
1:1000	10m	1cm
1:500	5m	1cm

Table 14 – Ratios for horizontal and vertical scales on 3D maps

Ideally, the ratio of horizontal scale and the vertical scale is 1:1. In other words, if the horizontal scale is 1:1000, then the vertical scale should also be 1:1000 (or each layer of carton or polystyrene with 1 cm thickness is equivalent to 10m). This gives the best representation of the reality in the miniature 3D map.

Considering that our topographic map above has a contour interval of 50m, thus a vertical scale of 1:5,000. In this case, our horizontal scale is 1:1000 and the vertical scale is 1:5000, and so our ratio is 1:5. What should be done in order to have the 1:1 ratio? All that is needed to be done is to obtain a contour interval of 10m to achieve a vertical scale of 1:1000 (Table 14). This can be done by dividing and tracing the current contour interval by 5 to obtain a new contour interval of 10m. A pen or small marker can be used. Consider the illustration below:



If the contour interval of the topographic map is originally 10m, then there is no need to go through the process of dividing and tracing new contour intervals.

Tips and tricks: *If there is a need to trace new contours to fit the desired vertical scale, it can be done before and after the enlargement of the topographic map. If the users preferred to do it before the enlargement, the tracing of new contour lines should be done in the original topographic map which is normally small and thus tracing is quite difficult. On the other hand, the tracing of contour lines can also be done after the enlargement in the actual base map material that should be larger in size compared to the size of the original topographic map and thus tracing is much easier.*

2. Base map preparation using GIS

Using GIS software is faster, flexible and more precise way of base map preparation. It is faster than direct enlargement of topographic map since contours can be generated automatically and the resizing of the base map to its actual size on the 3D map can be done in few clicks. Map elements and other map features and attributes can be added before the printing and thus more flexible. It is also more precise in a sense that contours are generated automatically and the actual dimensions or size can be verified before printing. However, all these practicalities of base map preparation using GIS are only possible if there are GIS software, GIS data and GIS personnel. If these are non-existing, then base map preparation using GIS is not practical at all.

Consider the following steps in preparing the base map using GIS. Our objective is to create a base map with a horizontal and vertical scale of 1:1000. The steps presented here are general steps and can be done using any GIS software.

2.1. Data requirements

1. GIS software
2. Boundary of the target area in GIS format
3. Digital elevation model or DEM containing the target area
    a. If a DEM is not available locally, a worldwide and high quality database is available in http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp
    b. Select the parcel that correspond to the study area
        i. Choose Arcinfo ASCII as file format
        ii. Select the parcel
        iii. Click 'Click here to begin search'

c. Download the file

   i. Click Data Download (HTTP)

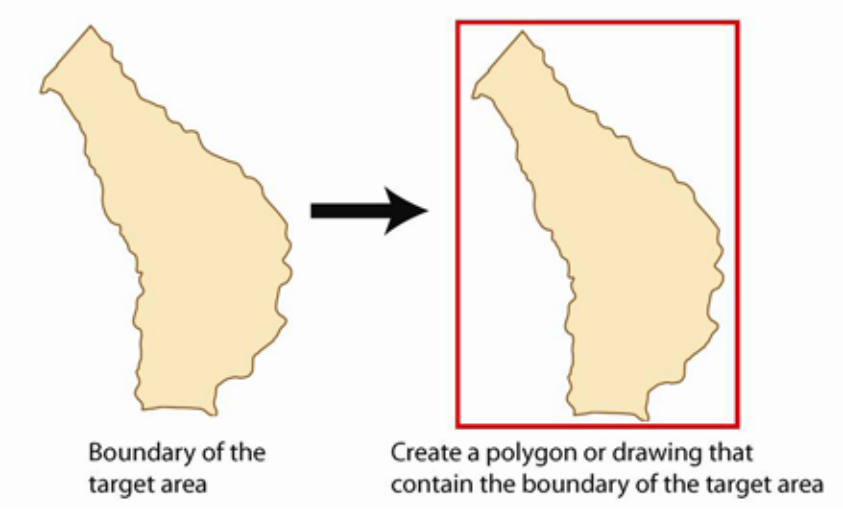
   ii. Save the file ‘srtm_xx_xx.zip’ in zip format

   iii. Create a folder in the desktop and unzip the ‘srtm_xx_xx.zip’

d. The unzip files include the DEM needed for the base map preparation.

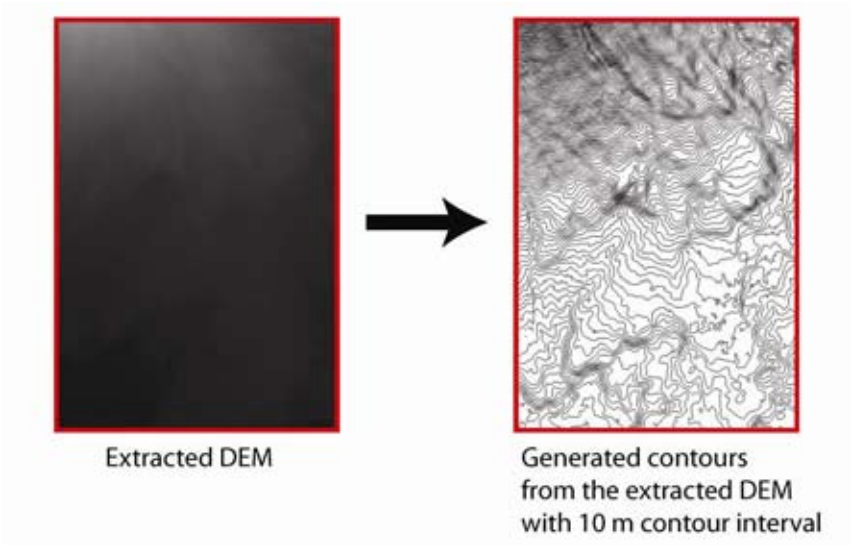
2.2. Steps

1. Create a polygon or drawing containing the boundary of the target area. The result is either rectangle or square depending on the shape of the boundary of the target area.

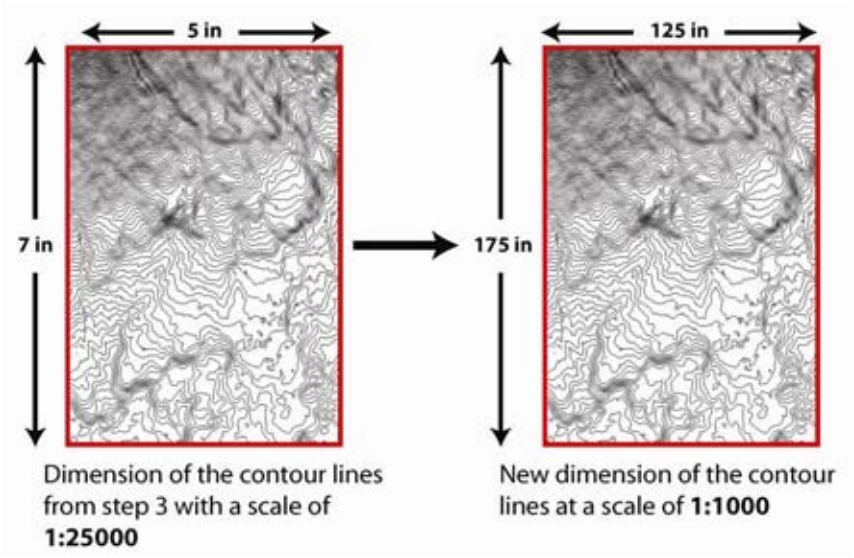


2. Extract the DEM that is within the rectangle or square created in Step 1. In some GIS software, this can be done by intersecting the rectangle or square to the DEM.

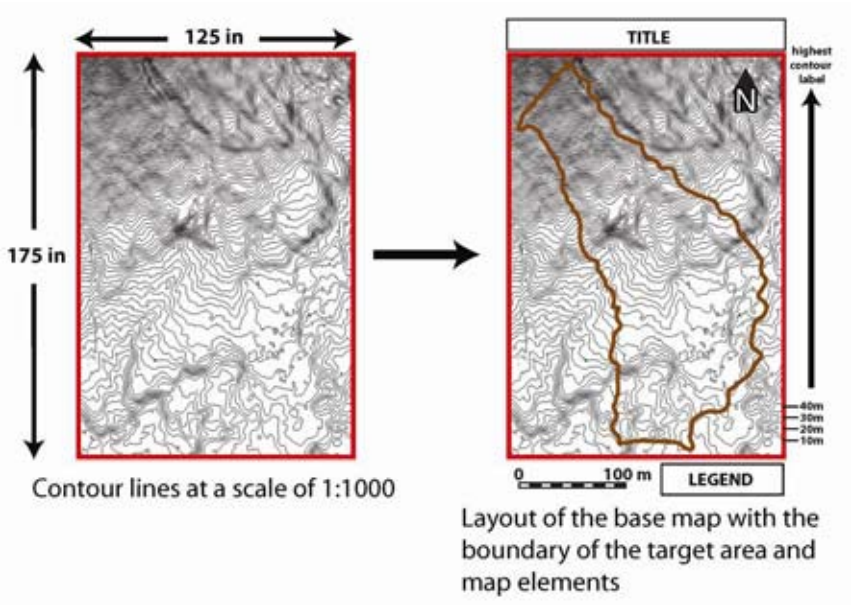
3. From the extracted DEM, produce the contour lines with 10 m contour interval (or vertical scale of 1:1000).



4. Obtain the generated contour lines in step 3 and set it at a scale (horizontal scale) of 1:1000.



5. Prepare the layout containing the contour lines at a scale of 1:1000 and contour interval of 10m (step 4). The size of the layout should be the actual size of the base map for the 3D map. Overlap the boundary of the target area and add the map elements such as title, north arrow, scale, legend, contour and labels.



Contour lines at a scale of 1:1000

Layout of the base map with the boundary of the target area and map elements

6. Print the base map.

ABOUT THE AUTHORS

JC Gaillard, Ph.D. is Associate Professor at The University of Auckland in New Zealand and a former member of the faculty of the University of the Philippines Diliman. He trained as a geographer with particular interest in disaster risk reduction (DRR) in Asia and the Pacific. Over the last 15 years, he has worked in the Philippines, Indonesia, Cambodia, Nepal, Kiribati, Samoa, the Solomon Islands, New Zealand, France, Guadeloupe, Comoros and Cape Verde. His present work focus on developing participatory tools for DRR and in involving marginalized groups in disaster-related activities with an emphasis on ethnicity, gender, and on prisoners and homeless people. JC actively collaborates in participatory mapping and community-based DRR trainings with NGOs, local governments and community-based organizations. He Also serves as editor of the journal Disaster Prevention and Management and was co-editor, with Ben Wisner and Ilan Kelman, of the Routledge Handbook of Hazards and Disaster Risk Reduction. More details from: http://web.env.auckland.ac.nz/people_profiles/gaillard_j/

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Both JC and Jake have conducted more than twenty P3DM for DRR projects in the Philippines, Indonesia, Cambodia, Nepal, France and Cape Verde. These projects have been funded by CAFOD and other local and international NGOs.

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