Community-Based Mapping of the Rice Terraces Inscribed in the UNESCO World Heritage List

(A component study of the project entitled "Towards the Development of a Sustainable Financing Mechanism for the Conservation of the Ifugao Rice Terraces")

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COMMUNITY-BASED MAPPING OF THE RICE TERRACES INSCRIBED IN THE UNESCO WORLD HERITAGE LIST[1]

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EXECUTIVE SUMMARY

The rice terraces in four municipalities of Ifugao were inscribed in the UNESCO World Heritage List in 1995 as the Rice Terraces of the Philippine Cordilleras under the category of organically evolved landscapes. This category includes landscapes that developed as a result of an initial social, economic, administrative or religious imperative, and by association with and in response to the natural environment. However, the terraces have deteriorated over the years, and those inscribed in the World Heritage List have been reclassified to the World Heritage in Danger List in 2001.

This study is part of a research project that aimed to develop a sustainable financing mechanism for the conservation of the Ifugao Rice Terraces. The report focuses on the estimation of the extent of the rice terraces in the heritage municipalities and the extent of damage that was undertaken with the participation of local communities. The other findings of the project concerning the financing mechanism are presented in a separate report.

We used geo-referenced and other data from various sources to produce maps showing the extent of the rice terraces in the heritage sites, as well as the extent of damage. The initial activities focused on secondary data from which basemaps were generated for each of the four heritage Ifugao municipalities. Individual GIS thematic layers were produced showing rice terraces along with the general features of the landscape (e.g. river network, road network, elevation, including municipal boundaries). These were consequently presented in workshops to the communities (e.g. farmers and local officials). The information generated from the community maps specifically showing the damaged rice terraces were used to estimate the cost of rehabilitating the terraces and the potential revenues that can be collected from local and foreign tourists.

The study concludes that:

1. Community-based mapping is a very effective means to produce up-to-date data and information on the current state of the landscape vis a vis land use, land cover, and other geographic features of the site. In addition, the approach engenders community participation, discussion among the stakeholders. Likewise, it builds and enhances community spirit.

2. The total area of the rice terraces in the heritage sites is estimated to be 10,324 ha, while the estimated area of damaged terraces ranged from a low estimate of 4.1 ha

[1] Component study of the project entitled "Towards the Development of a Sustainable Financing Mechanism for the Conservation of the Ifugao Rice Terraces"

to a high estimate of 461 ha, or 0.04% to 4.4% of the total area. These translate to total rehabilitation costs of P10.02 million to P1.122 billion, respectively, or annual costs of P 1,630,880 million to P 184,243,410 million (at 10% interest rate over a 10-year period). This finding is significant owing to the fact that one of the reasons for the downgrading of IRT is the lack of records on the extent of damage. Additionally, previous estimates of the extent of damage straddle between 5% and 30%.

3. GIS was used to express the various data from different sources into a unified processing and analytical environment. One important insight in the unification process is the exposition of inconsistencies arising from the data themselves. For one thing, boundaries of provinces, municipalities and barangays are grossly different at the sources where they are available.

This study recommends the following:

1. The community-based mapping should be pursued to monitor the land use change of the watersheds encompassing the IRT. Through this activity, 3D models of the IRT can be constructed and used as a planning tool by the communities and the local government units.

2. An updated map and database of the rice terraces in general and the abandoned/ damaged terraces in particular should be developed. In a recent meeting on protecting endangered traditional landscapes held in Banaue from December 3 – 7, 2007, experts agreed on a set of recommendations to rehabilitate the rice terraces and delist IRT from the UNESCO World Heritage in Danger List. The physical rehabilitation of the damaged rice terraces was identified as an immediate solution.

3. The results arising from this research should be considered a new baseline for the rice terraces in the Ifugao inscribed heritage sites. However, GPS-based surveys of the rice terraces and the damage points should be undertaken. Once a sustainable financing mechanism is set in place, a GIS-based monitoring system for the rice terraces should be installed to ensure an objective prioritization of the financial resources that will be earmarked for rehabilitation activities.

This component study demonstrates that tools of ICT (information and communication technology) like GIS can be popularized and brought down to the communities in a participatory exercise. Thus, the benefits of cutting edge technologies like GIS can, in fact, be used by the stakeholders themselves – even in remote communities that are seemingly inaccessible.

1.0 INTRODUCTION

1.1 Background

The Ifugao Rice Terraces are considered to be the best built and most extensive among rice terraces in the Asia-Pacific Region, and are also the most famous because they reach the highest altitude of 1,600 m (PHC 1940 as cited by Gonzalez 2000). They are a testament to the engineering and hydraulic skills of the early Ifugaos who built them more than 2,000 years ago.

The province of Ifugao is a landlocked province under the Cordillera Administrative Region in Northern Luzon. The terraces, in the municipalities of Banaue, Kiangan, Hungduan and Mayoyao were inscribed in the World Heritage List of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1995 under the category of organically evolved landscapes (Rossler n.d.). This category includes landscapes that developed as a result of an initial social, economic, administrative or religious imperative, and by association with and in response to the natural environment.

As a result of the deterioration of some of the terraces, those inscribed in the World Heritage List have been reclassified to the World Heritage in Danger List in 2001 (Rossler n.d.). The factors that have contributed to the terraces' deterioration include the loss of biodiversity due to bio-piracy, unregulated hunting, indiscriminate use of new technologies, and introduction of new species; reduced farm labor because of out-migration; and accelerated erosion and siltation of the watershed (IRTCHO 2004 as cited by Yap n.d.).

Other threats and dangers to the terraces include the abandonment of the terraces due to the neglect of the irrigation system in the area, causing many farmers to leave; unregulated development; tourism needs not being addressed; and the lack of an effective management system (World Heritage Committee 2006).

The research team studied the possibility of developing a sustainable financing mechanism for the conservation of the Ifugao Rice Terraces. A survey among Ifugao farmers in the heritage municipalities revealed that they do not plan to abandon rice terrace farming. However, majority indicated a need for labor subsidy for terrace repair and maintenance because this is the costliest among the different terrace farming activities. The incentives that can strengthen the Ifugaos' resolve not to abandon the terraces, and lure back those who have, are the rehabilitation of the irrigation system, labor subsidy for terrace repair and maintenance, and additional livelihood opportunities.

The study also showed the potential of generating revenues for the conservation of the terraces by collecting fees from local and foreign tourists. The information about potential revenues, however, will be more meaningful if they will be related to the costs of conserving the terraces. Estimating the cost of conservation requires information about the extent of damage in the rice terraces, specifically those in the heritage areas, and this was not available. As such, the team endeavored to estimate the extent of the rice terraces and the extent of damaged terraces in the heritage areas.

2.0 CONCEPTUAL FRAMEWORK

The study was guided by the conceptual framework shown in Figure 1. There were two major sources of data and information: the physical features of the landscape and the mental maps of the stakeholders. The physical features include the water bodies like rivers and creeks, roads and access routes, and the land cover/land use. The more vital source of information was the experiences of the community members owing to generations of interaction with the rice terraces and their immediate environment. These are engrained in them as mental maps.

The study attempted to generate estimates of the extent of the rice terraces and the extent of damage, focusing on the barangays of the four heritage municipalities using geographic information system (GIS). GIS may be defined as an integrated system of hardware/software, personnel and procedures for the capture, storage, analysis, manipulation, and display of geographically-referenced data for decision-making (Bantayan 2006). As a technology, GIS is able to store, analyze a display spatial and non-spatial data. It also involves the integration of geographically-referenced data in addressing issues that have to do with resource location and allocation, siting of infrastructure, generating management zones for biodiversity, among others.

The extent of the rice terraces in the four heritage municipalities has never been fully explained and visualized in its totality. While several attempts have been made in the past to give an indication of the extent of the terraces, none has so far purposively gone to the records as well as solicited the stakeholders themselves through a community-based mapping exercise, until this research effort. In 2004, a research report assumed a 5% damage/abandonment based on a sampling of two sites (JBIC 2004). The same report tracked the collapse of the terraces at various periods from 1966 to 2004 and found an average damage size of 0.1.494 ha from a minimum of 0.005 ha (or 50 sq m.) to a maximum of 0.0.56 ha/damage occurrence (or 5600 sq m.).

In addition, this research component also tried to generate an indication of the currently unproductive terraces due to either abandonment or damage. The various estimates of IRT and other relevant biophysical parameters were generated using geographic information system (GIS) and available remote sensing data.

At some point, UNESCO reclassified the inscribed rice terraces and put them on the endangered list, citing insufficient irrigation facilities, unregulated cropping schedule, and single cropping pattern. More importantly, one of the reasons for the downgrading is the lack of records on the extent of damage of IRT even though the estimate straddles between 5% and 30%.

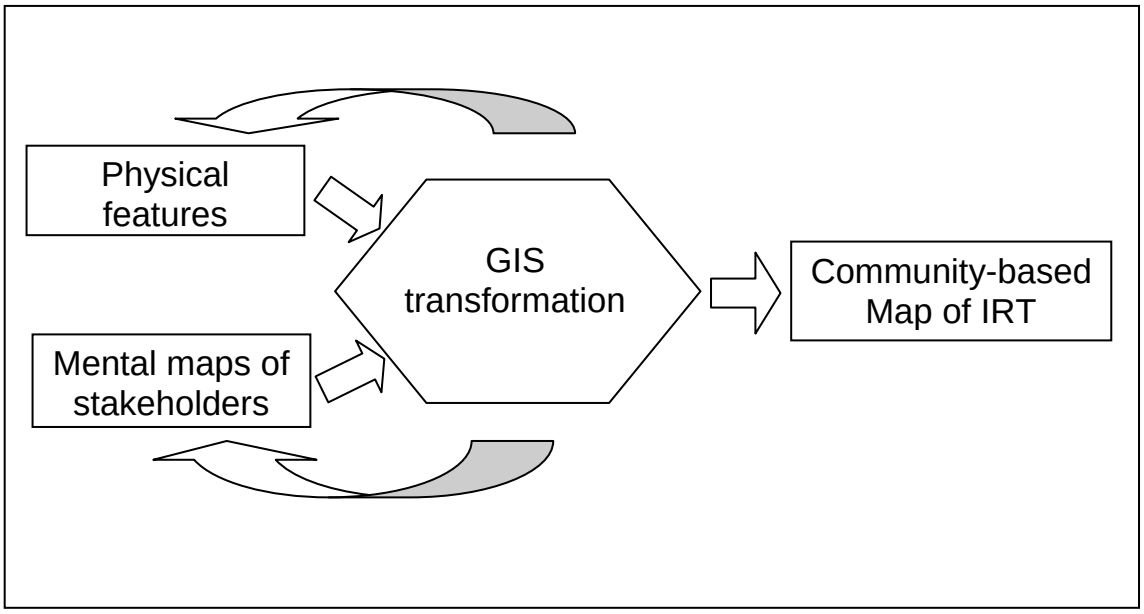

Figure 1. Conceptual framework.

3.0 RESEARCH METHODS

3.1 Research Questions

The study sought to answer the following questions:

a. What is the extent of the terraces that are inscribed in the UNESCO World Heritage List, and what proportion of these have been damaged?
b. Can local communities be involved in estimating the extent of damage in the terraces?

3.1.1 Estimation of the Extent of the Terraces and Their Damage

The investigation involved three activities, namely: developing a baseline dataset; GIS encoding, processing and analysis; and community- based validation of the GIS maps. The first activity included gathering of secondary data including reports, maps and other documents from all available sources (see Annex 1) especially the local government units (LGUs) of the province, municipalities and the barangays. This involved visits to provincial and municipal planning and development offices (MPDO) and agricultural offices (MAO), Bureau of Agricultural Statistics, Department of Agriculture – Bureau of Agricultural Research, National Mapping and Resource Information Authority (NAMRIA), Department of Environment and Natural Resources (DENR), National Irrigation Administration (NIA), the ICSU, among others.

During the second activity, all gathered data were organized and consequently transformed into the GIS environment. This process included scanning, mosaicking, georeferencing and digitizing of the maps and sketches. Documents and other tabular reports were likewise encoded using appropriate text editors (i.e. MS Word) and spreadsheet applications (i.e. MS Excel). As much as possible, remote sensing imageries were used to facilitate the mapping of the land cover and land use of the heritage sites.

After all the data were GIS-encoded, several layers of maps were produced, namely: topography, land use, soils, administrative boundaries (i.e. province, municipality, barangay), and the extent of the rice terraces. These were presented to the stakeholders and validated in a community-mapping exercise (activity 3). Workshops were conducted for this purpose in each of the heritage municipalities, namely Hungduan (August 19, 2008), Kiangan (August 20, 2008), Banaue (August 21, 2008), and Mayoyao (August 22, 2008).

4.0 RESULTS AND DISCUSSION

4.1 Extent of the Terraces in the Heritage Areas

On the average, between 2001 and 2006, the province devoted an estimated 14,513 ha to rice farming, of which 94% (13,607 ha) is irrigated while only 6% (906 ha) is rainfed (Table 4.1). Other planted crops reported for 2004-2006 include corn, vegetables and legumes.

Table 4.1. Area of farms devoted to rice (ha) from 2001-2006

Rice farms	2001	2002	2003	2004	2005	2006	Average
Irrigated (ha)	13,288	13,224	12,922	13,451	13,952	14,804	13,607
Rainfed (ha)	1,040	983	955	1,006	727	727	906
Total	14,328	14,207	13,877	14,457	14,679	15,531	14,513

Source: Bureau of Agriculture, Lagawe, Ifugao; SEP Ifugao 2005

Based on reports, the agricultural areas of the heritage towns of Banaue, Hungduan and Mayoyao are practically terraced (see Table 4.2; see also Figure 4.1). With about 2000 ha of rice terraces in Kiangan, this totals to about 10,880 ha.

Table 4.2 Distribution of land uses in the heritage towns

Municipality	Agricultural Area (ha)		Grassland (ha)	Woodland (ha)	Others (ha)
	Terraced	Non – Terraced			
Banaue	4,327	2	10,280	13,688	38
Hungduan	872	2	6,003	9,328	73
Kiangan	2,001	935	6,180	5,290	128
Mayoyao	3,680	4	13,469	6,686	84
Total	10,880	943	35,932	34,992	323

Source: IRTC 1995

The other land uses in the heritage towns comprise grassland, forest (woodland) and other uses and land cover (e.g. households, water bodies and access trails and roads). In general, a large portion of the area is grassland followed closely by forest. Based on observation, the higher slopes (see Table 4.3) are usually forested, which according to the stakeholders are maintained as such to sustain the watershed function but more importantly, ensure water recharge for their rice fields. The same table shows that the topography of the heritage towns is very steep with few areas below 30% slope. Based on interviews with the stakeholders, portions of the grasslands were once rice terraces. Observations also reveal that certain portions have started the early stages of natural forest formation.

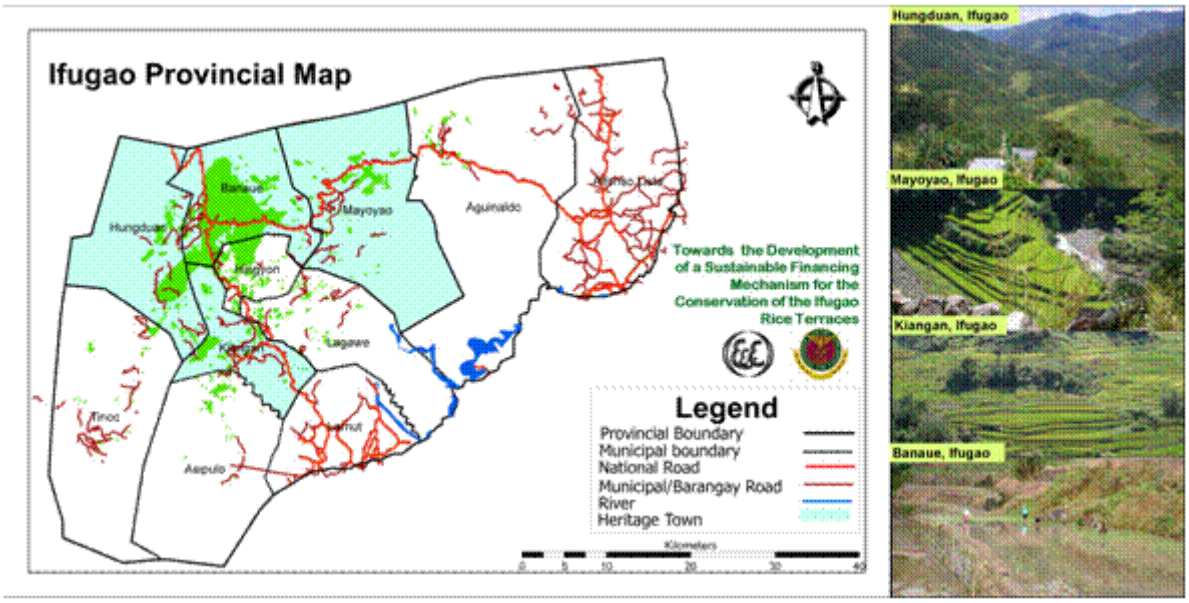

Figure 4.1 Provincial map of Ifugao province showing the rice terraces (green).

Table 4.3 Slope condition in the heritage towns

Municipality	Slope Category*			Steepness
	18 - 30	30 - 50	> 50 %	
Banaue	108	3327	19079	Severe
Hungduan	164	3007	11262	Moderate
Kiangan	2660	1342	6337	Moderate
Mayoyao	794	2482	16936	Severe

Source: IRTC 1995

*values in hectares

4.1.1 Banaue

Data gathering and GIS transformation

According to the forest management bureau (FMB DENR), Banaue's rice terraces are integrated in its forest areas. The entire municipality is technically classified as forest lands (forest reservation & timberland). Based on the Comprehensive Development Plan of Banaue (CY 2008 – 2010), the land use and land cover comprise the following: degraded grassland/shrubland – 34.05%; forest vegetation (commercial and ecological value) – 41.24%; agriculture – 16.94%; and land converted to residential, institutional, commercial and other uses – 2.77%.

For the heritage barangay of Batad, the rice terraces are tiered and take the shape of an amphitheater. These are spread over 14 sitios totalling about 1,240 ha. Expectedly, the topography is rugged, mountainous and hilly with V-shaped steep and narrow creek valleys and sharp ridges. The elevation ranges between 700 and 1200 m asl (meters above sea level) where 88% have 30% slope and above (Figure 4.2). Based on records, the main crop is still rice with about 204.09 ha (Table 4.4) devoted to rice farming. Annual production is reportedly 13,175 kg (based on 1 bundle = 1 kg when husked).

Table 4.4 Land uses of Barangay Batad, Banaue, Ifugao

Land Uses	Area (ha)	Percent to Total (%)
Timber / Forest land	868.37	70.03
Agricultural land	204.09	16.46
Grassland / Shrubland	135.53	10.93
Creeks and Rivers	17.73	1.43
Residential Area	11.16	0.90
Institutional	1.97	0.16
Roads	1.15	0.09
Total	**1,240.00**	**100.00**

See also Figure 4.3 showing land cover and land use generated from available remote sensing data

In comparison, the other heritage barangay of Bangaan has only about 116.70 ha devoted to agriculture (Table 4.5). Most of the area (about 70%) is forest land. Based on the FMB-DENR report, it is possible that portions of the forest land are also terraced for rice farming. Thus, it is also possible that the actual area devoted to rice terraces is higher.

Table 4.5 Land uses of Barangay Bangaan, Banaue, Ifugao

Land Uses	Area (ha)	Percent to Total (%)
Timber / Forest land	496.50	70.03
Agricultural land	116.70	16.46
Grassland / Shrubland	77.50	10.93
Creeks and Rivers	10.10	1.43
Residential Area	4.90	0.69
Institutional	2.13	0.30
Roads	1.13	0.16
Total	**709.00**	**100.00**

Source: Barangay Development Plan, 2002
See also Figure 4.3 showing land cover and land use generated from available remote sensing data

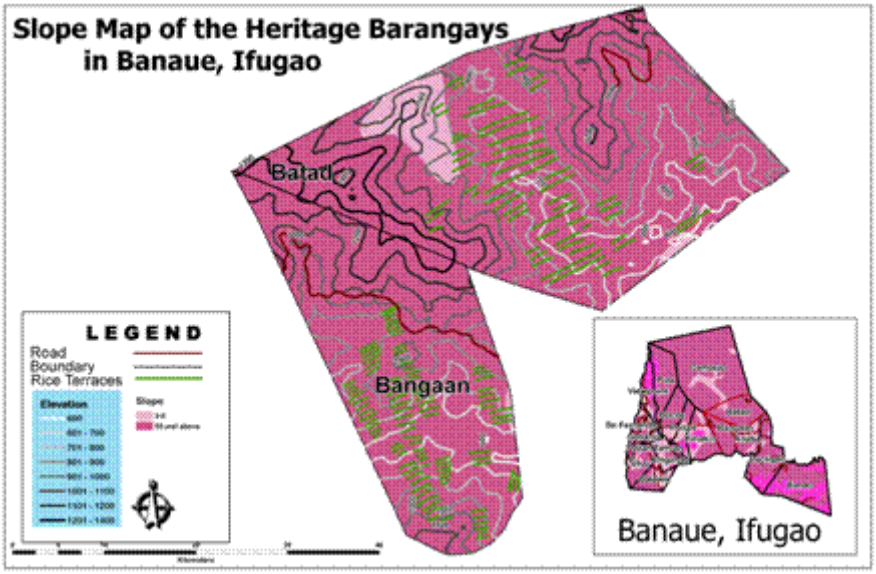

Figure 4.2 Slope map of Batad and Bangaan, Banaue, Ifugao.

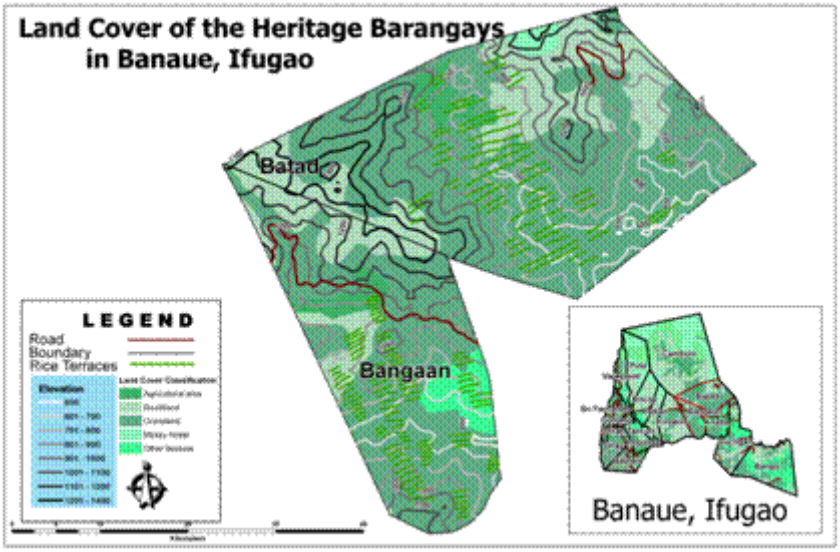

Figure 4.3 Land cover and land use of Batad and Bangaan, Banaue, Ifugao.
Source: FMB-DENR (2003) generated from satellite data

Based on data from 1970 until 2004 (JBIC 2004), the average damage size is 0.149 ha. (Table 4.6). The largest collapse was recorded in 1966 (0.56 ha) while the least damage (0.005 ha.) was recorded in 2004. Our observations show that damage occurrence follow a similar range of values. These estimates can be improved with a more rigorous ground survey and mapping of the rice terraces and its damages.

Table 4.6 List of collapsed rice terraces in Batad

Recorded Time of Collapse	**The size of the Collapsed Rice Terraces in Batad Barangay**		
	Width (m)	**Length (m)**	**Area (m^2)**
1966	70	80	5,600
1980’	55	60	3,300
1980’	30	100	3,000
1960’	45	30	1,350
1990’	50	40	2,000
1992	30	80	2,400
1992	40	80	3,200
1990’	30	20	600
2002	10	15	150
1990’	15	15	225
2000	10	30	300
2003	10	10	100
2004	5	10	50
1950’	25	30	750
1990	15	10	150
1990	40	10	400
1960’	50	60	3,000
1999	15	20	300
Total			**26,875**

Source: JBIC Pilot Study on rural revitalization for the conservation of IRT WHS. Final Report. Dec 2004

In addition, findings of surveys on the abandoned terraces after 1990 show a potential collapse of about 3.5 ha, specifically in Hungduan and Banaue (Table 4.7). The same JBIC (2004) report assumed a 5% damage of the rice terraces based on the surveys done.

Table 4.7 Findings of field surveys of collapsed and abandoned rice terraces

Municipality	Barangay	Survey Area (ha)	Collapsed Points	Collapsed Area (ha)	Collapsed Area Ratio %
Hundungan	Baang	12.5	5	0.80	6.4
Banaue	Batad	26.7	18	2.69	10.1
Total		**39.2**	**33**	**3.49**	**8.9**

Source: JBIC 2004

Community mapping

The community mapping was undertaken to validate the results of the data gathering. The resulting map which was produced using GIS (Figure 4.4) along with the other data gathered, were shown to the stakeholders and they were asked to indicate on the GIS map the relative locations of the terraces and damage therein.

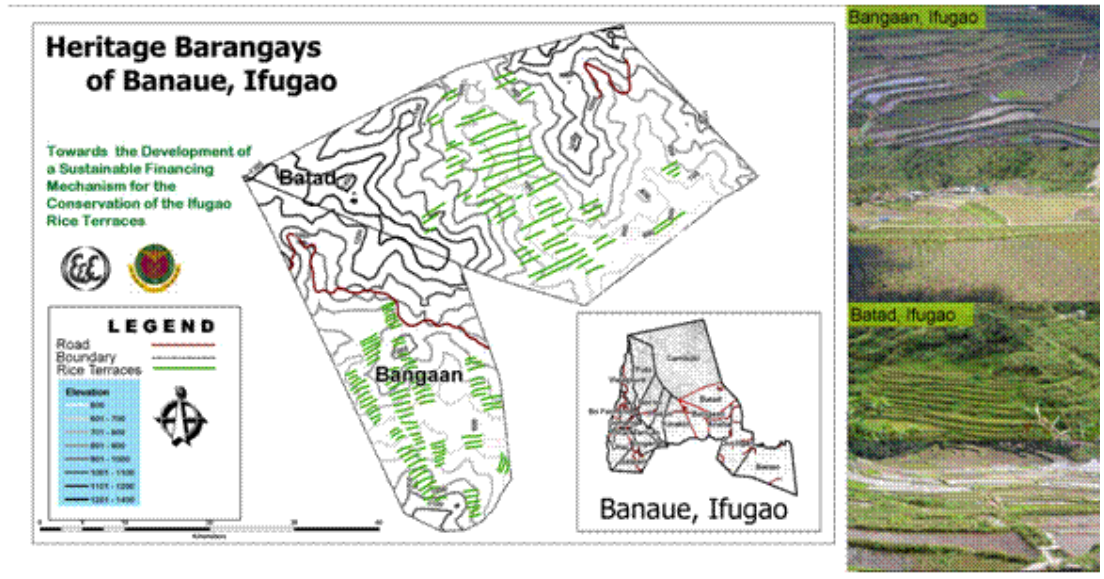

Figure 4.4 GIS map of Batad and Bangaan, Banaue, Ifugao

The exercise started slowly but as soon as the stakeholders were able to adjust to the features on the map, especially after familiarizing themselves with the creeks and access trails/roads, the validation became fluid, sometimes animated, and a more or less complete map of the rice terraces was produced.

The resulting community-validated maps of Batad (Figure 4.5) and Bangaan (Figure 4.6) showed that a total of about 1,320 ha of rice terraces are present (Table 4.8). Of these areas, 118 occurrences (or points) of damage were identified by the

stakeholders. There were fewer forests identified in Bangaan (99.5 ha) than Batad. In fact, Batad showed about the same amount of forest and rice terraces. More importantly, there were more damage points identified in Batad than in Bangaan.

Table 4.8 Estimate of rice terraces and damage, Batad and Bangaan, Banaue, Ifugao

Barangay	Area (ha)	Rice Terraces (ha)	Damage [pts]	Forest (ha)
Bangaan	768.4	659.6	38	99.5
Batad	1,299.0	660.4	80	639.2
Total	**2,067.3**	**1,320.1**	**118**	**738.7**

Table 4.8 also shows that there are 0.06 occurrence of damage in Bangaan for every ha of rice terraces compared to 0.12 occurrence of damage in Batad for every ha. Assuming an average damage of 0.149 ha for every occurrence, the total damage is 5.7 ha and 12 ha in Bangaan and Batad, respectively.

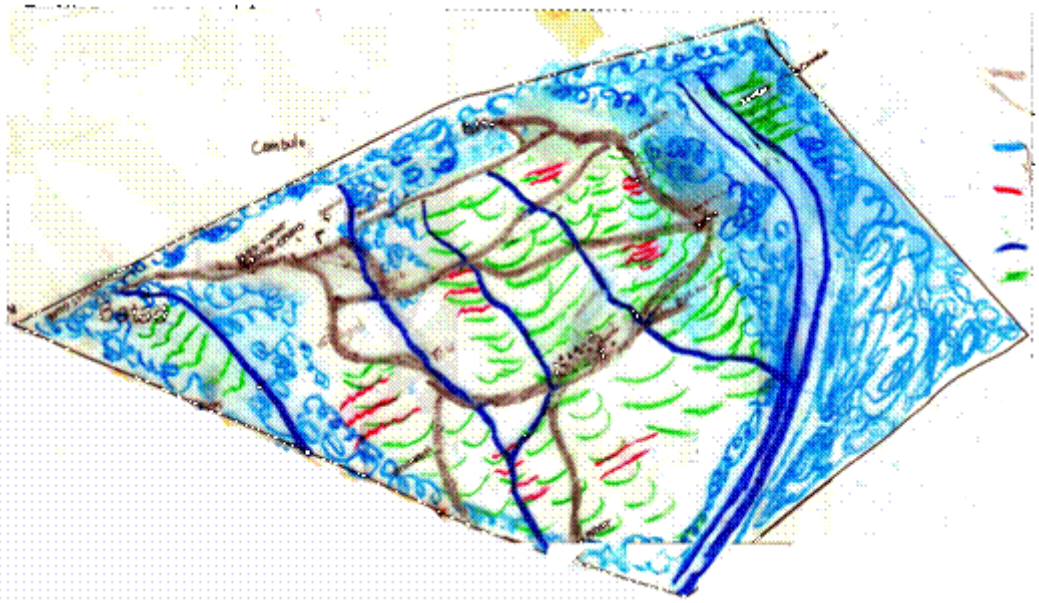

Figure 4.5 Community map of Batad, Banaue showing the rice terraces (green) and the abandoned/damaged rice terraces (red)

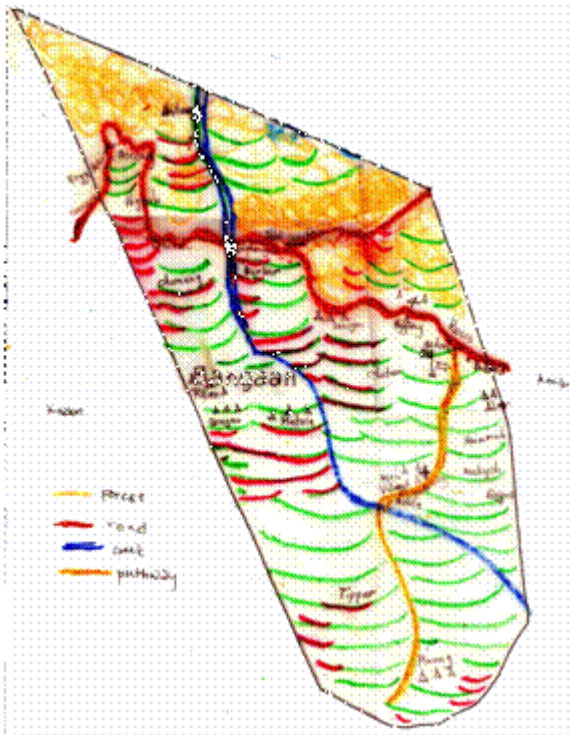

Figure 4.6 Community map of Bangaan, Banaue showing the rice terraces (green) and the abandoned/damaged rice terraces (red)

4.1.2 Hungduan

Data gathering and GIS transformation

The entire municipality of Hungduan is included in the World Heritage List totalling a land area equivalent to 22,789 ha. This is classified into: forest (11,403 ha or 48.48 %); agricultural, most of which are rice terraces (705 ha or 3.09 %); and the rest are other uses (Table 4.9). More than 73% (or 16,674 ha) have slopes greater than 50%.

In September 2001, a UNESCO Mission reported that 25% – 30% of the rice terraces are now abandoned and may lead to the damage of some of the walls. The same estimate is given by the agricultural officer of Hungduan (Table 4.10.). Looking closely at the estimated damage, there seems to be a uniformity of the amount of damage regardless of the extent of the rice terraces.

Table 4.9 Land cover and land use in Hungduan

Land Use	Area (ha)	(%)
Urban	3,919.0	17.19
Residential / Built up	22.6	0.10
Institutional	7.4	0.03
Agricultural / Rice Terraces	705.0	3.09
Grasslands	6,876.0	30.17
Forest	11, 403.0	48.48
Rivers / Creeks	179.0	0.86
Roads / Right of Way	19.0	0.07
Total	23,131.00	**100.00**

Source: CLUP Hungduan Ifugao 1998-2007

Table 4.10 Estimated area of rice terraces and damage for Hungduan

Total Area	Rice Terraces (ha)	Damaged Terraces (ha)
Luboong	78	31
Bokiawan	133	31
Nungulunan	106	28
Hapao	160	27
Baang	53	26
Poblacion	145	30
Bangbang	70	25
Abattan	89	24
Magguk	137	31
Total	**971**	**253**

Source: MAO Hungduan 2006

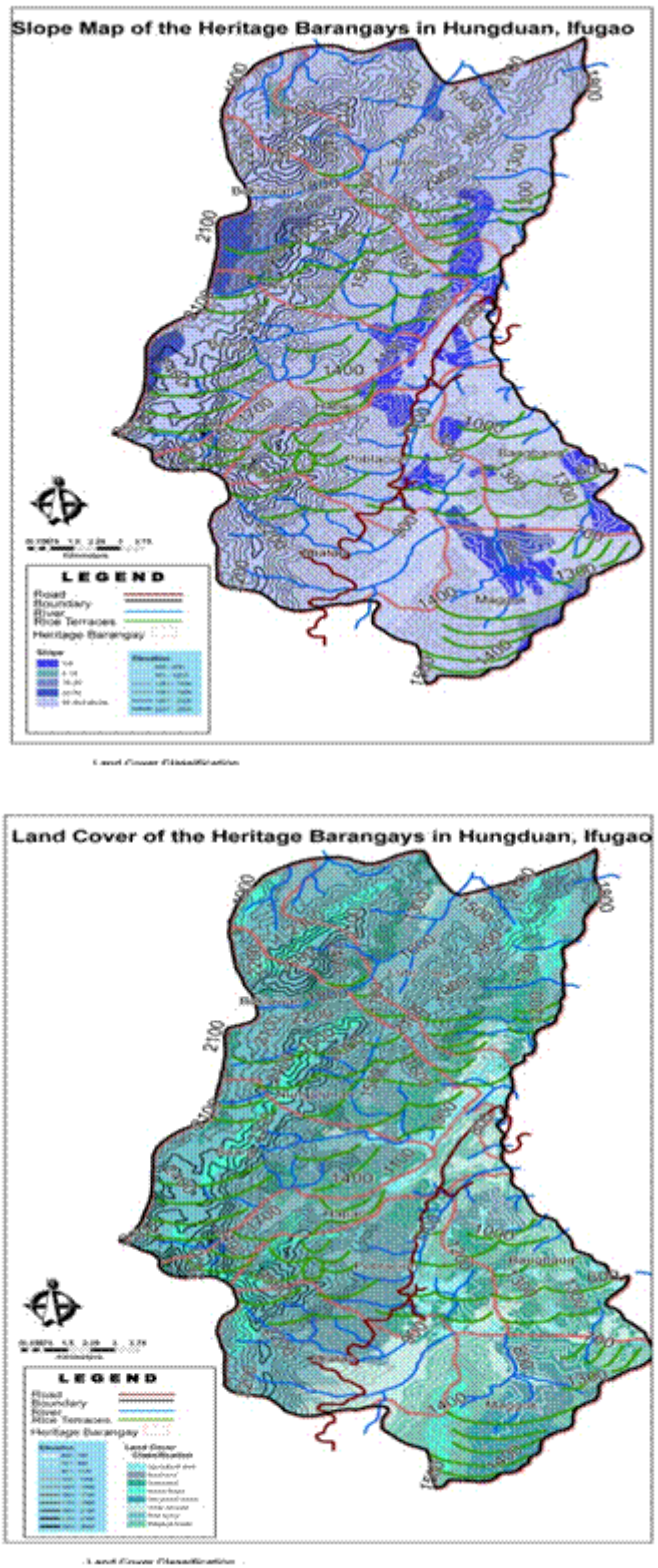

Figure 4.7 Slope map and land cover/land use map of Hungduan

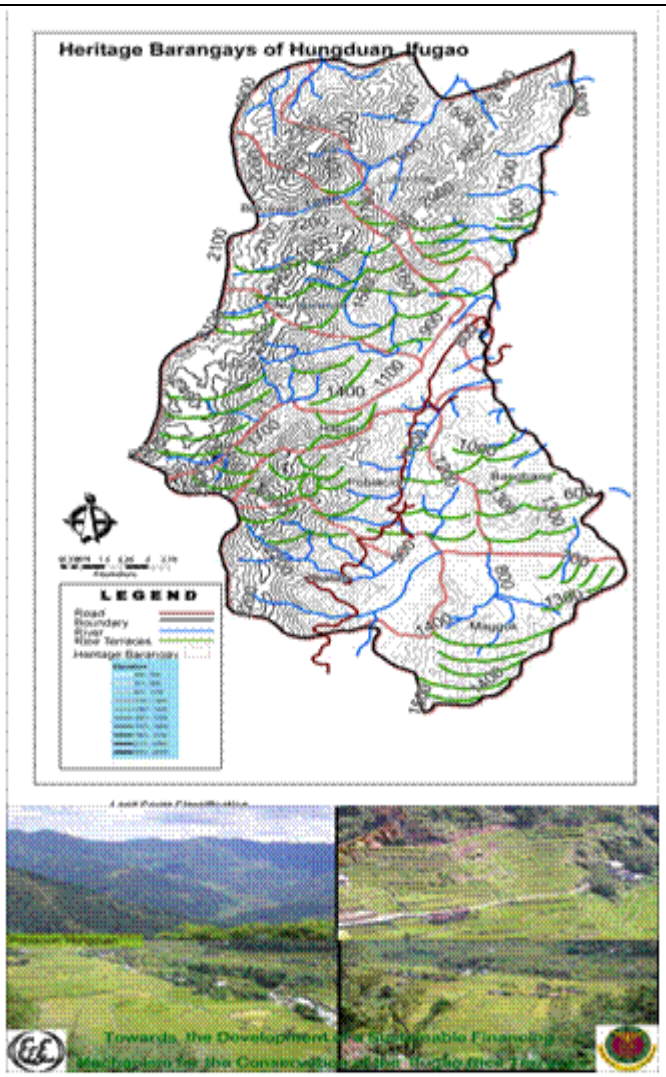

Figure 4.8 GIS map of Hungduan

Community mapping

The resulting community map of Hungduan revealed estimates of the forest (9,063 ha), grassland/brushland (1,865.4 ha) and rice terraces (7,224.2 ha) (Figure 4.9). At the same time, the stakeholders identified a total of 122 damage occurrences mostly in Bgy Luboong (32 occurrences) and Poblacion (27 occurrences) (Figure 4.9 and Table 4.11). Assuming a similar average damage size of 0.1494 ha, the total estimate for Hungduan is about 18.2 ha.

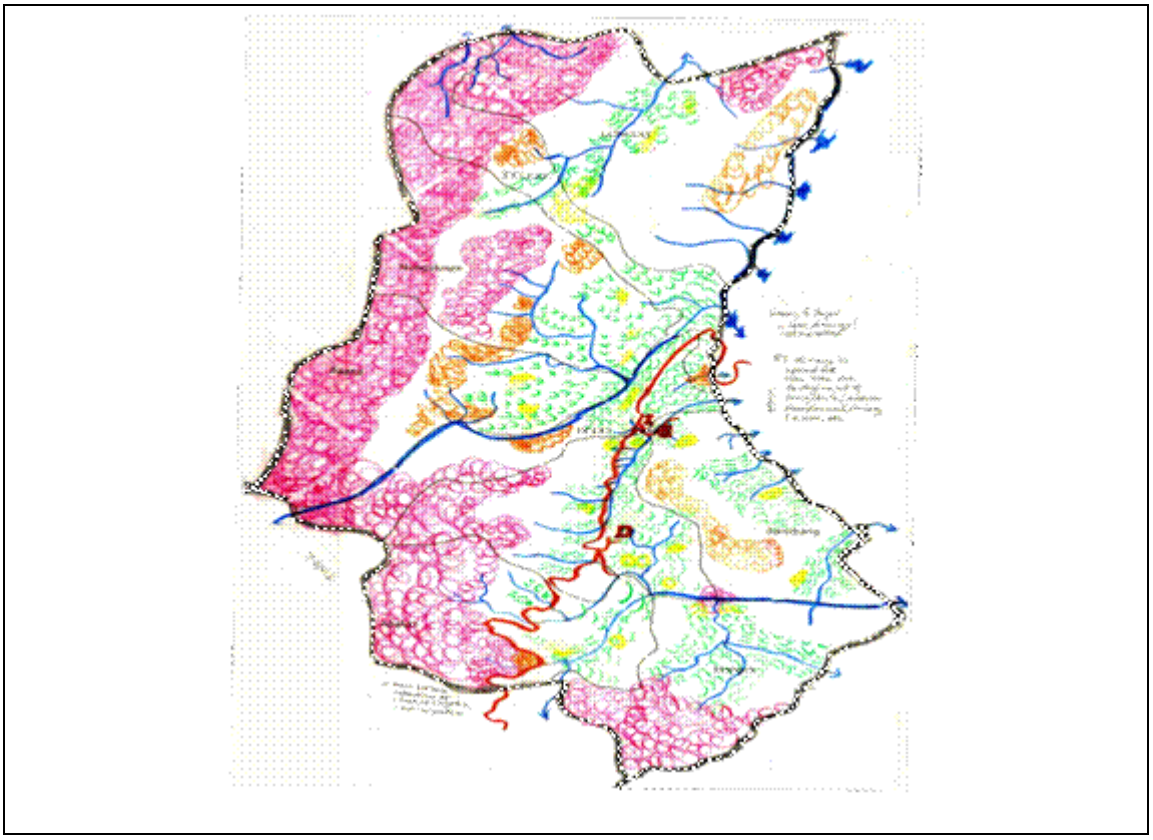

Figure 4.9 Community map of Hungduan showing extent of rice terraces (green) and abandoned/damaged terraces (yellow)

Table 4.11 Estimate of rice terraces and damage from community mapping, Hungduan, Ifugao

Barangay	Area (ha)	Area of Rice Terraces (ha)	Damage (occurrences)
Abatan	3,099.6	637.1	7
Baang	3,473.8	650.1	8
Bangbang	2,392.2	932.2	15
Bokiawan	1,890.1	674.6	15
Hapao	1,677.0	555.1	4
Luboong	5,222.2	662.7	32
Maggok	3,020.4	1,008.7	7
Nungulunan	3,611.4	991.1	7
Poblacion	2,872.4	1,112.7	27
Total	**27,259.1**	**7,224.3**	**122**

4.1.3 Nagacadan, Kiangan

Data gathering and GIS transformation

According to DENR records, the town of Kiangan, Ifugao has a total land area of 20,419.21 ha. The hectarage on rice farming differs depending on the source of information. It is estimated that out of Barangay Nagacadan's land area of 818 ha, about 70 ha are devoted to rice farming. However, town records in Kiangan report agriculture at 123 ha. Other reported land uses in the barangay are timber/forest land, agricultural land, grassland and shrubland, roads, residential and institutional areas (Table 4.12, Figure 4.10).

Table 4.12 Land use and land cover of Nagadacan, Kiangan, Ifugao

Land Uses	Areas (ha)	Percent to Total (%)
Timber/Forest land	512.00	63
Agricultural Land	123.00	15
Grassland & Shrub land	78.00	10
Creeks and Rivers	42.00	5
Roads	32.00	4
Residential Area	29.00	4
Institutional Area	2.00	0.2
TOTAL	818	100

Source: SEP Kiangan Ifugao 2004

In 2004, several instances of abandonment, erosion and conversion to other uses were reported in Nagacadan (Table 4.13). In three sitios (i.e. Bolog, Baywong and Dayya), erosion of the farms were reported. In farms of the other sitios, portions were left idle or otherwise planted to vegetables and rice. In general, the southern slopes of the barangay are steep while the northern portions gently sloping (Figure 4.11).

Comparatively, these areas are covered with forest. The rice terraces are found on the lower slopes following the forested areas.

Table 4.13 Rainfed paddies of Nagacadan, Kiangan 2004

Name of Sitio	Service Area (ha)	Beneficiary Households	Condition
Bayninan	5	11	Idle, rice, vegetables
Bolog	20	35	Idle, eroded, rice, vegetables
Ologon	6	14	Idle, planted to rice, vegetables
Nagacadan	8	18	Idle, planted to rice, vegetables
Imbintok	5	7	Idle, pasture, planted to rice, vegetables
Indutmog	3	5	Idle, planted to rice
Baywong	3.5	6	Eroded, planted to rice, vegetables
Dayya	3	5	Eroded, planted to rice, vegetables
Ihak	10	21	Idle, pasture, planted to rice, trees
Tangil	9	13	Idle, planted to rice, vegetables
Pauh	4	9	Idle, planted to rice, vegetables
Lappidic	6	12	Idle, planted to rice, vegetables
Total	**82.5**	**156**	

Source: SEP Kiangan, Ifugao 2004

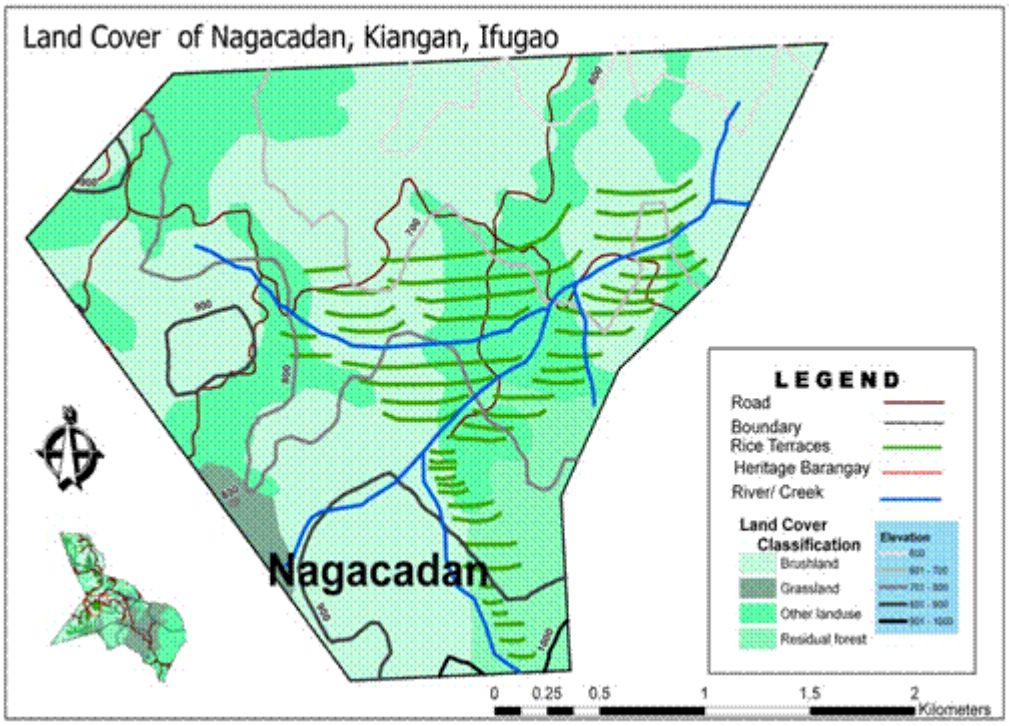

Figure 4.10 Land cover map of Nagacadan, Kiangan, Ifugao

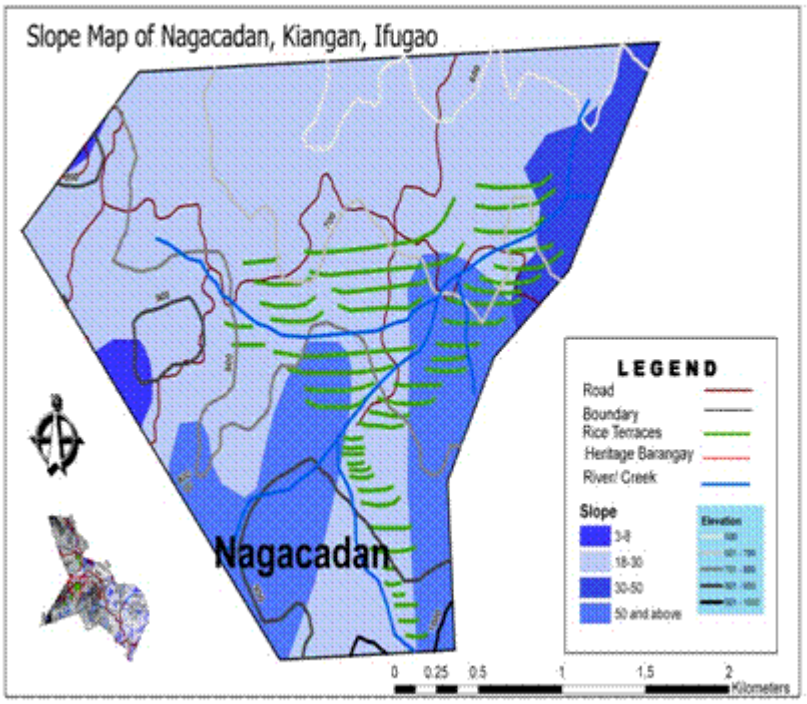

Figure 4.11 Slope map of Nagacadan, Kiangan, Ifugao

Based on the data that were gathered, the GIS map of Nagacadan was produced showing the topography (i.e. high elevation areas), river network and relative locations of the rice terraces (Figure 4.12). The map shows that the rice terraces are mainly located adjacent to the river system. These locations were validated during the workshop with the stakeholders of Nagacadan and other townsfolk.

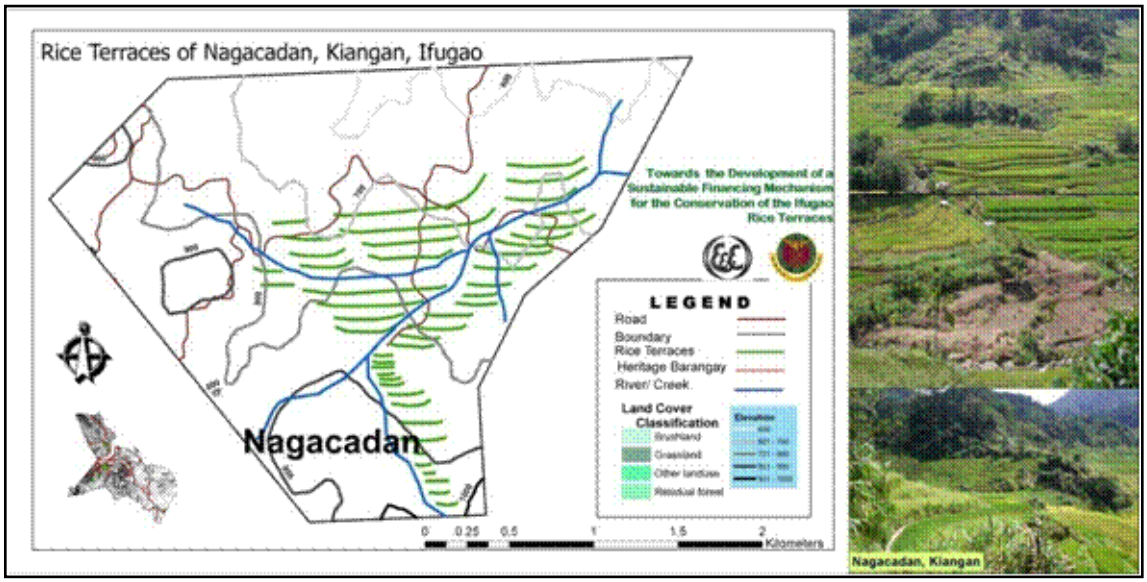

Figure 4.12 GIS map of Nagacadan, Kiangan, Ifugao

Community mapping

The resulting community map showed a slightly different picture from the GIS map specifically with regard to the locations and extent of the rice terraces. Our estimates show that there are around 241 ha of rice terraces in Nagacadan. At the same time, there are also around 111.2 ha of forest in the area. Of the rice terraces, there are about 97 damage points which is approximately 14.5 ha.

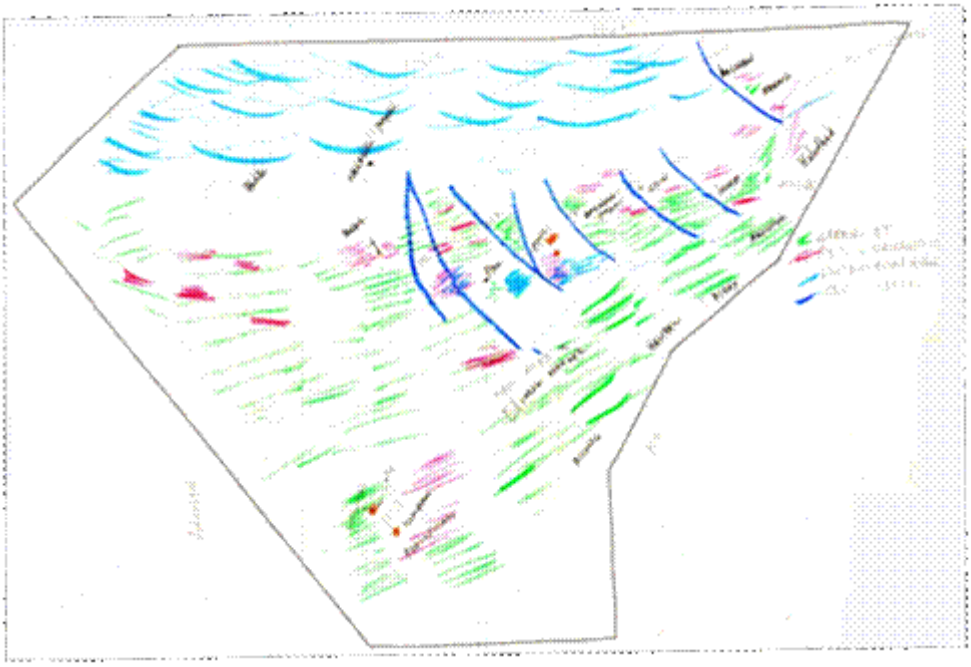

Figure 4.13 Community map of Nagacadan showing the rice terraces (green) and the abandoned/damaged rice terraces (red)

4.1.4 Mayoyao

Data gathering and GIS transformation

Data from the municipal records show that almost 14% (4,664.9 ha) are agricultural while more than 18% (6,243 ha) are forested. However, almost 70% of the town is covered with grass and shrubs (Table 4.14, Figure 4.14). Agricultural practice is basically rice terracing but other areas are used in the production of vegetables, food and other horticultural crops (Mayoyao MAO 2006). Based on the town's profile (2008), agricultural farms are serviced by 79 irrigation systems.

The topography is generally rugged with more than half of the town characterized by very steep slopes, mountainous and sloping in many directions (Table 4.15, Figure 4.15). In terms of soils and geology, there are four general soil types, namely: Guimbalaon annam clay loam, Guimbalaon annam complex, Pugao clay loam and annam clay loam (Table 4.16). Guimbalaon annam clay loam is severely eroded and found in hilly and mountainous areas. These areas are shallow and prone to moderate and severe erosions. Guimbalaon annam complex is moderately eroded and covers almost all barangays except portions of Mayoyao proper, Bonhal & Bongan. These areas are suited for the production of indigenous rice varieties. On the other hand, areas with Pugao clay loam are likewise severely eroded and are more suitable as forest lands. Lastly, areas with Annam clay loam are moderately eroded bench terrain. Geological rock formations comprise old sediments and pyroclastics while some areas are composed of metarmorphosed rocks and marly limestones.

Table 4.14 Existing general land cover and land uses Mayoyao, Ifugao

Existing General Land Uses	**Land Area (ha)**	**Percent (%)**
Urban Uses	75.1	0.2
Residential	63.2	0.2
Commercial	3.0	0.01
Institutional	8.6	0.03
Parks / Playgrounds	0.2	0.001
Agricultural	4,664.9	13.9
Forest / Timber	6,243	18.6
Grassland / Shrubland	22,460.2	66.8
Roads	40.8	0.1
Rivers / Creeks	72	0.2
Total	**33,631**	**100**
Source: MPT Land Use Survey. 1996		

Table 4.15 Slope classification of Mayoyao, Ifugao

Slope Range and Classification	Area (ha)	Percentage (%)	Description
0 – 8 % (N)	7,235	21.56	Level to undulating
8 – 18 % (O)	3,842	11.45	Undulating to rolling
18 – 30 % (P)	2,594	7.73	Rolling to moderately steep
30 – 50 % (Q)	2,542	7.58	Steep slopes, mountainous & hilly sloping in many directions
50 & above (R)	17,343	51.68	Very steep slopes & mountainous & sloping in many directions
Total	**33,556**	**100.00**	

Source: Bureau of Coast & Geodetic Survey 1945

Table 4.16 Soil classification of Mayoyao, Ifugao

Soil Classification	Area (ha)	Percentage (%)
Guimbalaon Annam Clay (GnAMHF3)	18,324.84	54.61
Guimbalaon-Annam Complex	2,067.05	6.16
Annam Clay Loam	557.03	1.66
Rugo Clay Loam	12,607.08	37.57
Total	**33,556**	**100**

Source: MDP 97-06 Mayoyao Ifugao

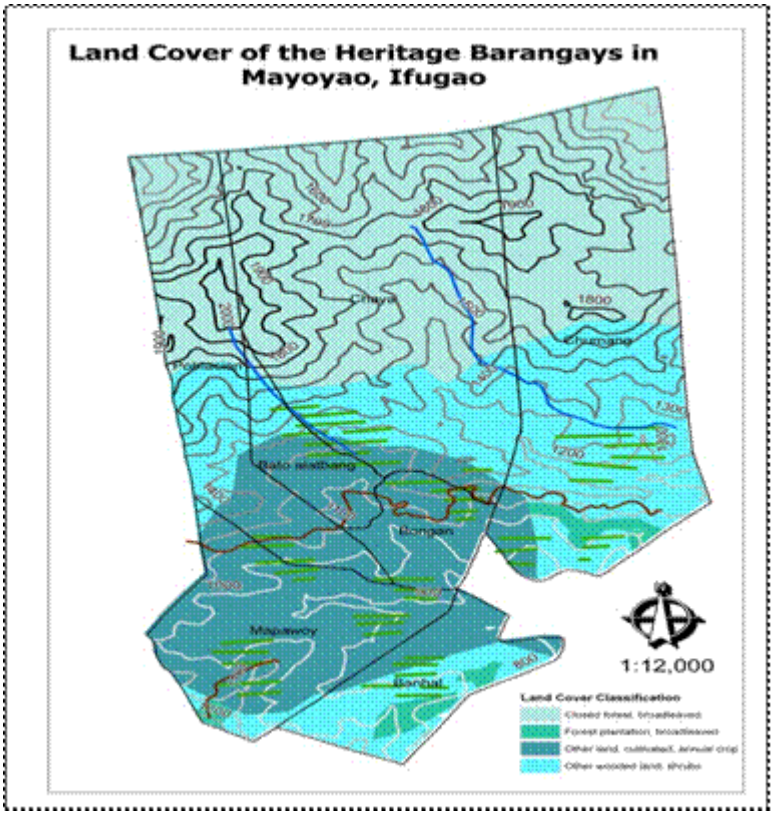

Figure 4.14 Land cover map of Mayoyao, Ifugao

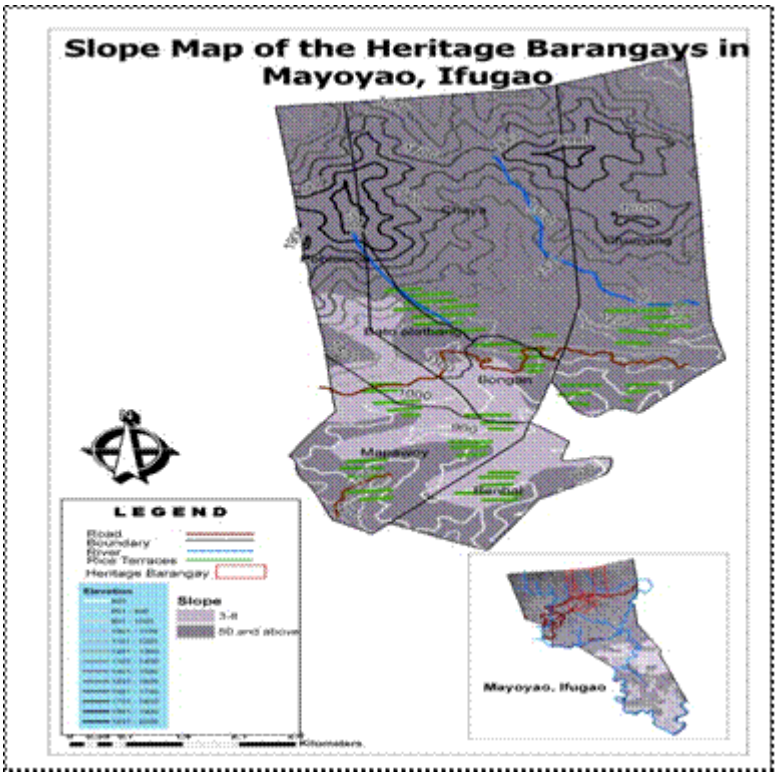

Figure 4.15 Slope map of Mayoyao, Ifugao

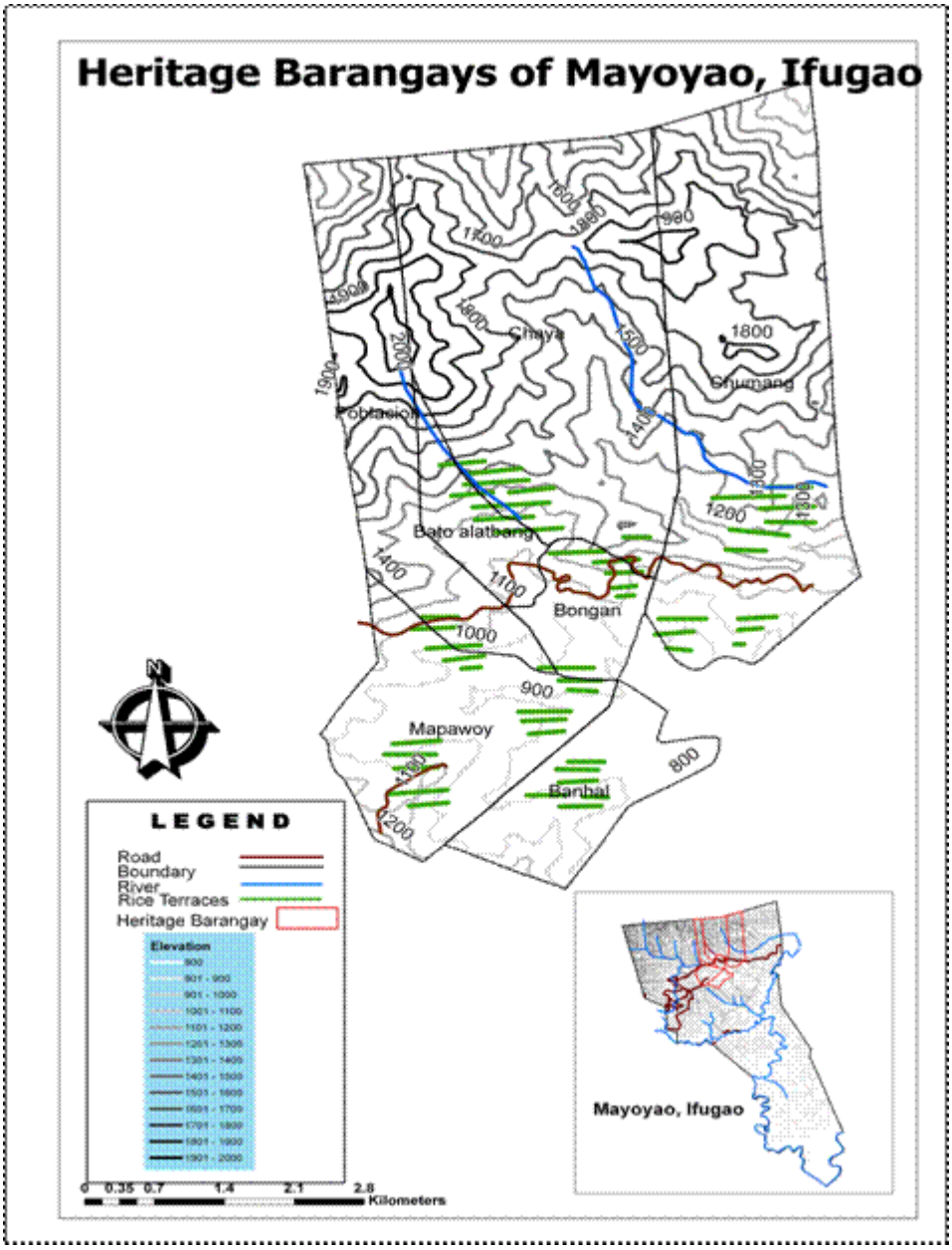

Figure 4.16 GIS map of Mayoyao, Ifugao

Community mapping

The estimated area of rice terraces within the inscribed heritage barangays of Mayoyao is 1,538.3 ha. On the other hand, there are 1,014 ha of forest while the rest of the area is devoted to other uses. The stakeholders pinpointed 479 damage points representing an approximate damage area of 71.6 ha.

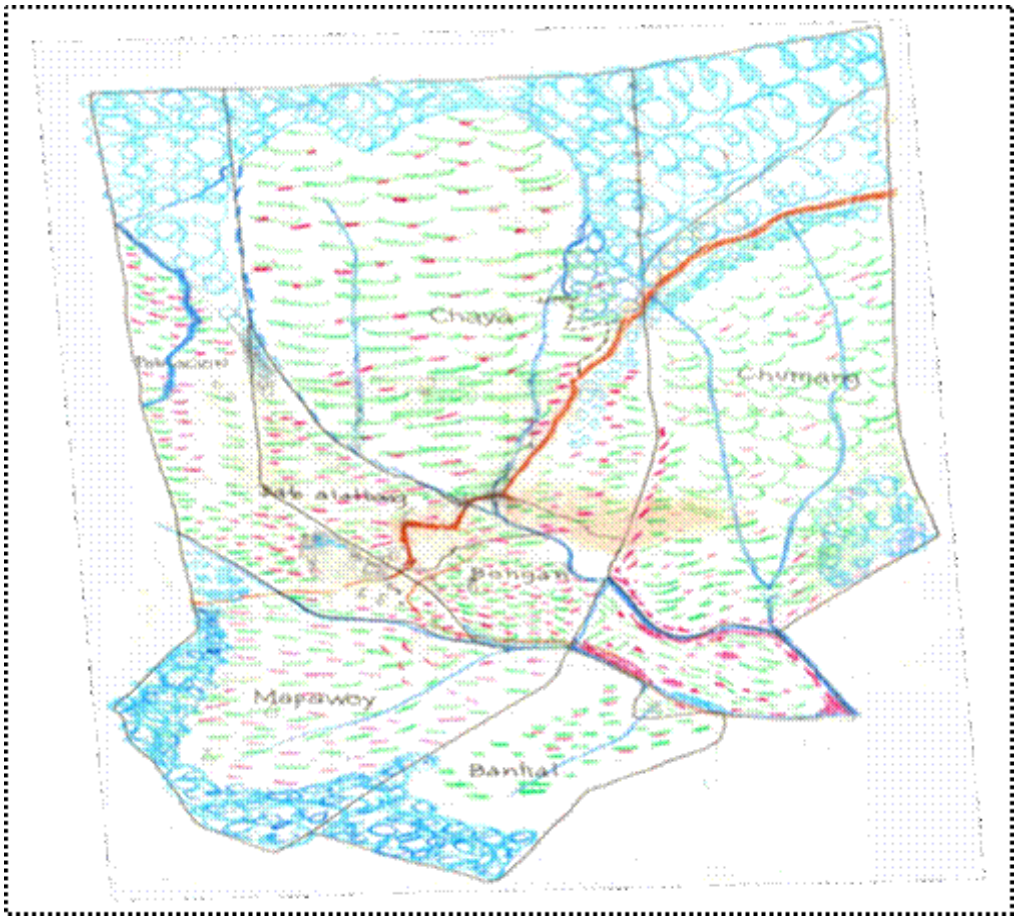

Figure 4.17 Community map of Mayoyao showing the rice terraces (green) and the abandoned/damaged rice terraces (red)

4.2 Extent of Damage and Estimated Cost of Rehabilitation

The extent of the rice terraces varies depending on the purpose and method of assessment and analysis used. According to a UNESCO Mission report in 2001, the extent of abandonment/damage of the rice terraces was quoted between 25% and 30%. However, a more recent report in 2004 by the JBIC pilot study on rural revitalization project for the conservation of the Ifugao Rice Terraces reported 5% based on a sampling of two points and expressed over the entire area. No research effort has been done specifically for the purpose of getting an indication of the extent of the rice terraces and the amount of abandonment/damage.

This report estimates that there are almost 11,000 ha of rice terraces within the inscribed heritage sites (Table 4.17). The stakeholders pointed to about 816 damage points, most of which are located in Mayoyao. Based on our observation, long spans of the Mayoyao rice terraces have been abandoned and already show signs of forest renewal. On the other hand, Nagacadan in Kiangan had the least damage points. On the basis of the range of damage size per damage point of 0.005 ha (min) and 0.56 ha (max), the total damage is between 4.1 ha and 457 ha or 0.04% to 4.4%.

The total cost of rehabilitating damaged terraces was estimated using the following assumptions: cost of terrace rehabilitation is P700/*maoha*; 1 *maoha* = 1.5 m X 1.9 m or 2.85 m^2, or P245.61/m^2. Based on these, the low and high estimates of rehabilitation costs for the four heritage municipalities are P5.88 million and P658.84 million for Mayoyao; P1.58 million to P167.80 million for Hungduan; P1.45 million and P162.3 million for Batad and Bangaan in Banaue; and P1.19 million and P133.42 million for Nagacadan, Kiangan. The estimated total costs of rehabilitation for all four heritage sites are P10.02 million (low) and 1.122 billion (high).

The wide range of estimates can be explained by the limitations of the two-dimensional (2D) maps which were used in the community-based mapping exercise. A 2D map only shows distances between points along a horizontal surface. It is limited by its inability to show with sufficient clarity the topography of the site, i.e. peaks and valleys which are characteristic of IRT even though elevation and slope maps were produced and presented during the workshops. Another limitation is the lack of sufficient time to enable the community members to encode and plot on the map the locations of the rice terraces, the damaged parts, and the other landscape features. Moreover, given more time, a sufficient amount of site visits should be undertaken to the damaged sites and located using satellite-based navigation tools (i.e. GPS receivers).

Ideally, a three-dimensional (3D) map is produced instead of a 2D map. This 3D map is constructed by the people themselves since they are intimately familiar with the rice terraces and their own environment. The participatory 3D mapping is conducted over several days until the 3D model is finally produced showing the landscape features and the existing land uses in the area. A 3D model is essentially a miniature of the site and peaks and valleys are clearly shown. More importantly, the participatory 3D modeling exercise becomes an avenue for lively discussions and consensus-building for the community.

Table 4.17 Extent of rice terraces and damage in the heritage sites

Municipality	Barangay	Rice Terraces (ha)	Abandoned/ Damaged (occurrence)	Estimated Abandoned/ Damaged RT (ha)	Abandoned/ Damaged (%) [low range: 0.005 ha/ damage pt]	Estimated Abandoned/ Damaged RT (ha)	Abandoned/ Damaged (%) [high range: 0.56 ha/ damage pt]	Cost estimate of rehabilitation [low]	Cost estimate of rehabilitation [high]
Hungduan		**7224.3**	**122.0**	**0.6**	0.01	**68.3**	0.9	1,498,245.61	167,803,508.77
	Abatan	637.1	7	0.04		3.92			
	Baang	650.1	8	0.04		4.48			
	Bangbang	932.2	15	0.08		8.40			
	Bokiawan	674.6	15	0.08		8.40			
	Hapao	555.1	4	0.02		2.24			
	Luboong	662.7	32	0.16		17.92			
	Maggok	1008.7	7	0.04		3.92			
	Nungulunan	991.1	7	0.04		3.92			
	Poblacion	1112.7	27	0.14		15.12			
Kiangan		**241**	**97**	**0.5**	0.20	**54.3**	22.5	1,191,228.07	133,417,543.86
	Nagacadan	241	97	0.5		54.3			
Banaue		**1320**	**118**	**0.6**	0.04	**66.1**	5.0	1,449,122.81	162,301,754.39
	Batad	660.4	80	0.40		44.8			
	Bangaan	659.6	38	0.19		21.3			
Mayoyao		**1538.3**	**479**	**2.4**	0.16	**268.2**	17.4	5,882,456.14	658,835,087.72
	Mapawoy	285.3	66	0.33		37.0			
	Banhal	99.2	9	0.05		5.0			
	Mayoyao Proper	106.1	93	0.47		52.1			
	Bongan	83.1	51	0.26		28.6			
	Poblacion	198.5	67	0.34		37.5			
	Bato-alatbang	98.4	33	0.17		18.5			
	Chumang	544.9	88	0.44		49.3			
	Chaya	122.8	72	0.36		40.3			
Total		**10323.6**	**816.0**	**4.1**	**0.04**	**457.0**	**4.4**	**10,021,052.63**	**1,122,357,894.74**

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the results of the study, we make the following conclusions:

1. Community-based mapping is a very effective means to produce up-to-date data and information on the current state of the landscape vis a vis land use, land cover, and other geographic features of the site. In addition, the approach engenders community participation and discussion and builds and enhances community spirit.

2. The total area of the rice terraces in the heritage sites is estimated to be 10,324 ha, while the estimated area of damaged terraces ranged from a low estimate of 4.1 ha to a high estimate of 461 ha, or 0.04% to 4.4% of the total area. These translate to total rehabilitation costs of P10.02 million to P1.122 billion, respectively, or annual costs of P 1,630,880 million to P 184,243,410 million (at 10% interest rate over a 10-year period). This finding is significant owing to the fact that one of the reasons for the downgrading of IRT is the lack of records on the extent of damage. Additionally, previous estimates of the extent of damage straddles between 5% and 30%.

3. GIS was used to express the various data from different sources into a unified processing and analytical environment. One important insight in the unification process is the exposition of inconsistencies arising from the data themselves. For one thing, boundaries of provinces, municipalities and barangays are grossly different at the sources where they are available.

5.2 Recommendations

We recommend the following:

1. An updated map and database of the rice terraces in general and the abandoned/ damaged terraces in particular should be developed. In a recent meeting on protecting endangered traditional landscapes held in Banaue from December 3 – 7, 2007, experts agreed on a set of recommendations to rehabilitate the rice terraces and delist IRT from the UNESCO World Heritage in Danger List. The physical rehabilitation of the damaged rice terraces was identified as an immediate solution.

2. The results arising from this research should be considered a new baseline for the rice terraces in the Ifugao inscribed heritage sites. However, it is highly recommended to undertake GPS-based surveys of the rice terraces and the damage points. Once a sustainable financing mechanism is set in place, it is recommended to install a GIS-based monitoring system for the rice terraces that will ensure an objective prioritization of the financial resources that will be earmarked for rehabilitation activities.

   GIS was used to express the various data from different sources into a unified processing and analytical environment. One important insight in the unification process is the exposition of inconsistencies arising from the data themselves. For

one thing, boundaries of provinces, municipalities and barangays are grossly different at the sources where they are available.

The role of remote sensing in this study was minimal due to the fact that continuous cloud cover over the area pervaded. However, the land cover and land use maps that were presented in this report were derived from satellite images. Ideally, aerial photography is the best option to avoid the clouds and fly below them. However, due to the terrain, such an activity is too dangerous. The other option is the use of radar images which are able to pierce through clouds. But the cost of higher resolution images is too prohibitive. The more practical option is to generate cloud-free images over a certain period of time using better than 5m resolution optical images.

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ANNEX 1. DATA SOURCES

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