

# **Ifugao Rice Terraces - Landuse Changes in a Traditional Agroecosystem from 1963 to 1997**

by

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## **1 Introduction**

Traditional rice cultivation on irrigated terraces has mainly influenced the ecological and sociological system in the province of Ifugao (N-Luzon, Philippines). More than thousand years of human-nature-interactions generated a unique cultural landscape with extraordinary value for nature conservation due to its high local biodiversity and its sustainable landuse. This has been underlined by the inscription of the "Ifugao Rice Terraces" as World Heritage Site by the UNESCO in 1995.

Throughout the last decade the continuous vanishing of the traditional single-crop system based on irrigated rice which is characterised by comparatively low yields and high labour inputs was postulated (EDER, 1982; MARGRAF & VOGGESBERGER, 1986, 1988; SETTELE et al., 1993b, 1995). According to these authors a growing population has been searching for alternative food and income sources. This should have led to increasing cultivation of former mossy forest areas. In the traditional system forest provides the water supply for the aquatic rice fields throughout the year. Reduction of their water holding capacity is seen as the major reason for a postulated serious reduction of the rice terrace area. This should affect the high level of biodiversity in the region supported by the traditional landuse system.

These reported trends in landuse changes in Ifugao evoked world-wide attention. UNESCO, the Government of the Philippines and local authorities are willing to maintain and to develop the traditional landuse system. Taking the right decision depends on an actual and precise database. The latest systematic analysis of landuse patterns in Ifugao dates back to 1963 (CONKLIN, 1972, 1980). The reported trends in landuse changes are therefore mainly based on rough assumptions and were not quantified until now. The aim of the present investigation is to provide data on the landuse in the Banaue region in 1997 and to assess its changes compared to 1963 and 1980.





**Picture 39:** Landuse categories 'shrub caneland' and 'settlement'  
(compare chapter 3.1, p. 81)



**Picture 40:** Landuse categories 'mixed caneland' on the left, 'forest succession'  
in the centre, and 'pine forest' on the right (compare chapter 3.1, p. 81)



## 2 Materials and Methods

### 2.1 Investigation area and survey period

The investigations were conducted in the surrounding of Banaue (Province of Ifugao, Philippines) from 4<sup>th</sup> to 14<sup>th</sup> of March 1997. The total area surveyed amounts to 149 ha (see Fig. 18, p. 84). It includes parts of the Tam-an Valley (Barangay of Tam-an) and of the Poitan Valley (Barangay of Poitan). The altitude ranges from 880 m to 1180 m above sea level.

### 2.2 Basic maps

Mapped information for the investigation area was made available in different quality for 3 time levels covering 34 years. The sources are summarized in Table 20.

**Table 20:** Sources of landuse maps

1963	Landuse map of the Ifugao region on the scale 1:5,000 (Fig. 16, p. 82); published by CONKLIN (1972); based on aerial photographs taken on 23 <sup>rd</sup> of April 1963.
1980	Landuse map of the investigation area on the scale 1:5,000 (Fig. 17, p. 83); based on aerial photographs taken in March 1980 (provided by CECAP Banaue) through interpretation by stereoscope; for creation of map CONKLIN (1972) was used as reference.
1997	Landuse map of the Ifugao region on the scale 1:5,000 (Fig. 18, p. 84); based on field mapping of the investigation area; within this study the map of CONKLIN (1972) was used as reference.

### 2.3 Classification of landuse

CONKLIN (1972, 1980) defined 6 main categories of landuse:

- Pond field terrace (irrigated terrace, mainly cultivated with rice)
- Drained field terrace (dry terrace, cultivated with vegetables)
- Swidden (slope field area cleared and under cultivation; mainly sweet potato)
- Caneland (light to intermediate secondary growth vegetation, esp. *Miscanthus* spp.)
- Woodland and Forest
- Settlement Site.

For the mapping of the actual landuse in 1997 a more detailed subdivision of these categories was used (details see chapter 3.1). However, most of them had to be summarised in order to facilitate the analysis of landuse changes since 1963.

Due to the limited quality of the aerial photographs of 1980, only 4 categories could be distinguished for this period. They are not in all cases compatible to the previous classifications and were used only for some specific questions (see Table 21).

## 2.4 Method of analysis

A weighing method was used to determine the absolute area of the different land use categories. Each map produced was cut by hand into pieces according to the categories, symbolised by different colours. All pieces of the same category were weighed together, using a electronic balance with a scale of 1 mg. In addition several squares representing a known area (e.g. 2x2 cm is equivalent to 1 ha) were cut and weighed, in order to standardize the weight-area-equivalent of the different maps. 1 mg represented slightly less than 150 m<sup>2</sup>.

**Table 21:** Landuse categories in 1963 (CONKLIN, 1972, 1980; based on aerial photographs), 1980 (own analysis of aerial photographs) and 1997 (own field mapping). The mapping key for 1997 is the most differentiated and is based in principle on CONKLIN (1972, 1980). The rather unsufficient quality of the aerial photographs taken in 1980 only permitted the differentiation of the mentioned summarized categories.

1963	1980	1997
Pond field terrace (rice)	-	Rice terrace
		Fallow rice terrace
Drained field terrace (cultivated with vegetables)	-	Vegetable terrace
-	-	Abandoned terrace
Swidden (Sweet potato cultivation)	Swidden or grass caneland (Caneland A)	Swidden
Caneland ( <i>Miscanthus</i> spp. dominated area)		Grass caneland
	Mixed or shrub caneland (Caneland B)	Mixed caneland
		Shrub caneland
Woodland, forest	Forest	Forest succession
		Forest
		Pine forest
Settlement site	Others	Settlement site
Others		Erosion site
		Others



### 3 Results

#### 3.1 Landuse classification in 1997

##### 3.1.1 Terraces

The pond field terrace of CONKLIN (1972, 1980) was differentiated in

- rice terrace (1963 and 1997)
- new rice terrace (new terrace at all)
- rice terrace (dry cultivation in 1963)
- fallow rice terrace (irrigated fallow in 1997)
- new fallow rice terrace (new terrace at all)
- fallow rice terrace (dry cultivation in 1963)

The drained field terrace of CONKLIN was differentiated in

- vegetable terrace (1963 and 1997)
- vegetable terrace (rice in 1963)

Additionally, terraces with broken walls were classified as

- abandoned rice terrace (rice in 1963)
- abandoned vegetable terrace (dry cultivation in 1963)

##### 3.1.2 Caneland

The further subdivision of CONKLIN's (1972, 1980) type 'caneland' was chosen due to differences, which are obvious by view from a certain distance. Binoculars were used, whenever necessary. The categories were checked by surveying sample sites on the dominant plant species and by botanical surveys (see DIEFENBACH et al., pp. 65-75) on succession types of fallow.

grass caneland	dominated by <i>Miscanthus</i> spp. (e.g. <i>M. floridulus</i> ) (Pict. 40, p. 78)
mixed caneland	<i>Miscanthus</i> reduced and mixed with mainly fern species (e.g. <i>Pteridium aquilinum</i> , <i>Nephrolepis bisserata</i> ) (Pict. 38, p. 76)
shrub caneland	wooden plants and shrubs in the dominating grass, herbs and fern vegetation (Pict. 39, p. 78)

##### 3.1.3 Forest

CONKLIN's (1972, 1980) type 'forest' was divided in 3 subcategories.

forest succession	last succession stage to forest, dominated by shrubs species, scattered tree individuals (Pict. 40, p. 78)
pine forest	dominated by <i>Pinus insularis</i> (Pict. 40, p. 78), mainly around settlement areas
forest	dense forest areas with mixed tree species



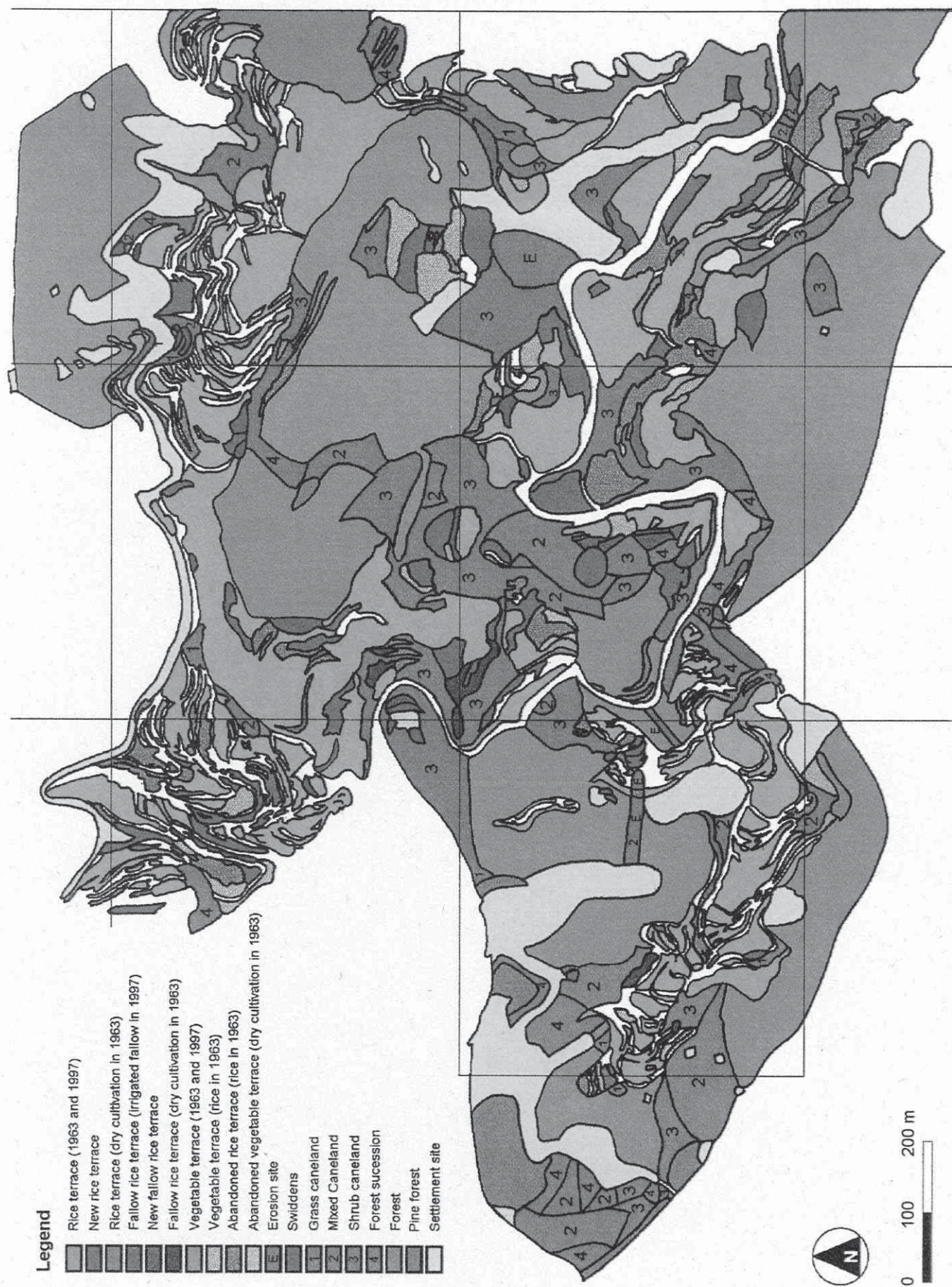






**Figure 17:** Banaue landuse in 1980 (investigation area of Tam-an and Poitan)





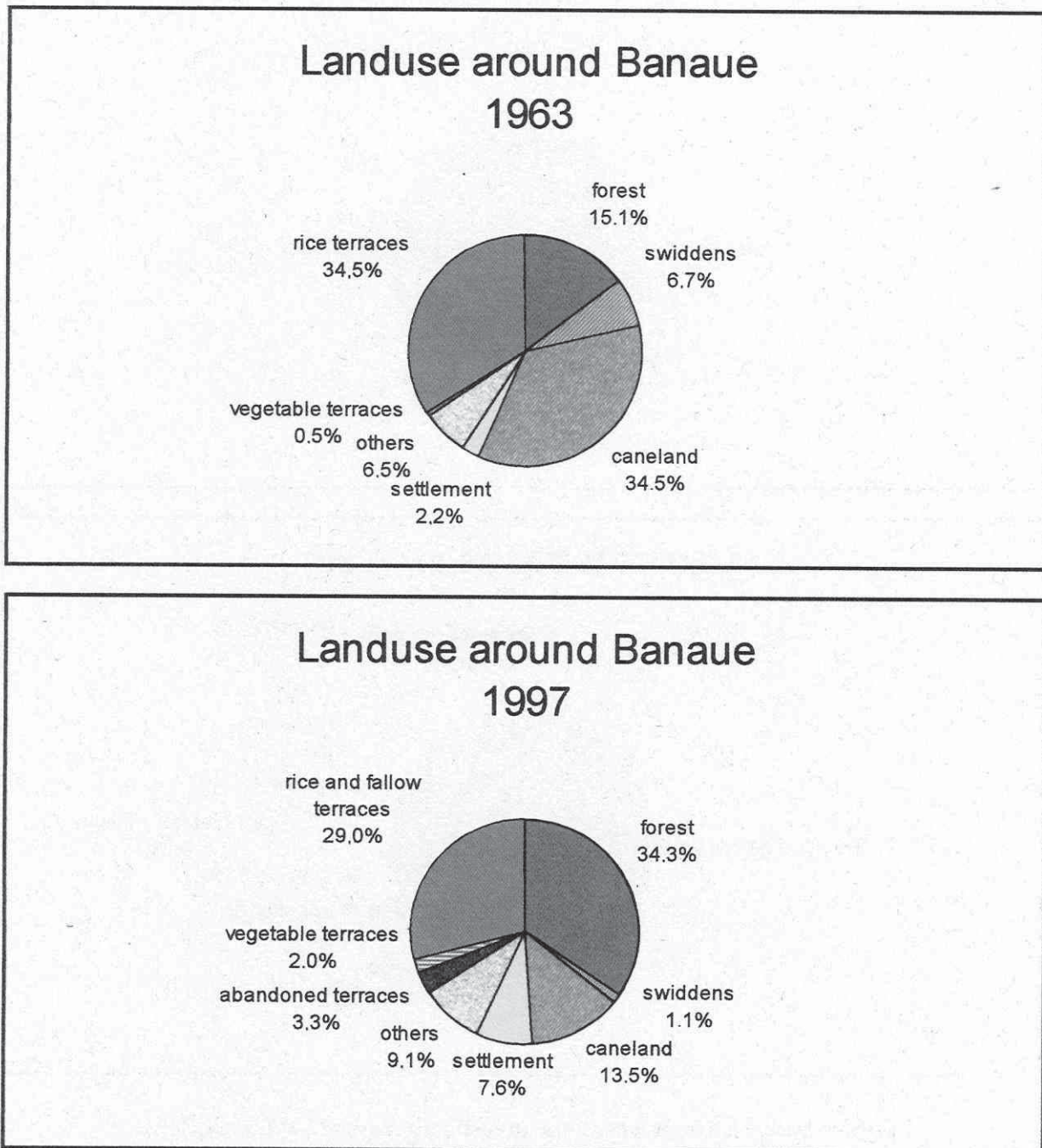
**Figure 18:** Banaue landuse in 1997 (investigation area of Tam-an and Poitan)



## 3.2 Landuse development

### 3.2.1 Landuse in the investigation area 1963 and 1997

Forest extended remarkably between 1963 and 1997 from 15 to 35% of the total area, whereas caneland and swiddens declined from 35 to 14% and 7 to 1%, respectively (Fig. 19). Changes of the rice terraces are moderate with a decrease from 35 to 29% of the total area. Especially, the extension of settlements is striking with 2 to 8% of the total area. In this context, the increase of the category "Others" from 7 to 9% has to be noted as well.

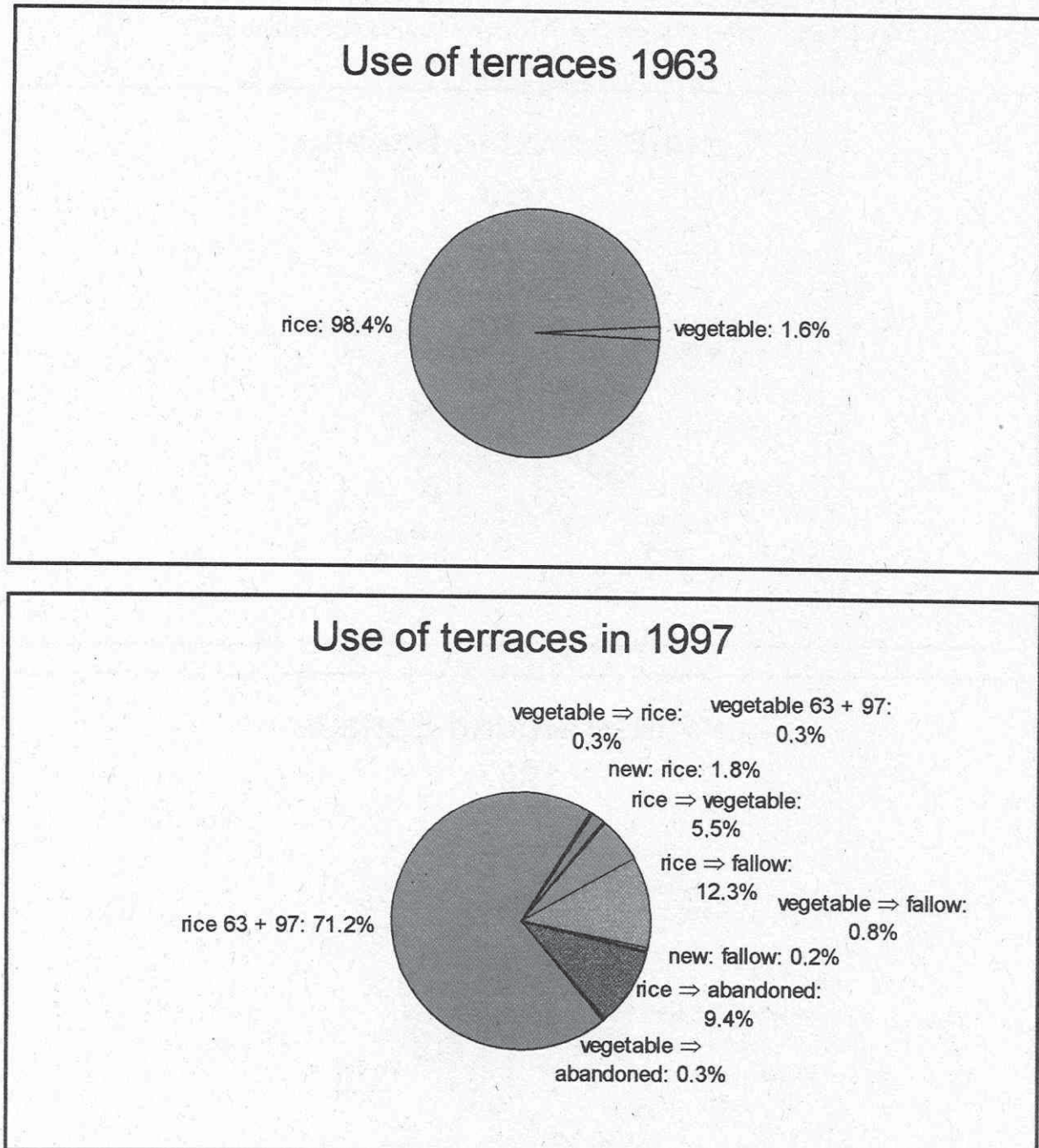


**Figure 19:** Total landuse in the investigation area in 1963 and 1997 (compare Fig. 16 and 18)



### 3.2.2 Changes in the use of terraces from 1963 to 1997

In 1963, 51.4 ha of the investigation area (total area: 149 ha) were terraced. In 1997, 5.0 ha of the former terraces are abandoned, which is a loss of about 10% (Fig. 20). Although new terraces were established, the extent of about 1.0 ha was too small for a compensation. The net loss of terrace area was therefore 8% in 34 years.



**Figure 20:** Use of terraces in the investigation area in 1963 and 1997  
(compare Fig. 16 and 18)



Rice cultivation covered 50.6 ha of the terraced area in 1963. This area decreased to 44.0 ha in 1997. For 1997 rice terraces (37.6 ha) and fallow rice terraces (6.4 ha) were treated together. This is due to the still ongoing preparation of rice fields during the investigation period (which made it difficult to distinguish between rice terraces in use and in fallow). During the period of investigation numerous “fallow” rice terraces were planted with rice again. They are therefore regarded as parts of the active rice cultivation system. Consequently, the loss of rice area within the total terrace area was between 13 and 15% from 1963 to 1997.

The abandoned terraces had broken walls and were frequently covered with shrubs, occasionally with trees. Mostly, abandoned terraces are clustered (see Fig. 18, p. 84). Some terrace clusters were obviously destroyed by landslides (compare Pict. 43, p.93). In the case of other clusters, farmers reported the breakdown of the irrigation system subsequently to earthquakes. Only few single abandoned terraces surrounded by active rice paddies could be found.

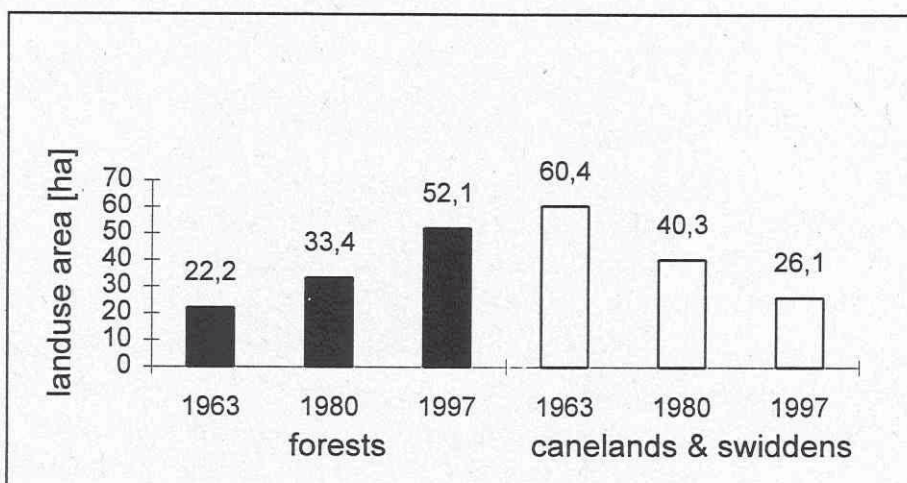
In the same period the percentage of dry crops on the terrace area increased from only 2% (0.8 ha) to 5.8 % (3.0 ha). The increase mainly originated from the conversion of former rice terraces.

The irrigation system of the rice fields in the investigation area in general doesn't seem to depend on a defined local watershed. Several long-distance channels provide water from distant mountain areas (partly from mossy forests of the Mt. Pulis range).

### 3.2.3 Changes of forests, canelands, and swiddens

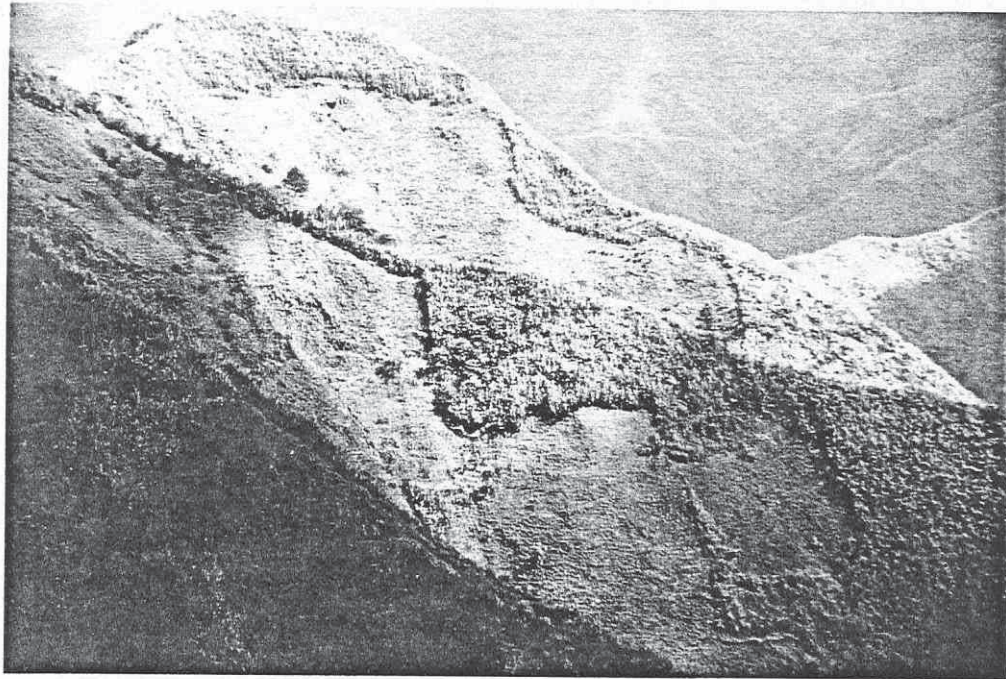
Swiddens, which covered traditionally the slopes above the terraces, decreased by 84% from 9.8 ha to 1.6 ha, and the area of caneland by 57% from 60 ha in 1963 to 26 ha in 1997. On the abandoned swiddens caneland successions up to forests could develop. Recently, forests and forest succession covers an area of 52 ha in contrast to 33 ha in 1980 and only 22 ha in 1963. This is an increase of more than double within 34 years (see Fig. 21).

A comparison of the forest distribution in 1963 and 1997 (Fig. 16, 18, 21) proves that most forest areas existing in 1963 were still present in 1997. New forest areas are covering former caneland and swidden areas.



**Figure 21:**  
Development of  
forests, canelands,  
and swiddens in  
the investigation  
area from 1963 to  
1997 (compare  
Fig. 16 and 18)





**Picture 40:** Typical swidden in use near Batad (March 1997)

#### 4 Conclusions

The results do not correspond with the hypothesis described above. The first main observation was that rice terraces in the investigation area were not as far reduced as expected by some authors (e.g. MARGRAF & VOGGESBERGER 1986, 1988). In general, stone and loam walls of active rice terraces were kept in good shape. This is valid for the irrigation system, too. In addition, construction of new terraces could be observed. Numerous farmers reported, that they would try to maintain rice cultivation on their family fields as long as possible (see also BARTHELMES et al., this volume, pp. 29-42). One reason for this attitude could be the close relationship between rice cultivation and the culture and religion of the Ifugaos, as described e.g. by DUMIA (1983). This conclusion is supported by Mr. J. Dait, Director of the Ifugao Terrace Commission (ITC; personal communication, 19<sup>th</sup> March 1997).

Nevertheless, since 1963 a net loss of 8% of the terraces was found in the investigation area. The reasons for abandoning rice terraces could however not be clarified. According to farmers, reconstruction of completely destroyed walls or irrigation systems is not carried out due to immense costs and work requirements.

The second important and unexpected result is the high increase of forests in the investigation area. This conflicts with the general opinion that reduced forest area should have led to insufficient water supply for the irrigation of terraces. In contrast, the increase of forest is accompanied by the observed decrease of caneland and swiddens in percentage of the total landuse. This leads to the conclusion that sweet potato cultivation was given up to a large



extent in the investigation area. In consequence, slopes were no more cultivated and the vegetation developed in succession to forest. Caneland mapped 1963 by CONKLIN (1972, 1980) and by the present survey are to be interpreted as fallow stages of swiddens with different age.

The changes in landuse discussed so far cannot be understood without their specific socio-economic frame. As the general hypothesis described at the beginning is not corresponding to the received results, a new explanation had to be developed.

In 1963 and before, the agricultural system of the Ifugaos was subsistence farming dominated by rice cultivation. Sweet potato cultivation and forestry covered those months in which labour requirement in the rice fields was low (CONKLIN 1980, MARGRAF 1988, VOGGESBERGER 1988). If any at all, there must have been few cash income sources. The yields had to satisfy the need of the population for food. Increasing population and low yields in the traditional rice growing system promoted the extension or at least maintenance of sweet potato cultivation on the slopes.

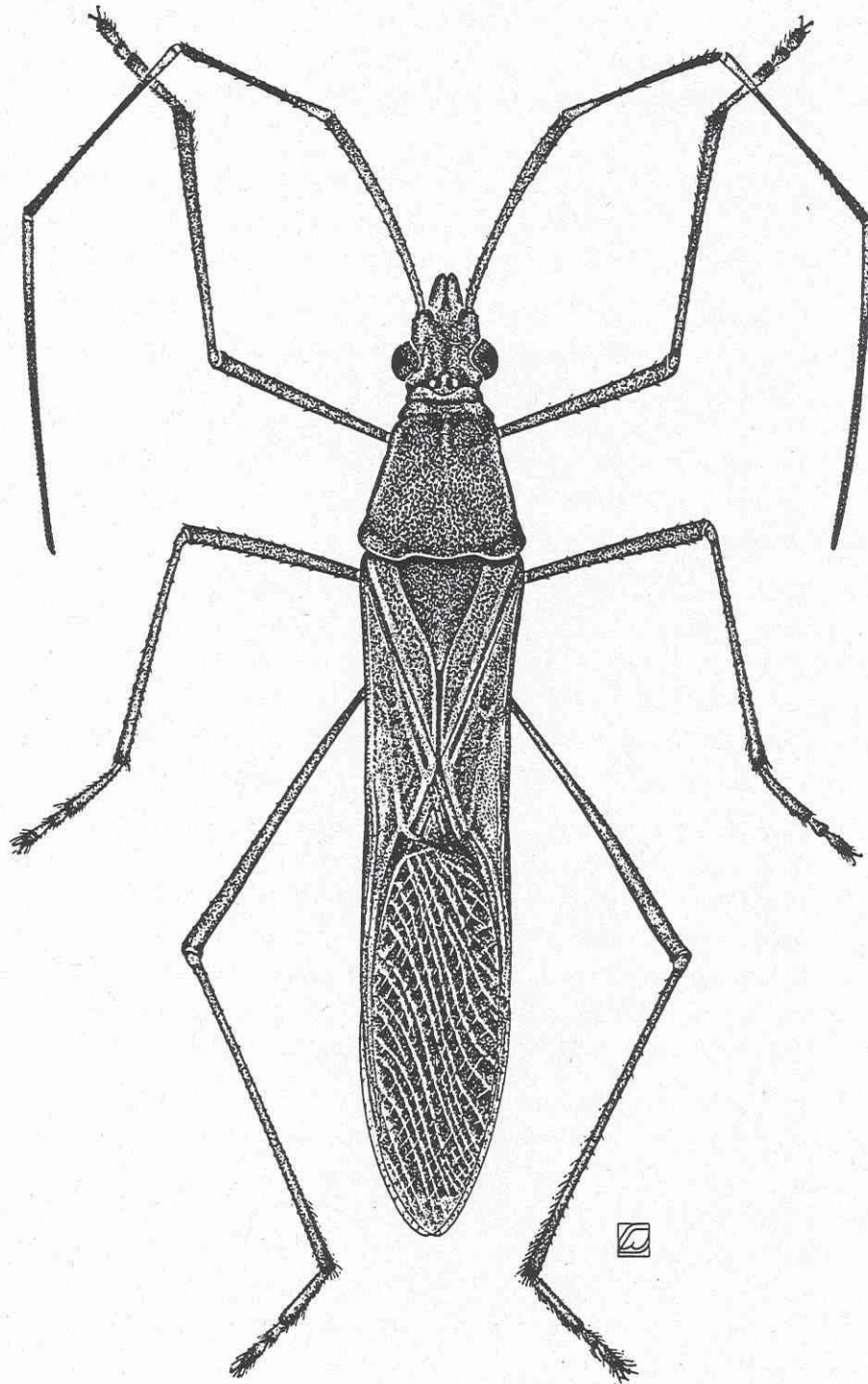
In the last three decades, Banaue developed into a congested area in which also tourism became an important economic factor. The position of Banaue as regional and touristic centre provides additional income sources. The inhabitants of Banaue increasingly receive cash by weaving, wood-carving and/or employment in the service sector. Field work is reduced due to limited time and low profit expectations. Cash income allows to buy additional food e.g. imported from the lowlands. In consequence, sweet potato cultivation was given up first.

In contrast, the rice terraces were not affected in the same extent by the socio-economic changes until now. Terraces are only abandoned if the need of investment in reconstruction of destroyed walls or irrigation systems is extremely high. Also, abandoned rice terraces due to new building activities (settlement) were observed. Cultivation of sweet potatoes and other vegetables ("cash crops") on former rice terraces increased, but is only of secondary importance. In contrast to the explanation of EDER (1982), a general lack of water, which might have led to abandoning of terraces, was not reported in recent times.

However, the water supply for the terraces in the investigation area is not only depending on the forests of the local watershed. Several long-distance channels provide water from distant mountain areas and are already mentioned by CONKLIN (1980). It cannot be excluded that, despite the increase of forest on the local level, insufficient water supply could result from negative influence in the mossy forests of far away regions. Investigations in valleys, where socio-economic changes did not happen in such high extent, could possibly clarify this suggestion. Due to the limited time, an extension of the investigation area unfortunately was not possible.

Predicting the development of the rice terraces in future is quite difficult, as there are many influencing factors. Without any other changes, the observed situation could completely change as a result of the generation cycle. At the time of our research mainly elder people were observed working in the terraces. Anyhow, we could not find out, whether this was usual in former times as well or whether the young generation is nowadays much less interested in these activities (see also BARTHELMES et al., this volume, pp. 29-42).





**Picture 42:** The rice bug *Leptocorisa acuta* attacks rice panicles at the milky stage;  
its one of the more common species in Ifugao  
(drawing: W. LANG; taken from SETTELE & BRAUN, 1986)



# **Rice Terraces of Ifugao (Northern-Luzon, Philippines) Conflicts of Landuse and Environmental Conservation**

- Report of a Scientific Students' Excursion -

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