Communities as Curators of Plant Genetic Resources: the case of Rootcrop Conservation in Southern Philippines

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Table of Contents

COMMUNITIES AS CURATORS OF PLANT GENETIC RESOURCES: THE CASE OF ROOTCROP CONSERVATION IN SOUTHERN PHILIPPINES[1]

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Users' Perspectives with Agricultural Research and Development (UPWARD), Philippines

Introduction

Why *in situ* conservation?

Received orthodoxy in plant genetic resources (PGR) collection and conservation ignores or downplays the much older ideas and practices of genetic diversity conservation found among rural households and communities. The orthodox history of PGR has been written from above and describes the scientific exploration of supposedly unknown regions and the collection, characterization and preservation in botanical gardens of "unknown" species. More recently it documents a global rescue mission, involving the systematic removal of plant genetic resources from their natural and cultural habitats for conservation in national or international genebanks and for use in plant breeding, industrial processes and medical science. In agriculture, this history has become the history of the Green Revolution, in which genetic diversity has been exploited to breed high-yielding varieties of many crops, most famously of rice and wheat. A paradox of this recent history is the erosion of genetic diversity in commercial farmlands as many traditional cultivars are replaced by a few of the new, high-yielding varieties, themselves bred from that diversity. Aside from the marginalization of local knowledge and practices, the complex issue of local rights over this genetic heritage has also been crudely and in some cases hypocritically brushed aside in the name of "free exchange of germplasm".

The older, local level history is spoken and performed from below. It is the history of the transformation of foragers into farmers and their development and diversification of agricultural crops over the millennia and into the present (Harris 1972;) Crop diversification has been driven by the interplay of natural selection of plants in heterogeneous environments with the efforts of local cultivators to increase the security and quality of life of the family through a cultural selection involving close observation and evaluation of plant habits and characteristics within environments and subsequent

[1] The authors wish to acknowledge the contribution of Dr. Virginia Nazarea-Sandoval both as leader of the "Memory Banking" Project -- which rigorously documented the indigenous knowledge of rootcrop diversity in Bukidnon, southern Philippines and constituted a preceding phase of the present activity. She joins us in acknowledging the enthusiastic participation of the curator groups in the four sites in Bukidnon, who continue to maintain their genebanks. The report is dedicated to them.

diversification has been driven by the interplay of natural selection of plants in heterogeneous environments with the efforts of local cultivators to increase the security and quality of life of the family through a cultural selection involving close observation and evaluation of plant habits and characteristics within environments and subsequent conservation of selected types (Simmonds 1979:18). The scientifically "unknown" cultivars are infact familiar products of this process and this has been extensively documented by anthropologists (e.g. Conklin 1954).

Given such a scenario, it might be thought that *in situ* conservation of crop genetic resources is already well taken care of. The best strategy should be to remind genetic resources scientists of local contributions and then expect some kind of synergy between the two forms of conservation. Unfortunately, household selection and conservation practices are under threat. Many of the global factors thought to cause loss of biodiversity (WRI et al, 1992) are actually manifesting themselves at the local household level: population build up leading to reduction of available land and thus of planted species and cultivars; increased demands for cash income leading to the adoption of one or two introduced species and the loss of the rest; adjustment to short term, 'industrial" agriculture, labouring or out-migration to satisfy growing family income needs with consequent reduction in household labour. All these trends can lead both to reductions in numbers of cultivars maintained by individual households(cf. Prain and Fano 1991) and affect relations between households such that replenishment exchanges of genetic diversity between households declines, which further contributes to absolute losses (Figure 1).

Why should we care about the deterioration in local capacity to conserve genetic diversity, if these materials are already under safe-keeping in *ex situ* collections? There are three main answers to this question. The first concerns the vulnerability of expensive *ex situ* collections, especially those managed by cash-strapped public sector institutions. Though detailed figures are not readily available, an IPBGR working group estimated in 1979 that even in the better funded genebanks of the North, more than 50% of crops introduced over the years have been lost. On the basis of a study of a US collection by RAFI, the figure could be much higher (Fowler 1990:63ff). A second reason concerns the way *ex situ* conservation 'freezes the evolutionary processes" as Miguel Altieri put it, by removing the landraces from their ecological and cultural contexts. Retaining the cultivars within their usual habitat can ensure the continuous of both national and cultural evolutionary processes. In other words not just the presentation of diversity but is continual creation.

A third reason is ethical and linked to the idea referred to above that crop germplasm should be 'freely exchangeable" between people and between countries. Though a noble and desirable sentiment, both politics and the practical everyday realities of poor, semi-literate, remote peasant farmers inconveniently intervene. State level political pressure has prevented the exchange of crop germplasm in the past and could well do so again (Fowler 1990). This means that countries should diversify their strategies for ensuring domestic conservation. Furthermore, the biggest source of landraces is often the most remote, subsistence oriented farmstead. What chance has that farmer of tapping national or international genebanks, should he seek to retrieve a favourite cultivar that disappeared? Crop genetic diversity is a product of farmer initiative and should continue as a local resource for other initiatives or adaptations in the future.

All this is not to say that *in situ* , farm household-managed conservation is an alternative to *ex situ* conservation in national or regional genebanks. They should be seen as complementary components of an overall national crop germplasm conservation effort. Part of the exploration of *in situ* conservation should be to understand that complementarity.

What can be done to give added strength to local conservation practices? Clearly, with the range of trends impinging on those practices, there are different possible strategies, including advocacy at policy making levels. The main hypothesis of the present approach is that existing household-level skills and conservation practices can best be helped and reinforced by "scaling them up", that is, by helping to build more visible links between households already engaged in types of conservation and even to support higher level genebanking (Figure 2). At the same time, "community conservation" of whatever form needs to be linked in some way to livelihood opportunities. However sensitive some of the partners involved in this research are to the long-term goals of conservation and the benefits expected to accrue to children and grandchildren, nevertheless, given existing poverty levels and the kinds of economic pressures mentioned earlier, some more immediate benefits need to be identified and amplified.

Why rootcrops?

Secondary crops with primary functions

Rootcrops are grown widely in many countries of Asia, and continue to be important sources of both food and income. To undertime the importance of rootcrops and other "secondary" crops, which are frequently associated with marginal, upland environments, Gelia Castillo refers to their "primary functions". These functions go beyond the crude division between "staple" or "subsistence" and "cash crop" or "commercial". They cover emergency circumstances, seasonal flexibility, nutritional supplements, food diversity and processing functions (Prain 1995). Genetic diversity is a key support to the diversity of functions since different functions often favor different genotypes.

Sweetpotato in an area of secondary diversity

The probable primary center of diversity of sweetpotato is in the north-east part of South America or in Central America (Yen 1974) Yet this is an area where sweetpotato is barely utilized by farming households, even in northern Peru where the diversity is so marked (Prain and Fano 1991). For this particular crop, the generally canvassed idea to focus *in situ* crop conservation efforts in primary centers of diversity does not make much sense. On the other hand, New Guinea, and the nearby islands which includes the southern-most part of the Philippines, which are considered secondary centers of diversity (Yen 1974), continue to cultivate sweetpotato as an important secondary or - in some cases in New Guinea - as a primary crop.

Primary Center of Diversity for Aroids and Yams

South and South east Asia and the southern Pacific is the likely center of domestication and an area of major diversity of several types of aroids, including taro

(*Colocasia spp)* and galiang (Alocasia spp) and two yam species (*Dioscorea alata* and *D. esculenta*). An *in situ* conservation effort in the Philippines which includes some of these rootcrops seems certainly justified on this account.[2]

Rootcrop "complex"

A final point, which justifies the inclusion of cassava - native to Latin America - is the real existence of a "rootcrop complex" in small scale plantings in this part of the Philippines. Farmers and homegardeners habitually plant together the different types of rootcrops, matching their different adaptive characteristics to variations in the planted area.

The area of study

Mindanao is the southern-most of the larger Philippine islands and enjoys a more uniform and wetter climate than northern parts (Figure 3). The "dry" season, from December to March or April is in reality a period of lower rainfall. Crops are planted during this period, though with higher risk from periodic drought. It is easier to maintain sweetpotato vines as planting materials through the year than in the northern Philippines - a factor of great importance for a rootcrop genebank - but there is always a danger that they may dry up during the low rainfall period.

Bukidnon, the province where this research takes place is located in north central Mindanao (see map), an undulating plateau of grasslands cross-cut with deep river valleys which radiate out like spokes of a wheel from the central volcano, Mount Kitanglad. The plateau is bounded by a once densely forested mountain chain to the east and lower hills along the western border with Lanao.

Bukidnon is a transitional land between the Hispanized coastal culture of north Mindanao and the Muslim world of the south west and west. Up until the early part of this century, the plateau was very sparsely populated by Maranao Muslim settlers in the south and Bukidnons and Manobos in the north (Edgerton 1982:364). Populations were located mainly in swidden settlements along rivers or in the hills, with few settlements on the grasslands themselves. During this century there has been a slow cyclical shift both in location of settlements and in agricultural activity. With the introduction of plough agriculture accompanied by a politically motivated drive to relocate populations on the grasslands so as to better control them, the grasslands saw the growth of towns and an increasingly vigorous agriculture. This process was accelerated through in migration of *dumagats* or "people from the coast". Increased areas of corn, rice and sweetpotato were reportedly planted, but expansion was slowed partly by the fact that indigenous families kept up their hillside farms as well as cultivating the grasslands. Another reason for the relatively limited expansion onto the grasslands was due to the presence of American ranchers and plantation owners: a subsidiary of Dell Monte was able to lease 20,000 ha. for pineapple plantations in the 1920s and continue to sub-lease this land today.

A reverse shift of population began after the second world war with the advent of logging operations both in the Kitanglad area and especially in the mountain chain to the east, in what are now the municipalities of Malaybalay and Cabanglasan. First as laborers for the loggers and then as farmers of the deforested land, migrants from the grasslands and from further afield adapted plough agriculture to the hilly areas, especially for corn, rootcrops and more recently, for vegetables. One additional agro-ecology which is very common throughout the province and which no doubt reflects for some families at least, an on-going survival strategy under conditions of high risk adaptation to the "new" grasslands agriculture, is the homegarden. In studies conducted as part of a recently started separate project on the role of homegardens in the same province, as many as 60 distinct species of fruit trees, food crops and ornamentals are planted, often with several varieties of particular species (Prain and Piniero, unpub.) In these three agro-ecologies, rootcrops have played an important role as supplementary staples and up until quite recently, there has been a steady increase in genetic diversity of what must have been already considerable diversity at the beginning of the century, as *dumagats* brought with them their favourite landraces to plant in their new farms. But as we will see later on, the growth in diversity may have peaked around the early 1980s and decline set in at the same time as agro-industrial and other markets have opened up and other of the pressures mentioned earlier have accelerated.

In the areas in which this project has been active, the ethnic composition consists of a mixture of indigenous tribal groups, especially Talaandig and Manobo and Dumagat, not just from the north coastal region of Mindanao but especially from the smaller islands further north, such as Bohol and Negros.

Methods

The methods used in this project have drawn from the menu of tools and approaches collectively known as participatory rural appraisal PRA (Chambers 1992). These have been particularly important for the initial understanding of agriculture farmer conservation practices in a particular area. Some examples of mapping, transects, elicited life histories etc. can be found in the historical profiles of the different sites in Appendix 1. The study also drew on a two sets of methods specially developed for working with local knowledge of crops and crop diversity. Collection of crop genetic diversity and associated indigenous knowledge (Prain et al 1995) permits relatively rapid documentation of the agro-ecological context of collected crop samples and the local knowledge about those samples. Memory Banking (Sandoval 1994) includes a set of procedures and techniques for carrying out a systematic, long-term documentation of both the genetic diversity of an area and the associated knowledge base - the memories - held by local people and which is evolutionarily entwined with the genetic make up of particular cultivars. The latter is particularly well-adapted for the long term commitment to a particular site which is implied in *in situ* conservation

In addition to PRA and crop genetic resources related methods, we have also utilized participatory planning techniques and groupwork approaches during the crystallization of the different forms of curator groups.

Part 1 *In situ* conservation as a social process

Concepts, research hypotheses and choice of curator groups

"Curatorship"

The term curatorship is meant to convey the investigative as well as the conservationist attitudes which local people exhibit in relation to the diversity they maintain (Sandoval 1994). Investigation includes evaluation and this can be expected to contribute to a the dynamic aspect of local genetic diversity through various types of new acquisition and through rejection. A third element of the term concerns the custodial role of households in maintaining diversity which may benefit relatives and neighbours, but most importantly, which are consciously meant to benefit future generations of the family.

Both household and community curatorship of PGR are inherently long-term activities. The present report, though "final" from the point of view of the contract between IDRC and ourselves, is nevertheless still "preliminary", reflecting a maximum of five seasons' experience (less for two of the sites) which is still very short to draw solid conclusions. The substantive, if still tentative conclusions and recommendations are contained in Part II. We would also like to include some methodological and "processual" insights we have gained, which we hope will be of use to others interested in supporting community curatorship of PGRs and these are discussed here.

What kind of community for community genebanking?

In support of the major goal of the project of helping to "scale up" rootcrop conservation, an objective has been to determine the kinds of "community" and community dynamics which are likely to support (or undermine) successful conservation of both germplasm and indigenous knowledge at the local level.

A recent compendium of terms and concepts for practitioners of primary and environmental health care offers as a basic definition of community "a group of individuals sharing the same territory and involved in the different but related aspects of local livelihood" Borrini 1992:44). To exclude very large groups like a city population (or the European Economic 'Community'?) which shares territory and has related aspects of livelihood but which is not intuitively a community, Borrini adds the idea that members of a community "are likely to have 'face-to-face encounters' and/or direct influences in their daily lives" (ibid.). In addition, there is the idea that a community would occupy habitats which are homogenous or which have interrelated ecological features which are jointly exploited (e.g. lakeside areas and forested areas). Communities are likely to show internal

inequalities in social status and in economic and political power but at the same time some form of social organization will exist with rules, symbols and sanctions which promote social integration and cultural continuity and offer means for dealing with conflicts which arise.

The definition encompasses a wide range of possible groupings among relatively small-scale demographic units in the Philippines such as villages (either local government-defined *barangay* or tribally defined settlements), quarters or hamlets (*sitio, purok*), special-purpose groups such as farmer organizations, cooperative societies, women's groups, etc.

Research hypotheses or variables

In trying to determine the kinds of "communities" to work with in exploring the potential and problems in scaling up conservation efforts, two variables in particular were felt to have special importance in identifying curator groups: gender, because of the frequent association of women with seed and variety management as well as the degree of cohesion and mutual support found in many women's groups; the degree of informality/formality of the group, because of the novelty of "self-conscious" or "public" genebanking, which on the one hand might benefit from informal flexibility, but on the other hand is bound to need some degree of local legitimization. Based on prior knowledge of several settlements in the province as a result of earlier research activities (Sandoval 1991; Piniero 1991) and after visiting and discussing with residents of other previously unknown areas where rootcrop diversity was felt to be quite high, four "communities" were identified as cooperators: a designated "tribal settlement" known as Dalwangan, represented by the tribal leader (*datu*) and other (male) tribal elders; an informal grouping of mainly migrant women[2] in the *barangay* of Maambong; an extended tribal kinship group in *sitio* Maraging in the Municipality of Cabanglasan; a *barangay* (village) development council in Mauswagon, also in Cabanglasan (see map and Figure 4). These, at least were the group structures as discussed. As will be seen, not only the genebank content is dynamic. Also dynamic and changing is the genebanking process itself.

Ethnic origin may seem to be a third important variable, given the presence of different tribal and migrant groups in the province. In fact, we originally included ethnicity as one of our key variables. However, Bukidnon tribal settlement of Dalwangan is highly integrated into "lowland" culture via its close contact with commercial plantations and government-run agricultural activities, and its tribal leaders have a high degree of political integration with all levels of government and non-government political activity. So in this case, ethnic differences seem to play only a small role in social and agricultural

[2] The population of Bukidnon Province consists of several tribal groups with ancient traditions of settlement in the mountain region, and migrant populations mainly from the northern Mindanao coast and the islands of central Philippines. Some came in the 1920s and 1930. They are known as Dumagats. More recently, a second wave of migrants came from the mountains of northern Philippines and is referred to collectively as Igorots.

organization. In the case of Maraging, the ethnic dimension turned out also to be complex. The extended kin group which made the original offer of partnership perceive themselves as tribal. But they are not originally from Bukidnon, but from the adjoining province of Agusan. But they contrast themselves with the *dumagat* from the coast and other islands and indeed, ethnicity has the distinguishing characteristic of being a relativistic concept: it can often be a tactic of differentiation. This is not of course to deny the cultural content of ethnic identity. At any event, it has not proved to be of great significance so far.

Clarifying conservation objectives

Long term perspectives, linking with existing experience

"Responding to local needs" is a basic aim of participative approaches to agricultural research and development. Yet clearly, different needs impose themselves more or less urgently on local attention. Most agricultural field researchers will have been faced at some point with strongly expressed needs -- for a local health clinic or a road or electrification -- to which they are incapable of responding. Many non-technical community workers will have felt helpless when faced with a locally expressed need to combat a serious crop pest. The need to conserve a wide range of landraces of secondary crops for hard-to-define future benefits is often not immediately apparent to a community. Even though household familiarity with and management of genetic diversity may be very common, it does not easily translate into an explicit, "public" project.

Extensive discussion of the long-term characteristics of the project proved to be essential. Early discussions with the communities concentrated on the conservation of the different "classes" of local rootcrop cultivars as a contribution to long-term agricultural security and adaptability. It was emphasized that the project would be an equal partnership between scientists and farmers aimed at the preservation of the diversity of locally valued root crops in a mutually satisfactory way and sustainable in the long run. Questions about incentives, access, monitoring, responsibilities, and rewards were openly explored. In this regard, it was necessary to explain the goals of UPWARD and distinguish it from other Government Organization and Non-Government Organization initiatives familiar to cooperators, especially in Dalwangan.

Concrete examples of the disappearance of genetic diversity in the case of local rice varieties, for example, and the unpredictability of the environment -- we discussed the recent eruption of Mount Pinatubo -- brought the issues alive.

The issue of livelihood benefits

In retrospect and as will be discussed further below, the complementary livelihood benefits of conservation activities were not sufficiently addressed in the early stages of the work. Thus in the longest running genebank, that of Maambong, the emphasis was on heightening awareness of the long term benefits of conservation for the community. 'Spill-

over" benefits did occur, such as the pleasure of participating in the curator group, but more material issues were not addressed. Livelihood was a major preoccupation of the Delwangan group and probably a reason for the collapse of their activities. As will be seen, the arrangement in Mauswagon offers the best option of the four for addressing this issue.

Curator group formation, dynamics and leadership

Group structure and leadership

When considering the different "shapes" or structures of the groups we distinguished "expected group structure" at the beginning of the project (Figure 4) from the actual shape of the groups managing the genebanks in practice. The structure of the Dalwangan group was expected to be hierarchical, unitary, and closed, focused on the authority of the *datu* and in fact we were able to document a complex local structure (Figure 5). The structure of the Maambong group was expected to be relatively egalitarian, with participation as individuals rather than as group members and open to the possibility of new members joining. It was assumed that Mrs. Lydia Vda. de Casseres, donor of the land where the Maambong site was to be located as well as because of her age, would be "first among equals." The ex officio participation of the barangay captain was expected to facilitate land preparation as well as help to legitimize the activity within the barangay (Figure 6). In the case of the extended kin group of Maraging, it was expected that the most active participants would be the household head Mr. Manginimba, because he made the initial offer to locate the genebank in his garden, his wife, because she was the main person responsible for the garden, assisted by her daughters. The husband and children of one of the daughters were also expected to be involved.

In Mauswagon, the "expected structure" was least clear right up to implementation. On the basis of preliminary discussions the Barangay Development Council (BDC) under the Barangay Captain was to make the activity one of their projects. But early on, discussions took place with women members of the disbanded Rural Improvement Club[3] which seemed the most appropriate group to take on the conservation activity. In fact, it was the need to reorganize the RIC under a newly elected barangay captain and council which left things unstable.

As early as at the planting of the first genebank in Dalwangan, the anticipated structure broke down. Although the tribal elders and youth involved in initial discussions and negotiations were led by the *datu*, he was unable to organize adequate preparation for or participation in the planting. Those who attended were mostly his relatives or assistants whom he sent for on the day. A few non-relatives also attended, either out of "shame" (*hiya*) because they attended the planning session, or because they were friends of the

[3] Disbanded due to the relocation of the previous president. RIC are established by the Department of Agriculture and focus on small-scale livelihood, nutrition-related and "rural beautification" activities.

datu's brothers. Most of the original group of elders consulted did not attend. Subsequently, the datu played almost no role in managing the genebank. He is a politician active at provincial and regional level, and is involved in many different projects. The lack of an immediate, short-term livelihood dimension also no doubt gave the activity low priority.

The genebank was established on land donated by the datu's brother, who was one of the original group of elders. The de facto structure of the curator group in Dalwangan became very rapidly based on this man's household, plus a few close relatives living nearby (Figure 7). The male members' role was restricted to land preparation. Day-to-day management and even replanting were handled by some of the women in this small kin group. The expected formal authority structure of leadership was transformed into a largely acephalous grouping of linked households. The failure to replace the expected formal authority with some other type of leadership may be one important reason for the eventual abandonment of this genebank. There was no clear point of contact for the researchers. Even though a number of the female family members were willing and interested to continue, they were not willing to take an initiative given the land title and position of the datu's brother.

In Maambong, the structure also changed in practice, becoming complex. The group became more like a multiple social network based on kinship links, ritual kinship, and special friendship ties (Fig. 8). Mrs. Casseres is central to this network. Several men participated in land preparation because of the membership of their wives. Participation by the barangay captain was also partly related to his wife's involvement, although she is a relative "outsider" compared with the other women. His communal interests probably were more important in explaining his involvement. Although he relinquished his official position of barangay captain during the first planting of the genebank, he sought to contribute in various ways to its success.

The fact that Mrs. Casseres donated the land for this genebank ("so that I can be remembered," she says) seemed to contribute relatively little to her authority. Her leadership depended more on example than on political or economic title. She did not order anyone to do anything, but she herself tried to be the most dedicated curator, hoping either to persuade or failing that, to shame others into emulating her. Even so, she was able to draw on several elements of culturally sanctioned authority, such as her age and kin relations (mother, mother-in-law, aunt, *ninang*, or godmother) and to bring into play reciprocal obligations between friends. In the end, she felt that "policy/regulation" was useless. She believed that the genebank would work only if the women incorporated it into their "daily living".

In the case of the Maraging kin group, the small kin group turned out to be again a much larger group of women who we know are related and linked in various ways as in the case of Maambong, but we have not yet been able to determine those linkages (Figure 9). It can be noted that the old kinship head who made the original offer no longer figures in the group.

A successfully reconstituted RIC in Mauswagon became the de facto curator group structure (Figure 10), though closely linked to and supported by the barangay and even the municipal organization. This close but not too close connection with the formal political structure has been one factor making implementation relatively easy, compared with the situation in Delwangan.

Identity formation and incentives

To give the cooperating groups greater communal visibility, the researchers encouraged them to give themselves and their genebanking project a name. The Maambong women appropriately called themselves *Inahan nga Makugihon* ("Industrious Mothers") since the mothers are the ones directly involved in the project. The tribal authority chose the name *Kauyagan ho Kahilawon* ("Livelihood for the People") since most local projects are expected to offer additional income sources. Once again, the expectation of a livelihood component which was even embedded in their name may have been an important misunderstanding at the beginning of the project in Dalwangan and highlighted the need to have addressed this issue more practically early on.

The Maraging women, who had been exposed to the activities of the longer established Maambong group during a cross-visit, followed them in the name they chose: *Nanay nga Makugihon* (Mothers who are industrious). In Mauswagon, they became "Mauswagon RIC Rootcrop Conservation and Homegardening Project" (in English).

Repeated discussion and explanation of the long-term goals of the project were essential for reinforcing commitment and ensuring that no misconceptions creep in about what the "outsiders" may or may not be able to offer. At the same time, we found that various incentives were very important to galvanize interest while the long-term perspective was crystallizing for the group. At the household level the long-term view was clearly present in the management of different kinds of crops and tree species, especially in the home gardens. But at the group level, trust needed building so that the long-term view of diversity could emerge.

A project interested in supra-household cooperation should design or at least encourage incentives that benefit the community. In that way, the project more easily becomes associated with communal action. In Maambong, a simple water tower was constructed for irrigating the genebank, but it also stored rainwater for general use by the community.

Incentives can also focus on households, since they are the basic production and consumption units. In Dalwangan, a small goat-raising enterprise was established to utilize genebank by-products as feed and offer a small income to the one or two households with responsibility for actually looking after the genebank. The tribal authority also saw this as the livelihood component, a potential means for the genebank to be self-sustaining. This is a crucial characteristic to which the tribal authority was perhaps more sensitive than was the women's group.

An incentive can give purely material benefit to the household or community, or it can have both a material and symbolic component. The power and importance of symbol in rural communities seem to be little appreciated by "down-to-earth" research and development workers. Certificates of membership in the "Industrious Mothers" group distributed to participants in a small ceremony proved to be very potent in building the spirit of the group. Similarly, certificates were distributed to members of the RIC in Mauswagon during a 'Convocation", which both helped to solidify the recently reformed Club and also to link the club very directly to the Conservation and Homegardening Project. Prizes were also awarded, at the suggestion of Maambong members, at the first harvest, to the women with the greatest overall rootcrop diversity and those with greatest sweetpotato diversity. The prestige attached to these awards counted at least as much as the prizes themselves.

Another important element in the choice of incentives is their long-term character. The water tank was constructed close to the genebank in Maambong to offer the possibility of hand irrigation of the genebank in case of an unusually severe dry season. But it also quickly became a clothes-washing spot and domestic water supply for households nearby . The long-term usefulness of the water tower gave it added force as an incentive over time. The women say that when they see the tank, it "pricks the conscience" (*makonsensiya man kami*) if they have not been maintaining their genebank plot very well.

Besides offering incentives with long-term relevance, we also introduced several incentives over time in step with the development of the genebank: trips for members of the curator groups to the other genebank sites and viewing films of user-perspective research related to rootcrop varieties; periodic improvements to the genebanks, such as construction of a fence to keep out animals; and installation of rat control devices. An important incentive was a sign for the fenced genebank in Maambong, expressing the sentiments of the group: *"maayong pag abot sa prokyekto sa mga inahan nga makugihon nga nag atiman sa mga lagutmon"* (welcome to the project of industrious mothers who maintain and conserve the different classes/types of rootcrops). The public display of the group name "industrious mothers" also prodded them to be industrious in looking after their plot. Similar signs, were erected at the other sites, in the case of Mauswagon accompanied by a small resting shed constructed at the clubs expense.

Agricultural context, genebank designs and first plantings

The different structure and characteristics of the curator groups at the two sites led inevitably to different genebank organization and design.

Dalwangan[4]

Dalwangan is located in the center of the Province, about 15 kms. south of the Provincial capital. The barangay straddles the main highway from north to south Mindanao, and it has been an important transition point, both physically and historically. The name comes from the Binukid *dalwang* or *dambaan* meaning "sloping downward either side", and it is indeed located where the slope of the plateau divides north and south. Such topographical importance gave it historical significance as a staging post for travelers. The agricultural area used to be primarily located in the surrounding hill land where farmers grew corn, upland rice, rootcrops and fruit trees in swiddens. In the years immediately after the Second World War there were almost 30 cultivars of sweetpotato being grown in the village according to local people, perhaps due to its increased importance during the war as an emergency food crop (Figure 11). Increasing migration, especially during the 1960s led to greater use of the land in the flatter, plateau area, and new crops such as citrus fruits were introduced there. With the arrival of migrant vegetable farmers from Baguio in the 1970s, many local farmers moved back to the higher altitude farms and forest margins to grow the more profitable vegetables. The increase in vegetable production was accompanied by a decline in both the area and the diversity of rootcrops grown, in the case of sweetpotato to about 18 in the early 80s and down to 15 by 1985. The arrival of Dell Monte in the area in the beginning of the 1990s had a further negative effect on local agriculture, both through leasing of land and the effect on soil structure of the plantation practices. Corn production in the area became increasingly unprofitable and there was some recovery in rootcrop cultivation, though this time for commercial purposes and with progressively fewer cultivars being planted, determined by market preferences.

This was the agricultural context of the establishment of the genebank in Delwangan. The decision to choose this location was partly determined by the presence of a formal, male-dominated type of communal arrangement interested to manage the genebank, but also because of personal contacts with people living in the village, which facilitated the initial arrangements.

The presence of a formal authority in the planning of the Dalwangan genebank resulted in a design that pooled available diversity in a single, communal bank. Site identification was more difficult than in Maambong, perhaps because of greater pressure on land. Eventually land was offered by the brother of the *datu* (Figure 12). Cultivars were brought by different members of the community allowing an automatic reduction or elimination of duplicates. The more common local varieties were represented by several plants, whereas a large number of cultivars had only one sample (Figure 13, Table 1). Because rootcrop diversity in Dalwangan is found in the mountain swidden fields, which lie far from the households, many of the cultivars were taken from the nearby Agricultural Research Station where a provincial-level sweetpotato collection is maintained[5].

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[4] For more details on the agricultural context of all sites, see Appendix 1.

[5] This transfer from *ex situ* to *in situ* is an interesting reversal of normal practice. In effect, it is a

As mentioned, the actual planting at Dalwangan was rather disorganized, with preparations made at the last minute and participation seemingly enforced by the tribal authority. Participants gradually slipped away throughout the day so that by late afternoon, only some youth and the members of the immediate family of the landowner were left.

Maambong

At around 300 m.a.s.l. Maambong is the lowest-lying site and is situated in the relatively flat, northern part of the grassland plateau. This is also the area where the Dell'Monte pineapple plantation began to rent land in the 1960s and the Company is a source of employment for some members of the population. Principal crops were corn, banana, coffee, taro, sweetpotato, cassava and fruitrees around the houses. Sweetpotatoes had been an important feed for the extensive pig raising during the 50s, but this declined in the 60s and with it, loss of some of the cultivars used at that time (Figure 14). However, this seems to have been compensated by the introduction of new varieties by the steady stream of migrants who settled in the barangay during these years so that the overall tendency was an increase of diversity, at least until the 1980s. The use of slash and burn techniques began to be replaced with permanent fields with rotations in the 1960s. Corn and sweetpotato or cassava was a common cropping pattern. In the 1970s a few farmers experimented with vegetable production, especially sweetpepper, potato and tomato. With the expansion of the Dell'Monte plantation, this coincided with the availability of fertilizers and pesticides and these became more widely used as the soil became depleted from the continuous rotations. Vegetable production has intensified in the area during the 1990s, especially for tomato. A polarization of farmers has occurred between the high input-using vegetable producers with few other crops and the commercial rootcrop producers, especially those growing cassava for commercial chipping and also sweetpotato for fresh market sales. As in the case of Dalwangan, the increased commercialization has probably contributed to a definite decline in numbers of cultivars over the past 10 years or so. An important recent factor which affected the activities in Maambong was the formation of a tomato producers' cooperative in response to the visit of a vegetable trader from the coastal city. This has had a big local impact on allocation of labor and time.

Aside from the transformations in field production, homegardens are widely cultivated in Maambong and are repositories of a very wide diversity of species and varieties. For many of the women they are a source of pride and this is certainly one of the counterweights to the trends in commercial agriculture.

The informal grouping of women in Maambong consisted, at the first planting, of 17 independent curators, each maintaining one or two long beds laid out side by side in a single plot donated by Mrs. Lydia Vda. de Casseres (Fig. 15). Individual beds were

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horizontal transfer of germplasm between localities mediated by the project.

planted to cultivars of different rootcrops. Because each woman had collected the cultivars herself (Fig. 16, Table 2), there was considerable repetition of some cultivars, unlike in the single genebank of Dalwangan, though a few rare types were planted by only one or two women. This built-in redundancy has potential importance for conservation.

The planting in Maambong was a communal affair. Before dawn, farmers began to gather, some with their husbands to help in land preparation, some with children or alone, but all with planting material and considerable light-heartedness. The planting turned into a kind of community celebration. The work was completed on the same day, which pleased everyone. Moreover there was a feeling of having done something significant, although there were clearly different levels of understanding of that significance. One of the mothers, when asked what they would do when the plot began to produce roots, observed:

> *"The yield is not that important to us as long as we can keep the collection as diverse (ang produkto dili importante kanamo. Ang importante mao ang patipig sa klase-klaseng lagutman) as it is right now or better in the future. That is what we will consider as a profit. With the help of this project, we will not be afraid that some of our rootcrops and its different varieties will become extinct and will not be known nor recognized by our children and our children's children in the future."*

We were surprised by the size of the genebank which the women eventually planted. Size was not discussed during the planning stage, nor of course the design of the genebank. The design was arrived at through discussion among the women, but the size seems to have been determined by the amount of land donated by Mrs. Casseres. The need to fill up the available space led to planting of multiple samples of the same cultivars. Lack of sufficient household labor to attend to all their needs and obligations eventually led to neglect of the collection by some women and a joint decision to reduce the size.

Maraging

Maraging is located in the isolated eastern part of Bukidnon in the once forested mountain chain forming a natural border with Agusan del Sur. It is a hamlet (*sitio*) of Iba which is a recently formed barangay of Cabanlasan and is about 5 kilometers from the municipal road. In the late sixties there were only three tribal families in Iba and a similar number living on the banks of the Pulangi river in what is now Maraging. A logging operation began in the area in the early seventies, drawing with it increased migration of laborers and also farmers interested to cultivate the newly opened areas. Rootcrops continued to be grown in the hillsides, but corn gradually became more widely grown on the flatter areas. Some vegetable production was also introduced in the late seventies. The arrival of hybrid corn in the 1980s had a major impact on agriculture, with a very large expansion of the area and almost certainly a decline in rootcrop production. The remoteness of the area, chosen because of the past importance of rootcrops and a reputation for managing considerable diversity, has made monitoring very difficult. In

addition, the remoteness also attracts the interest of the New People's Army and counter-measures by the Military.

Both the design and the planting of the genebank were very straightforward, which is understandable, since the site is the expanded homegarden of the Manginimba family and planting followed the often casual approach found in homegardening (Figure 17). For reasons mentioned above, we were unfortunately not present at the actual planting. Despite the considerable sweetpotato genetic diversity found and collected throughout the municipality of Cabanglasan (see Appendix 2, BC63-BC83), only seven sweetpotato cultivars were planted (Table 2), though the members confirmed that other varieties would be added when they had chance to visits more remote hamlets in the hill areas.

Mauswagon

As recently as the 1960s Mauswagon was still only a hamlet of Cabanglasan village, settled by a few *higanonon* tribal families and later, migrant *dumagat* from other islands. The area was still heavily forested with a wide range of tree species. Agriculture consisted of upland rice, native corn, sweetpotato and other rootcrops, though swiddens were vulnerable to attack from wild pig and monkeys. Sweetpotato and corn were more commonly grown in garden plots where this kind of damage could be avoided. Local people remembered only four varieties of sweetpotato in the hamlet at that time.

The population gradually increased during the 60s, but a much larger growth occurred as migrant labor accompanying the arrival of logging companies in the early seventies. By 1975, almost 75% of the forest had disappeared and larger scale agriculture was opening up. Plough agriculture was introduced at this time for native corn and rootcrops which could now be more successfully grown in the fields since the main pests - the monkeys and wild pigs - had disappeared along with the forest. With the advent of migrants from different parts of Mindanao and the central Philippine islands, new varieties were introduced and these years saw an increase in diversity. A second major change in agriculture occurred in the mid-1980s, with the introduction of hybrid corn varieties and irrigated lowland rice. Corn now dominates the landscape and there has been a corresponding reduction in area devoted to rootcrops. With total forested area down to 10% of total, local Government agencies began a reforestation program in the early 1990s.

Currently, the population of the barangay is 709 in 133 households. There is an active barangay council which, considering the relative isolation of the village, is well supported by the local Department of Agriculture office. Nevertheless, the village is by no means a homogeneous unit despite its nucleated character and no doubt that is why a village level genebank, which was the original plan, was so difficult to get off the ground. The apparent strength of the *purok* or neighbourhoods may be related to the various ethnic and kin affiliations of different in-migrations, but this still remains to be fully documented.

Building on both the predisposition to segmentary residential groups (the *purok*), the earlier experiences of *purok* women with homegardens-related activities through the Rural

Improvement Club and good support from the local government officials and the local DA has proved to be very encouraging. Village land in purok 3 (see map in Appendix 1) was donated by the barangay council and each group of purok based RIC women planted a strip with the different cultivars of sweetpotato (primarily), taro and cassava they were able to identify in the purok (Figure 18). In addition, since the activity was seen as both a conservation and a household welfare project, vegetables and legumes were also planted. This dual-track approach to the genebank is a further important element to their approach.

As with Maraging, a relatively small number of accessions of the different rootcrops were included in the beginning, compared with the known diversity in the area. Since planting, additions have been made via cross-visits to other *in situ* genebanks and to the *ex situ* site and the women also expect to include additions from the area. Though the genebank has only been functioning for one year, it is already seen as a model for conservation and self-help welfare activities in the Municipality. The mayor uses the site to show to visitors and the first harvest of the sweetpotato diversity (the other rootcrops were not mature) together with some vegetables and legumes were used as part of a Nutrition Month Celebration and Demonstration in the Municipality.

The curator-researcher partnership

Although conservation of crop genetic diversity is a common strategy of rural households, this strategy is not uniformly utilized, both in different areas and even in the same population. There is a need to know more about <u>why</u> variability exists and what its effects are on crop evolutionary dynamics. We are seeking this understanding as part of this project. At the same time, we try to transform unevenly applied household-based conservation into a more explicitly practiced group or communal activity, producing more secure, more widely distributed resource conservation benefits. Our experience in this project is that this transformation has a greater chance of occurring with a stronger initial partnership between "insiders" (the villagers) and "outsiders" (the researchers).

<u>Building trust and respect</u>

The four cases have given us a good opportunity to compare community genebanking under different conditions: in Maambong, documentation of indigenous technical and ethnobotanical knowledge ("memory banking") had been going on for several months before the genebanking began and camaraderie had already developed between researchers and local user-consultants. In Dalwangan, Maraging and Mauswagon, relations with curators had to be built up as part of the genebanking project itself. Because of the difficulties of turning a taken-for-granted private activity into a public, long-term commitment, the intensive discussions this requires, plus the need to monitor the actual management of diversity in the genebank, it is not easy to build trust at the same time. Other complicating factors such as personality quirks, can easily make things non-viable, as perhaps occurred in Dalwangan (see below).

Researcher presence and genebank sustainability

It was clearly important to curators for researchers to be regularly present at the site, especially for major events such as planting and harvesting/replanting. Even though the curator group in Maambong was encouraged to harvest and replant when they felt the moment was right, they often delayed these activities -- even risking the quality of the harvest -- to wait for the researchers. This shows a degree of dependency that is unsustainable in the long term, but seems an essential element of the early part of the partnership. Researcher presence is also important during the growing period, to demonstrate continuing interest in the activity. For unavoidable reasons, we were unable to visit either of the first two sites established for a period of five months. It was the dry season, the most vulnerable time for maintaining planting material. This fact, plus our absence probably accounted for the signs of abandonment on the subsequent visit. In fact, the Dalwangan site was terminally abandoned, whereas the Maambong site was quickly resuscitated and replanted after the construction of a fence and barrier system to keep out animals and rodents.

Researchers' presence had two functions in the early stages of the genebank: the first was clearly psychological, emphasizing the reality of the joint activity and demonstrating its importance by being on site (many visits involved several days' stay in the village); the second was iterative, offering to both curators and researchers the opportunity to reemphasize and discuss the purposes and goals of the genebanking activity. In support of this second function, regular informal meetings were held with the women's curator group during most visits at which the meaning of conservation was repeatedly debated and any problems associated with the activity discussed.

Part II The *ex situ* site: complementarity and research opportunities

As part of the earlier research activities, involving memory-banking of local knowledge of sweetpotato cultivars being grown in various sites within the province of Bukidnon, an *ex situ* genebank was established within a local Department of Agriculture Outreach Station. The original genebank introductions came from the memory banking sites of Salvacion and Intavas and the results of a "seed fair" attended by tribal groups from all over Bukidnon (Appendix 2, "BC" sub-collection). Unfortunately, through inexperience in the handling of accessions, problems exist with this sub-collection. The memory-banking information sometimes cannot be unequivocally linked to specific accessions. Differences exist between morphological and characterization "memories" recorded for accessions with the same name. Sometimes, the memory-banking work was done not in reference to a specific sample cultivar which the local consultant had provided, but in reference to "memories". This leaves open the possibility of the local description referring to some cultivar other than the one in the collection carrying the same name. In the sub-collection BU, these problems are compounded by loss of certainty about the original location of these accessions, apart from the tribal group name.

The more recent accessions in the BC sub-collection (BC63 onwards) come from the two new *in situ* sites and other parts of the same municipality of Cabanglasan and the memory-banking data can be much better correlated with these accessions. This is also the case for the BM and BD sub-collections which come from the first two *in situ* genebanks. This is the material which is currently the main focus of evaluation. Multiple accessions assigned the same name by curators are being evaluated for possible morphological and/or physiological variation and the differently names cultivars in the whole collection are being evaluated for duplicates (see Appendix 2 for existing characterization data).

Characterization still going on, both technical characterization of the accessions as indicated in the characterization sheets, and also of curator characterizations, some of which are also included in the Appendix. A cursory look at the technical characterization sheets suggests that there is considerable diversity represented in the collection, but there are also many accessions covering a very narrow genetic range. Many of these may turn out of course to be duplicates and that is one of the tasks which is still on going and in need of completion. To assist with this we hope to link up both with CIP scientists and national institutions to add some molecular techniques for assessing the actual genetic variability in this collection.[6]

Part III *In situ* conservation: results and lessons (so far)

Changes in genebank diversity[7]

Shifts in overall genetic diversity

The assessment of genetic diversity in the genebanks and monitoring of variation in that diversity over time can still only be provisional, since we are continuing the characterization of this collection at the *ex situ* site to identify duplicates with different names, genetic difference among cultivars with the same name and the degree of genetic variation across the whole collection. This information is needed to assess the way the changes in the *in situ* genebank accessions over time affect changes in the genetic diversity of the genebank. For the present analysis, it is assumed that differently named cultivars represent different genotypes and this section looks at the absolute changes in these genotypes considering the genebank as a whole.

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6 Advice on *ex situ* genebanking and suggestions for additional characterization and evaluation is gratefully acknowledged from Dr. Jose Bacusmo, former director of Philippines Root and Tuber Crops Research and Training Center at Visayas State College of Agriculture (PRCRTC-ViSCA) and from Dr. Zosimo Huaman, Potato and Sweetpotato Curator and genetic resources specialist, International Potato Center, Lima.

7 Because Mauswagon and Maraging genebanks were only relatively recently started, data in this section comes from Dalwangan and Maambong only.

In Dalwangan, where, it will be remembered, there was a considerable shift in the structure of the curator group between the planning and the execution, a very large loss of sweetpotato and other rootcrop diversity occurred between the first and second plantings. This was partly due to the unwillingness of the leader of the de facto curator group to transplant more than a few sweetpotato cultivars in December/January at the onset of the dry season (the taro and cassava, which has a much longer growth period, were still growing). The reason given was that it was too risky because of the difficulty of ensuring that the cuttings would establish themselves In fact, by the time the rains came, the few transferred sweetpotato cultivars were established, together with some cassava, but the other sweetpotato cultivars and species were lost. The new site quickly deteriorated and though the de facto curator discussed various plans for recovering three or four of the most commercial varieties for planting in a large new area, the genebank under this group had in most respects been abandoned.

In a spontaneous development, there was infact a slight recovery in the third planting when the genebank passed into the care of a new family and under direct, female management (Figure 19). The woman from this family selected 10 sweetpotato varieties from the original collection: *sugahak, amerikano, turay, si-uron, kapayas, kalibre, igorot puti, igorot pula, 5-fingers* and *sil-ipon*. These varieties were chosen because they were thought to possess the characteristics that she likes in sweetpotato. They were established near the house and served as a source of planting material for a planned larger site. Seven varieties of the original collection were finally transplanted to that site: *si-uron, igorot pula, igorot puti, 5-fingers, amerikano, turay* and *sil-ipon* because they had produced enough planting materials. The others, with little plant growth, were deselected by default. The new location proved to be an "experimental" site, however, rather than a genebank. She wanted to further evaluate the seven accessions from the original genebank planted out there, as well as varieties obtained from other sources, such as *igorot pula, igorot puti* (from Salvacion), which are felt to grow easily, *alma* and *moto* obtained from one of her neighbors) and *gireng-gireng* from the local Bureu Plant Industry (BPI).

Analyzing the shifts in diversity is more complex in Maambong, since the individual women semi-independently manage their own plots. There was a sharp rise in sweetpotato diversity in the second planting from 7 to 18 cultivars, with no losses (Figure 20, Table 5a). This increase can be explained by several factors. Considerable interest and enthusiasm built up during the first planting and crop development. The women regularly met together in the genebank for weeding activities; they received frequent site visits from the researchers for meetings and discussions; there was a distribution of certificates of membership in the group; and finally, prizes were awarded at the first harvest for the greatest number of rootcrop cultivars and sweetpotato cultivars maintained and successfully replanted. This led the curators to scour the locality for additional cultivars.

From the second to the third planting there was an overall reduction in diversity (remembering again that we are for the moment taking number of cultivars as an index of diversity). As Figure 20 shows, there was more fluctuation that the overall graph indicates however, with five cultivars dropping out altogether and three new ones being added. The

second planting took place in a new site ("abandoned second planting" shown on Figure 15) which was rather exposed both to rodents and to the invasion of weeds. Both these factors influenced the absolute loss of cultivars, primarily cultivars held by only one or two women and represented by only one or two hills. Of course, the presence of weed infestation is in a sense a "secondary cause", the lack of weeding by some women being the more important cause. A major reason for low level of management was the increase in tomato cultivation during 1993, but other factors, such as discouragement at the extent of rat attack, competing obligations in the house and in some cases, the contagious effect of others' lack of attention.

The size of the fluctuation with regard to lost and added cultivars increased between the third and fourth planting although there was a reduction in overall decline in diversity to just 1 cultivar. It is difficult to understand at this stage the disappearance of eight cultivars from the genebank. One reason may be the reduced number of women who continued as curators from the third planting. Whereas between the first and second plantings as well as adding new cultivars five new members also joined, which was again sign of the positive response to the genebanking idea or at least to elements of the genebanking project. Only two women withdrew at that stage, one through illness and the distance of the genebank from her house and the other through lack of sufficient family labor. But from the third planting only the twelve "core" curators continued. Though some of the most devoted to the project, there was indication that these curators expanded the area devoted to the preferred varieties (*klarin, 5-finger, igorot pula*), and planted very few hills of the less common cultivars. The increasing demands of the commercial tomato production work also suggests that they were able to devote less time to ensuring the survival of the few hills of these other cultivars. Of the seven new additions, four came from the researchers on request from the curators (see below).

A different pattern of conservation occurred with the other rootcrops. Domesticated taro shows a slow reduction in diversity from the original seven cultivars, and with less fluctuation as between additions and losses. The additions in the fifth planting could signify the beginning of the gently fluctuating cycle (Figure 21, Table 5b). This is partly explained by the later maturity of taro, so that new plantings in the early stages drew planting material from existing plants in homegardens or fields. The later design of the genebank in which a separate cycle of replanting is maintained for the longer-maturing species of taro, yam, cassava from that of sweetpotato has improved the potential for conservation. Another factor is the greater resilience of the taro varieties to weed growth, at least one it has established, as compared with the sweetpotato varieties, leading to fewer losses.

The figures for taro only refer to the domesticated species. As part of the surge of conservation fever which gripped the women at the second planting, Mrs. Lydia Vd. de Caseres added *lima-lima, baong, kapusaw*, and *biga*, which are wild species of taro and a wild species of yam, gathered in her native island of Bohol.

Other rootcrops in the collection, that is cassava, yam and yautia, show an overall decline in diversity (Figure 22, Table 5b). The fluctuation between the first and third planting can be explained in the same way as that of taro, that is, the second planting was done before the first one had matured, so that several of the cultivars were not located to include in the second planting, but were available for the third. The continuing decline into the fifth planting can only be interpreted as loss of interest by the reduced number of curators with a smaller area. Yautia has completely disappeared by the fifth planting.

Curator conservation behaviour

General patterns

If we look at curator behavior rather than genetic diversity -- i.e. the additions to and losses from particular plots, irrespective of duplication -- we see somewhat different patterns. In the case of sweetpotato, there is a quite regular fluctuation over the five plantings, with an overall increase in the average diversity of individual plots (Figure 23). An average of just under four cultivars per person planted initially (with a range of from 1 to 8) rose to a high average of seven (ranging from 2 to 12). A main explanation for the big increase at the second planting is the prize given for greatest genetic diversity offered at the first planting harvest. The increase at the fourth planting is harder to explain. It is partly due to the reduction in number of curators and their inclusion of a larger number of cultivars on average than at the beginning. But the most dramatic reduction in numbers occurred at the third planting, where there is much less reflection in the average number of cultivars. A main explanation is the inclusion by the reduced number of women of new cultivars, either ones obtained during cross visits with the other *in situ* sites or requested and received from the researchers.

The overall pattern of diversity management by the women curators for taro follows an and quite different pattern than that of the overall diversity(Figure 24). The explanation for the increase over the second and third plantings is partly due to the enthusiastic inclusion of existing taro diversity into more individual plots, but also the sharing of planting material among curators, especially amongst the smaller group involved in the third planting. Again, the gradual decline in average numbers of cultivars over the fourth and fifth plantings seems to reflect a shift in priorities by the reduced number of curators in their smaller plots.

The situation with other rootcrops reflects a similar pattern to the shifts in overall diversity and for the same reasons (Figure 25). The decline is certainly clearer than in taro and probably reflects on the one hand the use of one or two varieties of cassava in commercial field production and thus disinterest in other varieties and on the other, a lower prioritization of both yams and yautia as compared to taro. Yam does not grow very well in this area and almost no output was obtained from the yams that were planted.

Genebank rescue

Some of the women associated with the Dalwangan genebank attended the first harvest at Maambong site as part of the initial process of stimulating involvement and encouraging exchange of experiences between the two sites. This was a much appreciated opportunity to interact with people in an unfamiliar area, observe the way the other genebank was functioning and obtain cuttings of unknown cultivars to try out back home. But because they had already lost faith in the head of the curator household, they planted these cuttings in their own home gardens. In particular, one of the women accumulated a large collection based on her previous cultivars, those rescued from the genebank and those obtained during cross-site visits.

The recovery of the Dalwangan genebank through the individual efforts of this one woman relative was short-lived. This woman became sick and a large number of the rescued cultivars were lost.

Understanding conservation dynamics

Loss of interest

In the preceding section the level of enthusiasm, the "conservation fever" which gripped some of the curators, was mentioned. This commitment developed out of many factors, many of which were already discussed in Part I. Clearly, that commitment was not uniformly distributed among the women and intervening events and situations had variable impact on the willingness of women to continue their involvement. For some of the curators a pregnancy signified less regular tending of the plot close to the birth and then during the nursing of the newborn. For others this was a good reason for the abandonment of the plot and with it the cultivars. Distance between home and genebank was another factor, decisive for some in their withdrawal, yet not big enough to deter others. In the case of Maambong, loss of interest and consequent withdrawal from involvement is a complex and relative phenomenon. The distance away from the genebank, the domestic obligations at that time, especially the number of young children, the level of economic precariousness of the household, the presence of absence of the husband, as well degree of understanding of the project and level of personal commitment and energy all combine together to determine if and when "loss of interest" will occur.

The situation was rather more clear cut in Dalwangan. The male head of the de facto curator household lost interest in the complexity of a genebank itself. He said that he would plant *igorot puti*, *igorot pula* and *kalibre* because the thinks they have the best market potential. He said that one to three varieties would be ideal since you can give them the proper attention. When you have lots of varieties, on the other hand, you have too many to maintain and it creates too much complication. Other varieties which are not high yielding would become merely a "decoration" since you cannot get a good yield from them. This is the kind of loss of interest which for some people is the most likely outcome

of *in situ* conservation efforts. The reduction of diversity to the narrow dictates of the market.

Small numbers of plants

In the discussion of cultivar losses in Maambong and Dalwangan, the disappearance of accessions with only a few hills has already been mentioned. Where this occurs in a unitary genebank such as Dalwangan the chances of wholesale losses are very great. What minimized the losses in Maambong was the fact that frequently several women had a few hills of particular cultivars, so there was more chance of them surviving. What was not clear and still needs greater study, is why some cultivars did not find their way into several plots, but remained in only one or two plots from which they were then easily lost.

Sources of new material

For all genebanks except Dalwangan, the locality was the main source of initial cultivars planted(Figure 26). Since Maraging is in fact a hamlet, most cultivars came from other hamlets in the barangay rather than Maraging itself. The location of the Dalwangan site close to the *ex situ* site where the province wide collection is maintained meant that they had an alternative source of diversity very close by.

For the second and subsequent plantings other sources came into play, especially other barangays in the area, including the other genebanks, through the cross-visits which were made by some members of all genebanks. A source of new cultivars for the third planting of the Maambong site was the research team itself: four varieties were distributed, including a PNG selection, two local selections from northern Philippines, and a Seed Board variety.
When particular curators in Maambong obtained new cultivars from the different sources, some fellow curators obtained cuttings to evaluate the varieties themselves. This is still occurring on a small-scale and rather unevenly. In the case of a requested "carrot-like" variety which the researchers were able to make available, the expected multiplication and distribution of it occurred on a limited scale. One explanation may lie in the different understanding of genebank "redundancy" held by curators and researchers.

Redundancy in local genebanks

The repeated planting of locally known cultivars by the different curators introduced considerable redundancy into the Maambong genebank and the same is occurring in Mauswagon. This is a positive element that reduces the risk of erosion. The second planting in Maambong showed no loss of genetic diversity (Fig. 20) even though three duplicated cultivars were lost by the curators (Fig. 23). The third planting had an actual loss of five cultivars, even though a total of 26 cultivars were "lost" by curators. If we compare the situation with that in Dalwangan, we see that the 29 cultivars lost there

were gone for good (at least as far as the local genebank was concerned). On the basis of this experience, we feel that redundancy should be built into local genebanking, requiring a model of semi-independent curator associates rather than a single pooled group genebank.

However, there may be a different perception of redundancy on the part of the curators. One explanation for the limited diffusion of newly introduced cultivars among curators is their perception that the cultivar "already exists" in the genebank, so why worry about duplicating it. All curators want to have the main cultivars, because they will be harvested and eaten. But the value of duplicating to prevent inadvertent loss seems not to be recognized.

Evaluation and use of diversity

Dalwangan

Despite the unwillingness of the tribal authority to become involved in the Dalwangan genebank and the generally low level of community participation, the head of the household that became the de facto curator unexpectedly took an interest in evaluating a number of the genebank accessions. To limit the space occupied by the genebank, the original planting had been very dense, with narrow spacing between cuttings. This created an unnatural environment for the cultivars, according to the curator, making evaluation very difficult. He therefore planted out three cultivars, which appeared promising, in a bigger area for more detailed evaluation.

Evaluation and selection also took place as part of the "genebank rescue" by one of the original curator group. Initially, she did not choose all the varieties present in the collection because some of them did not pass her "criteria" of "good" sweetpotato varieties. The varieties she chose were: *sugahak, amerikano, turay, si-uron, kapayas and kalibre, igorot puti, igorot pula.* The last two were varieties she got from the other project site, Maambong, Libona. Some of the characteristics she used in her evaluation of sweetpotato cultivars are:

- early maturing;
- does not die easily;
- high yielding (less of vegetative growth);
- and stomach filling which can substitute rice and other staple food.

The first group of materials served as her observational trial where she tried distinguishing varieties which performed well based on the above mentioned criteria. In a short span of time that she planted the clones, she was able to give some planting materials to two other mothers in their area. Until now she is still looking for other varieties which can be added to her collection.

Community genebanks must show a concern for utilization as well as conservation. This has been a major preoccupation for some genetic resources specialists and a reason for dismissing *in situ* or community genebanking. Our own concept of local genebanks is one that is genetically dynamic rather than static, where novel material (mutated or

introduced) is evaluated for its potential for wider cultivation and where some material will inevitably disappear. This is both a very positive reason in favor of community genebanks -- their capacity to generate new landraces through the evaluative and selection procedures of local experts -- and also an argument in favor of the complementarity of *ex situ* and *in situ* conservation.

Maambong

There was a particularly strong incentive for the type of evaluation that occurred in Dalwangan because many of the cultivars pooled by community members were unfamiliar to the curator household. Spontaneous evaluation did not appear to occur in Maambong, mainly because most of the cultivars planted by the individual members were already known.

In response to curators' requests for "carrot-like" varieties of sweetpotato, researchers also introduced four exotic cultivars into the Maambong genebank for evaluation in the fourth planting: P16, a selected local cultivar for Mount Pinatubo; NPSP, a local selected cultivar for the Cordillera region of the Philippines; UPLSP, a Philippine Seed Board Variety, and PNGL, a variety from Papua New Guinea. P16 was given to all curators, but the rest were distributed according to availability of space, since other cultivars had already been planted.

Out of the 13 curators with plots in the fourth planting, only four still had P16 during the evaluation at the time of harvest. Two still had UPLSP and one had PNGL. Many of the UPLSP and all NPSP cuttings died. Both were found to be very susceptible to scab. The carrot-like P16 survived better and is valued for early maturity. The four curators who had it at the evaluation replanted in the fifth planting and some cuttings were given to other curators.

Mauswagon and Maraging

As with curators from Maambong and Dalwangan, the new curators from Mauswagon and Maraging were given the opportunity to visit the ex-situ genebank, where accessions from their own genebank were planted, together with a large collection of other accessions from the Province. Cuttings were selected by them, usually on the basis of familiarity and replanted in their genebank. Follow up monitoring will determine whether any of the cuttings obtained in this way will be successfully incorporated into either the Mauswagon or Maraging collections.

Issues and lessons

Types of genebank and curator group

One of the first lessons from the experience with the Dalwangan genebank was that "single unit" genebanks, even when managed by a group, are vulnerable to losses, especially of less common accessions which are represented by only a few plants. Conversely, the presence of redundancy created through a multi-unit collection can help to safeguard against losses. Nevertheless, it was noted that advantages of duplication need to be spelled out and discussed with curators, since some evidence from Maambong suggested that whereas redundancy will readily occur in the more common and popular varieties, the existence of a less common cultivar in someone else's plot might be taken as a reason for not including it with in their own plot.

It was also seen that single unit collections are even more vulnerable if they are managed by an individual or by one or two persons within a family. The very encouraging partial "rescue" of the Dalwangan collection by one of the women members was later undermined when that women became sick and was unable to look after the collection.

The future of the two newer genebanks at Mauswagon and Mariging will need to be considered in light of these lessons. The multi-unit arrangement in Mauswagon with each unit having several women curators looks like a very stable and sustainable arrangement. The extended kin/neighbour group in Mariging with a single genebank in the homegarden of one member, could be vulnerable.

One additional advantage of a multi-unit arrangement, at least on the basis of current experiences, is that it helps to build enthusiasm, a mild and advantageous competition and encourages exchanges evaluations and to some extent, diffusion of new entries. However, we need to be cautious in this assessment, in light of the Maambong experience. There was less exchange between curator partners than we expected on the basis of experiences form other research projects (Prain et al 1991).

It became apparent that the "density" of relationships linking curators involved in genebanking, that is, the multiplicity of kinds of relationships between group members, is very important for binding them together and facilitating their mutual support. In the case of Maambong, this was more important than any organizational structure and formal leadership.

However, the lack of local legitimacy in Maambong has been an important factor against its sustainability. The recent election of one genebank member to the Barangay Council has been a positive development, but it is still a very limited level of formal integration in the locality. The opposite case of Delwangan, where the original conception was to align the genebank fully with the local authority, did not work however, probably because that authority is strongly focused on relatively short-term livelihood activities and projects, both to build and consolidate their local political support and also to bring material benefits to themselves. It very quickly became apparent in Dalwangan that *in situ* genebanking was not that kind of thing.

Mauswagon offers an intermediate circumstance which again looks very promising. The women's Rural Improvement Club is a local project promoted by the Department of Agriculture and fully integrated into local government activities. It enjoys the legitimacy of the local authority without carrying the political baggage, or at least, not much of it. It is used by that authority - a showcase for the mayor for example - but is also supported by it. More time is needed to see how this optimistic scenario works out.

Evident in Mauswagon and much more so in Maambong is the fact that multi-unit collections with multiple curators entail a great diversity of knowledge about cultivars and different ideas about conservation. This has both advantages and disadvantages. Those with longer term vision and understanding about the need for conservation of genetic diversity can be very important spokespersons during meetings. They can communicate to their partners the power, importance and also the responsibilities and obligations of the local curators in the project, the fact that it is their project. On the other hand, some participants retain a dependent attitude towards the researchers and a limited grasp of long term conservation.

Conservation ideas and practice

In terms of practice, the results show quite clearly that *in situ* conservation is dynamic! In most of the rootcrops, curator behaviour tended to show a cyclical pattern of loss and addition, though five plantings is still a short period to understand this. In terms of the dynamics of crop genetic diversity, in as far as we can measure this on the basis of numbers of cultivars, the picture is variable for different crops. For sweetpotato, the trend may also be cyclical, but over a longer period. This may also be true of taro. For the other rootcrops, and for different reasons, the trend is not very encouraging. Part of the blame for this may lie with the researchers, for whom sweetpotato is the main interest and about which most documentation and discussion took place.

A second point is that on the basis of the *ex situ* evaluations of the material held in the different *in situ* genebanks, the diversity seems quite high, or at least, there is quite a range of morphological characteristics. On the other hand a large number of cultivars seem to be very close genetically. More work on the *ex situ* site is needed for this.

Conservation is still very local. None of the genebanks yet reflect even the range of diversity found in Bukidnon and kept in the *ex situ* site. Relatively little material has been introduced by curators following their visits to other areas. Consequently the 'local R&D" aspect of the genebank has not yet been very much exploited. Though planting materials have been drawn from the genebank by curators for their field plantings, relatively little material has been requested by non-curators for evaluation, or been introduced by non-curators after seeing performance in the genebank and hearing the recommendations of curators. This is an aspect in need of further work.

We are still a long way from understanding why losses occur and what their genetic significance is. Do the three or four varieties which is found in most plots in Maambong represent a narrow or very broad segment of the available genetic diversity in this region? Do losses represent indifference to poorer quality cultivars, bad luck, or mismanagement? We have responses from curators on at least the latter question, and all three reasons enter as factors for different women.

One failure of the project so far is the lack of a mechanism for *in situ* conservation of indigenous knowledge of the accessions. We hold a "memory bank" of this knowledge *ex situ* in the UPWARD office, but a major effort is needed to design a useable and durable means to maintain this local resource in the locality

The key to the sustainability of community-based genebanking is the way people think about conservation. In particular, it concerns 1) the way conserving is related to using and 2) the social and economic benefits derived from conservation/utilization compared with the opportunity and other costs incurred in conservation. Furthermore, this relationship has to be understood in the context of inter- as well as intra-specific diversity conservation. This became very evident when we conducted a simple experiment with the women curators in Maambong.

A quick, incomplete collection of leaf and/or fruit or root samples from the garden areas of the settlement was used to stimulate a discussion of diversity and conservation. The collection yielded almost 20 different cultivated species. The women explained that the crop diversity had increased significantly for many households over the past 30 years as exotic vegetable species had been added to well-conserved local crop and tree species. Maintenance or expansion of these species, almost all grown in the home gardens, reflects a strategy of cropping flexibility for multiple uses. Tree crops growing near the house give a regular, dependable supply of fruit for house or market at different times of the year. Garden crops are tended for the household and field crops mostly for market opportunities and/or as staples (corn in this system).

Varietal diversity also provides flexibility. The range of characteristics possessed by different cultivars makes them not only suitable for different uses (food, feed, market, etc.) at present, but also adaptive to ecological and socioeconomic changes over time. Varieties that appear of little importance today may have potential uses in the future, for example in household or industrial processing.

Whereas species diversity in the Maambong area has slowly increased over the past 30 years, there has been a decline in intra-specific variation in maize for example, and in sweetpotato (Figure 27). This seems to reflect prioritization choices being made by local people under pressures created by modern farming conditions and the increasing need for earning a cash income. Even though there is ample evidence from the women in both the Dalwangan and Maambong sites that they recognize not only the pragmatic advantages of intra-specific conservation but also the more diffuse need to make sure "different varieties will become...known (and) recognized by our children and our children's children," it appears that some women find they have no time for the

management of multiple cultivars, but do seek to maintain and even expand species diversity for the added commercial opportunities some species offer.

Genebanks and gender

Are women more diversity-conscious than men? The probable key role played by women in plant domestication and agricultural development through the transformation of their food collecting into seed selecting and garden planting activities (Harris 1969); the strong, present-day links between women, seed management, and indigenous knowledge of landraces (Mula 1992); and the close association of women with genetically diverse home gardens (Midmore et al. 1991) strongly support the possibility that they are more diversity-conscious than the men are. On the other hand, there is also plenty of evidence of male expertise and passion for genetic diversity (Levi Strauss 1966).

Several developments in the genebanking project also highlight the particular affinity between women and conservation. One is the growing enthusiasm demonstrated by the women's group in Maambong, but the RIC in Mauswagon and the women kin in Maraging for the curator role and the readiness of many members to associate the activity with the security of their children[8] [7]. Another development has been the way the curatorship of the Dalwangan genebank gradually, by default, passed on to the female family members, female relatives, or female friends, and ultimately, the way one of these women independently rescued a part of the diversity and began her own genebank, once it was clear that the original arrangement under the male authority was not going to survive. More generally, the closeness and mutual support of the women's group in Maambong continue to inspire the establishment of community genebanks.

the role of homegardening

A reason for the women's greater interest and skills in diversity conservation may derive from their frequent close association with home gardening. Often, the purpose of gardens is to maximize the range of inter- and intra-specific diversity, utilizing as many "tiers" as possible with trees and crops in imitation of the tropical forest (Geertz 1963) and as many landraces as possible to maximize nutritional and culinary benefits (Ninez 1985 Mula and Gayao 1991).

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[8] Unfortunately, we lack a systematic evaluation of male and female ideas and perceptions of crop genetic diversity before genebanking began. A comparison of the present situation will be conducted, however, to evaluate the impact of genebanking on different groups in the local population

[7]

One diagnostic element then in determining the feasibility of community genebanking may relate to the kind of management of home gardens or other sites of plant diversity that exist in an area. We should not forget that many socioeconomic and cultural circumstances can undermine both the capacity for and interest in management of home gardens, a fact that has negative implications for local-level genebanking (cf Verdonk and Vrieswijk 1992). It may be that a community genebank may function better as a small number of home gardens rather than as a large communal plot with all the organizational complexity this entails.

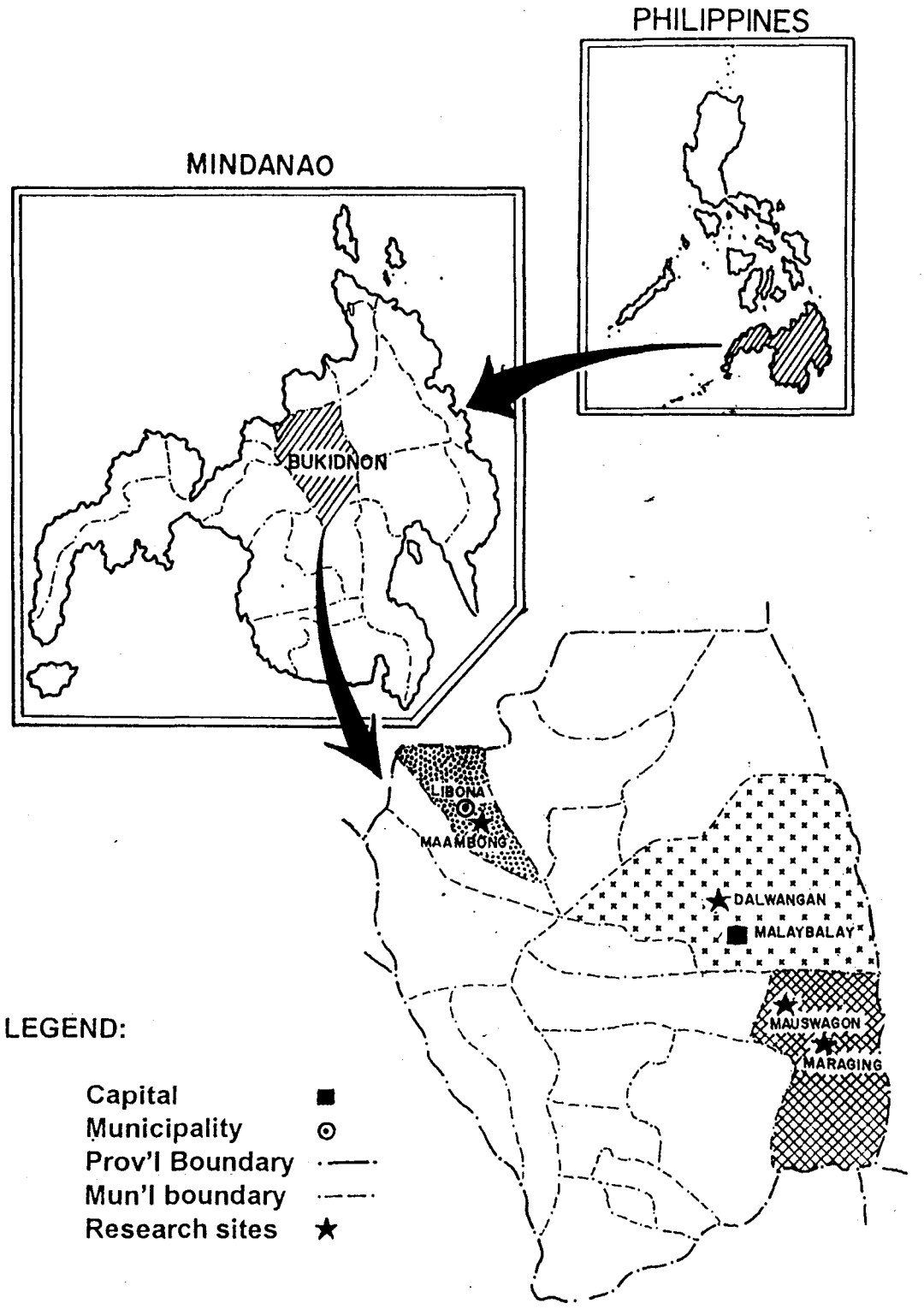
An advantage of the Maambong genebanking model is the way it mimics the familiarity, flexibility, and household basis of home gardening, while at the same time benefitting from the support and spirit of the group. Yet the homegardening model has perhaps not been sufficiently exploited in Maambong, thus reducing the utilitarian side of the project. In Mauswagon, the approach is explicitly duel track, involving both conservation and homegardening for family nutrition and small income generation. Consequently the genebank includes a range of other crops including vegetables and legumes for use in the household. Future project activities should aim to support both elements if either is to have a chance of long term viability.

Conclusions: actions needed

The following actions are needed as follow -up or follow-on from this activity:

- gender-sensitive analysis of changing perceptions of crop diversity conservation under impact of program
- improved technical assessment of genetic diversity under conservation and relation to losses, including identification of duplicates in the *ex situ* collection
- socio-cultural analysis of losses - is there a pattern
- support establishment of *in situ* memory bank
- validate and support species conservation and enhancement and link conceptually with cultivar diversity
- contribute to legitimation and diffusion of conservation beliefs in community

- evaluate niche marketing and green marketing options as well as encouraging more conventional use and marketing of homegardens produce for giving shorter-term livelihood dimension to conservation effort.



Location map of study areas in Bukidnon, Philippines.

Figure 1 Factors leading to loss of crop genetic diversity

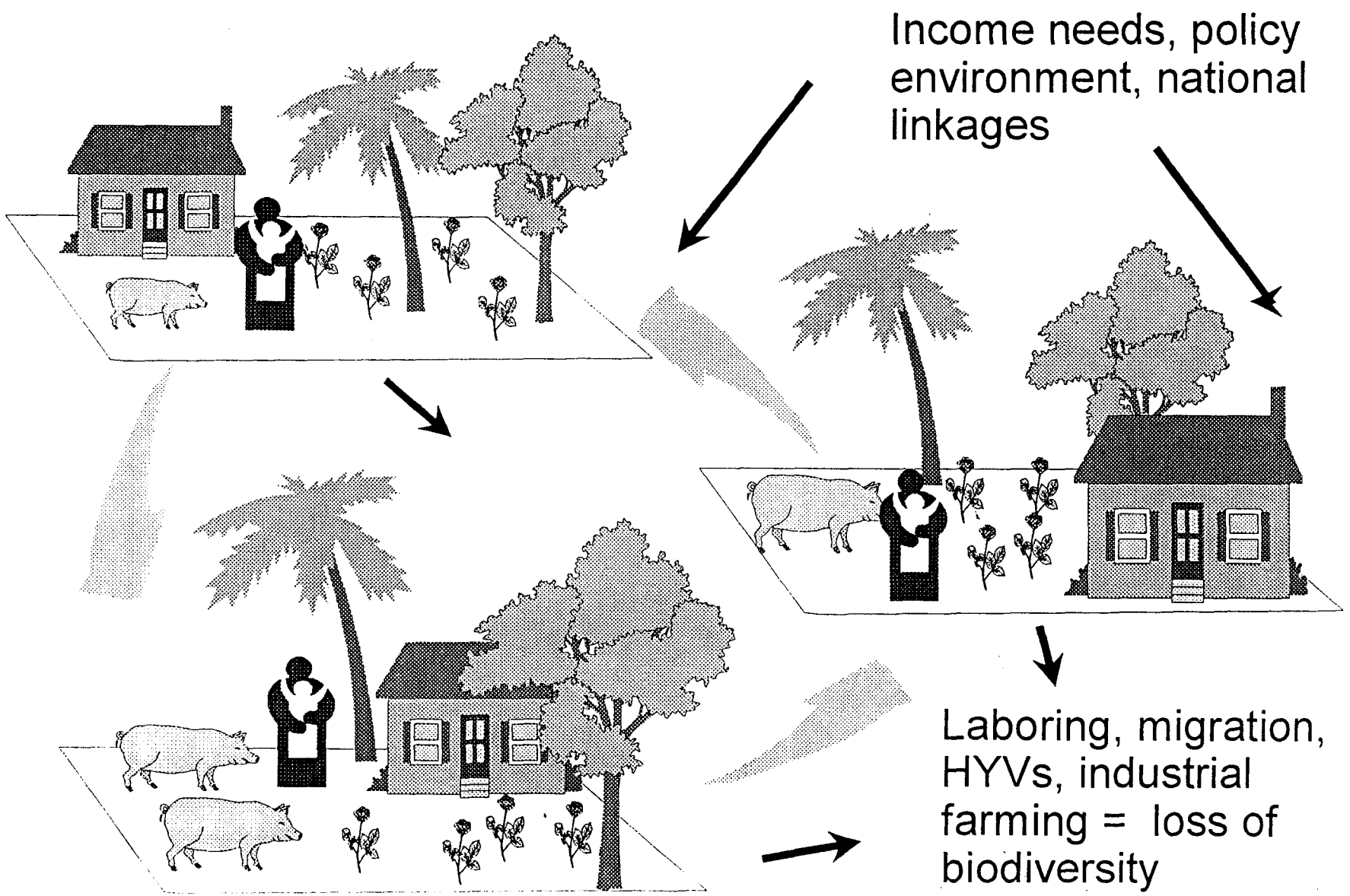


Figure 2 "Scaling up" the conservation/experimentation effort

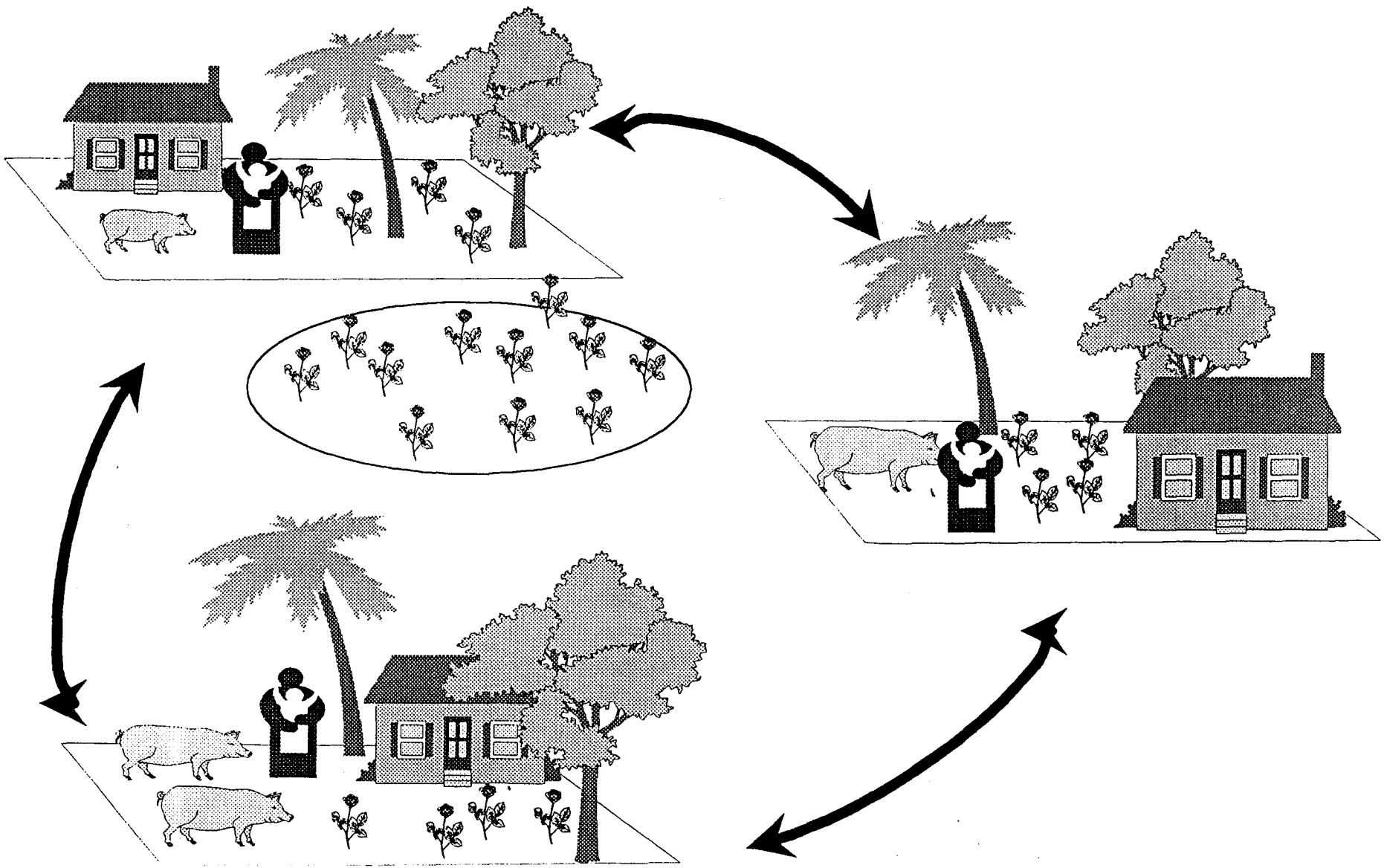
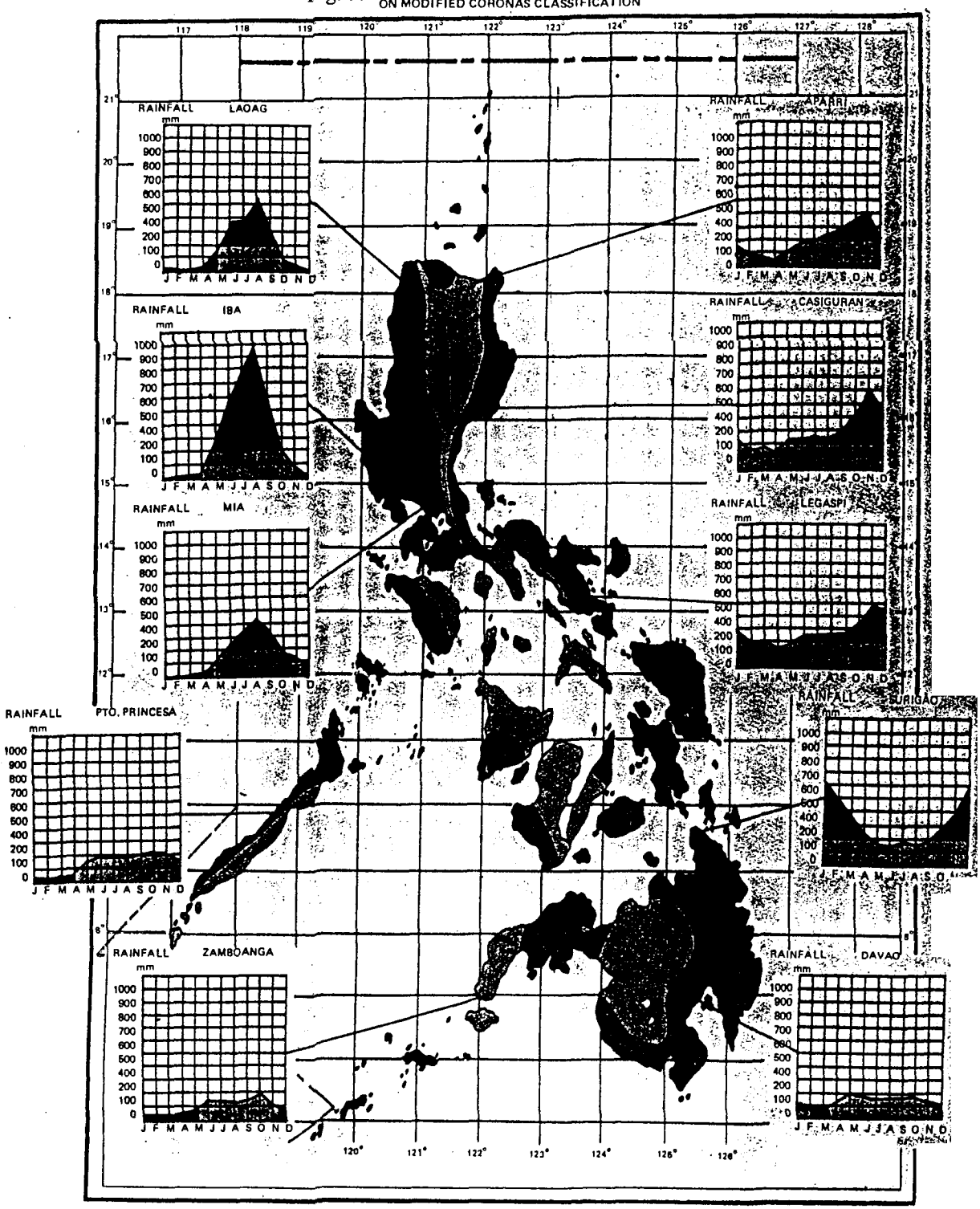


Fig. 3. CLIMATE MAP OF THE PHILIPPINES BASED ON MODIFIED CORONAS CLASSIFICATION



LEGEND:

Normal Rainfall
Wat Period
Growing Period
Dry Period

LEGEND:

TYPE I – Two pronounced seasons: dry in winter and spring, wet in summer and autumn

TYPE II – No dry season with a very pronounced maximum rain period in winter.

TYPE III – No very pronounced maximum rain period, with a short dry season lasting only from one to three months.

TYPE IV – Rainfall is more or less evenly distributed throughout the year.

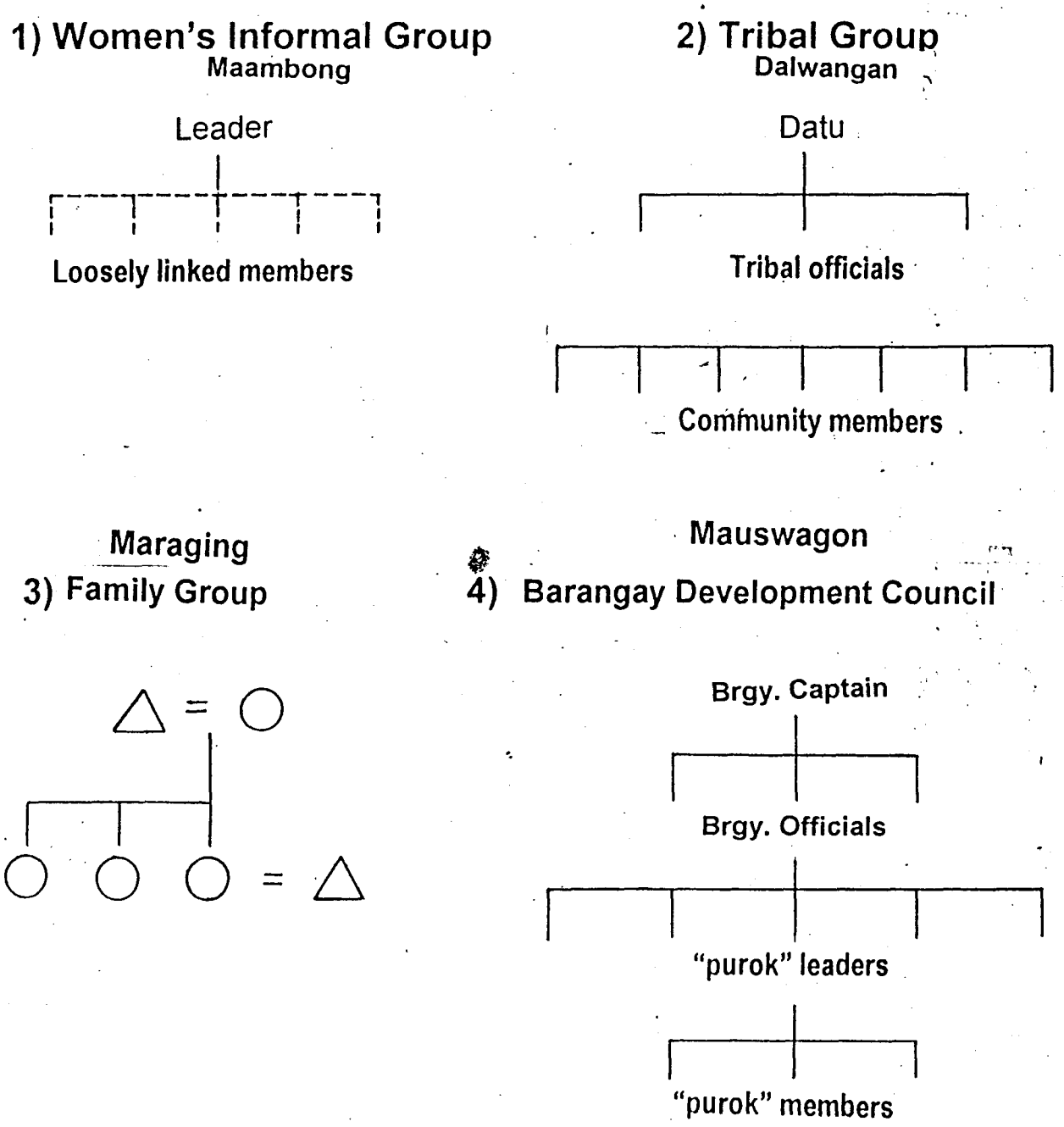


Figure 4. **Anticipated structure of the four curator groups**

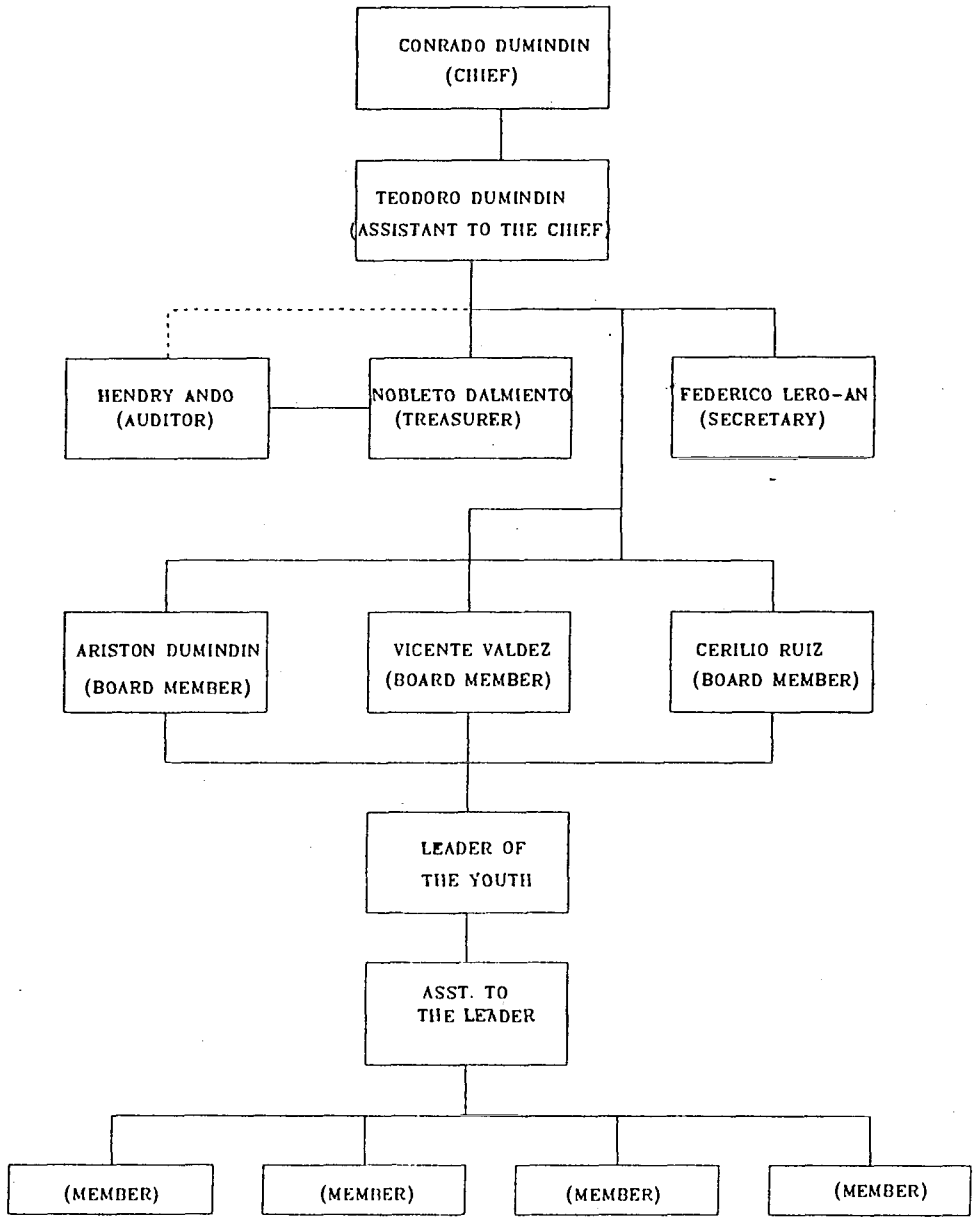


Figure 5. Proposed structure of management of "Kauyagan ho Kahilawon" in Dalwangan, Bukidnon, Philippines.

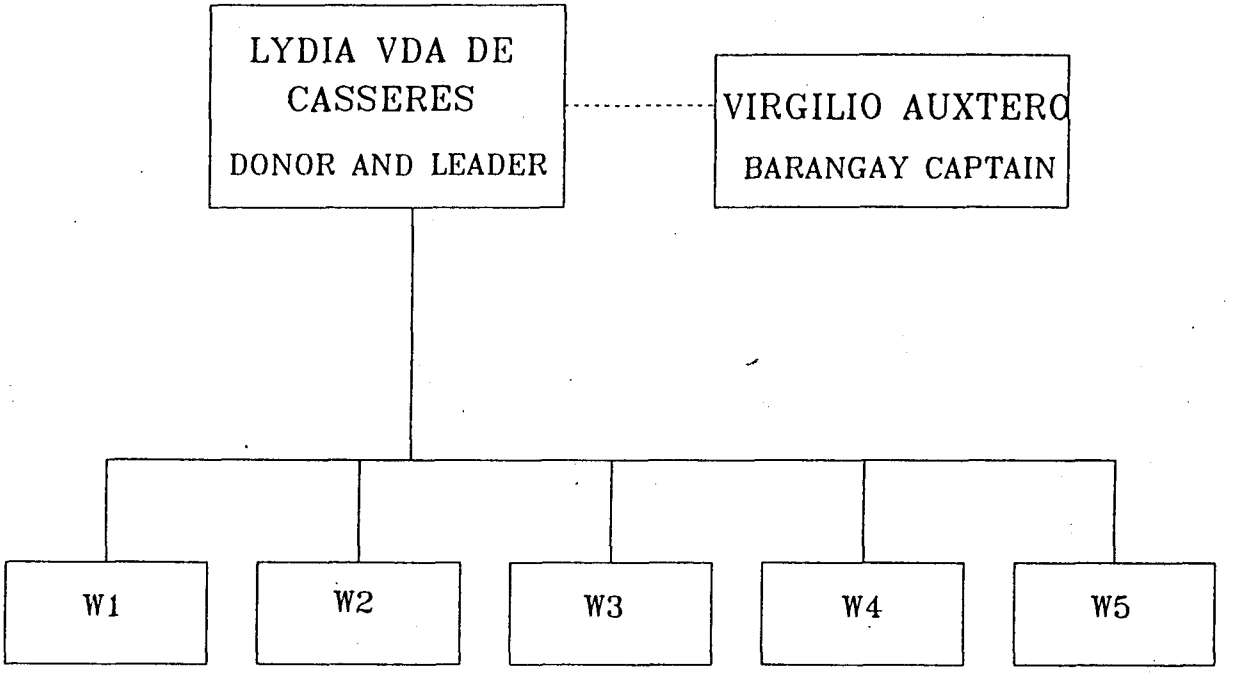


Figure 6. Proposed structure of management of "Inahan nga Makugihon" in Maambong, Bukidnon, Philippines. W1 - W5 = the women who will be involved. The barangay captain will be responsible for land preparation and will oversee the project as ex officio member of the management organization.

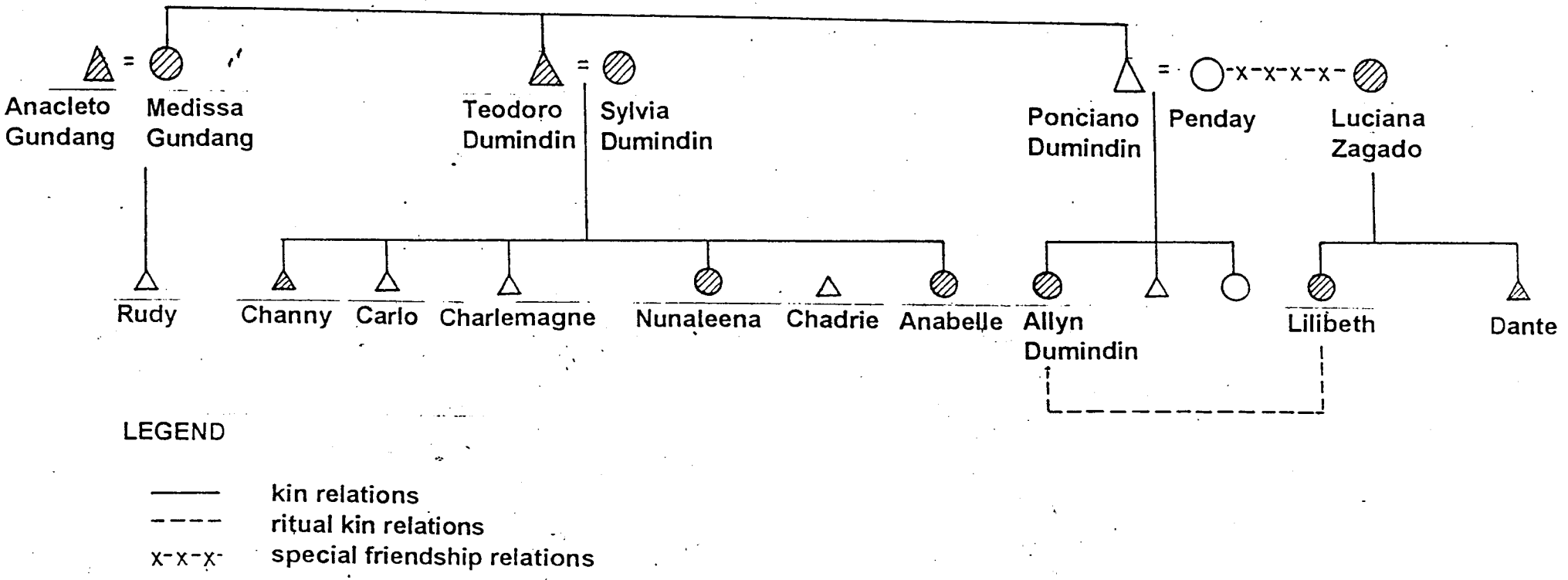


Figure 7. Relationships in the de facto curator group of Dalwangan genebank.

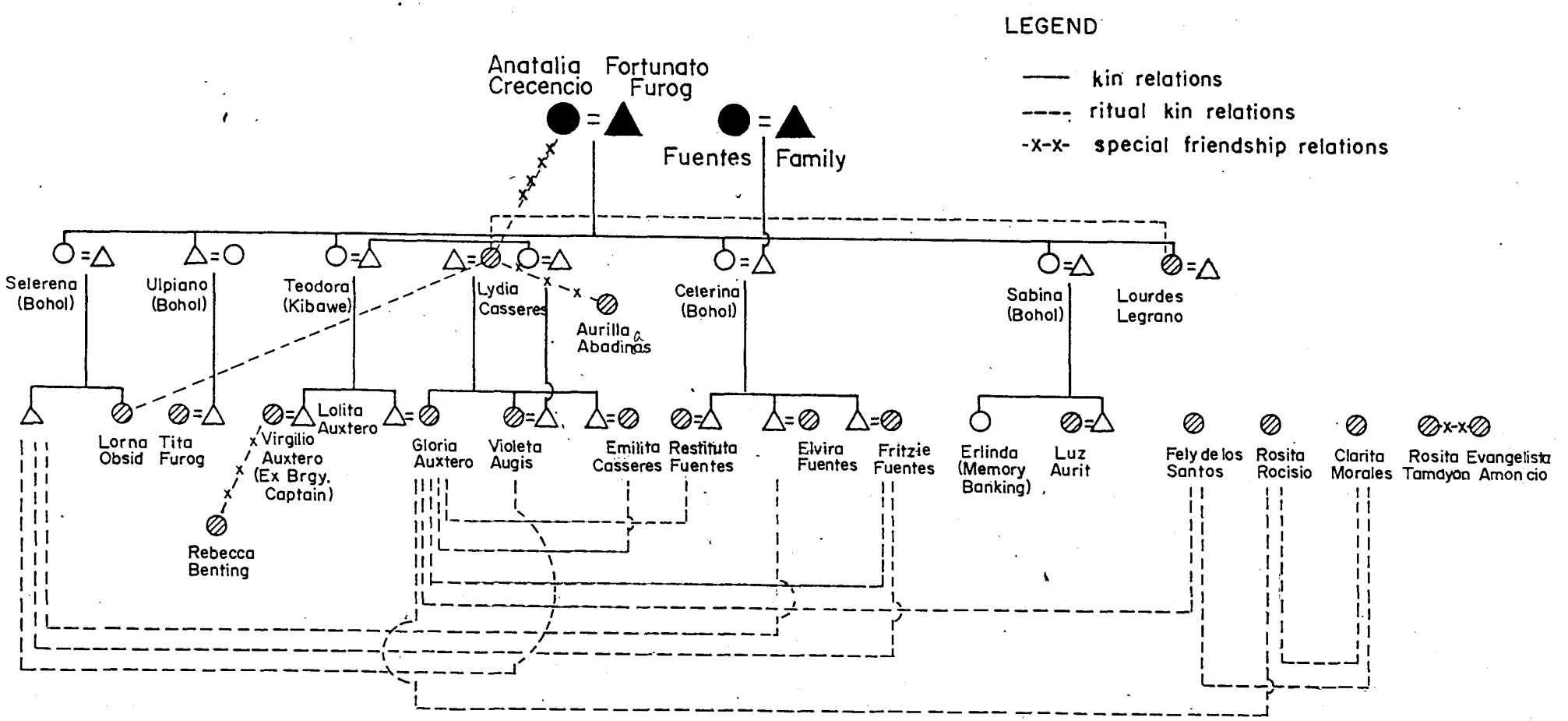
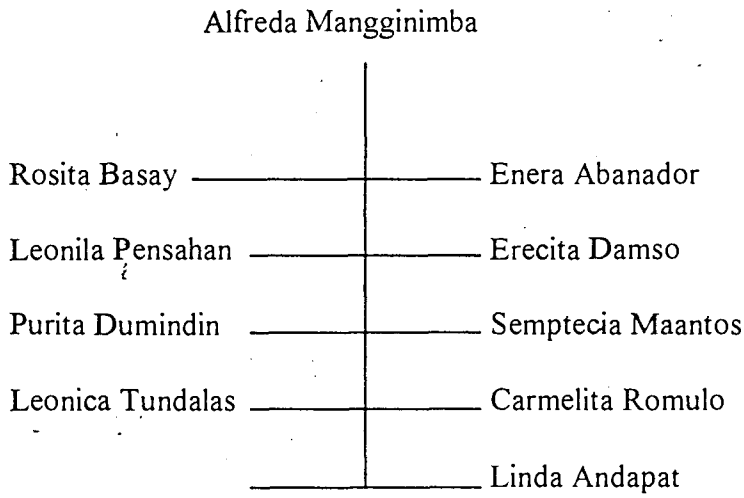


Figure 8. **Relationships in the de facto curator group of Maambong genebank.**

Figure 9. De Facto Members of Maraging Curator Group

First Planting Group



Other Members:

Remedios Tambag	Rosalinda Anglao
Emma Diahan	Efifania Degaila
Soledad Tambog	Beatriz Tambog
Letecia Pimentel	Delia Ampoeda
Antonita Mangginimba	Aida Diahan
Sosima Lihutan	Arsenia Lihutan
Meraluna Tambog	Carmelita Pimentel
Bebang Fernandez	Milagros Gayao

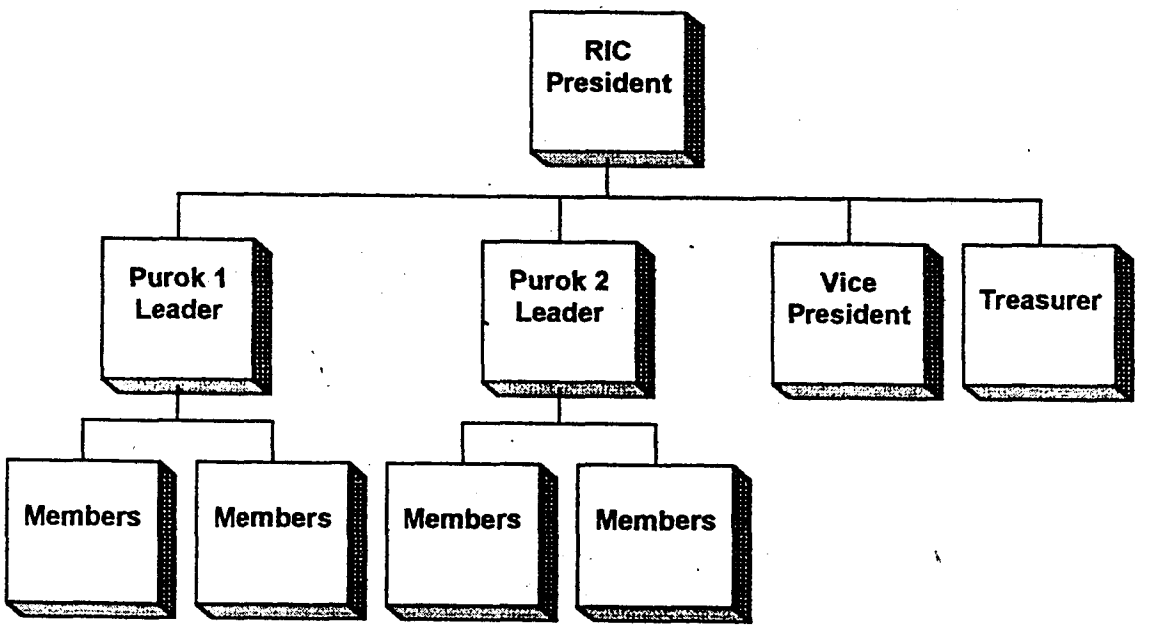
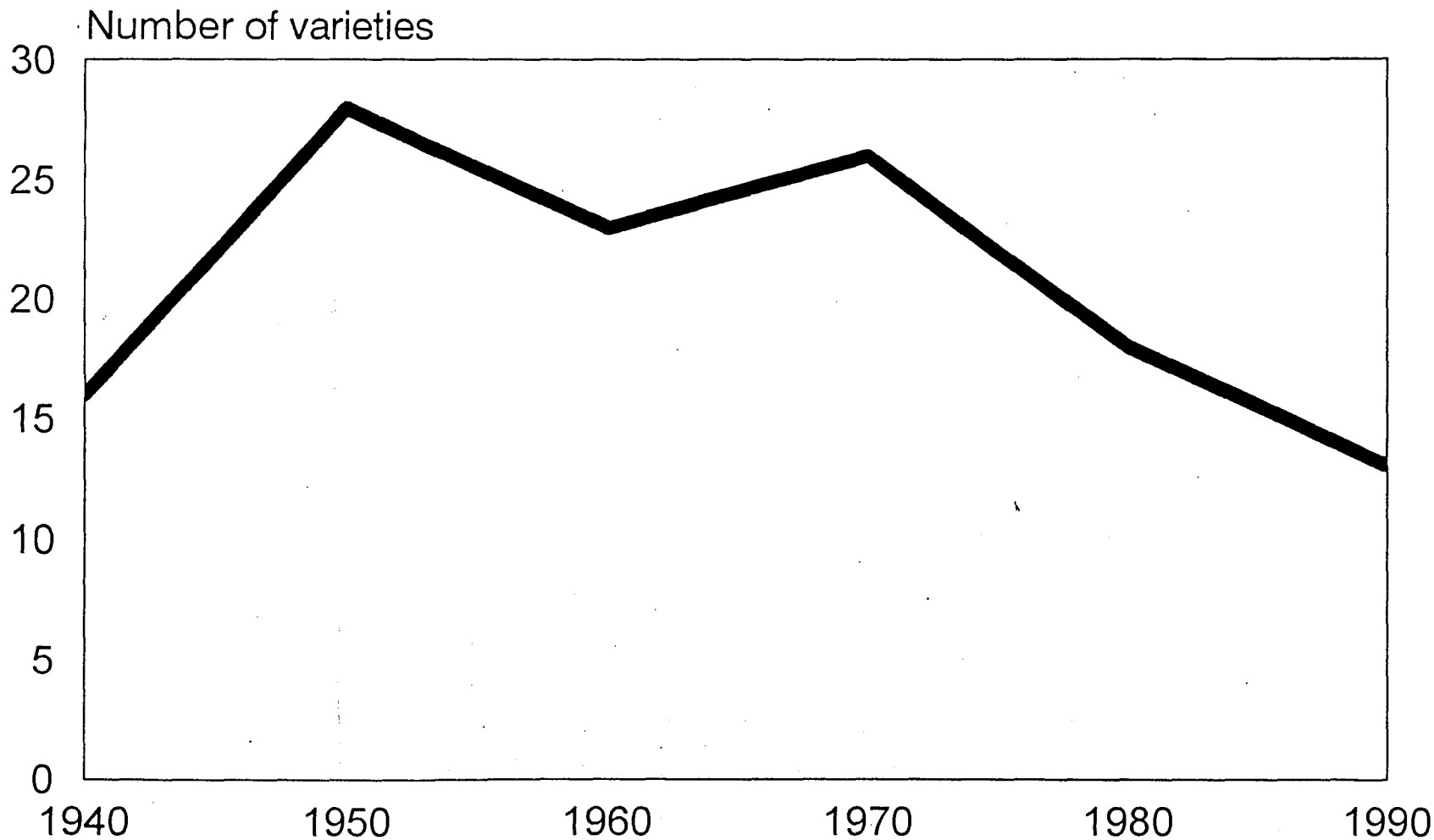


Figure 10. De facto organization of Mauswagon genebank.

Figure 11. Number of varieties planted over past 50 years in Dalwangan



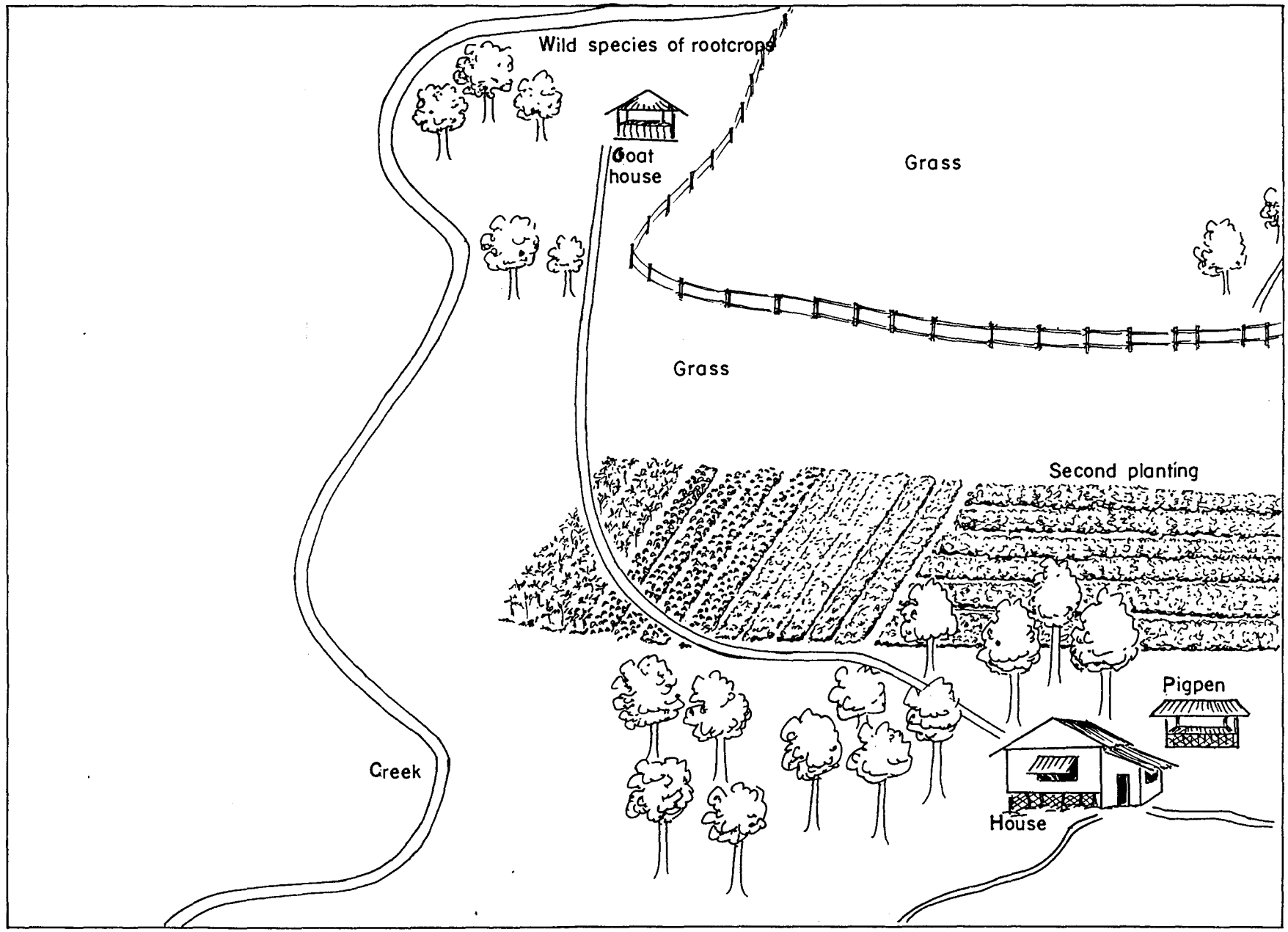


Figure 12. Dalwangan genebank, Bukidnon, Philippines.

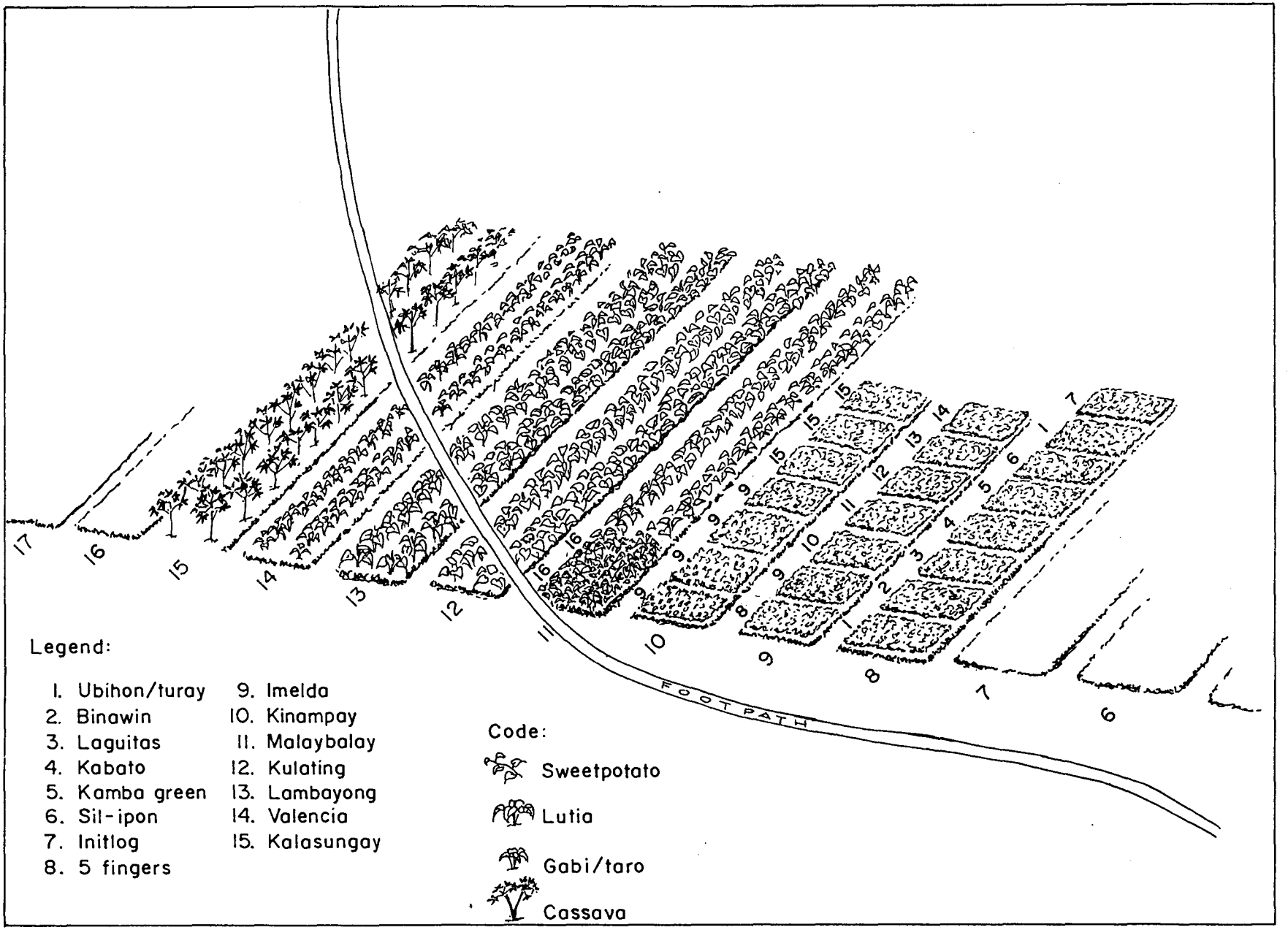
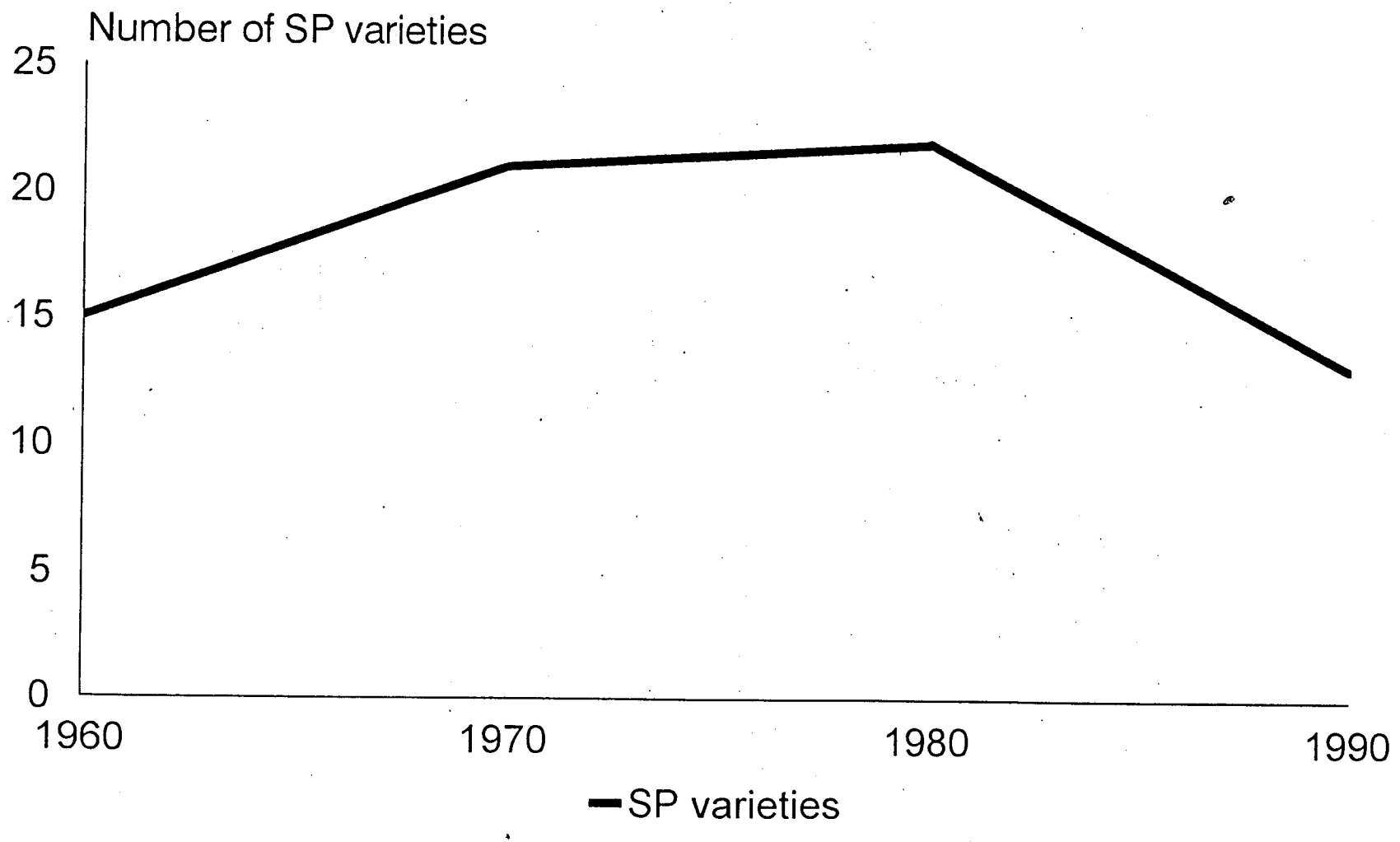


Figure 13. Part of "Kauyugan no kahilawon," Dalwangan, Bukidnon, Philippines.

Figure 14. Changing number of sweetpotato varieties in Maambong, 1960 - 1990



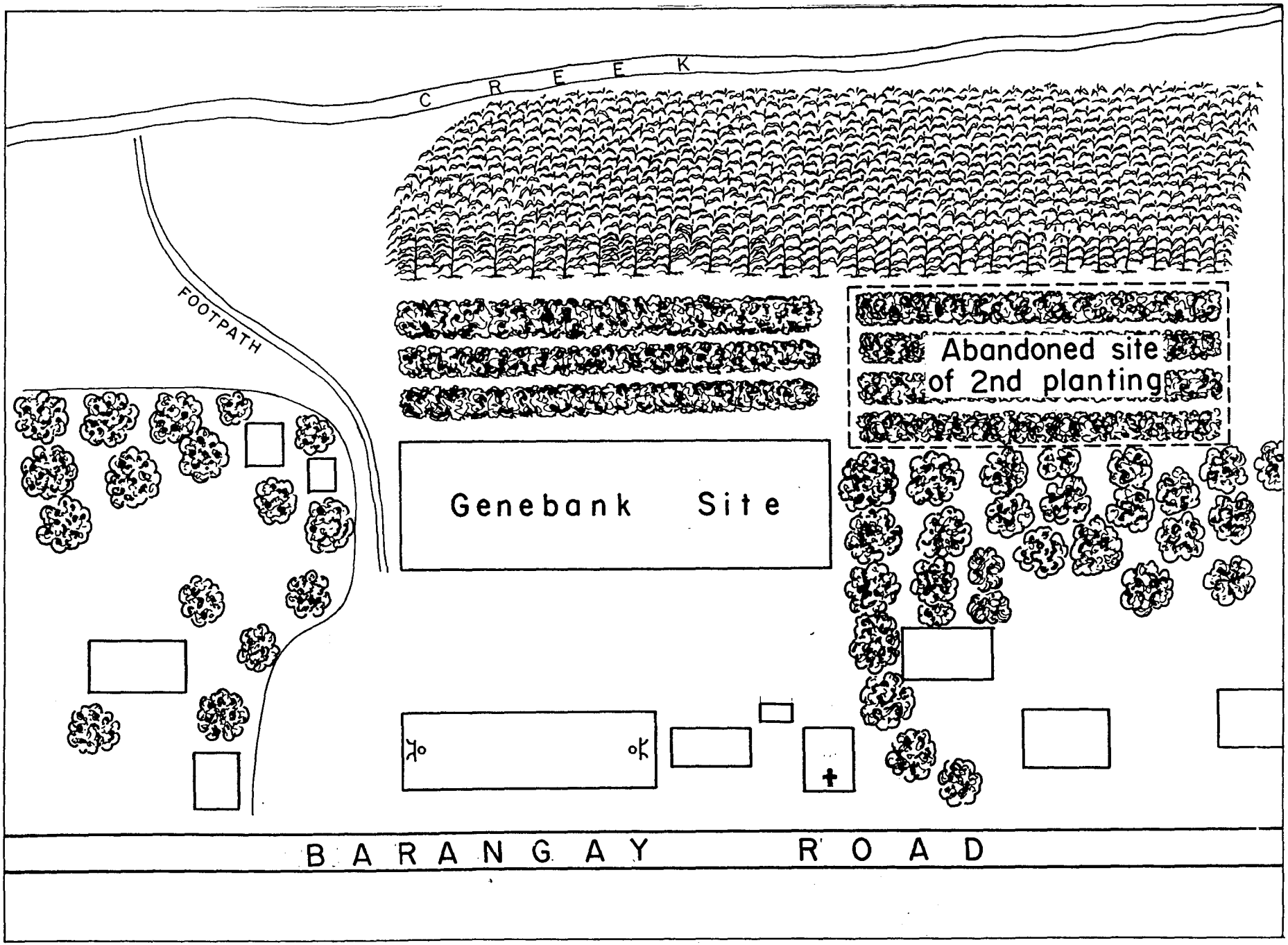


Figure 15. Maambong genebank, Bukidnon, Philippines.

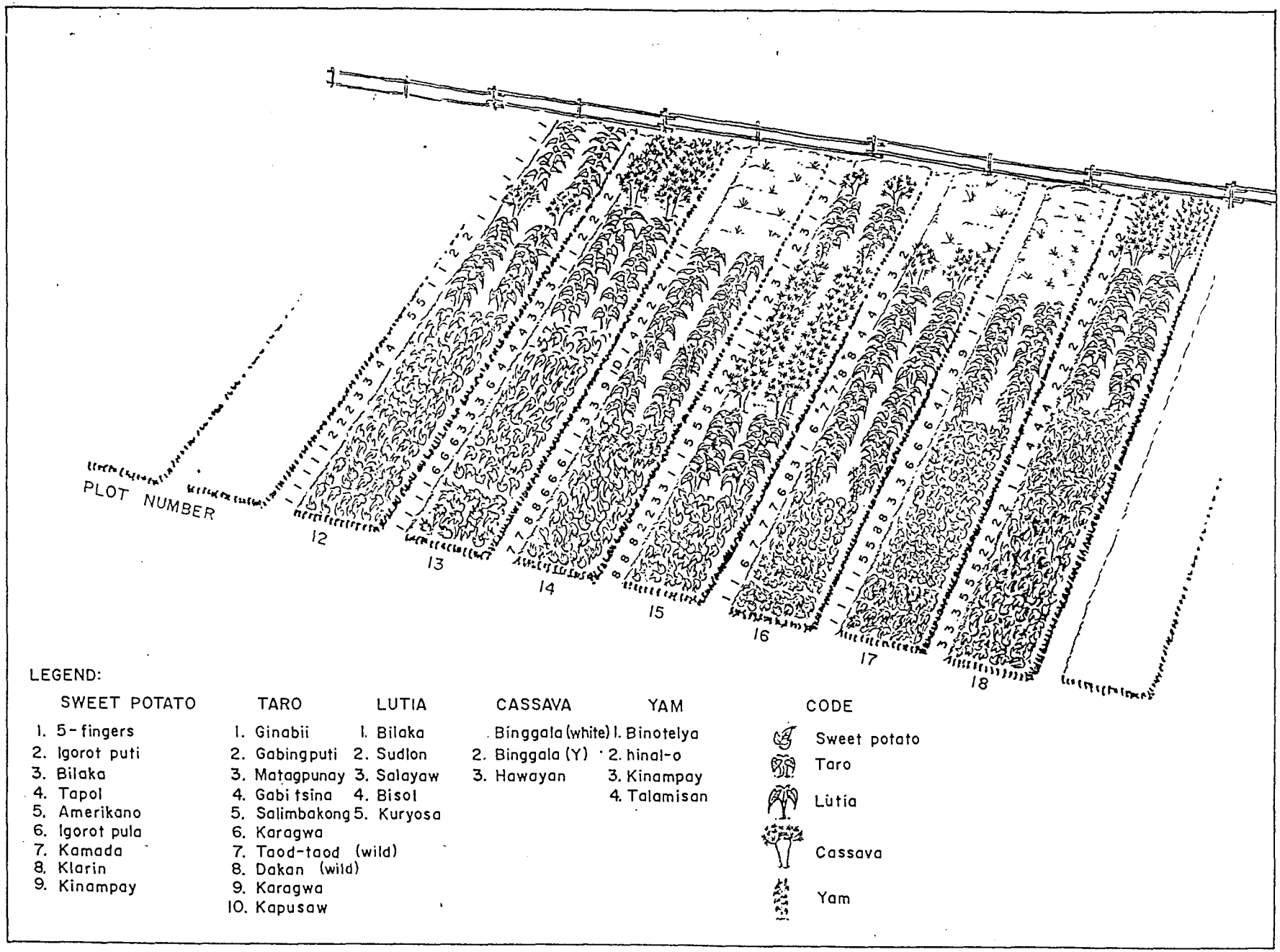


Figure 16. Part of "Industrious Mothers" genebank, Maambong, Bukidnon, Philippines.

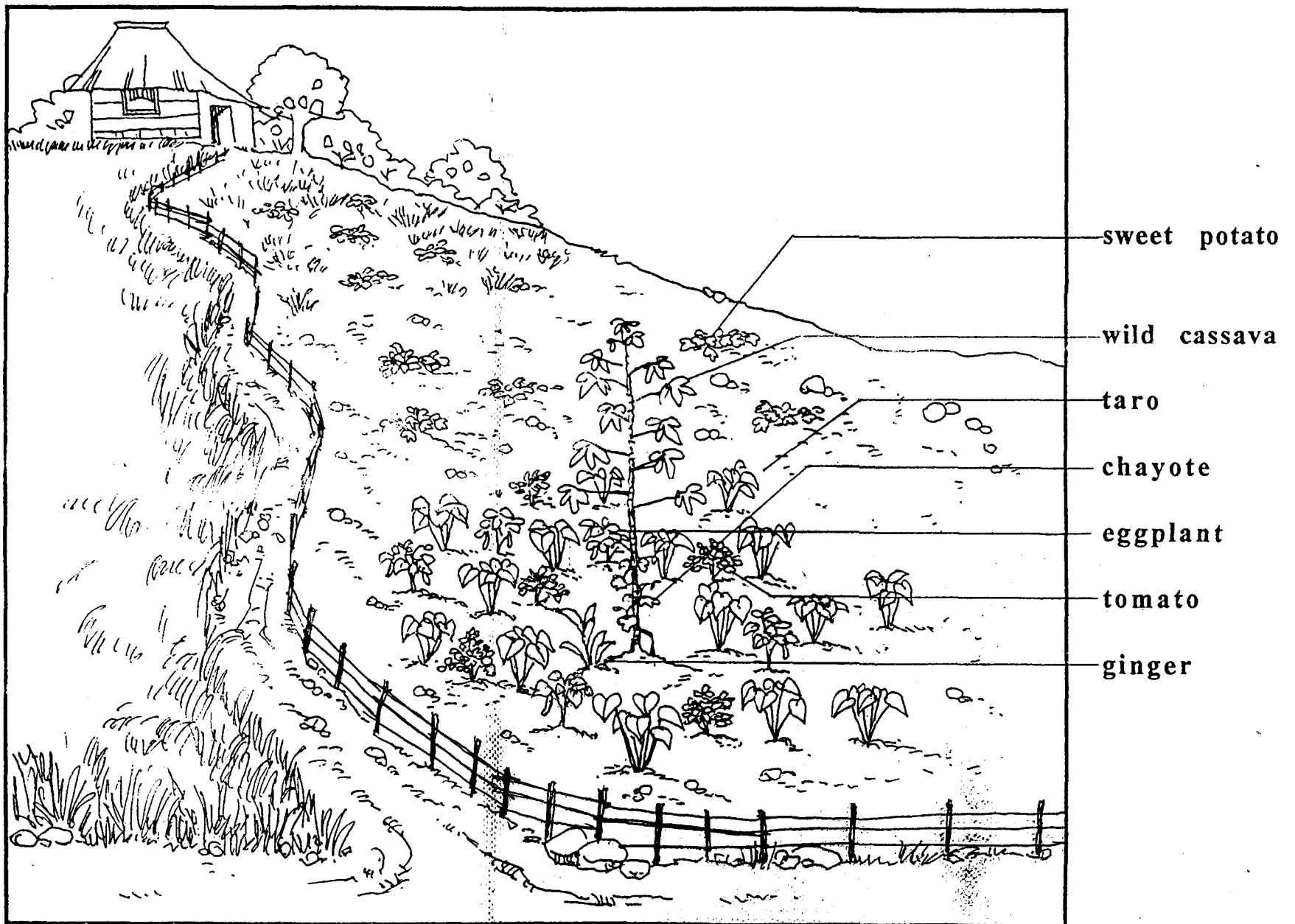


Figure 17. Maraging genebank, Bukidnon, Philippines.

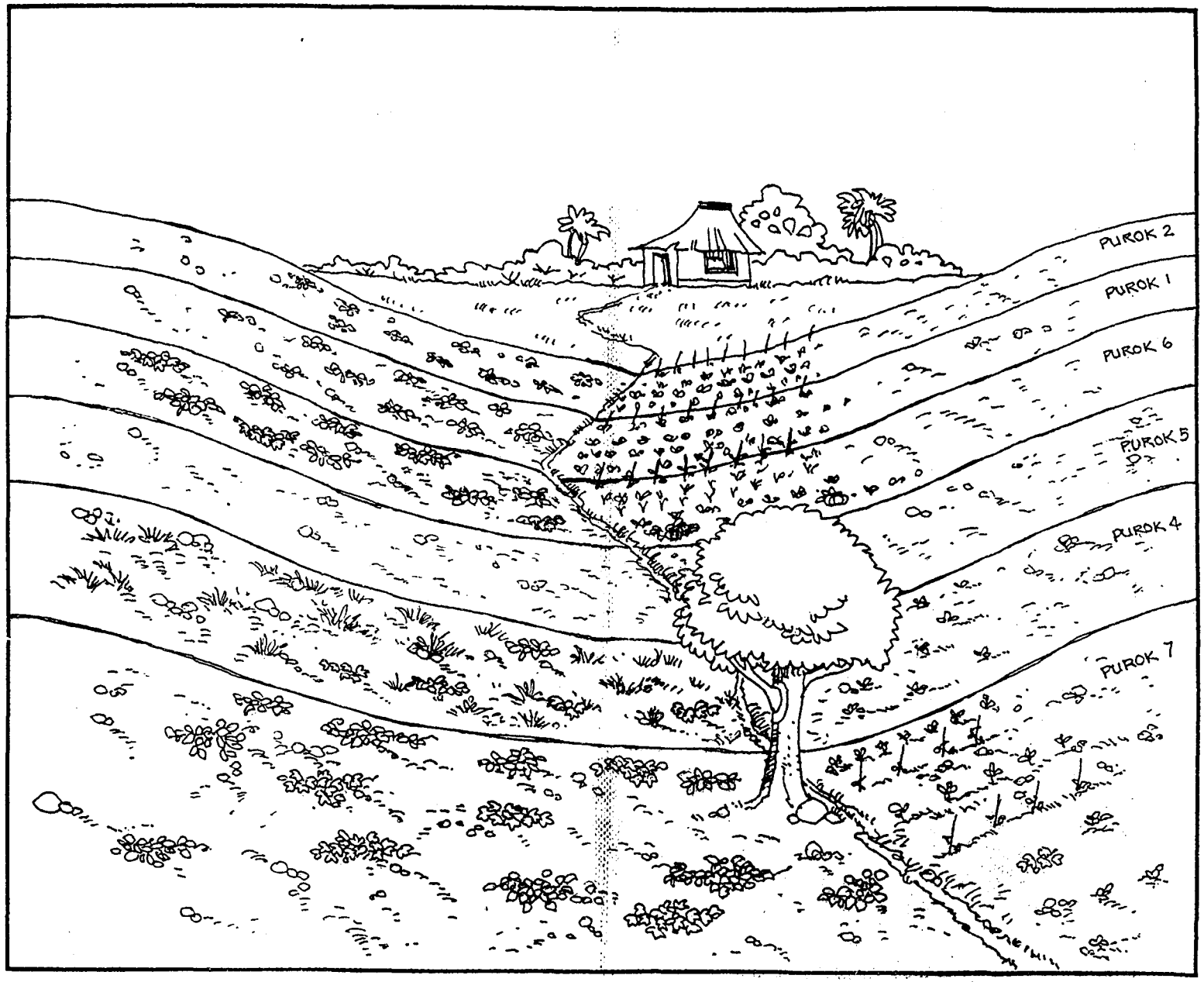
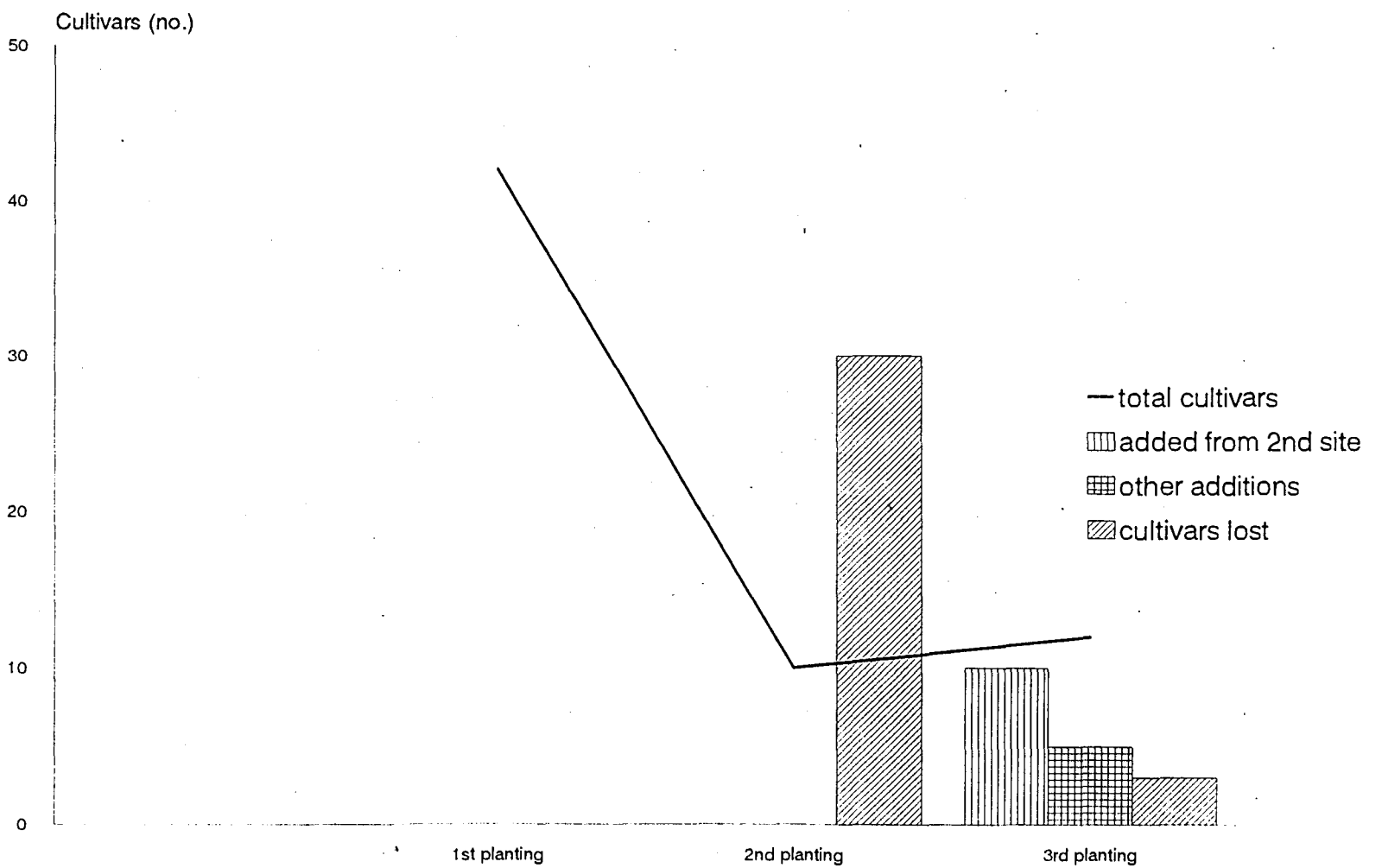


Figure 18. Mauswagon genebank, Bukidnon, Philippines.

Figure 19 Estimated changes in genetic diversity of sweetpotato over three seasons in Dalwangan*



* A new site was established after the second planting was abandoned

Figure 20 Estimated changes in genetic diversity of sweetpotato over five seasons in Maambong genebank

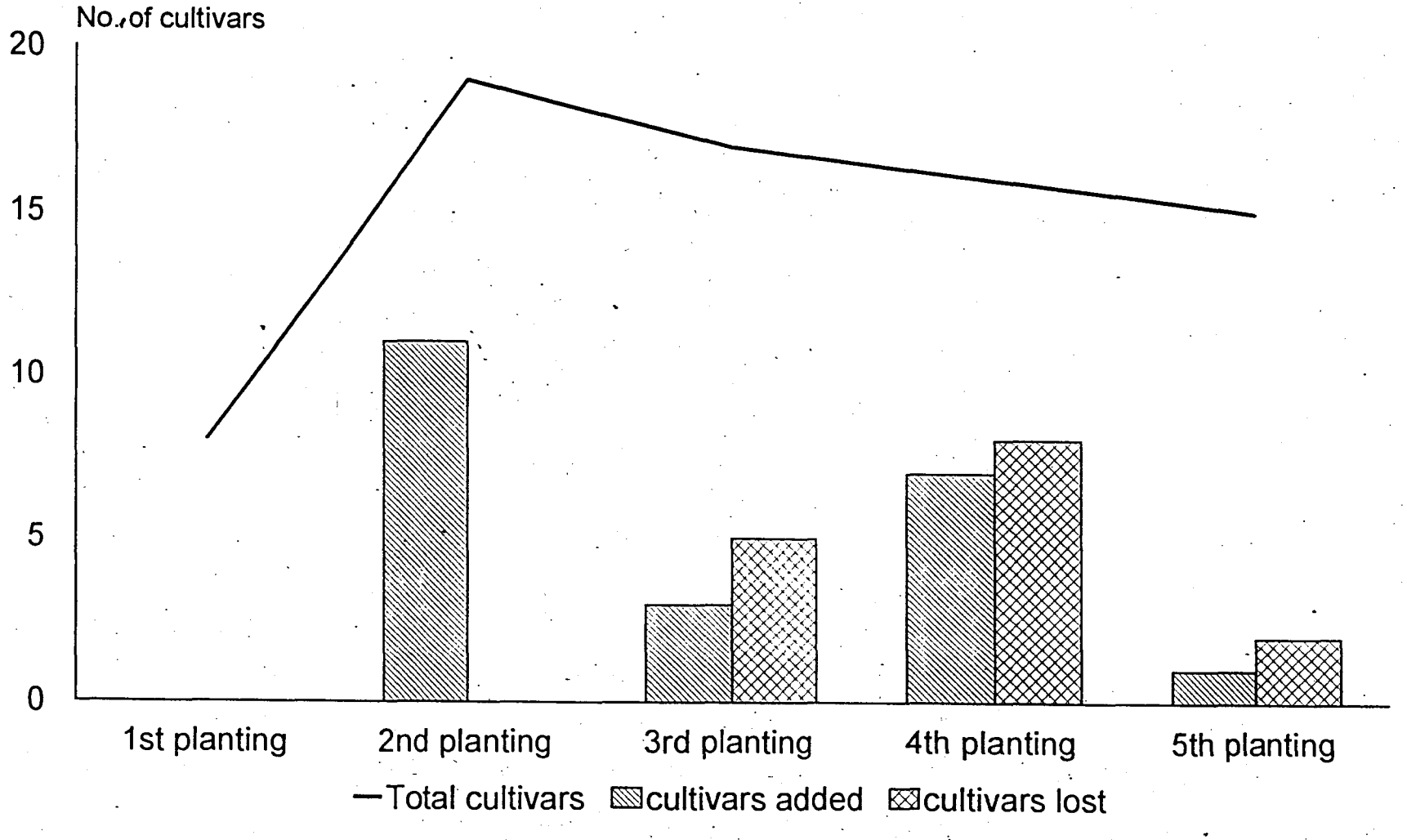


Figure 21. Estimated changes in genetic diversity of taro over five season in Maambong genebank, Bukidnon

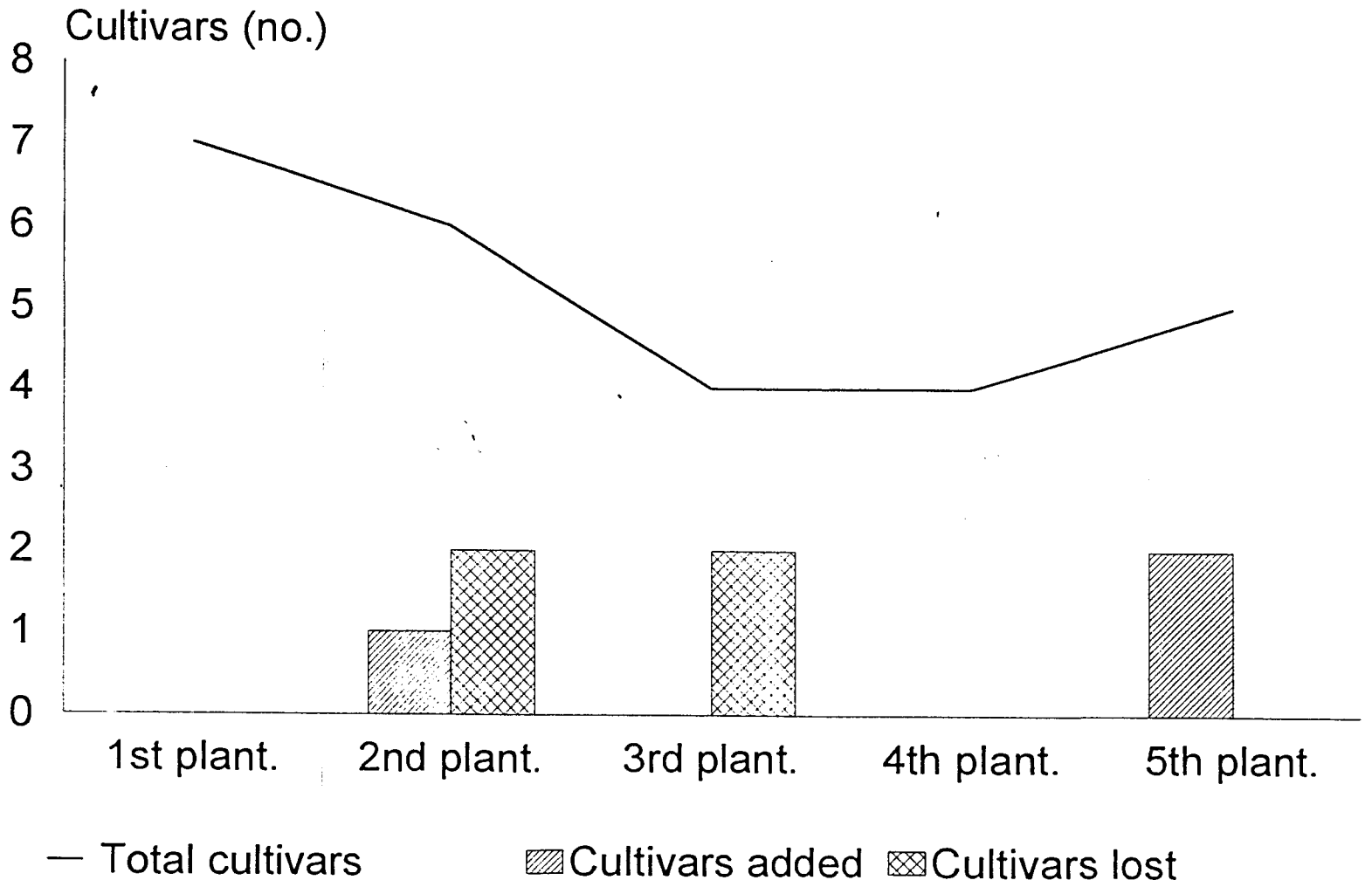


Figure 22. Estimated changes in genetic diversity of other rootcrops over five seasons in Maambong genebank, Bukidnon, Philippines

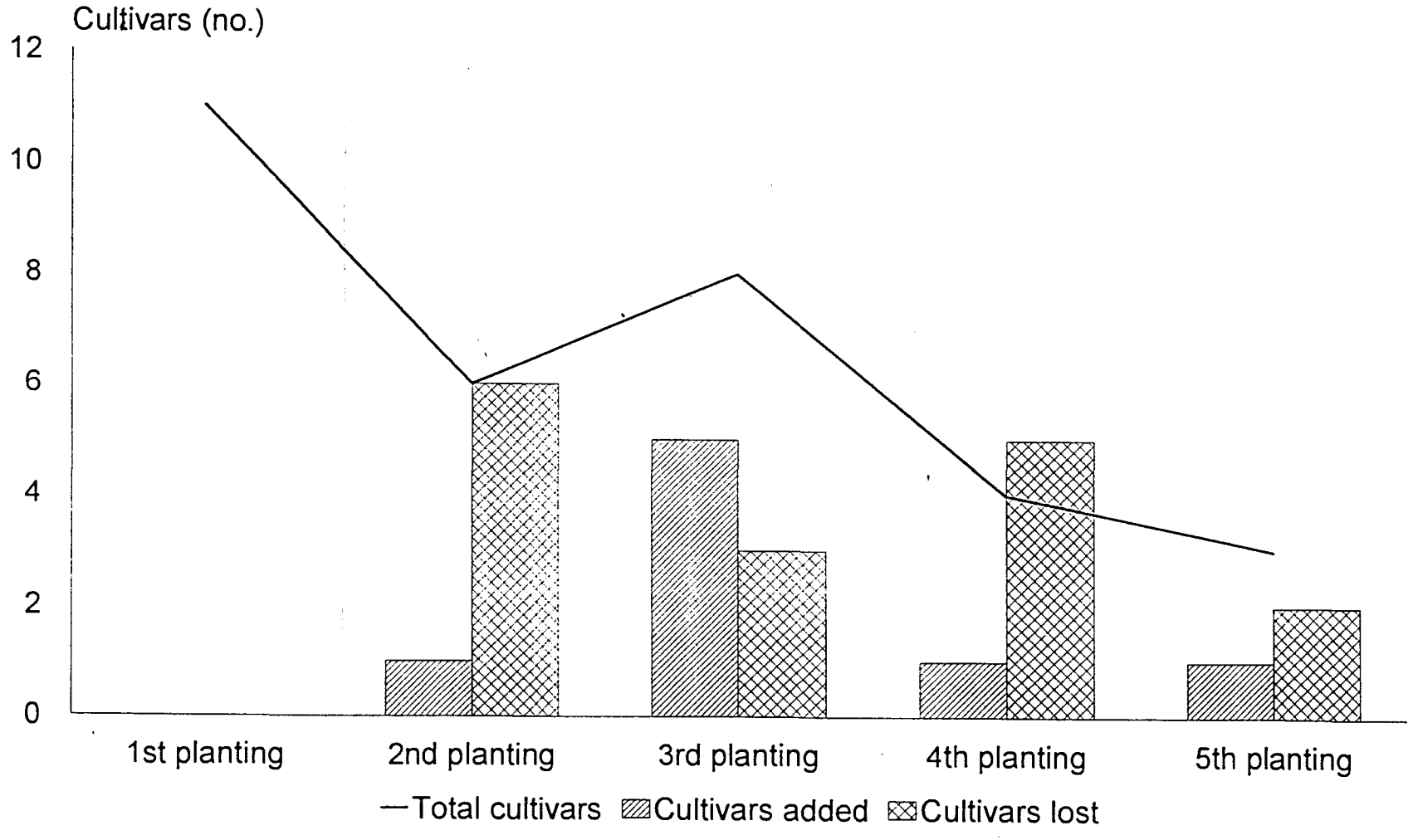


Figure 23. Curators' additions and losses of sweetpotato cultivars over five seasons in Maambong genebank, Bukidnon, Philippines

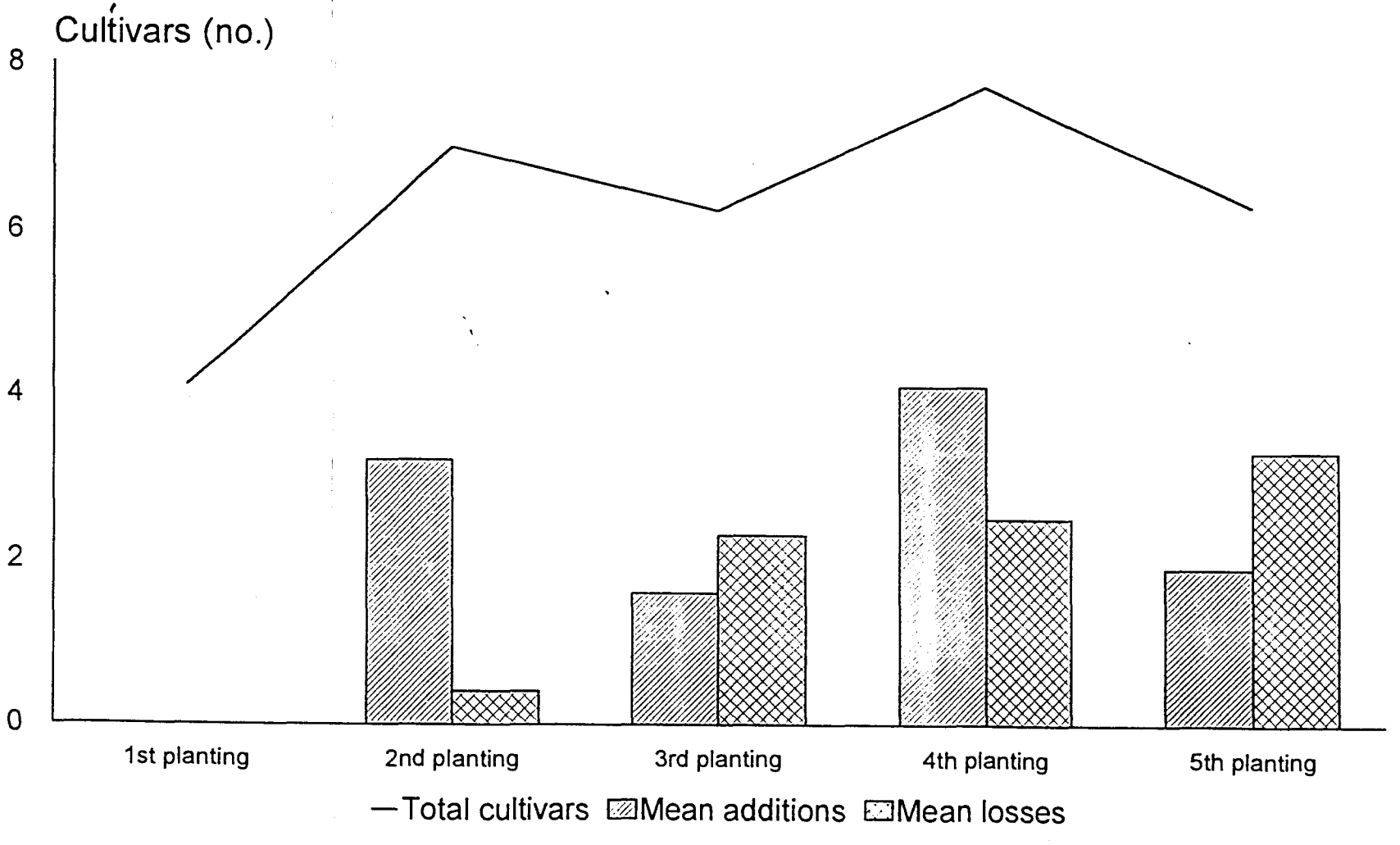


Figure 24. Curators' additions and losses of taro over five seasons in Maambong genebank, Philippines

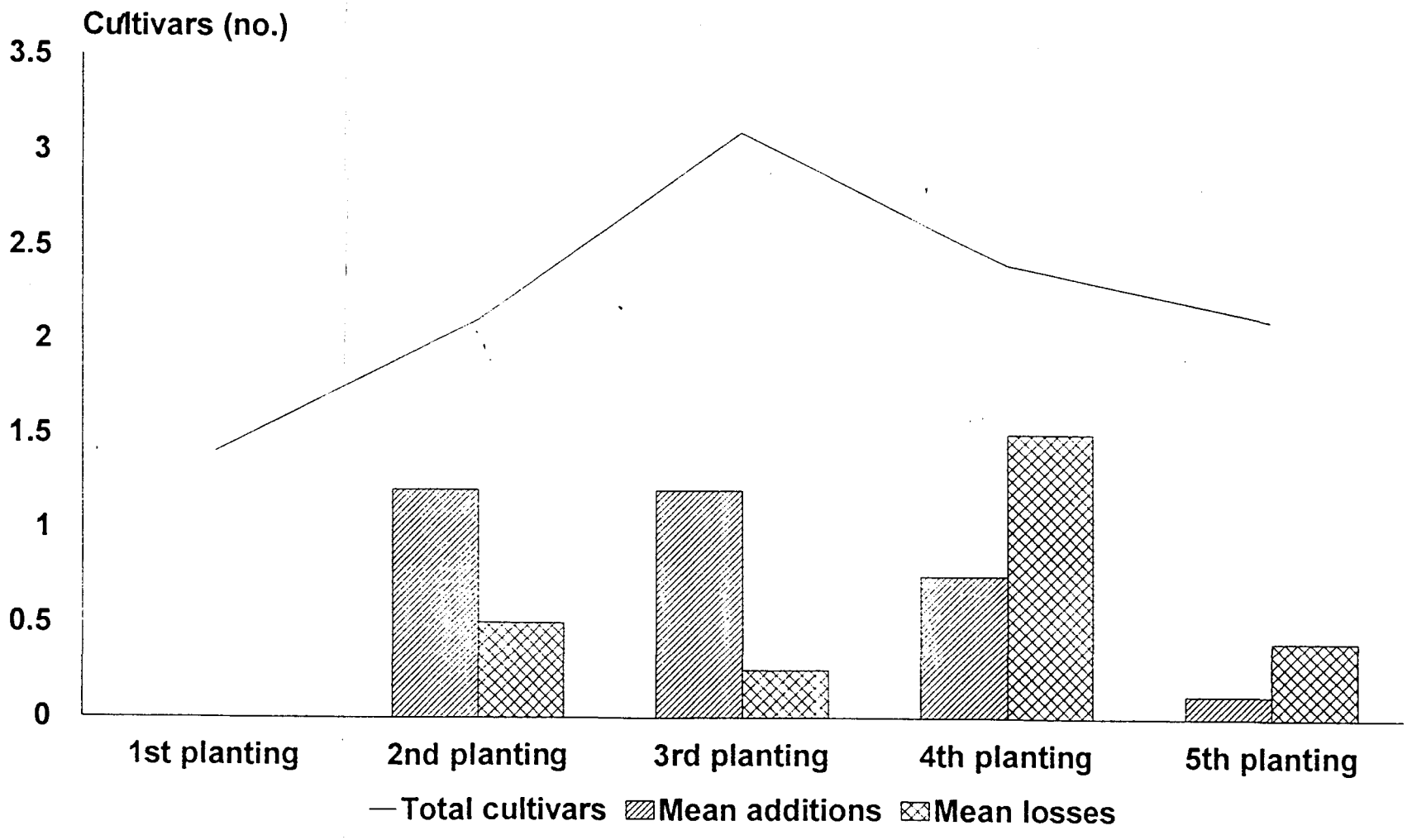


Figure 25. Curators' additions and losses of other rootcrop cultivars over five seasons in Maambong genebank, Bukidnon, Philippines

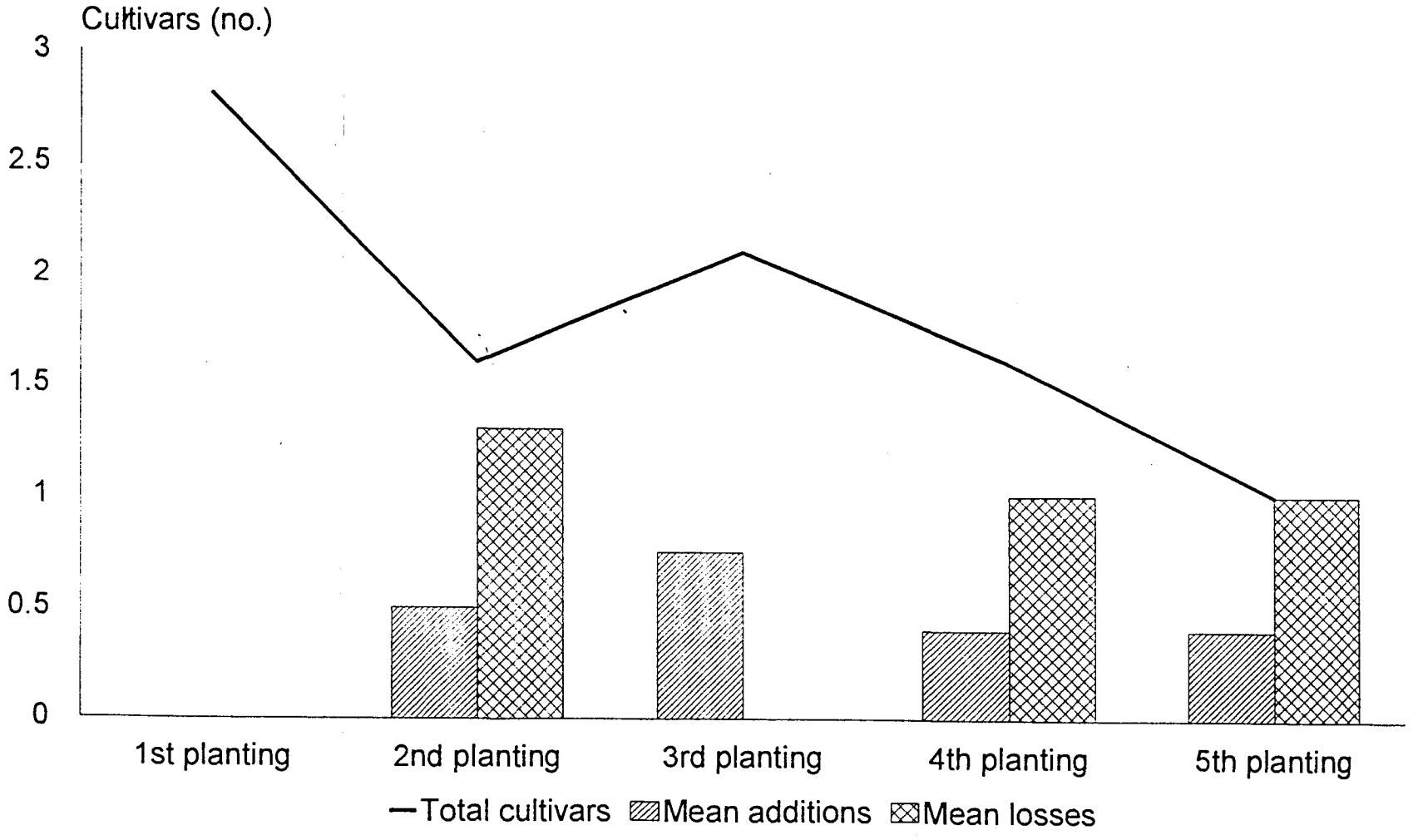


Figure 26. Sources of sweetpotato cultivars in four community-based genebanks

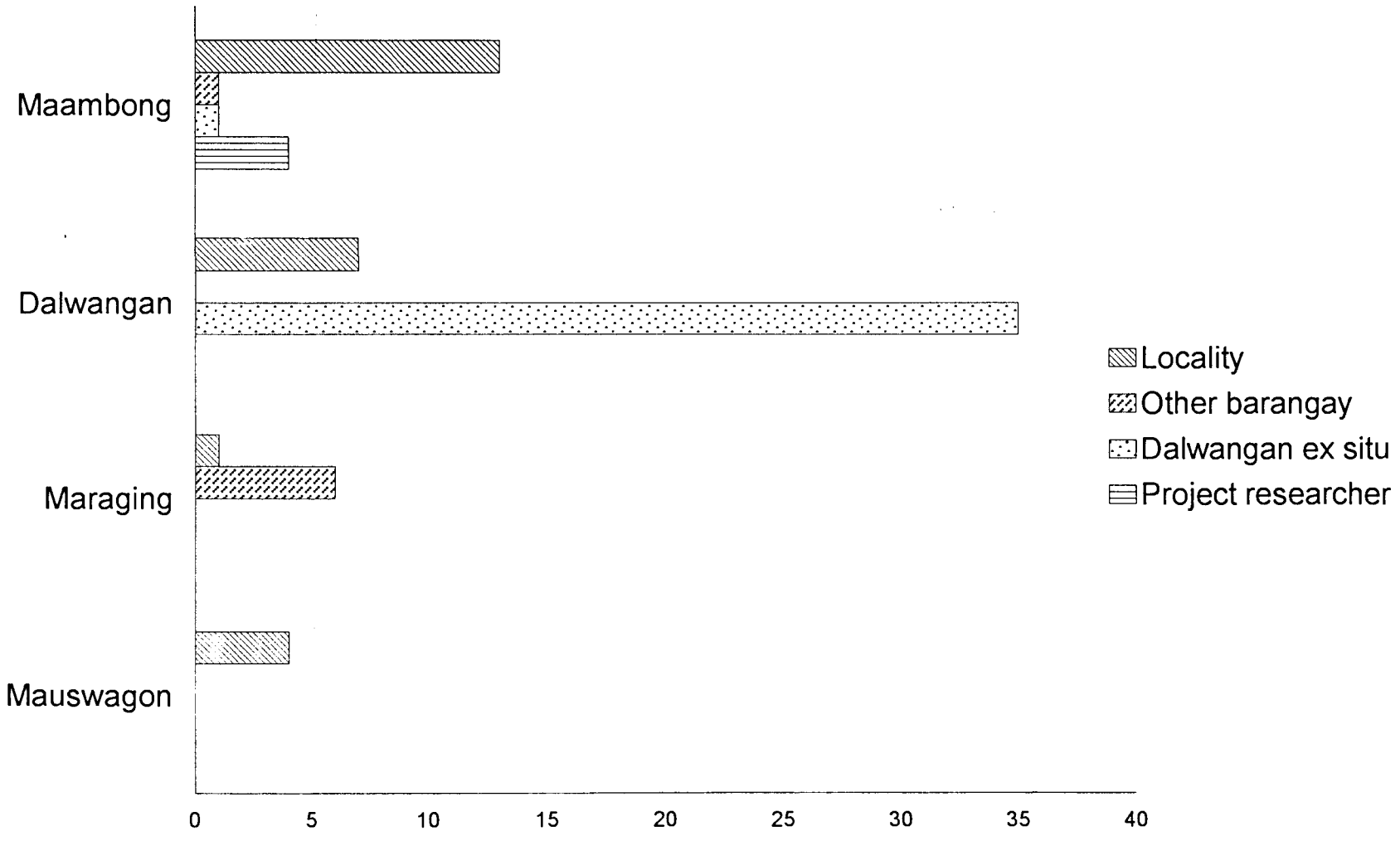


Figure 27. Species diversity and intraspecific diversity of sweetpotato in Maambong, 1960 - 1990

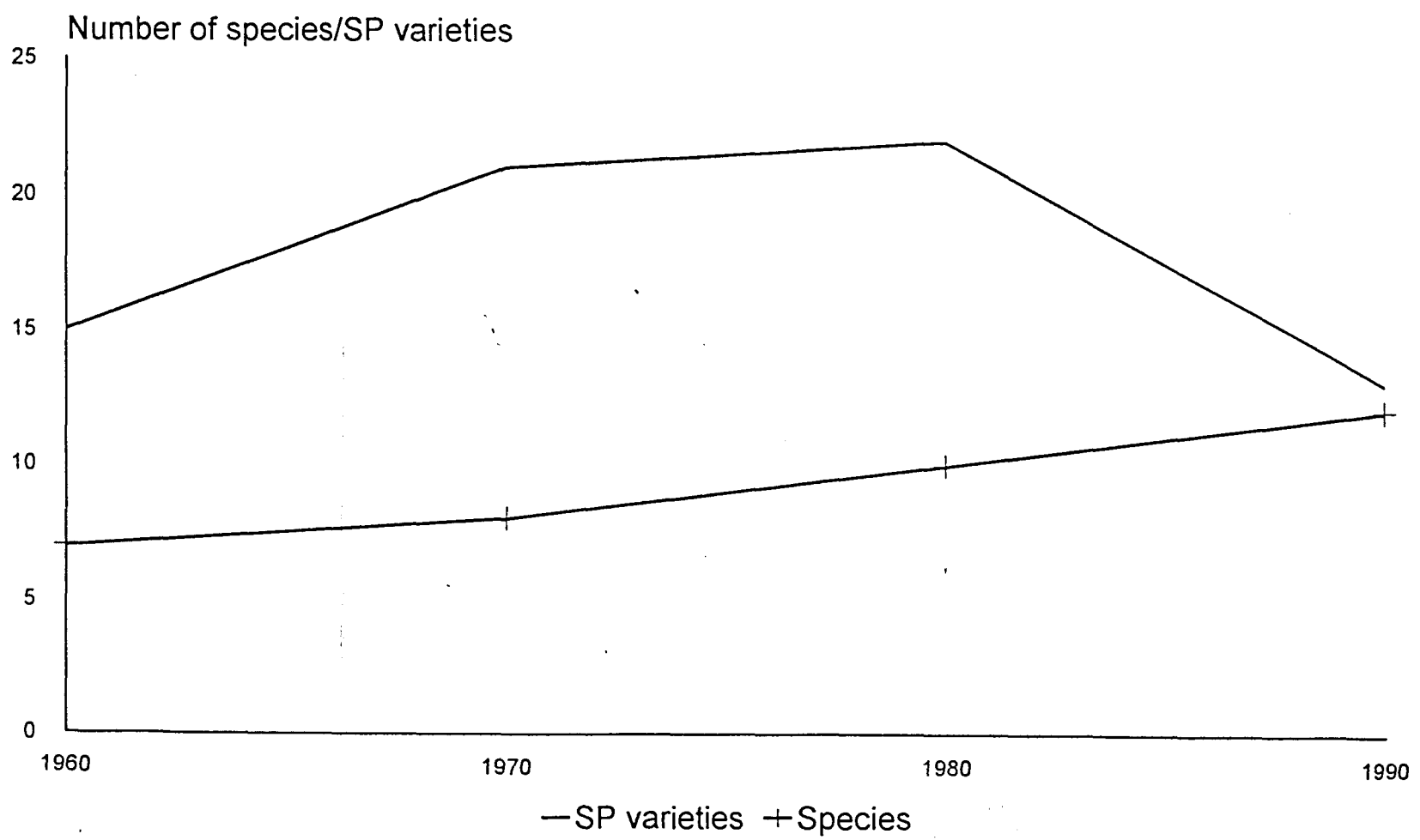


Table 1. Site Plan for the *in situ* Germplasm Collection in Dalwangan, Malaybalay

Plot 1	Plot 2	Plot 3	Plot 4
kalibre	igorot 1	pantaw	lamputi
kalibre	igorot 1	pantaw	sampalatay
kalibre	igorot 1	tinoson	katimpa
kalibre	igorot 1	tinoson	kapayas
kalibre	igorot 1	sil-ipon	magbanwa
guilang	guilang	sil-ipon	
guilang	guilang	valencia	
guilang	guilang	initlog	
sampayna	sampayna	sampayna	sampayna
sampayna	sampayna	sampayna	sampayna
Plot 5	**Plot 6**	**Plot 7**	**Plot 8**
kabutho	kalugti	malinbalin	ubihon
logom	katibor	samsaman	binawin
klarin	baliskad	sil-ipon 2	laguitas
gireng	kiloran	natuk	kabato
salvacion 4	manobo	kinampay	kamba green
	initlog 2	kampol	sil-ipon
	kalugti	igorot 2	ubihon
			initlog
sampayna	sampayna	sampayna	sampayna
sampayna	sampayna	sampayna	sampayna
Plot 9	**Plot 10**	**Plot 11**	**Plot 12**
gireng	imelda	inapog	lutia
imelda	imelda	karunsing lutia	
kinampay	imelda	gabi	lutia
malaybalay	imelda	gabi	lutia
kulating	karunsing	gabi	lutia
lambayong	kalasungay	gabi	lutia
valencia	kalasungay	gabi	lutia
sampayna	sampayna	sampayna	sampayna
sampayna	sampayna	samapayna	sampayna
Plot 13	**Plot 14**	**Plot 15**	**Plot 16-17**
Lutia	taro	cassava	cassava
lutia	taro	cassava	cassava
lutia	taro	cassava	cassava
lutia	taro	cassava	cassava
Plot 18-19	**Plot 20-21**	**Plot 22**	
guilang	kalibre	guilang (manobo)	
guilang	kalibre	guilang (manobo)	
guilang	kalibre	guilang (manobo)	
guilang	kalibre	guilang (manobo)	
guilang	kalibre	guilang (manobo)	

Table 2. Varieties planted in Maraging Genebank

pupuan	adela
panti ni Inday	baliskad
buldongan	salitliton
magbanwa	

Table 3. Cultivars planted in Mauswagon Genebank

kabato	kamada
amerikano	kalugti

Table 4. Sweetpotato cultivars planted in Dalwangan, Bukidnon, Philippines.

1st planting	2nd planting	3rd planting
Sugahak/Kinampay	Sugahak/Kinampay	Sugahak/Kinampay
Kapayas	Kapayas	Kapayas
Katuray	Katuray	Katuray
Siuron	Siuron	Siuron
Kalibre	Kalibre	Kalibre
Igorot puti	Igorot puti	Igorot puti
5-fingers	5-fingers	Igorot pula
Sil-ipon	Imelda	5-fingers
Lamputi	Lamputi	Sil-ipon
Katimpa	Guilang	Sampayana
Malaybalay	Tinangkong	Alma
Magbanwa		Guilang-Guilang
Kabutho		Amerikano
Logom		
Klarin		
Tinangkong		
Kalugti		
Katibor		
Baliskad		
Kiloran		
Manobo		
Malinbalin		
Malaybalay		
Kulating		
Kalasungay		
Guilang		
Pantaw		
Kamba		
Laguitas		
Samsaman		
Natuk		
Tapol		
Initlog		
Ubihon		
Binawin		
Kabato		
Valencia		
Lambayong		

Table 5a . Sweetpotato cultivars planted in Maambong, Bukidnon, Philippines.

1st planting	2nd planting	3rd planting	4th planting
Klarin	Klarin	Klarin	Klarin
5-fingers	5-fingers	5-fingers	5-fingers
Igorot pula	Igorot pula	Igorot pula	Igorot pula
Tapol	Tapol	Tapol	Tapol
Amerikano	Amerikano	Amerikano	Amerikano
Bilaka	Bilaka	Bilaka	-
Igorot puti	Igorot puti	Igorot puti	Igorot puti
Kamada	Kamada	Kamada	Kamada
	Tinangkong	Tinangkong	Tinangkong
	Valencia	Valencia	-
	Kapitlok	Kapitlok	-
	Kabohol	Kabohol	-
	Kaligatos	Kaligatos	-
	Sil-ipon	Sil-ipon	-
	Magtuko	-	-
	Maranding	-	-
	Senorita	-	-
	Imelda	-	-
	Kitam-is	-	-
		Lila	-
		Initlog	-
		Kinampay	Kinampay
			PNGL 16
			Kawakwak
			P16
			PNGL 1
			Salayaw
			Volunteers
			UPLSP

Table 5b.

Total taro cultivars planted in Maambong			
1st planting	2d planting	3d planting	4th planting
ginabii	ginabii	ginabii	ginabii
gabi tsina	gabi tsina	gabi tsina	gabi tsina
salayaw	salayaw	salayaw	salayaw
paagdaga	paagdaga	paagdaga	paagdaga
matagpunay	matagpunay	-	
bulokan	-		
karagwa	-		
	kabang		

Total cassava cultivars planted in Maambong			
1st planting	2d planting	3d planting	4th planting
dilaw	dilaw	dilaw	dilaw
puti	puti	puti	puti
hawayan	hawayan	hawayan	hawayan
kabutho	-	kabutho	-
	kalibre	kalibre	kalibre

Total yam cultivars planted in Maambong			
1st planting	2d planting	3d planting	4th planting
kinampay	-	kinampay	kinampay
talamisan	-	talamisan	-
matagpunay	-	-	-
bulakan	-	-	-
hinal-o	-	-	-
	binakson	-	-
	binotelya	binotelya	-
		katuray	-

Total yautia cultivars planted in Maambong			
1st planting	2d planting	3d planting	4th planting
bisol	bisol	bisol	-
kuryoso	kuryoso	kuryoso	-
sudlon			

APPENDIX 1

HISTORICAL PROFILES OF THE SITES

Historical Profile of Dalwangan

Before 1930's

History

The name Dalwangan was originated from the native Bukidnon word "*Dalwang*" or "*Dambaan*" which means "north and south sides slope downward". It was mentioned in the past that there was only one stone house in the place owned by Mr. Abatao. This house located at the upper portion of the barangay served as a resting place for the people who traveled far and served as a "hotel" for those who were caught travelling in the middle of the night. The people who came to the place always see to it to look at the surrounding area because of its magnificent view.

The place became a sitio on June 13, 1913 when people from the nearby barangays like Kalasungay, migrated to the area. The first barangay official was Mr. Juanito Casenabe, followed by a Barrio leutenant, Mr. Anselmo Binayao and after him, by Pedro Sumintan. Mr. Maricio Bagiohan was the next official who remained in the position for more than 24 years (1921-1945).

Agricultural History

According to Mr. Bagiohan (the eldest settler of the barangay), Dalwangan was used to be "green land" where people only practiced the slash and burn method of farming. There were only few families (approximately 14) living in the area hence, a family could own a parcel of land with an average of 50 hectares/family. Soil was very fertile because they allowed the land to fallow for more than ten years.

Crops cultivated

The major crops planted during those time were rootcrops (sweetpotato, taro, cassava, and yam), corn, upland rice, and other fruit trees. When few Ilocanos begun migrating to the place, lowland rice was also introduced.

The role of rootcrops especifically sweetpotato were very important. It was consumed as a staple substituting rice or corn whenever supply was scarce. It was also given for free to neighbors and friends and even to strangers who asked some pieces from the owner. The number of sweet potato varieties were already plenty (approximately 16-20 varieties), all of which were natives in the place.

Tools/Implements

Implements used were very simple such as bolo and sharpened stick. Carabaos were not yet commonly utilized because of limited number. At the latter part of 1930's, used of wooden plow was introduced. This came out of the ingenuity of the people since they need to develop tools that would ease some farm works.

1940's - 1950's

In the beginning of 1940's, some of the families were already starting to limit the area they till although slash and burn was still the farming practice that they utilized. The population continue to increase which resulted to the encrouchment of the virgin forest.

Crops cultivated

Corn, fruit trees, rootcrops, abaca and upland rice were the same crops that they cultivated. A certain Mr Quisumbing who came from urban area, introduced the cultivation of citrus. The crop then occupied the largest area in the barangay. But (maybe) because of marketing reason, its cultivation did not last long. Many farmers returned to planting rootcrops, corn, rice etc. because they could always depend on these crops as a source of food for the family.

Rootcrops had the same role in the household. It remained substitute for rice or corn and commonly consumed anytime of the day. Its commercialization had not yet practice and still given for free to anybody. The sweetpotato varieties even became more diversed (from 20 to 30 varieties). This maybe due to the fact that it was only after world war II and people were still dependent on rootcrops for survival (since rootcrops are the most easy to manage crop). Hence, many varieties were maintained so that source of planting materials as well as source of food was assured.

Tools/Implements

The use of iron plow called "*puthaw*" was introduced during this time. The number of farm animals specifically carabao, had also increased because most of the people who were given money by the americans as incentive for what they did during the war, bought carabaos so that their farmwork would be alleviated.

1960's

In the early 1960's, people from different parts of Bukidnon started settling to Dalwangan. Many natives and original settlers sold some portion of their land to these people and were forced to move higher into the mountains.

Same crops were cultivated during this time although, with lesser emphasis on citrus. Sweetpotato varieties decreased in number maybe because people were more or less adjusted to the new life after the war and begun to choose the varieties that they prefered from what they had collected during the war. Other crops (i.e. corn, abaca etc) were again incorporated to their farm.

Tools that were used did not change much. Carabaos and cows as source of labor begun to dominate the farm animals. The area that was utilized for farming decreased in size because of the increasing number of people living in the barangay. Fallow period also lessened since much of the area was utilized and people could not go to any other place.

1970's

Cropping system

The year 1970 marked the big changes occured in the place. It was on this time when many people from Bagiuo transferred to this area and introduced the cultivation of

different vegetables such as cabbage, tomato, potato, sweet pepper, baguio beans and chinese cabbage. The native people became interested with the new crops hence, many of them shifted from planting subsistence crops (i.e. rootcrops) to the more "profitable" crops. The area alloted to rootcrops had decreased and was allocated to vegetables. Because they were only experimenting on that stage, the varieties especifically on sweetpotato did not reduce. As a matter of fact, they even increased because the migrants brought some sweetpotato varieties from their native land. Upland rice was also eliminated in their crop list so that larger area could be given to cash crops.

The increasing number of population also aggravate the situation on land. Trees were cut and forests were destroyed in order to accomodate the increasing number of people. Even the marginal areas were used for agriculture.

Tools/Implements

Along with the introduction of new crops, new technologies and implements were also introduced. Chemical fertilizer and pesticides were used in order to have good yield. People from the Department of Agriculture also begun their intervention project with the farmers as part of their tasks and responsibilities . They encouraged them to plant the different vegetables, at the same time, to utilize the chemical fertilizers and pesticides. Tractors were also used for land praparation especially by big land owners

Because farmers needed capital in order to buy the different inputs for vegetable plantation, they begun to loan from banks. As a result, a lot of farmers became heavily indebted with the banks and were not able to regain even their capital. They were forced to sell their land or made it as collateral so that they could pay the bank back.

1980's

Cropping System

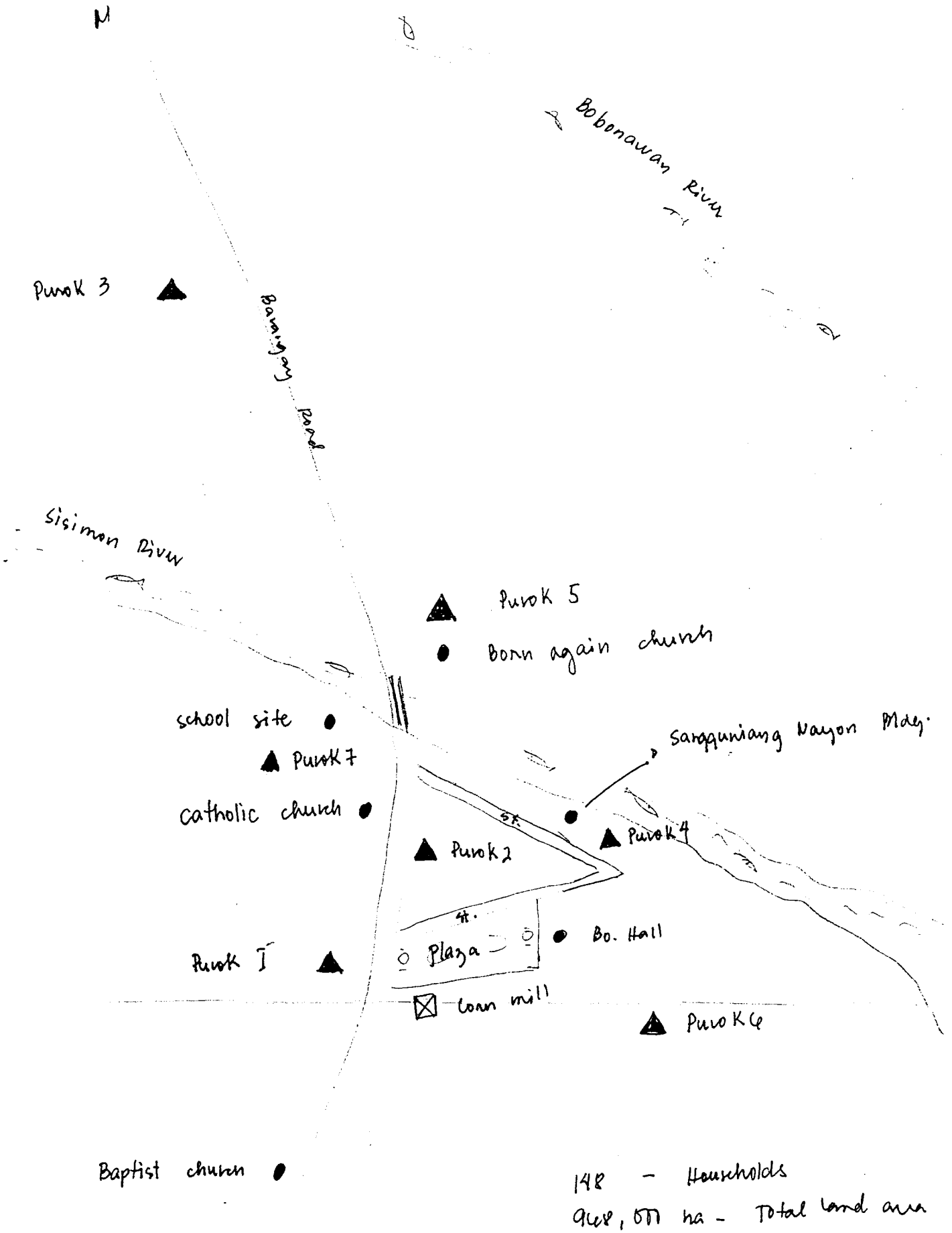
In the early part of the 80's, vegetable plantation boomed in the area and the rootcrops were, if not totally neglected, became the least priority crop. Most crops that were planted to every farm were the following: potato, tomato, cabbage, sweet pepper and chinese cabbage. Corn was still cultivated because it served as an assurance crop in case profit for vegetable garden was not that big. For the small scale farmers who could afford to buy inputs in planting vegetables, they begun selling the rootcrops especially the sweetpotato. The diversity of sweetpotato were slowly declining (from 26 vars. to 19 vars.). The varieties that were cultivated and maintained were only those which were commercially acceptable. It became even worse in 1985 when the number of varieties was reduced to 15. This was the time when media was very active in promoting the different fertilizer/pesticide for vegetable garden.

1990's

In 1990, Philippine Packing Corporation (PPC) started renting some portion of the land both from the people who were not native of the place and from the natives. This made the latter (but not all of them), who still practice some traditional method of farming and still planting the same crops, to move into the mountains. Most of them are already happily settled in the area up to the present time. This changed of land use did not

only affect the farming system of the people but the soil structure of the area as well. The top soil was removed to expose the subsoil which was the type fitted for pineapple planting. Farmers who were not leasing their land to PPC during their first year of exploration, were forced to do the same because some portion of their land was embedded by the plantation. Thus, whatever chemicals were sprayed to the pineapple were also being absorbed by their crops. Other farmers allowed their land to be rented by the PPC since they could not afford to continue planting vegetables because of the high inputs.

The rootcrops which were then only for home consumption are now commercially grown. The diversity especially in sweet potato decreased in number because only those which are acceptable and salable in the market are the only ones maintained. Varieteis which are early maturing and give good yield are preferred instead of the late maturing and do not produce plenty of roots. Other rootcrops such as taro and yam were planted to a very limited space and primarily consumed at home especially for animal feeds. Cassava is now being prioritized because of the presence of the traders who come from urban areas such as Cagayan de Oro. The crop is sold either in chips or in its raw form for flour production.



BANRANGAY MAP OF MAUSWAGON DRAWN BY ONE LOCAL CONSULTANT (July, 1994)

Historical Profile of Barangay Salvacion (including sitio Maambong)

Salvacion is one of the barangays in the municipality of Libona comprising three sitios namely: Salvacion, Maambong and Purok 1. It is about 303 meters above sea level, and is gifted with rolling and hilly land, which is conducive to plant growth. Majority of the settlers in the area are migrants, mostly coming from Bohol, Negros, Cagayan de Oro and nearby municipalities. It was said that this became the "Salvacion" area for the people in Negros when the place suffered from hunger and poverty problems. However, there are also some people who were born in the place while others settled in the area when they were still young.

1950's

During the 1950's, only few families were living in the barangay. Most of them were residing in the center of the barangay which is also called Salvacion. There were also people who migrated to the place from the nearby barangay, Silipon. Since there were only few families in the area, a family could own as much as 25 has. of farm land where they practiced slash and burn method of farming. What they did was to burn a portion of their land, cultivate certain crops then after a certain period would moved on to another area. For those who were new in the place, they worked as tenants to big land owners.

Crops grown were corn, taro, cassava, coffee and sweetpotato. Big portion of land was allocated to corn and coffee. Some families also allot bigger portion of their land to sweetpotato. However, all of the produce was consumed at home either feed for pigs or as table food. During this time, pigs raising was the main source of livelihood in the area and sweetpotato were the main source of food for pigs.

The varieties cultivated were only few around 14-17 varieties. Majority of which were indigenous in the place.

Planting materials were maintained by planting the cutting near the river so that survival was assured. During dry season, some of them maintained a small plot containing all the varieties and transplanted them on the on set of the rainy season.

Tools/Implements

During this time, bolo and grab hoe were the common tools used in preparing or cleaning the area that would be used in farming. After burning the area, they slashed the remaining debris and plant the crops that they wanted to grow. Only few families (those who were big land owners) afforded to use carabao-drawn-plow in their farm. No fertlizer (organic or inorganic) was used to enhance the fertility of the soil since soil was fallowed for at least two years.

1960's

At the later part of 1960's, Philippine Packing Corporation (Del Monte Corporation) started renting some portion of the land from the local people. However, bigger parcel were still maintained by the local farmers as their farm or garden. Crops

cultivated remained the same which were as follows: corn, banana, coffee, taro, sweetpotato, cassava and fruitress.

It was also during this time, when farmer realized that pig raising was not a profitable venture, hence many of them stopped raising pigs. This resulted to the decline of the sweetpotato diversity since the bulk of the harvest was given to pigs. Commercialization of the crop was not yet introduced and was still given for free to neighbors.

Slash and burn was the same system that they used although they had started doing alternate cropping. Usually alternating corn and rootcrops.

Tools/Implements

Bolo and grab hoe were the same implements used in preparing the land especially in the mountainous region. Farm animals like carabao were still minimal since farmers were doing the slash and burn method and were only subsistence crop producers.

1970's

The population was slowly increasing at the start of this decade. People coming from the nearby municipalities like Manolo Fortich and Cagayan de Oro and nearby provinces like Negros and Bohol decided to settle in the area because of the then rich resources that they saw in the place. However, many of them became tenants of the big land owners.

It was also during this time when few farmers started cultivating vegetable garden (ie. tomato) which was introduced by a trader from Cagayan de Oro. However, many of them only did it on experimental basis hence, same crops could be observed in the area. These were corn, rootcrops, banana and coffee. Sweetpotato varieties even increased in number (from 13 to 17 in 1970 and 20 in 1975) because of the migration process that took place. People from Negros and Bohol brought samples of their varieties to try planting it in the area. The now famous *5-fingers* or *Kasindol* was also introduced in this period. According to some farmers this was brought by certain Mrs. Aurillia Maglupay when she visited Lumbia. However, the area allocated for sweetpotato had decreased in size because of the increasing number of crops being introduced in the area. Furthermore wild species of indigenous crops especially sweetpotato were wiped out when Del Monte Corporation began clearing some part of the land.

Alternate cropping became the common method in farming. Usually alternating corn with rootcrops or vice versa. They also mixed banana with taro or cassava.

Tools/Implements

Along with the introduction of new crops and the expansion of Del Monte Corporation, new technologies were also introduced. The use of chemical fertilizer and pesticide was slowly spreading in the barangay. This was due to the depletion of soil fertility being affected by the continued use of land (without any fallow period) and as the effect of the new farm machineries being used by the Del Monte Corporation. Big tractors, sprayers and toxic chemicals were being used by the Del Monte Corporation on their pineapple area. Nevertheless, small farmers also used chicken dung and cow manure in enhancing the soil condition.

Although carabao-drawn-plow begun dominating farm land, only few family had afforded to use it because of high costs in buying or even in hiring one.

1980's

1980 marked the big grow in the barangays population. It was during this time when people from Negros suffered from economic problems such as unemployement and poverty which was brought about by the declined in the price of sugar. The life in Negros became very difficult which forced the people to move to other places. Barangay Salvacion became one of the places. According to some people, migration process started out when some wondering people (i.e. male) accidentally visited the place while attending certain festivals. After realizing that they can settle in the area even as tenants, they asked their families to follow them in Salvacion. From then on their relatives, neighbors and friends came to Salvacion and settled in the barangay.

The introduction of vegetables in 1970 also marked the big changes in the cropping system of the people. It all started when few farmers "experimented" in planting tomato, potato and sweetpepper in small portion of their land (either owned or tenanted). When their neighbors saw the "profit" that these farmers got from planting the crops, they adopted the same system. Hence, before the decade concluded, almost all of the farmers in the area were planting vegetables. However, corn and rootcrops were not eliminated in their crop list, although rootcrops became the least priority crop.

The situation became even worse when traders from nearby sites specifically Cagayan de Oro, begun buying their produce (i.e tomato). Situation worsened when DA technician encouraged the farmers to cultivate vegetables. The area assigned to sweetpotato reduced and given to corn, tomato or sweet pepper. Although the area given to sweetpotato decreased in size, the varieties became more diversed (from 17-22) because migrants from all over Mindanao took their own planting materials to Salvacion. Most of the varieties introduced were from Negros like *Kabato, Kabuhol* and *bilaka.* Commercialization of sweetpotato was started by those farmers who could not afford to buy inputs in planting vegetables. Migrant people (who were then only tenants) planted their sweetpotato at the boundaries of pineapple or at areas which were not utilized for vegetable. Since commercialization of sweetpotato had started, planting materials were also sold. It was usually sold at ₱20.00/sack.

Tools and Implements

The demand for tomato and sweet pepper increased in the urban areas which resulted to farmers planting the same crop for one whole year. Soil condition became worse and additional inputs were needed to enhance and bring back the fertility of the soil. Chemical fertilizer as well as pesticides were utilize by the farmers. Furthermore, bolo and grab hoe was not utilized anymore because of too much time needed to finish a hectare using the same implements. Nevertheless, these tools were used in rolling areas. For plain areas, cultivators had to hire carabao in order to finish the job on time. Still only few could afford to do it. Others were contented to be tenants or laborers of other farmers.

1990's

At the beginning of 1992, big financier from Cagayan de Oro City came to the area to finance tomato production. Producers created a cooperative that would supply these traders with big quantity of tomato. This innovation brought about the changes in the cropping system and prioritization (in terms of time), of the farmers in the barangay. If not all of the land, bigger portion of the farm was allocated to tomato and almost all of the time and energy of the farmers were allotted to attending the vegetative garden. However, not all of them could afford to buy the inputs needed in tomato farming, hence, others opted to work as laborers to other farmers. In order to have additional source of income, the farmers (who were laborers or tenants) cultivate rootcrops (especially sweetpotato) along the pineapple boundaries or in marginal areas (i.e. sloping area). Inspite of this, the diversity of sweetpotato lessened drastically (from 25-13 varieties) because the farmers opted to plant those varieties which were commercially acceptable. Most of these are early maturing, like *5-fingers* and *amerikano*. Commercialization of sweetpotato became very evident when farmers started selling their produced to the public market during the "market day". The sweetpotato was either sold directly to the consumers in retail, while others sold it in wholesale. The presence of the Del Monte Corporation also made the easy selling of the crop in the market.

As mentioned earlier, the situation for sweetpotato during this period became extreme. A farmer was either a sweetpotato grower-which means he is cultivating more than a hectare of sweetpotato in his land; or he was a vegetable grower mainly planting vegetable to his land with only few hills of sweetpotato.

Presently, corn and tomato were the two major crops being cultivated in the area. Sweet pepper and cabbage play a secondary role, mostly substituting tomato. Rootcrops especially sweetpotato is only grown when money is not avaialble to buy fertilizer and pesticide for vegetables. However, interview revealed that farmers are now beginning to realize the importance of rootcrops. According to them, vegetable growing is a very expensive business. Rootcrops cultivation on the other hand only needs once time and energy to get reasonable profits. They also mention that they will go back to planting rootcrops especially now that the inputs for vegetable production are very costly.

The use of organic fertilizer like chicken dung and the utilization of compost was being reintroduced in the area.

Historical Profile of Barangay Iba (including sitio Maraging)

Historical/social profile

Local folks in the barangay believed that barangay Iba was named after a big Iba tree said to be planted at the center of the barangay. The place was originally inhabited by very few Umayamnon natives who survived by farming (mostly by swidden or slash-and-burn agriculture). Crops planted were mostly forest trees such as narra, lawan and mahogany. When the present barangay captain (Mr. Joaquim Nellas) came to the place in 1967, there were only three families residing in the barangay headed by Datu Efefanio Jahan who was also the first chief datu and barangay captain in the area. He was followed by Mr. Vicente Adapat who took over in 1969. After him was Mr. Teburcio Buenaventura followed by the reigning barangay captain, Mr. Nellas who is serving the barangay for almost twenty years now. It was also during his term (1982) when Iba became barangay proper.

During the early seventies, Talakag Timber Incorporated and Valderama Corporated started their logging operations. Forest trees were cut and people begun to migrate in the barangay. Wild animals (i.e. wild pigs) and large birds were robbed of their original habitat resulting to their extinction (at least in the barangay).

Beginning with the 1980's, hyrbrid corn was introduced in the community by San Miguel Corporation (SMC hybrid) and Pioneer Company. The native corn which was the only commodity during that time along with upland rice, was replaced by the introduced variety. Many people were encouraged to plant the hybrid corn because of good yield. However, other inputs were also introduced such as fertilizer.

Presently, 90% of the farm is planted to corn (HYV) and the remaining 10% is allotted to upland rice and other crops like coconut, coffee, jack fruit, marang, pomelo, banana, and few rootcrops.

The barangy has a total households of 381 with 2275 population. It has 14 puroks and 8 sitios with 20-30 families per purok. Each family has an average household number of 6-7.

Migration Pattern

As mentioned earlier, migration of settlers into barangay Iba, started when TTI and Valderama Corp. begun their logging concession in the area. People especially the males, worked as laborers to the two companies with their families. At present, 60% of the population are from Cebu and the remaining 40% are mixed Bul-anon and Ilongo. The natives moved into the mountains and to other barangay (i.e. Catablaran). Inhabitants are mostly farmers comprising around 70% - 80% of the total population while the remaining 20%-30% are either teachers, military men and store keepers. Among the farmers, 70% own their respective farms with an average of ten hectares per family. The remaining 20%

and 10% are tenants and squatters, respectively. Around 60% of the farmers have an average monthly income of P4,000.00 and below followed by 23% earning above 4,000 but below 6,000. The remaining 17% has an average income ranging from 6,000 to 10,000 per month.

Agroecological Background

Iba has total land area of 4,352.41 hectares (Barangay Demographic Profile, 1990) with agriculture occupying the biggest portion of around 60% of the total land area. It is followed by uncultivated land occupying 30% of the area while forest only occupies 8% of the total land area. Residential lot has the least occupied area of only two percent of the total land area.

The topography of Iba ranges from flat, slightly sloping to rolling area. The soil type is conglomeratic hilly clay loam.

Sitio Maraging

Maraging is one of the sitios of barangay Iba located near Pulangi river. It is embedded in the mountains and is around 3-5 kilometers from the municipal road. Settlers are a combination of natives and dumagats (migrants) from Cebu and other parts of Mindanao. The natives and some dumagats can speak native languages like Binukid and Manobo. Farming is the main source of income with corn as the major crop planted to more than fifty percent of the total agricultural land. Rootcrops (i.e.sweetpotato) are major crop planted on subsistence basis, mostly grown in the mountains or rolling side of the farmers' farmland. Sweetpotato are usually consumed as table food either boiled or fried as animal feeds. Leaves are also eaten as vegetables or as feed for pigs. Selective or staggered harvesting is the usual practice and only harvest when needed by the family. Planting materials are usually taken from the tips or the apical cuttings and maintained by transferring the collection from one place to another. Sweetpotato farmers maintain a large number of sweetpotato varieties to cater the different tastes of the household members.

In 1952, forest trees like lawaan, tugas, narra, and almasiga dominated the farmland of the sitio. Only few natives were residing in the area. In 1969, people begun migrating to the area and thus the start of the small community. Inhabitants were very much dependent on swidden agriculture. Mobility was very difficult since gasoline-driven vehicle was not yet available. They had to ride a horse or carabao just to go to the market of around 50-80 kilometers away from the settlement.

Migration activities occurred during the early 70's also affected the settlement of Maraging. Some migrants went to the are a and started a new life. People also begun to cultivate other crops and to practice other farming system. Slash and burn agriculture became unpopular since people started growing vegetables that need fertilizer and other

external inputs. Other community facilities and services became available that according to the people made their lives better and easier.

Kin relations

It was evident that many of the settlers in the sitio are related with one another by blood. Although their settlements are built separately, everyone knows who lives where and how is one related to the other.

Agricultural Activities

Land preparation

- "lampas" (slashing)- this is usually done when the area to be cultivated has not been used for quite some time. Weeds and other undesirable plants are slashed or cut down. This is done by the male members of the family.

- "daro" (plowing) - after clearing the area from the weeds, the soil is plowed using carabao-drawn plow to loosen up the soil. This is also done by male family members.

- "paragos" (harrowing)- to pulverize the soil, harrow is used in the farm. Males also do this kind of activity.

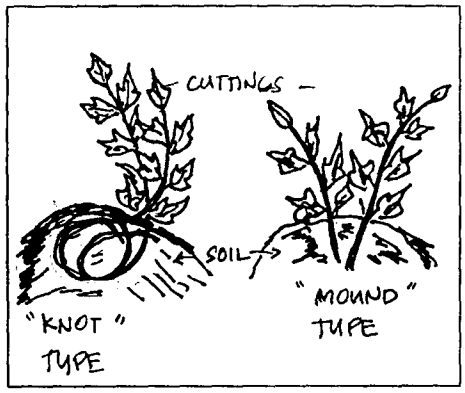
- "daro" (plowing) - plowing is done for the second time after all the weeds have been removed.

- "pon-pon" (burning)- weeds and other debris are burnt by the male members of the family.

- "tudling" (furrowing) - ridges or furrows are made after all the above mentioned activities are done. This is also being done by the males

Planting

Planting is done both by male and female members of the family. It is either in plots/ridges or in mounds. The distance between hills and between ridges is less than a meter. They usually plant five cuttings per hill (which they do not know the reason why). Two methods of planting are being followed by the natives. The "knot type" and the "mound type" See figure 1 for illustration. They prefer to use the "knot type" since harvesting is easier in this method of planting because roots grow adjacent to each other (clustered root formation)



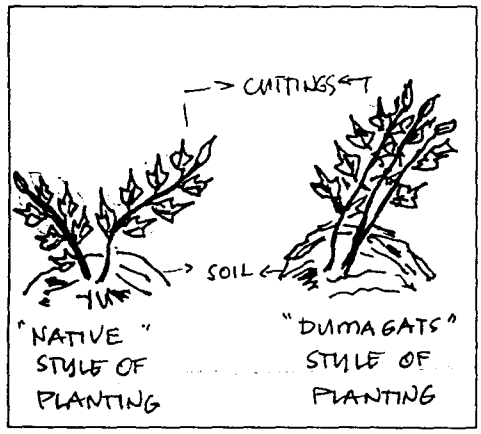
Weeding

"Basok" (weeding)- weeding is usually done a month after planting and when necessary. This activity is a sole responsibility of the female members of the family.

Harvesting

Women are responsible for harvesting since according to them they are responsible for food production and preparation in the household. Selective or staggered harvesting is the common practice. They look for the big roots and allow the smaller ones to develop for the next couple of days. Sharpened stick is the only implement used in harvesting since it will not cause any damage on the storage roots. Metal implements like knife or bolo is not used for the same reason that it can damage the roots especially the smaller ones. It is part of their beliefs not to broil or roast the first harvested roots for according to them it will cause heavy infestation of weevil.

The above mentioned agricultural activities are being followed and practiced by both the dumagats and the natives of the sitio. They only differ (at least according to the natives) in the methods of planting. Dumagats plant sweetptato in mounds, in standing position, with four cuttings (Fig 2).



Past practices in crop cultivation

When the area was still a virgin forest, land was prepared without the aid of carabao. They used the "hatsa" or the ox and the bolo in clearing the area where crops are planted. It was during those times when slash and burn was popular and people were in the hunting and gathering stage of societal development. "Bangkaw or sibat" (spear) was the implement used in hunting animals such as wild pigs and deers and in catching fishes. Domestication of animal and plants was not yet popular as they frequently changed their settlements and keeping animals would only complicate the situation.

It was in 1975 when some farmers started using carabao in the farm since they sedentary. Population had increased which resulted to limited area for crop cultivation. However, native varieties of crops like corn were still used and chemical fertilizer had not been introduced yet because the soil is still fertile. People could harvest more than what they needed. Thus, problems on food scarcity was not yet felt by the populace. High

yielding varieties of corn were introduced in 1986 by certain Mr. Jahan who was then the datu of the place. He was able to attend a seminar sponsored by San Miguel Corporation (SMC) and was encouraged to cultivate HYV of corn because of financial support that went with it.

Historical Profile of Barangay Mauswagon

Historical/social profile

Cabanglasan in 1960's was still a barangay of the municipality of Malaybalay. Mauswagon was then only a sitio of Cabanglasan called "Sisimon". It was named because the place is riched with water resources where birds of different kinds used to dwell. The first family remembered to settle in the place was to Salahag family. After several years, seven families joined them in the area. Three of them were natives belonging to Higaonon tribe while the rest were mixed migrants from Don Carlos and Bohol.

Mauswagon was very different in the past. Trees such as lawaan, ulayan, apitong, giho, tugas, malibato could still be found along with other crops like the upland rice. Native corn and sweetpotato were also cultivated in the farm but wild pigs and monkeys ate them hence the cultivation had stopped. Some families just did it in their garden where they could keep an eye on them. Every family owned two hectares of land mainly growing upland r ice and few vegetables in their home garden. Only 20% of the total land area was utilized by the settlers and the remaining 80% was forested area. During that time only four varieties of sweetpotato could be found in the area. These were magbanwa, kabatao, kamada and the unidentified one.

Year after year people begun to settle in the place and increased the population. But it was in 1970 when Talakag Timber Incorporated (TTI) begun to operate which contributed to the abrupt increase of the population in the area. People from Cebu, Bohol and other parts of Mindanao begun to settle in the barangay as they were hired as laborers of the corporation. Trees were cut and houses proliferated. In 1972, the first primary school (made of cogon grass) was constructed and a teacher was hired to educate the children. Areas cleared by TTI became the permanent area for agriculture.

In 1973, the sitio was approved as barangay Mauswagon coinciding the proclamation of Cabanglasan as a municipality. It was given the name because it was envisioned to be successful place in the future.

Agriculture

1975 marked the changes in agricultural practices when people begun using carabao and plow and begun cultivating large areas of land (since open areas become large after trees felled down). Almost 75% of the forest was gone. People also begun cultivating other crops like the native corn, banana and rootcrops since wild pigs and monkeys also vanished or changed their habitat after the forest was gone. With the increasing number of people in the area, the number of sweetpotato varieties also raised as the new settlers brought with them the varieties that they like from their hometown. Chemical fertilizer and pesticide were not used. Soil was very fertile as it being a virgin land.

In 1983, great fire burnt much of the forestal area in the place. The intense heat of the sun sparked the fire created by few slash and burn farmers. This created even a bigger area for cultivation.

The introduction of HYV of corn was done in 1986 by the DA technician (Mr. Casas) along with lowland irrigated rice. Other crops like soybeans and other leguminous plant were incorporated in the farmers cropping system. Other perennial trees were planted like coconut, mango and star apple. The school became big and provided higher grades (from Grade I to Grade VI).

Presently, only 10% of the forestal area remains in the barangay. The remaining 90% is utilized as agricultural land with corn occupying 80% and the remaining 10% planted to other crops. In 1991, DENR in collaboration with BFI started their reforestation program in the area planting gmelina and mahogany trees. The following year, electricity was installed.

Socio-economic situation

As the latest (1994) survey of the barangay nutrition scholar (BNS), the barangay has a total population of 709 comprising 133 households. The average number of children is ranging from 4-6 per family. Farming is the basis source of income by almost 80% of the population. Other also engage in family business like store keeping or private enterprises. Some are also employed in government agencies.

As mentioned earlier, the major food crops grown in the area are corn, rice, rootcrops (cassava, taro and sweetpotato) and vegetables like squash, tomato among others. Livestock like chicken, swine, goat and ducks are also being raised to augment the family income.

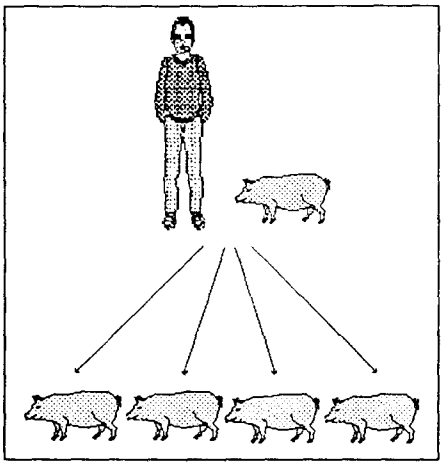
National and municipal roads are accessible to any vehicles. However, public jeepneys passed by the area only twice: in the morning bringing some goods and people to Malaybalay and in the afternoon in going home.

Local organizations profile

The local organizations such as the barangay council are active in the barangay. Government small scale projects being incorporated in these organizations are also being easily accepted and adopted by the people. To give examples, Livelihood Project introduced by DA involved the families of the barangay. Families were given high yielding varieties of corn and fertilizer to try in their respective farms. In connection with this, the Bgry. council held a competition where in the purok which has the most number of rootcrops and 'beautiful" home garden were given prizes. In 1992 (launching of the competition) the prizes given were farm tools while in 1993, the prize was in the form of cash (100.00 for the 1st prize, 75.00 for the second and 50.00 for the third).

Mothers Craft is also one of the organizations introduced by the DA people, but the time involving only the mothers. Its mandate is to improve the health status of the family members by giving some seminars on good food and good health as well as proper hygiene and sanitation.

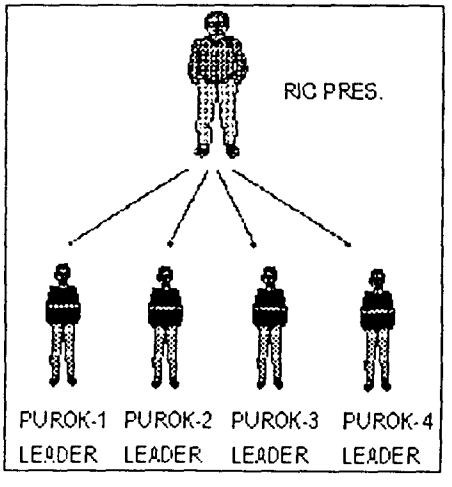
The other organization which also involved the mothers is the Rural Improvement Club or the RIC. This organization was still part of the DA's campaign to homegardening and "beautification" of the barangay. However, background information about this "beautification" project was not clearly defined (according to the brgy. chairman). This organization has two components: home gardening and animal dispersal or livestock raising. In livestock raising, the president of the organization was given one livestock (in their case goat or pig) and it was her responsibility to multiply it to be dispersed to other members (Fig. 1).



Homegardening on the other hand was operationalized by giving each member seeds of different vegetables and were grown in their garden. Inorganic fertilizer was also given to the members. On the first year of implementation, the organization did not work out very well since the president did not relegate the responsibilities to her members. She did not call any meeting or did not consult other members which resulted to loss of interest among the members.

In 1992, when the leaders of the organization changed, the first activity done in one communal area where each purok maintained one plot was successful. Each plot was planted with different vegetables and rootcrops. The maintenance was done by all members during their free time. The project also became an additional source of income since it was agreed that 70% of the produce would be given to members and the remaining 30% be given to the organization as revolving funds and as source of funds for the prizes.

Each purok had one leader who acted as the representative during the organization meeting (fig. 2) and the one responsible for collecting the 30% share from the members.



It was suggested that RIC could be reorganize to incorporate the community genebank project. This will make the organization and manpower management easier. Explanation of project goal will not be difficult as well since the "will be" members are already aware of its advantages (even just for its economic importance).

well since the "will be" members are already aware of its advantages (even just for its economic importance).

APPENDIX 2

EX SITU GENEBANK

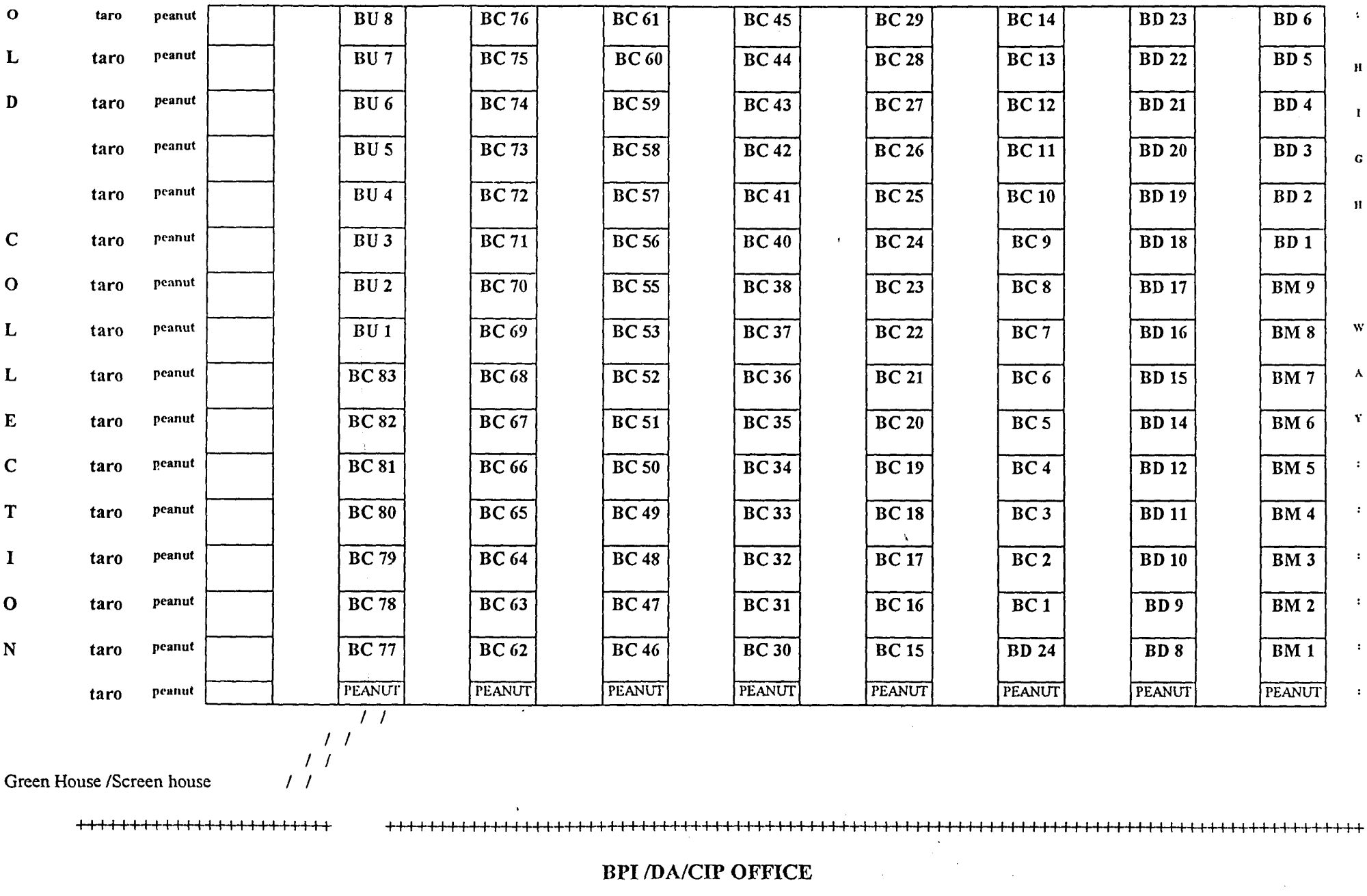

O taro peanut
L taro peanut
D taro peanut
taro peanut
taro peanut
C taro peanut
O taro peanut
L taro peanut
L taro peanut
E taro peanut
C taro peanut
T taro peanut
I taro peanut
O taro peanut
N taro peanut
taro peanut
BU 8 BC 76 BC 61 BC 45 BC 29 BC 14 BD 23 BD 6
BU 7 BC 75 BC 60 BC 44 BC 28 BC 13 BD 22 BD 5
BU 6 BC 74 BC 59 BC 43 BC 27 BC 12 BD 21 BD 4
BU 5 BC 73 BC 58 BC 42 BC 26 BC 11 BD 20 BD 3
BU 4 BC 72 BC 57 BC 41 BC 25 BC 10 BD 19 BD 2
BU 3 BC 71 BC 56 BC 40 BC 24 BC 9 BD 18 BD 1
BU 2 BC 70 BC 55 BC 38 BC 23 BC 8 BD 17 BM 9
BU 1 BC 69 BC 53 BC 37 BC 22 BC 7 BD 16 BM 8
BC 83 BC 68 BC 52 BC 36 BC 21 BC 6 BD 15 BM 7
BC 82 BC 67 BC 51 BC 35 BC 20 BC 5 BD 14 BM 6
BC 81 BC 66 BC 50 BC 34 BC 19 BC 4 BD 12 BM 5
BC 80 BC 65 BC 49 BC 33 BC 18 BC 3 BD 11 BM 4
BC 79 BC 64 BC 48 BC 32 BC 17 BC 2 BD 10 BM 3
BC 78 BC 63 BC 47 BC 31 BC 16 BC 1 BD 9 BM 2
BC 77 BC 62 BC 46 BC 30 BC 15 BD 24 BD 8 BM 1
PEANUT PEANUT PEANUT PEANUT PEANUT PEANUT PEANUT PEANUT
HIGHWAY
Green House /Screen house
BPI /DA/CIP OFFICE

TABLE 3. SITE PLAN FOR THE SWEETPOTATO GERMPLASM COLLECTION AT CIP, RESEARCH STATION, DALWANGAN, MALAYBALAY, BUKIDNON

		BD13	BD26	BC83	BC13	BC26	BC39	BC52	BC65	BC70
		BD12	BD25	BC82	BC12	BC25	BC38	BC51	BC64	BC69
		BD11	BD24	BC81	BC11	BC24	BC37	BC50	BC63	BC68
		BD10	BD23	BC80	BC10	BC23	BC36	BC49	BC62	BC67
	BM9	BD9	BD22	BC79	BC9	BC22	BC35	BC48	BC61	BC66
	BM8	BD8	BD21	BC78	BC8	BC21	BC34	BC47	BC60	BU8
12.70 meters	BM7	BD7	BD20	BC77	BC7	BC20	BC33	BC46	BC59	BU7
	BM6	BD6	BD19	BC76	BC6	BC19	BC32	BC45	BC58	BU6
	BM5	BD5	BD18	BC75	BC5	BC18	BC31	BC44	BC57	BU5
	BM4	BD4	BD17	BC74	BC4	BC17	BC30	BC43	BC56	BU4
	BM3	BD3	BD16	BC73	BC3	BC16	BC29	BC42	BC55	BU3
76.2 cm	BM2	BD2	BD15	BC72	BC2	BC15	BC28	BC41	BC54	BU2
38.1 cm	BM1	BD1	BD14	BC71	BC1	BC14	BC27	BC40	BC53	BU1
	1 meter									

First Collection Site

Main Road

Names/Codes

BM - Bukidnon Maambong

BM1 - Klarin
BM2 - Kamada
BM3 - Amerikano
BM4 - Tapol
BM5 - Igorot pula
BM6 - Igorot puti
BM7 - Five fingers 1
BM8 - Five fingers 2
BM9 - Five fingers 3

BD - Bukidnon Dalwangan

BD1 - Imelda
BD2 - Lamputi
BD3 - Kapayas
BD4 - Binawin
BD5 - Logom
BD6 - Kabato purple
BD7 - No plant
BD8 - Gireng/5 fingers
BD9 - Sampayna
BD10 - Initlog
BD11 - Kalibre
BD12 - Guilang
BD13 - Igorot puti
BD14 - Karunsing
BD15 - Ubihon
BD16 - Kabotho
BD17 - Katimpa
BD18 - Sampalatay
BD19 - Pantaw
BD20 - Kamada
BD21 - Turay
BD22 - Sil-ipon
BD23 - Lambayong
BD24 - Laguitas
BD25 - Baliskad
BD26 - Kinampay

3C - Bukidnon Identified Collection

BC1 - Kasindol- Salvacion
BC2 - Tinangkong -Salvacion
BC3 - Kamada - Salvacion
BC4 - Salvacion D - Salvacion
BC5 - Salvacion 4 - Salvacion
BC6 - Salvacion 2 - Salvacion
BC7 - Kamada green - Salvacion
BC8 - Salvacion 1 - Salvacion
BC9 - Katibor - Salvacion
BC10 - Kabato purple - Salvacion
BC11 - Kabato green - Salvacion
BC12 - Igorot 1 - Salvacion
BC13 - Igorot 2 - Salvacion
BC14 - Tapol - Salvacion
BC15 - Kulating - Intavas
BC16 - Malaybalay - Intavas
BC17 - Dinagat - Intavas
BC18 - Katimpa - Salvacion
BC19 - Initlog 2 - Intavas
BC20 - Ubihon - Intavas
BC21 - Laguitas 2 - Intavas
BC22 - Kauyag 1 - Intavas
BC23 - Laguitas 1 - Intavas
BC24 - Lamputi - Salvacion
BC25 - Kauyag 2 - Intavas
BC26 - Imelda - Intavas
BC27 - Amerikano 1 - Salvacion
BC28 - Binawin - Intavas
BC29 - Klarin - Salvacion
BC30 - Lambayong - Intavas
BC31 - Amerikano 2 - Salvacion
BC32 - Initlog - Intavas
BC33 - Sil-ipon - Salvacion
BC34 - Valencia - Intavas
BC35 - Magbanua - Bukidnon
BC36 - Kalugti - Bukidnon
BC37 - Kapayas - Manobo
BC38 - Natuk - Manobo
BC39 - Sil-ipon - Manobo

BC40 - Butigo - Manobo
BC41 - Pantaw - Manobo
BC42 - Baliskad - Umayamnon
BC43 - Samsaman - Manobo
BC44 - Bulakawon - Guilang-guilang
BC45 - Mabinbalin - Guilang-guilang
BC46 - Kapayas - Guilang guilang
BC47 - Lamputi - Intavas
BC48 - Kalugti - Bukidon
BC49 - Kabotho - Salvacion
BC50 - Kalarin - Talaandig
BC51 - Sil-ipon - Talaandig
BC52 - Logom - Talaandig
BC53 - Siudon - Bukidnon
BC54 - Kiloran - Talaandig
BC55 - Kayomyoman - Bukidnon
BC56 - Kolongkot -Bukidnon
BC57 - Kutong -Bukidnon
BC58 - Natuk - Sinuda, kitao-tao
BC59 - Pamada
BC60 - Posako
BC61 - Kapayas
BC62 - Mangubay
BC63 - Mindanao - Poblacion, Cabanglasan
BC64 - Sikwayon - Poblacion, Cabanglasan
BC65 - Burikat - Poblacion, Cabanglasan
BC66 - Arabia-Poblacion, Cabanglasan
BC67 - Gumuba-Poblacion, Cabanglasan
BC68 - Pupuan-Poblacion, Cabanglasan
BC69 - Dumukot)
BC70 - Baliskad)
BC71 - Adela)
BC72 - Manguluba)
BC73 - Klarin) Maraging, Iba
BC74 - Gulisok) Cabanglasan
BC75 - Pupuan)
BC76 - Salititon)
BC77 - Gatusan)
BC78 - Magbanwa)
BC79 - Silipon)
BC80 - Baling)
BC81 - Minamaon)
BC82 - Magbanwa) Poblacion,
BC83 - Imelda) Cabanglasan

BU - Bukidnon Unidentified Varities

BU1 - Salvacion 1
BU2 - Salvacion 2
BU3 - Salvacion 3
BU4 - BUT1 - Talaandig Tribe (Talakog, Bukidnon)
BU5 - BUT2 - Talaandig Tribe
BU6 - BUN2 - Manolo Fortich
BU7 - BUN1 - Manolo Fortich
BU8 - BUT1 - Manobo Tribe (Dalurong, Kitaotao, Bukidnon)

PLOT	ACCESSION CODE	COUNTRY	TWINING	PLANT	MAIN VINE COLOR	2ND VINE COLOR	VINE TIP PUBESCENCE	LEAF SHAPE	LEAF SIZE	LEAF VINE PIGMENT.	MATURE LEAF COLOR	IMMATURE LEAF COLOR	PETIOLE PIGMENT.	PETIOLE LENGTH	ROOT SHAPE	ROOT DEFECTS	CORTEX THICKNESS	SKIN COLOR	FLESH COLOR	CULTIVAR NAME	REMARKS
1	BU 7	PHL	0	0	1	0	3	3111	0	2	2	2	1	0	0	0	0	0	0	Bun 1	not yet ready for evaluation
2	BC 36	PHL	0	7	3	2	3	3111	3	2	2	2	1	1	3	0	3	230	200	Kalugti	
3	BC 56	PHL	0	7	1	0	3	3111	3	2	2	6	1	3	5	7	7	512	100	Kalongkot	
4	BC 59	PHL	0	0	3	2	5	3111	0	2	2	7	1	0	0	0	0	0	0	Pamada	
5	BD 9	PHL	0	7	3	2	3	3111	3	2	2	6	2	3	8	6	5	830	488	Sampayna	vigorous, katydid, cercospora
6	BD 22	PHL	0	7	3	2	3	3111	3	2	2	6	5	3	1	5	7	230	100	Sil-ipon	feathery mottle virus
7	BC 22	PHL	0	7	1	0	3	4111	3	3	2	2	3	3	3	5	7	235	471	Kauyag 1	cercospora, katydid
8	BC 64	PHL	0	0	3	2	5	3111	0	3	2	3	3	0	0	0	0	0	0	Sikwayon	
9	BC 33	PHL	0	7	3	2	5	3111	3	3	2	3	3	1	5	0	5	730	400	Sil-ipon	grab hoe, roots crack
10	BC 30	PHL	0	7	1	5	3	3111	3	3	2	9	3	1	1	6	7	512	344	Lambayong	
11	BD 14	PHL	0	9	3	5	3	3111	3	3	2	9	3	3	1	6	7	526	500	Karunsing	vigorous, weevil
12	BC 46	PHL	0	7	6	2	3	3111	3	3	2	7	5	3	5	7	7	512	100	Kapayas	purple spots
13	BC 45	PHL	0	7	6	2	3	3111	3	3	2	6	3	1	0	0	0	0	0	Mabinbalin	purple spots, no roots yet
14	BC 44	PHL	0	7	4	5	3	3111	3	3	5	6	3	3	0	0	0	0	0	Bulakawon	purple spots, no roots yet
15	BD 18	PHL	0	5	3	0	0	3111	1	3	2	6	8	1	6	4	7	230	542	Sampalatay	purple spots
16	BC 43	PHL	0	7	3	5	3	3131	5	5	2	7	8	3	2	2	5	825	100	Samsaman	looked "healthy"
17	BC 4	PHL	0	7	3	5	3	3111	5	5	5	9	8	3	4	5	5	830	200	Salvacion D	katydid
18	BD 23	PHL	0	7	3	0	3	3111	3	7	2	9	3	1	3	0	3	536	100	Lambayong	vigorous
19	BC 70	PHL	0	0	3	6	3	3111	0	7	2	6	5	0	0	0	0	0	0	Baliskad	
20	BC 55	PHL	0	7	6	0	5	3111	5	8	2	6	1	3	8	2	3	312	543	Kayomyoman	
21	BC 27	PHL	0	0	6	2	5	3111	0	8	5	9	3	0	0	0	0	0	0	Amerikano 1	not yet ready for evaluation
22	BC 57	PHL	0	7	6	0	5	3111	5	8	2	7	9	3	8	2	3	126	543	Kutong	
23	BM 3	PHL	0	7	7	0	3	3131	5	8	5	9	9	3	8	2	3	126	543	Amerikano	sprouts easily
24	BC 75	PHL	0	0	6	0	5	3111	0	8	5	9	9	0	0	0	0	0	0	Pupuan	
25	BD 21	PHL	0	7	6	0	3	3111	5	8	5	9	9	3	9	4	5	930	199	Turay	purple spots
26	BC 78	PHL	0	0	7	0	3	3131	0	8	5	9	9	0	0	0	0	0	0	Magbanwa	
27	BW 1	PHL	0	0	7	0	3	3131	0	8	5	9	9	0	0	0	0	0	0		
28	BW 5	PHL	0	0	3	0	3	3132	0	2	2	6	1	0	0	0	0	0	0		
29	BD 10	PHL	0	9	1	0	3	3132	5	3	2	2	3	3	4	0	7	220	288	Initlog	vigorous, katydid, GTB
30	BC 81	PHL	0	0	1	0	5	3132	0	3	2	3	3	0	0	0	0	0	0	Minamaon	
31	BC 80	PHL	0	0	1	0	3	3134	0	3	2	6	3	0	0	0	0	0	0	Bating	
32	BC 37	PHL	0	7	3	2	3	3134	5	3	2	6	3	3	9	6	3	520	100	Kapayas	purple spots, vigorous
33	BC 15	PHL	0	9	1	0	5	5334	5	2	2	2	1	3	4	5	7	230	100	Kulating	
34	BC 11	PHL	0	9	1	0	3	5334	5	2	2	2	1	3	4	5	7	230	100	Kabato green	vigorous, "healthy"
35	BC 26	PHL	0	9	1	0	5	5334	5	2	2	2	1	3	4	5	7	230	100	Imelda	
36	BM 2	PHL	0	5	1	0	0	5332	3	2	2	3	1	1	0	0	0	0	0	Kamada	katydid, GTB, no roots yet
37	BC 6	PHL	0	5	1	0	3	5332	3	2	2	3	1	1	4	3	3	132	300	Salvacion 2	looked "sad"
38	BD 20	PHL	0	7	3	2	3	3152	5	3	2	7	3	3	3	3	5	520	100	Kamada	grab hoe
39	BC 61	PHL	0	0	3	2	3	3152	0	7	2	6	1	0	0	0	0	0	0	Kapayas	

PLOT	ACCESSION CODE	COUNTRY	TWINING	PLANT	MAIN VINE COLOR	2ND VINE COLOR	VINE TIP PUBESCENCE	LEAF SHAPE	LEAF SIZE	LEAF VINE PIGMENT.	MATURE LEAF COLOR	IMMATURE LEAF COLOR	PETIOLE PIGMENT.	PETIOLE LENGTH	ROOT SHAPE	ROOT DEFECTS	CORTEX THICKNESS	SKIN COLOR	FLESH COLOR	CULTIVAR NAME	REMARKS
40	BM 4	PHL	0	5	7	0	5	3151	5	8	5	9	9	3	2	2	3	930	196	Tapol	vigorous
41	BC 20	PHL	0	5	7	2	3	3152	3	8	2	9	9	1	4	2	5	820	182	Ubihon	purple spots, scab
42	BC 5	PHL	0	9	1	0	3	3152	5	2	2	2	1	3	1	2	7	224	546	Salvacion 4	vigorous, katydid
43	BC 7	PHL	0	9	1	0	0	3152	5	2	2	2	1	3	1	6	7	234	546	Kamada green	cercospora
44	BC 24	PHL	0	7	3	2	3	3152	3	2	2	2	1	1	0	0	0	0	0	Lamputi	no roots yet, cercospora, katydid
45	BC 17	PHL	0	7	1	0	5	3154	3	2	2	3	1	1	0	0	0	0	0	Dinagat	no roots yet, looked "sad"
46	BD 2	PHL	0	7	3	0	0	3152	5	2	2	6	5	3	4	0	5	210	100	Lamputi	katydid
47	BC 48	PHL	0	7	3	0	3	3152	3	2	2	6	5	1	2	0	7	230	200	Kalugti	
48	BC 49	PHL	0	7	3	0	3	3152	3	2	2	6	5	1	2	0	7	230	200	Kabotho	
49	BC 58	PHL	0	0	1	0	3	3152	0	3	2	7	3	0	0	0	0	0	0	Natuk	
50	BD 3	PHL	0	9	3	2	3	3152	3	3	2	7	3	1	0	0	0	0	0	Kapayas	scab, no roots yet
51	BC 32	PHL	0	7	5	2	3	3153	3	2	2	7	1	1	6	6	7	514	200	Initlog	purple spots, roots crack
52	BM 1	PHL	0	7	1	0	3	5332	5	2	2	3	1	3	8	0	5	830	100	Klarin	weevil infested
53	BC 52	PHL	0	7	3	2	5	3132	3	3	2	3	3	1	5	0	5	730	400	Logom	
54	BC 77	PHL	0	0	3	2	3	5332	0	2	2	3	1	0	0	0	0	0	0	Gatusan	
55	BC 42	PHL	0	7	3	2	0	5332	5	2	2	7	1	3	1	1	5	730	200	Baliskad	purple spots
56	BC 38	PHL	0	7	3	2	5	5332	3	2	2	7	1	1	9	2	3	210	200	Natuk	purple spots
57	BC 67	PHL	0	0	3	5	3	5332	0	2	2	6	8	0	0	0	0	0	0	Gumuba	
58	BC 9	PHL	0	7	3	5	3	5332	5	2	2	6	8	1	3	1	3	130	188	Katibor	katydid, weevil infested
59	BD 11	PHL	0	7	3	5	3	5332	3	2	2	6	8	3	4	6	7	830	100	Kalibre	cercospora
60	BU 5	PHL	0	7	1	0	5	5332	3	3	2	3	3	1	5	0	5	730	400	BUT 2	
61	BD 5	PHL	0	5	1	0	3	5332	5	5	2	3	3	1	5	4	7	830	443	Logom	roots crack, GTB
62	BC 31	PHL	0	7	3	2	5	5332	5	3	2	3	3	1	1	0	7	730	200	Amerikano 2	
63	BC 51	PHL	0	7	3	2	5	5332	3	3	2	3	3	1	5	0	5	730	400	Sil-ipon	
64	BU 4	PHL	0	7	3	2	3	5332	3	3	2	3	3	1	5	0	5	730	400	BUT 1	
65	BM 6	PHL	0	9	3	0	3	5332	5	3	2	6	3	3	8	2	3	230	200	Igorot puti	sprouts easily, scab, vigorous
66	BD 16	PHL	0	9	3	2	3	5332	3	3	2	6	3	3	6	0	7	220	100	Kabotho	vigorous, weevil infested
67	BC 21	PHL	0	7	3	2	3	5332	3	5	2	6	4	1	0	0	0	0	0	Laguitas 2	no roots yet
68	BU 6	PHL	0	7	1	0	3	5332	5	3	2	7	3	3	9	6	3	520	100	BUN 2	
69	BC 34	PHL	0	5	3	2	3	5332	3	7	2	3	4	1	4	7	7	510	423	Valencia	
70	BC 14	PHL	0	9	3	5	3	5332	5	7	5	9	4	3	8	0	5	220	100	Tapol	vigorous
71	BC 16	PHL	0	9	3	5	5	3132	5	7	2	9	8	3	3	0	3	610	100	Malaybalay	vigorous
72	BC 82	PHL	0	0	3	5	3	5332	0	7	5	9	8	0	0	0	0	0	0	Magbanwa	
73	BU 1	PHL	0	9	3	5	3	5334	5	7	5	9	8	3	8	0	5	220	100	Salvacion 1	
74	BD 6	PHL	0	7	4	5	3	5334	5	7	5	9	8	3	4	5	7	220	100	Kabato purple	weevil infested
75	BM 5	PHL	0	7	3	5	3	5334	5	5	2	9	8	3	3	2	5	230	100	Igorot pula	sprouts easily, weevil
76	BD 15	PHL	0	5	7	0	0	5332	5	8	5	7	9	1	1	0	7	930	999	Ubihon	less vigorous
77	BC 3	PHL	0	9	3	2	0	5334	5	2	2	3	1	3	2	0	7	830	100	Kamada	vigorous
78	BC 28	PHL	0	0	3	2	5	5334	0	3	2	6	3	0	0	0	0	0	0	Binawin	not yet ready for evaluation

PLOT	ACCESSION CODE	COUNTRY	TWINING	PLANT	MAIN VINE COLOR	2ND VINE COLOR	VINE TIP PUBESCENCE	LEAF SHAPE	LEAF SIZE	LEAF VINE PIGMENT.	MATURE LEAF COLOR	IMMATURE LEAF COLOR	PETIOLE PIGMENT.	PETIOLE LENGTH	ROOT SHAPE	ROOT DEFECTS	CORTEX THICKNESS	SKIN COLOR	FLESH COLOR	CULTIVAR NAME	REMARKS
79	BC 42	PHL	0	7	6	2	3	5334	5	7	2	2	3	3	1	1	5	730	200		purple spots
80	BC 10	PHL	0	9	6	0	3	5334	5	5	2	7	8	3	8	0	5	220	100	Kabato purple	vigorous, purple spots
81	BC 25	PHL	0	7	6	2	3	5332	3	3	2	7	8	3	0	0	0	0	0	Kauyag 2	no roots yet, katydid
82	BC 47	PHL	0	7	3	5	3	6352	3	1	2	6	8	1	2	0	7	230	200	Lamputi	purple spots, GTB, vigorous
83	BD 12	PHL	0	7	6	0	0	6352	5	8	5	9	8	3	7	0	7	530	548	Guilang	purple spots, vigorous
84	BW 2	PHL	0	0	4	5	3	6354	0	3	2	9	8	0	0	0	0	0	0		
85	BC 60	PHL	0	0	3	2	3	6354	0	2	2	3	1	0	0	0	0	0	0	Posako	
86	BC 65	PHL	0	0	6	0	3	6354	0	3	2	7	5	0	0	0	0	0	0	Burikat	
87	BD 4	PHL	0	7	3	2	5	6354	5	7	2	6	4	1	4	6	5	612	100	Binawin	
88	BC 18	PHL	0	5	3	2	0	6354	3	8	2	2	4	1	1	0	7	220	189	Katimpa	
89	BU 8	PHL	0	0	1	5	3	6552	0	2	2	6	1	0	0	0	0	0	0	BUT 1	
90	BC 73	PHL	0	0	1	0	3	6554	0	2	2	2	1	0	0	0	0	0	0	Klarin	
91	BC 13	PHL	0	7	1	0	3	6554	5	3	2	3	3	3	3	1	5	630	100	Igorot 2	
92	BC 71	PHL	0	0	6	0	3	6554	0	7	2	6	3	0	0	0	0	0	0	Adela	
93	BD 17	PHL	0	7	1	6	0	6555	5	8	5	2	4	3	4	2	7	210	989	Katimpa	vigorous
94	BU 2	PHL	0	5	3	6	0	6554	3	8	5	2	4	1	1	0	0	722	19	Salvacion 2	
95	BD 24	PHL	0	5	3	0	3	6555	5	2	5	6	3	1	1	0	7	636	546	Lagultas	vigorous
96	BC 35	PHL	0	7	1	0	5	6556	5	7	2	3	3	1	2	0	5	630	200	Magbanua	looked "healthy"
97	BW 6	PHL	0	0	3	5	3	6556	0	5	2	9	8	0	0	0	0	0	0		
98	BC 1	PHL	0	5	3	5	3	6754	5	5	2	9	8	1	4	0	5	416	546	Kasindol	
99	BC 76	PHL	0	0	1	5	3	6754	0	3	2	6	3	0	0	0	0	0	0	Salititon	
100	BC 23	PHL	0	5	1	6	3	6755	5	3	2	6	3	3	7	0	2	630	448	Lagultas 1	weevil infested
101	BC 74	PHL	0	0	3	2	3	6755	0	2	2	7	1	0	0	0	0	0	0	Gulisok	
102	BC 19	PHL	0	7	3	2	5	6755	5	2	2	9	5	1	5	1	5	730	400	Initlog 2	looked "sad", purple spots
103	BM 7	PHL	0	7	1	5	3	6755	3	3	2	7	3	1	1	0	3	634	442	Five fingers 1	scab, katydid, weevil infested
104	BC 50	PHL	0	7	3	0	5	6755	3	3	2	7	3	1	1	0	3	344	442	Kalarin	
105	BC 68	PHL	0	0	3	2	3	6755	0	3	2	7	3	0	0	0	0	0	0	Pupuan	
106	BC 79	PHL	0	0	6	2	3	6755	0	3	2	7	3	0	0	0	0	0	0	Silipon	
107	BW 4	PHL	0	0	6	2	3	6755	0	3	2	7	3	0	0	0	0	0	0		
108	BC 12	PHL	0	7	1	0	3	6755	5	5	2	3	3	3	3	1	5	630	100	Igorot 1	sprouts easily, root shape varies
109	BD 19	PHL	0	5	1	0	5	6755	5	5	2	3	3	3	4	0	5	630	100	Pantaw	vigorous, weevil infested
110	BC 41	PHL	0	7	1	0	3	6755	5	5	2	2	3	3	2	2	5	825	100	Pantaw	looked "healthy"
111	BC 43	PHL	0	7	3	2	3	6755	5	5	2	3	3	3	2	2	5	825	100		looked "healthy"
112	BU 3	PHL	0	7	3	2	3	6756	5	5	2	3	3	3	2	2	5	826	100	Salvacion 3	
113	BW 3	PHL	0	0	3	4	3	6756	0	3	2	3	3	0	0	0	0	0	0		
114	BC 8	PHL	0	5	3	5	3	6755	3	5	2	7	3	8	4	5	7	614	546	Salvacion 1	sprouts easily
115	BM 9	PHL	0	7	3	5	3	6755	5	5	2	7	3	1	3	2	3	634	442	Five fingers 3	weevil infested
116	BM 8	PHL	0	7	3	5	3	6755	5	5	2	7	3	3	3	5	5	634	445	Five fingers 2	high yielding
117	BC 2	PHL	0	5	1	0	3	6955	3	7	2	2	4	1	8	0	5	230	400	Tinangkong	grab hoe, weevil infested
118	BC 66	PHL	0	0	1	0	3	6965	0	7	2	2	4	0	0	0	0	0	0	Arabia	
119	BD 8	PHL	0	5	1	0	3	6955	3	7	2	6	4	3	9	6	7	230	100	Gireng / 5 Fingers	weevil infested
120	BC 29	PHL	0	7					5	2				3	7	0	3	730	110	Klarin	weevil infested
121	BC 40	PHL	0	5					3					1	3	0	5	730	323	Butigo	
122	BC 53	PHL	0	7					5					1	0	0	0	0	0	Siudon	no roots yet
123	BC 69	PHL	0	0					0					0	0	0	0	0	0	Dumukot	
124	BC 72	PHL	0	0					0					0	0	0	0	0	0	Manguluba	
125	BC 83	PHL	0	0					0					0	0	0	0	0	0	Imelda	
126	BD 1	PHL	0	5					3					3	1	1	3	630	400	Imelda	weevil infested
127	BW 7	PHL	0	0					0					0	0	0	0	0	0		

TABLE 2. LIST OF KEY CHARACTERS FOR DUPLICATE IDENTIFICATION IN *Ipomoea batatas* COLLECTIONS.

TWINING

0 Non-twining
3 Slighty twining
5 Moderately twining
7 Twining
9 Very twining

PLANT TYPE

3 Erect (less than 75 cm)
5 Semi-compact (75 - 150 cm)
7 Spreading (151 - 250 cm)
9 Extremely spreading (more than 250 cm)

VINE INTERNODE

DIAMETER	LENGTH
1 Very thin (< 4 mm)	1 Very short (< 3 cm)
3 Thin (4 - 6 mm)	3 Short (3 - 5 cm)
5 Intermediate (7 - 9 mm)	5 Intermediate (6 - 9 cm)
7 Thick (10 - 12 mm)	7 Long (10 - 12 cm)
9 Very thick (> 12 mm)	9 Very long (> 12 cm)

VINE PIGMENTATION

PREDOMINANT COLOR	SECONDARY COLOR
1 Green	0 Absent
3 Grenn few purple spots	1 Green base
4 Green many purple spots	2 Green tip
5 Green many dark purple spots	3 Green nodes
6 Mostly purple	4 Purple base
7 Mostly dark purple	5 Purple tip
8 Totally purple	6 Purple nodes
9 Totally dark purple	7 Other

VINE TIP PUBESCENCE

0 None
3 Sparse
5 Moderate
7 Heavy
9 Very heavy

MATURE LEAF SHAPE

GENERAL OUTLINE OF THE LEAF

1 Rounded
2 Reniform
3 Cordate
4 Triangular
5 Hastate
6 Lobed
7 Almost divided

TYPE OF LEAF LOBES

0 No lateral lobes (entire)
1 Very slight (teeth)
3 Slight
5 Moderate
7 Deep
9 Very deep

NUMBER OF LEAF LOBES*

0
1
3
5
7
9

SHAPE OF CENTRAL LOBE

0 Absent
1 Teeth
2 Triangular
3 Semi-circular
4 Semi-elliptic
5 Elliptic
6 Lanceolate
7 Oblanceolate
8 Linear (broad)
9 Linear (narrow)

ABAXIAL LEAF VEIN PIGMENTATION

1 Yellow
2 Green
3 Purple spot at base of main rib
4 Purple spots in several veins
5 Main rib partially purple
6 Main rib mostly or totally purple
7 All veins partially purple
8 All veins mostly or totally purple
9 Lower surface and veins totally purple

* Excluding the two basal leaves

MATURE LEAF SIZE

3 Small (< 8 cm)
5 Medium (8 - 15 cm)
7 Large (16 - 25 cm)
9 Very large (> 25 cm)

FOLIAGE COLOR

MATURE LEAF COLOR	INMATURE LEAF COLOR
1 Yellow-green	1 Yellow-green
2 Green	2 Green
3 Green with purple edge	3 Green with purple edge
4 Greyish (heavy pubescence)	4 Greyish (heavy pubescence)
5 Green with purple veins on upper surface	5 Green with purple veins on upper surface
6 Slightly purple	6 Slightly purple
7 Moderately purple	7 Moderately purple
8 Mostly purple	8 Mostly purple
9 Totally purple	9 Totally purple

PETIOLE PIGMENTATION

1 Green
2 Green with purple near stem
3 Green with purple near leaf
4 Green with purple at both ends
5 Green with purple spots throughout petiole
6 Green with purple stripes
7 Purple with green near leaf
8 Some petioles purple, others green
9 Totally or mostly purple

PETIOLE LENGTH

1 Very short (less than 10 cm)
3 Short (10 - 20 cm)
5 Intermediate (21 - 30 cm)
7 Long (31 - 40 cm)
9 Very long (more than 40 cm)

STORAGE ROOT SHAPE

1 Round
2 Round elliptic
3 Elliptic
4 Ovate
5 Obovate
6 Oblong
7 Long oblong
8 Long elliptic
9 Long irregular or curved

STORAGE ROOT DEFECTS

0 None
1 Alligator-like skin
2 Veins
3 Shallow horizontal constrictions
4 Deep horizontal constrictions
5 Shallow longitudinal grooves
6 Deep longitudinal grooves
7 Deep constrictions and deep grooves
8 Other

STORAGE ROOT CORTEX THICKNESS

1 Very thin (1 mm or less)
3 Thin (1 - 2 mm)
5 Intermediate (2 - 3 mm)
7 Thick (3 - 4 mm)
9 Very thick (more than 4 mm)

STORAGE ROOT SKIN COLOR

PREDOMINANT COLOR	INTENSITY	SECONDARY COLOR
1 White	1 Pale	0 Absent
2 Cream	2 Intermediate	1 White
3 Yellow	3 Dark	2 Cream
4 Orange		3 Yellow
5 Brownish orange		4 Orange
6 Pink		5 Brownish orange
7 Red		6 Pink
8 Purple-red		7 Red
9 Dark purple		8 Purple-red
		9 Dark purple

STORAGE ROOT FLESH COLOR

PREDOMINANT COLOR	SECONDARY COLOR	DISTRIBUTION OF COLOR
1 White	0 Absent	0 Absent
2 Cream	1 White	1 Narrow ring in cortex
3 Dark cream	2 Cream	2 Broad ring in cortex
4 Pale yellow	3 Yellow	3 Scattered spots
5 Dark yellow	4 Orange	4 Narrow ring in flesh
6 Pale orange	5 Pink	5 Broad ring in flesh
7 Intermediate orange	6 Red	6 Ring and other areas
8 Dark orange	7 Purple-red	7 In longitudinal sections
9 Strongly pigmented with anthocyanins	8 Purple	8 Covering most flesh
	9 Dark purple	9 Covering all flesh

STORAGE ROOT ARRANGEMENT

1 Closed cluster
3 Open cluster
5 Disperse
7 Very disperse

Farmers' Description on SweetPotato Varieties

KLARIN

- came from Negros
- five months to mature
- vines grow easily after planting
- can be planted in plain and rolling areas
- can be intercropped with corn but the distance should be wide
- not good to intercrop with other vegetables
- vines also produce roots
- can be stored for 5 days - if stored for more than two weeks, roots will be watery
- suitable for forage
- when vines/cuttings/tops are cut before harvest, roots will be affected - number of roots will decrease
- best for table use
- red skin
- white flesh
- dry, sweet
- green leaves
- tops can be utilized as vegetables
- salable in the market
- no side effect when eaten
- when boiling sweetpotato roots, pinch of salt should be added with water to avoid cracking

5-FINGERS

- called as such because of the shape of the leaves
- best source of planting material is the apical cutting
- during dry season, leaf size becomes small
- during wet season, roots are few because of vegetative growth
- when vines or leaves are cut before harvest, roots will decrease in number
- roots are attacked by ants and worms
- easy to manage/maintain
- vines are big
- can be planted to plain and rolling areas
- not suitable to wet soil
- not good to intercrop with corn and other vegetables
- can be mixed with other varieties of sweetpotato
- can be stored for 3-5 days and beyond that will make the roots watery and very sweet (not good for consumption anymore)
- suitable for forage
- salable in the market but best to utilize as food and for camote que
- pink skin, yellow flesh
- not so sweet, watery
- 3-4 months to mature
- produce big roots

KAMADA

- came from Bohol
- best source of planting material is the apical cutting
- when vines and leaves are cut before harvest, roots that will be produced will decrease in number
- during dry season, leaves are the first to be damaged by pest and disease
- during wet season, roots are few because of fast vegetative growth
- not good to intercrop with corn and other crops
- can be mixed with other varieties of sweetpotato
- can be stored for a few days only if stored for more than a week will rot
- suitable for forage
- white skin, white flesh
- elongated roots
- sweet, watery
- 4-5 months to mature
- salable in the market
- spreading vines help to control the growth of weeds
- roots can be harvested all at one time - vines will continue to produce roots

IGOROT PULA

- originated from Negros
- best source of planting material is the apical cutting
- easy to manage/maintain
- can be mixed with other variety of sweetpotato
- during dry season, roots become smaller
- during wet season, roots are few because of fast vegetative growth
- during extreme weather condition, roots are few
- not good to intercrop with corn and other crops
- if vines or cuttings are cut before harvest, roots will decrease in number
- in harvesting, bolo or any sharp material can be used and will not affect the roots
- white flesh, white skin
- dry, sweet
- can be cultivated on plain and rolling areas
- 4-5 months to mature
- can be stored for one week and beyond that will make the roots very sweet
- salable in the market
- best to utilize after harvest

IGOROT PUTI

- easy to manage/maintain
- spreading vines help in controlling the growth of weeds
- best source of planting material is the apical cutting
- during dry season, roots are the first to be affected - roots shrunk and attacked by weevil
- during wet season, vines are big but roots are small
- not good to intercrop with corn and other crops
- can be mixed with other sweetpotato varieties
- suitable for forage
- best to cook as snack food (suman, camote que)
- salable in the market
- in harvesting, select only the big roots and allow the smaller ones to develop so that the plant will not die
- can be stored for 4 days
- five months to mature
- can be cultivated to plain and rolling areas
- white flesh
- sweet, dry
- elongated roots
- roots are clustered and dispersed
- best to consume after harvest rather than when stored at home

AMERIKANO

- was named as such because the color of the flesh is white and the roots are extra big
- red vines and red tops
- best source of planting material is the apical cutting
- easy to maintain/manage
- white skin, yellow flesh
- dry, sweet
- roots are in different shapes (round and elongated)
- during dry season, roots are only few
- during wet season, roots will rot
- roots are dispersed
- can be cultivated in plain and rolling areas
- 5 months to mature
- can be intercropped with taro but the distance should be wide
- can be mixed with other sweetpotato varieties
- salable in the market
- can be stored for 4 days
- taste changed when stored

BILAKA

- was called as such because of root formation which is clustered
- green leaves, green vines
- vines are not spreading
- white skin, white flesh
- dry
- easy to manage/maintain
- best source of planting material is the apical cutting
- roots are clustered
- not good to intercrop with other crops
- can be mixed with other sweetpotato varieties
- salable in the market
- 4 months to mature
- during dry season, roots are attacked by weevil
- can be stored for 3-5 days
- can be cultivated to rolling and plain areas
- roots crack when cooked
- used as forage

KALIGATOS

- many roots are produced but the size is small
- egg-like roots
- green leaves and red tops
- 5 months to mature
- can be cultivated to rolling and plain areas
- easy to maintain/manage
- during dry season, roots are only few
- when vines and cutting are cut/removed before harvest, root number will decrease
- not good to intercrop with corn
- can be mixed with other sweetpotato varieties
- yellow skin, yellow flesh
- not so sweet, not so dry
- used as forage
- not that salable in the market because of the small size
- can be stored for 4 days, if stored for a long period of time will become watery
- roots are clustered

KINAMPAY/TAPOL

- was called as such because of the color of flesh, skin, leaves and vines (violet -tapol)
- elongated roots
- can be cultivated to rolling and plain areas
- easy to manage/maintain
- best source of planting material is the apical cutting
- red purple skin, violet flesh
- not so sweet, watery
- can be mixed with other sweetpotato varieteis
- not good to intercrop with other crops like corn
- salable in the market because of the color
- during dry season, roots are attack by weevil

IMELDA

- leaves are like "kangkong" (serrated)
- vines are compact
- not producing a lot of roots
- best to consume as vegetables (leaves)
- green leaves, green vines
- white flesh, white skin
- not sweet, watery
- not producing roots during dry season
- easy to maintain/manage
- 4 months to mature
- best source of planting material is the apical cutting