seeds and survival:

crop genetic resources in war and reconstruction in Africa

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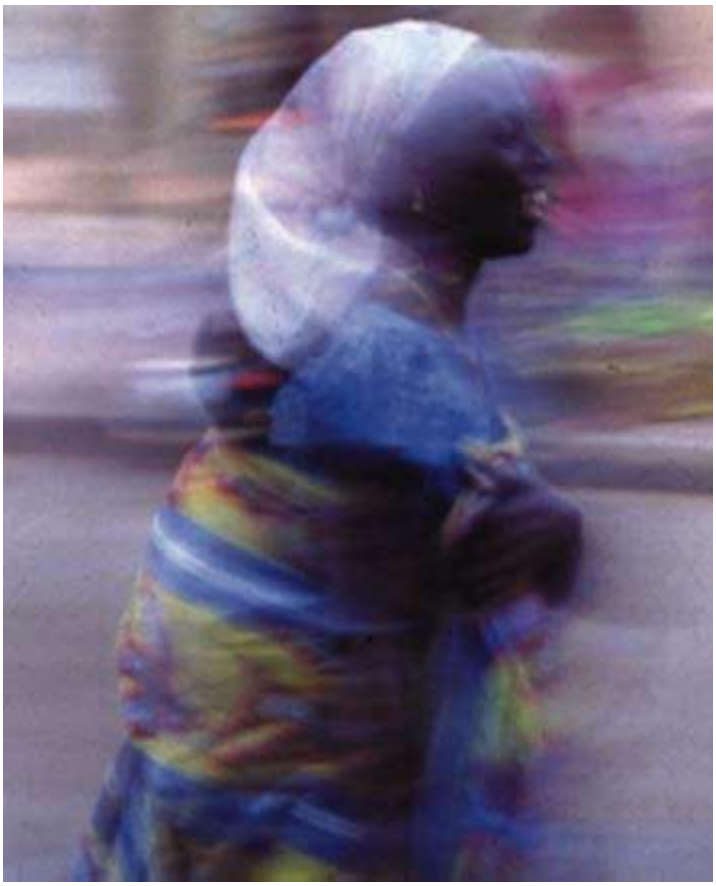
with contributions from Roy van der Drift, Mulbah Gonowolo, Malcolm S. Jusu, Catherine Longley and Shawn McGuire



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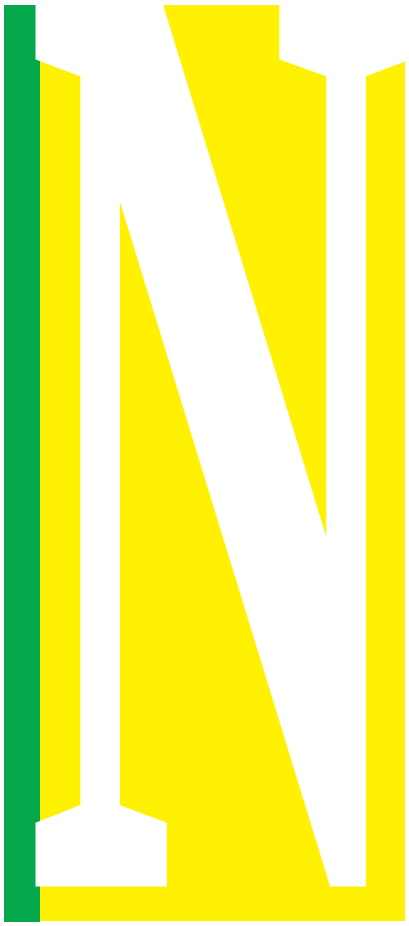

notes

This report was prepared during April/May 1995 by staff and associates of TAO (the Joint Working Group on Technology and Agrarian Development) of the Wageningen Agricultural University and University College London, (Department of Anthropology) under supervision of Prof. Dr. Paul Richards.

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Origin and intent

This report draws upon the research and personal experiences of the various authors. It also reflects discussions with representatives of various agencies. We would especially like to acknowledge the contribution to these discussions of Ineke van Winden of the Dutch Interchurch Relief organization (SOH) and Dr. Jaap Hardon of the Dutch genebank (CGN, Wageningen). The concepts presented here were discussed at a meeting in June 1995 with senior staff at IPGRI Headquarters, Rome. We thank Pablo Eyzaguirre, Toby Hodgkin and B. Landon Myer for their comments and editorial suggestions. Financial support for the preparation of the report was provided by the International Plant Genetic Resources Institute (IPGRI). Opinions expressed are those of the editors and contributors alone.

The report is intended to stimulate debate and further research on the linked issues of seed supply and genetic resource management in rural communities recovering from war, civil strife, and disasters. It deals with experiences in three West African countries and complements other work such as the CGIAR 'Seeds of Hope' initiative.

executive summary

This report considers the impact of war, civil strife, and low-intensity conflict (LIC) on plant genetic resource management, where crop plant genetic resources are still partly (or mainly) conserved *in situ* by small-scale agriculturalists. The following sets of issues are covered: war and LIC and erosion of plant genetic resources; relief, rehabilitation and management of plant genetic resources; policy and practical options to link effectively the fields of relief, rehabilitation and plant genetic resource management.

The impact of war and LIC on the management of plant genetic resources is traced through linked case studies of rice genetic resources in the ecoregion of the upper West African coastal zone from Senegal to Liberia. This zone has been affected by three major conflicts: the war of independence in Guinea-Bissau, 1962-75, the civil war in Liberia 1989-1996, and the insurgency of the Revolutionary United Front (RUF) in Sierra Leone, 1991-97. The cases are rendered more significant, from the perspective of managing genetic resources, by the possible importance of long-term geneflow between the local African species of cultivated rice and West African cultivars of Asian rice.

LIC has had a doubly disruptive effect on the management of plant genetic resource in the West African rice zone. It has damaged formal-sector (state-run) genetic resource management facilities, and equally importantly, has brought about major changes in the patterns of social cooperation through which local seed systems are managed. The impact on the flows and distribution of crop genetic diversity is likely to be considerable but as yet is unquantified.

In seeking to understand war damage to seed systems it is stressed that plant genetic resource management is social as well as technical work. Change in the interaction of social and technical factors must be taken into account when seeking to rehabilitate seed systems in the aftermath of war. Although seeds sometimes survive

conflict, there may be major shifts in patterns of labour mobilization or in commercial relations of agricultural production. These changes in agrarian social relations are liable to profoundly affect the working of seed systems. Rehabilitation solely directed towards the restoration of the status quo may be misplaced effort.

The report considers some of the ways in which seed issues might be effectively addressed in relief and rehabilitation activity. Where informal seed systems have collapsed, new alliances linking refugee/displaced farmer groups, relief agencies and specialists in managing genetic resources are needed. The report suggests some ways in which these new actor-networks might be fostered, while avoiding dependency implications associated with conventional relief.

Non-governmental Organizations (NGOs) and other relief and rehabilitation agencies operating in war zones address seed issues, and have some desire to further improve their sociotechnical capacity in this area. Some agencies would welcome better briefing on both technical and social dimensions of seed-relief activity, including some background on the implications for the management of plant genetic resources.

Institutions managing plant genetic resources must themselves change to meet the needs of these new client groups. The report discusses how genebank facilities might open their doors to NGOs and refugee and displaced farmer client groups in war-torn regions. Some suggestions include improving the socioeconomic passport data for accessions, ascertaining what relief and rehabilitation agencies need to know about seed issues, reorganizing genebank information systems to meet these needs, and developing the disaster preparedness of genebank facilities through joint exercises involving NGO personnel.

Recent work on humanitarian assistance in African war zones makes clear that relief aid must be designed against a sound background analysis of the causes of conflict, to guard against the danger of relief aid fuelling further conflict. The report ends with an overview of a model scheme that seeks to address some of the basic food-security needs of war-affected rural communities in the West African rice zone while taking account of local conflict dynamics.

contents

1 war and crop genetic resources

The importance of crop plant genetic resources

Global food security depends on a relatively small number of staple food plants. Currently rice and wheat are the two most important. Crop plant improvement has depended on the management of genetic resources, historically through protection and selection by farmers alone, and more recently through manipulation by breeders drawing on modern genetic theory. Since science has no capacity to create genes, agricultural progress will continue to depend on the rational management of the world's existing stocks of crop plant genetic resources. Additionally, we should note that in many poor countries with a low investment in science and technology, farmer management and selection complemented by science-based plant improvement will continue to be an important aspect of the total management of plant genetic resources. West Africa is one region rich in crop genetic diversity which continues to suffer the effects of war and civil strife.

The irregular distribution of crop plant genetic resources

Plant genetic resources are not distributed evenly across the planet. The greatest store of genetic variation within a crop tends to be found in the regions where wild ancestors are to be found, and where some local cultivar groups (landraces) still exchange genes (and thus co-evolve) with natural ancestors. Some regions in which habitat diversity is especially high are known not only for the genetic richness of single crop species but also for crop species diversity. These regions were identified by the Russian plant geneticist Vavilov and are now named 'Vavilov Centres' in his honour. The management of genetic resources in these Vavilov Centres is a matter of great concern, and war and civil dislocation in such regions is especially problematic.

Unknown and forgotten crop types

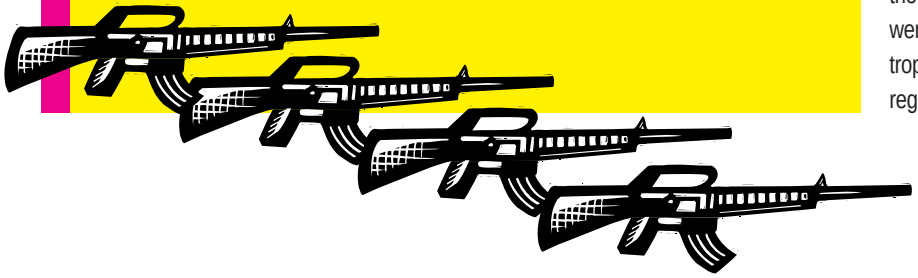
The loss of plant genetic resources (genetic erosion), often accelerated by social dislocation, is not less significant in the case of more localized, lesser known crops. Some of these crops may only be partially domesticated, and little studied in the scientific literature. A recent survey of Africa, a continent normally considered poor in plant genetic resources by world standards, has revealed literally hundreds of crop types falling under the headings of significant but little studied or unknown and/or forgotten (Vietmeyer 1996). This source demonstrates that Africa is poor not in crop plant genetic resources themselves but in documented knowledge of such resources accessible to outsiders. Furthermore, world rankings of the lesser crops fluctuate: cassava, for example, has changed from being a regional staple in the 15th century to a crop of world importance today. Some of the world's current neglected and partially domesticated crops may one day assume much wider significance. Current progress in genetic engineering increases this likelihood. Thus there is growing acceptance of the idea that global food security depends on much more than protecting genetic resources of high-profile crops in high-profile centres of diversity.

Changing patterns of war

The post-Cold War world has seen an upsurge of forms of low-intensity conflict (LIC). This type of warfare involves vigilante or bandit-style militias fighting among themselves or against regular state forces. The recent increase in LIC is a symptom of the state in crisis, especially in Africa and some parts of the former Eastern bloc. In Africa in particular, LIC feeds on rising numbers of disillusioned young people, in a fast-growing population, blocked in their aspirations for education and jobs. These young people, part-educated, part-urbanized, tend to be as anti-peasant as they are anti-government (Richards 1996a). Farming communities and isolated government research stations are equally vulnerable to, at times, barely coherent terrorist attack. Thus the spread of LIC damages both the *in situ* processes through which peasant farmers maintain local landrace materials and *ex situ* genetic resource conservation in government research centres.

low-intensity conflict

This type of warfare involves vigilante or bandit-style militias fighting among themselves or against regular state forces.



The size of the problem: the world's current trouble-spots

More than three-quarters of the world's armed conflicts were located in either tropical and sub-tropical regions or in rural areas

the world's armed conflicts

According to one estimate, the world in 1994 was experiencing 23 major armed conflicts (defined as events with more than a 1000 deaths per year) and 82 minor armed conflicts (events with less than 1000 deaths per year).

and agrarian communities. At least 11 of the major conflicts and 30 of the minor conflicts were concentrated in the poorer countries of the tropical zone, where genetic resource endowments tend to be both high and under-documented, and where farmer-managed *in situ* protection of crop genetic resources remains significant. Africa, a continent of 49 exceptionally poor countries with only weakly developed formal procedures for managing *ex situ* plant genetic resources, was especially badly affected by LIC, experiencing nine major insurrections or civil wars in 1994, in addition to a number of other more localized insurgencies.

Rice genetic resources in West Africa

Rice in West Africa is a good example of a localized plant genetic resource of potential global significance threatened by LIC. The West African rice zone is defined as that region of the Upper Guinea coast, running from Senegal to Côte d'Ivoire, where rice is the sole or major staple crop. Here, farmers make use of two cultivated species of rice - introduced Asian rice (*Oryza sativa*) and locally domesticated African rice (*Oryza glaberrima*). Two probable wild ancestors of African rice are found growing alongside cultivated rice and may continue to exchange genes with cultivated African rice. *O. glaberrima* is almost entirely restricted to West Africa but occasionally crosses with *O. sativa*. Some local landrace populations contain intermediate types. Genetic resources from African rice may be important for the future improvement of Asian rice, upon which so much of the world's food security depends. The West African rice zone is a region with a population of about 15 million people. It has recently experienced three major rural conflicts; the independence struggle in Guinea-Bissau, 1960s-70s, civil war in Liberia 1989-96, and rebel insurgency in Sierra Leone 1991-1997 and a more localized rural rebellion in the Casamance region of Senegal. The three remaining countries in the rice zone, Côte d'Ivoire, Guinea and the Gambia, have been forced to absorb large refugee populations.

The West African rice zone

The coastal rice zone from Casamance (Senegal) to the Bandama River in Côte d'Ivoire should be distin-

Early African rice still growing well in Poturu, Sierra Leone in 1992 despite disruptions from fighting

guished from two other West African regions in which rice is important but not the sole or major staple. There is the drier savanna from the Senegal River to Lake Chad, where rice is the major crop of the flood plains of the larger rivers; and the forest-savannah transition zone in Ghana and Nigeria, where rice is a more recent commercial introduction.

A basic agrarian feature of the West African rice zone is that the greater part of rural society (men and women, young and old) is directly involved in rice cultivation (Linares 1981; 1992). This contrasts with the situation in the savannah zone. Rice was once cultivated in inhospitable riverine settlements mainly by slaves; upland peasants grew dry grains (sorghum and millet). Today riverine rice is often a women's speciality crop (Carney and Watts 1990).

The timing of the spread of *O. sativa* from Asia to Africa is unknown. However, *O. glaberrima* is found only in Africa, and must have been domesticated by West African peoples in ancient times. A likely ancestor, the annual wild rice *O. barthii* (*O. breviligulata*), is widespread in wetlands from the Gambia to Lake Chad. The ancestry of *O. glaberrima*, complicated by gene transfer between wild and domesticated types in the region, is not yet fully understood. The recent discovery that African and Asian rice can be successfully crossed contributes significantly to knowledge of rice genetic resources in the West African rice zone. It now seems likely that during several hundred years in which the two species have been grown side-by-side local landraces of Asian rice may have been significantly modified by introgression from African rice.

Models of rice distribution in the West African rice zone

Porteres (1976) attempts to reconstruct a likely scenario for the emergence of African Rice cultivation, drawing upon ethnobotanical evidence. Porteres identifies three areas of rice germplasm diversity in West Africa: the Inland Delta of the Upper Niger in present-day Mali, the Gambia-Casamance-Guinea-Bissau coastal-riverine zone, and the Guinea Dorsal which covers the watershed between the Upper Niger and rivers draining to the Atlantic coast. Today, these three foci are associated with three distinct techniques for growing rice (Dresch, 1949): flood advance and recession agriculture in the Inland Delta (Harlan and Pasquereau, 1969), estuarine wetland cultivation along the coast (cf. Linares, 1981, van der Drift, 1992), and dryland-wetland catenary cultivation on the

regional production environments of west Africa

The three main regional production environments of West Africa are:
- coastal wetlands rice cultivation,
- riverine advance and recession agriculture, and
- forest dryland cultivation systems.

They intersect in a triangle with its base running along the coast from the Sherbro estuary in Sierra Leone to Cape Mount in Liberia and an apex around Kissidougou in Guinea-Conakry.

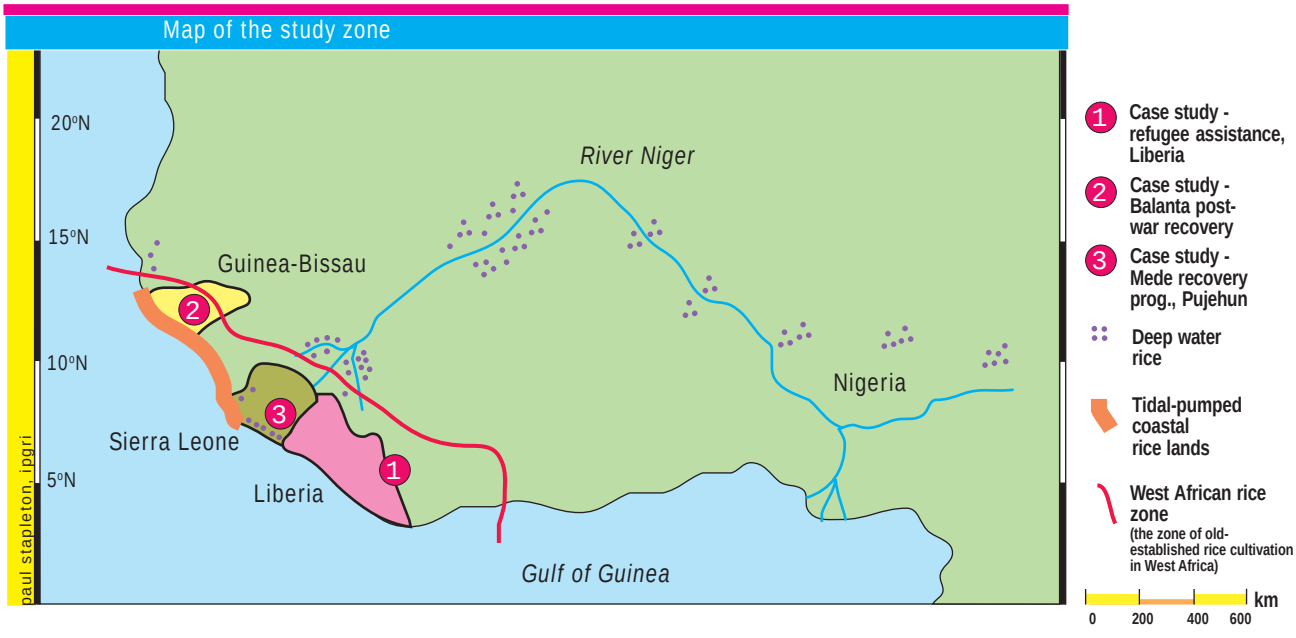
Guinea Dorsal (Richards, 1986).

However, Porteres never collected rice in Liberia and Sierra Leone, and his model may be skewed by this omission. Richards (1995) proposes an alternative, less centric, scheme for the distribution of rice genetic resources in the region (cf. Harlan, 1976), assuming progress towards domestication to have been quite widely distributed throughout the forest-savannah transition zone in ancient times. This alternative model draws attention to the significance of the meeting and mixing of germplasm from several separate ecospecific domestications. Such convergence may have been widespread, but seems most likely to have occurred where the three main regional production environments intersect (see box opposite, and map).

Farmers recognize several local genetic resource hot spots within this triangle: one is the so-called Kissi pan-handle, and the area around Bumpeh, south of Bo in Sierra Leone. Local rice genetic resources may have been further augmented by the introduction of Asian rices through early centres of Atlantic trade in Sherbro country and at Cape Mount.

War and rice genetic resources in the West African rice zone: general points

Whichever model is taken, recent patterns of conflict in the region overlay genetic resource hot spots in a rather worrying fashion. Conflicts in Guinea-Bissau and Casamance disrupted farming and seed systems in the first of Porteres' secondary centres of dispersal. The convergence model envisages a



particular concentration of hot spots along the Sierra Leone-Liberia border. This region has been especially severely disrupted by the invasion of Sierra Leone by the Revolutionary United Front (RUF) in 1991. The greatest loss of locally adapted planting material seems to have occurred where farming populations have been repeatedly uprooted by conflict, and seed stocks looted and burnt in recurrent fighting. This was the pattern on the Liberia-Sierra Leone border from 1991. One encouraging feature, however, is that displaced farming communities in the region have not always travelled far. Many farmers from Kailahun District sought refuge from the RUF in Guinea-Conakry, where local farming practices have been continued in a region rich in local landraces.

Dense refugee populations may actually be quite good for *in situ* genetic resource management, since there are more hands available to collect and sift material and greater incentives to make adaptive experiments. The possibility of measuring directly the genetic erosion in war zones is hard to imagine except for the uncommon existence of an adequate baseline data set. Rice researchers in Sierra Leone have access to one such data set for rice germplasm use in a village on the Liberia-Sierra Leone border in 1989 (Davies and Richards 1991). However, for the most part an indirect approach is the only one feasible. Molecular methods offer ways of testing hypotheses about patterns and processes of the distribution of rice genetic resources in the region. Recent work on *O. sativa*, *O. glaberrima* and presumed ancestors, using techniques of isozyme and DNA analysis, confirms the separate evolution of *O. glaberrima* as a cultivar and the plausibility of a relationship with *O. barthii*. In the future it may be possible to use such techniques (cf. Dally and Second 1990; Glaszmann, 1987, 1988) to clarify the ancestry of different varieties and establish baseline indices of genetic variability within local populations.

Members of a Limba farm household (headed by Karamoko Saidu Kamara) on the upland rice farm, where bunches of harvested rice have been left to dry on the tree stumps.

2 war and rice: three case studies

The three country case studies described here suggest some of the typical consequences of war for farmer-based seed systems in the West African rice zone. It is important to note that seed systems are sociotechnical ensembles; this chapter shows that damage to the social fabric of a seed system is as significant as direct physical loss of seeds. The three case studies illustrate this point in different ways. First, the Liberian case study illustrates the direct practical consequences of war for the basic functioning of seed systems. War deprives farmers of the basic raw materials for farming. When conflict is general, or prolonged over several seasons, possibilities for recovery through local action are very severely limited. The second case, drawn from experience in Sierra Leone, focuses on the micro-social dynamics of seed systems. Attention is drawn to the fact that farmer seed systems depend on trust and tacit understanding among neighbours. Combatants in African LIC deploy techniques intended to destroy trust because a divided and dysfunctional community is more readily exploited by lightly armed guerrilla bands living off the land. Such warfare is in the words of one Mozambican official 'anthropological'. As a result, informal seed systems may cease to function. The final case study in Guinea-Bissau brings out a third point: that war affects different social groups in different ways. Conflict may accelerate or trigger substantial social change. It may, for example, disrupt established control by the older generation of the labour of the younger generation, with implications (as in Guinea-Bissau) for labour supply in rice agriculture. Rehabilitation of seed systems thus may mean much more than restoration of a prewar status quo. It may mean that agrotechnical options have to be fundamentally reassessed. A recovering community may need not only recovery of lost cultivars but also access to new materials from which to fashion, by selection and

adaptation, cultivars adapted to radically altered post-war farming conditions.

Case-study One: Liberia

Civil war in Liberia

Insurgency in Liberia began on 24 December 1989 in rural Nimba County in northeast Liberia and spread rapidly to all parts of the country. The core of the insurgency was a small group of 100-150 fighters, the National Patriotic Front of Liberia (NPFL). The specific aim of the NPFL was to overthrow the regime of Samuel Doe and install NPFL leader Charles Taylor as president. Many NPFL recruits were conscripted from among the youth of rural Nimba County, a region known to be strongly opposed to the Doe regime. This transformed the NPFL into a movement with a strong ethnic character, later to be opposed by other ethnically based movements using similar recruitment and insurgency tactics. At one stage the NPFL controlled up to 90% of rural Liberia, with only Greater Monrovia beyond its direct control, but the rural districts subsequently became divided between several competing armed factions. Many rural Liberians, unarmed and defenceless low-resource farmers, adhered to none of these factions, but found life impossible when menaced by marauding gangs of ill-disciplined and often very young fighters. Combatants were given only rudimentary training in skills of guerrilla warfare, and elaborated for themselves a range of dirty tricks and bizarre punishments such as the 'tabay', a form of torture with soaked ropes tightening upon the victim as they dried, to terrorise local rural populations into submission. Field commanders were often young teenagers and the idea that war had rules, other than those they chose to invent for themselves, came as a surprise. Faction leaders were often quite ignorant of the atrocities being carried out in their names, and overall control of combat exercized by Taylor and his rivals was at times only nominal. In this climate of unpredictable and uncontrolled violence it is not surprising that a large proportion of the population of rural Liberia sought relative safety either in Greater Monrovia or as refugees across the international borders in Sierra Leone, Guinea and Côte d'Ivoire. Agricultural production was effectively halted in large parts of rural Liberia, as up to a million people - well over half the rural population of prewar Liberia - found themselves living as refugees.

The direct impact of war on farming in Liberia

Prior to the war, small farmers relied primarily on traditional rice farming and other cash-crop cultivation to earn income. The escalation of the civil war destroyed markets and made it physically too unsafe to farm. Subsistence activities, the basis of traditional rice production in rural Liberia, came abruptly to an end when the farming communities were displaced, sometimes fleeing into Côte d'Ivoire and Guinea. Farmers without kin in these two countries were forced into neighbouring villages with the hope

that the conflict might soon be resolved. Others remained in rebel-captured areas, but were unable to farm for fear of counterattack.

Hunger was soon a pressing concern in both rural and urban areas; food shortages worsened due to the predatory actions of competing factions mounting road blocks on major transportation routes. Wage, festive and reciprocal labour, the main sources of labour for traditional farmers, quickly broke down. Few farmers had money to pay wages. It seemed too foolhardy to contribute to reciprocal labour arrangements when from day to day it was uncertain whether or not social groups would become scattered by fighting.

In the turmoil of sudden and vicious attack, many Liberian farmers fled their farms, frequently abandoning all their belongings including farm implements and stored seed. Initially, much seed rice was lost not to looters but to animals and moisture in abandoned farms. Those farmers lucky enough to save some planting materials were forced to use seeds for food because of the general economic chaos in war-blighted areas. Others sold what little seed they had left, tempted by vastly inflated market prices for food. In border regions many farmers sold planting materials with the specific intention of acquiring enough money to move over the border into Côte d'Ivoire, Sierra Leone or Guinea. Even farmers who decided to stay put found it preferable to sell planting materials to avoid constant harassment from hungry militias, now victims of the economic chaos they had created. Rebel forces and other displaced people would roam the villages in search of stored rice seed. The gun was a passport to any food item the hungry militia fighter required. Soon, therefore, combatants had eaten their way through subsistence farmers' stored rice, including planting materials carefully selected and preserved for their high adaptability to local planting conditions. Lofa, Bong, Nimba and Grand Gedeh counties, once among the main rice-producing areas of Liberia, were soon reduced to an agricultural standstill, through random terror attacks, sudden displacement of population and subsequent near total loss of locally adapted germplasm.

Impact of displacement on farmer-based management of plant genetic resources

The displacement of the civilian population and farmers has a fundamental impact on local management of plant genetic resources because the labour supply is disrupted, thus rendering many routine agricultural activities, including labour-intensive seed selection, storage and exchange, impossible. Widespread fear of attack limited farming to small plots close to villages, or secluded 'corners' in the forest well away from main roads and paths. The vast majority of Liberian civilians were too terrified to farm. Most preferred to seek safety in refugee camps or cities, depending upon the availability of relief foods,

War empties people from forests and brings back wild animals. This leopard was killed after menacing farmers on land adjacent to Gola Forest on the Liberian border of Sierra Leone in 1992

paul richards

rather than risk farming in the bush unprotected. The multiplication of militia groups in Liberia (at maximum eight), absence of regular uniforms and recruitment of part-urbanized school dropouts and the young unemployed, meant that it was often impossible to distinguish between friend and foe, even where groups maintained some nominal ethnic or regional allegiances. Groups recruited new fighters by capture, and any conscript tempted to refuse would either be killed or forced into slavery. Militias needed slaves to undertake carrying tasks, or to fell the trees, slaughter wildlife, and dig the diamonds through which the factions gained the cash needed to buy further supplies of arms and ammunition.

Where displaced civilians were willing to farm they lacked the tools necessary to start again in new locations. This strictly limited the amount of land, and more importantly, the range of land types cultivated, with a knock-on effect on the types of rice planting materials in circulation. Where they have insufficient tools and labour for a fully diversified farm enterprise, farmers see no merit in struggling

to keep up the range of the types of local seed necessary for the more specialized rice-cultivation environments. The impact is that the more specialized varieties are soonest converted to food. Under local seed storage practices there is a definite limit to the viability of seed, and faced with a conflict with no apparent end in sight many farmers found it rational to convert rice seed stocks to food, to deal with the immediate hunger crisis. There was a general attitude of "hoping for the best", and that it would be possible to recover relevant seed types at some future point when peace had been restored.

Refugee farmers then encountered a range of problems in their attempts to grow rice in their new environments. Perhaps the biggest hindrance was a simple lack of land. Many displaced Liberian refugees, having crossed into Guinea or Côte d'Ivoire, were prevented from farming. The Guinean and Ivorian farmers, beginning to experience some degree of land hunger themselves, suspected that the displaced Liberians had entered their countries not as refugees but with the express intent of taking over their farm land. Persistent refusal of the Guinean and Ivorian farmers to provide the displaced Liberian farmers or refugees with arable land left Liberian farmers unable to undertake any agricultural activities. Those displaced farmers who had against all odds managed to preserve some seed for planting were then faced with no alternative but to consume the seed they had carefully transported to their new locations. It is interesting to note that Liberian refugees found villagers in Sierra Leone much more accommodating, and many were even welcomed (at first) and assisted to settle within villages in the border zone, as normal farming strangers rather than as camped refugees. The role of Charles Taylor and the NPFL in assisting the RUF to invade Sierra Leone changed local perceptions of Liberian refugees, though an accommodating attitude still prevailed in some parts.

For the farmers who did secure land, seed choice became a new problem. Refugee farmers often meet new and unfamiliar soil types, as well as new pests and diseases problems. The adapted varieties of rice with which they are familiar may not be appropriate to the new local conditions. In response to poor harvests, displaced farmers often decide to abandon any varieties they bring with them and quickly adopt rice selections appropriate to the new locale. In effect they are abandoning the varieties that they may one day need to resettle their home villages.

Finally, it should be emphasized that many farmers are not refugees in the strict sense, but are internally displaced persons within Liberia. These displaced groups are often in a particularly weak position because they suffer the disadvantages of enforced removal (e.g. loss of locally adapted planting materials), but are still highly vulnerable to intimidation by young fighters. Internally displaced farmers frequently do not

even attempt to grow crops, relying instead on whatever feeding programmes are available. Why bother, when fighters steal crops for provisions; or when farms have to be repeatedly evacuated due to resurgence or rumoured resurgence of fighting. It is to be anticipated that in areas with large numbers of internally displaced villagers, loss of local germplasm is especially high.

The impact of the war on managing plant genetic resources in Liberia is relatively simple to summarize. Due to lack of land and farm labour, and loss of suitable seed through abandonment, consumption or theft, the stock of indigenous rice cultivars became highly depleted over seven years of conflict ranging over nearly all parts of the country. Even when stored, local rice seeds rapidly lose viability in humid, tropical conditions. Farmer-based genetic resource management systems may be beyond revival without outside help in several of the areas most badly affected by population displacement. Whether rice cultivation can ever return to the same environments, and under the same production systems, now that a fragile peace has been restored, remains to be seen. Almost certainly, old rice varieties have dropped out of production, but many of the more important types may be recovered from collections or chance survivals. There is also a question as to how well prewar varieties will meet farmers' needs in new post-conflict agricultural situations. However, this does not mean that Liberian rice agriculture should be subject to a rapid externally driven programme for the transfer of exotic planting materials. Liberian farmers were before the war skilled in selecting and adapting rice landrace materials to suit their changing needs. Post-war, the issue is not recovery of old seeds versus introduction of new seeds. Farmers may have abandoned or lost familiar seeds, but so far we have found no evidence, or see any reason to suppose, that war has caused Liberian farmers to lose their capacity to select. It may be more important to consider how best to support farmer seed-selection capacities, and how to provide the right kind of mix of old and new materials upon which this intact adaptive capacity might be exercised.

Case-study Two: Sierra Leone

The main feature of the Liberian case study was a general disruption of rural livelihoods due to conflict. With half or more of the rural population displaced local seed systems experienced massive disruption. The early stages of the related insurgency in Sierra Leone, a spill-over from fighting in Liberia, were less intense, and there was a partial agricultural recovery once the initial RUF invasion was checked. The Sierra Leone case introduces us to some of the subtler damage sustained by seed systems. A local seed system is more than just seeds and storage. It also comprises the practices, knowledge and social relations which farmers use to promote the usefulness of crop genetic

resources. These elements are especially vulnerable to disruption where insurgents aim to control civilians through terror tactics. To fully understand the nature of the damage sustained by seed systems as a result of the RUF invasion we must first attempt to characterize such seed systems and explain how they functioned in Sierra Leone during periods of peace and stability.

Farmers fleeing with their belongings in the face of a rebel attack. Kambia District, Sierra Leone, January, 1995.

Community seed systems in Sierra Leone

There are many similarities among the cultures and practices of rural rice-farming communities across Liberia, Sierra Leone and Guinea-Bissau. Accordingly, this description of village-level management of plant genetic resources in Sierra Leone may be regarded as approximately applicable to other parts of the West African rice zone as well. The data have been collected over a 15-year period monitoring local seed systems and have contributed to the following case study.

Farmers actively and consciously manage plant genetic resources by collecting and screening unfamiliar rice planting materials. Locally this is described as experimentation, and farmers know that off-types are more often found in edge-reaped material (where spontaneous outcrossing with an adjacent variety is more likely). Some farmers consciously interplant different types (e.g. African and Asian rices) in a single plot, in the hope of reaping hybrid material (Longley and Richards 1993). At any one time farm households typically deploy between two and six distinct rice selections adapted to the main on-farm ecologies and soil types.

The number of distinct rices in any one average-sized village (of 250-500 people) totals about 20-40 types; nation-

changes in farmer's seed selection

Only 46% of rice in 1987 was planted by farmers planting the same variety in 1983. In other words, farmer change of seed selection 1983-7 was the norm rather than the exception.

Limba farmers (Karamoko Saidu Kamara and colleague) packing dried, harvested rice bundles into a *biri* on an upland farm, where it will be kept for several months.

wide, farmers in Sierra Leone make regular use of perhaps as many as 500 or more varieties, in a number of ecospecific landrace groupings. Duration and adaptation to flooded or rainfed conditions tends to determine where landrace groupings are used (on early planted run-off plots, in inland-valley swamps, in seasonally flooded riverine grasslands, on rain-fed uplands).

In a country-wide sample survey (1987) formal sources (i.e. projects) accounted for only 6% of rice seed acquisitions. A further 19% of rice seed was acquired through local purchases. Loans-in-kind from rice merchants accounted for a further 19%. But 55% of all seed rice came through informal non-market sources (including exchange 30%, and gifts or loans from friends and kin, 19%). Most seed acquisitions described as gifts from friends or kin were in fact loans-in-kind from patrons to clients, under the customary arrangement of one bushel at planting time for two at harvest (*lonei hou*, in Mende). Of local gifts, purchases, loans and exchanges, 37% came from friends and neighbours, including patrons, and 24% from relations. It is considered courteous to pass on small amounts of any interesting seed acquisition to friends and kin so that they can experiment for themselves. Anything interesting but hard to acquire is likely to be backed up by giving it to friends or kin in another neighbourhood, to help ensure that it can be recovered in case of loss. This behaviour underlines the importance of farmer-to-farmer exchange, and informal processes more generally, as the principle means whereby farmers circulate rice genetic resources and gain access to new material.

A detailed study was made over 5 years in the village of Mogbuama, Moyamba District, central Sierra Leone. Work was based on a complete inventory of varieties planted on all rice farms in this escarpment-foot village in 1983, and a resurvey of rice varieties planted in 1987. The study showed continuity in the overall

pattern of variety use over the 5 years, but many detailed changes. About half of all household farms planted the main 4-month upland rices exclusively (though often in catenary sequences, with the earliest plantings on lower slopes). The remainder - larger households with diversified labour supply - planted additional 3-month varieties on lower slopes and 5-month varieties in swamps. Altogether, 5-month varieties covered 3-5%, and 3-month varieties 12-15% of the total rice area. In both years about 40% of rices were planted on river terrace soils.

Within this stable general framework, important changes were evident in variety use. Some change resulted from farmer mobility between 1983 and 1987, as migrant farmers moved in and out of the village with their favourite varieties. Change of variety was also recorded in 53 out of a total of 59 farming households present in both 1983 and 1987 surveys. Many of these changes were the result of deliberate adaptive choice.

Excluding all long-duration swamp rices put by farmers under the undifferentiated category name *yaka*, households in both surveys planted 37 named varieties in 1983, including 24 4-month upland types and four 3-month varieties, and 32 varieties in 1987, including 19 4-month upland types and five 3-month varieties. 17% of all rice land (by area) in 1987 carried varieties not cultivated in 1983. Varieties no longer under cultivation by 1987 covered 15% of the rice area in 1983. Turnover rates, assessed by farmer, were even higher. Only 46% of rice in 1987 was planted by farmers planting the same variety in 1983. In other words, farmer change of seed selection 1983-87 was the norm rather than the exception.

These results (see box above) bring out clearly that in normal conditions farmers in Sierra Leone mostly acquire and distribute rice seeds via informal channels. Farming requires ceaseless experimentation with new selections and adaptation of old favourites to new

Factors influencing seed selection

Farmer change of seed selection 1983-87 was the norm rather than the exception. Three sets of factors may account for these changes:

- involuntary changes (e.g. seed rice consumed in a period of severe hunger and replaced by a loan from a neighbour);
- voluntary changes (e.g. to match a variety to conditions on a newly cleared farm, or replace mixed seed); and
- changes resulting from successful trials with new material.

The head of the household generally bears the main responsibility for managing major transactions in the seed system . Heads of household expect to store seed rice for next year's planting, and to negotiate bulk seed loans or exchanges. Males head most (85-90%) of the Sierra Leonean farming households, so decisions about seeds tend to be a male preserve. However, harvesting is an activity divided evenly between men and women, and the senior women of the household are responsible for seed management during the harvest (including roguing of off-types). Women also reserve seed for use on their own private rice plots. The harvest is mainly sold to replenish personal

savings or small stocks of trading capital. Women perform all threshing tasks. The decision to rogue mixed harvested material may be taken by women if they suspect later processing difficulties; some varieties are especially hard to clean for cooking. Women are especially knowledgeable about rice variety differences related to processing and cooking (cf. Gay 1989). Women sometimes reserve off-types for experimentation, especially material suited to the wetland environments where they tend to plant their private rice for cash. Women are also assiduous exchangers of planting materials for experimentation, valuing seeds as small tokens of everyday friendship and social solidarity.

Women's involvement in seed management needs to be underlined for rural communities from the Gola Forest, on the Liberia-Sierra Leone border, eastwards into Liberia, where men are less involved in planting and harvesting activities than in central Sierra Leone. Gay (1989) considers women to be the main seed selection experts among the Kpelle in northwest Liberia. Seed expertise seems to be relatively less gendered among groups such as the Kpa-Mende and Temne further west in Sierra Leone.

In general, it is important to note that informal seed systems, through which rice landrace populations are maintained and improved, depend very much on maintaining common courtesies and confidences of village social life. People make token gifts of seed to each other and loan serious amounts of seed for planting because they have confidence, that in a relatively settled and stable world, they will receive a return, or that one good turn will deserve another. In short, the informal seed system only works when the informal social institutions of village life remain in working order.

War, seeds and trust

Physical destruction is an obvious serious consequence of war. The Liberia case illustrates graphically how war results in direct loss of seed. Lightly armed insurgents burnt houses and barns rather than waste bullets, and many secret stores of seed rice went up in flames. Rebels and soldiers fed from the land, looting and eating seed set aside for planting. But beyond such physical losses, war corrodes the social confidences upon which informal seed systems rest. In Sierra Leone the RUF found no natural allies in the countryside. Enclaved in forest wilderness the movement's leaders taught principles of guerrilla warfare reflecting the experience of movements like Shining Path in Peru and Renamo in Mozambique. These lessons included instruction in the strategic advantage of dividing a hostile citizenry through trying to rake up the embers of old quarrels. RUF cadres sometimes carefully spied out rural communities, painstakingly compiling information on which families were party to chieftaincy or land disputes, perhaps noting meanwhile which households were Muslim, which Christian, etc. In the course of an

RUF attack, cadres might seek to involve disgruntled parties in a chieftaincy dispute, by prompting them to carry out violent acts of revenge. Or the houses of only Christians, or only Muslims, might be burnt in a raid. The RUF did not have a religious programme, but such actions divided neighbour against neighbour and made it easier for a numerically weak and lightly armed enemy secreted in nearby forest to maintain future control over civilians hostile to the RUF cause. It is common to find that these social wounds are very slow to heal. Households where one or two young people were suspected of joining in a looting spree after an attack might find themselves excluded from labour-sharing arrangements, weakening agricultural efficiency and collective food security. Much of the everyday confidence upon which the seed system rests evaporates in the face of the dirty tricks deployed by modern exponents of sociologically smart low-intensity guerrilla conflict. It follows that rehabilitating the seed system is not only a technical matter, but must also tackle crucial social issues, such as how neighbours might be encouraged to begin to cooperate once again.

Case Study Three: Guinea-Bissau

The third case study shifts attention to the macrosociological context within which seed systems operate. War often brings profound economic and social changes. The pattern of post-war recovery in the agrarian economy of Guinea-Bissau rendered prewar agrarian technology inappropriate. Plant genetic resource management must respond actively to these changes. New technical choices may be needed, based on careful analysis of basic changes within society and economy.

The impact of the Guinea-Bissau liberation war on mangrove rice

The 12-year independence war, from 1962-1974, particularly affected mangrove rice farming, the main source of food production in Guinea-Bissau. As might have been expected, rice production decreased significantly during the war. However, production further decreased in the period after the war ended, contrary to expectations for post-war recovery and in spite of the introduction of specific rehabilitation projects. To understand this phenomenon, it is necessary to understand the way in which the social organization of mangrove rice farming changed as society was reconstituted after the war.

Post-war rehabilitation

Young man (Aranfan Dumbuya) transplanting rice seedlings into a swamp.

efforts emphasized a particular rice variety: salt-tolerant ROK5 developed by Rokupr Rice Research Station in Sierra Leone for short-season mangrove farming regimes. This would have been feasible had post-war agricultural labour organization immediately returned to prewar conditions. But war changes many things, and in this case it had a major impact on household organization and with it local labour supply. These

the impact of war

the impact of war on local seed systems and management procedures of plant genetic resources is both direct through looting and destruction of seed reserves and indirect, via changes in social organization, as communities displaced by war attempt to regroup.

The history of mangrove rice farming

The main rice producers in Guinea-Bissau are the Balanta who make up 32% of the population. Their farming practices, which have considerable historic precedent, are mostly organized on the village level and around age and gender distinctions. In the early 1890's young Balanta men from the central region of Oio started seasonal migration to new, unexploited mangrove areas south of the Rio Gaba.

Extended families and even entire villages were the major production units. Mangrove-rice farming requires large labour groups that can be deployed at specific points in the agricultural cycle. To meet this demand, the patrilineal family compound, *pang*, was the major source of labour input, land and harvest management. A range of genetic material was used that was adapted to differences in quality of the parcels within the land allotments. These generally ranged from upland plots (sweet or male) to lower swampy and tidal fields (salt or female) fields. The diversity in the crop germplasm also enabled farmers to cope with wide fluctuations in the timing and volume of the rains.

The elders were responsible for the selection, separation and stocking of the seeds from the entire harvest. As a part of this selection, small experiments were executed on variety, seeding and transplanting methods in transition zones from one type of soil to another, in relation to the actual or expected rainfall. Local knowledge, and the mobilization of the labour potential, were major pillars of the mangrove rice farming system. However the large-scale development of rice farming in southern Guinea-Bissau, from the 1890s onwards, was only partly based on the expertise and dynamics of the Balanta. Largely underestimated was the fact that the rapid expansion of rice farming, corresponding to a massive migration movement of Balanta from the central Oio regions westward to the regions of Cacheu and Quinara, and south towards Tombali, was stimulated and partly organized by colonial entrepreneurs, known as *ponteiros*. As the shift away from the slave-trade towards agricultural exploitation in Guinea-Bissau was seen to be irreversible, these colonial entrepreneurs made pacts with traditional landlords, and opened new territory to migrants, called *pontas*.

Eventually, the Balanta took over the land and labour management of rice

production while the *ponteiros* focused on trading and seed management. Balanta were supposed to sell their rice to the *ponteiros*, to whom they also turned for assistance in times of scarcity. *Ponteiros* became a regular source of rice credit. Shaping local values through commerce (white rice was 'good rice' and local red rice came to be regarded as pig food), they began to play a significant role in the management and input of genetic resources.

The Balanta and the PAIGC

The urban-based PAIGC (African Party for the Independence of Guinea and Cape Verde) started its actions in the southern border area with Guinea Conakry in 1962. The PAIGC started its mobilization through traders and other local entrepreneurs, who spoke of the local lingua franca, Crioulo and, like the indigenes, were also deeply dissatisfied with Portuguese rule. Among the first Balanta to join the struggle were ambitious young men, who had already started a career outside the village context, attending mission schools and being employed in the shops of *ponteiros*. Consequently, the first wave of Balanta mobilization caused a physical and social dislocation of young men. Eventually, Balanta mobilization became widespread, and was controlled by the elders, who had by now become allies of the PAIGC. Despite this rapprochement between the PAIGC and Balanta village elders, military mobilization introduced a more outward orientation of youngsters, and the loosening of established labour relations, especially those crucial to successful mangrove rice production. Although the southern regions of Guinea-Bissau were freed from Portuguese rule at an early stage, the situation there remained dangerous, and agricultural production conditions stayed uncertain. Some authors (e.g. Rudebeck 1974) state that the PAIGC was able to profit from considerable rice harvests in Tombali, but the overall picture indicates that large areas of the tidal flood plains known as *bolanhas* were damaged or left unused.

Impact of the war on agriculture

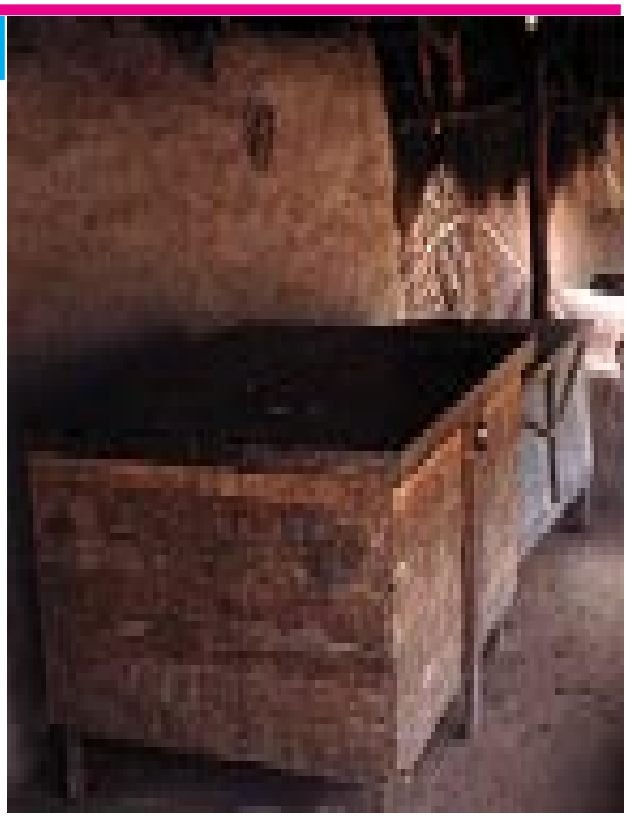
The 12-year long independence war affected mangrove rice farming in the first place because the Balanta rice farming peoples formed the majority of the armed guerrilla against the Portuguese army. As a result of its strategic and economic importance, the main rice-producing area, in the southwestern province of Guinea, saw intense fighting and suffered extensive damage. Many Balanta were displaced during the war. Some went into the bush to join the guerrillas, while others fled to safe havens or were moved by the colonial authorities into strategic villages.

One of the major consequences of destruction and dislocation was the deterioration of the dams and dykes which were the main water-control structures in the rice polders or *bolanhas*. This caused salinization of the soil which could only be

reversed after intensive labour input during several rainy reasons. Moreover, rice reserves decreased, or in some villages disappeared entirely, leading to a considerable loss of genetic resources. In some areas local varieties almost disappeared, while in other areas there were severe shortages of planting materials and farmers were forced to plant any available seed. As a result of these conditions, rice production decreased significantly during the war. In spite of rehabilitation projects concentrating on technical assistance (mainly repairing water control structures and distributing planting materials, such as ROK5), production declined even further after the war. The reasons behind the failure of these rehabilitation efforts are dealt with in more detail in Chapter 3.

The key point to note is that the impact of war on local seed systems and management procedures of plant genetic resources is both direct through looting and destruction of seed reserves and indirect, via changes in social organization, as communities displaced by war attempt to regroup. In this particular case, war weakened the social ties at the village level which are essential for mobilizing labour groups in mangrove rice farming in Guinea-Bissau.

Locked boxes used for seed and grain storage.



Rice varieties well-suited to prewar social conditions, notably the salt-tolerant varieties adapted to the main mangrove tidal areas, were no longer appropriate under the drastically altered conditions of post-war labour supply. War had ultimately deprived elders of their power to command the large numbers of young men necessary to work the extensive mangrove wetlands.

Rehabilitation efforts were misdirected, by concentrating on varieties such as ROK5, which was suited to the relatively large-scale labour mobilization of the prewar situation. A more successful programme would have sought to support other rice farming econiches, including the associated inland swamps more easily worked by individuals and smaller household groups.

Conclusion

Three points can be highlighted from the case studies.

War is a direct threat to crop plant genetic resources through looting and displacement of the farming population. Direct damage is especially serious when, as in the case of Liberia, farming is halted for seasons at a time. Several parts of Liberia have now suffered an almost complete collapse of rice agriculture for five seasons in succession. This clearly has major implications for the management of plant genetic resources, and steps must be undertaken to plan a major physical rehabilitation exercise based on crop plant genetic resources in use in cross-border regions. If actual genetic material needs to be reintroduced, it may not be the same as the prewar germplasm. Seeds are needed urgently for farmers to grow food, but the material may need to contain sufficient diversity to allow post-war farmers to select and adapt the material to the new conditions. The refugees living and farming in these cross-border regions may be a major human resource to be engaged in planning and executing such rehabilitation work.

Local seed systems depend for their continuation on complex and delicate social arrangements, which are easily threatened by warfare. The threat is especially grave in low-intensity conflicts, as in Sierra Leone, where insurgent movements seek deliberately to foment social disharmony to further their own strategic ends. For this reason the rehabilitation of the seed system cannot be considered a technical matter alone. One of the implications of the case described above is that farmers may require new incentives to cooperate in seed exchange to overcome fear and hostility. At the same time young people recruited into Liberian or Sierra Leonean style militia forces must be assisted towards a more positive assessment of local management of plant genetic resources.

In the longer term, war may accelerate or cause a change of direction in processes of social and agrarian change. In such cases rehabilitation efforts must be subject to careful critical review of the continuing relevance of prewar seed technologies. The Guinea-Bissau study

offers a useful lesson in this regard: rehabilitation agencies seized on the post-war reconstructing opportunity to bring about a further modernization of the rice-farming practices of the Balanta by emphasizing the introduction of a salt-tolerant, high-yield, modern variety adapted to the main mangrove rice ecology. The rehabilitation and development schemes failed to realize that war had undermined established social relations of production in this major rice-growing region of Guinea-Bissau. Thus the wrong approach to modernizing the seed system was attempted, with predictably poor practical results.

3 seed-relief assistance to war-damaged farming communities

This chapter looks at instances of seed assistance to farmers in war-damaged communities in the West African rice zone. Again, different lessons can be learnt from each of the case studies. Humanitarian-assistance agencies in Liberia supplied displaced and refugee farmers with seed, but with little attention to broader issues in the management of plant genetic resources. Seed supply to war-affected farmers was effective in Sierra Leone because agencies with detailed knowledge of local farming conditions were involved. The key conclusion arising from assessing the longer-term experience in Guinean Bissau is that rehabilitation must take account of war-induced socioeconomic change.

Relief and seeds in Liberia: a cautionary note

In Liberia, food and seed assistance were undertaken by a number of relief organizations based in Monrovia, Côte d'Ivoire, Guinea and Sierra Leone. The Catholic Relief Services (CRS), International Committee on Red Cross (ICRC), Lutheran World Services (LWS), Methodist Relief Service (MRS) and Baptist Relief Service (BRS) all contributed to the needs of Liberian refugees from bases in either Monrovia or Côte d'Ivoire. The CRS, MRS and BRS distributed parboiled rice to refugees, while LWS provided refugees with both parboiled rice and seeds. It is not clear where supplies were obtained.

Some seed stocks appear to have been acquired from multiplication sources specializing in improved types (often requiring high input of fertilizer and skilled management for successful cultivation). Other agencies bought seeds from local markets in neighbouring West African countries, but apparently without detailed consideration of their suitability for the main production conditions in Liberia, e.g. high levels of iron toxicity commonly found in Liberian inland valley swamps.

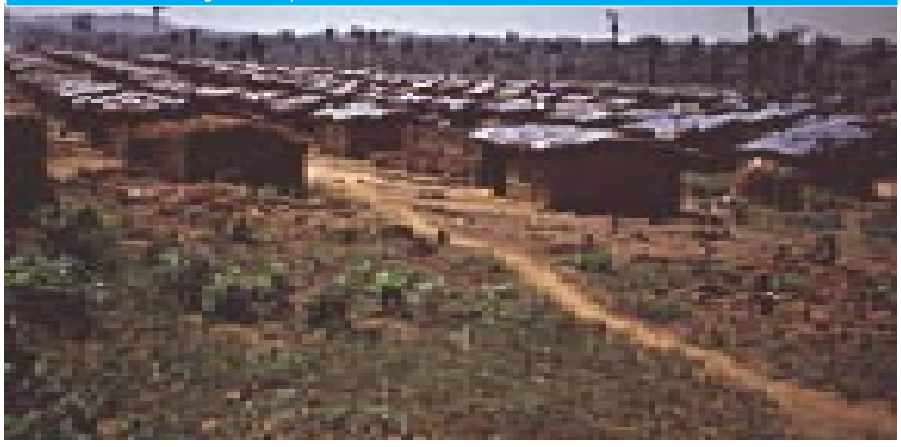
UN agencies (e.g. UNICEF) were also involved in distributing US

parboiled rice to Liberian refugees in Guinea and Côte d'Ivoire and to displaced people in Monrovia. In 1992, some rice seeds were given by UNICEF to the Ministry of Agriculture to be distributed to farmers around Monrovia. Farming tools and seeds (but not locally adapted types) were distributed to displaced people and farmers in the Greater Monrovia region. One UN official told us that he was not aware that there were significant differences in types of rice needed for seed in Liberia. He would have taken account of this issue had suitable and timely technical briefing been available. Unfortunately, as at present, advisory documentation is unavailable.

CARITAS International is another relief organization catering to the needs of farmers from Danane (on the Côte d'Ivoire border) and Monrovia. In early 1991 when the farmers in Danane refused to allow Liberian farmers to farm on their land, CARITAS negotiated for farm land for use by Liberian refugees. In addition to securing land, CARITAS also gave the refugees maize and rice seeds. A large quantity of rice seeds was acquired locally, from markets in Man and Danane. This was an opportunity to secure locally adapted cultivars. However, the seed purchases were made by Catholic priests apparently unaware of the different types needed. When it came to distribution it was found that the seeds had become mixed. The seed was all sown in upland farms, with consequent poor results. The improved maize seed, however, grew profusely and yielded very well.

The Ivorian government (sympathetic to the NPFL cause in the Liberian war) supplied about 40 000 bags of seed rice for displaced and dislocated farmers in areas controlled by the NPFL militia. The seeds were brought to Danane and stored in a warehouse given by the city mayor of Danane. Instead of free distribution to displaced farmers, as had been originally intended, much of the seed was sold, allegedly by staff of the self-styled Ministry of Agriculture of Greater Liberia (the name adopted by Taylor for territories under NPFL control). Some of the consignment did, however, reach Taylor's administrative headquarters at Gbarnga for onward distribution to farmers in

Janeah Refugee Camp, Forecariah District, Guinea.



NPFL-held territories. It is unclear whether the seeds donated by the Ivorian government were similar to the seed types used by Liberian farmers in their prewar rice cultivation practices.

In general, it would seem that there is little awareness among relief and rehabilitation agencies working in Liberia of the need for locally adapted rice seed. Few practical steps were taken to ascertain which varieties were needed where and in what quantities, or to plan for the multiplication of these varieties to assist post-war reconstruction. Small-farm agriculture in Liberia was almost ended by seven years of hostilities. Now there seems some prospect of peace, the seed-rehabilitation issue needs to be addressed in a comprehensive and co-ordinated manner.

Seed assistance to war victims in Sierra Leone

Prior to the war some rural development projects had built up considerable experience working with farmer rice selections, and some of these locally adapted types had found their way into the catalogue of the government's Seed Multiplication Project. During a lull in hostilities in 1992 some of this experience was drawn upon to plan seed assistance to war-displaced farming populations. This experience is worth some detailed review since it provides precedents for further schemes sensitive to the issues involved in managing plant genetic resources.

Patterns of dislocation and displacement

The total number of farm families dislocated by insurgency in Sierra Leone is not known with any accuracy. About 40 000 farming households were dislocated in the first main phase of RUF activity, 1991-92, when the conflict was confined mainly to about one fifth of Sierra Leone along the border with Liberia. Later activity by the RUF in the north and west of the country created new refugees on a larger scale. The RUF was never a large movement (with perhaps only 3000-5000 combatants) and attacks, though widespread throughout rural Sierra Leone from 1994 onwards, remained essentially sporadic. Away from the roads rice farming continued in many areas, and intensified in some cases, making use of labour input of young men driven out of the diamond mining districts by fighting. Perhaps in all about 33-50% of the 350 000 prewar farming households in Sierra Leone were displaced by the conflict.

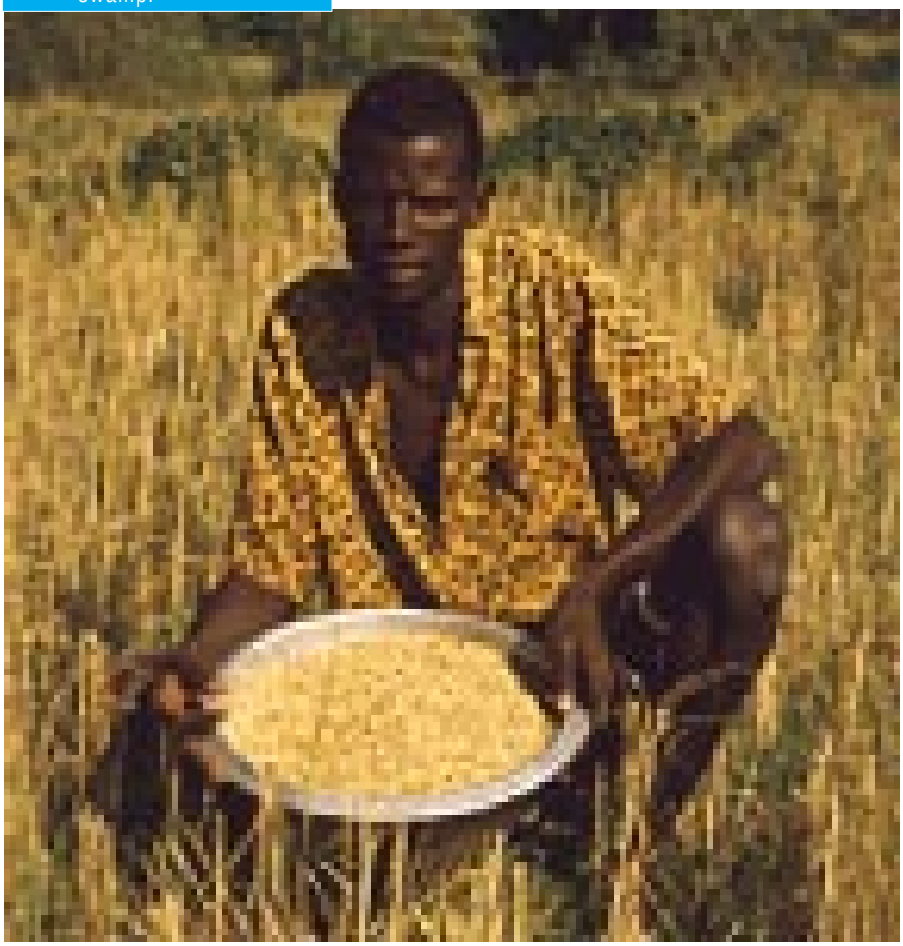
Like Liberia, Sierra Leone has a flexible land tenure system. Strangers generally find it relatively easy to gain access to land for annual cultivation. During the early stages of the Liberian war up to half a million refugees were settled and given land to cultivate in Sierra Leone and Guinea without being forced into camps. Access to land is less of a constraint for refugees and the displaced than seeds and tools. Communities may be generous with land, but the capacity of the local system to supply seeds and other farm inputs is

finite, and soon exhausted. Not surprisingly, groups suffering repeated displacements had the most difficulty with seeds and tools.

Insurgency and relief in Pujehun, 1992

Liberian irregulars (later ULIMO) and government troops stemmed the initial RUF advance into Sierra Leone in late 1991. Forced back into a few pockets of thickly forested land along the Liberian border, the RUF later switched its efforts to the diamond-rich Kono District. Meanwhile it proved possible for a number of agencies to organize relief and rehabilitation programmes for displaced farm households seeking to return to Pujehun and the southern parts of the Bo District for the 1992 farming season. Useful lessons were learnt from this experience. The RUF invasion in its initial phase had little direct adverse impact on the formal-sector seed organizations in Sierra Leone. In normal times the Sierra Leone Seed Multiplication Project (SMP) produces annually enough seed for about one fifth of all farm households in the country. This was approximately the number of farm households displaced by fighting in 1991. Timely orders by Catholic Relief Services, Save the Children and the Bo-Pujehun Project secured significant amounts of certified seed from SMP. SMP varieties are in most cases official releases from the Rokupr Rice Research Station, the main rice research facility in Sierra Leone. Several of these varieties are mainly intended for high-input wetland environments, but others are selections from local landraces suited to

Farmer (Samba Dumbuya) with threshed rice harvested from his swamp.



upland and low-resource farming conditions. The latter types exactly fit the situation of the great majority of farmers returning to war-devastated areas. Relief agencies sought advice on the suitability of seed-stock acquisitions from national institutions of plant genetic resources, and as a result targeted appropriate varieties, even if choice was limited.

One agency, Bo-Pujehun Project, had a great deal of in-house knowledge of local rice varieties, based on careful long-term research into local farming systems. The co-ordinator of the relief programme for war-affected chiefdoms in Pujehun District, anticipating shortages of SMP seed, explored the possibility of securing supplies of landraces through local merchants in areas outside the war zone. Specific use was made of baseline data from the Mogbuama case study (Richards 1986) and orders for 600 bushels of local landrace material were placed with a local rice merchant in this rice-surplus region north-west of Bo, at that stage unaffected by the RUF. The merchant was able to expand his buying operation significantly during the 1991 Christmas sales rush, when local farmers release seed to earn cash to cover holiday expenses, because he had been advanced capital by the project in anticipation of its 1992 rehabilitation needs. This successful case points to the fact that agencies with good local knowledge are sometimes able to make effective use of opportunities within the informal seed system to meet supply needs, provided not all districts are dislocated by conflict. However, it should be emphasized that the apparent success of this small Bo-Pujehun initiative depended largely on fortunate timing. Armed conflict in tropical forest zone conditions tends to peak during the dry season and become relatively quiescent in the rains. Local seed purchases in Sierra Leone and Liberia peak in the Christmas period (i.e. early dry-season) whereas conflict tends to resume a month or two later as rivers begin to drop. An agency with good local knowledge can make use of these windows of opportunity in cases of low-intensity conflicts. But once conflict becomes more widespread and intense, opportunities to secure local landrace materials rapidly disappear.

Rehabilitation that is sensitive to the management of plant genetic resources

The Bo-Pujehun Project was a rural development project established at the beginning of the 1980s with a mandate covering small-farm agricultural development in central-southern Sierra Leone, funded as a co-operation between the German aid programme and the Government of Sierra Leone. With about half its operational area affected by insurgency in mid-1991, the project opened a small relief and rehabilitation programme late that year. Earlier farming-systems analysis by the project had confirmed the value of local landraces of rice, and that these remained competitive with improved releases in the view of farmers. The

project was thus highly oriented towards management of plant genetic resources, having had earlier experience running a landrace-improvement programme called 'the panicle selection scheme' for dryland rice farmers. This background awareness of the long-term significance of management issues in small-scale farm development helps explain why the Bo-Pujehun relief programme in 1992 focused on distributing limited amounts of well-chosen planting materials (e.g. 2000 bushels of seed rice) backed up by high-quality supervision, rather than taking the bulk-oriented path to seed relief pursued by some other agencies. Measuring success in terms of amount of seed distributed, rather than in terms of its quality and effectiveness in application, other agencies sometimes expressed surprise at the limited character of the Bo-Pujehun programme. Unfortunately the resurgence of fighting in much of Pujehun District in 1994 made it impossible more fully to evaluate the comparative success of the two approaches. Even so, it is highly relevant to describe some of the apparently successful features of the Bo-Pujehun programme.

1 bushel = 36.4 litres

Throughout the Pujehun District, farmers were driven out of their villages during the early part of the 1991 farming season. Any crops already planted were lost, and stocks of planting materials destroyed, looted or abandoned to pests. Farmers' and traders' stocks of cash-crop produce (oil palm, kernels, coffee, cacao, kola) were also looted or destroyed. In some cases, farmers also lost coffee plantations close to villages, cleared on army orders to create free-fire zones and reduce the risks of ambush. The most urgent need of displaced villagers returning home in late 1991 was for relief supplies of food, clothing and basic household items to tide them over to the harvest season August-December 1992, in addition to agricultural inputs for the forthcoming farming season. Some tree crops were harvested during the 1991-2 dry season, and households with access to such crops were able to set aside a small amount of capital to buy farm inputs, primarily seed rice. The price of seed rice rose to Le 8000/bushel in the war zone, twice its cost in other parts of Sierra Leone. Many farmers trekked to neighbouring chiefdoms, sometimes 50 km or more, to buy seed rice, or borrow from sympathetic relatives. Some households exchanged palm oil for rice at the rate of one tin of oil for one can (0.5 bushel) of rice.

Two further difficulties hampered agricultural recovery in 1992. The first was unseasonably early rainfall, a major factor that periodically limits output on upland rice farms in the project area. Rainfall hampers burning off vegetation, with the result that extra labour is needed to clear the farm, the soil is less fertile and weed seeds survive to cause problems later. Early rainfall, one year in seven on average, is often the trigger for an exceptionally severe hungry season in the following year (Richards 1986).

The second difficulty was the sharp deterioration in agricultural labour supply. This labour bottleneck was particularly severe due to extra labour demands imposed by the effects of early rainfall. Prewar, labour shortage was the leading limiting factor in small-scale agricultural production in the war zone, especially in areas most affected by diamond-mining activities. The RUF conscripted both male and female young people, as potential converts to their cause, or simply to serve as labourers for militia groups in the bush, cooking, fetching water and carrying supplies. Some of these young people then perished in the fighting, or were summarily executed as suspect rebels by government troops. Others withdrew with the RUF towards the Liberian border region. Only a few were successful in escaping and returning to their villages without harassment. Jimi-Bagbo, a chiefdom headquarters in Bo District overrun in June-July 1991, had a prewar population of about 1000. Over 80 young people were captured by the RUF in the 1991 attack and two-thirds of this number remained unaccounted for in September 1992. Some households, with two or three young people carrying out farm work when the rebels first arrived, were attempting to manage farms without any youth labour inputs at all in 1992. Typically, young men aged 15-24 should comprise 7-9% of the total population in villages in the project area in normal times. The 1992 ratio for Jimi was less than half that. Reduced labour availability is perhaps the single most important factor affecting relief and rehabilitation activities in Liberia and Sierra Leone.

Some doubts were expressed about the

A farmer guarding a communal farm made by displaced people in the Sierra Leone eastern war zone in Segbwema in 1992

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emphasis on quality rather than bulk of seed distribution by agencies more familiar with food aid logistics and evaluation criteria. In the Bo-Pujehun rehabilitation, however, it seems the right choice was made. The relief programme distributed seed to farmers' groups registered with the project during the prewar period. These groups had some success in raising counterpart funds for community development activities, including various project-sponsored construction programmes, by growing and selling rice and other commodities. Farmers' groups became village seed-multiplication projects, using starter inputs from the relief programme to generate seed stocks for 1993 *in situ*. Seed inputs delivered to these groups by the project included carefully chosen local landrace materials.

Other relief programmes were limited to seed selections available from the Seed Multiplication Project. This restricted them largely to the distribution of a limited range of research-station releases, such as ROK3, 16, 17, CP4, etc. The first three of these are in fact research selections from local landraces, while the fourth is a long-established and popular cross between two introductions from south-eastern Asia suited to wetlands with low water-control. All four varieties were appropriate to farmers needs. But throughout the war zone farmers were keen also to secure niche-adapted hardy local cultivars, neglected prior to the war, but known to be especially well adapted to farm conditions under conditions of continuing uncertainty. Unable for security reasons to venture far beyond the village, many farmers were forced to clear short-fallow land of very low fertility, where weeds and birds also proved a problem. Lacking labour, many households were unable to carry out familiar labour-intensive tasks, such as the maintenance of improved wetland farms.

In this situation farmers needed specialized cultivars with ability to survive on very poor soils, tolerate

less weeding and pest control, or grow within specialized local ecologies, such as riverine wetlands or iron-toxic swamps. Where these types were available they helped supplement activities on the main farm, spreading labour peaks and increasing the duration of the harvest period. Among the required specialized varieties were floating rices used in farming the riverine grasslands along the lower Waanje and Malen rivers. Short-duration hardy types were required for special lowland (*bului*) farms, where cultivation prior to the main farming season produces a small harvest for family consumption during the mid-rainy season hunger period.

It was possible to meet a significant number of these special requests for local hardy and niche-adapted types through the Mogbuama purchasing arrangement. The matching of available germplasm to groups' needs and preferences was far from complete, however. With good prior organization and the right professional capacity, relief organizations could do more, not only to minimize the germplasm losses occasioned by war, but also to maximize the availability of these specially adapted types whose value only becomes fully apparent in emergency situations.

Rehabilitation and innovation

War changes the social conditions under which small-scale farmers produce crops. With careful thought, relief and rehabilitation work that takes into account the management of plant genetic resources can sometimes be set up to encourage useful innovation by farmers seeking to adapt in the post-war recovery phase. Changed labour-supply conditions is one of the most important factors to be considered. Experience in the Pujehun District in 1992 suggests that farmers may be quite prepared to experiment with new seed types and to reorganize farm production in quite radical ways, provided it leads to better utilization of available household labour. There is often a mismatch between the kinds of circumstances war-blighted farmers find themselves addressing and the sorts of innovations offered by conventional rural development sources. Many of these programmes assume intensified inputs of labour to improve the utilization of over-populated land. War imposes a different set of demands.

Farmers may have to cope with less than ideal farm sites while absorbing the physical losses of labour (or the breakdown of established labour-sharing arrangements, especially where these are dependent on significant levels of social harmony and trust). This is why post-war recovery may seem at first to be a step backward, as most farmers' first attempts aim to recover the resources and to revive the techniques that allowed prewar agriculture with limited labour. They also recognize a need to innovate to cope with artificially accelerated conditions of land-system breakdown.

In the flux of post-war recovery, many farmers are alert to the need to surpass the simple revival of old technologies. Studies of

farmers' utilization of rice seeds in Sierra Leone, based on a national sample in 1987, showed a 20% uptake of research station releases, but also a small but significant uptake of neo-traditional rice innovations that could not have come from the research sector (Lipton *et al*. 1989). These neo-traditional rices, reported by farmers as recent innovations, are typically classed by Sierra Leone rice researchers as types intermediate between African and Asian rice in morphology, and may have originated from farmer selection of spontaneous crosses (Jusu 1996).

One of these neo-traditional intermediate types, acquired as part of the Mogbuama seed purchase, aroused special interest among groups of war-affected farmers in Pujehun District in 1992. The rice in question is a short-duration (110-day) type originally collected in Kamba, Magbema Chiefdom (in the Kambia District of northwest Sierra Leone), where it was noted by farmers as one of the most highly valued innovations of recent years. It has no established local name, other than *tiri mont rais* (3-month rice). Strongly aromatic with small very dense reddish grains, it is considered by farmers in Kamba and neighbouring districts of northwest Sierra Leone an especially nutritious hungry-season type; eaten in the morning its effects are said to last the entire day. A small amount (1.0 kg) was introduced to farmers in Mogbuama (in central Sierra Leone) in 1988, for local evaluation, as part of a study on prospects for greater use of short-duration varieties to ameliorate the effects of the hungry season (Richards 1991). *Tiri mont rais* has been assigned provisionally by Malcolm Jusu to *O. glaberrima* on account of its simple-branched upright panicles, pear-shaped grains, and short ligules characteristic of that species. It is awaiting further investigation as a possible intermediate type. The grains are exceptionally small, and the seed coat dark in colour.

Mogbuama farmers have used the variety with great enthusiasm and it is now widespread in the villages of the northern Kamajei chiefdom under the name *sifoe-wangali*. One particular advantage as a hungry season rice is that it seems relatively unattractive to birds, due perhaps to the grain size as well as the colour and the toughness of the seed coat. A small amount was obtained by the Bo-Pujehun relief programme in late 1991 (with difficulty, since Mogbuama farmers are still

Displaced farmers were enthusiastic about early African rice. Pujehan,

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in the process of multiplying this variety for their own use) and distributed to Pujehun farmer groups on a trial basis in 1992. A group at Koranko-Kpaka planted 2.5 butter cups on 26 May and harvested 14 threepence pans (an input-output ratio of 1:25) on 13 September.

The speed and yield were major talking points, and members of the group planned to reserve all seed for multiplication purposes in 1993. A stand of the same rice at Lagoh, Barri Chiefdom, planted on 20 June, was in flower on 17 September. The farmer group owning this sample was highly interested in its performance because of its short duration, and because it had survived unscathed by birds during a short resurgence of fighting shortly after planting. This group also planned to reserve as much as possible for seed purposes in 1993.

Enthusiasm for adaptive experimentation by groups of farmers undergoing post-war recovery is not restricted to seed innovations alone. In some cases, particularly in the Barri chiefdom, farmers have learned the value of growing rice in the dry season. Reports indicate that in Potoru, before the rebel invasion, only one farmer did this on a regular basis despite an unusually large area of developed swamps in the chiefdom. However, several of the rehabilitation groups intended to continue the practice on their own initiative in subsequent seasons having experienced the benefits of dry-season rice cultivation.

Local measurements of volume

Management of plant genetic resources by displaced women farmers in Pujehun

It is important to clarify which members of the seed-multiplication groups are most skilled in managing plant genetic resources. We have noted that despite some general similarities in rice production systems across Sierra Leone and Liberia, there are often important differences in the relative roles played by men and women, and that these differences sometimes have a major bearing on the allocation of responsibility for seed accession.

The Bo-Pujehun relief programme sheds light on this issue. In a meeting to evaluate the impact of the seed-distribution programme in 1992, group at Lagoh-Barri confirmed that in this part of southeastern Mende, women are principally in charge of the rice harvest. This is similar in much of the border zone and Liberia more generally, but unlike Mogbuama, and central and northwest of Sierra Leone. Women in this part of Sierra Leone are aware of the need to manage plant genetic resources, and claimed to understand and practise panicle selection independently of project initiatives. Men only assist with rice harvesting and seed management, and are more concerned during the main rice harvest period with other aspects of bush work, including the harvesting of palm oil bunches.

Women make the main decisions about which rice to cook and which to keep

Young girl gleaning rice from an upland rice farm.

as seed rice, how to store batches set aside as seed,and where to hide these batches when they think (as in the aftermath of fighting) the seed will be under severe pressure from large numbers of indigent would-be consumers with strong social claims on household resources. In general, Mende women frequently emphasize their skilled knowledge of how to 'keep' things. From discussions, it was clear that men and women had interestingly divergent ideas about which of the varieties lost in the insurgency should be the focus of recovery efforts. Women in Lagoh mentioned *gbapoi* as a priority, for example, whereas men were more interested in *nduliwa* and *bundubai*. Some of these differences are explained by the differential properties of local rices when evaluated according to a number of distinct use dimensions. Lipton *et al.* (1989) assessed thirteen criteria deemed to be important in assessing rice variety performance by household members in Sierra Leone. Men tend to stress agronomic factors, including yield, whereas women are especially interested in processing characteristics, how much effort and fuel is needed to cook different varieties, and how well different types keep both before and after preparation.

Seeds, merchants and rehabilitation activities

The evaluation of the Bo-Pujehun programme in 1992 included a brief visit to Mogbuama to assess whether there had been any adverse reaction to the removal of 500 bushels (18 200 L) of landrace materials by the project. To secure supply, the project offered rates slightly above the local price in late 1991 and farmers seemed to think the good prices during the Christmas period were beneficial. This is a time of year when, just after the harvest all villagers have available rice, and a rise in preChristmas sales tends to depress prices; accordingly, this influx of purchases in the local market helped the majority of villagers.

There was a general air of satisfaction with the Bo-Pujehun purchases, since the local rice trader

(and main agent for the project) promptly reinvested some of his profits from an exceptionally busy trading season by buying stocks of white rice in Bo. This he sold to Mogbuama people at Bo prices, plus transport, to encourage them to continue to supply landrace materials in 1993. Timely availability of white rice at reasonable prices during the rainy season helped overcome the widespread production bottlenecks farmers faced as a result of unseasonably early rainfall, and there was some confidence locally that purchases of seed rice on behalf of the project might easily be doubled.

Despite ambushes and attacks along the main Freetown highway 7 km to the south, Mogbuama farmers report increases in areas of land cleared for rice production in early 1995, suggesting that even in conditions of more general destabilization there are still some parts of the rural economy functioning. From this it would seem that there is still some scope for repeating the earlier Bo-Pujehun initiative in purchasing landrace materials for farmer rehabilitation in the main war zones.

In other areas, however, the capacity of the local informal system to meet these seed-rehabilitation requirements is hampered by deliberate damage inflicted by the insurgents to local trading capacities. In the small chiefdom headquarters town of Sahn-Malen in Pujehun District there were 25 or more resident stranger-traders before the RUF invasion in 1991. In 1992 only five or six were left. Pursuing a revolutionary anti-trader rhetoric, the insurgents targeted and executed a number of traders to establish their populist credentials with farmers allegedly under the exploitative grip of these village 'usurers'. The merchants who could fled, and have been reluctant to return. Mainly Guinean Fulas and Mandingos, these small-scale merchants were essential to the performance of the local cash-crop economy, advancing farmers money against purchases of coffee, palm produce, cacao and kola (among other commodities). Farmers often use credit from traders to fund other productive activities (e.g. hiring labour, purchase of seed rice, etc.).

The rebels tried to rationalize to villagers the hostility to traders by claiming that a Fula merchant had opened fire on one group of insurgents in the initial incursion across the Liberian border. These stories are similar to ones circulating in Liberia that NPFL opposition to the Mandingo stems from two Mandingo merchants having revealed an earlier plot to assassinate President Doe. It seems more likely that the anti-trader animus originates from both a simple strategic consideration (a desire to gain the political support of highly indebted villagers), and from a more general ideological propensity among the core ex-student political leadership within the RUF to see all mercantile activity as inherently corrupt and corrupting.

In 1992 the cash-crop trade had reverted mainly to itinerants, such as the Fula kola traders who

venture down from Bo during the season. Even among this group many were deterred by the fear of further rebel attack, and uncertainty about the situation at military checkpoints. Local people recognized that the return of resident traders would be better for the local economy, but few large traders had the confidence to begin business again in Jimi or Sahn. One exception was a shop-keeper in Jimi, who having borrowed money from kinsmen in Bo to restock his shop, was doing business selling imported items to diamond diggers. By contrast, the main prewar produce trader in Jimi remained in Bo in 1992, and only one of the prewar Guinean traders returned to Sahn.

Agricultural reconstruction: lessons from Guinea-Bissau

The post-war strategies of national and foreign development agencies in Guinea-Bissau were aimed at restoring mangrove-rice farming. Apparently one of the underlying premises of these strategies was that this rehabilitation could be achieved by concentrating upon technical assistance. These efforts included repairing water works with modern materials, machinery or labour investments, mobilized through food for work programmes. They also included distributing rice varieties, notably ROK5, and other technical inputs. Balanta communities, it was assumed, would then resume their prewar activities, labour organization and production systems.

The engineers based their strategy on a stereotypically static image of Balanta society, which they believed still prevailed, or could be resurrected in the aftermath of war. This image of society was based on certain presuppositions about these peoples' culture: Balanta were known to be independently minded, tradition-oriented, cohesive, and everywhere focused on their major crop, rice. The assumption of the technical assistance agencies was that given the facilities for rice farming offered by aid programmes, the old Balanta society suppressed by war would spring back into life.

Post-war social organization and management of plant genetic resources in Guinea-Bissau

A comparison of pre and post-war social organization in Guinea-Bissau reveals two major changes integral to rice farming. First, the crucial relationship in Balanta society between elders and young men had broken down during the war. After the war, young men were no longer directly controlled by their elders, but sought sources of income outside their villages, and/or tended to produce rice on their own account. Secondly, elders shifted the focus of their political action from controlling their sons' labour towards the management of economic activities at the village level more broadly, mainly through their control over certain ritual processes.

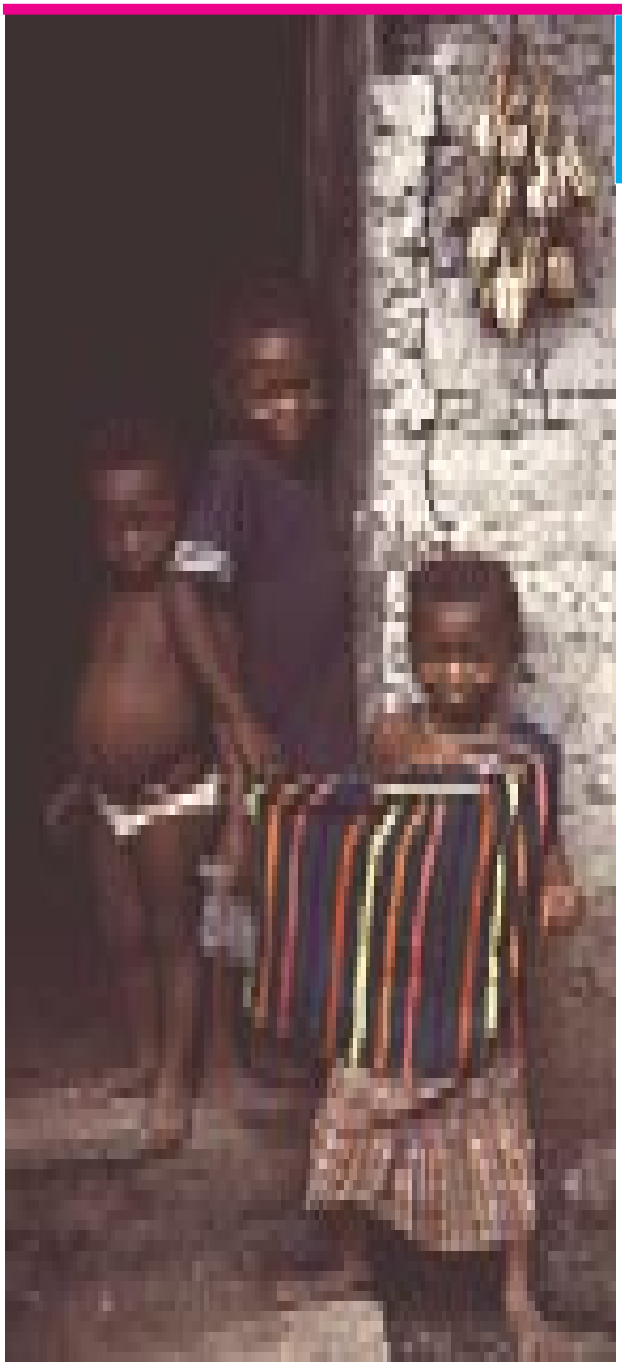
The most important consequence of these trends for rice farming was the fragmentation of units of management and labour mobilization (simply put,

there was a shift in organizational focus from the village/compound level towards household units). In turn, the large lower fields in the mangrove ecosystems were no longer used as they had been before the war. As agrocommercial entrepreneurs disappeared after the war, Guinea-Bissau (now independent) followed a model of state-controlled economic development. In practice, the state-controlled *armazens do povo* were not able to effectively replace the *ponteiros*. Interestingly, the *ponteiros* largely remained outside every analysis or study on mangrove rice farming; they simply had no place within the development strategies and social planning of the 1970s.

Surprisingly, a number of the most influential of these colonial entrepreneurs joined the Marxist PAIGC administration. By neglecting the nature and importance of these two sets of changes, rehabilitation strategies which seemed sensible from a technical point of view were directed primarily in a socioeconomic context which no longer existed. This explains in part the disappointing results from the introduction of ROK5. Up to the late 1980s, production had hardly improved over war-time levels. Over 50% of fields in the mangrove zone had fallen into disuse. Labour migration to the capital and neighbouring countries intensified after independence, and rice imports continued to increase.

In the immediate post-war period there was a considerable shortage of locally adapted mangrove rice cultivars, many of which had been lost during the conflict. ROK5 was introduced as the main alternative. Technically, this release was well-adapted to mangrove soil and water conditions in Guinea-Bissau. The variety gave high yields and its colour, taste and cooking time were also locally acceptable. But for ROK5 to be a success it was necessary to move back into full-scale cultivation of the main mangrove wetlands. Water control structures were rehabilitated or improved, but this alone was not enough. The key factor in the successful cultivation of the main mangrove areas is an abundant supply of well-organized labour. Before the war this was supplied by 'age grades' of young men often working on the scale of an entire village or village section under the co-ordinating authority of the village elders. The war changed this relationship, and undermined the authority of the elders. Outmigration reduced the pool of available labour; even when young men were available for the work they now preferred to work independ-

Fence constructed to keep pests out of a swamp rice plot.



Children playing on the back door step, under okra seed which has been kept by their grandmother (Sernor Fatmata Kamara).

ently, farming the associated (rain-fed) wetlands better suited to this purpose and growing crops other than rice on uplands. As water-control structures in rice cultivation are viewed as a marker of technical progress elsewhere in the world, it seemed clear to the newly independent Marxist government and aid agencies that rehabilitation of the mangrove farms was a priority.

Another important factor involved in the input of genetic material was the *ponteiros*. Since their activities were aimed at European markets they had a clear-cut preference for white-skinned, fast-cooking varieties of rice. This preference influenced farmers' decisions, since rice was cultivated as a cash crop as well as for subsistence. However, local cultivars of Asian Rice and all varieties of African Rice are red-skinned, leading merchants and rice cultivators in the mangrove rice zone in Guinea-Bissau to select against these varieties for economic reasons. Since red skin colour is a dominant

characteristic, farmer-managed supplies of white-skinned varieties tended to become more mixed over time. In the prewar situation this gave the *ponteiros* a strong vested interest in maintaining stocks of locally adapted seeds with the desired qualities to ensure that the rice they bought from farmers had the desired characteristics. *Ponteiros* thus became an integral link in the local seed supply chain, and their disappearance after the war may have been as disruptive of local management of plant genetic resources as the war itself.

The idea of isolated, autonomous Balanta communities hid the prewar role of the vital commercial networks through which mangrove rice producing villages and families were linked. For ideological reasons, politicians, scientists and development experts largely neglected these commercial networks. They were more concerned with the progressive socialist development of post-war Guinea-Bissau. It is worth noting that these commercial networks, integral to the rise of mangrove rice cultivation in Balanta country, were not dead but only dormant; as a consequence of recent economic liberalization they have experienced a renaissance.

Summarizing the lessons of Guinea-Bissau

The case of Guinea-Bissau clearly shows the extent to which prewar and post-war situations may differ. This has direct relevance for the way agencies interested in farmer rehabilitation in the aftermath of war view their task.

The main genetic input in the rehabilitation of rice farming after the Liberation War (1962-1974) consisted of ROK5 seed material. Although this has positive characteristics and was technically adjusted to the environment, it is a seed choice that implicitly assumed that the prewar socio-economic organization of the farmers (with a relatively large scale labour mobilization demand) would be readily revived. In reality land management and labour organization in rice farming was rapidly fragmented after the war, ultimately affecting the household unit of production. This had immediate consequences for the level of land and labour management, as lower, more productive and more labour-intensive fields were no longer used to the same extent as before the war.

In addition, the post-war disappearance of the agrocommercial entrepreneurs, a vital set of actors in the prewar rice farming complex, had serious consequences for the rice economy. This void effected not only commercialization, but also the local management of rice genetic resources when an important stimulus to seed selection was removed. Relief and rehabilitation programmes initiated aid, as water management infrastructure was restored or improved and new planting materials were introduced, under the assumption that farmers would make use of these facilities automatically. Due to the radical changes which the war had created in the fabric of rural agrarian society, these efforts proved largely unfruitful.

Conclusions

Successful seed assistance to war-affected farmers that is sensitive to management issues in plant genetic resources is feasible in the kinds of conditions currently experienced in countries of the West African rice zone, but two requirements stand out. There is need for good local knowledge of adapted seed types, and for cooperation from farmers in areas outside the war zone. As experience in Liberia has revealed, not all aid agencies have the requisite local knowledge. Where an entire country has been repeatedly destabilized over successive agricultural seasons (as in Liberia), cross-border assistance in recovering locally adapted planting material seems to be called for (a point developed in Chapter 4 below). Moreover, war is a social as well as a military process. Post-war relief and rehabilitation is often much more than an attempt to recover the original status quo; seed assistance may have to embed itself within complex processes of war-induced and post-war social change. Diverse sections of society (men and women, young and old) may find themselves engaged and affected by military processes in very different ways.

The post-war situation demands new and diverse crop genetic resources: It is a common experience in many wars that returning fighters do not easily find their place within war-distorted social formations. Inter-generational tension may result, and have a marked impact in a variety of ways, such as patterns of labour mobilization in agrarian societies. The Guinea-Bissau material indicates that crop plant genetic resources are not just adapted to specific econiches, but can also be specific to certain forms of labour organization. In addition, post-war conditions may dictate large changes in crop-type preferences as a result of alterations in the social relations of farming production. These changes need to be monitored and their significance for selecting and maintaining crop genetic resources fully and carefully evaluated. Specifically, every post-war rehabilitation initiative needs to understand exactly how conflict has altered the distribution of power and authority among the generations and between the genders as well as identify the implications of these changes for agricultural production systems.

4 the management of plant genetic resources and post-war recovery

This chapter addresses two questions. First, to what extent has war affected the institutions and procedures for managing plant genetic resources in the three case-study countries? Second, what role might management of plant genetic resources play in post-war recovery? Answering the second question we point to a new and potentially valuable cooperative linkage between management institutions and humanitarian assistance.

The existing framework

International, national and local frameworks

Formal responsibility for managing plant genetic resources is vested, in all three case-study countries, in national agricultural research systems (NARS). Rice researchers in all three countries collect and characterize local germplasm to improve rice. They also collaborate with international centres in the CGIAR system. IITA (in Ibadan, Nigeria) had a rice research programme for Africa, and IITA plant explorers collected about 500 local varieties in Sierra Leone in the mid-1970s. A duplicate collection was lodged with the national rice research station at Rokupr, but was lost in 1980, when cold storage equipment was looted from the station during action by the security forces to quell a riot of daily paid workers. IITA has more recently relinquished responsibility for rice in West Africa to a reconstituted WARDA, based in Bouake, Côte d'Ivoire. At a global level, formal management of plant genetic resources in the three case-study countries is supported by the major rice genebank collections maintained by IRRI in the Philippines, and by the policy work and technical support of IPGRI.

Rice researchers in the three countries collaborate, both bilaterally and through the CGIAR-system networks, in exchanging local germplasm and improved releases. A Liberian landrace selection, LAC23, was rereleased in Sierra Leone as ROK17, and has been adopted extensively by dryland farmers in that country.

Similarly, the Rokupr salt-tolerant release ROK5 was promoted extensively in Guinea-Bissau in the post-war recovery phase.

How well does the current system function in war?

The destruction of *ex situ* rice germplasm collections at Rokupr in 1980 serves as a warning that such collections are vulnerable to looting by ill-paid government security forces as well as irregulars. Rokupr was briefly threatened by RUF activity in January 1995 and again in February 1996, and staff were evacuated to Freetown. Some scientific staff returned to the station after a few weeks, and relatively little damage was sustained. By their nature, physically sprawling facilities in relatively inaccessible country districts, research stations are hard to secure against the proliferation of armed groups and bandit gangs of the kind that lingered in the aftermath of a period of more formal conflict, as in eastern Nigeria after the Civil War 1968-70.

In Liberia, rice research facilities were extensively damaged by fighting and are no longer functional. There were two main rice research stations in prewar Liberia: the national agricultural research systems (NARS) and the West African Rice Development Association (WARDA). CARI was located at Suacoco, Bong County, and WARDA at Fender, near Monrovia. CARI was involved in collecting, conserving, breeding, multiplying, documenting and releasing rice varieties to Liberian farmers. Two of the more successful of the varieties are Suacoco 8, an iron-tolerant variety well-adapted to swamp cultivation in Liberia, and LAC 23, an upland cultivar. Both are pureline releases from locally adapted farmer selections. The institute invested substantial efforts to purify and test Suacoco 8 and LAC 23.

Both CARI and WARDA suffered major reverses when the present civil conflict engulfed Liberia. Conserved plant genetic resources and research facilities were looted and destroyed, and several members of staff taken by surprise by fighters were killed. Of those who escaped some were displaced within Liberia, and others crossed the borders into Côte d'Ivoire, Guinea and Sierra Leone. CARI ceased to operate as a rice research facility, but was turned into a major guerrilla training camp and residential area for the NPFL faction in the civil war. For a long time on the actual front line between opposing forces, WARDA facilities at Fender repeatedly changed hands between faction fighters. WARDA was entirely reorganized in the interim and no longer has a direct presence in Liberia.

Rethinking the role of genebanks

In situ versus *ex situ* conservation, or a new approach?

There is an important debate in management circles about the relative merits of *in situ* and *ex situ* conservation of landrace materials. Those who advocate strengthening *in situ* conservation point out that farmer selective pressure is a neglected

aspect of the management of landrace materials. The two central arguments are sometimes conflated. The first is a biological argument, the claim that it may be better to encourage farmers to continue to manage a landrace genepool in evolutionary real time, rather than to abstract and 'freeze' this material in *ex situ* collections. The second argument is socio-political in nature and concerns the relative merits, strengths and weaknesses of formal and informal institutional arrangements for plant genetic resource management. Informal arrangements (such as farmer seed exchanges) may be better adapted than formal arrangements (like legal procedures governing acquisition and circulation of genebank accessions) to serve the adaptive needs of low-resource farm households in the typical circumstances faced in many regions where landrace materials remain important (bad communications, weak government, neglect of the interests of the poorest sections in society). Unfortunately the institutional argument does not apply in war-torn communities. The informal system, as we have seen, is severely inadequate. Local seed exchange is a major casualty of LIC. Much of the farm population is itself *ex situ* as a result of the war, living in camps for refugees or as displaced strangers. At the same time, the national levels of formal systems are also highly vulnerable to war damage.

Thus, post-war recovery seems to call for something entirely new in terms of organizational arrangements and practical initiatives. This new system (detailed below) should be a hybrid of some aspects of existing formal and informal practices together with new elements arising from practices more normally associated with the work of relief and rehabilitation agencies, and supported by international genebank facilities. There is (we have discovered) some willingness on the part of the interests involved in managing plant genetic resources, war-affected farmer groups and the relief and rehabilitation agencies, to contemplate practical outcomes from this unprecedented convergence of interests. As yet there exists no clear idea about how to build on this convergence; we seek to address this issue in the remaining sections of the chapter.

Relief agencies: food aid and seed aid

According to preliminary informal enquiries addressed to a number of British and Dutch based organizations, relief and rehabilitation agencies are potentially interested in the idea that post-war recovery initiatives in Africa might have explicit components involved in managing plant genetic resources. There is now the need to discuss scenarios as well as practical and action-ready, proposals.

These comments focus on a number of conceptual reorientations that might be necessary if the worlds of relief and genetic resource management are to find common ground. The first of these conceptual reorientations has already been noted in the discussion on efforts to develop

farmer rehabilitation programmes in war-affected regions of Sierra Leone in 1992. Relief and rehabilitation agencies are more oriented to bulk distribution of food aid than to the supply of high quality 'packages' of genetic information.

Seed supply to farmers seems on occasion to be managed as an extension of food aid. It is seen as an exercise in getting a standard bulk commodity in place as speedily as possible. Food aid oriented agencies often do not easily understand what is different about seed aid, and the new standards and criteria against which the effectiveness of such aid must be judged. The manager of a relief programme in one of our case studies, having procured large supplies of seed rice on the world market, was frank enough to tell us that no attention was paid to varietal suitability. He had simply never been briefed about the issue, and was surprised to find that not all seed rice was equally suitable to conditions in the country concerned. However, he was willing to change things in future if timely expertise could be made available. It is this kind of invitation to which the management community should seek to respond.

A farmer outside the war zone multiplying a local variety for sale to relief agencies, central-northern Sierra Leone, 1982

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Relief-development transitions

Conversations with relief and rehabilitation agency staff during the preparation of this report brought to light a second potentially important opportunity for managing plant genetic resources. Many agencies are acutely aware of the potential danger of food aid dependency developing among groups of refugees and people displaced by conflict. One way to counteract such tendencies may be to seek ways to link relief and rehabilitation activities with longer-term rural development initiatives.

Currently there is an important debate taking place within the agencies about why these two spheres of activity have been so separate in the past, with somewhat distinctive institutional cultures, and how to bring about better linkage and cooperation in future. Efforts to manage plant genetic resources might be a perfect focal point upon which some of these initiatives might converge, since the kind of management schemes for plant genetic resources outlined have drawn from the first phase of relief activities, namely getting inputs to displaced rural people to allow them to survive the

immediate aftermath of war. There is also potential to develop this into longer-term rural development initiatives by stimulating farmers' interest in innovation processes as they adapt to unprecedented post-war circumstances.

Opening the genebank to new clients

It becomes clear that relief and rehabilitation agencies are not yet very well informed about the technical and organizational resources upon which they might draw in developing any such initiatives. Here we conceptualize the issue as one of making genebanks accessible to NGO's. By this we mean not only the "back-stopping" institutions of final reference, but also all the networks of professional expertise in managing plant genetic resources and the processes, including farmer expertise and informal seed exchange, associated with *in situ* management of landrace materials.

It is important to decide who will act as the representatives of the farming communities in contacting genebanks and other management facilities if they have information and genetic resources of potential value for farmer rehabilitation in the aftermath of war. We suggest that NGOs and other agencies working for the relief and rehabilitation of farmers are best suited for this task. However, relief agencies do not have an accurate understanding of the services that genebanks and other elements in the network managing plant genetic resources might supply. Furthermore, genebanks and other management facilities currently do not yet count NGOs and other relief-oriented groups among their clientele and are instead too narrowly focused on the needs of breeders. In light of these points, we need to identify what can be done to facilitate new working relationships. We offer the following short list of points concerning technical changes and awareness-raising activities as a contribution to an urgently needed discussion of this issue.

Attempts need to be made to pinpoint what kind of assistance might be most crucial for farmer seed rehabilitation initiatives. War interrupts the normal circulation of landrace materials but renders such materials locally extinct only in the most dramatic instances. Even in Cambodia, many landraces survived a total disruption of local rice farming, though reintroductions from the IRRI genebank seems to have been effective in speeding up the recovery process. Probably the greater need is for relief and rehabilitation agencies to be able easily and quickly to tap the advice and information available within genebank facilities, not the genes themselves.

The focus then shifts to the structuring of genebank information systems to provide answers that relief agencies are likely to need. Many genebank collections are under-characterized, and when such work is undertaken many questions are raised about the actual validity of landrace collections (as suggested by a recent review of the barley collections in the

Dutch genebank by van Hintum 1994). Even more importantly, accession passport data typically tends to under-represent the kind of social-economic, cultural, and agronomic data likely to be of most use to relief agencies. Farmers' groups and their NGO agents are concerned with issues such as which landrace in a region should be collected and multiplied in anticipation of a sharp post-war deterioration in labour supply; what equivalents exist for temporarily unavailable landraces most suited to women's special needs; and what are the best hardy, short-duration types for a given area. To understand whether or not a genebank facility is able to accommodate the needs of new client groups (war-damaged farming communities/relief agencies), testing of the facilities in question against specific sets of circumstances will be required.

Building awareness of the expanded role of genebanks and *in situ* genetic resources

We suggest approaching these concerns in the following way. A number of workshops should be organized to bring together, in the first instance, specialists in managing plant genetic resources and field staff of relief agencies familiar with the post-war rehabilitation of farming communities (in time it might be possible to incorporate representatives of these communities directly into the process). The task of these workshops should be to build specific conflict and catastrophe scenarios. From these scenarios a list of questions would be generated to determine how the information and collecting systems of genebank facilities can best accommodate farmer needs when rehabilitating war-damaged communities. This type of activity would serve to develop a mutual understanding of the issues raised by professionals from both the management and relief fields, and lead towards the reorganization of collections and information-support systems in ways that would improve genebank disaster preparedness.

In more general terms, it is vital to identify the practical role of the genebank: whether national and international collections should seek to develop some of the diverse activities of the world's major museums and libraries, or if research is the only remit (Eyzaguirre and Iwanaga 1996).

Farmers visiting the Rice Research Station at Rokupr on Open Day.

Political support for conservation depends ultimately on public awareness; the specific capability to support rehabilitation of war-damaged rural communities might be a very effective way to raise public understanding of the issues involved in managing plant genetic resources, and to build broader popular support for conserving genetic resources.

Role of plant genetic resources programmes in post-war recovery

There are two underlying points in our attempt to identify the conditions required to make genebank collections more accessible to agencies undertaking post-war rehabilitation of farming. Drawing a sharp distinction between *ex situ* and *in situ* genetic resource conservation is not very helpful for war-affected countries. Farmers can and do hide, and sometimes later recover, important genetic resources, but these methods will never be completely effective against repeated waves of dislocation and violence. Displaced farming communities are themselves *ex situ*, and even the best-established national facilities will never be invulnerable to looting, the destruction of buildings, and the loss of key specialist staff during a war. If post-war rehabilitation activities are to restore farmers' prewar levels of genetic diversity, they will rely to an extent on regional and international *ex situ* facilities. The issue then becomes how to make these facilities more visible, accessible, and useable by a new and unfamiliar clientele (NGO relief and rehabilitation agencies and war-affected farmers). Certainly genebanks are limited in their holding capacity, and therefore could not be an effective direct source of all the planting materials needed for rehabilitation work. In some cases, they may be the last resort if rare material with potential value in post-war recovery has been entirely lost. In these instances a rehabilitation programme might turn to a genebank for initial materials, and incorporate long-term strategies for encouraging farmers and community seed projects to multiply landraces which are in high local demand. War is unlikely, however, to cause the local extinction of landrace materials; seeds survive in many unpredictable places, and landraces (by definition) are genetically diverse.

The more important role for genebanks is as a source of information about locally adapted planting materials and possible landrace substitutes (from neighbouring regions). Currently most genebank collections may not be optimally (or even well) organized for supplying this type of information. A recent assessment of the barley collections in a Dutch genebank highlights the problem of irregular collections, and much basic characterization work still remains to be done on even the best-managed collections (van Hintum 1994). Even when available, this information tends to be oriented towards the needs of breeders and not relief agencies. In light of these problems, we propose three initiatives to improve genebank support for the

post-war recovery constituency:

1) New collecting protocols for genebank accessions need to be developed which include the kind of socioeconomic passport data of greatest potential significance to relief agencies. Some idea about what data could be incorporated can be gained from a management-specialist review of the on-the-ground experience of relief and rehabilitation agencies trying to reactivate informal systems damaged by conflict. Recent efforts by IPGRI to revise the collecting forms to include socioeconomic and ethnobotanical information are one step in this direction (Eyzaguirre 1995).

2) The current effectiveness of existing genebanks and collection networks should be tested, using a number of potential (or actual) war and disaster scenarios, to meet the information needs of relief and rehabilitation agencies. This might be done through organizing country-focused NGO-genebank workshops in which the participants developed their war/post-war-recovery scenarios to evaluate the genebank facility in question. Such workshops might provide an effective way to develop better reciprocal understanding among agency staff of management issues of plant genetic resources in war-torn societies.

3) Working relationships need to be established between genebanks and on-site relief agents, for example through creating fellowships and bench facilities for refugee specialists in the management of plant genetic resources actively associated with the work of relief agencies. Such a refugee-visitor programme might have as one of its central aims the characterization of collections from the standpoint of rehabilitation needs, linked to ongoing relief and development transition projects in countries undergoing post-war recovery.

Post-war management of plant genetic resources: practical initiative

We conclude this report with a discussion of some practical possibilities for seed assistance that is sensitive to the management of plant genetic resources by farmers in war-torn communities. A potential programme is outlined for rice-farming communities disrupted by war in Liberia and Sierra Leone. This proposal has been developed by a Sierra Leonean specialist in rice genetic resources (Malcolm Sellu Jusu) and a Liberian agronomist (Mulbah Gonowolo) with experience of working with refugee communities on the Liberia/Côte d'Ivoire border, after reflection upon the general issues raised by this study.

The regional seed safety web: a new kind of genebank?

Both *in situ* and *ex situ* management facilities have proven highly vulnerable under conditions of West African rural insurgency. The old conception of a genebank as a free-standing, static, 'hardware' facility should be replaced, we suggest, by a new 'software' conception: a sociotechnical ensemble, linking seed reserves, seed systems, information networks, technical

facilities, relief agencies and farmer groups in a transnational web of mutually reinforcing interactions (a seed-safety actor-network). We propose calling this the regional seed safety web (RSSW). In an ideal model the RSSW should be in place before conflict arises. The present challenge is to construct such webs in conditions of ongoing conflict and post-war recovery. We propose to start the process of web-building in a 'bottom-up' manner, trying whenever possible to adapt the first steps in this new seed security initiative to the work patterns of relief agencies in the field.

First steps: the security collecting mission

The initial activities will be undertaken through the agency of a new type of emergency-oriented, seed-security management team we term the security collecting mission (SCM - small teams of management specialists of plant genetic resources accompanying emergency relief workers in the field).

Minimally, an SCM would comprise a genetic resources specialist/breeder, a social scientist familiar with local crops and farming environments, an NGO liaison officer, and representatives of refugee/displaced farmer groups. The SCM team would be trained, cleared and ready to follow emergency feeding programmes. Such feeding programmes generally require prompt registration of refugees and displaced people, and a SCM might use this registration exercise as an entry point to assess long-term needs for locally adapted varieties and potential germplasm losses. Displaced or refugee farmers may have lost control of their bulk seed supplies, but grain genetic resources are in fact often quite durable. With suitable early warning, many apparently lost seed types will be readily recoverable provided an assiduous search is instituted and researchers have a clear idea of their targets.

1) The first major task of a SCM will be to record what planting materials refugees or displaced farming populations depended on in their home areas and in what proportions. This establishes a baseline from which to assess how seed needs might have changed in the current environment. It also builds a framework for planning the process of securing and multiplying stocks of adapted materials for an eventual return home. The SCM will then need to

Outputs from the security collecting mission

The aim of the SCM is to secure the following outputs within a 3-year time scale:

- basic information from refugee and displaced groups about seed losses
- security collecting of threatened material
- preliminary assessment and characterization of key germplasm resources advice to relief agencies about seed acquisition and distribution policy
- advice to refugees/displaced farmer groups about locally adapted planting material for their new situations
- seed multiplication activities involving refugee/displaced farmer groups to secure supplies of appropriate planting material for returning farmers
- participatory analysis with refugee/displaced farmer groups of social changes induced by war affecting farmer-managed and local seed system activities
- social research with farmers' groups to rebuild or replace existing seed systems
- monitoring and evaluating the impact on genetic resource distribution, food security and livelihood security
- monitoring and evaluating war and post-war recovery programmes.

decide, on the basis of these data, whether the varieties in question are already known to science, whether starter supplies for multiplication can be acquired from existing regional genetic resource collections, and whether this is a purely local variety requiring collecting and characterization. Reference will be made to information networks maintained for this purpose by a series of participating regional institutions (see below).

2) The SCM should then organize meetings with refugee/displaced farmer groups at an early stage of the recovery process to elicit refugees' own ideas about a possible strategy for recovering important material. Even in peace time farmers often acquire starter seed through unusual routes (viable seeds scattered in the bush by birds, or attached to clothes, loads and packing materials). Alternatively, seed search activity may be something to be linked to food for work programmes and undertaken by children or older or weaker refugees unable to do more physically demanding farm work.

3) A third step at this stage is for the SCM social scientist to map local seed systems. Ultimately this process seeks to understand whether conflict has entirely disrupted the seed systems and if so what prospects might exist for rehabilitation, while also seeking to begin to analyze war as a social process and open discussion with displaced groups about key social aspects of seed-security issues. Two key examples of this from the Guinea-Bissau case study would be the commercialization of the seed system and the relationship between labour mobilization and seed choice.

4) Working in close consultation with relevant relief agencies and refugee/displaced farmer representative groups, the SCM will then assume the responsibility to plan and implement a seed collecting, multiplication and redistribution strategy for displaced, returning and resettled farmers. The SCM will expect to assist displaced farmers to adapt to new environments by acquiring and organizing the multiplication of appropriate locally adapted planting material. Where material has to be imported for refugee or returning farmers the SCM will expect to advise relief agencies on their seed-acquisition policies.

5) The SCM will stimulate and co-ordinate refugee/displaced farming groups to multiply scarce but important varieties as reimbursement for relief assistance. This component of SCM activity seeks to address the problem of dependency among refugee populations. The intention is to ameliorate the logistical bottleneck of finding suitable sources of planting materials when the focus shifts from relief to rehabilitation. Multiplication activity is intended to help focus the explicit attention of displaced farmer groups on the social aspects of seed system issues (such as the disruption to existing arrangements, and on the possible need for social innovation by refugee/displaced farmer groups themselves to overcome these disruptions).

Where women are key

agents in the seed-recovery process the social scientist on the SCM must understand gender issues, or a gender specialist must be added to the team. It is expected, given the particular significance of women rice farmers in managing local aspects of the informal seed system in Liberia and eastern Sierra Leone, that much of this activity will be focused on women's groups. The Pujehun rehabilitation experience in 1992 will also assist, where women expressed enthusiasm for the idea of a system of inter-village, cooperative, seed-exchange activities under their direct control. It is proposed to establish two SCM teams, with staff mainly recruited from among refugee and displaced scientists in the region, to work on a trial basis in cooperation with NGOs engaged in relief and rehabilitation activities arising from the civil war in Liberia and insurgency in Sierra Leone. The Liberia-oriented team will probably work in a cross-border context (based either in Guinea or Côte d'Ivoire). The Sierra Leone team would be attached to one or other of the NGOs currently operating in and around the Sierra Leone war zone. Both CARE and Action Aid are agencies that might be interested in hosting such an initiative. CARE has in-house staff who, through experience setting up and running a farmer-participatory crop germplasm development programme (the SAVE initiative), would be highly suited to the work proposed.

Higher levels in the regional seed security web

The intention behind the priority focus on SCM is not only to meet an urgent practical set of needs, but also to create a context in which higher level changes in genebanking activities are induced by the need to support SCM-type activities. Including SCM in the work of relief and rehabilitation agencies will strengthen the case for continued support and also induce the organizational reform of the management of plant genetic resources in war-affected regions. The continuing success of SCM will be ensured by efforts to create and sustain baseline data, back-up information systems containing suitable socio-economic as well as biological data, and collections of well-characterized and adequately sampled plant genetic resource accessions (with duplicates distributed across the region for security purposes). This implies careful attention to the dynamics of regional cooperation in the management of plant genetic resources in a political climate clouded by the regional tensions which cause or exacerbated conflict in the first place. In a particular sense, gene conservation authorities will have to become concerned with international relations.

Seemingly, the West African rice zone has some of the necessary institutional frameworks already in place. WARDA, one of the newest and smallest international research centres in the CGIAR system, has been able to maintain coordination of rice research issues despite the existence of national, and Anglophone-Francophone political

rivalries affecting the course of the present conflicts in Liberia and Sierra Leone. In several respects it is atypical, having existed previously as a regional cooperative venture supported (on paper at least) mainly by the governments of African rice-growing countries. Only recently has it joined the CGIAR system as a venture with strong African roots; an African director, and a majority of African scientific staff, might prove to be a timely solution to the kinds of diplomatically delicate situations that inevitably arise in attempting to build an effective system of regional cooperation in the management of plant genetic resources across a number of planes of political cleavage.

Earlier it was stressed that rehabilitating seed systems cannot be regarded as a technical activity taking place in a political vacuum. Additionally, WARDA is now committed to a policy of complementary support and capacity building in national research organizations. In the past its research programmes to some extent rivalled or overrode existing national programmes. This emphasis on complementarity and support should prove an effective basis for forging cooperative management activities designed to support recovery in war-damaged environments. Therefore we envisage a regional seed security web for rice in West Africa which might involve all national research centres with a rice speciality, coordinated by WARDA, with technical support and capacity building inputs from IPGRI. Each institution would make contributions to the information system, take part in data collecting exercises, maintain collections (including strategic duplicates), and undertake seed gathering and characterization work related to seed security and post-war rehabilitation.

Where possible, individual contributions would serve in a dual capacity. They would contribute to the overall seed security web while also fitting specific needs, such as national programmes for low input and sustainable agriculture targeted at low-input farmers. Additionally, the participating institutions would be encouraged to develop effective working links with the NGO sector and relief/rehabilitation programmes on a research contract and consultancy basis (for example, seconding personnel to SCM teams) via these NGO links with farmer groups (including refugee and displaced farmer groups). The participating national institutions would also be encouraged to take part in baseline and monitoring exercises in the management of plant genetic resources, either from the more general standpoint of exercises to prepare for disasters, or in response to specific post-war rehabilitation needs.

Conclusion

At a general level, the management system for plant genetic resources being proposed above would represent a shift in institutional culture. The system moves away from the idea that agricultural research is primarily a question of accelerated

growth of output. It tends towards the notion that maintaining, restoring or creating sustainable livelihoods is a focus of perhaps equal or greater importance. In the context of conventional agricultural research, genebanking is viewed as a service. The kind of distributed seed security web advocated here, by contrast, is no longer a service to a tiny group of agricultural professionals, but a way of conceptualizing and activating a vision of sustainable agriculture in poor countries facing turmoil and insecurity. Such a web would serve a double purpose - it would be a way of conserving plant genetic resource material, but also a way of protecting regions against food insecurities associated with the disaster of war. Daunted by prospects of mounting costs of security operations, the international community now talks increasingly about 'conflict prevention'. One of the lessons of the region examined in this study is that warfare becomes increasingly the only option for armies of youngsters cast loose by war-induced collapse of rural economies. Opportunities to exit this vicious circle arise at unpredictable moments. It would be tragic if such options were foreclosed by the loss of biotechnical viability of local agricultural systems. Thus it needs to be understood clearly that a properly thought-out and tried-and-tested system for the management of plant genetic resources in war-prone regions is an essential concomitant of conflict prevention.

The challenge, going beyond existing humanitarian assistance, is to establish and support plant genetic resources management institutions, formal and informal, that:

- contribute to better rural livelihoods
- create rural alternatives to militia warfare
- function to protect biotechnical viability of agricultural systems even during episodes of conflict
- support post-conflict reconstruction initiatives.

This is an agenda for the plant sciences on the scale of the post-1945 Green Revolution, though starting from different premises. Far-reaching debate about appropriate strategy, technique and institutional development is now needed to arrive at effective practical proposals. This document is offered as a stimulus to such debate.

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abbreviations and acronyms

BRS	Baptist Relief Service
CRS	Catholic Relief Services
CGIAR	Consultative Group on International Agricultural Research
IITA	International Instituite for Tropical Agriculture, CGIAR, Nigeria
IPGRI	International Plant Genetic Resources Institute, CGIAR, Italy
IRRI	International Rice Research Institute, CGIAR, Phillipines
LIC	Low intensity conflict
LWS	Lutheran World Services
NARS	National agricultural research systems
PAIGC	African Party for the Independence of Guinea and Cape Verde
ROK5	A rice variety introduced from the national rice research programme in Sierra Leone. It was intended for the salty reaches of the lower Scarcies estuary and more widely promoted by the WARDA Mangrove Rice Research group at Rokupr for areas requiring salt-tolerance
RSSW	Regional seed safety web
RUF	Revolutionary United Front
SCM	Security collecting mission
SMP	Sierra Leone Seed Multiplication Project
TAO/UCL	Working Group on Technology and Agrarian Development, Agricultural University, Wageningen
UNICEF	United Nations Childrens Fund
WARDA	West African Rice Development Association