Birgit Kundermann

Managing Agrobiodiversity in Disaster Situations
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Determinants of animal and plant genetic resource loss and options for its mitigation

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1 Summary

Disasters impact agricultural production systems severely through the losses in animal and plant genetic diversity that accompany them. The consequences of either war or natural disaster – earthquakes, cyclones or tornadoes, floods and drought – are equally great when agricultural production cycles are interrupted because of them. The present study was prepared on behalf of the sector project "Managing Agrobiodiversity in Rural Areas" of Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Technical Cooperation). It presents an evaluation of case studies conducted in disaster-prone regions and an analysis of the aspects of disaster that determine loss of animal and plant genetic diversity. The study also integrates information provided by other organizations and gleaned from the literature on loss limitation and rehabilitation of animal and plant genetic resources. Finally, it sets out options for German Technical Cooperation.

The debate on these issues is not yet particularly advanced; specifically, no information is available on the consequences of disasters for local farm animal populations and restocking. In the sphere of plant genetic resources, a few studies have examined the disaster-prone regions of Central and West Africa. With adoption of the Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, international efforts have begun to improve the situation in the sphere of plant genetic resources.

Crisis impacting agrobiodiversity conservation are differentiated according to the point at which disaster interrupts the agricultural production cycle and the duration of the interruption. Further important indicators are the extent of the disaster and whether all farms in a stricken region have suffered equal damage. Genetic resource losses are particularly dramatic when population groups stay for prolonged periods of time in refugee camps outside of their home region's agroclimatic area. Wherever disasters are predictable and early-warning systems are in place, there is at least some potential for containing loss. A variety of local strategies do exist for conserving native plant varieties and local farm animal breeds in regions with recurrent, cyclic disasters, but they are not yet sufficiently understood.

The manner in which farms are supplied with genetic resources is fundamentally important. In the sphere of plant genetic resources, seed is procured mainly – for subsistence crops in developing countries almost exclusively – through local management. Here, in particular, there is rarely sufficient ex situ conservation of native varieties for rehabilitation. As for local farm animal breeds in rural areas, whose conservation is exclusively in situ, local management is the sole guarantor of population conservation.

In general, a distinction needs to be made between the direct effects of disasters and their indirect consequences. Depending upon the type of crisis, direct losses during disasters can considerably reduce farm animal populations and destroy seed stocks in the field or in stores. Impoverishment following disasters leads to the consumption of seed and farm animals as food when no alternative is available. A lack of purchasing power often prevents people from replenishing farm animals and seed, although these may in principle be available. Disaster-induced modifications to agricultural production systems, such as the abandonment of
branches or systems of production, further accelerate the loss of animal and plant genetic diversity.

Additional problems frequently result from relief measures that displace local breeds and varieties. This happens when foreign genetic resources are introduced, or when seed and farm animals are distributed that are not as well adapted to local agroclimatic conditions as local genotypes are. The diversity of factors affecting local genetic resource stocks permits no generalizable strategies for their rehabilitation. Indeed, only detailed analysis of each specific situation can lead to appropriate options for action. The delay such analysis entails, however, is at odds with the urgency of the matter on the one hand and the institutional constraints within the constellation of intervening organizations on the other.

Steps need to be taken at a variety of levels to improve conservation of native varieties and local breeds in disaster situations. These include supporting local strategies to adapt to disaster situations for the informal supply sector and in situ conservation, promoting national and regional institutions for the formal supply sector and improving the ex situ conservation of native varieties and local breeds in the regions affected. At the international level, the interplay of preventive strategies, short-term disaster relief activities and, building upon these, medium-term restoration and structural cooperation efforts is a further prerequisite for successful action.

Local strategies to preserve animal and plant genetic resources are particularly well established wherever production systems have evolved in response to the regular recurrence of exceptional but limited situations (e.g. in drought-prone areas or frequently flooded regions). Here, in particular, utilizing local breeds and differentiating the seeds of native varieties and variety mixtures with an eye to potential exceptional situations is a preventive strategy. Disasters of limited extent can often be buffered by organizing communal storage of seed for emergency situations or by transferring farm animals on the basis of indigenous early warning systems, as nomadic peoples do.

Many countries have already developed national strategies to better provide for the population's needs for genetic resources following disasters. In areas in which food security is an important issue, notably in arid regions, supraregional networks have sprung up and are currently implementing seed security strategies. In the event of armed conflict, these networks have a greater capacity for action than national institutions do. All in all, however, the consideration being given to locally-adapted, indigenous breeds and varieties does not yet appear adequate.

At the international level, the picture is different. In the sphere of animal genetic resource conservation, there are as yet no specific strategies for disaster situations, despite the particularly urgent need for them. In the area of plant genetic resources, however, a forum for debate has recently been created under the auspices of FAO in which an array of different disaster-specific measures has been proposed. These include establishing a "Seed Security Consultative Group (SSCG)" as a constitutive element of international cooperation, undertaking preventive measures to improve the information base on local varieties and their utilizability, optimizing the ex situ conservation of plant genetic resources and their availability when needed, etc. Further measures envisaged include the development of tools to
improve seed needs assessment and mechanisms for institutional cooperation in the event of disasters.

Among German organizations operating in the area of emergency aid and development cooperation, little attention has been given as yet to issues relating to agrobiodiversity conservation in disaster-prone regions. The Information Centre for Genetic Resources (IGR), attached to the German Centre for Documentation and Information in Agriculture (ZADI), is charged with advising the German Federal Ministry for Food, Agriculture and Forestry (BML) on implementing GPA decisions. The GTZ in turn advises the German Federal Ministry for Economic Cooperation and Development (BMZ) on the execution of measures pertaining to implementation of the Convention on Biological Diversity (CBD) in developing countries.

As a result, a variety of options are open to German Technical Cooperation. These activities should dovetail with international efforts. It would be desirable to participate in the international debate taking place in the FAO discussion forum, in which interested international institutions are represented. Once fields of action have been agreed upon there, the GTZ could make specific contributions drawn from its rich experience both in structural activities in the context of development cooperation in disaster-prone countries and in relief and rehabilitation measures. Support for research and cooperation with relevant networks could also be utilized to augment the information base, particularly in regard to animal genetic resource conservation.

At the national level, the BMZ should be advised on guidelines for providing funding for disaster relief and rehabilitation and on coordinating food aid with seed deliveries. Further approaches include sensitizing non-governmental organizations operating in this field to the issues involved and cooperating with them where they have the relative advantage in terms of capacity to respond to disaster situations.

Preventive measures to address specific problems arising during disaster situations can be intensified within the scope of standard GTZ development cooperation activities, specifically in projects promoting partner country institutions that conserve and provide agricultural genetic resources. Projects in the fields of food security, agricultural extension and rural development can endeavour to increase knowledge of the uses of native varieties and breeds and their integration into ex situ conservation measures, as well as the expansion of in situ conservation. Further important measures include studies on the management of local animal and plant genetic resources and the development of guidelines for appropriate action in disaster situations.
2 Introduction

Both the frequency and magnitude of crises, wars and disasters with long-term effects have increased worldwide in recent years (World Disasters Report 1999). Crisis essentially means an escalation of social conflict that can no longer be resolved with existing mechanisms. Civil wars or armed interstate conflicts are often a direct outcome. A disaster is an event that disrupts or destroys the ability of a society to function due to severe human, material or ecological losses (GTZ 1998).

Among natural disasters, drought, floods, earthquakes and cyclones or tornadoes are the most important worldwide.\(^1\) In some regions, drought and floods are phenomena that have a more short-lived, cyclical and recurrent character. As a result, precautionary and adaptive mechanisms have already developed historically. These include early warning systems and corresponding agricultural production structures, e.g. the development and utilization of native varieties or variety mixtures and local animal breeds adapted to climatic conditions. In contrast to drought, cyclones or tornadoes\(^2\) can only be forecast at short notice by early warning systems. Moreover, such systems offer little opportunity to minimize risks to agricultural production systems and thus to prevent the loss of genetic resources, and cyclones or tornadoes are often highly destructive, as are earthquakes and floods. The duration of the immediate impacts of natural disasters is generally limited, while their consequences are generally long-term.

Civil strife and war often leads to interruptions in agricultural production of generally unforeseeable duration over large areas. Nonetheless, adaptation mechanisms exist where there are historical precursors or where the crisis situation is a permanent reality. Here small-scale precautions at the individual farm or communal level are important because events can incapacitate institutions and social structures. Alterations to boundaries as a result of war can curtail the delivery of genetic resources from the formal sector. If the population is forced to move or stay in camps, this raises particular risks of genetic resource loss, as does war-related destruction. Moreover, such events generally cause particular impoverishment of the population, which can lead to changed agricultural production structures.

The number of persons displaced by wars and disasters can be taken as a rough indicator of the extent of genetic erosion, as it can be assumed that such displacement causes interruptions in agricultural production. The tables reproduced in the annexes to this paper show that the number of persons displaced by civil strife and war is about five times higher than the number of persons living, often only temporarily, in camps due to natural disasters. By far the largest number of persons displaced by civil strife and war, particularly internally, is in Africa. Among natural disaster types, in contrast, it is floods, particularly in Asia, which lead to large numbers of people living in emergency shelters. Floods, earthquakes and storms wreak particular destruction upon the production base.

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\(^1\) Fires, volcanic eruptions and landslides are of subordinate or localized importance. Insect pests, e.g. locust calamities, can damage agricultural production and biodiversity over large areas, but are not treated here due to their specificity.

\(^2\) Earthquakes and cyclones or tornadoes occur more frequently in endangered regions, but usually only affect a limited area, so that the probability of occurrence in any specific location is lower.
In principle, propensity for crisis and vulnerability to disasters grow in step with population pressure. This is because, on the one hand, regions presenting high ecological production risks are cultivated increasingly and, on the other hand, resource stress increases the potential for armed conflict, as exemplified by cases of competition between different utilization systems (e.g. immigration of arable farmers into regions with pastoral utilization). In some crisis-prone regions, naturally induced disruptions interlock with human-induced crises (e.g. drought and civil war).

In the present discussion of the effects of crises, wars and disasters upon agrobiodiversity, events are treated in terms of their disruption of agricultural production systems, regardless of whether they are human-induced or naturally induced. The study therefore uses the term "crisis" in the sense of disruption. The common characteristic of all crisis and disaster situations is that they interrupt the agricultural production cycle and impair the production base. With regard to potential losses of animal and plant genetic resources through the consequences of crises or disruptions, the following determinants of events are crucial:  

- Time of onset of crisis in relation to the agricultural production cycle
- Duration of interruption of the production cycle
- Spatial extent of crisis
- Absence of population from farms (stay in camps)
- Predictability of crisis/disaster or preventive measures
- Causes of and possibilities to resolve crisis
- Genetic resource endowment and supply

In specific disaster situations the relief efforts of international organizations often lead to further negative effects if seed or farm animals poorly adapted to agroclimatic requirements are distributed to the population. This can have effects, such as crop failures, that exacerbate the crisis or can lead in the wake of crisis to genetic displacement ("genetic pollution", Menini 1998) of local varieties and breeds. Inadequate consideration has been given in the past to native varieties in the seed sector, even where these were available in gene banks. This has been due to partly inadequate information and documentation as well as to the small quantities of material available within the context of short-term relief activities.

The present report is based both upon a survey of existing strategies among German and international organizations operating in the spheres of relief, rehabilitation and development cooperation and upon a review of the technical literature. Because in many organizations neither an awareness of the problem nor corresponding precautions are yet apparent, the following presentation essentially contains the findings of specific analyses and case studies drawn from the literature. Detailed analyses of the problems of biodiversity loss refer mainly to the crisis-prone areas of Central and West Africa, while activities to improve agrobiodiversity conservation are documented mainly in southern Africa. The strategic

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3 See also Grunewald "Characterizing Disasters" and the excerpt from that paper in Annex C.
4 Annex D lists the organizations interviewed.
deliberations and activities set out in Sections 4–6 reflect the current state of international debate. At both the national and international levels, all efforts undertaken to date to address the problems of animal and plant genetic resources in disaster situations relate almost exclusively to plant genetic resources; issues relating to farm animals have not yet been addressed specifically.

3 The problem and its differentiation

In agrarian societies, in particular – which predominate in the disaster-prone regions of developing countries – plant and animal genetic resources are very important as operating capital. Depending upon the manner of capital formation of the society in question and the respective agricultural production system, in many societies farm animals in rural areas are exceedingly important as operating and household capital. Among nomadic peoples, animal husbandry is often the sole source of income, securing the livelihoods of families and underpinning social structures.

In arable societies, seed is the prime input. Worldwide, more than 80% of this derives from own production or local exchange (Longley and Richards 1998). Seed is of paramount importance for long-term food security. Particularly in regions subject to 'natural' or recurrent stress factors such as drought and floods, the diversity of plant species is an important basis of yield security. The more extreme the agroclimatic conditions, the greater the benefits of locally developed farmers' varieties over varieties produced by formal breeding programmes – in terms of yield, too. The losses caused by crises are thus particularly severe.

There is a fundamental linkage between the level or loss of production and the loss of agrobiodiversity. This linkage is the stronger the more the genetic reserves are reproduced and managed by users themselves. The more capital formation is characterized by genetic resources, the greater are potential losses, because production and management or storage happen at one and the same place. At the same time, however, the appreciation of genetic resources rises and possible preventive strategies are more likely to be in place. Crisis-related losses of animal and plant genetic reserves occur in different stages:

- Direct losses through crises: Destruction of seed or death of farm animals through earthquakes, floods and direct effects of war
- Direct effects of crises: Outbreak of animal epidemics without appropriate treatment options during the crisis, or destruction of seed due to dampness; theft and looting in war
- Losses caused by the plight of the people: Sale of animals in order to survive (e.g. in periods of drought, but also when in flight); consumption of seed reserves and farm animals in times of acute food shortage, destruction of tree stands (and thus of their genetic material) to meet short-term fuelwood requirements
- Losses caused by the impossibility of appropriate resource management: Crises impede necessary fieldwork (sowing, cultivation measures, harvesting) or animal husbandry activities (grazing, forage, veterinary care)
- Losses due to the problems associated with taking along and preserving animal
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and plant genetic resources when leaving the region or fleeing

- Indirect long-term effects of crises upon farming systems (see 3.2.)

It is impossible to generalize the crisis-related complexes of problems in terms of plant and animal genetic resources, as many factors play a role in assessing a specific situation and identifying purposeful solutions. The following discussion therefore sets out the determinants that are important when assessing any specific situation. As genetic resources often also have great importance as operating capital or operating reserves, their conservation is not only jeopardized through direct destruction during a crisis – considerable losses also result from accelerated processes of impoverishment in the wake of crises.

3.1 Agrobiodiversity assessment criteria in relation to crisis characteristics

3.1.1 Timing of crisis

Depending upon the time of occurrence of a crisis and its duration in relation to the production cycle in arable farming, a complete loss of seed reserves can occur. During the cultivation period, and particularly in own production or local reproduction, the seed is tied to the fields and, given its lack of mobility during the growth of the crops, is itself destroyed through stress factors such as drought, inundation, storms etc. If the crisis occurs during the sowing period, this may cause delays and corresponding yield reductions for the subsequent vegetation period. If at this point in time food supplies are scarce and households lack reserves, the stocks intended for seeds are frequently consumed. If the onset of the crisis falls in the harvesting period, refugees or military groups passing through the area can use the mature or harvested stocks for their own short-term food supply; the formation of seed reserves then becomes impossible.

For farm animals, too, the timing of the crisis in relation to the reproductive cycle is important: Young animals may have less resistance and mobility. If the crisis occurs in times of fodder scarcity, the animals, which have less vitality in any case at that time, are subjected to increased stress. They can only be moved along the route of available fodder and water reserves. Furthermore, particular disease and epidemic hazards arise if the animals have to be moved out of the agroclimatic zone.

3.1.2 Duration and spatial extent of crisis

The duration of a crisis is also paramount, as this determines the potential duration of interruption of the farming cycle. Crises whose effects are felt over only short periods often have, despite great vehemence, less severe impacts upon genetic resources than crises which interrupt production over one or several cultivation periods or reproductive cycles. The effects upon seed reserves of multi-year drought and multi-year war are similar (Grunewald 1998). Depending upon the type of crop and the specific decline of germination ability, seeds and planting material cannot be stored for long periods. Similarly, farm animals require suitable habitat for their existence and reproduction. The frequency of production cycles is also important, i.e. the number of cultivation periods per year and crop and the reproductive cycles
of farm animals. The longer the crisis continues and production cycles are interrupted, the greater the curtailment of the population of farm animals can become.

The spatial extent of crisis is an important factor in all disaster situations. This determines the degree of in situ loss of genetic reserves. Large-scale drought or floods destroy a relatively large proportion of genetic reserves, while locally contained crises or situations which do not affect the entire range of local varieties and breeds have less severe impacts. The topography of the region affected also creates differentiation: In mountainous regions, crops cultivated on the slopes can be less affected by flooding than those in the valley floodplains.

Shifting borders and fronts in the course of civil strife and war can prevent access to the seed or insemination institutions of the formal sector. It can also prevent informal exchange. On the other hand, the restricted exchange resulting from political or military isolation of regions or states can unintentionally promote in situ conservation of agricultural genetic diversity.

I) Angola: Unintentional promotion of local varieties through war-related isolation

The civil war in Angola already began before independence in 1975, and has continued to this day over several decades. Persistent unrest has not only interrupted agricultural production cycles over long periods, but has also led to almost complete stagnation in agricultural research, and a considerable loss of knowledge about farming systems and adapted varieties. Between 1970 and 1992, the state seed authority introduced improved varieties and distributed these in government-held areas. Over many years, the areas held by the UNITA rebels were cut off from this source of seed supply, and largely from other sources, too, with the result that local varieties were further developed and multiplied in these areas. The in situ conservation resulting from external restrictions is now seen as a genetic reserve for farmers in government-held areas, too, where recurrent crises and the introduction of foreign varieties has led to a collapse of local diversity. Now, in connection with the emergence of regional seed associations in southern Africa, the national awareness of the value of local varieties has risen and important genotypes have been consigned to ex situ conservation outside of the country. (After Matos 1998)

For livestock breeders whose herd management is based upon large-scale mobility in accordance with seasonally varying fodder reserves, however, restricted mobility often becomes an existential problem for herd viability. In situations of civil war and conflict between different ethnic groups who are also differentiated by keeping specific animal breeds, restricted mobility can lead to the extinction of herds and thus, depending upon their range, to drastic reductions in the population of the breeds concerned. If the remaining gene pool falls below a certain species- or breed-specific level, this leads to the disappearance of the entire animal breed.

3.1.3 Crisis-related human population displacement

Crisis-related movements of the human population generate a particularly high risk of loss of the genetic resources specifically developed and utilized within agricultural systems. In farm animals, stress factors result in reduced reproduction rates and in a greater likelihood of genetic exchange with other breeds at new locations. Contacts with wild animals en route can cause diseases to be transmitted, this leading to further reduction in the livestock population.
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However, many individual factors determine the actual loss of genetic resources. When people move to other climatic regions, conservation often cannot be continued. Camp situations hamper the storage and reproduction of seed and farm animals due to lacking access to land and fodder reserves, while if movements take place along robust social structures the greater willingness to cooperate presents opportunities for conservation (e.g. movements within supraregional or crossboundary clan structures, or to family members in other regions etc.). It is almost entirely out of the question that large animal herds can be kept over longer periods in camps.

II) Afghanistan: Cooperative relationships in refugee camp environments

Since 1979, the armed conflict in Afghanistan has led to massive flight of the population. Several million people have fled to Pakistan or Iran, living there for about a decade in refugee camps. Even after the Soviet troops moved out and repatriation measures began around 1990, of the formerly more than 3 million Afghans more than one million were still in camps in Pakistan in 1999.

In Pakistan, refugees are forbidden from acquiring land. Nonetheless, where there were traditional tribal connections between refugees and the inhabitants of the host regions, barter relationships developed permitting the continuation of agricultural production. Horticulture was widespread within the camps. The exchange of labour for leased farmland, grazing possibilities or fodder transfer permitted a limited level of livestock management. Farm animals brought to the camps, particularly the small animals, could thus be retained and reproduced. Under the precondition of adequate fodder conditions, the volume of livestock husbandry increased when the political conditions improved such that there was an improved prospect of return to Afghanistan. Due to the absence of many men in the war and the changed production conditions in the camps, with restricted access to production area, adjustments took place in the traditional division of labour between women and men. Similarly, new branches of production were taken up, such as forage cropping, which favoured the conservation of the genetic resources of farm animal populations despite restricted access to land. (After Christensen 1990)

A further important factor is whether the entire population has left the agroclimatic zone or whether individual groups have stayed behind, continuing agricultural production to at least a limited extent. This can take place by unaffected groups remaining during wars or older people and men remaining while women and children flee. Where the population stays for longer periods in camps without contact to production processes, there is a risk that indigenous knowledge of local varieties and farm animal breeds and the awareness of their importance for productivity and yield security – which are the precondition to genetic resource conservation – are lost.

III) Liberia: Loss of local rice varieties due to civil war

In Liberia, rice is the most important staple food. It is produced traditionally in a variety of cultivation systems reflecting regional ecological conditions and consumption requirements as well as different cultivation requirements of seed mixtures. The incessant internal conflict and high uncertainty led to massive flight of the rural population from the rebel-held areas. Agricultural production and marketing activities declined drastically and the wage labour system in rice cultivation collapsed. Seed and food stocks were largely destroyed by looting, animal feeding and dampness. For lack of food, the seed brought along to other regions
was consumed. Although in some cases land was available in the receiving regions, the opportunities for reproduction were limited by the different cultivation conditions. The genetic basis of selected native varieties was thus largely lost over the years of the crisis, but the knowledge and ability to select suitable varieties remained. Under these circumstances, it was only possible to regenerate native varieties from adjoining regions in the neighbouring countries. (After Richards and Ruivenkamp 1997)

3.1.4 Causes and predictability of crisis

The issue of predictability is closely related to that of the causes of crisis. Recurrent natural disruptions have led to the development of early warning systems. The recent debate on political crisis prevention has also led to the identification of indicators describing the propensity of societies for crisis (Spelten 1999)\(^5\).

Despite major investment and use of state-of-the-art technology, it remains impossible to predict earthquakes with sufficient accuracy\(^6\) to derive specific precautions beyond adjusting construction methods in endangered regions. Predictions of phenomena such as El Nino, which are already possible several months before occurrence, also remain subject to substantial limitations with regard to the actual pattern of disturbance.

The occurrence of storms can often only be predicted at very short notice, depending upon their type. All preventive measures at first pursue the goal of saving human life, while preventive measures to safeguard agrobiodiversity as such require a more fundamental and more supraregional frame of reference.

IV) Southern Africa: Imprecision of early warning systems

In early October 1997, meteorologists predicted severe drought for southern Africa in connection with El Nino. Zimbabwe and other countries already affected in 1991 and 1992 by drought responded by providing funds for food imports. Farmers used particularly drought-resistant varieties for the following cultivation season and set up seed reserves and water stocks. Instead of particular drought, heavy rainfalls set in during the following months, causing major flood damage, particularly in Somalia, Sudan and Kenya. In Somalia, entire harvests were destroyed over large areas, and with them the seed for the next season. The underground multi-annual seed security reserves in Somalia and Sudan were also destroyed. The usual strategies in times of crisis, such as selling cattle, were undermined by the floods: A great number of animals drowned or perished due to lack of fodder during the flood period or due to resultant diseases. (After World Disasters Report 1999)

The predictability of a crisis is only then a further important determinant of its impact upon the destruction of plant and animal genetic resources if, on the one hand, warnings do lead to preventive actions and, on the other, predictions are so unequivocal that appropriate prevention measures can indeed be taken. Early warning systems primarily monitor emerging food bottlenecks on the basis of the situation of food crops, in order to provide timely

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5 See also the Humanitarian Early Warning System of the United Nations in Geneva.
6 Only an elevated risk within the next ca. 30 years can be predicted for a region.
estimates of the requirement for additional food. They include to only a limited extent data which might, for instance, serve smaller livestock breeders as a basis for adjusting herd stocking in accordance with predictions and thus improving the perspective for breeding stock at reduced stocking rates. It remains questionable whether such data can be provided in a manner appropriate to needs and whether it would lead to responses among livestock breeders, particularly in situations in which markets do not respond transparently and efficiently as is the case in many marginal areas of developing countries (Toulmin 1995).

Endogenous preventive measures emerge where crises occur repeatedly, e.g. in regions prone to drought and flooding or where there are recurrent conflicts among groups of the population. Observations of the willingness of breeders to reduce herd size as a function of the availability of fodder reserves in the Sahel show that this willingness has increased since the severe drought of 1973 (Toulmin 1995).

V) Honduras: Disparate perceptions of early warning systems

Local experience with Hurricane Mitch in Honduras proves that despite clear warnings the precautions taken differed from region to region. While in some areas the losses of human life and movable goods remained low because appropriate precautions had been implemented at the local level, in other regions the opinion had been widespread that “Hurricanes never come here”. A contingency plan had been in place but was not observed. (After World Disasters Report 1999)

Tragic impacts upon agrobiodiversity are thus exacerbated where no precautions are taken. This also concerns ex situ conservation at the national or regional level – where natural disasters occur unexpectedly, there is scarcely any reason to take precautions and assign scarce means to the ex situ conservation of genetic resources. Where political systems are threatened before a war, there is often no willingness to undertake possible crisis prevention measures because the political evaluation of measures taken in anticipation of crisis could affect the government’s power status unfavourably. Such initiatives may then receive scant consideration in the interests of retaining power, or may be overridden by other priorities.

Ethnically motivated conflicts are often also reflected in relations between different production structures (e.g. arable farmers versus cattle breeders). Here the danger of destruction of the corresponding genetic resources is high, particularly with regard to farm animals. Cattle theft and looting can even partly be viewed as indicators of the escalation of crises. Even the interruption – in a context of conflict between the two groups – of the exchange between cattle breeders and arable farmers of fodder, food or other goods, which is important in some seasons, can jeopardize breeding success and thus the genetic potential of animal breeds (Schäfer 1998). Crises can further alter the willingness to cooperate in the exchange of genetic resources. Where social cooperation among different groups is important in the informal management of genetic resources, this can impact substantially upon local genotypes.

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7 Because of lack of transport for cattle or long distances by foot to markets, because price information is not accessible simultaneously to all market participants, because of lack of opportunities to preserve meat etc.
3.1.5 Supply of genetic resources

The greater the in situ loss of animal and plant genetic resources caused by severe and protracted crisis, and the more the supply dynamics of genetic resources take informal, local paths, the more difficult it becomes to reconstitute resources in the wake of crisis. While for main crops local varieties may be stored ex situ in gene banks, this is often not the case for crops of lesser interest for food security, such as local vegetable varieties, fruit or herbs and spices. Maintaining ex situ collections of animal genetic material is more difficult than for plant genetic material.

Moreover, factual availability of ex situ resources also depends upon the presence of information on the material and upon the processing of relevant information for potential use. A further aspect is that the cultivation of local varieties is not stable, but undergoes continuous further development by selection, with the result that stored resources may already no longer correspond to requirements within a few years.

On the other hand, informal systems often react more rapidly to demand arising after crisis than a higher-level institution ever could. In general, the formal seed sector tends to be less diverse, and is thus far more susceptible to crisis. It must be expected that political upheaval will also lead to state institutions, NGOs and higher-level private sector institutions being incapacitated. If research facilities are destroyed in war, it is important whether and to what extent safety duplicates of collections have been established in other supraregional institutes.

VI) Rwanda: Functioning informal seed supply despite civil war

In Rwanda, beans have long been a staple food for all sections of the population. Due to the high genetic diversity of local bean varieties, the Central African region is considered a secondary centre of genetic diversity for Phaseolus vulgaris. Farmers generally use mixtures comprising up to 20 different types, of which the greater part comes from their own production, an important part from local markets and 2–3% from the formal seed sector. Studies conducted during the first 3 post-war cropping periods have shown that farmers only lost a few, and generally less important, bean varieties due to the events of the war. In most cases, these varieties were essentially available on local markets, but access was restricted by the lack of cash. Because bean varieties are exchanged solely within the immediate family, but scarcely on a neighbourhood basis, the ethnosocial changes scarcely affected varietal variability. Real scarcity initially only resulted for improved varieties of pole beans, which, originating in the formal seed sector, had spread rapidly in pre-war years due to their high yields and resistance to root rot. All in all, the crop spectrum was changed more by the recent spread of root rot-resistant and higher yielding pole beans than by the effects of the war. In general, where the population had resumed agricultural activities shortly after the war, it was far easier to reconstitute local varieties than to gain access to pole beans from the formal seed sector. (After Sperling 1998)
3.2 Indirect impacts of crisis upon agrobiodiversity

3.2.1 Crisis-related processes of impoverishment

Crises usually involve processes of impoverishment; the longer the crisis continues, the more probable are substantial impacts upon agrobiodiversity. It has been found for naturally induced crises, such as drought, that farms with low capital reserves are affected particularly by genetic resource loss (Grunewald 1998). Toulmin (1995) has identified a three-phase cycle in animal husbandry in arid regions during drought, showing clearly how smaller animal breeders, in particular, are weakened by the altered terms of trade between revenues from animal sales and costs for buying in food during prolonged drought. It is often precisely the less capital-intensive, smaller farms whose herds consist of local breeds and who further develop these breeds. Similarly, the poorer sections of a population suffer more from storm damage and floods, because houses and farming facilities, such as seed stores, are less sturdy (World Disasters Report 1999).

In the wake of crisis, regardless of the general availability of resources (Longley and Richards 1998), it is often economic reasons which prevent people from gaining access to new resources (Sperling 1998). Impoverishment can make it impossible to engage in capital-intensive animal restocking or to rebuild the necessary animal housing. When food reserves are low, there is a tendency to cultivate more field crops with short production periods in order to gain food security, while abandoning other crops. Crisis-related changes often lead to the loss of off-farm sources of income which would have permitted procurement of the capital required to reconstitute destroyed branches of production.

Continuing insecurity in the region of crisis is a further factor which greatly exacerbates processes of impoverishment and the corresponding loss of genetic diversity in post-war situations. This often leads to a concentration of production on smaller areas close to the house, while abandoning remote areas. The result is that both the quantity of seed retained and its variability through varying site requirements are reduced. Similar impacts in terms of the quantity of seed retained result if, due to the presence of internally displaced persons, the harvest must be used to feed a greater number of people.

In addition, war-related events often damage richer groups and institutions particularly. This is the case when, for instance, seed traders or state or parastate research stations become the target of looting or their stocks are appropriated for survival priorities. In times of war, anarchistic actions without regard to future livelihood perspectives wreak major macroeconomic damage with long-term consequences.

Substantial processes of impoverishment frequently take place when an affected region is isolated, external intervention possibilities being prevented, or if trade with other regions becomes impossible. In the event of natural disasters, the destruction of infrastructure contributes to this (e.g. earthquakes), while during wars it is the security situation which prevents both adequate access and the collection of relevant information. Tragic consequences result when even food distribution can no longer take place or is insufficient, forcing people to consume farming resources originally intended for reproduction in order to survive in the emergency situation.
VII) South Sudan: Isolation of affected regions

In South Sudan, for instance, the United Nations World Food Programme (WFP) has worked within the context of Operation Lifeline Sudan to provide relief for the stricken population. Some regions here are only accessible overland by footpaths in the dry period. The internal unrest of the civil war, in which villages are subject to various warlords, even made the use of local airstrips periodically impossible. Despite the efforts made by participating organizations to combine food assistance with non-food items in a fashion appropriate to the local calendar and needs, and despite well-established contacts to village committees to clarify aid needs, programme implementation encountered major problems. Limited transport capacities led to the priority supply of food needed directly for survival, reaching only about 40% of the population. All other assistance inputs had to be withheld. During the sowing period, no food deliveries took place any more, which made it probable that seed reserves and the externally supplied seeds were partially eaten. The lack of direct exchange between village committees and technical assistance services caused by logistical problems also had negative impacts upon the choice of seed varieties. (After Hines 1998)

Even where farm animals have survived the direct consequences of crisis, high losses can ensue due to the absence of veterinary products or of a functioning veterinary service. Similarly, arable crop production can be constrained by the lack of fertilizer or phytosanitary products. Conversely, of course, all changes can also lead to a revival of varieties and breeds and thus of genetic potential which becomes of interest again due to the socio-economic conditions prevailing after crises.

3.2.2 Changes in farming systems

Farming systems can change in the wake of disaster situations if, due to the continuing subjective perception of hazard, accustomed conditions of production are not anticipated. This can lead on the one hand to adaptation as a useful preventive strategy with neutral or even beneficial effects in terms of agrobiodiversity, such as modified proportions of crops and varieties in arable farming or diversification for risk reduction.

On the other hand, for the most varied reasons, branches of production and the genetic resources used in them can be abandoned temporarily or completely.

An altered market situation due to trade embargoes and uncertainties in marketing within the region influences the production of goods intended for the market. Interruptions in the local exchange of agricultural produce can also lead to management modifications among both producers and purchasers.

The loss of machines and other inputs or of equipment for transforming agricultural produce can lead to the restriction or abandonment of production branches. For instance, the loss of draught oxen can weaken management systems using animal traction. Similarly, the loss of donkeys as pack-animals can hamper other farming procedures and marketing.

VIII) Rwanda: Decline in potato production due to economic changes

Potatoes are grown in Rwanda at higher altitudes, essentially as a cash crop. Cultivated varieties are limited to about 40 identified genotypes, regionally only one to three, a
substantial proportion of which (up to 30%) is procured from the formal seed sector. The events of the war led to a reduction in the available quantity of potato seed, but hardly to absolute scarcity, as long as farming cycles were not interrupted over several cropping periods. The relatively smaller share of potatoes in post-war production was due to the lower priority given to cash crops, the lack of inputs such as fertilizer and fungicide, or the lack of cash to purchase potato seed and inputs. The inability of the formal seed sector to operate and the sudden termination, due to the war, of the commitment of development projects to further potato seed dissemination, which had previously been strong, contributed to the temporary drop in potato production. Compared to subsistence crops, the initiatives of farmers to reconstitute potato seed were minor. (After Sperling 1998)

Where a danger of certain types of farm animal being looted persists after a crisis has broken out, this can lead to changes in livestock management practices. For instance, cattle breeding can be abandoned in favour of small animals kept close to the homestead and less at risk of theft.

When disaster situations persist over long periods, the knowledge of production branches abandoned and of the species and breeds used in them is lost. However, this knowledge will usually only be lost when farm management is handed on to the next generation or when changes in farm management which persist over the long term even after the crisis has ended make the use of available knowledge appear no longer essential. A massive loss of knowledge is also to be expected in situations in which the destructive effects of wars, civil strife or natural disasters persist for so long that population groups remain in refugee camps for long periods (see also 3.1.3.) or areas traditionally farmed can no longer be utilized in the same way as in the past.

### 3.2.3 Changes in social and institutional structures

When household composition changes, for instance due to the absence of men in times of war or the increased presence of men owing to lack of other forms of employment, branches of production assigned traditionally to men can be abandoned or intensified. This is also the case if women or men have a particular responsibility for specific types of work, or if the labour resources of farms are greatly changed. The degree of these phenomena determines the specific impact upon agrobiodiversity, i.e. if only a part of the men or women is absent in a village, the genetic basis will continue to be regenerated in some households and then remains available. As women are responsible in many cultures for selecting seed, the range of varieties cultivated will be affected particularly if women are absent. The absence of women can also be expected to lead to a drop in the production of food crops and an associated loss in diversity.

Crises also frequently cause changes in higher-level social structures and in institutional structures. This is particularly the case in human-induced crises. Such changes can impair the management of genetic resources in many different ways. Cooperation among different sections of the population in providing and exchanging genetic resources can decline if existing social structures are affected by civil strife and war.

The attitude of the community to disadvantaged groups is important in terms of the further access to genetic resources of families damaged particularly by crises. In livestock
management, in particular, disruptions can result in the organization of cattle breeding associations for the management of breeding and veterinary services.

IX) **Guinea-Bissau: Abandonment of mangrove rice cultivation due to social changes**

The cultivation of mangrove rice, a main food crop in Guinea-Bissau, was interrupted by the events of the war following independence between 1962 and 1974. Here the cultivation system requires a high labour input, generally organized at village level or in larger family structures. The disruption of village structures by the events of the war, intermittent absence of the entire population and permanent absence of many youths in military groups prevented establishment of the working parties required for rice cultivation. As a result, in some areas all local rice varieties disappeared, initially due to looting and then due to lack of regeneration. The dams and water-retaining facilities gradually collapsed, resulting in turn in rising levels of soil salination.

Even after the war, the envisaged rehabilitation of mangrove rice cultivation failed to function, despite the provision of salt-tolerant rice seed and support in restoring dams. The prime reason for this was the lack of opportunities to organize working parties. Young men, who played an important role in the villages, had abandoned traditional social and family commitments and dry-farmed rice on their own. The older men, too, had shifted priorities to other income-generating activities external to rice cultivation. It had further failed to be considered that the former key persons in marketing rice and in the corresponding selection of seed for restoring mangrove rice systems were not available, because there was no longer any place for them in the new political culture. (After Richards and Ruivenkamp 1997)
In addition to local structures, the entire structure of state, non-state and private sector organizations in the conservation and multiplication of animal and plant genetic resources and its interplay is important and is frequently incapacitated by the political upheavals associated with crises. The conservation or loss of genetic resources is also conditioned as a whole by societal and political framework conditions and their upheavals in the wake of political crises. Major changes have been observed in, for instance, the transition from socialism to market economy systems (Grunewald 1998).

3.3 Rehabilitating animal and plant genetic resources

The rehabilitation of genetic resources has become an important focus of international (relief) organizations. This is a response to the often catastrophic emergency situations experienced in many recent crises, and is an outflow of the general trend of relief activities towards a developmental orientation. Compared to pure aid measures, the cost-efficiency of measures serving the restoration of production and the benefits of such measures in the support of self-help processes is beyond doubt. However, the sustainability of implementation is often severely deficient. This is due particularly to a lack of sufficient consideration of the actual needs of the affected people. In most cases, scant consideration is given to agrobiodiversity issues. At best, a more or less detailed appraisal is conducted of the local adaptability of resources generally procured outside of the target region.

Short-term targets to boost production compete with long-term food security. In some cases, measures even exacerbate the crisis. Production losses can occur over the short term due to inappropriate genetic material if this has insufficient resistance to specific, not continuously occurring local stress factors. Losses can also become apparent only later. In many instances, institutional regulations and barriers and the scheduling of organizations and measures prevent better consideration of these aspects. The reasons for this are diverse:

In the first instance, in most cases the institutional situation is chaotic in terms of the functioning of national authorities and organizations within affected countries, and also in terms of the interplay of international aid organizations. A proper analysis of needs often cannot take place because the necessary know-how is not directly available. Interventions take place under the pressure of the short-term requirement for large quantities of seed at the beginning of the cropping period, but also under institutional pressures for donor organizations to use funds over the short term. In particular, the specific determinants of crisis set out in the previous sections cannot be appraised adequately together with the affected people, because such analysis would require significantly elevated effort or, depending upon the situation, would only be possible to a limited extent. Furthermore, there is often a tendency on the part of operating organizations to plan and control massive activities on their own accord. Local knowledge then often remains unconsidered.

For important crops, own provisioning with seed has a high priority in many agrarian societies. In contrast, research institutions and the formal seed sector tend rather to focus on the multiplication of high-yielding varieties as opposed to farmers' varieties and indigenous breeds. This results in the danger of influencing the traditional use of varieties: Due to the short-term availability of resources that are foreign to the region, or come from abroad, in many cases genetic material scarcely adapted to the affected region is introduced in large
quantities. Where appraisal of suitability to local conditions is lacking, this can lead to yield decline and crop failure, with effects that directly exacerbate the crisis (see also International Seed Trade Federation 1998).

If foreign resources, i.e. resources whose origin is outside of the target region, are handed out, their use can be favoured over the local varieties and breeds, because impoverished farmers then dispense with the alternative purchase of still available local seed. Over-valuation of foreign seed on the part of recipients where there is a lack of information and opportunities to assess the imported resources is just as possible as is the misappropriation of foreign resources due to lack of confidence in the unknown material. Where agricultural extension services or other intermediary organizations are incapacitated, consultation on the selection of adapted resources can be inadequate. Furthermore, there is frequently a lack of communication with recipients or of dissemination of information necessary for the cultivation and management of the genetic resources made available. Moreover, among both donor organizations and national organizations in affected countries, awareness of the importance of conserving native varieties and local animal breeds is often inadequate.

Potential short-term increases in production with foreign varieties and breeds can have devastating consequences if their disadvantages only manifest themselves with a time lag under deviating production conditions in the target region, e.g. lack of resistance to drought, pests or disease. Furthermore, the introduction of external genetic resources harbours the danger of uncontrolled crossings of foreign genetic material with the local genetic basis and thus the disruption of the existing genetic equilibrium (Benedetteli et al 1997), particularly for farm animals and allogamous (cross-pollinating) crops. The purchase of local seed by relief organizations, in contrast, usually means greater organizational effort and resistance from the administrative branch, because accounting procedures cannot always be ensured adequately.

Where indigenous genetic resources have suffered major losses, the options for short-term reproduction are limited. Even where varieties and relevant information on the material are available in gene banks, the reproduction cycles necessary to produce a sufficient amount of base material can only be managed over the medium term (Hodgkin and Anishetty 1998). The species-specific reproduction rates, i.e. the ratio of material employed to its reproduction during a reproductive cycle, is crucial to the rehabilitation of genetic resources. Due to the lower reproduction rates, restoring stocks of farm animals is a lengthier process.

In some cases, the common practice of separating budget lines for relief and rehabilitation on the donor side means that there is no needs-appropriate coordination of food and seed deliveries. The result can be that food is used for seed, or that seed supplies are consumed, particularly if their delivery is not synchronized with cultivation and harvesting calendars (Hines et al 1998). Toulmin (1995) provides an evaluation of experience made and discusses possible strategies for restocking farm animals in drought situations.

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8 Cf. Menini 1998: "genetic pollution".
9 The complete rehabilitation of a decimated cattle herd can take more than 20 years (Dyson-Hudson and Dyson-Hudson 1980).
4 Strategies and activities for agrobiodiversity conservation

4.1 Local strategies of the people affected by crises

The effects of short-term disruptions and crises upon agrobiodiversity are comparatively slight. This is largely thanks to local genetic resource management strategies by farms and households. The existence of indigenous early warning systems based on the local observation of changes, e.g. observation of nature or internal observation of escalating human-induced crises, which is as yet little researched, presumably has a major influence upon decisions on how to proceed at the local level.

Animal breeders have generally developed management systems which take into account recurrent stress factors such as drought – nomadic cultures and the farm animal breeds developed by them are in themselves already a special form of coping with extreme climatic conditions. Mobility strategies utilize the varying fodder availability within an arid region, e.g. in hollows or locations with sporadic rainfall, or through seasonal migration to other climatic regions. Sedentary breeders also apply ‘persistency strategies’: Adaptation of herd size and herd composition (animal breeds and species) and management of the herd depending upon the availability of different types of fodder (see also Bayer and Waters-Bayer 1995).

In plant production, adaptive reactions of farms to reduce drought risks take many shapes. These include variation of production locations within the farming enterprise and of sowing times, or the essential genetic heterogeneity of varieties or mixtures used in relation to differing precipitation conditions. Adjustments of rotations and seed mixtures in arable farming are reported from Bangladesh (Longley and Richards 1998).

The migratory behaviour and social structures of nomadic peoples often are not oriented to state boundaries. This is exemplified by transboundary cattle farming in Kenya (Masai in Kenya and Tanzania or also between Sudan and Kenya), and in West Africa and elsewhere. For instance, it has been found that breeders, as a part of preventive crisis management, moved cattle from Sudan to the Turkana region in Kenya in large numbers and without this becoming publicly noticed before armed conflict broke out there. The underlying strategy of herd dispersion is known as a response to drought of various pastoral societies (Schäfer 1998).

The establishment of communal depots and seed stores is known from, e.g., the arid regions of western and eastern Africa. In East Africa, these stores are often underground (FAO 1998c). In the semiarid regions of Kenya, double the amount required for seed is generally reserved as security for the following season. It is reported from Somalia that food and seed reserves are even stored over five years in order to secure supply (Grunewald 1998).

In western Africa, stores also serve as reserves in the event of locust calamities. Specially developed grain store designs permit safe conservation of seed reserves over lengthier periods (Enda Tiers Monde 1999). In southern Africa, seed storage is distributed across several households in order reduce risks (Walker and Tripp 1997). Here municipally administered local gene banks have also already emerged (Almekinders 2000).
4.2 Supraregional and national strategies and activities in affected countries

4.2.1 Supraregional strategies and activities

In southern Africa (SADC Countries)\(^\text{10}\), not least due to the susceptibility of the entire region to drought and other disruptions in production, a regional network for cooperation in the sphere of seed security formed in the early 1990s. Promoting the informal seed sector is an important concern of the network, not least because of negative experience made with seed imports from outside southern Africa and the severe crisis-induced decline in the number of varieties utilized in some regions. Furthermore, participation of the private sector and of non-governmental organizations is an important concern of the network, which is supported substantially by national agriculture ministries, FAO and other donors. The "Seed Security Initiatives in Southern Africa" project supported by the GTZ in Zimbabwe, for instance, contributes to strengthening the informal seed production sector through direct contacts with seed producer groups and their exchange.\(^\text{11}\)

The participating countries have adopted national activities such as developing community programmes at the local level (on-farm seed production, seed collections and stores, local seed production, emergency plans for seed security at household and community level) and national and supraregional activities to define and harmonize strategies and regulations for the seed trade and its preconditions. The network as such supports mainly training activities on seed security in the informal sector, seminars and conferences on important issues as well as journals and publications to improve the transfer of information and the development of an electronic database on seed security. It also functions as an advisory body for national and municipal programmes (Wobil 1998).

In addition there is the SSASI (Sub-Saharan African Seed Initiatives) body funded by the World Bank, and the African Seed Network (ASN) supported by FAO, in which efforts to strengthen the informal seed sector form an important component (World Bank Group 2000).

4.2.2 National strategies and activities

To illustrate the interplay between national and supraregional activities, we describe here the national strategy of Zambia in southern Africa, where deliberations on seed security have already reached an advanced stage – as they have in other countries of southern Africa:

Zambia is a member of the Southern African Development Community (SADC) as well as of the supraregional network for cooperation in the sphere of seed security. Seed security is understood here as permanent access to and availability of suitable seed and planting material for all farming households for food security at household and national level. Strategies to attain seed security comprise on-farm seed conservation, the establishment of municipal seed banks, the maintenance of national safety reserves and contributions to developing the supraregional

\(^\text{10}\) Southern African Development Community (Angola, Botswana, D.R. Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe)

\(^\text{11}\) See also: www.zimbabwe.netsadc-fanr/sssdpub.htm
network (see Section 4.2.1.). For emergency situations in which reserves at household and village level are inadequate or destroyed, there is a national seed reserve containing the main varieties utilized, amounting to 20–25% of annual requirements. In addition, there are reserves at network level, one purpose of which is to relieve state budgets of the burden of costly permanent reserves. An indirect goal of the strategy is also to largely limit international relief supplies.

At household level, the national strategy of Zambia has two components:

- to promote diversification in order to support an as large as possible range of different crops (beans, sorghum, millet, cassava and sweet potato)\(^{12}\), and
- to produce seed and planting material at locations with comparative benefits, i.e. in the regions of their most intensive distribution.

Other activities are concerned with the functioning of a spatially inclusive early warning system for arable farming, especially for regions at particular risk of drought and flooding, the improvement of weather forecasting services and the development of a national emergency response mechanism. In addition, advanced training programmes for engineers and farmers shall be intensified with regard to numerous aspects, including on-farm production of seed and planting material of both native varieties and the ‘improved varieties’ of the formal sector. Finally, research shall be intensified on alternative, low-risk management methods with regard to weather impacts.

The role of non-governmental organizations within the national programme is being debated, and work is underway on the preconditions for statutory provisions governing variety approval and trade in plant genetic resources in southern Africa (see Muliokela 1997).

### 4.3 Strategies and activities at the international and German levels

#### 4.3.1 Strategies and activities at the international level

At the international level, the issue of the disaster-related erosion of plant genetic resources was addressed for the first time during the 4th International Technical Conference on Plant Genetic Resources held in Leipzig, Germany in June 1996. Within the context of the Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, assisting farmers in disaster situations to restore agricultural systems was defined as a priority activity of *in situ* conservation. The GPA gives FAO the mandate to coordinate a corresponding programme in collaboration with the World Food Programme (WFP), the Office of the United Nations High Commissioner for Refugees (UNHCR), the Office of the United Nations Disaster Relief Coordinator (UNDRO), the International Plant Genetic Resources Institute (IPGRI), national and international agricultural research centres, supraregional plant genetic networks, donor and recipient countries and non-governmental organizations.

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\(^{12}\) The introduction of hybrid maize and its unpleasant consequences during years of drought gave an important stimulus for the policy of diversification.
In a FAO workshop on "Seed Security for Food Security" held as part of the GPA implementation process in Florence, Italy in 1997, contributions to developing seed security strategies for disaster-prone regions were debated. This second conference discussed the informal and formal sectors of the seed industry and components of an effective seed security strategy in accordance with the two key components:

- Protecting and preserving locally and regionally adapted varieties and landraces for important food crops
- Improving seed supply, seed multiplication capacities, the production of high-yielding seed and the dissemination of local seed (national and regional).

With respect to the particular problems of disaster-prone regions, the conference also debated the establishment of a Seed Security Consultative Group (SSCG) under the auspices of FAO.

The third international workshop titled "Developing Institutional Agreements and Capacity to Assist Farmers in Disaster Situations to Restore Agricultural Systems and Seed Security Activities" took place in Rome, Italy in November 1998. Its objectives were:

- to develop strategies to improve the capacity of disaster-prone countries to better prepare farm seed systems to minimize the effects of disasters
- to determine mechanisms of collaboration for a continuing partnership among governments and institutions involved in the maintenance or restoration of farmer seed systems, plant genetic resources, and seed security after disaster.

The results and recommendations of the workshop have been integrated into Section 5 of the present paper.

In the sphere of farm animals, the Global Strategy for the Management of Farm Animal Genetic Resources (AnGr) is a priority of FAO. The Domestic Animal Diversity Information System (DAD-IS) provides an overview of existing farm animals breeds. A report on the global status of farm animal genetic resources is currently in preparation. Furthermore, an early warning system for endangered farm animals shall be established within the context of the global strategy. This shall facilitate monitoring of animal genetic resources at national level and shall also support the work of all participants in disaster situations. In contrast to the diverse efforts to conserve the plant genetic diversity of farming systems in disaster situations, there are currently no concerted disaster-specific initiatives concentrating on the conservation of farm animal genetic diversity.

4.3.2 Strategies and activities at the German level

There are a number of intervening organizations which can be classified as belonging to the fields of relief, rehabilitation and development cooperation. Some organizations, such as the German Agro Action (Deutsche Welthungerhilfe), cover all spheres, while others, such as the German Red Cross (DRK), operate exclusively in the sphere of classic relief. Rehabilitation measures are carried out both by non-governmental organizations (NGOs) with a less
restricted relief mandate on the one hand, and by development cooperation organizations on the other. A number of NGOs have joined forces at the European level under the EuronAid umbrella, with the aim of improving food aid and food security. Various organizations involved in rehabilitation and development activities have a basic, but not priority interest in agrobiodiversity issues; these include Misereor and the German Committee for Freedom from Hunger as well as relief organizations without a directly limited period of operation (e.g. HELP).

The Federal Republic of Germany, or the Federal Ministry of Food, Agriculture and Forestry (BML) responsible for issues relating to genetic resources for food and agriculture (GRFA), has committed itself to implementing the Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. The Information Centre for Genetic Resources (IGR), attached to the German Centre for Documentation and Information in Agriculture (ZADI), advises and supports the Ministry in this task. Within this context, the IGR convened in November 1999 a first information and discussion event titled "Assisting farmers in disaster situations to restore agricultural systems – Seed supply in disaster situations". With representatives from the whole range of intervening organizations, ideas for prospective actions were collected and the intention was declared to integrate the related issues within existing activities (see minutes of the meeting in Annex E).

Within the context of Germany's signing of the Convention on Biological Diversity (CBD), which, besides plant genetic resources, also covers animal genetic resources for the first time, and the intention of the Federal Republic of Germany to support developing countries in implementing the GPA, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Technical Cooperation) is commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) to support contributions to preserving agrobiodiversity in developing countries. The GTZ's sector project "Managing Agrobiodiversity in Rural Areas", which concentrates especially upon the rural poor in marginal locations, contributes in particular to these efforts. Concern about the particularly high losses of genetic resources in disaster situations and the relevant activities defined in the GPA provided the stimulus to commission the present study. The prospective actions set out here shall provide a basis for debate on further activities.

5 Activities envisaged at the international level

The conclusions and recommendations debated at the FAO "International Workshop on Developing Institutional Agreements and Capacity to Assist Farmers in Disaster Situations to Restore Agricultural Systems and Seed Security Activities" relate to the following issues:

- Establishing a Seed Security Consultative Group (SSCG) with a broad constituency under the auspices of FAO, with the aim of optimizing the comparative advantages of the various stakeholders to assure seed security in disaster-prone regions
• Improving the **information basis** (gathering and consolidation) and its user-friendliness and accessibility to stakeholders within existing information management systems

• Improving plant genetic resource needs assessments in connection with disaster situations (developing needs assessment methodologies, supporting gender-sensitive **seed system analyses** in the formal and informal sectors, establishing guidelines and checklists for needs appraisals, linking seed needs analyses with other sectorial assessments including food security)
Managing Agrobiodiversity in Disaster Situations

• Improving **ex situ conservation** of plant genetic resources and their availability by increasing the amount of material held in gene banks, improving storage conditions and making available appropriate quantities when needed

• Promoting **networks and coordination mechanisms** for the procurement, multiplication and distribution of quality seed of locally adapted varieties at national and regional level on the part of FAO

• Promoting the regional **harmonization of seed rules and regulations** by establishing mechanisms, integrating all stakeholders, debating case studies…

• Improving **prevention and preparedness measures**, especially among donor organizations

Furthermore, there are within the United Nations three early warning systems of relevance to seed security which provide support for decisions on the need for action (FAO 1998c):

• The Humanitarian Early Warning System (HEWS) in Geneva, which provides information on potential humanitarian crises in connection with emerging conflicts, with a particular focus upon countries at risk of internal escalation.

• The Global Information and Early Warning System (GIEWS) developed by FAO, which monitors permanently weather conditions in relation to plant production and provides, in particular, information on potential periods of drought, floods and other environmentally related disruptions.

• The World Information and Early Warning System (WIEWS), also conceived by FAO, which specifically monitors the situation of plant genetic resources for food and agriculture; this comprises country profiles, information on national programmes and relevant institutions, information on the potential extinction of species and varieties in their natural environment and gene banks.

The **International Livestock Research Institute (ILRI)** is currently undertaking efforts in the sphere of animal genetic resources with the aim of preserving animal genetic diversity – although without concrete reference to the problems arising in disaster situations. These efforts are at the following levels:

• Development of methods to assess the population dynamics of farm animal breeds in the absence of government statistics

• DNA analysis for characterization of the genetic relationship of farm animals with regard to improving restocking measures

• Studies to identify strategies for optimizing the conservation of genetic diversity

• Economic assessments for setting priorities between conservation and utilization
Other deliberations relate to the following additional factors (inter alia Longley and Richards 1998):

- Activities for improved needs planning and timely preparation of the multiplication of seed or animal resources in collaboration with refugees during their stay in camps prior to their return to the region of origin
- Training measures for extension workers in order to improve the knowledge of local varieties and breeds and build capacity for rehabilitation measures
- Expanding the documentation of local varieties and mixtures in relation to socio-economic factors and their management
- Expanding the certification of local varieties, facilitating the cross-border transport of non-certified varieties
- Adapting the operational guidelines of donor organizations to requirements (reducing pressures to take immediate action, providing longer periods for programme implementation)

6 Options for German Technical Cooperation

Analysis of current problems and case studies indicates the near impossibility of defining widely applicable and concrete options for action. The complexity of the situation calls for interdisciplinary approaches and specific analysis of each respective case, which must also be distinguished in terms of its immediate surroundings. This runs fundamentally counter to the lack of time available in cases calling for immediate action and to the often poor preconditions for analysis. The challenge is twofold: first, to mitigate, through specific support tools, this contradiction between situational complexity and pressure to take action, and, second, to establish a productive interplay of preventive and remedial strategies.

The activities of Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Technical Cooperation) include 'standard' development cooperation, development-oriented emergency aid during and following disasters, and food security activities. Projects and measures are often the natural result of the succession or interlocking of these activity areas. Similarly, many technical cooperation measures for international clients also address emergency situations and involve the rehabilitation of agricultural genetic resources. A rich body of institutional experience is available, both within the countries and in terms of professional expertise. This knowledge and know-how can be mobilized to enable progress, both internally and at the national or international levels, toward addressing – in cooperation with other organizations – the issue of agrobiodiversity in disaster-prone regions.

6.1 Taking agrobiodiversity into consideration in GTZ projects

It would be desirable to increase awareness of agrobiodiversity issues generally and to integrate them at the points at which development cooperation, disaster relief, rehabilitation and food security interface. This could also serve to improve the quality and sustainability of projects for disaster relief and rehabilitation within the sphere of technical cooperation for international clients.
A greater effort needs to be made to foster the preservation of genetic resources within projects offering advisory services on agricultural policy, engaging in crisis prevention and consulting formal and informal institutions in the seed sector. The most efficient solution would be to link such measures to existing supraregional networks (such as "Promotion of Small Scale Seed Production by Self-Help Groups" in Zimbabwe, or supraregional projects to mitigate the impacts of natural disasters in Central America). In rural extension projects, greater consideration could be given to agrobiodiversity through the following activities:

- Training and sensitizing extension staff in projects in rural areas
- Analysing the management of agricultural genetic resources in the informal sector in rural areas
- Supporting, at local level, the development and improvement of preventive strategies by local populations
- Supporting in situ conservation (communal seed banks, stores, etc.)
- Improving the knowledge of local varieties and breeds, possibly working towards appropriate ex situ conservation in national and supraregional institutions

To provide better orientation and disaster relief, it would be useful to develop a checklist for needs-appropriate planning of interventions to rehabilitate genetic resources. The catalogue of questions in Annex F, which takes up the chief defining features of disaster situations in relation to genetic resources as set out in Section 3 above, can be used as a basis for development of a checklist. It would be expedient to link surveys of needs with the planning of food aid, as information requirements overlap and the design of measures should be linked. The need for a checklist and the form it takes should be discussed among the relevant activity areas at the GTZ. As FAO plans to prepare a guideline on needs survey methodologies (see Section 5), consultation or collaboration in this area would be desirable.

The BMZ directive on the promotion of food, emergency and refugee aid projects sets out in detail the assistance guidelines and regulations for providing food aid. The only statement concerning the supply of aid inputs like animal and plant genetic material is that local resources should generally be used (BMZ 1999). The regulations should if possible give due consideration to agrobiodiversity issues, thus underscoring their importance.

It appears particularly important to adjust funding procedures such as limits on the duration of assistance and financial processing modalities in order to allow some latitude for the lengthier process of providing native plant varieties and local farm animal breeds. For small-scale acquisition of genetic material in rural areas, it is essential to relax the present procedures for genetic resource procurement, which require, depending upon order volume, international invitations to tender.

6.2 Collaborating with other organizations

As work on agrobiodiversity issues in disaster situations has not yet progressed particularly, an effort should be made to sensitize other organizations in Germany and to ensure that native
Managing Agrobiodiversity in Disaster Situations

plant varieties and local farm animal breeds be taken into consideration during rehabilitation measures following disaster:

- Sensitization of non-governmental organizations (emergency aid organizations and organizations involved in rehabilitation and development cooperation)
- Provision of information about country-specific and local conditions in disaster-prone regions to organizations that only intervene in the event of disaster
- Cooperation with intervening organizations, also with an eye to improving participation of local partner organizations of all hues (state and private sectors)
- New forms of cooperation in the event of interruption of bilateral cooperation due to disasters

An effort should be made to involve the GTZ in both the international debate coordinated by FAO and in the sectoral forums at international research institutions (CGIAR, IPGRI, ILRI, etc.). Specifically, possible contributions to the catalogue of measures agreed upon at the FAO workshop should be discussed. Research at German universities can be used to increase the fund of knowledge available on the management of genetic resources in disaster situations. Detailed information on the management of agrobiodiversity in rural areas in exceptional situations, as known mainly from drought-prone regions, can provide important indications for the support and elaboration of preventive approaches (see also ZADI minutes in Annex E). Here it would be appropriate to engage in international consultation on the specific issues to be addressed at the international level. There is still a particular need for research on animal genetic resources in disaster situations.

It also would be desirable to promote gene banks in disaster-prone regions where these provide appropriate ex situ conservation of genetic resources. It would appear similarly expedient to engage in small-scale measures in collaboration with non-governmental organizations that make particular efforts to preserve agriculturally utilized genetic resources in disaster-prone regions.
7 References

Almekinders, C., 2000, Management of Crop Genetic Diversity at community level, GTZ Eschborn


Bundesministerium für Ernährung, Landwirtschaft und Forsten (BML) 1996, “Nutzpflanzen – Vielfalt für die Zukunft, Bericht über die Erhaltung und nachhaltige Nutzung pflanzengenetischer Ressourcen”, Bonn


FAO 1996, "Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture" (adopted by the International Technical Conference on Plant Genetic Resources, Leipzig, Germany)


Managing Agrobiodiversity in Disaster Situations


GTZ 1998, "Development-oriented Emergency Aid (DEA) – GTZ's working principles", Eschborn


International Federation of Red Cross and Red Crescent Societies 1999, "World Disasters Report 1999", Geneva, Switzerland


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World Bank Group, Africa Region 2000, "Sub-Saharan Africa Seed Initiative – Revised Program Description" (Draft)
8   Annexes

A) Overview of types and numbers of natural disasters and of the numbers of persons displaced by them

Table 1: Average annual numbers of natural disasters registered from 1988 to 1997, by region and type

<table>
<thead>
<tr>
<th>Disaster Type</th>
<th>Africa</th>
<th>America</th>
<th>Asia</th>
<th>Europe</th>
<th>Oceania</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquakes</td>
<td>2</td>
<td>6</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>Drought</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Floods</td>
<td>13</td>
<td>22</td>
<td>34</td>
<td>9</td>
<td>4</td>
<td>81</td>
</tr>
<tr>
<td>Landslides</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Strong winds</td>
<td>4</td>
<td>28</td>
<td>34</td>
<td>10</td>
<td>7</td>
<td>83</td>
</tr>
<tr>
<td>Volcanic eruptions</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Others</td>
<td>14</td>
<td>10</td>
<td>14</td>
<td>7</td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>75</td>
<td>106</td>
<td>31</td>
<td>16</td>
<td>269</td>
</tr>
</tbody>
</table>

Table 2: Average numbers of persons displaced by natural disasters, by region and period

<table>
<thead>
<tr>
<th>Year</th>
<th>Africa</th>
<th>America</th>
<th>Asia</th>
<th>Europe</th>
<th>Oceania</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973-77</td>
<td>146,950</td>
<td>325,217</td>
<td>3,026,946</td>
<td>104,200</td>
<td>394</td>
<td>3,603,706</td>
</tr>
<tr>
<td>1978-82</td>
<td>149,570</td>
<td>239,220</td>
<td>588,882</td>
<td>40,923</td>
<td>14,068</td>
<td>1,032,662</td>
</tr>
<tr>
<td>1983-87</td>
<td>188,984</td>
<td>385,988</td>
<td>2,361,435</td>
<td>14,878</td>
<td>15,746</td>
<td>2,967,031</td>
</tr>
<tr>
<td>1988-92</td>
<td>380,478</td>
<td>394,118</td>
<td>10,861,685</td>
<td>25,157</td>
<td>9,720</td>
<td>11,671,158</td>
</tr>
<tr>
<td>1993-97</td>
<td>571,721</td>
<td>207,451</td>
<td>4,250,166</td>
<td>26,925</td>
<td>33,070</td>
<td>5,083,333</td>
</tr>
<tr>
<td>1973-97</td>
<td>287,541</td>
<td>310,399</td>
<td>4,217,823</td>
<td>42,416</td>
<td>14,600</td>
<td>4,872,778</td>
</tr>
</tbody>
</table>

Table 3: Average numbers of persons displaced by natural disasters, by type and period

<table>
<thead>
<tr>
<th>Year</th>
<th>Earthquakes</th>
<th>Drought</th>
<th>Floods</th>
<th>Winds</th>
<th>Landslides</th>
<th>Volcanic eruptions</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973-77</td>
<td>304,467</td>
<td>0</td>
<td>1,994,735</td>
<td>1,262,962</td>
<td>320</td>
<td>2,000</td>
<td>1,000</td>
<td>3,565,484</td>
</tr>
<tr>
<td>1978-82</td>
<td>133,960</td>
<td>0</td>
<td>257,228</td>
<td>622,511</td>
<td>3,843</td>
<td>5,500</td>
<td>4,600</td>
<td>1,027,643</td>
</tr>
<tr>
<td>1983-87</td>
<td>201,336</td>
<td>100,000</td>
<td>1,501,246</td>
<td>631,444</td>
<td>506,781</td>
<td>8,220</td>
<td>12,150</td>
<td>2,961,177</td>
</tr>
<tr>
<td>1988-92</td>
<td>377,744</td>
<td>9,600</td>
<td>9,689,095</td>
<td>1,497,973</td>
<td>21,323</td>
<td>35,325</td>
<td>14,072</td>
<td>11,645,133</td>
</tr>
<tr>
<td>1993-97</td>
<td>178,819</td>
<td>0</td>
<td>3,367,925</td>
<td>1,506,840</td>
<td>5,117</td>
<td>24,953</td>
<td>200</td>
<td>5,083,494</td>
</tr>
</tbody>
</table>

14 Persons requiring tents
15 Hurricanes, cyclones, typhoons, storms and tornadoes
16 Avalanches, tsunamis, heat and cold waves, insect calamities and epidemics, forest fires
<table>
<thead>
<tr>
<th></th>
<th>1973 - 1997</th>
<th>239,265</th>
<th>21,920</th>
<th>3,362,046</th>
<th>1,104,346</th>
<th>107,477</th>
<th>15,128</th>
<th>6,404</th>
<th>4,856,586</th>
</tr>
</thead>
</table>

B) Overview of numbers of refugees and displaced persons

Table 1: Numbers of refugees and asylum seekers (in millions, by host regions)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>5,698</td>
<td>5,825</td>
<td>5,880</td>
<td>5,222</td>
<td>3,683</td>
<td>2,944</td>
<td>2,872</td>
</tr>
<tr>
<td>America und Caribbean</td>
<td>0.249</td>
<td>0.272</td>
<td>0.297</td>
<td>0.256</td>
<td>0.233</td>
<td>0.616</td>
<td>0.760</td>
</tr>
<tr>
<td>South and Central Asia</td>
<td>2,342</td>
<td>2,151</td>
<td>1,776</td>
<td>1,386</td>
<td>1,795</td>
<td>1,743</td>
<td>1,690</td>
</tr>
<tr>
<td>East Asia and Pacific</td>
<td>0.399</td>
<td>0.468</td>
<td>0.444</td>
<td>0.453</td>
<td>0.450</td>
<td>0.535</td>
<td>0.503</td>
</tr>
<tr>
<td>Near and Middle East</td>
<td>5,587</td>
<td>4,924</td>
<td>5,448</td>
<td>5,449</td>
<td>5,841</td>
<td>5,708</td>
<td>5,880</td>
</tr>
<tr>
<td>Europe</td>
<td>3,210</td>
<td>2,542</td>
<td>2,422</td>
<td>2,521</td>
<td>2,479</td>
<td>2,020</td>
<td>1,790</td>
</tr>
<tr>
<td>World total</td>
<td>17,484</td>
<td>16,182</td>
<td>16,267</td>
<td>15,338</td>
<td>14,480</td>
<td>13,566</td>
<td>13,496</td>
</tr>
</tbody>
</table>

Table 2: Numbers of displaced persons (in millions, by significant groups)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>17,395</td>
<td>16,890</td>
<td>15,730</td>
<td>10,185</td>
<td>8,505</td>
<td>7,590</td>
<td>8,770</td>
</tr>
<tr>
<td>America und Caribbean</td>
<td>1,354</td>
<td>1,400</td>
<td>1,400</td>
<td>1,280</td>
<td>1,220</td>
<td>1,624</td>
<td>1,765</td>
</tr>
<tr>
<td>South and Central Asia</td>
<td>1,810</td>
<td>0,880</td>
<td>1,775</td>
<td>1,600</td>
<td>2,400</td>
<td>2,254</td>
<td>2,120</td>
</tr>
<tr>
<td>East Asia and Pacific</td>
<td>0,699</td>
<td>0,595</td>
<td>0,613</td>
<td>0,555</td>
<td>1,070</td>
<td>0,800</td>
<td>0,527</td>
</tr>
<tr>
<td>Near and Middle East</td>
<td>0,800</td>
<td>1,960</td>
<td>1,710</td>
<td>1,700</td>
<td>1,475</td>
<td>1,475</td>
<td>1,575</td>
</tr>
<tr>
<td>Europe</td>
<td>1,626</td>
<td>2,765</td>
<td>5,195</td>
<td>5,080</td>
<td>4,735</td>
<td>3,695</td>
<td>3,269</td>
</tr>
<tr>
<td>World total</td>
<td>23,684</td>
<td>24,490</td>
<td>26,423</td>
<td>20,400</td>
<td>19,705</td>
<td>17,438</td>
<td>18,026</td>
</tr>
</tbody>
</table>

Source: International Federation of Red Cross and Red Crescent Societies, World Disasters Report 1999
### C) Grid crossing types of disasters and types of affected contexts

<table>
<thead>
<tr>
<th>Types of agrarian systems</th>
<th>Manual subsistence agriculture where farmers produce and keep their seeds.</th>
<th>Intermediary stages with various level and degrees of dependency on seed supplies external to the production unit.</th>
<th>Highly mechanised systems where farmers buy all their seeds from specialised companies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characterising disasters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types of disasters</td>
<td>Onset</td>
<td>Duration</td>
<td></td>
</tr>
<tr>
<td>Natural disasters</td>
<td>Slow onset</td>
<td>Short duration</td>
<td>Drought in Sahel in 73-74</td>
</tr>
<tr>
<td></td>
<td>Long duration</td>
<td></td>
<td>Floods in China in 98</td>
</tr>
<tr>
<td></td>
<td>Rapid onset, unpredictable</td>
<td>Short duration</td>
<td>Locust infestation in East Africa</td>
</tr>
<tr>
<td></td>
<td>and unexpected</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rapid onset and</td>
<td>Short duration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>predictable event</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man-made disasters</td>
<td>International war</td>
<td>Slow onset</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internation war</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rapid onset, unpredictable</td>
<td>Short duration</td>
<td>War between Senegal and Mauritania</td>
</tr>
<tr>
<td></td>
<td>and unexpected</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rapid onset and</td>
<td>Short duration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>predictable event</td>
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<td></td>
<td>Long duration</td>
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<td>Other</td>
<td>Short duration</td>
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<tr>
<td></td>
<td>Internal conflict</td>
<td>Slow onset</td>
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18 From: Grunewald, "Characterizing Disasters"
<table>
<thead>
<tr>
<th>Duration</th>
<th>Event Description</th>
<th>Country</th>
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<tbody>
<tr>
<td>Long</td>
<td>Rapid onset, unpredictable and unexpected</td>
<td>Uganda since '96</td>
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<td>Eritrea/Ethiopia war</td>
<td>Palestine</td>
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<td>Rwanda, Burundi</td>
<td>Azerbaijan/Armenia</td>
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<td></td>
<td>War in Zaire '96-'97</td>
<td>Albania</td>
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<td>South Sudan</td>
<td>Kosovo</td>
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<td>High tension leading to socio-economic disturbances</td>
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<td></td>
<td>Slow onset</td>
<td>Indonesia</td>
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<td>Guinea-Bissau</td>
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D) List of organizations interviewed

German organizations

Arbeitsgemeinschaft für Entwicklungshilfe e.V. (AGEH)
Arbeitsgemeinschaft Kirchlicher Entwicklungsdienst (AGKED)
Arbeitsgemeinschaft privater Entwicklungsdienste e.V. (APED)
Arbeitskreis Lernen und Helfen in Übersee e.V. (LHÜ)
Arbeiterwohlfahrt (AWO)
Verband zur Förderung angepasster, sozial- und umweltverträglicher Technologien e.V. (AT-Verband)
Bengo
Brot für die Welt
BUKO – Agrarkoordination
CARE Deutschland e.V.
Deutsche Welthungerhilfe
Deutscher Caritasverband
Deutscher Paritätischer Wohlfahrtsverband
Deutscher Entwicklungsdienst
Diakonisches Werk der EKD, Referat Katastrophenhilfe
Deutsches IDNDR (International Decade for Natural Disaster Reduction)
Deutsche Stiftung für UNO-Flüchtlingshilfe
Deutsches Rotes Kreuz
Dienste in Übersee e.V.
Eirene Internationaler Christlicher Friedensdienst
Evangelische Zentralstelle für Entwicklungshilfe (EZE)
Food First and Information Network (FIAN)
Forum Umwelt & Entwicklung (Projektgruppe Internationale Agrarforschung und Agrobiodiversität
Germanwatch e.V.
Help – Hilfe zur Selbsthilfe
Katholische Landjugendbewegung Deutschlands e.V.
Misereor
Missio
Oxfam e.V.
Pax Christi Internationale Katholische Friedensbewegung – Solidaritätsfonds Eine Welt
Technisches Hilfswerk (THW)
Verband Entwicklungspolitik deutscher NRO (VENRO)
World Vision Deutschland
International organizations

CGIAR (Consultative Group on International Agricultural Research)
EU (European Union)
FAO (Food and Agriculture Organization of the United Nations)
GRAIN (Genetic Resources Action International)
IIED (International Institute for Environment and Development)
ILRI (International Livestock Research Institute)
Instituto Agronomico per l’Oltremare
Instituto Sperimentale per la Frutticoltura
IPGRI (International Plant Genetic Resources Institute)
League for Pastoral People
Rare Breeds International
Rural Advancement Foundation
UNHCR (United Nations High Commissioner for Refugees)
Vétérinaires sans Frontières
WFP (World Food Programme)

Various projects and individuals

GTZ-Projects:

Proyecto de Seguridad Alimentaria-Nutricional Prov. Arque (PROSANA), Bolivien
prosana@pino.cbb.entelnet.bo

Promotion of Small-scale Seed Production on a Self-help Basis (SADC), Zimbabwe
oneuendorf@fanr-sadc.co.zw

projects from the work areas of emergency aid and food security as well as

Dr. Henner Simianer, Gutachter, Stuttgart
Simianer@genetics-network.de
E) Minutes of the information event on "Assisting farmers in disaster situations – Seed supply in disaster situations"

Venue: ZADI, Bonn/Germany
Date: 17 November 1999, 11.00–16.00
Organized by: Information Centre for Genetic Resources (IGR) at the German Centre for Documentation and Information in Agriculture (ZADI) and the Biodiversity and Development Working Group of the German Council for Tropical and Subtropical Agricultural Research (Fachkreis Biodiversität und Entwicklung der Arbeitsgemeinschaft Tropische und Subtropische Agrarforschung, ATSAF).

Participants:
Frank Begemann, ZADI
Regina Birner, ATSAF, Biodiversity and Development Working Group
Heinz Bitsch, Help – Hilfe zur Selbsthilfe (not throughout)
Gabriele Blümlein, ZADI
Thomas Gladis, ZADI
Albrecht Hartmann, World Vision
Birgit Kundermann, agrobiodiversity consultant
Reinhard Liersch, AT association
Ute Sprenger, Community Technology and Development Trust (CTDT), consultant and author
Wilhelm Thees, Misereor
Bianca Untied, GTZ, sector project "Managing Agrobiodiversity in Rural Areas"
Jeanette Weller, German Agro Action (Deutsche Weltungerhilfe)
Written contribution by P. Schwiebert, German Development Service (Deutscher Entwicklungsdiensst, DED)

What role does seed supply in disaster situations play in the work of German disaster relief organizations? How is seed supply handled within disaster relief activities? These issues were of particular interest in the light of the adoption almost four years ago of the Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture. The GPA identifies twenty priority activities geared to strengthening and improving worldwide the conservation and utilization of crop diversity. One of these activities is titled "Assisting farmers in disaster situations to restore agricultural systems" and is concerned particularly with providing adapted seed. This event was intended to provide a first exchange of information and experience on 'theory' and 'practice' – the goals and aspirations of the GPA and practical seed supply in disaster situations. A further aim of the meeting was to identify options for action.

Numerous organizations operating in the spheres of emergency and disaster aid and in development cooperation were invited to this event. The response to the first letter of invitation was poor. When contacted directly, it emerged that some of the organizations do not operate in the agricultural sphere, or that their structure (e.g. country divisions rather than sectoral departments) did not permit nomination of a competent person.
Managing Agrobiodiversity in Disaster Situations

Some organizations and institutions were greatly interested in the topic but were unable to take part in the event.

The event is convened by ZADI's Information Centre for Genetic Resources (IGR) and ATSAF's Biodiversity and Development Working Group.

Introduction

Dr. Begemann (IGR) gives a brief introduction to the political context. The Convention on Biological Diversity (CBD) was adopted in 1992 at the UN Conference on Environment and Development (UNCED, the Earth Summit) in Rio de Janeiro, and entered into force in December 1993. The Convention regulates the conservation of biological diversity, its sustainable use and the equitable sharing of the benefits arising from the use of genetic resources (benefit sharing). Genetic resources, as a component of biological diversity, thus fall under the provisions of the Convention, which is binding under international law. Plant genetic resources for food and agriculture (PGRFA), the diversity of crop species and varieties and the wild plants which can be used for food are particularly important for agriculture. Addressing this issue, FAO organized in 1996 in Leipzig, Germany, the 4th International Technical Conference on Plant Genetic Resources for Food and Agriculture. At that conference, a world status report on plant genetic resources was presented, containing comprehensive information on the loss, endangerment, conservation and utilization of PGRFA worldwide. Moreover, the Global Plan of Action (GPA) for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture was adopted by the more than 150 participating states.

The GPA identifies twenty activities whose implementation is urgent in order to promote the conservation and sustainable use of PGRFA. The activities concentrate upon the four spheres of

- **In situ** conservation and development
- **Ex situ** conservation
- Utilization of plant genetic resources
- Institutions and capacity building.

One of the activities of the GPA is "Assisting farmers in disaster situations to restore agricultural systems upon the basis of locally adapted seed and planting material". This issue was included in the GPA due to the experience that disasters often lead to the loss of farmers' seed and that this is difficult to acquire again; in addition, seed is often delivered that is poorly adapted to local conditions. This can cause considerable yield losses in subsequent years and can accelerate, in developing countries in particular, the loss of local varieties.

The question is now how to contribute within the context of disaster relief efforts to supplying adapted seed. This leads on to several specific questions, which were presented as a basis for discussion, integrating the results of a FAO workshop held in 1998 on these issues.

*If seed supply is to be restored with the commonly utilized varieties, the following questions arise:*
Which varieties were cultivated?
Is information available on these?
If so, where and from whom?

Information on varieties cultivated can be available among the farmers themselves, in development cooperation and rural development organizations, in seed networks, gene banks, national and international agricultural research centres or in UN organizations. It may also be entirely unavailable.

The World List of Seed Sources, a FAO database, is a potential source of information. This provides country-specific and crop-specific addresses of possible contact points. The database is available in the Internet at (http://www.fao.org/ag/agp/agps/seed/wlss.htm). A test search for Bosnia/Herzegovina and potato yielded the addresses of two institutions in Bosnia/Herzegovina which may be able to assist in the search for potato planting material. However, the quality of this source of information would need to be checked before it can be recommended to a broad public as a suitable source.

Where is seed of these varieties available?

Once suitable varieties have been identified, they can be found on local markets, in neighbouring countries and regions or in gene banks and other plant genetic resource collections.

Who can carry out seed multiplication?

In order to be able to deliver sufficient amounts of seed, it needs to be multiplied. This can be carried out by private seed producers, local seed multipliers, local seed networks or national and international agricultural research centres.

The central problems are:

Action must be fast and must commence swiftly.
The necessary information is often unavailable.
Financial support in disaster situations is limited to narrowly defined periods.
There are many participants but no coordination.
Probably more?

The meeting organizers put the following main questions to the participants:

To what extent is seed supply in disaster situations a component of the work of disaster relief and development cooperation organizations?
Are the problems noted here really the central problems in practical work?
Or do the problems lie in quite different areas?
Is there a need for coordination/action?
How can German development cooperation and disaster relief organizations contribute?
What should other German organizations do?
Presentation of the practical experience of the organizations represented, and debate

Help: In the "Humanitarian Aid" coordination committee, seed is not an issue. Disaster relief is primarily understood to mean meeting immediately the existential needs of the people: food, potable water, shelter and medical care. Seed supply only becomes an issue when meeting these elementary needs is assured, i.e. when disaster relief is finished. Seed supply accordingly is not a part of disaster relief in the narrower sense, but is situated in the sequence of activities between disaster relief and classic development cooperation.

German Agro Action (Deutsche Welthungerhilfe) operates in disaster relief and also has experience in seed supply. For instance, seed and plant material supplies have been provided to Tajikistan for some years now. In that instance, local authorities were able to provide information on suitable potato varieties, so that appropriate varieties were available. The Netherlands carried out multiplication. However, the European Union, as disaster relief donor, has its own tendering modalities requiring e.g. the cheapest supplier.

Worldvision's activities include those in Sudan, in which, due to the continuing civil war, there is a continuous state of emergency. Here local contact farmers were identified as contact points in cooperation with ICRISAT. The "Seeds and Tools" programme comes into play when disaster relief is finished and normal development cooperation not yet re-established, thus closing the scheduling gap into which seed supply would normally fall.

The Community Technology and Development Trust (CTDT) in Zimbabwe has been working for a long time on issues relating to plant genetic resources. As a preventive measure for calamities, local seed banks have been established in three communities, storing sufficient local seed for the next season.

Misereor undertakes mainly development cooperation activities, but also has experience in seed supply, e.g. in East Africa. Wherever possible, seed requirements are met within the countries concerned, or else imported from neighbouring countries. Long-term preventive measures are an essential precondition to good seed supply in disaster situations. In that vein, a number of development cooperation projects focus on local seed supply or participatory breeding approaches. However, little consideration is given to this area in general development cooperation work.

Debate:

Participants debated whether and to what extent seed supply is at all a component of emergency aid. Disaster relief concentrates upon the basic supply of people with food, potable water, clothing and shelter and upon medical care. Seed supply only becomes relevant when it has been assured that these basic needs are met again. Seed supply is accordingly more a component of the rehabilitation phase, the transitional period from the emergency situation to everyday life. For this, however, scarcely any funds are available, as disaster donations must be spent quickly and immediately. A requirement for seed supplies frequently only emerges when funds for disaster relief have already been exhausted. A further aspect is that seed supply requires longer term measures whose financing by disaster relief funds is difficult or impossible. Moreover, seed supply is not a spectacular or headline-grabbing issue, and thus unattractive when seeking donations. Seed supply in disaster situations thus falls, so to speak, 'between two stools'.
The experience of the organizations represented at the meeting underscores that, while it is often a concern to procure, as far as possible, adapted seed either within the country or at least from neighbouring countries, there is in fact no 'planned' procedure. Whether suitable seed is provided or not thus remains haphazard.

It became clear in the debate that a whole array of preventive measures needs to be taken in order to be able to respond rapidly and expeditiously in disaster situations. When in need, information on varieties cultivated and on the structure of the seed sector should be available, and suitable contact points in the countries should be known. The participants identified a major need for action in this area. A further approach is to establish local seed stores to which recourse can be taken in emergencies. This is particularly appropriate for areas in states of 'permanent emergency', such as Sudan with its ongoing civil war.

Seed is, albeit to a lesser extent, an issue in development cooperation (DC) projects. Such seed projects can be used to collect information on local seed availability, and can operate in emergency situations as information sources. Moreover, this issue area (participatory breeding, local knowledge etc.) could be integrated more frequently into agricultural DC projects.

The participants jointly drew up a collection of key points, reiterating the central problems and proposing approaches for action.

**The central issues can be grouped into five themes:**

**Varieties / Seed**

- Material distributed in emergency situations can contribute to locally adapted material being displaced.
- Permanent states of crisis lead to particularly large losses of native varieties.
- In disaster-stricken regions, gene banks can no longer carry out their tasks, seed multiplication no longer functions.
- Sufficient quantities of high-quality material are not available.
- Short-term acquisition of locally adapted seed is generally difficult.
- The national appreciation of native varieties or typical species is often low.
- Seed imports can be hampered or curtailed by local legislation.
- It is not known which varieties were cultivated locally.
- Where is locally adapted seed offering a good yield potential available?
- Many activities must be carried out in advance in order to be able to respond in disaster situations.
Local knowledge

- Knowledge on locally adapted varieties is not available.
- Knowledge on the importance/utilization of local varieties is inadequate (role in production systems, preferences, socio-cultural influences).
- Loss of knowledge entails loss of genetic resources.

Time issues / Logistics

- No contact points for seed issues are known in partner countries.
- Seed multiplication needs time.
- Changing organizations during crisis (and thus loss of knowledge) is a problem.
- How can the establishment of country-owned seed multiplication and certification systems be promoted?
- Who coordinates information on suitable varieties for specific regions?

Financing

- Absence of preventive measures to which recourse could be taken
- Absence of funding mechanisms for preventive measures
- The Global Plan of Action does not provide for a funding mechanism for supplying appropriate material (as opposed to the CBD).

Options for action

- Conserving local varieties \textit{in situ} and \textit{ex situ} must take a preventive approach.
- Provision of corresponding local logistics
- International approaches to the reconstitution of locally adapted seed varieties (UNHCR, ECHO, FAO)
- Establishment of emergency depots containing local seed for at least one vegetation period
- Establishment of local or regional gene banks
- Analysis of local seed supply strategies (including strategies in disaster situations)
Where do we go from here?

The participants agreed that seed supply is an important issue in disaster relief, but not the prime one. The participants intend to integrate the issue in their work, but in view of generally high workloads no additional resources can be assigned to this. While such resources would certainly be desirable in order to do justice to the importance of the issue, there are also options for action which can contribute much with little additional effort. These include the greater integration of the issue within existing or new development cooperation projects, or informing and sensitizing decision-makers and actors in the field. In research projects, inventories of existing local varieties could be drawn up which could then be used in the event of disaster. A further suggestion to improve the planning base is to study retrospectively in case studies which measures (including traditional prevention strategies) farmers have taken after a crisis and what degree of genetic diversity loss occurred.

Concerning the question of how to continue to address the issue in concrete terms, the participants agreed on the need for action but could not see any (time) capacities for corresponding activities. The proposal was made to disseminate the results of the meeting to all organizations concerned in the form of the present minutes, in order to clarify the degree of interest in the issue and the need for further information and debate, and to ascertain whether further activities should be planned.

Literature:


Bonn, March 2000

G. Blümlein
F) Catalogue of questions for the assessment of animal and plant genetic resources during and after disaster situations

(In parts, the information needs for assessing genetic resources as a component of production systems and household livelihood systems overlaps with the information needs for other activities such as food aid)

A) Information on the situation before the crisis

- Existing agricultural production systems
  - Arable:
    - Important crops and varieties (for subsistence and market)
    - Cultivation systems (cultivation periods / year, cropping sequences, mixed cultivation systems)
  - Animal husbandry
    - Farm animal species / breeds and their importance in the production system
    - Livestock management systems (grazing / fodder cultivation, housing, reproduction periods)

- Supply with genetic resources
  - Seed:
    - Crops / varieties with own seed management (own production, local exchange, local markets, role of private seed sector)
    - Crops / varieties with seed acquisition from formal sector
    - Important native varieties, varieties crossed in from formal sector
  - Farm animals:
    - Animal species / breeds with high proportion of local breeds
    - Animal species / breeds with high crossed-in proportion
    - Reproduction management
  - Formal agrogenetic resource supply sector
    - Linkage between informal and formal seed and animal breeding sectors
    - Handling of the issue of intellectual property rights to local breeds and native varieties
    - Organizations and persons having particular knowledge of local breeds and native varieties
Managing Agrobiodiversity in Disaster Situations

- State and private sector institutions and their distribution of tasks
- Role of private sector in seed production and animal breeding

**Responsibilities for agricultural production**
- Family and clan (gender differentiation) for production, seed selection, selection of varieties to be cultivated, livestock husbandry and reproduction
- Village: Differentiation of production systems according to population groups and social stratification, role of higher-level community in agricultural production and in the management of agrogenetic resources
- Local-level institutions of importance to production (NGOs, private sector)

**Existence of preventive strategies**
- General storage (short- and long-term)
- *In situ* and *ex situ* conservation
- Cooperative relationships with other groups of the population outside of the affected region
- Others

**B) Information on the effects of crises**

**Time of onset of crisis**
- Cultivation period: before sowing, vegetation period, harvest, after harvest
- Farm animals: nutritional situation and reproduction phase
- Stocks of food and seed
- Farm animal stocking in relation to season

**Spatial extent of crisis**
- Degree of overlap of region affected with agro-ecological zones
- Existence of comparable, unaffected agro-ecological zones
- Differentiation within the affected region (areas spared or particularly affected, e.g. refugees passing through, special exposure of local areas to natural disasters)
- Topography in relation to natural disasters (for floods, drought)
• Duration of crisis
  o Interruption of agricultural activities / loss of vegetation periods / potential harvest losses
  o Situation in relation to fodder reserves and grazing

• Differentiation of degree of affectedness by crisis
  o Affectedness of different production systems and social groups
  o Affectedness of social groups / differences (internal conflicts!)

• Destruction of resources by the crisis (direct and indirect)
  o Direct loss of stored seed, crops and farm animals
  o Crisis-related sale of farm animals and food
  o Secondary losses through effects of dampness, pests, disease and looting

• Absence from farms
  o Duration of absence from farms in relation to reproduction
  o Scale of absence of population (entire population, certain social groups, certain types of production, all household members or bearers of knowledge about genetic resources) / situation of the genetic resources available to parts of the population that have not fled
  o Taking genetic resources along to the new location (farm animals, seed)
  o Opportunities to reproduce seed or keep animals at the new location (ecological conditions, access to land and fodder resources, local cooperation in the host region...)

• Situation of institutions and organizations of relevance to agriculture or agrogenetic resources
  o State systems
  o Representation of state systems at local and regional level
  o Non-governmental organizations at local, regional and national level
  o Private sector at local, regional and national level
  o Research institutions and gene banks
  o Organizations and persons with particular knowledge of and experience in the management of native varieties and local breeds
C) Potential crisis-induced changes of importance to seed regeneration and farm animal restocking

- **General situation of households and farms**
  - Losses of operating and household capital / houses and general economic situation
  - Presence / return of all groups? (Men, women, young people, all social groups, specific production systems, particular damage to certain groups by the crisis, changes in social structure)
  - Perspectives of the population with regard to farm rehabilitation (priority branches of production, crops, varieties, farm animals, labour resources, utilizable agricultural area, grazing areas, subjectively perceived security situation or other production risks)

- **General situation in the affected region**
  - Security situation
  - Accessibility (functioning of infrastructure such as bridges, roads, airstrips)
  - Functioning of markets and marketing systems (purchasing power and demand for agricultural produce, changes in marketing channels or external relations of the affected region)

- **General reserves**
  - Food availability / food aid
  - Possible own contributions of the population to farm rehabilitation (by social group)
  - Ways in which impoverishment and particularly impoverished groups are dealt with at communal level and within social systems

- **Reserves of agrogenetic resources (type, quality and quantity)**
  - Locally available seed, according to crops and varieties
  - Breeding stock of species and breeds, population sizes
  - Agrogenetic reserves in comparable agro-ecological zones
  - Stocks in ex situ collections (local, regional, national, supraregional)
• Functioning of social systems
  o Are opportunities or willingness to exchange genetic resources changed?
  o Local trade in seed and breeding animals

• Presence, functioning and capabilities of institutions and organizations of relevance to agricultural production and agrogenetic resources (see also B)