REPUBLIC OF RWANDA

MINISTRY OF DISASTER MANAGEMENT AND
REFUGEE AFFAIRS (MIDIMAR)

NATIONAL CONTINGENCY PLAN FOR ANIMAL AND PLANT DISEASES

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i. FOREWORD

Animal and plant diseases pose a serious and continuing threat to food security, food safety, national economies, biodiversity and the rural environment. New challenges, including climate change, regulatory developments, changes in the geographical concentration and size of livestock holdings, and increasing trade make this an appropriate time to assess the state of knowledge about the impact that diseases have and the ways in which they are managed and controlled.

In this document, the case is explored for an interdisciplinary approach to studying the management of disasters related to infectious animal and plant diseases. Reframing the key issues through incorporating both social and natural science research can provide a holistic understanding of disease and increase the policy relevance and impact of research. Finally, in setting out this contingency plan a picture of current and future animal and plant disease threats is presented with a view to set mechanism to prevent those potential risks from becoming disasters

I however reiterate the specificity of this document in comparison with other contingency plans already developed: The document gives the window of thinking deeply about the risk with a view to set mechanisms to prevent the risk of becoming a hard controllable disaster. The NPDM recognizes the efforts continuously made by the National One health technical committee and respective institutions in epidemic prevention and management. This contingency plan is a set of thought within the angle of disaster readiness and anticipation of threats.

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Sincerely,

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iii. Contents of the National Contingency Plan for Animal and Plant diseases

This document sees the pairing of many different disciplines in a set of a plan that intends to address many of the most pressing issues in animal and plant disease management. It demonstrates the value of introducing historical perspectives to contemporary problems. Importantly, it demonstrates the limitations of the sciences to provide solutions to problems that have an inherently political and economic character. The paper highlights the relationship between scientific information and government's capacity to respond, a theme which also occurs in the analysis of endemic livestock diseases. The contingency plan therefore brings together a scientific analysis of the differing threats posed by a range of endemic cattle diseases with a political model of governance options, to show that policy responses are not always appropriate or proportional to disease risk. From these critique of prevailing approaches to disease control that fail to take adequate account of the full range of scientific knowledge available disaster managers come in to anticipate everything in the system that can make disease risks becoming a hard controllable disaster and propose actions to be undertaken. Including inter-relationships between government regulation, industry and trade, and their effects on disease, the communication of risk to the public which is a crucial element of any disease control strategy and the effective communication of complex information is explored in three papers in this issue.

This plan also provides the analysis of the future of disease, using predictive models to extrapolate future trends. The document discusses the tendency for modelers to focus on particular drivers of change (such as global warming) to the detriment of other potentially important social factors such as civil disruption. Ultimately, therefore this contingency plan for animal and plant diseases illuminates a part of the complex context in which disease outbreaks occur and are managed, and demonstrates the value of bringing multiple perspectives to bear on this inherently interdisciplinary problem.

iv. Introduction

Incidents of animal or plant disease are not solely natural occurrences. Human actions are extensively implicated in the spread and outbreak of disease. In turn, disease affects human interests widely, and much effort is spent in the control of disease. Consequently, it is difficult to take apart the natural phenomena of disease and the social phenomena of the drivers, vectors impacts and regulation of disease. Yet, our understanding of animal and plant diseases is riven by a great divide between the natural and social sciences, a divide that is entrenched in differences of research methods, approaches and languages. The resulting fragmentation of knowledge hinders progress in understanding and dealing with disease.

The aim of this document is to bring together different academic disciplines, to use past cases of animal and crops diseases in Rwanda to offer fresh insights into animal and plant disease threats. In this introductory we outline the complex interactions between the natural and the social in animal and plant diseases, and present the case for an interdisciplinary approach, combining natural and social sciences, to disease management.

Firstly, we address the two most pressing drivers of disease spread, climate change and globalization, to illustrate the interplay of human and natural factors. Secondly, we explore the inter-relationship between disease and the political, social and economic context in which it occurs, demonstrating the significance of that context by comparing and contrasting the different regimes surrounding plant and animal health.

The document then introduces the concept of interdisciplinary and the ways in which it can prompt new insights into the transmission, effects and management of disease. Finally, we set out the thought and the prospect on the present and future disease threats.

I. UNDERSTANDING THE RISK OF ANIMAL AND PLANT DISEASES AND PREVENTION FOR THE RISKS FROM BECOMING DISASTER

1. Drivers of future disease threats

Two contemporary processes stand out in their transformative and far-reaching impact on the spread of infectious animal and plant diseases. The first is climate change, which is profoundly altering the distribution of disease organisms, at the same time as it is increasing the vulnerability of agriculture in certain regions owing to drought, salinity, flooding or extreme weather events. The second is globalization, the increasing movement of people, goods and information that poses challenges for border controls, food supply chains and trade patterns, but is also a force behind the development of national and international systems of regulation.

For plant diseases, the major drivers identified were pesticide-resistant disease strains and a lack of new pesticides, an increase in trade and transport of crops and plants, and an increase in ambient temperatures. For animal diseases, the major drivers were inadequate systems for disease control and weaknesses in their international implementation, the threat of bioterrorism, emergence of drug resistance and a lack of new drugs, increased trade in animals, the spread of illicit trading and other risky practices, and increased temperatures. Interestingly, lack of understanding of the biology of the pathogens did not figure, but aspects of climate change and globalization appeared under both headings.

1.1. Climate change

Climate change in its contemporary form is not simply a 'natural' process, but is increasingly caused by human behavior. In turn, climate change affects disease transmission at three levels:

- firstly, it acts directly on the biology and reproduction of pathogens, hosts or vectors;
- secondly, it affects the habitats present in a region, the community of hosts that can live in them and the lifecycles, or lifestyles, of those hosts; -

- Thirdly, climate change induces social and economic responses, including adaptive and mitigating measures, which alter land use, transport patterns, human population movements, and the use and availability of natural resources .

While the first is a matter of biology, the second and third levels include increasing social components.

The effects of climate change on disease will differ between pathogens. Plant diseases may increase or decrease depending on their biology, temperature and water requirements.

However, there is evidence that certain pathogens such as wheat rust that currently flourish in cool climates could adapt to warmer temperatures and cause severe disease in previously unfavorable environments.

For animal diseases, increases are likely for vector-borne diseases, because insect and tick reproduction and activity are particularly sensitive to increases in temperature. As well as affecting the incidence and severity of disease, climate change will also influence the spread and establishment of non-native plants and animals. If they prove invasive, they too may impact on crop management, livestock husbandry, silviculture and infrastructure maintenance, as well as the native fauna and flora.

Such changes to host ecology and environment are additionally important as even relatively small changes in the basic reproduction rate can have large impacts on the incidence of infection in a population, as pathogens more successfully jump species.

While we can thus identify some likely trends in the status of particular diseases, a second and equally important feature of climate change is the increased uncertainty it ushers in. As the Foresight report notes, there is 'considerable uncertainty arising from the many, often conflicting, forces that climate imposes on infectious diseases, the complex interaction between climate and other drivers of change, and uncertainty in climate change itself'. Effects of climate change that act indirectly on infectious diseases, via effects on other drivers, are particularly hard to predict. These include the social and economic responses to climate change such as shifts in land use and transport and trade patterns.

Agricultural processes, for example, have an active interplay with climate change, altering the conditions for disease. While agriculture is affected by rising temperatures and changing precipitation patterns, and must adapt, the production of food is a significant generator of greenhouse gases and is under pressure to mitigate them. Agriculture contributes about 17% of the greenhouse gas emissions .

Changes in agricultural systems are therefore likely to have complex consequences for disease threats. For example, agricultural adaptation will necessitate geographical shifts in cropping zones, potentially introducing disease into new areas and prompting novel disease challenges. Even agricultural mitigation measures may have unintended consequences. For example, one technology recently promoted to combat greenhouse gas emission is on-farm anaerobic digestion as a means of processing farm waste and generating green energy simultaneously. However, pathogens can enter digesters in slurry and other feedstock and be re-introduced to the field when the digestate residue, if not properly treated, is applied to a crop.

1.2. Globalization

Globalization is the other major process exacerbating disease spread, through rising volumes of trade in plants and animals within and between countries, growing numbers of tourists and other travellers potentially transporting disease organisms, and an increasingly international food supply chain that extensively moves around plant and animal products for processing and sale. The effects are more strongly seen in the less regulated world of plants. For example, a rapid growth in horticultural trade has led to many new disease introductions including the fungus *Phytophthora ramorum* , which poses a serious threat to a range of indigenous trees and shrubs. Forestry in general has seen a dramatic pattern of new disease and pest introductions, particularly through the recent opening up of trade between East Asia and other regions. Over the twentieth century, the number of new plant fungal, bacterial and viral diseases appearing in Africa has risen from less than five to over 20 per decade. Much of this is attributable to increased trade, transport and travel, and there is no indication that the trend is abating.

Again, the agricultural sector is implicated in increasing disease threats, in this instance through changes to the scale of production and trade in response to globalizing markets. For example, structural change in the international horticultural industry has been towards fewer and larger producers and an increasing involvement of multiple retailers, leading to a concentration in the number and size of companies together with a major expansion of trade pathways.

The geographical concentration and intensification of production that globalization has fostered also favours certain diseases. For example, extremely high densities of European wheat crops have been linked to the increasing transmission potential of diseases such as yellow rust. Similar restructuring processes are heightening disease vulnerability in livestock. The reduction in income per animal, coupled with mechanization, has led to fewer farmers managing more animals per farm, and more animal movements between farms.

For example, pig farms purchase breeding stock to maximize uptake of new genetics, and young pigs from many farms are moved and reared together in their thousands. These behaviors, and similar developments in other livestock sectors, help pathogens survive in metapopulations.

The threat posed by increasing trade and tourist movements is largely a threat to the biosecurity systems of individual farms and those put in place to prevent disease entering particular countries.

Globalization also circumscribes the autonomy of traditional, nation-state-based systems of authority, emphasizing additionally: individual and collective arrangements and responsibilities among farms and businesses in sectors and supply chains; as well as transnational systems of regulation.

As this brief overview has illustrated, the spread of animal and plant diseases is heavily influenced by human behaviour in direct and indirect ways. Human-induced globalization and climate change are increasing the spread of disease, both separately and in conjunction. Disease organisms may be transported more easily as a result of extended trading systems, but they may also find more favourable conditions for reproduction and transmission as a consequence of global warming. Not just in relation to disease incidence, though, but in disease management also, one can see parallel inter-relationships between the natural and social aspects. The regulation of animal and plant diseases is a fluid and multifaceted collection of impacts and management responses. We now review some of these impacts and responses, demonstrating how scientific understanding of disease spread must be understood in the context of human responses to disease threats.

2. Regulatory relations of infectious diseases

The management of disease takes place within regulatory frameworks set out by national governments and intergovernmental organizations. In Rwanda, there are different regulatory frameworks for animal and plant diseases, partly reflecting biological differences between the two. For example, there are many more species of plant farmed than livestock. Key crop species and threats vary depending upon geography and climate, making a global shortlist of crop threats less relevant, and favouring local risk analysis as a means of identifying national priorities .

However, there are also historical political factors affecting the ways that plant and animal diseases are dealt with. Animals are high-value investments relative to crops, which may account for the greater protection afforded against animal disease historically . Over the past 50 years, diseases have been controlled for a whole variety of different reasons, including protecting the nation's reputation abroad, lobbying by livestock breeders, safeguarding public health and avoiding disruption of trade. The political imperatives to control disease have important consequences for the governance structures that are put in place to regulate trade and monitor and combat diseases.

The regulation of animal and plant diseases should be informed by scientific evidence about the likely spread of diseases and the severity of the animal and plant health problems they pose. Government policy for regulating disease is also determined, however, by the wider impacts that disease outbreaks have upon society and the economy. The differences between the two regimes stem largely from the fact that certain animal diseases are considered to have more detrimental social and economic effects than plant diseases. The following two sections examine more specifically how the social and economic relations of infectious diseases shape the way diseases are managed.

3. The social relations of infectious diseases

A range of social factors, including consumer concerns, human health risks, concerns for wildlife and risks to countryside users influence the political and regulatory context for the management of infectious disease. Consumers expect wholesome and healthy food, and food-borne illnesses place vulnerable groups at risk of infection. Certain infectious diseases of animals are controlled because the human health impacts of animal diseases can be severe: approximately 75 per cent of all recent emerging human diseases seem to originate from an animal source. The Foresight report argues that this trend is 'likely to continue and to be exacerbated by increasing human–animal contact and a growing demand for foods of animal origin'.

There are few direct risks to human health from plant diseases, notable exceptions being mycotoxins produced by some strains/species of *Fusarium*, which also cause head blight in cereal crops.

Consumers are also concerned with the provenance of food and in particular with animal welfare. Indeed, welfare standards in food production and the safety of meat produced by intensive farming methods are among the concerns most frequently expressed by consumers about food. Likewise, with regard to crop production, many consumers express preferences for organically produced food or food grown with minimal chemical pesticides [23]. The use of chemical pesticides continues to rise. Alternative strategies such as the use of transgenic, disease-resistant crops appear to be a distant possibility owing to public concern over genetically modified organisms (GMOs).

An emerging concern, that is beginning to influence government policy-making, is the potential for disease outbreaks to interfere with public use or appreciation of the countryside.

The final significant societal influence on government policy for disease control concerns the interplay between wildlife, livestock and society. There is substantial conflict surrounding wild mammals in agricultural ecosystems particularly in relation to the perceived impact of predation and disease on domestic stock. Wild mammals can infect livestock with a variety of diseases, including bovine tuberculosis, which has provoked significant conflict between badger conservation and farming groups. Likewise, the increase in deer populations in the countryside is causing discord with agriculture, in part because of the potential of the deer to act as sources of infectious disease for livestock. There is a tension between the management and regulation of wildlife for food chain security and that for biodiversity conservation. The former implies the need for a rigid protective boundary around any animal system connected with the human food chain. However, that could militate against the conservation of more 'natural' ecosystems, 'co-produced' with farming and landscape-level approaches to biodiversity conservation. An analogous situation arises with the interplay between crop or trade plants and natural plant communities, where there is a shared pathogen, as seen for *P. ramorum* and *Phytophthora kernoviae* affecting a wide range of host plants in both the ornamental nursery trade and woodland and heathland habitats.

The regulatory context and the social impacts of diseases are inextricably linked. Understanding the importance of societal attitudes and preferences is essential to understanding why attempts to control disease succeed or fail, because seemingly 'irrational' behaviour may undermine the premises or application of policy. This is particularly apparent in the case of public judgements of risk where there is much evidence to suggest that risk assessment in practice draws upon a wide variety of knowledge and experience, of which scientific information may be only a small part. Mills *et al*. demonstrate through their comparison of the ornamental and mushroom sectors (for diseases such as *P. ramorum* or Mushroom Virus X) and also the cereal and potato sectors that growers and their consultants make complex assessments of the risk of diseases. These risk assessments are based not only on technical analysis but on intuitive reactions and political judgements also.

The consequences of public concerns can be far-reaching in the changing political and regulatory frameworks. An example is the recent decision to move from a risk-based to a hazard-based assessment system for chemical pesticides. Risk assessment is based on a combination of the intrinsic properties of a chemical and likely exposure; hazard assessment takes account of only the intrinsic properties. This will have a significant impact on the range of pesticides that can be used. The next section examines shifts occurring in the onus of responsibilities for disease management between the public and private sectors in response to the changing public and political perceptions of the scale and fairness of the distribution of costs involved.

4. The economic relations of infectious diseases

The second dimension that must be considered is the economic costs of managing disease and how these are distributed. Again, this is linked to, and has an influence on, the regulatory context. The economic impacts of disease are felt in terms of culled animals, damaged crops, lost productivity, loss of international trade, control and compensation costs, and rising food prices. As explained above, animal and plant diseases are treated differently by government and consequently their economic impacts are determined and distributed differently between state and industry.

For plant diseases, the costs of outbreaks are borne almost entirely by producers who receive no compensation from the government. Historically, given that many plant pests and pathogens require expert (often laboratory-based) identification, plant health controls have primarily relied on government plant health inspectors (supported by an extensive government-funded diagnostic testing programme) intercepting regulated pest and pathogens in order to reduce the likelihood of serious outbreaks. As a consequence, although legislation allows Ministers to pay for the destruction of plants in certain circumstances, government has not normally relied on compensation to incentivize notification of regulated pests by producers. Should it become necessary to destroy plants in large private gardens, however, plant disease control would become a much more contentious and politicized issue. The costs that growers have to bear from plant diseases are considerable.

Endemic diseases of livestock that do not affect humans, like plant diseases, are left largely to farmers to manage as they choose, within legal limitations focused on public health and animal welfare. There may be a wider industry interest in the epidemiology of these diseases expressed in technical norms; for example, management of mastitis in dairy cows focuses on minimizing the levels of immune cells in milk while maximizing milk yield.

One consequence of the absence of external social and political interest in these endemic diseases, though, is a lack of funding for research. A major exception that reinforces government's reluctance to intervene in others is bovine tuberculosis, which government has been seeking to control and eradicate in the UK for more than a century.

There are wider costs of disease beyond the impact on government and the agricultural sector. This is particularly true for livestock diseases. In the 2001 FMD outbreak, the economic impact on tourism and rural businesses—caused by footpath closures, disturbing images of 'funeral pyres' and appeals from the government and farming groups for people to 'stay away' from the countryside—was more severe than the losses to farming. For example in Cumbria, one of the worst affected counties, losses to the tourism sector were £260 million, compared with £136 million losses to agriculture. Moreover, culled-out farmers received compensation for their losses from the government, whereas the mainly small rural businesses that suffered losses received no compensation.

The economic impact of plant and animal diseases is inextricably linked to the regulatory context. As the cost to the government of controlling animal diseases continues to rise to publicly unacceptable levels, the regulatory framework is beginning to change in order to curb and reallocate these costs.

New developments such as the government's responsibility and cost-sharing agenda could potentially transform the nature of disease control. Through the sharing of responsibilities, government wants to achieve better management of animal disease risks so that the overall risks and costs are reduced and rebalanced between government and industry. Industry will assume a greater responsibility in developing policy and deciding what forms of intervention might be needed. Producers will have greater ownership of the risks, but will face less of a regulatory burden. This will entail greater attention to farm-level biosecurity, private measures such as insurance to compensate for disease losses, collective preventative schemes within farming sectors and government–industry partnerships to tackle disease. Overall, there will be greater emphasis on farmer and industry responsibilities. This may be problematic because farmers' ability to control animal disease is subject to a range of influences and constraints

Even so, the pace of change is likely to be forced by wider pressures on public expenditure which demand that government prioritize its commitments ever more ruthlessly.

Plant disease management with its history of private sector responsibility offers examples that the livestock sector might follow. Indeed, growers have devised imaginative programmes for biosecurity and crop insurance for major crops such as potatoes. However, the threats posed by horticultural imports to growers in general and to the wider environment may elicit a more demonstrative response from the government.

There are a number of different sectors with different characteristics and disease vulnerabilities. It is also difficult if not impossible to assess the scale of the threat from as yet unrecognized pests and pathogens that could be introduced by unscrupulous or ill-informed traders. This leads to intractable issues about identifying who the risk takers and risk acceptors actually are in different situations and how the responsibilities and costs of risk assessment and management could be shared rationally and equitably between the taxpayer and different trade sectors.

5. An interdisciplinary approach

All of the emerging threats and challenges described above invite new framings of disease management as the relationship between agricultural production, the rural environment and society changes. It is imperative that debates around disease control take into account their intrinsic biological and physical factors. It is taken as given that we need to have a thorough understanding of the epidemiology of the diseases, the diagnostics available to recognize their presence and the available means of treating them. However, our understanding of the biology of animal and plant diseases must also inform and be informed through social science research.

As this review illustrates, animal and plant diseases impact upon society in many ways, including through changing landscapes and land use, issues of food security and safety, concerns over animal welfare and ethical food production, and the use of pesticides and GMOs. Societal drivers, in turn, impact upon the conditions for and transmission of disease, ranging from influencing the changing governance and nature of agriculture, food production and trade, to efforts to prevent or control disease outbreaks. The ability to predict future disease risks, taking into account drivers such as climate change, is a fundamental research priority.

The management of animal and plant diseases involves important political and economic choices that are more contestable the more the science is uncertain. For example, early in the BSE crisis, there was considerable scientific uncertainty about whether the prion could transmit to humans, what were the routes and probability of transmission and the likely extent of mortality.

Many persistent, food-borne, public health diseases such as *E. coli* 0157 are a function of complex, multi-causal relationships operating across food chains. Such uncertainty and indeterminacy demand both interdisciplinary framings in research and holistic governance approaches that can incorporate a broader range of evidence. In the past, policy-makers attempting to deal with disease and the contention it causes have taken a narrow scientific approach, sometimes with disastrous consequences..

True interdisciplinarity means not only that scientists and social scientists work together but that both parties have a role to play in problem formulation, strategy formation and problem-solving. This requires a willingness on the part of each to familiarize themselves with the others' scientific literature and vocabulary so that a meaningful exchange can occur.

Collaboration with the social sciences can bring different perspectives and methodologies to help reframe problems, or indeed reveal multiple or disputed understandings and thus expose diverse possibilities and alternative meanings. In the context of infectious disease, this means challenging the artificial barriers that are created by governmental institutions and research cultures, including the divisions between plant and animal diseases, between diseases that affect agricultural production and those that do not, and between endemic and exotic diseases. Transcending the social/natural science divide thus throws open the field of inquiry and the range of possible solutions. Inevitably, therefore, there are diverse approaches to interdisciplinary collaboration.

II. PREVENTING ANIMAL AND PLANT DISEASES FROM BECOMING DISASTERS

Outbreaks of infectious animal diseases such as foot-and-mouth disease, classical swine fever, and avian influenza may have a devastating impact, not only on the livestock sector and the rural community in the directly affected areas, but also beyond agriculture and nationwide.

The risk of introducing disease pathogens into a country and the spread of the agent within a country depends on a number of factors including import controls, movement of animals and animal products and the biosecurity applied by livestock producers.

An adequate contingency plan is an important instrument in the preparation for and the handling of an epidemic. The National Disaster Management Policy requires that all institutions involved draw up a contingency plan which specifies the national measures required to maintain a high level of awareness and preparedness and is to be implemented in the event of disease outbreak.

Under the Ministry of Agriculture and Animal Resources and the Ministry of Health national guards against the entry of foreign pests and diseases by monitoring plant and animal health throughout the region and setting effective agricultural import policies, the Rwanda Agriculture Board in partnership with other related agencie such as the RNP, RBS enforce these policies cooperatively. Additionally, designs and procedural conducts of pre-clearance programs help to mitigate the risk posed by foreign agricultural products before their arrival at Rwanda's points of entry.

The RAB works cooperatively with the States on programs to identify and survey for pests and diseases of concern and conduct control and eradication programs. Additionally, RBA and RBC monitor and regulates shipment of plants, animals, and related materials to prevent the spread of pests and diseases to previously unaffected areas.

A few examples of pest and disease activities include:

Avian Influenza

Institutions such as MINISANTE, MINAAGRI, MIDIMAR, RNP, RDF, have worked together to prevent the introduction of highly pathogenic avian influenza (HPAI) into Rwanda and ensure preparedness in the event of an outbreak. The RAB has made stocked additional vaccines, enhancing surveillance and diagnostic activities, increasing smuggling intervention and trade compliance activities, conducting investigations, carrying out research and development, administering planning and preparedness training, and conducting various activities internationally to combat the virus.

Bovine Spongiform Encephalopathy (BSE)

The RAB is strongly committed to protecting Rwanda animal and public health from bovine spongiform encephalopathy, or BSE. For more than 5 years, the MINAGRI has had in place a number of interlocking safeguards to protect animal and public health in Rwanda from this disease. This approach is science based and has been updated in accordance with recommendations made by the World Organization for Animal Health (OIE).

Asian Longhorned Beetle (ALB)

ALB is a wood-boring beetle that was discovered in New York and Illinois in the late 1990s and in New Jersey in 2002. The RAB program uses an area-wide pest management strategy for eradication that integrates visual survey, control through tree removal and chemical treatment, regulatory activities to prevent pest spread, replanting of removed trees with non-host species, and public outreach.

RECOMMENDATIONS FOR PREVENTION AND MITIGATION

- More attention in general should be placed on animal health threats and disease issues, including implementation of more livestock and crop disease prevention and eradication programs and continued national financial support.
- Many expressed the need for more prevention, control, and eradication of invasive species. This view was especially strong if border areas
- A clear and workable national and district cooperative program for detecting and eradicating foreign pests and weeds was suggested.
- Stricter agricultural trade enforcement and penalties to prevent entry of invasive species proposed
- It is important to initiate Hazard Analysis and Critical Control Points or similar food-safety-enhancing methods for farmer's
- Include line item funding for disease control and related surveillance programs for poultry.
- Continue to fund national and district programs to do surveillance work for avian influenza.
- Harmonize sanitary and phytosanitary standards and initiate national inspection of produce and plants entering the territory
- Provide research grant opportunities to quickly address emerging pests.

III. PREPAREDNESS RESPONSE AND RECOVERY

3.1. Animal diseases

In contrast to natural disasters, most animal epidemics can be prevented or mitigated. Therefore, the framework requires that these options are presented. It is also recognized that prevention, response and recovery is a cyclical process, with prevention the last step in recovery		
Actions	Lead Institution	Involved Institutions
PREPARDNESS		
Establishment of a national animal disaster risks emergency planning committee	MIDIMAR	MINAGRI, RAB
Create awareness and early warning in communities	MIDIMAR	MINAGRI, RAB
Installation of diagnostic capabilities for all high-threat diseases. Linkages shall be established with world and regional reference laboratories. Effective and timely diagnostic testing	RAB	MIDIMAR, MINAGRI
Arrangement for epidemic livestock diseases to be included in national disaster plans so that the police, army and other services can be involved as and when necessary	MIDIMAR	MINADEF, RNP,
Preparation of legislative and administrative frameworks to permit all necessary disease control actions to be implemented without delay	MINIJUST	MINAGRI, RAB
Ensured access to quality-assured vaccines through a vaccine bank or from other sources	RAB	MINAGRI, MIDIMAR
Harmonization of disease control programmes and cooperation with neighboring countries to	MINEAC	MIDIMAR

ensure a regional approach		
To provide early detection of diseases that could have a major impact on animal	MINAGRI	RAB
Implementation of an emergency disease information system including emergency disease-reporting mechanisms	MIDIMAR	MINAGRI
Training of veterinary officers and veterinary auxiliary staff in the clinical and gross pathological recognition of serious epidemic livestock diseases;	MINAGRI	MIDIMAR, RAB
Public awareness programmes for high-threat epidemic livestock diseases that involve improving the veterinary/farmer interface	MIDIMAR	MINAGRI, RAB
Ensuring the safety and security of the commercially produced meat, poultry, and egg products	MINICOM	MINAGRI, RAB
Regular health surveillance of our domestic animal herds and flocks, as well as monitoring animal disease outbreaks around the world.	RAB	MINAGRI
RESPONSE		
Ensured arrangements for involvement of the private sector (e.g. livestock farmers' organizations, veterinaries, livestock traders, commercial farming companies, animal product processors and exporters)	MINICOM	RAB, MINAGRI
Inspect and approve incoming of animals and animal products	RBS	IMMIGRATION, MINAGRI, RAB
Enforce regulations on movement of animals (Quarantine)	RAB	MIDIMAR

Sustained active disease surveillance to supplement passive monitoring	MINAGRI	RAB
Establishment of reliable livestock identification systems for enhancement of disease-tracking capabilities;	RAB	MIDIMAR
RECOVERY		
Identify ways to use revenue generated by the flow of livestock in normal times to develop the capacity and funding required to cope with emergency livestock market interventions.	MIDIMAR	MINECOFIN
Setting up a public communications plan to deal with fear and social disruption of the population	MIDIMAR	MINISANTE, MINALOC
Strengthen customs and border control staff to apply on import and export of livestock	IMMIGRATION	MINAGRI, RAB
Activate any disaster recovery fund provided to compensate for the loss of livestock, and other costs of the incident.	MINAGRI	MINECOFIN, MIDIMAR
Technical assistance and other support for farms and businesses and build prevention into the recovery operation by investing in biosecurity	RAB	MINAGRI, MIDIMAR
Continue to support surveillance systems as they are the best protection against a re-introduction of the disease.	RAB	MINAGRI

3.2. Plant diseases

PREPAREDNESS RESPONSE AND RECOVERY MEASURES

It is critical to designate which government agency or entity has the authority to declare a plant disease emergency, which agency or entity will assume lead authority and clearly define the roles and responsibilities of all participants in a strategic plan for a catastrophic plant disease recovery.		
Actions	**Lead Institution**	**Involved Institutions**
PREPAREDNESS		
Create awareness and early warning in communities	MIDIMAR	MINAGRI, RAB
Establishment of a national plant disease emergency planning committee	MIDIMAR	MINAGRI, RAB
Vaccination and spraying	RAB	MINAGRI
Strengthen disease surveillance programmes	MINAGRI	RAB
Adopt new and appropriate technologies	RAB	MINAGRI
Undertake proper case management of the affected plants	MINAGRI	MIDIMAR, RAB
Introduce disease resistant plants	RAB	MINAGRI
Promote research into pest resistant crops	RAB	MIDIMAR, MINAGRI
Surveillance of crop diseases and monitoring of crop production	MINAGRI	MIDIMAR, RAB
Promote proper post-harvest crop husbandry	MINAGRI	RAB
Diagnosing Samples presenting symptoms in Laboratories	RAB	MINAGRI
Inspection of the plants and plants products at the boarders and all entry points	IMMIGRATION	MINAGRI, RAB
Conduct training and update information needed to conduct effective agricultural inspections	RAB	MINAGRI
Surveys, identify and monitors invasive pests and diseases that can severely harm	MINAGRI	RAB

Identify and assess new pests, and develop methods for response	RAB	MINAGRI
Develop compensation policies and secure the financial means to follow through on compensation promises in the wake of an outbreak	MIDIMAR	MINECOFIN, MINAGRI
Strengthen customs and border control staff to apply sanitary and phytosanitary standards on crops and plants imports and exports	IMMIGRATION	MINAGRI, RAB, MIDIMAR
Provide training and equipment for rapid detection and diagnosis of plant disease outbreaks	MINAGRI	MIDIMAR, MINECOFIN, RAB
Design and support public awareness campaigns that target key behaviors that tend to spread the disease.	MIDIMAR	MINAGRI, RAB
Invest in communications programs that alert producers and consumers to the steps they can take to prevent plant disease.	MIDIMAR	MINAGRI, RAB
Support basic and applied research at national center. Develop new methods for disinfestation, disposal and diagnostics	MINAGRI	RAB
Establish or rebuild laboratory infrastructure for disease identification and treatment	RAB	MINAGRI
Train extension agents in basic disease recognition and response techniques	MIDIMAR	MINAGRI, RAB
Strengthen public policies on plant variety protection and the introduction of updated disease resistant varieties	MIDIMAR	MINAGRI, RAB

RESPONSE		
Establish and maintain surveillance systems based in agricultural extension or operated by commercial producers and community-based groups.	MINAGRI	RAB, MINICOM
Provide training and equipment for rapid detection and diagnosis of disease outbreaks.	RAB	MINAGRI
Design and support public awareness campaigns that target key behaviors that tend to spread the disease.	MIDIMAR	MINAGRI
Invest in rapid response teams that would be responsible for confirmation surveys that determining the traceability and possible expansion of the disease.	MIDIMAR	MINAGRI, RAB
Establish protocol for the destruction of infected plants	MIDIMAR	MINAGRI, RAB
Develop compensation policies and secure the financial means to follow through on compensation promises in the wake of an outbreak.	MIDIMAR	MINAGRI, RAB
Surveys movement of plant materials, products or other materials that could facilitate the spread of the plant disease;	RAB	MINAGRI,
Once the infected area defined, a quarantine area needs to be set up and should be destroyed.	MIDIMAR	MINAGRI, RAB
Activation of a Communication Strategy	MIDIMAR	RAB
RECOVERY		
Build prevention into the recovery operation by investing in biosecurity in new production facilities or enforcing plant variety protection standards.	MINAGRI	RBS, RAB
Financing to the specific characteristics of the crop	RAB	MINECOFIN,

being re-introduced.		MINAGRI
Continue to support surveillance systems as they are the best protection against a re-introduction of the disease.	RAB	MINAGRI
Pass legislation to ban practices that increase risk of new outbreaks and promote the introduction of biologically engineered varieties that carry disease resistant characteristics.	MINIJUST	MINAGRI
Encourage transboundary dialogue and cooperation between neighboring countries to protect against re-introduction	MINEAC	MINAGRI, RAB
Strengthen customs and border control staff to apply internationally recognized standards on crops imported and exported.	RBS	IMMIGRATION, RAB