MTF/CMR/034/STF

SUPPORT TOWARDS IMPROVING THE CONTROL OF TRANSBOUNDARY ANIMAL DISEASES OF TRADE LIVESTOCK

STRATEGIC PLAN FOR THE CONTROL OF FOOT AND MOUTH DISEASE IN CAMEROON

FEBRUARY 2015

Table of Contents

Table of Contents i

List of Abbreviations and acronyms v

List of Tables vii

List of Figures viii

GLOSSARY ix

Results based management terms: ix

Progressive Control Pathway (PCP-FMD) terms: x

EXECUTIVE SUMMARY 1

CHAPTER 1 INTRODUCTION 2

CHAPTER 2 SITUATION ANALYSIS 3

2.1.FMD SITUATION IN THE COUNTRY 3

2.1.1.CLINICAL FMD 3

2.1.2.SEROTYPES AND STRAINS 4

2.1.3.FMD INFECTION 5

2.2.IMPACT OF FMD ON LIVESTOCK AND LIVELIHOODS 7

2.2.1.VALUE CHAIN, STAKEHOLDERS AND IMPACT 7

2.2.1.aTypology of livestock farmers 7

2.2.1.b Livestock management practices 8

i-Housing 8

ii-Reproduction practices 8

iii-Feeding practices 8

iv-The use of animals for other purposes 9

v-The three major signs that make the herdsmen use to identify cases of FMD. 10

vi-Livestock marketing networks 10

vii-Herd health management 11

Implication of small ruminants in the epidemiology of FMD 14

Porcine-ruminant cohabitation and knowledge of porcine FMD 15

2.2.1.c Slaughter houses 15

2.2.1.d Importers and disributors of susceptible livestock and products 16

i. Importers, distributors and traders of susceptible animal products 16

ii. Major importers of livestock and susceptible production material.. 16
2.2.1.e Socio-economic impacts of FMD on different stakeholders in Cameroon. 16
2.3. IDENTIFIED RISK HOTSPOTS... 18
2.3.1.WORKING HYPOTHESIS 18
i-Entry 18
ii-Distribution 18
2-3-2-RISK HOTSPOTS 21
2-3-2-a-Management practices within farms 22
2.3.2.b.VSI Posts.. 22
i-The Douala seaport 22
ii-The Douala International airport 22
2.3.2.c. Slaughter houses and livestock markets 22
2.3.2.d. Livestock trade and marketing systems.. 23
2.4. ORGANISATION OF FMD CONTROL AND THE VETERINARY SERVICES 23
2.4.1.THE VETERINARY SERVICES AND PVS ANALYSIS 23
2.4.1.a. The veterinary service 23
2.4.1.b. PVS analysis... 23
2.4.2 GOVERNMENT TRANSPARENCY AND COMMITMENT TO PARTICIPATING IN REGIONAL FMD CONTROL. 24
2.5. APPROACH TO FMD CONTROL TO DATE 27
2.5.1. EPIDEMIOSURVEILLANCE 27
2.5.2 VACCINATION... 27
2.6. GAP ANALYSIS.. 29
2.6.1. KNOWLEDGE ABOUT FMD DISTRIBUTION AND CIRCULATING SEROTYPES AND STRAINS....... 29
2.6.2 MEASURING THE IMPACT OF FMD IN THE COUNTRY, OVERALL OR FOR DIFFERENT STAKEHOLDERS 29
2.6.3 IMPORTANT ASPECTS OF RISK HOTSPOTS THAT ARE NOT FULLY UNDERSTOOD 29
2.6.4 ORGANIZATION OF FMD CONTROL 29
2.6.5 THE EFFECTIVENESS OF PREVIOUS CONTROL MEASURES 29
2.6.6 LEGAL FRAMEWORK TO ENABLE FMD CONTROL 30
2.6.7 THE MONITORING AND SURVEILLANCE SYSTEM.. 30
CHAPTER 3. BENEFITS OF FMD CONTROL 31

3.1 LIVELIHOODS AND FOOD SECURITY 31
3.2 FINANCIAL CONDITIONS OF PRIVATE STAKEHOLDERS..31
3.3 THE PUBLIC SECTOR..31
3.4 TRADE 31
3.5 REGIONAL AND INTERNATIONAL COMMUNITIES 31
3.6 OTHER EXPECTED BENEFITS 31
CHAPTER 4. FRAMEWORK FOR A RISK-BASED STRATEGY 32
4.1 THE GLOBAL CONTROL STRATEGY..32
4.1.1OBJECTIVES OF THE GLOBAL STRATEGY 32
4.1.2 EXPECTED RESULTS OF THE GLOBAL STRATEGY 32
4.1.3 THE GLOBAL STRATEGY IMPLEMENTATION TOOLS AND PROCEDURES.................................32
4.1.3.a.The FMD Progressive Control Pathway (PCP-FMD) and regional roadmaps.....................33
4.1.3.b. Diagnostic laboratories, reference laboratories/centres, regional and global networks..33
i-Vaccines and vaccination 33
ii-National, regional and international surveillance; epidemiology skills and networks 34
4.2.THE CAMEROON FMD CONTROL STRATEGY 34
4.2.1. PHASE 1 34
4.2.1.a. Objectives..34
4.2.1.b. Expected outcomes of phase 1 34
4.2.1.c. Phase 1 Control activities and measures 35
i-Activities related to herd management practices. 35
i-1-Organisation and Structuring of livestock farmers...35
i-2-Training on good livestock production practices..35
ii-Activities related to livestock movement, trade and marketing practices 36
iii-Activities related to veterinary sanitary inspection. 36
iv-Other activities...37
4.2.2. PHASE 2 37
4.2.2.a. Objective 37
3.2.2.b. Expected outcomes of phase 2 37
i-Phase 2 control activities and measures 37
4.2.3.PHASE 3 38
4.2.3.a. Objectives..38

4.2.3.b. Expected outcomes..38
4.2.3.c. Activities 38
4.2.4. VACCINATION...38
4.2.5 PRESCRIBED ACTIONS IN CONFIRMED SECURED ZONES. 39
CHAPTER 5. OPERATIONAL PLAN...40
5.1. ORGANISATION OF FMD MANAGEMENT 40
5.2. LEGISLATION...41
5.3. BUDGET...42
5.3.1. INITIAL 5 YEAR COST OF FMD CONTROL WITHOUT VACCINATION AT COUNTRY LEVEL.........42
5.3.2. THE COST OF VACCINATION...43
REFERENCES..45
ANNEX..46

List of Abbreviations and acronyms

AGIDT	Agar Gel Immunodiffusion Test
ANOR	National Standardisation Agency
ARG	Argentina
BCL	Boucheries et Charcuteries du Littoral
CAMLAIT	Cameroon Milk Industry
CAR	Cameroon
CC	Communication Capacity
CFA	Communaute Francaise d'Afrique
CIG	Common Initiative Group
DVS	Director of Veterinary Services
ELISA	Enzyme-Linked Immunosorbent Assay
EMPRES	Emergency Prevention System
ERI	Eritiea
FAO	United Nations Food and Agriculture Organization
FMD	Foot and Mouth Disease
FMDV	Foot and Mouth Disease Virus
GAM	Gambia
GDP	Gross Domestic Product
GES	Growth and Employment Strategy
GF-TADs	Global Framework for the Progressive Control of Transboundary Animal Diseases
GLEWS	Global Early Warning System
HPAI	Highly Pathogenic Avian Influenza
Hpi	Hours post-infection
Inhab	Inhabitants
IRAD	Institute of agricultural Research for Development
IRQ	Iraq
KEN	Kenya
Kg	Kilogrammes
KNP	Kruger National Park
Km	Kilometers
MAL	Malawi

MINEPIA	Ministry of Livestock, Fisheries and Animal Industries
MOS	Mozambique
NB	Nota Bene
NCCC-FMD	National Consultative Committee for the Control of FMD
NGO	Non-Governmental organization
OIE	World Animal Health Organisation
PACE	Pan African Programme for the Control of Epizootics
PCR	Polymerase Chain reaction
PCP	Progressive Control Pathway
PVS	Progressive Veterinary Services
RCs	Reference Centres
RLs	Refernce Laboratories
SAT	Southern African Territory
SAU	Saudi Arabia
SDC-BOD	Specialised Divisional Cooperatives with Board of Directors
SODEPA	Societe de developpement et D'Exploitation des Productions Animales
TAD	Transboundary Animal Disease
TDC	Tadu Dairy Cooperative
UK	United Kingdom
USDA	United States Department of Agriculture
VS	Veterinary Services
VSI	Veterinary Sanitary Inspection
WAHID	World Animal Health Information Database
WAHIS	World Animal Health Information System
WRLFMD	World Reference Laboratory for Foot and Mouth Disease
ZIM	Zimbabwe

List of Tables

Table 1. Spatial distribution of identified serotypes in the various divisions of Cameroon

Table2. Correlation between feeding, transhumance and exposure to risks of FMD

Table3. Regional Expenditure on drugs for FMD and animals that died of FMD in the last 12 months

Table4. PCP and PVS activities prescribed for phase 1.

Table5. Cost of the first five years of the Cameroon strategic plan.

Table6. Cost of vaccination including PVM

List of Figures

Figure 1. Probang collection in Badzama, East Region.

Figure 2. Sample collection and disinfection of probing cup before re-use

Figure 3. Blisters from ruptured vescicles and epithelial sample collection from toungue of cattle in Badzama, East Region

Figure 4. Average cattle distribution in Cameroon

Figure 5. Distribution of membership in farmer' organisations

Figure 6. Typical private pasture farm in the East Region of Cameroon.

Figure 7. Predominance of wild animals in cattle grazing areas

Figure 8. National distribution of farmers who would buy FMD infected animals

Figure 9. Distribution of farmers whose cattle developed FMD two weeks after they were bought from the local market.

Figure 10. Distribution of FMD cases in 2012

Figure 11. Practice of empirical vaccination in Cameroon.

Figure 12. Spatial distribution of the practice of empirical vaccination

Figure 13. Distribution of herders per type of treatment administered in Regions

Figure 14. Distribution of small ruminants in mixed herds

Figure 15. Distribution of FMD cases in small ruminants in 2012.

Figure 16. Distribution of cattle mortality due to FMD in 2012.

Figure 17. Relative distribution of antelope in cattle grazing and transhumance zones

Figure 18. Relative distribution of buffaloes in cattle grazing and transhumance zones

Figure 19. Relative distribution of warthogs in cattle grazing and transhumance zones

Figure 20. Cattle on transhumance in the Waza game reserve and common drinking point in the Waza game reserve of the Far-north region

Figure 21. Distribution of FMD cases in 2012.

Figure 22. Organigram of the Department of Veterinary Services

Figure 23. The Foot and Mouth Disease Progressive Control Pathway

Figure 24. Prioritization of activities besides vaccination and distribution of allocated funds.

GLOSSARY

Results based management terms:

Goal: Refers to the national objectives which FMD control is designed to contribute to, eg improving livelihoods. The goal helps set the macro-level context within which FMD control fits, and describes the long-term impact that the FMD control is expected to contribute towards (but not by itself achieve).

Strategic objective: Refers to what FMD control itself is expected to achieve in terms of sustainable development results, if the relevant assumptions of FMD control design are correct. It is the positive developmental change that FMD control would produce if it were completely successful (and the assumptions were fully accurate). Examples might include increased animal health and production.

Component Objectives: Where FMD control is relatively large and has a number of components (output/work program areas) it can be useful to give each component an objective statement. These statements should help provide a logical link between the outputs of that component and the overarching objective. Examples may be the reduction of FMD transmission at the time of seasonal migration from X to Y in the spring of each year, or to reduce FMD transmission to new areas through the largest markets.

Tactics: Refer to the approach taken/decided to complete the component objective. It defines **how** a certain component of FMD control is going to be tackled. Examples may be the compulsory vaccination of 100% of young stock that will migrate, including booster dose, or an awareness campaign to owners in the areas of how to minimize the risk.

Activities: Are the actual actions taken and tasks implemented in order to achieve the component objective, through the strategies defined. These actions are part of the planned work of the strategies. Examples might include: Identification of all locations with which have young stock that will migrate on this route 4 months prior to migration, and estimate number of heads

Indicators: Measures of progress or lack of progress used to assess steps forward towards meeting stated (component) objectives. An indicator should provide, where possible, a clearly defined unit of measurement and a target detailing the quantity, quality and timing of the expected result. For example, the indicator for vaccination may be the vaccination coverage of a specific subsector of livestock per vaccination campaign

Target: The value, directly related to the indicator, used to define where the strategy is heading for. For example, using the example under indicator, the target for vaccination coverage may be 90% of livestock per vaccination campaign

Means of verification: Source of information that needs to be collected to qualify and/or quantify the defined indicators. It needs consideration how information will be collected, who will be responsible and the frequency with which information should be provided.

Progressive Control Pathway (PCP-FMD) terms:

Bias (in epidemiology)**:** An error in the design or implementation of a study, which produces results that are consistently distorted in one direction. Bias should be considered at the level of data collection (i.e. sampling method), data recording and laboratory analysis. Some biases might be unavoidable, but these should be described and communicated transparently.

Biosecurity: Implementation of practices that create barriers in order to reduce the risk of the introduction and spread of disease agents. Three principle elements of biosecurity are segregation, cleaning and disinfection (from FAO Biosecurity for Avian Influenza Handbook)

Constraints: A constraint is a limitation or restriction. In this case, it refers to the regulations, investment in human capital and infrastructure that limit what a stakeholder is able to do. For example, only certain FMD vaccines might be licensed for use within a country; or washing transport vehicles might be constrained by lack of running water.

Critical risk control point: A risk hotspot where <u>feasible</u> control measures exist to mitigate the risk. Feasible control measures implies that they can be implemented from both the technical and socio-economic standpoint.

Direct losses: A loss that is the immediate result of the hazard of concern, in this case FMD infection. For FMD, direct losses include: lameness (especially impacts draught power), weight loss, increased mortality in young animals, abortion and decreased milk yield.

Enabling environment: The 'environment' refers to the underlying setting or context, in this case in which animal production occurs, FMD circulates and control measures are applied. The 'environment' includes the socio-economic status of the country, the laws and norms that govern all aspects of the country (including animal production and trade), the proficiency and resources of the Veterinary Services. An 'enabling environment' indicates that this underlying setting and conditions are favourable to the control of FMD.

Epidemiological unit (epi-unit): A group of animals with a defined epidemiological relationship that share approximately the same likelihood of exposure to a pathogen. This may be because they share a common environment (e.g. animals in a pen), or because of common management practices. Usually, this is a herd or a flock. However, an epidemiological unit may also refer to groups such as animals belonging to residents of a village, or animals sharing a communal animal handling facility. The epidemiological relationship may differ from disease to disease, or even strain to strain of the pathogen. (source: OIE Terrestrial Code)

Husbandry systems/livestock sector: the different methods used to breed, raise and care for livestock.

Extensive husbandry system: Characterized by low animal density, animals are grazing or scavenging and the producer may not see them regularly (e.g. cattle or sheep may graze on a pasture for several months without regular contact with the producer)

Intensive husbandry system: Characterized by high animal density, feed provided by the producer, producer has regular contact with livestock.

Impact: Measure of the consequences of one 'thing's' (here: FMD's) influence upon another. The impact of FMD refers to the magnitude of the consequences of FMD entry and/ or spread. In this case, the consequences may be epidemiological, environmental and/or economic, and may be direct or indirect.

Epidemiological consequences refer primarily to the probability and extent of onward spread, given FMD infection in an animal/sector/area.

Economic consequences include both direct losses (production losses, losses due to morbidity and mortality) and indirect losses (due to lost trade, costs of control measures etc).

Environmental consequences are foreseen to be primarily related to resultant control measures, such as large-scale disposal of carcasses (eg burial), construction of fences.

Incentives: Something, such as the fear of punishment or the expectation of reward, that induces action or motivates effort.

In this case, incentives are the factors that cause a stakeholder to conduct their business in the way that they do. The most important incentives are usually <u>monetary gain and improved production</u>. For example, a dealer (stakeholder) might choose to sell animals at a particular market because that is where they can get the highest price (monetary gain). Or a producer chooses to vaccinate their animals because they believe that they will be more productive (or chooses not to vaccinate because they believe it will reduce production). Or a veterinarian might re-use needles in different farms to save money. All these are incentives that impact FMD risk.

Incidence : The number of cases of FMD in a defined population within a specific period. It is calculated by:

$$I = \frac{\text{the number of FMD infected epidemiological units in a given period of time (eg. 1 year)}}{\text{the total number of susceptible epidemiological units}}$$

Indicators: Indicators are measurements that can be repeated over time to track progress toward achievement of objectives.

***I**mplementation indicators* "indicate" the extent to which planned activities have been conducted, for example the percentage vaccination coverage that was attained in a sector or zone, the number of markets that had surveillance visits, the percentage of outbreaks for which the serotype was identified etc.

Impact indicators measure whether the Plan's objective is being achieved (e.g. percentage decrease in FMD incidence in a certain area or sector over 3 years, or the percent increase in profit or productivity in a given period of time).

Monitoring: Ongoing efforts directed at assessing the FMD status of a given population. This includes
routine recording, analyses and distribution of information related to the disease.

Non-structural protein (NSP) serosurvey: Sampling a population to determine the prevalence of NSP antibodies. Antibodies to NSP will be usually present in animals naturally infected by FMD virus, but NOT those that are vaccinated by a purified vaccine. Therefore, a carefully designed NSP serosurvey can be used to estimate the incidence of FMD in a population.

Outbreak investigation: A thorough case-study that describes the clinical presentation of the disease, verifies the diagnosis through laboratory testing, identifies the source and common mechanisms of spread, as well as the causative serotype. Ideally, there should Standard Operating Procedures and standard data recording forms should be developed and used for these investigations.

Risk: measure of the combination <u>of probability and impact</u> of FMD entry and/or spread

Risk hotspot: Point in production or marketing network where there is a high probability and/or consequence of FMD entry/spread. It may or may not be possible to mitigate the risk associated with the hotspot.

Risk-based control: Control measures that are selected based on their effectiveness at reducing the probability and impact of FMD entry and/or spread. Usually these will be identified through risk analysis, and mitigate risk at 'critical risk control points'.

Risk pathways: The risk pathway describes all the stages in the biological process that lead to theunwanted outcome. A risk pathway is a series of conditions that must be met, or events
that have to occur, in order for the unwanted outcome to occur (FAO. 2011. A value chain approach to animal diseases risk management.)

Robust epidemiological data: refers to data that are appropriate to generate the desired information and as reliable and free from bias as possible.

Stakeholders: A stakeholder is any person, group, or institution that—positively or negatively—affects or is affected by a particular issue or outcome. As such, stakeholders in FMD control can include producers of all types of susceptible livestock, vaccine suppliers, livestock transporters, veterinarians, dealers, animal health workers, consumers…

Socio-economic drivers: Social and economic factors that provide impulse or motivation; in this case the reasons behind the ways of raising and marketing (selling) livestock

Surveillance: The term *disease surveillance* is used to describe a more active system than monitoring and implies that some form of directed action will be taken if the data indicate a disease level above a certain threshold. Therefore, disease surveillance is made up by at least three components: (1) a defined disease monitoring system, (2) a predefined disease intervention strategy (directed action), and (3) a defined threshold of disease frequency.
Targets: A desired goal or aim to be achieved, in this case they should be measurable.

Implementation targets refer to goals set for the activities within the Strategic Plan, such as the vaccination coverage that should be achieved, number of surveillance visits that should be done within a year, the percentage of outbreaks for which the serotype should be identified.

Impact targets refer to the desired reduction in FMD incidence or FMD losses that occur because of the implementation of the strategy.

Transmission pathways: The routes and mechanisms by which a disease spreads from animal-to-animal, farm-to-farm and/or region-to-region.

Vaccination coverage (VC): Percentage of a target population that are immunized in a specified time period. Vaccination coverage is often reported in relation to a mass vaccination campaign, and may be reported at the animal level and/or epi-unit level.

$$\boldsymbol{AnimallevelVC} = \frac{Number of animals that received at least\ 1\ dose of FMD vaccine}{total number of susceptible animals}$$

When calculating animal level VC, the target population must be specified and may refer to animals within an epi-unit, district, region, province or country. For primo-vaccinates, it may be appropriate to only count animals who receive both the initial vaccination plus a booster.

$$\boldsymbol{EpiunitlevelVC} = \frac{Number of epiunits that were vaccinated}{total number of susceptible epiunits}$$

When calculating epi unit level VC, a ‘vaccinated epi-unit’ must be specifically defined and may include epi-units where the animal-level VC exceeds a specified minimum (e.g. epi-units may be considered “vaccinated” if <u>at least</u> 80% of susceptible animals in that unit have been vaccinated in the last 6 months).
Value chain: Description of all systems involving FMD susceptible species from input suppliers, through producers of animals, to the marketing system, processers and consumers. Importation of relevant animals and animal products as well as movements of animals associated with transhumance should also be described. It is important to describe the nature of the links between the components in the system, and to include consideration of <u>*why*</u> the network is structured as it is (economics, incentives, governance).
Working hypothesis: A tentative explanation for a set of observations, that is meant to be reviewed for accuracy, refined and improved as more information becomes available

EXECUTIVE SUMMARY

Foot and mouth disease (FMD) is the most contagious disease of mammals and has a great potential for causing severe economic loss in susceptible cloven-hoofed animals such as cattle, pigs and small ruminants. Due to its severe impact on trade in animals and animal products, it is the most important Transboundary Animal Disease (TAD) in the international context.

Cameroon, shares borders with six countries across two sub regions, and as the major livestock transit route between West and Central Africa,it is greatly exposed to this TAD and its economic consequences.

Livestock production provides 30% of the income of the rural population and accounts for 8% of the GDP of Cameroon, and the national development strategy the, Growth and Employment Strategy Paper (GESP) prescribes the development of short cycle speculations, amongst which, sheep, goats and pigs as well as increasing the quality and quantity of cattle production. This is in a bid to attain the objectives of the rural sector strategy, in attaining food self-sufficiency, by increasing meat and milk consumption from 13.3kg/inhab/year to 23kg/inhab/year by 2020 and from 9.5kg/inhab/year to 15kg/inhab/year respectively; and eventually exporting excesses to curb the trade imbalance (GESP, 2009).

FMD constitutes the biggest threat to the attainment of these objectives as it is the most economically important animal disease, whose endemicity automatically precludes trade of cattle, sheep, goats and pigs, as well as their products. This implies the health and productivity of circa 7 million cattle, 3.5 million sheep, 4 million goats and 1.7million pigs threatened by 64 diseases in 1.

The average cost of FMD treatment in Cameroon is estimated at 80 000F CFA/herder/year with on drugs to treat FMD and the average annual expenditure on drugs for the treatment of FMD is estimated at 32 000 000 000 F CFA (32 Billion F CFA).Furthermore each herder reportedly loses 1 adult cattle and 2 calves to FMD per year, costing the economy 30,000,000,000 F CFA (30 Billion FCFA) annually.Therefore, the total average annual direct cost of FMD in Cameroon is circa 62 Billion F CFA.

The less perceptible, but more important indirect cost associated with drop in meat and milk production, high costs of meat and milk, undernourishment and the general negative trade balance incurred in a bid to satisfy local demand are not easily quantified but could be qualitatively described as exorbitant.

This strategic plan is the outcome of a systematic and comprehensive nationwide assessment of the epidemiological parameters of the disease and its associated risk factors. Its main objective is to substantially reduce the impact of FMD on the livestock sector and permit Cameroon to attain stage 3 of the OIE/FAO progressive control pathway. To that effect about 4 531 500 000F CFA will be used over a five year span, for vaccination, post vaccination monitoring, reinforcing the performance of veterinary services, improving livestock management practices and controlling livestock movement.

CHAPTER 1 INTRODUCTION

Foot and mouth disease (FMD) is the most contagious disease of mammals and has a great potential for causing severe economic loss in susceptible cloven-hoofed animals such as cattle, pigs and small ruminants. There are seven serotypes of FMD virus (FMDV), namely, O, A, C, SAT 1, SAT 2, SAT 3 and Asia 1. In a bid to curb the nefarious effects of this disease on the Cameroonian economy, it was deemed necessary to elaborate a control strategy based on available data.

There had never been a systematic and comprehensive effort to assess the epidemiological parameters of the disease nationwide and its associated risk factors. Complementary and updated data was collected from susceptible livestock.Virus entry points and distribution pathways were assessed.All risk factors were systematically assessed and analysed for a technically and economically realistic and feasible control strategy to be conceived.

This involved an analysis of disease determinants and virus isolation and sequencing of 2400 bovine samples obtained from 480 herds/epidemiological units by a three stage sampling design based on the National Census Bureau's data base. A preliminary selection of sampling zones was done to select zones with at least 20 livestock producing families and 200 heads of cattle, followed by a random sampling of 5 herds per zone and a final random sampling of 5 animals per herd.

The sampling techniqueused for non-clinical animals was the probang. Samples fromclinical cases were collected from vesicles and other lesions. These were used for virus isolation and sequencing.Questionnaires were administered for risk analysis.

Aligned to the global strategy for the control of FMD and its prescribed PCP, this strategy which is presented on the OIE/FAO recommended RBSP template for PCP stage 1 countries contains amongst other things:

- The FMD situation in the country
- The impactof FMD on livestock and livelihood
- Working hypothesis and risk hotspots
- Organisation of veterinary services and prior control efforts
- Gap analysis
- The proposed FMD control strategy and operational plan
- The budget.

Its main objective is to reduce the impact of FMD in the country and sustainably mitigating all identified risk factors so as to attain PCP stage 3 after 5 years. To that effect all PCP and PVS stage one and two activities will be carried out along with targeted vaccination during the five year span.

CHAPTER 2 SITUATION ANALYSIS

2.1. FMD SITUATION IN THE COUNTRY

2.1.1.CLINICAL FMD

Prior to 2012, there had been very little comprehensive work done, at national level on the state of FMD in Cameroon there was thus a dearth of data and information on the epidemiology of the disease and the complete absence of any national epidemiological survey.
The first-ever comprehensive assessment of the epidemiological status of the disease in the country, was done in 2012, and it involved an analysis of disease determinants and analysis of 1000 bovine samples obtained from 500 herds/epidemiological units by a three-degree sampling of cattle populations over the national territory.

Samples of two types; epithelial tissue from clinical cases, and probangs from clinically healthy or recovered were collected in the 500 herds visited.


Figure 1. Probang collection in Badzama, East Region.


Figure 2. Sample collection and disinfection of probing cup before subsequent re-use

Figure 3. Blisters from ruptured vescicles and epithelial sample collection from toungue of cattle in Badzama, East Region

2.1.2.SEROTYPES AND STRAINS

A review of existing literature in 2000 by *Tanya et al.* identified three serotypes and summarised the history of their occurrence as presented below.

Serotype A:

- Since 1931, Serotype A was identified in cattle, and later in: 1975,in the North-west Region; 1975, in the East region; 1976, in the West Region; 1985, in the Adamaoua Region; and 1988 in the North Region. (Tanya et al., 2006)
- In 2005, 3 out of 119 bovine sample collected in the Vina Division of the Adamaoua region within the framework of the Pan African control of epizootics project (PACE) tested positive for serotype A. (Tanya et al., 2006)

Serotype O:

- Serotype O was first identified in cattle in 1931 and up to 1959 in the Adamaoua Region, and later in 1989 and 2000. It was also identified in the North-west region in 1988.(Ekue et al., 1990)
- Serotype O was first identified in pigs in the Adamaoua Region in 2000. This was in trade pigs coming from the Far-North Region. (Tanya et al., 2006)
- In 2005, 25 out of 119 bovine sample collected in the Vina Division of the Adamaoua region within the framework of the Pan African control of epizootics project (PACE) tested positive for serotype O. (Tanya et al.,2006)

SAT2:

- The firstreported cases of serotype SAT2 were 18 positive bovine samples isolated in the Adamaoua Region in 2000. (Bronsvoort, 2003)
- Later, in 2005, 54 out of 119 bovine samples collected in the Vina Division of the Adamaoua region within the framework of the Pan African control of epizootics project (PACE) tested positive for serotype SAT2. They also concluded that serotype A too had been endemic in

Cameroon for many decades with new strains evolving and causing outbreaks. (Tanya et al., 2006)

Tanya et al. attributed the SAT2 first isolated in the Adamaoua in 2000 to cattle trade from CAR and East Africa though without much evidence due to lack of isolates from the said countries for comparison.

FMD genome was detectedby classical PCR in 36 out of 455 probang samples in LANAVET, while all 53 epithelial tissue samples collected from clinical cases tested possitive for either SAT2. O, SAT1, Aor a combination of more than one of these serotypes by Ag detection ELISA. SAT2 was predominant followed by SAT1 and O of equal prevalence, while A was least prevalent. Detailled results are in annex.

2.1.3.FMD INFECTION

LANAVET submitted 46 of the possitive samples (22 probangs and 24 vescicular tissue) to the World Refernce Laboratory for FMD (WRLFMD), Pirbright, UK for confirmation and sequencing.

Of 46 samples diagnosed possitive by LANAVET in 2014, two serotypes were confirmed by the WRLFMD in Pirbright; A and SAT2. FMD virus genome was detected in the majority of the samples though no virus was isolated, while no FMD genome was detected in some of the samples tested possitive by LANAVET.

The table below, depicts the spatial distribution of serotypes based on theLANAVET and WRLFMD results.

Table 1. Spatial distribution of identified serotypes in the various divisions of Cameroon

No	Region	Division	A	O	SAT1	SAT2	Positive untyped (+)
1	Adamaoua	Vina					+
		Mbere					
		Faro et Deo					+
		Djerem					+
2	Centre	Mbam et kim					+
		Nyong et So'o					+
3	East	Lom et djerem					+
4	Far-north	Logone et Chari					+
		Mayo Kani					
		Mayo Danay					
		Mayo Tsanaga					+
5	North	Benoue					+
		Faro					
		Mayo Louti					+
6	North-West	Donga-Mantung					+
		Bui					+
		Mezam					+
		Ngoketunjia					
		Menchum					

7	South	Dja et Lobo					+
		Mvila					+
8	South-West	Fako					+
9	West	Nde					+
		Noun					

2.2. IMPACT OF FMD ON LIVESTOCK AND LIVELIHOODS

2.2.1. VALUE CHAIN, STAKEHOLDERS AND IMPACT

2.2.1. aTypology of livestock farmers

Ninety percent of cattle keepers are of the male sex and the livestock management system ranges from extensive and semi-intensive to intensive. The figure below depicts the distribution of cattle surveyed over the national territory.

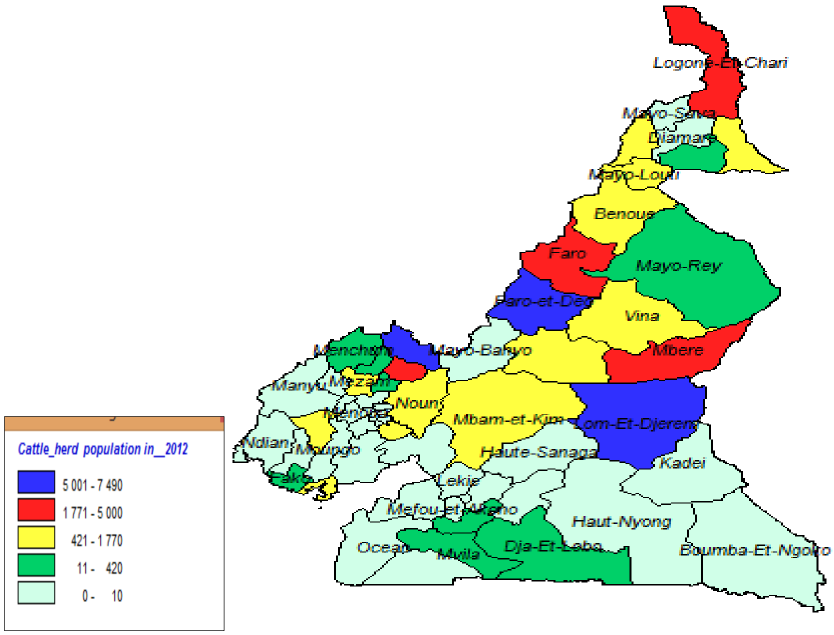


Figure 4. Average cattle distribution in Cameroon

The survey results show that, 30% of the livestock keepers who are members of farmers' organization are from the Adamaoua region, followed by the North-west Region with 29% and the East with 15% as seen in figure 5.

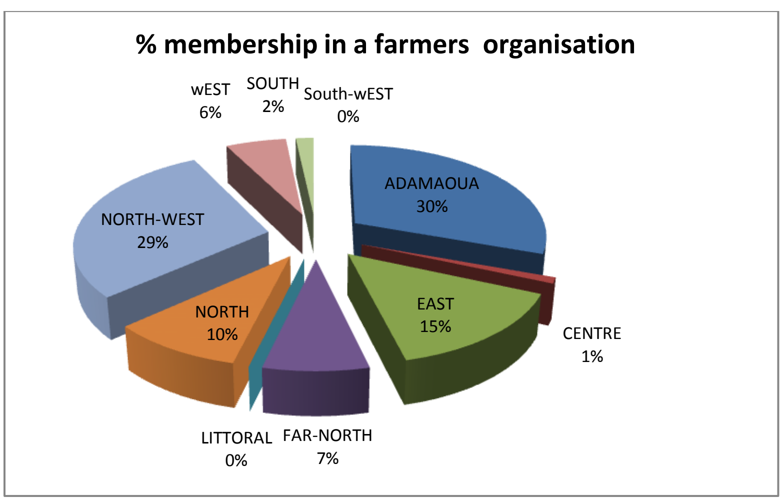


Figure 5. Distribution of membership in farmer' organisations

This could explain the predominance of good livestock management practices in these regions. For example, the survey results show that, 36% of pasture producers are in the North-west Region, followed by the Adamaoua and East with 34% and 20% respectively.

2.2.1.b Livestock management practices

*i-**Housing***

In Cameroon, about 69.5% of cattle herders house their animals in pens, sheds, or fences at night, with close to 100% in the South region, followed by 77% in the East.

More than 72% of herds that spend their night in open fields mixed with other herds reported cases of FMD in 2012.

ii-***Reproduction practices***

Artificial Insemination is not a common practice and is strictly limited to Government institutions (SODEPA ranches and IRAD Stations), and some private dairy farmers in the North-west (Tadu Dairy Cooperative Society), Adamaoua, and 70% of those practicing it are aware of the regulations rules and standards through support from NGOs, MINEPIA and IRAD who provide training for interested persons. However, 68% of herders lend out the bulls to neighbours for breeding purposes while 60% borrow bulls from neighbours for breeding purposes. The practice is highest in the NW with 91% of herders reportedly lending their bulls out, followed by the Adamaoua, Far-north and north Regions. This is understandable for the Adamaoua and north-west Regions where most herders belong to organizations but not so in the other regions.

iii-Feeding practices

In Cameroon, 52% of herders cultivate pasture, 87% use common grazing land and 95% hire herdsmen to watch over their herds when grazing. Close to 92% of herders in the North-west region, cultivate pasture, followed by the East and Adamaoua regions with 91% and 77% respectively. Only 1% of the herders in the Far-north region reportedly cultivate pasture. The North-west region has 97% of its herders using common grazing land because most of the cultivated pastures belong to farmer oganisations. This also explains the 86% in the East and 79% in the Adamaoua. While the 96% of herders using common grazing land in the Far-north, as well as the 74% in the North, is because of lack of pasture.

The figure below depicts a typical private pasture farm in Bazzama, East Region, Cameroon.

Figure 6. Typical private pasture farm in the East Region of Cameroon.

However, 90% of herders who used common grazing land reported having come across herds infected with FMD during grazing at least once. Thus, common grazing is clearly a major cause of FMD transmission in Cameroon. The table below presents the correlation between feeding, transhumance and exposure to risks of FMD in the different regions of Cameroon.

Table2. Correlation between feeding, transhumance and exposure to risks of FMD

	Common grazing herds that had signs of FMDV in the last 12 months (%)	Proximity of grazing area to transhumance route (%)	Proximity of grazing area to cattle market route (%)	Practice of transhumance (%)	FMD positive transhumance herds (%)
AD	63	63	46	11	57
CE	52	43	87	48	55
ES	73	75	54	7	50
FN	90	96	95	70	98
LT	75	67	92	58	86
NO	82	77	63	44	88
NW	92	70	46	42	90
OU	70	77	63	73	72
SU	10	10	10	0	0
SW	0	6	19	69	0

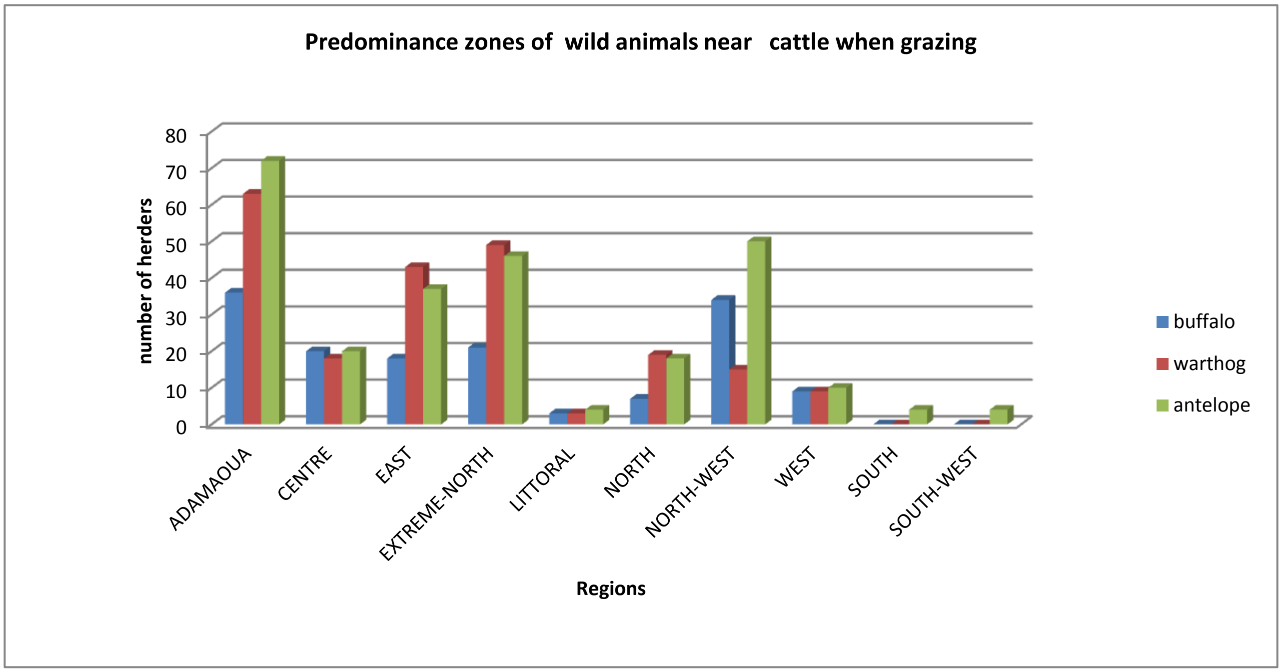


Figure 7. Predominance of wild animals in cattle grazing areas

iv-The use of animals for other purposes

In Cameroon livestock and crop farming are very integrated and most farmers are in essence agropastoralists and use their animals for plowing and other purposes. They do lend the animals to other farmers for similar purposes and this is usually a major source of disease because during the farming season a grazier can lend out several bulls to different farmers in different destinations on a daily basis. No effort is made to ascertain the FMD status of the area or that of the herds therein. This is also one of the most common practices that bring cattle in contact with pigs because most crop farmers own pigs and when the draft animals arrive, they are watered and fed in close proximity and with same utensils.

v-The three major signs that make the herdsmen use to identify cases of FMD.

In Cameroon, ninety-six percent of herders identify excessive salivation as a sign of FMD; ninety-eight percent recognize foot lesions of FMD as a sign of the disease and, ninety-seven percent correctly associate FMD tongue lesions to the disease.
From pictures presented to them, ninety-one percent of herdsmen can differentiate between Lumpy Skin Disease and FMD, while ninety-five percent can identify FMD foot and mouth lesions.

vi-Livestock marketing networks

Livestock marketing in Cameroon is involves transactions in conventional marketing infrastructures generally constructed and owned by the Government, but the greater majority of sales and acquisition is done privately between herders in grazer communities. 32% of herders declare buying their cattle from conventional cattle markets and the sales procedure there involves the payment of taxes by the seller, upon arrival at the market with the animals, presentation of the animals in the sales pen together with animals of other sellers, sales transactions with potential buyers and ultimately sale of the animals. Unsold animals are taken back to the herd.
Sales of livestock is done by the owners themselves or livestock traders. Livestock traders move from farm to farm buying livestock from grazers in the major production zones, assemble them in a given locality under the care of a temporary herdsmen, and then transport them on foot, by lorry or by train to the major markets in cities. The major production zones are the north-west, the Adamaoua, the Far-north and the North regions. The East region though not a major production zone, is a major transit zone for livestock from the Central African Republic.
The livestock from these zones are sold in the other regions of the country and also exported. Major markets are the cities of Yaoundé, Douala, Bafoussam, Limbe, Ebolowa and Bertoua.
Export markets for local production include Nigeria, Gabon, Congo and Equatorial Guinea.
Another type of marketing is that which involves transit livestock from the Central African republic, Chad, Sudan and Ethiopia which pass through Cameroon to Nigeria, Gabon, Congo and Equatorial Guinea. This is supposed to be a more organized and regulated marketing system with VSI done before entry and animals from ECCAS countries are expected to have passports before entering and throughout their stay and transit in Cameroonian territory. Transit is generally on foot and the animals are not expected to be sold in Cameroon.
Seventy percent of Cameroonian herdsmen can easily identify FMD in animals in a cattle market but 8% would still buy an animal suffering from FMD if the price was advantageous.
The results show that, 31% of those who would buy an infected animal are from the North-west followed by the North and the East with 14% and 12% respectively as shown in the illustration below.

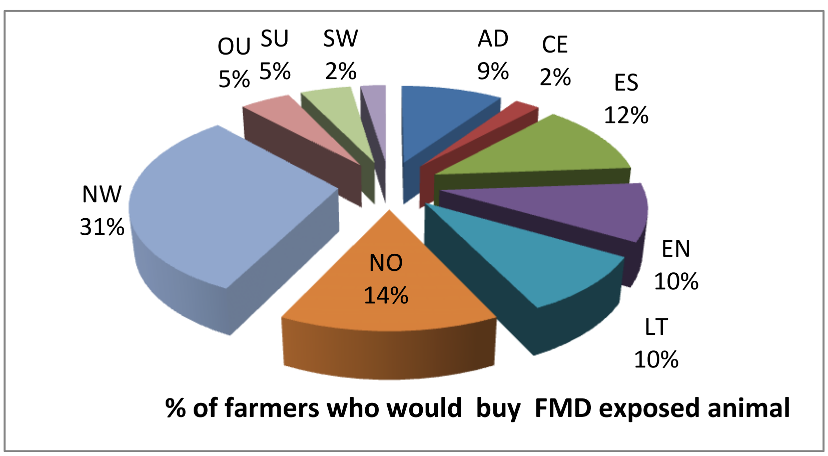


Figure 8. National distribution of farmers who would buy FMD infected animals across regions

In Cameroon, 32% of herders buy stock from their local markets and 25% of those who acquire animals from their local markets report cases of FMD in the newly purchased animals at most 2 weeks later. This clearly indicates that despite having a good knowledge of the disease, farmers still sell FMD affected animals.

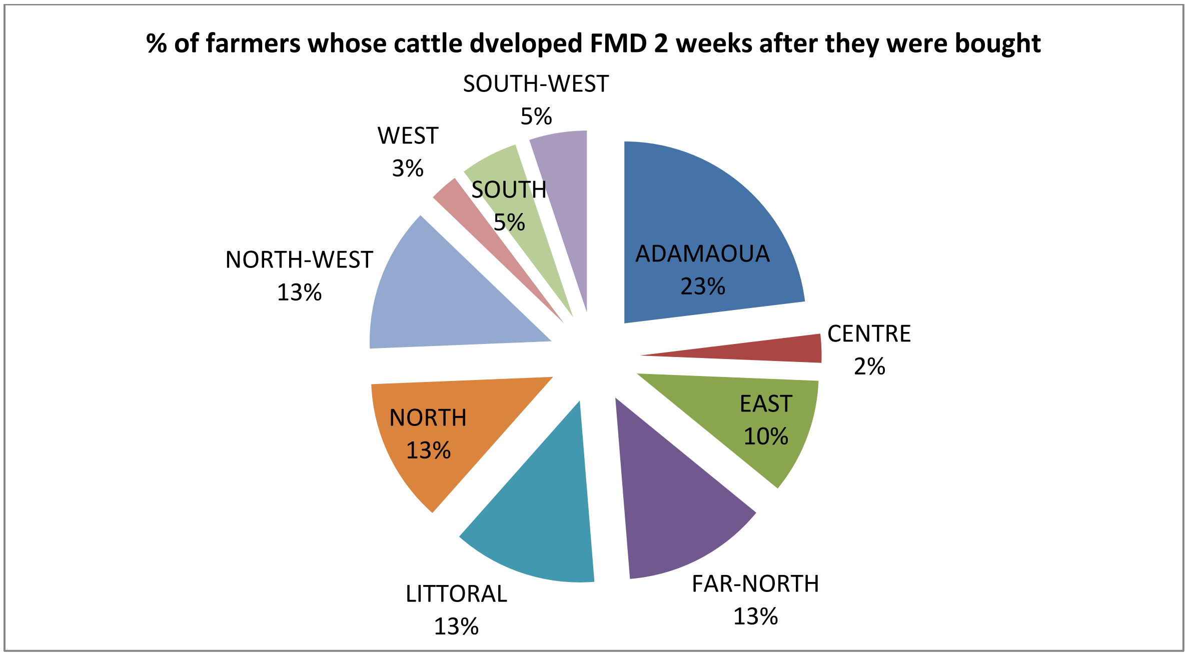


Figure 9. Distribution of farmers whose cattle developed FMD two weeks after they were bought from the local market.

vii-Herd health management

In 2012, 92% of Cameroonian herders reported cases of FMD and during outbreaks only 30% separated the sick animals from the rest of the herd, the remaining 70% kept the sick animals with the rest of the herd. Seventy five percent of herders consulted a veterinarian for cases of FMD and 96% administered treatment against FMD, which could range from antibiotics, anti-inflammatory etc. The relative distribution of FMD reported cases in 2012 is as presented in below.

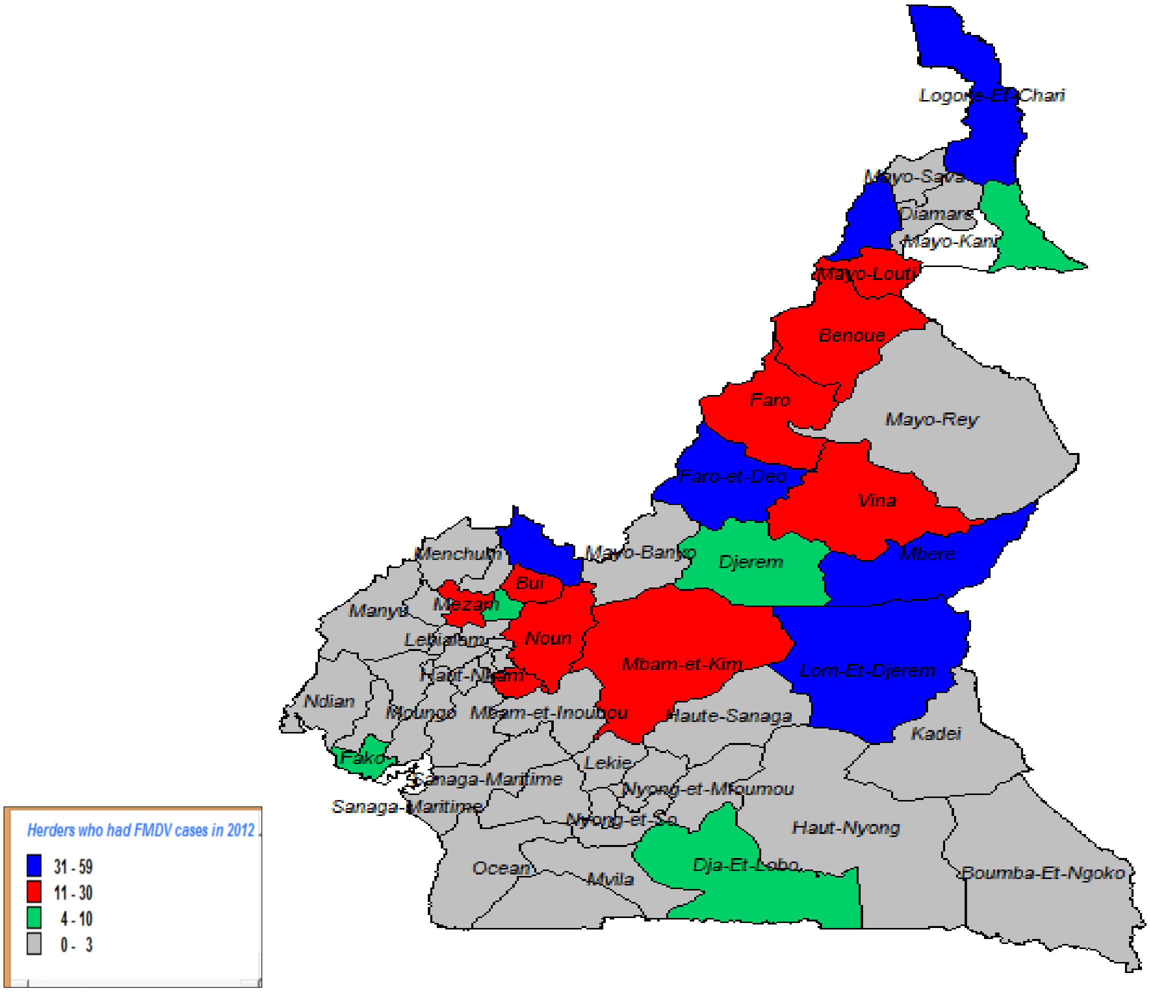


Figure 10. Distribution of FMD cases in 2012

The distribution of those who separated the sick animals from the rest of the herd is as presented in the figure below.

It can be seen that the practice is more common in the regions earlier identified as having a greater number of grazers belonging to grazers' organizations. These are the North-west, Adamaoua and the East regions

In Cameroon there is a common practice called empirical vaccination whereby herders on discovering a clinically affected animal, allow the sick animal to contaminate the rest of the herd so they will have to deal with the disease in their herd at once instead of having a sequence of cases over a longer period. The practice consists of having the sick animal feed on a salt meal or honey along with rest of the herd. In 2012, 40% of herders in the country reported carrying out the practice with highest rate being in the Far-north where 54% of herders there practice it, 49% in the Adamaoua and North-west followed by the East andNorth regions with 32% and 30% of farmers respectively. An illustration of the distribution of the practice as presented in the figure below.

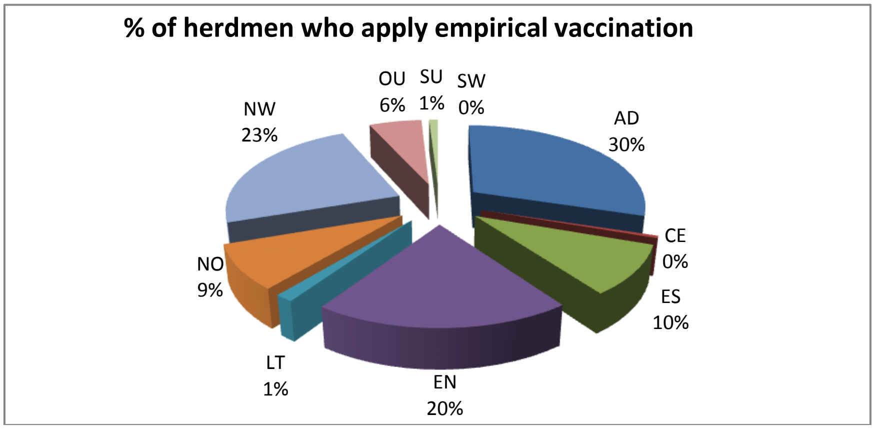


Figure 11. Practice of empirical vaccination in Cameroon.

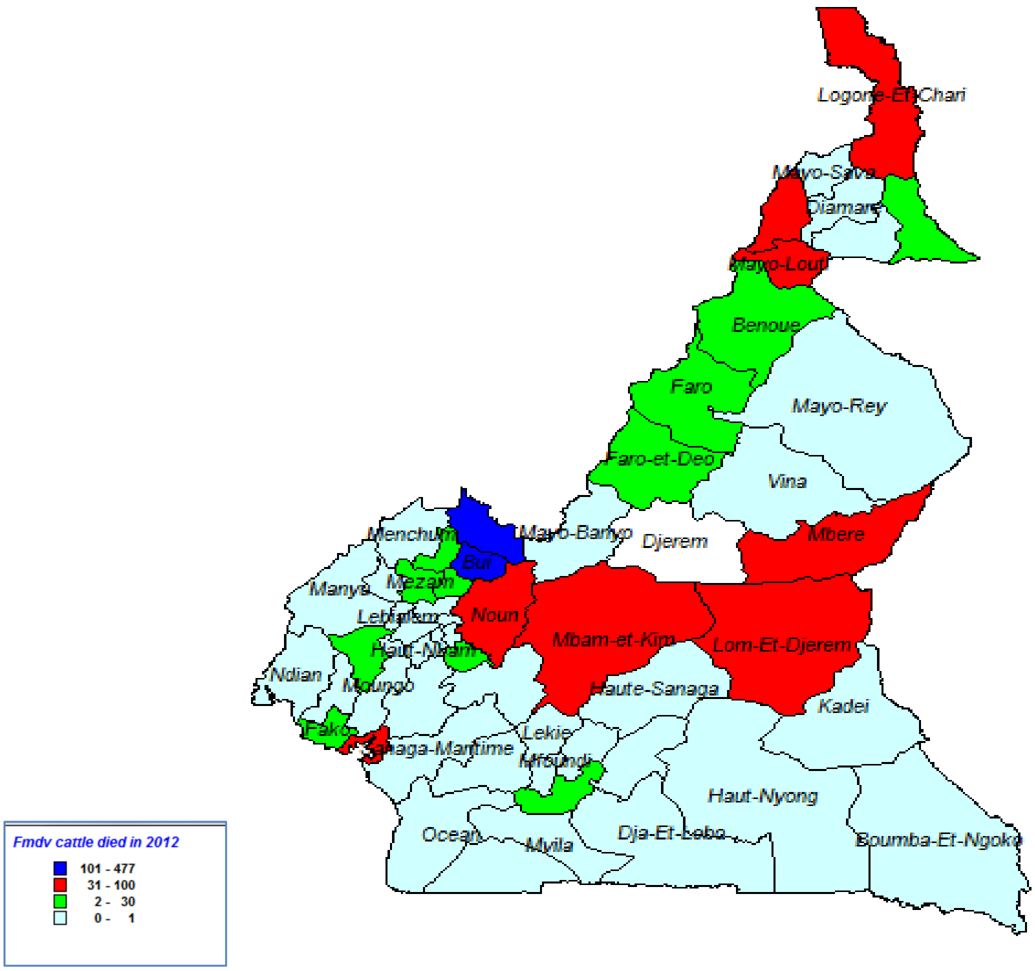


Figure 12. Spatial distribution of the practice of empirical vaccination

The distribution of the different types of treatment administered to cattle suffering from FMD in 2012 is presented in the figure below.

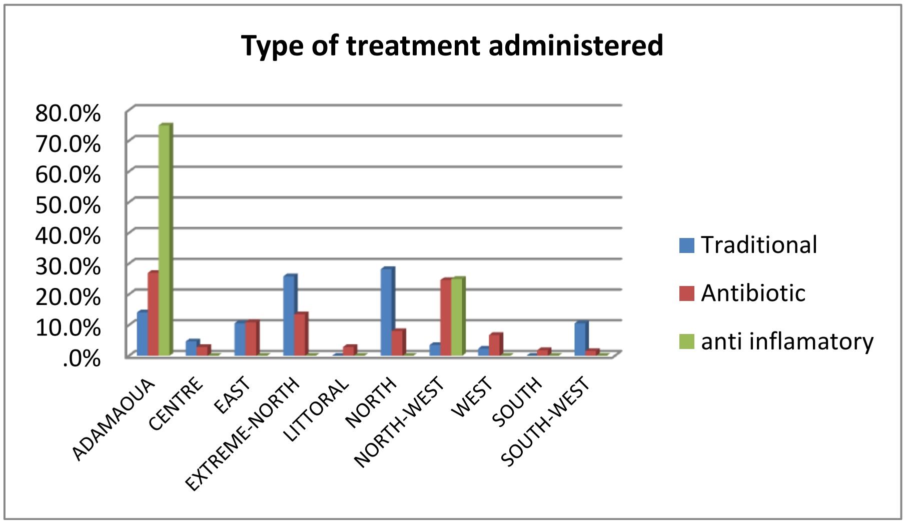


Figure 13. Distribution of herders per type of treatment administered in Regions

Implication of small ruminants in the epidemiology of FMD

As of 2012, seventy-one percent of cattle herders were aware that sheep and goats are susceptible to FMD, twenty-eight percent practice mixed herding with the cattle being housed and fed along with sheep and goats and twenty-two percent of herders reported cases of FMD in the sheep and goats.
The figures below depict the distribution of small ruminant presence in cattle herds and small ruminant FMD cases reported.

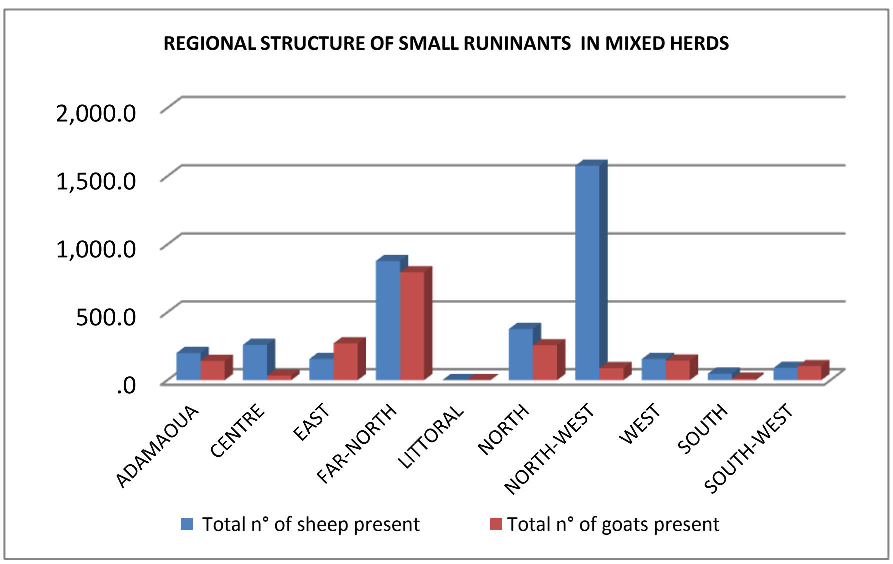


Figure 14. Distribution of small ruminants in mixed herds

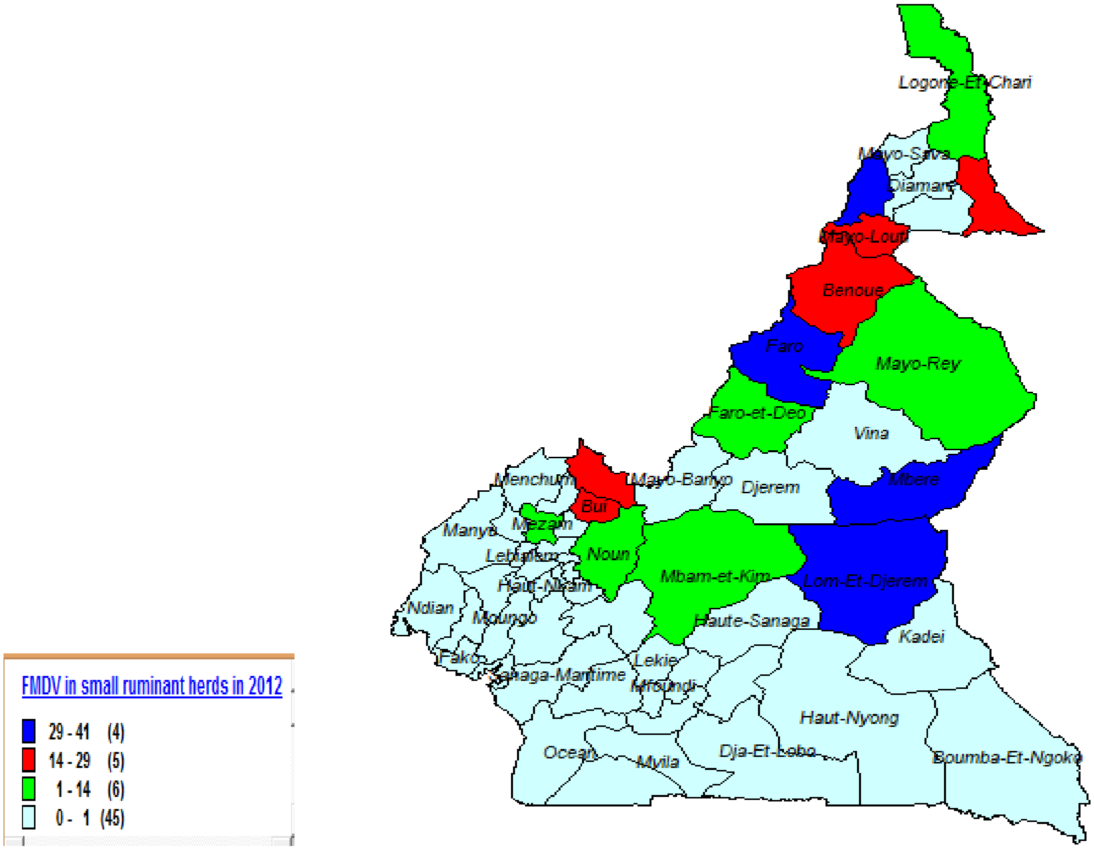


Figure 15. Distribution of FMD cases in small ruminants in 2012.

Porcine-ruminant cohabitation and knowledge of porcine FMD

In Cameroon average of 22% of herders are aware that pigs are susceptible to FMD while the majority do not attribute obvious clinical manifestations in pigs to FMD.

2.2.1.c Slaughter houses

The major abattoirs in Yaounde and Douala belong to the state-owned livestock production and exploitation corporation (SODEPA). In these abattoirs, VSI is done in identical manner; visual inspection of un-rested animals that usually just ran some kilometers from the cattle market, slaughter and post-mortem examination. There are no diagnostic facilities in the abattoirs, and as much as the abattoir staff presume inspection is done at the market, so do the market staff presume inspection is done at the abattoir. Neither facility has a quarantine park or a laboratory. Both report annual seizures worth about 7million Francs CFA but unrelated to FMD. The abattoir staffs know FMD, report having seen several cases in the lairages but have never registered seizures because of opposition from the owners. These are the best Government slaughterhouses. The rest, whose VSI standards amount to nothing are aptly called killing slabs. Illegal slaughter is rampant.

2.2.1.d Importers and disributors of susceptible livestock and products

i. Importers, distributors and traders of susceptible animal products

Major importers, distributors and traders of susceptible animal products such as meat, milk and their processed products play a major role in the epidemiology of FMD in Cameroon.

The butchery BCL, processes meat from local livestock, mainly beef mouton and pork. They are aware of FMD and understand the role they might play in its epidemiology though the claim to make efforts to avoid clinically ill animals. Their main sources of livestock are SODEPA and some prominent ranches.

CAMLAIT, NESTLE and SOTICAM are major milk importers and processors, and they all import milk from Europe, while Nestle also imports from New Zealand and Brazil. Nestle has an internal laboratory for quality control and sends samples to Kenya and France for external control, while CAMLAIT and SOTICAM employ the services of Centre Pasteur Cameroon for quality control. All three would destroy FMD contaminated products and have contracts with a local company for incineration of contaminated and expired products. The main recommendation formulated by the companies was the necessity of improving VSI at entry points such as the seaport and airports.

The major livestock product importers and distributors MAHIMA and CASINO supermarkets both import and sell processed meat and milk and MAHIMA also sells local beef chops.

MAHIMA products are controlled by visual inspection by MINEPIA staff while CASINO employs the services of the national standardization agency ANOR. Both structures also recommend the reinforcement of VSI entry points. The details are in table in annex.

ii. Major importers of livestock and susceptible production material

Importers of live animals and susceptible products such as semen include government ranches and livestock stations, private ranches and research institutions such as the National Institute For Agricultural Research (IRAD). Particular emphasis was placed on the Tadu Dairy Cooperative (TDC), IRAD Bambui, Heifer project Cameroon, the State cattle ranch at Dumbo and the ELBA private cattle ranch. All five structures have imported semen and live animals from countries such as the USA, Italy, Holland, South Africa, Kenya, Morocco but none reported specific VSI measures at entry point and none provided proof of such. None has the capacity to ascertain the FMD status the semen and all report annual outbreaks of FMD. The livestock station at Kounden in the west region imported about 100 live pigs from Denmark in 2013 with no VSI nor specific certification of freedom from FMD along the route to from Douala to Kounden.

TDC and IRAD produce and sell milk, cheese and yoghurts over the national territory, but none has laboratory facilities to ascertain the FMD status of the products or raw materials.

2.2.1.e Socio-economic impacts of FMD on different stakeholders in Cameroon.

Results of the survey carried out in 2012 within the framework of the formulation of this strategic plan show that, each Cameroonian herder incurs an average annual expenditure of 80 000F CFA on drugs to treat FMD, implying the total average annual expenditure for 40% of the estimated 100 000 herders is 32 000 000 000 F CFA (32 Billion F CFA).
This is depicted in the table below.

Table 3. Regional Expenditure on drugs for FMD and animals that died of FMD in 12 months

REGION	Expenditure on drugs	Cases per herd	Adult mortality per herd	Calf mortality
AD	40,008	11	0,24	0,21
CE	268,500	27	1	2
EA	550,483	18	0,28	1
EN	56,167	18	1	1
LT	103,091	70	2	2
NO	34,080	21	0,26	1
NW	231,939	58	2	4
OU	79,833	31	0,3	3
SU	22,500	1	0	16
SW	373,333	20	0,18	0,2
Total	146,585	27	1	2

Despite the above–stated expenditure, in 2012, the average loss of 1 adult cattle and 2 calves per herder over the national territory implied an average annual estimated loss of 100 000 adult cattle and 200 000 calves.

The illustration below depicts the distribution of mortality in cattle due to FMD in 2012.

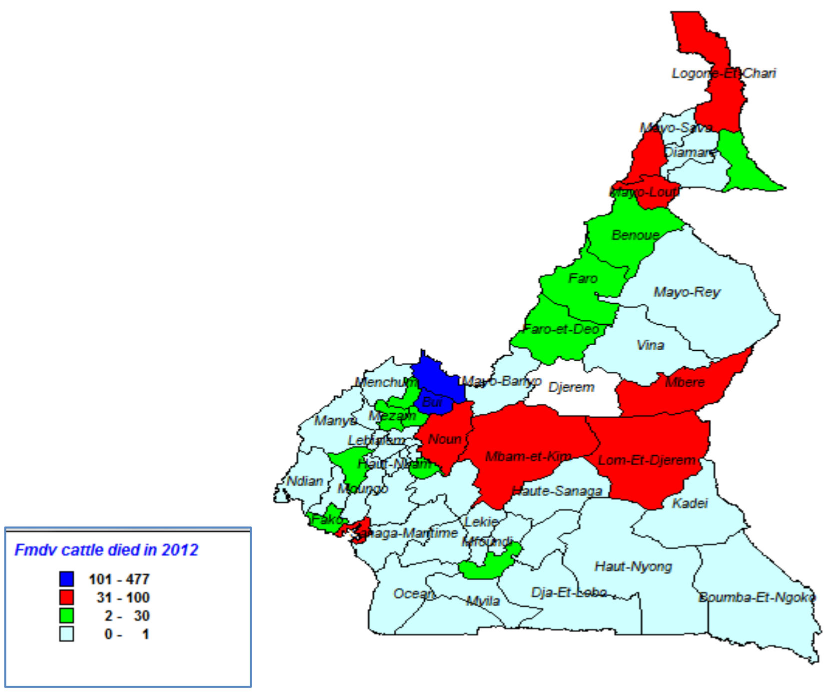


Figure16. Distribution of cattle mortality due to FMD in 2012.

This equivalent to 20 000 000 000 F CFA (20 Billion FCFA) and10 000 000 000F CFA (10 billion FCFA) respectively.

Therefore, the total average annual direct cost of bovine FMD in Cameroon is circa 62 Billion F CFA.

The less perceptible, but more important direct cost associated with drop in meat and milk production, high costs of meat and milk, undernourishment, draft work, reproduction losses and the general negative trade balance incurred in a bid to satisfy local demand are not easily quantified but could be qualitatively described as exorbitant.

2.3. IDENTIFIED RISK HOTSPOTS

2.3.1.WORKING HYPOTHESIS

i-Entry

FMDV entry into Cameroon is suspected to be essentially via trade animals from the Central African Republic and Chad and on transit to Nigeria, Gabon and Equatorial Guinea.
Another suspected entry mechanism is the importation of live animals and semen through the Douala seaport and the international airports in Yaounde, Douala and to a lesser extent, Garoua.
The third probable entry mechanism, though of lesser significance is imports of susceptible livestock products for human and animal consumption by big supermarkets, meat and milk processing firms through the above-mentioned seaport and airports.
Animals equally come in annually to the East and Adamaoua Regions, from Chad and the Central African Republic on transhumance and during annual vaccination campaigns. They are generally given no FMD-specific inspection.
Millions of heads of ruminant livestock also come annually on transhumance from Chad, Niger and Nigeriato the Far-north Region of Cameroon.
The major weakness at all these points is the dysfunctional VSI and the porosity of the borders.

ii-Distribution

Distribution is mainly through trade, marketing, poor management practices and transhumance.

Trade

The main destination of animals that enter from Chad into the Far-north Region is State of Borno in the Federal Republic of Nigeria. The animals then have to move across the Region to Nigeria. In the course or transit they mix with national herds on transhumance towards the Waza park. There, they come in contact with wild reservoirs through sharing of common pasture and drinking spots, as well as by direct contact. Those coming in through the North and Adamaoua regions from the Central African Republic face a similar situation in the Benoue and Bouba-Njidda game reserves on their way to the Adamaoua State of the Federal republic of Nigeria. Besides transit to Nigeria, there is transit to Gabon and Equatorial Guinea across all intervening regions to the South Region.

Transhumance

Transhumance of national herds is another major virus distribution mechanism and it involves southward movement of animals into game reserves, the Guinean savannah, the northwestern grasslands and the forest ecological zones. These zones generally have high buffalo, antelope and warthog populations as depicted in the figures below.

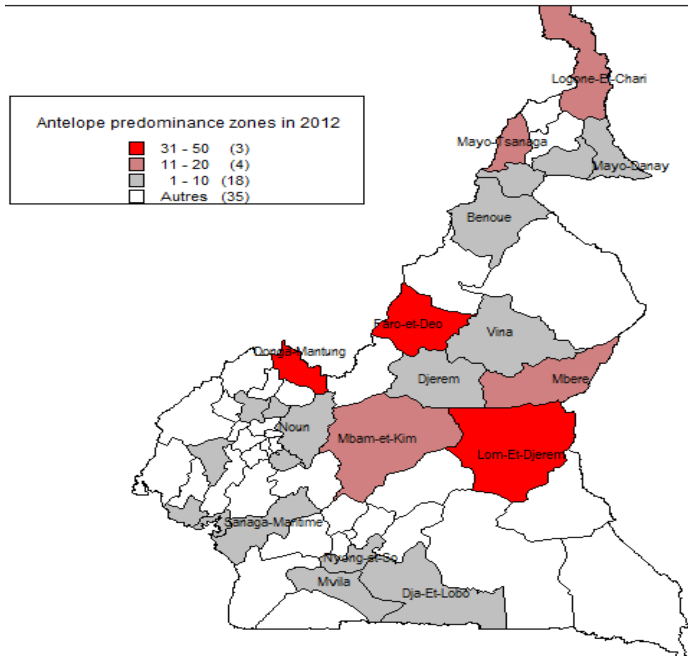


Figure 17. Relative distribution of antelope in cattle grazing and transhumance zones

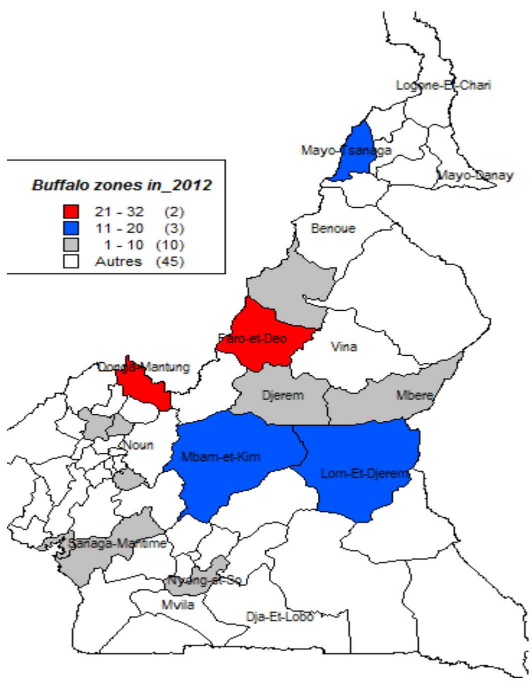


Figure 18. Relative distribution of buffaloes in cattle grazing and transhumance zones

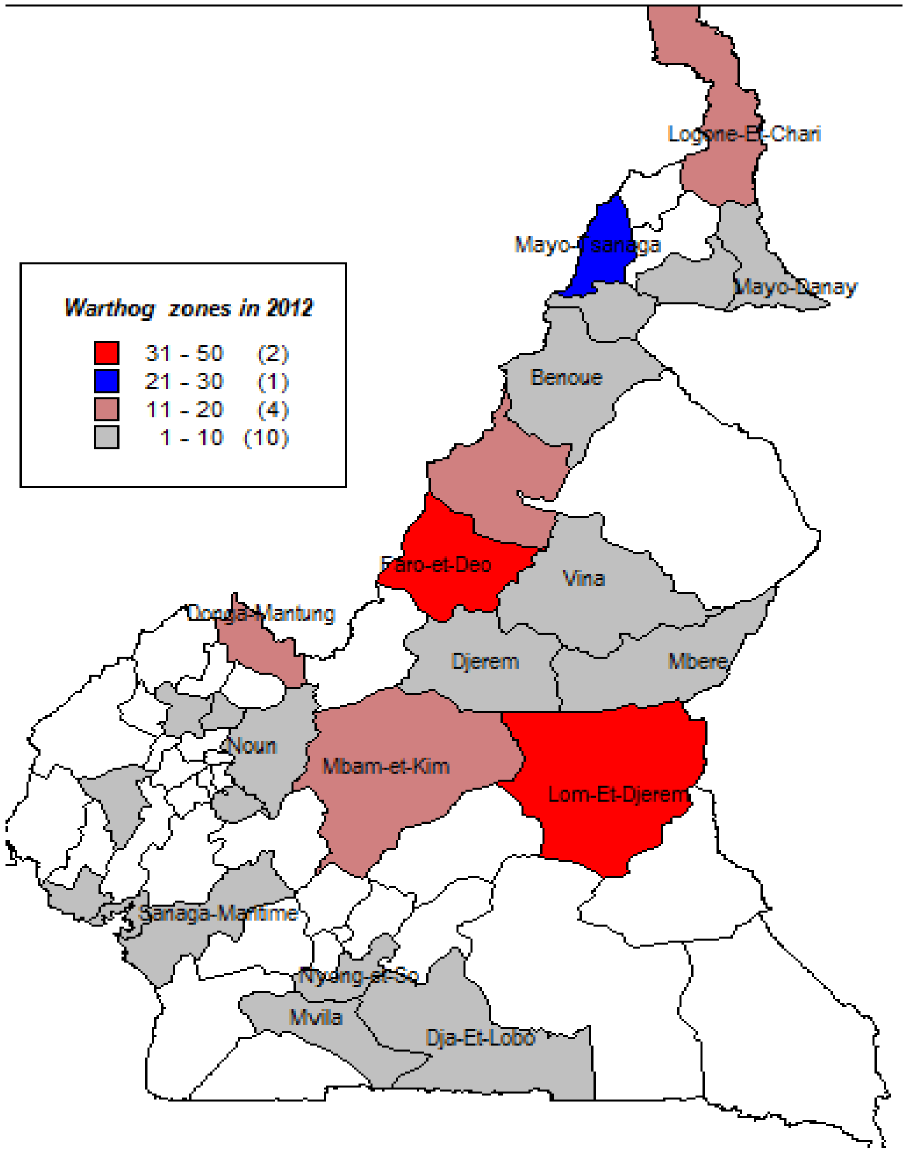


Figure 19. relative distribution of warthogs in cattle grazing and transhumance zones

The animals then come in contact with new and transmit such amongst themselves and to herds found at their destinations. A similar scenario occurs during the return trip and new infections are brought back to those animals that did not go on transhumance.
The peaks of outbreak occurrences and cases is at the beginning of rains when animals are returning from transhumance, on return from vaccination campaigns.

Figure 20. Cattle on transhumance in the Waza game reserve and common drinking point in the Waza game reserve of the Far-north region (*Image, Dr. CHEPNDA 2103)*

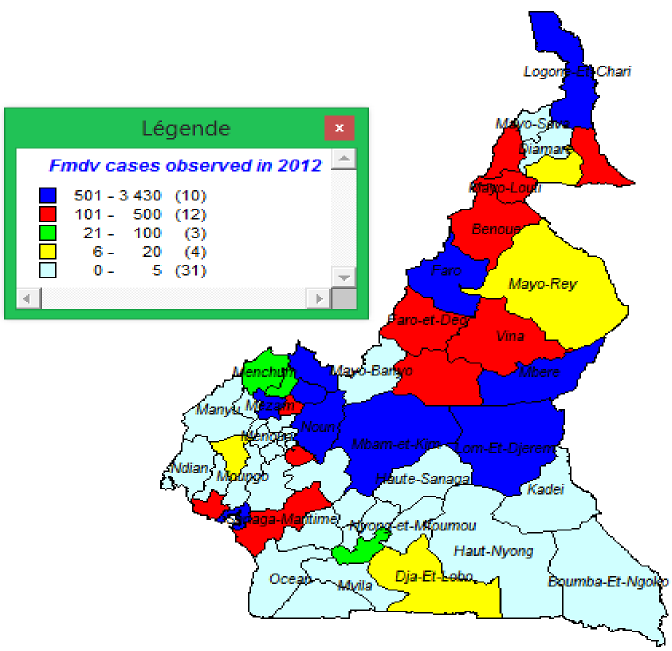


Figure 21. Distribution of FMD cases in 2012.

2-3-2-RISK HOTSPOTS

2-3-2-a-Management practices within farms

Farms constitute one of the major risk hotspots for several reasons. Firstly, despite the good grasp of the manifestations of the disease and its identification by the average Cameroonian herdsman, a substantial percentage of them carry out practices that facilitate the spread of the disease from their farms. Amongst such are, exchange of bulls for reproduction purposes, empirical vaccination, transhumance towards FMD wild reservoir niches with buffaloes, antelopes and warthogs, and mixed livestock farming, whereby herders mix herds of different susceptible species such as goats and sheep along with their cattle. It is uncommon to mix pigs and cattle but cattle are reared in the vicinity of pigs. Much of the dearth of information on good management practices can be attributed to the disorganized nature of the herders, very few of whom belong to farmers' organizations and the fact that unlike other diseases with higher mortality, FMD is perceived by most herders as an annual 'discomfort' with little or no mortality. They underestimate the economic impact of the disease.

2.3.2.b.VSI Posts

i-The Douala seaport

The Veterinary Sanitary Inspection Post of the Douala seaport is artisanal in structure and function. The post is housed in an abandoned metallic shipment container and sanitary inspection is strictly visual. The main inspection objective of livestock products is verification of the expiry date. There is no quarantine facility, no laboratory, no incinerators and the staff are not trained, and could not cite clinical manifestations of FMD, but know that cattle, sheep, goats and pigs are susceptible to FMD. When a ship arrives, the owner of the goods comes to the 'office' to declare the goods and pay the prescribed levy. A member of staff may then go and verify the conformity of the declaration and check the expiry dates on a few samples, in case of products. Live animals are simply given a visual inspection and entry is approved.

ii-The Douala International airport

The Veterinary Sanitary Inspection Post of the Douala international airport is an unequipped office outside the airport. Sanitary inspection is strictly visual. The main inspection objective of livestock products is verification of the expiry date. There is no quarantine facility, no laboratory and the lone staff there had never received any VSI training, but knows the clinical manifestations of FMD, susceptible hosts and vectors.

VSI consists of visual inspection and verification of expiry dates at a multifunctional post alongside custom officials, phytosanitary inspectors and the police. Goods transported by express services are not inspected at the airport but rather in the offices of the postal services in town.

Major imports of FMD epidemiological importance include, pork, beef, veal, mutton, sausages, milk, butter, semen and vaccines. In 2012 43 tons of such products were imported from France by SODICAM. The annual average of such imports from 2007 to 2012 is 42 tons from different countries such as France, Holland, Belgium, the UK, Italy etc.

2.3.2.c. Slaughter houses and livestock markets

Abattoirs and livestock markets in Cameroon have no diagnostic facilities, limited technical capabilities and dysfunctional infrastructure. There are hardly ever any quarantine facilities, and VSI consists of visual inspection in both facilities and post-mortem examination in the abattoirs. The abattoir staff presume inspection is done at the market, while the market staff presume inspection is done at the abattoir. Both facilities report cases of FMD suspicion but neither facility has registered seizures because of opposition from the owners. Hence they end up serving as sources of virus spread and transmission.

2.3.2.d. Livestock trade and marketing systems

Livestock transit on Cameroonian territory is a major source of transmission of FMD and this can be explained by the poor VSI at borders, for the reasons earlier expounded. The national market itself constitutes another FMD hotspot as the market infrastructures are insufficient for prompt detection of sick animals. There are no veterinary facilities and VSI is limited to fee collection. Animals come from varied origins and mix in a common pen for a whole day while transactions are going on and eventually ownership change and the animals move on to new destinations. This is clearly manifested by the very high rate of newly acquired animals which reportedly come down with FMD about a week after arrival and eventually contaminate the rest of the herd.

Another important factor that makes the markets hotspots is that as earlier mentioned, even though 70% of Cameroonian herdsmen can easily identify FMD in animals in a cattle market, 8% would still buy an animal suffering from FMD if the price was advantageous. This tells us a substantial percentage of farmers would consciously take clinical infected animals or convalescent animals to the market, thereby exposing all the other animals therein to infection.

2.4. ORGANISATION OF FMD CONTROL AND THE VETERINARY SERVICES

2.4.1.THE VETERINARY SERVICES AND PVS ANALYSIS

2.4.1.a. The veterinary service

The veterinary service is headed by a Director at the central level. The Director of veterinary services (DVS) is assisted by 3 sub-directors in charge of veterinary sanitary inspection and veterinary public health; herd health and epidemiosurveillance; and veterinary pharmacy and promotion of the private sector respectively. There are nine services in the Directorate of Veterinary Services and those directly concerned with FMD control include, the Herd Health (HH) service, the epidemiosurveillance (EPI)service, the Veterinary Sanitary Inspection service, the Quality Control and Certification (QCC) service, the Private Sector Promotion (PSP) service and the Wildlife, Bee and Non-conventional Livestock (WBNC) service. Figure 22 below depicts the organisational structure of the veterinary services.

2.4.1.b. PVS analysis

Cameroon had a PVS gap analysis in 2011 in conformity with the prescriptions of chapter 3.1 of the OIEterrestial code and subsequent to a PVS evaluation carried out in 2006.

The main identified weaknesses of the veterinary services included;

- ✓ Poor and insufficient networking of tthe veterinary professionals on the national territory
- ✓ Absence of specialised veterinarians at border sanitary control points
- ✓ Absence of specialised veterinarians in food hygiene and inspection in abattoirs, animal product processing units
- ✓ Insufficient fisheries and fishery products specialist
- ✓ Innappropriate and broken chain of command
- ✓ Insufficient communication
- ✓ Unadapted laboratory
- ✓ Poorly structured statutory veterinary order

- ✓ Poor credibility of the technical independence of veterinary services due to poor remuneration of personnel, unadapted chain of command and absence of written standard operation procedures

The gap analysis report strongly recommended the following remedial actions for the veterinary services over the subsequent five years;

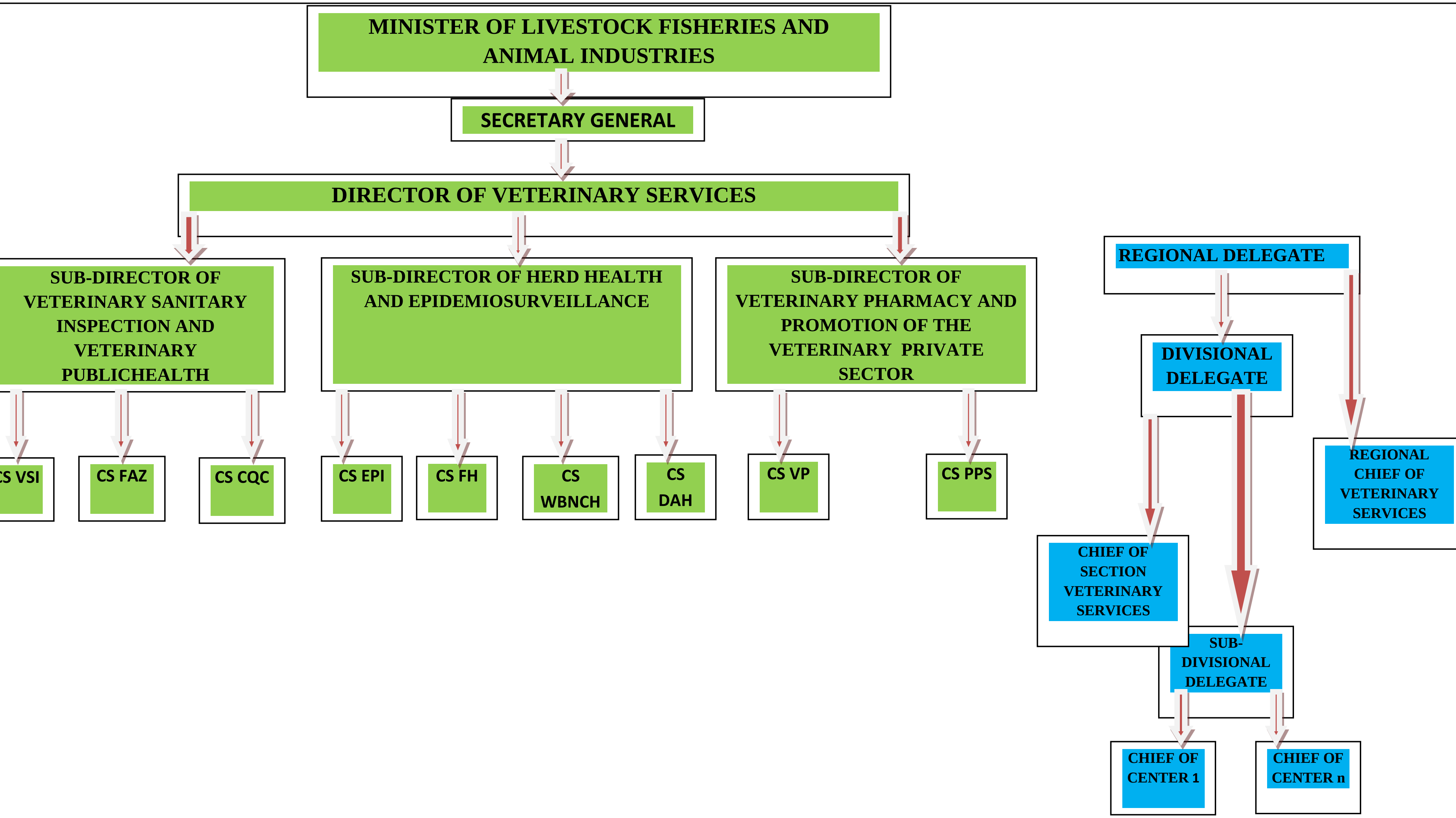
- ✓ Facilitate the creation of a network of private veterinarians covering the national territory. 30-50 private veterinary practices were expected to be installed annually over the five-year span.
- ✓ The private veterinary practitioners will receive government mandate to carry out all compulsory prophylaxy prescriptions and they will have the obligation to report to the national surveillance network.
- ✓ Progressively post veterinary sanitary inspection specialists to priority border posts such asmaritime borders and land border posts with the Federal Republic of Nigeria, livestock transhumance and trade routes with neighbouring countries.
- ✓ Train and post veterinary sanitary inspection specialists to the major abattoirs as well as all major animal and fisheries processing units.
- ✓ Private veterinary practices were to be mandated to carry out veterinary sanitary inspection in open-air slaughter slabs and other slaughter facilities not requiring the services of a full-time state veterinary officer.
- ✓ Create a communications team
- ✓ Properly plan the recruitment of state veterinary officers to replace those going on retirement and promote a culture of specilisation and posting by speciality.
- ✓ Prepare and disemminate standard operation procedures for all major activities in order to ensure good governance of the veterinary services.
- ✓ Sollicit expertise on veterinary legislation and review major national veterinary legislation.
- ✓ Institute a single command chain in the institutional framework
- ✓ Ensure the technical independence of the veterinary services in conformity with international quality standards prescriptions.

2.4.2 GOVERNMENT TRANSPARENCY AND COMMITMENT TO PARTICIPATING IN REGIONAL FMD CONTROL.

The most outstanding measure towards developing an enabling environment for control activities in Cameroon is the Government's commitment to control the disease as shown by its decision to formally elaborate a control strategic plan and subject its control effort to the evaluation of international certification institutions. During the formulation process, activities such as the reactivation of the epidemiosurveillance networks and training of its members were carried out. The staff of Divisional delegations were also trained on sample collection using a probing cup. The Government also grants annual financial support to the National Veterinary Laboratory (LANAVET) and signed a performance contract with the laboratory in 2012. In a bid to offer quality proximity service to farmers, LANAVET also created three new branches mostly committed to diagnosis

There are no records of FMD regional control initiatives in Central Africa, but the Government's commitment and transparency in other regional control initiatives such as that against rinderpest, HPAI and the PACE is evidence of commitment and transparency-readiness in case of an eventual regional control initiative. Cameroon is signatory to all regional animal health conventions and the national Veterinary Laboratory is focal point for the regional laboratory network in Central Africa.

ORGANIGRAM OF THE DIRECTORATE OF VETERINARY SERVICES



2.5. APPROACH TO FMD CONTROL TO DATE

2.5.1. EPIDEMIOSURVEILLANCE

Prior to 2013, activities related to FMD control were limitted to epidemiological surveys via case reporting, data collection and sample collection and analysis. The major actors included the epidemiosurveillance network of the DVS, the National Veterinary laboratory and the Institute for Agricultural Research for Development.

The epidemiosurveillance network attained their peak when the network was co-opted into the PACE program, equiped and trained for sample collection including FMD samples. Much of the work done by IRAD, cetered on surveillance in the Adamaoua Region,while LANAVET collected samples from reported outbreaks nationwide. In 2013 the FMD component of the WTO funded MTF/CMR/034 on the formulation of a cstrategic plan for the control of FMD was the First comprehensive attempt at developing a nationwide control approach based on a nationwide sample colection and risk factor analysis.

2.5.2 VACCINATION

In 2013, the Ministry of Livestock, within the framework of a pilot vaccination campaign, and through LANAVET, acquired 150 000 doses of an FMD vaccine prepared by BVI on the basis of identified endemic serotypes (Serotypes A,O and SAT2). The pilot campaign targetted dairy herds in four divisions of two regions, the Adamaoua(Vina and Mbere divisions) and the North-west Regions(Mezam and Bui divisions). Veterinarians in private practice were madated to Carry out the vaccination excercise.There was no post-vaccination monitoring and as such the campaign was not evaluated.

Herds of state-owned ranches (Faro and Ndokayo) were equally vaccinated against FMD by the personnel of the DVS. To that effct, 8500 doses were administered in each of the two ranches

The prescribed feild vaccination protocol involvedthe administration of two doses at a two week interval and ther war no post-vaccination monitoring. Only one dose was administered in the ranches wit no PVM either.

The major difficulties encountered as reported by the mandated private veterinarians included;

- The high cost incurred in carrying out the exercise. A total of five million francs CFA was spent in the course of the task. This went for transportation, telephone calls, acquisition of vaccination gear(syringes, needles etc), sensitisation meetings, lodging, feeding and hiring of assistants.
- Secondly the timing of the exercise and the duration was not appropriate and greatly compromised turnover.
- The short shelf life of the vaccine compromised coverage and necessitaed the hiring of more assistants which further increased the cost of execution.
- Poor vaccination infrastructure (crutches) in most places led to damage of vaccination equipment and spillage of vaccines.The crutches were also too dispersed making movement from one point to another very costly.
- High vaccine cost equally contributed to poor turnout. In some cases turnout was zero. In others multiple visits had to be made to the same crutches to be able to get many animals vaccinated.
- Poor sensitisation led to non adherence of farmers due to suspicion on the real objective of the excercise.

- Many farmers suggested the pilot phase should have been limitted to the state-owned ranches.

2.6. GAP ANALYSIS

2.6.1. KNOWLEDGE ABOUT FMD DISTRIBUTION AND CIRCULATING SEROTYPES AND STRAINS

Knowledge about FMD serotypes and strains as well as their distribution is very limited as no comprehensive national survey had been carried out prior to that of 2013.
The vailable information was limited to the Adamaoua Region where IRAD was actively involved in FMD research. The information obtained during the PACE project came over the project span and was not credible enough for mapping as the small herds could have been sampled several times over during transhumace. Sample collection, conditioning and transport methods were equally unreliable as the 2013 survey proved that neither the feild staff nor the epidemiosurveillance network personnel mastered them.

2.6.2 MEASURING THE IMPACT OF FMD IN THE COUNTRY, OVERALL OR FOR DIFFERENT STAKEHOLDERS

No comprehensive study has ever been carried out to evaluate the socio-economic impact of FMD on the different stakeholder categories. This is expedient.

2.6.3 IMPORTANT ASPECTS OF RISK HOTSPOTS THAT ARE NOT FULLY UNDERSTOOD

The real impact of live animal and semen imports is not known as VSI at borders is grossly ineffective and there is no recording system or traceability of imported genetic material

2.6.4 ORGANIZATION OF FMD CONTROL

FMD control requires credible and updated epidemiological information, much financial resources and technical ability, all hardly available to the private sector, which is why it is generally carried ou by the state veterinary personnel. The dearth of credible epidemiological data, technically competent private veterinarians as well as scarcity of financial resources required that the state personnel manage control initiatives. Conferring that responsibility to the private sector was premature.

2.6.5 THE EFFECTIVENESS OF PREVIOUS CONTROL MEASURES

The major gap in the vaccination strategy applied lies in the absence of essential pre-requisites, which include insufficient sesnsitisation of the cattle owners which wasmainfested by their reticence towards the campaign.

Other major setbacks include;

- The poor vaccine choice which did not take into account all endemic serotypes
- The decision to limit vaccination to dairy herds was unreliable because in Cameroon the husbandry system is not classified in production types. There are hardly any specialised herds and thus vaccination coverage and effectiveness were rather very poor. Not vaccinating all susceptible species is already problematic. Limitting the excersise to a particular breed or type within a species was ineffective.
- The absence of post vaccination monitoring was a major handicap at evaluating the success of the campaign.
- Lack of appropriate vaccination equipment where a piece of bamboo was inserted in syringe to serve as plunger

- Poor knowledge of vaccination procedure and technique where vaccine was administered via intramuscular route
- Inexperience both state personnel and mandated private veterinarians in vaccine storage and administration where a wet socks were used as vial insulator during vaccination

2.6.6 LEGAL FRAMEWORK TO ENABLE FMD CONTROL

The major gaps in the existing legislation is the absence of specific legislation on the following:

- Compensation to be paid to owners of livestock and property destroyed as part of FMD control programmes and the standards for such compensation;
- Zoosanitary codes of practice for FMD risk enterprises and activities (e.g. livestock markets, abattoirs and dairy factories) and authorize any necessary disease control actions;
- Compulsory vaccination of animals against FMD;
- Compulsory identification of animals.

2.6.7 THE MONITORING AND SURVEILLANCE SYSTEM

There is a well structured surveillance network created by ministerial decision and operational at the central administration but there are no feild staff. When eventually constituted and appointed the feild staff will need to be properly trained in FMD-specific monitoring and surveillance. As a temporary measure, the chief of sections serve as operational field staff but a problem of chain of command exists since they are subject to the authority of the Divisional Delegates and the Regional delegates and not so to the Regional chief of veterinary services, who is equally subject to the authority of the Regional Delegate only.

CHAPTER 3. BENEFITS OF FMD CONTROL

The benefits arising from FMD control will have a positive impact at many levels including but not limited to:

3.1 LIVELIHOODS AND FOOD SECURITY

Livestock production contributes significantly to socio-economic development and sustainable food security for smallholders. Livestock also contribute to less tangible outcomes such as capital reserves and social status.

3.2 FINANCIAL CONDITIONS OF PRIVATE STAKEHOLDERS

Livestock are a source of financial revenue in many different ways including the provision of meat, milk, manure for crops, and draught power for transport and ploughing. Through production losses, FMD translates into important financial losses that would decrease with improved control.

3.3 THE PUBLIC SECTOR

In addition to the direct benefits described above, improved FMD control will also benefit the public sector in many ways. By strengthening the veterinary services (component 2 of the Global Strategy), the efficiency and performance of the VS will improve which will result in their improved capacity to control other diseases as well as FMD. Also, the country moves along the PCP-FMD towards eradication, it is expected that fewer resources will need to be devoted to FMD control, freeing them up for other uses.

3.4 TRADE

The endemicity of FMD in the ECCAS and ECOWAS and the poor implementation of existing legislation on movement and trade favours exchange and trade of infected livestock. However, the harmonisation of regional livestock related legislation and support in its implementation is gradually improving the sanitary situation and equally constituting a major constraint to trade, internationally, regionally and even in national markets. This is typically true for the trade of live animals and animal products. Improved FMD control will open up new markets for the country's producers and industries.

3.5 REGIONAL AND INTERNATIONAL COMMUNITIES

FMD is the most important transboundary animal disease in Cameroon and so far not much has been done to control it. Sero-surveillance reports show a continuous evolution of the number of circulating serotypes and subtypes. This will greatly complicate any eventual control measures. The implication on the sanitary situation in neighbouring countries is serious as there is relatively free movement of susceptible livestock and wildlife between the countries in the sub-region. Being the major border nation between the ECCAS and ECOWAS, the implications are equally serious in both sub-regions. Therefore, controlling FMD in Cameroun will be of much benefit to both ECCAS and ECOWAS.

3.6 OTHER EXPECTED BENEFITS

The FMD situation in Cameroon involves wildlife reservoirs and controlling FMD will greatly improve wildlife health and biodiversity preservation.

CHAPTER 4. FRAMEWORK FOR A RISK-BASED STRATEGY

4.1 THE GLOBAL CONTROL STRATEGY

Following the recommendations of the first international conference on FMD control, organised by the World Animal Health Organization OIE and the United Nations Food and Agriculture Organization (FAO)in Asuncion, Paraguay, in 2009, the two Organizations embarked, under the umbrella of the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs), on a Global Strategy and Global Action Plan for FMD control.

A first outline was presented during the 79th General Session of the World Assembly of Delegates of the OIE in May 2011. The strategy was further developed, taking into account the experience gained in several regions and the views expressed by representatives of countries and regional organizations as well as expert opinions, including those of experts from OIE and FAO reference laboratories/centers.

The Global Strategy proposes a step-wise approach, the Progressive Control Pathway (PCP), to improve the FMD control capacity of a country in a sustainable manner,have a positive effect on the performance of the veterinary services (VS) and, in turn, improve animal health status in general.

The Strategy focuses on regions of the world where the disease is endemic and where the economic circumstances are often difficult.

4.1.1OBJECTIVES OF THE GLOBAL STRATEGY

The overall objective of the Global Strategy is to improve animal production, food security and economic opportunities, particularly in developing countries, and thereby alleviate poverty, increase income generation and improve the livelihoods of small farmers and general human wellbeing. The objective of the Global Strategy is also to maintain the production and export capacities and the status of the countries free from FMD.

The specific objective of the Global Strategy is to decrease the impact of FMD in the world by reducing the number of outbreaks and to improve animal health globally by reducing the impact of other major infectious diseases.

4.1.2 EXPECTED RESULTS OF THE GLOBAL STRATEGY

Three types of results (corresponding to the three components) are expected:

Component 1: FMD is controlled in most countries and eradicated in some countries not freetoday, while protecting the free status of others;

Component 2: VS and their infrastructure are improved;

Component 3: Prevention and control of other major diseases of livestock are improved as a result of the FMD control strategy.

4.1.3 THE GLOBAL STRATEGY IMPLEMENTATION TOOLS AND PROCEDURES

The Global FMD Control Strategy proposes to use various tools and procedures to combat FMD.

Some of them, in particular the PVS Pathway, are designed to strengthen VS, others are aimed more specifically at improving the FMD control, e.g. the FMD Progressive Control Pathway (PCP-FMD), FMD-specific surveillance, diagnostic laboratories, vaccines and vaccination coverage, and performance monitoring, field surveillance and general diagnostic capabilities, epidemiological and economic analyses, animal identification systems, biosecurity and the development of PPPs.

4.1.3.a.The FMD Progressive Control Pathway (PCP-FMD) and regional roadmaps

The PCP-FMD guides countries in the planning and management of efforts to increase the level of control of FMD from the early stages up to the point where an application to the OIE for official recognition of freedom from FMD (with or without vaccination) may be successful and sustainable.The PCP-FMD can also serve for a country's self-evaluation and monitoring, which can then form the basis for an external evaluation

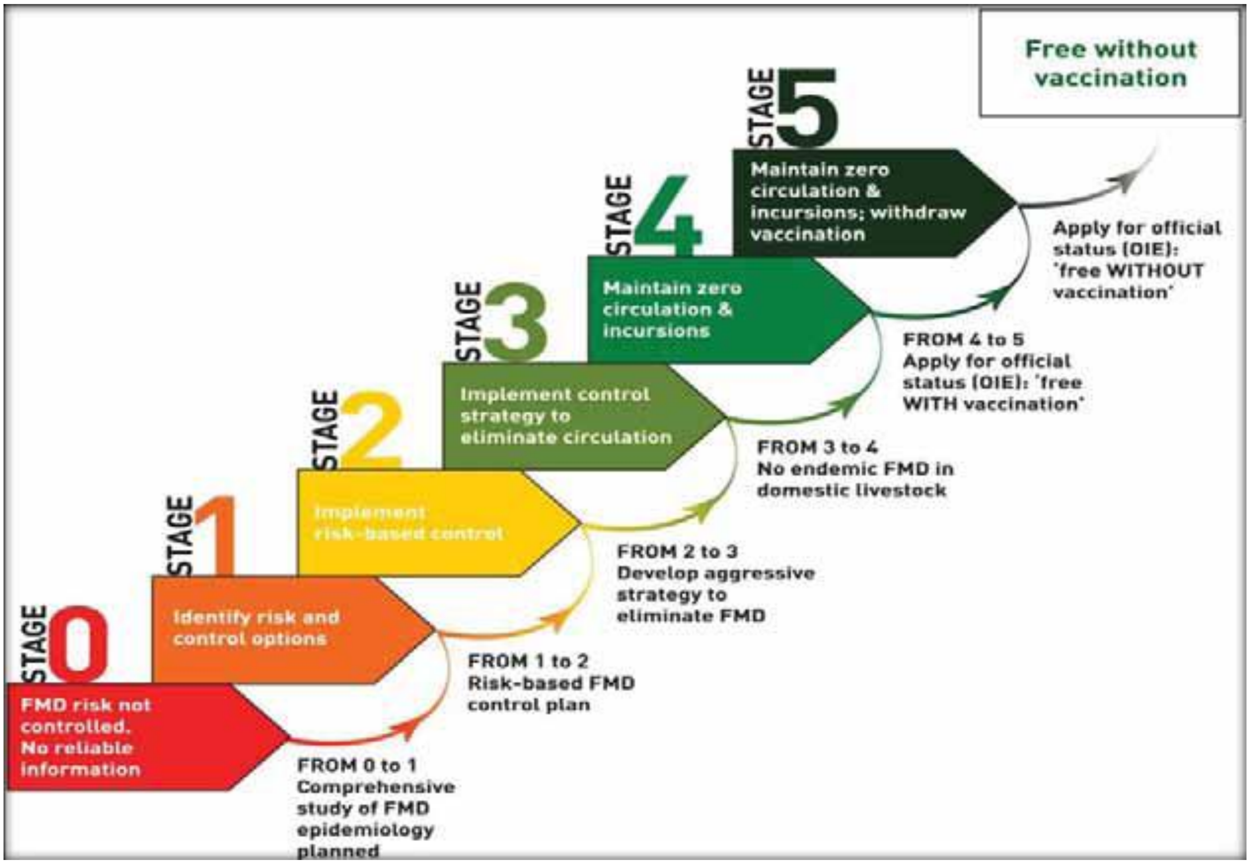


Figure 27. The Foot and Mouth Disease Progressive Control Pathway(FAO and OIE, 2012)

4.1.3.b. Diagnostic laboratories, reference laboratories/centres, regional and global networks

Effective and reliable laboratory diagnostics are indispensable at the national level. The Global Strategy supports countries in need – mainly those in the lower stages of the PCP – with equipment and reagents.

At the international and regional level, OIE and FAO Reference Centres (RCs) in each of the seven 'FMD virus pools' and the existing global network of OIE/FAO RLs/RCs for FMD will support countries' control efforts. Leading laboratories exist in regions where there is no RL/RC, along with additional expertise to be placed in the laboratories and financial support to carry out a number of specified tasks.

At the global level, an existing RC (the World Reference Laboratory, Institute for Animal Health, Pirbright, UK) acts as coordinating laboratory.

i-Vaccines and vaccination

To limit the impact of FMD, in particular in endemic countries, adequate supplies of vaccine are required. The vaccines should meet OIE standards of potency and safety. In endemic countries FMD vaccination is usually limited to dairy cattle and buffaloes and/or ring vaccination during outbreaks. The Global

Strategy therefore requires an increased production of vaccine as well as effective delivery systems. Support will be given to developing countries that cannot afford sufficient quantities of vaccine meeting OIE standards.

The delivery systems can involve the private sector.

ii-National, regional and international surveillance; epidemiology skills and networks

FMD control requires effective epidemiological surveillance and early warning systems at all levels, i.e. national, regional and international. The Global Strategy will establish and strengthen regional epidemiology networks financially and by making available and placing additional expertise in the regions. The epidemiology networks should be coordinated by a recognized regional epidemiology center, preferably one of the existing specialized OIE/FAO Reference Centers.

The FAO/OIE/WHO Global Early Warning System (GLEWS), and the OIE international information system (WAHIS-WAHID) will continue to be the basis for the dissemination of official disease information.

4.2.THE CAMEROON FMD CONTROL STRATEGY

The FMD control strategy for Cameroon is based on identified risk factors and their analysis, and will address stages 1 to 3 of the PCP and the PVS, which constitute components 1 and 2 of the global strategy.

In the preceding section, the epidemiology of FMD in Cameroon was presented as structured in the expected outcomes of stage 1 of the PCP. This was deliberately done so, in order to propose a strategy that would intrinsically imply commencement mid-PCP stage 1

This strategy document aims at reducing the impact of FMD in the entire national territory but prescribes a step-by-step approach which begins with cattle all over the national territory.

4.2.1. PHASE 1

4.2.1.a. Objectives

For the first two years of the strategy, the focus will be on improving the understandingof the epidemiology of FMD in the country and implementing a risk-based approach to reduce the impact of FMD.

4.2.1.b. Expected outcomes of phase 1

1. All husbandry systems, the livestock-marketing network and associated socio-economic drivers are well described and understood for FMD-susceptible species(value-chain analysis).

2. The distribution of FMD in the country is well described and understood and a ‘working hypothesis’ of how FMD virus circulates in the country has been developed.

3. Socio-economic impacts of FMD on different stakeholders have been estimated.

4. The most common circulating strains of FMDV have been identified.

5. There has been progress towards developing an enabling environment for control activities.

6. The country demonstrates transparency and commitment to participating in regional FMD control.

7. Important risk hotspots for FMD transmission are identified.

4.2.1.c. Phase 1 Control activities and measures

The control activities for the first phase of the Strategy are those that will contribute towards attaining the expected outcomes of PCP stage1 and equally mitigate the identified priority risk factors identified from the risk analysis.

The expected outcomes of PCP stage 1 are listed above.

The priority risk factors include:

- Herd management practices
- VSI practices
- Livestock movement
- Livestock trade and market practices

i-Activities related to herd management practices.

i-1-Organisation and Structuring of livestock farmers.

Earlier identified as a fundamental weakness in the sector and an asset where it exists, livestock farmer organizations constitute a reliable basis for control and medium for transfer of knowledge and information. Where they exist, the members cooperate towards their common benefits as seen in the fight against diseases, pooling of produce for processing, creation of pasture farms, control of market prices etc.

A typical example is the proportionate practice of pasture cultivation to membership in grazers' organizations across the country as well as with regions where at individual regional level, membership in grazers' association was proportionate to good practices like pasture cultivation. Notable exceptions are the Littoral and South-west where many grazers generally exploit palm plantations or cultivate pasture without necessarily belonging to grazer associations.

Farmer organizations, mostly common initiative groups (CIG) have been created for species that were subject of government projects, such as pigs and small ruminants. For cattle, the existing organizations were mostly initiated by the farmers themselves while a few in the Adamaoua were the product of the milk processing project that was implemented there about 20 years ago. The recommended organization is the specialized cooperative, CIGs having proven very difficult to monitor.

Therefore, the strategy will support the structuring grazers of susceptible livestock into Specialised Divisional Cooperatives with Board of Directors (SDC-BOD). These could be aggregates of grazers' associations of Sub-divisions or/and individual farmers.

Therefore, a maximum of 58 SDC-BODs will be expected per susceptible livestock specie.

i-2-Training on good livestock production practices.

The members of the SDC-BODs will be trained on good production practices in order to gradually bring them to abandon practices that hitherto exposed their herds to FMD. This will be a critical point as traditional practices are difficult to change, require tact and patience and expected change will be progressive. It will thus be necessary to win the support and adherence of community leaders who themselves ought to be members of the cooperatives. Training materials, manuals and guides will be produced for subjects like, FMD and its risk factors, animal identification, herd housing, feeding (pasture cultivation, processing, conservation and use), reproduction, empirical vaccination, FMD treatment, and FMD vaccination.

The SDC-BODs will make it mandatory for their members to identify their animals using a consensus identification tool.

Herd housing will be compulsory while empirical vaccination will be proscribed.

As far as reproduction is concerned, the common practice of exchange of breeding bulls will be discouraged and each SDC-BOD will constitute its gene bank for the preservation of the best genes (semen and oocytes). The cooperative will purchase the semen/oocytes from farmers and store. Interested grazers can then equally purchase desired genetic material from the cooperative.

*ii-**Activities related to livestock movement, trade and marketing practices***

Transhumance and trade movements are two of the major causes of transmission of FMDV from wild reservoirs to domestic livestock. Most grazers declare they encounter buffaloes, antelopes and warthogs during transhumance while traders, especially those on transit equally meet these animals when they deviate from legal cattle tracks mostly in attempts to avoid control.

Practices of selling clinically infected and convalescent animals in order to curb losses during and following outbreaks should be discouraged. Buying of such animals should also be discouraged.

This aspect of risk factor mitigation will be addressed at two levels, directly to the members of the SDC-BODs and livestock traders; and legislation enforcement and review. At farmer level, the nefarious consequences of transhumance, poor transit practices and bad marketing practices will be explained to grazers and traders and they will equally be provided training sessions on good transhumance destinations, good transit practices and good marketing practices.

Training on transhumance will target the grazers; training on transit practices will target livestock traders while training on marketing practices will target both grazers and traders.

The legislation addressing livestock marketing will be reviewed to formally enforce the prohibition of the sale of FMD infected and recovering animals. Trade and transit legislation will equally be reviewed to create new livestock routes, since urbanization and human encroachment have occupied some livestock routes and tracks pushing cattle traders into FMDV niches. Another legislation will be created to progressively prohibit transit on foot where transport by train, ship or automobile is possible and available.

iii-Activities related to veterinary sanitary inspection.

Earlier identified as a weak link in the value chain, VSI posts have literally become virus passage posts. VSI at all levels from the frontiers, through livestock routes to abattoirs and markets is completely dysfunctional. There are no infrastructures, no equipments, unqualified poorly trained personnel, and no monitoring nor tracing facilities.

A guide will be produced for the minimum standards in VSI posts and will be used to upgrade all VSI posts in the country. Essential facilities like quarantine pens, incinerators, lairages, laboratories, veterinary crushes, recording equipment, offices and vehicles will be mandatory.

At frontiers, priority in implementation will be given to the Douala seaport, the international airports in Douala, Yaounde and Garoua, the frontier posts in Kousseri, Garoua Boulai, Djohong and Biti and other frontier posts along the borders with Chad and the Central African Republic.

At the administrative level, priority will be given to the Regional services of veterinary services (VSI kits, laboratory diagnostic equipments and vehicles), the Divisional delegations (VSI kits, laboratory diagnostic equipments and vehicles) and the Sub-divisional delegations (VSI kits, sample collection, preservation and shipment equipments and motorbikes).

At the abattoirs, all existing abattoirs will be given priority while new abattoirs would have to comply.

The VSI personnel will have to be trained and qualified and the revision, formulation and enforcement of VSI legislation will be accentuated.

iv-Other activities

Other activities prescribed for the attainment of the expected outcomes of Phase 1 which will last for two years, are presented in the table below.

Table 4. PCP and PVS activities prescribed for phase 1.

PCP related activities and training will focus on	PVS related activities and training will focus on
- Improving the Understanding of FMD epidemiology: FMD occurrence, virus types and virus transmission pathways; - Improving risk analyses; - The socio-economic impact of FMD; - FMD surveillance in the field; - Improvement of laboratory facilities and capabilities; - Improving the information system; - Improving effective communication with stakeholders - Preparing an FMD control strategy to enter Stage 2	- re-assessing VS with respect to resources,staffing, funding and chain of command; - Reinforcing VS capacities to develop legislation and regulations; - Assessing and revising the legislation as appropriate; - Reinforcing cooperation with all stakeholders - Reinforcing communication capacity and a team of specialists; - Reinforcing reporting capacity / WAHIS notification; - Strengthening basic laboratory diagnostic capacities, preferably with bilateral support from a reference laboratory;

4.2.2. PHASE 2

4.2.2.a. Objective

Phase two of the control strategy which corresponds to the next three years following phase 1, has as objective to implement risk based control measures such that the impact of FMD is reduced in one or more livestock sectors and/or in one or more zones.

3.2.2.b. Expected outcomes of phase 2

1. Ongoing monitoring of circulating strains and risk in different husbandry systems.
2. Risk-based control measures are implemented for the sector or zone targeted.
3. Develop a revised, more aggressive control strategy that has the objective of eliminating FMD from at least a zone of the country

i-Phase 2 control activities and measures

These activities and measures will be implemented in priority zones as defined by the revised strategy document of phase 1. However, based on the forecasted epidemiological situation and the prescriptions of the global strategy, the following activities are proposed for stage 2 of the strategy:

a. Continuation of the activities listed for Stage 1;

b. Control of FMD in target areas/zones or farming systems;

c. In targeted areas/sectors, active (i.e. investigating FMDoutbreaks) and passive surveillance;

d.Raising the participation of producers and stakeholders by means of joint programmes, communication and operational funding;

e. Raising biosecurity awareness;

f. Vaccination based on vaccine matching information, respecting the cold chain and followed by post-vaccination monitoring.

g. Establishing a zoning approach with a national animal identification system.

4.2.3.PHASE 3

4.2.3.a. Objectives

Phase 3 of the control strategy which corresponds to the next five years following completion of stage 2 will have as objective the progressive reduction in outbreak incidence followed by elimination of FMDV circulation in domestic animals in at least one zone of the country.

4.2.3.b. Expected outcomes

1. Ongoing monitoring of circulating strains and risk in different husbandry systems.
2. The disease control plan developed at the end of Stage 2 is implemented, resulting in rapid detection of, and response to, all FMD outbreaks in at least one zone in the country.
3. The incidence of clinical FMD is progressively eliminated in domestic animals in at least a zone in the country.
4. There is furtherdevelopment of an enabling environment for control activities.

Inthis Stage, Cameroon will request formal OIE endorsement of its national FMD control programme.

4.2.3.c. Activities

PCP activities and training will focus on:

1. Extension of FMD control measures to all FMD- susceptibledomestic species;
2. Prompt response mechanisms (emergency plan, upgraded surveillance, implementation of emergency response measures, including culling);
3. Intensive targeted vaccination;
4. Up-dating and implementing the legal framework to effectively combatFMD and control outbreaks;
5. Developing public/private partnerships;
6. Application to OIE for endorsement of the National FMD Control Plan

Endorsement of this strategy document by the Government of Cameroon indicates Cameroon's completion of prerequisites for admission into stage 1 and implementation of measures targeting passage into stage 2 of the PCP.

4.2.4. VACCINATION

The vaccination protocol, prioritization of zoning, vaccines and methodology here proposed are based on the FAO prescriptions contained in the document '*vaccination campaigns in endemic situation*', which in itself complies with OIE and EMPRES recommendations. Hence, as a control tool, vaccination will be done in a step-by-step progression, moving from one zone to the next, supported by strong disease surveillance network that will monitor the effectiveness of the campaign. Measures will be taken to ensure that prior secured zones will not be re-infected. Hence, geographic barriers will be employed in the zoning process. Epidemiological, livestock production, livestock movement and livestock marketing patterns that influence disease spread have also been taken into consideration.

The Government of Cameroon officially launched the FMD vaccination campaign with priority objective being the revamping of the dairy sector; hence, the major dairy production zones of the country are equally given priority.

Vaccination against FMD in Cameroon will continue from the ongoing pilot phase in the first year of PCP stage 1 in six of the ten regions of the country, constituting approximately 60% coverage of the national territory.

Priority will also be given to the major state-owned ranches and livestock stations where a higher compliance and success rate is expected and which furthermore would serve as sources of disease-free animals for restocking other areas.

For optimal efficiency, and with respect to livestock movement patterns this plan prescribes vaccination of animals "upstream" beyond the primary control zone where the virus is present in its ecological niche, as well as the bovine population in the primarily targeted zone "downstream".

Vaccination will be done at times of the year before movements are likely to occur, e.g. before departure on transhumance. This will be to avoid extreme perturbation of local pastoralist practices and enhance adherence.

Based on the preceding facts, the North-west, West, East, Adamaoua, North and Far-north regions have been selected for vaccination for the first five years.

4.2.5 PRESCRIBED ACTIONS IN CONFIRMED SECURED ZONES.

In regions eventually confirmed FMD-free, action will be directed away from routine vaccination to increased early warning and early response activities. Active disease surveillance activities will be enhanced and a high-level preparedness against the disease will be maintained. In this way, any disease breakdowns will be detected and eliminated quickly by either a short, sharp, targeted vaccination campaign or by limited stamping out.

CHAPTER 5. OPERATIONAL PLAN

5.1. ORGANISATION OF FMD MANAGEMENT

The strategy will be under the overall responsibility of the Minister of Livestock, Fisheries and Animal Industries, while technical implementation of the Strategy will be supervised by the Director of Veterinary Services (DVS), and coordinated by a National Coordinator appointed by the Minister of Livestock, Fisheries and Animal Industries. Because of the multitude of stakeholders and administrations necessary for a successful implementation of a control strategy, a National Consultative Committee for the Control of FMD will be created by Order of the Prime Minister. The NCCC-FMD will comprise representatives of stakeholders and implementation partners such as:

- The Minister of Livestock, Fisheries and Animal Industries (Chairperson)
- The Director of Veterinary Services (Vice-Chairperson)
- The National Coordinator of the Control Strategy(Scribe)
- The General Manager of the National Veterinary Laboratory
- The President of the National Veterinary Council
- A representative of the Ministry of Defence
- A representative of the General Delegation for National Security
- A representative of the Ministry of the Economy, Planning and Regional Development
- A representative of one State faculty of Veterinary Medicine.
- A representative of the Ministry of Scientific Research
- A representative of the Ministry in charge of Wildlife
- Senior representatives of farmer groups or organizations
- Other technical experts, as required (with observer status).

The national coordination for the implementation of the strategy will comprise;

- A national coordinator
- A disease control specialist
- An epidemiologist
- An administrative and finance expert
- An accountant.

The national coordination for the control of FMD will have the following functions:

- implementing the disease control policies decided by the DVS and the NCCC-FMD;
- directing and monitoring the operations of regional coordinations;
- maintaining up-to-date lists of available personnel and other resources, and details of where further resources may be obtained;
- deploying staff and other resources to the regional coordinations;
- ordering and dispersing essential supplies, including vaccines if they are to be used;
- monitoring the progress of the campaign and providing technical advice to the DVS;

- advising the DVS on the definition and proclamation of the various FMD control zones;
- maintaining up-to-date lists and contact details of risk hot spots;
- liaising with other groups involved in the emergency response, including those that may be activated as part of the National Disaster Plan;
- preparing international disease reports and, at the appropriate times, cases for recognition of zonal or national freedom from the disease;
- managing farmer awareness and general publicity programmes, including press releases, and creating a public relations centre to liaise with the media;
- General and financial administration, including record-keeping.

5.2. LEGISLATION

The Cameroonian legislation already has provisions which:

- make FMD and other proclaimed animal diseases compulsorily notifiable;
- allow the entry of officials (or other designated persons) on to a farm or other livestock enterprise for disease surveillance purposes (including the collection of diagnostic specimens) and to carry out any other approved disease control actions;
- authorize the proclamation of infected and disease control zones;
- authorize the quarantining of farms or other livestock enterprises;
- authorize bans on the movement of livestock, livestock products or other potentially contaminated materials, or the issue of permits to move these only under specified animal health conditions;
- authorize the compulsory destruction and safe disposal of infected or potentially infected animals and contaminated or potentially contaminated products and materials, subject to fair compensation and cleaning and disinfection of properties;
- authorize the destruction of feral animals and uncontrolled/ poorly controlled livestock.

Specific legislation should be adopted and enforced to:

- provide for compensation to be paid to owners of livestock and property destroyed as part of disease control programmes and define standards for such compensation;
- allow zoosanitary codes of practice to be mandated for risk enterprises and activities (e.g. livestock markets, abattoirs and dairy factories) and authorize any necessary disease control actions;
- authorize the compulsory vaccination of animals;
- authorize the compulsory identification of animals, where appropriate;
- authorize other justifiable and necessary disease control actions.

Due to the near-unrestricted exchange of livestock and animal products under free trade pacts within the ECCAS, efforts will be made to bring the other member states to prepare and implement same measures. This could be done through CEBEVIRHA which could adequately and efficiently coordinate a sub-regional FMD control strategy/programme.

5.3. BUDGET

The cost of the activities foreseen under the Global FMD Control Strategy has been comprehensively calculated with the support of experts from the World Bank.
The cost of the Global Strategy for the initial five years of the programme would be US $ 820 million, of which US $ 762 million (93%), US $ 47 million (6%) and US $ 11 million (1%) are attributable to the country, regional and global levels respectively. The vaccination cost of US $ 694 million is by far the largest component of the cost.
The global strategy further carried out a comprehensive analysis taking into consideration the experiences of 79 PCP 0-2 countries. The figure below depicts the prioritization of activities excluding vaccination and distribution of allocated funds.

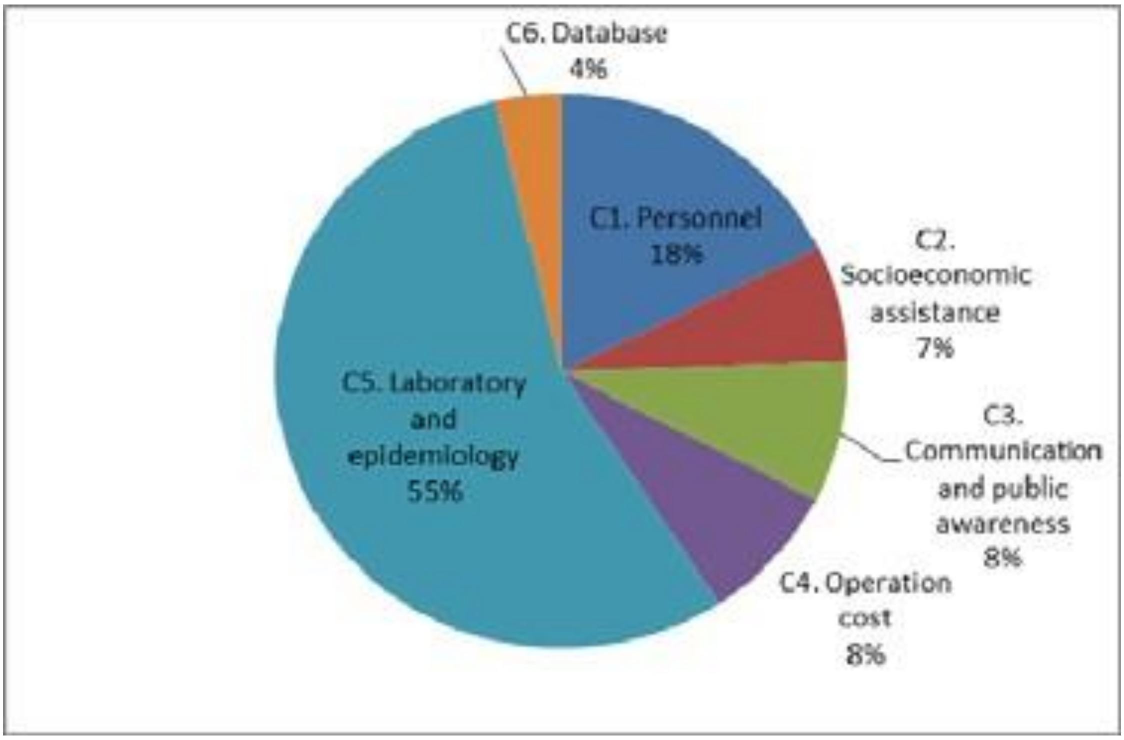


Figure 28. Prioritization of activities besides vaccination and distribution of allocated funds. (FAO and OIE, 2012)

5.3.1. INITIAL 5 YEAR COST OF FMD CONTROL WITHOUT VACCINATION AT COUNTRY LEVEL

The averag**e** initial 5 year **cost of FMD control without vaccination, equivalent to PCP levels 0-2 is estimated at 6**8 million **US** $, while the average cost for Africa is placed 34 million US $. Based on these estimates and the activities prescribed in this strategy, the figure below presents a comprehensive estimate of the cost of FMD control without vaccination, equivalent to PCP levels 0 to 2 and transition to PCP level 3.

Table 5. Cost of the first five years of the Cameroon strategic plan.

No	Category	Sub-category	Estimated cost (F CFA)
1	Personnel	Salary for a national coordinator	90 000 000
		Salary for a disease control specialist	60 000 000
		Salary for a epidemiologist	60 000 000
		Salary for a administrative and finance expert	48 000 000
		Salary for an M&E expert	48 000 000
		Salary for auxiliary staff	60 000 000
2	Socioeconomic assistance	Description of animal husbandry systems value chains analysis, socioeconomic studies, and analysis of FMD impacts	142 380 000
3	Communications and public awareness	Communication and public awareness	162 720 000
4	Operations costs	Office equipments	46 490 000
		Vehicles	90 000 000
		Unforseen	26 230 000
5	Laboratory and epidemiology	Purchase/Replacement of machine, equipment and warranty	132 006 600
		Annual cost for equipment, quality assurance and training	327 779 100
		Local labour for sample collection	48 104 100
		Local labour for sample laboratory testing	29 086 200
		Cost of laboratory testing	97 326 900
		Sampling material	54 816 300
		In-country training for field staff	274 081 500
		Travel expenses to participate in regional wet laboratory trainings	30 204 900
		Travel expenses to participate in regional calibration trainings	26 848 800
		Proficiency panel and shipping costs	26 848 800
		Database including user training and maintenance	71 596 800
	TOTAL		2 034 000 000

5.3.2. THE COST OF VACCINATION

As with the global strategy, the Cameroon strategy assumes vaccination will begin in the first year of PCP stage 2, targeting ruminants at critical points and high risk groups. It also assumes that Cameroon will identify a reliable good quality vaccine source with average price of $1 per dose and that each animal will be vaccinated twice per year. The money includes

cost for PVM. The global strategy estimates the average cost in Africa at $138 million, with $0 at stage 0, 23,3% at stage1, 10% at stage 2 and 66,7% at stage 3.The global strategy estimates the average vaccination cost per country at $15 million.
The table below presents the average vaccination cost as proposed for Cameroon.

Table 6. Cost of vaccination including PVM

PCP Stage	Cost of vaccination (F CFA)
1	1 747 500 000
2	750 000 000
3	5 002 500 000

Therefore the total cost of the first five years of the strategy including vaccination is estimated at 4 531 500 000 (Four Billion five hundred and thirty-one million five hundred thousand) F CFA.

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ANNEX

FAO World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD)

Detection And Serotyping Report

Report date for this batch: 05-Sep-2014

FMDV type: A, SAT 2

Country: CAMEROON

Year: 2014

Number of samples: 46

WRL BATCH: WRLFMD/2014/00019

THE Pirbright INSTITUTE

A UKAS accredited testing laboratory No. 4025

WRLFMD®

THE PIRBRIGHT INSTITUTE
Director: Professor John Fazakerley BSc, MBA, PhD, FRCPath

Ash Road, Pirbright, Surrey GU24 0NF
Tel: +44 (0)1483 232441 Fax: +44 (0)1483 232448
Email: enquiries@pirbright.ac.uk
Website: www.pirbright.ac.uk

FMD Detection And Serotyping Results

Lab Reference WRL batch Number: WRLFMD/2014/00019

Sender Details: Dr Ndamkou Ndamkou Christian, Laboratoire National Veterinaire (Lanavet) Garoua PO BOX: 503 Garoua, PHONE - (237) 77 70 70 50, PHONE - (237) 99 99 98 18, FAX - (237) 99 99 99 98 75, EMAIL - commercial@lanavet.com

Date Received: 07/05/2014

Country of Origin: CAMEROON

Dear Dr Ndamkou Ndamkou Christian,

Diagnostics work has now been completed in respect of the samples you submitted and the details are as attached.

Results Approved By:

Date: 3|9|2014

Official Stamp:

DR DONALD KING
HEAD: Vesicular Disease
Reference Laboratories
The Pirbright Institute
GU24 0NF

c.c.: D King, N Knowles, A Ludi, V Mioulet, B Statham, S Metwally, J Pinto, K Sumption, E Raizman, FAO Circulation, OIE Animal Health Information, Regional OIE Delegate.

To help us improve the quality of our service, please send any suggestions or requests to the Reference Laboratory by fax (+44 (0)1483 232621) or email (trish.ryder@pirbright.ac.uk). The Pirbright Institute actively seeks and appreciates feedback, if you would like to offer feedback please complete the WRLFMD survey: http://www.surveymonkey.com/s/WRLFMD

FMD Detection And Serotyping Results Report

THE PIRBRIGHT INSTITUTE
Director: Professor John Fazakerley BSc, MBA, PhD, FRCPath

Lab Reference WRL Batch Number: WRLFMD/2014/00019

Sender Details: Dr Ndamkou Ndamkou Christian, Laboratoire National Veterinaire (Lanavet) Garoua PO BOX: 503 Garoua, PHONE - (237) 77 70 70 50, PHONE - (237) 99 99 98 18, FAX - (237) 99 99 99 98 75, EMAIL - commercial@lanavet.com

Ash Road, Pirbright,
Surrey GU24 0NF
Tel: +44 (0)1483 232441
Fax: +44 (0)1483 232448
Email: enquiries@pirbright.ac.uk
Website: www.pirbright.ac.uk

Date Received: 07/05/2014 **Country Of Origin:** CAMEROON **Date Tests Completed** 05/09/2014

Your Reference	WRL Reference	Description of Sample	PCR Result	Serotyping Result by Cell Culture/ELISA
251	CAR 1/2013	CATTLE, fluid/oropharyngeal, Collected 12/07/2013	FMDV GD	NVD
252	CAR 2/2013	CATTLE, fluid/oropharyngeal, Collected 12/07/2013	FMDV GD	NVD
255	CAR 3/2013	CATTLE, fluid/oropharyngeal, Collected 14/07/2013	FMDV GD	NVD
22	CAR 4/2013	CATTLE, epithelium, Collected 15/07/2013	FMDV GD	A
256	CAR 5/2013	CATTLE, fluid/oropharyngeal, Collected 15/07/2013	FMDV GD	NVD
267	CAR 6/2013	CATTLE, fluid/oropharyngeal, Collected 16/07/2013	FMDV GD	SAT 2
269	CAR 7/2013	CATTLE, fluid/oropharyngeal, Collected 16/07/2013	FMDV GD	NVD
272	CAR 8/2013	CATTLE, fluid/oropharyngeal, Collected 16/07/2013	FMDV GD	NVD
273	CAR 9/2013	CATTLE, fluid/oropharyngeal, Collected 16/07/2013	FMDV GD	NVD
24	CAR 10/2013	CATTLE, epithelium, Collected 17/07/2013	FMDV GD	A

NVD - No Virus Detected FMDV GD - FMDV Genome Detected NGD - No Genome Detected

SOPs - WRL 026 (PCR), WRL 002 (Cell Culture), WRL 006 (ELISA)

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Your Reference	WRL Reference	Description of Sample	PCR Result	Serotyping Result by Cell Culture/ELISA
25	CAR 11/2013	CATTLE, epithelium, Collected 17/07/2013	FMDV GD	A
01	CAR 12/2013	CATTLE, epithelium, Collected 18/07/2013	FMDV GD	SAT 2
02	CAR 13/2013	CATTLE, epithelium, Collected 19/07/2013	FMDV GD	NVD
290	CAR 14/2013	CATTLE, fluid/oropharyngeal, Collected 19/07/2013	FMDV GD	NVD
03	CAR 15/2013	CATTLE, epithelium, Collected 20/07/2013	FMDV GD	NVD
04	CAR 16/2013	CATTLE, epithelium, Collected 20/07/2013	FMDV GD	SAT 2
05	CAR 17/2013	CATTLE, epithelium, Collected 20/07/2013	FMDV GD	NVD
291	CAR 18/2013	CATTLE, fluid/oropharyngeal, Collected 20/07/2013	FMDV GD	NVD
06	CAR 19/2013	CATTLE, epithelium, Collected 21/07/2013	NGD	NVD
07	CAR 20/2013	CATTLE, epithelium, Collected 21/07/2013	FMDV GD	NVD
08	CAR 21/2013	CATTLE, epithelium, Collected 22/07/2013	FMDV GD	NVD
09	CAR 22/2013	CATTLE, epithelium, Collected 22/07/2013	NGD	NVD
10	CAR 23/2013	CATTLE, epithelium, Collected 22/07/2013	NGD	NVD

NVD - No Virus Detected   FMDV GD - FMDV Genome Detected   NGD - No Genome Detected

SOPs - WRL 026 (PCR), WRL 002 (Cell Culture), WRL 006 (ELISA)

A UKAS accredited testing laboratory No. 4025.

Your Reference	WRL Reference	Description of Sample	PCR Result	Serotyping Result by Cell Culture/ELISA
297	CAR 24/2013	CATTLE, fluid/oropharyngeal, Collected 22/07/2013	FMDV GD	SAT 2
298	CAR 25/2013	CATTLE, fluid/oropharyngeal, Collected 22/07/2013	FMDV GD	NVD
11	CAR 26/2013	CATTLE, epithelium, Collected 23/07/2013	NGD	NVD
12	CAR 27/2013	CATTLE, epithelium, Collected 23/07/2013	FMDV GD	NVD
13	CAR 28/2013	CATTLE, epithelium, Collected 23/07/2013	NGD	NVD
299	CAR 29/2013	CATTLE, fluid/oropharyngeal, Collected 24/07/2013	FMDV GD	SAT 2
26	CAR 30/2013	CATTLE, epithelium, Collected 25/07/2013	NGD	NVD
302	CAR 31/2013	CATTLE, fluid/oropharyngeal, Collected 25/07/2013	FMDV GD	NVD
304	CAR 32/2013	CATTLE, fluid/oropharyngeal, Collected 25/07/2013	FMDV GD	NVD
305	CAR 33/2013	CATTLE, fluid/oropharyngeal, Collected 25/07/2013	FMDV GD	NVD
27	CAR 34/2013	CATTLE, epithelium, Collected 26/07/2013	FMDV GD	SAT 2
306	CAR 35/2013	CATTLE, fluid/oropharyngeal, Collected 26/07/2013	FMDV GD	NVD
33	CAR 36/2013	CATTLE, epithelium, Collected 27/07/2013	FMDV GD	A

NVD - No Virus Detected   FMDV GD - FMDV Genome Detected   NGD - No Genome Detected

SOPs - WRL 026 (PCR), WRL 002 (Cell Culture), WRL 006 (ELISA)

A UKAS accredited testing laboratory No. 4025.

Your Reference	WRL Reference	Description of Sample	PCR Result	Serotyping Result by Cell Culture/ELISA
28	CAR 37/2013	CATTLE, epithelium, Collected 28/07/2013	FMDV GD	SAT 2
29	CAR 38/2013	CATTLE, epithelium, Collected 28/07/2013	NGD	NVD
30	CAR 39/2013	CATTLE, epithelium, Collected 28/07/2013	NGD	NVD
309	CAR 40/2013	CATTLE, fluid/oropharyngeal, Collected 28/07/2013	FMDV GD	NVD
311	CAR 41/2013	CATTLE, fluid/oropharyngeal, Collected 28/07/2013	FMDV GD	NVD
313	CAR 42/2013	CATTLE, fluid/oropharyngeal, Collected 29/07/2013	FMDV GD	SAT 2
315	CAR 43/2013	CATTLE, fluid/oropharyngeal, Collected 29/07/2013	FMDV GD	SAT 2
426	CAR 44/2013	CATTLE, fluid/oropharyngeal, Collected 07/08/2013	NGD	NVD
430	CAR 45/2013	CATTLE, fluid/oropharyngeal, Collected 07/08/2013	NGD	NVD
436	CAR 46/2013	CATTLE, fluid/oropharyngeal, Collected 07/08/2013	NGD	NVD

NVD - No Virus Detected FMDV GD - FMDV Genome Detected NGD - No Genome Detected

SOPs - WRL 026 (PCR), WRL 002 (Cell Culture), WRL 006 (ELISA)

A UKAS accredited testing laboratory No. 4025.