A REVIEW OF MALIGNANT CATARRHAL FEVER
IN THE REPUBLIC OF SOUTH AFRICA

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LIST OF ACRONYMS
AIVH-1  Alcelaphine herpes virus 1
MCF    Malignant Catarrhal Fever
OvHV-2 Ovine herpes virus
RPO    Red Meat Producers Organization
WRSA   Wildlife Ranching South Africa,
CHAPTER 1 – INTRODUCTION

1. Definitions and terms
Malignant catarrhal fever (MCF) has been defined as a generalized viral disease of domestic cattle and buffaloes and many species of wild ruminants characterized by high fever, profuse nasal discharge, corneal opacity ophthalmia, generalized lymphadenopathy, leukopenia and severe inflammation of the conjunctival, oral, and nasal mucosa with necrosis in the oral and nasal cavities sometimes extending into the oesophagus and trachea. Occasionally central nervous system signs, diarrhoea, skin lesions, and nonsuppurative arthritis are observed (Heuschele, 1988).

Malignant catarrhal fever is caused by infection with either the gammaherpesvirus of blue wildebeest Connochaetes taurinus taurinus, white-bearded wildebeest Connochaetes taurinus albojubatus and black wildebeest Connochaetes gnou or that of domestic sheep (Reid & Van Vuuren, 2004). The wildebeest associated virus is the alcelaphine herpes virus 1 (AHHV-1) and the sheep associated virus is the ovine herpes virus (OVHV-2). Plowright first isolated the wildebeest associated virus from a blue wildebeest in 1960. The sheep associated virus was isolated from domestic cattle in Austria in 1990.

2. Background and problem identification

The Animal Deceases Act (1984)\(^1\) imposed certain control measures with regard to Malignant Catarrhal Fever (MCF) in the Republic of South Africa. During 1993 the control measures for MCF were lifted. The Animal Health Act (2002)\(^2\) substituted the Animal Diseases Act (1984). Presently no control measures exist in the legislation with regard to MCF. The lifting of the control measures and other factors has allegedly resulted in an increase in outbreaks of the disease in the Republic of South Africa. Outbreaks of the disease have not only caused large financial losses for cattle farmers, but have also emphasized land use conflicts and other contentious issues. In many instances disputes have led to legal action in courts of law. The decisions of the courts have a major effect on participants in the wildlife and livestock industries. No vaccine is available to protect animals and, as transmission to MCF – susceptible species tends to be erratic and eradication is usually impractical if it does not involve elimination of carrier species (wildebeest and sheep), control is difficult and generally relies on segregating carrier species from susceptible species (Reid & Van Vuuren 2004). Much of the disease, such as the method of transmission and the causes thereof, is unknown and contributes to the difficulties in controlling the disease. Airborne transmission has not been proved scientifically to date and only direct contact between wildebeest and

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\(^1\) Animal Diseases Act (Act 35 of 1984)
\(^2\) Animal Health Act (Act 7 of 2002)
cattle was observed in the past. The virus is extremely labile and cannot survive for long periods in the environment.

In a completed study it was established that there were 2 400 game ranches in the Limpopo Province, South Africa (Van Zyl & Sartorius von Bach 2002). These game ranches cover 4.1 million hectares, which reflects 29.7% of the total surface area of the province. Approximately 40% of the game ranches also carried livestock. It is an accepted principle that profitability increases when game is combined with livestock farming. Certain studies have also revealed that in certain areas game farming is more profitable than livestock farming. In the study quoted above it was established that although only 35% of the ranches catered for tourism the total income of game ranches in the Limpopo Province from tourism alone was estimated at R 28 million per year.

If other sources of income such as hunting, live sales and venison are added, it is quite evident that the wildlife industry is an important component of the economy in South Africa.

Species composition and diversity of species is not only important from an economic perspective, but also from conservation and more specifically a wildlife management perspective. In order to produce valuable populations of wildlife it is important that solutions are found to problems caused by wildlife such as MCF.

3. The purpose of the study

Wildlife management has been defined as the art of making land produce valuable populations of wildlife (Bailey, 1984). This statement also implies that pest populations and indirect pests resulting from wildlife should be controlled to limit negative values to wildlife. These negative values attached to wildlife may result due to damage caused by wildlife directly or indirectly through disease. Damage may be caused in different ways and by different species of wildlife. MCF is transmitted by wildlife species namely wildebeest, as the natural carriers of the virus causing the disease. Mortalities of cattle caused due to the disease result in financial losses to livestock owners. Wildlife management is an important activity of conservation. Conservation has been defined as a social process encompassing both lay and professional activities of wildlife habitats (Bailey, 1984). This process of conservation is multi-disciplinary and needs to involve specialists of different disciplines. A professional activity includes disciplines such as education, administration, research, law and law enforcement, management, veterinary, economics, science and technology. The principle purpose of this study is:

- To provide data on the occurrence and direct losses associated with MCF.
- To investigate the present state of MCF in South Africa with reference to different disciplines.
- To identify management options for further action to improve disease control.
4. Delimitations and assumptions

This study is limited to the wildebeest derived MCF virus (A1HV-1). Although reference is made to the sheep associated MCF virus (OvHV–2) in the study, it is merely for comparative purposes. MCF has occurred in different countries in the world and is not only limited to Africa. The virus doesn’t cause clinical disease in its natural hosts. The natural hosts also do not exhibit any clinical signs after infection. Infectious virus is only excreted by the natural hosts namely wildebeest. No transmission occurs between MCF susceptible species except by experimental inoculation (Reid & Van Vuuren 2004).
CHAPTER 2

1. Literature study

The information gathered and relating to this study falls mainly within the natural science, veterinary science and legal discipline. Books, science journals, veterinary journals and law journals were studied and are referred to in this review. With regard to the legal aspects of the study, legislation and decided court cases were investigated and are referred to.

The literature about MCF as a disease essentially differs in regard to the causes and transmission of the disease. Some authors relate the cause of the disease to stress associated factors (Barnard & Van Pypekamp 1988; Rweyemamu, Karstad, Mush, Otema, Jesset, Rowe, Drevemo & Grootenhuis 1974; Barnard, Van Lught & Mush 1994). Although the exact causes of the disease have not been established, stress has not been excluded. Another aspect about which authors have different views is the transmission of MCF (Barnard & Van Pypekamp 1988; Nevill 1985; Barnard 1991; Rweyemamu, Mush, Otema, Karstad, Jesset 1980; Rossiter, Jesset & Karstad 1983; Reid & Van Vuuren 2004; Plowright 1965). The exact method of transmission of MCF has not been scientifically established. No legislation in South Africa presently exists to control MCF. The common law contains general principles with regard to remedies under certain circumstances. (Neethling, Potgieter & Visser 1989; Neetling, Potgieter & Visser 2002; Neethling, Potgieter, Visser & Knobel 2006; Van der Merwe & Olivier 1985). These remedies may not be applicable to all circumstances in this review. Certain authors have specifically excluded the application of some remedies (Visser, 2006). A limited amount of court cases were decided on MCF and although different in the outcome, the principles appear not to have been applied differently. Although the outcome of certain cases has not been criticized, certain authors have criticized the reasoning in determining the outcome (Freedman, 2005).

In the field of natural science, literature dealing specifically with techniques in solving the occurrence of MCF could not be located and appear not to exist. In view of general considerations, the known characteristics of MCF and the behaviour of the carriers of the disease reference is made to wildlife management.

2. Methodology

Firstly as a general point of departure the issues regarding MCF were discussed with people identified as interested parties. Individuals such as game farmers and cattle farmers are directly affected by the existence of MCF. Veterinarians are indirectly involved, not only in privately combating the disease but also in monitoring the disease as appointed officials of the Government. Game ranch and cattle ranch managers are on a day-to-day basis burdened with the occurrence of MCF. Discussions were conducted with several individuals initially, to determine the prevalence of MCF. Where severe cases of outbreaks of MCF were established,
personal interviews were conducted to obtain and record relevant data and information about the occurrence thereof. These cases are referred to as case studies. Personal interviews were conducted with the appointed State Veterinarians situated at Mokopane for the district of Potgietersrust, and Lephalale for the district of Ellisras in the Limpopo Province of the Republic of South Africa. Information specifically regarding the amount of reported mortalities as a result of MCF was obtained.

Secondly interest groups such as the Red Meat Producers Organization of Limpopo Province (RPO) and South Africa and Wildlife Ranching South Africa (WRSA), national organizations were identified. Data was obtained from these organisations for this study. The RPO annual congress on 24 April 2007 held at Baltimore, Potgietersrust district, Limpopo Province, South Africa was attended. The Ombudsman for MCF amongst others gave a presentation and MCF was discussed. Personal conversations were conducted with cattle farmers, veterinarians and game farmers present at the congress. A personal interview was conducted with the secretary of the Ombudsman for MCF.

3. Presentation and interpretation of data

3.1. Case studies

In the Potgietersrust district, Limpopo Province Republic of South Africa, three cases of MCF occurred. Between May 2003 and January 2004 twenty five mortalities of cattle with suspected MCF occurred on the farm Mooiplaas. Twenty one of the mortalities were clinically confirmed by laboratory examinations to be MCF. Mooiplaas is situated adjacent to two game farms where blue wildebeest are kept. One of the game farms is approximately 300 ha in size and approximately 100 blue wildebeest are kept on the property. The other property is approximately 450 ha in size where an unknown amount of blue wildebeest occur. According to the observations of the owner who had lost cattle as a result of the disease, the incubation period of MCF varied from 1 month to 6 months. A further observation that was made is that most mortalities were pregnant cows with calves. Some of the calves also died. The estimated financial loss amounted to approximately R 110 000.00. Most mortalities occurred in the months of July, August and September 2003. According to the owner of the cattle he has adapted his grazing system to alleviate the problem. Rotational grazing is done whereby camps adjoining the game farms where blue wildebeest are kept are grazed when MCF is less prevalent.

Another case was reported on the farm Doornfontein. Between July 2006 and December 2006 twenty-five cows, two calves and one bull were lost as a result of suspected MCF. Altogether 14 mortalities were confirmed as MCF by laboratory examination. The property on which the losses occurred is adjacent to a game farm where approximately 100 blue wildebeest were kept. The property where the wildebeest were kept is approximately 1 000 ha in size and the blue wildebeest were relocated to this property several years prior to the outbreak of MCF on the adjoining
property. No mortalities occurred prior to 2006. The total estimated monetary value of the cattle lost as a result of MCF amounted to approximately R 120 000.00. According to the observations of the owners of both properties where the wildebeest and cattle were kept, dry conditions, with strong winds in the direction from the property where the wildebeest were kept to the adjoining property where the cattle were kept occurred during the time of the outbreaks. The owners of the properties agreed to settle the matter between them and compensation was paid for the losses incurred. The owners also agreed that all wildebeest were removed to prevent any further loss or damage.

Another case was reported on the farms Rykdom and Sterkfontein, which are managed as one farming unit. From 2004 until 2007 approximately 20 cattle died of MCF. The mortalities were clinically confirmed by laboratory examinations. The property where the mortalities occurred is adjacent to several properties and conservation areas where blue wildebeest are kept. Blue wildebeest on altogether five neighbouring properties may be the source of MCF. Two conservancy areas in excess of 15 000 ha with an unknown amount of wildebeest are in close proximity to the property where the mortalities occurred. Two properties smaller than 300 ha with approximately 50 blue wildebeest each and another property of approximately 1 200 ha and an unknown amount of wildebeest also adjoin the affected property. The losses incurred are in excess of R 120 000.00. One of the conservancy areas exists since the late seventies and no mortalities due to MCF were reported before 2004. This specific case is noteworthy because it indicates the difficulty with which the owner of cattle who has suffered damages is faced in establishing who is liable for his loss. Attempts were made by the owner of the cattle to resolve the issue with neighbouring owners, without success. Legal action is presently pending.

The following factors are of importance in the case studies and are discussed later in the study:

Disease related
- Long incubation period.
- High incidence amongst cows and calves.
- Wildebeest present for several years before outbreak.

Management related
- Rotational grazing.
- Removal of wildebeest and joint management decisions.
- No losses occurred from large conservancy since late seventies.

Legal related
- Prevented losses through management measures thereby avoiding legal action.
- Settlement of dispute through negotiation by interested parties.
- Difficulty in proving liability for the loss.
3.2. Statistics with regard to historic and current prevalence of the disease.

The RPO is a national organization created by the red meat producers of South Africa in order to advance the interests of red meat producers. The RPO of Limpopo Province, South African holds statistics of cases and outbreaks of MCF, which it obtains from its members. Statistics with regard to the occurrence of the disease in Limpopo Province exist from 2003. Table 1 contains the number of outbreaks and cases of MCF from 2003 until 2006. The RPO obtained the numbers from its members and do not reflect the exact number of confirmed MCF cases or the number of properties.

Table 1: Number of mortalities recorded by RPO, Limpopo

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER OF MORTALITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>88</td>
</tr>
<tr>
<td>2004</td>
<td>80</td>
</tr>
<tr>
<td>2005</td>
<td>116</td>
</tr>
<tr>
<td>2006</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>384</strong></td>
</tr>
</tbody>
</table>

Statistics were also obtained from the Provincial State Veterinary Laboratory of Lephalale, Limpopo Province, South Africa with regard to occurrence of MCF in its area. This information is recorded in Table 2.

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Table 2: Number of mortalities recorded by Provincial State, Laboratory, Lephalele\(^4\)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER OF MORTALITIES</th>
<th>NUMBER OF PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1994</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>1995</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>1996</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>1997</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>1998</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>1999</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2000</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>2001</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>2002</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>2003</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>2004</td>
<td>35</td>
<td>29</td>
</tr>
<tr>
<td>2005</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>2006</td>
<td>24</td>
<td>19</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>256</strong></td>
<td><strong>235</strong></td>
</tr>
</tbody>
</table>

Statistics were obtained from the Provincial State Laboratory of Potgietersrust situated at Mokopane, Limpopo Province South Africa with regard MCF in its area. This information is recorded in Table 3.

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Table 3: Number of mortalities and properties recorded by Provincial State Laboratory Potgietersrust

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER OF MORTALITIES</th>
<th>NUMBER OF PROPERTIES</th>
<th>YEAR</th>
<th>NUMBER OF MORTALITIES</th>
<th>NUMBER OF PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>1</td>
<td>1</td>
<td>1995</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1982</td>
<td>1</td>
<td>1</td>
<td>1996</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1983</td>
<td>1</td>
<td>1</td>
<td>1997</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>1984</td>
<td>5</td>
<td>5</td>
<td>1998</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1985</td>
<td>6</td>
<td>6</td>
<td>1999</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1986</td>
<td>2</td>
<td>2</td>
<td>2000</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>1987</td>
<td>7</td>
<td>6</td>
<td>2001</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1988</td>
<td>6</td>
<td>5</td>
<td>2002</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1989</td>
<td>5</td>
<td>5</td>
<td>2003</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>1990</td>
<td>3</td>
<td>3</td>
<td>2004</td>
<td>35</td>
<td>21</td>
</tr>
<tr>
<td>1991</td>
<td>6</td>
<td>6</td>
<td>2005</td>
<td>41</td>
<td>19</td>
</tr>
<tr>
<td>1992</td>
<td>7</td>
<td>7</td>
<td>2006</td>
<td>35</td>
<td>18</td>
</tr>
<tr>
<td>1993</td>
<td>10</td>
<td>7</td>
<td></td>
<td>222</td>
<td>155</td>
</tr>
<tr>
<td>1994</td>
<td>17</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Table 4: Comparison of outbreaks from 1981 to 1983 and 1988 to 1990

<table>
<thead>
<tr>
<th>Carriers</th>
<th>Outbreaks</th>
<th>Outbreaks</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue wildebeest</td>
<td>14</td>
<td>64</td>
<td>4,5</td>
</tr>
<tr>
<td>Black wildebeest</td>
<td>2</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Total:</td>
<td>16</td>
<td>78</td>
<td>11,5</td>
</tr>
</tbody>
</table>

The press release of the then Director of the Department of Animal Health in 1993, mentions that during the 5 years preceding the upliftment of the regulations with regard to wildebeest, 150 outbreaks of MCF whereby 500 cattle were involved occurred in the Republic of South Africa, the TBVC and self governed states (Bosman 1993). This relates to an average of 3 animals per outbreak.

5 Provincial State Veterinary Department.(2007) Mokopane. Unpublished data

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The decision of the Minister of Agriculture to abolish MCF as a controlled disease was based on the fact that in view of the relative low incidence of the disease the economic effect thereof, seen in a national context was relatively small. It was the view of the Minister that MCF as such could not result in epidemic proportions but was limited to sporadic localised outbreaks, which resulted in occasional mortalities.

It was also mentioned that wildebeest are the main carriers of MCF in South Africa and that they occur throughout the country. All wildebeest were considered as hosts of the disease, and as a result thereof the disease cannot be controlled on a geographic basis, as other diseases such as foot-and-mouth disease and Corridor disease of which buffalo are the carriers in certain regions of the country. Barnard (1991) mentioned that the fact that wildebeest and cattle are in certain instances kept together for years without MCF occurring, has led to the misconception that certain herds of wildebeest are free of the disease. According to (Barnard, 1991) that is however not the case. All black wildebeest herds that were tested for the presence of the virus, tested positive for the disease. No wildebeest have been conclusively shown to be free of MCF Barnard et al. (1994).

Although sheep also play a role in transmission of the disease, according to the records of the Directorate of Animal Health wildebeest were responsible for more than 90% of outbreaks. The legislation with regard to MCF, which restricted the keeping of wildebeest to certain registered game farms, was considered as being discriminatory towards game farmers and was difficult to justify in view of the economic impact of the disease.

The judgment of one of the court cases discussed later in this study, refers to statistics placed before the courts as evidence. In the unreported case in the Supreme Court of Appeal of PGB Boerdery Beleggings (Edms) Bpk and another v Somerville 62 (Edms) Bpk and another (2007) reference is made to 125 mortalities in 2004 and 108 mortalities in 2005 in the entire country. It can be assumed that more cattle in South Africa die of snake bite or lightning than MCF per annum.

3.3 Analysis of statistics

Table 1 only reflects the number of cases for 4 years. The lowest number of incidence was 80 cases in 2004 and 116 in 2005 in Limpopo Province. Although the increase from 2004 to 2005 reflects and increase of 45%, the cases fluctuated with decreases noted in 2004 and 2006 from the previous years. These numbers indicate a figure of the prevalence of the disease amongst cattle of members of the RPO in Limpopo Province. The exact amount of the financial losses suffered was not indicated to the RPO. Based on an average amount of R 5 500.00 per animal lost, it brings the total loss of animals for the period of 2003 to 2006 of the RPO members in the Limpopo

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6 SCA 145 (RSA)
Province at a conservative estimated amount of R 2 112 000.00. Comparisons cannot be made for previous years due to the lack of data.

Table 2 shows the number of mortalities for the 14 years from 1993 to 2006. During 2004 the highest number (35) was recorded and in 1993 the lowest number (5) was recorded. The numbers indicated in table 2 fluctuated from year to year and no increasing pattern can be established for this data over time. The absence of data before 1993, when the control measures were exercised makes comparison before and after 1993 impossible and there is no scientific proof that the control measures were effective.

Table 3 shows the number of cases for 26 years. This table is especially noteworthy because it indicates numbers of cases before the abolishment of the control measures on MCF. It also indicates the numbers of confirmed laboratory cases before the implementation of the control measures in 1987. The information in table 3 was used to make a comparison of the number of cases before implementation from 1981 to 1986 and during implementation from 1988 to 1992 and after abolishment, respectively form 1994 to 1999 and 2000 to 2005. These comparisons are reflected in table 5 and are broken up in time spans of six years respectively. In order to compare equal time spans, 1993 was not included in the comparison for table 5.

**Table 5: Comparison of mortalities from 1981 to 1986; 1988 to 1993; 1994 to 1999 and 2000 to 2005.**

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>MORTALITIES</th>
<th>INCREASE/DECREASE FROM PRECEDING PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981 to 1986</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>1987 to 1992</td>
<td>34</td>
<td>18</td>
</tr>
<tr>
<td>1994 to 1999</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>2000 to 2005</td>
<td>99</td>
<td>71</td>
</tr>
</tbody>
</table>

Table 5 reflects the numbers for the same time span in the same area respectively. Figure 1 indicates an increase in the number of outbreaks for the period 1987 to 1992 (period when the control measures were exercised). The following period from 1994 to 1999 indicates a decrease in the number of mortalities after the abolishing of control measures. The highest incidence in outbreaks occurred in the period from 2000 to 2005. The reasons for the increase are unknown. The data does not indicate that the control measure methods were effective.
Figure 1: MCF mortalities for different time periods to indicate the effectiveness of control measures.

The analyzed data of mortalities do not indicate an increase in MCF occurrence due to the termination of the control measures. Reid & Van Vuuren (2004) mention that in the period from 1993 to 1999, the number of fenced game ranches in South Africa doubled. Table 6 indicates a decrease in the number of MCF mortalities for the period from 1994 to 1999 when the number of game ranches doubled. When it is considered that 29, 7% of the total area of the Limpopo Province consists of game ranches (Van Zyl & Sartorius von Bach 2002), the data does not reflect a positive correlation in an increased incidence of MCF mortalities and the termination of the control measures.

The trend shows an increase in the incidence of the disease over a 23 year period. Table 3 shows a sharp increase in the number of MCF mortalities for 2004, 2005 and 2006. The total number of cases from 2004 to 2006 is equal to the total cases of the previous 23 years from 1981 to 2003. It can only be speculated what the reasons were for the notable higher number of outbreaks. Reasons may be a greater awareness of the disease, more cases were reported in recent years, increase in the number of mixed game/cattle ranches, increase in wildebeest numbers, decrease in the treatment of cattle for external parasites that may transmit the disease, poor maintenance of border fences between cattle and game ranches and movement of cattle and wildebeest.
The data in Table 2, 3 and 5 only reflect mortalities, which were confirmed through laboratory testing and reported to the relevant institutions and it could be assumed that cases are not reported and recorded in the statistics. Barnard (1991) is of the view that only very small percentages (10% to 15%) of confirmed cases of MCF are reported to the relevant authorities. Therefore the statistics of the incidence of the disease do not reflect the full proportions thereof. In the case of black wildebeest the incidence of the disease increased 4,5 times in the period from 1981 to 1983 and seven times from 1988 to 1990. It can be assumed that MCF will increase over the next decade if the management to prevent the contact between wildebeest and cattle are not improved. In the past most black wildebeest herds were small and 36% of the herds consisted of less than 10 animals and only 10% of herds were more than 30 animals. (Barnard 1991).

It has especially been noted that pastoralists in the rural areas of Limpopo do not report the disease\(^1\). It appears that amongst others some of the reasons advanced for not reporting the disease are the fear of owners that their livestock may be destroyed and they may suffer losses as a result thereof. Because MCF is a relatively unknown disease, mortalities as a result thereof are also not always reported (Barnard 1991).

Some of the statistics are contradictory and indicate the unreliability thereof. The numbers of MCF cases for 2005 of the RPO is indicated as 116 in Limpopo Province. The number mentioned in the court case referred to above indicated a figure of 108 cases for the whole of South Africa\(^2\). This contradiction is an indication of the inaccuracy and inadequacy of the present system of reporting and recording of the disease.

Awareness programs and education to inform stakeholders of the disease should be launched together with proper implementation of reporting and recording systems. Without properly researched statistics of the disease, planning cannot be done to improve the control of the disease.

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\(^1\) Wiese, W. December 2007. State Veterinary Laboratory Lephalale. Personal communication

\(^2\) Vide Chapter 2 3.2 :16

\(^3\) Vide = Latin for “see”
CHAPTER 3 - MALIGNANT CATARRHAL FEVER

1. Causes and symptoms of the disease:

The source of wildebeest associated MCF (A1HV-1) may be the two blue wildebeest subspecies and the black wildebeest (Reid & Van Vuuren 2004). This form of MCF occurs throughout the natural distribution of these antelope in Africa. In southern Africa this form of MCF also occurs in areas where these antelope were not endemic but to areas where the animals were relocated. Viruses identical or closely related to this form of MCF (A1HV-1) were isolated from several captive wild ruminant species in two zoos in the United States of America located in Oklahoma City and San Diego. Animals affected by this virus were amongst others Indian gaur Bos gaurus and greater kudu Tragelaphus strepsiceros. Clinical signs of infection of the wildebeest derived MCF was also found in other ruminant species such as deer, water buffalo, bison and banteng. Isolation of a causative herpes virus from these species could however not be accomplished (Heuschele, Nielsen, Oosterhuis & Castro 1985; Castro, Daley, Zimmer, Whitenack &Jensen 1982). The possibility that the presence of ruminant species in zoos with MCF may provide a reservoir for the virus was, however, not excluded. African wild ruminants, such as certain species of oryx and addax, may be the reservoir hosts although MCF has not been isolated from them either. Serologic, virologic and epidemiologic evidence indicates that the principal reservoirs of MCF viruses include species of wildebeest, topi, hartebeest, oryx, domestic and wild sheep and goats (Heuschele, 1985). Closely related herpesviruses have been isolated from one or more species of each of these groups. Based on epidemiologic evidence only wildebeest, sheep and goat species appear to shed transmissible cell-free MCF virus (Heuschele, 1985). There is no evidence that MCF is infectious to humans (Plowright, 1990). No cases of MCF have been reported from antelope species that normally co-habit wildebeest grazing areas in Africa.

The method of transmission of the disease has not yet been fully established. Outbreaks of the disease occur where wildebeest as the hosts of the disease are separated from cattle for a substantial distance without actual direct physical contact taking place. Barnard & Van Pypekamp (1988) reported transmission of the disease over a distance of 800 meters10 but could not find the method of transmission. The state of carrier cattle was also not proved in this case.

Different theories are discussed later with regard to the methods of transmission. Transmission of A1HV-1 in free-living populations of wildebeest is efficient. The cause of MCF is a virus, which is present in the tissues of normal wildebeest. The recovery of the virus from the spleen of a wildebeest foetus in utero showed that transplacental transmission occurs in this species (Plowright, Ferris & Scott 1960). It can be propagated in suitable monolayer tissue cultures and produces a cytopathology, which resembles that of herpes simplex, B virus, pseudorabies, viricella and herpes zoster.

10 Vide Chapter 3 3:29 - 32
MCF virus behaved in a manner similar to varicella-zoster agent in that no cell free infectivity was produced during passages by thyroid cell cultures or by a line of calf kidney cells in which it was serially propagated. After several passages, calf kidney cells produced cell free virus which passed through collodion membranes. Epizootiologically MCF virus behaves like B virus, herpes simplex and pseudo-rabies in that these agents usually cause very mild infections in their customary reservoirs but highly fatal diseases when introduced into experimental or natural hosts (Plowright, Macadam & Armstrong 1963).

Herpes is a classic example of a persistent infection. It was proved that a viraemia extending over many months to be present in cattle which recover from MCF (Plowright et al. 1960). It is thus probable that the same virus persists for long periods, if not for life, in sheep and wildebeest. MCF was isolated from blood or spleen of white bearded wildebeest (Plowright, 1965). Viraemic animals were found in all age groups but the infection rate was highest in the first three months of life. Some calves were probably infected congenitally. It seems probable that some wildebeest retain the virus throughout their lives but that the quantity of circulation falls to low levels after the first 13 to 14 months. The congenital infection of some calves is evidence that the virus may persist in female wildebeest through their breeding life.

The periodicity of MCF is traditional knowledge among the Maasai people of East Africa. They believe that the disease is acquired exclusively from wildebeest either at the time of the annual calving season or in the succeeding three to four months after calving (Plowright, 1965). They believe transmission is either from the placenta or calf hair-coat, which is shed at about three months of age. There is no evidence to support the concept, although in does indicate that parturient wildebeest are usually the source of infection. In Tanzania MCF is recorded only during the months of January to May, with the majority of outbreaks in March and April. In Kenya the disease normally occurs in the months of April and July. This information corresponds with the calving season of wildebeest in December to February in Tanzania and February to April in Kenya. It was found that cattle acquired MCF after a minimum of 30 days contact with viraemic wildebeest (Plowright, 1965). Because viraemia in wildebeest calves fell after the first three months of life, MCF would not occur after June in Tanzania and August in Kenya. The development of virus neutralizing secretary antibodies effectively prevents further virus excretion in calves more than three or four months old. All three wildebeest species have a high prevalence of MCF antibody (Heuschele & Fletcher 1984).

In South Africa the wildebeest calving season starts in December. The cases are therefore expected from January with the majority of outbreaks in March and April as in Tanzania. Most cases are concentrated in the months of September to November (Barnard & Van Pypekamp 1988). This difference cannot be explained. A possible explanation given for the difference is stress caused by unusually cold rainy weather during the winter months, together with poor grazing. Adverse climatic conditions have however never been shown to be responsible for increased excretion of MCF by
wildebeest. The stresses of late pregnancy and calving have been found to probably lead to reactivation of latent virus in wildebeest, to transplacental infection and wildebeest-to-wildebeest transmission Rweyemamu et al. (1974). Reactivation and secretion of the virus occurred in captured adult wildebeest at the time of confinement following changes in diet and betamethasone (a corticosteroid) treatment. These experiments provide evidence on the carrier status of MCF in wildebeest and demonstrate that nasal excretion may be the principal route of transmission of MCF from wildebeest to cattle and from wildebeest to wildebeest within the population. Adult wildebeest probably only excrete virus under conditions of severe stress such as during captivity and exposure to high environmental temperatures. The studies have not excluded the role of stress in the transmission of the disease and are a contributing factor under certain circumstances. Plowright (1965) is of the view that MCF can be recovered from wildebeest of all age groups but that wildebeest, beyond the initial stage of continuous high-level viraemia are not capable of transmitting the agent to cattle and the two species can be grazed together or be kept in close direct physical contact.

In all the studies of A1HV-1 infection in wildebeest, no evidence of clinical disease or pathological lesions has been reported. Direct transmission from wildebeest to MCF-susceptible hosts like cattle only occurs from wildebeest. Horizontal spread does not take place from MCF-affected animals like cattle to cattle. The failure to spread amongst cattle by “natural” routes is presumably due to the absence of, or inadequate amounts of, stable cell-free infectivity in the excretions of sick cattle (Plowright, Ferris & Scott 1984). It seems reasonable to suppose that the infectivity in cattle secretions die rapidly in the environment and become non-infectious. There are very few records of contact infection amongst cattle, although it is suspected that it has occurred (Plowright, 1990). Vertical (transplacental) transmission in cattle has been described (Plowright, Kalunda, Jesset & Hermiman 1972). Nine pregnant cows, infected with MCF virus in late pregnancy, developed the acute disease but virus was not demonstrable in their foetuses five to ten days after onset. Two further cows, which recovered from the experimental disease, produced uninfected calves two to eight months later. A third animal gave birth to two calves 14 to 22 months after recovery and both showed a delayed reaction to challenge at the age of 31 and seven weeks respectively. One cow produced her third calf 44 months after an apparent infection with MCF virus. Thyroid monolayer prepared from this calf developed cenotic effects, which were shown to be due to MCF virus of undiminished virulence. The same cow gave birth to three further calves, the last being born 80 months after initial infection. All of these calves were infected with MCF virus. One was born with the disease and another did not develop clinical signs of the disease until the age of 17 weeks.

In another study of 52 cases of MCF in 1988 and 1989 in the former north-western Transvaal (North-West), a high incidence of the disease was found in cows and calves (Barnard, 1990). The high incidence among cows and calves together with the low incidence in calves of unaffected cows, the short periods between the death of cows
and their calves and the occurrence of the disease in calves born after their mothers had been moved away from wildebeest, indicate the congenital transmission between cattle. It was also found that young cattle and dry cows are not as susceptible to MCF as pregnant cows and young calves.

The clinical and pathological changes associated with MCF resulting from infection with the A1HV-1 or OvHV-2 in susceptible animals species are similar and cannot be reliably differentiated (Reid & Van Vuuren 2004; Plowright, 1990).

Clinical MCF in cattle has been divided in the following 4 forms: (Heuschele, 1988).

**Per-acute form:**

Severe inflammation of the oral and nasal mucosas and hemorrhagic gastro-enteritis with a course of 1 to 3 days.

**Intestinal form:**

Pyresia, diarrhea, hyperemia of oral and nasal mucosa with accompanying discharges, and lymphadenopathy with a course of four to nine days.

**Head and eyes:**

This is the typical syndrome of MCF with pyrexia, nasal and ocular discharges progressing from serous to mucopurulent and purulent. Encrustation of the muzzle and nares occurs in later stages, causing obstruction to the nostrils and dyspnea, open-mouthed breathing and drooling. There is intense hyperemia and multifocal or diffuse necrosis of the oral mucosa, usually on the lips, gums, hard and soft palate and buccal papillae leaving them reddened and blunted is a common finding. Ocular signs referable to ophalmia include lacrimation progressing to purulent exudation, photophobia, hyperemia and oedema of the palpebral conjunctiva and injection of several vessels. Corneal opacity, starting peripherally and progressing to centripetally results in partial or complete blindness. Hypopyon may also be seen. Corneal opacity is usually bilateral, but occasionally is unilateral. Pyrexia is common and usually high (104 - 107°F) until the animal becomes moribund, at which time it is hypothermic. Increased thirst accompanies the pyrexia and anorexia is seen in late stages. Constipation is common in this form of MCF, but terminal diarrhea is sometimes observed. Nervous signs are not normally seen but may be manifested by trembling or shivering, incoordinated gait and terminal nystagmus. Necrotic skin lesions occasionally are seen and horn and hoof coverings may be loosened or sloughed in some cases. The course of this form, which is invariably fatal, is usually seven to 18 days.
Mild forms:

These are syndromes caused by experimental infection of cattle with attenuated viruses, and are usually non-fatal. Clinical signs in wild ruminants are less dramatic than the typical syndrome of MCF in the head and eye form in cattle. Clinical signs are not necessary diagnostic in wild ruminants except in members of the subfamily Bovinae, i.e. wild cattle. Although MCF is often more subtle in antelope species, death may occur suddenly.

*Lantana camara* occurs as a weed in the veld particularly in the high rainfall regions of South Africa. It is a noxious weed of tropical American origin. *Lantana Camara* poisoning is considered as being probably the second most important hepatotoxicosis of cattle in South Africa. Photosensitisation due to poisoning by *Lantana camara* is held responsible for 3% of the national stock mortalities from all plant poisonings and mycotoxicoses (www.ais.up.ac.za/vet/poison/bnames.htm). It mostly occurs in cattle. Some of the clinical signs of MCF and poisoning by *Lantana camara* are similar. The clinical signs of *Lantana camara* poisoning are photosensitivity resulting from damage primarily to the liver parenchyma and include anorexia, severe depression, icterus. Clinical pathological changes consistent with hepatosis and nephrosis have been recorded. The macroscopical lesions are typical of hepatogenous photosensitivity, namely, icterus photodermatitis, yellow to orange-brown discolouration and swelling of the liver, impaction of the caecum and colon, and nephrosis. The gall bladder may be oedematous and distended with straw-coloured or green bile. Histopathological changes involving the hepatocytes include swelling, distinct delineation of cell membranes, diffuse cloudy swelling and hydropic degeneration, and sometimes also mild to moderate fatty changes. Intracytoplasmic eosinophilic globules often accompany the above changes. (www.ais.up.ac.za/vet/poison/bnames.htm)

MCF results in the death of over 95% of affected animals (Heuschele, 1988; Mare, 1977). Although recovery of animals with the A1HV-1 virus does occur, the frequency with which this occurs is not clear (Reid & Van Vuuren 2004). More than 150 species of the suborder Ruminita are susceptible to MCF virus infection. Clinical diseases have been described in over 30 of these species, including domestic and wild, ruminants (Heuschele, 1988). Diagnosis on clinical and gross post-mortem examination is possible in acute and more protracted cases with the typical clinical signs of the disease. Laboratory examinations are however required to establish a definitive diagnosis. A history of contact with the animals that act as a reservoir of the disease such as wildebeest will support the diagnosis. The possibility of prolonged incubation periods may make it difficult to establish this contact. Methods of transmission may also make it difficult to establish this contact.

The duration of the natural incubation period is difficult to establish, as the time of infection cannot be identified. Evidence suggests that the incubation period may vary from two weeks up to as long as nine months (Reid & Van Vuuren 2004). Congenital transmission of the disease in cattle has occurred over even longer periods Plowright et
al. (1972). A cow produced a calf, which tested positive for MCF 44 months after infection with MCF virus. The same cow gave birth to three further calves, which were infected with MCF. One of the calves was born 80 months after initial infection. Another of these calves did not develop clinical signs of MCF until the age of 17 weeks.

2. Dispersal

The Serengeti ecosystem is a world heritage site that is known for the migration of large herds of blue wildebeest. The vaccination of cattle against rinderpest in the Serengeti had a major effect on the wildebeest migration during the past 40 years. The elimination of rinderpest by vaccination led to the elimination of rinderpest in cattle but also in wildlife. Wildebeest numbers increased from approximately 200,000 in 1962 to 1.3 million in 1977 and presently fluctuate between 1 million and 1.5 million. (Cleaveland, Kasiluka, Ole Kuwai, Bell & Kazwala 2001). With the increase in numbers of wildebeest, there has been a change to the migration cycles. Wildebeest utilize the Salei Plains to the east and the Angata Kheri plains to the north, with some herds moving, during the wet season, directly north to Kenya through the Loliondo area. Although little is known about the impact of the changes on the incidence of livestock diseases, MCF has been ranked by the Maasai as a disease of major significance in East Africa Cleaveland et al. (2001). In certain areas, it has been ranked as the most important disease of cattle.

Since 1974 there has been an increase in the occurrence of MCF in the United Kingdom and the United States of America (Pierson, Hand, Dardiri, Ferris & Schoer 1979). Outbreaks were reported in several mid-western and eastern states in America with smaller deaths than in the western states of Colorado, California and Arizona. In the last mentioned states, the economic losses as a result of the disease were severe. Although the disease is prevalent in the British Isles, Australia, Canada and New Zealand it appears that the sheep associated MCF virus (OvHV-2) is more prevalent in countries outside Africa Pierson et al. (1979); (Hong, Shen, Jessup, Knowles, Gorham, Thorne, Toole & Crawford 1996). Barnard (1991) mentioned that losses due to the disease reached alarming proportions in some localities in zoological gardens (Refer to Appendix 1). Exotic game ranching, often in conjunction with domestic livestock is an important concern because of high mortality of MCF. Although it is impossible to determine the form of MCF on a clinical and pathological basis, there is a difference in the ease of transmission, volume of inoculums required to transmit the disease, length of incubation period, duration of the illness and of frequency of successful viral isolation Pierson et al. (1974). Laboratory diagnosis is the only reliable method of identification between OvHV-2 and A1HV-1. This study focuses on the wildebeest derived (A1HV-1) form of MCF. This form of the virus does occur outside of Africa but is only transmitted where animals which contracted the disease were kept in close proximity to wildebeest kept in captivity in zoos. To date there has been no evidence that MCF occurs in susceptible species on contact with hartebeest, topi or oryx (Heuschele, 1985).
Wildebeest have a wide distribution in Tanzania and it is likely that MCF occurs in many parts of the country. Cases are, however, rarely reported to veterinary authorities and official incidence is therefore difficult to obtain. In Kenya wildebeest are limited mainly to the southwest of the country. The areas at greatest risk are those adjacent of the Maasai Mara Game Reserve and Amboseli National Park. Incidence rates in these areas have ranged from 1% to 21% on group ranches and private owned ranches Cleaveland et al. (2001). Cases have been documented every year. Smaller ranches and smallholders suffer substantial losses that cannot be compensated whereas losses on private group ranches are recovered by benefits from wildlife through tourism.

Maasai pastoralists in Tanzania estimated their direct losses ranging from approximately R 600.00 to R 1800.00 per case as a result of deaths, emergency slaughter, low prices for the sale of sick animals and lost milk production Cleaveland et al. (2001). The cost implication of losses in a herd with regard to reproduction and production has not been quantified. In Kenya direct losses as a result of death through MCF, emergency sales and slaughter was estimated at 4% to 8% in low incidence areas and 14% to 24% in high-incidence areas of herd value Cleaveland et al. (2001).

Incidence of the disease in South Africa has increased mainly as a result of the growth of the game ranching, wildlife and tourism industries. Losses in the North-West Province of South Africa with incidence of as high as thirty four percent have been reported Barnard et al. (1994). South Africa is the only natural habitat of the black wildebeest and an outbreak of MCF was reported in 1904 in the Eastern Free State. The area of distribution of black wildebeest is bigger than that of blue wildebeest (Reid & Van Vuuren 2002). Both black and blue wildebeest are distributed in all the provinces of the Republic of South Africa and outbreaks of MCF occur regularly in different areas of the country. No accurate information on numbers of game farms in South Africa exist. Wildlife Ranching South Africa is presently in the process of doing a survey to determine what amount of game ranches exist in the Republic of South Africa 11. Wildlife Ranching South Africa is a national organisation representing and advancing the interests of game ranchers in South Africa. MCF associated with wildebeest occurs in South Africa where free living and captive wildebeest are present.

The majority of cases occur in Limpopo and Northwest Provinces, where the number of game ranches have increased (Reid & Van Vuuren 2004). The peaks in the prevalence of the disease are encountered from January to May (with the highest number occurring in April) and again from September to November annually. The disease is rare in the months of December, January, February, June, July and August.


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3. Opinions and views of transmission

The method of transmission of MCF has not yet been established. Transmission of the disease has been reported over distances of over 800 meters (Reid & Van Vuuren 2004). The question therefore arises how the disease is transmitted over such distances. Different opinions exist with regard to this question. The method of transmission of the disease is of specific importance with regard to the control of the disease. If the method of the transmission is established, it may simplify the development of a vaccine against the disease. Other control measures may also effectively be implemented if the method of transmission is established with certainty.

Although it was previously considered that close contact between wildebeest and cattle is necessary for transmission of MCF to the cattle it was established that close contact is not essential for transmission (Barnard & Van Pypekamp 1988). Barnard & Van Pypekamp (1988) are of the view that the MCF virus is prone to undergo chemical change or alteration of atomic structure. Infectivity is associated predominantly with viable cells. The possible transmission of the virus by flies is not excluded. Several species of flies are abundant for most of the year and may act as vectors when a suitable reservoir of the MCF virus is available. *Parafilaria bovicola* transmission in the former northern Transvaal was found to correlate with high numbers of vector flies (Nevill, 1985). Transmission was found to be high at periods, with high incidence of vector flies. The simultaneous occurrence of MCF and *Parafilaria bovicola* ovipositioned blood spots on cattle may play a role in the transmission of MCF where vector flies visit these spots and spread the disease Barnard & Van Pypekamp (1988).

Barnard (1991) is of the view that the occurrence of the disease in August to November in South African cattle that are not in direct contact with wildebeest, indicates insect transmission.

Du Toit (1991) is of the view that a fly like *Oestrus* or *Gedoelstia* plays a role in the transmission of the virus. *Oestrus* deposit larvae in and around the nostrils of their hosts in the first stage of their life cycle. The second stage is completed in the nasal and perinasal cavities while in the last stage when a larva is formed, the host is left via the nostrils to pupate in the soil. *Gedoelstia* on the other hand deposit larvae on the cornea of the host’s eye, which migrate along the optic nerve via the nerve tracts and cavities in the head to the nasal passages to complete the second and third stages of their life cycle. These flies hatch in October and increase up to May. These time period’s co-inside with the occurrence of MCF. Certain experts12 relate the changes in temperature to when the flies hatch, thereby transmitting the disease. None of these theories have, however, been proven to be the method of transmission of MCF.

Blood and nasal swab specimens and various body tissues were tested for MCF from 66 wildebeest of different age groups and sexes Rweyemamu *et al.* (1974). It could not

12 Wiese. W. December 2007 State Veterinarian, Provincial State Veterinary Department. Lephalale. Personal communication

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be established with certainty that wildebeest excrete MCF virus nasally in a cell free stable infectious state. In a later study, four of 11 of free ranging wildebeest calves had MCF virus in nasal secretions (Mushi, Karstad & Jesset 1980). No virus was isolated from saliva or urine. The presence of the virus in these secretions supports the suggestion that MCF is disseminated in these secretions.

According to this study the ability of wildebeest calves to transmit MCF to bovine calves with which they were in contact was possible due to this route of excretion. The authors are of the view that the isolation of MCF virus from cornea and turbinates suggest that the virus replicates in these sites in young wildebeest calves Mushi et al. (1980). The presence of more viruses in nasal and ocular secretions than blood supports this view, despite the fact that blood has more cellular elements than these secretions. The fact that the virus is excreted in relatively low concentrations and in small volumes, suggests that a particular mechanism for efficient transfer of the infective virus, exists rather than transmission through low levels of virus excreted by wildebeest. Virus neutralizing secretory antibodies prevents further virus excretion in calves more than 3 - 4 months old.

Maasai pastoralists in East Africa believe that MCF is passed to cattle from wildebeest afterbirths and natal fluids and calf hair. In a study an attempt was made to isolate MCF virus from natal membranes and fluids from wildebeest afterbirths and calving sites Mushi et al. (1980). No MCF virus was isolated from natal membranes and fluids. It was further established that these materials were usually disposed of within 10 - 15 minutes. MCF virus was also found to be inactivated by sunlight. The rate of inactivation appeared to increase with the height of the sun. The virus must be present in large quantities not to be totally inactivated by the sun within a period of 1 - 2 hours. This rapid loss of infectivity closely resembles the rates of inactivation of pseudorabies virus by ultraviolet light. This inactivation confirms that it is improbable that cattle acquire MCF from low-level contamination of pastures with foetal materials or calf ocunusal secretions. The authors Mushi et al. (1980) are of the view that it is conceivable that droplet inhalation or mechanical transmission by flies may cause transmission of MCF over relatively short distances. It is however mentioned that in East Africa it is rare to see cattle and wildebeest within 100 meters of each other.

According to Reid & Van Vuuren (2004) the known physical characteristics of the herpes viruses, the efficient spread among wildebeest calves and observations on the closely related OvHV-2 virus support the view that natural spread of MCF is generally, if not exclusively, by aerosol over a short distance. According to these authors the anomalies, which exist and are quite apparent, can be explained by prolonged incubation periods occurring in animals as indicated above. Air currents causing oral and ocular infection in conditions of high humidity and favourable prevailing winds seem to be likely modes of transfer (Barnard, 1988). These likely modes of transfer however do not appear to relate to the fact that sunlight causes inactivation.
It is essential that an agent causing disease transmitted by the communication of disease by contact, direct or indirect should be present in a more or less stable form in some bodily excretion of infected individuals (Plowright, 1965). The absence of cell-free virus in cattle would account for failure of MCF to spread among susceptible cattle. Plowright (1965) is of the view that transmission of MCF by blood-sucking arthropods is unlikely for the following reason:

- The infectivity in cattle or wildebeest blood is entirely cell-associated and extremely fragile, since its persistence probably depends on the retention of cell viability.
- The quantity of virus in blood is small, especially in comparison with the known arthropod-borne agents; there are no known sites of superficial multiplication, such as the skin for poxviruses.
- If a blood-sucking arthropod is capable of transmitting the infection, then cattle-to-cattle transfers should sometimes occur and the disease would be expected to have a wider and more frequent incidence.
- It was previously thought that very close, even bodily, contact of the reservoir and indicator hosts is essential for transfer of MCF virus. This implies that any essential parasitic vector must be very restrictive in its range of movement and as it should also be world-wide in its occurrence and present throughout the year, no single arthropod species or group would appear to fulfil the requirements.
- Wildebeest-derived MCF virus has all the essential characteristic of herpes viruses. It is therefore unlikely that a member of this group would be unique in requiring an intermediate vector.

Due to the fact that the causative agent or agents of MCF is obscure, efforts need to be made to isolate and characterize the etiologic agents of MCF outbreaks, and also determine the carrier hosts and the mechanisms of transmission of the disease (Maré, 1977).
CHAPTER 4 - OVERVIEW OF THE LEGAL POSITION

1. Historic applicable legislation

The Animal Diseases Act (1984)\(^{13}\) contained certain provisions with regard to MCF and blue and black wildebeest. The relevant provisions as they applied before the upliftment of certain provisions in 1993 are discussed in this section of this study.

The purpose of the Act was to provide for the control of animal diseases and parasites, for measures to promote animal health, and for matters connected thereto. In terms of Section 9 of the Act the Minister of Agriculture may for any controlled purpose prescribe general control measures, or particular control measures in respect of particular animal diseases or parasites. This Section of the Act makes provision for certain conditions that the Minister may impose such as to the areas of the Republic of South Africa with regard to which the provisions may be prescribed, the time periods thereof and aspects to which such measures may relate. The aspects that control measures may relate to, amongst others include the following:

- Powers and duties of owners and managers of certain land and owners of animals in respect of certain animals.
- Certificates or documents.
- Restrictions on and control of the slaughter, killing, hunting or catching and the movement and removal of certain animals.
- Powers and duties of owners of certain animals with regard to fences, temporary or permanent structures.
- Particulars and information which are required to be recorded by owners of certain animals.
- Powers and duties of the director of Agriculture to require performance and abstaining from performance of acts of owners of certain animals.
- In general any other matter, which the Minister deems expedient or necessary in respect of the relevant, controlled purpose of certain animals or disease or parasite.

Section 11 of the Act\(^{14}\) imposes certain duties on owners and managers of land on which there are animals and on the owner of animals. The duties determine that they shall take all reasonable steps to prevent the infection of the animals with any animal disease or parasite and the spreading thereof from the relevant land or animals or which are necessary for the eradication of animal diseases and parasites on the land or in respect of the animals. They are also required to apply treatment, which may be deemed suitable or customary in the circumstances to infected animals.

\(^{13}\) Animal Diseases Act (Act 35 of 1984)

\(^{14}\) Animal Diseases Act (Act 35 of 1984)
They are further required to immediately report any controlled animal disease to the
director. The Director is the officer in the Department of Agriculture referred
to in Section 2(1). In terms of this Section the director is the director of the
Directorate of Animal Health of the Department of Agriculture, who shall be a
veterinarian, shall exercise the powers and perform the duties conferred or
imposed upon the director by or under the Act.

A controlled animal disease is defined in the Act\textsuperscript{14} as any animal disease in
respect of which any general or particular control measure has been prescribed,
and any animal disease, which is not indigenous or native to the Republic. A
control measure is defined as any measure prescribed by the Minister of
Agriculture under Section 9 of the Act in respect of any controlled purpose. A
controlled purpose is defined as the prevention of the bringing into the Republic,
or the prevention or combating of or control over an outbreak or the spreading, or
the eradication, of any animal disease, or where applicable, of any parasite. The
Act also contains general provisions with regard to certain powers granted to the
Director General of the Department of Agriculture. The provisions pertain to
control over certain land, entry and inspection, seizures, fences, compensation and
limitations with regard to investigations, experiments research with, and
manufacture and evaluation of, certain products. With regard to the powers of the
Director General, it is of significance that Section 19 makes provision for the
owner of any animal, which has been destroyed or disposed of pursuant to any
control measure, or any provision of the Act by the director or on his authority, to
be compensated. The director may fix a fair amount as compensation for the loss
of the animal.

In determining the amount the director may take the following into consideration:

- Compensation based on fair market value of the animal according to
  the prescribed value or value in accordance with criterion deemed
  applicable;
- The value of anything, which has in connection with, the animal
  been returned to the owner.
- Any amount, which is due by the owner pursuant to any provision of
  the Act in respect of the animal to the State.
- Any amount, which may accrue to the owner from any insurance
  thereof.

The Act\textsuperscript{15} also makes provision for the Minister of Agriculture to make
regulations with regard to the Act. Offences and penalties are contained in Section
32 of the Act. The Minister did make Regulations in terms of the Act with regard
to MCF and wildebeest. The Regulations were amended on several occasions. The

\textsuperscript{15} Animal Diseases Regulations (R2026, 26 September 1986)
relevant Regulations were contained in the Government Gazette 10469 dated 26 September 1986, volume 255. These regulations have been amended subsequently. The relevant regulations as contained therein applicable to MCF and wildebeest before 1993 are discussed in this study.

Act 35 of 1984 includes the regulations and control measures in the definition of the Act\textsuperscript{16}. The Regulations and control measures therefore have the same force and effect as the Act. The control measures relating to controlled animal diseases are contained in table 2 of the Regulations. Bovine Malignant Catarrhal Fever is mentioned therein. The nature, visual organism and symptoms of the disease are described as follows:

“Viral disease which can occur where there is contact between cattle and blue or black wildebeest and characterized by infection of the mucous membranes of the upper respiratory tracts and intestines, as well as the conjunctiva, with mucus-purulent discharge from the eyes and nose, enlarged lymph nodes emaciation and high mortality of infected cattle.” Cattle, blue or black wildebeest are indicated as susceptible species in terms of the regulations. The controlled veterinary act to be performed in respect of the susceptible animals is mentioned as the prevention of contact between cattle and blue or black wildebeest. With regard to contact animals and infected animals it is further mentioned that blue or black wildebeest which occur on land which is not registered in terms of Regulation 20A\textsuperscript{17} shall when they are found on such land or if their presence is reported, be removed or destroyed.

A contact animal is defined in the regulations as a susceptible animal that was in contact with or is on reasonable grounds suspected of having been in contact with an infected animal or progeny or products thereof.

An infected animal: is defined as a susceptible animal that is infected, or is on reasonable grounds suspected to be infected with the controlled animal disease concerned. Regulation 20A most probably contains the most important regulation with regard to blue and black wildebeest. This Regulation is an absolute prohibition on any person from keeping any blue or black wildebeest on any land, which is not registered by the director for such purpose. It further deals with the form of the application to the director for a permit. In the case of blue or black wildebeest the application shall be accompanied by a written declaration by the manager or owner of land or an owner of animals, of every unit of neighbouring land as well as the local farmers association concerned, in which they indicate that they have no objection to the keeping of black or blue wildebeest on the land concerned. Land for keeping of blue or black wildebeest will only be registered if that land is fenced in a game proof manner for wildebeest according to the

\textsuperscript{16} Animal Diseases Act (Act 35 of 1984)

\textsuperscript{17} Animal Diseases Regulations (R2026, 26 September 1986)
requirements of the concerned nature conservation authority. This provision appears to prevent the introduction of blue or black wildebeest to land where the neighbouring owners of land and the community represented by the farmers association do not approve the introduction. If the director approves the application, he shall issue a certificate. The certificate lapses, when blue or black wildebeest are no longer kept on the land or may under certain circumstances be withdrawn. A certificate is only valid in respect of the land specified therein.

The permit can be suspended by the director if the holder thereof is convicted of an offence under the Act\(^\text{18}\) concerning the registration, keeping or movement of wildebeest. Wildebeest, which are kept on land not registered in terms of regulation 20A\(^\text{19}\) or of which the registration has been withdrawn, shall be removed from the land or destroyed by the owner of the land or owner of the animals or the manager of the land. The state veterinarian may determine a time within which the wildebeest have to be removed or destroyed. Section 17 of the Act makes provision for seizure of the animal subject to certain conditions. This Section also makes provision for the animal to be disposed of or destroyed under certain circumstances and in a certain manner. Regulation 19(3) mentions that when blue or black wildebeest are found on land, which is not registered as contemplated in Regulation 20A, the responsible person of that land shall report the finding to the responsible state veterinarian. A responsible person is defined in the regulations as a manager or owner of land or an owner of animals.

A state veterinarian is a veterinarian who is an officer of the department. Another important provision with regard to blue and black wildebeest is Regulation 20, which contains provisions regarding movement. This Regulation contains an absolute prohibition on the movement or removal of live blue or black wildebeest from the land on which they occur or are kept to any other land except under the authority of a permit issued by the responsible state veterinarian. The state veterinarian may impose conditions in such permits, with regard to the movement of the animals. A permit shall not be issued unless the blue or black wildebeest are moved to land on which blue or black wildebeest already occur or have shown negative results for MCF in a test as determined by the director.

Other Regulations applicable to controlled animal diseases also exist in the Regulations. Regulation 11 and 12 respectively deal with controlled veterinary acts and reporting of incidence of controlled animal diseases. Regulations 13 to 19 respectively deal with the procedures to be followed in respect of controlled animal diseases amongst others isolation of animals, prohibition of access to certain places, disinfections of certain places, sampling, records, proof of performance of controlled veterinary acts and notification of isolation. The last mentioned Regulations are not specific to MCF. Regulations 22 to 24 deal with

\(^{18}\) Animal Diseases Act (Act 34 of 1984)  
\(^{19}\) Animal Diseases Regulations (R2026, 26 September 1986)
restrictions on slaughtering, actions with and disposal of animals and things, and are also not specifically applicable to MCF.

2. **Current applicable legislation**

During 1993 the Minister of Agriculture abolished MCF as a controlled animal disease in terms of the Animal Diseases Act (1984)\(^\text{20}\). Abolishment of the legislation with regard to MCF had the effect that wildebeest could be moved freely in the Republic of South Africa and be introduced and kept on any land. The Animal Diseases Act (1984)\(^\text{20}\) was substituted by the Animal Health Act (2002)\(^\text{21}\). The substitution of the Act did however not amend the position with regard to MCF and wildebeest. At present, the *status quo* as it existed after abolishment of the control measures still exists. Wildebeest can presently freely be moved, introduced and kept on any property in the Republic of South Africa.

The Animal Health Act (2002)\(^\text{21}\) in general contains similar provisions as the Animal Diseases Act (1984)\(^\text{20}\). One of the provisions which needs special reference is Section 21 of the Animal Health Act\(^\text{21}\). This provision is the equivalent of section 19 of the Animal Diseases Act (1984)\(^\text{22}\). Both these sections deal with payment of compensation when an animal has been destroyed or otherwise disposed of. This provision is discussed fully later\(^\text{23}\).

3. **Legal position and remedies**

In terms of the common law the stockowner that has lost cattle as a result of MCF has two basic remedies in terms whereof he may exercise his rights namely a claim for damages or to apply for an interdict.

3.1. **Claim for damages**

The purpose of the law is to regulate relations between individuals in a community. The law would be unnecessary if people lived in perfect harmony with one another. Conflicts of individual interests occur continuously. The function of the law is to recognize interests, delimit them and attempt to harmonise those that are in conflict. The role of the law is to recognize which interests are protected against infringement and how the balance of interests may

\(^{20}\) Animal Diseases Act (Act 35 of 1984)  
^{21}\) Animal Health Act (Act 7 of 2002)  
^{22}\) Animal Diseases Act (Act 35 of 1984)  
^{23}\) Vide Chapter 4 3.3: 54-55
be restored. Infringement is when the impairment of a legally recognized interest constitutes a delict (Neethling, Potgieter & Visser 2002). The law of delict, in general, determines under which circumstances a person is obliged to bear the damage he has caused another. A wrongdoer has an obligation to compensate for the damage suffered and the person prejudiced has a corresponding right to claim compensation for the loss suffered. A delict has been defined as follows: Neethling et al. (1989: 4) “A delict is the act of a person which in a wrongful and culpable way causes harm to another”

In this definition **five elements** can be distinguished namely an **act, wrongfulness, fault, harm and causation**. All five requirements are required before liability in terms of a delict arises.

A wrongdoer shall thus only be liable if all the elements exist. The first element of a delict is that the wrongdoer must have caused damage or harm by means of an act or conduct. Conduct has been defined as a voluntary human act or omission Neethling et al. (2002). It should be noted that when an animal is used as an instrument in the commission of a delict, a human act is still present. An omission is also regarded as conduct. An omission may be considered as a failure to take any positive steps to prevent damage to another person.

The **second element** of a delict is **wrongfulness** of the act or omission. Wrongfulness has been defined as a legally reprehensible or unreasonable manner Neethling et al. (2002). In order to determine whether an act or omission is wrongful it has to in the first place be determined whether an individual interest has been infringed and in the second place whether such prejudice occurred in a legally reprehensible or unreasonable manner. The second requirement thus relates to the violation of a legal norm. An act or omission can only be diliactually wrongful when it has as its consequence a factual infringement of an individual interest. The question whether a consequence infringes an individual interest requires an investigation of the facts by means of the evidence available. An act and its consequence are always separated by time and space. The general norm or criterion to be employed whether an infringement of interests is unlawful is the legal convictions of the community. This test is objective. It entails whether interests were infringed in a reasonable or unreasonable manner, according to the legal convictions of the community and in the light of all the circumstances of a particular case. The interests of the parties involved must be weighed up against one another in determining whether the infringement was reasonable or not.

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In determining the reasonableness of an act or omission many factors may be taken into consideration such as the following:

- the nature and extent of the harm and of the foreseeable or foreseen loss;
- the possible value to the defendant or to society of the defendant’s harmful conduct;
- the costs and effort of steps which could have prevented the loss;
- the degree of probability of the success of preventive measures;
- the nature of the relationship between the parties;
- the motive of the defendant;
- economic considerations;
- the legal position in other countries;
- ethical and moral issues as well as other considerations of public interest.

The test is a measure, which gives expression to the conviction of the community with regard to right and wrong and may be adapted to reflect the changing values and needs of the community.

All people or legal subjects are bearers of subjective rights. The bearer of a subjective right has a right to something against other people. A subjective right is infringed when the relationship between the holder of a right and the object of his right has been infringed in a legally reprehensible manner. Wrongfulness need not necessarily be determined with reference to the infringement of a subjective right. In some instances it may be more appropriate to determine wrongfulness by inquiring whether a legal duty has been violated than by asking whether a subjective right has been infringed. In cases of liability for an omission and the causing of pure economic loss wrongfulness is not normally determined by asking whether a subjective right has been infringed, but rather by asking whether the defendant had a legal duty to prevent the loss. It has to be determined in every particular case whether there is a legal duty to act positively or to avoid the causing of pure economic loss. The test whether a legal duty has been breached is the same as that applied to determine whether a subjective right has been infringed. It is determined with reference to objective reasonableness with reference to the general legal convictions of the community. The test to determine whether an omission is in conflict with community standards is objective. The circumstances of a particular case must be taken into consideration. Certain factors have in the past been taken into consideration, which may indicate the existence of a legal duty to act positively to prevent damage. A person acts wrongly when he creates a new source of danger by means of a commission and subsequently fails to eliminate that danger, with the result that damage is caused to another person. Prior conduct in the form of a positive act, which creates a danger of harm, may be a strong indication of a legal duty on a defendant to take steps to prevent the damage from occurring. Prior conduct is however not a pre-requisite. In certain circumstances a legal duty to act positively rests on a person to exercise control over a dangerous object or situation to ensure that
nobody is harmed. An example is the control over a dangerous animal. The owner or occupier of land where a dangerous animal is kept has a legal duty to prevent harm to others by the animal. The fact whether a person is obliged to act positively by exercising control must be determined with reference to the facts and circumstances of each case.

Once a legal duty has been established, failure to control the situation is *prima facie*\(^{24}\) wrongful. Once a legal duty exists, it is mostly presumed that wrongfulness exists. In determining whether a legal duty exists it may be considered whether the defendant knew or should reasonably have known about the dangerous situation and whether the harm was reasonably foreseeable. The further question to be asked is whether in the circumstances the defendant took reasonable steps to prevent the loss or harm. The defendant may escape liability by proving that his omission is lawful because grounds of justification exist or if he took reasonable steps to endeavour to prevent the loss. If he took reasonable steps to prevent the loss, he did not act negligently and cannot be held liable.

Grounds for justification are special circumstances, which reveal that conduct, which appears to be wrongful is in reality, lawful because there are no violations of a norm. Grounds of justification are concerned with the question whether the violation of an individual interest was reasonable in the circumstances and therefore lawful. The weighing of interests of legal subjects by reasonableness criterion may result in justifying a wrongful act. When a ground of justification is present, the plaintiff’s right does not extent so far as to be infringed by the defendant even though the interest concerned is in fact violated by the defendant. The extent of the right of the plaintiff is limited by the defendant exercising his own right. Examples of grounds of justification as defences are necessity, provocation, consent, statutory authority and official command.

The *third requirement* of fault consists of two forms namely *intention and negligence*. These terms refer to blameworthiness for the reprehensible state of mind or conduct of somebody who has acted wrongfully. It is therefore a subjective element because it refers to a person’s attitude. Fault can only exist where a wrongful act or omission has occurred. The existence of either intent or negligence is sufficient to blame a wrongdoer. The conduct of a wrongdoer is blameworthy where there is fault on his part. Before it can be established whether a wrongdoer is blameworthy it must be established whether he has the capacity to have a blameworthy state of mind. If a person has a blameworthy state of mind it is legally referred to as accountability. A person’s mental ability must be such that the intent or negligence may be imputed to him. A person is accountable if he has the necessary mental ability to distinguish between right and wrong and if he can act in accordance with such insight Neethling *et al.* (2002).

\(^{24}\) *Prima facie* = Latin for “at first site”
A person acts intentionally if his will is directed at a result which he causes while he is conscious of the wrongfulness of his conduct. The definition of intent consists of the direction of the person’s will and consciousness or knowledge. There are three forms of intent namely direct intent, indirect intent and *Dolus eventualis*. Direct intent is where a wrongdoer desires a particular consequence of his conduct. Indirect intent is present where a wrongdoer has direct intention in regard to one consequence of his conduct but at the same time has knowledge that another consequence will unavoidably or inevitably occur. *Dolus eventualis* is present where a wrongdoer, while not desiring a result, foresees the possibility that he may cause such result and reconciles himself with this fact. The wrongdoer therefore foresees the possibility of the consequence and nevertheless performs the act, which brings about the consequence. Knowledge of wrongfulness means that the wrongdoer must realize or foresees the possibility that his conduct is wrongful. In general a mistake or error with regard to either a relevant fact or the law may exclude intent. Where negligence is a sufficient form of intent, a mistake or error will not be relevant.

In the case of negligence, a person is blamed for an attitude or conduct of carelessness, thoughtlessness or imprudence, because, by giving insufficient attention to his actions he failed to adhere to the standard of care legally required of him Neethling *et al.* (2002). The criterion to establish whether a person has acted negligently is the objective standard of the reasonable man. A person is negligent if the reasonable man in his position would have acted differently. According to the courts, the reasonable man would have acted differently if the unlawful causing of damage was reasonably foreseeable and preventable Neethling *et al.* (2002). The reasonable man is a fictitious person, which the law invents in order to have a workable objective norm for conduct in society. It is not an exceptionally gifted, careful or developed person but neither is he underdeveloped, nor somebody who recklessly takes chances or who has no prudence. The reasonable man therefore, in summary, serves as the legal personification of those qualities, which the community expects from its members in their daily contact with one another. The reasonable man has a certain minimum knowledge and mental capacity which enables him to appreciate the dangerous potential of certain actions. Everyone is expected to conform to the objective standard of the reasonable man. The test for negligence as indicated previously is whether the reasonable man could reasonably foresee and prevent damage or harm. Forseeability is based on the premise that a person’s conduct may only be described as negligent in regard to a specific consequence or consequences. It is a prerequisite for the existence of negligence that a specific consequence must be reasonably foreseeable. Preventability relates to precautionary steps, which the reasonable man would have taken to prevent damage or harm from occurring.

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*25 Dolus eventualis = “intent by possibility consciousness or awareness”*
The following factors may be taken into consideration: Neethling et al. (2002).

- The nature and extent of the risk created by the conduct of the wrongdoer.
- The seriousness of the damage.
- The relative importance and object of the wrongdoer’s conduct.
- The cost and difficulty of taking precautionary measures.

In general negligence of conduct may only be evaluated in the light of all the relevant circumstances of a particular situation. These circumstances must be considered as a whole to determine the possible negligence of a wrongdoer’s conduct.

The fourth element is causation. A person cannot be liable if he has not caused any damage through his act or omission. The question whether a causal nexus or link exists between the conduct or omission and the damage is a question of fact, which must be answered with regard to the available evidence. In most cases occurring in practice there is not a problem in determining whether or not the conduct or omission has caused harm. The legal system however cannot hold a wrongdoer liable without some limitation for the endless chain of harmful consequences, which the act may have caused. Legal causation arises when it must be determined for which of the damaging consequences caused by the wrongdoer’s act he should be held liable or should be imputed to him. Different theories exist with regard to what criterion should be applied to determine legal causation. The Supreme Court of Appeal has acknowledged the principle that a single measure to establish legal causation should not be applied to all cases Neethling et al. (2002). A flexible approach is propagated. The question is whether a sufficient nexus or link exists between the act or omission of the wrongdoer and the consequence thereof that the consequence may be imputed to the wrongdoer on policy considerations such as reasonableness, fairness and justice.

The fifth element of a delict is that the act or omission has to have some or other damaging consequence. The law of delict has a compensatory function. In the context of this study damages is limited to a sum of money. It should be mentioned that damages might take another form than a sum of money. Pecuniary or patrimonial loss can be defined as a calculable pecuniary loss or diminution in the plaintiff’s estate resulting from the defendant’s unlawful and culpable conduct Neethling et al. (2002). A comparative method is used to establish whether pecuniary loss has been suffered and what the extent of such loss is. To determine whether a plaintiff has suffered patrimonial loss as a result of the wrongful conduct of the defendant, the plaintiff’s patrimonial or pecuniary position before the commission of the delict must be compared with the position which the plaintiff finds himself in (after commission of the delict) and the position in which he would have been had the delict not been committed Neethling et al. (1989). The extent or quantum of the loss is indicated by the quantitative difference between the two patrimonial positions. The extent of the loss is expressed in money. From the definition it is evident that future loss is also taken into consideration.
Future damage may take the following forms Neethling et al. (1989).

- Prospective expenses made necessary by the defendant’s delict.
- Prospective damage as a result of loss of future income.
- Prospective damage as a result of the loss of a chance to secure a future advantage.

It is important to note that it is a principle of our law that a plaintiff in an action for damages must take steps to mitigate his loss. The basic rules applicable in regard to this duty are the following:

- The plaintiff must take all reasonable steps to mitigate the loss caused to him, which implies that he cannot recover damages for losses which he could have prevented by such steps.
- The plaintiff can recover the costs and expenses of reasonable steps, which he has taken to mitigate his loss.
- Where the extent of the loss of the plaintiff is reduced, the defendant is only liable for the actual loss sustained. The general object of an award for damages is that is intended to compensate losses actually sustained.

The owner of property is entitled to restitution based on the principle that he be placed in the position, which he was before the property was damaged. In general damages are computed with reference to the diminution in the market value of the property at the time of the damage. He must prove on a balance of probabilities that he has suffered damages and the extent of the damages.

The fact that plants and animals occur on a property can have significant impacts on neighbouring properties through various natural processes, such as migration and cross pollination (Glazewski:2005). In terms of the common law, the owner of land owns everything beneath and above it. Plants and trees are considered as part of the land and belong to the owner. In the common law wild animals that roam freely and may traverse the land of different owners were considered as *res nullius* meaning they are owned by nobody. The Game Theft Act (Act 105 of 1991) however modifies the common law position. The Game Theft Act27 determines that where a wild animal is brought under a landowner’s control, with the intention to become the owner of it, it ceases to be a *res nullius* and is owned by the captor.

The law on harm by animals was recently summarised as follows: (Uys, 2008)

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27 Section 2 (Act 105 of 1991)
1. DEFINITIONS

(1) “Harm” means the result of conduct which causes injury or death of an animal or a human, or breakage or destruction or consumption of a thing.

(2) “Damages” means compensation for harm.

(3) “Owner” includes a person under whose control an animal is.

(4) “Unnatural act” means conduct by an animal which a reasonable person would not expect from such an animal.

2. FAULT LIABILITY

A person by whose fault an animal does harm, is liable for damages.

3. OWNER LIABILITY

(1) The owner of an animal which acts unnaturally and does harm, is liable for damages, even if the owner was not at fault.

(2) The owner of an animal which does harm by grazing another’s pastures without consent, is liable for damages, even if the owner was not at fault.

4. JOINT LIABILITY

(1) If persons jointly by their fault cause an animal to do harm, every one is liable for all the un-apportioned damages.

(2) If animals of different owners jointly cause harm, every owner is liable for all the un-apportioned damages.

(3) A person who suffered damages may claim all or any proportion of the un-apportioned damages from any one or more such persons or owners.

5. CRIMINAL LIABILITY

A person by whose negligence an animal cause harm, commits an offence and may be fined, imprisoned or declared unfit to own an animal, and the court may moreover order the animal to be removed or destroyed.

6. DEFENCES

The amount of damages may be reduced by contributory negligence.

7. CLAIM

A person who claims damages for harm caused by an animal must allege and prove:
In the event of a person intending to institute a claim for damages caused as a result of MCF, the above-mentioned elements of a delict have to be proved. The specific grounds on which a claim for damages in regard to MCF may be based are discussed later. It should however also be mentioned that in the Roman law, from which our common law is derived, an action which was not based on fault also existed. The *actio de feris*[^27] is an action, which is not based on the fault of the person in control of a wild or dangerous animal that causes damage to someone. Neethling *et al.* (1989); Neethling *et al.* (2002); (Van der Merwe & Olivier 1985). It is suggested that the basic principle of the strict liability in regard to this action is the risk principle (Van der Merwe & Olivier 1985). A person who keeps and controls a wild or dangerous animal in his own interest is liable without fault because he creates an increased risk of harm to the community.

In the context of the damage caused by wildebeest indirectly as the carriers of the MCF virus, different grounds exist on which a person may claim damages, namely:

- Negligence.
- Breach of a legal duty.
- Section 17 of the Animal Health Act (Act 7 of 2002).
- The *actio de feris*[^28].

In the case of negligence the defendant will be held liable for the damage caused on the basis that his conduct deviated from the conduct of the reasonable man. If the reasonable man in his position would have acted differently, the defendant will be liable for damages caused. The owner or person in control of wildebeest would thus foresee the possibility of harm to the property of another, which may cause damage or patrimonial loss. Wildebeest as the carriers of MCF cause infection of the virus in cattle, which causes their death and resultant damage or loss to the owner of the cattle. The reasonable man would foresee and take reasonable steps to guard against such an occurrence. A defendant who fails to do so is negligent and may be held liable for damages.

[^27]: *Actio de feris* = a particular action originating from Roman – Dutch law

[^28]: *Actio de feris* = a particular action originating from Roman-Dutch law
Liability based on the breach of a legal duty arises where the omission of a person is wrong. It will be the case if in the particular circumstances a legal duty rested on the defendant to act positively to prevent damage occurring, and he failed to comply with that duty. The question whether such a legal duty existed is answered with reference to the convictions of the community. A person who introduces wildebeest onto a property creates a source of danger. When he subsequently fails to eliminate that danger with the result that damage is caused to another he is in breach of a legal duty and may be held liable for damages. The defendant acts wrongful when he fails to perform the duty, which rests on him. It may also be argued that a legal duty exists on the defendant to exercise control over the wild animals that are on a property that cause a danger and ensure that nobody is harmed. It is irrelevant whether they were introduced or not. Once a legal duty has been established, damage, which arises as a result of the failure to control the situation, is wrongful. The defendant has to prove that his omission was lawful (because of a ground or justification) or that he took reasonable steps to endeavour to prevent loss to escape liability. There rests a legal duty on the owner of wildebeest, which are kept and which have the potential to cause loss or damage to another. If the owner of the wildebeest fails to control the situation or to take reasonable steps to endeavour to prevent the loss or damage, he may be held liable for damages.

Section 17 of the Animal Health Act (2002)\(^\text{29}\) is the equivalent of section 11 of the Animal Diseases Act (1984)\(^\text{30}\). This legislation places an obligation on the owners and users of land and owners of animals to perform certain acts. The failure to perform the acts points to the wrongful nature of the omission. The legal duty in this instance is created by the relevant legislation and the mentioned persons may be held liable if they are found to be in breach of the duties imposed on them by the legislation. This is an example of a statutory legal duty. The wrongdoer may be held liable for damages. The provisions of section 17 of Act 35 of 1984 determine that the owner or user of land on which there are animals or any owner of animals, has to take reasonable steps that are necessary to prevent the infection, the spreading of and for the eradication of any animal disease and/or parasite from/or on the land. It further places an obligation on the persons to apply certain treatment and report the incidence of the animal disease or parasite to the national executive officer under certain circumstances. Abnormal morbidity and mortality amongst animals also have to immediately be reported to the national executive officer. It should be noted that these provisions are applicable to any animal disease. The obligations in respect of these provisions also rest on the particular persons in the case of the incidence of MCF.

The last ground on which an action for damages may be based is the \textit{actio de feris}.\(^\text{31}\) The reasoning for liability based on this action is that animals such as wildebeest, which are on land or brought onto land hold a risk within them. The risk is the

\(^{29}\) Animal Health Act (Act 7 of 2002)
\(^{30}\) Animal Diseases Act (Act 35 of 1984)
\(^{31}\) \textit{Actio de feris} = a particular action originating from Roman - Dutch Law
potential of causing damage or harm as the carriers of MCF virus, by causing MCF in other animals such as cattle. The person who keeps or controls them is therefore liable for the damages caused, without having to prove fault, because he has caused the risk. This action is drastic in the sense that because liability is not based on fault, it requires a lighter burden of proof on the plaintiff.

A claim for damages resulting from MCF may be instituted for the following damages:

- The fair market value of the cattle that have died as a result of the disease. The fair market value is determined by the replacement cost of the particular animal that has died. If an animal is a pedigree animal of high value or an animal that is highly productive such as a milking cow, the value may differ considerably from a normal commercial animal.

- Loss of income where income-producing animals have died, which is based on the production, which has been lost as a result of MCF. A cow which produces calves which are sold is an income-producing animal. The loss of the income, which would have been produced, may be claimed. A milking cow also produces milk from which an income is derived and may similarly be claimed.

- In the event where alternative grazing has to be found or where other measures have to be taken to avoid the loss or mitigate the loss, a claim may be instituted for the cost of the alternative grazing or the cost of the measures taken.

The legal issues with regard to MCF are relevant and applicable to wildlife management. Wildlife managers need to not only have knowledge of the disease in particular, but also to the legal aspects with regard to the consequences thereof. The law expects certain conduct from the relevant persons involved in the management or as owners of wildebeest and also animals in general. The grounds of liability on which a person is held liable, will determine how a person’s conduct is judged. It is very important that wildlife managers in each instance shall assess the circumstances and act according to what is required of them. The legal principles do not only apply with regard to MCF but are in a broader sense also applicable to any damage caused by wildlife and invasive plants. The unique problem in regard to MCF has however forced wildlife managers, stock farmers, veterinary practitioners, landowners and legal practitioners to consider the relevant issues. Some of these issues also relate to the defences that may be raised by a defendant against a claim for liability.

Where there are different sources from where the infection could have resulted, the defendant may avoid liability on that ground. This defence relates to the element of causation of the disease. It will depend on the facts of any particular case if it has been proved that a causal nexus or chain exists between the source of the disease and the resulting consequence.

It is important for both the plaintiff (stock owner) and the defendant (game owner/manager) to gather information and hold proper records of facts which could
prove that the disease did or did not emanate from a certain source or circumstances. The characteristics of the disease as discussed above with regard to the distance over which it may be transmitted and method of transmission are of great importance and relevance in this regard.

Other possible defences are that wildebeest naturally occurred in an area and are endemic to the area or that the area is inherently more suitable for wildebeest than for cattle. These defences relate to the element of wrongfulness and shall be determined in accordance with the convictions of the community. Society is constantly changing and the convictions of society also may change over time and in differing circumstances. In the South African environment, where a significant shift from traditional agriculture to the eco-tourism and wildlife industry has occurred, a change in the convictions of the community with regard to wildlife is inevitable. The greater awareness of people towards wildlife and community conservation has made communities view wildlife differently. Under these changed circumstances the concept of what the community regards as wrongful conduct in relation to wildlife may change.

3.2. The interdict

The delictual actions are directed at compensation for patrimonial damages caused by a wrongful act or omission. An interdict is a legal remedy that does not aim at compensation, but with which a person can avert a threatening wrongful act that has already commenced. An interdict can take two forms namely a prohibitory interdict or a mandatory interdict. A prohibitory interdict is an interdict, which prohibits or prevents somebody from certain, wrongful conduct and from continuing to commit such conduct. A mandatory interdict is an interdict, which requires a person to perform certain conduct. Each is directed at preventing a person from acting wrongfully. Fault is not a requirement for the granting of an interdict Neethling et al. (1989); Neethling et al.(2002).

The following requirements need to exist for the granting of an interdict:

- There must be an act by the respondent.
- The act must be wrongful.
- No other remedy must be available to the applicant.

As in the case with a delict, it may be a positive act or an omission. An act which has not yet commenced and is merely threatening may entitle an applicant to apply for an interdict. A person may apply for an interdict where a threat of damage exists with regard to wildebeest as the carriers of MCF. Wrongfulness means that there must be a threat to, or an infringement of a so called “clear right”. A clear right is interpreted as any subjective recognized right Neethling et al. (2002). Wrongfulness with regard to an interdict may also lie in the breach of a legal duty Neethling et al. (1989); Neethling et al. (2002). In the context of wildebeest and MCF the infringement of a “clear right” may take different forms. If damage is caused to somebody as a result of MCF being
transmitted through wildebeest to cattle, the subjective right of the owner of the cattle is infringed by the wrongful conduct of the owner or person in control of the wildebeest. It may also be argued that the rights of a owner of a property adjoining the property where wildebeest are kept are infringed on the basis that his ownership and undisturbed use of his property is infringed. The owner of the property cannot use his property for cattle farming because of the danger caused by MCF through wildebeest.

3.3. Potential remedy against the state

Section 19 of the Animal Diseases Act (1984)\textsuperscript{32} has already been discussed\textsuperscript{33}. The equivalent of section 19 of the abovementioned act is section 21 of the Animal Health Act (2002)\textsuperscript{34}. The provisions of this section of this Act determine that the owner of any animal that has been destroyed or otherwise disposed of pursuant to any prescribed measure or any provision of the Act, by the national executive officer or on his authority, may submit an application for the loss of the animal.

The national executive officer may fix a fair amount as compensation. In fixing the amount of compensation, the national executive officer may take the following into consideration:

- The applicable compensation, based on fair market value of the animal, that has been prescribed or any amount fixed by the national executive officer in accordance with any criterion deemed applicable by him;
- The value of anything that has, in connection with the animal been returned to the owner;
- Any amount that is due to the state by the owner pursuant to any provisions of the Act in respect of the animal;
- Any amount that may accrue to the owner from any insurance.

Section 21\textsuperscript{34} does not create a right to enforce a claim in a court of law. The provisions of the section are clearly subject to an application to the national executive officer on whose authority it may be granted and his discretion to grant such application. The section nevertheless does make provision for compensation to be granted under certain circumstances. The concept of fair market value as compensation in terms of section 19 of the Animal Diseases Act (1984)\textsuperscript{35} was decided on, in the case of Blueilliesbush Dairy Farming (Pty) Ltd and Another v. Minister of Agriculture and Others (2007)\textsuperscript{36}. In the mentioned case the director in

\textsuperscript{32} Animal Diseases Act (Act 35 of 1984)
\textsuperscript{33} Vide Chapter 4 1:33 - 38
\textsuperscript{34} Animal Health Act (Act 7 of 2002)

\textsuperscript{35} 2007 (3) SA 35
\textsuperscript{36} Animal Health Act (Act 35 of 1984)
\textsuperscript{37} Animal Diseases Act (Act 7 of 2002)
terms of Act 35 of 1984\textsuperscript{36} granted owners of slaughtered animals lower compensation, which was based on the reasoning that an animal infected with bovine tuberculosis has no other value except being sent for slaughter. The High Court in the mentioned case set aside the decision of the director. The view of the court was that compensation had to be based on the fair market value. The productivity of a milk-producing cow was an integral part of the assessment of her market value and has to be taken into consideration. Her value in the open market would be determined by her productivity. Her capacity to produce and continue producing milk for a period of time had to be taken into account when her market value was determined. The fair market value could thus never be the price for the carcass and the skin. The value had to be determined on the basis of the price that another milk producer would pay for her, on the assumption that she would have continued producing milk and not been slaughtered. This decision is not alone significant in regard to the Animal Diseases Act (2002)\textsuperscript{37} and the Animal Health Act (1984)\textsuperscript{36} but may also in general be applied to the concept of the fair market value of cattle that are lost as a result of MCF.

3.4. The Ombudsman

The Red Meat Producers Organization (RPO) and Wildlife Ranching South Africa (WRSA) in a joint step, appointed an Ombudsman to attend to complaints with regard to MCF. This step was decided upon in an attempt to attend to the problem of MCF in a structured and responsible manner. Litigation is a time and cost consuming exercise. The intended purpose of the appointment of the Ombudsman was to enable cattle and game ranchers alike to avoid costly time consuming litigation by introducing a relatively simple inexpensive process.

The RPO and WRSA agreed on Rules\textsuperscript{38} according to which disputes regarding MCF should be attended to. The following definitions are of significance.

“Plaintiff” is defined as the person putting in a claim for damages he allegedly suffered as a result of MCF allegedly caused by wildebeest on a nearby farm.

“Defendant” is defined as the person against whom the claim is instigated and who is the owner of the nearby farm and the wildebeest.

“An Ombudsman” is defined as a knowledgeable person appointed by the RPO and WRSA to investigate matters expounded in the rules, between cattle farmers and game ranchers and to bring out a report.

\textsuperscript{38} Unpublished Simple Rules WRSA and PRO (Appendix 3)
Rule 2 of the Rules[^38] sets out the purpose of the Rules which appears to be to save the parties costs in an attempt to resolve the issue, without legal representation, by the Ombudsmans. It is also stated that should any party not accept the Ombudsmans report, he is entitled to proceed with court action, without the proceedings instituted in terms of the rules prejudicing such a party. Rule 3 makes provision for the procedure to be followed and information required from the defendant to institute proceeding in terms of the Rules. Information such as the location of the properties where the wildebeest and cattle were kept, the alleged unlawful and irresponsible action of the defendant, a breakdown of the damages suffered and the cause of death is required. Available evidence such as the value of plaintiff’s cattle, which died, and proof of the cause of death by an expert is also required. The defendant may within one month reply to the plaintiff’s claim. It is required from the defendant to furnish certain information and to indicate where wildebeest are kept, relative to the farm owned by the plaintiff. The defendant is also required to reply to the plaintiff’s allegations by denying or admitting the allegations.

The duties of the Ombudsmans are to assess the information, if necessary to gather further evidence and to hold a hearing with the parties. Once a hearing has been held, the Ombudsmans must compile a report of his finding within three months. It appears that the appointment of the Ombudsmans and the purpose for which the process was instituted is not serving the purpose (Wessels, 2007). No matters have been successfully finalised[^39]. Although rule[^40] mentions that the defendant is compelled to reply within one month to the claim, the defendant is under no obligation to in any way react to the claim. A defendant who is unwilling to participate in the process cannot be forced or compelled to do so. The Rules are therefore ineffective in their purpose. As a result thereof matters are not effectively disposed of by this procedure. The fact that the RPO and W RSA implemented this procedure is an acknowledgement of the seriousness with which disputes regarding MCF are viewed by the organizations, which represent these two important industries. It is a further acknowledgement that the legal process in its present form is not only ineffective but also inaccessible due to the high cost thereof and time consumption.

4. CASE LAW

Although court cases have been instituted based on claims for damages caused as a result of MCF, most cases are settled out of the courts between the parties. In the case of Wright and Another v Cockin and others (2004)[^41] an application for an interdict was made. In this decision, the principles in regard to MCF based on the legal remedy of an interdict were thoroughly dealt with. The respondents were owners of the

[^38]: Mathis, S. Secretary Ombudsmans of MCF. Personal communication. December 2007
[^39]: Unpublished Simple Rules W RSA and RPO (Appendix 3)
[^40]: 2004 (4) SA 207
neighbouring property, which was used as a conservancy. The respondents introduced 27 blue wildebeest to their property. The applicant’s ran a cattle-farming operation consisting of 600 to 900 head of cattle on their property.

Since the introduction of the blue wildebeest four of the applicant’s cattle died of MCF emanating from the blue wildebeest. Most of the animals, which were infected, were a part of the herd of cows and calves numbering 376 in total, which were grazing adjacent to the boundary of the respondent’s farm and within 1 000 meters of the wildebeest. The infection rate was 0.79%. The natural distribution of blue wildebeest did not previously extend to the Eastern Cape Province. The applicants applied for an interdict prohibiting the respondents from allowing any of the wildebeest to come within 1 000 meters of the applicants’ property. The applicants’ main contention was that the respondents’ animals had transmitted, and would continue to transmit, MCF to their cattle. The applicants adduced scientific evidence indicating that MCF is commonly found in blue wildebeest. According to the evidence all wildebeest are carriers of the virus but blue wildebeest tend to be more frequently associated with outbreaks that black wildebeest. The evidence was further that adult wildebeest tend to shed the virus under stressful conditions while calves under the age of four to five months shed significant quantities thereof and calves between nine and ten months also cause infection. The methods of transmission were indicated as inhalation of infectious aerosol droplets, ingestion of feed or water contaminated with infectious secretions and possibly insect vector. The evidence indicated that high humidity and winds make transmission more viable and if wildebeest and cattle are separated by a strip of land 1 000 meters wide, the rate of transmission drops to 0.1%.

It was argued on behalf of the applicants that their cattle would at some time or another be grazed in reasonably close proximity to the boundary between their respective properties; that it was impractical and unreasonable to expect them to abandon stock farming within 1 000 meters of the boundary; and that they had been compelled to inform prospective purchasers of their cattle of the viral infection in view of the extended incubation period thereof, which would inevitably lead to a loss of business. Prospective purchasers would avoid purchasing cattle, which may have been infected with MCF. The respondents did not deny that the applicants’ animals were infected by MCF but denied that their wildebeest were the source of the infection. The respondents avered that it would be impossible to remove the blue wildebeest to a position 1 000 meters away from the boundary fence as the wildebeest would be “out of the conservancy”. It would also bring about further costs to the respondents. They further avered that if they would have to destroy or get rid of the wildebeest by selling them it would be done at a loss. They also further avered that tourists “expect to see wildebeest in any game ranch worth its salt and the absence of blue wildebeest would indicate that the game farm is not a true farm in the African context”. The respondents also stated that overseas hunters visited the Eastern Cape for hunting and spent large amounts of money, which were to the benefit of individual farmers and the South African economy. If the application was granted it would have a detrimental affect on the tourism industry.
The court granted the application of the applicants for the final interdict. The reasons on which the court based its decision can be summarized as follows:

- The matter fell to be determined in accordance with the principles relating to the law of nuisance. It was clear that fault was not a requirement for the award of an interdict to restrict a nuisance as the interdict is aimed at the abatement of the nuisance alone.

- The question was whether the respondents’ activities on their land with regards to the introduction of and the running of blue wildebeest adjacent to the boundary of the applicants’ property constituted an unreasonable interference with the applicants’ use of their land to farm cattle.

- The present issue was not one in which the Court was required to render a value judgment as to what society’s notion of justice demanded. A landowner has an intrinsic right to the reasonable enjoyment of his land. If his neighbour through his positive actions unjustifiably interfered with that right thereby causing him physical or patrimonial harm, then his actions were wrongful. If, therefore, the applicants were able to establish that they had a reasonable apprehension that the virus would be transmitted to their cattle by the respondents’ blue wildebeest running adjacent to their boundary then they would satisfy the first two requirements for the granting of a final interdict.

- The applicants had established that they had a reasonable apprehension of harm resulting from the introduction of blue wildebeest onto the respondents’ property since it was common cause that the blue wildebeest carried the virus which they shed at certain times; that the virus could be carried by aerosol droplets in the air over a distance of at least 1 kilometre, the risk of transmission becoming greater the closer the wildebeest were to the cattle.

- The injury to the applicants was not verging on the trivial. The applicants were faced with a continuous and ongoing situation. Furthermore, potential buyers might well be frightened off for fear of possible transmission of the virus to their cattle, and there was no knowing what the scale of the loss might be if mischief were not removed.

- It was unreasonable that the applicants, if they wished to avoid the risk of infection to their cattle caused by the introduction of non-endemic game species into the area, should effectively have to abandon stock farming within 1 000 meters of their common boundary with the respondents’ property.

Although the decision of the court has been criticized because the court did not apply the general criterion of reasonableness directly to the case it is conceded that the
outcome would still have been the same (Freedman, 2005). A positive act which causes harm to a person or property is unreasonable and presumed to be unlawful. Freedman (2005) is of the view that whenever it is necessary to determine the lawfulness of a landowners harmful positive act, two conflicting freedoms (entitlements) must be taken into account.

They are the landowner’s freedom to act (that is, his entitlement to use his property as he pleases), and on the other hand, the neighbouring landowner’s freedom to be secure from harm (that is, the neighbour’s entitlement to the ordinary or peaceful use of his property). Neither of these freedoms may be preferred over the other. If the freedom to act is preferred over the freedom to be secure from harm, the right to ownership of the owner of the property where cattle are kept would lose much of its value. If the freedom to be secure from harm is preferred over the freedom to act, the owner of the property where the wildebeest are kept would lose much of its value. It must therefore be accepted that a landowner does have the freedom to act even if it does cause harm, provided his actions are reasonable according to the general criterion of reasonableness.

Freedman (2005) is of the view that the actions of the respondents were unreasonable for the following reasons:

- The harm suffered was serious.
- The use that the respondents were making of their land was abnormal and unusual. This is supported by the fact that blue wildebeest were not endemic to the Eastern Cape.
- It was reasonably practicable for the respondents to prevent the harm. In this respect the court pointed out that the prejudice which the respondents would suffer if the interdict was granted would not be severe because as the court put it: “any eco-tourist worth his or her salt would not expect to see game which was not endemic to the area upon a game farm”.

Glazewski (2005) is of the view that the principles of this case have potential application in many other contexts such as spreading alien invasive vegetation and genetic pollution.

The High Court of Appeal of South Africa gave a decision in regard to MCF in the case of PGB Boerdery Belegging (Pty) Ltd v Somerville 62 (Pty) Ltd (2007 SCA 145 RSA). In this decision, the appellant wanted to prevent the respondent to introduce a herd of 500 blue wildebeest to the respondent’s property. The respondent was in the process to develop an area of approximately 9 000 hectares as a game farm with a hotel for 1 370 guests. The ranch was fenced totally and it was intended that 2 500 employment opportunities would be created. On the other hand, that appellant is a cattle farmer on a large scale with 1 300 cattle, which are run on a property of 7 500 hectares. The property of the appellant is not in one block and only one property adjoins the property of the respondent. Another portion thereof is separated by a

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provincial road. The portion that directly adjoins the property of the respondent is only 300 hectares of size whereof only half of the boundary is affected. The appellant farms scientifically with a commercial herd of cattle which amongst others comprises that rotational grazing is done. The camps adjoining the property of the respondent are therefore not utilized permanently. The respondent notified its neighbours of the intended introduction of blue wildebeest to its property and further gave an undertaking to pay compensation for any losses suffered as a result of MCF. This was however not acceptable to the appellant. The appellant also kept blue wildebeest on his property, until shortly before the lodging of the application. The appellant also kept sheep, which are also considered carriers of MCF, on its property without separating the cattle and sheep. Approximately one month before lodging the application, the appellant obtained a permit from the Department of Nature Conservation to keep blue wildebeest on its property. The appellant approached the court on an urgent basis for an interdict to prevent the respondent to in any way introduce and farm with blue wildebeest on its property.

In the judgment, the requirements for an interdict are discussed with regard to the requirement of wrongfulness. It was decided that the use of land as a game reserve is not an abnormal or unreasonable use of the land. An owner of land is entitled to use land in a normal and reasonable way. The next question, which the court had to decide, was whether the keeping of blue wildebeest is an unreasonable and abnormal use of land. The court answered the question by not applying the test for reasonableness according to the reasonable man test. The court mentioned that the purpose of the evaluation is to decide whether it is fair or appropriate to require the complainant to tolerate the interference or whether the perpetrator ought to be compelled to terminate the activities giving rise to the harm. This is achieved by comparing the gravity of the harm caused with the utility of the conduct, which has caused the harm. The court came to the conclusion that the interfering of the respondent can only be harmful if it is substantial or material. The court further mentions that because wild animals used for game ranching are not dipped, it may increase the tick population. Should game ranching therefore be prohibited because more ticks than are normal, result on a neighbouring property? On the other hand, should a stock farmer be prevented from farming with stock because they cause diseases to the game of an adjoining game farmer?

The court accordingly found that the appellant did not succeed in proving that the introduction of blue wildebeest would interfere with the rights of the appellant. The court based this decision on the following facts:

- The exceptional nature of the legal remedy required by the appellant.
- The low incidence of the disease. The court conceded that the statistics available to the court failed to indicate whether the disease was caused as a

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42 PGB Boerdery Belegging (Pty) Ltd v Somerville 62 (Pty) Ltd 2007 SCA 145 RSA 49
result of blue wildebeest or whether all cases were reported. Only 125 fatal cases occurred in 2004 and 108 cases in 2005 in the whole of South Africa.
- The fact that the respondent had agreed to pay compensation for any mortalities.
- The fact that the appellant could with a simple adaptation of its grazing programme avoid the risk of disease totally.
- The fact that the appellant did not show that a fence approximately 1 000 meters from the appellant’s fence would be suitable and cost-effective and would not in any way limit the rights of ownership of the respondent in an unreasonable way.

Although the above two court decisions came to different conclusions, it appears that the law was not differently interpreted and applied. The different judgments must rather be sought in the difference of facts. The conduct of the parties specifically in regard to the reasonableness of their conduct, accounts for the difference in the decisions. The facts in both cases should be an indication to landowners and wildlife managers concerned with the keeping of wildebeest, what is reasonable in certain circumstances to warrant the keeping of wildebeest under conditions where conflicts are caused as a result of MCF.

One further unreported decision of the Transvaal Division of the High Court which needs mentioning is the matter of Lewies v Rhinoland Safaries (Pty) Ltd (2003)43. The claim in this decision was based on the principles of the *actio de feris*44 for damages. The decision has been criticized (Visser, 2006). The basis of the criticism is that the legal literature does not make provision for the *actio de feris*44 to be applied where damage caused by an animal, is in accordance with the situation where MCF is transmitted by blue wildebeest. According to the author the damage in such instances is considered “too remote” to be based on this specific action and should be based on the normal principles for dilictual actions (Visser, 2006). These principles have a higher burden of proof because fault is required as an element of an action based thereon. From the legal position as contained in the common law, legislation and decided cases it is evident that the conduct required from landowners, wildlife and cattle managers and owners are management decisions and actions. Certain conduct which relates to management is required.

The obligation in terms of Section 17 of the Animal Health Act (2002)45 as discussed above determines that reasonable steps that are necessary have to be taken to prevent the infection, the spreading of, the eradication of the disease and to apply certain treatment. All of the abovementioned relate to management. For a wildlife manager to execute what is required in this section, management strategies with regards to MCF have to be decided upon, be implemented, be monitored and adapted where necessary.

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43 TPD Case number 187/2003T
44 *Actio de feris* = a particular action origination from Roman-Dutch Law
45 Animals Health Act (Act 7 of 2002)
The case law discussed above also expressly mentions certain actions, which relate to management. The following were mentioned:

- Fencing requirements.
- Grazing programmes.
- Introduction of endemic species.

The abovementioned are management actions. These actions are not limited to what has been mentioned. Any management actions may be judged in regard to the legal principle of reasonableness. The way in which wildlife managers address a specific situation with regard to MCF through management, will determine the reasonableness of their conduct. Management of the MCF and the control thereof are discussed later in this study.\(^{46}\)

\(^{46}\) Vide Chapter 5 3: 73 - 87
CHAPTER 5 – SOLUTIONS

There are three possible fields of study, which may solve the problem, in regard to MCF namely:

5.1. Legal solutions.
5.2. Scientific veterinary solutions.
5.3. Management solutions.

Each of these is a totally different unrelated field of study. Nevertheless knowledge of each may be useful to formulate solutions in a specific field or combination of fields.

1. Discussion of legal solutions

It has been indicated that the legal system consists of the common law, legislation and case law.

The common law consists of two remedies namely an interdict and a claim for damages, which were discussed in detail. The principles on which both these remedies are based are to a large extent complicated technical aspects of the law which require specialist knowledge to which lay persons do not necessary have access. The common law remedies are not easily accessible because they have to be enforced in the courts of law. Enforcment by legal means is a costly and timeous process. It may take years to finalize a matter at great cost to the parties involved therein. In the matter of PGB Boerdery Belegging (Pty) Ltd v Somerville 62 (Pty) Ltd (2007 SCA 145 RSA) the total cost for the applicant was approximately R500 000.00.47 This amount includes the costs paid in terms of the order of the court to the successful party. As it has been indicated there are three possible grounds on which a claim for damages may be based. The plaintiff in a matter carries the burden of proof on a balance of probabilities that he is entitled to be awarded damages. The plaintiff has to further prove how the damages are quantified. In an action based on negligence, the elements of a delict as discussed have to all be proved. This places a heavy burden of proof on a plaintiff, which holds a certain risk for the plaintiff. The risk of not succeeding to satisfy the burden of proof rests upon the plaintiff. If not satisfied, the court may award costs against the plaintiff in the matter. Opposed High Court matters may take a minimum time period of two years or more. Magistrate Court matters may take a shorter time period, but are limited to matters not exceeding R 100 000.00.

Similarly in a matter based on the breach of a legal duty a substantial burden of proof rests on a plaintiff. In the absence of a legal duty based on a statutory provision, it may be difficult to prove an existing legal duty. In the absence of a legal duty a plaintiff is placed in a similar position as a plaintiff who bases his claim on negligence. Although

47 Gouws, D. July 2009. Managing Director PGB Boerdery Belegging (Pty) Ltd. Personal communication
section 17 of the Animals Health Act (2002)\(^{48}\) places a statutory legal duty on certain persons, it appears not to have been used as a ground for a claim for damages. All the elements of a delict with the exception of negligence have to still be proved in an action based on section 17. Therefore a considerable burden of proof still rests on a plaintiff in an action based on this ground. As it has been indicated previously doubt exists whether an action based on the *actio de feris*\(^{49}\) may be used in a claim for damages, as a result of MCF. If it is assumed that a claim may be based on this ground, all the elements of a delict with the exception of fault still have to be proved, with the resultant burden of proof on the plaintiff. As in the case of a claim for damages, the remedy of an interdict requires from the applicant to satisfy the burden of proof before he may succeed and be entitled to the relief sought. Similar problems face the applicant in an application for an interdict. As in the case of a claim for damages the burden of proof, which rests on an applicant to prove the requirements for an interdict, have to be satisfied.

A further possible remedy which was discussed was a claim against the state based on section 21 of the Animal Health Act. It has been indicated that it is doubtful whether a claim based on this section may be enforced in a court of law. This section does not appear to have been used as a remedy to institute a claim for damages caused as a result of MCF.

Case law refers to decided cases on a particular legal issue such as MCF. The decisions of the courts are based on the common law principles and applicable legislation, which exists in regard to a particular issue. Decided cases form precedents and the courts have to follow the decisions of cases which have been decided on any particular legal issue. In the cases, which were discussed, it was indicated that the court in Wright and another v Cockin and others (2004)\(^{50}\) decided in favour of the cattle owner and in PGB Boerdery Beleggings (Pty) Ltd v Somerville 62 (Pty) Ltd (2007)\(^{51}\) in favour of the wildebeest owner. The differences in the facts of the cases account for the difference in the decisions. The decided cases however do indicate that the courts may in different circumstances and on different facts come to different decisions. Each matter is decided on merits. These decisions may not always be predicted or are predictable. The law remains a complicated field of study, which does not necessarily provide solutions to the problem which interested parties experience as a result of MCF. Litigation should be avoided as it is expensive and time consuming. A decision of a court only provides an analysis of the facts of a case and sets out the applicable law. It does not provide a solution. Courts are not structured to provide solutions to problems, neither is it their duty to do so. Litigation should only be resorted to when clarity regarding the law is required. (Barnard, 1999:341) Case histories are of importance to other parties involved in similar disputes by providing

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\(^{48}\) Animal Health Act (Act 7 of 2002)
\(^{49}\) *Actio de feris* = a particular action originating from Roman-Dutch Law
\(^{50}\) 2004 (4) SA 207
\(^{51}\) 2007 SCA 14 RSA
guidelines as to how such a dispute could be settled and the way in which legal principles should be applied.

The attempt of the RPO and WRSA to resolve the issue of MCF through the appointment of an Ombudsman doesn’t bring the issue of MCF closer to a solution. Although this step had the intention of addressing the shortcomings of the legal system and process, it has not succeeded in achieving that aim. The fact that both these reputable organizations have jointly made an attempt to put a system into place to solve the problem caused by MCF is not only an acknowledgement of the problem, but also an acknowledgement that the law and legal system doesn’t adequately deal with it. The processes, which have been put into place, in their present form, do not contribute to a solution for the problem.

The current legislation does not contain any specific reference to MCF. The general provisions of current legislation do not contain solutions to the problem. The previous legislation contained specific provisions with regard to MCF. The provisions were aimed at specific measures to control the occurrence and control of the disease. The control measures were enacted in 1984 and owners of wildebeest were given authorization up to 1987 to register their properties for keeping of wildebeest. Subsequent registration was possible subject to strict requirements enforced by the Regional State Directorate of Animal Health. Consent of neighbouring landowners and the local community was required. It is significant to note that Table 5 indicates comparative statistics of outbreaks from 1981 to 1983 and 1988 to 1990.

It is significant that after implementation of the control measures through legislation, an increase is noted in wildebeest derived MCF. It is thus questionable whether the implementation of control measures through legislation effectively solved the problem. These statistics do not indicate a reduction in the occurrence of the disease, but a notable increase thereof. The data while the control measures were in place as indicated in Table 5 show an increase of more than 4, 8 times. Table 6 indicates an increase in the period from 1987 to 1992 from the previous period of 1981 to 1986 of double the amount of mortalities. The exact reasons for the respective increases are unknown and are speculative. The fact however remains that irrespective of the stringent control measures the disease still occurred, was prevalent and increased. The question can therefore be asked whether the control measures in fact did in any way serve any significant purpose. When the control measures imposed through legislation were abolished, game ranchers and groups involved in eco-tourism argued that notwithstanding all the measures being implemented to regulate the distribution of wildebeest, MCF had not been significantly controlled (Reid & Van Vuuren 2004).

If the effect of the Regulations with specific reference thereof to MCF is examined critically, there may be merit in the argument. The most important provisions are those relating to registration of properties to keep wildebeest and the prohibition on the

52 Animal Diseases Regulations (R2026, 26 September 1986)

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movement of wildebeest without a permit. These provisions *per se*\(^{53}\) cannot prevent
the occurrence of MCF. Firstly, the provision regarding the movement of wildebeest
may have been implemented to avoid wildebeest spreading the disease while being
transported. The effect of the legislation is that wildebeest could only be transported to
properties that are registered. In view of the characteristics of the disease, it is unlikely
that MCF may be transmitted during transportation. In all of the literature no
mentioning is made of any such occurrence. As all wildebeest are carrier hosts of the
disease, the disease may in any event spread or be transmitted from properties which
have been registered to keep wildebeest and to properties which have been registered
which wildebeest were transported to. The intention of the legislator with regard to the
prohibition on movement of wildebeest is not clear, because a property has to in any
event be registered before wildebeest may be kept. The intention appears to have been
to prevent the spreading of the disease through transportation of the carrier hosts. As
indicated this is an unlikely way if at all in which the disease may spread.

Secondly, the provision on the keeping of wildebeest is prohibited on properties that
have not been registered in terms of the legislation. The intention of this provision
appears to be that the owners of neighbouring farms or animals and the community
represented by the farmers association should consent to the keeping of the wildebeest.
In doing so, such owners of land or animals may not be entitled to hold the owner of
the wildebeest or the owner of the registered property liable for damages caused as a
result of MCF. On the same basis the State may not be held liable for damages as a
result of MCF. By consenting the owners of the land or animals have consented to
prejudice by allowing wildebeest to be kept. The registrations of properties for keeping
wildebeest therefore are aimed at the consequences of MCF and not the causes thereof.
It may be that due to the registration process and neighbouring owners of animals,
owners of neighbouring properties and farmers associations not consenting, less
property are registered. As a result of less properties being registered to keep
wildebeest, less disease occurs. The fact that properties have to be registered does
however not mean that the transmission of disease does not occur. This argument is
supported by the data, which was discussed earlier in this study\(^{54}\).

A further aspect which is not dealt with satisfactorily in the previous legislation is that
it does not take into consideration that land in South Africa changes ownership
regularly. The effect of registration of properties on neighbouring properties, which
are subsequently sold after consent has been granted, is unclear. The question may be
asked whether such newly acquired property is bound by the consent granted by the
previous owner of the property. In view of the fact that the consent is in no way
attached to the property, such previously granted consent cannot be binding on the
new owner. Such an owner shall consequently be entitled to institute legal action
based on damages against the owner of the wildebeest on the property, which was
registered, and possibly against the State for losses incurred. It is doubtful whether the

\(^{53}\) *Per se* = Latin for “in itself”

\(^{54}\) Vide Chapter 2 3.2;3.3: 12-19
legislator would have intended such a consequence. The fact that such a consequence appears possible and probable together with the fact that the control measures appear not to have the required result indicate that the previous legislation with regard to MCF was not well considered. In the event of legislation being suggested as a suitable method of controlling MCF, special consideration should be given to the aspects discussed by taking into account the exceptional nature of MCF as a disease.

2. Veterinary solutions

No vaccine is available to protect animals from MCF (Reid & Van Vuuren 2004). Nearly all attempts to immunize cattle against wildebeest derived MCF, using virus which may have been attenuated, have failed (Plowright, 1990). Claims that cattle have been immunized have not been confirmed (Plowright, 1990). In spite of the production of high levels of virus neutralizing antibodies in vaccinated rabbits and cattle, the development of inactivated vaccines by conventional methods have so far been unsuccessful (Barnard et al 1994).

In East Africa strong support for the development and use of a vaccine against MCF was found in a study by Cleaveland et al. (2001). A high percentage (98%) of respondents indicated that they would use a vaccine, if available. In the same study the opinion of respondents was that the use of a vaccine would prolong the duration of grazing on the short grass plains. The short grass plains are considered as good grazing and utilized by both stock farmers and wild animals, especially wildebeest, alike. The prolonged duration of grazing these grass plains would allow utilization of these areas during the most productive months of the year and not lead to substantial shifts of the Maasai communities. The productive months of the year were during the rain season which also co-incide with the calving season of wildebeest in this region namely January and February. It is understandable that problems are caused for communities having to move as a result of MCF. Some of these problems were security concerns and a lack of suitable fertile land in areas where communities are forced to move. In the Republic of South Africa the benefit of a vaccine would also appear to solve land use conflicts in areas which are suited and favourable for the keeping of wildebeest and beef production through commercial farming. In East African conditions, it has been raised that the introduction of a MCF vaccine would result in changes to the grazing pattern, with improvements to the efficiency of grazing management Cleaveland et al. (2001). Changes in the grazing pattern are a cause of concern that over grazing may occur and an increased influx in people.

Although the development of a vaccine against MCF may have benefits to improve the livelihoods of stockowners, certain reservations exist to a vaccine. As a solution, the introduction of a vaccine has potentially far reaching repercussions on environmentally sensitive areas, such as the Serengeti (Cleaveland et al 2001). It is crucial that the impact of the vaccination program is closely monitored to evaluate the following:

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- Changes in livestock demography.
- Cattle and small ruminant production.
- Disease incidence.
- Vegetation patterns.
- Human settlements and immigration.
- Numbers and distribution of wildlife.

It is generally considered that the use and development of a vaccine could not be justified by the losses incurred. There, however, appears to be evidence that MCF is a growing problem especially in certain parts of Africa. Cleaveland et al. (2001) are of the view that public private partnerships should be formed to develop a vaccine and that no real reason exists to expect that a MCF vaccine could not be achieved. Immunity to MCF is possible and occurs in rare cases where cattle recover from the disease.

Two likely feasible approaches have been suggested to the development of a vaccine by Cleaveland et al. (2001). The first is that it may be possible to manipulate the host immune response to stimulate T-lymphocyte responses and/or high levels of neutralizing antibody. As an example the use of tissue culture propagated virus that could stimulate high levels of neutralizing antibody at mucosal surfaces (e.g. by exclusion of cholera toxin as an adjuvant and through mussel immunization) may prevent virus uptake in exposed cattle. This is a simple approach that offers a feasible strategy for vaccine development in the short term. The second approach requires a longer development phase, through recombinant technology to specific pathogen genes against which the host needs to be protected. Recent studies have elucidated the full sequence of the genome and identified genes involved in virulence, which raises the possibility of constructing recombinant proteins and vaccines. This knowledge about the molecular biology of AH1V-1 makes the development of a vaccine possible.

It should however be realised that a vaccine against MCF is not an instant solution. Mass cattle vaccination programs for example against rinderpest, have had an impact on sensitive ecosystems. The reason partly being that any pathogenicity of non-target species could have far reaching implications for valuable wildlife resources of an area Cleaveland et al. (2001). It is suggested that small-scale pilot trials are first done to evaluate the potential impacts. Even if a vaccine is developed successfully it therefore appears that the application thereof cannot effectively achieve its goal without management also playing an important role in the process thereof. It must however be mentioned that a vaccine would reduce mortality and morbidity. It was found in a study that MCF has increased the disease burden of infectious diseases for tick-borne and directly transmitted diseases such as contagious bovine pleuropneumonia and foot-and-mouth disease Cleaveland et al. (2001). Trypanosomiosis or nagana disease was also reported as an indirect effect of MCF in the same study. In this respect a vaccine would not only solve mortality as a result of MCF but also of these diseases. A vaccine would also enhance survival and fertility of cattle though access to high quality grazing at certain times of the year, which may be considered as being critical
times. The environmental impacts associated with concentration of people and cattle in certain areas as a result of MCF may be mitigated. These impacts include overgrazing, erosion and tree felling which might be mitigated.

3. Discussion of management solutions

In view of the legal remedies, legislation and the absence of vaccines, the prevention of MCF rests simply on the prevention of the disease by management. Although it is conceded that legal and scientific measures such as vaccines may play a role and have their place in the control and prevention of the disease, the basis of the prevention of MCF should rest on management of the problem. It is suggested by certain authors that cattle should be kept away from wildebeest during and for three months after the wildebeest calving season. (Plowright, 1965; Mushi et al. (1980); Plowright, 1965) has shown that animals beyond the initial stage of continuous, high levels of viraemia are not capable of transmitting the agent to cattle and the two species can then be housed or grazed together with impunity. In South Africa it is suggested that contact is not essential for the transfer of MCF to cattle, and that transmission can occur over distances of up to several hundred meters. However, the method of transmission over long distances could not be validated. The investigation of the role that carrier cattle could have played under these conditions were not investigated. It was further indicated in South Africa that wildebeest older than 3 months might also be a source of infection. Separation of wildebeest and cattle by at least 1 000 meters is thus regarded as necessary to prevent the infection of cattle. In the case of free-living wildebeest, this is becoming increasingly difficult to achieve due to encroachment into and settlement of humans in traditional wildlife areas. Similarly, where mixed animals species systems are kept on ranches or in zoological collections, effective separation may not be practical. At present the most effective means of prevention of MCF in cattle and other susceptible species is to prevent direct contact with potential carrier species of the causative virus. How to achieve this in traditional natural wildlife areas and on game ranches alike depends on effective management methods. Preventing the spread of MCF among captive ruminants and domestic livestock is an important concern because of high mortality as a result of MCF. Game ranching of exotic species in conjunction with domestic cattle ranching, is an increasingly popular enterprise not only in Africa but also in other countries of the world such as the United States of America Heuschele et al. (1985).

MCF does not only pose a threat to commercial livestock farming but also to wildlife conservation in general. It is in the interest of all stakeholders to combine forces to develop strategies that promote the problems caused by MCF to be addressed. These parties should not only include conservation authorities, private owners of conservation areas and commercial farmers but also traditional pastoralists. Control through management of MCF is an important factor for sustained wildlife and livestock co-existence.

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In South Africa 14 game ranching regions have been identified in terms of game ranching potential (Van Rooyen, 2002). The historic distribution of black wildebeest has been indicated as the following regions namely Lowveld, mopane veld, sweet and mixed bushveld, mountain or sour bushveld, Kalahari and grassland central Highveld. The historic distribution of black wildebeest has been indicated as the following regions namely Kalahari, grassland: central Highveld and grassland: mountain and escarpment. The urge to introduce these species to areas where they did not occur historically should be exercised with great circumspection and caution. It is an accepted principle that habitats have been modified, fragmented or degraded and therefore each opportunity should be considered on its own merits (Van Rooyen, 2002). It is not justified to introduce these species to areas where they did not traditionally occur simply because of general conceptions. The ecological capacity of each specific area should be studied scientifically and objectively before making a decision to introduce wildebeest to these areas.

By doing so the threat of MCF may be reduced in these areas. In East Africa within the general management plan for the Ngorongoro conservation area are recommendations to identify priority areas for livestock development and pastoralism, wildlife management, tourism, forestry and archaeology Cleaveland et al. (2001). Zones for pastoralist development have been focused on areas with relatively large permanent settlements. It is suggested that without methods to control MCF, strategies to extend utilization of short grass are limited. Fencing of zoned areas in this area is considered as being unacceptable because it is incompatible with the aesthetic, cultural and conservation goals of the Serengeti and Ngorongoro. These conservancies are world heritage sites. Fencing is likely to have a catastrophic effect on the world-renowned wildebeest migration, limiting access to areas that are critical for survival when resources are scarce. Fences may also pose constraints to traditional pastoralism. Due to the fact that it has been found that it is necessary to separate wildebeest and cattle by at least 1 000 meters, fences as a control method do not necessary provide an ideal solution. As it has been indicated that MCF occurs commonly in South Africa where the source of infection is wildebeest herds which are kept on fenced game ranches and are separated from domestic cattle by fences. As indicated in the case law referred to above fencing which separate the two species by at least 1 000 meters are impractical and costly to erect59.

In Northern Tanzania wildebeest play an important role in the savanna ecology. They are a dominant species, which contribute to ecological modifications. In the Tarangire-Manyara ecosystem of approximately 20 000 square kilometres wildebeest migrate beyond the Tarangire National Park and Lake Manyara National Park into communal village lands (Goldman, 2007). These two parks which are in total approximately 2 930 square kilometres only act as dry season refuge sites in the semiarid ecosystem. Wildebeest spend more than six months each year in Maasai dominated, village-based communal rangelands. These rangelands are undergoing conversion to cultivation and

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wildebeest movement patterns are important for conservation in the area. Maasai consider hunting wildlife for meat as culturally unacceptable and as something only those who are without cattle should do (Goldman, 2007). Understanding the movement and birthing patterns of wildebeest are important for the Maasai. It is an important husbandry strategy for the Maasai to observe the movement of the wildebeest, which are known to follow the rain. As cattle herders, the Maasai are constantly in need of quality grazing which follows the rain. It is equally important for the Maasai to observe wildebeest behaviour in order to avoid MCF and for their livestock in particular cattle to successfully and sustainably co-exist with wildebeest. They need to know where, when and why wildebeest move. On the other hand the conservation of the migration routes in particular in areas outside the parks is a conservation goal, which cannot be achieved without the co-operation of the local communities. The Maasai explain the movement of the wildebeest with reference to habitat selection.

Habitat selection is according to them directly related to avoidance of predators and movements are directly related to rainfall (Goldman, 2007). Wildebeest prefer wide-open places, where they can easily spot predators. These areas are especially selected in the calving season. Wildebeest also need water and prefer fresh green grass, especially when calving. The open plains can only be utilized during the rains when seasonal water is available as a result of the rains. When water is no longer available they are forced to move to areas where permanent water resources are available. The Maasai are of the view that the reason for wildebeest to return from the communal lands, which consist of open plains, to the parks, is for water. Permanent rivers containing dams are situated inside the parks. Once they return to the parks the wildebeest stay near these water sources until it rains sufficiently for the production of grass and water outside the parks. It was even found that some Maasai believed that wildebeest move out of the parks after the rains because the areas are too densely vegetated by grass, scrub and trees (Goldman, 2007). From the above information it is evident that in this area as in all savanna ecosystems rainfall is a dominant force, which determines vegetation productivity. The Maasai observe where wildebeest move to in order to locate suitable grazing for their cattle. Although it is believed by them that wildebeest move in reaction to rainfall, the availability of drinking water and fresh green grass, they are of the view that habitat preference of wildebeest is based on predator avoidance. Predator avoidance explains wildebeest behaviour and habitat preference, which is modified by intra-annual and inter-annual rainfall (Goldman, 2007). According to the Maasai, predator avoidance also explains the association of wildebeest with zebra. Zebra clear densely vegetated areas to make them more accessible and safer for wildebeest. Zebra also hear and see well and may alert wildebeest to the danger of predators. The interaction between different species does not only therefore explain their behaviour but may also explain the behaviour of wildlife towards people and domestic animals.

It is believed that wildebeest benefit in a similar way from cattle as they do from zebra because cattle also open the areas which are densely vegetated to make them more
accessible to wildebeest. Wildebeest have also been found to move close to bomas at night for safety against predators. It is quite evident therefore that the way in which the ecology of the specific area operates, can be explained with reference to the interaction between wildlife, humans and livestock. Human habitation with the livestock grazing which accompanies it may be favourable to wildlife. The Maasai further observe that cattle and wildebeest have a preference to certain grasses than others. With regards to cattle they also observe the effect that different grasses have on the condition and health of their livestock. The movement of wildebeest is also related to their reproduction cycle, not only do they move to open areas during the calving season, but also when rutting (Goldman, 2007). These two activities are according to the Maasai periods when wildebeest have to avoid predators. Calves are an easy and favourite prey. It is further necessary that wildebeest are near water during the calving season to assure the production of milk. During the rutting season males are territorial and need space and freedom to compete over mating with females.

The wildebeest movement has also been explained scientifically as opposed to the observation and experiences of the Maasai (Goldman, 2007). It was found that during lactation, female wildebeest have higher nutritional and caloric needs. These needs are more likely to be met on the short grass plains than in the dry season refuge of the woodlands.

Research in the Serengeti-Mara ecosystem indicates that calcium is the most important nutrient during lactation. It was found that calcium was a limiting factor in the woodland which is occupied in the dry season. It has also been found that the short grass plains were higher in copper, magnesium, nitrogen, sodium, phosphorus, and the calcium phosphorus ratio. This difference in nutrient value of the different habitats was the likely driving force for the movement of lactating herds. Mineral deficiencies in an analysis of serum and urine electrolytes of lactating herds also indicated a phosphorus deficiency in the Tarangire National Park. This was also considered as a likely driving force of not only the wildebeest migration but also the zebra migration to areas rich in phosphorus during the wet season. It was further found that in the event of migrations not taking place to certain areas rich in minerals the number of wildebeest would be adversely affected.

The quality of the grazing also increases energy levels of animals and therefore wildebeest migrate to short, fresh green grass to maximize their energy intake. It has been argued that wildebeest movements correspond at the ecosystem level to the availability of grass swards at low (3 centimetres or less) to medium (10 centimetres or less) heights. There are several reasons for the genetic variant of grass. Low-to-medium height grasses are higher in crude protein and are of more value to herbivores. Scientists have also explained the grazing association of zebra and wildebeest with reference the understanding of grass quality with differences in crude protein availability based on grass height. Zebra prefer grazing on tall grasses, which are high in fibre but low in protein. These grasses are suitable grazing for bulk grazers such as zebra, which are also hindgut fermenters. Zebra are at the front of the grazing
succession and open the vegetation, for wildebeest to gain access to shorter grasses. Shorter grasses are higher in protein content. Protein content is important for the ruminant digestive system of the wildebeest. Grazing by cattle and burning in a similar way result in short grasses preferred by wildebeest.

Scientists have also found that rainfall is a factor which influences movement of wildebeest. The reason being that acceptable grazing follows sufficient rainfall. Once water supply on the plains dry up, wildebeest relocate. Certain studies have also found that wildebeest movements are more related to the greenness of the grass than the shorter height thereof (Goldman, 2007). It was found that wildebeest tend to follow the rainfall in search of fresh green grass, even if herds are split. Other factors, which have been advanced to explain the movement of wildebeest, are the following:

- Avoidance of tsetse flies and other disease vectors.
- Escape of predators in tall grasses.
- Reduction of predator threats by moving out of the home range.

Goldman (2007) is of the view that especially grass height and quality of grass can assist in predictions regarding movement of wildebeest. To a lesser extent rainfall and anti-predator behaviour may also be used in experiments for models to solve MCF by management.

By observing and scientifically studying the behaviour of wildebeest, not only in large unfenced areas, but also in smaller fenced areas, valuable information is obtained to base management decisions on. These decisions may be taken for different reasons in order to manipulate certain conditions to reduce or totally avoid the risk of MCF to cattle thus creating a friendly habitat where cattle and wildebeest can co-exist in harmony.

Fires, licks and water may be used to induce wildebeest to areas where it is less likely that they may be the cause of MCF. Burning sections of a game ranch, is an effective method of attracting animals away from localized sweet veld areas (Van Rooyen, 2002). It has been indicated above that wildebeest prefer not only to graze on certain grass species, but also prefer fresh green grass. Fire is used as a management tool to remove moribund plant material that has accumulated from previous seasons and for managing undesirable woody or herbaceous plants or weeds that reduce the productivity of the grass layer (Van Rooyen, 2002). In this way fire may be used specifically to manipulate plant populations, to decrease the height of grazing and to increase biotic and habitat diversity. In general fire may be used to maintain and create a wildebeest friendly habitat. Acceptability, nutrient content and digestibility of the forage are enhanced after burning. It was found that the crude protein of the grass was 16% five weeks after a late season burn, compared with less that 9% in similar grassland that was not burned (Van Rooyen, 2002). For wildebeest as ruminants that require forage with high protein content, it is evidently a significant difference. Burning may be done at critical times when the threat of MCF is high to attain certain
management objectives. In this specific instance the main objective would be the avoidance of the spread of MCF.

The use of salt and other licks, especially in the dry season, will encourage wildebeest to move to certain areas. Care should however be taken not to place licks in areas, such as sweet-veld areas, where the veld may be overexposed or utilized by animals, causing overgrazing and severe trampling of the veld. Areas susceptible to erosion should also be avoided. Licks containing parasitic remedies (Ivomec) can help to prevent transmission of MCF via parasitic vectors. A lack of grazing at the end of the dry season in East Africa was emphasized as one of the consequences of MCF in certain areas Cleaveland et al. (2001). The high energy and mineral content of the short grass plains are not only advantageous to wildebeest, but also to cattle. As it has been indicated this type of grazing contributes to lactation of both species, improving survival of both calves and adult female. It furthermore allows cattle to re-establish body condition at the end of the dry season, which is critical for ensuring cattle survival and fertility in the subsequent season Cleaveland et al. (2001). The lack of salt in woodland pastures also necessitated movement of cattle to certain wildebeest calving areas. These so-called salting trips posed a significant risk of exposure to MCF in these areas. Reproductive and production losses arising form salt deficiency occurred. However it is evident that losses increased due to MCF which is indirectly caused by cattle moving to areas in need of salt and other minerals, increasing their exposure to MCF. Wildebeest are for the same or similar reasons attracted to these areas.

Bonsma (1980) is of the view that nutrition is the most important single factor in the environment. The role of soil fertility and pH as supplementary factors in determining the level of nutrition are also of importance. These factors can influence the conformation and physiology of animals. Soil reaction and fertility has an effect on the development of grass and subsequently on the animals feeding on the grass cover. As indicated above the nutrient value of the different habitats was a driving force for the movement of wildebeest during lactation. The grass on the plains preferred by wildebeest, contain essential elements such as calcium and phosphorus. Approximately 85% of the mineral matter in animals consists of calcium phosphate, 14% of calcium carbonate and 1% of magnesium phosphate (Bonsma, 1980). Approximately 80% of the phosphorus of the body occurs in the bones and teeth. Large amounts of phosphorus found elsewhere than in the bones are in organic combinations such as phosphoprotein, nucleoprotein, phospholipids, phosphocreatine, hexo-phosphate (Bonsma, 1980). In the body of animals, phosphorus and calcium mostly occur combined. An inadequate supply of either limits the nutritive value of both. The development of the skeleton dependant upon the supply of calcium and phosphorus in the feed of animals.

It is a fact that in South Africa soils are deficient in phosphorus (Bonsma, 1980; Van Hoven, 2002). Growth and development is adversely affected by a phosphorus deficiency. Phosphorus has to therefore be supplemented artificially. In a study
(Bonsma, 1980) done in the bushveld savanna area of South Africa the veld was divided into two types namely “Haak-en-steekveld” Acacia tortilis, which is a typical sweet veld type, and “Rooibosveld” Combretum apiculatum, which is a mixed veld type. In a grazing experiment it was found that the mass of oxen that grazed on the “Haak-en-steek” were fatter and obtained better grades. The organs and soft structures of the body of the animals consist of mainly protein. Therefore a sufficient and continuous supply thereof is needed in the food for growth and repair. The transformation of food protein into body protein is an important part in the nutritional process. From this information it is quite evident that plant nutrients play a role in the metabolism of animals and more specifically wildebeest. It has been indicated that wildebeest seek grass with a specific nutritive value, which plays an important role in their survival and existence. With advancing season and advanced growth stage the percentage of protein and phosphorus decrease in grass, while the crude fibre increases. Some of the reasons for this happening are the following (Bonsma, 1980):

- The formation of dry matter and the accumulation of carbohydrates proceed at a faster rate than the absorption of soil nutrients, thus leading to a decreased concentration of protein and nutrient elements in the plant, which is especially pronounced during the formation of stems, which are lower in protein and nutrient elements.
- The losses of nitrogen and elements from the herbage take place after flowering, when these elements are translocated to the roots for storage for the next season’s growth.
- Further losses of nitrogen and elements occur by rain through leaching of the maturing dead herbage, which supports the belief that abundant rains appear not to favour a high phosphorus content of grasses.

The decrease in protein and nutrient content during winter is less pronounced in sweet veld that in sour veld. It is suggested that this may be as a result of the fact that sweet veld grasses are annuals, in which case slow translocation of nutrients from the shoots to the roots takes place (Bonsma 1980). Frost in sweet veld areas is later, if at all, and less rain causes no leaching to take place. Sweet veld areas also appear to stay greener longer because of the presence of more bush and shrubs than grass. Under South African climate conditions it was found that purely from a qualitative point of view, taking chemical composition as the criterion, sweet veld is better than sour veld, but that animals will probably be able to satisfy their daily needs on a smaller area and shorter time on sour veld than on sweet veld (Bonsma, 1980). The reason for that is generally because of denser vegetation. Young animals require a larger proportion of protein and nutrient elements because of extreme rapid growth. As they become older these required nutrients decrease. From the abovementioned it is quite evident that the fertility of the soil and the consequent nutritive value of the grazing may differ in an ecosystem, country, district, farm or even a section of a farm and has an effect on the way animals behave as well as the way they are physiologically adapted thereto.
In Zimbabwe it was found that cattle run on the sweet-veld areas were larger than those run on sour-veld areas (Bonsma, 1980). More important for this study is that animals at different times of the season and at different ages have different preferences. These preferences need to be established in order to base management decisions on to attain an objective such as minimizing the risk of MCF.

Habitat refers to plants, animals, climate, rocks, soil and water. The habitat provides food, shelter and water to an animal. The vegetation is an important component of the habitat. Plant species are assembled in plant communities with similar appearance. The plant communities occur in relatively consistent types of physical environment. Plant communities provide specific habitats for animals. Plant communities react differently to vegetation management and influences such as fire and grazing.

The habitat of wildebeest may be manipulated by creating more grassland in areas or changing the position of waterholes. In doing so wildebeest may be induced away from areas where they pose a threat due to transmission of MCF to cattle. A management program is not only necessary for purposes of conservation and utilization but also in management with specific regard to a disease such as MCF. Homogeneous plant communities or habitats should be identified, described and mapped. The purpose of habitat classification for MCF is to establish information to base a system on which wildebeest are managed to reduce the transmission of the disease. This information may not only assist in identifying preferred wildebeest habitat but also in planning watering points, fences, burning programs, monitoring and identifying ecologically sensitive areas and identifying predator preferences. It has been indicated that some of the abovementioned may play a role in the behaviour of wildebeest. Classification may also assist in identifying suitable areas to be manipulated for creation of wildebeest friendly habitat.

Salt (sodium chloride) is an essential nutrient for herbivores. In low rainfall regions brackish water and salt rich grazing may be sufficient to satisfy the requirements of the animals’ physiology. In south grassveld regions salt is generally deficient and animals show a craving for salt. Salt may be used to induce animals to move away from a particular area or to remain in a particular area at certain times when it is required. Care should however be taken that salt licks are put out timeously to avoid the possibility of animals developing a hunger for salt that could lead to over consumption at a later stage when it becomes available. It has also been found that a protein response in sour veld regions from January to February occurs (Schmidt & Snyman 2002). This is earlier than it was generally believed and justifies protein and energy supplementation in these regions in the wet season as opposed to supplementation in the dry season. It is an accepted principle under South African conditions that summer phosphorus supplements are made available to animals (Schmidt & Snyman 2002). Supplements such as urea, fishmeal, carcass meal, blood meal, brewers grain, lucerne, oil seeds like sunflower, groundnut cotton and soya bean are protein sources. Energy supplements may be made available in grain such as maize, grain sorghum, barley, wheat and oats. By products of the above grains such as maize bran, maize germ meal,
maize gluten and wheat bran are also sources of energy. Minerals may be supplemented in different forms.

Licks are useful in supplementing protein, macro elements such as phosphorus and small quantities of trace elements while at the same time satisfying the need for sodium. Pastures and fodder may be planted in areas to lure wildebeest away in order to minimize the transmission of MCF. Wildebeest prefer certain grass species. By artificially planting the species as fodder and pastures preferred by wildebeest at critical times when MCF is a risk, they may move away from areas where their presence is not wanted. Planted pastures may also supplement natural grazing at critical times during the season when natural grazing is scarce and low in nutritional value.

Closing certain waterholes and drinking places may force wildebeest to move to other grazing areas where they have access to drinking water. Wildebeest are strongly water dependent. During 1982/3 wildebeest and zebra herds were promoted to move northwards from their main range in the central region of the Kruger National Park (Harrington, Owen-Smit, Viljoen, Biggs, Mason & Funston, 1990). Their dispersal was facilitated by the construction of numerous wind pumps and dams in previously waterless regions of the Kruger National Park Harrington et al. (1990).

The natural migration of wild herbivores plays a limited role in fenced game ranches because most fenced ranches are comparatively small. In large conservancies it may play a role in areas where it occurs such as in East Africa. On a smaller scale wildebeest may prefer certain habitat conditions in smaller fenced ranches, which may make them territorial and as a result thereof adjustments may be planned to avoid the risk of MCF. MCF is most prevalent at two peak seasons in South Africa from April to June and from August to November. As indicated above the peaks differ in East Africa

60. The period from April to June in South Africa is during the late autumn and early winter period. The condition of herbivores is determined on how they utilize grazing during different seasons of the year. The condition of grazing differs drastically at different times during the season of the year. The condition thereof also has an influence on how animals react and behave as it has been indicated. In South Africa sweet veld dominant grazing plants maintain their palatability and nutritional value throughout the year and for their entire life cycle (Van Rooyen, 2002). Animals utilize grazing plants throughout the year and remain in good condition and reproductive state. Only a minimal translocation of nutrients from leaves to roots occur during the winter. In sour veld dominant grazing plants lose their palatability and nutritional value at maturity. A translocation of nutrients occurs towards the end of the growing season, usually late summer and in autumn.

Sour veld is only palatable and nutritious during the growing season. In can only maintain a good condition and reproductive state for six to eight months of the year.

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Phosphate, calcium and protein deficiencies often occur. Supplements are therefore essential. Mixed veld grazing is suitable for six to ten months of the year. In order to manage MCF by manipulating the grazing and feeding patterns of wildebeest and also cattle, knowledge of the seasonal changes in the nutritional value of grazing is important. The nutritional value of grazing depends on the degree to which the animals eat the plants voluntarily, and the efficiency with which they utilize the nutrients (Van Rooyen, 2002). Grasses are generally slower than woody species to break their vegetative dormancy during the spring and it is a limiting factor during this time of the year. This is significant for wildebeest and cattle management as both are grass feeders. The nutritional value of grass species in sour veld and sweet veld areas decreases as summer progresses.

It appears that the peak periods of MCF coincide with the seasonal loss in nutritional value of grasses. Supplementary winter and spring feeding to remedy deficiencies and stimulate the appetite of grazing animals may as an additional objective be used to manipulate the grazing patterns of wildebeest in avoiding them to transmit MCF to cattle. Burning may also be considered at appropriate times. It must however be kept in mind that rangelands show considerable heterogeneity at both local and landscape level. This heterogeneity is especially in terms of plant composition, structure and productivity. The resource value of any specific area may differ in respect of quality and quantity of the forage, distance to water, the cover and exposure to the elements. These factors vary within a season, between seasons and for different animal species and also in relation to interaction between different species. It is evident that animals such as wildebeest select sites and are therefore patch and area selective for different reasons, which have been indicated. Not only is the separation of veld types essential for the management and distribution of animals for area selective grazing, but it also may in the case of wildebeest be important for the avoidance of disease transmission. Each ecosystem or part thereof which is managed should be intensively studied and researched to establish what management steps would be best suited under the prevailing circumstances. The species which are kept and their interaction should also for the same reason be studied.

An example thereof occurred in a new conservation area in the Tarangire – Manyara ecosystem that officially combined wildlife conservation and Maasai pastoral land use (Goldman, 2007). During the first year of its operation the area had a dismal showing of wildebeest despite scientific reports suggesting that they occupy the area during certain times of the year. Although the manager of the area accepted it that movements can vary with inter-annual variation in rainfall, he was of the opinion that the area was nutrient poor. He argued that the soil and grasses had to be tested for nutrients. It was assumed that due to deforestation in the area of particularly Acacia tortilis had lead to a phosphorus deficiency in the soil. With no funds available to conduct necessary research to test the theory of nutrient deficiency, a management decision was taken in terms whereof burning was prohibited to allow new tree growth. This it was argued would create needed nutrients in the grass, which would make wildebeest, return to the area. On the other hand the Maasai believed wildebeest were not in the area because of
better rainfall outside the area and that such variation was normal. The lack, according to them, of burning was leading to increased grass height, which would keep wildebeest out. They suggested burning as a management strategy in areas that had not been sufficiently grazed, to produce the open grass plains favoured by wildebeest. This example illustrates how different explanations and consequently management strategies can produce different outcomes, critical to conservation management. It emphasizes the importance of studying and properly researching the circumstances in each particular case.

Stress in wild animals may be the result of a variety of causes. It has in fact been found that animals, which recover from acute MCF, may usually be expected to remain persistence virus carriers, with the potential for recrudescence later if subjected to stress (Heuschele, 1988). The disturbance of normal social organization, changes in diet and a strange environment all create stress that will decrease the general resistance of animals to diseases. Keeping animals fenced in may thus cause unnatural conditions, which can have far reaching consequences with regards to disease (Ebedes, Van Rooyen & Du Toit 2002). Overpopulation of animals also creates unfavourable conditions. It may cause deterioration of the veld and natural grazing and over utilization of the available natural resources, which may place the animals under stress. Similarly, wild animals that do not belong in a certain habitat may be more susceptible to parasites and disease caused as a result thereof. These factors may cause a weakened condition of the animals, which in turn leads to greater susceptibility to diseases such as MCF.

Stress is the manifestation of a complex physiological and psychological interaction that is difficult to define in simple terms Ebedes et al. (2002). An elementary explanation is that it is the resistance of the body to harmful and damaging external forces. Each force stimulates an opposing reaction that tends to weaken the body. Once the body is weakened, it is vulnerable to more weakening and it is difficult to stop the process. Wild animals that are disturbed or herded unnaturally will flee instinctively for their lives and keep fleeing until they are out of danger or exhausted. Anxiety and fear are related to capture stress and relentless hunting. Animals in good physical condition are not necessarily fit and should not be forced to run fast or for long distances. In natural environments, animals seldom have to run far to escape danger. Difficult terrain such as deep sand, stony veld or marshes, which hinder animals, to flee may cause stress.

The following factors tend to exacerbate stress in wild animals Ebedes et al.(2002):

- An instinctive or inborn fear of any danger, but especially the fear and anxiety related to being captured - this includes fear of the proximity of humans, vehicles and helicopters.
- Sudden and excessive muscular activity when the animals flee from danger.
- Bodily injuries inflicted while running through obstacles such as dense bush, or by being confined.
- Injuries caused by other animals.
- Strange and unnatural surroundings and accompanying noises and smells.
- Food and water that are strange and unfamiliar.

It has been suggested that adverse climatic conditions can cause stress in wild animals (Barnard & Van Pypekamp 1988). It is known that drought conditions and a lack of proper habitat to feed on causes stress in wild animals, which could ultimately lead to their death. The incidence of MCF on properties adjacent to relatively small fenced ranches with wildebeest may be an indication of MCF caused due to stress.
CHAPTER 6 – CONCLUSION

It has been attempted to indicate the problems experienced as a result of MCF as a disease. Attempts are being made to solve these problems in different fields of science and other disciplines. It appears that management and more specifically wildlife management has to form an integral part in providing a solution to the problem. Community conservation is acknowledged as the future for the existence of conservation in the world today. As a part thereof it is acknowledged that people and wildlife should co-exist together. Attempts that have been made through legal means have been unsuccessful thus far in providing a solution to the problems and losses caused as a result of MCF. Comparative law has been considered as an aspect of sociology of law (David and Brierley, 1985:13-14). There are points of contact and some common ground. Both seek to identify the extent to which law determines man’s behaviour and the place law has in the social order. The way in which the law is presented in its formal sources such as legislation and the courts is not necessarily the only factor conditioning social relationships.

Legal rules and procedures we consider essential in our legal system may play a minor role in other legal systems, their place being taken by non-legal factors. In the Far East good citizenship means settling disputes through conciliation rather than recourse to law and court action, which are considered shameful. The same concept is found in African law as opposed to Western law. In African law justice consists of assuring cohesion of the group and restoring peace and understanding among its members. In Western law justice consists of the application of substantive rules that see to the enforcement of rights. Law taken alone and considered in its strict theory, gives a false view in which social relations operate. The social relations with regard to the problem of MCF are not acknowledged. Law as a strict theory is applied in an attempt to reach a solution in regard to the problem. The differences in court decisions, legal opinions of experts and the inability of solutions through legislation and other means reflect the lack of understanding the social relations with regard to the problems caused by MCF. Dispute resolution through legal means and previous legislation mainly places the emphasis on compensation and prohibition. This emphasis is not conducive to harmonious co-existence, which is required for successful community conservation. It is important that interested parties interact and participate actively in obtaining solutions to problems such as those caused by MCF in order for conservation to be successful.

Attempts have been made by the RPO and the WRSA for participation by affected parties. Previous legislation attempted to involve the community through the farmers associations. Although these attempts are steps in the right direction, enough emphasis has not been placed on measures for harmonious co-existence between affected parties for the sake of conservation. Members of government institutions, organizations, such as WRSA and PRO farmers associations, cattle farmers and communities as affected parties in a broad sense should be involved to find common solutions to the problem. It is not argued that the legal and veterinary fields do not present possible solutions to
the problem of MCF. Thus far these fields of study on their own have however not attained a solution to the problem. The facts suggest that it is unlikely that a solution would be achieved in either of these fields of study or in combination, without management being included in solving the issue. It is in this respect that wildlife management and conservation efforts can play an integral role in facilitating a solution to this persistent problem.

Lee (1999) mentions the following with regard to a search for the meaning of conservation:

“Conservation of this kind is emerging from two forces: the realization that highly valued ecological processes and species can only be preserved in large ecosystems; and the recognition that many ecosystems high in biodiversity are and will continue to be inhabited by humans. These factors inform a redefinition of conservation in a way that points towards an ambitious goal: reconciling conservation biology with sustainable development – that is, bringing together two of the principle themes of environmentalism”.

In the South African context this twofold concept is encompassed in the increase in game ranching. Game ranching is in principle for economic purposes, while it at the same time ensures biodiversity by preserving species. The importance of biodiversity is acknowledged in the National Environmental Management: Biodiversity Act 10 of 2004 (the “Biodiversity Act”), which Act is a consequence of South Africa’s ratification of the 1992 Convention of Biological Diversity. In short, biodiversity can be described as all living organisms, including fauna and flora, and the habitat in which they live. (Glazewski, 2004:257) The term biodiversity comprises the following components: (Glazewski, 2004:257-258)

- Genetic diversity;
- Species diversity;
- Ecosystem diversity;
- Landscape diversity;
- Knowledge and practices of indigenous communities.

Section 3 of the Biodiversity Act provides for the state and its organs to manage, conserve and sustain biodiversity and its components and genetic resources.

The reasons for conserving nature and biodiversity are threefold namely: (Glazewski, 2004:258)

- biodiversity provides an actual potential source of biological resources (including food, pharmaceutical and other resources);
- biodiversity contributes to the maintenance of the biosphere in conditions which support human and other life;
- and biodiversity is worth maintaining for non-scientific reasons namely for ethical or aesthetic considerations.
Wildebeest as a species contribute to biodiversity. Conflict due to MCF is however caused as a result of the presence of wildebeest in ecosystems inhabited by humans or non-endemic areas. The uncertainties with regard to the management of MCF in these ecosystems have been stated. Some of these uncertainties include the uncertainty about the characteristics and reaction of the disease, the relationships of affected parties towards one another, land use, the role of authorities and institutions and the methods to prevent transmission of the disease. Despite the uncertainties, the natural resources have to be managed to produce sustainable wildlife populations.

Reliable knowledge of natural systems used by humans is essential if a sustainable economy is to be achieved (Lee, 1999). Where losses occur as a result of MCF, the economy is influenced. Losses due to MCF do not only have an effect on the profitability of cattle farmers. Conflicts and disputes result in legal action against game ranchers preventing them from keeping wildebeest. Game ranching and conservation is adversely affected as a result thereof because it leads to a loss of biodiversity, which has negative impacts. From a tourism and hunting perspective tourists and trophy and venison hunters expect biodiversity. For biodiversity to be achieved a variety of species and genetic composition is necessary. Game ranchers and conservancies are therefore indirectly economically affected by not being able to keep species such as wildebeest.

It is evident that a sufficient amount of reliable knowledge is needed to manage ecosystems in which wildebeest occur together with cattle. This knowledge is necessary to manage and create a wildebeest-friendly habitat in which wildebeest and cattle can co-exist. Adaptive management formulates policies as experiments that probe the responses of ecosystems as people’s behaviour in them changes (Lee, 1999). The goal thereof is to learn more about the processes and structure of the ecosystem, which explain it’s functioning. This approach is scientific. Ecosystem are dynamic and change continually. (Bothma, 2002) Fluctuation is an important part of an ecosystem, without which it cannot function viably. Wildlife management techniques can be used as tools to induce changes in ecosystems. Natural ecosystems respond to changes. Management on the other hand should respond to problems and opportunities. The question may be asked how may adaptive management be initiated and sustained with reference to a problem such as MCF. It may be a difficult process. The most challenging problems in applying adaptive management are not scientific, but rather in the social/political arena (Johnson, 1999). MCF is an environmental problem, which involves a large number of stakeholders. The stakeholders were identified as the following:

- Cattle farmers/managers.
- Game ranchers/managers.
- Veterinary practitioners.
- Law practitioners.
- The RPO.

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- WRSA.
- State veterinarian officers.
- The Ombudsman for MCF.
- Pastoralists.
- Farmers associations.
- Conservation authorities.

The large number of stakeholders may be a constraint because management strategies that are not broadly supported are unlikely to be effectively implemented. At the same time it offers an opportunity to involve different and diverse perspectives in analyzing this environmental issue.

Gilmour, Walkerden & Scandol (1999) suggest the following issues that prospective adaptive management projects should consider:

- A transparent, community-based process of stakeholder participants in the workshops of the project.
- A hypothesis in the form of a conceptual system model, sometimes expressed as a computer-based simulation model, which represents the understanding (agreed to by the stakeholders) of the system elements, structure, and processes.
- A set of strategies that represent management policies or actions that recognize the uncertainties inherent in the system, designed to test assumptions about the data and the processes incorporated in, and the responses of, the modelled system.
- A set of criteria for judging the success of the implementation of management actions and policies tested in the model and to be implemented in the real system.
- A process and preferred set of management responses to be implemented at defined stages as the post-workshop project progresses.
- A clearly defined suite of responsibilities for implementing management actions and policies with an explicit, public reporting procedure.

Three problems have been identified in regard to the social process namely: (Johnson, 1999).

- Integrating stakeholders more effectively into decision making.
- Developing institutions that are amenable to adaptive management.
- Embracing risk as a part of management.

If applied in the context of MCF, management should be aimed at ultimately increasing the value of wildebeest as a resource to humans. The way stakeholders view the resource and their knowledge about the resource should be considered in management.
A lack of defined objectives of stakeholder values may result in less support for the process. Stakeholders need to engage in discussion of differences about values to develop objectives. These objectives need to be incorporated into management processes. For effective management, change is necessary. Institutions such as the RPO, WRSA and government departments such as conservation authorities and State veterinary offices should explore the relationships within themselves and other stakeholders. By doing so, flexible, co-operative management and long term objectives should be identified. The processes of adaptive management holds an amount of risk to participants. The risk of economic loss or of negative effects on certain participants in attempting to reach solutions through adaptive management may not be eliminated. It is the role of management to identify, define, implement and execute steps to minimize such risks.
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APPENDIX 2: LIST OF DEFINITIONS

Animal: any animal declared to be an animal in terms of the relevant sections of the following legislation - The Animal Improvement Act, 1998 (Act 62 of 1998); Animal Diseases Act, 1984 (Act 35 of 1984), and the Animals Protection Act, 1962 (Act 71 of 1962).

Buccal: of or pertaining to the mouth or cheek.

Community: any group of persons or a part of such a group who share common interests, and who regard themselves as a community.

Contact animal: is defined in the regulations as a susceptible animal that was in contact with or is on reasonable grounds suspected of having been in contact with an infected animal or progeny or products thereof.

Controlled animal disease: is defined in the Act as any animal disease in respect of which any general or particular control measure has been prescribed, and any animal disease, which is not indigenous or native to the Republic

Control measure: is defined as any measure prescribed by the Minister of Agriculture under Section 9 of the Act on Animal Diseases in respect of any controlled purpose.

Controlled purpose: is defined as the prevention of the bringing into the Republic, or the prevention or combating of or control over an outbreak or the spreading, or the eradication, of any animal disease, or where applicable, of any parasite.

Damage causing animal: means an individual of a listed threatened or protected species that, when interacting with human activities, there is substantial proof that it:

Dedema: a morbid accumulation of serous fluid in various organs or tissues of the body.

Defendant: is defined as the person against whom the claim is instigated and who is the owner of the nearby farm and the wildebeest.

Delict: the act of a person which in a wrongful and culpable way causes harm to another.

Dyspnea: labored, difficult breathing.

Encrustation: the causing of a crust or hard coat.
Extensive wildlife system: means a system that is large enough and suitable for the management of self-sustaining wildlife populations in a natural environment which requires minimal human intervention in the form of:

Fence: any structure that comprises a vertical physical barrier used either to prevent passage or to direct passage or any person or animal

a) causes losses to stock or to other wild specimens;
b) the provision of water;
c) the supplementation of food, except in times of drought;
c) presents a threat to human life; or
d) is present in such numbers that agricultural grazing is materially depleted.

d) the provision of health care.

Hyperemia: abnormal accumulation of the blood in any part of the body.

Hypopyon: is pus in the eye

Infected animal: is defined as a susceptible animal that is infected, or is on reasonable grounds suspected to be infected with the controlled animal disease concerned.

Indigenous: plants and animals occur naturally in a given region. The word indigenous is derived from the Latin word indigena which means to be born in a specific place. Indigenous plant: means any plant, herb, shrub or tree, whether alive or dead, indigenous to the Republic, the territory of South West Africa or a territory which was formerly part of the Republic, whether it is or has been cultivated or whether or not it is growing in the wild state, or has for some time not been growing in the wild state, and includes the flower, seed, cone, fruit, bulb, tuber, stem or root or other part of such a plant, herb, shrub or tree, but excluding a plant, herb, shrub or tree declared to be a weed in terms of any law.

Lacrimation: the act of shedding tears.

Mucus: a viscid animal substance, secreted by the mucous membranes.

Mucopurulent: relating to and consisting of both mucus and purulent matter.

Malignant catarrhal fever (MCF): has been defined as a generalized viral disease of domestic cattle and buffaloes and many species of wild ruminants characterized by high fever, profuse nasal discharge, corneal ophthalmia, generalized lymphadenopathy, leukopenia and severe inflammation of the conjunctival, oral, and nasal mucosa with necrosis in the oral and nasal cavities sometimes extending into the
oesophagus and trachea. Occasionally central nervous system signs, diarrhoea, skin lesions, and non-suppurative arthritis are observed.

**Nares:** openings into the nose or nasal passages.

**Necrosis:** the death of a part of the body.

**Ombudsman:** is defined as a knowledgeable person appointed by the RPO and WRSA to investigate matters expounded in the rules, between cattle farmers and game ranchers and to bring out a report.

**Plaintiff:** is defined as the person instituting a claim for damages he allegedly suffered as a result of MCF allegedly caused by wildebeest on a nearby farm.

**Purulent:** consisting of or secreting pass.

**Palpebral conjunctiva:** the mucous membranes lining the eyelids and covering the anterior part of the eyeball.

**Pyrexia:** an abnormal elevation of bodily temperature.

**Responsible person:** is defined in the regulations as a manager or owner of land or an owner of animals.

**State veterinarian:** is a veterinarian who is an officer of the department of Agriculture.

**Stress:** occurs when the animal's mechanisms for coping with stressors have been over-extended. This frequently results in increases in the animal's susceptibility to disease and reduces its capacity to grow and reproduce. Signs of stress may include hair loss, dermatitis, weight loss, stereotypic behaviour, abnormal ingestion, scouring, increased incidence of disease, self-mutilation, abnormal activity levels, catatonia, depression, elevated aggression levels, inhibited digestion, suppressed immune system and elevated corticosteroid levels.

**Stressor:** any factor that produces stress when experienced in excess, for example heat, cold, overcrowding, inadequate husbandry, social deprivation, pain and the inability to exhibit characteristic behaviours.

**Serous:** a thin watery fluid secreted by the serous membranes.

**Wildlife:** a collective term meaning wild animals, and game which only refers to wild animals that are hunted. While the term wildlife includes game animals, it represents a much greater diversity of animals.
APPENDIX 3: Unpublished Simple Rules WRSA and PRO.

1. IN THESE RULES THE FOLLOWING MEANINGS ARE ATTACHED TO THE WORDS:

“Wildlife Ranching South Africa (WRSA)” a national organisation representing and advancing the interest of game farmers in South Africa.

“Plaintiff” The person putting in a claim for damages he allegedly suffered as a result of Malignant Catarrhal Fever allegedly caused by wildebeest on a nearby farm.

“A Month” is thirty days, including Saturdays, Sundays and holidays.

“An Ombudsman” a knowledgeable person appointed by the RPO and WRSA to investigate matters expounded in the rules, between cattle farmers and game farmers and to bring out a report.

“Red Meat Producers’ Organisation (RPO)” a national organisation created by the red meat producers of South Africa in order to advance the interests of red meat producers.

“Secretariat” a person appointed by the RPO and WRSA to administer the matters to be handled by the Ombudsman.

“Defendant” The person against whom the claim is instigated and who is the owner of the nearby farm and the wildebeest.

2. The purpose of these rules is to save the parties costs and therefore the paper work must be limited to a minimum and it should be possible for the plaintiff and the defendant to personally put their case on paper and to put this verbally to the Ombudsman. The idea is that the parties’ case can be presented to the Ombudsman without legal representation and that the Ombudsman meet the parties, ask them questions and where necessary hold inspections in order to compile his report. Should any one of the parties not accept the Ombudsman’s report, he would be free to take the matter to a competent court and the proceedings in front of the Ombudsman would not form part of any court case and the parties are prohibited to use it whatsoever in the court case. It would be privileged just like settlements.

3. There would be a draft form to be completed by the PLAINTIFF and this form must contain the following:

i) Identity and full name of the plaintiff or the name of any other legal persona putting in the claim.
ii) His full address.

iii) The property or properties where he farms.

iv) The location of this property/ies as well as the location of the defendant’s farms.

v) The location of the properties on which the cattle and wildebeest dwelled when it was infected with Malignant Catarrhal Fever by wildebeest. In this regard a simple map would be required to show how the two properties join one another. The map can be prepared by the plaintiff himself.

vi) **The actions of the defendant**

The plaintiff must state in what way the defendant acted unlawfully and irresponsibly. The plaintiff must supply reasons why the defendant is held responsible and in this regard complete details must be given regarding where the wildebeest were kept and where the plaintiff’s cattle were kept and also where the cattle died and the reasons supplied why the plaintiff’s cattle were infected by the defendant’s wildebeest. It is essential that a simple map be drawn up showing the location of the cattle farmers’ property relative to the location of the wildebeest owner’s property as well as showing where the cattle farmer’s cattle were kept and where the wildebeest of the defendant were kept during the alleged infection. The distance must be mentioned from the plaintiff’s border where his cattle were kept to the border where the defendant’s wildebeest were kept.

vii) **The amount damages suffered**

The plaintiff must fully unpack his damages and use market value as norm to determine the value of his cattle. If an evaluation from an independent person who knows the plaintiff’s cattle can be had, this would be great assistance.

viii) **The cause of death of the cattle**

Here expert testimony must show what caused the death of the cattle and the method followed to establish this. The plaintiff must show who took the blood samples of the cattle that had died, how the blood samples arrived at the experts who analysed the blood and how the result was given to him. In other words, the **chain** that had been followed to have the blood tested must be given in full and correctly. It is essential that the veterinarian who drew the blood submit a certificate in which he
confirms that the blood he drew had been sent for analysis and that this is
the result of the blood he drew from the cattle of the plaintiff. The result
of the analysis must also be attached.

ix) **The identity of the person or persons**

Held responsible to pay the plaintiff’s damages and in this regard the
defendant’s identity and full address must be given.

At the end of the form must be attested, signed and dated.

4. There will be a draft form to be completed by the **defendant** and the
defendant is compelled to reply within one month to the plaintiff’s claim.
The defendant is also compelled to make the following facts known:

i) His full name and identity number.

ii) His address.

iii) The farm or farms belonging to him and on which he farms.

iv) The farm on which his wildebeest are normally kept and a simple map
indicating where his wildebeest are kept, relative to the farm owned by
the plaintiff. The defendant can prepare the map himself.

v) The defendant must **reply fully** to the plaintiff’s allegations, by denying
or admitting the allegations one by one. It would be essential for the
defendant to reply specifically to the following aspects:

a. Whether the cause of death is admitted.

b. Whether the defendant admits that his wildebeest spread the
Malignant Catarrhal Fever to plaintiff’s cattle.

c. Whether he accepts the damages suffered by the plaintiff as
reasonable.

d. Whether he accepts responsibility for paying the damages.

e. Should he not admit the plaintiff’s claim, he must supply full reasons
why he is contesting the claim.

At the end the form must be attested, signed and dated.

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5. **The duties of the Ombudsman are:**

   i) To go through the forms and other documents of the plaintiff and the defendant prior to the hearing and should be of the opinion that certain evidence is lacking, to inform the parties responsible for supplying such evidence about this and to afford him an opportunity to rectify the matter within a specific time.

   ii) To determine a date, time and place where he could listen to the parties.

   iii) To give the parties a reasonable opportunity to present their case to him and should any party have a witness available, to interrogate such a witness.

   iv) To afford a party that had not complied with the rules to give opportunity to supply reasons for his neglect to comply with the rules within a certain time.

   v) To condone non-compliance with any rule should fairness and justness require this.

   vi) After having heard the parties, he must make a concise report of his findings available to the secretariat within three months. His finding must also have one on who must pay the cost of the hearing.

6. **Duties of the Secretariat:**

   i) To supply information regarding procedures to the parties.

   ii) To supply the necessary forms and rules to the parties.

   iii) To inform the parties of the address, postal address and telephone numbers where a prospective plaintiff can submit his claim.

   iv) After the plaintiff had submitted his claim, he (the Secretariat) must give the defendant a copy and request him to reply to this within one month.

   v) After receipt of the forms and documents of both parties these must be made available to the Ombudsman without delay.

   vi) To hold the documents of the parties for safe-keeping.

   vii) To comply with the requests of the Ombudsman by informing the parties of any relevant fact and to perform any administrative tasks concerning the actions.
viii) To see to it that proper record is being kept of the matters before the Ombudsman and should the latter or any party require the testimonies to be typed and this to be done and supplied.

ix) To make the Ombudsman’s report available to the parties without delay after receipt.

x) Should the parties not agree on the items in the cost account, the cost account could be presented to an attorney, approved by both parties, for final settlement.

5. The duties of the RPO and WRSA:

i) Not to get involved in any dispute instigated or contested by its member.

ii) To make a secretariat available to the parties and the Ombudsman and to make available to him the necessary office space and other aids to perform his duties as set out in these rules.

iii) To remunerate the secretariat for his services and costs by paying at the end of each month.

iv) To pay the fees and other costs such as traveling, accommodation and typing to the Ombudsman via the secretariat within one month after an account had been rendered to them by the secretariat.

v) To accede to the reasonable requests from the secretariat and the Ombudsman in order to allow this settlement procedure to function properly and give expression to it thereby rendering a service to their members and the industry.