

# Proceedings of the first Tanzania Wild Dog Conservation Action Plan Workshop

Tanzania Wildlife Research Institute  
(TAWIRI)

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TAWIRI, Arusha, Tanzania



## **Proceedings of the first Tanzania Wild Dog Conservation Action Plan workshop**

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## 1. AGENDA

### *Day One*

<b>Time</b>	<b>Event</b>	<b>Responsible</b>
8.30 - 8.45	Registration	Flora Kipuyo
8.45 - 9.00	Official opening	Dr. G. A. Sabuni
9.00 - 9.15	Self introduction	Facilitator/All
9.15 - 9.30	Meeting background	Dr. S. Durant
9.30 - 10.00	Agreement on the agenda	Facilitator
10.00-10.15	Group photograph	
10.15-10.30	<i>Tea/Coffee break</i>	All
10.30-12.30	Wild dog distribution and abundance	Mr. A. Lobora
12.30 -1.30	<i>Lunch</i>	All
1.30 - 3.00	Conservation threats	All
3.00 - 3.30	<i>Tea/Coffee break</i>	All
3.30 - 4.30	Conservation threats	All

### *Day Two*

9.00-10.30	Overall Priority Settings	All
10.30-10.45	<i>Tea/Coffee break</i>	All
10.45-12.30	Site Based Issues	All
12.30–12.45	Closing	Mr. M. Msuha

## 2. SUMMARY

This report covers the proceedings of the First Tanzanian Wild Dog Workshop held in February 2005. The workshop brought together a group of key stakeholders to assess existing information and establish a consensus on priorities for research and conservation for African wild dogs *Lycaon pictus* in Tanzania. Tanzania holds an estimated one third of the world's remaining wild dogs, more wild dogs than any other country. In addition, the biggest surviving single population survives in Tanzania's Selous Game Reserve. All participants to the workshop were deeply proud of Tanzania's international status for wild dog conservation, however they agreed that there is an urgent need to obtain better information on the distribution of wild dogs across the country, as well as more detailed data within specific regions.

Wild dogs were known to occur to the east and south of the Serengeti, west Kilimanjaro and Longido, Manyara ranch, Tarangire and much of the Maasai steppe, Ugalla, Katavi, the Ruaha/Rugwa ecosystem, Rukwa/Lukwati, south east of Sumbawanga, Selous Game Reserve and Mikumi. However there was currently not a single region in the country with a good up to date estimate of wild dog population size and trends, and hence establishing minimal information for different regions was a key priority. Data needed could be broken down into distribution, population trends, density, demographic parameters such as survival and reproduction and ranging patterns. Different areas were thought to require data of different quality depending on what data already exists and likely threats. The group went through all methods currently available and summarized the type of data each method could generate, whilst also noting that not all methods would work in all areas. Only radio collaring generated data for all possible data needs. However other potentially worthwhile techniques included photo surveys using photographs from tourists, which can generate good information but is unlikely to be applicable in most areas because of a lack of visitors, and the use of working dogs, to locate wild dog scat, which shows much potential but is currently untested in Africa.

The group also discussed potential threats and agreed that persecution, habitat loss/change and disease were the three most important factors affecting wild dog conservation in Tanzania. However, there was a paucity of information on the impacts of any of these threats. The techniques suitable for gathering information on wild dog distribution and status discussed earlier were found to be also useful for collecting information about threats. For example a questionnaire survey could potentially provide information on persecution and land use change, and even on some easily recognizable diseases such as rabies, whilst spoor surveys, working dogs and camera traps can provide information on the other predators (and prey) in the ecosystem. Radio collaring, because it involves handling, has the potential to provide good information on many diseases if a blood sample is collected, and because it is easier to monitor individuals if they are collared, information on deaths due to disease, persecution, snaring, road kills and even interspecific competition.

Managers need information on the status and threats to wild dogs in their areas to plan management activities and to enable wild dog conservation, as well as assessing the impact of these activities on wild dog conservation. All participants wished to improve the standards of information on wild dogs across the country and their hard work in this workshop and report reflects this wish, and will hopefully provide wild dog research and conservation with a new impetus to address the identified priorities hand in hand with training and capacity building.

### 3. INTRODUCTION

The First Tanzanian Wild Dog Workshop was held from 18<sup>th</sup> to 19<sup>th</sup> February 2005 at the Tanzania Wildlife Research Institute (TAWIRI) headquarters in Arusha. The workshop was intended to bring together stakeholders to assess existing information and set priorities for conservation for African wild dogs *Lycaon pictus* in Tanzania. The workshop was attended by 14 participants from TAWIRI, Wildlife Division, Tanzania National Parks (TANAPA), Ngorongoro Conservation Area Authority (NCAA), Wildlife Conservation Society (WCS, US), Frankfurt Zoological Society (FZS) and Carnivore Disease Project (Appendix 1). TAWIRI through the Tanzania Carnivore Monitoring Project is collecting information on all carnivores in Tanzania including wild dogs with the ultimate objective of providing information that can be used in compiling an action plan for carnivore conservation in the country. These proceedings will provide a draft chapter for the wild dog section in this plan. There is already an IUCN international action plan for wild dogs (Woodroffe et al. 1997) and a more recent plan for canids (Sillero-Zubiri et al. 2004), which includes a chapter on wild dogs.

The African wild dog is one of the world's most endangered large carnivores. Wild dogs present a particular challenge for conservation because they live at low densities and range very widely. These aspects of their ecology and life history mean that populations require vast areas to remain viable in the long term. Tanzania is internationally important for the conservation of the world's remaining wild dogs, as it holds one third of all wild dogs, including the single largest population in the Selous Game Reserve. However, despite this international importance, information on wild dogs in the country is still very limited, making it difficult to plan for the conservation of this species. This workshop therefore aimed to document what we currently know about wild dog status and conservation across the country and to set priorities for future research and conservation.



**Fig. 1** Participants at the meeting from starting from left, back row: Emmanuel Hosiana, Maurus Msuha, Sarah Durant, Peter Coppolillo, Joe Ole Kwai, Karen Laurenson, Novatus Magoma, B. M. Midala. Front row: Titus Mlengeya, Christine Mentzel, Rehema Tibanyenda, Flora Kipuyo, Jerome Kimaro (Alexander Lobora and George Sabuni are not pictured).

## **4. WILD DOG DISTRIBUTION AND ABUNDANCE**

Despite Tanzania's importance for wild dog conservation, surprisingly little is known about the status of wild dogs within its borders. There is no ongoing long term study in Tanzania, but there are such studies in Botswana, Zimbabwe and South Africa, and a relatively recent (5 year old) long term study initiated in Kenya. There is a need to readdress this balance and put Tanzania at the forefront of wild dog research and conservation, in reflection of its international importance for the conservation of the species.

### **4.1 What do we know: Summary of current knowledge.**

The morning session summarized existing information on wild dog status in Tanzania, including distribution, density and trends. Mr. Alexander Lobora from the Tanzania Carnivore Project at TAWIRI presented a briefing on wild dog distribution across the country from the project's carnivore database compiled since 2002. The distribution pattern of wild dogs showed participants areas where wild dogs have been sighted and helped identify areas where there is no data on wild dog presence (Fig. 2). We have summarized the distribution within the regional sections below. However areas that are also potentially important for wild dogs but which lack even rudimentary sighting information include:

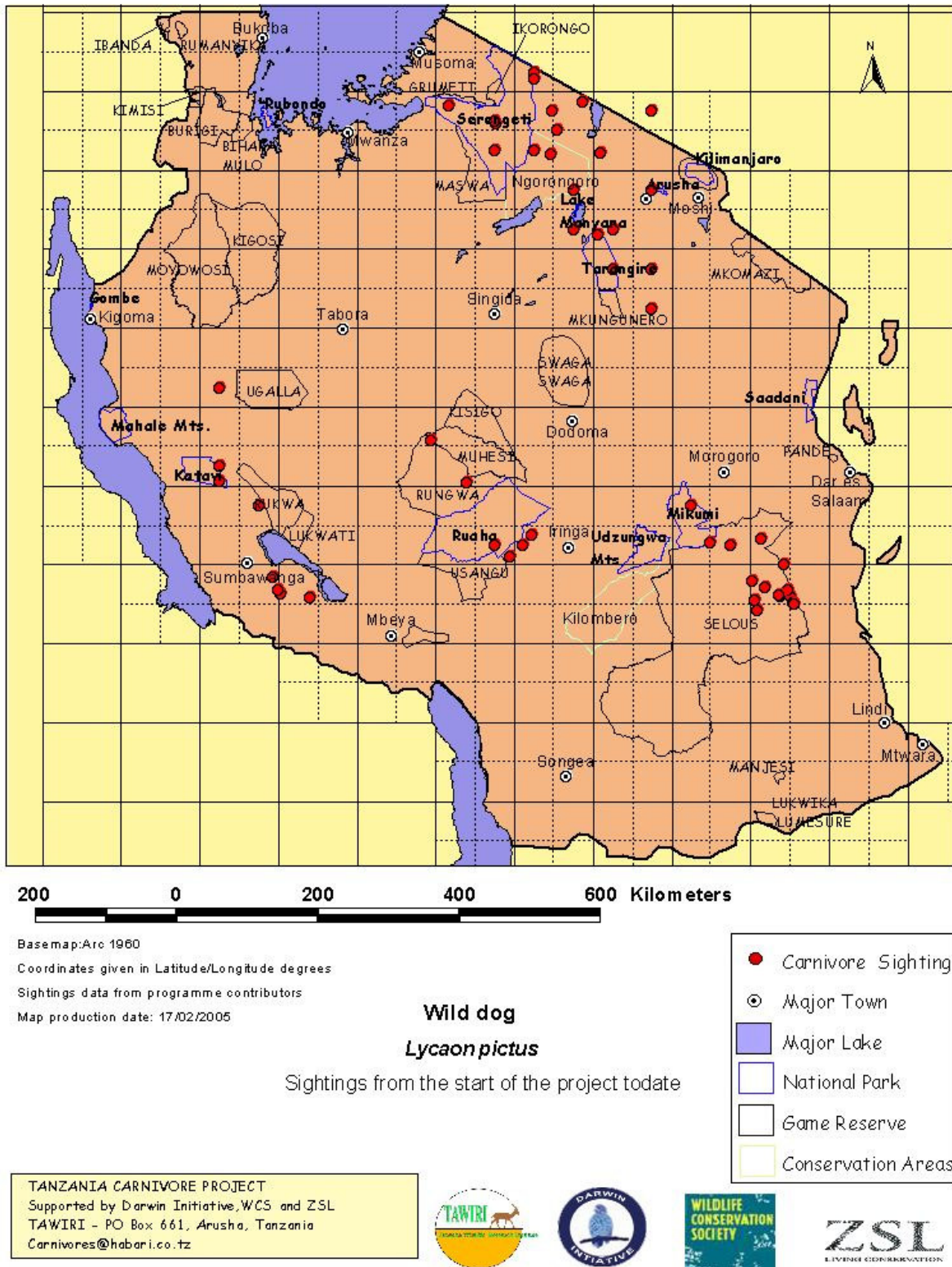
- Ugalla Game Reserve
- Lukwika-Lumesule Game Reserve
- Moyowosi
- Mkomazi Game Reserve
- Maswa Game Reserve
- North western part of the country (Biharamulo, Burigi, Rumanyika etc.)

Whilst distribution information tells us where dogs are, it does not necessarily inform us about the relative importance of one area over another for wild dogs, or even the status of dogs in an area – such as whether they are increasing, declining or stable. Tanzania still lacks this type of data across much of the wild dog range. The only reliable estimates of density of wild dogs in Tanzania are from the Selous Game Reserve where the density was estimated at 4 adult wild dogs/100km<sup>2</sup> (Creel & Creel 2002) and the Serengeti National Park before the population disappeared from this area (Burrows 1995; Ginsberg 1996). Information on species density and status are needed for prioritizing between different areas and habitats, planning for long-term conservation and assessing the impact of conservation actions.

The following sections summarize distribution patterns grouped on a regional basis, approximately aligned to major ecosystems.

#### **4.1.1 Northern Region (Serengeti National Park, Maswa Game Reserve, Ngorongoro Conservation Area and Loliondo Game Controlled Area)**

Wild dogs apparently disappeared from the Serengeti National Park, Tanzania, the Maasai Mara National Reserve (MMNR), Kenya and their immediate environs in the early 1990s. Although data are sketchy, a 30 year-decline had been coincident with an increase in lion numbers. Disease, particularly rabies, was definitely involved in the demise of a number of packs, although the reason for the final extirpation of the population will never be known. Although dogs, possibly emigrant groups, were very sporadically sighted in the 1990s, sightings have increased outside the protected areas, particularly to the east in Maasai pastoralist areas, since 2000, coincident with an apparent increase in wild dogs across the region. In 2004 there are reports that at least 2 packs bred in Loliondo District (one of ~8 adults, with up to 20 dogs reported in the other breeding pack, including pups), and regular sightings of further groups both in the Loita Hills in Kenya and north-



**Fig. 2** Map of known sightings of wild dogs submitted to the Tanzania Carnivore Project since 2003 up until the time of the workshop. Data submitted are in two forms, either direct GPS locations, or grid square reference as identified on the map. The former data type are plotted on the map directly, whilst the latter data type are plotted at the centre of the reported grid square.

western Loliondo. Sporadic sightings have been reported in the Aitong area to the north of MMNR, throughout Ngorongoro and Loliondo and also more regular reports at the very south of the ecosystem, south of the Makao open area. In summary, there could have been between 3-6 packs in the northeastern Serengeti/Mara in 2004, but further intensive monitoring is required to improve estimates. Livestock predation is also reported of goats and even cows and this became a particular problem for villagers in Sonjo between April and June 2004, when a pack denned in an area that was depauperate of wild prey. In the Serengeti National Park, there have been only sporadic sightings in the last few years, with no resident packs. Whether this is due to the current very high density of lions in the park, or because wild dogs have not yet recolonised this area, is currently unknown.

Since 2000, wild dogs have started to reappear across the entire region, from the Loliondo region, across the Serengeti National Park and the NCA. The reason behind the reappearance of wild dogs is unknown, but one suggestion raised at the meeting was that the increase could be, at least in part, due to decreases in lion or hyaena numbers, however there are no data support this conjecture.

#### **4.1.2 Maasai Steppe (Tarangire and Manyara National Parks, Simanjiro plains, Mkungunero and Singida)**

In this region very little information is available. From what we know, the status of wild dogs appears to vary greatly from one area to another. For example, in Manyara National Park and surrounding ecosystem, the population appears to be increasing, with packs being sighted regularly on Manyara ranch, while in Tarangire National Park the population seems to be relatively stable. At the beginning of 2000 the population of wild dogs in Simanjiro plains was thought to be increasing - however there is no reliable data to support this impression. In other areas e.g. Hanang, the central Maasai steppe, Makuyuni the population of wild dogs is probably decreasing due to conflict with livestock keepers. There are reports of poisoning, road kills and shooting of wild dogs in these areas.

#### **4.1.3 North west and central region (Ugalla Game Reserves, Mahale Mountains National Park)**

The population of wild dogs was thought to be probably reasonably good in this region, although there were little data to substantiate this. In the 1990s no wild dogs were seen in Ugalla Game Reserve, however wild dogs have since been sighted in 2000 and 2004, suggesting a recent range expansion. Livestock keepers around the reserve have been sensitized on how to live with endangered wild animals. Since wild dogs are shy it is relatively easy for people to chase them away from livestock should they approach, provided livestock are adequately attended. There is limited information from Mahale and so the status of that population is unknown, although there have been the sightings of wild dogs in Mahale. The limited information is due to a limited number of trained personnel in that region, which has contributed to a low feedback of data. There is no information for Moyowosi-Kigosi and Biharamuro-Burigi regions and surveys are needed for these areas.

#### **4.1.4 Ruaha/Rungwa including Katavi National Park and Rukwa- Lukwati ecosystem**

There is not much information available for this region, however the population of wild dogs is assumed to be stable due to relatively low numbers of lion and spotted hyenas outside protected areas which can impact wild dogs in other regions, and due to an extensive protected area system. However as with the previous region, there is extremely limited information from this area, due to a combination of factors, including:

- Thick miombo forest vegetation.
- A network of swamps which make access to some areas difficult.
- Low number of visits from tourists.

WCS have surveyed a small area within the Rungwa-Ruaha ecosystems. Within this area, wild dogs are sighted almost every month, except denning months August- October. The main sources of data are photographs from tourists, lodges and Ruaha National Park (RUNAPA) questionnaire surveys. Sightings are few but most stakeholders report an overall decline over the last 10-15 years. Lions have not been systematically sampled, but their numbers appear to be increasing in Ruaha National Park. A joint database has been established by WCS and RUNAPA. More wild dogs are sighted outside RUNAPA, possibly as these areas may be more attractive to them, due to relatively high densities of lions and hyaenas within the park. Pack sizes appear to have increased from the year 2000. There is no information from Manyoni, Itigi thickets or Swaga Swaga Game Reserve, all of which may be important for wild dogs, and surveys are needed for these areas. At least two whole-pack die offs were recorded in the last 5 years, with canine distemper reported as the suspected cause.

#### **4.1.5 Selous - Niassa ecosystem**

Sightings have been reported in Mikumi over many years. However no information is available on trends. There is good information from the Selous due to a 6 year study of collared dogs in this area between 1991-1997 (Creel & Creel 2002). However there has been no information from the reserve since the end of the study which the group sees as a serious data gap, considering the global importance of this population. There is information from Pesambili, the project manager for Lukwika-lumesule Game Reserve that there is a wild dog pack in the reserve. However, there is no information to the south of Selous Game Reserve which may be important for wild dogs and surveys are needed for these areas.

#### **4.1.6 Coast, Mtwara, Saadani ecosystem**

There is no information on wild dogs from the coast in Tanzania. A survey is urgently needed for this region.

### **4.2 How to get information on status: Available methods**

There are several methods that can be used to survey large carnivores. Which method is selected for use depends on the questions that need to be addressed, and the suitability of that method for a particular region. Key methods appropriate for wild dog surveys identified in the workshop follow those identified by the International Cheetah Monitoring Workshop held in Tanzania in June 2004. They include spoor counts, radio collaring, tourist photos, working dogs, questionnaires, camera trapping and visual search. Each is discussed in detail below, with a list of their main advantages and disadvantages.

#### **4.2.1 Radio collaring**

With this method VHF, GPS or Satellite collars are fitted to one or more wild dogs in a pack. For most such collars, the collar allows subsequent relocation of the collared dog, due to a signal transmitted from the collar, either to a VHF receiver, or via a satellite. Some GPS collars do not transmit a constant signal, but store GPS reference points visited by the dog, at a set rate (once, twice or several times a day) and transmit a signal only when they drop off after a set time, to allow them to be located and the data retrieved and downloaded to a computer. In order to fit the collar the wild dog has to be immobilized, usually by darting. The method allows the collection of a huge amount of data, not just on the single wild dog collared, but, provided the dogs are relocated

on the ground, on the entire pack. All the reliable density estimates for wild dogs result from radio collaring studies (Sillero-Zubiri et al. 2004).

*Advantages:*

- Can provide a huge amount of data, not only on population size, but also on disease monitoring, ranging patterns, identification of threats to the population and demographic information including birth and survival rates
- Relatively low manpower demands
- Relatively accurate

*Disadvantages* – only if using satellite and GPS collars:

- Satellite and GPS collars are expensive
- Makes use of relatively complicated technology – and hence implementation requires some training.

#### **4.2.2 Questionnaires**

Questionnaire surveys of residents within a region can be used to collect information on wild dogs in two key ways. Firstly as a simple presence absence survey, by gathering information from residents in an area on wild dog sightings. Secondly as an in depth survey to not only gather information on distribution, but also to assess levels of conflict with people and attitudes of residents to wild dogs in their area. All data gathered through questionnaire surveys needs to be interpreted with caution, as interviewees will not necessarily respond honestly and openly to questions.

*Advantages:*

- It is perhaps the only convenient and feasible method for mapping the distribution of wild dogs at a national scale.
- It is relatively cheap.
- It makes relatively low demands on manpower.
- At a basic level, the method can be implemented by relatively unskilled field workers.
- Can provide extra information on potential threats – such as conflict with people.

*Disadvantages:*

- Provides only very coarse data, and is no use for detecting local changes in population density.
- Provides no information on other potentially important factors such as demographics, ranging patterns and disease.
- Requires highly skilled labour when combined within a GIS framework.

#### **4.2.3 Working dogs**

In this method highly trained domestic dogs are used to find scat of wild dogs, in much the same way as dogs are used by the police to find narcotics. Scat can either be counted in much the same way as spoor counts (see below) to give a density estimate, or DNA can be extracted and typed to provide a unique genotype that can then be used in a mark-recapture analysis framework to provide a more accurate estimate of density. The method has been used successfully in the US to estimate population densities of several carnivore species, including kit foxes and grizzly bears (Smith et al. 2003; Wasser et al. 2004), however, aside from a training program conducted by the Serengeti Cheetah Project in Laikipia in July 2004, is largely untested in Africa. The training program did demonstrate that it was possible to train Kenyan dogs to locate and distinguish cheetah and wild dog scat from other scat such as that from jackals.

*Advantages:*

- Potentially useful outside protected areas.
- May provide genetic samples for individual identification of wild dogs and hence accurate monitoring.
- Genetic samples can provide extra information – such as population structure.

- Scat samples can provide extra information on diet.
- Relatively cheap to implement (except when using DNA analysis).

*Disadvantages:*

- Method untested in Africa.
- Requires training of both dogs and handlers.
- DNA analyses currently expensive and labour intensive.
- Would require a change in permit regulations to be used inside protected areas.

#### **4.2.4 Camera traps**

For this method cameras are positioned along animal trails which show active use, and linked to a beam that detects any changes in infrared in front of the camera such as occurs when an animal moves along the trail. Whenever such a change is detected the camera takes a photograph, hence the expression 'camera trap', and in so doing produces a photographic evidence of the carnivore community in an area. Photographs of wild dogs can be used for individual recognition as each wild dog has unique black, white and tan markings. Once they are put in place, the cameras are generally left undisturbed for a minimum of 2 months, except for battery checks and changing film. Individual animals are recognized from their photographs and a library established of individuals within an area. Mark recapture analysis is then used to estimate population size. The technique has been very effective for surveying tigers and jaguars (Karanth & Nichols 1998; Silver et al. 2004). However the method works best in forest and for species with relatively small home ranges.

*Advantages:*

- Useful in forested areas where visibility is poor and most of the other methods difficult to implement.
- Can provide accurate density estimates when using individual recognition.
- Can provide useful other additional information such as the carnivore and prey community in an area.

*Disadvantages*

- Method is untested for wild dogs
- Set up equipment is costly and can only be used in relatively secure areas such as protected areas, otherwise is likely to be stolen.
- Generally works best for species with relatively small range sizes, unlikely it could be effective for a species with such a wide home range as a wild dog.

*Proviso* – the method could be a potentially non-intrusive means of identifying the composition of packs if camera traps are set up at den sites.

#### **4.2.5 Tourist photos**

This method relies on encouraging visitors to an area with wild dogs to send in photographs that they take of any wild dogs that they see. The photographs can then be used to individually identify wild dogs and build up a profile of population size and structure. The Tanzania Carnivore Project has such a scheme in place – the Wild Dog Watch Campaign, but to date has had little success in accumulating photographs. By contrast, the project's Cheetah Watch Campaign has had a good record for monitoring cheetahs on the Serengeti plains.

*Advantages:*

- Good for areas well visited by tourists.
- Relatively easy to implement, provided an infrastructure exists.
- Has potential to provide good information on population size, demography and possibly pack structure.

*Disadvantages:*

- Not suitable for areas seldom visited by tourists.
- Depends on promotion by tourism industry to be successful.

- Requires active promotion e.g. production of promotional materials such as leaflets.
- Can be time consuming to implement and requires reasonably well trained manpower.

#### **4.2.6 Visual search**

This method relies on an observer finding and following wild dog packs from a vehicle with no other aids such as radio collars. Since wild dogs range so widely and live at such low densities, relying on visual search is unlikely to generate sufficient information for monitoring.

*Advantages:*

- Can provide good information on the population, provided dogs can be located sufficiently often.

*Disadvantages:*

- Requires highly skilled personnel able to locate and follow wild dogs.
- Extremely expensive in terms of money and manpower for relatively poor information reward.
- Very time consuming.
- Highly labour intensive.

#### **4.2.7 Spoor counts**

In this method a vehicle is driven at a slow speed along existing tracks with a dusty or sandy covering that has a good potential to show spoor. The vehicle should be mounted with a specially modified chair on which a skilled tracker can be seated. The tracker should record all spoor that is fresh (less than 24 hours old) seen on the track. This information is then used to generate a spoor frequency, i.e. the number of kilometers per spoor (Stander 1998).

*Advantages:*

- Relatively easy to implement.
- Can provide presence or absence data.
- Low technology.
- Relatively cheap.
- Trackers are in most cases available e.g. from hunting companies.
- Can be used to estimate relative density of other carnivores in the area.

*Disadvantages:*

- A suitable soil substrate is required to enable detection of spoor.
- Without special calibration the method cannot be used to compare densities between different areas.
- Relatively poor data quality.
- Relies on accurate identification of spoor – tracker needs to be sufficiently skilled to not confuse spoor with that of domestic dog.
- Relies on a good network of roads.

### **4.3 Status Summary**

There is obviously a need to gather information about the status of wild dogs across the country. Different regions have different specific needs, depending in part on what information already exists. The Serengeti region is relatively well known, however there is currently not a single region in the country with a good up to date estimate of wild dog population size and trends. Status can be broken into different levels depending on the quality of the data: distribution, population trends, density, demographic parameters such as survival and reproduction and ranging patterns. Different areas are likely to require data of different quality depending on what data already exists and likely threats. The methods available to gather relevant data on status are listed above and are summarized in Table 1 according to the types of information they can potentially provide on wild dog status. Not all methods will work in all areas, for example photo surveys can only work in

an area which is regularly visited by tourists and spoor surveys in areas with sufficient tracks and suitable substrate. Only radio collaring generates data for all the status categories. Other potentially worthwhile techniques include photo surveys, which can generate good information but are unlikely to be applicable in most areas because of a lack of visitors, and the use of working dogs, which shows much potential but is currently untested in Africa.

	Questionnaire	Spoor	Photos surveys	Working dogs	Camera Traps	Radio Collars
<b>Distribution</b>	Y	Y	Y	Y	Y	Y
<b>Relative Abundance</b>	Limited	Y	Y	Y	Unlikely	Y
<b>Trend</b>	Limited	Y	Y	Y	Unlikely	Y
<b>Density</b>	N	N (but can if calibrated)	Y	Y	Unlikely	Y
<b>Ranging</b>	N	N	N	N	Unlikely	Y
<b>Demography</b>	N	N	Poss but unlikely	Poss but unlikely	Unlikely	Y

**Table 1.** Data generated by the different methods covered in the sections above. 'Y' indicates that the method could generate appropriate data, 'N' the method could not generate appropriate data, and 'Limited' the method might generate some appropriate data, but is open to interpretation. Finally 'Unlikely' indicates that whilst the method could theoretically generate the appropriate data, it is unlikely that sufficient data would be collected to fulfill the objectives.

## **5. CONSERVATION THREATS**

After the thorough discussion of distribution and abundance, together with available methods for gaining more information, the group moved on to examine potential threats to wild dog conservation. The group identified the following threats:

- Disease
- Persecution
- Loss of habitat / land use change
- Snaring - by-catch targeted at game
- Road kills
- Ecological constraints - inter-specific competition

Each are discussed in detail below.

### **5.1 Disease**

Infectious disease is a recognised threat to wild dogs across Africa and has contributed to the extirpation of at least one population and has thwarted two reintroduction attempts in southern Africa. The importance of this threat is often difficult to assess especially as disease outbreaks are often part of a natural process causing population fluctuations. However, when disease is a consequence of manmade factors, there is an argument that it is not part of a natural process and intervention may be justified. Disease may have particularly severe consequences on population viability when populations are small, when other external factors are causing mortality, such as snaring or persecution or where the chance of recolonisation after extirpation are small, due to low connectivity with other sub-populations. Such situations strengthen the argument for intervention.

#### **Rabies**

Rabies is thought to be a potential threat to wild dog conservation and has certainly caused mortality in wild dog populations in a number of countries. Rabies has been endemic in domestic dog populations in Tanzania for several decades: for example areas around RUNAPA have been under quarantine since the 1960s. Ring vaccination of domestic dogs around Serengeti shows promising results for the control of rabies in dog and human populations with preliminary results suggesting that rabies cases in wildlife have also declined, in line with the hypothesis that domestic dogs are the reservoir of infection. However, the proportion of dog populations vaccinated must be maintained at around 70% in such cordon sanitaires around core wildlife areas, and also be of adequate width in order to prevent breakthrough of rabies from more distant dog populations. Transmission to wild dogs need not be direct: chains of spillover transmission through other wild carnivores such as hyaenas and jackals can occur. With domestic dog populations increasing across rural Tanzania, the threat rabies poses to wild dogs will not reduce unless rabies is controlled at the local, national or regional level.

#### **Canine distemper**

Although canine distemper virus (CDV) can cause significant mortality in wild dog populations, it can also exert no detectable impact on populations. For example, 49 out of 52 wild dogs in a semi-captive population in Mkomazi died due to a CDV outbreak in 2000, whereas in other populations, CDV antibodies have been detected in healthy dogs, indicating prior exposure, but no deaths have been recorded (van de Bildt et al. 2002). The effect of CDV on wild dog population therefore varies with ecological and epidemiological circumstances, and there is a clear need to understand the epidemiology of canine distemper and monitor its status in Tanzania.

## **Anthrax**

Anthrax has been reported in Selous Game Reserve, and at least two outbreaks have been recorded in RUNAPA. Wild dog pups have been once affected by the disease. However, there is not much information available countrywide.

### ***What more do we need to know?***

Priorities are to assess the level of threat that disease poses in Tanzania and then to develop cost-effective tools, should intervention to reduce this threat be required

- Determine importance of rabies and CDV as a threat to wild dog populations across wild dog range in Tanzania by monitoring the status and dynamics of disease in domestic dogs, wildlife and wild dogs.
- Improve understanding of rabies and CDV dynamics and reservoirs.
- Determine the safety and efficacy of modern rabies and CDV vaccines for wild dogs, particularly oral vaccines.
- Develop delivery systems for oral vaccines to wild dogs, particularly less habituated packs.

### ***How do we find out?***

A disease monitoring scheme should be developed to collect baseline data and establish the impacts of the different diseases on wild dog populations in the long term. Postmortem samples, particularly brain samples, should be obtained systematically from all carnivores found dead, as these will indicate whether the animal had died from a disease and, if so, identify the pathogen responsible. Serological sampling can be used to ascertain the status of CDV in domestic and wild carnivores, whereas examination of hospital and veterinary office records and questionnaires in rural populations will help determine the prevalence and patterns of rabies infection. More detailed information on sampling techniques are available both in the Canid Action Plan (Sillero et al. 2004) and at the following website (<http://www.vetmed.ucdavis.edu/whc/pdfs/necropsy.pdf>).

The Carnivore Disease Project is currently carrying out these research and monitoring activities in the Serengeti region, in combination with rabies and CDV control campaigns.

## **5.2 Persecution**

We have little information on the importance of persecution to wild dog conservation. However we do know that wild dogs do occasionally kill livestock and conflict does exist in some areas. Dr. Sarah Durant reported that in 1998 she found two wild dog yearlings on the road close to Makuyuni. She took these dogs to the Veterinary Investigation Centre in Arusha for a post mortem. Their subsequent report disclosed that the dogs had been clubbed and then dumped on the road. Some communities are also known to use poisons on carnivores (Maddox 2002), whilst snaring is common in many areas. Veterinary officers in Iringa also report attempts to poison wild dogs outside Ruaha, though it is not known how successful these attempts were. The group agreed that basic information on the impact and extent of persecution is lacking.

### ***What more do we need to know?***

- Relative importance of persecution to the conservation of wild dogs.
- Why does persecution happen – uncovering the reasons for persecution e.g. conflict due to depredation of livestock.
- Establishing livestock management techniques that reduce livestock depredation.
- Assessing perception against reality – verification of reported depredations by wild dogs.
- Ecological circumstances in which conflict and hence persecution occurs – e.g. around denning sites?

### ***How do we find out?***

- Questionnaire surveys to assess perceptions of conflict.

- Assessment of livestock management techniques and their relationship to livestock loss.
- Incident reports.
- Rapid follow up of reported incidents.
- Establishment of an effective reporting system.

### **5.3 Habitat loss / land use change**

Habitat loss and land use change put extra pressures on wildlife, particularly species like wild dogs that live at low densities and range across vast areas. Ensuring that sufficient habitat remains and that corridors between protected areas are maintained are priorities. TANAPA and the Wildlife Division are in the process of accumulating information on all wildlife corridors in Tanzania. However this analysis has largely focused on movements of large ungulates, and hence needs to be readdressed for wild dogs. There is currently little information on wild dog distribution and movement patterns between areas.

#### ***What more do we need to know?***

- Threats to corridors.
- The use of corridors by wild dogs.

#### ***How do we find out?***

Geographical Information Systems (GIS) provide a very useful mechanism to allow us to review all corridors and investigate their potential suitability for the movement of wild dogs.

- Identification of potential threats along corridors.
- Movement patterns of wild dogs – assessing whether wild dogs make use of corridors.

### **5.4 Snaring**

Wild dogs can be caught in snare lines laid out for game to be used for meat. Wild dogs are frequently attracted to such snare lines due to the presence of trapped game in these areas. However the impact on snaring at the population level is not well understood. The presence of snares and the species of animals caught in snare lines are recorded during anti-poaching patrols by rangers and game scouts working for TANAPA and WD.

#### ***What more do we need to know?***

- Snaring is probably of particular importance in western Serengeti and Ugalla where snaring is relatively common. There is a need to establish whether it has an impact on wild dogs in these areas.

#### ***How do we find out?***

- Review existing information from anti-poaching patrols.

### **5.5 Road kills**

Wild dogs have been reported as being victims of road kills particularly on the main road going through Mikumi National Park. Road kills are also a potential problem on the Arusha-Nairobi and Arusha-Dodoma roads. However, apart from these specific areas, road kills are probably currently of limited importance to wild dog conservation due to the lack of tarmac roads across the country.

#### ***What more do we need to know?***

- Identify trouble spots for wild dogs on the roads so that mitigation action can be taken – e.g. the placing of speed bumps.

#### ***How do we find out?***

- Obtain GPS locations of all road kills to enable mapping of trouble spots.

## 5.5 Ecological constraints to wild dog conservation

Whilst interspecific competition is natural and an inherent component of functioning ecosystems, it can be a major constraint to the effectiveness of conservation. Of particular importance to wild dogs are the relative densities of lions and spotted hyaenas in a region. Wild dogs are vulnerable to competition from lions and spotted hyaenas, which can take their kills and kill pups and occasionally adults, and hence their numbers in protected areas are likely to be limited by these species. Lions are thought to pose the biggest threat to wild dogs, and have been reported as killing both adult and young wild dogs. In Kruger National Park for example, lion predation accounts for 39% of natural pup deaths and 43% of natural adult deaths, and hence is likely to have a major impact on wild dog populations (Mills & Gorman 1997).

### ***What more do we need to know?***

- Investigate the importance of interspecific competition across a range of different habitats.
- Can lion hunting be a management option for wild dog conservation?

### ***How do we find out?***

- The group agreed that there was a need for cross habitat/site comparisons and in hunted and unhunted areas.

## 5.6 Summary

The group in general agreed that persecution, habitat loss/change and disease were the three most important factors affecting wild dog conservation in Tanzania. There is a paucity of information on the impacts of the threats discussed, with the exception of the Serengeti Carnivore Disease Project which is gathering relevant information about the impacts of disease in the Serengeti ecosystem. The techniques discussed in section 4.2 for gathering information on wild dog distribution and status are potentially also useful for collecting information about threats (Table 2), and hence the choice of a particular technique might depend on what other information the technique might additionally provide. For example a questionnaire survey could potentially provide information on persecution and land use change, and even on some easily recognizable diseases such as rabies, whilst spoor surveys, working dogs and camera traps can provide

	Questionnaire	Spoor	Photos surveys	Working dogs	Camera Traps	Radio Collars
<b>Disease</b>	Rabies	N	N	N	N	info on CDV - but more likely to pick up dead individuals in disease outbreaks..and hence greatly increases chances of identifying cause of death
<b>Persecution</b>	Y	N	N	N	N	More likely to get direct evidence of deaths
<b>Land use change</b>	Y	N	N	N	N	N
<b>Snaring</b>	N	N	N	N	N	Possible due to close monitoring of packs
<b>Road kill</b>	N	N	N	N	N	Possible due to close monitoring of packs
<b>Interspecific Competition</b>	N	Y	N	Y	Y	Y

**Table 2. Data on threats generated by the different methods for investigating wild dog status covered in 4.2. 'Y' indicates that the method could generate appropriate data, 'N' the method could not generate appropriate data.**

information on the other predators (and prey) in the ecosystem. Radio collaring, because it involves handling, has the potential to provide good information on many diseases if a blood sample is collected, and because it is easier to monitor individuals, information on deaths due to disease, persecution, snaring, road kills and even interspecific competition. It can also be used to locate individuals for in depth behavioural observation which might provide additional information about the impacts of interspecific competition. Radio collared animals are also more likely to be detected quickly after death and thus an accurate diagnosis is more probable. Finally, although radio collaring itself is not appropriate for assessing the direct consequences of land use change, it can provide information about how it affects ranging patterns of wild dogs.

## 6 Conservation and Research Priorities

In this last part of the meeting the group discussed priorities for wild dog conservation and research in Tanzania. The inputs from the management authorities from WD, TANAPA and NCAA were particularly important for this session. The group agreed that there was currently very little information on wild dogs, and that there was an increasingly urgent need to gather data relevant to wild dog conservation across the country. The group also agreed that conservation action should be implemented wherever there are clear indications that such action is necessary. Overall the group felt that there were four major national priorities:

- To obtain baseline information on the distribution of wild dogs in Tanzania - additional information on trends and abundance can follow later.
- To provide training to wildlife stakeholders in survey techniques e.g. game scouts.
- To set priorities for wild dog conservation in the country.
- To identify threats.

However there were also regional differences in specific information and conservation needs, and hence the group addressed these needs in detail for each of the major regions in section 4.1. Needs were divided into two sections: status (wild dog distribution, demography, ranging patterns and density – see section 4) and threats (information needs and management priorities – see section 5). Agreed regional priorities are summarized in Table 3 and are described below.

Wild dog status was separated into 5 components ranging from broad distribution data, through information on trends and density, to detailed information on demographic parameters (such as survival and reproduction) and ranging patterns. Appropriate methods used to gather this information are covered in section 4.2. All participants felt that information on ranging patterns was particularly useful. Ranging patterns were important to TANAPA to show how often dogs leave protected areas and how far they travel from them and to WD and NCAA to alert them to potential conflict situations with local communities. Information on ranging patterns combined with good information on threats can also help identify specific threats to which a pack might be exposed over an annual cycle. The only method that can be used to estimate range size is radio collaring (Table 1), and so areas where ranging patterns are deemed as a priority should also regard the implementation of a radio collaring study in these areas as a priority. Radio collaring studies are currently also the only suitable method to gain good data on density and trends. Other methods, such as spoor counting, can be used to monitor density within areas, but not between areas, and hence can be useful for trends. Photo surveys, which can potentially supply very good information, are unfortunately only effective in areas with a lot of visitors. The use of working dogs can potentially provide good information on distribution, trends, density and demography across a wide range of habitats however the method is as yet untested in Africa.

Threats represent the main means through which people have an impact on wild dogs, and hence also are the main means through which managers can have an impact on wild dog conservation. Their importance should thus be viewed in terms of both gathering information (threats, like wild dog status, should also be monitored), but also in terms of activities that can reduce each threat, such as management, education or policy changes, which can be adapted as more information about each threat is accumulated. Monitoring threats to wild dogs were agreed to be as important as monitoring status, and should be a component of any planned survey.

Threats were divided into the 6 broad headings as outlined in section 5, however threats were further broken down to include specific issues. Disease was broken down into the two key diseases outlined in section 5.1, rabies and CDV, with rabies as probably having the greater impact. CDV was seen to be potentially important, however there is a need for further information in order to assess whether it has a real impact. Any effective disease monitoring should not be limited to wild dogs but should also include domestic dogs and wildlife to gain a full understanding of routes of transmission and hence potential means of control. Disease monitoring will necessarily involve handling, as blood needs to be collected to ascertain exposure to disease, and a good reporting

and collecting system for dead animals to enable quick recovery and subsequent post-mortem and tissue collection. In the Serengeti ecosystem information about both rabies and CDV is relatively advanced, and there is already a program run by the Serengeti Carnivore Disease Project determining disease reservoirs and the effectiveness of ring vaccination for both rabies and CDV. Such a program has been shown to be effective for controlling rabies in wildlife, however the epidemiology of CDV is less well understood. The group agreed that such a program, although expensive, should be considered where possible for other areas, as it provides a management option for disease control. As part of an overall vaccination strategy, the group agreed that there was a need to explore alternative delivery systems for vaccination, particularly oral vaccines. An effective bait delivery for oral rabies vaccines has been developed in South Africa, where chicken heads proved to be the bait of choice for wild dogs. However, further work is required, particularly where dogs are not well habituated, to ascertain the most effective system to maximise pack vaccination coverage and whether oral vaccination provides a cost-effective method of reducing disease, particularly rabies, threats to wild dogs.

Persecution was agreed to be a relatively high priority threat as it is known to be an issue around the Serengeti ecosystem and in the Maasai steppe. Management responses to persecution issues depend on the impact of persecution on the population and the reasons for persecution – e.g. livestock predation or a perceived disease threat will require different management responses. In addition, local livestock management practices might contribute to livestock depredation and hence persecution, and modifications to existing practices should be fully explored. Reports of depredation should also be validated to ascertain whether perceptions reflect reality. Very often perceived depredation by predators is higher than the reality. Persecution issues are probably generally best addressed through outreach and education programmes in problem areas, and through establishing good livestock management practices, the details of which will depend on regional circumstances.

Habitat loss and land use change were seen to be a medium priority threat throughout the country. All regions of the country are affected by these processes which are likely to have an impact on wild dog conservation. The group agreed that the best approach to minimize their impact is the establishment and maintenance of effective corridors between protected areas, and hence recommended a review of the TANAPA/WD/FZS corridor analysis with respect to wild dogs, to identify and map corridors for the species. Landscape genetics was seen to be a potentially important tool in this process, as genetic differentiation between different sub populations of wild dogs can demonstrate the extent to which subpopulations mix with each other.

Of the remaining threats, snaring was thought to have local importance only around the Maswa Game Reserve and Ugalla. The group agreed that it was important to review information collected on animals caught in snares collected by game scouts and rangers in routine patrols in these areas. Road kill was deemed to have a relatively low impact everywhere except Mikumi, where there was a need to improve reporting procedures, in order to identify potential trouble spots (see section 5.5). Interspecific competition was judged to be of a low priority except in the Ruaha/Rungwa region where a simultaneous study inside and outside the PA was deemed to be of a medium priority, to demonstrate the relative importance to wild dog conservation of areas where lions are hunted, and hence the possibility of using lion management as a tool for wild dog conservation.

Conservation and research priorities are reviewed region by region below. It should be remembered that all priorities in Table 3 are based on current information and educated guesswork, and will need to be reviewed and updated as more information is gathered.

## **6.1 Northern region**

Information on distribution, population trends and ranging patterns of wild dogs were agreed to be of a high priority in this region, whilst information on density and survival were agreed to be of medium priority. Comprehensive data such as this can only be gathered through radio collaring (Table 1). Of the threats, disease and persecution were deemed to be of the highest priority. There is already an ongoing extensive study of rabies and CDV in the ecosystem conducted by the Serengeti Carnivore Disease Project, which includes a ring vaccination program, and hence the region is fortunate that this project is currently addressing many of the information needs regarding disease, however the wealth of data already accumulated suggests that this region could also be a priority area for the investigation of vaccination delivery methods for wildlife and domestic dogs. A new project funded by FZS aims to investigate the reasons underlying conflict with wild dogs to the east of the Serengeti National Park, this study is being conducted under CIMU. Habitat loss and snaring were agreed to be of medium priority in the region, and there was a particular need to assess the impact of snaring in the Maswa Game Reserve. The likelihood of road kill was thought to be low whilst the impacts of interspecific competition probably also low, as the areas where wild dogs occur are outside the Serengeti National Park and hence have relatively low densities of lions and hyaenas.

## **6.2 Maasai Steppe**

Information on wild dogs in the Maasai steppe is currently very poor, and hence the group agreed that the first priority for this region should be to gather basic distribution data. Information on ranging patterns were also agreed to be a high priority as the region is largely unprotected. Such information would inform managers of protected areas about where wild dogs go when they leave the areas under their jurisdiction. Information on trends were judged to be a medium priority, whilst information on density and survival of a low priority at present. There is currently very little information about threats to wild dogs, although there is reasonably good information about other wildlife in Siminjaro. The group felt that of all the threats, persecution is probably of the highest priority, whilst disease and habitat loss of medium priority. Snaring, road kill and interspecific competition were relatively low priorities, pending further information, the latter principally due to the low numbers of lions and hyaenas outside the protected areas. The high priority information needs for this area could be addressed by implementing a questionnaire survey combined with a radio collaring study.

## **6.3 Selous/Niassa**

The Selous/Niassa region contains the largest and most important population of wild dogs in the world, and the group agreed that because of its global importance, long term monitoring of wild dogs in the region should be a priority. Information on distribution and trends were agreed to be high priorities for the region, whilst information on ranging patterns medium priority, although these priorities might increase if a high degree of conflict were to be uncovered in the region. Information on density and survival were deemed to be of relatively low priority, partly due to the comprehensive study carried out by Scott Creel in the 1990s (Creel & Creel 2002). It should be noted, however, that given the existence of the previous study, the easiest means of uncovering trends in the region is likely to be through a (less detailed) replicate study to that carried out by Creel & Creel.

Only one threat was judged a high priority in the region, road kill, due to a number of known incidents of wild dogs being killed on the road through Mikumi National Park. Further information as outlined in section 5.5 should be gathered to address this issue and implement speed bumps where necessary. Persecution was agreed to be a potential problem of medium priority in the region, but the group recognized that little information currently exists on the existence or impacts

<b>Status</b>					
	<b>Northern region</b>	<b>Maasai Steppe</b>	<b>Selous/ Niassa</b>	<b>North west and central</b>	<b>Ruaha/ Rungwa</b>
<b>Distribution</b>	High	High	High	High	High
<b>Trends</b>	High	Medium	High	High	High
<b>Density</b>	Medium	Low	Low	Medium	High
<b>Demography</b>	Medium	Low	Low	Low	Medium (pending distribution and disease data)
<b>Ranging</b>	High	High	Medium (depending on conflict data)	Low	Medium (pending distribution and disease data)
<b>Threats</b>					
	<b>Northern region</b>	<b>Maasai Steppe</b>	<b>Selous/ Niassa</b>	<b>North west and central</b>	<b>Ruaha/ Rungwa</b>
<b>Disease</b>	High	Medium	Medium (monitoring)	Medium	High
<b>Persecution</b>	High	High	Medium (importance, spec. Mikumi)	Low	Medium (assess importance)
<b>Habitat loss/land use change</b>	Medium	Medium	Medium	Medium	Medium
<b>Snaring</b>	Medium (particularly Maswa)	Low	Low	Low	Low
<b>Road kill</b>		Low	High (Mikumi)	Zero	Low
<b>Interspecific competition</b>	Low	Low	Low	Low	Medium (simultaneous study inside and outside PA)
<b>Rest of country - Information needs limited to preliminary distribution assessment:</b>					
Sadani, Mkomazi, Mozambique border, Bihalo Mulo/Burigi and the northern limit of the western distribution					

**Table 3. Information priorities for the major regions for where dogs are known to occur categorized into low, medium and high priority. The table is divided into two sections according to information needs regarding status and threats. The group prioritized the list of areas at the bottom for obtaining information on distribution as there is currently no information on wild dogs in these areas.**

of persecution on wild dogs in the region, and there was a need to determine the status of this threat. Such information could be gathered through a questionnaire survey of areas around the game reserve. Disease was thought to be of medium priority, but again, there is very little information on disease in the region and the group agreed that a disease monitoring program should be implemented prior to any intervention. Habitat loss and land use change were agreed to be of medium priority. GTZ have an ongoing project in the region mapping elephant corridors, which could provide important baseline information. The routes used by elephants in the region uncovered by this study should be investigated for their appropriateness for wild dogs. Snaring and interspecific competition were judged to be of low priorities, the latter partly because Creel's study demonstrated that the Selous population of wild dogs was of high density despite the presence of spotted hyaenas and lions in the game reserve.

#### **6.4 North west and western central region**

This region is very little developed with limited agriculture. There is very little information about wild dogs in the region and so, as with the Maasai steppe, basic information on distribution was agreed to be of the highest priority. Information on trends were also agreed to be of a high priority and density a medium priority. Information on survival rates and ranging patterns were agreed to be of relatively low priority, pending further information. Of the threats, the group thought that this population was probably not greatly threatened by the listed threats, with the most important threats likely to be disease and habitat loss. Persecution was deemed to be a relatively low priority in the region. However there was so little known about this region, the region itself should be a priority for a basic survey, and a further refinement of priorities might be necessary pending further information. Distributional data and information on some threats could be addressed through a well designed questionnaire survey throughout the region.

#### **6.5 Ruaha/Rungwa**

The group felt that the Ruaha/Rungwa region had great potential for wild dogs, possibly second only to the Selous in terms of overall importance, but there was a paucity of information from the region. As such the group agreed that this region should be of a particularly high priority, and information on distribution, trends and density of wild dogs were all judged to be high priority, as such data would inform the wildlife authorities about the relative national (and global) importance of the region for wild dogs. Information on survival and ranging patterns were agreed to be of medium priority, however further information on distribution and disease might change this priority level. For example, if diseases were found to be widespread in wild dogs and surrounding wildlife and/or domestic dogs, ranging patterns would indicate whether wild dogs come into contact with wildlife or domestic dogs carrying the disease whilst survival and reproduction data would indicate whether these diseases had real impact on overall numbers of wild dogs in the region.

Disease was agreed to be a high priority threat to the wild dogs in this region, whilst persecution and habitat loss and land use change were judged to present a medium priority threat. However because there was a lack of information on persecution the group agreed that there was a need to reassess its importance prior to any management interventions. Interspecific competition was thought to be of medium priority due to the high densities of other large carnivores in protected areas in the region and the wide extent of these protected areas. The group agreed that this region presents a good opportunity to assess the relative importance of interspecific competition and the impact of lion hunting on wild dog populations by initiating a simultaneous study of wild dogs inside and outside protected areas. Snaring and road kill were deemed to be of low priority by the group.

## **6.6 Other areas**

There was very little information about the rest of the country, although there were almost certainly wild dogs in areas outside the regions outlined above. The group therefore prioritized areas where basic distribution data should be gathered to establish the presence and distribution of wild dogs. Priority areas were as follows: Saadani, Mkomazi, the Mozambique border, Biharamulo/Burigi and establishing the northern limit of the western distribution of wild dogs. This would be best addressed through a series of questionnaire surveys.

## 7 The Way Forward

There is an urgent need to get better information on the distribution of wild dogs across the country, and TAWIRI, through the activities of the Tanzania Carnivore Project, will continue to gather this information, targeting areas with data deficiencies. There is also a need to gather more detailed data targeted at specific regions. In particular, all the management authorities required information on trends and ranging patterns and potential threats for wild dogs in many areas. The priorities listed in Table 3 provide a useful tool for planning specific research and conservation activities on wild dogs. High priority activities should focus on those priorities judged as high by the group, and medium priority activities on priorities identified as medium. Tables 1 and 2 list the methods available for obtaining information to address these priorities. Many of the recommended information priorities by the group involve handling of wild dogs. All present agreed the conservation gains by such interventions outweighed any possible negative impacts - which were deemed to be small. Only one other technique identified in section Table 1 has the potential to provide data of the detail and quality of that provided by radio collaring, that using of working dogs, but this technique has as yet not been fully trialed in Africa.

Managers need information on the status and threats to wild dogs in their areas to plan management activities and to enable wild dog conservation, as well as assessing the impact of these activities on wild dog conservation. All participants are deeply proud of Tanzania's international status for wild dog conservation, and wish to improve the standards of information on wild dogs across the country. The hard work that participants put into this workshop and report reflects this wish, and will hopefully provide wild dog research and conservation with a new impetus, to address the identified priorities hand in hand with training and capacity building.

## References

- Burrows, R. 1995. Demographic changes and social consequences in Wild Dogs, 1964-1992. Pages 400-410 in A. R. E. Sinclair, and P. Arcese, editors. Serengeti II: Dynamics, management and conservation of an ecosystem. University of Chicago Press, Chicago.
- Creel, S., and N. M. Creel 2002. The African Wild Dog: Behavior, Ecology, and Conservation. Princeton University Press, Princeton.
- Ginsberg, J. 1996. Survivorship in African Wild Dogs. Conservation Biology **10**:313-314.
- Karanth, K. U., and J. D. Nichols. 1998. Estimation of tiger densities in India using photographic captures and recaptures. Ecology **79**:2852-2862.
- Maddox, T. 2002. The ecology of cheetahs and other large carnivores in a pastoralist-dominated buffer zone. PhD Dissertation, Department of Anthropology. University of London, London.
- Mills, M. G. L., and M. L. Gorman. 1997. Factors affecting the density and distribution of wild dogs in the Kruger National Park. Conservation Biology **11**:1397-1406.
- Sillero-Zubiri, C., M. Hoffmann, and D. W. Macdonald 2004. Canids: Foxes, Wolves, Jackals and Dogs. Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland.
- Silver, S. C., L. E. T. Ostro, L. K. Marsh, L. Maffei, A. J. Noss, M. J. Kelly, R. B. Wallace, H. Gomez, and G. Ayala. 2004. The use of camera traps for estimating jaguar *Panthera onca* abundance and density using capture/recapture analysis. Oryx **38**:148-154.
- Smith, D. A., K. Ralls, A. Hurt, B. Adams, M. Parker, B. Davenport, M. C. Smith, and J. E. Maldonado. 2003. Detection and accuracy rates of dogs trained to find scats of San Joaquin kit foxes (*Vulpes macrotis mutica*). Animal Conservation **6**:339-346.
- Stander, P. E. 1998. Spoor counts as indices of large carnivore populations: the relationship between spoor frequency, sampling effort and true density. Journal of Applied Ecology **35**:378-385.
- van de Bildt, M.W.G., Kuiken, T., Visee, A.M., Lema, S., Fitzjohn, T.R., Osterhaus, A.D.M.E. 2002. Distemper outbreak and its effect on African wild dog conservation. Emerging Infectious Diseases **8**:211-213

- Wasser, S. K., B. Davenport, E. R. Ramage, K. E. Hunt, M. Parker, C. Clarke, and G. Stenhouse. 2004. Scat detection dogs in wildlife research and management: application to grizzly and black bears in the Yellowhead Ecosystem, Alberta, Canada. *Canadian Journal of Zoology- Revue Canadienne De Zoologie* **82**:475-492.
- Woodroffe, R., J. R. Ginsberg, D. W. Macdonald, and I. S. C. S. Group 1997. *The African Wild Dog - Status Survey and Conservation Action Plan*. IUCN, Gland, Switzerland.

## Appendix I

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