

TECHNICAL REPORT ON WATER AVAILABILITY IN THE RUAHA RIVER AND THE STATE OF USANGU GAME RESERVE, NOVEMBER 2003



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Summary of Aerial Surveys conducted 25, 26 November 2003

Executive Summary

This document reports the results from an aerial survey of Usangu Game Reserve, the adjacent wetlands and the Ruaha River bed from Ihefu Swamp to Mtera Reservoir. The surveys were undertaken to:

1. Identify potential threats to wildlife and to the integrity of the Ruaha River and its hydrology;
2. Provide a quantitative assessment of human activities and livestock densities in and around Usangu Game Reserve;
3. Characterize water availability for human use and as a component of wildlife habitat
4. Establish a reference point against which to assess changes in the factors mentioned above.

We found that human activities and livestock heavily impact Usangu Game Reserve. Virtually all of Usangu Game reserve's swamp and wetland habitats are heavily grazed. Livestock are at very high densities and appear to be displacing wild herbivores, either through resource competition and/or direct persecution. The remainder of the area sampled, the alluvial fan habitats, are also affected, though not as severely, by sawpits and settlements. These areas are also likely subjected to incidental hunting pressure that accompanies these uses.

Wildlife densities and spatial distributions have been severely affected by the encroachment of livestock in Usangu Game Reserve. There is virtually no overlap between livestock and wildlife. In fact, all large mammals and most wildlife overall have been driven from the wetland and swamp portions of Usangu Game Reserve. It is believed that wattled cranes are already locally extinct, and topi (the only population in the entire Rungwa-Ruaha Landscape) may be close to local extinction. In the areas where they do remain wildlife densities are very low.

The Ruaha River survey found around 60% of the riverbed completely dry. The effect is most severe in the eastern portion of the River, from Msembe (Ruaha N.P. headquarters) to Mtera Reservoir. Some standing water remained in the western portion of the riverbed, but it was no longer flowing and algal blooms and hippo dung affected much of the water observed.

In summary, Usangu Game Reserve is heavily impacted by human activities, and the data presented here suggest that these human activities (including livestock herding) have had tremendous impacts on the hydrology of the Ruaha River.

We recommend the following actions: 1) consolidate conservation efforts to address unsustainable grazing and water use in Usangu; 2) ensure funding mechanisms for water enforcement; 3) work with the Wildlife Division, TANAPA and local government to assist in clearing illegal settlements and livestock; 4) work with agro-pastoralists to establish more sustainable livestock systems outside Usangu G.R.; and 5) continue to emphasize the plight of the Ruaha River in the broader Tanzanian media.

Introduction

Tanzania and its people have been committed to wildlife and natural resources conservation since independence in 1961 when Mwalimu Julius Kambarage Nyerere, the first Prime Minister, declared the Arusha manifesto which states, in part:

“we will do everything in our power to make sure that our children’s grandchildren will be able to enjoy this rich and precious inheritance. The conservation of wildlife and wild places calls for specialist knowledge, trained manpower, and money and we look to other nations to co-operate in this important task...”

One of the largest challenges facing Tanzania, as stated in the nation’s wildlife policy of 1998, is the conservation of areas with great biodiversity that represent the major habitats of Tanzania. As stated in the wildlife policy, the ultimate goal of the Protected Area Network (National Parks, Game Reserves, Game Controlled Areas and Wildlife Management Areas) is to create a series of viable conservation areas that embrace a representative sample of all important habitats and viable populations of all species, with particular reference to those that are threatened and endemic to Tanzania. Such areas include Ruaha National Park and its surrounding protected zones: Rungwa, Kizigo, Muhesi and Usangu Game Reserves, and the Lunda-Mkwambi proposed Wildlife Management Area (WMA).

The wildlife policy’s stated objectives for conserving and managing biological diversity also include the conservation of water catchments. Strategies for conserving and managing wildlife resources include conserving core wildlife species habitats (such as wetlands) through wildlife authorities like Tanzania National Parks Authority (TANAPA), Ngorongoro Conservation Area Authority, and the Wildlife Division (WD) of the Ministry of Natural Resources and Tourism.

National Parks are the highest category of wildlife protection areas in Tanzania and TANAPA offers the highest protection to wildlife in Tanzania. Ruaha National park management objectives include:

- Protect and maintain the parks exceptional resources including its wilderness character, *as well as its full range of landforms, habitats and biodiversity*;
- Ensure that the park management is in harmony with the conservation requirements of the entire Ruaha-Rungwa ecosystem.

The Ruaha National Park management objectives, in accordance with the General Management Plan (GMP) approved by the Trustees of TANAPA include:

- Protect important catchment areas in the park to preserve a constant supply of water to major and smaller rivers in the park;
- Ensure those portions of the great Ruaha and the entire Mzombe River systems within the park are never threatened by human activities;
- Provide a secure environment to enable wildlife populations to be maintained at appropriate Levels;
- Harmonize the management of the Park with respect to conservation requirements of the entire Ruaha Rungwa-Kizigo ecosystem;
- Encourage constructive and useful research that will assist management to eliminate any impacts that threaten natural resources.

Ruaha National Park (RUNAPA) has been carrying out many of these activities in order to meet natural resource objectives ever since the trustees of TANAPA approved the GMP. However, despite conscientious efforts by RUNAPA to meet natural resources objectives, the Great Ruaha River continues to dry up during the dry season every year since 1993, and the period of time the river stays dry has increased each year.

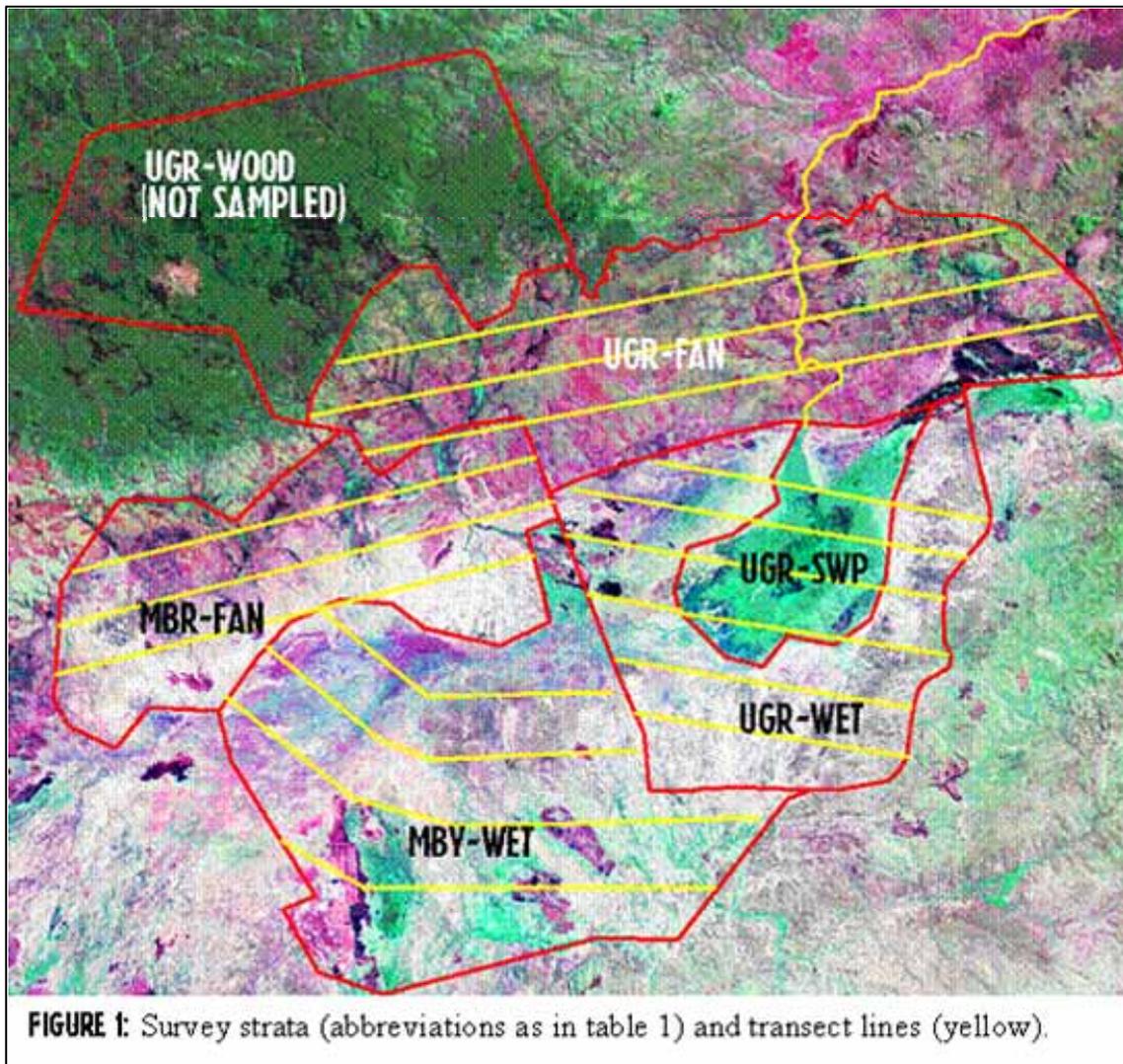
WWF and WCS, acting as partners and stakeholders in wildlife conservation, carried out an aerial survey at the end of the dry season in 2003, on the 25th and 26th of November, to assess the extent of annual drying of the great Ruaha and assess the status of some of the major drivers of the hydrological disruption, specifically cattle in Usangu Game Reserve. The results of this survey, presented here, provide a snapshot of the status of Usangu Game Reserve, the Ihefu Swamp, and the Ruaha River. This survey will form a baseline against which to measure progress toward threat reduction and river restoration in subsequent years.

Methods

We surveyed the Ruaha River corridor from Mtera dam upstream to the Ihefu (Usangu swamps) using a Cessna 182 aircraft with 3 and 4 observers aboard on days 1 and 2 of the survey, respectively. The observers examined 100% of the river between Mtera dam and Ihefu in order to locate surface water. We recorded water point positions using GPS.

Usangu Game Reserve and its surroundings were stratified into six categories: woodlands, alluvial fans, swamp (Ihefu), wetlands, Mbarali fans, and Mbeya wetlands (see Table 1 and Fig. 2). Five of these six strata, excluding woodlands, were sampled using the Systematic Reconnaissance Flight (SRF) method as described by Norton-Griffith (1978), flying at a nominal height of 300ft above ground and surveying a strip 250 meters wide on either side of the aircraft (i.e. nominal strip width of 500 meters). Transects were located five km apart and ran approximately east west (see Fig. 1).

Label	Name	Area Km ²	Km sampled	Effort * (km/km ²)	N
UGR-WOOD	Usangu GR Woodlands	1232.23	0	Not sampled	
UGR-FAN	Usangu GR Alluvial Fans	1492.68	227.39	0.15233674	3
UGR-SWP	Usangu GR Swamp (Ihefu)	393.08	64.4	0.16383433	4
UGR-WET	Usangu GR Wetlands	951.19	150.86	0.15860133	6
MBR-FAN	Mbarali Fans	979.51	153.95	0.15717042	3
MBY-WET	Mbeya Wetlands	1588.13	182.23	0.11474501	4
Ruaha	Ruaha River (Ihefu-Mtera)	n/a	231.3	n/a**	
	Transit	n/a	320		
Total Km			1330.13		
* km/km ² approximates proportion of area sampled if one assumes 500m strip width on both sides of the aircraft					
* 100% of the Ruaha River from Mtera Reservoir to Ihefu Swamp was sampled					



Results

Human Activities:

Human activities observed during the survey flights were recorded as one of the following categories:

- Cattle
- Goats and sheep
- Bomas (livestock only),
- Settlement (includes permanent structure, boma, and sometimes cultivation)
- Cultivation (no structures or bomas)
- Sawpits
- Fishing
- Fish camp
- People (walking, riding bicycles or any other activity)

Livestock

Cattle are by far the most abundant herbivore and the most significant ecological influence the survey area (Figure 2). Figure 3 shows the observed distribution of cattle and goats and sheep and their relative densities across the survey strata. The linear nature of the mapped points reflects the location of survey transects, not overall distribution. (Note that because the airplane was not fitted with a functional radar altimeter at the time of the survey, these figures are not comparable to SRF data from previous years. However these data are valid in demonstrating relative differences between the strata and the overall spatial distribution, since each record is individually geo-referenced.)

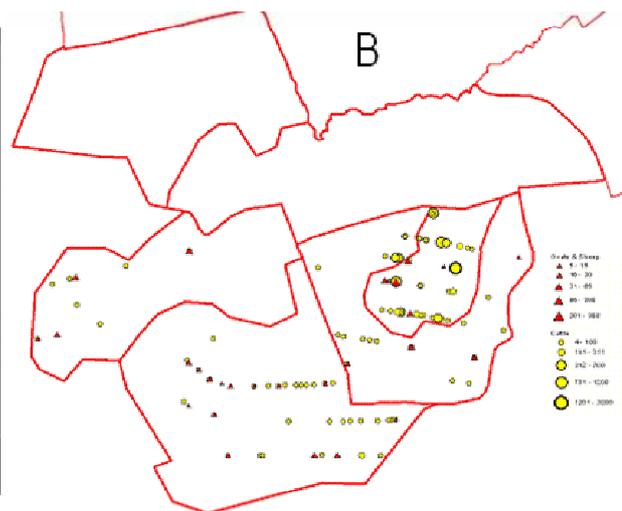
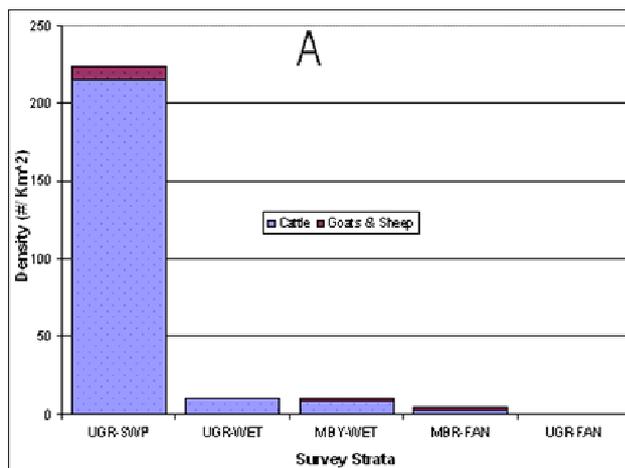
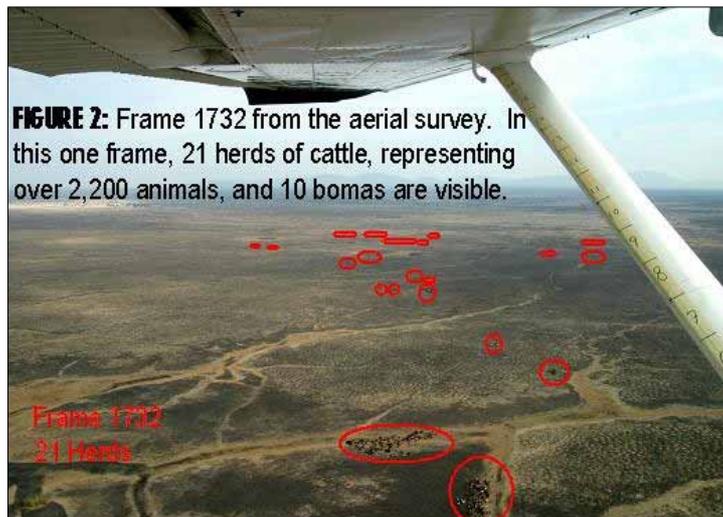


Figure 3: Estimated livestock densities (a) and spatial distribution of observations (b) in Usangu G.R. and adjacent areas. (Marker sizes in (b) for cattle (circles) and goats and sheep (triangles) are scaled to group size observed).

Cultivation and Settlement

Overall, human activities (below) dominate the southern portion of the reserve, and are common in the margins of the northern portions. Cultivation (defined as cultivated areas *not* associated with permanent settlements) is less widely distributed than livestock grazing within the reserve. Sawpits are the most common human activity in the woodlands. Figure four, showing bomas and settlements, demonstrates that most livestock are kept in the wetland area and are herded into the swamps. Note that encroachment is a serious problem, with both bomas and settlements abundant within the Game Reserve.

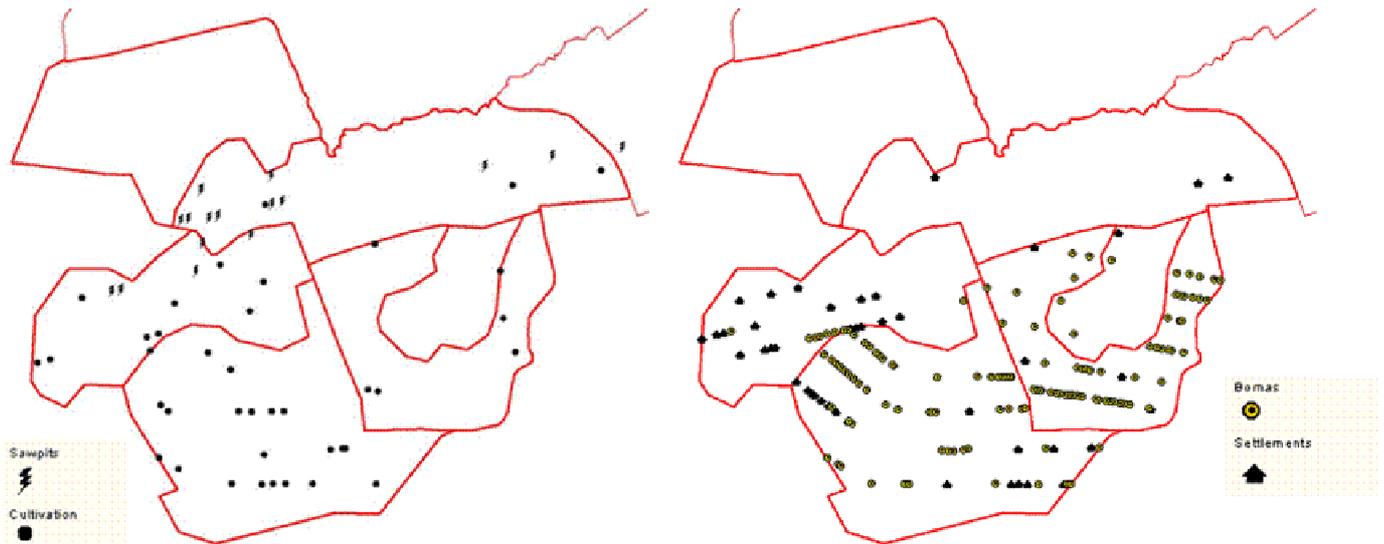


Figure 4: Locations of settlements and bomas in Usangu G.R. and surrounding areas (right) and sawpits and cultivation (left). See text for details.

Wildlife in Usangu

Wildlife numbers are seriously reduced in Usangu Game Reserve. Duiker, the most commonly sighted wild species, was recorded only 7 times; followed by warthog (4 records), ground hornbill (3 records), roan, zebra, eland and ostrich (2 records each). Topi, Lichenstein's hartebeest, sable, and giraffe were each recorded only once. In total, 112 individuals of 11 wild species were observed, as compared to around 17,000 individuals for livestock species.

The distribution of wildlife is nearly a mirror image of human settlement and livestock, suggesting significant resource competition and direct persecution.

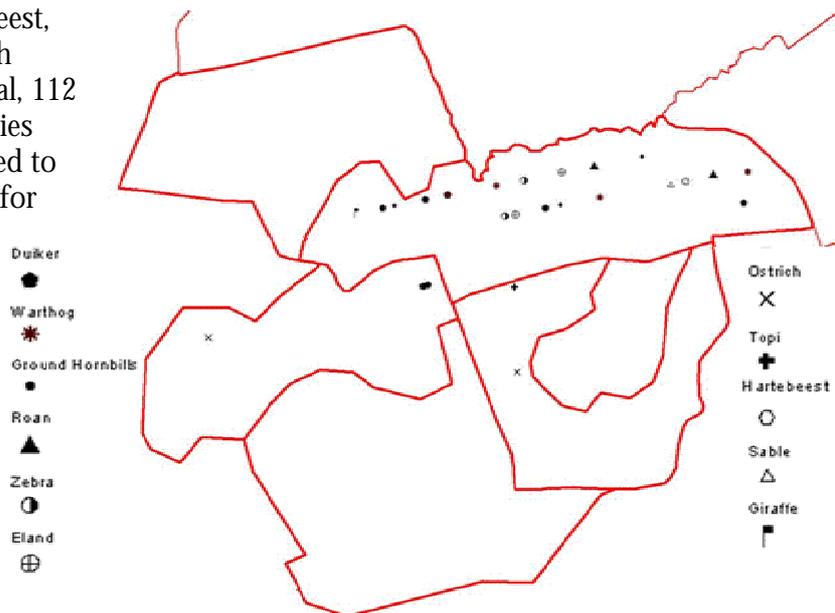


Figure 5: All observations of wildlife (excluding waterbirds)

Water Resources in the Ruaha River

Figure 6 reveals that the late dry season distribution of water in the Ruaha River is significantly reduced from the historical situation, where the Ruaha River flowed along its entire distance throughout the year.

It is important to note that these data only characterize the spatial distribution of surface water. It provides no measure of volume, which means that significant reductions in flow must occur before sections of the river dry and the spatial distribution of water is reduced below 100%. Thus, these estimates should be interpreted as significant underestimates of the habitat lost to hydrological disruption. In fact, these data characterize the distribution of water primarily as a resource for water-dependent terrestrial species. In terms of fish and other aquatic, flow-dependent species, significant, or total habitat loss would occur before the spatial distribution of surface water was reduced.

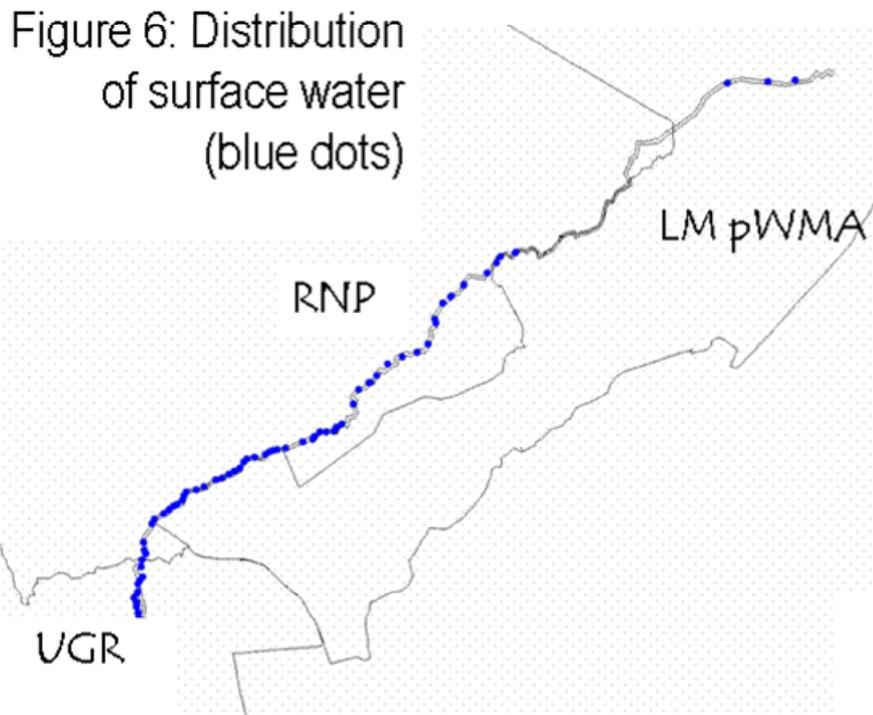


Figure 7 shows the changes in landscape structure for water dependent species. In both panels red shows “lost habitat,” or those areas that are now too far from water for species to use. The top panel depicts the situation for species that must remain within 6 km of water, and the lower panel shows the situation for highly dependent species, or those that must remain within 1 km of water.

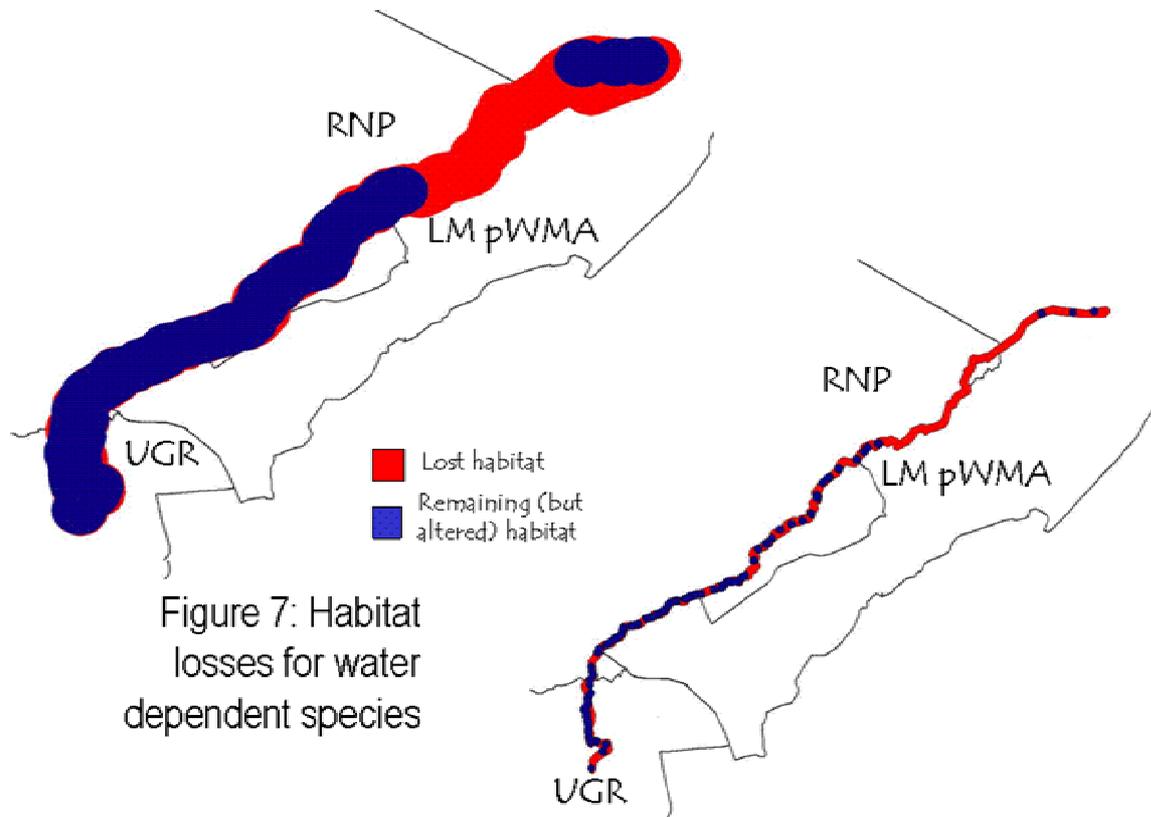


Table 2 shows a preliminary calculation of the area lost according to species’ dependence on water. These data demonstrate that species closely tied to water (i.e. those that must remain within 1km of water), like waterbuck and buffalo, have lost up to 60% of their dry season habitat in the Ruaha River Basin. Species that range farther from water, like elephants, impala and kudu have lost more habitat in absolute terms (as much as 659 km² for species confined to within 6km of water), but this represents less in the total percentage of habitat available in the Ruaha Basin (around 27%).

Table 2: Wildlife habitat losses from river drying.				
Wildlife ranging distance from water (m)	Area historically available (km ²)	Area available November '03 (km ²)	Absolute area lost (km ²)	Percentage of habitat lost
6000	2478	1819	659	27
5000	2062	1480	582	28
4000	1648	1150	498	30
3000	1227	824	403	33
2000	897	499	398	44
1000	456	187	269	59

As mentioned earlier, these losses must be viewed as absolute minima: places where surface water exists were treated in this analysis as remaining habitat, but these areas are degraded by altered flow regimes and heavy use, as is apparent in figure 8.



Figure 8: Many pools where water does remain are choked with red algae and hippo dung, reducing water quality as water quantity declines. It is not known whether water quality played a role in the anthrax deaths of 49 hippos.

It has been suggested that some species will simply shift their habitat use to track water or other species, like elephants and baboons, will dig for water. Unfortunately, in this arid landscape alternative water sources are limited, and neither of these scenarios offer reprieve for water-dependent species. Species that are mobile enough to follow the restricted distribution of water will likely pay significant energetic costs, given the long distances needed to travel, and these costs will likely be exacerbated by high grazing pressure and reduced forage quality on the areas near water.

Elephants do dig for water, but in many places the water table has fallen so low below the riverbed that elephants abandon the area entirely. Even where elephants dig for water, their holes generally collapse quickly in the soft sand, so the benefits to other species are limited.



Figure 9: Elephants are able to dig for water in areas where the water table remains high enough, but other areas have been abandoned. This has led to a concentration of elephants where water is available, and has left large tracts of habitat unoccupied (see table 2).

These losses are particularly significant for Ruaha National Park, which is losing critical dry season habitat. In addition to the ecological costs, however, the economic costs are also high. The eastern areas of the Park are the highest-value tourism zones,

and tourism is greatest in the dry season, when wildlife concentrate around available water. Lunda-Mkwambi pilot Wildlife Management Area (LM pWMA), where WWF and WCS are supporting the MBOMIPA Association's bid to become one of Tanzania's first Community Based Organizations given the authority to manage and benefit from wildlife conservation, is also severely affected by the loss of water. This is because the bulk of MBOMIPA's revenue currently comes from the sale of buffalo hunting quotas. WCS and WWF are working to help MBOMIPA diversify its revenue streams, but this takes time, and like Ruaha National Park, the development of Lunda-Mkwambi's tourism industry is severely hampered by the diminished distribution of water.

Conclusions and Next Steps

The drying of the Great Ruaha river during the dry season every year since 1993 is a serious issue and of great concern to RUNAPA, MBOMIPA, The Wildlife Division, and other stakeholders of the river, such as peasant farmers and fishermen, TANESCO (Tanzania's power supplier), the Presidents office, regional administration and local government offices, the Vice- Presidents office, Division of Environment, and the Ministries of Water and Livestock, Agriculture and Food, and Natural Resources and Tourism, to mention just a few.

The data presented here demonstrate that the land uses in Usangu Game Reserve continue to have significant effects on the Ruaha River. While the hydrological impact of the cattle in the reserve was not directly measured, the extraordinary densities observed clearly indicate that trampling and heavy grazing are significantly reducing the water holding capacity of the Ihefu Swamp, and therefore, the flow of the Great Ruaha River.

Thus grazing, combined with the effects of water diversions for rice cultivation (well documented by the SMUWC Program, see www.Usangu.org), constitute the two major factors diminishing the dry season flow of the Ruaha River. This is not to imply that other factors, like diversion and/or erosion in the upper catchment (above Usangu) do not have measurable effects. However, it does suggest that restoration of the Ruaha cannot take place without solving the cattle and rice problems. Indeed, solving these two problems may provide sufficient water savings so that many of the other land use issues could be given lower priority or even ignored. What's more, livestock grazing in Usangu and misuse of water are already illegal under existing laws and regulations. Therefore, these issues can be tackled under the existing legal framework and without additional infringements on local stakeholders' rights. The same cannot be said for other land uses, like cultivation in the upper catchment, planting of exotics, small-scale diversions and artisanal fishing, all of which are currently legal. Unfortunately, the Rufiji Basin Water Office (RBWO), which is in charge of water regulation, has been hampered by a lack of funds, which in past years has stemmed from water users not paying the proper tariffs for use.

Recommendations:

Based on the data presented and the discussion, we offer the following recommendations:

1. Consolidate river restoration efforts to address the two principle drivers of hydrological disruption: cattle in Usangu G.R. and misuse of irrigation water.
2. Work with rice producers to ensure that their water use bills are paid, and applaud TANESCO for paying its bills and supporting RBWO's efforts to examine the water situation and find solutions.
3. Work directly with the Director of Wildlife and the Usangu Project Manager, Mbarali District, Commissioner, MP and Executive Director to clear settlements, cultivation, fishing, and livestock from the swamp and surrounding wetlands that are within Usangu Game Reserve.
4. Liaise with the parties in no.3 above and with agro-pastoralists currently occupying he Usangu Game Reserve to resettle livestock outside the Ihefu Swamp, and the Game Reserve itself. Given the high incidence of livestock disease in Usangu, the lack of pastoral land tenure, and the constant and sometimes violent conflicts between livestock keepers and reserve management, livestock extension services (including veterinary extension, provision of water and land use planning) could potentially be strong incentives to leave Usangu Game Reserve. However, any such effort *must* be combined with enforcement inside the reserve to ensure that it leads to a shift in the livestock population, rather than an influx. Veterinary extension may be particularly effective since it would also benefit wildlife, which is vulnerable to diseases from livestock.
5. Communicate the plight of the Ruaha River to the broader Tanzanian population through the media. Broad support for river restoration could be built by highlighting the links between the Ruaha River and the high cost of power, rolling blackouts in Dar es Salaam, water pollution, and the decline of the Mtera Reservoir fishery. For example, a short documentary film on the Ruaha River, aimed at and told from children's perspective, has just been produced. Helping to place the Ruaha River situation on Tanzanian television would also keep the issue at the forefront and galvanize support for river restoration.