SCENARIO BASED PLANNING FOR A SUSTAINABLE FUTURE IN SOUTHWESTERN TANZANIA

August 1, 2018

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AFRICA BIODIVERSITY COLLABORATIVE GROUP

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Report of the meeting held by the Land Use Management Impact Working Group on July 17-18, 2018, Morogoro, Tanzania

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Introduction

African Wildlife Foundation (AWF) and Wildlife Conservation Society (WCS) organized a two-day workshop on July 17-18, 2018 in Morogoro with a goal of outlining a vision for a more sustainable future for South-western Tanzania using findings from a scenario-based modelling approach. The workshop convened 27 participants from government and development and conservation non-governmental organizations (NGOs) representing 23 organisations. This report summarizes the two-day workshop on scenario based planning for a sustainable future in Southwestern Tanzania as part of the Africa Biodiversity Collaborative Group (ABCG) project. The report starts with the background information before covering main issues that were presented and discussed during the course of the two days.

Participants' group photo

Background

Conservation has been a reactive discipline, and land-use planning as a tool for achieving conservation outcomes has often been reactive as well. As issues arise, the conservation sector initiates a new planning process to assess impact and identify solutions. This piecemeal approach to conservation planning is insufficient to address the complex realities and rapidly emerging conservation challenges facing the African continent.

ABCG recognizes that critical landscapes are being reshaped, not by a single driver, but by a suite of drivers including population growth, changing resource utilization patterns, economic development, and increasingly, climate change. In many landscapes these drivers are accelerating. Conservation planning frameworks need to adapt and incorporate the current and forecasted future cumulative impact of these drivers of change to identify more robust conservation interventions. Under the ABCG Land Use Management Task area, AWF and WCS, with contributions from Conservation International and World Resource Institute are developing a planning framework emphasising a scenario analysis approach for Southern Tanzania where much of the area intersects the Southern Agricultural Growth Corridor of Tanzania (SAGCOT).

Thus, this workshop is the follow up workshop after the one held in Mbeya in 2017 which aimed at providing a high level introduction to the project for key stakeholders in Southwestern Tanzania land use planning, launching a situational analysis for the region covering socio-economic trends and conservation issues, formulating objectives to guide the scenario modeling, and identifying potential datasets. The workshop agenda and presentations can be accessed here1.

Workshop Objectives

The purpose of the workshop held on July 17-18, 2018 were to:

a. Reach a common understanding of the planning framework, process, and project.
b. Review the questions/objectives stakeholders agreed on in the Mbeya April 3-4, 2017 workshop to guide scenario model construction.
c. Review key datasets compiled to create the scenario models.
d. Assess scenario planning models, interpret results, and use them to develop strategies towards a more sustainable future.
e. Discuss how to implement strategies in terms of influencing other processes (e.g., SAGCOT), stakeholder identification, communications to engage them, and likely challenges.
f. Assess unanswered questions and potential pathways to addressing them.

Welcome Note

The workshop opened at 9:30am followed by introduction from each participant. Dr. Joseph Paul from National Land Use Planning Commission (NLUPC) officiated the meeting. He gave his narration based on the workshop held in Mbeya 2017 and highlighted that the expectation from the workshop was to come up with policy recommendations to integrate conservation initiatives in land use planning process.

[1] https://awf.box.com/s/5yleiwp4o12uvybkikv0wasrvq2nti2o

Workshop facilitator, John Salehe of Nature Tanzania pointed out that 28% of Tanzania land is occupied by protected areas while more than half of the country is occupied by other uses such as agricultural expansion, pastoralism, and infrastructure development which are placing increasing pressure on land that is actually limited. Thus, land use planning is a means of finding a balance that minimizes conflict among different users so that the future of Tanzania is not jeopardised by such pressure on land.

Workshop I Review

David Williams of AWF and ABCG's Land Use Management task group member, gave an overview of Workshop One (I) held in Mbeya, April 3-4, 2017 on ABCG Multistakeholder Participatory Planning Framework; the workshop focused on data compilation/analysis to feed spatially explicit scenarios that meet objectives and minimize tradeoffs/conflict. He highlighted key points from the situation analysis involving the following areas:

a. Conservation status, threats, and trends related to large and threatened mammals specifically large mammals mostly lost from outside reserves.
b. Wildlife corridors: Of 31 corridors, 13 intersect the study area. Encroachment due to high demand of arable land, charcoal manufacture, logging activities and subsequently ploughed agriculture make some of these corridors on the extreme condition.
c. Climate change
d. Water resources (World Bank 2017): Rapidly expanding economy and population, renewable per capita freshwater resources dropped by almost half in the last 25 years. The situation will place Tanzania on the list of water stressed countries before 2025. Tanzania agricultural sector suffers ~$ 200 M/year in average losses because of weather-related incidents, particularly drought.
e. Conservation International's Vital Signs monitoring system designed to provide site level information to guide sustainable agricultural development. Their research determined that significantly lower return on investment in agriculture in degraded areas verses near intact forests.
f. Land use planning and implementation in Tanzania: Village land use plan demarcate land for community services, residential uses, agriculture uses, livestock grazing, conservation and land for investment. However, only 13% of country's villages have land use plans.

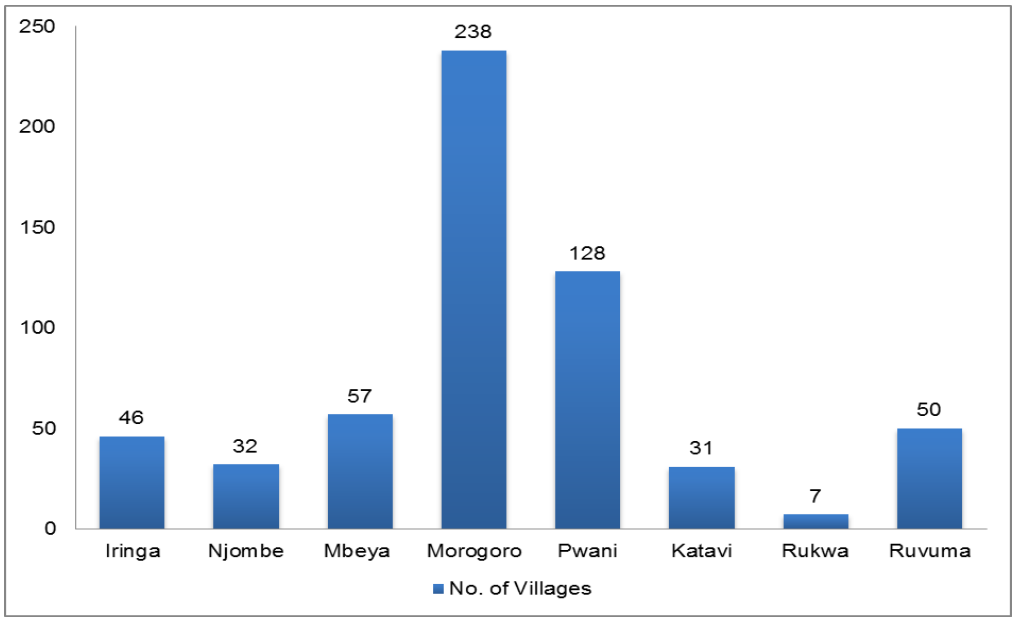


Figure 1: Status of Village Land Use Planning in the South-Western Region (SAGCOT Area)

During workshop I, participants identified four to five key objectives for land use planning in the region. Objectives were grouped by themes including livelihoods/economic development (agriculture + costs); biodiversity; water; governance; capacity building; and scale of planning. Based on the objectives, the team formulated nine rough scenarios representing stakeholder objectives for further exploration in term of feasibility considering data requirements and assimilation into Marxan:

- Protected Areas effectiveness: Reduced effectiveness in some/all protected areas due to increased human population pressure and unsustainable hunting
- Reach agricultural productivity targets sustainably e.g., using change in technology
- New crop type Climate change (e.g. rainfall change or drought) affecting crop yields + ecosystem persistence
- Policy change: recognize/gazette current agricultural land, so that land is managed effectively (would cropping/grazing conflict?).
- Improved knowledge, agri-tech or industries that (a) maximizes yields or (b) increases market values of products
- Will infrastructure (power lines) increase human pressure?
- If all villages had land use plans? Would that cater to better outcomes?
- Increased access to alternative energies

Thus, refined planning objectives were:

- Reach targets for increased agricultural investment in a sustainable manner.
- Manage the threat of illegal hunting in protected areas cost-effectively.
- Avoid wasted investment in areas with high-risk of future environmental degradation due to drought.

- Minimise risk of conflict between alternative agriculture incomes (commercial cropping, smallholder cropping and grazing).

Workshop II Introduction

David offered the context of the workshop stressing the need for increased food production to be able to feed the world population expected to exceed nine billion people in 2050. To this note, sub-Saharan Africa play major role through higher yields/expansion of cultivated area. However, agricultural growth poses risks including species declines/extinctions through conversion, increased hunting access, human-wildlife conflict together with water stress (sector accounts for 89% of total use in Tanzania). The question is how can this agricultural transformation be done sustainably? He then presented on foreign investment with an aim of boosting transport infrastructure that facilitates natural resource extraction and underpins agricultural productivity/poverty reduction.

David emphasized on the need for new, more holistic and forward looking conservation planning approaches. Current approaches to conservation planning are inadequate to address current complex conservation challenges involving many drivers i.e. population growth, economic and infrastructure development, and climate change. The goal is to create a planning framework for South Western Tanzania that incorporates current and forecasted impact of these change drivers to enable identification of robust sustainable development and conservation strategies. On the ABCG Multi-stakeholder participatory framework, the workshop concentrated on the review scenario to evaluate alternative futures by varying objectives (e.g., triple agricultural yield via commercial vs. smallholder) and use the scenarios as basis for strategy development (e.g., policies).

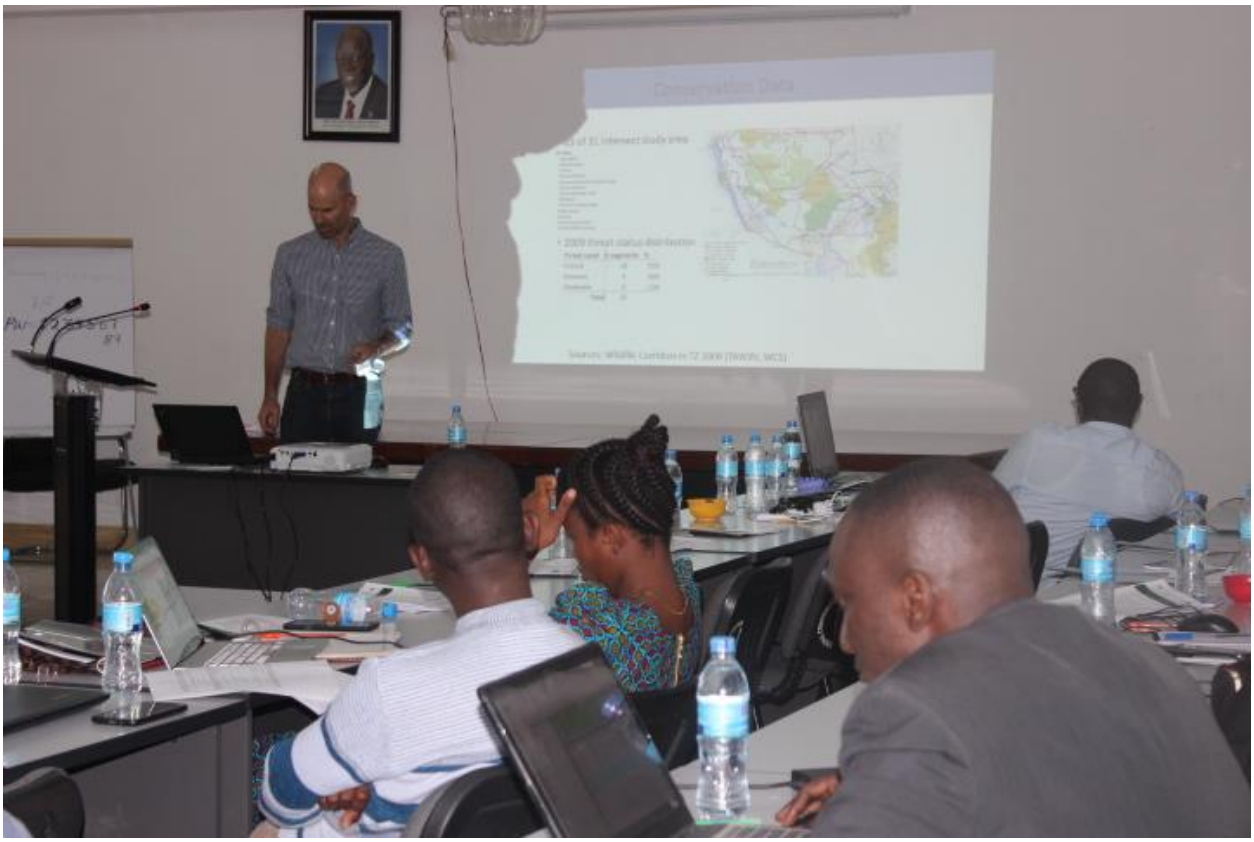
Africa Biodiversity Collaborative Group (ABCG)

David explained that ABCG's mission is to tackle complex and changing conservation challenges by catalyzing and strengthening collaboration, and bringing the best resources from across a continuum of conservation organizations to effectively and efficiently work towards the vision of an African continent where natural resources and biodiversity are securely conserved in balance with sustained human livelihoods. His explanation went further to give the history and context of ABCG which was created in 1999 to address priority emerging African conservation issues with members from US based conservation NGOs with field programs in Africa. USAID funded most recent phases involving food security, managing extractives, climate change, global health and biodiversity, and emerging tools (e.g., SMART). The ABCG Land use management tasks engages four landscapes in Democratic Republic of Congo, Madagascar, Republic of Congo, and Tanzania with WCS playing a lead role with the scenario modeling in each.

Systematic Conservation Planning & Select Dataset Profile: David Williams

David introduced the history and rationale for systematic conservation planning before profiling salient datasets used in the scenario planning in this project.

Conservation planning guides decisions about the location, configuration and management of conservation areas and other land uses. Systematic conservation planning is a process for making conservation decisions that is efficient, repeatable, transparent and inclusive. Systematic Conservation Planning began in the early 1990s with a recognition that conservation efforts were insufficient to abate the biodiversity loss crisis. Decision-support tools like Marxan were developed to guide users through a data-driven process to perform scenario analyses that meet conservation targets while minimizing conflict with competing land uses.



David Williams introducing the ABCG project

SAGCOT Updates

Michael Nkonu of IUCN gave an overview of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) including goals and geographical coverage and further narrated by John Banga of SAGCOT. Created in 2010, the SAGCOT initiative is a public-private partnership dedicated to ensuring food security, reducing poverty, and spurring economic development in Tanzania's Southern Corridor. The SACGOT area stretches from the Indian Ocean to the Zambian border; the Southern Corridor encompasses nearly 300,000 square kilometers extending along both sides of the infrastructure backbone that extends inland from Dar es Salaam. While the region has considerable agricultural potential, it currently suffers from low productivity, low levels of investment, and high rates of poverty. To unlock the region's potential, the SAGCOT initiative seeks to attract more than US $3.5 billion of investment in agriculture by developing 350,000 Ha of land to dramatically increase food production, increase annual farming revenues by more than US $1.2 billion, supporting 100,000 smallholder farmers to commercialize, and establish southern Tanzania as a regional food exporter[2].

To meet these goals, in 2011 the SAGCOT Blueprint was released, describing where and how investment in the agriculture sector could be scaled-up and better coordinated to establish productive clusters of new economic activity. The strategy has three features which are public-private partnership, cluster approach and attention to impact on small holders.

The cluster approach involves co-locating different types of investments in specified priority areas where actors access services and advantages that they would never have managed to get if they would have worked isolated in a specific area or without collaborating with others. Priority clusters are Ihemi (Iringa and Njombe regions) launched in 2015, Mbarali (Mbeya and Songwe regions) launched in 2017 and the third to be launched by December 2018. The cluster supports 10 interconnected value chains, potentially engaging over 1 million farmer households and; about 100 partners aligning public and private investments in inputs, production, storage, processing, infrastructure research and services. He then stressed the importance of land use planning in the region for sustainable agricultural development, issues raised in stakeholders land use dialogue convened in 2016 and 2017 and current status of database of farmers with Certificates of Customary Rights of Occupancy (CCROs). Key actors on these initiatives are Ministry of Lands Housing and Human Settlement Development, National Land Use Planning Commission, IUCN, WWF and Care International.

[2] Jeffrey C. Meilder, et al 2012. A green Growth Investment Framework for SAGCOT, Tanzania

John Banga of SAGCOT centre limited responding some of questions from invited participants

Overview of Land Use Planning Initiatives in Western Tanzania

Dr. Joseph Paul of National Land Use Planning Commission (NLUPC) gave an overview of land use planning in Tanzania. He pointed out that land is the basic resource for the livelihood of the vast majority of the Tanzanians living in rural areas. Appropriate strategies are presently required more than ever to counteract the consequences of the increasing pressure on land resources which hamper rural development and even may further marginalise the majority of the rural population[3]. Thus, village land use planning, administration and management is an important tool for land conflicts prevention and resolution; protection of biodiversity, food security, responsible land governance, facilitating foreign direct investment on land, natural disaster management, sustainable natural resources management and; adaptation and mitigation to climate change.

He also took the participants through different levels of land use planning in Tanzania which are:

- National level where policies, legislations, directives, guidelines, training and awareness creation to regulate land and natural resources management at the national to grassroot level take place.

[3] NLUPC, 2011. Guidelines for Participatory Village Land Use Planning administration and Management in Tanzania 2nd Edition, Tanzania

- Zonal and Regional level plans involve two (2) or more Districts to comprise a region (e.g. SAGCOT) or a sub-national combination of regions.
- District level where communities or organisations attempt to solve their problems by determining how various land and natural resources should be best utilised at district level in order to improve livelihoods and meet national or international concerns such as conservation of the environment. Land uses are planned within the district boundaries.
- Village level, at this level the Village Land Act No 5 of 1999 Sections 12 & 13 empowers the village councils through their village assemblies to prepare, approve and implement village land use plans in their respective areas of jurisdiction.

For the year 2017/2018 NLUPC in collaboration with developing partners facilitated preparation of 61 Village Land use Plans in Western Tanzania (Table 1). Also, the Commission has received and scrutinized 38 Village Land Use Plans. Other initiatives include:

- Capacity building to 16 PLUM teams in 16 Districts in the South West Zone.
- NLUPC have started working with TANAPA in preparing Village Land Use Plans for villages surrounding National Parks in Tanzania.
- The Commission expects to work with TFS in preparing Land Use Plans of villages surrounding Forest Reserves in Tanzania.
- The Commission shall also work with the Vice President's Office to prepare VLUPs in the region.

Table 1: Village Land Use Plans in Western Tanzania prepared in the year 2017/2018

Region	District	Village	Total
Katavi	Nsimbo	Igongwe	1
	Mpanda	Mnyagala	1
	Tanganyika	Nkungwi,	1
	Kalambo	Samanzi, Kisala	2
Kigoma	Uvinza	Mgambazi, Rukoma, Lubalisi	3
Lindi	Kilwa	Kikole, Kisangi, Kipindimbi, Mitole	4
Morogoro	Ulanga	Isyaga, Kituti, Mbangayao, Lyandu, Minepa, Kivukoni, Mbuyuni,Nakafulu, Idunda, Ikungua.	10
	Kilombero	Mkasu, Bwawani, Mpanga, Idete, Idete B, Ihenga, Chiwakiwa, Mkusi, Nakaguru, Lukorongo, Mngeta, Kidete, Mkangawalo, Ichongoa	14
	Malinyi	Tanga, Ngoheranga, Kilosa Mpepo, Ihowanja, Mbalinyi, Biro, Kiswago, Sofi Mission, Kalengakero, Usangule A, Usangule B.	11
	Morogoro	Tandai, Amini, Tawa, Kitungwa, Ludewa, Lung'ara	6
Iringa	Kilolo	Lyamko,Ngo'nde	2
	Mufindi	Mapogolo, Lugodalutali, Utosi, Igombavanu, Uhambila , Kibada	6
Shinyanga	Shinyanga	Nsalala, Welezo	2
	Total		**61**

In terms of success in land use planning, Dr. Joseph Paul noted that over 1700 VLUP and 40 District Land Use Frame work Plans have been prepared, National Land Use Framework Plan 2013-2033 has also been prepared by the Commission and capacity building done to over 80 District Councils in Tanzania and; guidelines for Participatory Village Land Use Planning, Administration and Management in Tanzania are in place. Participatory Land Use Planning is a powerful tool for capacity building, empowerment and conflict resolution when communities are really partners in the process and their interests are central. He concluded on the potential of land use planning in addressing resources management in a holistic way and incorporating broader interactions between natural and socio-economic conditions of local production systems, macro-policy implications and the national context.

Spatial Scenario Modelling To Support Integrated Landscape Management in the Kilombero Landscape in Tanzania

Netherlands Environmental Assessment Agency (PBL), Eco Agriculture Partners and AWF piloted a stakeholder driven, scenario modeling approach in Kilombero Tanzania to help stakeholders achieve multiple Sustainable Development Goals (SDGs) through integrated landscape initiatives. AWF played the role of landscape facilitator and co-hosted a workshop in the landscape in March 2018.

Pastory Magingi from AWF introduced the subject by giving an overview of Kilombero Valley. He pointed out that Kilombero valley has abundant natural resources which people are highly depended on, including wildlife, forests/woodlands, fisheries, grazing land and water for agriculture and human consumption. The natural resources in this valley are under growing pressure due to population growth, agriculture intensification, uncoordinated and fragmented land use changes, and unsustainable demand for grazing as influenced by economic, social and environmental changes taking place at the local, national and international levels. Thus, the Kilombero workshop held on March 5-8, came up with six (6) major ambitions over the next 15-20 years which aimed at improving:

- Conservation of forest cover, wildlife and corridors
- Water conservation, access and security
- Livelihoods (food security; crop and livestock production; commercial development; energy security)
- Social equality (particularly on health and gender)
- Sustainable management of crop/ livestock areas (soil and water conservation, production efficiency)
- Improve and strengthen governance (land use plan development/enforcement; policy and planning coordination; reduce conflict)

Drawing from the workshop and PBL modeling, David provided an overview of the project's situational analysis, methodology, and findings. He pointed out socio-economic challenges in the landscape where smallholder farmers suffer from food insecurity due to low yields (climate change, soil degradation, poor inputs, pests/disease, and water shortages) and external factors such as inadequate access to markets and financial services, human-wildlife conflicts.

Rapid forest/wetland conversion due to expanding agriculture, settlement, and pastoralism (migrants from north) threaten ecological functions, wildlife habitat for rare/endemic species, e.g. Red colobus monkey and Puku antelope; and connectivity between Tanzania's two largest elephant populations which are Selous Game Reserve and Ruaha National Park. In summary, stakeholders identified environmental degradation and a lack of livelihood opportunities and effective land use planning as the major challenges for development in Kilombero valley.

He went further to introduce participants to the scenario to 2030 which are Business As Usual (BAU) and Integrated Landscape (IL). The BAU scenario was based on literature, government plans, historical/current data and assumed:

- Current pressures will persist and no new policies implemented
- Population increases by 3.5% annually
- Driven by population increase, agricultural food production increases 60%
- Driven by population increase, grazing expands accordingly
- A slight increase in monoculture production
- Plantation forestry follows Kilombero Valley Teak Corporation model growth ambitions on their own teak plantations and for outgrower expansion.

The IL scenario shares similar landscape ambitions but aims for synergies and reducing trade-offs between economic and agricultural growth, environmental protection and local livelihoods. Key interventions are to:

- Improve livelihoods
- Increase local sustainable foods production by emphasizing mixed cropping
- Promote sustainable watershed management
- Expand 'green infrastructure', including forests, protected areas, corridors
- Promote sustainable eco-tourism development around protected areas and corridors
- Strengthen land rights and territorial planning

Comparing the two scenarios, the 'green growth' or IL scenario outperformed the business as usual scenario in offering more agricultural productivity, cleaner and more abundant water resources, more robust wildlife/biodiversity and far greater prospects for a sustainable future to 2030 and beyond. A multi-stakeholder platform emerged from the process to work towards landscape ambitions informed by the integrated landscape scenario.

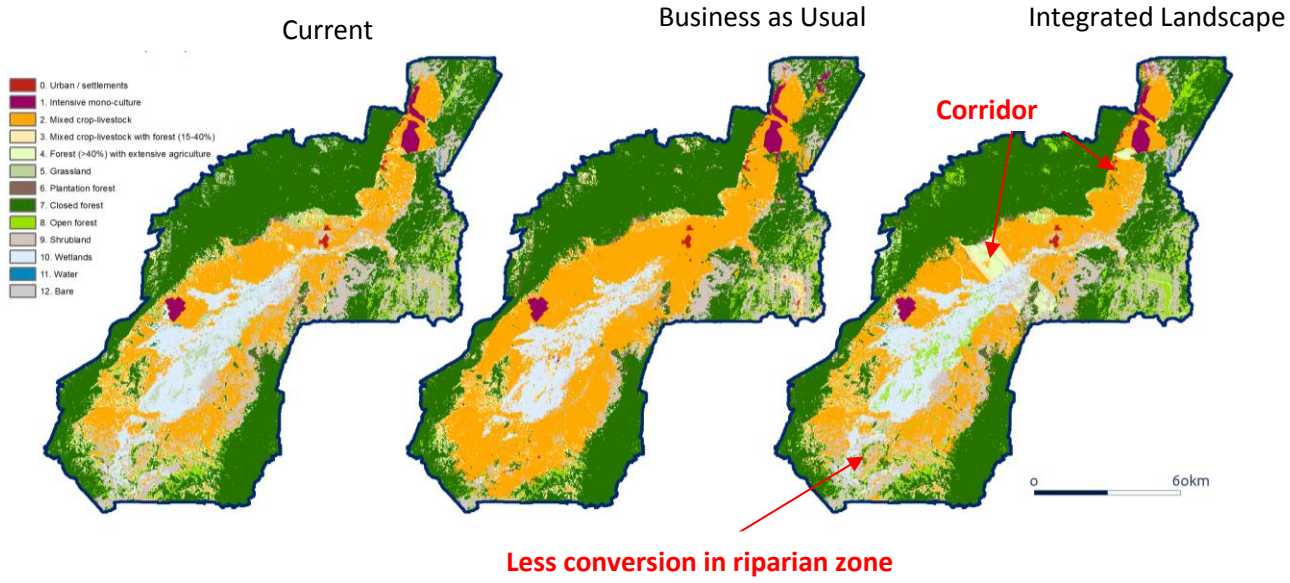


Figure 1: Current land use/cover on the left with the two scenario outcomes.

Landscape Characterization (Since Workshop 1)

Species

A set of 13 species were selected that are likely to come into conflict with objectives of increasing agricultural land uses in the region, either due to being threatened by clearing for agriculture (five primate species), or being threatened by hunting due to resource conflict associated with cropping and grazing occurring in places preferred by native species (four mammalian predators and the elephant), or threatened by both hunting and clearing for agriculture (two small ungulate species and the giant pangolin that are declining due to hunting plus loss of habitat from clearing for agriculture). Species range maps were downloaded from the IUCN (for predators) or from other published sources, and the distribution of each species was allocated to each planning unit.

Ecosystems

Data on the identity and distribution of ecosystems across the study area were downloaded from the "Potential natural vegetation of east Africa" dataset (http://vegetationmap4africa.org/). This resulted in 22 ecosystems ranging from freshwater swamps to rainforest. These were overlaid with data on the quality of natural vegetation in Tanzania (high, medium or low), and all low quality vegetation areas were removed, resulting in a final list of 41 ecosystem features classified as either high or low quality.

Other conservation data

Because bird distribution maps or models were not available for the study area, a map of the 22 Important Bird Areas (IBAs) identified by BirdLife International as having very high value for the conservation of birds in Tanzania and globally was used. These IBAs are chosen for a number of reasons such as having very high population abundances and/or richness of rare or endemic species, being important breeding or feeding grounds for migratory species.

To represent water availability across the study region a map of water budget derived from the Tanzania Waterworld dataset was created. The map shows the local water balance (mm/yr), i.e. rainfall + fog + snowmelt minus evapotranspiration.

A map representing cumulative long-term drought conditions across the landscape was generated by compiling information from all years between 1990 and 2016 on the Vegetation Condition Index (VCI), a remotely-sensed NDVI product.

Agriculture

Information on cultivation land use was downloaded from the FAO Global Agro-ecological Zones[4] Data Portal version 3.0 (hereafter GAEZ v3). Maps of crop suitability were created for seven crops: maize,

[4] *FAO/IIASA, 2011-2012. Global Agro-ecological Zones (GAEZ v3.0). FAO Rome, Italy and IIASA, Laxenburg, Austria*

soybean, wetland rice, dryland rice, sugarcane, Irish potato and citrus under high input level rainfed conditions most likely to be replicated by commercial agriculture. These maps indicate the agro-climatically attainable yield for low, medium or high input level rain-fed crops for a baseline period 1961-1990. Only medium and high input rain-fed crops were considered, with high input cropping analogous to commercial farming and medium input cropping more representative of intensive smallholder farming.

For each crop map, the GAEZ crop suitability index (baseline period 1961-1990) was converted from a categorical value between zero (0) (not suitable) and >85% (very high suitability) to a binary "suitable" or not by classifying any planning units with suitability >55% ("good suitability") to one and all others to zero. For each crop, the potential economic yield within each planning unit was calculated by multiplying GAEZ-estimated total production capacity (t/ha) under high input level rainfed conditions with the average market value of each crop (http://nbs.go.tz/nbstz/index.php/english/statistics-by-subject/agriculture-statistics/1023-2016-17-annual-agriculture-sample-survey-crop-and-livestock). All costs were adjusted for inflation from the time of cost data collection at average inflation rates of 2.7% per year.

Landscape Approach Presentation From Joseph Maina: David Williams

On behalf of Joseph Maina of WCS, David Williams presented the WCS generated scenario planning models constructed to address and interpreted the results. Marxan with Zones conservation planning software, which finds multiple, near-optimal solutions for this multiple land-use planning problem using a simulated annealing algorithm was used. This algorithm also accounts for the impact of undesirable combinations of adjacent land uses (for example, avoids placing cropping adjacent to protected areas, where possible). Each scenario (and scenario variation) was run 1,000 times to ensure near-optimal solutions were found.

The application of Marxan with Zones to land use planning in southern Tanzania required information on land use and conservation strategies and the cost of implementing these strategies, the distribution of biodiversity, conservation targets, and the contribution of each land use to achieving these targets.

The goals elaborated on in the first workshop can be summarized as:

(1) Improve management and survival of biodiversity in existing protected areas
(2) Increase economic yield of agriculture through innovations
(3) Minimise conflict between cropping and biodiversity
(4) Minimise conflict between cropping and grazing land uses

The study results were framed using three questions as outlined below.

> Q1: Is there likely to be conflict between agricultural development driven by production targets and biodiversity values?
>
> Q2: How well does the existing reserve network protect key biodiversity features and water quality?
>
> Q2b: How much investment is needed to improve the effectiveness of protection?

Q1: Is there likely to be conflict between agricultural development driven by production targets and biodiversity values?

Under SAGCOT, future change in agricultural investment is to increase the target area cropped for major investment crops and smallholder crops. How will expansion of major crop type distributions impact biodiversity areas? Regression models were used involving seven major target crops- citrus, dryland rice, potato, maize, soybean, sugarcane, wetland rice-to assess whether areas of high potential agricultural production capacity overlapped with more intact (generally highest biodiverisity) areas. The models indicated a positive relationship between potential crop production and vegetation intactness for most crops (Figure 2) meaning they were more likely to have higher production yields inside rather than outside of intact vegetation areas (Figure 2). Only maize and citrus posed little likelihood for conflict.

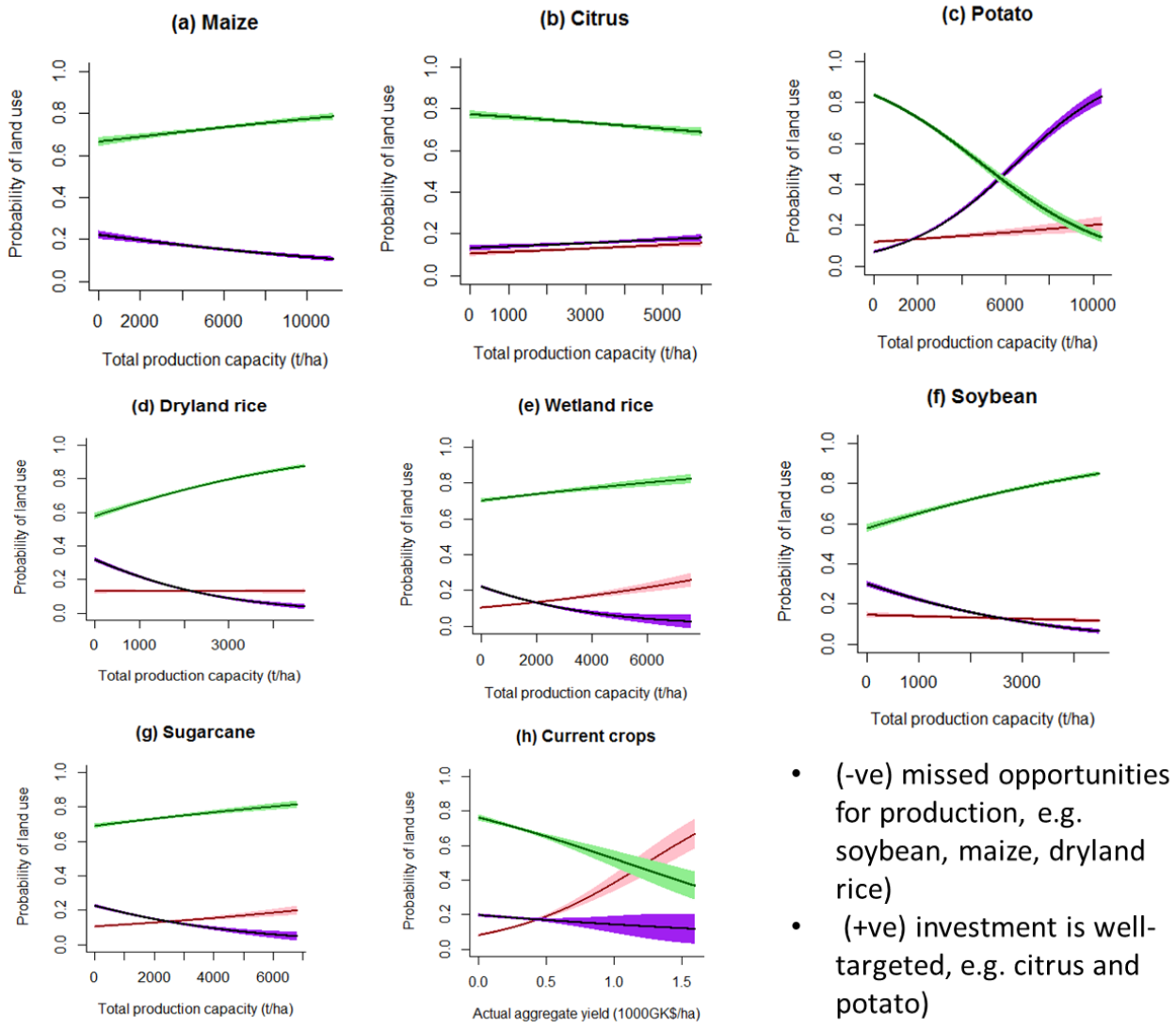


Figure 2: Relationship between land use classes and production capacity for crops targeted for major investment in Tanzania, where green line represents land with high potential biodiversity value (mostly intact vegetation), purple line represents land uses with medium biodiversity value (partially cultivated) and red line represents land with low biodiversity value (cleared and built up land uses). For high biodiversity value land (green), a negative relationship means that the intact vegetation is more likely to occur in places with low potential production yield (with low chance of conflict, e.g. citrus and potato), whereas a positive relationship means that achieving high crop yields is likely to occur on intact land (possible conflict between human and wildlife needs, e.g. maize, rice, soybean, sugarcane).

Q2: How well does the existing reserve network protect key biodiversity features and water quality?

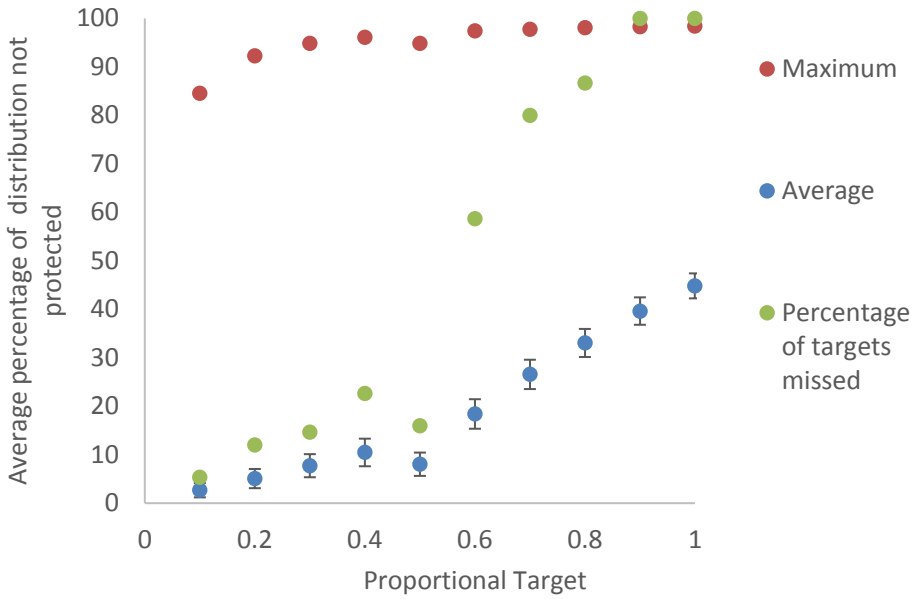


Figure 3. Relationship between target for biodiversity feature representativeness and the ability of existing protected area network in southern Tanzania to adequately protect 74 biodiversity features.

The current protected area network protects approximately 30% of the land within the ABCG study area. How well does this protect biodiversity in the region? If setting a low proportional target of 20% of biodiversity feature distributions, the protected area network meets the target for 90% of features (see grey dots in Figure 3). Increasing targets to 60% of distributions represented in protected areas results in 60% of features not being adequately protected by the existing protected area network.

Q2b: How much investment is needed to improve the effectiveness of protection?

This analysis explored how future change in ecoguard investment in protected areas could protect 13 focal species from illegal hunting by contributing to improved management (more rangers, better equipment such as aircraft). Scenarios of increasing investment within national parks using different allocations of fixed versus variable patrol effort show high returns for all biodiversity features. Increasing protected area investment increases management effectiveness and reduces the shortfall in biodiversity distributions saved (Figure 4) to a point; a threshold in the average effectiveness of management, with investments >$100 million not associated with increased management effectiveness or improvement in feature representation was identified.

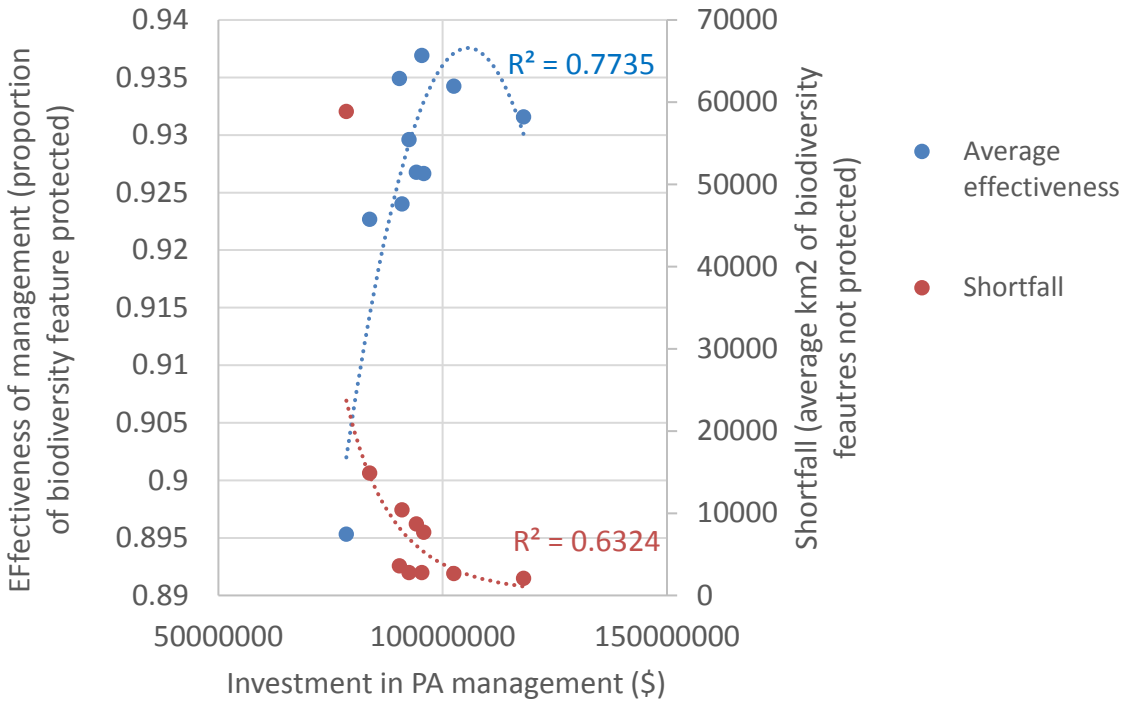


Figure 4b. Relationship between investment in protected area management and average effectiveness of management for 74 biodiversity features.

Q3: How do scenarios that increase agricultural production whilst addressing resource and conservation conflicts associated with agriculture change conservation priorities?

Three scenarios that resulted in different amounts of area allocated to alternative land uses as followed were created: (S1) Baseline scenario of agricultural growth based on SAGCOT objectives and ignoring risk of drought, (S2) Triple agricultural growth but ignore risk of drought, (S3) Account for risk of drought in agricultural growth based on SAGCOT objectives. (Figure 5). The three scenario resulted in different amounts of area allocated to alternative land uses.

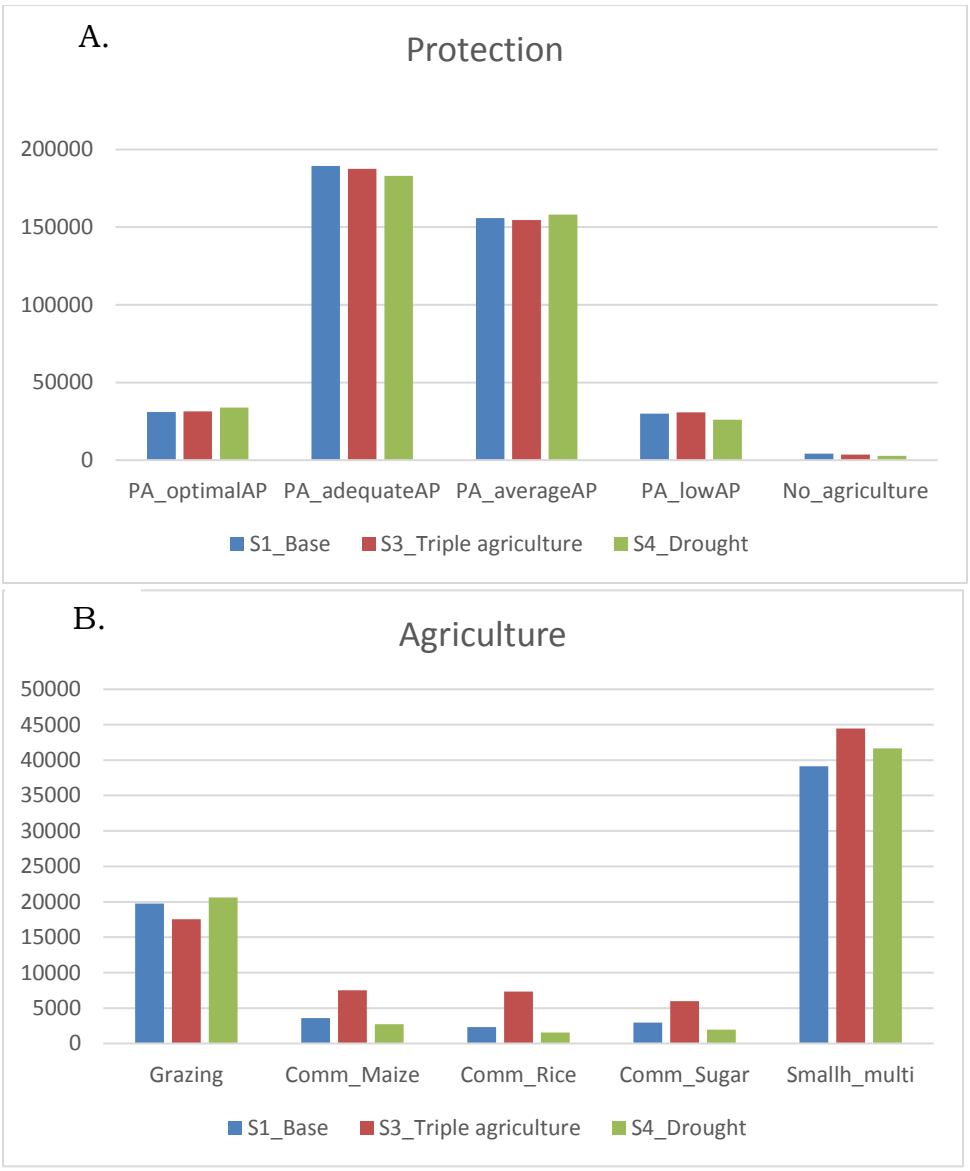


Figure 5. Results of land use prioritisations under three scenarios.

Hydrologic implications of projected land use change under a business as usual scenario vs. a Marxan scenario (Figure 6) was assessed. Here the proportional change of average river flow for each month obtained as a ratio of simulations based on Marxan land use scenario to projected land use. Results suggest a difference of up to ~15% during the wet season and 5% during the dry season with the Marxan scenario generating less run off/river flow than the projected land use. This outcome might be explained by the aggressive agricultural expansion involved in the Marxan scenario. Further, these results are based on two stations along the Great Ruaha River that drains one of the three basins included in the Marxan study area extent.

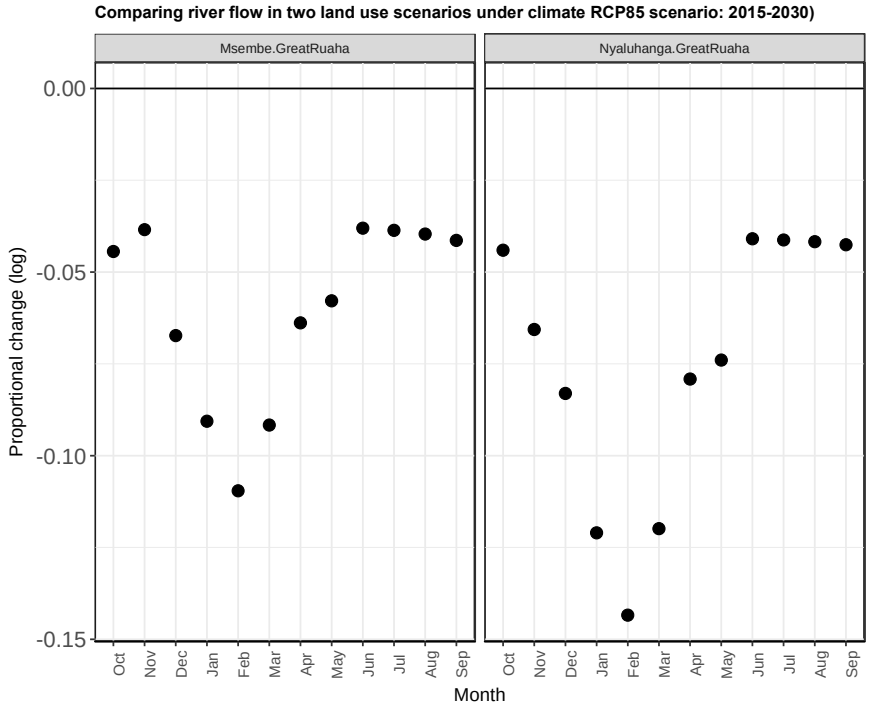


Figure 6. Proportional change of average river flow for each month obtained as a ratio of simulations based on Marxan land use scenarios to projected land use for (a) a baseline scenario of SAGCOT investment in alternative crops (scenario 3), (b) a future scenario of tripling investment in cropping (scenario 4) and (c) a scenario of SAGCOT investment in alternative crops that avoid drought-prone areas (scenario 5). Y axis is the logarithm of the ratio of Marxan land management to projected land use. Therefore, it could be interpreted as % change by multiplying change values by 10.

Summary Findings

The major findings from the Marxan scenarios are summarized below:

- Protected area investment in patrol effort can be done in way that maximises coverage of vulnerable species while targeting key species at-risk areas.
- Increased agricultural investment can reduce conflict with biodiversity whilst ensuring increased economic yields.
- Future risk of drought could erase these yields if investment is only focused on commercial crops (e.g. maize, rice). Investment in smallholders is important to ensure yields under possible future drought conditions. Pastoralism is also particularly vulnerable to drought.
- Agricultural expansion will likely result in decreased water flows in the wet season; more work needed, however, to confirm this.

Participants posed many questions about the results and implications. Much of the next steps discussion emphasized SAGCOT and the NLUPC as key stakeholders. Potential collaborations emerged from the discussions as the workshop closed.

Issues Emerging From the Discussion and Way Forward

The following are issues that emerged during discussion and the way forward:

a. Land Use Planning is an important tool to strike a balance among different land uses and bringing all sectors together in land use management.
b. There has to be a comprehensive mechanism in Tanzania for implementing, monitoring and evaluating land use plans as recommended in the guidelines. Most of the time, participatory village land use planning efforts culminate in paper plans (stage four). There is a need to advance more villages through to implementation of village land administration and village land use management (stages five and six).
c. Need for upgrading land use planning into zonal/regional level to address cross-sectoral priorities and shared resources. The regional or zonal plans focus on conservation or utilization of major land resources e.g. lake basins, river basins, major wetlands, transportation corridors and coastal areas. Normally these are resources, which transcend the boundaries of two, or more districts/regions.
d. Inclusive land use planning. Wide community involvement in land use planning is essential to promote a more open and transparent process.
e. Increase awareness and capacity building to the planning authorities and community at large. Participatory land use planning process has to include strengthening of local level decision-making through institutional capacity building at the district and village levels. Participatory land use management teams should be established and trained as part of the process to better manage land, and deal with land use problems.
f. District Land Use Planning Authority should have a sufficient budget for effective land use planning and management. Local Government Areas (LGAs) should be facilitated to realise the need of using integrated participatory land use planning as a tool for land allocation for sectoral uses, so that respective sectors can embark on land management with confidence. Thus, they should budget for integrated participatory land use planning and management as an entry point for natural resources management and sustainable socio-economic development.
g. Participatory land use planning ensures land tenure security, and that the rights to resource access of pastoralists, agro-pastoralists and crop farmers are negotiated and protected.
h. The government should enhance collaboration with stakeholders and development partners to support integrated land use planning process.
i. A land use data management system should be established to house the input data and scenario model outputs presented at the workshop.
j. Enhancement of land use planning systems including GIS capacity at the regional and district levels would, in tandem with the data management system, enable planning agencies to formulate, implement, and assess the impact of plans more effectively.
k. Climate smart landscapes. This landscape approach is essential to finding common solutions across the core sectors of agriculture, forestry, energy and water, supporting food and nutrition security, ecosystem conservation and poverty reduction. It also enables a deeper understanding

of the impacts of climate change, as well as the necessary responses needed at multiples levels of intervention. Evaluation of the impact of water balance future climate change in scenario modelling was an identified as an objective in workshop 1 but there were insufficient resources to explore it.

l. More analysis is needed on different land uses to extrapolate the impacts over certain years.

Potential Next Steps for Project

The NLUPC invited AWF to work with them to incorporate recommendations from the scenario analyses to guide land use planning in the region. The collaboration could involve

- AWF technical support to help NLUPC streamline uptake of case study findings at district to village scales;
- Effort to address NLUPC technical capacity constraints in plan development and implementation.

Given AWF's experience, presence, and ongoing programs, the Kilombero region would be a likely place to pilot collaboration. That collaboration could also benefit from the PBL/EcoAgricultural process findings and related multi-stakeholder platform.

By streamlining uptake of the case study recommendations and bolstering NLUPC technical capacity, the collaboration could make NLUPC land use planning and implementation with other stakeholders in the region (e.g. Southern Tanzania Elephant Program and Jane Goodall Institute) more impactful and sustainable.

Concluding Remarks

The two-day workshop was concluded with reflection that public-private partnership aims to further develop the Tanzania agricultural sector through agribusiness investments in the country's southern corridor; and agricultural production is expected to triple in the next 20 years. However, such an increase risks negative ecological impacts in the region such as biodiversity loss, invasive species, increased water scarcity that could in turn pose significant economic and social costs. This scenario-based conservation planning exercise reveals means to strike a more effective balance between agricultural development and other land uses to address conservation and ecological concerns, uplift livelihoods, and cater to a more sustainable future for Tanzania.


Objectives by 2030

Scenario based planning for a sustainable future in Southwestern Tanzania
July 17-18, 2018 Edema Conference Center and Hotel; Morogoro, Tanzania

Meeting Goal:

Outline a vision for a more sustainable future for South-western Tanzania using findings from a scenario-based modelling approach.

Workshop Objectives

- Reach a common understanding of the planning framework, process, and project
- Review the questions/objectives stakeholders agreed on in the Mbeya 2017 workshop to guide scenario model construction.
- Review key datasets compiled to create the scenario models.
- Assess scenario planning models, interpret results, and use them to develop strategies towards a more sustainable future.
- Discuss how to implement strategies in terms of influencing other processes (e.g. SAGCOT), stakeholder identification, communications to engage them, and likely challenges.
- Assess unanswered questions and potential pathways to addressing them.

Agenda

Day 1

Hour	Theme	Responsible
09:00	Arrival and registration of partcpants	Damas Mbaga
09:30	Welcome Message	DG
09:45	Participant introduction	John Salehe
10:00	Project introduction	David Williams
10:30	Break	
11:00	Overview of initiatives for land use planning in Western Tanzania	NLUPC
11:30	SAGCOT update	SAGCOT Participant

12:00	Kilombero Case Study	Pastory/David Williams
12:45	Group Photo	John Salehe
13:00	Lunch	
14:00	Session 1: Workshop 1 Review • Objectives • Systematic Conservation Planning Using Marxan • Planning Scenarios	David Williams
15:00	Session 2: Data inputs • Key data/analytical inputs driving scenario models	David Williams
15:45	Break	
16:15	Review of day 1/ look ahead to day 2	John Salehe
16:30	Conclude day 1	John Salehe

Day 2

Hour	Theme	Responsible
08:30	Recap day 1	John Salehe
09:00	Session 3: Scenario development & findings • Presentation of the scenarios • Group discussion on results and implications	Joseph Maina
10:30	Break	
11:00	Summary of the discussions • Basis for the strategy development/policy recommendations • Communication strategy to engage/convey findings to various audiences • What questions did we answer/not? Opportunities? • Challenges	NLUPC and all stakeholders
12:00	Links to other processes and next steps	NLUPC and all stakeholders
12:45	Workshop closure	John Salehe
13:00	Lunch	

Appendix 2: Participants

Name	Organization
Patrick Damas	AWF
Damas Masologo	Watershed Project
Erica Engstrom	AWF
Joseph Mgana	Kilombero DC
Linus E. Chuwa	Kilombero RAMSAR
Idris A. Msuya	RBWB
Vicky Mbofu	WCS/SHCP Mbeya
Pastor Magingi	AWF
Lucia Chacha	MLF
Venance	Regional Secretariat
Proches H. Msigula	SUA
Fadhili Njilima	AWF
Enock Sanga	VPO
Grace Chitanda	LRBWB-Mbeya
Peter Lorry	TNC
John Salehe	Nature Tanzania
Damas Mbaga	AWF
Amon Elias	IFDO
Simon Mosha	TFCG
Michael Nkonu	IUCN
Mmari William	TARI
Liz Felkar	TFD
Kasukura Nyamaka	SNV
John Banga Nakei	SAGCOT
Dr. Joseph Paul	NLUPC
Nakivona Rajabu	NLUPC
Hamza Kija	TAWIRI