

アフリカと日本の架け橋となる次世代の人材を育成する

国際獣医学・保全医学教育プログラム [IVCMEP]

～ザンビア - 北大の頭脳循環成果を基盤として～

International Veterinary and Conservation Medicine Education Program



保全医学に資する人材育成

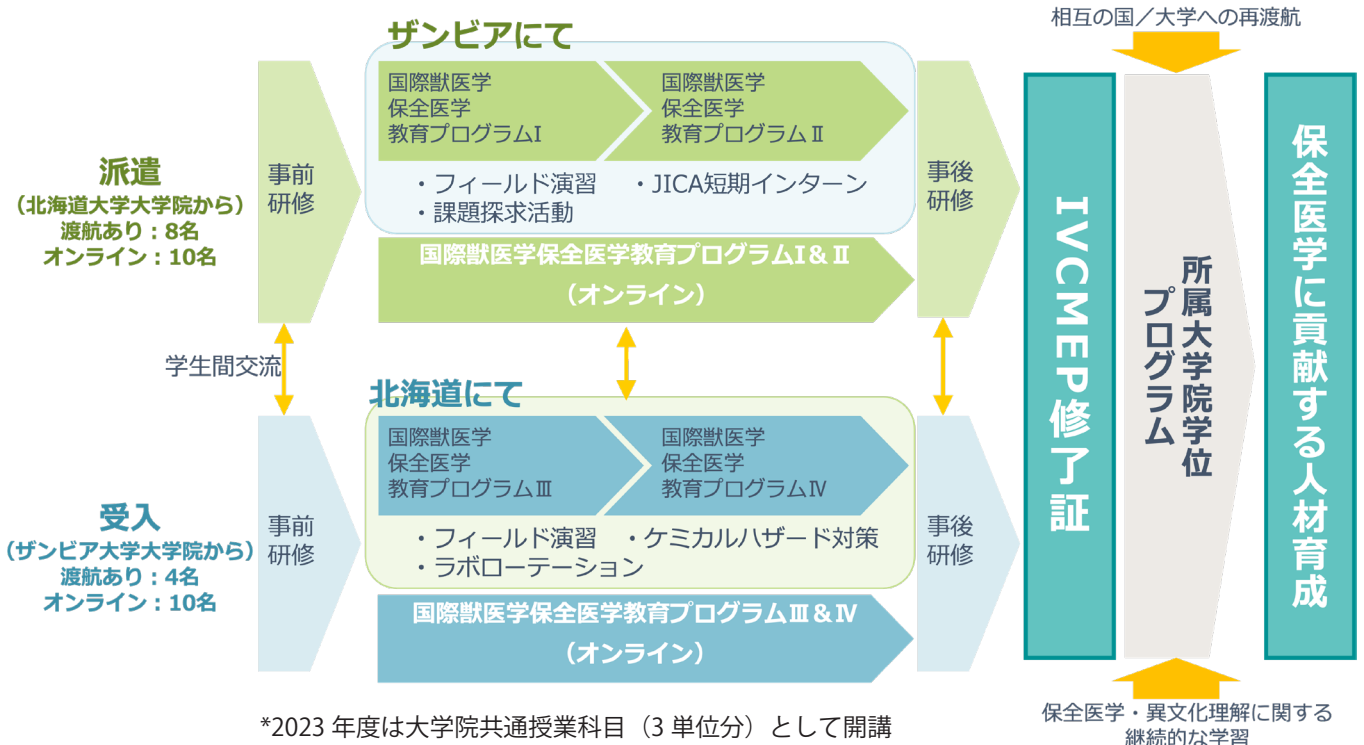
保全医学 (conservation medicine) の概念は 2000 年に入り急速に世界に広まった新しい学問分野です。人間の活動に伴う環境の変化とそれに付随する感染症や汚染物質による健康問題は世界的に解決しなければならない課題です。保全医学は、「健康」について、人間だけではなく、動物や生態系、社会、そして広くは地球全体の健康問題として捉える One Health の概念の下で進められます。保全医学の推進のためには医学、生態学、獣医学、工学、農学、経済学、地球科学、情報学、文学、人類学など、文系理系の枠を超えた多分野間の連携が必要です。IVCMEP では多分野の学生が参加できるようカリキュラムを構築し、北海道大学のどの学院／研究院からでも応募できます。

ザンビア大学との「知の循環」

IVCMEP はアフリカの中でもこれまで約 40 年間にわたって交流を続けてきたザンビア大学と連携したプログラムです。ザンビア大学には北海道大学で学位を取得したザンビア人教員が多く在籍しており、感染症や環境・資源分野など、保全医学に関して大学間で組織だった教育交流が可能となっています。本事業では、日本で育ったザンビア人教員や在学生、過年度の参加者が日本の大学院生を教育する頭脳循環のグッドプラクティスとなる取り組みを実施しています。



コースの構成



コンピテンシー評価

コンピテンシー評価とは、学習における到達目標の内容を詳細に定義した上で学習効果を評価するものです。コンピテンシーは日本語で行動特性と訳されることも多く、学生が各目標を達成した場合に表に現すことができる知識、技能、行動を具体的に示した到達度の評価指標として利用されます。従来の評価と比べ評価者の主観ではなく、具体的な行動とベースとした評価手法のため客観的で公正な評価に結びつきやすいことで近年注目を集めています。評価される学生側も「どのような行動特性を評価されたのか」「どの行動特性については、不十分だったのか」が理解できるため、結果としてモチベーションの向上にもつながります。今年度は① One Healthに関する知識 ② 異分野融合 ③ 異文化理解 ④ 課題解決能力 ⑤ 語学力の5つの観点ごとに5段階でコンピテンシーを設定した表(ルーブリック)を作成・運用しました。

2023年度ルーブリック

Level	S: Advanced	A: Sophisticated	B: Competent	C: Fair	D: Incompetent
Description	実際に保全医学に関する課題解決を行う能力を持っている	保全医学に関する知識を体系的に習得し、課題解決の方法を提案できる	保全医学に関する社会課題について複数の分野/ステークホルダーについて自分の専門分野の観点から説明できる	保全医学に関する特定の課題について自分の専門分野の観点から説明できる	保全医学の概念について理解し、保全医学の概念をほとんど持たない
1. One Healthに関する知識 1. Understanding of One Health	One Healthの概念と知識を専門家一般市民に説明でき、かつ保全医学に関する社会課題を推進することができる One Healthに関する知識を積極的に発信する	One Healthの概念と知識を自分の専門分野と結びつけて理解でき、自分の専門分野における課題や社会的な需要をOne Healthの文脈で捉える	One Healthの概念を理解し、異なる社会課題の事例を挙げる ある価値を創出した時に、One Healthとの関連を見出す	One Healthの概念について理解している One Healthに関する話題に関心がある	One Healthの概念や知識をほとんど持たない One Healthに関する話題に関心がない
2. 異分野融合 2. Interdisciplinary Sense	自分の専門と異なる分野の専門家とネットワークを構築し協働できる	自分の専門と異なる分野について情報や知識を集め、自らの課題解決に活用できる 自分の専門分野の課題が多分野のメンバーによってどのように捉えられているかを把握している	自分の専門と異なる複数の分野について情報を集め知識を整理することができる 異なるソースから得た情報について、それぞれの違いを認識し比較する	自分の専門と異なる分野について情報を集めることができる 自分の専門分野の課題について、複数の視点から情報を得る	専門外の分野について知識や情報を集めることができない 自分の専門分野にのみ関心がある
3. 異文化理解 3. Intercultural diversity and international attitude	異なる文化を持つ多様な立場の人々とネットワークを構築し協働できる	異なる文化を持つ多様な立場の人々と自分たちについて議論することができる 意見の違いに対し、価値を尊重し意見を共有しなかに協働する	異なる文化を持つ人々に自分の意見を円滑に伝え理解を求めることができる 意見の違いに対し、なぜその意見があるのかを理解し、自分のもとの意見があった理由を共有しなかに協働する	異なる文化を持つ人の意見を尊重することができる 自分と同じ属性のコミュニティにのみ属している	異なる文化を持つ人々を嫌うこと 自分と同じ属性のコミュニティにのみ属している
4. 課題解決能力 4. Problem-Solving Skills	自分の専門分野に関する社会課題の解決方法を提案し議論することができる 社会課題に対し自分の専門分野の観点から解決策を提案する	自分の専門分野に関する社会課題の解決方法を提案し議論することができる 社会課題に対し自分の専門分野の観点から解決策を提案する	自分の専門分野に関する社会課題を認識し原因や構造について深く考察し理解しようとする 社会課題の表面的な対策だけでなく、自分の行動や研究を複数の社会課題の中心位置に当てはめることができる	自分の専門分野に関する社会課題を認識し原因や構造について深く考察し理解しようとする 自分の行動や研究を複数の社会課題の中心位置に当てはめることができる	何が社会課題となっているのかを認識することができない 社会課題について関心がない
5. 語学力 5. Foreign Language	英語でOne Healthに関する社会課題の解決について多人数のグループで議論できる。	英語でOne Healthに関する社会課題の解決について多人数のグループで議論できる。	英語で自分の専門外のトピックについての説明や議論し、ディスカッションにより理解を深めることができる	英語で自分の専門分野について説明することができる	英語による日常的なコミュニケーションがとれない

IVCMED 名称とロゴについて

International Veterinary and Conservation Medicine Education Programの頭文字をとって“IVCMED”、読み方は“I’ve come up”です。北海道大学とザンビア大学との交流の中で育った人材がそれぞれ自国に戻り、互いの国の次の世代を導くという頭脳循環のコンセプトが込められています。ロゴは様々な分野が関わり合い地球全体の健康を考えるOne Healthの概念を表したものと、北海道大学とザンビア共和国の国旗のベースカラーとなる緑色でロゴを形どった2種類があります。

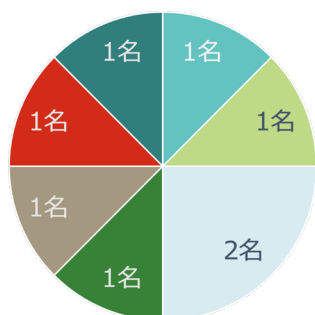


2023 年度実施概要

学生派遣

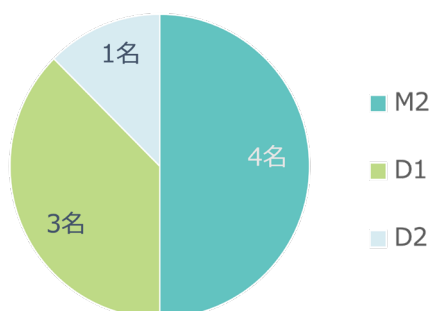
北海道大学参加学生人数：8 名

派遣学生所属別内訳



- 文学院
- 国際食資源学院
- 獣医学研究院
- 国際感染症学院
- 環境科学院
- 総合化学院
- 工学院

派遣学生学年別内訳



活動内容

事前学習

[6～7月]

- ・ アカデミックイングリッシュ
- ・ 海外リスクマネジメントセミナー
- ・ JICA ザンビア事務所オンラインセミナー
- ・ 課題探求活動企画／調整



ザンビア渡航

[8月18～9月4日]

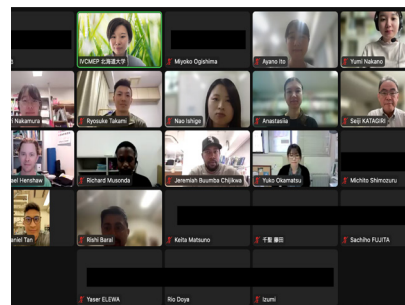
- ・ JICA ザンビア事務所
- ・ 重金属汚染環境修復サイト
- ・ 農業技術開発センター
- ・ Mosi-Oa-Tunya 国立公園
- ・ 課題探求活動 (SDA)



事後学習

[9～10月]

- ・ 活動報告会
(ザンビア大学とオンライン接続)
- ・ レポート作成



「課題探求活動 (Self-Designed Activity; SDA)」とは？

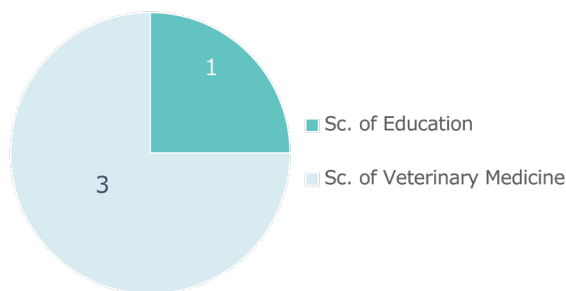
保全医学の実現には今まさに起きている**社会課題の抽出 / 解決能力と専門分野や文化を超えたコミュニケーション能力**が必須となります。そこで、滞在中の原則3日間はフリーデザインとし、学生が主体的に活動する期間としました。参加学生はまず、事前学習の一環として**各自の関心に沿って One Health/ 保全医学に関するテーマを設定**します。テーマは大学院の専攻内容に準じたものである必要はなく、卒業後のキャリアまで見据えた上でザンビア特有の課題を抽出し一人一人企画書を作成します。IVCMEP 事務局の仲介によりザンビア大学の研究者や JICA 職員、およびその関係団体にカウンターパートを依頼し、そのあとは学生が直接カウンターパートと活動内容や詳細なスケジュールの調整を行いました。実際にザンビアに渡航してからは、フリーデザインの日程でフィールド計測やインタビューなどをカウンターパートとともに実施し、帰国後にはプレゼンテーション形式の報告会の開催とレポートの作成を行いました。最終成果物となったレポートは本冊子にも掲載しています。



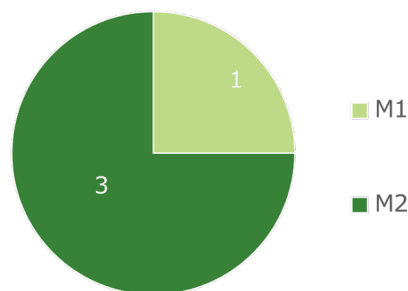
学生受入

ザンビア大学参加学生人数：4名

Students' affiliation



Academic year



活動内容

事前学習

[6～7月]

- ・ 日本文化と言語のオンライン学習
- ・ ラボローテーション企画

北海道渡航

[7月16～7月29日]

- ・ ケミカルハザード専門家講習
- ・ 豊羽鉱山フィールド演習
- ・ 知床生態系フィールド演習
- ・ ラボローテーション



事後学習

[9～10月]

- ・ 活動報告 / 交流会
- ・ レポート作成
- ・ ラボローテーション
フォローアップ



OUTLINE

- General guidance to this class
International Veterinary and Conservation Medicine Education Program to foster the next generation of human resources to bridge between Africa and Japan: Japanese culture
- Japanese culture & society
- Quick language training

オンライン受講

参加学生人数：14名

開講内容

ケミカルハザード対策、感染症対策、環境修復など幅広いラインナップから3授業分（1コースあたり8科目相当）を学生自ら選択しオンデマンド形式にて受講しました。受講後に講師とオンライン会議システムで質疑応答などを行う Student Interactive Session が開催され、1対1での活発なディスカッションが交わされました。

【 Example of the classes 】

- Chemical Hazard Control
 - ・ Field Toxicology & Risk Analysis
 - ・ Chemical Analyses
 - ・ Comprehensive Studies on Chemical Hazard Control
 - ・ Environmental Remediation and Diagnostic Techniques
 - ・ GIS and satellite remote sensing
 - ・ Informatics
- Mechanism, Assessment and Remediation of Environmental Pollution
- Advanced and Comprehensive Studies on Zoonosis Control
- Advanced Seminar on Conservation Medicine

次のページより派遣学生の訪問先及び課題探求活動のレポートを掲載しています
受入学生のレポートは逆開きの英語版をご覧ください

参加者による訪問先レポート

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- Kabwe 環境修繕事業 p.9
- GART 農業開発トラスト p.9
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- Mosi-Oa-Tunya 国立公園 p.12
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在ザンビア日本国大使館

Embassy of Japan in the Republic of Zambia

2023年8月21日

国際食資源学院 M2 石毛奈緒

Graduate School of Global Food Resources M2

Nao ISHIGE

Background

We visited a Japanese embassy as our first activity in Zambia on the 21st of August. We were welcomed kindly by the Ambassador, H.E. Mr. Takeuchi, and discussed the inspiration from Zambia. Even though He arrived in December last year in Zambia, the points of view of see relationship with Japan were remarkable. This page is the summary of what we discussed with him about Zambia.

The beacon of hope in Africa

This word is from the message of the Ambassador on the website of the Japanese embassy to show Zambia. According to history, Zambia has been one of the relatively stable countries in Africa because there has been no civil war since the colonial era of Great Britain. When we passed out a road to go to a lodge from the airport, there was a big gate with the slogan "One Zambia, One Nation". It was given by the first president of Zambia, Kenneth Kaunda. It is said that there are 73 languages and more tribes. So, the multiracial nation makes this a unique situation.

When we discussed the impression of Zambian according to our stay, many of us mentioned "kindness" and "hospitality". The Ambassador agreed and he added

that the cultural similarity with Japanese in terms of our style to go with the slow. One of the coordinators of IVCMEP mentioned her insight to Zambians that they are good at finding the customs and following them. I felt this kind of custom gives Zambia a peaceful atmosphere.

Japanese in Zambia

Next year, 2024, will mark the 60th anniversary of the establishment of diplomatic relations between Zambia and Japan. The main part of the cooperation is engaged by JICA, and the projects of various fields help the development of capacity building.

For example, the veterinary in UNZA was one of the projects from the Japanese ODA. Before the independence of African countries, the system of the license of veterinary followed suzerain. Therefore, it was necessary to develop an education hub to support livestock management, and the relationship between the University of Zambia and Hokkaido University is valuable to establish the baseline of Zambian livestock production. Because of the success of the cooperation, "Zambeef" became one of the leading meat companies in Africa.

The other presence of Japan in Zambia is the industrial section. When we see vehicles on the road, there must be Japanese Logos like Toyota, Suzuki, etc. I was surprised when I saw some buses with Japanese like "〇〇幼稚園 (〇〇 kindergarten)", and "老人ホーム (facilities for the aged)". Actually, the market size of used cars in Africa has doubled in this decade, and the population explosion must accelerate the demands.



Fig.1 Reused Japanese car as a public bus

On the other hand, we discussed the presence of China. Recently, the population of China has been getting higher, and we can see many buildings and factories in Lusaka. Of course, collaboration must be necessary with other countries.

Future Vision of Zambia

When we talk about the economy in Zambia, there is no doubt that copper is the key. On the other hand, this situation is a so-called “resource curse” in economic words. After independence, the management of copper was the most important social issue, and the economic state was highly dependent on the world market (the world recession in the 1980s, the plan for the revolution of copper export in the 1990s, and the high demand for resources in the 2000s).

The ambassador pointed out that the Zambian government is always trying to see new ways of developing and he wants to work on the promotion of tourism for Japan. Though the consciousness of Africa from a business aspect is getting high, the Japanese interest in tourism is still low. During our stay in Zambia, we visited some national parks and enjoyed the game safari tour. Moreover, Victoria Falls is one of the most famous tourist sites, and it is a resource the tourism. However, the reasons why Zambia is not a popular site for vacation are the distance and lack of information. I strongly felt the possibility of the demand for the wild nature of Africa, and it will be a nice chance to see the possibility.

[Reference]

1. 在ザンビア日本国大使館 HP https://www.zm.emb-japan.go.jp/itprtop_ja/index.html (2023/10/2)
2. 島田周平・大山修一編著 (2020) ザンビアを知るための55章, 明石書店

JICA ザンビア事務所

JICA Zambia Office

2023年8月21日～22日

国際食資源学院 M2 石毛奈緒

Graduate School of Global Food Resources M2

Nao ISHIGE

Background

Japan International Cooperation Agency (JICA) is an independent administrative agency that works on human security and quality growth in developing regions from various fields. In Zambia, the first project of JICA started in 1970, and the kickstart was the volunteer program of Judo. Then, the technical support program was started in

1987, and the relationship is continuing. The total number of volunteers (JOCV) was over 1600 (in 2020), and 13 main projects are in progress now.

We visited a JICA office on the 21st of August and had a briefing about “what is international cooperation” from the head officer Mr. Yonebayashi, and we discussed the future of Zambia. One of the impressive things in his opinion was about chance and luck. As I mentioned on the Japanese embassy’s part, the presence of Japan is limited in Zambia because of the budget of ODA. It is decreasing due to the Japanese governmental policy, but he mentioned that general business change can happen in time. For example, the usage of smartphones in Zambia is increasing dramatically. Therefore, if Japanese companies realized the future demand, there would be a chance of a high presence not only of cars. Of course, there is a risk, but investment is a thing like that. Therefore, the capacity building by the international corporation JICA can be a support to find the new chance for interactive benefits. In this report, I picked up some projects which we learned.

National KAIZEN Project (Phase2)

“KAIZEN” is JICA’s worldwide program to enhance the quality and productivity control capacity. One of the engines to pushed the Japanese economic growth was the engineering technology with high speed after the WW II . The word “KAIZEN” shows not only the techniques to archive such a development but also the independence, creativity, and education style. Therefore, this project is an outcome of the proud “Made in Japan” style, and many other countries are interested in such knowledge. Zambia is one of the countries to follow this concept and utilized it for two projects. One is the planning of the classes and the other is the support for private sectors. A national staff mentioned that the KAIZEN program worked well to cheer the worker’s motivation and enhancement to get a master’s and Ph.D.

The other good point of this project is that the goal is infinite. If someone gives money or resources just to raise the income, it can work for a short time. However, the “KAIZEN” project is different from such support because JICA doesn’t give them money but knowledge and experience.

Assistant for the former refugees

Zambia is one of the politically safe countries in Africa, and there are many refugees from other regions like Angola, etc. However, the support from the United Nations is limited because of the international definition

of “refugee”, and JICA is now doing a support program for the former refugees who don’t have the certification of refugee anymore. First, I thought that this project seemed like NGOs or NPO. However, the project is run by national staff in the JICA Zambia office and she is proud of working on protecting humanity and peace building. I learned that JICA is working not only on technical support but also society.

Clean-up project in Lusaka

On the 22nd of August, we visited a project site and saw the situation of the dumping site and garbage collecting management. The common reasons for the bad management system of garbage in developing regions are below.

1. Insufficient budget and system of garbage management service
2. Informal sector’s activity like scavengers at dumping sites
3. Risk for infection disease due to harmful waste

According to the governmental policy, 80% of the garbage can be collected and transported to the proper site by 2030. Due to this project, the Lusaka city office established a “Lusaka Integrated Solid Waste Management Company (LISWMC)” to manage the garbage around the government

When we crossed the road in Lusaka (Not only Lusaka but other cities as well), the scattered trash beside the road made my feelings uncomfortable because of the smell and the scenery. JICA is now supporting to building of the basic capacity to manage the projects, and the first monitoring phase was completed and is now in the second phase.



Fig1. the project site in Chunga land fill

We were explained by a local staff who is engaging in managing dumping sites. We learned that the environmental damage to surrounding areas like

contaminated water and air, then the lives of scavengers. I asked her about the proximity of the housing site to the Chunga landfill. She pointed out the other social issues about illegal states because of the rapidly increasing population, especially in Lusaka. Originally, it was illegal to build the residents around the landfill due to the negative effect on the people’s health. However, it is now ignored because of the lack of land, and there is no conflict between the landfill and the residents.

In the future, we can’t miss the improvement of this situation; otherwise, the environmental damage can be a more crucial issue conclusion. Personally, the site visit made me mixed feelings. I’ve read and seen about the people who live with income from the government. However, it was the first time to visited the real site, and I was amazed at the situation there and the lives there. During our stay in Zambia, normally we didn’t separate garbage because of the single hole in the trash box. However, I felt that kind of daily habitat is the possibility to educate the people and raise awareness of waste management. In the future, I’m planning to be a professional engineer of agriculture to solve the issues in developing regions. Therefore, I felt the necessity of professional insight to tackle the problems, and the knowledge and experience are necessary to build my capacity as well.

[References]

1. ザンビア国ルサカ市きれいな街プロジェクト (https://www2.jica.go.jp/ja/announce/pdf/20220706_225275_1_01.pdf) Last view 2023/10/05
2. 島田 周平・大山 修一 編著 (2020) ザンビアを知るための 55 章, 明石書店
3. JICA ザンビア事業概要 (https://www.jica.go.jp/Resource/zambia/ku57pq0000046g2k-att/business_summary.pdf) Last view 2023/10/9

Kabwe 鉱山跡

Black Mountain, Kabwe

2023年8月23日

工学院 D1 中野佑美

Faculty of Engineering D1 Yumi NAKANO

Sable Zinc is strategically positioned approximately 2 kilometers south of the central hub of Kabwe in the Republic of Zambia’s central province, and about 150 kilometers north of Lusaka, stands as a pivotal copper and cobalt processing facility. Established to handle the concentrated output from Ruashi and various other ore suppliers, Sable Zinc Kabwe boasts a sulfuric acid plant

dedicated to fulfilling its operational requirements. Notably, any excess production is channeled to meet the needs of other producers in the Zambian Copperbelt, and the Democratic Republic of the Congo engaged in oxide copper production.

The Kabwe mine, a cornerstone of Zambia's mining legacy, has been in continuous development for over seven decades, evolving into one of the nation's largest copper mining entities. While its historical contributions to economic growth are undeniable, the encompassing region has garnered global attention for being among the most environmentally compromised areas, courtesy of soil contamination stemming from residual heavy metals.

As the demand for copper experiences an upswing in Zambia, propelled by burgeoning markets in China and India, a paradoxical trend has emerged – a decline in the country's overall copper production. This anomaly serves as a catalyst for a nuanced exploration of the trajectory of the copper industry, a linchpin in Zambia's economic framework. It also prompts a comparative analysis, scrutinizing the disparities between Zambia and its neighboring African countries with analogous social structures, unraveling the intricacies of their respective copper sectors. In essence, this situation presents a unique opportunity to delve into the complexities of Zambia's copper industry and its distinctive positioning amidst regional counterparts, shedding light on the dynamic interplay of economic forces and market dynamics.



Kabwe 精錬施設

Metal industry in Kabwe

2023年8月24日

総合化学院 M2 高見亮佑

Graduate School of Chemistry and Engineering M2

Ryosuke TAKAMI

Introduction

We visited Jubilee Metal Group which is located in

Kabwe Zambia. Kabwe is one of the copper-rich cities and supports the inductors of Zambia. Copper is now used in all over the world because it has some features; highly ductile semi- precious, high thermal and electrical conductivity, and excellent corrosion. Copper is used for electricity transmission and distribution.

This metal group get this Sable refinery system from Glencore in 2019 and the capacity of producing Copper Cathode is 14,000 tones per year. Copper Cathode means Raw copper sheet product with a purity of 99.96% or higher with a rough surface refined by electrolysis (cathodic deposition). The company, Jubilee is now setting a target to expand its access to refining capacity, to achieve a targeted 25,000 tons of copper units per year. They are now working on following projects mainly.



Fig.1 View of copper refinery at Kabwe

Project Roan

This project is a new concentrator processing both ROM copper ore and tailings to produce copper concentration for refining at Sable and this production is 10,000 tones per year. Hence, they have done this project and made their copper production efficient.

Project Lechwe

This project is a copper refinery using electric refining and 150 million tons of copper containing surface tailings has been secured. Project Lechwe targets to reach a production level of 7500 copper units per annum at a dedicated newly constructed copper concentrator for further refining at the targeted Northern Refinery at Kitwe



Fig2-1,2. Learning and friendship

Kabwe 市での環境修繕事業 Zambia Mining and Environmental Remediation and Improvement Project (ZMERIP), Kabwe

2023年8月24日

工学院 D1 中野佑美

Faculty of Engineering D1 Yumi NAKANO

The ZMERIP aims to strengthen the capacity of national and state level institutions, improved enforcement for pollution prevention and address the environmental health impacts associated with poor mining practices. The overall objective of the project is to reduce environmental health risks to the local population associated with the mining sector in critically polluted areas in Kabwe and Copperbelt provinces through improved capacity of the key institutions.

The overarching goal of this initiative is to effectively mitigate the environmental health hazards faced by the indigenous populace residing in the Kabwe and Copperbelt provinces, emanating from the mining sector's adverse impact in areas characterized by critical pollution. This formidable objective is envisaged to be realized through the enhancement of the operational capabilities of pivotal institutions.

The multifaceted strategy to attain these objectives encompasses various key components, prominently including the meticulous remediation and rehabilitation of sites contaminated by mining activities. Additionally, a pivotal facet of the approach involves fortifying the regulatory framework and augmenting the monitoring and institutional prowess of crucial entities such as the Ministry of Mines and Minerals Development, Zambia Environmental Management Agency (ZEMA), Mines Safety Department (MSD), Radiation Protection Agency (RPA), and Municipal Councils.

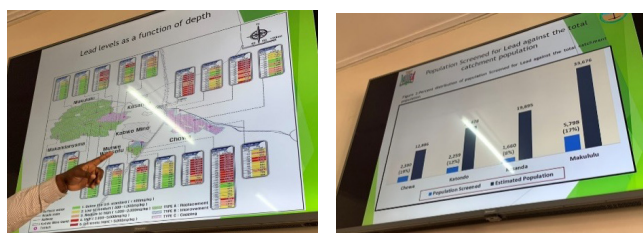


Fig.1 (left)Lead levels as function of depth

Fig.2 (right)Population screened for lead

Furthermore, the holistic vision extends beyond mere regulatory measures, extending a proactive hand towards the amelioration of local socio-economic dynamics. This

encompasses a concerted effort to enhance job prospects within the affected communities, with a particular emphasis on fostering opportunities for women and segments within the mining-polluted regions. In essence, the comprehensive strategy aspires not only to rectify environmental imbalances but also to catalyze positive socio-economic transformations at the grassroots level.

GART 農業開発トラスト Golden Valley Agriculture Trust

2022年8月24日

国際感染症学院 D1 紀田泉

Graduate school of Infectious Diseases D1 Izumi KIDA

Introduction

The Golden Valley Agricultural Research Trust (GART) was created in 1993 as a Public Private Sector Partnership between the Government of the Republic of Zambia and the Farmers of Zambia through the Zambia National Farmers Union (ZNFU). It consists of two core science and technology programs; Research and Development of Climate-Smart Conservation Agriculture Technologies, and Research and Development of Smallholder Livestock Systems. They conduct Applied and Adaptive Research, Contract Research, Technology Dissemination, and Commercial Production and Smart Marketing. The aim at conducting public trials is to provide solutions to the challenges that farmers face.

Agriculture

They produce a wide variety of plants, including not only crops like maize and wheat but also fruits like dwarf mangoes and oranges, as well as trees like moringa. Dwarf mangoes are cost-effective because of their fast growth and quick fruit production.



Fig.1 Wheat



Fig.2 Dwarf mangoes

They have also developed a method for cultivating mushrooms, which are typically harvested during the rainy season, to increase farmers' income in the dry season.

There are several farm animals, chickens, pigs, and aquatic animals. In chicken farm, they have several varieties of

chickens to crossbreed and create F1 which has high growth performance, feed efficiency and egg production by natural selection. Also, they verified the effective minimum dose of vaccine such as Newcastle disease to reduce the cost. In the aquatic farm, there are several ponds for growing and nursery. The pig farm was located near the ponds because their excreta can increase phytoplankton production in the ponds which are natural foods for the fish. Instead of pigs, chickens can also be used because some people don't consume pork for religious reasons. They measured factors like water pH and create guidelines for water change frequency, providing instructions to the farmers.



Fig.3 Mushroom



Fig.4 Ponds for aquatic culture with chicken farm

When the water quality in the ponds become worse, it is drained into an independent sedimentation pond. This drained water contains a lot of nutrients hence they use it to irrigate a vegetable garden. By providing nutrient rich water, it also helps in conserving fertilizers for the fields. This system is highly cost-effective and sustainable, with minimal waste.



Fig.5 Piggery located near the ponds to collect excreta

In veterinary school in Japan, we don't have the opportunity to learn about aquatic animals, so I was very impressed to discover the collaboration between agriculture and farm animals including aquatic animals, and their sustainable strategies. Furthermore, I would like to visit farmers who accept their strategies and to know how it works on site.

Livingstone 概略

Introduction of Livingstone Area

2023年8月27日～9月1日

文学院 M2 伊藤彩乃

Graduate School of Humanities and Human Sciences M2

Ayano ITO

Introduction

The group of us had a three-day trip to Livingstone from August 28th to August 29th. Additionally, for my Self-Design Activity (SDA), I stayed on extra days from August 30th to September 1st, totaling six days. In this report, I will offer an overview and share my thoughts on the town of Livingstone.

Livingstone

(1) About Livingstone

Livingstone, situated in southern Zambia, is approximately a 6 to 7-hour drive from the nation's capital, Lusaka. The town was founded in 1905 and holds historical significance as it was named after the renowned Victorian-era British missionary and explorer, Dr. David Livingstone. In 1911, Livingstone was designated as the capital of Northern Rhodesia, which was the former name of Zambia during the British colonial era. However, in 1935, the capital was moved to Lusaka.

In Livingstone, there is a national park named Mosi-Oa-Tunya National Park, which translates to "the smoke that thunders" in the local language. It ranks as the second smallest among Zambia's 20 national parks, covering an area of 66 square kilometers. What sets it apart is its close proximity to the borders of three neighboring countries: Namibia, Botswana, and Zimbabwe.

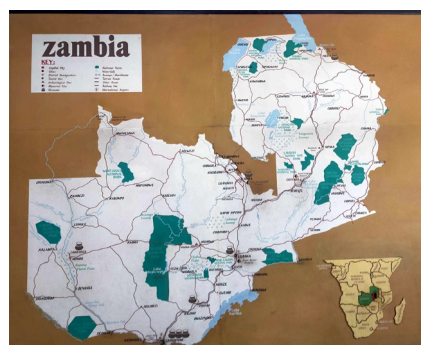


Fig.1 The map of Zambia (taken in the Livingstone Museum)

Due to the presence of a national park, Livingstone is a unique area where the proximity between wildlife and people is exceptionally close. This is also because there is no buffer zone between Mosi-Oa-Tunya National Park and the communities where local residents live. In fact, during

our stay, we witnessed several occasions when wild animals such as elephants, zebras, and hippos appeared in areas where people reside. I would like to share one particularly memorable episode.



Fig.2 Elephants crossing the railway. During the one-month period leading up to our stay, three people were killed by elephants

(2) A hippo in the hotel

During the first two days of our arrival in Livingstone, we stayed at Chrismar Hotels, located just in front of the gate of Mosi-Oa-Tunya National Park. I'd like to share a surprising incident related to the proximity between wildlife and people that occurred here.



Fig.3 The fence separating the hotel and the national park. You can see the hotel faces the national park.

On the second morning of our hotel stay, my friend and I decided to do some wildlife observation before breakfast since the hotel was adjacent to the national park. We strolled within the hotel premises toward the boundary fence with the national park. It was during this walk while realizing that we had forgotten our binoculars and were about to return to our room, that an unexpected event took place. As we were casually conversing and walking, suddenly, we heard shouts from behind. Startled, we turned around to see a person near a building diagonally behind us, shouting at something moving. We gazed attentively, trying to understand what was happening. To

our surprise, a large hippopotamus had entered the hotel premises. The hippo confidently walked through the hotel grounds, then exited the hotel and disappeared.

I still remember the feeling of fear and being frozen in place, partly because hippos are considered the world's most dangerous animals. The fact that such a "dangerous" creature was casually strolling through the accommodations where tourists stay was shocking enough. However, what astonished us even more was that the hotel cleaning staff who were present at the same location as us seemed unperturbed as they calmly observed the hippo. When we asked one of the cleaning staff members about this, they explained that the hippo we saw in the morning is a daily visitor to the hotel's premises, and it's something they are used to, so they don't think much of it.



Fig.4 A hippo leisurely strolling within the hotel grounds

(3) Reflecting on Human-Wildlife Relations in Livingstone: Insights from the Hippo Incursion Incident on Hotel Grounds

According to the hotel cleaning staff, this hippo was a daily visitor to the hotel premises. However, there were no warnings or notices from the hotel regarding this matter. Considering the potential danger and the risk of encounters between uninformed tourists and the hippo, it was a situation where accidents could have occurred due to people unintentionally getting too close. Therefore, I believe the hotel should have undertaken some risk management in this regard. In fact, during our stay, I heard there was an incident where tourists approached elephants too closely, and a potential accident was narrowly avoided.

Staying in Livingstone, I couldn't help but think of Shiretoko. Shiretoko is also known for its proximity between wildlife and humans, especially with brown bears. In Shiretoko, there are explanatory signs in various facilities that provide information about how to maintain

a safe distance from brown bears and the issues related to feeding them. In Livingstone, I believe it's becoming increasingly important not only for the safety of tourists but also for the local residents and wildlife to educate visitors about how to interact with wildlife and maintain a proper distance.



Fig.5 Upon arriving at our destination in Livingstone, we were greeted by a herd of elephants. In front of us, there was a wildlife ranger's office and a bustling road, too

Mosi-Oa-Tunya 国立公園 Mosi-Oa-Tunya National Park

2023年8月27日～28日
獣医学研究院 D2 アナスタシアコウヴァ
Graduate School of Veterinary Medicine D2
Anastasiia KOVBA

Introduction

During our three-day visit to Mosi-oa-Tunya National Park, we had the opportunity to explore its unique attributes and challenges. After traveling from Lusaka to Livingstone, we were introduced to Mr. Chikanya, the principal ranger of the park, who provided us with valuable insights into its history and current management practices.

Park Origins and Location

Mosi-oa-Tunya National Park was a zoological garden before being transformed into a national park. This transformation explains its proximity to Lusaka city and the absence of a buffer zone. Additionally, the park's location near the borders of Namibia, Botswana, and Zimbabwe allows wildlife to move freely between these countries, particularly between Zimbabwe and Zambia. Also, a few ancient wildlife migration routes lay through the Livingstone town area and Mosi-oa-Tunya National Park resulting in the rich abundance of wild animals and notable presence of elephants during the dry months. These geographical features pose significant challenges

for park management, particularly in preventing poaching and mitigating human-wildlife conflicts.



Fig.1 Wildlife abundance in the Mosi-oa-Tunya National Park
Poaching Prevention

Given the park's relatively small size of 23.4 km², poachers seldom use firearms and instead opt for snares. Park rangers are tasked with patrolling the territory and regularly removing these snares, often collaborating with staff from non-governmental organizations (NGOs). The rangers are also actively involved in law enforcement and the capture of poachers, relying on information provided by local residents and by conducting an active investigations.



Fig.2 White rhinos in Mosi-oa-Tunya National Park



Fig.3 Rangers protect the rhinos and other wildlife 24 hours a day

A critical role of the rangers in Mosi-oa-Tunya is the conservation of White Rhinos. White Rhinos were once locally extinct in Zambia, prompting the reintroduction of

a few individuals into Mosi-oo-Tunya. The park now plays a pivotal role in rhino conservation, serving as a breeding ground for rhinos.

Consequently, rangers provide constant protection to all rhinos within the park.

Human-Wildlife Conflicts

The park has witnessed an increase in human-wildlife conflicts, primarily due to the growing elephant population. Elephants, which are present in Livingstone for several months each year, frequently cause damage to crops and sometimes lead to confrontations resulting in human fatalities.

Other animals, including hippopotamuses, zebras, giraffes, crocodiles, and baboons, also contribute to conflicts that are challenging to control. Despite these challenges, local residents maintain a positive attitude towards wildlife protection and do not hold the animals responsible for the conflicts. However, they do suffer the consequences in the absence of governmental support after crop damage or loss of life.

Mosi-oo-Tunya National Park boasts numerous unique features that make it an intriguing place to study wildlife conservation and management strategies.



Fig.4 Elephants coming close to the Mosi-oo-Tunya managers' office

Mukuni 村

Mukuni Village Community

2023年8月28日

獣医学研究院 D1 中村汐里

Graduate School of Veterinary Medicine D1

Shiori NAKAMURA

Introduction

On August 28, our second day in Livingstone, we visited Mukuni village. The village has more than 7,000 human residents and is located 9.6 km southeast of Livingstone. In

addition, the village was founded in the 13th century. Many traditional houses like the one in the photo below were built in the village. Mr. Brave showed us around a part of the village. In this section, I would like to present three aspects of the human-wildlife conflict, health care, and economic situation in Mukuni Village.



*Fig.1(left) A house made from natural materials
Fig.2 (right) Market in the village*

Human-wildlife conflict

In this village, elephants, buffaloes, and baboons have conflicts with humans although there is no damage from hippos because the river is far away. In particular, elephants are the most dangerous. They destroy crops and even kill humans. Actually, one woman had died two weeks just before our visit. The striking story was that when someone was killed, the emotions weren't channeled into hatred towards uncontrollable animals, but rather, they primarily focused on the profound sadness directed at the individual who lost their life. Countermeasures for elephants are challenging. It is financially difficult to enclose fields with electric fences, etc. Therefore, when elephants come, people notify everyone, make noise to drive them away, and contact national park staff.

Health care

Several buildings of medical facilities were clustered in the village. We were able to hear about health care from Miss. Brenda, a nurse there. The most problematic disease in this village is AIDS. There are 640 HIV-infected people in this village. Especially a British NGO is assisting in the health care of this village.

In addition to maternity assistance, all woman who are pregnant and wish to use these facilities have to agree to be tested for HIV and will receive education on how to prevent mother to child transmission. Also, in case of a positive result, medication will be provided. Here, pregnancy is considered a woman's responsibility, and it is common for women to take responsibility for family planning and ask men to wear condoms. Other common illnesses include tuberculosis and hypertension. In response to the Covid-19 pandemic, symptomatic treatment was provided, and information about

prevention measures was disseminated.



Fig.3 and 4 Medical facilities

Economic situation

The soil is relatively infertile and wildlife damages crops, so they cannot rely on agriculture. Therefore, they have shifted their focus to tourism. The men in the village create intricate crafts and sell them on the market. This becomes their primary source of income. Mukuni Village has transformed into a popular tourist destination, offering visitors a chance to experience the local culture and purchase intricate wood carvings or crafts and so on.

Conclusion

I had the opportunity to walk through the village and witness the way of life there during my visit. Even in the limited time I spent, I could see that there are many challenges in agriculture and healthcare. Additionally, there is an issue with education accessibility due to a shortage of schools, often located far away. While there is already NGO support in the healthcare sector, it seems that international assistance will continue to be crucial in many aspects. Furthermore, I strongly felt that it is important not only to provide temporary economic aid, but also to spread knowledge of disease prevention and encourage the residents to take continuous action. Finally, we express our deep gratitude to Mr. Brave and Miss. Brenda, as well as to all those who warmly welcomed us and took the time to teach us various aspects of the village.



Fig.5 One of the places where wood carvings were made

ヴィクトリアの滝 Victoria Falls

2023年8月29日

環境科学院 M2 今川知美

Graduate School of Environmental Science M2

Satomi IMAGAWA

Basic information

Victoria Falls lies on the international boundary of Zambia and Zimbabwe between the towns of Livingstone and Victoria Falls. The width is estimated to be around 1,700m and the height is about 100m. The upper stream is relatively loose but the downer site is rapid and this flow is eroding the george like zig-zag shape.

The local name "Mosi-oa-tunya" means "smoke that thunders" in Lozi. The waterfall is located at a 1,300m point from the origin of the Zambezi River which has a total of 2,740km. The peak flow in April is 500 million liters per minute; in November, when it is lowest, it's about one tenth of the peak season. During the rainy season, a stream of water covering the entire surface of the cliff can be seen, and it is known as the largest curtain of waterfalls in the world. The water falls at a speed of 150km/h, entraining the air around the gorge, and downdrafts are generated. In ordinary waterfalls, the water fall wind descends and spreads, but in Victoria Falls, because it's located in a rift in the earth, it bounces off the cliff opposite the falls and turns into an updraft, creating the plum of water. These gorges continue along the river below a distance of about 150 km. Today, the Zambezi River originates in the highlands of northwestern Zambia and flows eastward, following the borders of Zambia and Zimbabwe before emptying into the Indian Ocean at Mozambique.



Fig.1 Zig-zag shaped gorge of the Falls

Reputation

Historically the waterfall was discovered by the British

explorer Dr. David Livingstone and he named the falls after the queen's name in 1855. The name has remained pervasive after the colony's liberation, partly because of its international marketing significance and partly because Zambians hold him in high esteem for his work against slave oppression in Central Africa. In 1989, it was registered as a World Natural Heritage by UNESCO. The site's unique combination of social and natural features were evaluated. The geological features formed by changes in the location of the falls over geological time scales are also focused on. For its provision of rare habitats for the ecosystems, and for the discovery of weapons, ornaments, and mining tools that indicate the presence of an ancient civilization. Especially for the upstream is a spectacular series of riverine islands formed by ongoing geological and geomorphological processes. The land is characterized by banded basalt, Kalahari sandstone, and chalcedony from ancient lava flows, from which 3-million-year-old *Homo habilis* stone tools, Middle Stone Age stone tools, and Late Stone Age weapons, ornaments, and digging tools that indicate hunter-gatherer occupation have been recovered.



Fig.2 Islands being seen upstream of the falls

Geological features and their formation

0.2 million years ago, the first waterfall was formed. The place was 8km lower than today. The main geology is the basalt rock which is originally from the volcanic eruption. The African continent was formed 180 million years ago. During the era, many cracks were formed by the cooldown and flood basalt erupted. As the magma cooled, it cracked and opened countless fissures. After that, the basalt land sank to the bottom of the lake once, so the dead organisms and mud accumulated in the cracks. Then the land rose again. The sediments accumulated in the cracks were transformed into limestone and sandstone. A river that formed next to the land changed its course 2.5 million years ago and began to flow across

the land (Zambezi River). The river preferentially eroded sedimentary and limestone rocks that dissolve easily in water, finally forming the first waterfall 200,000 years ago.

Biological importance

There are many creatures that live using the water from the river Zambezi. It's also famous that the waterfalls make the habitat for the migration birds and for some endangered species. According to the guide, the birds try to fly into the waterfalls to catch the water insects in the dry season. Rock Pratincole, a small brownish bird with longish wings extending beyond its tail and noticeable white collar on the back of its neck is one example. And by the humidity of the waterfalls, the rainforest is seen inside of the waterfalls' splash zone. They enable the birds to capture food, so over 500 species of birds inhabit the area. One of the most common species is Red-winged starling birds (*Onychognathus morio*).



Fig.3 *Onychognathus morio*(wikimedia)

For the fish, there are similar kinds of species found around waterfalls as well Zambezi River. Many fish can be seen around the Zambezi River, including Zambezi bream and tilapia, but fishing is prohibited during the Breeding season. It's also said that some fish use the steps of the waterfall to migrate upstream.

Vegetation

Vegetation in this region is loosely defined as a "Mixed Deciduous Woodland" which reflects the relatively dry climate of this area. The main trees are hardly species such as the white syringa (*Kirkia acuminata*); the remarkable large-leafed star-chestnut (*Sterculia quinqueloba*) with its tall, ghostly-white and straight tree trunks; and various corkwood (*Commiphora*) species. The sparse woodlands give way to denser, mixed Combretum woodland on the mid-slopes which in turn grade into near pure stands of open mopane woodland woodland (*Colophospermum mopane*) with tall perennial grasses along the valley floors. This distinct downslope difference reflects the presence of deeper clay-rich soils and greater water

retention on the basal slopes.

Relationships with Human Life

For humans, waterfalls provide water not only for domestic use but also for power generation. In Zambia, hydroelectric power generation accounts for about 90% of the country's electricity. And 72% of Zambia's electricity generation is supported by hydropower from the Zambezi River.



Fig.4 Victoria Falls Bridge

In addition to serving agriculture and fisheries, this water also serves as a tourist resource as the land is scenic.

Tourism started after 1876 and arrivals were boosted in 1904 when the first trains were able to reach. The Victoria Falls Bridge, which connects the two countries, has long been used for trade. The bridge was built in 1905 and it's as much more than a means of the World Heritage Site as are the trees of the RainForest.

Beliefs of Nyaminyami

Around the Zambezi river, some local people believe Nyaminyami. His head is thought to be a fish, covered from the neck down with serpent scales, and is sometimes worshiped as a dragon god or a snake god. It's thought of as the gold which is the guardian deity. So, residents prayed for a good harvest and no disasters for a long time. In 1960, Kariba Dam which lies over the Kariba gorge from Lake Kariba; one of the World's largest man-made lakes, was constructed. After that, they thought the male Nyaminyami is living in the upper stream of the dam, while the female one is living downstream of the dam.

[Reference]

Rob Burrett & Clare Mateke. *Shongwe: The RICH HERITAGE OF LIVINGSTONE AND VICTORIA FALLS*, Khami Press, 2018, 160p.



ゾウの糞から食性を学ぶ [Mosi-Oa Tunya 国立公園, リビングストーン]

課題探求活動 (SDA) レポート

参加学生が事前学習で作成した initial proposal (企画書) と事後学習で作成した実施報告書を合わせて掲載しています (一部抜粋)

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Effects of COVID-19 lockdown and its lifting on the wildlife conservation efforts and wildlife perception in Zambia

獣医学研究院 D2 アナスタシアコウヴァ

Initial Proposal / 企画書

1) Activities theme/title

Effects of COVID-19 lockdown and its lifting on the wildlife conservation efforts and wildlife perception in Zambia

2) Background

I have studied Veterinary Medicine in the Undergraduate degree and Virology in Masters. Now I continue combining my knowledge to investigate infectious diseases transmission between humans and wildlife. In collaboration with researchers from Hokkaido University and International Institute for Zoonosis Control, the National Institute for Environmental Studies, local government, and businesses, I am conducting research on zoonotic infectious diseases, including COVID-19, in urban wildlife in Hokkaido.

COVID-19 transmission to wildlife may cause the risk of virus circulation in wildlife, and for this reason I conduct my current research. However, infectious diseases spread may have an indirect effect on the wild animal health and conservation. The lockdown due to COVID-19 had the tremendous effects on wildlife conservation in Africa (Lindsey et al. 2020). Still, it remains unclear how the lockdown lifting of COVID-19 restrictions can affect conservation efforts restoration and how does the local people perceive the interaction and coexistence with the wildlife. As a student conducting research on COVID-19 in wildlife in Japan, I believe that the research on COVID-19 effects on wildlife in Zambia will greatly contribute to my current research activities and enhance my

knowledge of infectious diseases effects on wildlife and conservation.

3) Specific targets and goals of the research

The specific targets can be divided into 3 groups:

1. Investigate lockdown effect on the wildlife conservation efforts in National parks in Zambia (increase/decrease of poaching, wild animals intrusion in the buffer zones, number of staff before and during the lockdown, change in the number of visitors)
2. Lockdown lifting effects and conservation efforts restoration (changes in number of visitors and staff compare to before and during the lockdown, poaching, strategies to prevent the loss in conservation efforts for the next big epidemic/pandemic)
3. Changes in perceptions of the wildlife and infectious diseases (whether people are more/less prone to interact with wildlife, awareness of the infectious diseases transmission routes, perception of wild animals approaching the human living areas)

4) Means to achieve the goals above

The research will be conducted by the following means:

1. Interview with National Park staff and local people living in the areas close to National Parks (buffer zones)
2. Interview with the researchers in the University of Zambia
3. Collection of the data on the poaching events and wildlife intrusion (local government, researchers, media or directly from the National Parks)
4. Review of the data available online on the overall trends of the conservation efforts after COVID-19 lockdown lifting in various parts of the world

5) Necessary resources, facilities and preparation

1. Prepare the interview questions beforehand
2. Send the questionnaires to the University of Zambia for preliminary check and approval
3. Contact in advance the staff in the National Parks of choice and receive approval for the interview and data collection
4. Expenses for the National Parks visits (entry pay, hotel stay)

5. Expenses for writing materials, questionnaires copies

実施後報告書

Introduction

The COVID-19 pandemic has had tremendous effects on human livelihood and health across the globe, especially in the vulnerable communities of low income countries. Despite the expectations, the restriction lifting did not lead to complete and speedy recovery from the pandemic. The pandemic also had damaged the wildlife conservation efforts in Africa, as highlighted by Lindsey et al. (2020). However, the impact of the pandemic varies across countries. Although some reports are present, it remains to be elucidated how the pandemic affected wildlife conservation and local population health and livelihood in Zambia.

As in many countries, in Zambia, the tourism industry was heavily affected by the COVID-19 lock down (Fig.1).

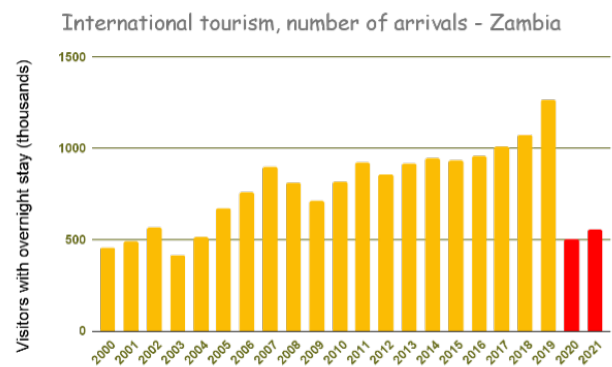


Fig.1 International tourism decline in Zambia at the beginning of COVID-19 (Data source- World Bank Data)

This raised concern of the decline in wildlife conservation efforts across the country. Fortunately, Zambia government recognized that wildlife conservation, especially law enforcement as an essential service, so the conservation of wildlife continued during COVID-19, but financial support decreased, forcing the National parks to look for support from international NGOs. With the lifting of COVID-19 restrictions, it is crucial to assess the extent to which conservation efforts have been strengthened and how local perceptions of wildlife and infectious diseases have changed.

I aimed to investigate the effects of COVID-19 on conservation efforts in Zambia, including changes following the lifting of lockdown measures, remaining challenges, and the local population's perception of wildlife and zoonotic diseases.

The research activities involved data collection in Mosi-oa-Tunya National Park, both before and after the lifting of COVID-19 travel restrictions. Interviews with National Park rangers and local people to understand the challenges they faced during and after the lockdown.

During these activities I faced many difficulties, such as difficulty to assemble an official data and recruit participants. Despite those challenges, I received an opportunity to speak to some of the local people and observe their lifestyle, learn about conservation and law enforcement strategies, deepened my understanding of the challenges faced by the wildlife conservation managers, especially importance of mitigating the human-wildlife conflicts.

COVID-19 effects on wildlife conservation in Mosi-oa-Tunya National Park

As no official data were available, I spoke to the principal ranger of Mosi-oa-Tunya National Park to get some image of the conservation efforts and wildlife protection in the park. Below I add the overall trend of the poaching in the park before, during and after the pandemic.

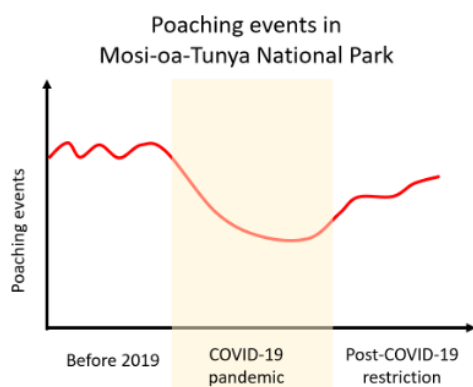


Fig.2 Poaching events in Mosi-oa-Tunya National Park

Interestingly, opposite to the expectations, poaching did not increase, but rather decreased during the pandemic, which may be caused by the difficulty to detect the poaching during the pandemic restrictions, but more probably caused by the lockdown of the international transportation (causing difficulty in bushmeat and ivory transportations) and increased financial support from NGOs that resulted in increased efforts for wildlife protection in the park during the pandemic.

COVID-19 effects on wildlife perception and livelihood in Zambia

The interviews included 20 questions on the effects of COVID-19 and restriction liftings. During two days of SDA activities, I interviewed 6 people in total: 2 rangers in Mosi-oa-Tunya National Park, 2 local guides and 2 drivers.

All respondents were 30-50 years old males.

The results can be summarized in the next points:

- All participants knew how the infection spread and one of them experienced the COVID-19 disease
- All participants felt stress and anxiety during pandemic, as well as worry about their families
- Most of them suffered financially, had to search for different income sources, although the situation was better in participants with governmental jobs
- There were no much difficulties in accessing healthcare, although it was difficult to reach a doctor, when the respiratory infection signs were present
- All believed that COVID-19 originated in lab and most of them did not feel any concern about infectious diseases spread from wildlife, while they do worry about future pandemic risk
- Most of them were satisfied with the government response to COVID-19 and support they received (education, sanitization, masks etc.)
- Some of participants were vaccinated, some not, but all of them were concerned about side effects

Although only few people were interviewed, from the communication with them I learned that locals seem to believe in the artificial nature of COVID-19 and do not think that the wildlife is dangerous to them, although some of them did worry that wild animals such as bats and primates may transfer the virus causing COVID-19 to the villages. All participants were heavily affected emotionally and financially by the pandemic restrictions, they worry about future pandemics and other disasters that may occur, so they try to prepare for such events by implementing cautiousness to spending and maintaining sanitation habits they acquired during COVID-19.

COVID-19 restriction lifting effects on wildlife perception and livelihood in Zambia



Fig.3 Interview with a local guide

During the interview I also inquired about the restriction lifting and the summary of results is next:

- Mostly participants were satisfied with the timing for restriction lifting
- The life improved after lockdown lifting in all participants, but it is not yet back to pre-COVID-19 state
- Most participants did not feel any changes in the human-wildlife interactions after restriction lifting, while some mentioned an increase fear of some animal species (primates, bats, dogs)
- Tourism activities increased after lock-down and most of the local people seems to not worry about COVID-19 spread, although the tourism did not recover completely yet

The restriction lifting greatly improved the lives and livelihood of local people, but the tourism activities did not yet recover, which is caused not by the fear of wildlife, but rather the overall economically difficult situation in countries from which tourists used to come.

Summary

Due to the limited time and resources I spoke to only



Fig.4 Close elephant encounter in Mosi-oa-Tunya National Park

a few local residents, but despite this limitation, the interview was conducted with the open-end questions, giving participants the opportunity to share their opinions freely. All of the participants mentioned that they learned from pandemic the importance of savings and disaster preparedness, as well as the importance of hygiene and sanitization.

It was a great opportunity for me to learn about local people lifestyle, their experience of the pandemic and conservation of wildlife in Zambia.

Acknowledgments

I would like to thank IVCMEP office for management and

preparation of the program, for research support from Prof. Kon and my counterpart in Zambia without whose supported this SDA would not be possible. I also want to express my gratitude to the WISE office, DX Fellowship and my laboratory for their continuous support of my research and extracurricular activities.

[References]

1. Lindsey P, Allan J, et al. *Conserving Africa's wildlife and wildlands through the COVID-19 crisis and beyond.* *Nat Ecol Evol.* 2020;4(10):1300-1310.
2. Buxton RT, Bergman JN, et al. *Three lessons conservation science can learn from the COVID-19 pandemic.* *Conserv Biol.* 2020;34(6):1331-1332.
3. Manda S. *Inside Zambia's 'new normal': COVID-19 policy responses and implications for peri-urban food security and livelihoods [published online ahead of print, 2022 Nov 28].* *J Int Dev.* 2022;10.1002/jid.3720.
4. WWF <https://www.worldwildlife.org/magazine/issues/fall-2022/articles/an-online-tool-charts-the-recovery-of-africa-s-tourism-from-the-pandemic>
5. World Bank Data <https://data.worldbank.org/indicator/ST.INT.ARVL?locations=ZM>

Conservation and Management of Hippopotamuses in Zambia

獣医学研究院 D1 中村汐里

Initial Proposal / 企画書

1) Activities theme/title

Conservation and Management of Hippopotamuses in Zambia

2) Background

I decided to participate in this program because I wanted to acquire an international perspective on conservation medicine and learn in depth about wildlife management, which differs from country to country. Since elementary school, I have wanted to be involved in wildlife conservation and management with a global approach in mind, and in high school I actively participated in nature-related field training. At university, I belonged to the Laboratory of Wildlife Biology and Medicine in the Faculty of Veterinary Medicine, which emphasizes conservation medicine, and I experienced many approaches to wildlife that are unique to the field of veterinary medicine. I have also gained experience in full-scale field research, and have acquired a wide range of skills necessary for practical wildlife research. However, I have never had the opportunity to actually go abroad. Therefore, I would like to learn about the conservation and management of wildlife in Zambia, where many wild animals inhabit, as well as the local situation. Through

this, I hope to gain the ability to implement better wildlife conservation and management in Japan and the world, and ultimately, to apply this knowledge to One Health.

In my undergraduate thesis research, I developed a novel age estimation method based on DNA methylation of blood in brown bears, and my main topic in the PhD program is the elucidation of the ecology of bears using epigenetics. Although the themes are different from those of the activities conducted in this program, they share the same aspiration to contribute to wildlife conservation and management. Indeed, age information is very important for wildlife ecological research and conservation and management.

I am interested in learning about conservation and management of hippopotamuses in Zambia. I chose this animal as a target because it shares similarities with bears, which I have worked with for a long time in my university career, in that it is considered an animal that should be protected but also has conflicts with local people and needs to be managed. Hippos are an important member of the African riparian ecosystem, but they are also dangerous animals that cause human accidents and are sometimes culled because of the damage they cause to crops. Learning management methods for hippos in Zambia, a treasure trove of wildlife, and comparing them with management for bears and other animals in Japan, will broaden my knowledge and may lead to new approaches of management that can be applied and coordinated beyond national borders.

3) Specific targets and goals of the research

1. Conflicts between hippos and people

Hippos are sometimes responsible for agricultural damage and pose a risk of personal injury. I would like to ask how the hippopotamus has actually harmed people, how people feel about hippopotamus, and what policies people hope the government will implement.

2. Culling of hippos

The Zambian government made a decision in 2016 to cull up to 2,000 hippos over a 5-year period in Luangwa Valley. The Department of National Parks and Wildlife (DNPW) had approved this to prevent the future spread of anthrax among wild animals. This decision likely generated a range of

opinions both in favor and against it. I would like to understand how a consensus was reached on this matter and the subsequent implementation of the measures.

Additionally, while the population dynamics of hippos in Luangwa have been studied, I was unable to find available data on their abundance in other rivers, such as the Zambezi River. Hippos are known to inhabit Mosi-oa-Tunya National Park and Lower Zambezi National Park along the Zambezi River. It would be valuable to know how these hippos are managed and whether any monitoring or other research is being conducted.

3. Conservation of hippos

In recent years, I have heard that hippos, like elephants, are sometimes poached for their tusks. Also, anthrax caused mass deaths in 2011. I would like to know what measures should be taken to protect hippos.

4. Translocation

Although translocation may not be done very often with hippos, this section is one of the things I would like to implement if possible.

In Japan, when it comes to managing wild animal populations, the primary approaches used to increase their numbers involve protecting them within their natural habitats or in conservation centers and zoos located both within and outside their habitats. On the other hand, population reduction is often achieved through culling. I would like to know why the translocation method is used, and how animals is followed to adapt to the new location and how the problem of genetic disturbance is dealt with, with a view to the possibility of implementing such a method in Japan.

4) Means to achieve the goals above

1. Conflicts between hippos and people

I will conduct interviews with citizens who live close to hippos and have suffered damage to their crops.

2. Culling of hippos and 3. Conservation of hippos

I am planning to observe the approaches taken in areas with abundant hippopotamus populations, such as the Lunsemfwa and Zambezi Rivers, regarding their management through culling

or protection. Specifically, I am interested in gathering insights from researchers who specialize in studying hippos in Zambia, such as Dr. Chansa Chomba, as well as members of local conservation and management organizations. I am keen to learn about their experiences and hear their perspectives on policies concerning hippos.

4. Translocation

I will conduct interviews with local ecologists and wildlife conservancies. If possible, I would like to visit translocation sites.

5) Necessary resources, facilities and preparation

I am planning to read articles and papers about hippos in Zambia to gain an understanding of their current situation. Based on that, I will create content for interviews with both citizens and researchers. Furthermore, I will reach out to potential interviewees in advance to schedule appointments and obtain permission to visit the management site of the hippos.

実施後報告書

Changes from the initial proposal

Before going to Zambia, I had planned to focus my studies on the conservation and management of wildlife, especially hippos. Initially, I was considering Dr. Chansa Chomba, who had authored many research papers on hippos in Zambia, as a counterpart.

The IVCMEP staff, including Ms. Doya and Ms. Ogishima, recommended and contacted Prof. Musso Munyene of the University of Zambia (hereafter UNZA) as a counterpart, along with Dr. Chomba, a specialist in hippos whom I had mentioned in my initial proposal. As a result, it was decided shortly before the trip that I would be under the care of Dr. Musso, and I began communicating on August 14th. Then, on the evening of August 20, it was decided that we could meet in person the next morning.

However, a significant issue arose at this point. On the night of the 20th, I suddenly fell ill. Due to the severity of my condition, I had no choice but to cancel the meeting. Furthermore, as a result of testing, it was determined that I had infected with Covid-19. From that point until August 25th, I had to stay in a hotel to recuperate.

After recovering, I once again contacted Dr. Musso, but the next problem emerged. It became clear on August 26th that he would be unavailable until September 1st due to field surveys and meetings. While the SDA dates were set for August 30 to September 1, it appeared

that there were no other ecology or wildlife biologists available in Lusaka. Despite Ms. Doya's efforts to find a replacement, we were unable to locate anyone else we could rely on. Therefore, I realized the need for significant revisions to the SDA plan. On the evening before the start of SDA, I decided to conduct a survey at UNZA to gauge the general attitudes of the people of Zambia towards wildlife as a whole, rather than solely focusing on hippos.

On August 30, the first day of the SDA, I conducted the questionnaire survey with the support of Mr. Madalitso Tembo, whom Ms. Ogishima introduced to me. He was one of last year's IVCMEP participants. Additionally, I received assistance from Ms. Thadze, Ms. Sehera, and Ms. Vital, who are students in the School of Veterinary Medicine. Thanks to their cooperation, I was able to have many students on the university campus respond to the survey. Furthermore, on the same evening, I had the opportunity to listen to Dr. Musso speak online. I was able to hear many valuable insights, including measures against hippos and zoonosis that have become a concern in Zambia.

On August 31st, I managed to arrange to visit Maambo's village for a talk. This was made possible because Ms. Doya and Ms. Ogishima reached out to Mr. Maambo Bhagoos, a participant of last year's IVCMEP, for their collaboration. This village is Mr. Maambo's hometown, and it was frequently affected by hippos due to its proximity to a river. Additionally, the village engaged in farming and livestock operations, leading to conflicts with other wild animals. Consequently, it provided a valuable opportunity to hear the villagers' stories from a unique perspective, distinct from that of university students.

Thus, there were significant changes from the initially anticipated activities in the SDA. However, I was able to address the topic of human-wildlife conflict, which is of personal interest to me. From this experience, I deeply realized the importance of building connections with people in international activities. Since I didn't have acquaintances in Zambia, I was greatly assisted by the network that the IVCMEP staff had cultivated. I believe that if I had friends or connections in my research field in Zambia, I could have planned my research more proactively. Additionally, when collaborating with individuals overseas, I learned that it is crucial to be less concerned about Japanese customs and conventions, and instead, actively initiate communication. I found that, if possible, making phone calls rather than relying on emails

or text messages is valuable.

Questionnaire about wildlife and people's feeling

In this section, I will report the findings from the questionnaire survey.

1. Implementation sites

University of Zambia (UNZA): It consists of 13 faculties (Agricultural Sciences, Education, Engineering, Graduate School of Business, Health Sciences, Humanities and Social Sciences, Law, Medicine, Mines, Natural Sciences, Nursing Sciences, Public Health, Veterinary Medicine).

Maambo's village: It is a village headed by Mr. Maambo's father. Residents grow maize, sugarcane, beans, cotton, sunflower, and so on, and keep cattle, goats, chickens, Nile tilapia. Kafue river is located nearby, and some farmers had been harmed by the hippos.



Fig.1(left) University of Zambia
Fig.2 (right) Maambo's Village

2. Methods

The questionnaire was administered orally. I prepared sheets of paper containing questions and answer choices and asked the participants to respond to 10 questions. Basically, the participants were instructed to choose their answers from the provided choices, and depending on the situation, I further explored their responses with additional questions.



Fig.3 Conducting the questionnaire at Maambo's village

3. Results and Findings

Participants at UNZA (male: 22, female: 18) were mostly university students, with the majority being in their 20s, particularly from the veterinary medicine department. In the village, I had the opportunity to converse with six farmers (all male) spanning a diverse age range from their

20s to 60s.

Questions	
Q1. How old are you?	Q7. Have you ever experienced harm caused by wildlife? 1. Never 2. Once 3. 2 or 3 times 4. More than 3 times 5. Not sure
Q2. Are you male or female?	Q8. If yes, please specify the type of harm. 1. Bodily injury 2. Crop damage 3. Intrusion into property (home, etc.) 4. Livestock damage 5. Traffic disruption 6. Others
Q3. How interested are you in wildlife? 1. Very interested 2. Interested 3. Somewhat interested 4. No opinion 5. Not interested 6. Not interested at all	Q9. Do you believe the government should take more measures to address conflicts with wild animals? 1. Strongly agree 2. Agree somewhat 3. Neither agree nor disagree 4. Disagree somewhat 5. Strongly disagree
Q4. Do you believe wildlife conservation is important? 1. Very important 2. Moderately important 3. Slightly important 4. Not important at all 5. Conflicted Animals	Q10. If you agree, what measures do you think should be taken? 1. Compensation for damages 2. Financial support for preventative measures 3. Training for handling conflicts 4. Human resource development for conflict control 5. Extermination and capture of problem animals 6. Crackdown on illegal hunting
Q5. Which animals do you believe experience the most conflicts with humans? 1. Elephants 2. Hippos 3. Rhinos 4. Buffalos 5. Baboons 6. Crocodiles 7. Hyenas 8. Others	
Q6. How do you perceive wildlife? 1. Tourism assets 2. Food resources 3. Potential harm to humans 4. No particular thoughts 5. Desire to coexist 6. Others	

※For Q5, 6, 8 and 10, multiple choices are possible, but no special note such as "multiple choice" is given.

Fig.4 Question contents

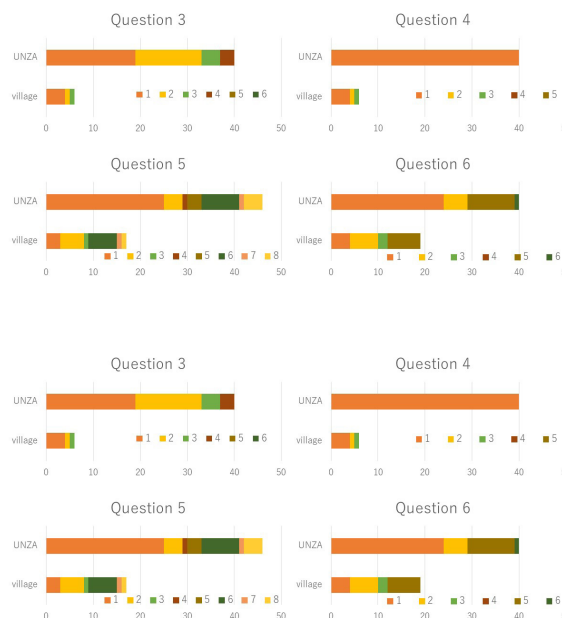


Fig.5 Results of Questions 3 to 8

At both locations, over 90% of the people were interested in the wildlife. Surprisingly, all participants at UNZA expressed the view that wildlife conservation is very important. Species perceived to have notable conflicts with humans included elephants, crocodiles, and hippos. Elephants, in particular, attracted high attention and were frequently featured in the news. As for the crocodiles, human accidents sometimes occur when fishing. Other species mentioned included lions and snakes. While few people at UNZA had experienced harm from wild animals, those from rural areas or with family-owned farms had encountered such incidents. The harms were caused by a variety of animals, and hippos, crocodiles,

and baboons were the main attackers. Interestingly, many people perceive wildlife as both tourism assets and food resources. In addition, despite various conflicts, they had desire to coexist with wildlife, including farmers. One UNZA student said that wildlife is a natural resource like trees and rivers. This sentiment left a strong impression on me. Almost all individuals believed that the government should take more measures to address conflicts with wildlife. Regarding measures to handle wildlife, fewer people than expected expressed a preference for killing problematic animals. The farmers also wanted tools to drive away animals. Currently, they drive away hippos by making noise.

In Japan, similar to Zambia, there is crop damage by wild animals such as deer, boars, and bears. The primary countermeasure is often population reduction through culling. However, in Zambia, many individuals, including affected farmers, expressed a reluctance to resort to killing these animals. This surprised me, as I had taken for granted that problematic animals would typically be culled. The significant reason for this difference may be Zambia's richness in natural beauty and wildlife. The country's numerous national parks and safaris serve as an essential source of income. Furthermore, according to Mr. Tembo, in Zambia, children start learning about wildlife as part of social sciences from elementary school. Differences in education like this might also be influencing the perspectives.

Wildlife issues from a wildlife medical perspective in Zambia

In this section, I will describe some of the information I have heard from Dr. Musso, an expert in zoonosis and wildlife management.

Currently, Zambia faces several challenges in terms of zoonosis, with anthrax being the most concerning, although African sleeping sickness and rabies also pose significant threats. Anthrax infects both animals and humans and is a dangerous disease with a notably high mortality rate and infectivity. Hippos often die in large numbers due to anthrax. In case where there is a carcass of an animal suspected of having anthrax, it is crucial not to open it. Instead, prompt communication with managers is essential. While established protocols exist for handling such carcasses, there is a risk of citizens may open them without proper knowledge, or sometimes driven by the need for protein, potentially leading to infections.

In 2016, the Zambian government decided to undertake a

culling initiative targeting up to 2,000 hippos over a 5-year period in Luangwa Valley. The primary objective is to proactively prevent the potential future spread of anthrax among the wildlife population. To achieve effective outcomes, it is important to conduct comprehensive surveys of hippo habitats, densities, distribution, ecology, and vegetation. In other words, scientific basis is important, not just culling. The culling hippos in areas with high densities could reduce contamination of grass and soil with anthrax spores, thereby contributing to a more targeted and strategic approach to disease prevention.

Acknowledgement

The valuable experiences and insights gained in Zambia have become highly significant to me. Understanding the differences in approaches and perspectives towards wildlife between Japan and Zambia was a crucial step for my future growth in my field of expertise. I intend to keep the insights gained from these experiences in my mind and apply them to address future challenges. Moving forward, I aim to broaden my international perspective and strive to become a person who can contribute to local communities. Finally, I would like to express my heartfelt gratitude to Ms. Doya and Ms. Ogishima, who greatly contributed to the realization of this SDA, Dr. Musso, who generously shared valuable insights during our conversations, Mr. Tembo, Ms. Thadze, Ms. Sehera, and Ms. Vital, for their assistance in conducting the survey, Mr. Maambo, who not only invited us to the village but also kindly provided translation in Tonga, and to his welcoming family and the villagers. I extend my sincere appreciation to everyone who cooperated in the survey.

Seroepidemiological study of SARS-CoV-2 infection in animals in Zambia

国際感染症学院 D1 紀田泉

Initial Proposal / 企画書

1) Activities theme/title

Seroepidemiological study of SARS-CoV-2 infection in animals

2) Background

I worked as a veterinarian in small animal hospital after graduating from university. During that time, I became interested in feline coronavirus infections and wanted to learn more about infectious disease. Therefore, I

have decided to conduct a seroepidemiological study on SARS-CoV-2, which belongs to the same coronavirus family as feline coronaviruses, in animals.

3) Specific targets and goals of the research
I will conduct a seroepidemiological study of SARS-CoV-2 in animals such as dogs and cats, as well as pangolins, which are known to have SARS-CoV-2 related viruses.

- Estimating the seroprevalence of SARS-CoV-2 in animals.
- Learning the testing method, sample collection from pangolins.
- Field research on pangolin conservation.

4) Means to achieve the goals above

- Sample collection
- Conducting ELISA
- Field research in pangolin sanctuary

5) Necessary resources, facilities and preparation
Facilities

- Central Veterinary Research Institute (CVRI) in Lusaka
- Pangolin sanctuary

Preparation

- Asking counterpart candidates to join their project of seroepidemiological study of SARS-CoV-2 in animals.

実施後報告書

Introduction

My professional background is a veterinarian specializing in small animals, particularly dogs and cats. I am currently doing my Ph.D. at Graduate school of Infectious Diseases, Hokkaido University. My research focuses on Molecular mechanism of feline infectious peritonitis pathogenesis. I am interested in both animal diseases and human diseases.

Infectious diseases such as malaria, HIV/AIDS, tuberculosis, COVID-19, and others are still prevalent in Zambia. These diseases can significantly contribute to leading causes of death in humans, presenting a situation markedly different from that of Japan. Infectious diseases in animals are also prevalent, so I would like to learn about methods of diagnosis, countermeasures and the challenges faced. I have heard about the project for seroepidemiological study of SARS-CoV-2 in animals at Central Veterinary Research Institute (CVRI) in Lusaka, so I asked Professor Sawa, who belongs to Institute for Vaccine Research

and Development, Hokkaido University, to refer me to Dr. Chambaro. He is a graduate of Division of Molecular Pathobiology, International Institute for Zoonosis Control, Hokkaido University and currently working as a researcher at CVRI.

Research activity

I contacted Dr. Chambaro two months before departure. He was kind enough to accept my visit and arrange my schedule for three days. My initial schedule was as follows: day1-day2; Visiting to CVRI, day3; Visiting to Pangolin sanctuary. Unfortunately, I could not visit the sanctuary because of the trouble (A burglar broke into the sanctuary), however, I had the opportunity to talk to a woman who takes care of pangolins.

On my first day, Ms. Angela, who is a chief technician, took me to laboratory rotation. They are divided into many sections; bacteriology, parasitology, biochemistry, pathology, biotechnology, vaccine development, virology. I learned that what they are doing and problems they are facing in each section.

Firstly, I would like to start parasitology section because when I was an undergraduate in faculty of veterinary medicine, I belonged to the laboratory of parasitology. I am familiar with some pathogens' name but don't know the details about diseases of livestock. There are tick-borne diseases such as *Theileria*, *Babesia* and *Anaplasma* in Zambia. Among them, *Theileria parva* causes the most important disease in cattles, known as East Coast Fever. To my embarrassment, I have never heard about the name of the disease before. It is usually characterized by high fever, swelling of the lymph nodes, dyspnea, and high mortality. It is a serious problem in east and southern Africa. A therapeutic drug, buparvaquone, is available to treat the disease, but it is expensive, and control of the disease usually involves either prevention of tick infestation or vaccination. The government is providing financial assistance for vaccination and supporting farmers, but some farmers don't adopt it because of the cost. A similar situation is also a concern for viral and bacterial diseases that can be prevented with vaccines. Despite organizing workshops and other educational opportunities for farmers about the importance of vaccines, the vaccination rate does not improve. There are few occasions to think about infectious diseases in daily life in Japan. On the other hand, I propose that infectious diseases are prevalent among both humans and animals in Zambia, and farmers don't pay much attention to them,

resulting in low vaccination rates. Although I didn't have the opportunity to meet with farmers this time, if given the chance, I would like to inquire about their opinions on vaccines. Furthermore, I have heard that even if infectious diseases can be controlled with vaccines, there can still be illegal transportation of animals across borders from other countries. I realized that the challenges of infectious disease control differ significantly between Japan, an island nation, and other countries.

In biochemistry section, they conduct examinations for meat, water, milk, and other contaminated materials, such as Aflatoxins in Maize. Antibiotic resistance and contamination of lead and copper in food have become concerns. I had not been aware of food contamination previously, but I had a bacterial infection from chicken liver two days before departing Zambia. Therefore, as a veterinarian, I have to remain vigilant and continue to enhance my knowledge about this concern. I would like to provide an overview of all of the sections; nevertheless, due to space constraints, I am required to skip the remaining sections.

After laboratory rotation, I joined virology section. I planned to conduct ELISA, but I couldn't because of the power/water outage. We had lunch at the canteen and concluded the first day's activities..



Fig.1 Laboratory in virology section

On the second day, I conducted ELISA for detection of SARS-CoV-2 nucleocapsid in dog sera. I was able to learn about the testing method and was surprised to find that more dogs were seropositive to SARS-CoV-2 than I expected. In the virology section, it's important to highlight that in addition to SARS-CoV-2, there are other viral diseases that present significant challenges. These include Foot and Mouth Disease (FMD) in cloven-hoofed livestock, particularly cattle, rabies in dogs, and Newcastle Disease in poultry. I was very surprised to learn that there are still many cases of rabies not only in dogs but also in

humans. The expected cause is the rabies vaccine. Previously, vaccines were manufactured at CVRI. However, due to ethical concerns regarding the manufacturing process, imported vaccines are currently available. Surveillance is ongoing, but there is a possibility that the most likely cause could be insufficient antibody titer. I'm really curious about the results of the surveillance.



Fig.2 Lunch at the canteen; nshima (the best nshima in Zambia for me!), beef, vegetables

In virology section, they also conduct to identify animal (host) DNA in samples, such as meat, to protect wildlife. It is essential to secure and manage evidence from discovery at the crime scene until it is presented in the courtroom. It also enables to differentiating of beef from buffalo meat and provides support for uncovering poachers. I knew about the identification method of host DNA using PCR, but never considered its application in wildlife conservation.

On my last day, I was unable to visit the pangolin sanctuary. Fortunately, I had the chance to learn about pangolins from the lady who takes care of them. She came to University of Zambia for her job and kindly made time to talk with me. She showed many pictures of pangolins and told me about their rehabilitation-rescue to release. There are numerous challenges, including difficulties in conducting examinations, administering medication and handling itself.



Fig.3 Campaign poster (Cited from Protect the Pangolins)

When they rescue pangolins, the first step is to administer anesthesia, followed by taking a blood sample and assessing their overall condition. I am very surprised to hear that there are reference ranges for their hematological test, including cortisol. Her dedication to working with pangolins inspired me, and I've decided to learn more about pangolin veterinary care before my next visit to Zambia so that I can contribute when I visit the sanctuary.

Acknowledgment

I would like to thank my counterpart, Dr. Chambaro and the entire team at CVRI for providing me with this opportunity. Their support helped me to understand infectious diseases in Zambia and gain valuable experience in my field. I am deeply grateful for IVCMEP's support and the opportunity they have provided me.

[References]

1. CDC in Zambia. (September 6, 2023) Global Health Home. <https://www.cdc.gov/globalhealth/countri/c/zambia/default.htm>
2. MSD MANUAL Veterinary Manual. (September 6, 2023) Theileriosis in Animals. <https://www.msdsmanual.com/circulatory-system/blood-parasites/theileriosis-in-animals>
3. African Wildlife Forensics Network. (September 7, 2023) Activities. <https://africanwildlifeorensics.org/en/about>
4. Protect the Pangolins. Home. Facebook. (September 7, 2023) <https://www.facebook.com/protectthepangolins/>

Investigation on Indoor Air Quality in Housing in Zambia

工学院 D1 中野佑美

Initial Proposal / 企画書

- 1) Activities theme/title
Research on Indoor Air Quality in Zambia Housing
- 2) Background
My academic background
Thesis topic in master's degree (2019-2022): "Research on Actual State of Living Environment in Winter Season Using Deprivation Indices in Snowy Cold Region".
Research topic doctoral degree (2023 ~) : " Research on Improving Indoor Environment as Solution of Poverty in Cold Regions".
Reason of my research theme in this program
According to a WHO report, indoor air pollution from combustion emissions from cooking and heating is a very serious problem in developing countries. It is

estimated that this causes 2.8 million deaths each year, 90% of which are in developing countries. I have been mainly studying the indoor environment in cold regions of developed countries, but I would like to gain knowledge of the actual indoor environment in warm regions of developing countries, which is the exact opposite, and increase my experience in improving indoor environments around the world.

- 3) Specific targets and goals of the research
 - Indoor air quality condition of the house (Temperature, humidity, carbon dioxide concentration, particulate matter) .
 - Relationship between indoor environment and occupants' health and lifestyle.
 - Target households are family households and single households, minimum 5 households.
- 4) Means to achieve the goals above
 - Questionnaire survey on indoor environment (Indoor environment, health conditions, room layouts, and building materials, life style etc.)
 - Indoor measurement(Temperature, humidity, carbon dioxide concentration, particulate matter)
- 5) Necessary resources, facilities and preparation
 - Questionnaire paper
 - Indoor measurement instrument (thermo-hygrometer, CO₂ censer , Particle measuring censer)

実施後報告書

Activity overview

This study investigated air quality pollution indoors in Zambia. The performance of buildings in developing countries is said to be lower than in developed countries, and building structures and materials are relatively simple. In addition to this, in rural cities in Zambia, road are not usually paved and soil dust can easily enter indoors, which is a health hazard for the occupants. This study aims to extract data on air quality in buildings in Zambia using air quality sensors and to analyze the actual state of air quality.



Fig.1 Environment censor

Finding counterparts

The IVCMEP Office introduced me to Innovation for Poverty Action (IPA), an organization working as an international NGO in Zambia, and we were put in direct contact with Ms Tamara, the senior manager for policy and programs. We also learnt that a research team from the Faculty of Economics at Hokkaido University would be conducting a household survey during our stay in Zambia, and we were given the opportunity to accompany them on short notice.

Activity Day 1 in Kabwe (21st August)

With the help of a research team from the Faculty of Economics at Hokkaido University, we joined a household survey in Kabwe district. We visited about six households per day and interviewed each household for about one hour. Interviews were conducted by local researchers. The experience provided an opportunity to observe the condition of the local buildings and the indoor environment. Most of the buildings were single-story and made of concrete. All the homes had electricity, and there were electric lights, TVs and kitchen stoves in the rooms. On the day of the survey, the outside temperature was hot, but the interior was cool and airy. Windows were always covered with lace and there were few doors between rooms, making the space airy.



Fig.2 (upper left) Exterior of the building
 Fig.3 (upper right) Galvanized steel roof
 Fig.4 (lower) Air ventilation

Activity Day 2 in Lusaka (30th, August)

In the morning, we met Ms. Tamara from IPA and went to the Lusaka compound for the ZamCharts project with IPA researchers. It was a follow-up on parent-child households interviewed in 2021. In the initial household, cognitive tests, physical measurements, and blood tests were conducted using children's toys. The 2021 growth chart poster with guidance on ideal weight, height, and a nutritious diet was still displayed. Nutritional supplements

and food interventions were provided based on the results.

In the afternoon, we visited UNZA to install environmental sensors in two classrooms to measure air quality. In addition to this, students living in the UNZA student residence were also given environmental sensors to help them measure the indoor air quality.

Results of air quality measurements (Small class room in UNZA)

Air quality measurements were carried out for two days. This room is an uncrowded classroom. The temperature and humidity results show that the daytime temperature is around 25 ° C, which is not too hot and provides a comfortable room temperature environment. The VOC values are below the permissible standard value of 400 µg/m³. On the other hand, PM_{2.5} values exceeded the environmental standard of 35 µg/m³ in many places during the day.



Fig.5 Small classroom

Results of air quality measurements (Student dormitory in UNZA)

Air quality measurements were carried out for two days. The temperature and humidity results show that the daytime temperature is around 25° C, which is not too hot and provides a comfortable room temperature environment. The VOC values are below the permissible standard value of 400 µg/m³. M_{2.5} value is below the standard value of about 24 µg/m³, but higher than typical indoor PM_{2.5} values.

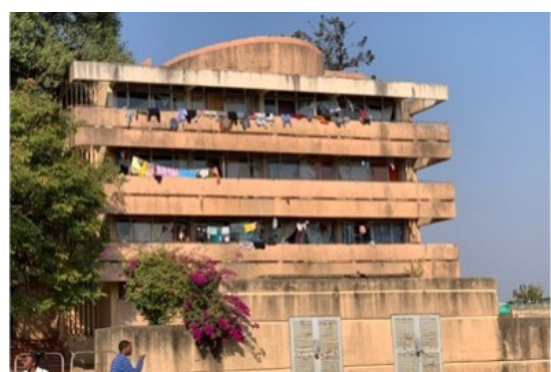


Fig.6 Student dormitory

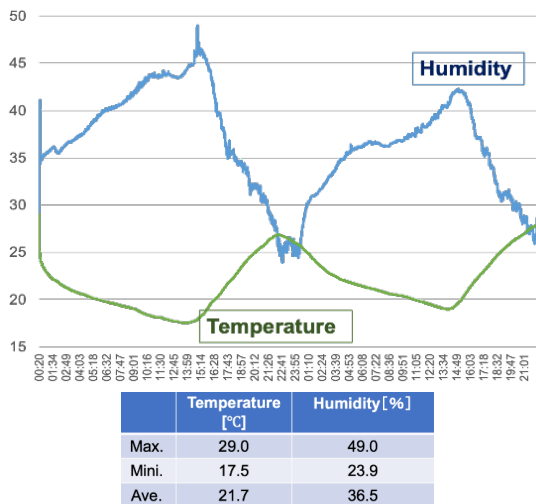


Fig.7 Temperature and humidity in small classroom

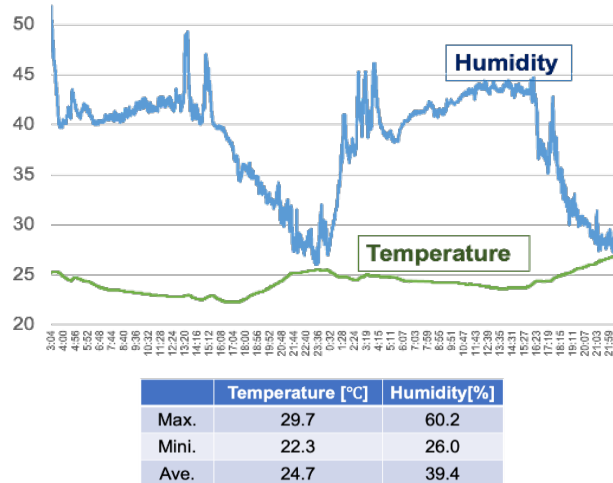


Fig.9 Temperature and humidity in student dormitory

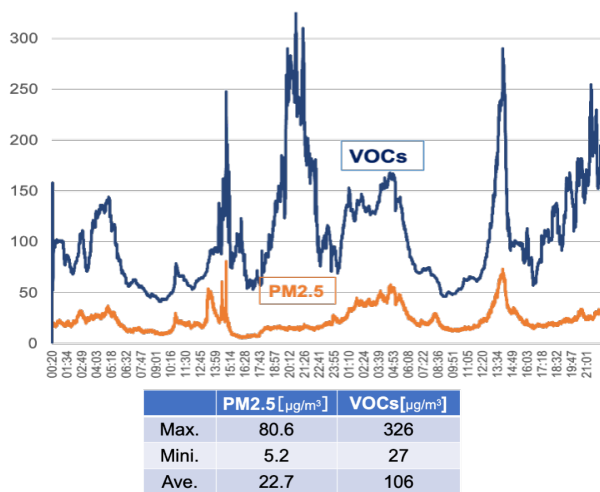


Fig.8 PM_{2.5} and VOC in small classroom

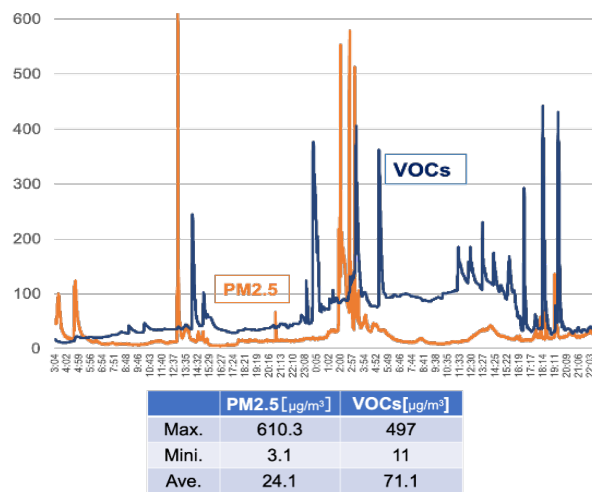


Fig.10 PM_{2.5} and VOC in student dormitory

Activity Day 3 in Lusaka (31th, August)

We visited a hospital near Lusaka, where an IPA researcher showed us around the pediatric ophthalmology facilities on the premises. The actual consultation process and the equipment used during the consultation were explained. As the consultation results are used for research purposes, there is no charge for the consultation, which is borne by the patient, and a small gratuity is paid to the patient.

Changes in activities and points to note

The difficulty in carrying out the SDA was to conduct a survey of the actual indoor air quality in the local area. The actual measurement involves entering the homes of local households and taking actual measurements, which may cause privacy issues. The collaborating local households may also be reluctant to place measurement equipment in their rooms. It is important to obtain a clear explanation of the measurement and permission from the collaborator when taking actual measurements in the local building.

Acknowledgment

I would like to thank all the IVCMEP staff, my counterpart IPA staff, all those who helped me with the field measurements and the local households who hosted me during the field survey.

Survey of stakeholders' intentions for the management of Victoria Falls

環境科学院 M2 今川知美

Initial Proposal / 企画書

- 1) Activities theme/title
Outreach activities at tourist Victoria Waterfall using 3D terrain models and measurement of their effectiveness
- 2) Background
There are differences in understanding and awareness of the environment in tourist destinations among management entities, local residents, and tourists. For

local residents, it is one of the resources that support their daily lives as tourism income, and for tourists, it is a different world where they can experience something extraordinary. I am interested in how this gap in awareness affects environmental conservation and sustainable management plans. I am also interested in outreach, having taken a teaching course in the past and having learned that practical educational development is required in Japanese educational settings. Therefore, I was interested in how ecotourism/geotourism could be developed in Zambia, a country blessed with abundant nature. I also wanted to think about what kind of more effective ways to enjoy it could be implemented. Currently, I belong to a laboratory in the field of environmental geography, and I thought that my background in geomorphological analysis and knowledge in the field of ecology would be applicable to this project. Since my supervisor is a researcher who is familiar with waterfalls, I wanted to conduct a field project in the southern border area of Zambia based on my insights into the geomorphological conditions created by waterfalls and the related ecological field.

3) Specific targets and goals of the research

The target area for the survey is Victoria Falls in southern Zambia. (If it is difficult to conduct the survey due to accessibility and/or accommodation issues, we will consider changing to activities in the Lusaka National Park area or to visit local school.)

Goals to be achieved

- To understand the management plan and local issues around the waterfalls in Zambia/Zimbabwe.
- To confirm the level of understanding of the waterfalls and their surrounding environment, including their academic value (geology, ecology). I would like to confirm whether there are differences in understanding and preferences among tourists based on their nationalities (including differences in awareness between tourists, local residents, and stakeholders).
- Consideration and proposal of better guiding methods, if possible, and management plans compatible with ecosystem conservation

Details of the survey

- To compare how waterfalls and parks should be managed in Zambia's management plan and how they are actually managed.
- To find out in advance what kind of awareness

local stakeholders have about the management of waterfalls and parks in Zambia.

- To confirm the local guiding and displaying methods, and investigate their challenges and potential areas for improvement.
- To explain the academic value of the site using a 3D model, and investigate its effectiveness.

Stakeholders under consideration as survey targets (survey approach)

- Government agencies: (preliminary research mainly through literature, interviews if possible with rangers in the field)

Government agencies and local government officials related to waterfall management and protection, such as Ministry of Environment and Ministry of Tourism.

National Parks Administration and managers of protected areas.

- Local people: (Questionnaire)

Local people and communities living around the waterfalls.

Local tourism operators and guides.

- Tourism providers: (Questionnaire, interviews if possible)

Hotel and resort owners and staff.

Travel agents and tour operators.

- Academic researchers: (questionnaire and interviews, 8/20)

Researchers and scholars in geology, environmental science, ecology, etc. University and research institute personnel.

- Non-profit organizations and NGOs: (Questionnaire if contacted)

Groups and organizations interested in environmental protection and sustainable development. Organizations that support nature conservation and community development.

- Tourists: (questionnaire on site)

Tourists and travelers visiting Victoria Falls.

4) Means to achieve the goals above

The method under consideration is to conduct a pre-survey, an explanation using a model, and a post-survey to determine the effectiveness of the explanation among tourists and local residents. I would like to confirm the local residents' impressions of the waterfall and their understanding of the ecosystem and environmental creation through this

survey. I would also like to conduct a similar survey of tourists to determine the purpose of their visit, their understanding of the waterfalls, and the effectiveness of exhibits and explanations. Before departure, if we can establish a good relationship, I would like to conduct an interview survey with local stakeholders via Zoom or other means. During our stay in the area, I would like to conduct environmental education (mainly geology and ecology) using 3D models and confirm its effectiveness. At present, we would like to collaborate with local tour guides and management entities to use the 3D models during tours to explain the geology and ecology of places that appear to be nearby but are inaccessible. I would like to evaluate the effectiveness of the tour by using a google form questionnaire. Since it is expected that there will be a difference in awareness between those who do not participate in the tour and those who do, I would like to conduct a similar explanation near the lookout points to confirm and compare the effectiveness of the tour. After returning to Japan, I would like to examine and propose effective guiding methods based on the data obtained. If necessary, after returning to Japan, we would like to continue to conduct on-site surveys in cooperation with partner organizations to verify the superiority of our proposals.

- 5) Necessary resources, facilities and preparation
- Establish relationships with stakeholders (management entities, geotour guides) and plan for collaboration. Considering to contact via email and the use of Zoom.
 - Prepare a place to stay if staying for 3 days around waterfall and transportation to the meet-up location.
 - Preparation of 3D models and maps to be used during explanations
 - Formulate questionnaire items, create google form and prepare paper version's too

実施後報告書

Background

In Zambia, the tourism industry is one of the biggest income generators. Especially for Victoria Falls, more than one million tourists visited the place before the pandemic of the COVID. The place is famous as the World Natural Heritage site for its unique landscape including the ecosystem surrounding the waterfalls. This place is

managed by the Zambian National Heritage Conservation Commission by getting advice from UNESCO or IUCN and collaborating with the Zimbabwe side. From this background, I had questions about how they sustain the place collectively and what can be the issue to achieve sustainable tourism. Additionally, this place has a unique value in terms of the geological value, so I was interested in how the visitors understand the importance of such a specialty and what can be done to make the exhibition more meaningful.

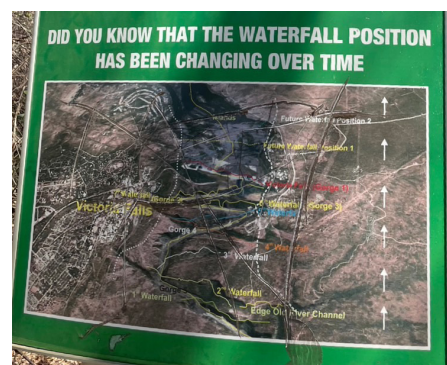
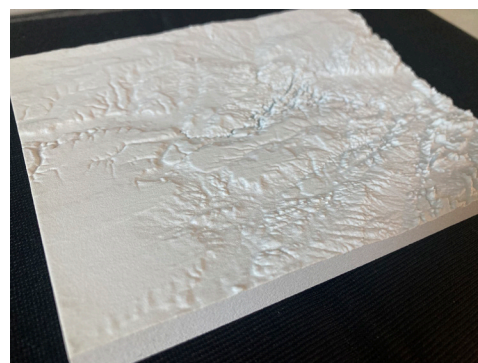


Fig.1 Sign explaining the recession of the falls

In 1972, the zoological park was redesigned as part of the expanded Mosi-oa-Tunya National Park which is managed by the Zambian Department of National Parks and Wildlife. The National Heritage Conservation Commission manages the Falls and its immediate surroundings, as well as all historic and cultural sites within the National Park.

Planning

The first plan was to conduct an outreach activity that focused on spreading the geological value to the visitors and finding out about their understanding by using the 3D model.



3D Falls model including the basin of Zambezi River (made by Dr. Hayakawa, source: AW3D, 3D model: <<https://sketchfab.com/3d-models/victoria-falls-and-surroundings-1c2381fa9c21457e940cc68434c61820>>)

At the same time, I was thinking of asking the tourists around the waterfall about the reasons for their visit, and how much they were interested in and understood the geological perspective. However, there were difficulties

in gathering the information and finding the places for conducting it previously. So, I changed the plan to extend the questionnaire to the manager of the heritage. For the place of the activity, I set up the Livingstone Museum with the introduction of my collaborator Chibamba. Before the visitation, we tried to contact the ecologist who is researching near the waterfalls, because I was interested in the interaction between waterfalls and surrounding environments, especially expected learning about relationships between ecological function and topographic features. However, he was so busy for his field works and we couldn't make good contact with the planned counterparts. Then, I tried to find collaborators through the introduction from my lab mate who is coming from Zambia. Fortunately, he introduced me a friend, Chibamba who is from Livingstone and familiar with tourism in Zambia. This decision was made on the bus leaving Lusaka for Livingstone, just two days before I was supposed to work on SDA.

Methodology

To understand the mindset of the stakeholders, I used the questionnaire on the Google form. I prepared several sections to find how their different backgrounds affect the formation of their impressions on tourism and future visions to realize sustainable tourism. Although I brought paper questionnaires, only those in electronic format using QR codes were collected. Actually, the main activity became interviews with the people involved in the management.

Details of the activity

1. Victoria Falls visitation guided by the manager from National Heritage Conservation Commission

Firstly, I went to Victoria Falls to ask for detailed information about Victoria Falls from the field staff of the National Heritage Conservation Commission (NHCC). NHCC has the function to preserve, protect, and manage Zambia's natural and cultural (i.e., the prehistoric, historic, and contemporary monuments and relics) heritage (NHCC, 2018). With the help of Charles who is the staff of the NHCC, I managed to interview for more detailed information about the falls. He guided me around the upper part of the falls and explained the topography and vegetation in more detail. Additionally, I asked Richard Mbewe and Musawa Hamusonde, who is the chief at the NHCC office about the general situation of heritage management.



Fig.3 Stones lined up to prevent people from entering
3D model: <<https://skfb.ly/oNPIR>>



Fig.4 Potholes (diameters are around 10 to 50cm)
3D model: <<https://skfb.ly/oNXXw>>

2. Livingstone Museum

In Livingstone, there is a Zambia's oldest museum which has collections related to the archaeology and natural history of southern Africa. They display not only African prehistorical and historical artifacts but also creatures found around the waterfalls. Thanks to Chibamba's arrangement, I was able to talk with entomologist Chabwera, who is also a cultural anthropologist and museum guides.

3. Zambia Tourism Agency

On the museum grounds, there is Zambia Tourism Agency. They're introducing tourists the sight to see around but the officer helped me to grasp the entire situation for the tourism, especially in Livingstone.

Findings

1. Victoria Falls visitation

Along the river, spiky stones were lined up to warn people to stay away from the river. I was told that it also served to keep elephants from coming near the waterfall. Charles also explained that elephants come more frequently during the dry season because food is more limited. Many

potholes formed when stones were rotated by water flow and eroded. It was the dry season and access to the upper part of the falls had only been granted a few days before our visit.

Otherwise, some trees lose their leaves with drying, there are water hyacinths and salvinia can be seen where there is water flow. Water hyacinth is an invasive species and has been spreading at a very fast rate in the Maramba River which meets above the waterfall.

Regarding heritage conservation, there is an integrated management plan between Zambia and Zimbabwe for tourism around the falls. Musawa Hamusonde, who is the chief at the NHCC office said that what is required for the future of tourism is to create awareness. What the future of tourism needs is creating an awareness, which includes promoting the sensitivity and value of nature and heritage, explaining what not to do for conservation, and developing a cooperative system and learning environment to promote the need for research and its ecological value and function to people. Regarding conflicts between wildlife and local people, the chief said that the problems of poaching and hunting of rhinos have already been improved. However, there are still problems with elephants and bamboos. She also explained that bamboos eat and destroy, but monkeys don't destroy so much, and that the behavior of elephants change depending on where they move for. By this, the buffer zone is working well. She also explained that Zambia's 8 national policies include investment in tourism recently. And the social sector has been changed to economic sector including tourism part in the policy. It seems that the whole country is trying to expand the tourism industry.

2. Livingstone Museum

According to Chabwera, bird surveys have been conducted in Zambia for more than 30 years, with monitoring begun in 1994. This was contrary to our expectations, as we had difficulty obtaining a local bird book. Although there are many illustrated books on South African animals, there were not so many books specialized about Zambian Animals. But we were introduced a book called "Birds of Zambia" in the museum. And the plant species are also being included from the perspective of conservation and sensitization specimens. In addition, they are also focusing on outreach activities by visiting schools and villages in the neighborhood to explain the need for conservation. According to the curator who is a

cultural historian, historically local people have the mind to respect nature or animals by naming the family's name. Although Zambians' perception of Zambians these days is strongly influenced by Western education, the Western people also dealt with plants and animals, and it is said that the vestiges of this tradition still take root in Zambia. Even before colonization, there was a strong respect for nature, requiring permission from the village head to cut down a single tree, and cutting trees in such a way as to leave the roots intact. In the eastern part of Zambia, such as around the Luangwa valley, there is a culture of eating elephants, and it seems that dried elephants are also eaten. The Tongan people are one of the tribes with a long-established sense of symbiosis with animals.

Moreover, they celebrate by holding ceremonies, the significance of natural cycles, past military glories, or age-old traditions. The ceremonies they perform express gratitude for fruits grown from the soil and benefits of waterfalls, respect for waterfalls and animals, and religious belief in gods. Sometimes, they mimic animals in their movements. Even in the COVID-19 time, they prayed in their rituals for the suppression of the epidemic. Thus, the country's ethnic diversity resulting in over 30 traditional ceremonies taking place annually in different parts of the country. In the exhibition, we found a 3D model of the city of Livingstone, including the area around the waterfall at the entrance of the museum. This was clearer than the one placed around the falls and covered a wider area of the land. However, there was no direct explanation of the geomorphic changes involved in the formation process of the waterfalls, a detailed explanation of their formation, nor their relationships with the ecosystem. Nevertheless, the display of these spectacular waterfalls together with the horizontal spread of the city made comparisons possible, which was an effective way to understand the magnificence of the actual waterfalls.



Fig.5 A 3D model of Victoria Falls exhibited in the museum
3D model: <<https://skfb.ly/oNXZv>>

3. Zambia Tourism Agency

They had discussed sustainable tourism at the tourist information center just a few days before our visit and had left a note about the stakeholders they had considered. They were trying to build a sustainable tourism system by including not only managers like the NHCC or National parks but also residents including socially vulnerable people like street children or village people. According to the manager, there is no conflict of opinion between Zambia and Zimbabwe regarding the management of the waterfalls. And the government is preparing a document to realize sustainable tourism. In the document, they have considered the gender base balance, too. I asked what is needed for the future development of tourism, problems are how to improve tourists' understanding of wildlife and the large amount of garbage generated by tourists. To improve the situation, insurance, and public transportation or assessment over roads are needed to ensure some stability. And to achieve the coexistence of wildlife and tourism. They are trying to promote tourism and merchandising in the city and corporations with Zambia environmental agency and wildlife management.

that their purpose of the visit was to enjoy the beauty of nature. And 66.7% of the answers were one-day trip visitations for the falls. Over 90% of the respondents answered that they have interests in natural or social sciences, and over half of them are especially interested in earth science. However, it seemed that understanding academic information or specialized topics was not so easy for them. Visitors to the falls were asked to identify topographical features, but many of them only indicated that it was located on the border. There is room for improvement in the way visitors enjoy insight into the formation and value of the land. And for the question to the residents "What initiatives do you think should be taken by residents to achieve sustainable tourism?" there were two answers. One is about the accessibility to the museum from the Falls. Another was to make the system learn more about the marketing of the falls to make it effective. And there was one suggestion from the researcher to the question, in order to improve in conducting surveys related to waterfalls. It's about the implementation of a platform to share data in real time on the findings of local residents and tourists visiting the falls. The goal is to create a system that will allow researchers to access the latest data on ecosystem changes. At the same time, it has the potential to deepen tourists' understanding of the ecosystem.

Summary

Interviews with curators, tourist information center staff, and NHCC officials revealed that a plan for sustainable tourism was developed including town residents and other stakeholders, more so than I had imagined before the trip. Outreach efforts are being developed to deepen the understanding of residents. And tourism industry workers on how to create a town that coexists with wildlife. The awareness of residents regarding conservation has been improving as a result of these activities, and the challenge for the future is to share this awareness with tourists and people engaged in the tourism industry. Words are not necessary to convey to tourists the beauty of the area in terms of enjoying the geomorphological value of the falls. However, it's clear from the survey that there is still room for improvement in promoting the waterfall's function to the higher ecosystem and its unique existence. The Livingston Museum is the best museum that exhibits these materials, but it is located a little far from the falls. One way to symbolize the reception of functional value would be to

PROVINCE	CHIEF	DISTRICT	TRIBE	CEREMONY	MONTH
CENTRAL PROVINCE	Sr Chief Mwanamwambwa	Chitumbulo	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Numbwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Isi-Tashi	Lunda	Chibambala	September
COPPERBELT PROVINCE	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
EASTERN PROVINCE	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
LUAPULA PROVINCE	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
LUSAKA PROVINCE	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
MUCHINGA PROVINCE	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September
	Sr Chief Mwanamwambwa	Mwambwa	Lunda	Chibambala	September

Fig.6 Poster of the List of the ceremonies held in Zambia

4. Results of the questionnaires

I received 15 answers thanks to the corporation of the curator of the museum. From the results, most people visit the museum in combination with the waterfalls. Visitors tend to expect the history part about Zambia, and then about falls for the exhibit. But they weren't thinking about fauna and flora so much. It seems that many people were sufficient the information which were got around the waterfalls and the museum. But from the results, there is a possibility that there are not enough displays and explanations around the falls, although the number of responses is small. And many tend to be unfamiliar with the geological features of the falls. 12 people answered

promote exhibits that share stories, such as the meaning of ceremonies held in neighboring villages, or the coexistence of animals and plants that the artist reflected in their works. The proposed mechanism to facilitate the sharing of findings from tourists with researchers is a way to improve the functionality of the city, speed up the intervention of experts in case of emergency, and facilitate the realization of proper management.

Acknowledgments

I appreciate staffs from NHCC, Livingstone Museum, and Zambia Tourism Agency, who helped me a lot to realize this self-designed activity. I could have learned many aspects of Victoria Falls and ecological values by hearing the actual voice in the field. Thank you.

[References]

NHCC. "Chapter 173 – Laws of Zambia" <<http://nhcc.org.zm/nhcc-act/chapter-173-laws-of-zambia/>> (last visit: 2023/11/27)

The future market of weeds compost and the possibility of "agribusiness" in Zambia

国際食資源学院 M2 石毛奈緒

Initial Proposal / 企画書

1) Activities theme/title

Current Situation of Start-up Support of Agriculture x Environmental section in Zambia

2) Background

My master's research is focused on evaluating the effects of land-use change on soil physicochemical properties in cacao plantations in Ecuador. During my actual five-month stay and sampling in the field, I became interested in the value chain of agricultural crops. Cacao is a cash crop, and the higher the flavor, the higher the market value and the higher the price. On the other hand, farmers need to understand such a market price and are sometimes sold off at a discount, no matter how high the quality is. This situation could be solved through technology and the creation of new businesses.

3) Specific targets and goals of the research

The potential for agribusiness, which is second only to finance in size, will continue to rise. According to the JICA's report (<https://www.jica.go.jp/zambia/ku57pq0000046g2k-att/jcap.pdf>), despite the fact that 70% of Zambia's population is engaged, the economy

is still dependent on mining development.

In my theme, I would like to focus on the gap between the momentum building and the current state of the start-up ecosystem, especially in the environmentally friendly agricultural sector.

(1) The environment surrounding entrepreneurs and their supporters (in relation to foreign capital)

(2) Building relationships with stakeholders to establish business models

(a) Capital for large-scale agriculture (South Africa)

(b) Diffusion of the aquaculture industry

(c) Zambeef (not sure)

4) Means to achieve the goals above

(1) Interviews with managers who actually have products, including JICA's NINJA project

(2) Visits to sites where the new services which are given by the startup are used

(3) Entrepreneurship education at universities or high schools

(a) I myself have had the opportunity to think about business possibilities after participating in a program on entrepreneurship (DEMOLA; <https://demola-hokudai.jp/>) offered by Hokkaido University's Cooperative Organization for Business and Academia.

(b) I would like to interview the younger generation to find out what their expectations are or observe and discuss the program.

5) Necessary resources, facilities, and preparation
The survey is basically interview-based, so no supplies are needed. Since we only have 3 days, I would like to conduct interviews including online meetings etc. prior to the trip. How to interact with entrepreneurial people (I am not going to pitch anything myself, so I wonder what would be beneficial to them as well)

実施後報告書

Summary

My research concerns the possibility of new agribusiness (agriculture x business). In Zambia, the rapid increase in population and the environmental issues due to agricultural activity are now getting social consciousness. I conducted a few interviews to learn about the difficulties of agriculture and business in Zambia. In conclusion, the networking of stakeholders is necessary to enhance agribusiness in the future, and a workshop or symposium

to share knowledge might be effective in achieving the objective.

Background

Zambia is one of the remarkable developing markets in Africa. According to the World Bank report, the population growth rate is 2.7% per year, and it is said that the young generation can be pressured by the national budget to support the community. However, I feel that start-up businesses especially those focusing on agriculture must be game changers in the future.

The motivation to set the theme of my activity is I saw the same situation during my stay in Ecuador for my master’s research. The capacity and potential for new technology in agriculture are high enough, but people don’t have much chance to collaborate with other institutions because of the lack of education. So I set the goal to find the possibility of new agribusiness (agriculture x business) during my stay in Zambia.

Communication with counterpart

When I first set the theme for the self-designed activity, I didn’t have any specific topic to focus on. Therefore, I decided to collaborate the environmental consciousness and the chance to implement it as a business in the future. I attempted to contact about 10 people and was eventually able to interview four, Three were in person and one was online, to know the stakeholders’ situations.

The Environmental Issue

Victoria Falls is one of the popular tourist sites in Zambia, and it is located in the Zambezi River basin which covers most of the major rivers in Zambia without the north-east part. Even when visiting was a dry season, we could find that Zambia is full of agricultural resources from this kind of rich water resources. However, high land-use changes are now creating social issues by leaching out the nutrients from the farmland. It is called “Eutrophication” and the mechanism is below.

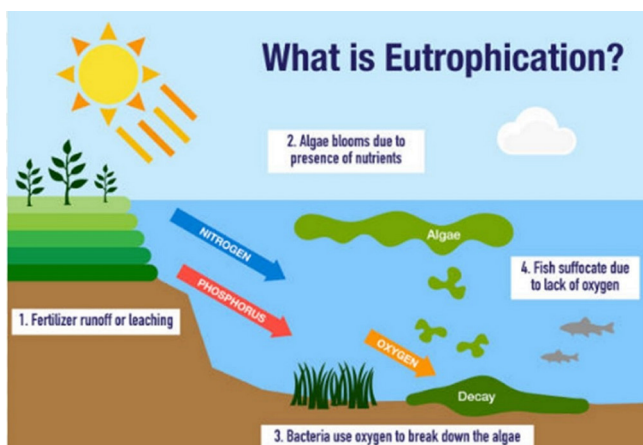


Fig.1 The mechanism of eutrophication

It is reported that chemical fertilizer can ruin soil quality and cause eutrophication easily even if it enhances the yield.

Now the Zambian government has implemented machines to get over the problem, but it’s not enough to solve the issues. Then I got some contacts from Dr. Ikabongo who is working at GART as an R&D manager, and did some interviews.

So, the purpose of this study is to

- ① Find the solution to crucial social issues
- ② Think about the possibility of collaborating with new businesses.

Interview1 ~scientist~

First, I interviewed a Ph.D. student at Wageningen University (Netherlands) on the first day. He is working on composting with weeds (water hyacinth and hippoglass)

The benefit of composting from weeds

- Lower price
- High nutrient
- High demand from smallholder farmers
- Familiar with locals

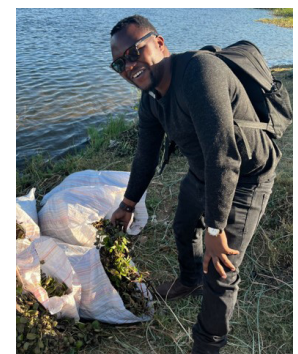


Fig.2 (left) Invasion of the water hyacinth and hippoglass at Kafue River

Fig.3 (right) Mr.Cindi who is working on the weeds compost project

In the morning, I visited his office and he told me about the progress of his study. The technology is already developed, and GART will assist in implementing it in the field from the academic aspect. Mr. Cindi found a strong effect of the compost on weeds when he applied them to onion fields. For example, in Zambia, it is difficult to make the big size onions though the consumption is high due to the soil type. However, the field with weeds compost was quite fertile and it was enough to see the positive effect. According to several former reports, it’s already been found that weeds’ fertilizer can promote the growth of plants significantly, and he is now proving that it is possible in Zambia.

Then, in the afternoon, we went to Kafue Bridge which

is located 60km away from UNZA to collect the weed samples to make the compost. He employed some fisheries who work around the area and they collected a weed for one week. As I mentioned before, the government has already installed a machine to collect the weeds, but he asked them because it can control the amount of weeds and a truck to pick up the sample was full finally.

I couldn't see the way to process the weeds, but he is now working with the students from the soil science laboratory (Fig.4).

He thinks that it is a chance to start a new business with the weeds fertilizer, but the results will be turned out next year. Then, collaboration with some national institute or academic association is the closest way to implement as soon as possible. Then, the campaign to use organic fertilizer can be one of the options to promote his activity in the future.



Fig.4 The composting process with the students(photo by Mr. Cindi)

Interview 2 ~Farmer~

On the second day, I went to a Mamambo village farm and interviewed farmers. It is because one of the members of the IVCMEP project last year is working on his farm now, and we had an opportunity to visit there.

First, I asked the farmers about the effects of climate change and the other problems they have right now. They mentioned the crucial issues on their farm like soil acidity, irregular patterns, and soil degradation. They usually use chemical fertilizer, and they don't trust the effect of the compost from the weeds, because it is normal to use organic material as the soil amendments (just for the soil microbes). However, the quality of the water of the river is important for their future and they have seminars that are given by NGOs sometimes.

Now, they are relying on imported fertilizer and they mentioned the possibility of alternative materials because of the high price. Then, they mentioned the consciousness for support is irrigation rather than fertilizer currently. Irrigation can support resilience and productivity in rain-fed farming systems. Before, JICA's project was run to promote building a small-scale irrigation system. The feedback was good enough to move on to the next stage.

I felt the farmers' expectations are high for international cooperation, and it will be beneficial for the support agency as well.

On the other hand, I found that the women in the village control their gardening farm with organic manure. The reason is only the price, but it looks managed nicely. The World Bank is now working on a project to support women's livelihoods through entrepreneurship. The program can also collaborate to promote awareness of the use of weed compost in the future.

Interview 3 ~ Start-up ~

On the final day morning, I interviewed Dr. Eugene, who is engaging in the start-up business with chicken manure online. First, I asked about the start point of his business. When he took the Ph.D. course at Hokkaido University, he was working on animal health research. Then, he wanted to connect his study to change the current social problems and started the project with a technical partner (Dr. Ikabongo) because of the business awards that he won. He realized that the market chance with the huge population of small-scale farmers in Zambia. The estimated number of farmers in Zambia is over 70%, and only 84% of the land is still unutilized as a farm. Therefore, he emphasized that he can encourage the motivation of smallholder farmers by fertilizing the soil at a lower cost than usual.

However, the investment from the other side is necessary to implement his facilities. He concluded that the investment is the power to innovate something new. And there is the possibility to solve the poverty issues in Zambia as well.

Interview 4 ~Education~

On the final day at noon, I met Ms.Mirriam, who is working in entrepreneur support. "Entrepreneur" is a training program for starting a new business. The ranking of the innovation score which is calculated by various parameters like human capital and technology output, of Zambia is 117 out of 128 countries. The bubble chart (Fig.5) below shows the relationship between income levels (GDP per capita) and innovation performance (GII score), and the red point shows Zambia. The classification level is "performing below expectations for the level of development".

She doesn't have her own business, but arranging the internship and the chance to do new business for the younger generation can be effective in getting out of poverty. She feels the access is open for everyone, but it's

still limited to getting contact with the people who don't have money to have higher education.

Therefore, supporting start-up businesses especially those related to agriculture is an indirect way to raise the people's capacity in rural areas.

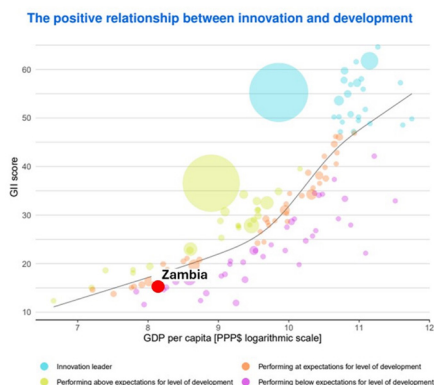


Fig.5 The positive relationship between innovation and development

The potential of agribusiness in Zambia

In conclusion, the technology is enough to solve the environmental issues from the weeds, but the demand and support system are not enough. According to the farmer's interview, they have a high motivation to solve the environmental issues that they have on their farm. However, the information is not about the weeds and they don't believe in the effect of the new organic fertilizer as an alternative. Therefore, having a seminar or some education course is needed to enhance the awareness of environmental issues. One of the candidate solutions for this situation is a start-up ecosystem. As Dr. Eugene and Ms. Mirriam are doing, some of the people already realized the potential of the new business. It is beneficial not only for the founder of an institution or new business but also for the people who may use the service or products to know the current issues as a stakeholder.

The keyword to think about my theme is "networking" with each other. I hope the stakeholder's network can be enhanced and the many collaborations will be realized. For example, a workshop to share knowledge with farmers is effective. When I went to the village, the farmers said that they expected some opportunities to learn knowledge and skills from NGOs, etc. Therefore, it can be useful to share ideas to raise awareness toward organic fertilizer usage.

Acknowledgment

My research was supported by many interviewees. Especially, Dr. Ikabongo introduced me to the all members who have any specialty in agriculture and business. And, the JICA office in Zambia tried to connect with some NPO

which is related to my research as well. I appreciate the help a lot, thank you very much for all. Zikomo.

[References]

1. Zambia: Supporting WSMEs' Access to Finance and Capacity Building (<https://we-fi.org/project/zambia-supporting-wsmes-access-to-finance-and-capacity-building/>) Last view: 2023/10/9
2. Singh, J., & Kalamdhad, A. S. (2012). Concentration and speciation of heavy metals during water hyacinth composting. *Bioresource Technology*, 124, 169–179. <https://doi.org/10.1016/j.biortech.2012.08.043>
3. 小規模農民のための灌漑開発プロジェクト (<https://www.jica.go.jp/oda/project/1102919/index.html>) Last view 2023/10/9
4. Global innovation index 2022 (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_2000_2022/zm.pdf) Last view 2023/10/9

The Relationship Between People and Nature -in Livingstone, Zambia-

文学院 M2 伊藤彩乃

Initial Proposal / 企画書

1) Activities theme/title

The research of the current state of wildlife conservation and management activities with local people in Zambia.

2) Background

As part of my life's work, I want to contribute to building communities where people and wildlife can live in harmony.

In my own research, I am exploring a better future relationship between people and brown bears through interviews with the local residents. I am also considering approaches that can be linked to local issues other than conflict with brown bears (e.g., declining birth rate, ageing population, weakening community ties, tsunami disaster prevention, etc.). I believe that my activities to learn more about the relationship between wildlife and humans in Zambia will be a valuable experience that I can apply to my own study topics, such as the above, and to human-wildlife issues throughout my life.

3) Specific targets and goals of the research

I would like to explore the actual situation of wildlife conservation activities in Zambia.

Firstly, I would like to participate in and observe the activities of NGOs, JICA and other organizations and individuals working with local people on wildlife conservation and community support activities. I would like to have the opportunity to learn what kind of communication and relationship-building is actually

carried out between support groups and local people. Next, I would like to conduct interviews with the support groups and local residents I have observed. The interviews will explore in more detail how each actor interacts with each other and conducts conservation activities in the region. Furthermore, we would like to explore the ways in which sustainable wildlife conservation activities can be carried out in regions by clarifying the challenges and future prospects in carrying out conservation activities.

4) Means to achieve the goals above
Participant observation and interviews.

5) Necessary resources, facilities and preparation
Preparation of interview survey items.

★ Information to be researched as a preliminary step

- Specific activities and objectives of the target NGO
- The main occupations, sources of income, size of the community, location, culture and livelihoods of the local people.
- What kind of animals inhabit the area and their relationship with the local people (what kind of damage they do).
- Historical evolution of the target area (whether it was originally inhabited or not, who manages it, who uses it)
- Availability of relevant research papers

★ List of questions

(NGO)

- What are the goals of your activities?
- What do you pay attention to when working with local people?
- What are the challenges you face in the course of your activities?
- What kind of activities do you want to carry out in the future?
- What are the challenges you face when working with local communities?

(Local people (if possible))

- Are there any negative impacts of wildlife?
- Are there any benefits from wildlife?
- Are there any improvements that have been made in working with NGOs? Are there any good things?
- Are there any challenges in working with NGOs?
- Are there any animals you don't like (or find troublesome)? Are there any animals you like?

• Do you like wildlife?

実施後報告書

Background

I am currently conducting research on human-wildlife conflicts at Hokkaido University's graduate school. Specifically, I am investigating the perspectives of local residents regarding the coexistence of brown bears and humans. I employ methods such as interviews and participant observation for my research. Furthermore, as part of my lifelong commitment, I aspire to contribute to the establishment of communities where both people and wildlife can coexist harmoniously.

In pursuit of this goal, during my Self-Design Activity (SDA), I explored the human-wildlife conflicts that exist in the wildlife-rich country of Zambia. I aimed to uncover the various challenges and activities related to these conflicts and their resolution. My intention was to find a key to building a better relationship with wildlife and nature, which inspired the plan for this SDA.

About my counterpart

During my SDA, I had the privilege of working together with 'NJOVU African Wildlife Conservation,' an organization established in 2020. The term 'NJOVU' translates to 'elephant' in the local Nyanja language. However, their conservation efforts go beyond elephants to encompass a variety of other wildlife species. Furthermore, their work covers a broad spectrum of activities, including animal rescue, environmental education, and snare sweeps. While the representative of NJOVU is Spanish, they collaborate with numerous local staff members to execute these initiatives. NJOVU places a strong emphasis on community engagement, and I discovered that many of the local staff members supporting NJOVU's projects have personal connections with NJOVU staff, which enhances their cooperation.



Fig.1 NJOVU office

SDA Schedule

During the 3-day SDA, I engaged in the following activities. On the first day, there was an Introduction to NJOVU. On the second day, I participated in a Snare Sweep in the morning alongside local staff and joined an Evening Safari in the afternoon. Lastly, on the third day, I visited the Livingstone Museum and the local market to learn about the region’s history and culture. I also received a lecture on the local trees and an animal rescue lecture. I will now provide more details about the two activities that particularly relate to the relationship between humans, nature, and wildlife, namely, (1) the Snare Sweep and (2) the tree lecture.

(1) Snare Sweep

To start, I will provide information about snares and the situation related to them in Mosi-Oa-Tunya National Park. This park faces a significant issue with illegal snares, many of which are set by local residents in order to capture animals for meat consumption or sale. These snares are primarily designed to catch animals like buffalos and impalas. Regrettably, these snares not only ensnare animals but also cause severe injuries, sometimes resulting in their death. In response to this problem, NJOVU, along with local staff, conducts weekly snare sweeps.

In the morning, we spent about two hours walking through the bush in Mosi-Oa-Tunya National Park in search of snares. Snares are difficult to spot because they blend in with the natural colour of the branches. On that day, we found a total of 29 snares.



Fig.2 A bone of wildlife caught in a snare



Fig.3 (left) Remove snares using your hands or pliers
Fig.4 (right) We found a total of 29 snares in a day

Numerous local young residents actively participated as volunteers in the snare sweep. Upon speaking with some of them, it became evident that their motivation to engage in these activities stemmed from their deep love for wildlife. One of the volunteers shared that his passion for wildlife began at the age of 16 when he had the opportunity to witness the beauty of wildlife during a safari.

(2) Tree Lecture

During my SDA, I learned about not only the relationship between people and wildlife but also about the relationship between people wildlife and plants. *Accacia albida* is one of the important trees for both people and wildlife. Local people use them for medicine, snake repellent, energizing livestock and so on.

This *Accacia albida* tree and wildlife, especially elephants, are closely connected to each other. *Accacia albida* is a unique tree with a distinct phenology of shedding its leaves during the rainy season and leafing out abundantly during the dry season, making it a crucial food resource and a refuge for elephants during the dry season. On the other hand, the seeds of *Accacia albida* don’t germinate simply by falling to the ground. They require heat to initiate germination. Therefore, they can only sprout after being consumed by elephants, warmed within the elephant’s digestive system, and subsequently excreted.



Fig.5 Apple ring: the fruits of *Accacia albid*

Summary

Through my SDA, I gained valuable insights into the subtle relationship between people and nature. I discovered both similarities and differences compared to Hokkaido. To be honest, during this short stay, I cannot claim to have found a definitive key to building a better relationship with wildlife and nature. However, through this SDA experience, I’ve reaffirmed my commitment to carefully examine the circumstances, relationships, and

connections that exist in that place and to share and collaborate on a global scale. It's through these efforts that I believe we can open up a future full of possibilities.

Acknowledgements

I'd like to express my gratitude to everyone who made my stay in Zambia, including my SDA, safe and enriching. Firstly, I want to thank the entire NJOVU community, especially Dr. Jaime and the dedicated local staff, for their warm welcome and support. Your hospitality made my stay memorable. A big thanks to our skilled drivers for ensuring our safety and comfort during our journey in Zambia. I'm also grateful for the friendships formed with my counterparts and fellow travellers, adding depth to my learning. Lastly, a shout-out to Doya-san and Ogishima-san for their wonderful coordination, ensuring a smooth and secure exploration of Zambia. Thank you to all who contributed to this unforgettable journey. This concludes my SDA report.

Prevention of poaching

総合化学院 M2 高見亮佑

Initial Proposal / 企画書

- 1) Activities theme/title
Why poaching occurs?
- 2) Background
Poaching is a serious problem in Africa. However, for Japanese people, we just know poaching is a crucial problem. We don't know why poaching is a serious problem and why it is occurred. To understand poaching problem further, we may need to look into the social structure of Africa and find out other underlying problems that are connected to poaching. Also, learning about poaching allows one to gain some understand of current situation of Africa. We can clarify how Japan and Africa cooperate each other.
- 3) Specific targets and goals of the research
Goal : Understand why poaching is occurring? from the view point of a social structure.
 1. Relationship between poverty and poaching
 2. What kind of poaching is conducted? (Ivory, leather, etc...)
 3. Relationship between Poaching in Africa and foreign countries
(Ivory demand in foreign countries for luxury items)
- 4) Means to achieve the goals above

Interview to

- people who are engaged in Wildlife protection,
 - Scholars who are doing research about poaching
- 5) Necessary resources, facilities and preparation
No need to acquire specific items, however, I need to search on poaching prior to onsite self-designed activity.

実施後報告書

Introduction

In Africa, there are social problems related to resources (oil, diamond and rare metal). These problems are not only social problems in Africa, but also related to developed countries. In this report, I focused on one of the social problems, which is called poaching.

In developed countries, demands for poached items (Ivory, python, and horn) are enormous. One example is, in China, Ivory is considered as a luxury item and some people use it as a medicine. Also in Japan, Ivory is used to make "Hanko" which is used for signature.

Poaching Types

In poaching, there are two types of poaching. One is Domestic poaching, and the other is Commercial poaching. The purpose of domestic poaching is to get food for their own consumption and sell game meats for living. This type of poaching is related to poverty, The other poaching which is called commercial poaching means selling poached items (Ivory, python skins and horns) for business. This type of method is not only related to Zambia but also related to foreign countries indirectly. The demand of poached items in foreign countries is quite high. For example, Ivory is considered as luxury items and medicine. Python skin is also considered as luxury item and used for martial of luxury bag.



Fig.1(left) Ivory
Fig.2 (right) Python skin

Poaching method

As I described in section 2, Domestic poaching and Commercial poaching exist. There is also difference of poaching method between domestic and commercial poaching.

In domestic poaching, poachers use home made snares, hunting dog and homemade gun (Fig. 3, 4). These methods are quite simple, and cost is not high because they can make these items from daily items. On the contrary, the situation of commercial poaching is completely different. Poachers use high-caliber bullets to hunt animals. High-caliber round has huge stopping power for hunting the animals. In addition, there are some poachers using suppressor to conceal muzzle flash and sound. The method of commercial poaching is getting evolved and the ranger police is struggling to deal with these problems.



Fig.3(left) Snares
Fig.4 (right) Home made gun

Conceal Carry

After poaching, poachers are trying to carry poached items outside of the country. The method of concealing are getting gradually intimate(Fig. 5, 6). However, ranger police has long experiences and intelligence, they can detect hidden items.



Fig.5(left) Concealed carry
Fig.6 (right) Inside the carry

Ranger police equipment

As poachers' equipment are evolving and to prevent poaching more, rangers needs more supplies. I did interview with rangers and got lots of answers what they really need. First, Patrol equipment is needed. GPS helps them identifying where they are patrolling.

Also, Drones can see an overview of national park and they can observe 24/7. Second, they need more gear. They said the number of combat uniforms is small and they need to deploy patrol more. In addition, they need bulletproof vests like plate carrier. If they face criminals, there is a risk of being shot. To defend life, they need plate career because it is easy to move, high heat release, and proof for high caliber Third, they need rations and fuel when they patrol a long time. Also, food supplies are important.

If there are many rations, they can deploy long patrols more. Also, there is a restriction on using oil per week in ranger patrol, they said they need more oil. The last one is manpower. In Zambia, young people who apply to the ranger police is increasing. However, there is a limitation of budget and employment. To patrol the vast national park, rangers feel they need more manpower.

Due to budget and employment limitations, this problem has not yet be solved.

Conclusion

There are two types of poaching, domestic poaching and commercial poaching. Contrary to domestic poaching, the method of commercial poaching is getting evolved, and the rangers are struggling to deal with these problems. Also, the rangers need more equipment to make their patrol efficient. Commercial poaching is related to foreign countries indirectly, and we can cooperate each other to deal with poaching problem by sending equipment which the rangers really need.

