Final Evaluation Report

Your Details	
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Project Title	eTrack: Linking indigenous knowledge, citizen science and artificial intelligence (AI)
Application ID	36723-B
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1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
3D modelling of cheetah tracks and trails.				An MSc student recorded and analysed 162 tracks and 32 trails from cheetahs in Naankuse, Namibia. The aim was to use the tracks to identify the foot position, age, sex, ID, and weight, to study the impact of the track degradation with time, and to develop a new technique for gait analysis by using a drone. The results were published in a Master's thesis. Unfortunately, we couldn't publish the results in scientific articles due to the limited size of the dataset.
Mentoring and work session with the San trackers.				We spent a week working with a group of four San trackers in Kgalagadi Transfrontier Park, South Africa. The aim was to make sure that the trackers understand the CyberTracker tracking standards and to brainstorm about the possibilities of creating the Khomani San Tracking School. Unfortunately, we couldn't draft a Business Plan for the creation of the Khomani San Tracking School as we couldn't involve all stakeholders due to internal politics, which we first try to understand before engaging everyone.
Development of eTrack App.				We contracted an IT company to develop the eTrack App. This app enables the recording of animal tracks and signs. The aim of the app is to be user-friendly. Therefore, it was developed with inputs from professional and indigenous trackers.

2. Describe the three most important outcomes of your project.

a). 3D analysing of cheetah tracks enabled the identification of the foot position (front-hind, right-left; 93% accuracy), individual identity (82.9%), sex (87.9%), and weight (87.6%). The accuracy for weight identification increased to 90% when

considering only male cheetahs. The track degradation study showed that tracks are 3D readable for at least 96 h (4 days). Drones can be used to sample trails and identify the sex of the cheetahs by simply looking at the way they walk (gait analysis). The measurements extracted from 3D models reconstructed from pictures taken by a drone, flying 2 m above the ground, were as accurate as direct measurements using a measuring tape. The gait measurements brought enough information to identify the sex of cheetahs.

b). The creation of the Kgalagadi Transfrontier Park in 1931 resulted in the expulsion of the indigenous San people from their ancestral lands. Following a long land claim battle, the Government of South Africa allocated about 28,000 ha of the national park to the San community. This San Heritage Land is managed by the South African National Parks (SANParks). A group of four San trackers would like to use their land to establish an indigenous tracking school. For 1 week, we hired an instructor from CyberTracker, Adriaan Louw. Adriaan is a Master Tracker and he worked alongside Andrew Kearney. Andrew is a Senior Tracker who volunteered to be part of this tracking mentoring session. The most significant outcome was to see the eagerness from the four trackers to create their own tracking school to teach community kids and visitors. Furthermore, this project enabled us to better understand the politics around the San trackers, who seem to be pushed aside in the decision-making process.

c). We sub-contracted an app developer in South Africa to create the eTrack app. The front end of the app is now completed, and it enables to take pictures of any animal tracks and signs, and to record all related information (on the animal and on the substrate). The eTrack records are all geo-tagged, time-stamped, and they synchronise on the cloud when a Wi-Fi network is available. The app is user-friendly, and it shows a simple protocol to take five pictures from different angles for each track or sign to be able to create a digital 3D model. A global community of eTrackers can share their information, therefore, creating a network of citizen scientists and indigenous trackers. During the tracking session in the Kalahari, a beta version of the app was introduced to the four San trackers to receive their feedback on how to make it more user-friendly. After a quick training on how to take five pictures from different angles, the San trackers were able to sample a few tracks to feed our database. The app exists in two forms: mobile app and web app. Both enable the recording of data directly in the field or to enter historic data (that could have been taken with a normal digital camera, for example). The mobile app is available on both App Store (for iPhone users) and Google Play (for Android users). The web app is available by using the following link: https://wildlife-3d-tracking.web.app/tracks. A total of 3,607 historic tracks (representing more than 30,000 track pictures) were uploaded onto the app.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

- Difficulties to communicate with the San trackers: Despite Omakhai Kruiper being part of the team, it was very difficult to communicate with the team of San trackers. They live in a remote desert area where electricity and cell phone network are scarce and unreliable – especially with the current

electricity crisis in South Africa. Furthermore, most of them have to make a living by selling handcrafts in a lodge where there is no internet connection. Therefore, they can be out of reach for weeks, if not months. The San trackers also speak Afrikaans with a little bit of English, thus, creating a language barrier.

- Difficulties to get the permit to access the San Heritage Site in Kgalagadi Transfrontier Park: We discover a lot of politics between the San, the Mier (an ethnic group of mixed ancestry living in the area), and SANParks. They seem to be significant blockages for the San to be able to use their heritage land for their benefits. It took us many months to finally get the necessary permit to access the San Heritage Land in Kgalagadi Transfrontier Park.

- The development of the eTrack app was much longer than expected: It took more than 14 months to develop the eTrack app (which is already at its Version 0.3.5). Developing an app takes much longer than it seems, as there are several back-and-forth exchanges with the developer to fix bugs and harmonise the workflow.

4. Describe the involvement of local communities and how they have benefitted from the project.

The four San trackers, Omakhai Kruiper, Jan Tieties, Klaas Kruiper and Mohammed Witbooi, were an important part of the project. For one week, we went out between the dunes for some intensive tracking sessions and track sampling by using the 3D protocol. During lunch and dinner, we brainstormed about the Khomani San Tracking school and the ambitions of the four trackers. The discussions were inclusive, and we made sure that all the ideas were coming from the San themselves – to avoid patronising. If we want this project to be a success, then it shouldn't be imposed by outsiders. It should come from within the San community. We also met with Isak and Lys Kruiper, two San elders who are running their own bush school (Veld School) to teach the community children about the San heritage. Isak and Lys were very welcoming of our project as they see many synergies with their school that is also based in the San Heritage Land. We discovered that they even have the power to issue the access permits for the San Heritage Land, and they assisted us when we couldn't get a permit through the normal route, by issuing one themselves.

5. Are there any plans to continue this work?

Yes, much still needs to be achieved. We definitely plan to: (i) assist the San trackers to create their own indigenous tracking school, to (ii) improve the eTrack app; and (iii) further the research on tracking - as a non-invasive technique for monitoring wildlife (bio-monitoring), for mitigating the human-wildlife conflict, and for anti-poaching (by recording human footprints and shoeprints). We also believe that the ancestral art of tracking is a crucial indigenous knowledge that should be preserved and used for environmental education.

6. How do you plan to share the results of your work with others?

We plan to update W3DT website and our social media platforms with the results from this project. The eTrack app is already freely available on the App Store and Google Play. We will do some marketing to advertise the app. We are also in discussion with two journalists to publish two articles: one on the Khomani San Tracking school, and the other one on eTrack app.

7. Looking ahead, what do you feel are the important next steps?

The important next steps are: (i) to continue the collaboration with the four San trackers to help them set up their tracking school, (ii) to market the eTrack app so that it can be widely used, (iii) to collaborate with zoos for them to use eTrack to record reference tracks, (iv) to develop the back-end of eTrack app to implement the 3D processing and the AI recognition, and (v) to further the research on the use of tracking in bio-monitoring, human-wildlife conflict, and anti-poaching.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The Rufford Foundation logo has been used in:

- Master's thesis and presentation (see attached).
- eTrack mobile app (under Sponsors; on App Store and Google Play).
- eTrack web App https://wildlife-3d-tracking.web.app/tracks (under Sponsors).
- W3DT website.

9. Provide a full list of all the members of your team and their role in the project.

Antoine Marchal: Project leader and coordinator. Preparation of the proposal and reports. Co-supervision of Alicia Delvaux.

Omakhai Kruiper: Team leader of the group of San trackers. Point-of-contact with the San community, and particularly with Isak and Lys Kruper from the Veld School.

Alicia Delvaux: Research on the cheetah tracks and trails in Namibia. She was in charge of the data recording and analysis, and the publication of the results in her Master Thesis.

Philippe Lejeune: Co-supervision of Alicia Delvaux. As head of the Forest Resources Management Laboratory in Gembloux Agro-Bio Tech (Belgium), Philippe provided all the necessary equipment for the implementation of the research on cheetah tracks and trails.

10. Any other comments?

We thank The Rufford Foundation for their continued support, and we apologise for the delays in executing this project. We hope to apply for a 2nd Booster Grant to

further the overall goals of this project. We believe that much effort will need to be put in capacity building of the San trackers. We wish that we would be able to hire Omakhai Kruiper so that he can focus entirely on the Khomani San Tracking School and on the preservation of his disappearing culture. In the next grant, we also would like to facilitate the exchange with other bushman communities in Botswana. To do so, we are planning to invite to two bushman trackers from Botswana to take part in the next project in the San Heritage Land in Kgalagadi Transfrontier Park.