Pass NetZero Research Progress Report

Reporting Period: May-June 2025
Report Date: June 27, 2025

Status Overview

Phase Status

- **NUST (Namibia):** Phase 1 completed, Phase 2 pending test specifications approval
- **LUANAR (Malawi):** Phase 1 advanced, proposal defense scheduled July 2025
- **University of Botswana:** Agreement finalization in progress, overhead waiver delays
- **Angola Expansion:** Research agreement drafted, meeting scheduled for discussion
- **Multi-Country Kavango Ecosystem Team:** Framework implementation in progress

Budget Status

- **NUST Team:** Phase 2 payment (€10,000) pending test specifications approval
- **LUANAR Team:** Phase 1 funding fully utilized, Phase 2 preparation initiated
- **Botswana Team:** Phase 1 payment (€3,750) pending agreement finalization
- **Communications Team:** €700 monthly + new initiatives (€5,000 total)
- **Angola Expansion:** €15,000 total budget (€5,000 Phase 1 upon signature)
- **Additional Scholarships:** UB expansion under consideration, NUST research expansion under review (budgets TBC)

Significant Development: Strategic Expansion and Communications Enhancement

The project has entered a significant expansion phase with multiple strategic developments. **Angola integration** is advancing with a research agreement under discussion, potentially adding another key Southern African partner. **Botswana operations** face administrative delays but alternative funding mechanisms through the Botswana Academy of Science are being explored to prevent further postponement.

Communications initiatives have been substantially enhanced with a €2,500 budget proposed to TAKTICAL media for multimedia content creation, pending approval of a detailed fund utilization plan. Content includes filmed interviews, a 5-minute project presentation movie, and

artistic representations for the "Art in the Park" event in Lilongwe (November 2025). Additionally, **Ramsar Convention COP15 participation** (July 23-31, 2025, Victoria Falls) is under consideration with €2,500 budget, pending accommodation solutions.

The research implementation phase continues advancing with both LUANAR and NUST teams transitioning from proposal development to active experimental work, while maintaining the comprehensive scope of carbon sequestration research across diverse Southern African aquatic ecosystems.

Strategic Developments

Angola Integration: Research agreement under discussion with €15,000 budget allocation for 4 BSc students (due to UJES Master's program discontinuation) focusing on peatland carbon sequestration and greenhouse gas mitigation in the Angolan portion of the Cubango and Cuito river basins.

Botswana Operations: Administrative delays with overhead waiver. Alternative funding through Botswana Academy of Science being explored for September 2025 semester start.

Legal Framework Development: IP agreements finalized establishing 50/50 revenue sharing (PNZ/partner universities) with Creative Commons licensing for research outputs and joint ownership of commercially valuable applications.

Communications Enhancement: TAKTICAL media proposed €2,500 budget for multimedia content pending detailed utilization plan approval. Ramsar Convention COP15 participation (July 23-31, 2025, Victoria Falls) under consideration with €2,500 budget.

Program Adjustment: Hansen (NUST MSc) deregistered due to personal commitments.

Team Updates

LUANAR Team (Malawi)

Steven Chirwa - Phragmites australis/Typha latifolia Phytoremediation

- Progress: 90% proposal completion, July defense scheduled
- Innovation: Investigating synergistic plant combinations for enhanced carbon sequestration
- Challenges: Study site identification, equipment planning, funding for laboratory analyses

Ellen Kachulu - Spirulina Aquaculture Systems

- Progress: Proposal completed, NUST collaborations established

- Approach: 70-80% spirulina diet for tilapia, greenhouse cultivation
- Expected: 15-20% improved juvenile survival rates

NUST Team (Namibia)

Fenni Amadhila - Ulva rigida Carbon Capture/Bio-bricks

- Progress: 2.5kg biomass collected, processed to 0.5kg powder
- Challenge: 80% biomass loss during processing, insufficient material for bio-brick production
- Next: Scale up collection, material procurement

Hilia Hatutale - Water Hyacinth/Cyperus papyrus

- Progress: Experimental procedures established, industry collaborations initiated
- Challenge: Equipment access delays due to stipend issues
- Status: Material suppliers identified, seedlings ordered

Veruschka Dumeni - Aquatic Ecosystem Phytoremediation

- Progress: Research finalized, suppliers secured, experimental site established
- Partnerships: City of Windhoek, Gammams Water Reclamation
- Challenge: Permit delays, large-volume sampling logistics (250L × 52 drums)

Communications Team

Website blog development ongoing, social media posting schedule maintained, event participation planning progressing, multimedia content development with TAKTICAL media pending budget approval, NUST IP agreement processing advanced.

Funding Challenges: Continued pursuit of institutional funding faces obstacles including limited visual content for proposals and project's early-stage status while many grant programs target scale-ready initiatives. Preparing first crowdfunding campaign to engage public support while maintaining institutional funding efforts. Enhanced content creation and potential research discoveries leading to patents expected to strengthen future funding applications.

Expansion Framework

Angola Integration: UJES partnership agreement covers 4 BSc students focusing on peatland carbon sequestration, greenhouse gas mitigation, and transboundary basin management in the Angolan portion of the Cubango and Cuito river basins. Features standardized IP framework (50/50 sharing, Creative Commons licensing) and cross-university collaboration with NUST, UB, and LUANAR.

Additional Research Sites: UB/NUST expansion discussions scheduled for July 21, 2025.

Looking Ahead

The next reporting period will focus on:

- **NUST Phase 2 Activation:** Completing test specifications for funding release
- **Botswana Operations Launch:** Finalizing agreement through UB or Botswana Academy of Science pathways
- **Angola Partnership Formalization:** Concluding UJES agreement signature process
- **LUANAR Proposal Defenses:** Supporting July 2025 committee presentations and experimental initiation
- **Enhanced Communications:** Implementing multimedia content strategy through TAKTICAL media and COP15 participation decisions
- **Funding Development:** Launching crowdfunding campaign while pursuing institutional opportunities
- **UB/NUST Expansion:** July 21 discussions on additional research sites and collaboration framework

Budget Outlook: With €5,000 communications enhancement, €15,000 Angola expansion allocation, and pending phase payments, the project demonstrates robust growth trajectory while maintaining strategic focus on comprehensive Southern African aquatic carbon sequestration research.

The progression toward multi-country integration, enhanced public engagement through multimedia content, and practical implementation phases positions Pass NetZero for significant regional impact in climate solutions research and policy influence as the project matures from early-stage research toward scalable implementations.

Attached: Detailed NUST & LUANAR student progress reports

Student Advancement Report

Institution:	**LILONGWE UNIVERSITY OF AGRICULTURE AND NATURAL RESOURCES (LUANAR)**
Name(s):	**STEVEN CHIRWA**
Research Topic:	**THE ROLE OF *Phragmites australis* AND *Typha latifolia* IN PHYTOREMEDIATION AND CARBON SEQUESTRATION IN AQUATIC ECOSYSTEMS**
Date:	**23 June, 2025**

Current Progress

Current progress summary

As of June 2025, the research proposal is almost 90% developed. The proposal includes detailed Introduction, objectives, literature review, methodology, expected outcomes, and a precise work plan and budget. It critically outlines how each and a combination of both plant species will be evaluated to determine its contribution to phytoremediation and carbon sequestration.in aquatic ecosystems.

Presentation Readiness

The research proposal is now almost complete and has undergone thorough internal review. I am almost fully prepared to present the proposal to the appropriate academic committee at LUANAR during the upcoming academic months of July 2025. All necessary supporting documents and presentation materials have been prepared in anticipation of the formal proposal defense.

Challenges
One of the key challenges faced during this phase was managing time effectively. Balancing proposal development with academic timelines requires careful planning to ensure that each of them is completed on schedule. Another challenge was logistical planning, especially in identifying appropriate study sites for the research. Selecting locations that meet both scientific relevance and accessibility has taken considerable effort. Additionally, anticipating the types of tools and apparatus and resources required for the fieldwork phase posed some difficulty. Proper planning is essential to ensure smooth implementation once the research begins. Adding to the challenges is the issue of finances. With rice I cost chemicals, it is a concern whether there will be enough financial resources to support the data collection and laboratory analyses of the collected samples.

Next Steps
Upon approval by LUANAR, the next phase will be an experimental setup in the selected study area. and field data collection. The goal is to begin implementation immediately after the proposal is approved to remain on schedule with the research timeline.

Other Notes
A comprehensive review of relevant literature is on-going, with particular focus on the application of *Phragmites australis* and *Typha latifolia* in phytoremediation and carbon sequestration. Special attention is being given to studies conducted in sub-Saharan Africa and Malawi, which provided valuable insights into local wetland dynamics, species behaviour, and environmental conditions. This foundational knowledge has guided the development of

context-specific objectives and methodologies.

In preparation for the next research phase, plans for field site reconnaissance and a list of required equipment is being undertaken. A tentative list of field equipment is being compiled, including water quality testing kits, biomass measurement tools. Implementation of these plans will commence immediately upon receiving LUANAR's formal approval of the proposal.

Response to research questions

Steven: Do you aim to test the 2 selected plants together or separately? Do these species form a symbiotic relationship? Would be interesting to know if there are any other species that could also present synergies/symbiotic relationships with these species that could be tested.

The research investigates the role of *Phragmites australis* and *Typha latifolia* in phytoremediation and carbon sequestration within aquatic ecosystems. These plants will be tested in combination. This is because the efficiency of the individual plants in abstracting nutrients and heavy metals in wastewater have ever been tested. However, their combined (synergistic relationship) has not been assessed yet.

These combinations could enhance phytoremediation efficiency and carbon sequestration, particularly in degraded or constructed wetland systems. Overall, the study not only evaluates individual plant performance but also lays a foundation for future research on functional plant pairings that support sustainable wetland management in Malawi.

Institution:	**Namibia University of Science and Technology (NUST)**
Name(s):	**Fenni Magano Amadhila**
Research Topic:	**Evaluating the potential of *Ulva rigida* for carbon capture and the development of bio-bricks**
Date:	**22 June 2025**

Current Progress

- **Collected 2.5 kg of fresh *U. rigida* biomass from Walvis Bay beach.**
- **Washed the biomass with distilled water to remove sand, salt and debris.**
- **Air-dried the biomass until completely dry.**
- **Crush the dried biomass into a fine powder (yield 0.5 kg of *U. rigida* powder).**
- **Requested quotes for materials required for laboratory experiments. Final step remaining is to make the purchase order for materials.**

Challenges

- **The biomass loss after drying is significant (from 2.5 kg fresh to 0.5 kg dried powder).**
- **The current biomass is not sufficient for the development of biobricks.**

Next Steps
● **Collect enough *U. rigida* materials for biobrick production.** ● **Make purchase order for materials required for laboratory experiment**

Other Notes
● **Monitoring the physical parameters of seawater at the different sites where *U. rigida* material is collected.** ● **Investigate potential species that can change pH of seawater to more Alkaline** ● **Determine whether potential natural environment such as shells capture and sequester the carbon.**

Institution:	**Namibia University of Science and Technology (NUST)**
Name(s):	**Hilia N. Hatutale**
Research Topic:	**Evaluating the potential of water hyacinth and Cyaperus papyrus in carbon sequestration and wastewater phytoremediation**
Date:	**22 June 2025**

Current Progress
● Established a new experimental procedure **● Emailed NAMWATER and Gammas Water Care works for a possible collaborative study** **● Ordering seedlings of Cyperus papyrus** **● Compiled a list of materials needed for the experimental procedure as well as possible suppliers** **● Narrowing down research topic and plant species to work with**

Challenges
• **School progress slowed down due to not having a laptop and not having means to get one since the stipend has not been received** • **Duplication of experimental procedure**

Next Steps
● **Finalize quotes for materials, chemicals and instruments required for this experimental phase** ● **Possible biodegradable products to create from the biomass** ● **Finalizing experimental procedure and refurbished topic**

Institution:	**Namibia University of Science and Technology (NUST)**
Name(s):	**Dumeni, Veruschka**
Date:	**11/06/2025**

Current Progress

- Research focus and experimental design clarified and finalized.
- Acquired all necessary material suppliers and quotations - aquatic plants, drums, courier, analysis equipment standards etc.
- Acquired one of the two permits and documentation for plant importation.
- Acquired site for experimental set-up and necessary permissions (site inspection done).
- Made the necessary industry liaisons (City of WIndhoek Scientific Services - all permissions for using the Dam facilities, Gamamms Water Reclamation and Treatment Works process engineer - source of sludge water for nutrient spiking).

Challenges

- Slow permit application process and long waiting period, which means I cannot move forward with procuring the materials until I have received all the necessary permits.

- Logistics for obtaining water samples from the dam (due the volumes required - 250L * 52 drums) forecasted to increase costs i.e labor.

Next Steps

- Procurement and purchasing of all materials.
- Preparation of the necessary protocols and data recording templates.
- Planning and arranging labor for logistics.

Other Notes

Response to Research Questions

ELLEN KACHULU (LILONGWE UNIVERSITY OF AGRICULTURE AND NATURAL RESOURCES)

Will Spirulina be used as the role sole feed source for the fish, or will it be supplemented with other feeds?

What is the planned source of Spirulina: in house cultivation or external sourcing?

In what form will Spirulina be incorporated into the fish feed(e.g., powder, pellets or liquid)?

If cultivating Spirulina, what type of facility will be used: greenhouse or open-space culture?

Can small scale farmers feasibly scale up Spirulina production to meet the demands of large scale aquaculture operations, and what challenges might they face in doing so?

Does the use of Spirulina as a feed source improve the survival rate of juvenile fish compared to traditional feeds?

Have you selected a target fish species for this Spirulina-based feeding approach, and if so, which one?

I think of Tilapia fish species for spirulina-based feeds due to its warm-water preference and ability to thrive on plant-based feeds. Spirulina will comprise 70-80% of the fish's diet, with the remaining 20-30% consisting of wheat flour (15-20%) and rice bran (5-10%) to provide essential nutrients like fiber and carbohydrates (NRC, 2011). A greenhouse will be used for spirulina cultivation, allowing for optimal temperature (25-30°C) and light conditions. With proper infrastructure and expertise, small-scale farmers can scale up spirulina production. Spirulina supplementation can improve juvenile tilapia survival rates by 15-20% (Takeuchi et al., 2002) and contribute to carbon sequestration.

Student Advancement Report

Institution:	**LILONGWE UNIVERSITY OF AGRICULTURE AND NATURAL RESOURCES (LUANAR)**
Name(s):	**ELLEN CHRISTABEL KACHULU**
Research Topic:	**EFFICACY OF *ARTHROSPIRA PLATENSIS* (SPIRULINA) IN CARBON SEQUESTRATION AND FISH GROWTH PERFOMANCE IN AQUACULTURE SYSTEMS.**
Date:	**21 June, 2025**

Current Progress

Current progress summary

Thorough research and planning was conducted

Research proposal outlining research goals, methods, and expected outcomes was structured. For instance, I clearly defined research questions, identified the target population, and outlined the data collection and analysis procedures.

The proposal underwent a careful review to ensure it meets academic standards and is feasible to implement. This review process involved evaluating the proposal's coherence, validity, and potential impact, as well as assessing the resources required to complete the project.

LUANAR and NUST team also developed and delivered presentations to showcase our work and receive feedback from our supervisors.

Supervisors offered insightful comments and suggestions, helping us strengthen our research design, clarify our research questions, and better articulate our expected outcomes.

Challenges
Time management was a significant issue, as balancing multiple tasks and deadlines required careful prioritization. Access to relevant and up-to-date literature was another hurdle, particularly for niche topics. Additionally, articulating a clear and concise research question, defining the scope and boundaries of the study, and ensuring the proposal's feasibility and potential impact were also areas that demanded attention and refinement.

Next Steps
Upon approval by LUANAR, the next phase will involve field data collection and experimental setup in selected study area. The goal is to begin implementation immediately after the proposal is approved to remain on schedule with the research timeline.

Other Notes
Through the research proposal development process, we have established potential collaborations with students and lecturers from NUST, particularly those with expertise in climate change, who showed interest during our presentations. We have also identified opportunities to work with other stakeholders who manage ponds, which could provide valuable insights and resources for our research. A key lesson we have learnt from this process is the importance of effective communication, stakeholder engagement, and interdisciplinary collaboration in shaping a robust and impactful research project. These partnerships and lessons will likely enhance the quality and relevance of the research.