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THE EU ERASMUS+ CONTAN PROJECT: DEVELOPING CURRICULA FOR BIODIVERSITY MONITORING AND CONSERVATION IN TANZANIA

*Claudia Barelli, **Francesco Rovero

*University of Florence, claudia.barelli@unifi.it;
barelli.cla@gmail.com
**University of Florence and MUSE – Science Museum of Trento,
francesco.rovero@unifi.it; francesco.rovero@muse.it

Abstract

L'economia globale rischia perdite fino a 5 trilioni di dollari all'anno a causa del declino della biodiversità. Con la sua straordinaria biodiversità, l'economia della Tanzania dipende fortemente dai suoi ecosistemi. Tuttavia, le inadeguate capacità e risorse ostacolano l'integrazione efficace della conservazione della biodiversità. Finanziato nell'ambito della linea di budget EU Erasmus+ Capacity Building in Higher Education, il progetto CONTAN (2021–2025) ha contribuito ad affrontare queste sfide rafforzando la capacità delle università Tanzaniane di offrire formazione sulla biodiversità attraverso aggiornamenti dei curricula, l'istituzione di una piattaforma di e-learning, formazione sul campo e la fornitura di attrezzature per il monitoraggio della biodiversità.

Keywords: Africa, training, e-learning, educazione superiore, foreste tropicali

Il progetto EU Erasmus+ CONTAN: sviluppare curricula per il monitoraggio e la conservazione della biodiversità in Tanzania

The global economy faces potential losses of up to $5 trillion annually due to biodiversity decline. Renowned for its outstanding biodiversity, Tanzania relies on its rich and diverse ecosystems for significant economic and environmental benefits. However, limited research

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capacity and inadequate resources hinder effective mainstreaming of biodiversity conservation. Funded under the EU Erasmus+ Capacity Building in Higher Education budget line, the CONTAN project (2021–2025) contributed addressing these challenges by boosting the capacity of Tanzanian academia to deliver training in biodiversity through updated curricula, establishment of an e-learning platform, field training, and the provision of equipment for biodiversity monitoring.

Keywords: Africa, training, e-learning, higher education, tropical forests

Background and Project Objectives

Tropical forests play a crucial role in global ecosystems by offering essential services such as climate regulation, water filtration, and supporting biodiversity. However, these forests are under severe threat, and their loss represents one of the greatest risks to global biodiversity, affecting ecosystem services vital for human well-being and economic stability. Africa, home to 18% of the world's tropical forests, holds a central position in mitigating this biodiversity crisis. The European Union (EU), recognizing the need for global action, acknowledges that addressing the environmental crisis requires efforts not only within the EU but also in biodiversity-rich, resource-constrained countries like Tanzania. Through its commitment to global biodiversity goals under the Convention on Biological Diversity (CBD) and its 2030 Biodiversity Strategy (European Commission 2025), the EU seeks to "step up efforts to avert global biodiversity loss". However, achieving these targets necessitates capacity building

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and collaboration, especially in countries like Tanzania, which are facing significant challenges in biodiversity conservation.

Tanzania, known for its exceptional biodiversity and iconic parks such as the Serengeti, Kilimanjaro, and Ngorongoro, has dedicated 33% of its land to conservation, with biodiversity playing a crucial role in sectors like tourism, which contributes nearly 18% of the gross domestic product. Despite this, Tanzania faces serious socio-economic and environmental challenges, with approximately 70% of its rural population relying on agriculture and natural resources. The country struggles with inadequate research capacity, outdated educational curricula, and limited resources for biodiversity conservation. The Tanzanian National Biodiversity Strategy and Action Plan (2015) and the National Five-Year Development Plan (2016) highlight these gaps, particularly in Higher Education Institutions (HEIs), which lack the capacity to integrate biodiversity conservation effectively into national development.

The CONTAN project (Developing Curricula for Biodiversity Monitoring and Conservation in Tanzania) (see CONTAN project website) aimed to enhance Tanzania's capacity to provide modern, scientifically rigorous education on biodiversity assessment and conservation. Its main objectives were (1) *enhancing curricula* by integrating updated biodiversity knowledge into Tanzanian HEIs through e-learning and collaborative platforms; (2) *building capacity* among faculty and technical staff to improve biodiversity monitoring methods; and (3) *developing skills* among students and professionals

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to implement standardized biodiversity monitoring techniques, bridging the gap between policy and practice.

Partners and Targets

The CONTAN project, funded by the European Commission under the Erasmus+ Program - Ka2 (Cooperation for Innovation and the Exchange of Good Practices in Capacity Building in the Field of Higher Education), brought together a diverse consortium of seven institutions, including four European partners, two natural science museums: the Natural History Museum of Denmark (NHMD) and the MUSE - Science Museum of Trento in Italy, and two universities: the University of Florence (UNIFI) in Italy – that coordinated the project – and the University of Bayreuth (UBT) in Germany. The project activities were designed based on Tanzanian HEIs needs assessment, with each of the three Tanzanian institutions involved - Mweka College of African Wildlife Management (CAWN-Mweka), Sokoine University of Agriculture (SUA), and University of Dar es Salaam (UDSM) – that had its own needs and challenges. For example, CAWM-Mweka required substantial investment in modern infrastructure and field equipment to support its specialized training programmes effectively, SUA struggled with overcrowded classrooms, limiting the quality of education, alongside a shortage of practical training opportunities. Hence, there was a clear need to enhance the curricula and invest in faculty development to improve

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educational outcomes, as also for UDSM that faced outdated curricula that did not align with current academic or industry standards, as well as insufficient field training, especially in advanced fields like molecular biology and quantitative ecology. This lack of training hampered the ability to address contemporary environmental and conservation challenges.

Overall, this collaboration aimed to leverage the collective expertise of both European and Tanzanian institutions to address critical issues in education, conservation, and capacity building. It is important to mention that all European partner institutions involved in the project had long-established, strategic ties with Tanzania, particularly in the areas of biodiversity conservation and institutional capacity building. These partnerships have allowed EU institutions to work closely with Tanzanian organizations on some of the country's most important conservation programmes. For example, MUSE (Italy) and NHMD (Denmark) are leading a significant conservation initiative in the Udzungwa Mountains, while UBT (Germany) is at the forefront of efforts to preserve Mount Kilimanjaro. These enduring collaborations highlight a strong and ongoing commitment to safeguarding Tanzania's rich biodiversity and empowering local institutions to manage these resources more effectively. Therefore, through the synergy of these established EU-Tanzania collaborations, the project combines international expertise in conservation with a deep understanding of local needs and challenges.

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The project targeted primarily students (Bachelor and Master of Science) in biodiversity-related disciplines and faculty members at Tanzanian HEIs, while secondary beneficiaries included professionals working in protected areas, government agencies, and conservation organizations. By tackling both conservation challenges and capacity-building needs, the CONTAN project emerges as a pivotal initiative in promoting sustainable practices. It not only addresses the urgent need to preserve Tanzania's rich biodiversity but also empowers local communities and institutions to play an active role in these efforts. By enhancing technical skills, improving educational curricula, and investing in infrastructure, the project strengthens the ability of Tanzanian organizations to manage natural resources sustainably.

Project Activities and Outcomes

The project was funded 100% by the EU through a grant of €790,431.00 and was initially planned to run for three years starting on 15 January 2021. However, due to the complexities involved in finalizing the accreditation processes for the updated Hei curricula, an amendment to the Grant Agreement extended the eligibility period to January 2025. This extension ensured the completion of all project outputs, enabling the partner HEIs to address their challenges more effectively and sustainably.

The CONTAN project addressed the gaps envisaged by the Tanzanian HEIs by (1) developing an *e-learning platform* aimed at providing the learning material for *updating curricula*, (2) building the capacity of

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lecturers and technicians through targeted, peer-to-peer training, (3) creating a *Toolkit* to facilitate training and (4) providing *equipment*. The project also enhanced students' practical skills and updated professionals' expertise through (5) *field-based training courses* in standardized biodiversity monitoring techniques. Key stakeholders were involved from the project's commencement, including Tanzania National Parks (TANAPA), the Ministry of Natural Resources and Tourism, and the Tanzania Wildlife Research Institute (TAWIRI), as well as various local and international NGOs.

To achieve its three main objectives, the CONTAN project has begun by procuring the necessary equipment for its activities, ensuring that it not only meets the immediate demands of the project but also provides long-lasting solutions for future use. The combined equipment list covered a broad range of field and laboratory tools designed to support environmental and biological research, including *computers and electronics* for data management and analysis (i.e. 45 laptops, 10 desktop monitors, 16 cameras, 2 projectors, etc.), field *equipment for wildlife monitoring and environmental measurements* (i.e. 6 rangefinders, 9 Gps units, 18 binoculars, 32 insect nets, etc.), *microscopy and herbarium tools* for scientific observation and specimen preservation (i.e. 5 microscopes, 160 insect boxes, herbarium pressers, insect pins, forceps, etc.), *measurement tools* for data collection in the field (i.e. dendrometers, bio tree sticks, soil moisture sensors, etc.) as well as storage for organizing specimens and equipment. This extensive list of equipment ensured that the

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institutions were well-equipped for various field studies, monitoring projects, and laboratory analyses.

Moreover, 89 lecturers from the European partners engaged in the establishment of the e-learning platform, as a strong foundation for knowledge-sharing and capacity-building. The platform was integrated into the University of Florence's Moodle platform[1]. The content for each subject was developed with input from Tanzanian lecturers gathered through dedicated online workshops, with EU lecturers responsible for module preparation and production. As a result, the three main courses developed were (i) *Ecological Monitoring and Conservation Biology* (35 lectures) on tropical rainforests, biodiversity monitoring, conservation biology, and molecular ecology; (ii) *Quantitative Methods for Ecological Monitoring* (34 lectures) exploring scientific methods, sampling techniques, wildlife ecology, remote sensing, and vegetation ecology; and (iii) *Methods in Taxonomy and Biodiversity Inventorying* (20 lectures) on methods for studying arthropods, plant biology, vertebrates, and microclimate measurements. All 89 lectures of 30-50 minutes each, divided into 4-5 modules per subject, were uploaded to the Moodle platform, along with videos, Pdfs, and practical resources. A total of *90 students, 51 lecturers* from both EU and Tanzanian institutions, as well as *10 stakeholders* gained first access. All activities under this work package focused on delivering e-learning content and integrating it into Tanzanian HEI curricula, with strong

[1] see https://formstudelearning.unifi.it/course/index.php?categoryid=192

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engagement from all participants, positioning the platform to support ongoing teaching and biodiversity research.

Building upon the e-learning content, the CONTAN project further enhanced the learning experience with immersive, field-based training. This training, conducted at the Nkweseko Field Station in the Kilimanjaro National Park (Arusha) and at the Udzungwa Ecological Monitoring Centre (UEMC) in Udzungwa Mountains National Park (Morogoro), allowed the students to apply their knowledge in real-world ecosystems, emphasizing biodiversity monitoring, conservation, and ecological research through hands-on activities and advanced techniques such as Gis-based forest inventory and camera trap data analysis (Figure 1). Students were engaged in training at both field stations to experience varied ecosystems, with EU faculty providing consistent guidance. Training at the foot of Mount Kilimanjaro (coordinated by UBT) focused on integrating biodiversity knowledge, research tools, and field-map technology for forest inventory and monitoring. This technology, combining real-time Gis software with electronic equipment, enables accurate, efficient data collection and processing, proving vital for biodiversity conservation. The program's second part at UEMC (coordinated by UNIFI and NHMD) featured advanced training on camera trap data analysis using R-statistical software, emphasizing proper techniques to enhance wildlife ecology studies. Camera traps, crucial for understanding spatial species richness, were applied in mammal monitoring and conservation. M.Sc. students in Ecosystems Science and Management

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and Forestry participated in ecological methods training, including primate surveys to assess biodiversity in Udzungwa Mountains National Park, a global biodiversity hotspot with endemic species such as the Sanje mangabey and Udzungwa red colobus. Upon completion, students demonstrated the ability to integrate biodiversity knowledge into conservation strategies, employ research tools and technologies for ecological studies, conduct ecological surveys for mammals and related fauna, utilize camera trapping techniques effectively and analyse ecological data as well as prepare scientific reports. This 14-day activity, which engaged 89 students, 28 faculty members, and local stakeholders, underscored the critical role of biodiversity in ecosystem health while equipping participants with practical skills to support sustainable conservation efforts.

Figure 1. CONTAN field (top), laboratory (middle) and class (bottom) training of students at the Udzungwa Ecological Monitoring Centre in the fall of 2022 (Author’s elaborations).

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The outcomes of the project included the development of new courses and updates to existing ones, aimed at producing a more competitive workforce of biodiversity experts, increasing research output, and integrating international standards into biodiversity programmes. A remarkable total of seven courses were upgraded, specifically, five Master of Science courses and 2 Bachelor of Science courses across the three Tanzanian partner HEIs. On average, 33% of modules in each course were updated, representing 35% of teaching credits updated, and 50% of the actual teaching content. The curricula accreditation process follows a rigorous multi-step procedure, including departmental submission, faculty board endorsement, Senate approval, and final submission to the Tanzania Commission for Universities (TCU) via the Programme Management System (PMS).

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The TCU then assesses compliance with quality assurance standards and coordinates peer reviews, integrating their feedback into the curricula before final approval by the accreditation committee. The accreditation process for updated curricula across the three HEIs has been fully completed and received official accreditation, with new courses being implemented from the 2024-2025 academic year for CAWM-Mweka and 2026 for SUA and UDSM. These developments demonstrate significant progress in aligning HEI curricula with current academic and market demands, facilitated by the project's collaborative framework.

To mark the conclusion of a four-year project supported by the European Union, a two-day final symposium was held in August 2024. This event celebrated the achievements of the CONTAN network, which brought together over 100 participants, including students, lecturers from three Tanzanian higher education institutions, EU faculty and partners' representatives, as well as local stakeholders. The symposium served as a platform to present the results of the project, with various stakeholders showcasing the key outcomes and accomplishments. These included the effective use of professional research equipment and the successful integration of both theoretical knowledge and practical skills learned throughout the project. Additionally, the symposium provided an important opportunity for the launch of the Toolkit (Figure 2). This online and printed manual was developed to address gaps in available reference materials. It includes comprehensive summaries, tutorials, and guidance to support

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both the e-learning and field training components of the project, ensuring that students and lecturers have a lasting resource to guide their future work in biodiversity conservation and research. The Toolkit is intended to bridge the gap between classroom learning and practical application, further enhancing the project's educational impact.

Figure 2. Front page of the CONTAN Toolkit, launched and distributed at the final project symposium and available online to this link: https://www.erasmuscontan.eu/wp-content/uploads/2024/08/Muse-ToolkitContan-mag24-v09-WEB.pdf (Authors' elaboration).

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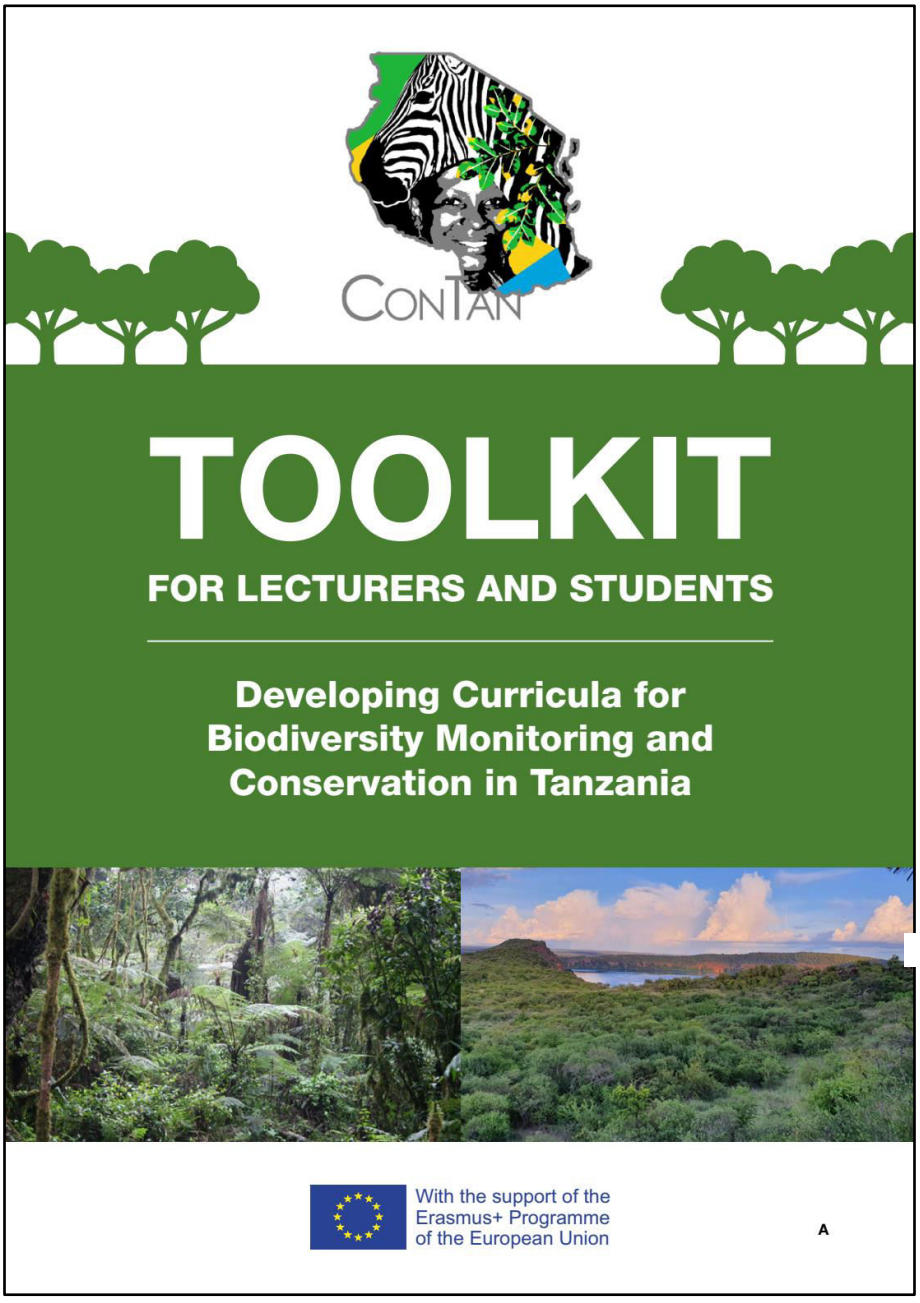

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In addition to the core activities of the CONTAN project, several complementary initiatives have been undertaken to ensure the successful achievement of its objectives. These included short-term joint staff training sessions, interactive workshops, and participation in public events both in Tanzania and the EU. These efforts have been pivotal in fostering collaboration, sharing knowledge, and engaging stakeholders across different regions. To further enhance visibility, the project's outcomes and key findings have been widely disseminated through a range of materials, including brochures, leaflets, and semi-permanent exhibitions, ensuring that the results reach a diverse audience. CONTAN maintains an active online presence through a dedicated website (CONTAN project website), social media platforms (Facebook, Twitter, Telegram), where the project's activities, milestones, and results are regularly showcased. These platforms have allowed the project to engage with the public, ensuring that its work is accessible and transparent. In addition, various educational gadgets and materials have been distributed to targeted groups such as students, lecturers, and key stakeholders, further extending the reach of the project and its educational impact to the broader community.

Conclusions

Although the full impact of the project can only be quantified in the years to come, we are confident that it had significantly contributed to the long-term sustainability of Tanzania's biodiversity by addressing the critical gap in applied skills for standardized biodiversity

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assessment and monitoring. This gap, reflected in the insufficient capacity of staff at protected areas and conservation agencies, has been a major challenge. Additionally, the project has provided substantial capacity-building opportunities for HEIs, enabling them to become centres of excellence in biodiversity conservation. This positions the country as a leader in conservation efforts across Africa and beyond.

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Acronym

CBD	Convention on Biological Diversity
CONTAN	Developing Curricula for Biodiversity Monitoring and Conservation in Tanzania
EU	European Union
Gis	Geographic Information System
Gps	*Global Positioning System*
HEI	Higher Education Institution
MUSE	Muse - Science Museum of Trento
CAWM-Mweka	Mweka College of African Wildlife Management
NHMD	Natural History Museum of Denmark
PMS	Programme Management System
TCU	Tanzania Commission for Universities
TANAPA	Tanzania National Parks
TAWIRI	Tanzania Wildlife Research Institute
UEMC	Udzungwa Ecological Monitoring Centre
SUA	University of Agriculture
UBT	University of Bayreuth
UDSM	University of Dar es Salaam

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UNIFI University of Florence