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FORestore

Forest Restoration through VET Capacity Building

CB VET FORestore

"T2.6: Transnational Research leading to the development of an evidence-based Curriculum on sustainable Forest Management and Restoration techniques"

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1. Introduction

1.1 Purpose and Scope of the Report

The purpose of this report is to present the evidence base, analytical process, and outcomes that informed the design of the FORESTORE Curriculum on Sustainable Forest Management and Restoration Techniques. The curriculum development process draws on two complementary research streams: comprehensive desk research, which gathered data from EU and Sub-Saharan African (SSA) partners, and empirical field research, which was conducted by SSA partners to capture real-world conditions, local knowledge, and on-the-ground training needs. Together, these inputs ensure that the curriculum responds to actual capacity gaps, aligns with current policy frameworks, and integrates international best practices with local ecological, social, and economic realities. This collaborative evidence-gathering process involved all project partners:

EU Partner Countries
Slovakia – Technická Univerzita vo Zvolene (TUZVO)
Italy – Eduforma SRL (EDU)
Italy- Mine Vaganti NGO (MVNGO)
Greece – Simeio Evropaikis Gnosis MAKE (EKS)

Sub-Saharan African (SSA) Partner Countries
Cameroon – International Bilingual Academy -IBAY SUP (HEIS)
Ghana – African Centre for Technical Training Ltd (ACTT)
Nigeria – Obafemi Awolowo University (OAU)
Uganda – Uganda Youth Skills Training Organization (UYSTO)
Somalia (Puntland) – Puntland Technical University (PTU)

The report falls under Work Package 2 (WP2), led by the designated partner responsible for research coordination. The WP2 leader developed detailed research guidelines that established:

- Clearly defined objectives and methodological approaches,
- A distribution of responsibilities among project partners,
- Standardized templates for data collection and reporting, and
- A shared framework for synthesizing results across participating countries.

These guidelines ensured methodological coherence across partners and facilitated the production of a unified Transnational Research Framework that underpins the curriculum development process.

The scope of this report encompasses both desk-based and field-based research streams, providing a dual-layered evidence structure that grounds curriculum design in policy relevance, scientific rigor, and on-the-ground realities.

1. Desk Research
The desk research focused on four main thematic areas gathering data from :

1. **Legislative and Policy Frameworks** for Sustainable Forest Management and Restoration – reviewing relevant EU, regional, and national legislation, strategic plans, and institutional mechanisms guiding forestry, biodiversity conservation, and climate adaptation.

2. **Challenges of Deforestation** – identifying structural drivers and cross-sectoral impacts in participating countries to contextualize the skills and knowledge gaps in forest governance and restoration practices.
3. **Identification of Best Practices** – analyzing innovative, transferable models from Europe and Africa (e.g., Pro Silva Slovakia, AdaptFor Greece, Great Green Wall Nigeria, FMNR Uganda) to extract operational lessons, success factors, and potential curriculum content.
4. **Curricula Mapping and Review** – assessing existing forestry and environmental VET programs to identify content gaps, outdated methodologies, and insufficient integration of digital technologies and green entrepreneurship.

This analysis provided the strategic and theoretical foundation for defining the knowledge and competence domains of the FORESTORE curriculum.

2. Field Research

Complementing the desk research, the field component provided empirical evidence through direct engagement with the training ecosystem—capturing the voices and experiences of representatives from VET centers and VET learners. It included:

- **Questionnaires** administered to 10 VET centers and 10 VET learners per SSA country, applying the Borich Needs Assessment Model (BNAM) to measure the discrepancy between the perceived importance and current competence levels of key forestry-related skills. The resulting Mean Weighted Discrepancy Scores (MWDS) identified priority training areas such as forest management, reforestation planning, maintenance and monitoring, digital forest technologies, and governance frameworks.
- **Focus Group Discussions (FGDs)** in Cameroon with educators, learners, and stakeholders to explore Cameroon local perceptions of employability, and capture qualitative insights on the relevance of current training provision.
- **Stakeholder Partnership Questionnaires** targeting Vocational Training Centers to assess the extent of public–private cooperation, availability of internships, and co-creation of curricula.

These combined data sources allowed for a robust triangulation of findings—validating skill gaps identified in the desk research while revealing local barriers to effective implementation.

Integration and Output

The integration of desk and field research provided a comprehensive, multi-scalar understanding of the forestry training landscape across the partner countries. Findings were synthesized through a transnational comparative analysis, leading to the co-creation of a nine-module curriculum in Sustainable Forest Management and Restoration Techniques.

To ensure academic and practical rigor, the draft curriculum was subsequently reviewed by two external forestry and reforestation experts. Their feedback informed the final refinement of module content, learning outcomes, and pedagogical approaches, ensuring that the FORESTORE curriculum is relevant, adaptive, and transferable across diverse regional and institutional contexts.

1.2 Background of the FORestore Project

Sustainable forest management (SFM) is dedicated to preserving the health and productivity of forests while addressing the needs of society and the environment. It ensures that forests continue to provide vital resources, such as timber and clean water, as well as essential ecosystem services like carbon sequestration for both present and future generations. SFM skillfully integrates ecological, economic, and social factors to achieve a harmonious balance between resource utilization and forest conservation. The goal of SFM is to create outcomes that are socially just, ecologically sound, and economically viable, representing the three pillars of sustainability.

The Erasmus+ FORestore project recognizes the importance of effective regulations to combat deforestation and supports a comprehensive approach to solutions that ensures inclusivity and encourages everyone to contribute to a dual transition. This project considers the latest methods and restoration techniques employed by its partners in Slovakia, Italy, Greece, Cameroon, Ghana, Nigeria, Uganda. This approach is anticipated to yield innovative results and solutions that will not only benefit the project's specific area of focus but also address the diverse needs of the geographical context in which it operates. By enhancing learners' understanding of various restoration techniques, the project will improve their green and digital skills, aligning them with current and future job opportunities and thus contributing to the dual transition.

An international learning activity will pilot a Massive Open Online Course (MOOC) alongside a field study to provide hands-on experience with these techniques. Recognizing that climate change can influence the effectiveness of certain restoration practices, the curriculum will incorporate climate-resilient strategies, prioritizing adaptability and equipping learners with the skills to navigate evolving environmental conditions.

These collaborative efforts span two continents (EU and SSA) , fostering a rich exchange of knowledge and best practices in both reforestation techniques and educational approaches within the vocational education and training (VET) sector.

2. Methodological Framework for Developing the Evidence-Based FORESTORE Curriculum

The methodological framework guiding the transnational research of the FORESTORE project was designed to ensure that the proposed curriculum for sustainable forest management and restoration is grounded in evidence, policy relevance, and field-based realities.

It combines two complementary components:

1. **Desk Research**, which examined policy frameworks, deforestation trends, best practices, and existing curricula; and
2. **Field Research**, which captured empirical data from VET institutions, learners, and stakeholders through structured tools and participatory methods.

3.1 Desk Research Component

The desk research served as the analytical foundation for understanding the policy, institutional, and educational landscape influencing forestry education and training in partner countries. It encompassed four core elements:

(1) Legislative and Policy Framework Analysis

This phase reviewed national and regional legislative frameworks governing Sustainable Forest management and restoration techniques in all Partner countries. The analysis examined policies such as forest acts, land tenure systems, reforestation strategies, and national adaptation plans to determine their alignment with international agreements like REDD+. The findings revealed that while all countries have established legal provisions for forest protection, the degree of implementation and institutional coordination varies significantly. This analysis informed the governance and legal literacy modules of the FORESTORE curriculum ensuring that learners develop an understanding of the regulatory environment underpinning sustainable forest management.

(2) Challenges of Deforestation

The second analytical strand focused on assessing the drivers and impacts of deforestation in the participating countries. Through a review of academic studies, reports, and institutional data, the project identified common structural factors such as agricultural expansion, charcoal production, illegal logging, and weak enforcement of land-use regulations. Country-specific nuances were also documented—for instance, energy dependence on charcoal in Somalia, land conversion for cocoa cultivation in Ghana, expansion of subsistence agriculture in Uganda and urbanization pressures in Nigeria. This situational analysis provided the contextual foundation for defining the competence needs in forest restoration, community forestry, and climate resilience, later validated through field data.

(3) Identification of Best Practices

A targeted review of nine best practices in sustainable forest management, restoration and alternative restoration techniques (spanning Europe and Sub-Saharan Africa) provided evidence-based models for curriculum design. These included cases such as *Pro Silva Slovakia* (close-to-nature silviculture), *AdaptFor Greece* (climate-adapted management), *FMNR Uganda* (farmer-led restoration), and the *Great Green Wall Nigeria* (large-scale landscape restoration). Each case was analyzed through a comparative lens to identify the innovative features, operational mechanisms, results, and scalability potential.
Key lessons distilled from these best practices—such as ecosystem-based management, participatory governance, data-driven monitoring, and livelihood integration—were directly translated into training modules, pedagogical activities, and learning outcomes within the FORESTORE curriculum.

(4) Curricula Mapping and Review

A mapping of existing forestry and environmental curricula across VET and higher education institutions in the partner countries was undertaken to assess content coverage, methodological approaches, and digital integration. This review revealed that most programs remain technically focused, with limited digital/innovation integration and minimal industry linkages. In several cases, curricula were found to be outdated and delivered exclusively face-to-face, which restricts wider access and limits opportunities for blended or online learning. The gap analysis provided the structural basis for designing the nine FORESTORE modules, each aligned with labor market needs and policy priorities identified during the desk research phase.

3.2 Field Research Component

The field research component provided the empirical validation of the desk study and ensured that the FORESTORE curriculum reflects the real skills gaps, priorities, and opportunities within the forestry sector. It combined quantitative and qualitative methods, involving representatives from 10 VET centers and 10 VET learners per SSA country.

(1) Questionnaires with VET Centers and VET learners

Structured questionnaires were administered to 10 VET centers and 10 VET learners per SSA partner country to capture skills and knowledge gaps, institutional capacity, teaching practices, and collaboration with industry and public bodies. Using the Borich Needs Assessment Model, respondents rated the importance of specific skills/knowledge in four critical areas: forest management, reforestation, deforestation and legal framework. The resulting Mean Weighted Discrepancy Scores (MWDS) enabled the identification and prioritization of training needs in areas such as forest inventory and mapping, digital forest management, reforestation planning, maintenance and monitoring.

(2) Focus Groups

Focus group discussions in Cameroon were conducted with representatives of the VET sector. These sessions explored participants' perceptions of training relevance, employability, and ecosystem restoration priorities. Key findings included the lack of structured cooperation between VET centers and industry, insufficient practical exposure, and the need for green entrepreneurship training to create alternative livelihoods in forest-dependent communities. The focus groups also highlighted regional priorities.

(3) Stakeholder Partnership Analysis

Data from stakeholder questionnaires revealed varying levels of public–private collaboration.

- In Cameroon and Ghana, cooperation primarily occurs through internships, capacity-building workshops, and project partnerships with research institutions and ministries.
- Nigeria demonstrated the most advanced network of partnerships, including joint curriculum design, seedling supply, and field projects with government and private actors.
- In Uganda, institutions actively engage communities and private landowners through farmer field schools and outreach initiatives.
- Somalia showed emerging collaborations, focusing on linking VET centers with NGOs and private enterprises to promote reforestation and renewable energy initiatives.

3.3 Integration of Findings

The methodological integration of desk and field research ensured that the FORESTORE curriculum development process was both top-down (policy-informed) and bottom-up (practice-driven).

- The **desk research** defined the strategic and policy framework for sustainability and revealed international best practices.
- The **field research** grounded these findings in the realities of VET delivery, skill demand, and stakeholder collaboration.

Together, these complementary strands enabled the design of an evidence-based, regionally adaptable, and competency-oriented curriculum structured around nine interconnected modules that address ecosystem governance, restoration techniques, digital innovation, and community empowerment in forestry education.

3. Acknowledgements

We would like to express our sincere gratitude to all the partner institutions, experts, and stakeholders whose collaboration and dedication made the FORestore project—Forest Restoration through VET Capacity Building—a reality. This project, funded under the ERASMUS-EDU-2024-CB-VET programme, has been a result of shared vision, mutual commitment, and extensive cooperation among European and African partners.

Special thanks go to the coordinating institution, **the Technical University in Zvolen**, for providing academic leadership and steering the consortium with professionalism and foresight. We also acknowledge the crucial contributions of the dedicated research, administrative, and technical teams at the university.

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Finally, we thank the European Commission for the funding and support that enabled this transnational initiative. FORestore exemplifies the potential of cross-border collaboration in addressing global challenges such as deforestation, and building green, inclusive, and sustainable futures through education.

Together, we plant the seeds for tomorrow's forests.

4. Desk Research: Legal Framework and Policy Clarity

4.1 Legislative Framework for Sustainable Forest Management in EU

Central to EU forest policy, this strategy puts forests at the core of the green economy, emphasizing sustainable management, protection, and the provision of ecosystem services. It encourages a holistic, cross-sectoral approach and alignment of national policies with EU objectives (Guran-Nica & Rusu, 2016; Guran, 2016).

The Pillars of the European Legislative Framework

The European legislative framework for sustainable forest management is based on several interdependent pillars:

- **The Common Agricultural Policy (CAP):** Although not exclusively dedicated to forests, the CAP plays a key role in supporting sustainable forestry practices through agri-environmental and climate measures (Regulation (EU) No 1305/2013). The CAP National Strategic Plans, set up for the period 2023-2027, include specific objectives for forest management.
- **The Habitats Directive and the Birds Directive:** These fundamental directives of the EU environmental policy contribute to the conservation of natural habitats and wildlife, including forests (Directive 92/43/EEC; Directive 2009/147/EC). They impose management and protection obligations on Member States for Natura 2000 areas containing forest habitats of Community interest.
- **The Forest Regulation:** This regulation, adopted in 2013, aims to strengthen forest governance at EU level by promoting the exchange of information and cooperation between Member States (Regulation (EU) No 525/2013). It also encourages forest certification.
- **The EU Forest Strategy 2030:** Adopted in 2021, this strategy sets out a long-term vision for Europe's forests, with a focus on protecting, restoring and sustainably managing forests (European Commission, 2021). It sets ambitious targets for reforestation, fighting forest fires and strengthening the resilience of forest ecosystems.
- **The Deforestation and Forest Degradation Regulation:** This recent regulation, which came into force in 2023, aims to prohibit the placing on the EU market of products associated with deforestation and forest degradation from 2021 (Regulation (EU) 2021/2085). It imposes due diligence obligations on economic operators involved in the trade of these products.
- **Taxonomy Regulation (EU 2020/852):** Directly applicable across member states, this regulation establishes criteria for environmentally sustainable activities, directing investments toward sustainable forestry and supporting the goals of the European Green Deal. It utilizes financial instruments such as green bonds to channel capital into sustainable forest management (Brożek et al., 2024).
- **LULUCF Regulation:** This regulation integrates land use, land use change, and forestry into the EU's climate and energy framework, requiring member states to account for greenhouse gas emissions and removals from forests, with a "no net debit" target. It incentivizes sustainable practices and climate-smart forestry (Brożek et al., 2024; Nabuurs et al., 2018; Nabuurs et al., 2017; Leśkiewicz, 2020).
- **EU Timber Regulation and Renewable Energy Directives:** These regulations address illegal logging and promote the sustainable sourcing of timber and bioenergy, with due diligence, certification, and sustainability criteria that have extraterritorial effects (Henn, 2021; Leśkiewicz, 2020).

Forest management remains primarily a national competence, resulting in a polycentric system where 90 national and sub-national governments implement both EU-wide and local policies. This situation leads to significant variations in governance, reflecting differences in land ownership, history, and local priorities (Lazdinis et al., 2019; Nichiforel et al., 2020).
Evolving National Laws: Over the past two decades, most EU countries have updated their forest laws to align with EU principles, expanding landowners' rights while strengthening environmental protections and the use of financial incentives (Guran-Nica & Rusu, 2016; Guran, 2016; Nichiforel et al., 2020). Designing effective, WTO-compliant sustainability criteria and ensuring coherence across trade, climate, and forest policies remain ongoing challenges (Henn, 2021; Leśkiewicz, 2020). Effective implementation requires regionally adapted approaches that engage multiple stakeholders and consider diverse landscapes and ownership structures (Lazdinis et al., 2019).

On 19 April 2023, the European Parliament and the Council approved the revision of two regulations in land use and forestry (LULUCF). The revised Effort Sharing Regulation sets stricter emission reduction targets for Member States to be achieved by 2030. The revised LULUCF Regulation will strengthen the contribution of the LULUCF sector to the EU's overall climate ambition for 2030. For the period 2026-2030, individual Member States will have binding national 2030 targets for increasing net greenhouse gas removals, which will collectively achieve the above-mentioned common EU target.

Slovakia

Former forest legislation in the SR originated from the 1970s. Because it was created in connection with state ownership of forests, forest legislation was too directive. As such, due to the social, political, and economic changes that occurred after 1989 (e.g., the restitution of original property rights), forest legislation had to be significantly amended in the 1990s.

The contents of the new Forest Act consist of the following main parts:
Basic provisions include the purpose of the Act and legal definitions, the definition of forest land and principles for its protection, principles of differentiated forest management, including provisions on forest categories, management systems, timber felling, and forest ameliorations. Additionally, it covers the purpose and practical performance of forest protection, principles of public use of forests, including the right to public access and activities prohibited in forests, a system of professional forest management dealing with issues related to management plans, forest information systems, and authorized forest managers, as well as the financing of public activities necessary for sustainable forest management, etc.

There are two basic parts within the structure of the NFP – the first consists of 5 strategic objectives: 1. Support of ecological management of forests 2. Improvement and protection of the environment 3. Improvement of the quality of life4. Increasing long-term competitiveness 5. Enhancement of cooperation, coordination and communication and 18 priorities: 1. to support close-to-nature forest management 2. to support development and use of environmental-friendly technologies and machinery 3. to preserve and improve biodiversity in forests 4. to mitigate climate change impact and to support adaptation of forests to effects of climate change 5. to enhance forest protection 6. to develop forest monitoring 7. to preserve and improve protection functions of forests 8. to increase contribution of forests and forestry to rural economy 9. to increase long-term competitiveness and economic viability of multifunctional forestry 10. to support research and technological development in order to improve competitiveness of forestry sector 11. to monetize and market non-wood forest products and services12. to support use of forest biomass for energy production13. to support cooperation of forest owners and to improve education and training in forestry 14. to secure implementation of international commitments in relation to forests and forestry within the implementation of the objectives of the NFP 15. to strengthen cross-sector cooperation and coordination of policies affecting forestry 16. to secure eligible interests and needs of forest owners and the whole society 17. to support utilization of timber originated from forests managed in a sustainable way 18. to support environmental education and systematic public relations in order to achieve positive changes in public understanding of the importance of forestry. The second part deals with financial arrangements, including EU and SR financial support.

The National Forest Programme of the SR is a key document of forest policy and its significant role is highlighted by the fact that the SR NFP, except of the so-called “traditional” priorities (e.g. support of close-to-nature forest management, support of use of environmental- friendly technologies and machinery, enhancement of forest protection, preservation of protection

functions of forests, support of use of forest biomass for energy production, support of cooperation of forest owners), comprises also the "modern" innovative priorities (e.g. preservation and improvement of biodiversity in forests, mitigation of climate change impact, increase of contribution of forestry to rural economy, increase of competitiveness and economic viability of forestry, strengthening of cross-sector cooperation and coordination of policies affecting forestry, support of systematic PR).

Greece

The principle of sustainability in the current Greek Constitution and laws

The early 20th century marked a pivotal period in Greece for the development of forestry legislation. A cornerstone of this era was Law 4137/1929, which remained in force—with amendments—until 1969. Commonly referred to as the Code of 1929, this law was primarily designed to regulate the economic exploitation of forests, addressing the widespread issue of overexploitation of forest lands at the time. Among its key provisions was the prohibition of allocating public forest areas for quarrying, reflecting an early effort to manage and protect forest resources (Koulia K., 2015).

A significant shift toward environmental awareness in Greece began to emerge in the 1970s, with the first clear milestone in national environmental policy occurring in 1975. The Constitution of 1975 was the first in Greek constitutional history to include explicit provisions for environmental protection. Most notably, Article 24 established the State's obligation to safeguard the environment, setting forth legally binding principles for all branches of government—the legislature, the executive, and the judiciary. This constitutional recognition laid the foundation for a more holistic and rights-based approach to environmental governance in Greece.

The 2001 constitutional revision introduced the explicit recognition of the "principle of sustainability" in Article 24, establishing that economic development must be balanced with environmental protection. This enshrinement elevates the natural environment to the status of a protected legal asset, not merely for its utilitarian value, but for its intrinsic worth—ensuring ecological balance and the preservation of natural resources for the benefit of future generations. Within this constitutional framework, forest ecosystems are recognized as a fundamental component of the natural environment, playing a crucial role in maintaining ecological equilibrium and representing a valuable natural resource. The protection of forests is explicitly guaranteed by Articles 24(1) and 117(3) and (4). Furthermore, the interpretative declaration of Article 24, also introduced in the 2001 revision, provides a clear and constitutionally grounded definition of "forest" and "forest area." It emphasizes the organic unity of forest vegetation, which is essential to the area's identity and central to its constitutional protection. The Greek Constitution provides strict protection for forest ecosystems to preserve their ecological balance and intended use. According to Article 117(3), any forests—public or private—that are destroyed by fire or deforestation must be compulsorily reforested and cannot be repurposed for other uses. While Article 24(1) mandates environmental protection, constitutional law and case law recognize that other national interests—such as economic development, resource exploitation, regional growth, and employment (Articles 106(1) and 22(1))—must also be considered. However, any such considerations must be balanced with the State's obligation to safeguard the environment and promote sustainable development, especially when environmental risks are involved.

Law 998/1979 is a key legal framework in Greece for the protection, conservation, and management of forests. It outlines the state's jurisdiction over both public and private forests, detailing responsibilities, ownership rights, forest exploitation, reforestation, fire prevention, and logging regulations, with a strong emphasis on environmental protection. In addition, Law 1650/1986, adopted after Greece joined the EEC, reinforces forest protection by promoting

sustainable forest management, reforestation, and the creation of forest maps to identify areas requiring special protection.

The Strategic Development Plan for Forestry, established under Article 60 of Law 4280/2014, outlines Greece's forestry policy for 2018–2038. It defines long-term principles, objectives, and implementation resources, aiming to promote employment, local economic development, and the sustainable and equitable management of forest ecosystem services. public dialogue, Law 4572/2018 empowered the Minister of Environment and Energy to approve the plan and set relevant Action Plans. This led to the official adoption of the National Forestry Strategy (NFS) through Ministerial Decision 170195/758/2018, solidifying the country's forest policy framework for the next 20 years.

Ministerial Decision 166780/1619/2018 modernizes outdated forestry study specifications from 1953 and 1965. Key updates include:

- Digital compilation and submission of forestry studies, aligned with national and EU legislation and Natura 2000 requirements.
- Forest division based on natural and technical features (e.g. streams, ridges, roads).
- Use of GIS for accurate area measurement.
- Incorporation of climate change adaptation practices.
- Emphasis on forest ecosystem functions and non-wood product production (e.g. mushrooms, honey, medicinal plants).
- Integration of validated forest maps and grazing plans into forestry studies.

Regulation (EU) 841/2018 on Land Use, Land Use Change and Forestry (LULUCF) updates the previous Regulation 525/2013 and sets out Member State commitments to help achieve the Paris Agreement and the EU's 2021–2030 climate goals.

- It recognizes forestry as a central tool for climate change mitigation for the first time.
- The regulation emphasizes the role of forests, agricultural land, and wetlands in greenhouse gas reduction and carbon sequestration, including through afforestation.
- It promotes sustainable forest management, as endorsed by ForestEurope, and highlights that sustainably managed forests are effective in absorbing and storing CO_2.
- Article 6 addresses carbon accounting for managed forests, underscoring the importance of maintaining and enhancing natural carbon sinks to meet the EU's 2050 emission reduction targets.

Forest management bodies and their advice on forest protection and conservation

Early management of protected areas was conducted by the Forest Service through Forest District Offices, under the Ministry of Agriculture (now Ministry of Environment and Climate Change), with centralized decision-making and strict protection policies, without public participation.

Law 1650/1986 shifted more authority to the Ministry of Environment, particularly for protected areas created after 1986. However, those established before 1986 are still managed by Forest District Offices.

In 2002, 28 protected areas were officially assigned Management Bodies under Law 3044/2002.

The 1992 implementation of the EU Habitat Directive marked a major turning point:

- Led to changes in administration and governance
- Expanded the roles of conservation authorities
- Opened new funding opportunities
- Promoted participatory decision-making in forest and conservation policy

Th Natura 2000 network introduced a multi-purpose, sustainable forest management framework within designated protected areas.

Forest management authorities are crucial for the protection, conservation, and sustainable use of forest resources.

- They balance economic, social, and environmental needs, enforce compliance with forest laws, prevent illegal logging, and address climate change and natural disasters.
- They also promote sustainable forestry practices and engage in public awareness and education on the importance of forests.

1. The Ministry of Environment and Energy is the national forest management authority, responsible for:
   - Formulating and implementing forest policy
   - Overseeing laws and regulations related to forest ecosystems (ypen.gov.gr)
2. Directorate of Forest Management and Forest Environment, within the Ministry focuses on
   1. Department of Management of Public Forest and Rangeland Ecosystems
      - Oversees the implementation and monitoring of sustainable management practices in public forests and rangelands.
      - Coordinates involved stakeholders and addresses any management issues.
   2. Department of Non-Public Forestry
      - Focuses on policy monitoring and supports the sustainable management of non-public forests and woodlands.
   3. Department of Wildlife and Game Management
      - Responsible for habitat enrichment and wildlife species conservation, particularly in game management areas.
   4. Department of Forest Protected Areas and Forest Recreation
      - Provides guidance for the planning, implementation, and monitoring of Action Plans and Management Studies in protected forest areas and recreational forests.

Italy

Italy has established a comprehensive legislative framework for Sustainable Forest Management (SFM), aligning with European Union directives and international commitments. This framework integrates legal measures, strategic planning, and certification standards to ensure the sustainable use of forest resources while addressing climate change, biodiversity conservation, and socio-economic development.

One of the key pillars of Italy's forest management legislation is the Consolidated Law on Forests and Forest Supply Chains, enacted through Legislative Decree No. 34/2018. This law recognizes forest ecosystems as a crucial part of Italy's natural capital and establishes principles for sustainable forest resource management. It seeks to balance environmental protection with socio-economic benefits and harmonize regional forestry policies under a unified national approach (Food and Agriculture Organization [FAO], n.d.). Additionally, the decree acknowledges the role of forests in carbon sequestration, biodiversity conservation, and hydrogeological protection. A defining aspect of this legal framework is the emphasis on participatory governance, ensuring the involvement of local communities, environmental organizations, and private forest owners in decision-making processes.

Building upon this foundation, Italy introduced the National Forestry Strategy (NFS) in February 2022, setting a 20-year roadmap for the sustainable management of forest resources. The strategy prioritizes the enhancement of forest resilience, the protection of biodiversity, and the strengthening of forests' role in climate change mitigation and adaptation (MedForest, 2022). Developed through extensive consultations with experts, policymakers, and stakeholders in the forestry sector, the NFS reflects a participatory governance model. Its objectives include the

promotion of sustainable forestry practices, the support of local economies dependent on forest resources, and the enhancement of ecosystem services. Furthermore, it aligns with broader EU strategies, such as the EU Forest Strategy for 2030, ensuring that Italy contributes to European climate and biodiversity goals.

Beyond national legislation, Italy has embraced internationally recognized forest certification schemes. In August 2024, the country adopted a revised version of the Forest Stewardship Council (FSC) Forest Stewardship Standard, incorporating innovative approaches to sustainable forest management (Forest Stewardship Council [FSC], 2024). This updated standard emphasizes biodiversity conservation, ecosystem service provision, and the socio-cultural significance of forests. The revision process involved broad stakeholder engagement, including public agencies, environmental organizations, and industry representatives. By adhering to FSC principles, Italy reinforces its commitment to responsible forest management and strengthens its position within the global sustainable timber trade.

At an international level, Italy has also demonstrated its commitment to sustainable forestry through its participation in the Alpine Convention, a transnational treaty aimed at promoting sustainable development in the Alpine region. The convention highlights the need to balance ecological protection with economic and social development, ensuring that forestry practices contribute to both conservation efforts and local livelihoods (Alpine Convention, n.d.). Given the increasing vulnerability of the Alpine region to climate change, this agreement plays a significant role in preserving forest ecosystems and their associated biodiversity.

Italy's approach to Sustainable Forest Management reflects a combination of robust legal frameworks, long-term strategic planning, and internationally recognized certification standards. The Consolidated Law on Forests and Forest Supply Chains and the National Forestry Strategy provide a structured policy foundation, while FSC certification ensures adherence to sustainable practices. Moreover, Italy's involvement in international agreements, such as the Alpine Convention, highlights its commitment to transboundary forest governance. As challenges such as deforestation, climate change, and biodiversity loss persist, Italy's legislative framework is expected to continue evolving to address emerging environmental and socio-economic priorities.

4.2 Legislative Framework for Sustainable Forest Management in Africa

The Sustainable Forest Management Framework for Africa (2020-2030) was developed to address the challenges of deforestation, land degradation, and unsustainable forest management practices across the continent. The study was conducted with the technical and financial support of the Food and Agriculture Organization (FAO) in collaboration with the African Forest Forum (AFF). The preparation process involved expert consultations, desk reviews, electronic surveys, country visits, and validation workshops, culminating in a final approval by the African Union (AU) Assembly in 2020. The framework was designed to align with Agenda 2063, aiming to ensure zero deforestation and the sustainable management and restoration of Africa's forests for socio-economic and environmental benefits. The framework is built on five key priority areas to guide sustainable forest management (SFM) efforts. First, it focuses on enhancing the value of forests, improving sustainable production, processing, marketing, and trade of forest products and ecosystem services. Second, it emphasizes capacity development and knowledge management, strengthening institutions, forest producer groups, and communities to better manage forest resources. Third, it calls for the development of supportive policies and institutional frameworks, including legal reforms, tenure security, and decentralized governance. Fourth, it promotes forest restoration and landscape rehabilitation to build resilience and sustainable livelihoods. Finally, it

seeks to mobilize partnerships and financial resources for achieving long-term forest sustainability.

Forest legislation in African countries varies, but many shares common themes. Legislation often aims to promote sustainable forest management, conserve biodiversity, and address deforestation. Many countries have passed or are considering new forest acts, often to strengthen enforcement and improve governance. Some legislation also focuses on community involvement and transferring rights over forest resources to local communities.

In Africa, sub-regional organisations such as the Southern African Development Community (SADC) and the Central African Forests Commission (COMIFAC) play a significant role in promoting forest law enforcement and governance across borders. Many countries are tackling the issue of deforestation through legislation that regulates logging, promotes reforestation, and encourages sustainable agricultural practices. The key aspects of forest legislation focus on conservation and sustainable management. From this perspective, many laws prioritise conserving forests to ensure their long-term health and biodiversity. Efforts to strengthen forest law enforcement and governance are a key focus, especially in combating illegal logging and trade. Some countries are moving toward greater community involvement in forest management, including recognising local communities' rights to forest resources. Moreover, numerous opportunities for private sector investment in commercial plantations are often enhanced through new forest laws.

Examples of Specific Legislation:

SADC Forest Law Enforcement, Governance and Trade Plan (2013): This plan aims to strengthen forest law enforcement and governance across the Southern African region.

National Environmental Management: Biodiversity Act (South Africa, 2004): This act provides for the management and conservation of South Africa's biodiversity.

Forest Acts in East and Southern Africa: South Africa, Lesotho, Mozambique, Tanzania, Zambia, and Malawi have all passed new forest acts since 1997, reflecting a trend of updated legislation.

Central African Forests Commission (COMIFAC): This commission was created in 2000 to promote sustainable forest management in Central Africa.

VPA-FLEGT (European Voluntary Partnership Agreement on Forest Law Enforcement, Governance and Trade): Some African countries, like Cameroon, are incorporating this global governance instrument into their domestic policies.

Cameroon

The Congo Basin, the second largest tropical forest in the world, is home to exceptional biodiversity and plays a crucial role in regulating the global climate. Sustainable management of its forests is therefore a major issue, both locally and globally. Each country in the basin has implemented a specific legislative framework, but regional initiatives aim to harmonize approaches and promote concerted forest management.

Each country in the Congo Basin has a forest code that defines the rules for forest management on its territory. These codes have evolved over time to incorporate the principles of sustainable forest management, including:

●**Democratic Republic of Congo (DRC):** The Congolese Forest Code, adopted in 2002 (Law No. 11-2002 of 29 August 2002 on the DRC Forest Code), emphasizes sustainable forest

management, biodiversity conservation and the participation of local communities. It provides for the creation of protected areas and forest certification.

●**Congo: The new Congolese forest code**, adopted in 2020, strengthens provisions for sustainable forest management. In particular, it introduces the concept of a simplified management plan for small concessions and emphasizes forest certification (Forest Code, 2020).

●**Gabon:** Gabon has adopted an ambitious forest policy that aims to preserve 88% of its forests. The Gabonese forest code emphasizes sustainable forest management, the fight against illegal logging and the conservation of biodiversity (PFBC, 2022).

●**Cameroon:** Cameroon also has a forestry code that governs forest management. This code has been reformed several times to integrate new requirements for sustainable management (COMIFAC, 1999).

Beyond national legislation, several regional and international initiatives aim to promote sustainable forest management in the Congo Basin:

●**The Central African Forest Commission (COMIFAC):** Created in 1999, COMIFAC brings together the countries of Central Africa and is tasked with promoting sustainable forest management. It has developed regional action plans and legal instruments to harmonize the forest policies of member countries.

●**Congo Basin Forest Partnership (CBFP):** The CBFP is a platform for cooperation between Congo Basin countries, donors and civil society organizations. It aims to support the implementation of national forest policies and promote sustainable forest management.

●**Voluntary Partnership Agreements (FLEGT VPAs):** These bilateral agreements between the EU and timber-producing countries aim to combat illegal logging and promote the legality of the timber trade. Several Congo Basin countries have signed a FLEGT VPA.

Cameroon is also home to significant biodiversity in its forest ecosystems, which must be imperatively protected and sustainably managed. Several legal texts have been drafted with a view to the sustainable management of Cameroonian forests.

Law No. 94/01 of January 20, 1994 relating to the forest, wildlife and fishing regime. This law defines the general legal framework for the management of forests, wildlife and fisheries in Cameroon. It recognizes the right of local populations to use forest, wildlife and fishery resources, while allowing the authorities to restrict it for reasons of public utility (Article 8). The law distinguishes between permanent forests (state and communal) and non-permanent forests (national, community and private domain) (Articles 20-39). It regulates the terms of forest exploitation, in particular through exploitation titles (sales of cutting, exploitation agreements, exploitation permits, etc.) (Articles 41-62). The law regulates the protection of wildlife, hunting and the capture of animals (Articles 78-104). It defines the legal framework for the exercise of fishing, management and conservation of fishery resources (Articles 109-140). The law provides for a system of criminal and administrative sanctions in the event of non-compliance with its provisions (Articles 141-153).This law marks a major turning point in Cameroon's forestry and environmental policy, by integrating the principles of sustainable management of natural resources.

Ghana

Ghana's commitment to sustainable forest management is anchored in a robust legislative framework that encompasses various laws and policies:

1.Forests Act, 1927 (Cap. 157): Establishes the creation and management of forest reserves.

2.Forests Protection Act, 1974 (NRCD 243) and its amendment in 2002 (Act 624): Defines offenses related to forest reserves and outlines the powers of forest officers.

3.Timber Resource Management and Legality Licensing Regulations, 2017 (LI 2254): Regulates the granting of timber rights and ensures legality in timber operations.

4.Land Use and Spatial Planning Act, 2016: Provides a framework for land use planning, including forest lands.

5.Forestry Commission Act, 1999 (Act 571): Establishes the Forestry Commission, responsible for regulating forest use and resources.

6.Forest and Wildlife Policy, 2012: Guides the sustainable management and utilization of forest and wildlife resources.

7.Environmental Protection Agency Act, 1994 (Act 490): Tasks the EPA with monitoring and controlling activities impacting the environment, including forestry.

8.National Climate Change Policy, 2013: Promotes REDD+ implementation and sustainable land use practices.

These laws are implemented by key institutions:

1.Ministry of Lands and Natural Resources (MLNR): Oversees land, forest, wildlife, and mineral resources management.

2.Forestry Commission (FC): Regulates forest use, monitors activities, and provides services for forest protection and development.

3.Lands Commission (LC): Manages public lands, including those designated as forests or protected areas.

4.Community Resource Management Areas (CREMAs) and District Assemblies also contribute to local forest governance.

Nigeria

Nigeria's forestry legislation has evolved over time, influenced by its colonial history, post-independence goals, and current environmental concerns. The country's forest governance began in 1887 with the establishment of the Office of Woods and Forests in Lagos. A key development was the 1901 Forest Ordinance, which aimed to regulate timber exploitation through the imposition of fees, girth limits for logging, and tree replanting requirements. After gaining independence, Nigeria shifted its focus on forest management to align with national development goals, driven by the need to exploit forest resources for economic growth and meet the demands of a growing population.

Key Legislative Frameworks for Promoting Sustainable Forest Management in Nigeria

The framework governing sustainable forest management (SFM) in Nigeria comprises national policies, acts, and regulations, often supplemented by laws at the state level. The main instruments for legislation are:

National Forest Policy (1988, Revised 2006, 2020): The 1988 forest policy in Nigeria aimed to increase the forest cover from 10% to 20% of the land area, with a focus on conservation and sustainable resource management. The 2006 revision emphasized biodiversity and climate

resilience to align with global commitments (FGN, 2006). The 2020 update aims for 25% forest cover by 2030, aligning with initiatives like REDD+ and promoting afforestation, community involvement, and private-sector engagement.

Forestry Law (Derived from State Edicts): Forestry in Nigeria is regulated at the state level, with laws such as the Cross River State Forestry Commission Law 2010, Ekiti state Forestry law 2016 and Edo state Forestry commission 2023 dedicated to ending deforestation and actively restoring forests across the states.

Land Use Act (1978):This act places all land under the jurisdiction of state governors, who are tasked with managing it for the benefit of the public, encompassing forested areas. It provides governors with the power to allocate land, which impacts forest reserves and the accessibility for local communities.

National Environmental Standards and Regulations Enforcement Agency (NESREA) **Act (2007):** The agency was created to implement environmental regulations, particularly those concerning the protection of forests. This legislation grants NESREA the authority to oversee deforestation, manage industrial operations that affect forest ecosystems, and ensure adherence to global agreements like the Convention on Biological Diversity.

REDD+ Framework (Initiated 2010): The initiative aims to mitigate carbon emissions resulting from deforestation while fostering sustainable livelihoods, with backing from the UN and World Bank. Its objective is to incorporate forest carbon inventories, community management, and climate finance into national policy frameworks. As of 2021, Nigeria successfully restored 555,480 hectares and planted 15 million trees (UNREDD+, 2021)

Uganda

Uganda has approximately 5 million hectares of forest, covering 24% of the country's total land area. Of this forested land, 80% is woodland, 19% is tropical high forest, and less than 1% consists of plantations. Of the total forest area, 70% is located on private land, while the remaining 30% falls within the permanent forest estate, primarily as part of protected areas (Kazoora, 2002). In Uganda, the forest estate has shrunk from 24% of the total land area in 1990 to 9% in 2015, amounting to a loss over 3,000,000 hectares. This has occurred both in unprotected forests and in protected areas, mostly under the National Forestry Authority (African Development Bank 2021). The government acknowledges that Uganda's forests and woodlands are vital to the three pillars of sustainable development, economic growth, social well-being, and environmental protection yet recognizes that the forestry sector has not been given the attention it deserves. Uganda's forest resources offer a wide range of benefits, including energy, timber and non-timber products, employment opportunities, livelihood support, government revenue, business prospects, vital environmental functions and services, as well as the preservation of ecological integrity.

Uganda Vision 2040 sets a target of increasing forest cover from 15% in 2010 to 24% by 2040. Under NDP II, GoU sought to increase sustainable production, productivity and value addition as key growth opportunities under which a target to increase forest cover to 18% in 2020 was set. The strategic direction of NDP III spells out the target for doubling the current forest cover by 2025 with an overall goal of, "Increased household income and improved quality of life"(National Forestry Authority, 2020).

International and regional development frameworks, such as the United Nations' Sustainable Development Goals, the African Union's Agenda 2063, and the East African Community Vision, emphasize the significant role of forests and forestry in driving development. According to the Uganda Forestry Accounts Report (NEMA, 2011), forestry resources contribute as much as 8.7% to the national economy. Forests play a crucial role in supporting livelihoods and sustaining the environment.

The first colonial forest policy in Uganda: This was Uganda's first forestry policy established in 1929. Since then, it has experienced numerous revisions, shifting between a stronger focus on conservation and a more flexible approach emphasizing the economic utilization of forest resources. The most recent policy review took place in 1988; however, it offered limited direction regarding implementation principles and strategies, forestry activities outside gazetted reserves, and the balance between resource production and environmental conservation (Turyahabwe & Banana, 2008). It also failed to address the roles of the government, private sector, and rural communities in forestry, as well as the connections between forestry, other sectors, and various land uses (Ministry of Water and Environment, 2016 and MWLE, 2001).

The second colonial forest policy in Uganda: In 1948 the country's second forest policy was gazetted for the first time by the coronial Governor. This policy aimed at consolidating the legal division of management responsibility between the central and local governments that had been put in place 10 years earlier. It included a more definite statement of implementation steps including consolidation and demarcation of the remaining reserves (Turyahabwe & Banana, 2008).

The National Environment Act Cap 153 (1995); Section 2 (2) (c), (d) and (e) of the Act describes the principles of environmental management that indirectly recognize forest as important in providing public goods and services.

- To use and conserve the environment and natural resources of Uganda equitably and for the benefit of both present and future generations, taking into account the rate of population growth and the productivity of the available resources;
- To conserve the cultural heritage and use the environment and natural resources of Uganda for the benefit of both present and future generations;
- To maintain stable functioning relations between the living and nonliving parts of the environment through preserving biological diversity and respecting the principle of optimum sustainable yield in the use of natural resources

The Land Act Cap 227, (1998): Sections 44(1), (2) of The Land Act Cap 227, 1998 states that;(1) The Government or a local government shall hold in trust for the people and protect natural lakes, rivers, ground water, natural ponds, natural streams, wetlands, forest reserves, national parks and any other land reserved for ecological and touristic purposes for the common good of the citizens of Uganda

The Forestry Policy (2001): The Forestry Policy 2001, recognizes that forests also provide important environmental services in the protection of watershed and soil. There are increasing pressures on important watersheds due to their high agricultural potential. Poor crop and livestock management practices, including the cultivation and over-grazing of steep slopes and riverbanks, have contributed to extensive soil erosion, and in some areas landslides. The destructive

harvesting of forest resources in watershed catchment forests is further contributing to soil erosion and sedimentation, and to a reduction in the quantity and quality of water (Deininger et al., 2011).
National Forest Plan (2002) revised in 2012; The main focus of the first NFP (2002) was on the management of tree and forest resources for the economic, social and environmental benefits for all the people of Uganda, in line with the pillars of Poverty Eradication Action Plan (PEAP). To this end, the National Forest Plan (NFP) was designed to improve the livelihoods of Ugandans, especially those living in rural areas through raising the incomes of the poor, increasing the number of jobs and enhancing the contribution of forests to Uganda's economic development, while ensuring that the future of the country was not jeopardized in the process.
The National Forestry and Tree Planting Act, 2003: This intended to provide for the conservation, sustainable management and development of forests for the benefit of the people of Uganda; to provide for the declaration of forest reserves for purposes of protection and production of forests and forest produce; to provide for the sustainable use of forest resources and the enhancement of the productive capacity of forests; to provide for the promotion of tree planting; to consolidate the law relating to the forest sector and trade in forest produce; to establish a National Forestry Authority; to repeal the Forests Act, Cap. 246 and the Timber (Export) Act Cap. 247; and for related matters. The Act intended to serve and fulfil the following purposes;

- To create an integrated forest sector that will facilitate the achievement of sustainable increases in economic, social and environmental benefits from forests and trees by all the people of Uganda;
- To guide and cause the people of Uganda to plant trees;
- To ensure that forests and trees are conserved and managed in a manner that meets the needs of the present generation without compromising the rights of future generations by safeguarding forest biological diversity and the environmental benefits that accrue from forests and trees;
- To promote the improvement of livelihoods through strategies and actions that contribute to poverty eradication;
- To encourage public participation in the management and conservation of forests and trees;
- To facilitate greater public awareness of the cultural, economic and social benefits of conserving and increasing sustainable forest cover;
- To promote the decentralization and devolution of functions, powers and services within the forest sector; and ensure that environmental benefits, costs and values are reflected in strategies and activities relating to forestry.

Somalia

In Somalia, the legislative landscape for forest management is evolving. The Forestry and Wildlife Conservation **Law No. 69/2015** serves as a foundational legal instrument, aiming to halt biodiversity loss and habitat destruction.
This law assigns responsibilities to the Ministry of Environment and Rural Development, including monitoring plant and wildlife resources, developing reforestation programs, and promoting the creation of private and community forests.
Additionally, Somalia has introduced the National Environmental Policy and the Environmental Management Bill, which provide frameworks for environmental governance and sustainable practices. Despite these efforts, challenges such as limited enforcement capacity, insufficient funding, and fragmented institutional frameworks hinder effective implementation

4.3 Deforestation: The Challenge to Address

Slovakia

In 2023, the area of forest land reached 2.03 million hectares, representing 41.4% of the total area of the Slovak Republic (Fig. 1). Forests are characterised by high species diversity, with broadleaved trees making up 65% and conifers 35%. The growing stock on forest land reached 487 million m³, indicating the stability and quality of forests. Despite facing challenges such as harmful agents and climate change, we did not record a significant increase in damage to forest stands in 2023. Forests were regenerated over an area of ten thousand hectares, of which natural regeneration represented 37% (Fig. 2). This trend is vital for transforming our forestry towards close-to-nature management, which will enhance the stability and resilience of the forests. Timber harvesting in 2023 reached 7.2 million m³, nearly 0.5 million m³ less than the previous year. This decline aligns with the trend of decreasing timber felling in recent years.
The forestry-timber sector has significant potential for further development, providing high-quality products and services. To secure funding for Slovak forestry, the National Forestry Program of the Slovak Republic for the period 2025-2030, titled "FORESTS FOR SOCIETY," approved by the government in 2024, will serve as an important tool. One of the primary objectives of the Program is to guide activities and investments toward achieving a defined vision and global goals in the Slovak forestry sector.

Annual growth is primarily attributed to changes in land use categories. The forest percentage reached 41.4%. Most Slovak forests are production forests (72%). The second most common type is protected forests (17%), where ecological functions are of prime importance. Lastly, special-purpose forests (10.7%) prioritise social and cultural functions.
Due to a great diversity of natural conditions and habitats, Slovak forests showcase a rich composition of tree species, varied age structures, and spatial arrangements. The most abundant tree species include European beech (33.6%), Norway spruce (22.7%), and English/sessile oak (10.5%). Broadleaved species are 62.8% more prevalent than conifer species, positively impacting the biological diversity and stability of forest ecosystems. The area of coniferous species has been decreasing since 2005, from its original 41% to 37.2% in 2017; this is particularly true for Norway spruce. The total growing stock is increasing, reaching 537.67 million m³ in 2017, marking a 33.9% increase from 1990 figures. It can be said that Slovakia currently has the highest historically recorded growing stock in at least the last century. However, the volume of the current growing stock is at its peak; in the coming years and decades, it is expected to decrease due to the gradual change in the age composition of forests in Slovakia. To support biodiversity, deadwood is also an essential component of forest ecosystems.
Currently, there are 1.22 million hectares of forests in existing systems of protected areas (national and European) in Slovakia, representing 62.8% of the total area of forest stands. The national system of protected areas covers approximately 840 thousand hectares of forest area (43.1%), while the average for FOREST EUROPE member countries is 19.4% (FOREST EUROPE 2015a). The European NATURA 2000 system occupies 29.7% of Slovakia's territory, whereas the EU average is 18.15%. This comparison clearly shows that the area of forested protected territories in Slovakia is significantly above average.
Slovak forests are experiencing an unprecedented frequency and intensity of harmful agents. Various restrictions often severely hinder timely and systematic incidental felling and subsequent removal of materials from forests damaged by biotic agents (particularly bark beetles).
In Slovakia, there are existing forest-related policy documents: the National Forest Programme, the National Programme on the Utilization of Available Timber Resources, and other strategic and legislative documents addressing climate change mitigation and adaptation measures in forests,

which also include provisions on current forest-related issues and create opportunities for the further development of both forest and timber processing sectors.
The Ministry of Agriculture and Rural Development of the Slovak Republic (MARD SR) is the supreme national authority on forests. At the district level, there are 49 Land and Forest Departments.
In 2016, the Slovak Republic assumed the chairmanship of FOREST EUROPE, the most important pan-European political process on forest policies. Its Secretariat, "Liaison Unit Bratislava," is located at the NFC in Zvolen. It continues to follow the Work Programme as planned until 2020. The Ministerial Conference on the Protection of Forests in Europe is scheduled to take place in the autumn of 2020 in Bratislava.
https://openknowledge.fao.org/server/api/core/bitstreams/9ab65bbe-1ae8-4a07-bc44-e167ffbc52eb/content

Greece

Forest Biodiversity in Greece

- Ownership and Composition:

Over 75% of forests and forested land in Greece are State-owned.
Only about 20% are high forests, mostly naturally regenerated.
The remaining areas include bushlands, grazing lands, rocky, or bare land.
Coppicing and clearcuts are mainly practiced on non-state-owned lands (municipal, church, or private).

- Coppiced Forests and Management Trends:

48–50% of forests are coppiced, though there is growing pressure to convert them into seedling/high forests.
Average growing stock is estimated at 62 m³/ha.
Around 70% of harvested wood is used as firewood.

- Biodiversity and Natura 2000:

About 60% of forested areas are part of the Natura 2000 network.
Greece has one of the richest forest biodiversity in Europe, due to its climatic and geographic diversity and relatively low historical human pressure.

- Climate Vulnerability and Adaptation Needs:

Greece is highly vulnerable to climate change due to rising temperatures and water scarcity.
Land use conflicts and changes further complicate forest conservation.

- Urgent Need for Climate-Adapted Forest Management:

Requires understanding ecological responses and species vulnerabilities.
Adaptation should start proactively, not reactively.
Strategies include: Converting coppiced stands to high forests; Promoting genetic diversity and in situ conservation, especially of mature and overmature forests; Maintaining large effective population sizes for keystone species to preserve high biodiversity quality (Ministry of Agriculture, 1992)

Challenges and Strategic Needs in Greece's Forest Sector

- Geographic challenges: A large portion of Greek forests are located on steep, mountainous terrain, making harvesting difficult and costly.
- Production limitations: Wood production and quality are hindered by managerial and ecological factors.
- Trade deficit: Greece has faced a longstanding trade deficit in forest products, which worsened during the euro era.
- Key obstacles to efficient forest resource use include:

Complex harvesting procedures
Insufficient financial support for forest management

Unclear land ownership and regulatory conflicts
Weak governance, bureaucracy, and ineffective policies
Illegal logging

- Strategic need: A modern legal and management framework is essential, focused on:

Reducing environmental impacts
Promoting reforestation and sustainable logging
Addressing threats such as wildfires, droughts, and pest outbreaks
Ensuring long-term sustainability and forest productivity

Forest legislation in Greece has become increasingly fragmented, with numerous piecemeal provisions allowing interventions in forests. These additions are often made under the pretext of addressing legal gaps or stimulating the economy. However, this approach distorts the original legal framework and undermines the principles of environmental protection and sustainability. This legislative drift risks creating a legal regime disconnected from the core objectives of forest conservation, threatening the environmental acquis.
Greece currently faces major forest management challenges, including:

- Forest fires
- Illegal logging
- Urban sprawl into forested areas

In response, efforts have been made to:

- Increase funding for fire prevention and firefighting
- Combat illegal logging
- Promote sustainable tourism in forested region
  (Source: WWF Greece, 2008)

Until 2018, Greece lacked a National Forest Programme and had no formally recorded National Forest Policy. This gap was highlighted in the mid-term evaluation of the EU Forest Action Plan, where Greece was not listed among countries using the Plan to develop a national strategy. Greece adopted its first National Forest Strategy through Ministerial Decision No. 170195/758 on 28.11.2018, titled *"Forestry Development Strategy Plan 2018–2038."*

The Strategy outlines the principles of national forest policy for the next 20 years, focusing on:

- Mediterranean forestry
- Sustainable forest management
- Strengthening the role of forests in the national economy
- Addressing climate change challenges

Italy

As of 2000, 29% of Italy's land cover was tree cover with a canopy density exceeding 30%. By 2020, Italy had 7.43 million hectares (Mha) of natural forests, covering approximately 25% of its total land area, with an additional 1.5% classified as non-natural tree cover. However, deforestation and degradation have led to significant losses over time. In 2023 alone, Italy lost 34.4 thousand hectares (kha) of natural forests, contributing to 19.8 million metric tons (Mt) of CO_2 emissions. Between 2001 and 2023, the top five regions accounted for 56% of all tree cover loss, with Tuscany being the most affected, losing 96.5 kha—significantly higher than the national average of 24.4 kha.

Wildfires are a major driver of forest loss in Italy, with the fire season typically beginning in early June and lasting about 14 weeks. From 2001 to 2023, Italy lost 51.8 kha of tree cover due to fires, while 437 kha was lost to other causes. The worst year for fire-related deforestation was 2017,

with 9.35 kha lost—accounting for 27% of that year's total forest loss. More recently, between March 4, 2024, and March 3, 2025, Italy recorded 483 high-confidence VIIRS fire alerts, while from March 8, 2021, to March 3, 2025, a staggering 23,088 VIIRS fire alerts were reported. These figures highlight the increasing risk of wildfires, which continue to contribute significantly to the degradation of Italy's forests.

Between 2021 and 2023, 85% of Italy's tree cover loss occurred within natural forests, resulting in the destruction of 80.1 kha of natural forest and emitting 30.5 Mt of CO_2e. The ongoing trend of forest depletion poses a major challenge for conservation efforts, especially given the critical role forests play in carbon sequestration, biodiversity preservation, and climate regulation. While Italy has implemented policies to mitigate forest loss, the combination of wildfires, land-use changes, and deforestation pressures continues to threaten its natural landscapes. The situation calls for enhanced monitoring, reforestation efforts, and stricter policies to curb further environmental degradation.

Source: Global Forest Watch (2023)

(https://www.globalforestwatch.org/dashboards/country/ITA/?location=WyJjb3VudHJ5IiwiSVRBIl0%3D)

Uganda

The key drivers of deforestation and forest degradation in Uganda are; expansion of subsistence agriculture, unsustainable harvesting of tree products, mainly for charcoal, firewood and timber, expanding settlements and impacts of refugees, free-grazing livestock, wildfires, artisanal mining operations and oil exploration activities.

The underlying causes include:

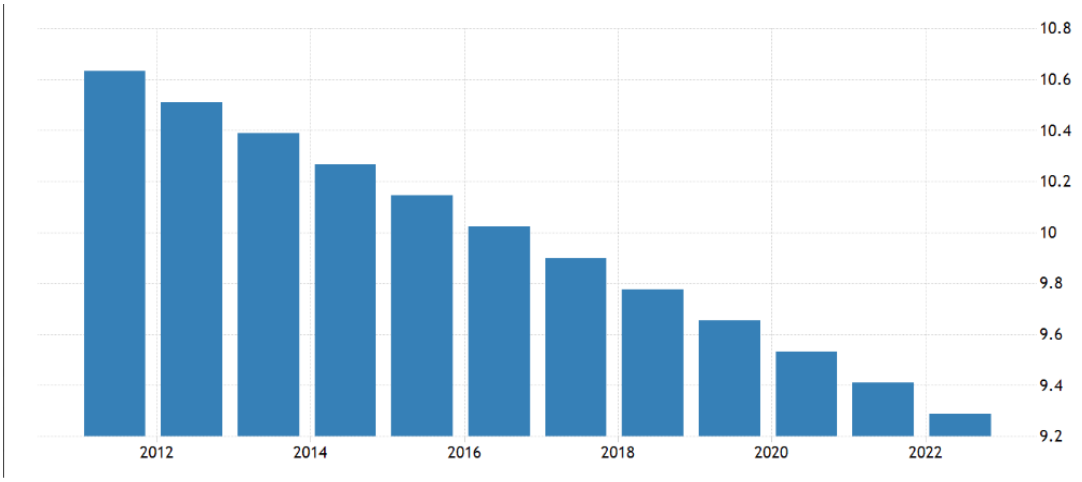
i. High rates of population growth
ii. High dependence on subsistence agriculture, natural resources and biomass energy, as well as competing economic returns from land that disfavour long-term investments in forestry.
iii. Weak forestry governance: nsufficient funding, weak enforcement of laws, and a lack of coordination between government agencies undermine efforts to protect and restore forests.

iv. Weak policy implementation,
v. Climate change and, land tenure systems: Changing climate patterns can also pose challenges to forest restoration, making it difficult to establish and maintain new forests

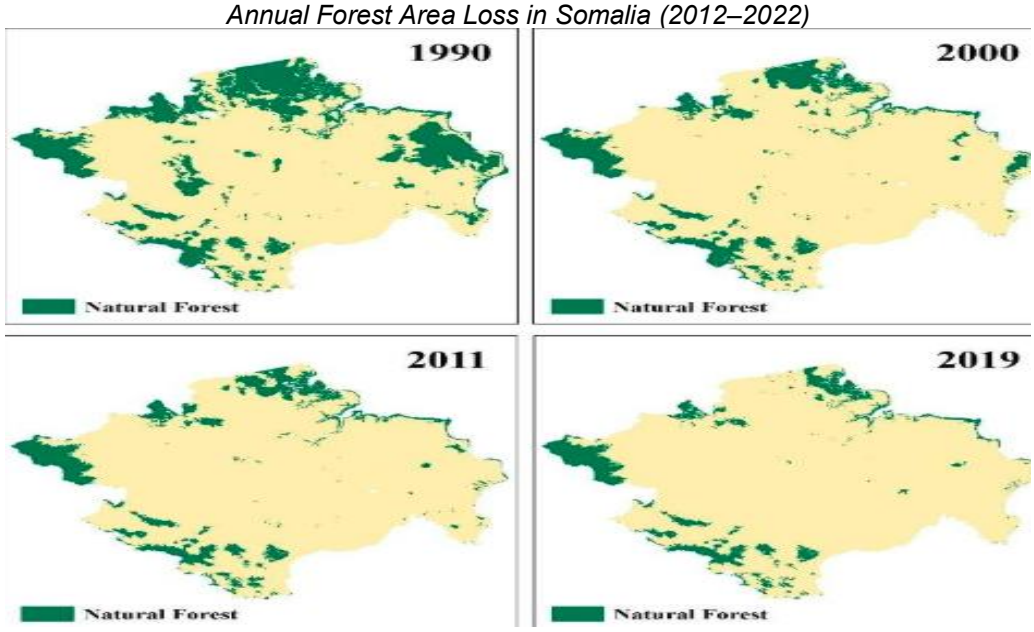
Somalia

Deforestation in Somalia poses a significant environmental challenge. Key drivers include:

1. **Charcoal Production**. The production and export of charcoal, often involving the felling of Acacia trees, is a major contributor to deforestation. Despite a UN Security Council ban on Somali charcoal exports since 2012, the trade persists, driven by demand in Gulf Cooperation Council (GCC) states. This illicit trade not only depletes forest resources but also finances armed groups, further destabilizing the region.
2. **Overgrazing**. Pastoral communities rely heavily on grazing lands, leading to overgrazing, soil degradation, and hindered natural regeneration of forests.
3. **Land Degradation**.Unsustainable agricultural practices and the expansion of settlements contribute to land degradation, exacerbating deforestation.



Annual Forest Area Loss in Somalia (2012–2022)



The cumulative effect of these factors not only reduces forest cover but also impacts biodiversity, water regulation, and the livelihoods of communities dependent on forest resources.
While Somalia has established legal frameworks and initiated various programs to promote sustainable forest management, several challenges impede effective implementation:

1. **Legislative and Institutional Gaps**. Fragmented enforcement of environmental policies and limited financial and technical resources hinder progress.
2. **Technical Capacity Deficit**: A shortage of trained personnel affects the deployment of both conventional and innovative restoration techniques.
3. **Socio-Economic Pressures**: High dependency on practices such as charcoal production and unsustainable grazing impedes reforestation efforts.
4. **Data and Monitoring Limitations**: Insufficient local monitoring systems limit the ability to track forest cover changes and evaluate the impacts of restoration initiatives.

Nigeria

According to the FAO (2016), Nigeria's forest area decreased by 46% from 1990 to 2015, dropping from 17.5 million hectares to 9.5 million hectares. According to Global Forest Watch data from 2020, Nigeria had 20.4 million hectares of natural forest, accounting for approximately 22% of its total land area. However, between 2001 and 2022, Nigeria lost 12% of its tree cover, equivalent to 2.48 million hectares, with an average annual deforestation rate of 163,000 hectares (Global Forest Watch, nd). FAO (2016) revealed that Nigeria had the highest rate of primary forest deforestation globally between 2000 and 2005, losing 55.7% of this crucial ecosystem annually. In 2020, Nigeria lost 97,800 hectares of natural forest; a preliminary estimate for 2022 suggests a further loss of 207,000 hectares. It is projected that by 2025, Nigeria's forest cover will fall below 10 million hectares. Nigeria's annual loss rate (3.5–5% per FAO and GFW) exceeds the global tropical average of 0.5–1%, driven by its unique socio-economic context. Primary forest loss outpaces secondary forest regrowth, with plantations masking net declines in natural ecosystems. Key deforestation challenges include:

1. **Poverty and Livelihood Dependence**

Poverty affects over 40% of Nigerians, leading to heavy reliance on forests for fuelwood, agriculture, and income. This contributes to forest degradation, as evident in the high demand for firewood in Enugu State and the illegal clearing of land in Bauchi State.

2. **Illegal Logging and Weak Enforcement**

Inadequate enforcement facilitates illegal logging, as officials and companies often bypass regulations. Logging for forestry products contributes to 26% of global forest loss, depleting Nigeria's unprotected reserves.

3. **Rapid Urbanization and Infrastructure Development**

Nigeria's population is projected to reach 223 million by 2025, driving urban growth and increasing demand for infrastructure projects. This has led to the destruction of forests, causing soil erosion, habitat loss, and increased CO_2 emissions.

4. **Agricultural Expansion**

Agriculture contributes 21% to the GDP, putting pressure on natural resources. Commodity crops are responsible for 14% of tropical deforestation linked to imports from wealthier nations, with Nigeria playing a significant role as a supplier.

5. **Policy and Institutional Failures**

The National Forest Policy and REDD+ initiatives aim to address deforestation in Nigeria, but face challenges of funding, and coordination issues. The Land Use Act complicates land tenure, hindering conservation efforts.

Addressing enforcement, land tenure, and socio-economic factors will enable Nigeria to change its current path, aligning with international climate objectives and ensuring a sustainable ecological future.

Cameroon

Sustainable forest management in the Congo Basin faces many challenges, including:

- **Illegal logging:** Despite efforts, illegal logging remains a major problem.
- **Population pressure:** Population growth leads to increased demand for agricultural land and forest products, which puts additional pressure on forests.
- **Climate change:** Climate change has negative impacts on forests, including increasing the frequency and intensity of droughts and wildfires.
- **Weak institutional capacities:** Forestry administrations in Congo Basin countries often lack the resources to ensure effective forest management.
- **Limited skills in Forestry sector:** Admistrative staff, local populations; regional or national bodies lack relevant and updated skills inline with the forestry management
- **Lack of cooperation with other communities or countries:** Many rural areas are isolated one to others that implies to limiting collaboration or exchange of good practices

The legislative framework for sustainable forest management in the Congo Basin is constantly evolving. While progress has been made, many challenges remain. Ensuring the sustainability of the Congo Basin forests requires strengthening regional cooperation, combating illegal logging, supporting local communities, and adapting to climate change (Anonymous, 2010).

Ghana

Ghana has one of the highest rates of deforestation globally and has experienced significant deforestation over the past decades:

- Between 2001 and 2020, Ghana lost approximately 1.31 million hectares of tree cover, representing an 18.9% decrease from 2000 levels.
- In 2022, Ghana recorded a loss of 18,000 hectares of primary forest, marking the highest proportion of loss among tropical countries that year.
- The average annual deforestation rate increased from 1.82% in the early 2000s to 1.89% between 2000 and 2005.

Statistical Deforestation Data

- Tree Cover Extent in 2000: Approximately 6.96 million hectares, covering 30.6% of Ghana's land area.
- Tree Cover Loss (2001-2020): Approximately 1.31 million hectares, equating to an 18.9% reduction.
- Primary Forest Extent in 2001: Approximately 1.09 million hectares, representing 4.8% of the land area.
- Primary Forest Loss (2002-2020): Approximately 101,110 hectares, a 9.3% decrease from 2001 levels.

Socio-Economic Implications

- Deforestation threatens biodiversity, water security, and livelihoods.
- Forest-dependent communities suffer resource scarcity.
- Reduces ecosystem services, exacerbates climate vulnerability.

Drivers of Deforestation

- **Agricultural Expansion:** The primary driver, notably due to cocoa cultivation. Agricultural expansion is the leading driver of deforestation in Ghana, with cocoa farming being the most notable contributor. Ghana is the second-largest producer of cocoa globally, and the sector supports the livelihoods of approximately 800,000 smallholder farmer. However, the growth of cocoa production has historically come at the expense of forested land. Farmers often clear forest reserves, including protected areas, to cultivate new cocoa

farms due to declining soil fertility, low yields from aging trees, and land tenure insecurity. This "extensification" strategy—rather than intensifying productivity on existing lands—has led to:

-Encroachment into Globally Significant Biodiversity Areas (GSBAs)
-Conversion of secondary forests and forest reserves into cocoa fields
-Pressure on sensitive ecosystems in the Western and Ashanti regions

Agroforestry and climate-smart cocoa farming have been promoted as solutions, but uptake is still limited due to inadequate incentives, knowledge gaps, and land tenure issues.

- **Illegal Logging**: Accounts for significant forest degradation, with nearly 80% of forest resources under state management lost to illegal activities between 1990 and 2016. Illegal logging continues to be a major contributor to forest degradation and biodiversity loss. Between 1990 and 2016, Ghana is estimated to have lost up to 80% of its forest resources under state management due to illegal harvesting activities. Key aspects include:
  -Harvesting of timber beyond regulated quotas
  -Logging without legal permits in protected forests
  -Use of chain saw operators who supply local lumber markets, bypassing regulation
  -Corruption and weak enforcement mechanisms in the forest sector

Despite Ghana's efforts to strengthen forest governance—such as the Timber Legality Assurance System (TLAS) under the Voluntary Partnership Agreement (VPA) with the EU—illegal logging remains prevalent, particularly in off-reserve areas where monitoring is weaker.

- **Mining Activities**: Illegal mining (galamsey) has led to the loss of approximately 190,000 acres of cocoa farmlands. Illegal small-scale mining, locally known as galamsey, is a growing threat to Ghana's forests and water bodies. While small-scale mining is officially permitted under Ghanaian law, a significant portion operates informally or illegally, often within forest reserves and riparian zones. The Environmental Protection Agency (EPA) and Minerals Commission have reported the following impacts:
  -Deforestation for mining access and settlement camps
  -Destruction of forest soils and vegetation through open-pit techniques
  -Contamination of rivers and groundwater with mercury and other pollutants
  -Loss of 190,000 acres of cocoa farmlands—particularly in the Western and Eastern regions

Efforts to formalize small-scale mining, including the Community Mining Programme and the ban on galamsey, have had mixed success due to enforcement challenges and the economic appeal of gold.

Infrastructure Development: Urbanization and infrastructure projects contribute to forest loss. The expansion of infrastructure to support Ghana's economic development has also led to forest clearance. Key drivers include:

-Road construction, especially rural feeder roads
-Urban sprawl into forested peri-urban zones
-Hydroelectric and energy projects
-Housing development in previously forested lands

Urban areas like Accra, Kumasi, and Takoradi have witnessed rapid growth, increasing demand for land and construction materials. As Ghana's population and economy grow, the pressure on forest ecosystems is expected to intensify unless land-use planning and zoning regulations are more strictly enforced.

4.4 Synthesis and Challenges

1. Legal Framework and Policy Clarity
EU Countries Advantages:

- Strong, comprehensive legal frameworks that are harmonized at the EU level (e.g., EU Timber Regulation, FLEGT).
- Clear definitions of responsibilities for governments, private actors, and communities.
- Integration of international commitments (biodiversity, climate change, carbon neutrality) into national law.

Disadvantages:

- Sometimes overly bureaucratic, creating delays in implementation.
- Rigid frameworks can limit local innovation or flexibility in forest management.

African Countries Advantages:

- Many countries are updating laws to align with sustainable development goals and community rights.
- Flexibility in integrating local customary practices and community-based forest management.
- Regional cooperation (COMIFAC, SADC) helps harmonize efforts and share best practices.

Disadvantages:

- Legal frameworks often fragmented, outdated, or weakly enforced.
- Overlaps between national, regional, and customary laws can create confusion.
- Implementation gaps due to lack of clear operational guidelines.

2. Institutional Capacity and Governance

European Countries Advantages:

- Strong institutions with technical expertise and enforcement capacity.
- Well-funded monitoring systems, GIS-based forest inventories, and research programs.
- Established mechanisms for stakeholder participation and public accountability.

Disadvantages:

- High administrative costs for managing forests.
- Stakeholder involvement can be formalistic rather than practical.

African Countries Advantages:

- Opportunities to integrate traditional knowledge into forest governance.
- Community forest rights can empower local stewardship and sustainable livelihoods.

Disadvantages:

- Limited technical capacity in many countries for monitoring and enforcement.
- Corruption or weak institutional coordination hinders effective governance.
- NGOs and donor programs sometimes substitute for state responsibilities, creating dependency.

3. Community Involvement and Social Considerations

European Countries Advantages:

- Strong recognition of public participation and property rights.
- Incentive schemes for private landowners to engage in sustainable forestry.

Disadvantages:

- Less focus on poverty alleviation or livelihood generation from forests.
- Community-based management is limited because most forests are state-managed.

African Countries Advantages:

- Community forestry programs (e.g., CREMAs in Ghana, community forests in Cameroon) allow local populations to benefit directly.
- Greater potential to link forest management with poverty reduction and economic development.

Disadvantages:

- Lack of clear land tenure and resource rights can create conflicts.
- Communities may lack training or financial resources for effective forest management.

4. Environmental Protection and Sustainability

European Countries Advantages:

- High environmental standards and strict enforcement (biodiversity, carbon sequestration, soil protection).
- Long-term planning ensures sustainable forest cover and ecosystem services.

Disadvantages:

- Limited forest expansion opportunities due to land scarcity and competing uses.
- Monoculture plantations may sometimes be promoted for economic purposes at the cost of biodiversity.

African Countries Advantages:

- Large areas of forest allow for ecosystem restoration and carbon sequestration projects.
- Integration of forests into landscape management can provide multiple ecosystem services.

Disadvantages:

- High rates of deforestation and forest degradation due to agriculture, logging, and infrastructure development.
- Weak enforcement and illegal logging reduce the effectiveness of laws.

5. Economic and Investment Opportunities

European Countries Advantages:

- Well-developed timber markets with legal trade verification (FLEGT, certification systems).
- Forests contribute to rural economies through recreation, eco-tourism, and timber industries.

Disadvantages:

- Returns on forestry are often secondary to industrial or urban development.
- Small-scale operators may struggle to meet certification and compliance costs.

African Countries Advantages:

- Forest resources provide timber, non-timber products, energy, and ecosystem services critical for livelihoods.
- Potential for REDD+ and carbon finance to attract international investment.

Disadvantages:

- Poor infrastructure and weak market access limit economic benefits.
- High reliance on forests for subsistence can conflict with sustainability goals.

Aspect	European Countries	African Countries
Legal Framework	Strong, clear, harmonized	Improving, sometimes fragmented
Institutional Capacity	Well-funded, technical expertise	Limited capacity, donor-dependent
Community Involvement	Formal, limited local control	Strong potential, integrated with livelihoods
Environmental Protection	High standards, strict enforcement	Rich biodiversity, enforcement challenges
Economic Opportunities	Certified timber, eco-tourism	Timber, non-timber products, REDD+ potential
Challenges	Bureaucracy, rigid systems	Deforestation, weak governance, limited finance

- Europe excels in law enforcement, institutional strength, and environmental standards but can be rigid and less tied to livelihoods.
- Africa has great potential for community-based, multi-functional forest management and economic benefits, but struggles with enforcement, governance, and financial resources.

SWOT Analysis: Forest Management – European Countries

Strengths (Internal Positive Factors):

- Strong, clear, and enforceable forest laws (EU Timber Regulation, national laws).
- Advanced institutional capacity, skilled workforce, and monitoring technologies (GIS, remote sensing).
- High environmental protection standards; emphasis on biodiversity and carbon sequestration.
- Structured public participation and stakeholder engagement mechanisms.
- Developed timber and non-timber forest product markets with certification systems.

Weaknesses (Internal Negative Factors):

- Bureaucratic systems can slow decision-making and implementation.
- Less flexibility to integrate local innovations or traditional knowledge.
- Monoculture plantations sometimes reduce biodiversity.
- Limited focus on rural poverty alleviation; forest management is not always livelihood-oriented.
- High compliance costs for small-scale operators.

Opportunities (External Positive Factors):

- Integration of green policies and carbon markets (REDD+, carbon credits).
- Eco-tourism and recreation as alternative revenue streams.
- International cooperation and funding for biodiversity and climate projects.
- Innovation in sustainable timber and biomass production.

Threats (External Negative Factors):

- Climate change impacts (droughts, forest fires, pests).
- Urban expansion and land scarcity limiting forest growth.
- Market pressures favoring high-yield monocultures over diverse forests.
- Dependence on global timber prices can affect profitability.

SWOT Analysis: Forest Management – African Countries (Uganda, Somalia, Nigeria, Cameroon, Ghana)

Strengths (Internal Positive Factors):

- Large, biodiverse forest areas with high ecological value.
- Opportunities for community-based forest management and integration with local livelihoods.
- Flexible legal frameworks allowing integration of customary laws.
- Forests provide critical timber, non-timber products, and energy resources.
- Potential to attract international funding (REDD+, conservation projects).

Weaknesses (Internal Negative Factors):

- Weak or outdated forest laws; enforcement gaps.
- Limited institutional capacity and technical expertise.
- Corruption and poor governance in forest management.
- Conflicts between customary rights and national laws.
- Inadequate infrastructure and market access for sustainable forestry.

Opportunities (External Positive Factors):

- International climate finance for forest conservation and carbon credits.

- Potential for community-based eco-tourism and sustainable harvesting.
- Partnerships with NGOs and private sector for forest restoration and protection.
- Rising global demand for sustainable forest products.

Threats (External Negative Factors):

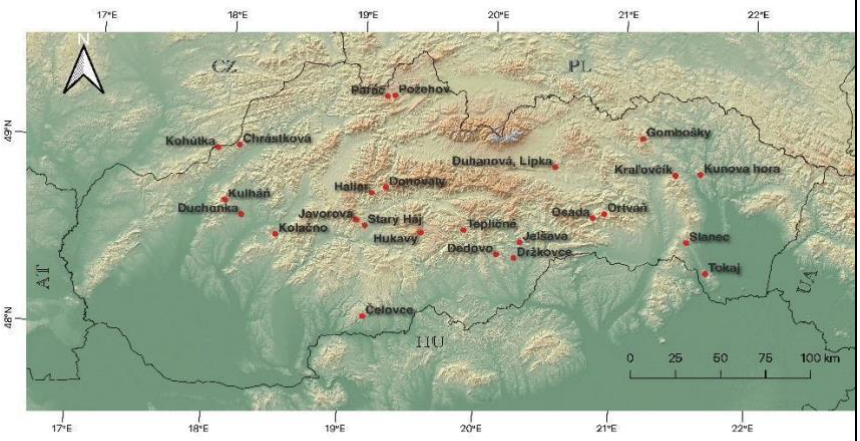
- Rapid deforestation from agriculture, logging, and infrastructure expansion.
- Illegal logging and charcoal production reducing forest cover.
- Climate change impacts (drought, desertification, floods).
- Population pressure increasing dependency on forest resources.
- Political instability affecting enforcement and policy continuity.

Factor	European countries	African countries
Strengths	Strong laws, institutional capacity, monitoring, environmental protection	Large biodiverse forests, community-based management potential, flexible laws, livelihoods
Weaknesses	Bureaucracy, limited livelihood focus, high costs	Weak laws, limited capacity, governance issues, infrastructure problems
Opportunities	Green policies, carbon markets, eco-tourism, international cooperation	International finance (REDD+), eco-tourism, sustainable product markets, NGO partnerships
Threats	Climate change, land scarcity, market pressure, monocultures	Deforestation, illegal logging, population pressure, climate change, political instability

5.Desk Research: Best Practices in Sustainable Forest Management

5.1 Best Practices in Sustainable Forest Management

Title	**Pro Silva Slovakia: Demonstration Sites for Close-to-Nature Forestry Across Diverse Slovak Ecosystems**
Geographical location: where it was implemented	Activities of the Pro Silva Slovakia association works based on voluntary and active cooperation of representatives of state and non-state forests and scientific institutions and, in practice, it is an association of forestry-oriented individuals and organisations, thinking and acting in terms of the principles of close-to-nature forest management, which manage demonstration objects throughout the territory of Slovakia in all vegetation stages and in different ecological conditions. There are 26 demonstration objects in state forests, covering a total area of 19,227.34 hectares, and 10 demonstration objects in non-state forests,

	covering a total area of 1,216.33 hectares.  Figure: Demonstration objects of state forests. https://www.lesy.sk/o-lese/pro-silva/prakticka-aplikacia/objekty-pro-silva/
Context/Problem addressed	The activities of Pro Silva Slovakia aim to acquire and exchange the theoretical knowledge and long-term practical experience of foresters and forest owners regarding this progressive method of forest cultivation. The intention is to validate and demonstrate to the public that close-to-nature silviculture optimises the conservation, protection and management of forest ecosystems, enabling them to fulfil their productive, environmental and protective functions sustainably.
Objectives	The main objectives of demonstration objects are to raise awareness among stakeholders in forest management of the benefits of close-to-nature forestry and to present the possibilities of its wider use in diverse conditions of Slovakia. The basic objectives of close-to-nature forest management include: Restoring natural stand structure, what means a) creating mixed forests with diverse multi-aged and multi-layered structure, b) protecting natural forest communities, old trees, dead standing and lying timber, c) favouring native tree species, d) supporting rare and endangered tree species, e) enhancing the recreational and aesthetic function of the forest. Increasing ecological stability through the creation of natural forest to ensure reduction of abiotic and biotic pest impacts, reduce calamities, increase stability of production. Rationalisation of the costs of silvicultural activities via giving priority to natural regeneration, targeted use of natural processes in forest tending activities. Improvement of the growing stock through harvesting of mature trees ensures a) optimisation of timber stocks, b) increase of

	value increment, c) improvement of production quality, d) harvesting stability
Description/Implementation	Slovakia is one of the founding members of the European organization Pro Silva Europa. Pro Silva Slovakia subscribes to the principles of the sustainable maintenance of forest ecosystems capable of fulfilling economic and environmental functions in equal measure. It modifies the general principles and recommendations of the pan-European organization to the conditions of forest management in Slovakia.
Results/Impact	In addition to promoting and disseminating the ideas of close-to-nature forest management, the Pro Silva Slovakia aims to consistently apply them in practice. The Forests of the Slovak Republic, state enterprise, adopted a methodological guideline that makes this progressive strategy a basic management practice in state forests (https://www.lesy.sk/o-lese/pro-silva/prakticka-aplikacia/metodicky-pokyn-lesy/).
Success/Challenges/Lessons learnt	The greatest achievements: active support of the ideas and principles declared by the Pro Silva association in the close-to-nature management of the forests via adoption of the methodological guidelines for the Forests of the Slovak Republic, what makes this progressive strategy a fundamental practice of its management, supports of different activities of forestry operations for practical application of the ideas and principles in the close-to-nature management, e.g. establishing and expanding a network of demonstration sites with close-to-nature management based on the principle of permanent forest, organizing of courses, forestry days, excursions and study tours to demonstration sites (https://www.lesy.sk/o-lese/pro-silva/aktivity/), promoting research into silvicultural concepts that respect the natural patterns of the forest, cooperating in the publication educational publications and leaflets for the professional and general public (https://www.lesy.sk/o-lese/pro-silva/odborne-prispevky/), providing a website to inform public about the activities of the Pro Silva association (https://www.lesy.sk/o-lese/pro-silva/co-je-pro-silva/)
Transferability and Scalability	Only based on sufficient and objective information from operational practice and a comparison with the results of classical silvicultural and restoration practices will it be possible to assess their benefits and, on that basis, to ensure their further extension in practice. Therefore, the Forests of the Slovak Republic, declare Pro Silva demonstration objects for which it has created own documentation so that it is possible to assess and compare their initial state and periodically evaluate the effectiveness of the application of management methods (https://www.lesy.sk/lesy/o-lese/pro-silva/prakticka-aplikacia/objekty-pro-silva/vyberte-si/tabulka.html).

Link: https://www.lesy.sk/o-lese/pro-silva/co-je-pro-silva/

Title	AdaptFor - Adaptation of forest management to climate change in Greece
Geographical location: where it was implemented	**Pieria Mountain (Central Macedonia)** • Dominated by pure stands of Scots pine (Pinus sylvestris) with Vaccinium myrtillus understory. • Marks the southernmost range of Scots pine in Europe, making its conservation critical. • Scots pine dieback has been observed since the 1980s, particularly during drought years. **Aspropotamos – Kalampaka Forest (Central Pindos)** • Composed of mixed deciduous broadleaved forests: Chestnut, Turkey oak, Fir, and Black pine. • Increasing intrusion of pioneer conifer species (Fir and Black pine) into traditionally broadleaved forest areas. • Observed in both municipal and state forests of Kastania and Aspropotamos. **National Park of Parnitha (near Athens)** • A protected area prioritizing biodiversity conservation over timber production. • Forests dominated by Fir (Abies cephalonica), mixed with Aleppo pine, Juniper, and broadleaved evergreen shrubs. • Fir dieback has been reported, especially above 800 m elevation. **Taygetos Mountain (East Taygetos Forest, near Sparti)** • Dominated by Fir and Black pine, with Juniper and broadleaved shrubs. • Represents the southernmost range of Fir (Abies cephalonica) in Greece. • Fir infestations by bark-eating insects have been noted, especially in poor soil and dry conditions, indicating climate vulnerability.
Context/Problem addressed	Forests cover 25.4% of Greece's total area (~3.36 million ha). **Ownership**: • 65.5% are state-owned. • 34.5% belong to private entities, local authorities, monasteries, and welfare institutions. **Management Structure**: • Regional Services implement forest policies and local programmes based on directives from the Central Forest Service. **Climate Considerations**: • Historically, forest management in Greece has not accounted for climate change impacts. • Due to the uncertainty of future climate scenarios, Forest Services apply “no- or low-regret” measures that offer benefits under various conditions. **Forest Degradation**:

	• Most forest degradation is linked to coppice management or non-management, particularly in evergreen and deciduous broadleaved forests. • Only coniferous forests and about 20% of broadleaved forests are managed more sustainably.
Objectives	Develop a forest management system that adopts more flexible planning techniques and tool, in order to be able to adapt forest management to climate change.
Description/Implementation	**Adaptation Process** consists of three key steps: 1. Vulnerability assessment of forest ecosystems to climate change. 2. Definition of management objectives and development of cost-effective adaptation measures. 3. Monitoring and evaluation of forest status and the effectiveness of adaptation measures, with periodic reassessment. Vulnerability assessment is the foundational step: -Helps avoid maladaptive actions that could harm ecosystems. -Involves evaluating: Exposure to climate changes (intensity, duration, shifts from historical patterns). Susceptibility of species and ecosystems, combined with other pressures (e.g., land use change, poor management). Overall impact on ecological, social, and economic systems. Capacity of institutions and communities to plan and implement adaptation (infrastructure, skills, awareness). **Adaptation measures** should: • Be holistic, moving beyond traditional wood-production goals. • Be scientifically grounded and ecosystem-specific. • Be socially acceptable, cost-effective, and responsive to local conditions. <u>Adaptation framework:</u> **Biodiversity Protection**: Preserve habitats and protect biodiversity across genetic, species, ecosystem, and landscape levels. **Species Selection**: Promote forest species and genotypes that are drought-tolerant and resilient to extreme weather and disturbances. **Adaptive Management**: Modify forest management practices, including promoting mixed and uneven-aged forests suited to changing climate conditions. **Silvicultural Adjustments**: Tailor thinning and harvesting techniques to drier conditions to reduce stress on trees and protect soil health. **Fire Risk Mitigation**: Implement measures for preventing, detecting, and rapidly responding to forest fires, especially in fire-prone regions like the Mediterranean.

	Community Integration: Align forest management with the social and economic needs of local communities by supporting local enterprises, ecotourism, and new forest product markets. **Institutional Support:** Strengthen public administration to effectively implement adaptive forest management, promote information sharing, monitor progress, and combat illegal activities. Management measures are continuously monitored to support ongoing adjustment and improvement. Due to the uncertainties of climate change, forest adaptation is approached as a "learning-by-doing" process. Monitoring is a key component throughout all stages and focuses on: (a) Changes in climate parameters (b) Key climate impacts on vulnerable forests (c) Effectiveness of implemented adaptation measures
Results/Impact	Information, based on scientific basis, was shared and disseminated to promote application of planned adaptation to climate change in Greek forests. The assessment of climate change impacts on forests is difficult due to the limited information and data regarding: a) alterations of climate parameters both in time and in space, particularly at local level and b) the vulnerability of forest ecosystems and species. Furthermore, the adaptation of forest management to climate change needs to take into account not only ecological, but also socio-economic considerations. In addition, the implementation of decisions regarding adaptation of forest management, such as the change of silvicultural forms or the change of growing stock composition per forest species, is a time-consuming procedure.
Success/Challenges/Lessons learnt	This practice is highly innovative and is considered to be pioneer at a national scale as the adaptation of forest management to climate change. It can be replicated in other Greek or even Mediterranean forest ecosystems. Greek Public Investment or EU Rural Development funds, Green fund of the Ministry for the Environment, LIFE or other EU programmes' funds may be used for the application of the project approach and results in other areas or the continuation of the efforts in the project areas. The relevance, reliability and availability of past data is the most critical issue.
Transferability and Scalability	**Applicable Beyond Pilot Areas**: Although developed in specific Greek forest regions, the adaptation framework is suitable for other Mediterranean or climate-sensitive regions facing similar environmental pressures like drought, forest dieback, species intrusion, and fire risk. **Ecological and Socioeconomic Integration**: The project considers both ecological vulnerability and community needs, making it adaptable to diverse socio-ecological contexts.

	Policy Compatibility: It aligns with EU and national climate strategies, making it readily transferable to areas under similar governance or funding mechanisms. **Training and Capacity Building**: The emphasis on empowering public institutions and local actors facilitates replication through knowledge transfer, workshops, and administrative capacity-building. **Scalability:** **Modular Implementation**: The three-phase approach—vulnerability assessment, planning/adaptation, and monitoring—allows step-by-step scaling across forest types and administrative regions. **Use of "No or Low Regret" Measures**: These measures ensure benefits regardless of the precise future climate scenario, supporting scaling under uncertainty. **Monitoring for Continuous Improvement**: The "learning-by-doing" model supports long-term scaling by incorporating feedback and improving practices over time.

Title	**Collaborative and Communal Forestry in Italy: Nature-Based Solutions from Occhito Lake to the Venetian Eastern Alps**
Geographical location: where it was implemented	• Sustainable Management of Forests Surrounding Occhito Lake in Apulia • Communal Forestry in the Venetian Eastern Alps
Context/Problem addressed	• The area around Occhito Lake, Italy's largest artificial lake, underwent extensive conifer reforestation in the 1970s to enhance hydrogeological protection. However, challenges such as climate change and the need for sustainable forest management practices necessitated a new approach • Historically, these mountainous regions practiced communal forestry, where local communities collectively managed forest resources. This approach aimed to maximize both private and social utility functions, ensuring sustainable use of forest resources and supporting local economies.
Objectives	• To create a community of practice that collaboratively manages the forested area sustainably, integrating environmental, economic, and social aspects to enhance ecosystem resilience and valorize rural areas • To sustainably manage forest resources through communal ownership, balancing ecological health with socio-economic benefits for local communities.
Description/Implementation	• The PABLO project (Environmental and Forest Planning of Occhito Lake) brings together public and private partners to form a community of practice. This group developed an environmental and forestry management plan incorporating nature-based solutions to enhance the

	resilience of the forested area surrounding Occhito Lake to climate change. • Communal forestry involves collective decision-making by local communities regarding forest management practices. This system has persisted over centuries, adapting to modern socio-economic developments while maintaining traditional practices.
Results/Impact	• The initiative aims to preserve ecosystem services, enhance biodiversity, and promote sustainable rural development. While specific results are not detailed, the approach is designed to make the forested area more resilient to climate change. • Regions practicing communal forestry have well-conserved and efficient multipurpose forests. These areas have seen balanced development, with forests contributing to local economies, environmental conservation, and social cohesion.
Success/Challenges/Lessons learnt	• The collaborative governance model is innovative, emphasizing the importance of integrating various stakeholders in forest management. Challenges likely include coordinating diverse interests and ensuring long-term commitment. Lessons highlight the value of community involvement and nature-based solutions in sustainable forest management. • The success of communal forestry lies in its ability to integrate community involvement in forest management, leading to sustainable outcomes. Challenges include adapting traditional practices to contemporary socio-economic contexts. Lessons highlight the importance of community-based management in achieving sustainable forestry.
Transferability and Scalability	• This model of collaborative governance and integrated management can be adapted to other regions seeking to enhance forest resilience and rural development through sustainable practices. • Communal forestry practices can be adapted to other regions seeking to involve local communities in sustainable forest management, especially in areas with strong communal traditions.

Reference Link Apulia
Reference Link Venetian Eastern Alps

5.2 Best Practices in Restoration Techniques

Title	**Landscape and Ecosystem Restoration in Italy: Terraced Farming in Cinque Terre and Peatland Rewetting in Tuscany**

Geographical location: where it was implemented	• Cinque Terre National Park, Liguria, Italy • Massaciuccoli Lake Basin, Tuscany, Italy
Context/Problem addressed	• In Cinque Terre, terracing and dry-stone walls are deteriorating due to rural abandonment, leading to hydrogeological risks such as landslides. • In Tuscany, peatland drainage for agriculture has led to soil degradation, biodiversity loss, and increased greenhouse gas emissions
Objectives	• Restore terraced landscapes to prevent hydrogeological risks and preserve cultural heritage in Cinque Terre • Rewet drained peatlands to restore ecosystem functions and reduce CO_2 emissions in Tuscany
Description/Implementation	• Cinque Terre: Land managers and farmers are restoring terraces and dry-stone walls, using monorail systems to facilitate farming on steep slopes • Tuscany: Water management strategies and rewetting techniques are applied to restore the peatland ecosystem
Results/Impact	• In Cinque Terre, restored terraces enhance land stability, reduce fire risks, and support local economic development through sustainable agriculture • In Tuscany, ecosystem restoration improves biodiversity, water quality, and carbon sequestration
Success/Challenges/Lessons learnt	• Success: Effective land management reduces environmental risks and supports local economies. • Challenges: High restoration costs, lack of skilled workers, and difficult access to restoration sites. • Lessons: Long-term commitment and community involvement are crucial for sustainable restoration
Transferability and Scalability	• The restoration techniques used in Cinque Terre and Tuscany can be applied to other Mediterranean landscapes with similar environmental challenges • Success depends on financial support, local engagement, and tailored restoration strategies

Reference Link | Pg 95 - 101 Tuscany | Pg 313 - 316 Liguria

Title	**Farmer Managed Natural Regeneration (FMNR) and Best Practices in Forest Restoration in Uganda**
Geographical location: where it was implemented	FMNR and associated forest restoration practices have been implemented in various districts across Uganda, particularly in regions like Arua, Offaka, and Anyiribu Sub Counties. These areas were first introduced to FMNR in 2012 by Tony Rinaudo, with the support of World Vision Uganda. By 2014, FMNR was being practiced in over 15 districts across the country.
Context/Problem addressed	Uganda, like many other countries, faces challenges related to deforestation, land degradation, and climate change, which threaten its forest ecosystems. Forest restoration is vital for maintaining biodiversity, improving ecosystem services, and

	ensuring sustainable livelihoods for local communities. However, issues such as weak governance, insufficient funding, deforestation due to agricultural expansion, and limited capacity to manage restoration efforts have hindered effective forest restoration.
Objectives	The primary objectives of these forest restoration practices, particularly FMNR, are to: 1. **Restore degraded landscapes**: Promote the regeneration of indigenous trees through the natural regeneration process. 2. **Enhance ecosystem services**: Improve soil fertility, reduce erosion, and restore habitats for wildlife. 3. **Improve livelihoods**: Engage communities in sustainable forest management practices, creating economic opportunities through agroforestry and forest products. 4. **Promote community ownership and responsibility**: Encourage active community participation in the planning, decision-making, and implementation of restoration projects. 5. **Build capacity**: Equip local communities and organizations with the knowledge and skills to sustainably manage and restore forests.
Description/Implementation	FMNR involves allowing indigenous trees to naturally regenerate through coppicing (regrowth from stumps) or sprouting from roots. Farmers are encouraged to protect and prune these regenerating trees, fostering a sense of ownership and responsibility. Key components of the implementation include: 1. **Community Participation**: Engaging local communities in forest restoration through planning, decision-making, and execution ensures that their needs and priorities are considered, leading to more effective and sustainable restoration. 2. **Collaborative Forest Management (CFM)**: Involves various stakeholders (local governments, NGOs, and the National Forestry Authority) working together for coordinated forest restoration efforts. 3. **Focus on Native Species**: Prioritizing native tree species for regeneration, which enhances biodiversity and ensures ecological resilience. 4. **Integrated Land Management**: Combining forest restoration with agroforestry and sustainable agricultural practices to ensure long-term land use sustainability. 5. **Capacity Building**: Providing training on forest restoration best practices, with access to resources and support, enhances community capabilities in forest management.

	6. **Monitoring and Evaluation**: Regular assessments ensure the restoration efforts are progressing towards set goals and objectives.
Results/Impact	The implementation of FMNR and associated forest restoration techniques has led to: 1. **Restoration of Degraded Land**: Increased tree regeneration and biodiversity. 2. **Improved Livelihoods**: Communities have benefited from the sale of forest products such as wood, fruits, and leaves, as well as improved agricultural productivity. 3. **Enhanced Ecosystem Services**: The restoration of native forests has contributed to improved soil fertility, reduced erosion, and better water retention, benefiting agriculture. 4. **Increased Community Engagement**: Communities have gained a sense of ownership and responsibility in forest management, which has contributed to the sustainability of restoration efforts. 5. **Biodiversity Conservation**: Focus on native species has enhanced local biodiversity, ensuring that the restored forests are resilient to environmental changes.
Success/Challenges/Lessons learnt	**Successes**: • **Increased Tree Regeneration**: FMNR successfully facilitated natural tree regeneration, improving forest cover and biodiversity. • **Economic Opportunities**: Communities benefited from forest products such as firewood, timber, and non-wood products. • **Collaboration and Participation**: Engaging local communities and various stakeholders has enhanced the success of restoration projects. **Challenges**: • **Climate Change**: Unpredictable weather patterns and changing climate conditions can make forest restoration more difficult. • **Weak Governance**: Insufficient funding and weak law enforcement can undermine restoration efforts. • **Land Conversion**: Ongoing deforestation driven by agriculture and urbanization poses a threat to forest restoration. **Lessons Learnt**: • **Community Ownership**: Involving local communities in forest restoration leads to higher success rates, as communities are more likely to protect and manage their restored forests. • **Collaboration is Key**: Coordination between government bodies, NGOs, and local communities is crucial to ensure the success of restoration projects.

	• **Capacity Building**: Investing in training and building local capacity strengthens the sustainability of restoration efforts.
Transferability and Scalability	FMNR and related forest restoration techniques can be applied to other regions facing similar environmental and socio-economic challenges. Key factors for successful transfer and scaling include: 1. **Community Engagement**: Ensuring that local communities are actively involved in planning, decision-making, and execution increases the likelihood of successful restoration. 2. **Focus on Native Species**: Prioritizing native species ensures ecological compatibility and supports biodiversity. 3. **Integration with Other Land Management Practices**: Combining forest restoration with agroforestry and sustainable agricultural techniques ensures long-term sustainability. 4. **Building Local Capacity**: Providing the necessary training and resources for local communities to manage and restore forests strengthens the long-term effectiveness of the initiative.

Title	**The Great Green Wall (GGW) project**
Geographical location: where it was implemented	Jigawa, Kano, Katsina, Kebbi, Sokoto, and Zamfara State, Northwest Nigeria and Adamawa, Bauchi, Borno, Gombe, and Yobe State, Northeast Nigeria
Context/Problem addressed	Desertification has significant economic and environmental consequences, affecting over 70 million Nigerians and degrading 75 million hectares of land. It also affects 1.4 billion people globally, with more than 70% of them living in poverty. Nigeria is actively working to improve rural livelihoods and living conditions through a project aimed at establishing a green wall of trees to combat desertification and mitigate the risks associated with the encroachment of the Sahara Desert in the northern region. This project is part of the ambitious African Union-led Great Green Wall initiative, which seeks to restore degraded landscapes across the continent, rejuvenate numerous communities, enhance food security, and bolster climate resilience.
Objectives	The project's objectives were to restore 100 million hectares of degraded land, sequester 250 million tons of carbon, create 10 million green jobs in rural areas, enhance the well-being of affected populations, reduce vulnerability to desertification, combat rural poverty, and mitigate climate change.
Description/Implementation	Key activities of the project include establishing a 1,500 km greenbelt through extensive tree planting initiatives, woodlot plantations are being established in the affected communities to improve the livelihoods of the communities by providing

	timber for furniture, construction purposes, source of fuel (to discourage indiscriminate felling of forest trees), enhance forestry activities and improvement of vegetation cover as well as soil fertility. The project introduced the use of indigenous tree species in restoring ecosystems as native plant species known for the adaptive nature to the climate conditions of the areas and as such result to high survival rate. Implementing management and support services and providing infrastructure such as solar systems and water access for herders and farming communities. Additionally, the project focuses on rehabilitating degraded land for agricultural purposes, establishing grazing reserves and fodder farms, and supporting income-generating activities for rural residents in the project areas.
Results/Impact	The project successfully planted 21 million trees in the eleven frontline states of Nigeria in the North. It established 30 community nurseries and 10 central nurseries in five states. Additionally, 300 km of shelterbelt was set up in Borno, Jigawa, Katsina, Sokoto, and Yobe states. About 170 hectares of woodlots were created in Adamawa, Bauchi, Gombe, Jigawa, and Kano states. The project enhanced farmers' capacity for climate resilience. It provided solar home systems, as well as livelihood empowerment through activities such as balanites oil extraction, honey production, and micro-gardens for vegetable cultivation. A total of 560 hectares of degraded ecosystems were restored in Bauchi, Jigawa, and Sokoto. Indigenous tree seeds and herbaceous fodder species were used, with 150,000 seedlings raised in five community nurseries. Plantations established with these indigenous tree seeds have been set up in seven frontline states.
Success/Challenges/Lessons learnt	The project has faced setbacks during its implementation, such as failed contracts, insecurity, and a lack of community ownership.
Transferability and Scalability	This initiative can be replicated and expanded to other states and regions facing similar desertification challenges.

5.3 Best Practices in Alternative Restoration Techniques

Title	**Community-Led Sustainable Reforestation in Garowe**
Geographical location: where it was implemented	**Region** Garowe, Puntland, Somalia **Coordinates** Approximately 8.4°N latitude and 48.5°E longitude **Topography** Semi-arid region with flat terrains interspersed with seasonal watercourses (wadis) such as Togga Garowe and Lan Alifirin. The area lies at an elevation of about 450 meters above sea level.

Context/Problem addressed	**Environmental Challenges** - **Deforestation Drivers.** Heavy reliance on firewood and charcoal for energy, accounting for 85% of Puntland's energy consumption, leading to significant deforestation and environmental degradation. - **Climate Conditions.**Arid climate with mean annual rainfall around 108 mm, predominantly received in May (averaging 51 mm), and temperatures ranging from 14°C to 34°C. - **Soil and Water Issues.** Predominantly dry soils with poor absorption capacity, leading to runoff during heavy rains, causing erosion and seasonal flooding, particularly along river beds like Togga Garowe. - **Biodiversity Loss.** Reduction in native vegetation cover, impacting local flora and fauna, and diminishing ecosystem services vital for community livelihoods.
Objectives	**Environmental Restoration.** Rehabilitate degraded lands through afforestation and reforestation using native, drought-resistant species. - **Community Engagement.** Empower local communities by integrating traditional ecological knowledge with modern restoration techniques. - **Sustainable Livelihoods.** Develop alternative income-generating activities to reduce dependence on charcoal production and unsustainable land use practices. - **Capacity Building.** Enhance vocational education and training (VET) capacities to equip individuals with skills in sustainable forest management and restoration techniques. - **Policy Advocacy.** Support the implementation of environmental policies aimed at reducing deforestation and promoting renewable energy sources, such as solar energy, to alleviate pressure on forest resources.
Description/ Implementation	**Project Initiation.** - **Stakeholder Collaboration.**Formation of partnerships between Puntland's Ministry of Environment and Climate Change, local NGOs, community leaders, and international environmental organizations. - **Baseline Assessment.** Conducted comprehensive environmental assessments to identify the extent of deforestation, soil degradation, and areas suitable for restoration. **Implementation Strategies** - **Tree Planting Campaigns** - **Species Selection.**Focused on native species such as *Acacia nilotica* and *Moringa oleifera*, known for their resilience to arid conditions and benefits to soil stabilization. - **Community Nurseries.** Established nurseries managed by local communities to cultivate seedlings, providing both employment and education opportunities.

	- **Planting Events.** Organized mass planting events during optimal planting seasons, involving schools, local organizations, and government officials to foster community ownership. - **Sustainable Land Management Practices** - **Agroforestry Systems.** Integrated trees with agricultural crops to enhance biodiversity, improve soil fertility, and provide additional income sources. - **Soil Conservation Techniques** Implemented contour bunding and terracing to reduce soil erosion and improve water retention. - **Alternative Energy Promotion** - **Solar Energy Initiatives.** Promoted the adoption of solar cookstoves and solar panels to reduce reliance on firewood and charcoal, addressing one of the primary drivers of deforestation. - **Community Training.** Conducted workshops on the benefits and use of solar energy technologies. - **Policy Implementation** - **Plastic Bag Ban Enforcement.** Supported the enforcement of the ban on plastic bags to reduce environmental pollution and encourage the use of sustainable alternatives. - **Legislation Against Illegal Charcoal Export.** Collaborated with authorities to monitor and prevent illegal charcoal exports, preserving local tree cover.
Results/Impact	**Environmental Outcomes** - **Increased Forest Cover.** Successful planting and growth of over 20,000 trees within a week-long campaign, contributing to improved air quality and carbon sequestration. - **Soil Stabilization.** Reduction in soil erosion and improved soil fertility in treated areas, leading to better agricultural yields. - **Biodiversity Enhancement.** Return of native wildlife species and increased plant diversity in reforested areas. **Socio-Economic Outcomes** - **Employment Opportunities:** Creation of jobs through nursery management, planting activities, and maintenance, particularly benefiting women and youth. - **Energy Transition.** Increased adoption of solar energy solutions, leading to reduced household expenditures on fuel and decreased health issues related to indoor air pollution. - **Community Empowerment** Strengthened community cohesion and capacity through active participation in environmental conservation efforts. **Educational Outcomes** - **Skill Development.** Enhanced skills in sustainable land management and renewable energy technologies among community members and VET students.

	- **Awareness Raising.** Increased public awareness about the importance of environmental conservation and sustainable practices.
Success/Challenges/Lessons learnt	**Successes** - **High Community Engagement.** Active participation of local communities in all project phases ensured sustainability and local ownership. - **Policy Support.**Alignment with governmental policies facilitated smoother implementation and access to resources. - **Public-Private Partnerships .**Collaboration with private sector entities led to innovative solutions and additional funding opportunities. **Challenges** - **Water Scarcity.** Limited water resources posed challenges for seedling irrigation, especially during dry seasons. - **Technical Capacity.** Initial lack of technical expertise in advanced restoration techniques required extensive training programs. - **Market Access.**Difficulty in accessing markets for alternative energy products hindered widespread adoption. **Lessons Learnt.** - **Integrated Approaches Are Essential:** Combining reforestation with alternative livelihood strategies and energy solutions addresses multiple drivers of deforestation. - **Continuous Capacity Building.**Ongoing training and education are crucial to equip communities with the necessary skills and knowledge. - **Adaptive Management.** Flexibility to adapt strategies based on monitoring and feedback enhances project effectiveness. - **Sustained Advocacy.** Continuous engagement with policymakers ensures that environmental issues remain a priority on the development agenda.

Transferability and Scalability	The community-led reforestation model implemented in Garowe exhibits strong potential for replication and expansion in other arid and semi-arid regions facing similar environmental challenges. Key factors contributing to its transferability and scalability include: **Community Engagement.** Active involvement of local communities in planning and implementation fosters ownership and sustainability. **Integration of Traditional and Scientific Knowledge.** Combining indigenous practices with scientific approaches enhances the effectiveness of restoration activities. **Policy Support:**.Alignment with governmental policies facilitates resource allocation and support.**Financial Mechanisms:** Securing diverse funding sources, including international donors and private sector investments, is crucial for scaling up. **Capacity Building.** Training programs and knowledge exchange platforms enable the dissemination of best practices and lessons learned

Title	**Contribution of Assisted Natural Regeneration (ANR) in Improving the Living Conditions of Producers in the Maradi Region**
Geographical location: where it was implemented	This study was conducted in two (2) village areas in the Maradi region of Niger: • **Boussaragui** (Rural Commune of Chadakori) • **Dan Saga** (Urban Commune of Aguié) The geographical coordinates for the study areas are: • Dan Saga: Longitude 006°48.3350'E, Latitude 13°47.1618'N • Boussaragui: Longitude 7°44' East, Latitude 13°42' North These areas are located in the Sahelo-Sudanese climate zone, characterized by a rainy season (June-September) and a dry season (October-May). The average annual precipitation ranges from 450 to 550 mm, and temperatures can reach a maximum of 44°C in April and a minimum of 8°C in January.
Context/Problem addressed	Niger, especially the Maradi region, faces severe degradation of natural resources, which threatens agriculture and livestock farming—the main economic activities of the region. The depletion of plant cover and decline in soil fertility contribute to increasing food insecurity. Assisted Natural Regeneration (ANR), introduced in the 1980s, offers an effective solution for combating desertification and enhancing the resilience of local communities. It promotes the natural regrowth of trees and shrubs, restoring land and improving the living conditions of farmers.

Objectives	The main goals of the study were to: 1. Evaluate the impact of ANR on food security by analyzing increases in agricultural productivity in the study areas. 2. Analyze how ANR contributes to farmers' income, through the sale of wood and non-wood products (fruits, leaves, wood). 3. Assess ANR's impact on livestock farming, specifically in terms of fodder availability and animal productivity. 4. Study the role of ANR in traditional medicine by identifying medicinal plant species and their accessibility to local populations. 5. Compare the impacts of ANR between Boussaragui and Dan Saga, focusing on differences in practice duration and local conditions. 6. Propose recommendations to improve and disseminate ANR practices to increase the resilience of rural populations.
Description/Implementation	ANR practices involve two main tree protection techniques: 1. **Recovery of Young Plants**: Farmers protect and stimulate the growth of young tree and shrub shoots that naturally regenerate in their fields. These shoots are safeguarded from livestock, tillage, and bushfires. 2. **Regeneration of Woody Stumps**: Stumps from previously cleared trees are encouraged to regenerate. Farmers leave 2-5 stems per stump and prune them yearly to maintain healthy growth. Implementation occurs in stages: 1. **Step 1**: Awareness raising and identification of adopters. 2. **Step 2**: Training and supervision in identifying and protecting valuable species. 3. **Step 3**: Organization of inter-producer visits and visibility events. 4. **Step 4**: Continuous support through monitoring and experience-sharing.
Results/Impact	The study revealed several key impacts of ANR: • **Agriculture**: There was a significant increase in crop yields. In Boussaragui, millet, sorghum, and cowpea yields increased by 144.17 kg/ha, 54.84 kg/ha, and 16.11 kg/ha respectively. In Dan Saga, these increases were even greater at 537.3 kg/ha, 104.24 kg/ha, and 58.7 kg/ha. • **Income Generation**: Farmers in both areas earned more income through the sale of wood and other products from ANR. In Dan Saga, the annual income from ANR products reached 284,046.03 FCFA/ha, while in Boussaragui, it was 48,408.32 FCFA/ha.

	• **Livestock Farming**: ANR contributed to the availability of aerial fodder, benefiting livestock, particularly during the dry season. Species such as **Piliostigma reticulatum** and **Faidherbia albida** were widely used for animal feed. • **Health Benefits**: Medicinal plants from ANR were used by 51% of the respondents for treating various diseases. Species like **Guiera senegalensis** and **Piliostigma reticulatum** were commonly used for traditional medicine.
Success/Challenges/Lessons learnt	**Successes**: • **Economic Benefits**: Increased crop production and income from the sale of ANR products (wood, fruits, etc.). • **Ecological Benefits**: Improved soil cover, increased tree density, reduced wind erosion, and enhanced soil fertility. • **Socio-cultural Benefits**: Enhanced food and nutritional security, better living conditions, and creation of solidarity spaces among local communities. **Challenges**: • Limited awareness in some areas, which affects the widespread adoption of ANR. • The need for better dissemination of knowledge and technical assistance for long-term sustainability. **Lessons Learnt**: • **Local Participation**: Ensuring the active involvement of farmers in the process leads to better adoption. • **Integration with Livestock Farming**: Incorporating ANR into livestock farming systems enhances the resilience of rural communities.
Transferability and Scalability	The findings suggest that ANR can be scaled and transferred to other regions facing similar environmental and socio-economic challenges. Key recommendations for broader adoption include: 1. **Clarifying Legislation**: Clearer policies on tree management in agricultural zones to encourage adoption. 2. **Incentives for Adoption**: Development of incentive measures and farmer field schools to spread awareness and increase adoption. 3. **Community Engagement**: Increased voluntary engagement in ANR management, supported by local authorities and educational initiatives.

Title	**Cocoa & Forests Initiative (CFI)** **A Collaborative Effort to Combat Cocoa-Driven Deforestation in Ghana**

Geographical location: where it was implemented	Nationwide The CFI is implemented across Ghana's major cocoa-growing regions, including: • **Ashanti Region** • **Western and Western North Regions** • **Eastern Region** • **Central Region** • **Brong-Ahafo Region** These areas represent the heartland of Ghana's cocoa production, which is directly linked to both rural livelihoods and deforestation pressures.
Context/Problem addressed	Forest loss due to cocoa expansion Ghana is the world's second-largest cocoa producer. However, cocoa farming has been a major contributor to deforestation and forest degradation due to: • Agricultural expansion into forest reserves • Poor land use planning • Slash-and-burn practices • Weak enforcement of land tenure and forest regulations • Lack of incentives for sustainable cocoa practices From 2001 to 2020, Ghana lost over 1.31 million hectares of tree cover, with cocoa farming being one of the leading causes.
Objectives	The Cocoa & Forests Initiative aims to: 1. End deforestation associated with cocoa production 2. Restore degraded forests and landscapes 3. Promote sustainable cocoa farming through agroforestry 4. Enhance cocoa traceability and farmer livelihoods 5. Foster multi-stakeholder collaboration between government, industry, and civil society
Description/Implementation	Public-private collaboration involving industry and government for traceability, forest monitoring, and livelihood development Launched in 2017 by the Governments of Ghana and Côte d'Ivoire in partnership with the World Cocoa Foundation (WCF) and IDH – The Sustainable Trade Initiative, the CFI brings together 35+ cocoa and chocolate companies. Key implementation elements in Ghana: • Frameworks for Action signed in 2019 by the Government and companies • Action Plans developed by stakeholders outlining timelines and KPIs • Mapping of farms and forest reserves using GPS and satellite imagery • Tree distribution and agroforestry promotion • Farmer training on Good Agricultural Practices (GAP), forest law compliance, and climate-smart techniques

	• Policy alignment with the Ghana Forest and Wildlife Policy (2012), REDD+ strategy, and Forest Plantation Strategy
Results/Impact	Stakeholder mobilization; development of action plans in 2019; ongoing progress efforts to improve cocoa traceability and reduce deforestation • Over 10 million trees distributed for agroforestry since 2019 • Cocoa farm mapping of over 500,000 farmers for traceability • Training of more than 350,000 farmers in sustainable practices • Community Forest Management Committees (CFMCs) activated in various districts • Reduced deforestation rates in targeted zones • Private investment mobilized to support landscape restoration These outcomes represent a significant step toward the dual goals of forest protection and sustainable cocoa livelihoods.
Success/Challenges/Lessons learnt	Success in multi stakeholder collaboration; challenges in achieving full traceability and compliance with upcoming EU regulations; challenges in enforcement and monitoring **Successes** • Strong public-private collaboration model • Clear goals and measurable actions • Engagement of both large multinationals and local partners • Integration with national policies (REDD+, Forest Investment Program) **Challenges** • Enforcement gaps in forest reserve boundaries • Incomplete traceability systems across all cocoa-producing areas • Farmer incentives sometimes insufficient to fully prevent encroachment • Pressure from illegal mining (galamsey) and other land uses **Lessons Learnt** • Joint accountability between industry and government is essential • Tree tenure reform and secure land rights incentivize reforestation • Community inclusion improves sustainability and monitoring • Data transparency enhances trust and progress tracking

Transferability and Scalability	Scalable to other cocoa-producing regions as model can be adapted in other cocoa-producing countries facing similar challenges The CFI model is highly transferable to other cocoa-producing countries facing similar deforestation challenges, especially: • Côte d'Ivoire (already participating) • Nigeria, Cameroon, and Sierra Leone (potential adopters) • Other agricultural sectors with forest-linked value chains Scalability within Ghana is feasible, especially with: • Strengthened farmer cooperatives • Expanded private sector participation • Enhanced funding for forest monitoring technologies

5.4 Best Practices Synthesis

The desk research phase of the FORESTORE project identified and analyzed nine exemplary practices in sustainable forest management, restoration, and governance across Europe and Africa. These initiatives, drawn from Slovakia, Greece, Italy, Uganda, Nigeria, Somalia, Niger, and Ghana, collectively illustrate how forest ecosystems can be managed, restored, and sustained through innovation, community engagement, and evidence-based governance. Together, they can provide a diverse foundation for shaping the FORESTORE curriculum and for addressing the skill gaps revealed through field research among VET learners and centers.

Cross-Cutting Insights

The synthesis of these best practices revealed a set of unifying principles that underpin effective and sustainable forest management. These principles shaped the FORESTORE curriculum framework and its nine modules:

1. Close-to-Nature and Ecosystem-Based Management
Prioritizing natural processes, native biodiversity, and multi-aged forest structures to enhance ecological stability, resilience, and long-term productivity.

2. Climate-Smart and Adaptive Management
Designing management approaches that remain flexible under climate uncertainty—using continuous monitoring to adapt practices as conditions evolve.

3. Community Engagement and Co-Management
Ensuring local communities actively participate in planning, decision-making, and implementation. Community ownership increases sustainability, supports livelihoods, and aligns management with local realities.

4. Integrated Restoration and Landscape Approaches
Combining forest restoration with agroforestry, sustainable agriculture, soil conservation, water management, and biodiversity protection to address degradation holistically at the landscape scale.

5. Sustainable Livelihoods and Economic Incentives
Linking forest management and restoration to income-generating activities—such as agroforestry products, alternative energy technologies, and value-added forest products—to reduce pressure on ecosystems.

6. Strong Governance, Capacity Building, and Multi-Stakeholder Collaboration

Strengthening institutions, enhancing technical capacity, and fostering cooperation between governments, research institutions, private sector actors, and civil society to enable effective forest management and restoration at scale.

6. Desk Research: Curricula Mapping in Sustainable Forest Management

6.1 Curricula Mapping in Sustainable Forest Management in SSA countries

Cameroon

As part of the FORestore initiative on strengthening vocational education and training (VET) in forestry, agriculture, and environmental sciences, three Cameroonian institutions have provided representative curricula. These programs highlight the country's commitment to training professionals who can address challenges in sustainability, food security, and environmental protection.

1. **Higher Institute of Environmental Sciences (HIES–IBAYSUP) – Environmental Sciences Curriculum.**

The Environmental Sciences curriculum at HIES–IBAYSUP is an advanced academic pathway offering Bachelor's and Master's degrees. The program encompasses a wide range of specialties, including environmental and social assessment, agroforestry, biodiversity conservation, climate change, environmental health, environmental law

- **Objectives:** To produce professionals capable of designing, implementing, and evaluating policies/projects in natural resource management, biodiversity conservation, forest restoration, and climate change adaptation.
- **Content:** Tree domestication and applied forestry, Biodiversity assessment and conservation, Climate governance and carbon stock assessment, Environmental impact assessment (EIA), GIS and remote sensing, Environmental law and health
- **Learning Outcomes**: Graduates gain theoretical knowledge and applied skills in forestry, biodiversity monitoring, and policy development. They can apply GIS, manage ecosystems, and support climate resilience projects.
- **Strengths:** Strong theoretical and policy orientation; sustainability integrated across multiple disciplines; GIS/remote sensing adds digital skills; ministerial backing ensures policy relevance.
- **Limitations**: Industry involvement limited mainly to ministries, not private actors.

2. Higher Institute of Environmental Sciences (HIES–IBAYSUP) – Agriculture Curriculum

HIES also delivers a specialized **Higher National Diploma (HND)** program in Agriculture, covering **crop and animal production** with a strong ecological and environmental foundation.

- **Objectives:** The program trains specialists in plant and animal production who can work across the value chain—from production management to processing, conservation, and marketing of agricultural products. It emphasizes biosecurity, food safety, soil fertility, and agronomic innovation.
- **Content:** Modules include *plant biology, agronomy and , crop production systems, livestock management, phytopathology, agroforestry, agricultural mechanization, seed systems, entrepreneurship, and marketing*.
- **Learning Outcomes:** Students gain both plant and animal production skills, such as Production management (market gardening, perennial crops, legumes, fodder, cereals, or oilseeds); processing, packaging, and preserving plant products; marketing of plant products, animal production techniques, as well as biology and biochemistry

- **Strengths:** The curriculum reflects national education reforms under the Ministry of Higher Education (MINESUP). It integrates sustainability, entrepreneurship, and preparing graduates for modern agri-business roles.
- **Limitations:** Limited digital integration (precision agriculture, ICT-enabled services absent); industry involvement underdeveloped.

3. Agricultural Technician School of Maroua – Agricultural Technician Curriculum

The Agricultural Technician School of Maroua offers a 2-year HND-level diploma designed to prepare competent technicians in agropastoral entrepreneurship

- **Objectives:** The program focuses on equipping students with technical, managerial, and entrepreneurial skills to design, implement, and monitor agricultural projects. Emphasis is placed on food security, sustainability, and environmental stewardship.
- **Content:** Core modules include *plant production, sustainable crop management, use and maintenance of farm infrastructure, product development for marketing, data analysis in cultivation systems, and work team management*.
- **Learning Outcomes:** Graduates acquire the ability to explain the biological cycles of crops and livestock, along with their nutritional and health requirements, analyze the factors influencing agricultural productivity, such as soil fertility, irrigation, pest and disease control, Interpret meteorological and soil data to support informed decision-making in agricultural planning, identify key challenges related to sustainability, food security, and natural resource management.
- **Strengths:** The program is closely aligned with policies of the Ministry of Agriculture and Rural Development (MINADER). It has a strong practical orientation, focusing on team leadership, production cycles, and value-chain integration. Sustainability is embedded in training for real-world applicability.
- **Limitations:** Weak digital/innovation integration; private-sector input limited.

Conclusion (Cameroon): The curricula collectively prepare graduates from technician to advanced level in agriculture and environmental sciences. They integrate sustainability and policy relevance but show weaknesses in private-sector involvement, advanced digital integration, and applied circular economy practices.

Chana

As part of the FORestore project's curriculum mapping in Sub-Saharan Africa, three key educational programs from Ghana were identified, covering short-cycle diplomas, certificates, and degree-level qualifications. Together, these curricula illustrate Ghana's progressive approach to building capacity in forestry, agroforestry, and natural resource management, with strong attention to sustainability and alignment with industry needs.

1. HND in Agriculture with Specialization in Agroforestry and Environment (Kumasi Institute of Tropical Agriculture)

This one-year Higher National Diploma (HND) program provides learners with skills for integrating trees, crops, and conservation practices into sustainable land use systems.

- **Objectives:** Focus on equipping learners with sustainable integration of trees, crops, and conservation techniques, with silviculture as a key component for developing skills in tree establishment, management and forest resource restoration.
- **Learning Outcomes:** Graduates are able to design and implement agroforestry plans, restore degraded lands, manage tree nurseries, apply soil and water conservation techniques, establish protective vegetation systems.
- **Strengths:** Industry involvement from organizations such as FORIG, Trees for the Future (USA), and the Ghana Permaculture Institute ensures real-world relevance. The

curriculum emphasizes sustainability through community tree planting projects and mangrove restoration, though it has limited digital/innovation content.

- **Limitations:** Weak digital integration; private-sector involvement beyond research bodies limited; sustainability largely conservation-focused, not linked to entrepreneurship.

2. Certificate in Natural Resource Management (Forestry Commission Training Centre)
This **18-month certificate program** provides hands-on training in forest management, regulation, and conservation.

- **Objectives:** Build practical skills with skills in forest protection, climate change and emerging forest practices and its regulations, and the development and managing of forest resources.
- **Learning Outcomes:** Learners understand plantation oversight, wildlife habitat supervision, timber resources and safeguarding forest ecosystems and anti-illegal activities enforcement
- **Strengths:** Updated in 2024, the program incorporates digital tools such as drones and satellite imagery for monitoring. It also emphasizes entrepreneurship in forestry, aligning with Ghana's national development goals. Industry stakeholders such as the Forestry Commission and University of Energy and Natural Resources (UENR) are actively engaged.
- **Limitations:** it is delivered exclusively face-to-face, which restricts accessibility for learners in remote or rural areas. In addition, while it emphasizes practical forestry skills, the curriculum offers limited integration of broader digital innovation and entrepreneurship competencies beyond basic drone and satellite applications.

3. Degree in Forest Resource Technology (KNUST – College of Agriculture and Natural Resources)
This two-year **Bachelor's degree program** focuses on **land reclamation and rehabilitation** within the forestry sector.

- **Objectives:** Provide learners with in-depth knowledge and practical skills for rehabilitating and reclaiming degraded lands, applying ecological restoration methods, and engaging communities in sustainable resource use.
- **Learning Outcomes:** Students are trained to assess degraded land, analyze soil samples, establish tree nurseries, plant appropriate species, and manage reclamation projects. They also develop problem-solving and stakeholder engagement skills.
- **Strengths:** The curriculum integrates GIS mapping and remote sensing, alongside industrial attachments and field projects. It benefits from strong collaboration with Brosankro Field Station, FORIG, MOFA, and international partners such as ICRA and CIDA. Updated in 2025, the program is highly aligned with labor market and policy needs.
- **Limitations:** Digital integration strong but still limited to mapping; private-sector participation in design modest.

Conclusion (Ghana): The curriculum mapping in Ghana highlights a well-structured progression from certificate to degree-level programs, all strongly rooted in sustainability, conservation, and practical forestry skills. While the curricula show robust industry alignment and integration of modern tools such as GIS, drones, and remote sensing, digital innovation and entrepreneurship remain areas for further strengthening.

Uganda
Uganda's contributions to the FORestore curriculum mapping highlight a diverse set of training programs that integrate forestry, agroforestry, and agricultural practices with strong relevance to sustainability, biodiversity, and rural livelihoods. The three curricula span from certificates to

diplomas and degree-level programs, reflecting Uganda's commitment to capacity building in both technical and academic domains.

1. Degree in Conservation Forestry and Products Technology – Entomo-Forestry (Makerere University)

This degree-level specialization, offered at both undergraduate and postgraduate levels, introduces learners to the emerging field of entomo-forestry—the study of forest insects and their ecological, economic, and social roles.

- **Objectives:** Equip students with knowledge of insect roles in forest ecosystems (pest control, pollination, biodiversity conservation) and the use of insect products for sustainable livelihoods.
- **Content:** Modules cover *forest insect pests, beneficial insects, insect-tree interactions, insects as bioindicators of forest health, insect products (honey, silk, edible insects), and climate change–insect dynamics*.
- **Learning Outcomes:** Students gain skills in integrated pest management (IPM), insect biodiversity conservation, and the use of insect products in agroforestry systems. They learn to integrate insect diversity considerations into sustainable land management and ecosystem restoration. Understand the ecological roles of insects, including pollination, pest control, and nutrient cycling.
- **Strengths:** Recently updated (2024) with input from the National Forestry Authority and communities. Strong emphasis on linking entomology, forestry, and rural development for climate resilience and income generation.
- **Limitations:** Weak digital integration; industry partnerships mainly institutional, not private-sector; commercialization of insect products underdeveloped.

2. Certificate in Nursery Bed Production (St. Matthias Mbuye Agricultural College)

This short **national certificate program** provides technical training in nursery management for youth, women, and stakeholders.

- **Objectives:** Train learners in the principles and practices of nursery establishment and management as a foundation for reforestation and agroforestry initiatives.
- **Content:** Courses cover basic considerations for a nursery site, nursery establishment procedure, common soil mixtures for nursery seed beds and transplant beds, nutrient management and fertilization, watering and irrigation practices, methods of sowing seed, tree nursery management, common pests and diseases in tree nurseries, common tree nursery problems and solutions.
- **Learning Outcomes:** Learners acquire hands-on skills in nursery establishment, seedling care, and pest management, with the ability to run small-scale nursery enterprises. They also gain competencies in sustainable water use, organic practices, and biodiversity-friendly nursery management.
- **Strengths:** Strong focus on practical application and livelihood support. The program supports climate resilience and local income generation.
- **Limitations:** No digital/innovation integration; industry linkages minimal.

3. Diploma in Agriculture Production – Coffee Agroforestry (Bukalasa Agricultural College)

This **12-week diploma module** is tailored to Uganda's coffee sector, emphasizing the integration of coffee with agroforestry practices.

- **Objectives:** Enable learners to understand and apply coffee-based agroforestry systems for improved productivity, environmental sustainability, and farmer livelihoods.
- **Content:** Key areas include *multistrata perennial agroforestry, coffee agroforestry systems, nursery establishment, tree management in coffee systems, and sustainability practices*.

- **Learning Outcomes:** Trainees acquire skills in designing, managing, and monitoring coffee-agroforestry systems, including tree-crop compatibility, soil fertility, shade management, pest and disease control, and biodiversity integration.
- **Strengths:** Updated in 2024 with industry engagement. Focuses directly on Uganda's key export crop while embedding climate resilience, ecological sustainability, and economic viability. The program balances technical training with environmental stewardship.
- **Limitations:** No digital integration (traceability, precision coffee farming absent); weak private-sector partnerships with exporters/cooperatives; sustainability more ecological than economic.

Conclusion (Uganda): Uganda's curricula are innovative and context-specific (entomo-forestry, coffee agroforestry), with strong ecological sustainability and practical training. Weaknesses lie in digital gaps, limited private-sector involvement, and insufficient socio-economic sustainability models to turn ecological practices into scalable livelihood opportunities.

Nigeria

Nigeria contributes three forestry and environmental training programs that span diploma, certificate, and higher diploma levels, reflecting a structured progression in vocational and technical forestry education. These curricula demonstrate a balance between theory and practice, with strong attention to reforestation, plantation establishment, and forest conservation.

1. National Diploma in Forestry and Environmental Technology (Federal College of Forestry, Ibadan)

This national diploma program, last updated in 2022, is designed for secondary school leavers and provides foundational training in silviculture.

- **Objectives:** To equip learners with theoretical and practical knowledge on silviculture.
- **Content:** key areas include: Aim and importance of silviculture, types of forests in Nigeria; Methods of forests seed collection, procurement, and storage; Techniques employed in forest nursery; Establishment of forest plantation
- **Learning Outcomes:** Students acquire skills in regenerative forestry, species management, nursery operations, and forest inventory monitoring, with competencies extending to GIS-based mapping.
- **Strengths:** labor-market alignment; sustainability content through ecosystem services focus; practical nursery and plantation training.
- **Limitations:** Digital integration limited to GPS and GIS tools; lacks broader ICT or advanced modeling applications. The curriculum is delivered exclusively **face-to-face**, which restricts wider access and limits opportunities for blended or online learning.

2. Certificate in Plantation Establishment (Entrepreneurship Education Development Center, Ibadan)

This short, four-week non-formal training program targets youth, local farmers, and forest guards, focusing on practical plantation establishment skills.

- **Objectives:** To provide participants with knowledge of forestry's role in the economy, land use, tree species management, nursery operations, and plantation tending.
- **Content:** Benefits of forestry to national economy; Forestry and land use; Tree species; Herbarium; Forest plantation establishment; Planting activities; Tending operation; Mensuration terms; Tree and stand management; Sampling techniques in forestry
- **Learning Outcomes:** Learners develop skills in site selection, nursery management, plantation planning and tending, as well as basic entrepreneurial knowledge.
- **Strengths:** Practical and accessible to local communities; integrates sustainability through plantation health and timber quality improvement.

- **Limitations:** No digital/innovation content; very short duration limits depth. The curriculum is delivered exclusively **face-to-face**, which restricts wider access and limits opportunities for blended or online learning

3. Higher National Diploma in Forestry and Environmental Technology (Federal College of Agriculture, Akure).
This advanced diploma builds on the national diploma and focuses on forest conservation and biodiversity protection.

- **Objectives:** To equip learners with knowledge, practical skills in forest conservation
- **Content:** Meaning and scope of forest conservation, concept of biodiversity conservation, components of biodiversity, insects of importance in forestry, procedures for collection and preservation of insects, characteristics of plant disease causing fungi, bacteria and viruses
- **Learning Outcomes:** Students gain competencies in insect identification, collection and preservation techniques, and pest management strategies in plantations and nurseries.
- **Strengths:** Strong emphasis on sustainability, biodiversity protection, and practical pest/disease management; includes GPS applications for monitoring.
- **Limitations:** The curriculum is delivered exclusively face-to-face, which restricts wider access and limits opportunities for blended or online learning.Its digital and innovation content is minimal, limited mainly to the use of GPS tools. The focus is heavily on theoretical and technical aspects of forest conservation (insects, pathogens, biodiversity) but less on entrepreneurship, sustainable business models, and industry innovation that could enhance employability.

Conclusion Nigeria : While strongly aligned with sustainability and labor market needs, the programs remain limited by their exclusive face-to-face delivery and modest digital integration, with innovation largely restricted to GPS/GIS tools. Strengthening entrepreneurship, blended learning, and advanced digital applications would enhance their relevance and impact.

Somalia
Somalia's curricula focus strongly on community forestry, dryland agroforestry, and nursery establishment, reflecting the country's ecological realities and restoration priorities. The programs cover different levels, from community-based certificates to institutional diplomas and short practical courses, designed to empower youth, farmers, and local practitioners with practical restoration and land management skills.

1. Certificate in Community Forestry Management (Puntland Technical University)

- **Objectives:** Train learners in community-driven forest restoration and governance to address degradation, promote local participation, and strengthen sustainable resource use.
- **Content:** Forest degradation drivers and community governance, community-based reforestation techniques, forest extension communication and participatory land use planning, tree nursery management and planting.
- **Learning Outcomes:** Students understand degradation drivers, engage communities in restoration, and apply participatory mapping, nursery management, and basic GIS tools. They gain competencies in facilitating stakeholder engagement and monitoring community-led initiatives.
- **Strengths:** alignment with local needs; industry input from Puntland Ministry of Environment; sustainability integrated into ecological and community practices; use of basic GIS/mobile tools for mapping.
- **Limitations:** Limited digital integration beyond entry-level GIS; private-sector engagement is modest; curriculum last updated in 2021, potentially requiring revision to

reflect emerging climate and livelihood needs. The curriculum is delivered exclusively **face-to-face**, which restricts wider access and limits opportunities for blended or online learning

2. Diploma in Agroforestry and Sustainable Land Use (SATG with FAO/GIZ Somalia)

- **Objectives:** Provide practical training in dryland agroforestry to enhance food security, soil fertility, and biodiversity while building climate resilience.
- **Content:** Agroforestry systems/models (alley cropping, silvopasture, windbreaks), soil fertility and organic matter management, drought-resilient species and crops, climate-smart land use planning, GIS and remote sensing for land suitability, agroforestry policy and extension services
- **Learning Outcomes:** Learners design multipurpose agroforestry systems, integrate trees/crops/livestock, and recommend adaptive strategies for resilience. This involves the practical ability to select appropriate tree and crop species, plan spatial arrangements, establish nurseries, plant, and manage trees and crops in an integrated manner to achieve multiple benefits like food production, fodder, timber, and soil improvement.
- **Strengths:** Comprehensive coverage of dryland agroforestry; strong sustainability dimension (soil regeneration, climate resilience, livelihood diversification); blended delivery with Moodle-based modules and remote sensing integration.
- **Limitations:** Industry involvement partial (mainly NGOs/FAO, limited private agribusiness participation); labor-market alignment moderate; digital tools included but not deeply mainstreamed into practice.

3. Short Course in Nursery Establishment and Seedling Production (Hargeisa Technical Institute)

- **Objectives:** Train participants in seedling production, nursery management, and supply chain processes for reforestation and urban greening.
- **Content:** Nursery site selection and construction, Seed collection and propagation, Soil media preparation and potting, Water-efficient irrigation methods, Pest and disease management, Record-keeping and seedling logistics
- **Learning Outcomes:** Learners identify suitable species, set up low-cost nurseries, manage pests/diseases, and autonomously run small-scale nursery enterprises, including sales/logistics.
- **Strengths:** Highly practical and community-focused; promotes native species and water-efficient techniques; accessible to farmers, women, and urban volunteers.
- **Limitations:** No digital/innovation integration; industry involvement only partial (consultations with NGOs); short duration limits depth of technical knowledge and entrepreneurial scaling.

Conclusion – Somalia

Somalia's forestry and agroforestry curricula are highly practice-oriented, reflecting the country's ecological challenges and restoration priorities. They emphasize community forestry, dryland agroforestry, and nursery establishment, equipping youth, farmers, and local practitioners with hands-on skills for land restoration and sustainable resource use. While the programs integrate sustainability and, in some cases, basic digital tools, they remain limited by modest private-sector involvement, exclusive reliance on face-to-face delivery in most cases, and relatively shallow integration of advanced digital and entrepreneurial competencies.

6.2 Curricula mapping: Joint Comparative Conclusion

The curriculum mapping across the five countries highlights a strong commitment to vocational and higher education in forestry, agroforestry, and environmental sciences, with programs ranging from short community-based certificates to diplomas and degree-level qualifications. Common strengths include a solid grounding in sustainability, biodiversity conservation, agroforestry, and land restoration, as well as strong alignment with national policies and ecological priorities. Practical, hands-on training is emphasized in all contexts, equipping youth, farmers, and professionals with applied skills in nursery management, forest conservation, agroforestry systems, and community engagement.

At the same time, important limitations emerge across the curricula. Digital integration is generally modest, with most programs relying primarily on basic GIS or GPS tools, and only a few integrating more advanced digital innovations such as remote sensing or blended learning. Private-sector involvement in curriculum design and delivery remains limited, with most partnerships concentrated in ministries, NGOs, and research bodies rather than industry actors who could strengthen employability and entrepreneurship. Additionally, some courses delivery modes are heavily reliant on face-to-face instruction, restricting access for learners in remote areas and limiting opportunities for flexible, blended, or online approaches.

Overall, the curricula demonstrate clear progress toward building skills for ecological sustainability and resource management. However, to maximize impact, they would benefit from deeper integration of entrepreneurship, advanced digital competencies, and private-sector collaboration, enabling learners not only to conserve and restore ecosystems but also to create innovative, sustainable livelihood opportunities in the forestry and agroforestry sectors.

7. International Quantitative Field research

7.1 Knowledge and Skills Gaps Findings of VET Centers

Cameroon

Forest Management

The training needs in forest management based on the Borich needs assessment shows that the highest forest management skill area where more competencies are needed by VET centers in Cameroon is National Forest Management policies and regulations. This is followed by Community Forest Management (MWDS= 9.24),Fire Forest Prevention (MWDS=8.97), and biodiversity monitoring (8.74).

Knowledge/Skill	MWDS	Rank
National Forest Management policies and regulations	11.27	1
Community forest management (Engagement of local communities in forest conservation)	9.24	2
Forest Fire Prevention and Control	8.97	3
Biodiversity monitoring	8.74	4
Forest inventory and mapping	8.55	5
Sustainable harvesting/logging techniques	7.31	6

Training Needs of VET Centers in Forest Management

Reforestation

The training needs in Reforestation based on the Borich needs assessment shows that the highest skill area where more competencies are needed by VET centers in Cameroon is Site selection and soil preparation (6.58) followed by tree nursery management (5.72) and Maintenance and aftercare (weeding, watering, pest control (5.52)

Knowledge/Skill	MWDS	Rank
Site selection and soil preparation	6.58	1
Tree nursery management	5.72	2
Maintenance and aftercare (weeding, watering, pest control)	5.52	3
Monitoring reforestation success	5.46	4
Planting end spacing techniques	5.32	5

Training Needs of VET Centers in Reforestation

Deforestation

The training needs in Deforestation based on the Borich needs assessment shows that the highest skill area where more competencies are needed by VET centers in Cameroon is Use of advanced technology (8.4) followed by the Use of digital tools such as GPS, GIS and IA for forest monitoring and Land-use planning and alternatives.

Knowledge/Skill	MWDS	Rank
Use of advanced technology such as satellite imagery; satellite maps and remote sensing	8.4	1
Use of digital tools such as GPS, GIS and IA for forest monitoring	5.88	2
Land-use planning and alternatives	5.2	3
Identifying drivers of deforestation	5.17	4
Impact assessment of deforestation	4.5	5
Advocacy and communication	3.7	6

Training Needs of VET Centers in Deforestation

Legislative Framework

The training needs in legal framework based on the Borich needs assessment shows that the highest skill area where more competencies are needed by VET centers in Cameroon is the recognition of forest crimes and enforcement strategies (8.19) followed by the Alignment of forest activities with NDCs(Nationally Determined Contributions) and climate strategies (8) and the analysis of the requirements and processes for EIAs in forest-related projects (7.6).

Knowledge/Skill	MWDS	Rank
Recognize types of forest crimes and enforcement strategies	8.19	1
Align forest activities with NDCs(Nationally Determined Contributions) and climate strategies	8	2
Analyze requirements and processes for ElAs in forest-related projects	7.6	3
Interpret National forest acts, land tenure systems, and land use classifications	7.14	4
Identify legal measures that promote gender equality in forestry	6.29	5
Understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD	5.46	6

Training Needs of VET Centers in legislative framework

Ghana

Forest Management

The training needs in forest management based on the Borich needs assessment show that the highest forest management skill area where more competencies are needed by VET centers in Ghana is Forest Fire Prevention and Control (MWDS = 5.39). This is followed by National Forest Management policies and regulations (MWDS = 4.41), Community Forest Management (engagement of local communities) (MWDS = 4.41), and Biodiversity Monitoring (MWDS = 3.01). Other training priorities include Forest Inventory and Mapping (MWDS = 2.70) and Sustainable harvesting/logging techniques (MWDS = 1.76).

Knowledge/Skill	MWDS	Ranks
Forest Fire Prevention and Control	5.39	1
National Forest Management policies and regulations	4.41	2
Community forest management (Engagement of local communities)	4.41	3
Biodiversity monitoring	3.01	4
Forest inventory and mapping	2.70	5
Sustainable harvesting/logging techniques	1.76	6

Training needs of VET Centers in Forest Management

Reforestation

The training needs in reforestation based on the Borich needs assessment show that the highest skill area where more competencies are needed by VET centers is Site selection and soil preparation (MWDS = 4.40). This is followed by Monitoring reforestation success (MWDS = 3.60), Tree nursery management (MWDS = 3.44), and Planting and spacing techniques (MWDS = 2.52). Other training priorities include Maintenance and aftercare (weeding, watering, pest control) (MWDS = 2.15).

Knowledge/Skill	MWDS	Rank
Site selection and soil preparation	4.40	1
Monitoring reforestation success	3.60	2
Tree nursery management	3.44	3
Planting and spacing techniques	2.52	4
Maintenance and aftercare (weeding, watering, pest control)	2.15	5

Training needs of VET Centers in Reforestation

Deforestation

The training needs in deforestation based on the Borich needs assessment show that the highest skill area where more competencies are needed by VET centers is the use of digital tools such (MWDS = 5.40). This is followed by Advocacy and communication (MWDS = 3.96), and the use of advanced technology such as satellite imagery and maps (MWDS = 3.96). Other training priorities include Land-use planning and alternatives (MWDS = 2.58), Impact assessment of deforestation (MWDS = 1.29), and Identifying drivers of deforestation (MWDS = 0.00).

Knowledge/Skill	MWDS	Rank
Use of digital tools such as GPS, GIS, and AI for forest monitoring	5.40	1
Advocacy and communication	3.96	2
Use of advanced technology such as satellite imagery and maps	3.96	3
Land-use planning and alternatives	2.58	4
Impact assessment of deforestation	1.29	5
Identifying drivers of deforestation	0.00	6

Training needs of VET Centers in deforestation

Legislative Framework

The training needs in the legislative framework based on the Borich needs assessment show that the highest skill area where more competencies are needed by VET centers is the ability to align forest activities with Nationally Determined Contributions (NDCs) and climate strategies (MWDS = 4.51). This is followed by the capacity to identify legal measures that promote gender equality in forestry (MWDS = 4.29), and to interpret national forest acts, land tenure systems, and land use classifications (MWDS = 3.52). Other training priorities include recognizing types of forest crimes and enforcement strategies (MWDS = 2.58), analyzing requirements and processes for Environmental Impact Assessments (EIAs) in forest-related projects (MWDS = 2.46), and understanding multilateral environmental agreements such as UNFCCC, REDD+, and UNCBD (MWDS = 2.00).

Practice	MWDS	Rank
Align forest activities with NDCs (Nationally Determined Contributions) and climate strategies	4.51	1
Identify legal measures that promote gender equality in forestry	4.29	2
Interpret national forest acts, land tenure systems, and land use classifications	3.52	3
Recognize types of forest crimes and enforcement strategies	2.58	4
Analyze requirements and processes for EIAs in forest-related projects	2.46	5
Understand multilateral environmental agreements (UNFCCC, REDD+, UNCBD)	2.00	6

Training needs of VET Centers in legal framework

Nigeria

Forest Management

The training needs in forest management are outlined, based on the Borich needs assessment. The Mean Weighted Discrepancy Score (MWDS) shows that the highest forest management skill area where more competencies are needed by VET centers in Nigeria is National Forest Management policies and regulations (MWDS = 6.60). This is followed by Sustainable harvesting, logging techniques (MWDS= 6.11), Fire Forest Prevention (MWDS=5.52), Fire Inventory and Mapping (MWDS=5.40) and Community Forest Management (MWDS= 5.28).

Knowledge/Skill	MWDS	Rank
Forest inventory and mapping	5.40	4th
Sustainable harvesting/logging techniques	6.11	2nd
Biodiversity monitoring	4.92	6th
National Forest Management policies and regulations	6.60	1st
Community forest management (Engagement of local communities in forest conservation)	5.28	5th
Fire Forest Prevention	5.52	3rd

Training Needs of VET Centers in Forest Management

Reforestation

The training needs in reforestation are based on the Borich needs assessment. Maintenance and aftercare (weeding, watering, pest control, etc.) was ranked first (MWDS 5.39). This was followed by tree nursery management (MWDS=2.82) and monitoring reforestation success (MWDS=2.70). Planting and spacing techniques and site selection and soil preparation recorded low MWDS (1.35 and 1.32, respectively). The high weighted mean discrepancy scores indicate a strong gap between the importance of maintenance and aftercare and the existing level of competence of the VET centers, highlighting a high priority for training. However, training is less required in planting and spacing techniques and site selection and soil preparation than in maintenance and aftercare.

Knowledge/Skill	MWDS	Rank
Tree nursery management	2.82	2nd
Site selection and soil preparation	1.32	5th
Planting and spacing techniques	1.35	4th
Maintenance and aftercare (weeding, watering, pest control)	5.39	1st
Monitoring reforestation success	2.70	3rd

Training Needs of VET Centers in Reforestation

Deforestation

The knowledge and skill gaps of VET centers on deforestation (Understanding and Mitigation). Use of advanced technology (MWDS=10.0) and use of digital tools (MWDS=9.5) were the high-priority skills identified by centers. The finding is important with the advancement in technology in the forestry sector, where there is an increasing reliance on technological innovations to enhance efficiency, precision, and sustainability in forest management. Land use planning and alternatives was ranked 3rd (MWDS=3.68), also highlighting priority for training. This acknowledges the pivotal role of land use in shaping forestry outcomes. Competing demands for land for agriculture, housing estates, mining, and infrastructure are major drivers of deforestation in Nigeria and suggest that centers understand the need to manage the conflicts. Similarly, advocacy and communication (MWDS=2.94), identifying drivers of deforestation (MWDS=2.76) and impact assessment of deforestation (MWDS=2.70) were also moderately identified gaps by VET centers.

Knowledge/Skill	MWDS	Rank
Identifying drivers of deforestation	2.76	5th
Impact assessment of deforestation	2.70	6th
Land-use planning and alternatives	3.68	3rd
Advocacy and communication	2.94	4th
Use of advanced technology such as satellite imagery, satellite maps and remote sensing	10,0	1st
Use of digital tools such as GPS, GIS and AI for forest monitoring	9.5	2nd

Training Needs of VET Centers in Deforestation

Legislative frameworks and policy.

The highest skill priority was observed in the knowledge and skills required to interpret national forest acts, land tenure systems and land use classifications (MWDS= 4.73).The ability to analyses requirements and processes for EIAs in forest-related projects was also identified as a high-priority skill gap (MWDS=4.67). The ability to understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD had a moderate gap (MWDS=2.96), which indicates that learners lack knowledge of international agreements critical for global forestry efforts required for aligning national policies with global goals. Identifying legal measures that promote gender equality in forestry was also ranked 4th with an MWDS of 2.59, indicating centers' lack of awareness of policies promoting inclusivity in forestry, which is critical for equitable resource management. Aligning forest activities with NDCs and climate strategies was ranked 4th (MWDS=2.59). Surprisingly, recognising types of forest crimes and enforcement strategies had no mean weighted discrepancy score (MWDS = 0.0), indicating VET institutions felt they were competent enough in this practice relative to its importance. As such, they require no immediate training intervention.

Knowledge/Skill	MWDS	Rank
Understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD	2.96	3rd
Interpret national forest acts, land tenure systems, and land use classifications	4.73	1st
Analyze requirements and processes for EIAs in forest-related projects	4.67	2nd
Recognize types of forest crimes and enforcement strategies	0.00	6th
Align forest activities with NDCs (Nationally Determined Contributions) and climate strategies	2.40	5th
Identify legal measures that promote gender equality in forestry	2.59	4th

Training needs of VET Centers in Legislative framework

Uganda

Forest Management

The training needs in forest management based on the Borich needs assessment show that the highest skill area where more competencies are needed by VET centers in Uganda is Forest Fire Prevention and Control (MWDS = 6.6). This is followed by Community Forest management (engagement of local communities in forest conservation) (MWDS = 3.3), Biodiversity monitoring (MWDS = 1.5), and Forest inventory and mapping (MWDS = 1.4). Other training priorities include Sustainable harvesting/logging techniques (MWDS = 0.5) and National Forest Management policies and regulations (MWDS = 0.0).

Knowledge/Skill	MWDS	Rank
Forest Fire Prevention and Control	6.6	1
Community forest management (Engagement of local communities in forest conservation)	3.3	2
Biodiversity monitoring	1.5	3
Forest inventory and mapping	1.4	4
National Forest Management policies and regulations	0.0	6
Sustainable harvesting/logging techniques	0.5	5

Training needs of VET Centers in Forest Management

Reforestation

The training needs in reforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET centers (teachers) in Uganda is Monitoring reforestation success (MWDS = 2.3). This is followed by Site selection and soil preparation (MWDS = 1.2), and Planting and spacing techniques (MWDS = 0.6). Another training area, though with a negative priority value, is Maintenance and aftercare (weeding, watering, pest control) (MWDS = -1.1), indicating it may be perceived as less critical compared to other competencies.

Knowledge/Skill	MWDS	Rank
Monitoring reforestation success	2.3	1
Site Selection and Soil Preparation	1.2	2
Planting and spacing techniques	0.6	3
Maintenance and aftercare (weeding, watering, pest control)	-1.1	4
Tree nursery management	0.0	5

Training needs of VET Centers in Reforestation

Deforestation

The training needs in deforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET centers (teachers) in Uganda is Advocacy and communication (MWDS = 2.9). This is followed by the use of digital tools such as GPS, GIS, and AI for forest monitoring (MWDS = 2.1), identifying drivers of deforestation (MWDS = 1.9), and impact assessment of deforestation (MWDS = 1.7). Other training priorities include land-use planning and alternatives (MWDS = 1.1) and the use of advanced technology such as satellite imagery, maps, and remote sensing (MWDS = 1.0).

Knowledge/Skill	MWDS	Rank
Advocacy and communication	2.9	1
Use of digital tools such as GPS, GIS and AI for forest monitoring	2.1	2
Identifying drivers of deforestation	1.9	3
Impact assessment of deforestation	1.7	4
Land-use planning and alternatives	1.1	5
Use of advanced technology such as satellite imagery, satellite maps and remote sensing	1.0	6

Training needs of VET Centers in Deforestation

Legal Framework

The training needs in the legal framework based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET centers in Uganda is the ability to analyze requirements and processes for Environmental Impact Assessments (EIAs) in forest-related projects (MWDS = 4.4). This is followed by the need to understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, and UNCBD (MWDS = 4.3), and to interpret national forest acts, land tenure systems, and land use classifications (MWDS = 3.6). Other training priorities include recognizing types of forest crimes and enforcement strategies (MWDS = 3.5), identifying legal measures that promote gender equality in forestry (MWDS = 2.9), and aligning forest activities with Nationally Determined Contributions (NDCs) and climate strategies (MWDS = 2.8).

Knowledge/Skill	MWDS	Rank
Analyze requirements and processes for EIAs in forest-related projects	4.4	1

Understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD	4.3	2
Interpret national forest acts, land tenure systems, and land use classifications	3.6	3
Recognize types of forest crimes and enforcement strategies	3.5	4
Identify legal measures that promote gender equality in forestry	2.9	5
Align forest activities with NDCs (Nationally Determined Contributions) and climate strategies	2.8	6

Training needs of VET Centers in Legal Framework

Somalia

Forest Management

The training needs in forest management based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET centers in Somalia is Biodiversity Monitoring (Monitoring and Evaluation of Forest Operations) (MWDS = 13.76).This is followed by Forest Inventory and Mapping (MWDS = 11.48), Sustainable Harvesting Techniques (MWDS = 10.4), National Forest Management Policies and Regulations (MWDS = 7.98), and Fire Prevention and Forest Safety (MWDS = 2.04).

Knowledge/Skill	MWDS	Ranks
Biodiversity monitoring (Monitoring and evaluation of forest operations)	13.76	1
Forest inventory and mapping	11.48	2
Sustainable harvesting techniques	10.4	3
National Forest Management policies and regulations (Ecosystem-based forest management)	7.98	4
Fire prevention and forest safety	2.04	5

Training needs of VET Centers in Forest Management

Reforestation

training needs in reforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET centers in Somalia is Tree Nursery Management (MWDS = 6.24).This is followed by Planting and Spacing Techniques (Afforestation and Reforestation Practices) (MWDS = 5.32), Site Selection and Soil Preparation (Climate-smart Reforestation Planning) (MWDS = 4.44), Maintenance and Aftercare (Weeding, Watering, Pest Control) (MWDS = 3.24), and Monitoring Reforestation Success (MWDS = 2.45).

Knowledge/Skill	MWDS	Rank
Tree nursery management	6.24	1
Planting and spacing techniques (Afforestation and reforestation practices)	5.32	2
Site Selection and Soil Preparation (Climate-smart reforestation planning)	4.44	3
Maintenance and aftercare (weeding, watering, pest control)	3.24	4

Monitoring reforestation success	2.45	5

Training needs of VET Centers in Reforestation

Deforestation

The training needs assessment on deforestation for VET centers in Somalia revealed that the highest competency gap lies in Deforestation Impact Assessment (MWDS = 5.92).
This is followed by Land Use Planning and Alternatives, including Land Use Conflict Analysis (MWDS = 4.32), and Identifying Drivers of Deforestation, including Socio-economic Research on Forest Loss (MWDS = 2.38). The area with the lowest identified need is Advocacy and Communication (MWDS = 1.32).

Knowledge/Skill	MWDS	Rank
Deforestation Impact assessment	5.92	1
Land use planning and alternatives (Including Land use conflict analysis)	4.32	2
Identifying drivers of deforestation (including Socio-economic research on forest loss)	2.38	3
Advocacy and communication	1.32	4

Training needs of VET Centers in Deforestation

Legislative Framework

The assessment of training needs related to the legal framework for forest management in Somalia indicates that the highest priority area is Interpretation of National Forest Acts, Land Tenure Systems, and Land Use Classifications (including Forest Certification and Standards), with an MWDS of 6.48.This reflects a significant capacity gap in understanding and applying existing legal and institutional frameworks for sustainable forest governance. The second-ranked need is Recognition of Types of Forest Crimes and Enforcement Strategies (Forest Policy and Legal Compliance), with an MWDS of 0.64, highlighting a lower—but still relevant—need for capacity building in legal enforcement and compliance.

Knowledge/Skill	MWDS	Rank
Interpret National forest acts, land tenure systems, and land use classifications (including forest certification and standards)	6.48	1
Recognize types of forest crimes and enforcement strategies (Forest policy and legal compliance)	0.64	2

7.2 Knowledge and Skills Gaps Findings of VET Learners

Cameroon

Forest Management

The training needs in forest management based on the Borich needs assessment shows that the highest forest management skill area where more competencies are needed by VET learners in Cameroon is Fire Forest Prevention (MWDS=12.25), followed by Community Forest management (MWDS=8.74) and Biodiversity monitoring (MWDS=8.17),

Knowledge/Skill	MWDS	Rank
Forest Fire Prevention and Control	12.25	1
Community forest management (Engagement of local communities in forest conservation)	8.74	2
Biodiversity monitoring	8.17	3
National Forest Management policies and regulations	7.2	4
Sustainable harvesting/logging techniques	7.04	5
Forest inventory and mapping	6.97	6

Training needs of VET learners in forest management

Reforestation

The training needs in Reforestation based on the Borich needs assessment shows that the highest skill area where more competencies are needed by VET learners in Cameroon is Monitoring reforestation success (MWDS=6.9), followed by Site selection and soil preparation (MWDS=4.8) and Tree nursery management (MWDS=2.94),

Knowledge/Skill	MWDS	Rank
Monitoring reforestation success	6.9	1
Site selection and soil preparation	4.8	2
Tree nursery management	2.94	3
Planting end spacing techniques	2	4
Maintenance and aftercare (weeding, watering, pest control)	1.32	5

Training needs of VET learners in Reforestation

Deforestation

The training needs in Deforestation based on the Borich needs assessment shows that the highest skill area where more competencies are needed by VET learners in Cameroon is Use of advanced technology (MWDS=9.8), followed by Land-use planning and alternatives (MWDS=7.2) and Advocacy and communication (MWDS=6.97).

Knowledge/Skill	MWDS	Rank
Use of advanced technology such as satellite imagery; satellite maps and remote sensing	9.8	1
Land-use planning and alternatives	7.2	2
Advocacy and communication	6.97	3
Identifying drivers of deforestation	6.75	4
Use of digital tools such as GPS, GIS and IA for forest monitoring	6.44	5
Impact assessment of deforestation	5.72	6

Training needs of VET Learners in Deforestation

Legislative Framework

The training needs in the legislative based on the Borich needs assessment shows that the highest skill area where more competencies are needed by VET learners in Cameroon is

Understand multilateral environmental agreements (MWDS=8.28), followed by Analysis of the requirements and processes for EIAs in forest-related projects (MWDS=7.98) and the Interpretation of the National forest acts, land tenure systems, and land use classifications Tree nursery management (MWDS=7.74),

Knowledge/Skill	MWDS	Rank
Understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD	8.28	1
Analyze requirements and processes for EIAs in forest-related projects	7.98	2
Interpret National forest acts, land tenure systems, and land use classifications	7.74	3
Recognize types of forest crimes and enforcement strategies	6.6	4
Identify legal measures that promote gender equality in forestry	3.74	5
Align forest activities with NDCs(Nationally Determined Contributions) and climate strategies	3.4	6

Training needs of VET learners in legal frameworks

Ghana

Forest management

The training needs in forest management based on the Borich needs assessment show that the highest skill area where more competencies are needed by VET learners is Forest Fire Prevention and Control (MWDS = 7.36). This is followed by National Forest Management policies and regulations (MWDS = 7.20), Biodiversity monitoring (MWDS = 7.05), and Forest inventory and mapping (MWDS = 6.58). Other training priorities include Sustainable harvesting/logging techniques (MWDS = 6.44) and Community Forest management (engagement of local communities in forest conservation) (MWDS = 5.98).

Knowledge/Skill	MWDS	Rank
Forest Fire Prevention and Control	7.36	1
National Forest Management policies and regulations	7.20	2
Biodiversity monitoring	7.05	3
Forest inventory and mapping	6.58	4
Sustainable harvesting/logging techniques	6.44	5
Community forest management (Engagement of local communities in forest conservation)	5.98	6

Training needs of VET learners in forest management

Reforestation

The training needs in reforestation based on the Borich needs assessment show that the highest skill area where more competencies are needed by VET learners is Site selection and soil preparation (MWDS = 4.70). This is followed by Monitoring reforestation success (MWDS = 4.60), Tree nursery management (MWDS = 3.76), and Planting and spacing techniques (MWDS = 3.15). Another training priority includes Maintenance and aftercare (weeding, watering, pest control) (MWDS = 2.25).

Knowledge/Skill	MWDS	Rank
Site selection and soil preparation	4.70	1
Monitoring reforestation success	4.60	2
Tree nursery management	3.76	3
Planting and spacing techniques	3.15	4
Maintenance and aftercare (weeding, watering, pest control)	2.25	5

Training needs of VET learners in Reforestation

Deforestation

The training needs in deforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by learners is the use of advanced technology such as satellite imagery, maps, and remote sensing (MWDS = 6.30). This is followed by the use of digital tools such as GPS, GIS, and AI for forest monitoring (MWDS = 5.59), land-use planning and alternatives (MWDS = 5.17), and advocacy and communication (MWDS = 5.06). Other training priorities include impact assessment of deforestation (MWDS = 4.80) and identifying drivers of deforestation (MWDS = 4.32).

Knowledge/Skill	MWDS	Rank
Use of advanced technology such as satellite imagery, maps and remote sensing	6.30	1
Use of digital tools such as GPS, GIS and AI for forest monitoring	5.59	2
Land-use planning and alternatives	5.17	3
Advocacy and communication	5.06	4
Impact assessment of deforestation	4.80	5
Identifying drivers of deforestation	4.32	6

Training needs of VET learners in Deforestation

Legal Framework

The training needs in the legal framework based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by learners is to understand multilateral environmental agreements such as UNFCCC, REDD+, and UNCBD (MWDS = 5.04). This is followed by the ability to interpret national forest acts, land tenure systems, and land use classifications (MWDS = 4.84), and to identify legal measures that promote gender equality in forestry (MWDS = 4.40). Other training priorities include analyzing requirements and processes for Environmental Impact Assessments (EIAs) in forest-related projects (MWDS = 3.69), aligning forest activities with Nationally Determined Contributions (NDCs) and climate strategies (MWDS = 2.80), and recognizing types of forest crimes and enforcement strategies (MWDS = 2.58).

Knowledge/Skill	MWDS	Rank
Understand multilateral environmental agreements (UNFCCC, REDD+, UNCBD)	5.04	1

Knowledge/Skill	MWDS	Rank
Interpret national forest acts, land tenure systems, and land use classifications	4.84	2
Identify legal measures that promote gender equality in forestry	4.40	3
Analyze requirements and processes for EIAs in forest-related projects	3.69	4
Align forest activities with NDCs (Nationally Determined Contributions) and climate strategies	2.80	5
Recognize types of forest crimes and enforcement strategies	2.58	6

Training needs of VET learners in Legal Framework

Nigeria

Forest Management

Forest inventory and mapping skills had the highest deficiency in the category (MWDS=5.08), indicating a significant gap in the ability of VET learners to conduct forest inventories and create maps. Accurate forest inventory and mapping are critical for assessing forest resources, planning sustainable management, and monitoring changes over time. Fire forest prevention and knowledge of national forest management policies and regulations are tied for the second-highest deficiency (MWDS=4.05). Fire prevention is crucial for protecting forest ecosystems, particularly in regions prone to wildfires. The gap in policy knowledge indicates that learners may not understand and find it difficult to apply national regulations, which could hinder compliance with sustainable forestry practices.

Knowledge/Skill	MWDS	Rank
Forest inventory and mapping	5.08	1st
Sustainable harvesting/logging techniques	3.22	4th
Biodiversity monitoring	3.78	3rd
National Forest Management policies and regulations	4.05	2nd
Community forest management (Engagement of local communities in forest conservation)	3.01	5th
Fire Forest Prevention	4.05	2nd

Training needs of VET learners in Forest Management

Reforestation

The Reforestation category addresses skills related to restoring forest cover. Skills in tree nursery management were the highest priority in the category (MWDS=2.80). This skill involves seed selection, propagation, and seedling care, which are important for successful reforestation. This gap suggests a need for practical training in nursery operations. Skills in site selection and soil preparation ranked second in training needs in this category (MWDS=2.76). Proper site selection and soil preparation are critical for ensuring seedling survival. The moderate deficiency indicates that learners may lack knowledge of ecological and soil science principles.

Knowledge/Skill	MWDS	Rank
Tree nursery management	2.80	1st
Site selection and soil preparation	2.76	2nd

Knowledge/Skill	MWDS	Rank
Planting and spacing techniques	2.64	3rd
Maintenance and aftercare (weeding, watering, pest control)	2.30	5th
Monitoring reforestation success	2.58	4th

Training needs of VET learners in Reforestation

Deforestation

This category focuses on understanding the causes of deforestation and strategies to mitigate it. The skill in the use of digital tools such as GPS, GIS, and AI for forest monitoring had the highest MWDS across all categories, indicating a severe deficiency in the use of advanced technologies for forest monitoring. The ability to leverage GPS, GIS, and AI is increasingly important for real-time forest management and combating deforestation. Use of advanced technology, such as satellite imagery, satellite maps, and remote sensing skills, also showed a significant gap, reinforcing the need for training in remote sensing technologies to monitor deforestation. Advocacy and communication skills were also deficient among the learners, with a MWDS of 4.20.

Knowledge/Skill	MWDS	Rank
Identifying drivers of deforestation	2.00	6th
Impact assessment of deforestation	3.69	4th
Land-use planning and alternatives	2.52	5th
Advocacy and communication	4.20	3rd
Use of advanced technology such as satellite imagery, satellite maps and remote sensing	4.40	2nd
Use of digital tools such as GPS, GIS and AI for forest monitoring	7.31	1st

Training needs of VET learners in deforestation

Legislative Frameworks and Policy

The ability to understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD skills had a significant gap (MWDS=6.15), indicating that learners lack knowledge of international agreements critical for global forestry efforts. Understanding MEAs is essential for aligning national policies with global goals. Another skill gap identified in this category is the ability to interpret national forest acts, land tenure systems, and land use classifications (MWDS=4.50). This skill also highlights a high-priority gap, suggesting challenges in navigating national legal frameworks. In 3rd position was the ability to identify legal measures that promote gender equality in forestry (MWDS=4.40). The gap here indicates that learners may not be aware of policies promoting inclusivity in forestry, which is critical for equitable resource management. Also, of moderate priority is analyzing requirements and processes for EIAs in forest-related projects (MWDS=2.88), recognising types of forest crimes and enforcement strategies (MWDS=2.80), and aligning forest activities with NDSs and climate strategies (MWDS=2.52), highlighting a critical gap in policy knowledge, which is essential for compliance and effective forest governance

Knowledge/Skill	MWDS	Rank
Understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD	6.15	1st
Interpret national forest acts, land tenure systems, and land use classifications	4.50	2nd
Analyze requirements and processes for EIAs in forest-related projects	2.88	4th
Recognize types of forest crimes and enforcement strategies	2.80	5th
Align forest activities with NDCs (Nationally Determined Contributions) and climate strategies	2.52	6th
Identify legal measures that promote gender equality in forestry	4.40	3rd

Training needs of VET learners in legislative framework

Uganda

Forest Management.

The training needs in forest management based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Uganda is Forest inventory and mapping (MWDS = 2.4). This is followed by Forest Fire Prevention and Control (MWDS = 1.9), Community Forest management (engagement of local communities in forest conservation) (MWDS = 0.9), and National Forest Management policies and regulations (MWDS = 0.6). Other training priorities include Sustainable harvesting/logging techniques (MWDS = 0.6) and Biodiversity monitoring (MWDS = -1.1), indicating a relatively lower perceived training need in this area.

Knowledge/Skill	MWDS	Ranks
Forest inventory and mapping	2.4	1
Forest Fire Prevention and Control	1.9	2
Community forest management (Engagement of local communities in forest conservation)	0.9	3
National Forest Management policies and regulations	0.6	4
Sustainable harvesting/logging techniques	0.6	5
Biodiversity monitoring	-1.1	6

Training needs of VET learners for forest management

Reforestation

The training needs in reforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Uganda is Monitoring reforestation success (MWDS = 1.3). This is followed by Site selection and soil preparation (MWDS = 1.2), Tree nursery management (MWDS = 0.6), and Planting and spacing techniques (MWDS = 0.6). Another identified training area is Maintenance and aftercare (weeding, watering, pest control) (MWDS = 0.0), indicating it is viewed as a comparatively lower training priority among learners.

Knowledge/Skill	MWDS	Rank
Monitoring reforestation success	1.3	1
Site Selection and Soil Preparation	1.2	2
Tree nursery management	0.6	3
Planting and spacing techniques	0.6	4
Maintenance and aftercare (weeding, watering, pest control)	0.0	5

Training need of VET learners for Reforestation

Deforestation

The training needs in deforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Uganda is Land-use planning and alternatives (MWDS = 2.6). This is followed by Advocacy and communication (MWDS = 1.9), use of digital tools such as GPS, GIS, and AI for forest monitoring (MWDS = 1.0), and the use of advanced technology such as satellite imagery, maps, and remote sensing (MWDS = 0.6). Other training areas, including impact assessment of deforestation (MWDS = 0.0) and identifying drivers of deforestation (MWDS = 0.0), reflect comparatively lower training priorities among learners.

Knowledge/Skill	MWDS	Rank
Land-use planning and alternatives	2.6	1
Advocacy and communication	1.9	2
Use of digital tools such as GPS, GIS and AI for forest monitoring	1.0	3
Use of advanced technology such as satellite imagery, satellite maps and remote sensing	0.6	4
Impact assessment of deforestation	0.0	5
Identifying drivers of deforestation	0.0	6

Training need of VET learners for Deforestation

Legal Framework

The training needs in the legal framework based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Uganda is the ability to align forest activities with Nationally Determined Contributions (NDCs) and climate strategies (MWDS = 1.8). This is followed by the need to understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, and UNCBD (MWDS = 1.7), and to recognize types of forest crimes and enforcement strategies (MWDS = 1.3). Other training priorities include identifying legal measures that promote gender equality in forestry (MWDS = 1.3), analyzing requirements and processes for Environmental Impact Assessments (EIAs) in forest-related projects (MWDS = 1.1), and interpreting national forest acts, land tenure systems, and land use classifications (MWDS = 0.6).

Knowledge/Skill	MWDS	Rank
Align forest activities with NDCs (Nationally Determined Contributions) and climate strategies	1.8	1
Understand multilateral environmental agreements (MEAs) such as UNFCCC, REDD+, UNCBD	1.7	2
Recognize types of forest crimes and enforcement strategies	1.3	3
Identify legal measures that promote gender equality in forestry	1.3	4
Analyze requirements and processes for EIAs in forest-related projects	1.1	5
Interpret national forest acts, land tenure systems, and land use classifications	0.6	6

Training need of VET learners for Legal Framework

Somalia

Forest Management

The training needs in forest management based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Somalia is Sustainable Harvesting Techniques (MWDS = 12.6).This is followed by Biodiversity Monitoring (Monitoring and Evaluation of Forest Operations) (MWDS = 11.07), National Forest Management Policies and Regulations (Ecosystem-based Forest Management) (MWDS = 8.19), Forest Inventory and Mapping (MWDS = 8.00), and Forest Resource Data Management (Community Forest Management) (MWDS = 6.46).

Knowledge/Skill	MWDS	Ranks
Sustainable harvesting techniques	12.6	1
Biodiversity monitoring (Monitoring and evaluation of forest operations)	11.07	2
Forest inventory and mapping	8.00	4
National Forest Management policies and regulations (Ecosystem-based Forest management)	8.19	3
Forest resource data management (Community Forest management)	6.46	5

Training need of VET learners for Forest Management

Reforestation

The training needs in reforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Somalia is Planting and Spacing Techniques (Afforestation and Reforestation Practices) (MWDS = 6.08). This is followed by Site Selection and Soil Preparation (Climate-smart Reforestation Planning) (MWDS = 3.96) and Monitoring Reforestation Success (Post-planting Care and Monitoring) (MWDS = 2.04).

Knowledge/Skill	MWDS	Rank
Planting and spacing techniques (Afforestation and reforestation practices)	6.08	1

Site Selection and Soil Preparation (Climate-smart reforestation planning)	3.96	2
Monitoring reforestation success (Post-planting care and monitoring)	2.04	3

Training need of VET learners for Reforestation

Deforestation

The training needs in deforestation based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Somalia is Identifying Drivers of Deforestation (MWDS = 6.46).This is followed by Deforestation Impact Assessment (MWDS = 3.15), Land Use Planning and Alternatives (Including Mitigation and Restoration Strategies) (MWDS = 2.38), and Advocacy and Communication (MWDS = 1.32).

Knowledge/Skill	MWDS	Rank
Identifying drivers of deforestation	6.46	1
Deforestation Impact assessment	3.15	2
Land use planning and alternatives (including mitigation and restoration strategies)	2.38	3
Advocacy and communication	1.32	4

Training need of VET learners for Deforestation

Legislative Framework

The training needs in the legal framework based on the Borich needs assessment show that the highest knowledge and skill area where more competencies are needed by VET learners in Somalia is Interpretation of National Forest Acts, Land Tenure Systems, and Land Use Classifications (Including Forest Certification and Standards) (MWDS = 5.18). This is followed by Recognition of Types of Forest Crimes and Enforcement Strategies (Forest Policy and Legal Compliance) (MWDS = 0.99).

Knowledge/Skill	MWDS	Rank
Interpret National forest acts, land tenure systems, and land use classifications (including forest certification and standards)	5.18	1
Recognize types of forest crimes and enforcement strategies (Forest policy and legal compliance	0.99	2

Training need of VET learners for legal framework

7.3 Comparative Analysis of Skills Gaps for VET Centers

1. Forest Management

The analysis reveals significant differences in training needs across countries.

- **Cameroon** shows gaps in *National Forest Policies and Regulations (11.27)* and *Community Forest Management (9.24)*, emphasizing governance and participation.

- **Nigeria**'s focus is on *National Forest Policies (6.60)* and *Sustainable Harvesting Techniques (6.11)*, reflecting a balance between technical and regulatory needs.
- **Ghana** and **Uganda** present comparatively lower MWDS values, emphasizing *Fire Prevention* as key need.
- **Somalia** has the highest MWDS values overall, showing strong skill gaps in *Biodiversity Monitoring (13.76)* and *Forest Inventory and Mapping (11.48)*.

Comparative Forest Management Skill Gaps (VET Centers)

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	National Forest Management Policies & Regulations	11.27	Community Forest Management	9.24	Fire Prevention & Control	8.97
Ghana	Forest Fire Prevention & Control	5.39	National Forest Policies & Regulations	4.41	Community Forest Management	4.41
Nigeria	National Forest Policies & Regulations	6.60	Sustainable Harvesting Techniques	6.11	Fire Prevention	5.52
Uganda	Forest Fire Prevention & Control	6.60	Community Forest Management	3.30	Biodiversity Monitoring	1.50
Somalia	Biodiversity Monitoring	13.76	Forest Inventory & Mapping	11.48	Sustainable Harvesting Techniques	10.40

2. Reforestation

In *reforestation*, practical and technical competencies dominate the identified gaps.

- **Cameroon** and **Ghana** both emphasize *Site Selection and Soil Preparation*
- **Nigeria** ranks *Maintenance and Aftercare* as the highest need, suggesting a focus on post-planting sustainability.
- **Uganda** highlight *Monitoring Reforestation Success* as a major need, reflecting challenges in long-term evaluation.
- **Somalia** emphasize Tree Nursery Management as a priority with Cameroon and Nigeria also highlighting this area as the second skill/knowledge gap.

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Site Selection & Soil Preparation	6.58	Tree Nursery Management	5.72	Maintenance & Aftercare	5.52
Ghana	Site Selection & Soil Preparation	4.40	Monitoring Reforestation Success	3.60	Tree Nursery Management	3.44
Nigeria	Maintenance & Aftercare	5.39	Tree Nursery Management	2.82	Monitoring Reforestation Success	2.70
Uganda	Monitoring Reforestation Success	2.30	Site Selection & Soil Preparation	1.20	Planting & Spacing Techniques	0.60

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Somalia	Tree Nursery Management	6.24	Planting & Spacing Techniques	5.32	Site Selection & Soil Preparation	4.44

3. Deforestation

The *deforestation* category reflects the growing importance of technological proficiency in forest monitoring.

- **Nigeria** and **Cameroon** report very high MWDS for *Use of Advanced Technology (10.0 & 8.4)* and *Digital Tools (9.5 & 5.88)*.
- **Somalia**'s priorities center on *Impact Assessment (5.92)* and *Land Use Planning (4.32)*, aligning with governance and socio-economic challenges.
- **Ghana** and **Uganda** show moderate needs, particularly in *Advocacy and Communication* and digital literacy for monitoring.

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Use of Advanced Technology (Satellite & Remote Sensing)	8.40	Use of Digital Tools (GIS, GPS, AI)	5.88	Land Use Planning & Alternatives	5.20
Ghana	Use of Digital Tools (GIS, GPS, AI)	5.40	Advocacy & Communication	3.96	Advanced Technology (Satellite)	3.96
Nigeria	Use of Advanced Technology (Satellite & Remote Sensing)	10.00	Use of Digital Tools (GIS, GPS, AI)	9.50	Land Use Planning & Alternatives	3.68
Uganda	Advocacy & Communication	2.90	Use of Digital Tools (GIS, GPS, AI)	2.10	Identifying Drivers of Deforestation	1.90
Somalia	Deforestation Impact Assessment	5.92	Land Use Planning & Alternatives	4.32	Identifying Drivers of Deforestation	2.38

4. Legal and Policy Framework

Training gaps in the **legal framework** are evident across all countries, but with varying emphases.

- **Cameroon** shows a high need in *Forest Crime Recognition* (8.19) and *NDC Alignment* (8.00), reflecting governance strengthening priorities.
- **Nigeria** and **Somalia** emphasize *Interpretation of National Forest Acts* (4.73 and 6.48)
- **Ghana** shows similar governance training needs with *the alignment of forest activities with NDCs* (4,51).
- **Uganda** displays lower but steady gaps across analysis of EIA processes (4.40)

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Recognize Forest Crimes & Enforcement Strategies	8.19	Align Forest Activities with NDCs	8.00	Analyze EIA Processes	7.60
Ghana	Align Forest Activities with NDCs	4.51	Identify Gender Equality Measures	4.29	Interpret National Forest Acts	3.52

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Nigeria	Interpret National Forest Acts & Land Tenure Systems	4.73	Analyze EIA Processes	4.67	Understand MEAs (UNFCCC, REDD+, UNCBD)	2.96
Uganda	Analyze EIA Processes	4.40	Understand MEAs (UNFCCC, REDD+, UNCBD)	4.30	Interpret National Forest Acts	3.60
Somalia	Interpret National Forest Acts & Land Tenure Systems (I including forest certification and standards)	6.48	Recognize Forest Crimes & Enforcement Strategies	0.64	—	—

7.4 Comparative Analysis of Skills Gaps for VET Learners

1. Forest Management

Across all five countries, the most critical skill needs cluster around fire prevention, biodiversity monitoring, and sustainable harvesting.

- **Cameroon and Ghana** show the highest priority in *Forest Fire Prevention and Control (12.25 and 7.36)*, reflecting a strong focus on disaster management.
- **Nigeria and Uganda** emphasize *Forest Inventory and Mapping*, suggesting a gap in data-driven forest management.
- **Somalia follows** with *Sustainable Harvesting Techniques (12.6)* and *Biodiversity Monitoring (11.07)*, highlighting sustainable use priorities

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Forest Fire Prevention and Control	12.25	Community Forest Management	8.74	Biodiversity Monitoring	8.17
Ghana	Forest Fire Prevention and Control	7.36	National Forest Policies & Regulations	7.20	Biodiversity Monitoring	7.05
Nigeria	Forest Inventory and Mapping	5.08	National Forest Policies & Fire Prevention	4.05	Biodiversity Monitoring	3.78
Uganda	Forest Inventory and Mapping	2.40	Fire Prevention and Control	1.90	Community Forest Management	0.90
Somalia	Sustainable Harvesting Techniques	12.6	Biodiversity Monitoring	11.07	National Forest Management Policies	8.19

2. Reforestation

In *Reforestation*, planting techniques, site preparation, and monitoring success are the most common training gaps.

- **Cameroon and Nigeria** rank Monitoring Reforestation Success as top priority.
- **Ghana** ranks *Site Selection and Soil Preparation* as top need, reflecting challenges in early-stage reforestation planning.
- **Nigeria** emphasize *Tree Nursery Management* and *Planting Techniques*, indicating a need for practical field-level training.
- **Uganda** displays the lowest MWDS range, suggesting less focus on reforestation competencies among learners but ranks Monitoring Reforestation Success as a priority
- **Somalia** shows highest need in Planting & Spacing Techniques

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Monitoring Reforestation Success	6.9	Site Selection & Soil Preparation	4.8	Tree Nursery Management	2.94
Ghana	Site Selection & Soil Preparation	4.7	Monitoring Reforestation Success	4.6	Tree Nursery Management	3.76
Nigeria	Tree Nursery Management	2.8	Site Selection & Soil Preparation	2.76	Planting & Spacing Techniques	2.64
Uganda	Monitoring Reforestation Success	1.3	Site Selection & Soil Preparation	1.2	Tree Nursery Management	0.6
Somalia	Planting & Spacing Techniques	6.08	Site Selection & Soil Preparation	3.96	Monitoring Reforestation Success	2.04

3. Deforestation

Training gaps in *Deforestation* highlight a need for digital literacy and technological integration.

- **Nigeria, Cameroon, and Ghana** show strong needs in *using satellite and digital tools (GIS, GPS, AI)* for forest monitoring.
- **Somalia** prioritizes *Identifying Drivers of Deforestation*, linking deforestation with socio-economic research and environmental impact.
- **Uganda** shows moderate needs in *Land-use Planning* and *Advocacy*, suggesting focus on land governance**.**

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Use of Advanced Technology (Remote Sensing)	9.8	Land-use Planning & Alternatives	7.2	Advocacy & Communication	6.97
Ghana	Use of Advanced Technology (Remote Sensing)	6.3	Use of Digital Tools (GIS, GPS, AI)	5.59	Land-use Planning & Alternatives	5.17
Nigeria	Use of Digital Tools (GIS, GPS, AI)	7.31	Use of Advanced Technology (Remote Sensing)	4.40	Advocacy & Communication	4.20
Uganda	Land-use Planning & Alternatives	2.6	Advocacy & Communication	1.9	Use of Digital Tools (GIS, GPS, AI)	1.0

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Somalia	Identifying Drivers of Deforestation	6.46	Deforestation Impact Assessment	3.15	Land-use Planning & Alternatives	2.38

4. Legal / Legislative Framework

Legal and policy-related competencies show consistent gaps across all countries, particularly in understanding multilateral agreements and national forest acts.

- Cameroon, Ghana, and Nigeria exhibit high MWDS in *MEAs (UNFCCC, REDD+, UNCBD)*, reflecting limited exposure to international frameworks.
- Somalia and Uganda emphasize *interpreting national forest acts* and *NDC alignment*, respectively, suggesting national-level implementation gaps.

Country	Highest Skill Gap	MWDS	Second Priority	MWDS	Third Priority	MWDS
Cameroon	Understand MEAs (UNFCCC, REDD+, UNCBD)	8.28	Analyze EIA Processes	7.98	Interpret National Forest Acts & Land Tenure Systems	7.74
Ghana	Understand MEAs (UNFCCC, REDD+, UNCBD)	5.04	Interpret National Forest Acts & Land Tenure Systems	4.84	Gender Equality in Forestry	4.40
Nigeria	Understand MEAs (UNFCCC, REDD+, UNCBD)	6.15	Interpret National Forest Acts & Land Tenure Systems	4.50	Gender Equality in Forestry	4.40
Uganda	Align Forest Activities with NDCs & Climate Strategies	1.8	Understand MEAs (UNFCCC, REDD+, UNCBD)	1.7	Recognize Forest Crimes & Enforcement Strategies	1.3
Somalia	Interpret National Forest Acts & Land Tenure Systems (Including Certification knowledge)	5.18	Recognize Forest Crimes & Enforcement Strategies	0.99	—	—

7.5 Comparative Summary: Highest Skill Gaps (MWDS) per Country per Field.

Below a consolidated **comparative table** showing the **highest Mean Weighted Discrepancy Scores (MWDS)** per country and thematic field — combining findings from **VET learners** and **VET centers** across *Cameroon, Ghana, Nigeria, Uganda, and Somalia*.

Country	Forest Management (Highest MWDS)	Reforestation (Highest MWDS)	Deforestation (Highest MWDS)	Legal / Legislative Framework (Highest MWDS)
Cameroon	*Forest Fire Prevention and Control* – **12.25**	*Monitoring Reforestation Success* – **6.9**	*Use of Advanced Technology (Remote Sensing)* – **9.8**	*Understanding MEAs (UNFCCC, REDD+, UNCBD)* – **8.28**
Ghana	*Forest Fire Prevention and Control* – **7.36**	*Site Selection and Soil Preparation* – **4.7**	*Use of Advanced Technology (Remote Sensing)* – **6.3**	*Understanding MEAs (UNFCCC, REDD+, UNCBD)* – **5.04**
Nigeria	National Forest Management policies and regulations- **6.6**	Maintenance and aftercare (weeding, watering, pest control)- **5.39**	*Use of advanced technology such as satellite imagery, satellite maps and remote sensing* – **10**	*Understanding MEAs (UNFCCC, REDD+, UNCBD)* – **6.15**
Uganda	Forest Fire Prevention and Control- **6.6**	*Monitoring Reforestation Success* – **2.3**	*Advocacy and communication*- **2.9**	*Analyze requirements and processes for EIAs in forest-related projects* -**4.4**
Somalia	Biodiversity monitoring (Monitoring and evaluation of forest operations) -**13.76**	Tree nursery management -**6.24**	*Identifying Drivers of Deforestation* – **6.46**	*Interpret National Forest Acts & Land Tenure Systems* – **6.48**

8.Local Qualitative Field research

The aim of this discussion was to better understand the perceptions, expectations, challenges and proposals for improvement formulated by students and teachers of vocational education and training centers in the sub-Saharan region of Africa. The main objective was to collect qualitative data on the experiences of these two groups in order to formulate concrete recommendations to improve the quality of professional training in Cameroon country. The methodology used is based on the organization of two distinct focus groups: The first brought together students enrolled in different professional training centers, representing various sectors (forestry, agronomy, livestock, etc.); The second brought together teacher-trainers, Policy Makers, NGOs, and Private Companies working in these same sectors above. The discussions were led by a neutral moderator using a semi-structured interview guide. They were recorded, transcribed and analyzed using a thematic approach. As the main results obtained, students recognize the importance of professional training for integration into the job market, but deplore the lack of practical materials, adapted equipment and company internships. Teachers emphasize their commitment, but say they are limited by insufficient resources, restricted access to continuing training and programs that are sometimes unsuitable for the realities of the local market. The two groups mention generally respectful relations, but which would benefit from being strengthened by more constructive exchanges and better educational supervision. Students express concern about their professional future, particularly due to the lack of partnerships with local businesses. Teachers share this concern and call for better collaboration with the private sector. Participants

suggested updating curricula, modernizing equipment, increasing practical training time, and strengthening links between training centers and the professional world. This discussion made it possible to bring out a convergence of views between students and teachers on the strengths and weaknesses of professional training in Cameroon. The main challenges identified relate to the lack of material resources, the need to adapt training to the local market, and the need for better support for learners towards employment. These results can guide decision-makers in implementing more effective and more inclusive policies in the field of vocational education and training regarding the restoration of degraded landscapes.

Narrative Report on Focus Group Discussion with VET Learners in Cameroon

1. Objective of the Focus Group

The purpose of this focus group was to assess the current **skills, perceptions, and training needs** of 10 VET learners enrolled in forestry and environmental management programs in Cameroon. The discussion aimed to:

- Identify the skills acquired and the gaps in current reforestation training.
- Explore challenges faced in practical implementation of reforestation techniques.
- Gather learners' perspectives on career prospects and future curriculum improvements.
- Collect recommendations for training support mechanisms (equipment, mentorship, internships, etc.).

2. Methodology

A **semi-structured focus group** was organized using seven guiding questions covering technical, practical, entrepreneurial, and institutional aspects of training in reforestation and forest management. Each participant responded individually before an open discussion followed. Notes and thematic coding were applied to extract key insights and recurring themes across responses.

3. Key Discussion Questions and Findings

Question 1: What skills have you gained so far in your training related to reforestation and forest management?

Findings:

Participants demonstrated a solid foundation in theoretical forestry and ecological knowledge, particularly in:

- Identification of local and native forest species (forest taxonomy).
- Conducting forest inventories and basic ecological assessments.
- Nursery establishment and seedling management.
- Forest mapping using QGIS and GPS tools.
- Raising awareness among local communities about sustainable resource management.

Interpretation:

Training programs provide good ecological and technical grounding. However, the skills remain fragmented and lack practical integration—particularly in linking technical forestry with project management and restoration planning.

Question 2: Which areas (technical, practical, or entrepreneurial) do you feel least prepared for?

Findings:

The participants expressed clear skills gaps in the following areas:

- Project management and proposal writing (budgeting, planning, and implementation).
- Green entrepreneurship and development of forest-based enterprises.
- Field-based monitoring and use of digital technologies (GIS, drones).
- Post-planting management and long-term maintenance of plantations.
- Legal and land tenure systems relevant to forest use.

Interpretation:
While learners understand forest operations theoretically, they lack applied management, entrepreneurial, and digital competencies necessary for employment or self-employment in the forestry sector.

Question 3: How relevant is your current training to the realities of local reforestation and land restoration?

Findings:
Most participants felt that the curriculum is scientifically strong but contextually weak, citing the following concerns:

- Training is too theoretical and not sufficiently aligned with local ecological and socio-economic contexts.
- Participatory and community-based approaches are underrepresented.
- Limited field exposure and practical case studies.
- Insufficient focus on local climate conditions, soil variation, and land-use pressures.

Interpretation:
Learners perceive a gap between classroom learning and real-world application. There is an urgent need for contextualized, field-oriented, and participatory approaches within the reforestation curriculum.

Question 4: What challenges do you face when applying reforestation techniques in practice?

Findings:
Commonly cited challenges include:

- Lack of equipment and tools, leading to manual and less efficient work.
- Water scarcity and poor site selection affecting seedling survival.
- Low-quality planting materials and absence of follow-up after planting.
- Limited funding and logistical resources for implementing reforestation projects.
- Land use conflicts and community resistance due to weak consultation.
- Lack of coordination between institutions and absence of extension support.

Interpretation:
Technical and logistical limitations undermine practical training. Learners require access to field equipment, irrigation systems, quality seedlings, and institutional support mechanisms to implement what they learn.

Question 5: How do you see your future career opportunities in the forestry and restoration sector?

Findings:
Participants expressed strong motivation and environmental commitment but felt uncertain about job security. They identified key trends:

- Growing opportunities in agroforestry, GIS, REDD+, and forest certification.
- Desire to engage in entrepreneurship and local NGO creation.
- Perceived inequality of access to jobs, with international actors dominating the field.
- Limited awareness of possible career pathways in forestry.

Interpretation:
The participants are highly motivated but need clearer career guidance, mentorship, and exposure to green economy opportunities.

Question 6: If you could add one new subject or module to your training, what would it be?

Findings:
Learners suggested five categories of additional modules:

1. Practical modules: Ecological restoration, nursery management, and post-planting maintenance.

2. Digital tools: GIS, remote sensing, and drone technologies.
3. Green entrepreneurship: Climate finance, eco-enterprises, carbon credits.
4. Community management and communication: Participatory forestry, conflict resolution, awareness raising.
5. Legal and policy frameworks**:** Land tenure, forest governance, REDD+, and FLEGT.

Interpretation:

There is a strong desire to modernize the curriculum with hands-on, digital, and business-oriented content, ensuring it reflects current and emerging trends in sustainable forestry.

Question 7: What type of support (materials, guidance, internships, financial aid) would most help you succeed?

Findings:

Participants highlighted six main categories of support:

- Material support: Access to laptops, internet, laboratories, and well-equipped libraries.
- Financial support: Scholarships and seed funding for student projects.
- Career orientation: Mentorship, coaching, and professional guidance.
- Field experience: Structured internships with forestry organizations and local NGOs.
- Technical training: Access to specialized courses in GIS, drones, and project management.
- Entrepreneurial support: Business incubation and project start-up assistance.

Interpretation:

Training institutions need to combine academic content with career development, mentorship, and resource access to enhance employability and self-reliance among forestry learners.

4. Summary of Key Themes and Implications

Dimension	Findings	Training Implications
Technical Skills	Good ecological and mapping skills but weak in field implementation and digital applications.	Integrate more field-based modules and technology use (GIS, drones).
Practical Experience	Limited exposure to real reforestation sites and field internships.	Establish structured internship programs and community field projects.
Entrepreneurship & Project Management	Learners lack confidence in project planning, proposal writing, and business development.	Introduce a Green Entrepreneurship & Project Management module.
Relevance & Context	Training is not fully adapted to local realities and lacks participatory approaches.	Embed community-based forestry and climate-smart site planning.
Support Mechanisms	Inadequate tools, financial resources, and guidance.	Provide digital access, mentorship, and funding opportunities.
Career Outlook	Learners are motivated but uncertain about pathways.	Strengthen career counseling, networking, and partnerships with industry.

9.Stakeholders' engagement level of private-public sector cooperation

The analysis of responses collected from ten (10) VET centers in each partner country reveals varying degrees of collaboration between training institutions and external stakeholders in the forestry and environmental management sectors. Overall, the findings indicate a strong culture of collaboration through internships and project-based partnerships, but a relatively limited degree of structured co-design of curricula, joint research, and innovation transfer.
The engagement patterns are summarized and interpreted below.

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The engagement patterns are summarized and interpreted below.

Cameroon

Across Cameroon, VET centers reported active and diverse forms of cooperation with both public institutions and non-governmental organizations.
Key partners include the Institute of Agricultural Research for Development (IRAD), the Ministry of Forests and Wildlife, foreign universities, and a range of national and international NGOs.

Collaboration mechanisms most frequently cited include:

- Hosting of professional internships for students in forestry and agroforestry;
- Joint implementation of projects related to sustainable land use and ecosystem restoration;
- Capacity-building activities, including co-organized workshops, seminars, and technical demonstrations;

These engagements have provided practical exposure for learners, aligning VET training with the operational needs of the forestry and environmental sectors. However, partnerships tend to be project-dependent rather than institutionalized, indicating potential for more formalized cooperation frameworks.

Ghana

In Ghana, the private–public partnership landscape is marked by strong internship programs and material support from industry actors.

The most common forms of engagement include:

- Internships;
- Equipment donations and logistical support for forest mapping and nursery operations;
- Co-designed training modules responding to industry demand;
- Consultancy services and joint outreach activities for local communities

Nigeria

In Nigeria, institutions reported a well-developed system of collaboration with forestry companies, state governments, and NGOs, to provide internships for learners. These partnerships serve as the backbone of experiential learning and skills transfer for VET students.
Common engagement practices include:

- exposure to field operations
- co-design of curricula with industry partners
- Cooperative organizations and agencies occasionally support institutions with donations and joint field projects that strengthen practical training.

Uganda

VET institutions in Uganda reported vibrant collaborations with both universities, research institutes, and private landowners.

Such engagement bridges academic learning and community-based practice, ensuring that training remains relevant to local ecosystems and livelihood contexts.
The primary forms of engagement include:

- Internship placements for students in forestry and environmental management;
- Farmer Field Days and on-site demonstrations conducted in collaboration with private landowners;
- Joint fundraising and experimental projects, enabling applied research on sustainable forestry and agroforestry.

Somalia
In Somalia, public–private cooperation in the forestry sector remains at an early stage but is progressively developing through donor-supported and NGO-led initiatives. Stakeholders emphasized two priority directions for strengthening engagement:

- Linking VET centers with private forestry enterprises to facilitate apprenticeships and on-the-job training;
- Encouraging NGOs and community-based organizations to co-fund and implement reforestation demonstration projects in collaboration with educational institutions.

Synthesis and Observations

Across all five countries, internships and field-based learning emerged as the dominant form of engagement between VET centers and the private or public sectors. Such collaborations have been instrumental in:

- Enhancing learners' practical skills and employability;
- Strengthening institutional links with local forest-based economies;
- Supporting the joint implementation of restoration and reforestation projects;
- Building bridges between theory and practice in sustainable forest management.

However, the analysis also revealed several gaps and opportunities for improvement:

- Partnerships are often informal or project-specific, lacking structured Memoranda of Understanding (MOUs) or long-term cooperation frameworks;
- Private sector engagement in curriculum design remains limited, reducing the alignment of training outcomes with labor market needs;

- Innovation and entrepreneurship components are underdeveloped, particularly in linking VET training to green enterprise development;
- The potential for joint certification, technology transfer, and digital skills development remains largely untapped.

10.Rationale and Evidence Base for the Sustainable Forest Management and Restoration Techniques Curriculum

The design of the 9-module curriculum in *Sustainable Forest Management and Restoration Techniques* is grounded in a comprehensive analysis of desk research and field research (skills gap assessment findings from Cameroon, Ghana, Nigeria, Uganda, and Somalia, focus group from Cameroon and Stakeholder Partnerships). Together, these data sources provide clear evidence-based justification for a competency-oriented curriculum that bridges legal, technical, entrepreneurial, and digital skill deficits among VET learners and training institutions in Sub-Saharan Africa.

10.1 Evidence from the Desk Research

The desk research established the conceptual, policy, and methodological foundations of the FORESTORE curriculum through four interconnected strands:

(1) Legislative and Policy Framework Analysis:
The review of both EU and African forest governance systems revealed substantial policy commitments to sustainable forest management (SFM), climate adaptation, and biodiversity protection. The EU's robust regulatory ecosystem—including the EU Forest Strategy 2030, LULUCF Regulation, and Deforestation-Free Products Regulation—provided a model of integrated, cross-sectoral governance. African frameworks, such as the Sustainable Forest Management Framework for Africa 2020–2030, demonstrated continental commitment to sustainable practices but highlighted challenges in enforcement, decentralization, and financing. This comparative policy analysis confirmed the need to integrate policy literacy and governance competencies into the curriculum to equip learners to navigate both national and international legal frameworks.

(2) Challenges of Deforestation:
Desk analysis across participating countries exposed common deforestation drivers—agricultural expansion, illegal logging, charcoal production, population growth, and weak enforcement—and regional variations such as wildfire frequency in Southern Europe and energy poverty in Somalia. These findings justified the inclusion of modules on reforestation planning, ecosystem restoration, and landscape management, emphasizing context-specific, adaptive, and climate-resilient restoration techniques.

(3) Identification of Best Practices:
Nine international best practices—from Pro Silva Slovakia's close-to-nature forestry to FMNR Uganda's farmer-led restoration—demonstrated the effectiveness of combining ecological, participatory, and livelihood-based approaches. Lessons from AdaptFor Greece and Cocoa and

Forests Initiative (Ghana) highlighted the importance of monitoring systems, community engagement, and data-driven decision-making.
These insights directly shaped the FORESTORE training design, embedding ecosystem-based management, participatory governance, community engagement and livelihood diversification throughout the modules.

(4) Curricula Mapping and Review:
Mapping forestry-related curricula across Cameroon, Ghana, Nigeria, Uganda, and Somalia revealed a predominance of traditional, technically oriented programs, with limited digital content, weak private-sector engagement, and minimal focus on entrepreneurship or community forestry. This evidence underlined the need for a modernized curriculum emphasizing digital forestry tools, green entrepreneurship, and community-based approaches—ensuring that learners gain both employability and sustainability competencies.

10.2 Evidence from the Field Research

The field-based component involved data collection through Borich needs assessments, focus groups, and stakeholder consultations with VET learners and representatives from VET centers in the five target countries. The findings confirmed the desk research conclusions while providing empirical grounding for the proposed curriculum design.

Forest Management
Across all countries, the highest MWDS values were reported under *Forest Management*, signaling urgent skill deficits in this domain.

- Cameroon recorded high needs in *Forest Fire Prevention and Control* and National Forest Management Policies & Regulations
- Ghana recorded also high trends in *Forest Fire Prevention and Control*
- In Nigeria the National Forest Management policies and regulations and Sustainable Harvesting techniques *were identified as the most critical gaps.*
- In Somalia, *Biodiversity Monitoring* and *Sustainable Harvesting Techniques* were identified as the most critical gaps.

Curriculum Response: The curriculum should embed a Forest Management module cluster focused on sustainable harvesting techniques and developing technical, ecological, and policy-based competencies. This approach ensures that learners acquire holistic knowledge and practical skills for managing forests sustainably, balancing environmental conservation with socio-economic needs. It should also include a separate module on fire prevention and emergency responses using early warning systems, digital monitoring, and community involvement.

Reforestation and Restoration Techniques
Reforestation emerged as the second-highest skill gap area.

- Cameroon recorded high needs in Monitoring Reforestation Success and site selection and soil preparation

- Ghana recorded high needs in Site Selection and Soil Preparation in both VET centers and learners.
- In Nigeria the Maintenance and aftercare (weeding, watering, pest control) was identified as the most critical gap followed by the Tree nursery management
- In Somalia Tree Nursery Management ranked highest followed by Planting and spacing techniques
- In Uganda Monitoring Reforestation Success ranked highest in both VET centers and learners.

Curriculum Response:

Given the skill gaps identified across the five countries, the curriculum should integrate three dedicated module clusters to comprehensively address the core competencies required for effective forest landscape restoration. Reforestation and Restoration Techniques This module should equip learners with end-to-end technical skills in site selection, soil preparation, species choice, planting design, and early-stage management. Maintenance, Monitoring, and Evaluation of Restoration Projects. This module should focus on maintaining planted sites, ensuring seedling survival, controlling weeds and pests, and applying monitoring tools to measure restoration success. Nursery Management and Seedling Production This module should build strong competencies in seed sourcing, selection, propagation techniques, and nursery operations that support sustainable restoration initiatives

Deforestation Control and Digital Competence

Digital and technological literacy was consistently among the highest gaps across the five countries.

- Cameroon, Ghana and Nigeria recorded high needs in the Use of Advanced Technology (Satellite & Remote Sensing) and the use of Digital tools
- Uganda cited gaps in Advocacy and communication while Somalia reported high gaps in identifying the drivers of deforestation.

Curriculum Response:

To address these multidimensional gaps, the curriculum should incorporate a Deforestation Control and Digital Competence module cluster that bridges drivers of deforestation, technological literacy, policy understanding, and advocacy capacity.

Legal and Policy Frameworks

In all participating countries, learners and educators alike displayed weak understanding of **forest laws**, **land tenure systems**, and **international environmental conventions**.

- Cameroon Ghana, Nigeria reported particularly high needs for Understanding MEAs (UNFCCC, REDD+, UNCBD) while Cameroon also emphasized the need for the recognition of forest crimes and enforcement strategies.
- Somalia reported high in Interpret National Forest Acts & Land Tenure Systems (including knowledge on forest certification and standards)) and Uganda in the Analysis of the requirements and processes for EIAs in forest-related projects

Curriculum Response:
Include a Legal Framework and Forest Policy Module to strengthen governance literacy, forest certification knowledge, and law enforcement understanding.

Qualitative Findings (Focus Groups):

Focus group discussions in Cameroon revealed that while learners and trainers understood the ecological importance of forest restoration, they lacked access to practical training, digital tools, and structured collaboration with industry. Participants highlighted employability challenges and lack of confidence in project planning, proposal writing, and business development. These insights emphasized the need for competency-based, experiential learning approaches integrated into all modules and the need for the introduction of a module focused on Green Entrepreneurship.

Stakeholder Partnerships:
The stakeholder engagement surveys indicated that public–private cooperation in forestry VET varies widely:

- In Cameroon and Ghana, collaboration occurs mainly through internships and capacity-building with ministries and research bodies.
- In Nigeria, extensive partnerships with forestry companies and NGOs include curriculum co-design, joint projects, and equipment support.
- In Uganda, engagement includes community outreach and farmer field schools.
- In Somalia, emerging PPPs link VET centers with NGOs to support reforestation and renewable energy projects.

10.3 Introduction to the VET Curriculum on Sustainable Forest Management and Restoration

Grounded in evidence-based research across Europe and Sub-Saharan Africa, the curriculum responds to real-world skill gaps identified, focusing on climate resilience, biodiversity conservation, and the green and digital transitions.

Below, you will find the **proposed curriculum**, structured into **nine comprehensive modules**. Each module is organized to provide a clear learning pathway, beginning with a *general description* that outlines its purpose and relevance, followed by detailed *learning outcomes* covering knowledge, skills, and competences. Each section concludes with a set of *indicative topics* that guide content delivery and ensure alignment with the identified capacity needs across the forestry sector.

Module 1. Forest Policy and Governance Frameworks for Sustainable Forest Management

General Description

This foundational module introduces learners to the governance architecture of forest management and its links with national legislation, international agreements, and institutional coordination mechanisms. It highlights the critical role of legal and policy instruments in promoting transparency, accountability, and sustainability in forest management.

Learners will explore the interaction between global environmental conventions (such as REDD+, UNCBD, and UNFCCC) and national forestry frameworks across selected countries (Cameroon, Ghana, Nigeria, Uganda, and Somalia). Special emphasis is placed on understanding how governance failures, weak enforcement, or unclear land tenure systems contribute to deforestation and resource conflicts — and how well-designed policies and community participation can reverse these trends.

The module adopts a comparative and applied approach, blending theoretical concepts of environmental governance with practical exercises such as mock Environmental Impact Assessments (EIAs) and policy brief development. Learners will develop the analytical and procedural skills necessary to interpret laws, assess compliance, and engage in policy dialogue. By the end of the module, participants should be able to critically analyze policy frameworks, advise on sustainable governance mechanisms, and contribute to policy reform processes in their local contexts.

This module lays the groundwork for all subsequent training, establishing the institutional literacy and governance competences that underpin effective forest management, restoration, and entrepreneurship.

Learning Outcomes

Knowledge

Upon successful completion, learners will demonstrate comprehensive understanding of:

- Legal and policy frameworks regulating forest resources at global, regional, and national levels.
- The roles and mandates of institutions responsible for forest governance, including ministries, agencies, and local authorities.
- The principles of environmental governance, such as transparency, stakeholder participation, accountability, and equity.
- The structure and objectives of international environmental conventions (REDD+, UNCBD, UNFCCC) and how they interact with national policy.
- The procedures and importance of Environmental Impact Assessments (EIAs) in forestry planning and project approval.
- Certification mechanisms and their role in ensuring responsible sourcing and trade of forest products.

Skills

By the end of the module, learners will be able to:

- Interpret, analyze, and compare national forest laws and international agreements.
- Conduct simplified EIAs for forestry-related projects, identifying key environmental and social impacts.
- Draft policy briefs or position papers summarizing governance challenges and proposing actionable reforms.
- Apply governance tools to evaluate policy effectiveness and institutional performance.
- Facilitate stakeholder dialogues on forest policy implementation and compliance monitoring.

Competences

After completing this module, learners will be able to:

- Operate effectively within multi-level governance structures and contribute to evidence-based policy formulation.
- Ensure legal compliance and support transparency mechanisms in forest projects.
- Advise institutions and communities on aligning national forestry policies with global environmental commitments.

- Demonstrate leadership in ethical governance, upholding principles of accountability and participatory management in the forestry sector.

Indicative Topics

1. Introduction to Sustainable Forest Management (SFM) concepts and global frameworks
2. National forest legislation and institutional structures (Cameroon, Ghana, Nigeria, Uganda, Somalia)
3. Land tenure systems, customary rights, and land-use classifications
4. Multilateral Environmental Agreements: REDD+, UNCBD, UNFCCC
5. Forest certification systems and sustainable sourcing (FSC, PEFC)
6. Governance, transparency, and accountability in forest management
7. Environmental Impact Assessment (EIA) procedures and applied case studies

Module 2. Sustainable Forest Management and Ecosystem-Based Approaches

General Description

This module deepens learners' understanding of the ecological and technical principles that form the foundation of Sustainable Forest Management (SFM). It connects theoretical knowledge of ecosystem processes with applied forest management practices, enabling participants to balance environmental integrity with productive use of forest resources.

Learners will explore ecosystem-based and adaptive management approaches that promote climate resilience and biodiversity conservation. The module emphasizes the use of modern mapping and inventory tools (such as GIS, GPS, and remote sensing) to collect, analyze, and apply ecological data in decision-making.

By combining classroom instruction with field-based exercises and digital mapping tasks, learners will develop the capacity to interpret ecological patterns, monitor forest health, and design management strategies that integrate sustainability, productivity, and community needs. This module builds the scientific and technical foundation required for reforestation, restoration, and monitoring modules later in the curriculum.

Learning Outcomes

Knowledge

- Understand the principles and objectives of sustainable forest management and its role in the green transition.
- Explain the functions and dynamics of forest ecosystems, including soil, water, and biodiversity interrelations.
- Identify ecosystem-based management concepts and adaptive management cycles.
- Describe biodiversity monitoring systems and climate change adaptation strategies in forestry.
- Understand forest inventory methods and their application to forest resource planning.

Skills

- Conduct forest inventories using GPS, GIS, or other mapping tools.
- Apply silvicultural techniques suitable for different forest types and ecological conditions.
- Analyze ecological data to support adaptive management decisions.
- Develop forest management plans integrating biodiversity, climate resilience, and community participation.

Competences

- Design and implement forest management strategies balancing ecological, social, and economic priorities.
- Utilize technological and scientific data to improve sustainability outcomes.

- Engage with stakeholders to apply ecosystem-based practices at local or regional levels.

Indicative Topics

1. Principles of sustainable forest management and conservation
2. Forest ecosystem functions and ecological services
3. Silvicultural systems and stand management techniques
4. Adaptive and ecosystem-based management approaches
5. Forest inventory and mapping (GIS, GPS, remote sensing)
6. Biodiversity monitoring indicators and tools
7. Climate change adaptation and mitigation in forestry

Module 3. Forest Fire Prevention, Risk Reduction, and Emergency Response

General Description

This module builds critical competences in forest fire prevention, preparedness, and emergency response, addressing one of the most significant threats to forest ecosystems worldwide. Learners will explore the ecology of fire, its natural and anthropogenic causes, and the socio-economic impacts of uncontrolled wildfires.

Participants will learn how to assess risk, design fire management strategies, and implement prevention measures such as controlled burning, fuel management, and community awareness programs. The module integrates digital fire monitoring tools, including GIS, drones, and early warning systems, allowing learners to apply modern technologies to real-time risk management.

Through simulation exercises and practical group projects, learners will gain the ability to coordinate fire response operations and engage communities in proactive fire management — a key aspect of sustainable and resilient forest governance.

Learning Outcomes

Knowledge

- Understand fire ecology and its influence on forest ecosystems.
- Identify major causes, types, and impacts of wildfires.
- Explain principles of fire risk management, prevention, and safety procedures.
- Understand the operation of digital tools for early warning and fire monitoring.
- Recognize post-fire rehabilitation techniques and policy frameworks for fire control.

Skills

- Conduct fire risk assessments and develop hazard maps using GIS or drones.
- Design fire prevention and emergency response plans for different ecosystems.
- Simulate coordination and communication processes in emergency contexts.
- Analyze and report fire incidents using digital data and case studies.

Competences

- Coordinate integrated fire management and community awareness programs.
- Apply risk reduction and preparedness strategies in field operations.
- Support the implementation of fire control policies and local contingency planning.

Indicative Topics

1. Fire ecology and forest fire dynamics
2. Causes, behavior, and ecological impacts of wildfires
3. Fire risk assessment, zoning, and hazard mapping
4. Preventive silvicultural measures and vegetation management
5. Early warning and monitoring systems (GIS, drones, remote sensing)
6. Emergency response coordination and safety protocols
7. Post-fire rehabilitation, policy response, and case studies

Module 4. Nursery Management

General Description

This highly practical module equips learners with the technical skills and scientific understanding required to establish and manage forest nurseries for reforestation and restoration programs. It focuses on seed collection, propagation, and nursery operations using climate-smart and nature-based approaches.

Learners will understand the entire seed-to-seedling production cycle, including the physiological and environmental factors that influence germination, growth, and plant survival. They will also explore nursery infrastructure design, pest and disease management, and quality assurance protocols that ensure healthy seedlings for large-scale restoration.

By engaging in hands-on nursery establishment and management exercises, learners will gain the capacity to operate professional nursery facilities and contribute to sustainable forest restoration efforts at local, community, or institutional levels.

Learning Outcomes

Knowledge

- Understand the biological principles of seed physiology, germination, and early plant development.
- Recognize different nursery systems, infrastructure requirements, and management practices.
- Identify the role of nurseries in reforestation, restoration, and climate adaptation strategies.
- Understand quality assurance processes and sustainability standards in seedling production.

Skills

- Collect, test, and store seeds appropriately for different species.
- Prepare soil and propagation media suited for various growth conditions.
- Manage watering, pest control, and record-keeping systems.
- Plan nursery operations, including scheduling, inventory control, and budget estimation.

Competences

- Establish and manage nurseries that meet sustainability and restoration standards.
- Apply climate-smart practices to improve seedling survival and ecosystem resilience.
- Provide technical support and training in nursery operations to community or institutional partners.

Indicative Topics

1. Nursery establishment and infrastructure planning
2. Seed collection, viability testing, and storage methods
3. Germination and propagation techniques
4. Nursery management systems, logistics, and scheduling
5. Soil media preparation, irrigation, and pest control
6. Climate-smart nursery management and sustainability practices
7. Quality assurance and record-keeping in nursery production

Module 5. Reforestation and Restoration Planning

General Description

This module provides the methodological and practical knowledge required to design and manage reforestation and ecosystem restoration projects adapted to specific ecological, climatic, and social contexts. It bridges the gap between ecological science and field practice, equipping

learners with the ability to plan interventions that enhance forest cover, biodiversity, and ecosystem resilience.
Participants will learn to assess degraded sites, select appropriate native species, and design planting schemes that align with ecological restoration principles and climate-smart strategies. The module also highlights the importance of community participation and multi-stakeholder engagement in ensuring sustainability and local ownership of restoration initiatives.
Practical sessions involve the preparation of site assessment reports, restoration maps, and project design plans, helping learners translate theoretical understanding into professional project management capabilities.

Learning Outcomes
Knowledge

- Understand the ecological principles of reforestation and restoration.
- Recognize biophysical, climatic, and socio-economic factors affecting restoration success.
- Identify site selection criteria and methods for assessing land suitability.
- Understand species selection, planting density, and site preparation techniques.
- Explain the role of community participation and governance in restoration initiatives.

Skills

- Conduct field assessments, soil analyses, and vegetation surveys.
- Design and map reforestation projects, incorporating ecological and social variables.
- Develop work plans, budgets, and timelines for restoration interventions.
- Facilitate participatory planning workshops with local communities.

Competences

- Lead reforestation and restoration projects from design to implementation.
- Integrate ecological, economic, and social dimensions in project planning.
- Ensure inclusiveness and sustainability in restoration practices.

Indicative Topics

1. Principles and objectives of ecological restoration
2. Site assessment and soil evaluation methods
3. Species selection, planting design, and density planning
4. Restoration project planning, phasing, and budgeting
5. Participatory co-design approaches and stakeholder roles
6. Resilience, native species restoration, and habitat connectivity
7. Case studies (e.g., Great Green Wall, Mount Elgon reforestation)

Module 6. Maintenance, Monitoring, and Evaluation of Restoration Projects

General Description
This module equips learners with the knowledge and tools to manage post-planting care, maintenance, and monitoring of restoration projects. It emphasizes the importance of continuous evaluation to ensure long-term survival and ecological performance of restored areas.
The module introduces digital monitoring tools such as GIS, remote sensing, and drones, which enhance data accuracy and support adaptive management decisions. Learners will practice collecting and interpreting field data, developing indicators, and preparing monitoring and evaluation (M&E) reports aligned with international restoration standards.
Through practical exercises, participants will learn to design M&E frameworks, implement field monitoring protocols, and interpret spatial data to adjust management actions based on evidence.

Learning Outcomes
Knowledge

- Understand the principles and methodologies of M&E in forest restoration.
- Identify indicators for forest health, biodiversity, and ecosystem services.
- Recognize digital technologies for monitoring (drones, GIS, remote sensing).
- Comprehend adaptive management processes and data feedback mechanisms.

Skills

- Collect, record, and analyze monitoring data.
- Use GIS and drone tools to track restoration progress.
- Develop and apply indicators for performance evaluation.
- Prepare professional M&E reports with visual data outputs.

Competences

- Manage and coordinate monitoring systems for large-scale restoration projects.
- Apply adaptive management strategies based on evidence and field data.
- Communicate results effectively to funders, communities, and decision-makers.

Indicative Topics

1. Maintenance practices and post-planting care
2. Monitoring indicators for forest health and biodiversity
3. GIS and remote sensing for progress tracking
4. Drone-based mapping and digital imaging
5. M&E frameworks and adaptive management loops
6. Data analysis, visualization, and reporting
7. Case studies of successful long-term restoration monitoring

Module 7. Deforestation Drivers, Digital Forestry, and Smart Monitoring Tools

General Description

This module combines socio-environmental analysis with digital innovation, teaching learners to identify the drivers of deforestation and apply smart technologies for monitoring and prevention. It explores the complex interaction between economic development, governance, and land-use change, providing a systems understanding of deforestation dynamics.

Learners will be introduced to digital forestry tools — such as satellite imagery, AI, blockchain, and drone technology — to improve forest traceability and transparency. The module strengthens learners' capacity to interpret digital data for decision-making, report deforestation trends, and design technology-based monitoring frameworks.

By bridging policy and technology, this module enables learners to participate in data-driven sustainable forest management and to advocate for digital transformation in environmental governance.

Learning Outcomes

Knowledge

- Understand the main environmental, economic, and social drivers of deforestation.
- Explain the principles of remote sensing, GIS, and digital monitoring systems.
- Recognize data management processes and traceability mechanisms in forestry.
- Identify policy and governance responses to deforestation challenges.

Skills

- Use digital platforms and tools (GIS, drones, AI) for forest monitoring.
- Analyze satellite imagery and deforestation data sets.
- Develop traceability systems for forest products and value chains.
- Prepare digital reports visualizing deforestation patterns.

Competences

- Implement data-driven monitoring and traceability systems.

- Integrate technological innovation into forest management processes.
- Support policy development and advocacy through digital evidence.

Indicative Topics

1. Deforestation trends and socio-economic drivers
2. Policy and governance dimensions of deforestation
3. GIS, AI, and remote sensing in forestry
4. Digital data platforms and monitoring tools
5. Drone mapping and aerial imagery interpretation
6. Traceability systems in sustainable value chains
7. Data literacy, transparency, and digital ethics

Module 8. Community Forestry, Stakeholder Engagement, and Participatory Management

General Description

This module focuses on the social and governance dimensions of forest management, equipping learners with the tools to facilitate inclusive, participatory, and community-driven forest governance. It emphasizes the importance of involving local stakeholders — including women, youth, and marginalized groups — in planning, decision-making, and benefit-sharing.

Learners will acquire facilitation, communication, and negotiation skills necessary for managing multi-stakeholder processes and resolving natural resource conflicts. Real-life simulations and case studies (e.g., Italy's community forestry, Somalia's Garowe model) will help participants apply participatory tools to diverse governance settings.

By the end of this module, learners will be capable of leading participatory processes, designing engagement strategies, and strengthening community-based management systems that enhance social cohesion and forest sustainability.

Learning Outcomes

Knowledge

- Understand principles and models of community forestry.
- Identify participatory management frameworks and governance mechanisms.
- Recognize gender and social inclusion strategies in natural resource management.
- Understand conflict dynamics and mediation approaches.

Skills

- Conduct stakeholder mapping and engagement analysis.
- Facilitate participatory decision-making and negotiation processes.
- Design communication and awareness campaigns for forest projects.
- Apply conflict resolution and consensus-building techniques.

Competences

- Coordinate inclusive and participatory forest governance initiatives.
- Ensure equitable participation of diverse community actors.
- Mediate and resolve conflicts over forest resources.

Indicative Topics

1. Principles and models of community forestry
2. Stakeholder mapping and engagement methodologies
3. Participatory tools and co-management models
4. Communication, facilitation, and negotiation skills
5. Gender and inclusion in forestry governance
6. Conflict resolution in natural resource contexts
7. Case studies: Italy's Communal Forestry and Somalia's Garowe Model

Module 9. Green Entrepreneurship, Climate Finance, and Sustainable Value Chains

General Description

This final module promotes the entrepreneurial and financial skills required to link sustainable forest management with green economy opportunities. It prepares learners to develop forest-based enterprises, manage sustainable value chains, and access climate finance instruments.
The module covers business planning, market analysis, eco-certification, and carbon credit mechanisms, connecting restoration outcomes to employment and income generation. Learners will design sustainable business models that balance profitability with ecological impact, integrating innovation and digital marketing tools.
By the end of the module, learners will be capable of transforming environmental initiatives into viable enterprises, contributing to circular value chains, green jobs, and sustainable rural development.

Learning Outcomes

Knowledge

- Understand the concepts of green entrepreneurship and circular economy.
- Recognize market structures and value chain opportunities in forestry.
- Understand eco-certification, labeling, and traceability systems.
- Explain climate finance mechanisms and carbon market operations.

Skills

- Conduct market research and value chain analysis.
- Develop business and financial plans for forest-based enterprises.
- Prepare concept notes and proposals for green financing.
- Apply sustainability and certification standards to business operations.

Competences

- Launch and manage sustainable forest-related enterprises.
- Access climate finance and diversify funding opportunities.
- Lead innovation and entrepreneurship in the forest and restoration sectors.

Indicative Topics

1. Green entrepreneurship and circular economy concepts
2. Market analysis, value chain mapping, and product development
3. Eco-certification, labeling, and traceability systems
4. Climate finance mechanisms (carbon credits, green bonds)
5. Proposal development and funding access
6. Digital marketing and business innovation in the forest sector
7. Case studies: Successful green enterprises in Africa and Europe

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