





ONE FUTURE :

**For a Conscious Resilience
of Living Beings in the Face
of Existential Challenges**



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Welcome Address

Pr Mahmoud Ben Romdhane,

President of the Academy

**Ladies and Gentlemen,
Dear Colleagues,
Honored Guests,**

It is with great pleasure that I warmly welcome you to this scientific symposium entitled: *One Future: Towards a Conscious Resilience of Life in the Face of Existential Challenges*.

This gathering holds particular significance as it addresses issues that transcend national borders and call for enhanced regional and international cooperation. As an Academy, we firmly believe in the necessity of addressing contemporary challenges with both an interdisciplinary and a geographical openness.

The Maghreb and Africa, regions particularly vulnerable to climate change, social crises, and economic upheavals, are also centers of resilience, innovation, and ancestral knowledge. It is imperative to capitalize on these resources to construct a future in which humanity and the living world coexist harmoniously.

The Academy is thus committed to promoting an approach that underscores scientific complementarities between the Global South and the Global North while highlighting the intellectual, scientific, and cultural contributions of our region. This symposium exemplifies this commitment by bringing together researchers from diverse fields—biologists, economists, geographers, and mathematicians—to collectively envision a viable and equitable transition.

I would also like to emphasize several key aspects of our Academy's vision:

- A firm grounding in an interdisciplinary and regional approach, wherein the Maghreb and Africa hold a strategic position in addressing global challenges.

- The recognition and integration of local and ancestral knowledge, in dialogue with international scientific advancements.
- The commitment to responsible science, oriented towards the concrete issues of our society and dedicated to the preservation of life.

I would like to commend the Department of Natural Sciences and Mathematics for selecting the theme of this symposium and extend my sincere gratitude to the scientific and organizing committees for their exemplary dedication.

I firmly believe that this event will provide an opportunity for Beit al-Hikma to initiate a process of self-reflection involving all stakeholders, transforming this historic site—where fundamental milestones of Tunisian independence were marked, such as the proclamation of internal autonomy by the French Council President Pierre Mendès France on July 31, 1954, the signing of the Personal Status Code on August 13, 1956, and the proclamation of the Republic on July 25, 1957—into an open and dynamic space for interdisciplinary reflection and collaborative knowledge-building in the service of our planet and region.

I wish you all fruitful and inspiring discussions.

Thank you for your attention and commitment.

Mot de bienvenue

Pr Mahmoud Ben Romdhane

Président de l'Académie

**Mesdames et Messieurs,
Chers collègues,
Chers invités,**

C'est avec une réelle satisfaction que je vous souhaite la bienvenue à cette journée scientifique intitulée : *One Future : Pour une résilience consciente du vivant face aux défis existentiels.*

Cette rencontre revêt une importance particulière, car elle porte sur des questions qui dépassent les frontières nationales et appellent une coopération régionale et internationale renforcée. En tant qu'Académie, nous croyons fermement en la nécessité de penser les défis contemporains avec une ouverture interdisciplinaire, mais aussi géographique.

Le Maghreb et l'Afrique, régions particulièrement vulnérables aux changements climatiques, aux crises sociales et économiques, sont également des territoires de résilience, d'innovation et de savoirs ancestraux. Il est essentiel de capitaliser sur ces ressources pour construire un futur où l'humain et le vivant cohabitent de manière harmonieuse.

L'Académie s'engage ainsi à promouvoir une approche qui valorise les complémentarités scientifiques entre les pays du Sud et du Nord, tout en mettant en lumière les contributions intellectuelles, scientifiques et culturelles de notre région. Cette journée témoigne de cet engagement à travers la mobilisation de chercheurs venus d'horizons variés — biologistes, économistes, géographes, mathématiciens — pour penser ensemble une transition viable et équitable.

Je tiens également à mettre en avant quelques signaux forts de la vision de notre Académie :

- L'ancrage dans une approche interdisciplinaire et régionale, où le Maghreb et l'Afrique occupent une place stratégique pour relever les défis mondiaux.
- La valorisation des savoirs locaux et ancestraux, en dialogue avec les avancées scientifiques internationales.

- L'engagement pour une science responsable, tournée vers les problématiques concrètes de notre société et au service de la préservation du vivant.

Je tiens à féliciter le département des sciences naturelles et des mathématiques pour le choix de la thématique de cette journée et remercie le comité scientifique et d'organisation pour leur dévouement exemplaire.

Je suis convaincu que cette journée représentera une occasion pour Beit al-Hikma de lancer une démarche d'auto-saisine impliquant l'ensemble des parties prenantes, en transformant ce lieu historique, où furent marquées des étapes fondamentales de l'indépendance tunisienne — tel que la proclamation de l'autonomie interne par le Président du Conseil français Pierre Mendès France le 31 juillet 1954, la signature du Code du Statut Personnel le 13 août 1956, ainsi que la proclamation de la République le 25 juillet 1957 — en un espace ouvert et dynamique de réflexion interdisciplinaire et de co-construction de savoirs au service de notre planète et de notre région. Je vous souhaite des échanges fructueux et inspirants.

Merci pour votre attention et votre engagement.

Merci pour votre attention et votre engagement.

One Future : For a Conscious Resilience of Living Beings in the Face of Existential Challenges

Coordinator's Preamble

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1. Introduction to the Context and Purpose

As the coordinator of this booklet, I am honored to present this collective work, which embodies the effort, vision, and collaboration of all those involved. The purpose of this booklet is to offer insight, foster understanding, and contribute to the field by showcasing diverse perspectives and expertise. Through this preamble, I aim to provide the context in which this work was conceived, outline the guiding principles that shaped its development, and highlight the collective effort that went into bringing it to fruition. It is a testament to the dedication and commitment of every contributor, whose work has enriched the pages that follow.

Through a Tunisian lens, this booklet explores what it means to live consciously in the face of existential threats. It examines how the nation can navigate the pressures of globalization, climate change, and economic inequality while preserving its cultural heritage and ecological wealth.

This preamble is an invitation and a provocation in equal measures. It invites readers to journey through the interwoven narratives of crisis and hope from a North African lens, zooming into Tunisia as a microcosm of resilience. And it provokes reflection on the profound question: How can Tunisia, and the broader North African region, consciously build a resilient, equitable, and prosperous future, rooted in new economic models and behaviors, in the face of existential challenges?

Drawing from these examples and more, this booklet seeks to inspire action and illuminate pathways toward a future in which Tunisia and its neighbors lead the way in resilience, sustainability, and solidarity.

To address these complex challenges, we explore three interconnected themes:

- Redefining Crisis Management: Moving beyond reactive measures to ethical solutions for a sustainable future.
- Leveraging Transformative Tools: Harnessing eco-finance, circular economy, and international cooperation to reconcile development with planetary boundaries.
- Fostering Knowledge Sharing: Encouraging openness and collaboration as pillars for resilience-building.

2. Adopted Approach

2.1 Redefining Crisis Management: Ethical Solutions for a Sustainable Future

This reflection goes beyond managing crises. It seeks to understand their root causes and reinvent the underlying social, economic, and environmental dynamics. Solutions are grounded in ethical and justice-based values, integrating interdisciplinary perspectives.

In this context, tools like eco-finance, circular economy, and international scientific cooperation emerge as essential levers. These are not merely technical means: they reconcile human development with planetary limits while creating conditions for shared prosperity. Another pillar of this transformation lies in openness and knowledge sharing.

Beit Al-Hikma is part of this dynamic by promoting collaborations with universities, research laboratories, and learned societies. Since its founding in 2012, the Department of Mathematical and Natural Sciences (DMNS) embodies this spirit of innovation. Inspired by the philosopher Condorcet, the DMNS advocates for open, accessible, and useful knowledge, refusing to confine scientific debates to a narrow circle. This vision is essential to tackle contemporary existential challenges by forging links between science, ethics, and society.

2.2 One Future: Integrating Health, Environment, and Sustainable Development

The concept of “**One Future**” builds on the interdependencies between health, environment, and sustainable development. It is based on the idea that human, animal, and environmental health are inextricably linked (Kamoun-Chouk S., 2022). The COVID-19 pandemic revealed the risks incurred when these links are neglected. This holistic approach invites us to systematically address problems, considering the interactions between ecosystems, human populations, and wildlife.

This requires a redesign of health and environmental policies for integrated and anticipatory risk management. **The One Health-One Future** strategy combines One Health, eco-finance, and circular economy, thereby creating a resilient and inclusive development model.

2.3 Collaboration for Innovation: Empowering Transition Through Multidisciplinary Action

To succeed in this transition, collaboration between the public sector, private sector, and civil society is essential. Businesses, governments, researchers, Media, and citizens could co-create innovative solutions, especially in the fields of eco-finance and circular economy (Van Langen et al., 2021). New technologies and inclusive models play a key role, as does raising awareness within local communities.

In developing countries, the role of researchers is crucial. The priority is to develop suitable research infrastructures, promote action research, and strengthen local and international partnerships to access funding and expertise (Rosetta, 2023). Multidisciplinary research informs decisions and facilitates the transition to an interconnected world.

2.4 Redirecting Investments: Building Resilience Through Eco-Finance and Circular Economy

In the context of multiple crises, redirecting investments toward sustainable solutions is imperative. Eco-finance funds projects supporting the green economy, particularly renewable energy, clean technologies, and sustainable resource management (Taghizadeh-Hesary & Yoshino, 2020). By directing financial flows to ecological sectors, it reconciles economic profitability with environmental protection.

A circular economy, meanwhile, aims to reduce waste and recycle resources within a closed loop. It minimizes dependency on natural resources and reduces the environmental impact of production (Morseletto, 2019). By adopting more sustainable practices, it contributes to a resilient economic model in the face of future crises.

3. Conclusion

The scientific day One Future offers a vital platform to confront interconnected social, environmental, and health crises, calling for systemic and innovative solutions. Yet, pressing questions remain: How do we stand firm before a world led by ideologies of exclusion, supremacy, and conquest? With which ear will we listen to narratives that advocate hatred, war, and domination?

In the face of technological and military blindness, are we merely passive spectators? Have we been prepared to confront these drifts? Which economic model can we trust today—the one rooted in conquest and individualism or one based on collective strength and sustainable control? Can development truly be sustainable if it disregards the citizen's awareness and the collective good, threatening our very human identity?

The answers lie in fostering a conscious resilience, where collaboration, ethical development, and human dignity take precedence over hollow pursuits of power and conquest. The future demands not only reflection but decisive action to redefine development as a shared, inclusive, and sustainable endeavour.

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Session 1 :

One future : Scientific and Mathematical Foundations for Resilience





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«Toward mathematical resilience: Lie Theory in service of life sciences»

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Abstract: This study highlights the pivotal role of Lie theory in advancing various fields related to living systems. The utility of deformation theory significantly reinforces this relevance. By exploring symmetry and its deformations, this abstract discusses how Lie theory contributes to numerous scientific domains, including medicine, physics, chemistry, and biology. Examples of Lie groups and their applications in these fields are presented to underline their critical importance. This work emphasizes how Lie theory and deformation concepts can substantially impact scientific studies and contribute to understanding complex phenomena in the natural world.

Keywords : Lie theory, deformation, physics, medicine, earth sciences.

Introduction

Lie theory plays a fundamental role in understanding phenomena across disciplines related to life and living systems. Its principles, particularly in symmetry and deformation theory, serve as valuable tools in exploring complex systems. The talk briefly reviews some historical facts, outlines methods employed in the study, and provides a preview of the key findings demonstrating the interdisciplinary applications of Lie theory.

Methodology

This work enumerates selected examples of Lie groups that have proven essential across various scientific fields, including medicine, physics, chemistry, and biology. The methodology involves identifying and analyzing specific applications where Lie groups and their deformations contribute to understanding and solving critical problems in these domains.

Findings

The findings emphasize the significant contributions of Lie theory to science. Through symmetry and deformation principles, Lie groups provide powerful frameworks for modeling and interpreting natural and physical systems. Their utility spans disciplines, influencing advancements in medicine, enabling breakthroughs in physics, and offering insights into chemical and biological processes.

Conclusions

The study concludes that Lie theory, through its foundational principles of symmetry and deformation, is indispensable for advancing various scientific disciplines. Its applications provide crucial insights into understanding living systems and addressing challenges in multiple areas of research. Recommendations include further interdisciplinary exploration of Lie theory to unlock its potential in emerging scientific studies.

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is a Full Professor of Systems Theory and Control at the University of Tunis El Manar (UTM) with nearly 40 years of experience in higher education and research. He has taught and conducted research internationally and holds the titles of Fellow at the World Academy of Art and Science (WAAS), Fellow of the Academy of Engineering and Technology of the Developing World (AETDEW), founding Chairholder of the UNESCO Chair on Science, Technology, and Innovation Policy (STIP), and Advisory Board Member for the UNESCO Science Report 2020. Additionally, he has previously served as the Director-General of International Cooperation at the Ministry of Higher Education and Scientific Research. Dr. Ezzine also founded and currently directs UTM's Master Program on Science, Technology, and Innovation Policy, and his accomplishments have earned him recognition in both Who's Who in the World, Who's Who in Science and Engineering.

Facing the Future: Empowering Resilience Against Existential Threats

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Abstract – Humanity faces existential threats from climate change, resource depletion, and ecological collapse, driven by overconsumption and unsustainable practices. This paper explores systemic solutions emphasizing equitable degrowth in the Global North and sustainable growth in the Global South, grounded in planetary boundaries and resilience-building. Highlighting the urgency of transformative change, it critiques ineffective climate policies and economic models, advocating adaptive strategies to align human activity with ecological constraints and secure a sustainable future.

Keywords : climate change; ecological footprint; collapse; degrowth; resilience

Introduction

Humanity stands at a precipice, confronted by existential threats of unparalleled magnitude—climate change, rampant inequality, and the accelerating loss of biodiversity, to name just a few. At the root of these crises lies the dominant neoliberal capitalist paradigm, which thrives on the twin engines of overconsumption and the unsustainable extraction of resources, all while perpetuating pollution on an unprecedented scale. This system, by design, can only function through the continual exploitation of Earth's finite resources, and without this, it would inevitably stall and collapse. Yet, this insatiable overexploitation is pushing the global system to its breaking point, triggering catastrophic consequences: wildfires raging unchecked, floods of unprecedented scale, and prolonged droughts, among many other environmental disasters. Tragically, it is the world's

most vulnerable—those already burdened by poverty and marginalization—that disproportionately bear the devastating impact of these crises, left to carry the weight of a system designed to benefit the few at the expense of the many.

The only way to help humanity navigate the accelerating collapse with minimal harm and loss is to urgently rein in overconsumption within the planet’s ecological limits, bolster global resilience, and enhance collective well-being. Achieving this formidable yet essential goal requires a paradigm shift: the economies of the Global North must embrace deliberate degrowth, curbing excess and reducing resource use, while the economies of the Global South should grow sustainably within their nations’ carrying capacities. This balanced approach recognizes the need for equitable development, ensuring prosperity for all without further compromising the Earth’s fragile systems.

Ecological footprint

The world’s ecological footprint [1] has been in a state of increasing overshoot since the early 1970s, as clearly illustrated in Fig. 1. Furthermore, the data unequivocally demonstrates that demographic growth is not a primary driver of this ecological overshoot, challenging common misconceptions and highlighting the systemic issues underlying our unsustainable practices.

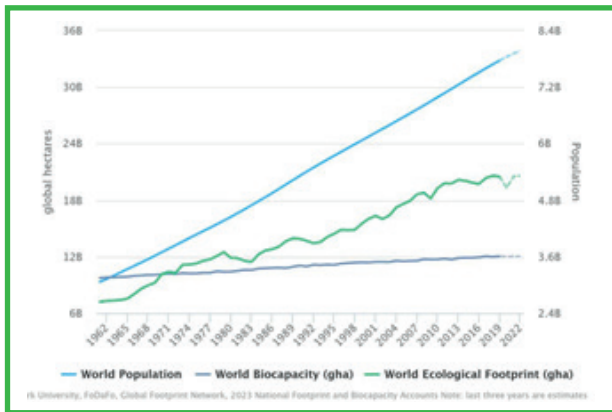


Fig. 1: World ecological footprint

It's important to recognize that the figure above can be represented with the y-axis in terms of «number of Earths» rather than global hectares. In 2024, humanity's consumption of natural resources surpassed the planet's regenerative capacity by the equivalent of 1.75 Earths [2]. To put this into perspective, if every person on Earth consumed resources at the rate of the average U.S. resident, we would require five planets [3] to sustain that level of demand. Additionally, CO₂ emissions remain the largest driver of this ecological overshoot, accounting for roughly 60% to 70% of the global ecological footprint, reflecting the disproportionate impact of fossil fuel use on the planet's health and sustainability.

Global climate governance

Over the span of more than fifty years, 29 Conferences of the Parties (COPs), numerous major international climate agreements, and countless warnings from leading scientists and experts, the global community has consistently failed to effectively address the escalating crisis of CO₂ emissions. Despite the adoption of ambitious targets, declarations of intent, and a growing awareness of the dire consequences of inaction, meaningful progress in reducing emissions remains elusive. This persistent failure underscores the urgent need for transformative, decisive action to mitigate the climate emergency and to implement solutions that match the scale and urgency of the crisis. The time to act is not just now—it is long overdue.

Global climate policies, including the Kyoto Protocol and Paris Agreement, have shown lack of effectiveness. The Kyoto Protocol's binding commitments applied only to developed nations and introduced mechanisms like the Clean Development Mechanism (CDM). Conversely, the Paris Agreement adopted a universal approach, requiring all nations to submit Nationally Determined Contributions (NDCs). However, its non-binding nature and lack of enforcement undermine its capacity to drive significant reductions in greenhouse gas emissions.

These policy failures are compounded by flawed economic models, such as those of William Nordhaus [4], which trivialize the systemic impacts of climate change. By assuming that most economic activities remain unaffected by climate change due to their indoor or underground settings, such models fail to account for the interconnectedness of ecosystems and economies.

Limits to growth was right

Moreover, the persistence of unsustainable practices aligns with the predictions made in “The Limits to Growth” (1972) (Fig. 2) and subsequent updates (1992, 2004, 2020). These works demonstrate that humanity has exceeded ecological and biological thresholds, with models forecasting economic and ecological collapse by 2040 under a «business-as-usual» scenario [5].

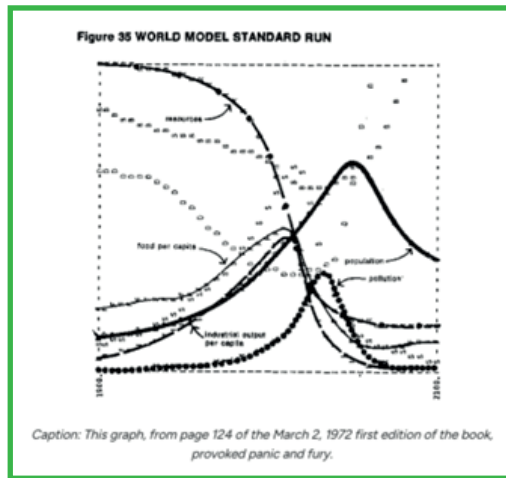


Fig. 2: Limits to Growth

Dennis Meadows, principle investigator, and co-author of “The Limits to Growth,” emphasizes the need for managed decline and resilience. Recognizing the inevitability of limits, he advocates for peaceful and equitable transitions. “The challenge is not merely avoiding collapse but fostering

constructive action for a livable future,” Meadows asserts. His reflections echo the presentation’s core message: humanity’s survival depends on aligning human activity with ecological constraints while enhancing well-being.

A differentiated degrowth solution

It is indisputable that the Global North has been the primary contributor to global warming since the industrial revolution, while the Global South bears the brunt of its most devastating consequences. These regions, often least responsible for the emissions driving climate change, are enduring the harshest impacts, from extreme weather events to rising sea levels. Moreover, the window for effective action is rapidly closing. According to the latest CO₂ emissions estimates, humanity now has a mere five years to radically alter course and avert the accelerating collapse of our ecosystems and societies. The urgency of this moment cannot be overstated; the time for transformative change is now.

To reduce the scale of human activity, as depicted in Fig. 3, while simultaneously enhancing the quality of life for all, we must adopt a dual approach: prioritizing degrowth (red arrow) in the Global North and fostering sustainable growth (yellow arrow) in the Global South. The former entails embracing a sufficiency-oriented lifestyle, focusing on reducing excess consumption and waste, while the latter emphasizes improving living standards and ensuring equitable development within ecological limits.

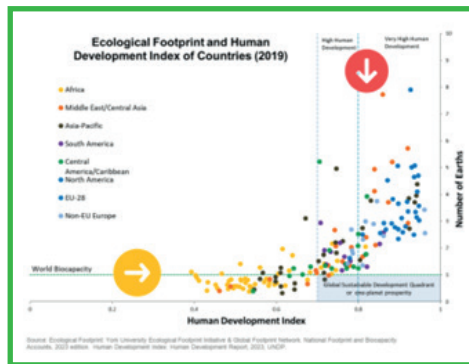


Fig. 3: Differentiated Degrowth.

Admittedly, this path is easier said than done, but it is the only viable option to navigate the current crisis. Success will require adaptive learning, ongoing innovation, and the flexibility to make necessary adjustments along the way. While the challenge is immense, the stakes—securing a livable planet for future generations—leave us no alternative but to proceed with urgency and determination.

Conclusion

Humanity stands at a crossroads, facing an urgent choice between continued unsustainable practices and transformative action. The path forward is daunting but necessary: reining in overconsumption, embracing equitable degrowth in the Global North, and fostering sustainable development in the Global South. Our survival depends on aligning human activity with ecological limits while enhancing global well-being. The stakes are immense, and the time to act is now. Let us not falter but rise to the challenge, forging a future that respects planetary boundaries and secures a livable world for generations to come.

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Hafedh Abdelmelek

Pr. Hafedh Abdelmelek academic path commenced in Veterinary School of Sidi Thabet, from which he was awarded the degree of Doctor of Veterinary Medicine in 1994. He then received a PhD (1997) in Neurophysiology from UCB-Lyon I (France). Since 1999, he's been occupying the position of Professor of Physiology at Carthage University with special emphasis on bioeffects of EMF and nanosciences. In 2023, Prof. Abdelmelek becomes President of Department of Mathematical and Natural Sciences at the Tunisian Academy of Sciences, Letters and Arts.

Scientific revolution and change in the One Health paradigm: Ambitions of an integrated approach to health

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Abstract Humans and nature are intimately and interdependently intertwined with exceptional harmony, leading to compatibility, coordination, and cooperation. A failure to recognize this has resulted in humanity experiencing different crisis rooted in the increasingly virulent relationship between Human beings and the rest of nature such as Mayotte (Chido Cyclone 2024) and Los Angeles (California fire 2025) crises.

Keywords : Harmony, One Health, climate change, sustainable development, crises.

Introduction

Harmony with nature refers to holistic co-existence between humanity and nature. It is used prominently in relation to sustainable development (SD). Nowadays, based on emointelligence equation ($I = t * E^{\alpha * \varepsilon}$) by Abdelmelek (2019) and One Health concepts, the increasingly disharmonious relationship is contributing to the occurrence of extreme natural events, like climate change, zoonosis (COVID-19), antibioresistance, migration, and food security. Interestingly, living in harmony with nature can contribute to health, well-being and SD. Harmonious relationships between Humans and nature increases people's SD sense of attachment to ecosystems. Interestingly, regular interaction can result in key adaptive capacities becoming culturally and socially embedded in people's everyday living and knowledge systems (Buergelt et al [2]).

One health paradigm

Introduction of the topic One Future with a special point of view based on One Health and harmony of living system; help people and scientists think about resilience. In addition, harmony and One Health paradigms have established that nature constantly change and we have to ask the question “What is ‘normality’ for Human, Animal, Plant, and Environment?”. According to these recent climatic crises, it is important to go beyond adaptation by using EcoHealth or One Health concepts. The approach can be applied at regional and global levels, and relies on shared and effective governance. Having the One Health approach in place makes it easier for people to better understand the co-benefits, risks, trade-offs and opportunities to advance equitable and holistic solutions. Our point of view argues that accommodating these issues highlights the importance of conceptualizing DRR activities in ways that include adaptation and transformation. In particular, it is argued that a key transformative element involves learning to live and co-exist with the natural environment. Accordingly, living in harmony is synonymous with health and well-being. More specifically, emotional self-regulation refers to the ability to manage disruptive emotions and impulses; in other words, to think before acting. Self-regulation also involves the ability to rebound from disappointment and to act in a way consistent with universal values. It is a key component of emotional intelligence, harmony, melody, and beauty concepts developed by Abdelmelek [1]. Learning how to self-regulate is an important skill that children learn both for emotional maturity and, later, for social connections.

Bioinspired models of harmony and Disharmony

The most effective way to achieve harmony with nature is to learn traditional Indigenous knowledges. Doing so may hold the key to Human survival particularly in the tumultuous climate changing times ahead, Zoonoses (COVID-19), mirror bacteria, prion, nanodrug, Miro-RNA... etc by providing insights not only into how such outcomes can be secured

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*but also how they contribute to attaining enduring social, ecological and economic benefits for people.

Based on our analysis of disharmony in biological systems; i) Mirror Bacteria' could pose serious global health risks because all known life is homochiral. DNA and RNA are made from “righthanded” nucleotides, and proteins are made from “left-handed” amino acids. Thus, in Beit Al Hikma conference (February 17th, 2025), we call for broader discussion on the possible disharmony induced by mirror bacteria among the global research community and policy-makers ii) prions are infectious conformations of certain naturally occurring proteins. These misfolded proteins can structurally alter healthy protein, creating misfolded copies that repeat the process and form protein aggregates that lead to disharmony and neuronal cell death such as Creutzfeldt-Jakob disease and mad cow disease iii) Nanomedicine is a developing area of medicine, which uses the techniques and tools of nanotechnology to deliver nanodrugs. A new branch called nanotoxicology with various risks (disharmony and health risks) with the use of inorganic or organic nanoparticles and iv) classical models of xenobiotics evoked with One health concept is the cases of Diclofenac and antibioresistance. Finally, precision One Health and Harmony of nature is committed to studying the intricate connections among genetics, the environment, and lifestyle factors and their effects on disease prevention and treatment via the development of personalized healthcare strategies that provide individuals with the most effective treatment options at the right time.

Understanding harmony and change with the one health paradigm

1. Natural harmony is necessary to solve the problem of global warming.
2. Harmony within, emotions, body, health, human needs & aspirations.
3. Harmony in Society: comprehending consciousness and governance system.
4. Confronting risks related to research such as “How synthetic mirror life bacteria could infect the world”.

Conclusion

This paper marks a starting point for a broader discussion about the risks from mirror bacteria, prion, nanodrug including participation from the global scientific community, policymakers, research funders, and other stakeholders. As one health expert, I am involved in planning a series of events throughout 2025, including events planned at the Tunisian Academy of Sciences, Letters, and Arts, to scrutinize the findings of the paper and discuss steps that can be taken to prevent risks from mirror bacteria, prion, nanodrug...etc.

Refereces

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Biodiversity, Ethics, and Well-being: A Pathway to a Sustainable Future.

Ouajdi Souilem

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Abstract The current existential challenges facing life on Earth call for a conscious and resilient response that places biodiversity, environmental preservation, and human well-being at the heart of global ethics. This thematic reflection emphasizes the interconnectedness between ecological systems and societal well-being, advocating for a paradigm shift toward sustainable living. Animal welfare emerges as a pivotal concern, highlighting the ethical imperative to respect all forms of life. By promoting a balanced and inclusive approach, this exploration underscores the need for transdisciplinary dialogues that integrate ecological, ethical, and human-centered perspectives. This event seeks to foster a collective awareness and action plan toward preserving the intricate fabric of life, nurturing resilience, and sustaining harmonious co-existence for generations to come.

Keywords : Biodiversity, Environment, Human Well-being, Animal Welfare, Global Ethics.

Introduction

The preservation of biodiversity has long been recognized as a crucial pillar of sustainable development, notably since the Rio de Janeiro Earth Summit in 1992. The synergistic interplay between the ecological, species, and genetic dimensions of biodiversity ensures the sustainability of biological ecosystems and, by extension, the planet itself. A reasoned

co-evolution between humans and other living beings emerges as a guarantee for preserving human and animal well-being in a healthy environment. However, humanity's exploitation of natural resources without regard for ecological balance poses existential threats that require a shift towards conscious and ethical resilience.

Problem Statement

Numerous studies have demonstrated that biodiversity loss significantly increases the risk of infectious disease transmission, whereas preserving animal species in their natural habitats provides a buffering effect that limits pandemic spread. Despite this, humans continue to destabilize ecosystems through overexploitation driven by egocentrism and short-term interests. Ethics emerges as the best defense against such destructive tendencies, compelling us to reconsider the human relationship with non-human life and to reject a purely instrumental view of nature. This study aims to establish the foundations of a global ethics that prescribes new rules of conduct toward living beings and the environment.

Research Question

How can the integration of biological diversity, ethics, and well-being contribute to building a conscious resilience in the face of existential challenges?

Methodology

This study adopts a qualitative and exploratory approach based on a comprehensive review of prior literature and empirical investigations. Building on interdisciplinary studies in biodiversity, environmental ethics, and human well-being, the research framework integrates ecological models, ethical frameworks, and social perspectives. Data collection involved the analysis of published articles, policy reports, and case studies that

address the intersection of global ethics, animal welfare, and sustainability. Comparative analysis techniques were used to identify best practices and emerging challenges. Additionally, participatory research methods were employed to capture insights from environmental experts, ethicists, and animal welfare advocates.

Discussion

The findings highlight the growing ethical and ecological imperative to balance human development with biodiversity preservation. Prior studies underscore the need for integrating ecological ethics and sustainable practices to build resilience in the face of existential threats. However, translating ethical frameworks into actionable policies remains a persistent challenge. The inclusion of animal welfare as an essential component of environmental discourse reflects a necessary paradigm shift toward holistic ecological resilience.

Historical perspectives provide valuable insights. Al-Jahidh (776–868) emphasized in *Kitab El Hayawan* the interconnectedness between species and their environments, stressing that each plays a vital role within the ecosystem. Despite this ancient wisdom, modern society continues to exploit nature unsustainably. Joseph Fletcher’s assertion that «nature is first and foremost a source of hazards, risks, and disorder» illustrates a mindset that still dominates today, contributing to ecological degradation.

The loss of biodiversity has clear implications for human and animal health. Climate change and ecological imbalances accelerate the spread of vector-borne diseases, zoonoses, and antimicrobial resistance. According to INSERM (2021), zoonotic diseases account for over two billion contaminations each year. Environmental degradation also exacerbates food insecurity, water crises, and malnutrition, further threatening human well-being. The intensification of agricultural practices and soil degradation has depleted plant species with potential therapeutic properties and increased the reliance on antibiotics, fueling the phenomenon of antimicrobial resistance.

Ethical Perspectives

In light of these ecological crises, ethics remains the best defense for rethinking humanity's relationship with non-human life and challenging the instrumental view of nature. Moving from a human-centered to a global ethics perspective necessitates establishing new rules of conduct that respect the interdependence of all living beings. Environmental ethics encourages questioning harmful practices and reversing the trend of environmental destruction before reaching irreversible thresholds.

Conclusion

To address the existential challenges of biodiversity loss and environmental degradation, a conscious and resilient approach is essential. This requires an ethical paradigm that integrates biodiversity conservation, human well-being, and animal welfare. Only through a transdisciplinary and ethically grounded dialogue can humanity build a sustainable and harmonious future for all living beings. As highlighted by this study, fostering ethical resilience and ecological awareness will be key to preserving the delicate balance of life on Earth.

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Session 2 :

Socio-Environmental Challenges and Sustainability





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Shared thoughts on the path of Social Responsibility of Universities in Tunisia

Jouhaina GHERIB

Former President-Rector of the University of Manouba (UMA), Tunisia

Abstract: How do the academic community deal with the challenges of sustainable development? Are they perceived as opportunities or as threatening pressures? How do faculty members integrate these concerns in their curricula and scientific research? Does it result in a transformation of the missions and boundaries of universities? What about the roles of university values when facing economic, environmental and societal issues? How does this challenges affect the activities and operating methods of these institutions? Does the Social Responsibility of Universities (SRU) take the form of a coherent set of rules of behavior increasingly accepted collectively? Is SRU giving rise to an organizational field leading to a gradual homogenization of university practices?

In an attempt to answer the questions above and drawing on her professional experience, the author shares an ongoing reflection on the scope, issues and concrete methods of implementation of social responsibility of universities (SRU) in Tunisia. Challenging and extending the work carried out in the field of Corporate Social Responsibility (CSR), she attempts to identify the emergence and characteristics of SRU from a dynamic perspective. Aiming, more specifically, to understand its path in front of economic, environmental and societal issues, through a reflexive exploration of the causes, actors and processes that underlie it.



Ines LABIADH

Ines LABIADH est diplômée ingénieure agronome de l'École Supérieure Agronomique du Kef (2007). Elle poursuit ensuite ses études avec un master de recherche en Innovation et Développement des Territoires Ruraux en 2008, suivi d'un Master of Science en 2009, dans la même spécialité, à l'Institut Agronomique Méditerranéen de Montpellier (IAMM). En 2017, elle obtient un doctorat en géographie de l'Université Grenoble-Alpes. Elle a acquis une expérience de cinq ans dans le domaine du développement rural et territorial, tant en France qu'en Tunisie, en particulier dans les zones défavorisées du Sud et du Nord-Ouest. Actuellement, elle est coordinatrice du département de la justice environnementale et climatique au Forum Tunisien pour les Droits Économiques et Sociaux (FTDES), où elle coordonne un projet visant à promouvoir l'accès équitable aux ressources naturelles ainsi qu'aux droits environnementaux et climatiques.

The Challenges of Justice in the Face of Water Resource Scarcity and Environmental declines

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Abstract This article examines the challenges of achieving environmental justice in Tunisia in the context of increasing natural resource scarcity and ongoing ecosystem degradation.

The study undertakes an analysis of the concept of environmental justice and its practical implications in the Tunisian context. It draws on official statistical data and insights from fieldwork, focusing on support for socio-environmental movements and advocacy for the rights to water and a healthy environment.

Keywords : environmental justice, water, environment, rights, Tunisia

Introduction

The world is currently experiencing rapid economic development, marked by an intense race to accumulate wealth and boost production and means of consumption. However, this progress is at the cost of natural resources and biodiversity, which are essential to all productive sectors. These resources have been significantly affected in terms of quantity and quality in recent decades as a result of increased pressure on the natural resources, in particularly water, soil and biodiversity.

The climate and environmental crisis is causing serious difficulties in reconciling respect for nature with the growing human needs. Moreover,

catastrophes and extreme events, such as the wildfires currently devastating large areas of natural vegetation and residential areas in California¹, are becoming more frequent and intense. Hurricanes, fires, floods and severe droughts have affected several countries, causing significant human and economic losses. Similarly, human health is endangered by the degradation of the living environment (Wallace, 2016)².

The unequal impact of environmental degradation and water scarcity on humanity today paints an alarming picture of a deeply unbalanced distribution of environmental resources and ecosystem services between different regions and societies. Moreover, current methods of exploiting the natural environment are predictably leading to a global increase in inequalities (Flipo, 2002). This environmental marginalisation calls for the development of concerted strategies and integrated, multidisciplinary approaches to strengthen the resilience of vulnerable areas and to design measures that are adapted to the natural and anthropogenic stresses specific to each ecosystem.

Environmental justice: Conceptual framework and Tunisian reality

The concept of environmental justice, first emerged in the United States in the early 1980s³ and was formally recognised at the Rio Conference in 1992, particularly in parallel forums organised by NGOs and civil society. Environmental justice refers to a principle that encompasses both equal opportunities for sustained access to vital natural resources (water, food, air) and environmental services (drinking water, sanitation, waste management), within countries and between rich and poor regions of the world. It also involves a more equitable distribution of negative externalities

1- At least 25 dead according to the latest toll

2 -In his book *Big Farms Make Big Flu*, Rob Wallace highlights the impact of intensive agribusiness, which heavily uses pesticides and chemicals, on human health and the emergence of new diseases and pandemics. Additionally, forests play a crucial role as a natural barrier against the spread of viruses and pathogens, a role they can no longer fulfill when large numbers of trees are cut down for agricultural expansion or urban development.

3 - The concept of environmental justice was used to denounce the economic, social, and environmental apartheid experienced by African-origin minorities, who lived in slums lacking infrastructure and exposed to pollution, particularly due to the concentration of waste disposal sites.

linked to the overexploitation and pollution of environmental resources. Growing awareness of the unequal impact of environmental degradation on populations and regions, often linked to factors such as racial disparities, gave rise to early environmental movements⁴. These were particularly influenced by the concept of 'environmental racism', coined by Benjamin Chavis in 1982.

Environmental Justice in Tunisia : A Gap Between Social and Environmental Concerns

Current laws, power dynamics and the lack of policies that balance the rights of the powerful and the vulnerable lead to environmental injustice, especially when the environment is viewed as a «common good» that can be exploited by all.

In Tunisia, environmental inequalities remain a neglected aspect of public policy. The environment and sustainable development are often sidelined in national strategies and policies. Despite numerous environmental crises, in particular the water crisis and the worsening pollution throughout the territory, the responses of politicians and environmental authorities remain inadequate to the scale of these challenges and to the expectations of citizens, who are victims of environmental injustices.

Challenges of Water Justice in the Face of Scarcity and Water Shortages

The challenges of water justice in Tunisia require in-depth reflection, particularly on the question: «How can the right to water for all be guaranteed in the face of dwindling resources and their degradation, amidst ever-increasing demand?».

Tunisia's available water resources (surface and groundwater) are estimated at 4.865 billion m³. In comparison, the country's needs across all sectors are around 19 billion m³, placing Tunisia in a state of water scarcity of approximately 15 billion m³ (National Water Sector Report, 2022⁵).

4 - Including the Chipko feminist movement in India (1973) against attacks on the forest, and the American ecofeminism of the 1980s, which denounced environmental violations and their threats to the future of humanity.

5 - All the statistics related to the water sector presented in this article come from this report.

The national rate of connection to the SONEDE network stood at 85.6% in 2023. However, there are significant disparities between governorates and within the same governorate, particularly between urban and rural areas. Central-western governorates, such as Kairouan, are the least served with drinking water (only 84.9% coverage). In 2021, 143 cases of hepatitis were reported in rural schools of Kairouan due to difficulties in maintaining hygiene without access to water or functional sanitary facilities⁶.

In 2022, parents in Segdoud, part of the Redeyef delegation, boycotted the start of the school year to demand the connection of their primary school to the SONEDE network.

Additionally, the tragedy of the commons reminds us that during times of scarcity, conflicts over access to environmental resources become inevitable. Water scarcity sparked anger in early 2023 among farmers in the B'hirine region of Siliana, who expressed outrage over the increasing number of bottled water factories in their area, despite the continuous decline in the groundwater table and the growing difficulty they face in irrigating their lands. The conflict between industrial enrichment and agricultural survival (FTDES, 2023) highlights the urgency for state services to prioritize resource allocation.

The tragedy of thirst affects several regions of the country that are either not connected to the SONEDE network or suffer from the degradation of the services provided by it. Approximately 170,000 Tunisians have no access to any drinking water source, and 650,000 depend on public fountains. In rural areas not connected to the SONEDE network, 1,400 GDAs supply water to 1.56 million citizens, but these structures face significant governance challenges that impact their performance⁷. In total, over 2 million Tunisians suffer from water insecurity and a violation of their right to water.

6 - Nationally, 1,361 schools are not connected to the SONEDE network, and 527 have no access to water (Ben Ali, 2024).

7 - The services provided by the GDA in rural areas remain insufficient due to internal issues of corruption and over-indebtedness to STEG and SONEDE. The GDA's debt to STEG in 2022 reached 10 million dinars, and 3.8 million dinars to SONEDE.

GDA's are also responsible for ensuring the continuous supply of water to rural schools and health centres, which are often affected by repeated interruptions. Violations of the rights to water, education and health therefore create layers of vulnerability that threaten human health, children's right to education and human dignity as a whole.

Challenges of Environmental Justice in the Face of Pollution and Its Impact on Human Well-being and Social Justice

In recent years, the emergence of several crises related to waste management, coupled with growing protest movements against environmental degradation in several regions, highlights the ongoing crisis affecting society and the well-being of citizens. Major events such as the Italian waste crisis in 2020, the crisis in Agareb and Sfax since 2021 and the crisis on the island of Djerba in 2014 reflect the persistent inability of the Ministry of the Environment to propose effective and long-term solutions, calling into question the legitimacy of public authorities and even the political regime.

Currently, 63% of household waste is buried in controlled landfills, only 4% is recycled and the rest is dumped in illegal landfills or left in the countryside. This situation leads to concentrated pollution on the outskirts of major cities where landfills are located, such as Borj Chakir in Tunis, where pollution encourages the spread of disease and pandemics. ANGED's internal functioning, marred by corruption and the influence of waste sector lobbies, hinders the adoption of recycling policies, waste separation at source and the decentralisation of environmental issues.

The linear model of waste management persists, with authorities opting to reduce social tensions by shifting pollution from one place to another, often to marginalised areas and vulnerable communities who are less able to resist these decisions. This environmental discrimination exacerbates social inequalities and refers to the concept of 'slow violence' developed by Rob Nixon in 2011 .

8 - In his book *Slow Violence and the Environmentalism of the Poor*, Rob Nixon develops this concept, which refers to forms of violence that are neither spectacular nor instantaneous, but rather gradual and progressive over time and space, such as climate change, deforestation, and pollution.

Industrial pollution is another aspect of Tunisia's current environmental challenge. It is mainly located in the Sahel region, around the textile industry, and in the Gafsa mining basin.

Gafsa, once an agricultural region, is now suffering the consequences of phosphate mining. The phosphate waste, known as 'sterile phosphate', forms huge mounds that blight the landscape of mining towns and pollute the air and groundwater. Respiratory and skin diseases are widespread in mining towns, and the contamination of tap water by phosphate residues has led to 90% of the population of Redeyef suffering from dental fluorosis (Bizani, 2022).

In the Bay of Monastir, the discharge of wastewater laden with dyes and chemicals directly into nature threatens marine biodiversity and the livelihoods of small fishermen.

In the southeast, in Gabes, the approximately 7 million tons of phosphogypsum, rich in heavy metals and fluoride, released annually by the chemical group operating in the region since the 1940s, has caused the loss of nearly 90% of marine species in the Gulf of Gabes.

Conclusion : Towards Just Environmental Policies and Sustainable and equitable alternatives

There is an urgent need to raise awareness about the inefficiency of current environmental policies and to highlight the importance of adopting best practices to protect the environment and ensure equitable access to water and a healthy environment. Human rights-based, holistic, and interconnected approaches offer an effective framework to combat extractivism and promote environmental and social justice, affirming that rights are universal and indivisible. Businesses must assume social and environmental responsibilities on an equal basis with their economic activities, respecting the ecological balance and avoiding the overexploitation of natural resources.

In Tunisia, the 2018 law on corporate social responsibility remains insufficiently clear and non-binding. It urgently needs to be reviewed to impose concrete obligations on companies to protect the environment and respect community rights (Zaier, 2021). Furthermore, the lack of

legislation that prioritises water for domestic use and small agriculture deprives citizens and farmers of their fundamental right to water. The updated 2012 Water Code must mainstream principles of water justice and ensure equitable distribution of resources across regions, citizens and economic sectors.

Similarly, the 2022 Environmental Code is still too technical and lacks a focus on social aspects. It must include tools for transparency and accountability, and replace the term 'information' with 'consultation' for local communities in waste management projects (article 215 of the code). This would ensure social acceptance of projects and mitigate potential opposition that could disrupt social harmony.

Finally, the waste crisis must be addressed from an environmental, economic and social perspective.

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CIRCULAR ECONOMY AND ECO-FINANCE: ASSESSING ENVIRONMENTAL AND SOCIO-ECONOMIC CHALLENGES IN TUNISIA

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Abstract The circular economy (CE) offers a visionary shift from linear economic models, emphasizing environmental restoration and social equity. For Tunisia, CE provides an opportunity to rethink growth. Yet, the success of CE hinges on eco-finance—an underexplored but vital dimension. This study delves into the interplay between eco-finance and circular practices in Tunisia, revealing that institutional inertia, limited individual capacities, and fragmented organizational dynamics constrain progress. By advocating a human-centered approach, this research underscores the potential for fostering collaboration and resilience. Policymakers and scientists alike are invited to view CE not only as a technical solution but as a socio-environmental narrative connecting human agency and systemic transformation.

Keywords : Circular Economy (CE), Climate Change, Eco-Finance, Linear Model, Tunisia

Introduction

In today's world, the relentless pursuit of growth has led humanity to exceed ecosystems' regenerative thresholds. This overexploitation exacerbates inequality, depletes resources, and intensifies global warming. The

linear economic model—characterized by «take-make-dispose»—reveals its limitations, especially in the wake of crises like COVID-19 and escalating natural disasters (Mattour, N., & Kamoun-Chouk, S. 2024). Sustainability now demands a fundamental rethink of our approach to production and consumption. The circular economy (CE) emerges as a promising alternative. Anchored in regenerative principles, CE strives for closed-loop systems that minimize waste and optimize resource use. In Tunisia, this paradigm holds significant promise. With a fragile economy compounded by climate risks, CE offers pathways for resilience and inclusivity. However, its implementation requires a robust eco-finance ecosystem, a domain currently underexplored.

1. This paper is part of an ongoing doctoral thesis that aims to explore the role of eco-finance in advancing CE in Tunisia, considering the interplay of environmental and socio-economic dimensions. Specifically, it examines:

2.

3. The urgency of transitioning from resource-intensive linear models.

4. The alignment of eco-finance mechanisms with sustainable practices.

5. The necessity of human-centered interventions to foster systemic change.

ral events, like climate change, zoonosis (COVID-19), antibioresistance, migration, and food security. Interestingly, living in harmony with nature can contribute to health, well-being and SD. Harmonious relationships between Humans and nature increases people's SD sense of attachment to ecosystems. Interestingly, regular interaction can result in key adaptive capacities becoming culturally and socially embedded in people's everyday living and knowledge systems (Buergelt et al [2]).

Méthodology

The study employs a multi-faceted approach, integrating:

- A comprehensive literature review (2014–2024) on CE and eco-finance.
- Analysis of Tunisian national strategies and international frameworks on ecological transition.

- Insights from reports such as the World Bank's 2023 Tunisia Climate and Development Report.

This methodology uncovers gaps in Tunisia's eco-finance landscape while mapping potential pathways for alignment with international sustainability standards. The conceptual framework prioritizes indicators of circularity, inclusion, and social justice to evaluate progress.

Expected finding

Tunisia exhibits significant potential for CE, yet its progress remains hindered by systemic limitations. At this stage of our research, we cannot present actual findings, but rather the expected findings that we anticipate discovering during our empirical study. These expected findings aim to highlight key areas of focus and guide the direction of our investigation.

Key expected findings include:

1. **Institutional Barriers:** A fragmented regulatory framework limits cohesive eco-finance strategies. Policy inconsistencies undermine efforts to transition towards CE.
2. **Individual Capacities:** Resistance to behavioral change and skill deficits impede the adoption of sustainable practices Kamoun-Chouk, S. (2021).
3. **Organizational Dynamics:** Insufficient awareness and resilience-building efforts curtail collective sensemaking and learning for anticipative actions and foresight (Kamoun-Chouk, S. 2020).

Despite these challenges, Tunisia's low-carbon strategy and emerging green finance initiatives offer hope. Bridging gaps in eco-financing requires:

- **Institutional Reforms:** Enhancing policy coherence and visibility.
- **Capacity Building:** Empowering individuals through education and incentives.
- **Organizational Synergy:** Promoting collaborative ecosystems that align economic, social, and environmental goals.

Conclusion

In conclusion, the transition to Circular Economy (CE) in Tunisia is a societal shift that goes beyond technical challenges. Eco-finance must evolve to support this transformation, with a focus on resilience and inclusivity. By viewing CE as a shared narrative of ecological and social renewal, Tunisia can serve as a model for global sustainability. Our ongoing research investigates the role of knowledge management and interdisciplinary collaboration in enhancing eco-finance systems. We believe that integrating diverse perspectives is crucial to addressing the complex challenges of CE and ensuring a sustainable legacy for future generations.

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Round Table :

**Critical Perspectives
on «One Future» in Light
of the SDG Discourses**





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est docteur de l'Université Paris I Panthéon-Sorbonne, professeur d'Université à l'école supérieure de commerce (Tunis), professeur associé au « Business science Institute » (Paris) et président du think-tank «Cercle kheireddine» ainsi que de l'association «Nouvelle Chance» pour l'emploi des jeunes. Ancien directeur de l'Institut Supérieur de Comptabilité et d'Administration des Entreprises de Tunis (2009-2014) et de l'école doctorale d'économie, de gestion, de comptabilité et de finance de l'ISCAE et de l'ESCT (université la Manouba). Ses travaux de recherche et d'expertise portent sur la gouvernance publique et privée en Afrique ; l'évaluation des politiques publiques ; la prospective ; le capital humain ; le développement ; le changement institutionnel et organisationnel ; la stratégie et l'épistémologie des sciences.



Maher Gassab

Maher Gassab is a full Professor in Economics. He obtained his PhD in 1997 from the University of Paris I (Panthéon-Sorbonne). From 1995 to 1997, he taught at the Université François Rabelais in Tours (France). Since 1997, he has been a lecturer at the École Supérieure de Commerce de Tunis (University of Manouba). Since 2016, he has been a founding member of the ThEMA research laboratory at the University of Manouba and was a member of the board of the Tunisian Association of Economists (ASECTU) from 2018 to 2023.

He is also a founding member of the African Observatory for Sustainable Finance (OAFD), and a member of the Scientific Councils of ITCEQ and CONECT.

In addition to his academic work, particularly in the fields of public economics, environmental economics and governance, he has contributed to numerous reports for national and international organizations. He was Director of the Ecole Supérieure de Commerce de Tunis (2011-2017), Director General of Higher Education (2017-2018) and Chief of Staff to the Minister of Higher Education and Scientific Research (2019-2020).

Circular Economy: An Alternative Model for a Common Future

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Abstract The circular economy (CE) offers an alternative model to the dominant linear economic paradigm. It aims to limit resource consumption and waste production while fostering sustainability, reducing greenhouse gas emissions, and creating new economic opportunities. This model is based on key principles such as eco-design, sustainable sourcing, the functional economy, and recycling. CE seeks to transform how societies produce and consume by promoting a systemic and integrated approach. It addresses current environmental challenges such as resource depletion and waste management while encouraging more inclusive and collaborative economic processes. However, despite its undeniable advantages, transitioning to a circular economy faces numerous challenges, including technological constraints, high initial transformation costs, and resistance to change. This paper explores the principles of the circular economy, its benefits, and the barriers to its adoption. A particular focus is placed on the state of economic circularity in regions highly vulnerable to climate risks in Africa, the Maghreb, and Tunisia.

Keywords : circular economy, sustainable development, recycling, eco-design, ecological transition, waste management, innovation, Africa, Maghreb, Tunisia.

Introduction

The modern of global economy primarily relies on a linear economic model, which follows the traditional process of resource extraction, consumption, and disposal. This model, long considered viable due to the

apparent abundance of resources, is now facing unsustainable limits: rapid resource depletion, pollution, climate change, and biodiversity loss. In response to these challenges, the circular economy (CE) emerges as a potential pathway for transitioning to a more sustainable model. CE seeks to optimize resource use by extending their lifespan, reducing waste, and reintegrating materials into closed production cycles model on natural ecosystems.

Problem Statement

While the circular economy offers a relevant solution to address the ecological crisis and reinvent production and consumption models, its large-scale implementation faces several obstacles: misunderstanding of the concept, technological limitations, high adaptation costs, resistance to change from businesses and consumers, and the absence of suitable global regulations. A major challenge lies in understanding how to overcome these barriers to effectively integrate circular practices into global value chains and assessing the environmental and socio-economic impacts of such a transition.

Objectives

this paper aims to examine the circular economy as an alternative and viable model to linear economic practices. Specifically, we seek to:

1. Clarify the concept of the circular economy by exploring its fundamental pillars and practical applications across various economic sectors.
2. Analyze the environmental, economic, and social benefits of implementing circular practices.
3. Identify barriers to adopting this model and propose solutions to overcome these challenges.
4. Illustrate the benefits of transitioning to the circular economy through real-world case studies, such as Kalundborg (Denmark) and Mud Jeans (Netherlands).

Methodology

The methodology adopted for this study combines a comprehensive review of the theoretical principles of the circular economy and a detailed examination of practical case studies. These cases were selected based on their ability to demonstrate the successful application of circular economy principles in industrial and commercial contexts. Additionally, data from recent reports and studies, such as the Circularity Gap Report 2024, were used to evaluate the extent of CE adoption and its effectiveness on a global scale.

Results

The results of this study reveal that adopting the circular economy can generate multiple benefits on several levels:

Environmental

The circular economy significantly reduces waste and greenhouse gas emissions. Through practices such as high-quality recycling, eco-design, and the reduction of non-renewable materials, businesses can minimize their ecological footprint. For instance, chemical and mechanical recycling has enabled some companies to convert complex waste, such as mixed plastics, into high-quality raw materials, thereby reducing pressure on natural resources.

Economic

The circular model opens new pathways for innovation and wealth creation. The adoption of the functional economy, which prioritizes usage over ownership, has allowed many businesses to offer services rather than products, contributing to resource consumption reduction. Mud Jeans in the Netherlands, for example, offers a jeans rental model, which generates new revenue, streams while extending product lifespans and reducing the production of new goods.

Social: The circular economy can also strengthen social bonds by promoting community initiatives, such as Repair Cafés, which encourage repair rather than replacement of goods. These initiatives not only reduce waste but also create local jobs and foster solidarity within communities. Industrial symbiosis in Kalundborg, where local businesses exchange energy, water, and materials to maximize resource use, is another example of a circular approach benefiting both the environment and the local economy.

Discussion

The findings suggest that the circular economy holds significant potential to reduce environmental impacts while fostering economic innovation and strengthening the social fabric. However, several challenges remain that could hinder the large-scale adoption of this model:

Technological

A major obstacle is the inadequacy of recycling technologies, particularly for complex materials. For example, recycling mixed plastics or composite materials still requires technological innovations to be truly effective on a large scale.

Financial

The initial costs of investments needed for transitioning to a circular model, such as establishing suitable infrastructure, can be a barrier, especially for small and medium-sized enterprises (SMEs). However, supportive policies such as subsidies, tax credits, and public funding can play a key role in overcoming these economic barriers.

Political and Regulatory:

The lack of unified global legislative frameworks and the absence of incentivizing regulatory mechanisms are additional obstacles. Strengthened global governance, combined with public-private partnerships, would be

essential to promote an effective transition to a circular economy.

Despite these challenges, the overall benefits of the circular economy justify the investment required to overcome these obstacles. Reduced CO₂ emissions, enhanced business competitiveness, and the creation of new sustainable jobs are all compelling arguments for this model. In Tunisia, which has faced economic crises for over a decade, the circular economy appears to be a major opportunity as an alternative development model that reconciles economic, environmental, and social objectives. With a circularity rate of approximately 4%, many challenges remain in promoting the circular economy in Tunisia, one of the main pillars of the country's National Ecological Transition Strategy.

Conclusion

The circular economy presents itself as a viable economic model in the face of environmental challenges and the limitations of current linear models. Although it still faces technical, financial, and political obstacles, the results show that it can provide innovative solutions for more sustainable resource management and long-term economic prosperity. The examples of Kalundborg and Mud Jeans demonstrate the effectiveness of circular practices and their capacity to transform production systems while reducing ecological impact.

Transitioning to a circular economy requires collective commitments and adapted public policies, but it also represents an opportunity to create more resilient and responsible business models. In a context where sustainability is becoming imperative, the circular economy constitutes a promising pathway to ensure a more equitable and environmentally respectful future.

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Mohamed Jaouad

Dr. Mohamed Jaouad is a Professor in Agriculture Economics and Rural Development from the National Agronomic Institute of Tunis (INAT - Tunisia). He is currently, Senior Researcher and Head of the Laboratory of 'Rural Economy and Societies' at the Arid Regions Institute (IRA) in Médenine (Tunisia). His research programs have focused on Agriculture economy and he explores the quantitative dimension of economic analysis and research, mainly economic modeling, database management, decision support tools, climate change impact assessment, value chain, local development, governance. Jaouad has made over 63

scholarly contributions, including nearly 50 peer-reviewed research papers (h-index = 7; i10-index = 4; January 2025). He has also contributed to training and capacity building through the supervision of trainees and students of all levels from national and international centers, organizations and universities.

<https://scholar.google.com/citations?user=ddbvxikAAAAJ&hl=fr>

“LIVING” IN FACE OF CLIMATIC ARIDITY THREATS: WHAT ROLE DOES AGRICULTURAL RESEARCH PLAY?

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Abstract : Climate change adds to the already challenging environmental situation for rural arid areas of the southern Tunisia. Water resources, pastoralism, and rainfed agriculture, are the most vulnerable. The agricultural development of rainfed and irrigated crops has resulted in the unsustainable use of natural resources, marked by the exponential expansion of tree plantations and oases at the expense of pastoral lands. To this end, agricultural research is doing a great job of coming up with new solutions to face the damaging results of climatic aridity risks. The focus of this paper is to explore the role of agricultural research in increasing the resiliency of agricultural production systems, in promoting water use efficiency, and in facilitating the adoption of sustainable land use practices. This work aims to provide guidelines and approaches for agricultural research to promote territorial development and help rural populations cope with the more stringent risks of climatic aridity.

Key words : Agricultural Research, Governance, Natural resources, Development, Production systems,

Introduction

Tunisia is highly exposed to climate change and particularly in the rural arid areas of the southern part where the environment is already harsh. The most vulnerable sectors are mainly water resources, pastoralism and rainfed agriculture, especially arboriculture dominated by olive cropping.

Tunisia is highly exposed to climate change and particularly in the rural arid areas of the southern part where the environment is already harsh. The most vulnerable sectors are mainly water resources, pastoralism and rainfed agriculture, especially arboriculture dominated by olive cropping.

In addition, these areas have undergone rapid changes in recent decades, affecting agricultural production systems, farming practices and management of natural resources. These changes have led to an increased exploitation of natural resources through the development of rainfed agriculture (rapid extension of tree plantations at the expense of pastoral areas) and irrigated agriculture (extension of oases and irrigated areas). The transformation of agricultural production systems is the result of a multiparty effort of public authorities which have implemented vast agricultural and rural development programs, and of farmers, who are carrying out agricultural development actions on their farms, particularly following the privatization process of collective lands. These changes have resulted, on the one hand, in profound transformations in the modes of access, management and exploitation of natural resources and, on the other hand, in the development of new socio-economic strategies of local actors (migration, sharing of collective assets, pluri-activity of farmers, diversification of production systems, etc.) in the face of resource scarcity, vulnerability of the ecosystem and changes in the socio-economic and institutional context.

Purpose of reflection

Taking into account all these transformations and the climatic constraints observed almost everywhere, the question of vulnerability has become the subject of a large number of multidisciplinary and interdisciplinary research projects at international scale (Thomas, 2008). In this field of research, animal and vegetal 'living' suffer from different forms of vulnerability in a territory that is of major importance through the interactions that take place between populations, in vulnerable situations, and the plant cover that occupies the space. As a result, 'living' in face of the threats of climatic aridity has to be the heart of scientific as well as the political and economic debates.

In this context, it should be noted that the impact of the climate aridity has been controlled partially by infrastructure installation and the mobilization of water resources to the different regions of the country from North to South. However, these policies have reached their ecological, financial, economic and social limits (Elloumi, 2006). These limitations concern first and foremost the extreme pressure exerted on water resources, due to overexploitation: Total groundwater losses (aquifers) by 2050 have been estimated at about 220 million m³ per year, which represents about 75% of all available resources (MARHP, 2010).

Methodology

Research programs will mobilize a conceptual and integrated framework, based on theoretical concepts including: production systems, ecosystems, resource governance, vulnerability, resilience and adaptation strategies. These programs is also based on the use of tools, nested scales (household, territory, delegation, region), scenarios, and approaches to gauging impact indicators (capital approach).

Given the complexity of the research problem posed, and the inter- and intra-systemic interactions involved, new generations of approaches and tools will be developed as part of a multidisciplinary and participatory process that aims to combine, interpret and inter-exchange knowledge from various scientific disciplines in order to provide a better understanding of complex phenomena.

In this respect, various tools and methods that take into account the multi-dimensionality of environmental and socio-economic problems at different spatial and temporal scales will be mobilized. A concerted approach to data collection and hoarding would be implemented throughout the development of the three phases of the approach.

Finding

Since the beginning of the 1970s, the national agricultural research system¹ has taken over from the first agricultural research actions undertaken mainly by IRA, INRAT and CRGR/INRGREF in the oasis and pastoral environment of southern Tunisia. IRA has gradually succeeded in providing Tunisia's arid zones with a real multidisciplinary research and development structure, and has succeeded in undertaking numerous research works on the transformation that affects the agricultural sector and rural areas of the Tunisian drylands.

In face of all kinds of threats and increasingly amplified social, environmental and health issues that threaten the resilience of the living of our ecosystems, a renewal of the main questions of agricultural research is of urgent interest.

To do this, in view of the complexity of the environmental situation in these areas, these various scientific questions have to be addressed at the level of research themes which in turn will be arranged in an integrated and complementary manner. Thus, the research question will be developed around three nested scales :

- The national level focuses on the analysis of policies for the use of natural resources, particularly land: this analysis will be carried out in terms of examination of these policies and their impact on the management of natural resources.
- The regional scale focuses on the analysis of agrarian systems in arid regions, and on the analysis of the regional economy and its relationship with the household economy
- The micro-economic scale, i.e. at the farm level according to the systemic approach. The functioning of agricultural production systems is a common axis for almost all other related themes: oasis and agropastoral production systems.

¹The Institute for Arid Regions (IRA) in Médenine, created in 1976, is part of the national agricultural research system led by the Institution of Agricultural Research and Higher Education (IRESA) under the supervision of the Ministry of Agriculture, Water Resources and Fisheries (MARHP).

proposed research program, the research activities would have a dual scientific interest:

The first consists of contributing to providing answers, in a decision-making support approach, to inherent scientific questions in:

- The endurance and resilience of socio-economic systems and drylands in a context of transition and change.

- The development of irrigation water production and management systems and its governance in arid climate regions of southern Tunisia

- Human mobility and new alternatives for sustainable local development

- The formulation of guidelines for development and planning in arid environments from a dual perspective: on the one hand, the sustainability and viability of the human development process and, on the other hand, the preservation of 'living' and natural resources and the fight against forms of degradation;

The second is at the level of the establishment of databases and synergies with other disciplinary fields in the sense that it allows the development of the interdisciplinary approach in collaboration with other laboratories and other disciplines.

On the other hand, these questions respond well to national priorities reflected in the strategies for the management of natural resources (GRN) and combating desertification (LCD), the national strategy for adaptation to the CC, and the sectoral strategies of soil and water conservation.

In a context of scarcity of natural resources and precarious environment, the objective was in principle to seek to rationalize the exploitation (Fetoui, 2021), management and access to natural resources, and in particular water and soil resources, with a view to sustainable development.

However, the research undertaken has highlighted the growing conflict between actors over access to resources (soil, water and rangeland) and the need to build systems of concerted governance to ensure both equitable access and sustainable management of natural resources.

Agricultural research in the arid rural territories of Tunisia has to grasp the complexity that is both theoretical (what definition(s), what episte

Conclusion

These abstract traces the evolution of research questions in southern Tunisia and attempts to report on its main achievements in this field. In other words, it questions the notion of rurality in the light of the changes brought about by the demographic, social and environmental upheavals observed in recent years. It problematizes the challenges and opportunities that arise in the conceptualization and implementation of rural studies, and highlights transdisciplinary and participatory perspectives and approaches. How are methodologies and new practices evolving to capture the richness and diversity of arid rural territories? What role can research play in rural communities? How does participatory research expand our understanding of rural realities in drylands?

It also questions the implementation of the social, territorial, environmental, economic and cultural dimensions that interact in rural areas. How can research help solve these interconnected issues and shape a brighter future for vegetal and animal living in drylands?

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Aljia Ben Smida

Aljia Ben Smida is a Tunisian geologist and environmental project coordinator specializing in oasis management and sustainable development. Holding a master's degree in coastal and wetland adaptation (ClimAdapt), she has led environmental initiatives with NGOs, focusing on sustainable resource management and awareness. Proficient in geophysical methods, soil and water analysis, and field diagnostics, she has supported local farmers and trained women in oasis regions. With expertise in investment proposal development and fundraising, she applies her technical and managerial skills to climate adaptation and environmental restoration efforts in southern Tunisia.

Rethinking Resilience through Ecological Solidarity and Community-Led Adaptation

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Abstract The contemporary world faces multiple global crises, such as climate change, biodiversity loss, and social inequality, which call for a fundamental rethinking of resilience. Traditional resilience approaches focused on recovery need to be replaced by a proactive, systemic, and holistic model. This paper explores the concept of «One Future,» advocating for resilience that integrates ecological health and human well-being. The study analyzes community-led adaptation as a key mechanism for building resilience, with an emphasis on ecological solidarity, education, and the role of climate activism. Findings suggest that building resilience requires collaboration across diverse sectors and communities to address the interconnected challenges of the 21st century.

Keywords : Resilience, climate change, ecological solidarity, community adaptation, sustainability

Introduction

The world today is grappling with an unprecedented combination of environmental, social, and economic crises, primarily driven by climate change, deforestation, and biodiversity loss. These challenges demand a shift in how we conceptualize resilience. Traditionally, resilience has been understood as the ability to recover from shocks. However, given the scale and complexity of the current crises, resilience needs to be redefined as a proactive, systemic, and adaptive capacity that not only addresses recovery but anticipates future challenges.

This paper introduces the concept of «One Future,» a vision of resilience that is grounded in both ecological health and human well-being. It emphasizes the interconnectedness of ecosystems and human societies, asserting that resilience can only be achieved if both are considered in tandem. This paper explores community-led adaptation as a critical component of this redefined resilience and evaluates the role of education and activism in promoting sustainable practices and policy.

Methodology

The research employs a qualitative approach, combining literature review and case studies of community-led adaptation initiatives. The paper reviews key theoretical frameworks on resilience, including ecological solidarity and climate justice. Furthermore, case studies from various regions, such as the Bolivian highlands and indigenous communities in the Andes, are used to demonstrate successful community-led adaptation strategies. Data sources include academic articles, reports from environmental organizations, and interviews with activists and local leaders involved in climate resilience work.

The methodology aims to assess the viability and effectiveness of community-driven resilience strategies and evaluate the role of education, activism, and policy in facilitating these approaches. The research also considers the broader implications for global resilience building, offering theoretical and practical insights for practitioners and policymakers.

Findings

The findings reveal that community-led adaptation (CLA) is an effective strategy for building resilience in the face of climate change. Communities with strong local knowledge and a sense of solidarity are more successful in implementing adaptive strategies that are both sustainable and culturally appropriate. These communities employ a variety of strategies, from climate-resilient agriculture to water management systems, that reduce vulnerability to climate impacts.

Furthermore, the concept of ecological solidarity is essential in this context. A key finding is that communities that view their relationship with nature as cooperative rather than exploitative tend to develop more sustainable and enduring resilience strategies. The integration of ecological health into resilience-building frameworks encourages a shift from individual to collective responsibility, which is vital for long-term sustainability.

The research also highlights the significant role of education in fostering climate resilience. Educational initiatives that promote environmental literacy empower individuals and communities to take action and advocate for sustainable policies. Climate activism, especially by youth movements such as Fridays for Future, has been instrumental in raising awareness and demanding urgent action from governments and corporations.

Conclusion

The findings of this study underline the importance of a holistic approach to resilience that integrates ecological sustainability, social solidarity, and economic stability. Resilience must not only focus on recovery from shocks but also anticipate and mitigate future risks. The principles of ecological solidarity—recognizing the interdependence of all life forms—are crucial for achieving this kind of resilience.

The research suggests that while community-led adaptation is a powerful tool, there are challenges in scaling these initiatives. These challenges include limited resources, political resistance, and the need for broader policy support. Nonetheless, the study underscores the need for a paradigm shift in both theory and practice. Building resilience requires a collaborative, multi-sectoral approach that includes local communities, governments, and global institutions.

The paper concludes with recommendations for policy interventions that support community-led adaptation and the integration of ecological solidarity into resilience frameworks. Additionally, it stresses the importance of continued education and activism to engage communities and ensure long-term sustainability.

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ANNEXES



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SCIENTIFIC DAY



TOWARD A CONSCIOUS RESILIENCE OF LIVING BEINGS IN THE FACE OF EXISTENTIAL CHALLENGES

Monday February 17th, 2025
from 8h30
at the Academy palace

25, Avenue de la République. 2016 - Carthage Hannibal / قرطاج حنبعل - 2016، شارع الجمهورية.

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Prof. Karim Ben Kahla
ESCT - UMA - ECOFIGES



Mrs. Aljia Ben Smida
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Energy, and Environment



Prof. Souad Kamoun Chouk
Moderator
Member of the Tunsian Academy
Beit al-Hikma



Prof. Maher Gassab
ESCT - UMA - ECOFIGES



Prof. Mohamed Jaouad
Arid Regions Institute, Medenine



Tunisian Academy of Sciences
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Science Department



المجمع التونسي للعلوم والآداب والفنون
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PROGRAM

ONE FUTURE : TOWARD A CONSCIOUS RESILIENCE OF LIVING BEINGS IN THE FACE OF EXISTENTIAL CHALLENGES



Monday February 17 th, 2025 from 8h30
at the Academy Palace

8:30 - 9:00 Welcome and Participant Registration

9:00 - 9:15 Opening Remarks

- **Prof. Mahmoud Ben Romdhane**, President of the Tunisian Academy *Beit al Hikma*

- **Prof. Hafedh Abdelmelek**, Head of the Department of Mathematical and Natural Sciences, *Beit al-Hikma*

9:15 - 9:20 Program Presentation by the Project Leader

- **Prof. Souad Kamoun Chouk**, Member of the Department of Mathematical and Natural Sciences, *Beit al-Hikma*

9:30 - 10:55 am, Session 1 : One future : Scientific and Mathematical Foundations for Resilience

9:30 - 9:45 *Toward Mathematical Resilience: Lie Theory in Service of Life Sciences*

Prof. Ali Baklouti, Faculty of Sciences, University of Sfax, Tunisia, Member of the Department of Mathematical and Natural Sciences, *Beit al-Hikma*

9:45 - 10:10 *Facing the Future: Empowering Resilience Against Existential Threats*

Prof. Jelel Ezzine, L3S, ENIT, UTM, Founding Chair of UNESCO Chair on Policy, FWAAS, FAETDEW.

10:10 - 10:35 *Scientific Revolution and Paradigm Shift in One Health: Ambitions for an Integrated Health Approach*

Prof. Hafedh Abdemelek, Department of Mathematical and Natural Sciences, *Beit al-Hikma*

10:35 - 10:55 *Biodiversity, Ethics, and the Well-Being of Life: An Imperative for a Sustainable Future*

Prof. Ouajdi Souilem, Hospital-University Professor at the National School of Veterinary Medicine. CEO of Biotechpole Sidi Thabet.

10H55- 11H10 : Q&A Session

11:10 - 11:25 Coffee Break

11:25 - 13:05 pm, Session 2 : Socio-Environmental Challenges and Sustainability

11:25 - 11:50 *Organizational Transformation Dynamics in Response to Sustainability Challenges: A University Perspective,*

Prof. Jouhaina Gherib, UMA-LIGUE, holder of the UNESCO Chair on Higher Education for Sustainable Development in Africa, University of Manouba.

11:50 - 12:15 *Justice Challenges in the Face of Scarcity and Degradation of Water and Environmental Resources,*

Inès Labiadh, Docteure en géographie, coordinatrice du département de la justice environnementale et climatique au FTDES

12:15 - 12:40 *Circular Economy and Eco-Finance: Current State of Environmental and Socio-Economic Challenges in Tunisia,*

Med Fayçal Kadhkadhi, UMA ESCT-LIGUE & **Prof. Souad Kamoun Chouk**, Department of Mathematical and Natural Sciences, *Beit al-Hikma*

12:40 - 13:05 Q & A Session

13:05 Lunch Break

14:30 - 15:30 pm, Round Table : Critical Perspectives on "One Future" in Light of the SDG Discourses

Moderator: **Prof. Souad Kamoun Chouk**

Participants:

- **Prof. Karim Ben Kahla**, ESCT - UMA - ECOFIGES
- **Prof. Maher Gassab**, ESCT - UMA - ECOFIGES
- **Prof. Mohamed Jaouad**, Arid Regions Institute, Medenine
- **Mrs. Aljia Ben Smida**, Tunisian Association for Water, Energy, and Environment

15:30 - 16:00 | Closing Remarks and Key Takeaways



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The President of the Tunisian Academy of sciences,
letters and arts, *Beit al-Hikma*
is pleased to invite you to the scientific day on the theme.

**ONE FUTURE :
TOWARD A CONSCIOUS RESILIENCE OF LIVING BEINGS
IN THE FACE OF EXISTENTIAL CHALLENGES**

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