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EXPLORING ECOLOGICAL RESTORATION MANAGEMENT APPROACHES: A CASE STUDY OF RÉUNION ISLAND'S COMMUNITIES OF PRACTICE IN THE LIFE

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Abstract: *Ecological restoration has emerged as a heightened scientific response to human-induced degradation in natural ecosystems. This movement arises from a collective effort to comprehend and counteract these dynamics. The institutionalization of ecological restoration has developed gradually and in various forms, gaining recognition and scientific validity through experiments and the endeavors of the International Society for Ecological Restoration (SER). This society has played a pivotal role in disseminating practical knowledge and fostering widespread adoption of ecological restoration approaches. In the context of our study on the island territory of La Réunion, we aim to explore ecological restoration management approaches by examining the diversity of social representations within communities of practice involved in a LIFE program-funded project. Using participatory observation and 36 semi-structured interviews, the study employed cognitive mapping to analyze data. The findings highlight three key components of ecological restoration approaches practiced in the area: (i) management of invasive species, (ii) selection of indigenous plants, and (iii) governance challenges spanning local and European contexts. These contrasting perspectives among actor communities illustrate the complex and varied approaches to ecological restoration, aligning with the study's focus on exploring heterogeneity in restoration strategies.*

Key words: Ecological Restoration, Social Representation, Communities of Practice, Island Territories, Tropical Dry Forest

Introduction

The Anthropocene epoch has witnessed the emergence of humanity as a dominant force, leading to dramatic disruptions in ecosystems and a biodiversity crisis (Bonneuil et Fressoz, 2017). While conservation efforts aim to safeguard these endangered environments, they often appear insufficient or even futile. Indeed, within this intricate, interconnected dynamic, conservation measures alone cannot effectively mitigate the ongoing degradation of habitats. It is in acknowledgment of this sobering reality that the concept of ecological restoration has gained prominence as a timely, coherent, and essential approach, becoming institutionalized at both international and national levels as a critical strategy to address this pressing environmental challenge. This study will examine the social representations of ecological restoration practices in the dry tropical forest through the LIFE+ Forêt sèche project (Aber et Jorddan III, 1985; Higgs et al., 2018; Aronson et al., 2006). Employing cognitive mapping, the research will first investigate the representations held by communities of practice, then detect any potential disparities in order to test the hypothesis of heterogeneity in the perceptions of ecological restoration based on the communities of practice (Abric, 2001; Moliner et Guimelli, 2015; Kosko, 1986; Gray et al., 2013). By delving into the social representations of ecological restoration, the aim is to gain a deeper understanding of how diverse stakeholder groups perceive and approach this critical environmental challenge. This analysis will shed light on the varied perspectives and potential barriers to effective restoration efforts, which is essential for developing more inclusive and successful conservation strategies in the Anthropocene.

Ecological Restoration: Tracing its Evolution and Definition

The origins of ecological restoration remain unclear, but the 1930s were a pivotal period in its development (Jordan and Lubick, 2011; Mc Donald et al., 2016; Miller and Bestelmeyer, 2016). During this time, significant progress was made, including the launch of the Civilian Conservation Corps programs in the United States and Aldo Leopold's groundbreaking experiments to restore prairies in Wisconsin (Alizadeh et al., 2013, Jordan., 2010). At the University of Wisconsin, Professor and botanist Norman Fassett led a large-scale prairie restoration project under Leopold's guidance. Ecologist Dr. Theodore Sperry, an expert in prairie plant roots, played a crucial role in executing this project in 1935, which covered approximately 24 hectares of nearby farmland. However, the task of restoring prairies proved immensely challenging, as Leopold's directive to "Go plant a prairie!" confronted the reality that the once-abundant prairies, spanning over 800,000 hectares, had dwindled to a mere 16 hectares. Nevertheless, the field of ecological restoration has expanded significantly across the globe in the following decades (Curtis, 1959).

Distinguishing ecological restoration and restoration ecology is crucial. While ecological restoration emphasizes practical, hands-on approaches, restoration ecology concentrates on the underlying theoretical and scientific principles. Tracing the origins of the term "restoration" is challenging, yet insightful. As noted in a prominent editorial marking the 25th anniversary of the *Restoration Ecology journal*, the term "restoration" first appeared in documentation about the forests of DeKalb County, Illinois, dating back to 1940 (Higgs et al., 2018). Later, the term was used by scholars George Ward and Paul Shepard at Knox College in 1954. Additionally, Jim and Elizabeth Zimmerman are recognized as pioneers who introduced and promoted the teaching of restoration ecology and related practices at the University of Wisconsin-Madison starting in 1973 (Court, 2012). Restoration ecology emerged as a distinct field thanks to key publications and events in the 1980s. The influential "*Restoration and Management Notes"* journal, edited by Jordan III in 1980, as well as a 1984 symposium led by Gregory Armstrong and Jordan III, helped solidify the discipline's theoretical foundations (Aber et Jordan III, 1985). This was further cemented with the 1987 publication of "*Restoration Ecology: A Synthetic*

Approach to Ecological Research". The expansion of restoration ecology was catalyzed by a groundswell of collective support for acting, particularly through the founding of the Society for Ecological Restoration in the United States in 1988, which mobilized widespread advocacy for the field. The Society for Ecological Restoration (SER) is a leading organization that promotes ecological restoration. With over 4,000 members from 76 countries, SER brings together a diverse group of experts, including scientists, practitioners, administrators, Indigenous representatives, and others. As an authority on ecological restoration, SER collaborates with prominent international organizations like the IUCN, the Convention on Biological Diversity, and the UN. SER's initiatives, such as biennial conferences, aim to foster collaborative networks and facilitate the exchange of scientific knowledge. The international scientific journal *Restoration Ecology*, published since 1993, has strengthened the academic understanding of various restoration-related topics. In 2004, SER released a primer titled "*Primer on Ecological Restoration*" that defined ecological restoration as:

"*Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed."* (SER, 2004).

This definition has been widely accepted and acknowledged. The primer emphasizes that ecological restoration is a deliberate endeavor to initiate or hasten the self-healing process of a degraded ecosystem. To accomplish this change in trajectory, robust prior knowledge, particularly historical data about the ecosystem and its initial dynamics, is crucial.

Initiating a restoration project requires the agreement of all stakeholders to avoid potential issues or cancellations. The plan's design depends on the known causes of ecosystem damage. In some cases, simply removing a specific disturbance, such as a dam, can facilitate the ecosystem's natural recovery. However, complex situations may necessitate long-term interventions, including the introduction, removal, or control of certain species. The plan must define a reference ecosystem, which can be based on a real site, a written description, or a combination of both. While a single reference represents one possible state, it may not capture the full range of ecosystem variations. The SER recommends using multiple reference sites to develop a more comprehensive and realistic plan. These references draw upon various resources, such as descriptions, old photographs, site remains, plant samples, archives, historical accounts, and past data. The more sources utilized, the stronger the reference, which is crucial for restoration and sets the standard for project evaluation. Assessing the success of ecological restoration efforts involves two key questions: whether the established objectives are being met and if the overarching goals are achieved. While goals represent broad ideals, objectives are specific, measurable milestones that guide the restoration process. Unfortunately, environmental disturbances, such as fires, storms, or conflicts, can disrupt restoration trajectories, making the initial objectives unsuitable. To assess restoration objectives, performance standards, also known as success criteria, are developed based on interpretations of the reference state. The Society for Ecological Restoration proposes three evaluation strategies:

1. Direct comparison: The restored site's parameters are compared to the reference state. However, this method may be limited by incomplete information about the reference state.
2. Attribute analysis: SER defines a restored ecosystem using nine attributes (Table 1). While not all attributes are required, some are easily measured, and others are indirectly evaluated. These attributes need explicit descriptions for each ecosystem.

3. Trajectory analysis: Collecting long-term periodic data is considered a promising approach. Myriam Garrouj's thesis (Garrouj, 2019) showed how management choices influence initial restoration trajectories, improving knowledge for future projects.

SER distinguishes ecological restoration from related practices. While rehabilitation focuses on mending processes and ecosystem services without reviving historical integrity, reclamation emphasizes land management, safety, and limited revegetation. In contrast, ecological engineering resolves specific problems, whereas restoration embraces unpredictability and broader goals.

Table 01: The Society for Ecological Restoration's Criteria for Assessing Restored Ecosystem

1	The restored ecosystem contains a representative set of species from the reference ecosystem, establishing a suitable community structure.
2	The restored ecosystem primarily consists of native species. In cultural ecosystems undergoing restoration, non-invasive exotic, ruderal, or segetal species that have likely co-evolved with the area may be included.
3	The restored ecosystem contains all the essential functional groups needed for its stability and development.
4	The restored ecosystem's physical environment can support reproducing populations of key species necessary for ecosystem stability or desired development.
5	The restored ecosystem functions typically in its ecological development stage, exhibiting no signs of abnormal behavior.
6	The ecosystem appropriately integrates within the larger landscape, interacting through biological and physical processes.
7	Risks from the surrounding landscape to the ecosystem's health and integrity have been reduced or removed as much as possible.
8	The restored ecosystem can withstand normal local environmental stresses without losing its integrity.
9	The restored ecosystem is self-sustaining like the reference ecosystem, able to persist indefinitely under current conditions. Its biodiversity, structure, and function may naturally evolve or fluctuate with periodic disturbances. Composition or attributs may change as environmental conditions shift.

The Emergence of Ecological Restoration in France

The 1976 *Nature Protection Law* established a foundation for conservation efforts, including environmental impact assessments, nature reserves, and protected species lists. Subsequently, in 1995, the French government initiated a national research program on ecosystem restoration, leading to the creation of the REVER network (Network for Exchange and Valorization in Restoration Ecology), which was inspired by the Society for Ecological Restoration. In 2016, the Biodiversity Law adopted a "*avoid, reduce, compensate*" approach to biodiversity restoration, but insufficient resources hindered its goals by 2020. The legal framework also sometimes complicates restoration projects, such as those involving wetlands, requiring administrative authorization (Gallet et al., 2017). The REVER network, established in 2008, serves to connect stakeholders, foster consensus on definitions, and promote knowledge sharing, though its national scope has limited impact in overseas territories. In 2018, the French Biodiversity Office launched a €6 million project to support 99 overseas biodiversity restoration initiatives, prioritizing habitat restoration, species conservation, and scientific knowledge advancement in underrepresented regions. Additionally, La Réunion established the Initiative for Insular Ecological Restoration (IRI) in 2020, focusing on both terrestrial and marine habitats. Ecological restoration remains an expanding field in France, relying on knowledge-sharing and adaptable models to address diverse socio-economic and environmental realities.

Study site – Tropical dry forests in Reunion Island

The dry tropical forest of *La Réunion* is one of the most threatened habitats globally (Janzen, 1988; Miles et al., 2006), with a critical conservation status. Its distribution is determined by

hydrological characteristics, with annual rainfall ranging from as low as 500 mm to below 1800 mm (Murphy et Lugo, 1995). The average annual temperatures in this area vary between 18°C and 24°C. The best-preserved remnants of this unique ecosystem are located in the northern part of the island, on steep slopes and rugged ridges of ravines in the La Montagne massif, extending down to the lower areas of the Mafate cirque. The soil of the dry tropical forest is very dry and considered moderately desaturated ferralitic (Riquiet et al., 1975, in Triolo 2005).

Humans have quickly colonized the dry tropical forest to establish settlements and engage in agricultural activities, particularly on the lower slopes. The exploitation of this ecosystem met the need for resources, such as sugar cane and coffee cultivation (Balvanera et al., 2011; Balvanera et al., 2017). Numerous non-native species were also introduced for grazing, and some of them adapted to their new environment, displacing local species and altering the structure and dynamics of the original ecosystems. This degradation and conversion of natural environments led to the irreversible loss of many plant and animal species, some of which played a crucial functional role in the natural regeneration of these ecosystems. While dry tropical forests once dotted the western coast of the island, they now occupy less than 1 percent of their original area (Cadet, 1977; Strasberg, 2005). This alarming degradation is mainly due to the uncontrolled spread of invasive alien species and the occurrence of frequent fires, both of which have caused a significant loss of biodiversity in the dry tropical forests of *La Réunion*. The study site is located between the communes of Saint-Denis and La Possession (Figure 1), and includes the village of La Grande Chaloupe, which has historical significance for the island (Oberlé, 2006; Leveneur, 2007). The village of La Grande Chaloupe has remnants from the period of indentured labor (*Engagisme*), a form of disguised slavery. During this time, foreign workers from various regions, including India, Africa, Madagascar, the Comoros, China, Australia, and Europe, were hired under indenture contracts to work for an employer (figure 2a, 2b).

The LIFE+ Forêt sèche Project: A European Initiative for Ecological Restoration of La Réunion's Dry Tropical Forest

The European Union established the LIFE financial instrument in 1992 to support environmental conservation. LIFE comprises three principal components: "LIFE-Nature" for implementing the Natura 2000 network, "LIFE-Environment" for integrating environmental objectives into European policies and updating environmental policy, and "LIFE-Third Countries" for building administrative capacity and infrastructure for environmental conservation in certain neighboring third countries. The LIFE+ *Forêt sèche* project was part of the LIFE-Nature component, which focuses on conserving natural habitats, wild fauna, and flora, as well as implementing the Natura 2000 network. The project's development benefited from local stakeholder expertise, and the La Réunion National Park coordinated it through a team of five project managers. The project officially commenced in October 2014 for a six-year period, with an initial budget exceeding 3 million euros, half of which came from European funding. Its objective was to "demonstrate an innovative approach for the sustainable conservation of the dry forest of La Réunion and beyond," and it concluded in 2020.

The LIFE+ *Forêt sèche* program was designed as a collaborative, territorial project where various stakeholders played distinct roles. Elected officials and institutional representatives promoted the conservation of this environment in their jurisdictions and provided resources to achieve this goal. National Park agents, municipal nurseries, local companies, and sponsors contributed to the project's ecological work and mobilized civil society to assist in production and planting, with schoolchildren becoming the guardians of the future forest. The project also considered parts of the forest habitat not addressed in the

previous LIFE+ COREXERUN project, including animal species such as the Bourbon green gecko (*Phelsuma borbonica*) and the Aldabra tortoise (*Aldabrachelys gigantea*), which could play a functional role in forest regeneration and invasive species control. The priority was to promote the expansion of this habitat by considering its ecological functions, dynamics, and genetic diversity, with the aim of reconnecting the existing forest remnants with restored environments along the altitudinal gradient. The LIFE+ Forêt sèche project was designed to ensure the long-term protection of the restored forest habitats through the involvement of public land management stakeholders in the La Montagne massif, where nearly 80 percent of these natural areas belong to the state.

Figure 01: Study Area Location (Source: IGN and Natural)

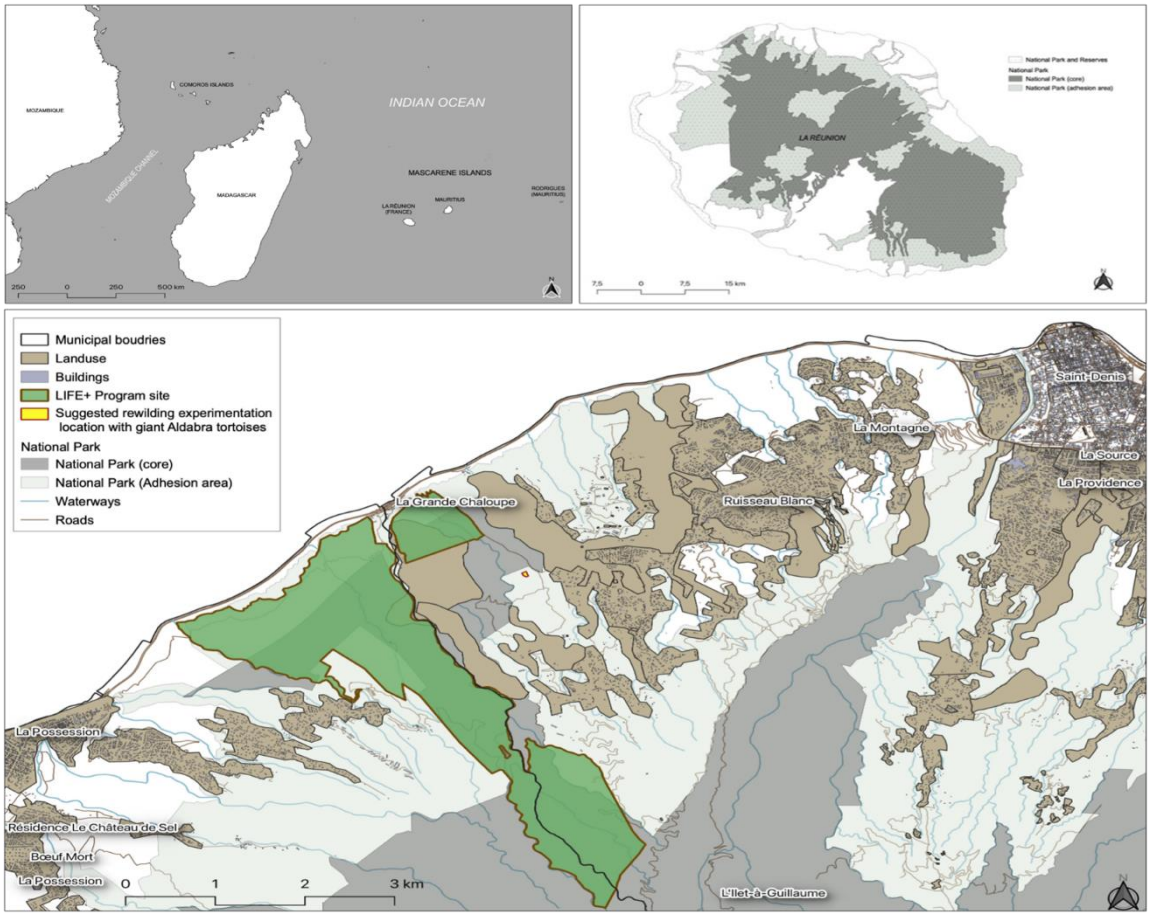


Figure 02: The village of La Grande Chaloupe

(a) (b)

(a) Photograph of Chemin Crémont, also known as Chemin des Anglais, a 18.8 km long road built in 1775; (b) Photograph of the Lazaret of la Grande Chaloupe: one of the quarantine sites used to accommodate indentured laborers to limit the spread of epidemics.

Materials and Methods

Data Collection Methods: In order to investigate social representations of ecological restoration practices, we utilized a "triangulation" approach, drawing upon both quantitative and qualitative data obtained through diverse data collection methods (Dury et al., 2011). The sample of "Community of Practice" (CoP) members was selected through an immersive approach within the national park premises and sites, without restricting the inclusion to only those fully embedded within the institution (Table 2). This approach enabled the identification of a diverse set of stakeholders engaged in the ecological restoration of the dry tropical forest at La Grande Chaloupe.

The data collection process for this study involved preliminary preparation of the survey instrument, with the specific choices guided by the conceptual research framework underpinning the investigation. The framework centered on examining the social representations held by practitioners, researchers, naturalists, and policymakers engaged in the ecological restoration efforts targeting La Réunion's dry tropical forest. The data collection approach comprised two key components: participant observation conducted within the context of the LIFE+ Forêt sèche project from December 2017 to December 2020 (Weiss, 1994; Cicourel, 2004; Manfredo; 2008; Dury et al., 2011), and thirty-six semi-structured interviews with key stakeholders. The participant observation employed an inductive method to identify pertinent stakeholders and develop the interview guide. The interviews ranged from 40 minutes to 1.5 hours in duration. The thesis project context was systematically presented to each participant prior to the interviews, which maintained a neutral approach with open-ended questions. Approximately 40 hours of interviews were recorded during this phase of the research. The interview guide was formulated based on an extensive literature review and covered a wide range of topics:

- Forest dynamics in La Réunion, including tropical dry forests.
- The meaning of ecological restoration in the context of La Réunion, particularly in the LIFE+ Forêt sèche and COREXERUN projects.
- The effectiveness of European and local governance in the ecological restoration efforts of the LIFE+ Forêt sèche and COREXERUN projects.

Data Analysis

Fuzzy Cognitive Mapping is a mental modeling technique employed to analyze and reason about complex systems. It is rooted in fuzzy logic, which enables the representation of relationships between concepts or variables using ambiguous or uncertain values, rather than binary or precise numerical values. FCMs consist of nodes denoting concepts or variables, and weighted links depicting the relationships between these nodes. The link weights are fuzzy values indicating the intensity and direction of the association between the nodes. FCMs are extensively utilized to model complex systems across various fields, such as engineering, environmental management, and social sciences. Bart Kosko, the inventor of fuzzy cognitive maps, introduced this approach in his 1986 publication as a type of artificial neural network capable of representing and reasoning about complex systems using fuzzy logic. Since then, FCMs have been applied in numerous diverse domains, including engineering, environmental management, business, and health. Cognitive mapping is a valuable tool for investigating social representations (Abric, 2001). It can illustrate the intricate relationships between different elements, enhancing our understanding of how people perceive and organize information. Cognitive mapping also enables the visualization of changes in these representations over time. Fuzzy cognitive maps offer a relevant tool for uncovering representations of ecological restoration practices in La Réunion. This semi-quantitative method facilitates a comparative framework between different social groups. The primary objective of the cognitive maps in this study was to describe the perspectives of the

communities of practice on the effectiveness of the ecological restoration practices within the LIFE+ *Forêt sèche* project, as well as to gather their respective opinions on the socio-ecological outlooks following the completion of the work.

Table 02: Socio-demographic characteristics of the Community of Practice (CoP)

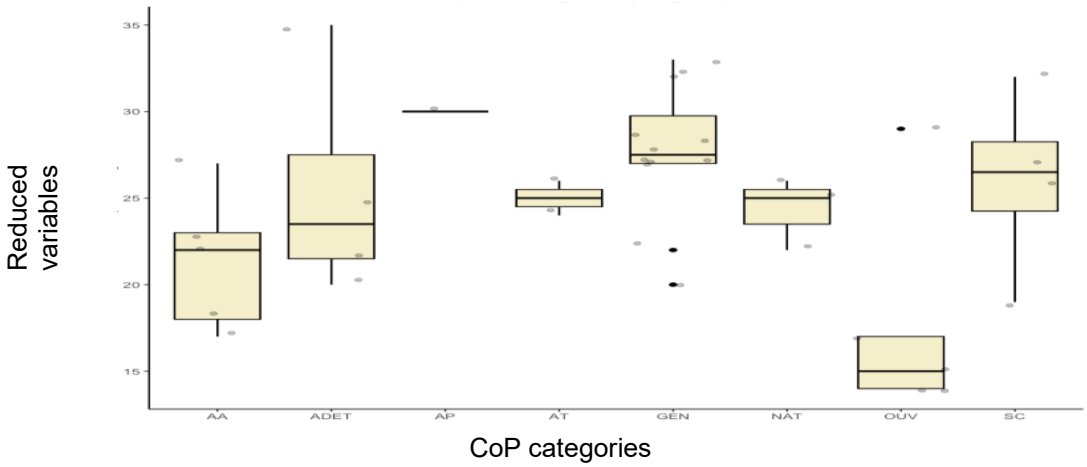
Characteristics		**n**
Associative actor (AA)	Functions	5
Driver of economic and regional development (ADET)		4
Political figure (AP)		1
Community leader (AT)		2
Scientists (SC)		4
Manager of natural areas (GEN)		12
Naturalists (NAT)		3
Natural area workers (OUV)		5
	Gender	
Male		31
Female		5
	Age	
<30		6
31-45		17
46-50		8
>60		6
N		36

The research involved a semi-structured interview process that covered three main themes: the ecosystem dynamics of dry tropical forests in La Réunion, the effectiveness of restoration practices from the LIFE+ *Forêt sèche* and LIFE+ COREXERUN projects, and the socio-ecological outlooks after the project completion. For each theme, specific questions were asked to collect key terms or concepts mentioned by the participants, followed by a numerical evaluation for each key term. The 361 distinct terms collected for developing the cognitive maps were grouped into "reduced variables" to facilitate comparison of the resulting cognitive maps (Soilihi 2018; Vuillot 2015 ; Kermagoret et al. 2016). Although various grouping methods have been reported in the literature, the classic approach of grouping terms based on semantic proximity was selected. Two indices were used to analyze the cognitive maps (Kermagoret et al. 2016): (1) the cognitive complexity index, which represents the number of terms included in each map, and (2) the causality index, calculated based on the average perceptual scores assigned to each term.

Results

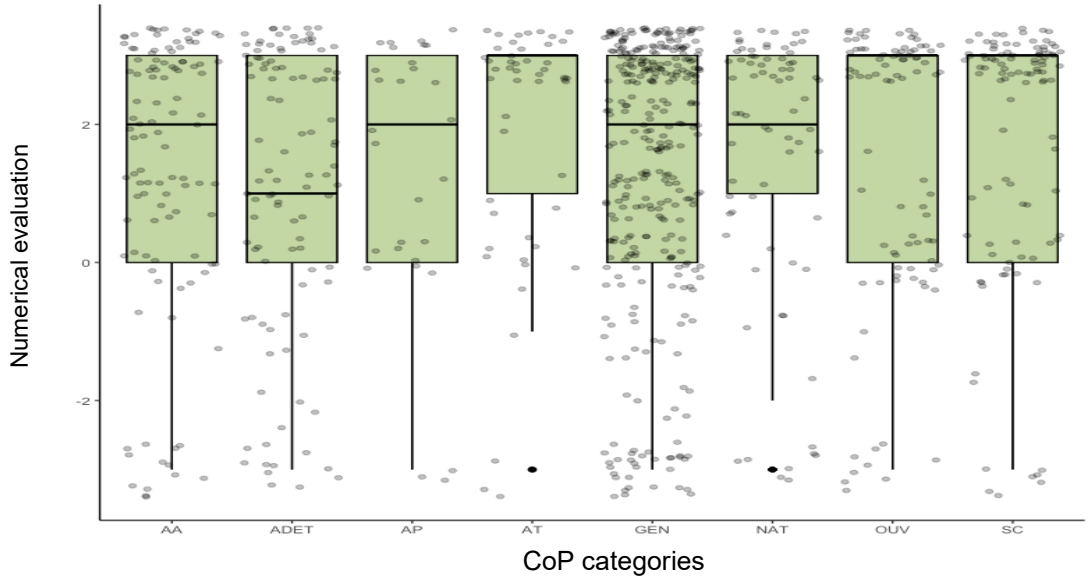
The cognitive complexity indices varied across the different stakeholder groups. The coefficient of determination (R^2) indicates the strength of the linear correlation between the complexity indices for each group, while the Fisher value (F) and p-value represent the statistical significance of this relationship. Notably, the natural space managers exhibited the highest average complexity index at 27.6 words per response, likely due to the broad scope of their field and their diverse expertise in ecological restoration, including both legal and scientific knowledge. The economic and territorial development actors followed closely with an average of 25.5 words, and the researchers and scientists involved in the project averaged 26 words. In contrast, the worker group displayed the lowest cognitive complexity, with an average of 17.8 words.

Figure 3: Boxplot of the Distribution of the Complexity Index by Cop Category



The study utilized the causality index, which represents the "perceived cumulative impacts" on each cognitive map, to quantify the perceptions of ecological restoration among the different actor groups. With an average index of +1.4, the respondents collectively expressed a "positive" perspective on the practice of ecological restoration in the dry tropical forest of La Réunion. This finding suggests that the objectives of the restoration project were broadly shared across the diverse stakeholder groups. However, this interpretation, derived from participant observations, may fail to capture certain nuances in the perceptions held by the various actors.

Figure 4: Boxplot of the Distribution of the Causality Index by Actor Category



Discussion

The study examined the social perceptions surrounding ecological restoration practices in the dry tropical forest of La Réunion, engaging stakeholders across all levels of involvement. Through various analytical approaches, the research identified three overarching themes within the social representations associated with the LIFE+ Forêt sèche and COREXERUN projects:

1. Invasive non-native species management.
2. Plant species selection.
3. Local and European oversight.

Invasive Species Management

The study's findings indicate that the primary social representation of ecological restoration centered on the practice of controlling invasive exotic species. This was reflected in a citation frequency of 80.1 percent among all respondents, despite the diversity of approaches employed in these control efforts. Indeed, control actions accounted for 50 percent of the ecological restoration activities undertaken in the study area. Consequently, the mitigation of invasive species was perceived as a critical element before, during, and after restoration work, constituting a major socioeconomic challenge for all stakeholders involved. It is noteworthy that the French Office of Forestry was the sole contractor responsible for control measures during both the LIFE+ Forêt sèche and COREXERUN projects. Participant observations revealed that this arrangement was a limiting factor in the social relations between the National Park and the French Office of Forestry. Although these social dynamics were not directly addressed in the semi-structured interviews, they were informally discussed during meetings, field visits for monitoring, or project evaluations. As a result, some National Park agents reported instances of unsuccessful control efforts in certain parcels:

"*...the ONF has somewhat aging teams, and it has its own ways of doing things, so it is not always easy to question practices and try to do things differently. But the fact is that we have entered the site and… well, we have gone about 30 meters in, and already we can see… I would say around fifteen patches of the butterfly vine starting to grow… Knowing that it is a highly invasive species capable of completely collapsing a tree canopy... this does not inspire much optimism for the future of the plantings… If there are no more interventions, that is to say, if there is no more maintenance, we can clearly see that the plantation will not have time to develop."*

National Park agent 1

"*…it must have been cut by mistake during the control efforts made by the ONF agents. So, we still find a lot of plants that have been accidentally cut during maintenance, which we definitely cannot blame the ONF agents for, because I think the task is really not easy. But we can still question the relevance of repeating the same actions when... well! We realize that we're causing quite a bit of... there are still some significant damages that are caused by these control techniques, and there hasn't really been any effort to improve or at least to reduce that impact*."

National Park agent 2

The ONF agents also reported encountering difficulties related to the field, describing it as risky and challenging to manage the more resilient invasive species, such as the butterfly vine.

"*The field is complicated and risky... when we encounter wasp nests, we put up caution tape to warn others*."

ONF agent 1

"*Difficult! Especially with the young workers... I see the current generation... how they are... uninterested and lazy with little knowledge about the flora.*"

ONF agent 2

"*... as you can see, this is a new technique for covering the butterfly vine... it slows it down (unpacks the stump) ... the stump isn't even rotten or anything, and it's been a year!*"

ONF agent 1

One of the respondents recommended a practical guide titled "Practical Methodology for the Restoration of Natural Environments in Réunion" developed by the associative group "*Plant'ali*". This guide aligns its methods with the principles of permaculture and proposes interventions at three scales: a broad scale for invaded areas, an intermediate scale for restoration plots, and a 'human' scale that focuses on the individual.

Plant Species Selection

The selection of plant species was a prominent focus in the cognitive mapping analysis. The natural resource managers and scientific experts discussed the diverse endemic and indigenous plant species found on-site, emphasizing their perceived significance for the project's success. They highlighted the ecological importance of these native flora, noting their crucial roles in maintaining the integrity and functionality of the dry tropical forest ecosystem. Specific plant species, such as *Benjoin* and *Dombeya*, were described in detail, with references to their distinctive botanical characteristics, habitat preferences, and ecological relationships. The managers also expressed concerns about the regeneration and mortality rates of certain plant populations, underscoring the need for more comprehensive pedological, entomological, and paleobotanical studies to better understand the complex interactions within the ecosystem and inform effective restoration strategies. The ecological properties of these species were articulated using specialized botanical terminology.

"*You can really sense that we are in different humidity conditions here, because the two that dominate are benjoin and Dombeya. Benjoin, Dombeya, Benjoin, Dombeya, Benjoin again…"*

National Park agent 3.

They focused on the species' phenology and the presence of regeneration seedlings around individual plants, noting that:

"*So, that's no longer a problem with fruiting on-site; now it's more about regeneration*"

National Park agent 3.

However, some actors expressed concerns about the excessive mortality of certain populations, highlighting the lack of existing pedological, entomological, and paleobotanical studies, stating:

"*We're unable to recreate a simple ecosystem because of the complexity of interactions in the soil*"

Scientist 1.

Local and European Oversight

The institutional framework of the LIFE+ Forêt sèche project highlighted the involvement of local and European governance structures. However, the end-of-project evaluation revealed divergent perspectives and tensions among the project coordinators, service providers, and the European Commission, underscoring significant differences in political dynamics and decision-making processes. The evaluation reports had the potential to scrutinize the coherence and rationale behind certain pre-project decisions, thereby exposing the specific actors responsible and potentially subjecting them to increased oversight or accountability. These tensions and divergences reflected the complex interplay of diverse stakeholder interests, priorities, and approaches within the overarching project structure. The evaluation process unveiled the underlying power dynamics and competing agendas that had shaped the implementation and outcomes of the restoration efforts, prompting a closer examination of the institutional and governance challenges inherent in large-scale ecological restoration initiatives.

Conclusion

The study examined the social representations surrounding ecological restoration practices in the dry tropical forest of La Réunion through the LIFE+ Forêt sèche project. The analysis identified three key components of the social representations held by the different stakeholder communities involved: control of invasive species, selection of plant species, and issues of local and European governance. Calculating the index of cognitive complexity related to ecological restoration revealed that natural space managers, scientists, and economic and territorial development actors had the highest indices, suggesting their broader conceptual

understanding reflects their greater involvement and personal commitment. The research findings also indicate that overall, the various aspects of "ecological restoration of the dry tropical forest" are perceived relatively positively by the participants. However, while specific practices like control and planting are viewed favorably, frequent disagreements regarding methods are reported. Notably, "invasive species" or "invasive exotic species" received the most negative perception score.

The analysis of cognitive maps uncovered the heterogeneity of social representations within the LIFE+ Forêt sèche project, underscoring the need to consider diverse approaches to achieve the intended restoration objectives. This suggests that conflict risks are heightened when restoration goals fail to account for the history and individual involvement in the space. Furthermore, the study's participant observations revealed a lack of traditional ecological knowledge, a system of understanding and practices developed by the local population in response to their natural environment, which could significantly contribute to defining reference ecosystems for ecological restoration in Réunion. Incorporating this traditional knowledge, understanding, and consideration could enrich both the theory and practice of ecological restoration, including eco-cultural and reciprocal restoration approaches that better address cultural aspects and the reciprocal relationships between humans and nature.

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