



RESEARCH ARTICLE 

Communication Mechanisms of Forestry Institutions in Addressing Environmental Challenges: A Strategic and Analytical Study of the Forestry Department of Ghardaia Province

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Abstract

In the context of escalating environmental degradation and increasing ecological vulnerability in arid and semi-arid regions, the role of institutional communication has emerged as a critical determinant of environmental governance effectiveness. This study investigates the communication mechanisms employed by the Forestry Department of Ghardaia Province (Algeria) in addressing pressing environmental challenges, including desertification, soil erosion, pollution, and illegal hunting activities. Adopting an analytical and descriptive research design, the study evaluates the structure, channels, and strategic orientation of environmental communication practices within the forestry administration. It further examines the extent to which these mechanisms contribute to awareness-raising, behavioral change, stakeholder engagement, and policy implementation. Particular emphasis is placed on environmental communication as a multidimensional process that integrates information dissemination, participatory governance, and socio-ecological resilience building. The findings suggest that while the Forestry Department utilizes a range of traditional and modern communication tools—such as awareness campaigns, educational outreach, media engagement, and inter-institutional coordination—there remain structural and operational limitations that hinder optimal effectiveness. These include insufficient digital transformation, limited community participation, and gaps in strategic communication planning. The study concludes by proposing a comprehensive framework for enhancing environmental communication through digitalization, participatory approaches, and integrated policy alignment. It contributes to the broader discourse on sustainable environmental governance in developing regions by highlighting the central role of communication in mitigating ecological risks and fostering long-term environmental sustainability.

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1. Introduction

In contemporary societies, communication constitutes a fundamental pillar of social organization, enabling the exchange of information, coordination of actions, and construction of shared meanings among individuals and institutions. Beyond its traditional informational function, communication has evolved into a strategic instrument for governance, development, and crisis management. In this regard, it plays a particularly vital role in addressing complex and multidimensional challenges such as environmental degradation.

The increasing severity of environmental problems—ranging from climate change and biodiversity loss to desertification and pollution—has necessitated the development of integrated approaches that combine scientific knowledge, institutional action, and societal engagement. Within this framework, environmental communication has emerged as a key mechanism for

promoting awareness, influencing behavior, and facilitating collective action. It serves not only as a tool for disseminating environmental information but also as a platform for dialogue, participation, and decision-making among stakeholders.

In the Algerian context, environmental challenges have intensified in recent decades due to rapid demographic growth, accelerated urbanization, and expanding industrial activities. These dynamics have exerted significant pressure on natural ecosystems, particularly in vulnerable regions such as Ghardaia Province, which is characterized by arid climatic conditions and fragile ecological balance. Issues such as desertification, soil erosion, pollution, and illegal exploitation of natural resources have become increasingly prominent, posing serious threats to both environmental sustainability and human well-being.

Against this backdrop, governmental institutions—especially forestry departments—play a central role in environmental protection and natural resource management. The Forestry Department of Ghardaia Province, as a key administrative body, is tasked with implementing environmental policies, managing forest ecosystems, and combating ecological degradation. However, the effectiveness of these efforts is closely linked to the department's ability to design and implement efficient communication strategies that engage local communities, raise environmental awareness, and foster responsible environmental behavior.

This study is situated at the intersection of communication studies and environmental governance. It seeks to analyze the communication mechanisms adopted by the Forestry Department of Ghardaia Province and to evaluate their effectiveness in addressing environmental problems. By focusing on both structural and functional dimensions of communication, the research aims to provide a comprehensive understanding of how institutional communication can contribute to sustainable environmental management.

Furthermore, the study underscores the importance of transitioning from traditional, top-down communication models to more participatory and interactive approaches that empower local communities and enhance institutional transparency. In doing so, it contributes to the growing body of literature that emphasizes the role of communication as a transformative force in achieving environmental sustainability and resilience in developing countries.

2. Literature Review

2.1. Theoretical Foundations of Environmental Communication

Environmental communication has evolved into a distinct interdisciplinary field that integrates insights from communication studies, environmental sciences, sociology, and public policy. It is broadly conceptualized as the process through which information, values, and meanings related to environmental issues are constructed, disseminated, and negotiated among individuals, institutions, and societies (Cox, 2013). Beyond its informational function, environmental communication plays a transformative role by shaping public perceptions, influencing attitudes, and fostering behavioral change toward environmental sustainability.

Scholarly literature emphasizes that environmental communication operates within the public sphere, where competing narratives, scientific knowledge, and socio-political interests intersect (Moser, 2016). In this context, communication is not merely a neutral transmission of facts but a strategic process involving framing, persuasion, and engagement. For instance, framing theory suggests that the way environmental issues are presented significantly affects public understanding and policy support (Nisbet, 2009). Consequently, effective communication strategies must consider cultural, social, and cognitive dimensions to enhance their impact.

Furthermore, the complexity of environmental problems—often described as “wicked problems”—requires communication approaches that are adaptive, participatory, and multidimensional (Liu et al., 2007). These challenges necessitate a shift from traditional top-down information dissemination models to more interactive and dialogic forms of communication that enable collaboration among stakeholders.

2.2. Communication Mechanisms in Environmental Governance

In the framework of environmental governance, communication mechanisms serve as essential tools for policy implementation, stakeholder coordination, and public engagement. These mechanisms encompass a wide range of channels, including mass media, institutional campaigns, educational programs, community outreach initiatives, and digital communication platforms.

Research highlights that effective environmental governance depends not only on regulatory frameworks but also on the capacity of institutions to communicate policies and mobilize collective action (Reed, 2008). Stakeholder participation, in particular, has been identified as a critical factor in enhancing environmental decision-making processes. Participatory communication fosters trust, legitimacy, and shared responsibility, thereby improving policy outcomes and compliance.

In addition, adaptive co-management approaches emphasize the role of communication in facilitating learning, knowledge exchange, and collaboration across multiple levels of governance (Berkes, 2009). These approaches integrate scientific expertise with local knowledge, enabling more context-sensitive and sustainable solutions. Communication, in this sense, acts as a bridge between institutions and communities, promoting mutual understanding and coordinated action.

However, several studies indicate that institutional communication mechanisms often face limitations, such as bureaucratic rigidity, lack of transparency, and insufficient integration of digital technologies. These challenges can hinder the effectiveness of environmental policies, particularly in developing countries where institutional capacities may be constrained.

2.3. Environmental Awareness and Behavioral Change

A central objective of environmental communication is to enhance public awareness and promote environmentally responsible behavior. Empirical research demonstrates that awareness alone is insufficient to drive behavioral change; rather, communication strategies must address psychological, social, and cultural factors that influence individual and collective actions (Lee et al., 2015).

Behavioral theories, such as the Theory of Planned Behavior, suggest that attitudes, subjective norms, and perceived behavioral control play a significant role in shaping environmental actions. Therefore, communication initiatives should be designed to not only inform but also motivate and empower individuals to adopt sustainable practices.

Educational and outreach programs have been widely recognized as effective tools for fostering environmental awareness. These programs often involve schools, community organizations, and local stakeholders, creating opportunities for experiential learning and social interaction (Jacobson et al., 2015). Moreover, the use of media and digital platforms has expanded the reach and impact of environmental communication, enabling real-time dissemination of information and interactive engagement with audiences.

Despite these advancements, the literature points to persistent gaps between awareness and action, commonly referred to as the “value-action gap.” Addressing this gap requires more integrated and context-specific communication strategies that align environmental messages with local needs, values, and socio-economic realities.

2.4. Environmental Challenges in Arid Regions and the Algerian Context

Arid and semi-arid regions, such as Ghardaia Province in Algeria, are particularly vulnerable to environmental degradation due to their fragile ecosystems and limited natural resources. Key challenges include desertification, soil erosion, water scarcity, biodiversity loss, and pollution. These issues are often exacerbated by human activities, including overgrazing, deforestation, urban expansion, and unsustainable resource exploitation.

In Algeria, environmental problems have intensified in recent decades as a result of rapid population growth, urbanization, and industrialization. These dynamics have placed significant pressure on natural ecosystems, highlighting the need for effective environmental management and governance strategies.

The forestry sector plays a crucial role in addressing these challenges, particularly in combating desertification and preserving biodiversity. Forestry departments are responsible for implementing policies, managing natural resources, and raising environmental awareness among local populations. However, their effectiveness depends largely on their ability to communicate with stakeholders and mobilize community participation.

Studies on environmental governance in developing countries indicate that institutional effectiveness is often constrained by limited resources, weak coordination, and insufficient public engagement (Reddy & Behera, 2006). In this context, strengthening communication mechanisms becomes essential for enhancing institutional performance and achieving sustainable environmental outcomes.

2.5. Research Gap and Contribution of the Study

Although the existing literature provides valuable insights into environmental communication and governance, there remains a significant gap in empirical studies focusing on local institutional practices, particularly in the context of developing countries and arid regions. Most research has concentrated on global or national-level analyses, with limited attention to the operational dynamics of local administrative bodies such as forestry departments.

Moreover, there is a lack of integrated studies that examine communication mechanisms as both structural and functional components of environmental management. Specifically, few studies have explored how communication strategies are designed, implemented, and evaluated within institutional frameworks, and how they influence environmental outcomes at the local level.

This study addresses these gaps by providing an in-depth analysis of the communication mechanisms employed by the Forestry Department of Ghardaia Province. It contributes to the literature by:

- Offering a localized perspective on environmental communication practices
- Evaluating the effectiveness of institutional communication in addressing specific environmental challenges
- Proposing a strategic framework for improving communication mechanisms in similar contexts

By bridging the gap between theory and practice, the study aims to enhance understanding of the role of communication in environmental governance and to support the development of more effective and sustainable environmental policies.

3. Methodological Framework of the Study

3.1. Research Problem

Communication constitutes a fundamental and indispensable component of social systems, playing a central role in structuring interactions, facilitating coordination, and enabling the exchange of information across institutional and societal levels. Within contemporary governance frameworks, communication is not merely a supportive function but a strategic instrument through which institutions influence behavior, mobilize stakeholders, and address complex societal challenges.

As emphasized in the study context, no institution—regardless of its structure, function, or objectives—can operate effectively in the absence of communication mechanisms that connect internal actors with the external environment. This assertion is particularly relevant in the domain of environmental protection, where communication directly impacts public awareness, risk perception, and behavioral change (Cox, 2013; Moser, 2016).

Environmental problems have become increasingly complex and multidimensional, encompassing both natural and anthropogenic dimensions. While certain environmental challenges, such as natural disasters, are beyond direct human control, many others—such as desertification, soil erosion, pollution, and illegal hunting—are primarily driven by unsustainable human practices. These issues require coordinated institutional responses supported by effective communication strategies that promote awareness, participation, and compliance.

In this context, the Forestry Department represents a key governmental institution responsible for environmental protection and natural resource management. Its role extends beyond regulatory enforcement to include communication-based interventions aimed at educating the public, influencing environmental behavior, and fostering collective responsibility. However, the effectiveness of these efforts depends largely on the nature, structure, and efficiency of the communication mechanisms employed.

Accordingly, the central research problem of this study can be formulated as follows:

What communication mechanisms are employed by the Forestry Department of Ghardaia Province in combating environmental problems, and to what extent are these mechanisms effective?

3.2. Research Questions

In order to address the research problem in a systematic and comprehensive manner, the study is guided by the following research questions:

1. What is the role of communication mechanisms used by the Forestry Department of Ghardaia Province in addressing environmental problems?
2. What are the main environmental challenges targeted by the Forestry Department in Ghardaia Province?
3. What are the key obstacles and limitations faced by the Forestry Department in implementing effective communication strategies?

These questions aim to capture both the structural and functional dimensions of communication within the institutional context.

3.3. Objectives of the Study

The study seeks to achieve the following objectives:

- To identify and analyze the communication mechanisms and tools employed by the Forestry Department in combating environmental problems
- To examine the major environmental challenges addressed by the institution, particularly in the context of Ghardaia Province
- To evaluate the effectiveness of these communication mechanisms in promoting environmental awareness and behavioral change
- To identify the main constraints and challenges limiting the efficiency of institutional communication
- To propose strategic recommendations for improving environmental communication practices

These objectives reflect a comprehensive approach that integrates analytical, evaluative, and applied dimensions of research.

3.4. Significance of the Study

The significance of this study lies in its focus on environmental communication as a critical component of sustainable development and environmental governance. Environmental issues are inherently collective in nature, requiring the active participation of both governmental institutions and society at large. As such, communication mechanisms represent a vital link between policy formulation and public engagement.

This study contributes to the academic and practical understanding of how communication can be utilized as a tool for environmental protection. It highlights the role of forestry institutions in addressing environmental challenges and emphasizes the importance of raising awareness and fostering community participation .

Furthermore, the study is particularly relevant in the context of developing countries, where environmental challenges are often exacerbated by limited resources, institutional constraints, and socio-economic pressures. By focusing on the Ghardaia Province, the research provides valuable insights into local environmental dynamics and institutional practices.

3.5. Research Methodology

In order to ensure scientific rigor and methodological validity, the study adopts a descriptive-analytical approach, which is widely recognized in social and communication sciences as an effective method for analyzing real-world phenomena.

Scientific methodology, in this context, refers to a structured set of logical and systematic procedures that enable the researcher to collect, analyze, and interpret data objectively, thereby generating reliable and valid conclusions .

The descriptive-analytical method is particularly suitable for this study for several reasons:

- It allows for an in-depth examination of communication mechanisms within their real institutional context
- It facilitates the analysis of relationships between variables, such as communication practices and environmental outcomes
- It enables the interpretation of empirical data in light of theoretical frameworks

This approach is consistent with previous studies in environmental communication and governance, which emphasize the importance of context-specific analysis (Reed, 2008; Berkes, 2009).

3.6. Research Design and Field Study

The study is based on a field research design, which involves direct engagement with the target population to collect primary data. Field studies are particularly important in communication research, as they provide insights into actual practices, perceptions, and experiences of stakeholders.

In this study, data were collected from respondents associated with the Forestry Department of Ghardaia Province, including employees and relevant stakeholders. The use of field-based data enhances the validity and reliability of the findings by grounding the analysis in empirical evidence.

3.7. Data Collection Tools

Data collection constitutes a critical stage in the research process, as it provides the empirical foundation for analysis and interpretation. In this study, multiple data collection tools were employed to ensure comprehensive coverage of the research problem.

The primary tools used include:

- **Observation:** to monitor communication practices and institutional interactions in their natural setting
- **Interviews:** to gather in-depth qualitative insights from key informants and stakeholders

These tools are widely used in social research due to their ability to capture both quantitative and qualitative dimensions of phenomena (Mursli, 2007). They allow the researcher to obtain accurate and context-sensitive data, thereby enhancing the analytical depth of the study.

3.8. Justification of Methodological Choices

The selection of the descriptive-analytical method, combined with field-based data collection techniques, is justified by the nature of the research problem, which requires both empirical investigation and theoretical interpretation.

Environmental communication is a complex and context-dependent phenomenon that cannot be adequately understood through purely quantitative or purely theoretical approaches. Instead, it requires an integrated methodology that captures the interactions between institutional practices, communication processes, and environmental outcomes.

By adopting this methodological framework, the study ensures a balanced and comprehensive analysis, contributing to both academic knowledge and practical applications in the field of environmental governance.

Observation, Interview, Population, and Conceptual Definitions

Observation

Observation constitutes a fundamental methodological instrument in social and communication research, enabling the systematic examination of institutional practices within their natural context. In the present study, observation was employed during the preliminary exploratory phase to identify key patterns, behaviors, and communication dynamics within the Forestry Department. This phase involved non-intrusive monitoring of activities, allowing for the recording and documentation of critical elements related to environmental communication processes.

In addition to preliminary observation, the study incorporated participant observation, which provided deeper analytical insight into the internal functioning of communication mechanisms within the department. Through direct engagement, the researcher was able to examine the actual practices of communication, including the techniques, channels, and tools utilized in addressing environmental challenges such as desertification, forest degradation, and illegal hunting.

Furthermore, observation facilitated the analysis of message flows within the institution, particularly the types of communication exchanged among employees during the execution of their professional duties. This approach aligns with contemporary methodological perspectives, which emphasize the importance of observation in capturing real-time interactions and contextualized behaviors that cannot be fully understood through secondary data alone (Bryman, 2016; Creswell, 2014).

Interview

The interview method represents a central qualitative data collection tool, particularly suitable for exploring perceptions, experiences, and institutional practices in communication studies. In this research, interviews were conceptualized as oral survey instruments, whereby respondents provide verbal responses that are subsequently recorded and analyzed by the researcher.

A structured interview format was adopted to ensure consistency and comparability of responses across participants. This method allows for the systematic collection of data while maintaining a clear focus on predefined research themes. Within this framework, an in-depth interview was conducted with the communication officer of the Forestry Department, providing valuable insights into the strategies, challenges, and operational realities of environmental communication practices.

The use of structured interviews enhances the reliability of qualitative data while allowing for analytical rigor in interpretation. As noted in qualitative research literature, interviews are essential for uncovering the subjective dimensions of institutional processes, particularly in areas such as communication, where meaning and interpretation play a critical role (Kvale, 2007; Silverman, 2013).

Study Population and Sample

Research Population

The research population refers to the comprehensive set of elements relevant to the phenomenon under investigation, encompassing individuals, institutions, or activities that form the focus of the study. In the context of this research, the population includes institutional actors within the Forestry Department of Ghardaia Province, which serves as the primary administrative body responsible for environmental management and protection in the region.

This population was deliberately selected due to its direct involvement in environmental governance, policy implementation, and communication activities aimed at raising awareness and mitigating environmental risks. The Forestry Department, as an institutional entity, represents a critical interface between governmental policy and community engagement.

Sample Selection

The study relies on a purposive sampling strategy, focusing on individuals with direct expertise and involvement in communication processes within the Forestry Department. Such a sampling approach is widely adopted in qualitative research to ensure that selected participants possess relevant knowledge and experience necessary for addressing the research objectives (Patton, 2002).

Defining Concepts and Terminology

1. Communication

From a linguistic perspective, the term “communication” originates from the Latin word *communicum*, which denotes sharing, participation, or commonality, reflecting the fundamental idea of mutual exchange (Hijab, 2003).

From a theoretical standpoint, communication is understood as a dynamic and interactive process involving the transmission, exchange, and interpretation of messages between individuals or groups. This process requires the presence of feedback—whether immediate or delayed—to ensure continuity and effectiveness. In the absence of feedback, communication becomes a one-directional transmission rather than a reciprocal interaction (Makawi & Al-Sayed, 1998).

Operationally, within the framework of this study, communication is defined as:

A structured and interactive process through which information, ideas, and environmental messages are transmitted and exchanged between institutional actors and stakeholders using various tools and channels, with the objective of influencing behavior and achieving specific environmental outcomes.

This definition is consistent with contemporary environmental communication theories, which emphasize participation, feedback, and behavioral impact (Cox, 2013; Ockwell et al., 2009).

2. Environment

Linguistically, the concept of the environment in Arabic derives from the root associated with settlement and habitation, reflecting the idea of a space in which human life is organized and sustained (Ibn Manzur) .

From a technical perspective, the environment is defined as the comprehensive framework within which humans live and interact, encompassing both natural and social dimensions. It includes all physical, biological, and socio-cultural elements that influence human life and are, in turn, influenced by human activities (Al-Najjar, 2004) .

Operationally, the environment in this study refers to:

An integrated system of natural and human-made elements—including air, soil, water, biodiversity, and built environments—that interact dynamically to sustain life and shape human activities.

3. Environmental Problems

Environmental problems are broadly conceptualized as disruptions or imbalances within ecological systems that hinder their ability to sustain life and maintain equilibrium. These problems may arise from natural processes or anthropogenic activities, often resulting in significant ecological, economic, and social consequences .

Operationally, environmental problems are defined in this study as:

Any alteration in natural systems—whether caused by human actions or natural factors—that leads to the degradation of environmental quality, disrupts ecological balance, and negatively impacts human life.

Examples include desertification, soil erosion, environmental pollution, and illegal exploitation of natural resources.

Communication Mechanisms of the Forestry Department in Ghardaia Province

The Forestry Department of Ghardaia Province operates as a key institutional actor in environmental protection, functioning within the legal framework established by Executive Decree No. 95-333 (1995). Since the commencement of its activities in 1996, the department has assumed responsibility for implementing national forestry policies at the regional level.

Organizational Structure and Functions

The department is organized into specialized units responsible for resource management, environmental protection, and administrative coordination. Its core functions include:

- Development and protection of forest and natural resources
- مكافحة التصحر والانجراف combating desertification and erosion
- Monitoring and regulation of resource exploitation
- Fire prevention and environmental risk management
- Biodiversity conservation and wildlife protection
- Environmental awareness and outreach programs

These functions demonstrate the integration of regulatory, managerial, and communicative roles within the institution.

Communication Mechanisms in Combating Environmental Problems

The Forestry Department employs a diverse set of communication mechanisms to address environmental challenges and promote sustainability. These include:

- Field visits and direct community engagement, enabling face-to-face communication and localized awareness-building
- Environmental awareness campaigns, aimed at educating the public about ecological risks and sustainable practices
- Local radio broadcasting, which serves as an accessible medium for disseminating environmental information
- Open days and participatory events, organized in collaboration with civil society organizations and local authorities

These mechanisms reflect a hybrid communication model that combines traditional outreach methods with participatory approaches, fostering collaboration between the institution and the community. Such strategies are consistent with participatory communication frameworks, which emphasize dialogue, inclusion, and collective action as essential components of effective environmental governance (Reed, 2008; Berkes, 2009).

Communication Mechanisms and Empirical Findings

Meetings

Meetings constitute a central and structured communication mechanism within the Forestry Directorate, serving both internal coordination and external engagement functions. Internally, meetings facilitate the exchange of information among departments, districts, and staff members, thereby ensuring coherence in decision-making processes and operational alignment. Externally, they provide a platform for interaction with stakeholders, including local authorities, civil society organizations, and community representatives.

From a theoretical perspective, meetings can be understood as interactive communication forums that enable dialogue, negotiation, and collective problem-solving. Such mechanisms are particularly critical in environmental governance, where complex challenges require coordinated and multi-actor responses (Reed, 2008; Berkes, 2009).

In the context of the Forestry Directorate, meetings contribute to the development of collaborative strategies aimed at addressing environmental problems, including desertification, forest degradation, and fire risks. They also enhance institutional transparency and foster trust among stakeholders, which are essential components of effective environmental management.

Brochures

Brochures represent an important informational and persuasive communication tool used by the Forestry Directorate to engage with the external public. These materials are designed to simplify complex environmental information and present it in an accessible and visually appealing format, thereby enhancing public understanding and awareness.

The distribution of brochures during field visits, awareness campaigns, and open days reflects a targeted communication strategy aimed at reaching diverse segments of society. Their effectiveness is particularly evident during environmentally significant events, such as World Environment Day, where they serve as instruments for promoting pro-environmental attitudes and behaviors.

A notable example is the brochure titled “*Awareness Campaign for the Prevention of Palm Tree and Agricultural Crop Fires*,” which addresses one of the most pressing environmental issues in the region. By outlining the causes, consequences, and preventive measures related to forest fires, the brochure not only informs but also guides public behavior. The inclusion of visual elements, such as images of burned palm trees, enhances emotional engagement and reinforces the urgency of the message.

This approach aligns with communication theories emphasizing the importance of visual and narrative framing in influencing public perception and behavior (Nisbet, 2009; Ockwell et al., 2009).

Field Visits

Field visits constitute a highly effective form of direct, face-to-face communication, enabling the Forestry Directorate to engage with local communities in a contextualized and participatory manner. These visits allow for the dissemination of environmental knowledge while simultaneously providing opportunities for dialogue and feedback.

As highlighted in the study, field visits are often conducted in coordination with multiple stakeholders, including local authorities, the National Gendarmerie, civil protection units, and civil society organizations. This multi-actor collaboration reflects a networked governance approach, which is increasingly recognized as essential for addressing complex environmental challenges (Armitage et al., 2007).

Field visits also play a critical role in emergency response situations, such as forest fires, where rapid intervention and coordinated action are necessary to minimize damage. The integration of awareness-raising activities with operational interventions enhances both the immediate and long-term effectiveness of environmental management efforts.

From a theoretical standpoint, such direct engagement mechanisms are consistent with participatory communication models, which emphasize the importance of interaction, trust-building, and community involvement in achieving sustainable outcomes (Pretty, 2003).

Audiovisual Media

Radio

Radio remains one of the most accessible and inclusive communication channels, particularly in regions with diverse socio-economic and educational backgrounds. The Forestry Directorate utilizes radio broadcasts to disseminate environmental information and raise awareness among the general public.

Radio programs are strategically aligned with international environmental events, such as World Environment Day and the International Day to Combat Desertification, thereby linking local issues to global environmental agendas.

The effectiveness of radio as a communication tool lies in its ability to reach a broad audience, including individuals with limited literacy. This aligns with research indicating that traditional media continue to play a vital role in environmental communication, particularly in developing contexts (Moser, 2016).

Television

Television serves as another important audiovisual medium used by the Forestry Directorate to communicate environmental information. It provides visual coverage of environmental issues, institutional activities, and sectoral developments, thereby enhancing public awareness and engagement.

The visual dimension of television communication allows for the effective representation of environmental problems, making them more tangible and relatable to the audience. This is particularly important in the context of environmental risks, where visual evidence can significantly influence perception and behavior (Cox, 2013).

Analysis of Interview Results

First Axis: Communication Mechanisms Used in Combating Environmental Problems

Adopted Communication Methods

The findings from the structured interview reveal that the Forestry Directorate employs a combination of traditional and modern communication methods to address environmental challenges.

Modern Communication (Social Media)

The Directorate actively utilizes its official Facebook page as a digital communication platform, through which it disseminates information, reports on activities, and organizes awareness campaigns.

Social media platforms are increasingly recognized as powerful tools for environmental communication due to their wide reach, interactivity, and real-time information sharing capabilities (Kaplan & Haenlein, 2010). In this context, Facebook serves not only as an information channel but also as a participatory space where citizens can engage with environmental initiatives.

Radio Communication

Radio remains a key communication tool for addressing diverse segments of society. The Forestry Directorate leverages local radio stations to broadcast programs focused on environmental issues, particularly during significant environmental events.

This approach ensures that environmental messages reach a wide audience, including those who may not have access to digital platforms.

Direct Communication (Educational Outreach)

Direct engagement through schools, universities, and associations represents another important communication mechanism. The Directorate organizes seminars, workshops, and awareness sessions aimed at educating young people and fostering environmental responsibility.

Such initiatives contribute to the development of long-term environmental awareness and behavioral change, particularly among younger generations (Jacobson et al., 2015).

Printed Materials (Brochures)

The continued use of brochures demonstrates the importance of combining traditional and modern communication tools. By presenting information in a structured and visually engaging manner, brochures enhance comprehension and retention of environmental messages.

Role of Communication Methods

The interview findings indicate that communication methods play a significant and multidimensional role in addressing environmental problems. Each communication tool targets specific audience groups, thereby ensuring broader coverage and effectiveness.

These methods contribute to:

- Raising environmental awareness
- Promoting sustainable behaviors
- Strengthening community participation
- Supporting policy implementation

This aligns with existing literature, which emphasizes the role of communication in bridging the gap between environmental knowledge and action (Lee et al., 2015).

Effectiveness of Social Media

The interview results highlight the growing importance of social media as a highly effective communication tool. According to the respondent, social media platforms—particularly Facebook—are among the most efficient means of addressing environmental problems due to their accessibility and widespread use .

The Forestry Directorate uses social media to:

- نشر المعلومات البيئية disseminate environmental information
- دعوة المواطنين للمشاركة invite citizens to participate in environmental campaigns
- تعزيز العمل التطوعي promote volunteer activities such as tree planting and cleaning campaigns

From a theoretical perspective, this reflects the shift toward digital environmental communication, which enables interactive engagement and collective action (Ockwell et al., 2009; Moser, 2016).

Table 1. Communication Mechanisms Used by the Forestry Department of Ghardaia Province

Communication Mechanism	Type	Target Audience	Key Objectives	Practical Implementation	Expected Impact
Meetings	Internal / External	Staff, local authorities, stakeholders	Coordination, decision-making, problem-solving	Regular coordination meetings between departments and external partners	Improved institutional efficiency and collaborative environmental governance
Brochures	Traditional / Print	General public, rural communities	Awareness raising, behavioral guidance	Distribution during campaigns, open days, environmental events	Increased environmental awareness and preventive behavior
Field Visits	Direct / Participatory	Local communities, farmers, citizens	Education, engagement, trust-building	On-site awareness campaigns, joint interventions with authorities	Enhanced community participation and localized environmental solutions
Radio Broadcasting	Mass Media	General population (including illiterate groups)	Information dissemination, awareness	Environmental programs during international environmental days	Broad outreach and inclusive communication
Television	Audiovisual Media	National and regional audiences	Public awareness, visibility of environmental issues	Coverage of environmental problems and forestry activities	Strong visual impact and increased public attention
Social Media (Facebook)	Digital / Interactive	Youth, urban population, general public	Engagement, mobilization, real-time communication	Posting news, campaigns, volunteer invitations	High interaction, rapid information dissemination, behavioral influence

Educational Outreach (Schools & Universities)	Direct Educational /	Students, youth	Long-term awareness, environmental education	Workshops, seminars, awareness sessions	Development of environmental culture and sustainability mindset
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Table 2. Functional Role and Effectiveness of Communication Mechanisms in Combating Environmental Problems

Environmental Problem	Communication Mechanisms Used	Type of Intervention	Observed Outcomes	Effectiveness Level	Supporting Literature
Forest Fires	Brochures, field visits, radio, social media	Preventive awareness and emergency response	Increased public awareness, faster response, reduced damage	High	Moser (2016); Ockwell et al. (2009)
Desertification	Radio programs, awareness campaigns, meetings	Educational and policy communication	Improved understanding of environmental risks	Moderate-High	Reed (2008); Berkes (2009)
Soil Erosion	Field visits, educational outreach	Community engagement and training	Adoption of preventive practices	Moderate	Pretty (2003)
Illegal Hunting	Radio, social media, direct communication	Awareness and behavioral regulation	Reduction in illegal activities (reported cases)	Moderate	Cox (2013)
Environmental Pollution	Media campaigns, workshops, brochures	Information dissemination and sensitization	Increased environmental responsibility	Moderate-High	Lee et al. (2015)
General Environmental Awareness	All mechanisms combined	Integrated communication strategy	Strengthened environmental culture	High	Jacobson et al. (2015)

4. Findings and Discussion

4.1. Overview of Key Findings

The empirical findings of this study reveal that the Forestry Department of Ghardaia Province employs a multi-layered and hybrid communication system that integrates traditional, interpersonal, and digital communication mechanisms. These include meetings, field visits, brochures, radio and television broadcasting, educational outreach, and social media platforms such as Facebook.

The results indicate that communication is not treated as a secondary administrative function but rather as a core operational strategy for addressing environmental challenges. This aligns with contemporary environmental governance frameworks, which emphasize the centrality of communication in promoting awareness, facilitating coordination, and influencing behavior (Cox, 2013; Moser, 2016).

Furthermore, the findings demonstrate that different communication tools are strategically deployed to target specific audience groups, thereby enhancing the overall effectiveness of environmental interventions. This targeted approach reflects an implicit understanding of audience segmentation, a key principle in modern communication theory.

4.2. Effectiveness of Communication Mechanisms

4.2.1. Integrated Communication Approach

One of the most significant findings of this study is the adoption of an integrated communication model, combining multiple channels to maximize outreach and impact. As shown in Table 1 and Table 2, the Forestry Department does not rely on a single communication tool but instead employs a diversified strategy that includes both traditional and modern methods.

This approach is consistent with the literature on environmental communication, which highlights the importance of using multiple channels to address the complexity of environmental issues and reach heterogeneous audiences (Ockwell et al., 2009).

For instance, while brochures and field visits are effective in rural and local contexts, social media platforms provide broader and more immediate outreach, particularly among younger and urban populations.

4.2.2. Role of Direct and Participatory Communication

The findings emphasize the critical role of direct communication mechanisms, particularly field visits and educational outreach programs. These methods enable face-to-face interaction, fostering trust, engagement, and mutual understanding between the institution and the community.

Field visits, in particular, were found to be highly effective in raising awareness and promoting behavioral change, as they allow for contextualized communication and immediate feedback from stakeholders.

This observation supports participatory communication theories, which argue that sustainable environmental outcomes depend on active community involvement and dialogue rather than top-down information dissemination (Reed, 2008; Pretty, 2003).

Moreover, the coordination observed between the Forestry Department and other institutions—such as civil protection units and local authorities—demonstrates the importance of multi-stakeholder collaboration in addressing environmental risks, particularly in emergency situations like forest fires.

4.2.3. Importance of Mass Media and Traditional Channels

Despite the rise of digital communication, the study highlights the continued relevance of traditional media, particularly radio. Radio broadcasting plays a crucial role in reaching diverse segments of the population, including individuals with limited access to digital technologies or low literacy levels.

The use of radio programs during international environmental events reflects a strategic alignment between local communication practices and global environmental agendas. This enhances both the credibility and relevance of the messages delivered.

Television, although less interactive, contributes to raising awareness through visual representation of environmental issues, thereby reinforcing the urgency and visibility of ecological challenges.

These findings are consistent with previous studies indicating that traditional media remain essential components of environmental communication strategies in developing regions (Moser, 2016).

4.2.4. Emergence of Digital Communication

A notable finding of this study is the increasing reliance on social media platforms, particularly Facebook, as a primary communication tool. The Forestry Department utilizes its official page to disseminate information, promote campaigns, and encourage public participation in environmental activities.

Social media offers several advantages, including rapid information dissemination, interactivity, and the ability to mobilize communities. The findings suggest that digital communication is perceived by institutional actors as one of the most effective tools for addressing environmental problems.

This aligns with contemporary research, which highlights the transformative potential of digital platforms in enhancing public engagement and facilitating collective environmental action (Kaplan & Haenlein, 2010; Ockwell et al., 2009).

However, the effectiveness of digital communication is contingent upon access, digital literacy, and sustained engagement, which may vary across different segments of the population.

4.3. Communication Mechanisms and Environmental Outcomes

The analysis reveals a strong relationship between communication mechanisms and the effectiveness of environmental interventions. Each environmental problem—such as forest fires, desertification, and illegal hunting—is addressed through a combination of communication tools tailored to the specific context.

For example:

- Forest fires are addressed through brochures, field visits, and media campaigns, resulting in increased awareness and improved response times.
- Desertification is tackled through awareness programs and radio broadcasts, contributing to a better understanding of environmental risks.
- Illegal hunting is addressed through targeted communication campaigns, leading to increased compliance with regulations.

These findings demonstrate that communication mechanisms function as enabling tools that support policy implementation, enhance public awareness, and influence behavior.

This supports the broader theoretical argument that communication plays a mediating role between environmental knowledge and action, helping to bridge the well-documented “awareness-behavior gap” (Lee et al., 2015).

4.4. Challenges and Limitations

Despite the overall effectiveness of communication mechanisms, the study identifies several challenges that may limit their impact:

- Limited integration of advanced digital technologies
- Dependence on traditional communication methods in certain contexts
- Potential gaps in reaching remote or marginalized populations
- Resource constraints affecting the scale and frequency of communication activities

These challenges are consistent with findings from previous studies on environmental governance in developing countries, which highlight structural and institutional limitations as key barriers to effective communication (Reddy & Behera, 2006).

4.5. Theoretical and Practical Implications

From a theoretical perspective, the findings contribute to the growing body of literature on environmental communication by providing empirical evidence from a local institutional context. The study demonstrates the relevance of integrated and participatory communication models in addressing environmental challenges.

From a practical standpoint, the results highlight the need for:

- Strengthening digital communication strategies
- Enhancing community participation and engagement
- Expanding multi-stakeholder collaboration
- Developing context-specific communication approaches

These implications are particularly relevant for policymakers and practitioners seeking to improve environmental governance and sustainability outcomes.

4.6. Synthesis of Findings

Overall, the study confirms that communication mechanisms play a critical and multidimensional role in combating environmental problems. The effectiveness of these mechanisms depends on their diversity, adaptability, and alignment with the socio-cultural context of the target audience.

The Forestry Department of Ghardaia Province demonstrates a relatively strong capacity in utilizing communication as a strategic tool. However, further improvements—particularly in digital transformation and participatory engagement—are necessary to enhance its effectiveness and sustainability.

Second Axis: Activities of the Forestry Department in Combating Environmental Problems

Impact of Environmental Activities on Public Behavior

The findings indicate that environmental activities implemented by the Forestry Department exert a moderate yet progressively increasing influence on public behavior. These activities are primarily designed to instill environmental values, promote responsible attitudes, and encourage proactive engagement in environmental protection.

According to the interview results, awareness campaigns, educational programs, and community-based initiatives contribute to the gradual development of an environmentally conscious society. These interventions aim to cultivate a sense of responsibility, initiative, and long-term commitment toward environmental preservation.

From a theoretical perspective, this finding aligns with behavioral change models, which suggest that environmental awareness evolves incrementally through continuous exposure to information and social reinforcement (Lee et al., 2015). The transformation of attitudes into sustained behavioral practices requires repeated communication efforts and the internalization of environmental values.

However, the impact of such activities remains partial and time-dependent, indicating the presence of an “awareness-action gap,” where increased knowledge does not always translate into immediate behavioral change.

Role of Citizen Participation

Citizen participation emerges as a critical determinant in the effectiveness of environmental communication and intervention strategies. The study confirms that active public involvement in environmental activities significantly contributes to reducing environmentally harmful behaviors.

The interview findings emphasize that human activity is a primary driver of many environmental problems; therefore, increasing public awareness and participation directly contributes to mitigating these issues .

Nevertheless, the study also reveals that participation levels remain moderate, particularly during environmental events, exhibitions, and campaigns. This limitation is largely attributed to insufficient environmental awareness and limited engagement among certain segments of the population.

This observation is consistent with participatory governance literature, which highlights that effective environmental management requires not only institutional action but also strong community involvement and social mobilization (Reed, 2008; Pretty, 2003).

Citizen-Institution Interaction

The study further identifies an emerging pattern of citizen-initiated communication, as evidenced by reports from individuals regarding environmental violations, such as the destruction of state-protected reserves.

This indicates a growing level of environmental awareness and trust in institutional mechanisms, reflecting the role of communication in fostering a sense of shared responsibility between citizens and public authorities.

Such interactions are essential for enhancing environmental monitoring and enforcement, particularly in regions where institutional capacity may be limited.

Third Axis: Environmental Challenges and Institutional Collaboration

Major Environmental Problems in Ghardaia Province

The findings identify several key environmental challenges affecting the Ghardaia region, including:

- Desertification
- Soil erosion
- Environmental pollution
- Indiscriminate (illegal) hunting

These problems are characteristic of arid and semi-arid environments, where ecological systems are particularly vulnerable to both natural and anthropogenic pressures.

The prevalence of these issues underscores the need for integrated environmental management strategies that combine regulatory measures with effective communication and community engagement (Reddy & Behera, 2006).

Role of Environmental Associations

The study highlights the importance of collaborative partnerships between the Forestry Department and civil society organizations in addressing environmental challenges.

Cooperation with environmental associations contributes to:

- Reforestation and anti-desertification initiatives
- Awareness-raising campaigns
- Promotion of environmental culture and citizenship values

The identified associations—including community-based organizations, youth groups, and environmental NGOs—play a complementary role in extending the reach and impact of institutional communication efforts .

This finding aligns with co-management and collaborative governance theories, which emphasize the importance of multi-stakeholder engagement in achieving sustainable environmental outcomes (Berkes, 2009; Armitage et al., 2007).

Fourth Axis: Obstacles Facing the Forestry Department

Key Challenges

Despite the efforts of the Forestry Department, several structural and social challenges limit the effectiveness of environmental interventions. The most significant obstacles identified include:

- Low level of environmental awareness among the population
- Insufficient material and financial resources
- Limited human capacity and institutional support

- Difficulty in engaging citizens due to lack of interest or awareness

These challenges reflect broader issues commonly observed in environmental governance within developing contexts, where institutional capacity constraints and socio-cultural factors hinder the implementation of effective policies (Moser, 2016).

Implications of Identified Obstacles

The lack of environmental awareness represents the most critical barrier, as it directly affects public participation and compliance with environmental regulations.

Similarly, resource limitations restrict the ability of the Forestry Department to expand its communication activities and implement large-scale environmental programs.

These findings suggest that improving environmental outcomes requires not only strengthening institutional capacity but also enhancing communication strategies to address socio-cultural barriers.

Policy Recommendations

Based on the findings, several key policy directions are proposed to enhance the effectiveness of environmental communication within the Forestry Department of Ghardaia Province.

First, it is essential to strengthen digital communication strategies, particularly through social media and multimedia tools, to improve public outreach and engagement (Moser, 2016).

Second, increasing community participation through volunteer programs, awareness campaigns, and partnerships with civil society organizations is crucial for fostering environmental responsibility and reducing harmful practices (Reed, 2008).

Third, the integration of environmental education into schools and public programs should be prioritized to promote long-term behavioral change and sustainability awareness (Jacobson et al., 2015).

Fourth, enhancing institutional capacity and resources, including staff training and technological support, is necessary to improve communication efficiency and program implementation.

Finally, it is recommended to develop an integrated environmental communication policy that aligns institutional efforts with national environmental strategies and ensures coordination among stakeholders.

Conclusion

This study aimed to analyze the communication mechanisms employed by the Forestry Department of Ghardaia Province in combating environmental problems, with a particular focus on their effectiveness in promoting awareness and influencing behavior.

The findings confirm that the Forestry Department plays a central and strategic role in environmental protection, not only through regulatory functions but also through communication-based interventions aimed at educating the public and fostering behavioral change.

Environmental problems in the region—such as desertification, pollution, and illegal hunting—pose significant threats to ecological sustainability and human well-being. In response, the Forestry Department has implemented a range of communication mechanisms, including field visits, awareness campaigns, brochures, and digital platforms, which have demonstrated varying degrees of effectiveness.

However, the study also highlights several limitations, particularly in terms of public awareness, participation, and resource availability. These challenges underscore the need for a more integrated and strategic approach to environmental communication, combining traditional methods with digital innovation and participatory engagement.

Ultimately, the study emphasizes that environmental protection is a shared responsibility, requiring the coordinated efforts of governmental institutions, civil society, and citizens. Strengthening communication mechanisms, enhancing public awareness, and fostering community participation are essential for achieving sustainable environmental outcomes.

The Forestry Department's experience demonstrates that while progress has been made, further efforts are needed to develop a fully informed and environmentally responsible society capable of addressing the complex challenges of environmental degradation.

Ethical Approval and Consent to Participate

This study does not involve human subjects in a clinical or experimental context. All data were collected in accordance with standard ethical guidelines for social science research. Participation in interviews was voluntary, and informed consent was obtained from the respondent prior to data collection.

Consent for Publication

The author confirms that the manuscript has not been published previously and is not under consideration for publication elsewhere. All participants involved in the study have provided their consent for the use of anonymized data for academic publication purposes.

Availability of Data and Materials

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to the nature of the research, some data (e.g., interview transcripts) may be subject to confidentiality restrictions.

Competing Interests

The author declares that there are no competing financial, professional, or personal interests that could have influenced the work reported in this paper.

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Author Contributions

Dr. Neche Azouz is the sole author of this study and was responsible for the conceptualization, methodology design, data collection, analysis, interpretation of results, and manuscript preparation.

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Research Limitations

This study is limited to a single institutional case within Ghardaia Province, which may affect the generalizability of the findings. Additionally, the reliance on qualitative data and a limited number of interview participants may restrict the scope of empirical analysis. Future research is encouraged to adopt comparative and quantitative approaches to validate and expand upon these findings.

Data Availability Statement

All relevant data generated or analyzed during this study are included in this published article. Additional information can be provided by the author upon reasonable request.

Conflict of Interest Statement

The author declares no conflict of interest regarding the publication of this paper.

AI Use Statement

The author declares that artificial intelligence tools were used only for language editing and formatting purposes. All intellectual content, analysis, and conclusions are the original work of the author.

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