

Guidelines

Exploring the Growing Importance of Forensic Geoarchaeology in Italy

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Abstract: Forensic geoarchaeology provides a comprehensive and interdisciplinary approach to investigating crime scenes. This field combines the techniques and methods of archaeology, geology, geophysics, and remote sensing, to provide a more comprehensive picture of the events that have occurred at a site. Forensic geoarchaeologists can not only provide valuable information about the context of a crime scene but also help reconstruct past events and collect relevant information about missing persons. Moreover, the use of geospatial technologies and the analysis of evidence together with a vast range of scientific methods and techniques help forensic geoarchaeologists provide compelling and reliable evidence before courts and law enforcement agencies. Although some reticence still prevails among Italians about recognizing forensic geoarchaeology as a fundamental discipline vis-a-vis crime scenes, the recognition of its vital significance is growing in Italy, thanks to the decision of the Italian Standards Organization (UNI) to standardize it alongside other fields of criminalistic expertise.

Keywords: forensic geoarchaeology; SOP; Italy; criminalistics; forensic investigations



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1. Introduction

Forensic science and criminalistics commonly adopt methods and approaches from fundamental sciences such as biology, chemistry, physics, geology, and other related fields (e.g., archaeology, anthropology, and taphonomy), tailoring them to address investigative inquiries within the forensic domain [1,2].

In the past, a forensic science team typically comprised a pathologist, a toxicologist, and DNA and fingerprint experts. Nevertheless, with more comprehensive investigations of crime scenes involving missing persons, clandestine graves, and hidden caches, the adoption of geoarchaeological approaches has increased. An initial development involved Patricia Wiltshire's pioneering utilization of palynology at crime locations, resulting in the establishment of a novel applied field known as environmental profiling [3]. This methodology incorporates insights from plant and animal ecology, geology, and pedology to generate circumstantial evidence that aids legal cases, whether for the prosecution or the defense [4–6].

Within modern forensic science, there exists a substantial and significant role for forensic geoarchaeologists to fulfill [1,7–10]. Their involvement might encompass suggesting potential locations for missing persons or clandestine graves to search and rescue teams, employing remote sensors and considering factors such as variations in vegetation growth [11–16]. Similarly, forensic geoarchaeology can involve the use of forensic geophysics such as penetrating radar to forensically investigate the subsoil, fresh water, and construction of walls in a non-destructive manner [10,14,17–24]. It can also help establish a connection between a suspect and a crime scene through the analysis of geological information at the crime scene [8,25,26].

Geoarchaeologists play an indispensable role in reconstructing a precise framework of events and timelines pertinent to the arrangement of a crime scene. In a broader context, geoarchaeological methodology aligns with various applications of archaeological science in crime scenes and forensic contexts [1,2]. Thorough and interdisciplinary science-based procedures are now regularly employed by international law enforcement agencies, governmental bodies, and non-governmental organizations (NGOs), to provide evidentiary backing during legal proceedings [2,27].

However, in Italy, the concept of forensic geoarchaeology has only been discussed in recent times [28,29]. Fortunately, due to the modern and substantial international literature on criminalistics and forensic sciences [30,31], as well as the global advancement of the forensic geoarchaeological field and the improvement in technologies [32,33], Italy too, despite some limitations, is striving to update its protocols in this discipline. This brief paper aims to inform the Italian and international forensic scientific community about the very recent and essential updates related to the development and standardization of forensic geoarchaeology in Italy.

2. Materials for a Standardization

As explained in [28,29], Italy has been gradually venturing into the world of forensic geoarchaeology, attempting to provide some sort of guidelines for crime scene investigations by expanding the holistic approach to crime scenes in various scenarios.

Between the end of 2019 and the beginning of 2020, the Italian Organization for Standardization, UNI—a private non-profit association recognized by the Italian government and the European Union that has been developing, publishing, and disseminating standards in various sectors for over 100 years—made efforts to create a regulation that would bridge gaps in the field of unregulated professional activities, such as those of criminalists. This regulation established requirements for knowledge, skills, autonomy, and responsibility.

To frame the regulation, the UNI formed a working group with experts from different fields (such as crime scene experts, ballistics experts, graphologists, and digital forensics experts), also including, for the first time, forensic geoarchaeologists. After almost two years of work, numerous meetings, and multiple revisions, the regulation came into effect on 15 July 2021 (UNI 11822:2021) [34]. This brief paper will highlight the innovative aspects and protocols established in the field of forensic geoarchaeology at the national level, as a result of this regulation.

The UNI 11822:2021 defines and specifies the requirements for pursuing the profession of a criminalist, beginning with specific tasks and activities and the identification of their content in terms of knowledge and skills. The purpose is to determine the levels of autonomy and responsibility, in accordance with the National Qualifications Framework (Italian QNQ) [35]. These requirements have also been formulated to ensure that the conformity assessment processes are as consistent and transparent as possible.

The Italian QNQ is the tool that describes all the qualifications issued within the national competency certification system. The QNQ relates national qualifications to the European Qualifications Framework (EQF) [36], to coordinate the national qualification system with that of other countries. The purpose of the QNQ is to coordinate all the various systems comprising the entire public offering of lifelong learning and qualification issuance.

The general rules identified by UNI regarding the methodology and structure of all standards related to unregulated professional activities can be summarized as follows:

- Ensure continuous monitoring of the relevant legislative context, at both national and international levels, during the pre-standardization phase, including periodic review of the developed standards;
- Ensure coherence between the EQF and the QNQ, paying attention to terminology; expression of descriptors (knowledge, skills, autonomy, and responsibility); and the application of the principle that “learning outcomes” are more decisive than the chosen

path, to promote the portability of skills among formal, informal, and non-formal areas;

- Involve all relevant stakeholders at various levels as much as possible (e.g., regions and ministries, business representative organizations, labor unions, consumer organizations, professional orders and associations, conformity assessment bodies, NGOs, universities, research institutions, and cultural associations);
- Provide specific indications for relevant conformity assessment processes.

With reference to the Law of 14 January 2013, no. 4 [37], in cases where the standards concern unregulated professional activities, as defined in Article 1 of the same Law, according to the same Article 1, paragraph 4, and Article 6, paragraph 4, these standards are also directed toward consumers/users for their protection. Moreover, according to Article 6, paragraph 3, the standards establish the general principles and criteria for the self-regulated practice of individual professional activity and ensure its qualification.

The regulatory framework for professional activities is also part of the European Union context, serving as a tool for public mobility and the removal of barriers to the free movement of human capital. Further, where considered relevant, the guidelines specified in CEN Guide 14:2010 were followed [38].

3. Results in Defining Specific Standards

In the context of unregulated professions (Law 4/2013 “Provisions concerning unregulated professions” [37]), UNI 11822:2021 defines a criminalist as a professional figure who carries out technical-forensic investigations to verify criminal and/or illicit acts and discover their perpetrator. As a technical expert, a criminalist employs the knowledge and methodologies of forensic sciences within 10 specialist profiles: Crime Scene Analyst, Telephonic and Telematic Data Traffic Analyst, Phonetic Analyst, Anthropometry and Somatic Traits Analyst, Ballistic Analyst, Dactyloscopy Analyst, Digital Forensic Analyst, Geoarchaeologist, Forensic Graphologist, and Transcriptions Analyst.

A criminalist performs autonomous activities but may potentially collaborate with other professionals to fulfill specific tasks at the crime scene. It is worth noting that, in accordance with the legislative context of the aforementioned Law 4/2013, this standard does not apply to members of law enforcement agencies.

With specific reference to forensic geoarchaeology, the standard defines a forensic geoarchaeologist as a criminalist responsible for the acquisition and analysis of remote sensing images and non-invasive geophysical data of the investigated area. This includes systematic reconnaissance and territorial assessment, along with potential stratigraphic excavation of the area. A forensic geoarchaeologist also generates a geographic information system as a reference for the investigative area and collaborates with archaeologists, geologists, and geophysicists as per protocols and best practices.

3.1. Specific Tasks, Knowledge, and Skills of the Professional Figure

3.1.1. Tasks

The 10 profiles are characterized by a set of tasks, classified as listed below:

- Common tasks across all specialist profiles: tasks that can be performed by any criminalist, regardless of their specific specialist profile;
- Specific tasks of the specialist profile: tasks that can be performed by a criminalist based on their specific specialist profile, as each specialist profile is to be considered a separate and independent entity.

The UNI 11822:2021 identifies seventeen common tasks of a criminalist, divided into four process phases inspired by the Deming Cycle (PDCA—Plan, Do, Check, Act) [39]. The four process phases are (i) the initiation of the assignment, (ii) planning, (iii) implementation, and (iv) results delivery.

Specifically, the initiation involves an initial phase of identifying and defining the needs of the interlocutor/client, a second phase of preliminary analysis of the situation, a third phase of information sharing, and a final phase of accepting the mandate. Simi-

larly, the planning phase includes a first phase of acquiring documentation (documents and/or evidence), a subsequent phase of studying and analyzing the context based on the interlocutor/client's needs, and a final phase of assessing the collaboration requirements along with other professional figures. Next comes the implementation phase, consisting of six stages: assessment of information and data, method selection, execution of dedicated techniques relevant to the specific profile, potential collaboration with other professional figures, information and data analysis, and processing of information and data. Last, the results delivery phase involves presenting the outcomes, explaining them, preparing the fee statement, and returning documents and/or evidence.

3.1.2. Knowledge and Skills

To perform the abovementioned tasks, a criminalist must possess knowledge, skills, and competencies at levels 5–6 of the EQF [36]. Specifically, the guiding level of autonomy and responsibility required for a criminalist is associated with level 5 for all profiles, except for the criminalist—an expert in forensic geoarchaeology, for whom, the required level of autonomy and responsibility is higher and associated with level 6 of the same classification.

Tables 1 and 2 list the knowledge and skills required for all 10 profiles including forensic geoarchaeologists.

Table 1. List of knowledge (K) compulsory for the 10 criminalist profiles including forensic geoarchaeologists.

Knowledge	
	K1
Basic knowledge of Criminal Procedure Law	
	K2
Basic knowledge of Civil Procedure Law	
	K3
Basic knowledge of data protection matters	
	K4
Knowledge of major criminalistic theories and best practices, related to various competency areas	
	K5
Knowledge of major communicative and relational theories	
	K6
Basic knowledge of qualitative/quantitative processing techniques for the material to be examined	
	K7
Basic knowledge of the organizational model wherein the interlocutor is situated	
	K8
Knowledge of various operational dimensions relevant to the task	
	K9
Basic knowledge of information sources (open and closed) and personal information sources	
	K10
Basic knowledge of universally accepted forensic sciences within the most reputable scientific communities of reference	
	K11
Knowledge of specific regulations related to fee requests [40]	

Certain elements of knowledge and skills are common to all profiles. Specifically, regarding knowledge, these include (i) knowledge of state-of-the-art technical laboratory practices; (ii) knowledge of procedures for on-site inspections and/or technical surveys (descriptive, fingerprint, three-dimensional models, plans/elevations, video/photography); (iii) knowledge of procedures for documentation and record keeping; and (iv) knowledge of techniques to ensure the chain of custody and replicability of operations. Similarly, regarding the skills common to the 10 profiles, the criminalist must (i) be capable of using technical equipment, (ii) perform on-site inspections and/or technical surveys, (iii) evaluate the on-site inspection and/or the manner and quality of technical surveys, (iv) use procedures for documentation and record keeping, and (v) ensure the chain of custody and replicability of operations.

Table 2. List of skills (S) compulsory for the 10 criminalist profiles including forensic geoarchaeologists.

Skills
S1 Ability to decode the needs of the interlocutor/user
S2 Ability to apply foundational criminalistic theory, with reference to various competency areas
S3 Ability to utilize investigative technical tools
S4 Ability to synthesize essential elements of forensic investigations
S5 Ability to identify significant elements within the context and contextualize them within the specific analysis
S6 Ability to synthesize key findings of investigative research
S7 Ability to identify relevant stakeholders and witnesses
S8 Ability to interpret theoretical sources
S9 Ability to interpret practical sources
S10 Ability to identify material for examination, quantitatively and qualitatively
S11 Ability to process material for examination based on the needs of the interlocutor/client
S12 Ability to communicate with the interlocutor regarding intervention type and potential actions, guiding choices as necessary
S13 Ability to quantify economic and human resources needed for projects/interventions
S14 Ability to estimate timeframes for projects/interventions
S15 Ability to collaborate to achieve common goals, recognize and appreciate others' resources within the interacting professional group, and adapt to the group's needs
S16 Ability to comprehend essential aspects of problems, prioritize, evaluate significant facts, and develop potential solutions, using both experience and creativity to achieve effective solutions within reasonable timeframes
S17 Ability to effectively manage positive and negative emotions across different situations, controlling impulses and responding in a balanced manner, even in stressful scenarios
S18 Ability to express personal viewpoints without dominating others or being dominated, respecting individuality, showing openness, and willingness to review one's own positions if necessary
S19 Ability to listen actively, understand others' viewpoints, respond to feelings and moods even if not explicitly expressed, and build relationships based on mutual respect
S20 Ability to adapt to diverse contexts and requests, facing situations, problems, and non-problems, to achieve expected outcomes
S21 Ability to perform an examination of the adequacy and suitability of available documentation
S22 Ability to perform further examinations of adequacy and suitability of available documentation, if required
S23 Ability to process available information and data
S24 Ability to draft a final report with clarity and objectivity

Table 2. *Cont.*

Skills
S25
Ability to explain results in a contradictory setting when required
S26
Ability to justify fee statement requests related to various characteristic details
S27
Ability to manage the return of documents and/or evidence responsibly and autonomously

This section will focus on the specific knowledge and skills of a forensic geoarchaeologist. Specifically, a criminalist–expert in geoarchaeology must have knowledge of the history of geoarchaeology; the procedures for on-site inspections and technical geophysical, spatial/territorial, and geoarchaeological surveys; the classification systems; the common geophysical and GIS database software; and the techniques for comparison. Moreover, a criminalist–expert in geoarchaeology must possess the ability to conduct and assess on-site inspections and the mode and quality of technical, geophysical, spatial/territorial, and geoarchaeological surveys; recognize and use classification systems; use geophysical and GIS database software; and apply comparison techniques.

3.2. Elements for Conformity Assessment

The UNI 11822:2021 also provides guidelines for the assessment of conformity related to learning outcomes, specifically focusing on the third-party certification process (also known as “certification examination”), in accordance with UNI CEI EN ISO/IEC 17024 [41]. It aims to ensure enhanced uniformity and transparency. The path to the conformity assessment for the criminalist–expert in geoarchaeology, according to the specific reference profile, is described below.

In forensic geoarchaeology, the requirements related to formal learning are the educational qualifications characterized by the achievement of the expected levels of Ks and Ss and the levels of responsibility and autonomy corresponding to EQF 6.

The requirements related to non-formal learning are having attended an advanced training course, a specialization course provided by a university or specified training institution, or courses with a duration of at least 125 h in Geoarchaeology. Finally, the requirements related to informal learning are specified in terms of proven experience, with a minimum of eight expert or consultancy assignments in the specific field carried out in the last five years in case of a bachelor’s degree (level 1); five expert or consultancy assignments in the specific field carried out in the last five years in case of a master’s degree (level 2); or five expert or consultancy assignments in the specific field carried out in the last five years in case of previous affiliation with law enforcement and exclusively in the operational sector relevant to the specialization under examination. For all paths of non-formal learning, one or more courses of the indicated duration are considered acceptable if they have the characteristics of the designation “Training Course/Advanced Training Course/Specialization Course/Master’s Degree” and if they are provided either in classroom or e-learning modes by public universities or Training Institutes recognized by the Italian Ministry of University and Research—MIUR. Demonstration of experience (informal learning) is subject to self-certification of completed assignments related to the procedures or, in the case of former law enforcement personnel, service within the administration’s specialization. For both bachelor’s and master’s degrees, degrees related to the knowledge outlined in this regulation and relevant to the specific profile, subject to conformity assessment, are considered valid.

According to this regulation, different methods have been indicated for the purpose of conformity assessment. First, an analysis of the integrated curriculum vitae, supplemented by documentation and substantiating the work and educational activities declared by the candidate, may be conducted. Second, a written examination may be conducted for the assessment of knowledge, consisting of a test with closed-ended questions: for example, for

each question, at least four answers are provided, of which only one is correct (excluding “true/false” types). Alternatively, a test with open-ended questions may be conducted: for example, the candidate must provide an appropriate response for each question. Third, an oral examination may be held to clarify any uncertainties found in the written tests and/or to delve deeper into the level of knowledge acquired by the candidate. Finally, an analysis and evaluation of completed cases may be requested, including a comparison, in the presence of the candidate, to further assess the candidate’s skills, knowledge, and relational abilities.

The UNI 11822:2021 also describes elements for maintaining the certification, applicable to all specialist profiles, including forensic geoarchaeologists. The maintenance frequency is biennial, and the maintenance method should consider elements such as the absence or proper management of complaints and the presence of a continuous professional development process (lifelong learning): namely, a minimum of 10 h of annual professional updating in the reference subjects of the specific profile, a continuous and documented practice of the profession or an increase in training credits, and a minimum of 20 h of annual professional updating in the case of intermittent activity.

The requirements for certification renewal for a duration of five years, applicable to all specialist profiles including forensic geoarchaeologists, are as follows: a renewal method considering the absence or proper management of complaints and the presence of a continuous professional development process (lifelong learning), i.e., 10 h of annual professional development in the specific profile’s reference areas, the continuous and documented practice of the profession or an increase in training credits, a minimum of three assignments per year, and possible partial re-examination with an oral test. Exceptions can be made for proven impossibility due to maternity, serious health reasons (e.g., illness or injury), or other cases of force majeure, activating a compensatory process.

4. Discussion on Ethical Standards

Along with the specific standards, the UNI 11822:2021 comprehensively outlines aspects that go beyond technical specificities but are integral to integrity, general ethics, and professional ethics.

Specifically, the ethical-value framework, defining the infrastructural elements of a culture of professional integrity, is represented by the relevant indications of Law 04/2013 (Article 1, paragraph 3) [37] and Articles 2, paragraph 2, and 27-bis of the Consumer Code [42]. These indications highlight “safeguarding of human dignity” as the foundational principle of the professional’s activity and, consequently, of “human rights” originating from the same human dignity.

Therefore, the professional is obliged to draw inspiration from and ensure that their activity complies with the Principles of the Italian Constitution [43], the European Convention on Human Rights [44], and the Universal Declaration of Human Rights [45], expressing the universal ethical stance based on respect for and protection of human dignity and fundamental human rights.

In this context, the following professional ethical principles define the universal ethical perspective based on the respect for and protection of human dignity and fundamental human rights [43–45]:

- Principle of respect for human dignity: in every action and intention, for every objective and means, every human being is treated as an end and never as a means;
- Principle of non-maleficence: in all professional activities, any harm to individuals is avoided;
- Principle of beneficence: professional activities should aim to promote the well-being of individuals;
- Principle of integrity: maintain personal conduct standards suitable for a professional in all circumstances, decisions, and behaviors;
- Principle of justice: treat others appropriately as human beings, with fairness and equality;

- Principle of utility: decisions and professional activities should aim to achieve maximum benefit for the greatest number of people, without violating the rights and dignity of each person; and
- Principle of double effect: in decision-making and the conduct of professional activities, avoid foreseeable negative side effects that are disproportionate to the potential benefit derived from the main effect.

Professional values represent valid and functional means for the proper expression of professional activity through which principles are pursued, defined, and ordered, according to the following hierarchy of relevance:

- I. Legality: act in accordance with existing laws and rules;
- II. Sustainability: pursue a development capable of ensuring the satisfaction of the present generation's needs without compromising the possibility of future generations to realize their own;
- III. Social justice: act and engage to achieve a just and equitable society;
- IV. Honesty: act with sincerity and respect promises;
- V. Incorruptibility: act while maintaining independence from private interests;
- VI. Impartiality: act without prejudice and independently of specific group interests, avoiding any form of discrimination and identifying and managing any real or potential conflicts of interest;
- VII. Responsibility and transparency: act in a manner that can be subjected to checks, to justify and explain actions to stakeholders;
- VIII. Competence: act with the necessary knowledge and skills, constantly taking care of personal training and professional updating, to ensure high-quality performance in line with the latest qualifications achieved in professional practice as also analysis techniques and methodologies;
- IX. Service: act usefully and reliably, in accordance with customer preferences, ensuring quality performances and achieving desired goals with the minimum necessary resources;
- X. dedication: act with diligence, enthusiasm, and perseverance; and
- XI. innovation: act with imagination and creativity, inventing or introducing new products, services, or processes capable of generating value for relevant stakeholders.

Finally, the professional deontological code lays down a set of rules and behaviors that represent specific obligations and responsibilities related to the minimum level of acceptable professional conduct. In general terms, the rules' domains can be identified via the intersection of two dimensions: (i) the kind of relationship (professional–client, professional–professional, professional–public) and (ii) the characteristics of professional service (loyalty, service, responsibility, independence, remuneration, advertising).

5. Conclusions

The field of forensic science and criminalistics has evolved over time to incorporate methods and approaches from various fundamental sciences, including forensic geoarchaeology, to provide circumstantial evidence for legal cases.

Forensic geoarchaeologists play a crucial role in reconstructing timelines and events relevant to crime scene arrangement, given the growing demand for comprehensive investigations of various crime scenes. Italy has taken a significant step forward in this field by pioneering standards tailored for forensic geoarchaeologists operating at crime scenes. The UNI 11822:2021 regulation, developed by the Italian Organization for Standardization (UNI), establishes requirements for the professional activity of criminalists, including specialists in various fields such as geoarchaeology. This regulation outlines specific tasks, knowledge, and skills required for each specialist profile, ensuring a consistent and transparent approach to certification.

In this context, the UNI 11822:2021 regulation provides guidelines for conformity assessment, including formal, non-formal, and informal learning paths. These paths ensure that criminalists, including forensic geoarchaeologists, possess the required knowledge

and skills at specified levels of autonomy and responsibility. Additionally, the maintenance and renewal of certification emphasize ongoing professional development and practice to uphold the standards set forth in the regulation.

The ethical and value framework underlying these standards emphasizes the protection of human dignity and fundamental human rights. Criminalists are obligated to adhere to principles such as respect for human dignity, non-maleficence, beneficence, integrity, justice, and utility. These principles are supported by professional values, which guide ethical conduct, competence, responsibility, and innovation.

As forensic science continues to advance and encompass diverse disciplines, Italy's commitment to pioneering and standardizing forensic geoarchaeological practices exemplifies its dedication to advancing the field of forensic science. By creating a structured framework and providing clear guidelines for experts operating at crime scenes, Italy plays a crucial role in ensuring the integrity of investigations and legal proceedings. The UNI 11822:2021 regulation serves as a critical framework for maintaining ethical and professional standards in the field, ensuring the integrity of investigations and legal proceedings. This regulation not only facilitates the development of skilled forensic geoarchaeologists nationally and internationally but also contributes to the delivery of justice through evidence-based practices and methodologies that reduce wrongful investigations and miscarriages of justice.

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