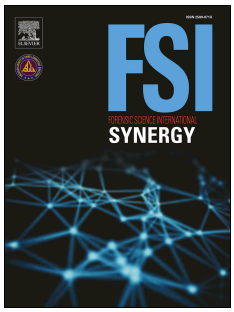
Journal Pre-proof



Perspectives on the Establishment of a Canadian Human Taphonomic Facility: The Experience of REST[ES]

Emily L. Pecsi, Gilles Bronchti, Frank Crispino, Shari L. Forbes

PII: S2589-871X(20)30056-5

DOI: https://doi.org/10.1016/j.fsisyn.2020.09.001

Reference: FSISYN 118

To appear in: *Forensic Science International: Synergy*

Received Date: 28 May 2020

Revised Date: 2 September 2020

Accepted Date: 2 September 2020

Please cite this article as: E.L. Pecsi, G. Bronchti, F. Crispino, S.L. Forbes, Perspectives on the Establishment of a Canadian Human Taphonomic Facility: The Experience of REST[ES], *Forensic Science International: Synergy*, https://doi.org/10.1016/j.fsisyn.2020.09.001.

Full Length Article– Forensic Science International: Synergy

Perspectives on the Establishment of a Canadian Human Taphonomic Facility: The Experience of REST[ES]

Authors: Emily L. Pecsi[a*], Gilles Bronchti[a], Frank Crispino[b], Shari L. Forbes[b]

emily.pecsi@uqtr.ca, gilles.bronchti@uqtr.ca, frank.crispino@uqtr.ca, shari.forbes@uqtr.ca

Affiliations :

[a] Département d'Anatomie, Université du Québec à Trois-Rivières, 3351 boulevard des Forges, Trois-Rivières, Québec G8Z 4M3, Canada

[b] Département de Chimie, biochimie et physique, Laboratoire de recherche en criminalistique, Université du Québec à Trois-Rivières, 3351 boulevard des Forges, Trois-Rivières, Québec G8Z 4M3, Canada

* Corresponding author

Key Words:

Human decomposition, forensic taphonomy, body donation, human ethics, social acceptability

Highlights:

- Establishment experience of REST[ES];
- Difficulties with government approbations;
- Facility infrastructure, health and security measures;
- Body donation program and requirements;
- Social acceptability initiatives.

Full Length Article– Forensic Science International: Synergy

Perspectives on the Establishment of a Canadian Human Taphonomic Facility: The Experience of REST[ES]

Abstract:

REST[ES] is the first Canadian human taphonomic facility (HTF) dedicated to research and training relating to human decomposition in a northern temperate climate. The following paper outlines the measures taken to successfully establish, open and operate this novel Canadian HTF with particular focus on: project team and partnerships, facility location, approvals and permits, infrastructure and social acceptability. It is intended that our experience of establishing REST[ES] may serve as an example to help others with the establishment of future HTFs, thus contributing to the expansion in the global accessibility to human decomposition research and training.

1.0 Introduction

In the early 1980s, Tennessee based forensic anthropologist Dr. William M. Bass opened a pioneering outdoor laboratory at the University of Tennessee, Knoxville where semi-controlled human decomposition research was conducted [1]. Observations from the first eight years of studies concluded that several factors such as temperature, humidity, soil characteristics and necrophagous scavenger activity significantly influenced the decomposition rate of human bodies. It was noted that the majority of these influencing factors varied spatially, thus it was hypothesized that the processes of human decomposition would differ from one region to another [2]. Similar facilities in regionally distinct locations of the United States subsequently opened in order to conduct human decomposition studies in alternative environments. A comparative study at the San Marcos facility noted that the semi-arid climate and Texan fauna resulted in accelerated decomposition rates when compared to those recorded in Tennessee [3,4]. As a result, decomposition researchers and specialists now strongly advise against the extrapolation of decomposition data to incomparable eco-geographic regions [2,5]. The confirmed regional variability in human decomposition has further promoted the opening of seven additional research facilities throughout the United States, as well as one each in Australia and the Netherlands (Table 1).

These sites, often referred to as human decomposition facilities, or human taphonomic facilities (HTF) as used herein, permit researchers to conduct studies involving decaying bodies for regionally specific applications in the fields of forensic science, search and recovery, anthropology, archaeology and numerous other disciplines. The majority of research projects are focused on enhancing the methods used for victim recovery, victim identification and time-since-death estimation. The resulting knowledge and techniques significantly aid forensic science,

police and recovery teams in suspicious death cases involving crime, accidents or mass disasters. These facilities also provide realistic training simulations for law enforcement agencies. There is additional potential for facilities to expand their training services to the military, search and recovery teams, scene of crime officers, students and more [6]. Despite the importance and need for these installations globally, many countries and climatic regions still lack HTFs for research and training purposes.

In the absence of a HTF, many researchers continue to use human analogues such as dogs, cats, rodents, monkeys, deer and most commonly domesticated pigs (*Sus scrofa*) as decomposition research test subjects [7,8]. These studies can benefit from using animal remains, since it is argued that they provide larger sample sizes and greater homogeneity due to similarities in genetics and rearing conditions between individuals [9,10]. However, animal carcasses have been shown to decompose at different rates to human cadavers within the same environment due to variations in gastrointestinal bacteria and scavenger feeding preferences [7,11]. Although animals are credible subjects for pilot testing and method development, it is recommended that techniques and concepts be validated on human cadavers prior to applications in the field or in a court of law [11].

The unreliability of human analogues in combination with eco-geographical variability supports the need for additional HTFs in distinct environments. Unfortunately, progress has been slow in many parts of the world because the successful installation and operation of a HTF is dependent on a myriad of cultural, social, financial, political, ethical, legislative, and environmental factors. Attempts to open facilities in different climatic regions in the past have failed due to some of these complexities. For instance, a Nevada facility failed to open since adequate funding was unable to be obtained [12]. Plans for a second Tennessee facility at the

Carson-Newman University were abandoned due to strong public opposition and the filing of a lawsuit by the local community. Furthermore, a facility at the University of California, Davis was forced to close by administration after an incident where individuals in a hot-air balloon complained about seeing the bodies deposited at the site from the air [13]. Due to such events and complexities, the global HTF network for human decomposition research and training remains limited.

2.0 REST[ES]: The First Canadian HTF

Opened in 2020, REST[ES] (*Research in Experimental and Social Thanatology / Recherche en Sciences Thanatologiques [Expérimentales et Sociales]*) is a HTF located within the province of Québec, Canada. The facility is affiliated with the *Université du Québec à Trois-Rivières* (UQTR) and is intended to additionally be utilized by law enforcement and forensic agencies across Canada. Bodies that are placed at REST[ES] are exclusively donors registered with the willed body donation program of the *UQTR Laboratoire d'Anatomie*. REST[ES] was established to cater to a range of decomposition research interests centered around human decomposition under a Canadian northeastern temperate/continental climate [14,15]. REST[ES] intends to host a variety of training for police, search and recovery teams, military, cadaver detection dogs, and university students. Additionally, REST[ES] aims to use its scientific research activities as a catalyst for philosophers, sociologists, historians and even artists to explore death, dying and decomposition from the perspective of the humanities. This duality in natural and social science research is reflected in the name of the facility and its acronym.

This article aims to recount the major processes, decisions and challenges involved in the establishment of Canada's first HTF, while additionally highlighting measures that were unique

to REST[ES] and the province of Québec. Some elements described were modelled off the experiences of establishing human and animal taphonomic facilities in the United States [16], United Kingdom [17] and Australia. The experience of establishing REST[ES] may similarly help with the development of future HTFs by providing our perspective on certain complexities and obstacles involved in the establishment process, especially in Canada and the province of Québec.

2.0 The Establishment of REST[ES]

2.1. Formation of a multidisciplinary team & partnerships

The establishment of a HTF is a large endeavour that requires a diverse range of skills, knowledge and expertise. The formation of a multidisciplinary team for REST[ES] was found to be the most efficient way to address and delegate project tasks. Researchers in domains related to forensic sciences were recruited early in the process in order to identify and promote the research needs of the facility. These researchers further acted as representatives of the project to the public and media as they were capable of advertising the importance and application of the facility. Legal advisors were added to the team in order to navigate complex legislature, laws and regulations, as well as to draft and submit legal documents required for the establishment and operation of the facility. Likewise, financial advisors assisted with the management of funds and expenses since the establishment of a HTF can be relatively costly [18]. Engineers and architects were also included to draft plans and select construction materials for building the physical infrastructure. Environmental, public health and security specialists were often consulted to conduct risk and impact assessments relating to potential contamination and the safety of researchers, donors and the surrounding community. Finally, a project coordinator was

designated to manage the team's responsibilities, timelines, meetings and correspondences in order to ensure the successful opening of the facility.

The formation of partnerships and collaborations with external organisations and institutions was extremely beneficial to the establishment of REST[ES]. It was advantageous to all parties involved since it encouraged the sharing of knowledge, ideas and resources. For instance, a partnership with the *Société du parc industriel et portuaire de Bécancour* led to the donation of land and the sharing of associated hydrogeological and ecological information. Collaborating with the national police academy of Québec additionally allowed REST[ES] to offer alternative applications beyond research (i.e.: use as a police training center). The affiliation to pre-existing, well-respected institutions further helped to increase the public's trust in REST[ES] and its activities.

2.2. Facility location, approvals & permits

The most difficult and lengthy step in the establishment of REST[ES] was the determination of a suitable plot of land and the acquisition of required approvals and permits. This step was found to be the most challenging due to the particular needs of an HTF and its nonconformity with current regulatory definitions and procedures. Regulators sometimes try referring to the cemetery industry as a close approximate since they are often more familiar with their establishment and associated risks [19]. Unfortunately, traditional cemeteries differ significantly from HTFs, particularly in the use of caskets, burial vaults, embalming and pesticides in landscaping [20,21].

Complying with regulatory bodies at the local, state/provincial and national level was necessary for establishing a safe and legal facility, and for adhering to the federal funding

agencies framework for responsible conduct of research (including human ethics). The majority of ministerial requests required the lot number of the proposed site in order to evaluate compliance with the applicable rules and regulations. The search for land was therefore one of the first major steps taken in the establishment process for REST[ES]. Consultations with provincial police (Sûreté du Québec) revealed that, within the scope of suspicious death investigations, bodies in a state of decomposition are more often discovered in a remote, forested area. Consequently, only sites within forested areas were considered for REST[ES] in order to ensure that the environment held both research and training value in Québec. The forest canopy provided the additional benefit of acting as a barrier against photos being taken from the air using drones and recreational aircrafts. When searching for suitable land, it was necessary to verify that the potential lot was not located within a protected area (i.e.: area of conservation, national park) or contained any protected or endangered species and/or habitats (i.e.: wetlands). It was also requested by the environmental authorities that the site not be located in proximity to any waterways, large bodies of water, or drinking sources (i.e.: stream, river, lake, aquifer) in an effort to minimize the risk for potential contamination [17]. Furthermore, it could not be located in proximity to potential flood zones and/or highly populated or frequented areas (i.e.: recreational trails, busy roads, etc.).

Conflicts between zoning and land usage rights excluded many prospective sites. REST[ES] was categorized as an industrial project by the *Ministère de l'Environnement et de la Lutte contre les changements climatiques du Québec* (provincial ministry of environment) since its activities did not coincide with the other official land use categories (residential, commercial, agricultural). Land zoned for industrial use was therefore required for REST[ES]. Requesting a change in zoning was possible but was quickly excluded as an option due to the associated costs

and lengthy processing delays. The requirement for guaranteed long-term land use (min. 25 years) by REST[ES] also became a requirement after an available lot was rejected due to future construction and development plans in the area that may have necessitated eviction.

A 1600 m^2 lot within the *Parc industriel et portuaire de Bécancour* (Bécancour, Québec) was ultimately chosen as the site for REST[ES] (Figure 1B). The site lies within a young (30-50 years) mixed temperate forest dominated by maple and white spruce trees on soil with a sandy-loam texture and a minimal incline (≤ 2%). The site is located along an uninhabited road in an industrial parc approximately 25 km from UQTR (Figure 1A). The provincial ministry of environment was consulted soon after the site was chosen to ensure that it adhered to the requirements needed to obtain the necessary authorizations for an industrial project. Past vegetation and ecological surveys conducted by the industrial park suggested the presence of seasonal swamplands (wetlands) in the area. This prompted the ministry of environment to request an extensive hydrogeological study prior to construction of the facility in an effort to verify that potential biological contaminants from decomposing bodies would not enter the water table or small streams in the vicinity. The ministry of environment further evaluated and later approved the site as posing little to no negative risk to the surrounding environment, including fauna and flora. Research on the environmental impact of this facility is ongoing to monitor any variation in soil or groundwater content over time. Addressing this current gap in knowledge and providing evidence on the potential long-term environmental impacts of our HTF could limit the future need for new facilities to conduct costly and lengthy environmental risk assessments in Canada.

In concordance, the provincial ministry of health, *Ministère de la Santé et des Services Sociaux du Québec* was approached to certify that the facility and its protocols posed no

significant risk to the health of the public and those working within the HTF. Guidelines on grave construction and body handling by the World Health Organisation and the Pan American Health Organisation were consulted for strategies on how to protect public health [22,23]. Protective health measures adopted by REST[ES] for all staff and research personnel include: vaccination against tetanus, Hepatitis A and B; wearing of full personal protective equipment (i.e.: Tyvek suits, double latex gloves, surgical mask, safety glasses) when handling donors or material contaminated with decomposition products; proper biohazard disposal of all potentially contaminated material; and wearing of ankle-length waterproof boots that remain within the facility at all times. The security measures (i.e. infrared cameras, electronic access) and emergency protocols (i.e. in case of intrusion, fire, flood, etc.) implemented at the facility were also validated for efficacy to protect the safety and privacy of donors, facility personnel and the local community.

2.3. Facility infrastructure

The presence of cadavers within a HTF has the potential to attract curious intruders and scavengers. Uncontrolled human or animal activity not only introduces additional variables to decomposition research, but it also disrupts the privacy, dignity and integrity of donors. Many infrastructure characteristics of REST[ES] were purposely implemented to help reduce the occurrence of such disturbances. For security, the facility is enclosed by 7-foot-tall anti-climb fence equipped with horizontal barbed wire and a view-obstructing shade cloth. The fence is buried a residual 2 feet below ground as recommended by Bytheway et al. (2015) in order to impede burrowing animals. An electric fence was added to the facility's perimeter in an effort to hinder any large carnivores in the area (i.e.: bears, coyotes) from approaching the facility. Bilingual (French/English) signage posted on the exterior of the facility informs potential

198 passersby of trespassing penalties and contact details for further information. REST[ES] is
monitored by infrared surveillance cameras that are housed in a protective heated structure for
200 when external temperatures fall below 0°C (32°F), as they regularly do during winter in Québec.
Entry to the facility is limited to authorized personnel who have been granted electronic access
202 after completing an induction training on safety, security and ethical practices. Furthermore, all
donors at REST[ES] are placed under anti-scavenger cages in an effort to preserve donor
204 integrity by preventing the scattering of remains.

Functional elements were also integrated into the infrastructure of REST[ES]. An
206 insulated building was installed on the premise to serve as a storage unit for research equipment
and consumables. Biohazard waste is temporarily stored but removed at the end of each day and
208 discarded through the normal university protocol. Unlike the facilities in the USA, an indoor
laboratory for cleaning, analysis and curating of skeletal remains was not included at REST[ES]
210 due to legislation prohibiting the long-term retention of remains (see following section). All
laboratory work is carried out at the university campus in appropriately-certified biosafety
212 laboratories.

A modular weather station with sensors for temperature, rainfall, humidity, solar
214 radiation, wind speed and direction, was mounted within the facility in order to record site-
specific meteorological data for research applications. Wells of approximately 7m deep were
216 installed for the ministry requested hydrogeological survey. Two experimental wells and one
control well are respectively located within the interior and exterior of the facility. The wells
218 have been retained to be used for continuous groundwater monitoring to study the leaching of
potential decomposition-related contaminants over time.

220 REST[ES] is accessible by car from the main road via a gravel driveway that is secured by an electronic gate. A contracted private snow removal company ensures that the path is
222 cleared during the winter months to maintain access for researchers, staff, trainees and donor transport. Walking paths within the facility have been established and are cleared of snow by
224 staff and/or researchers so that donor deposition locations are easily reached by foot without contamination of other deposition sites.

226 *2.4. Body donation*

Human bodies need to be ethically and legally acquired in order to conduct human
228 decomposition research or training in a HTF. In the experience of REST[ES], it was necessary to affiliate with the pre-existing willed body donation program of the UQTR teaching and research
230 human anatomy laboratory. The UQTR body donation program already had the protocols, permits, equipment, infrastructure and personnel needed to accept, transport, store and process
232 cadavers, prior to their transferral to REST[ES]. Provincial licensing restrictions on body procurement, storage and use for teaching and research purposes further required REST[ES] to
234 fall under the management of an educational institution [24]. The university's proximity to REST[ES] eliminated the need for an on-site indoor laboratory and morgue. In accordance with
236 article 64 of the Québec Funeral Operations Act, all body transportation on public roads to and from REST[ES] and/or the university are carried out by a funeral service contracted by the
238 UQTR anatomy laboratory [25]. The pre-existing donation program additionally holds a registry of potential donors who have consented to donating to REST[ES], thus greatly reducing the time
240 between the opening of the facility and the deposition of the first donor.

The Québec civil code (CCQ-1991, a.43) states that individuals of 14 years or older in age, a parent or guardian for those younger or incapacitated, have the right to consent verbally or in writing their desire to donate their body for scientific purpose [26]. Informed consent is therefore practiced by REST[ES] and by the UQTR anatomy laboratory through the distribution of an information booklet, donor registration forms and donor cards. To ensure that the donor's last wishes are respected, they are encouraged to share their decision and receive approval from family and next of kin. Disputes over the disposition of the deceased can be distressing to the bereaved, and often places the university staff and researchers in a difficult position. It is important for the donor to understand that at the time of death, their family or next of kin can rescind the donation if they choose. Donors are also urged to organize alternative funerary plans in the event that their donation is unable to be accepted at the time of death.

As with all research involving human participants in Québec, inclusion and exclusion criteria have been established for ethical, safety and experimental reasons. Donors suspected of carrying any major infectious disease (i.e.: HIV, Hepatitis, COVID-19) are rejected in order to protect the health of staff and researchers [18]. For decomposition research, donors may be rejected if their body is embalmed, already displays signs of decomposition or has been subjected to recent physical trauma (i.e.: accident, burn, surgery, autopsy, organ donation). Major wounds can serve as a point of entry for microbes, insects and scavengers, which can alter decomposition rates and therefore impact experimental results [11,27]. Exceptions may be made if a proposed study is specifically investigating the impacts of trauma on the process of decomposition. Emaciated donors are not accepted as they are known to undergo minimal decomposition in comparison to larger individuals [28]. Donors located outside of the province of Québec are unfortunately rejected because section 126 of the Québec Regulation Respecting

the Application of the Funeral Operations Act requires coroner authorization for out-of-province body transportation, which can involve lengthy delays during which time the first signs of decomposition often appear (typically 48-72 hours) [29]. All costs associated with body transport, processing, storage and final disposition of accepted donors is absorbed by the university.

All staff, researchers, trainees and collaborators who enter the facility are required to adhere to a strong code of ethics that promotes donor respect and dignity. Personal photos of any kind are prohibited within REST[ES]. Only approved research-related photographs may be taken of the donors using cameras registered to the facility. This policy is intended to prevent the publication of potentially harmful or disrespectful photos of donors to social or other media. Due to the provincial legislation, donors remains can only be retained on-site for a maximum of 3 years, after which their remains are collected for cremation. Donors can choose to consent to a longer period of retention which is particularly beneficial for REST[ES] given the research impact on the search for, recovery and identification of victims with extended post-mortem intervals. Donor cremains are returned to the family or next of kin. Unclaimed donor cremains are buried with funerary rites at the St-Michel cemetery (Trois-Rivières, Québec). All donors are commemorated at an annual ceremony at the university to which family and friends are invited.

2.5. Social acceptability

The social acceptability of research and activities at a HTF is highly important to its success since a negative public reception can result in the cessation of development or the subsequent closure of a facility. Public acceptability not only reduces the risk of protests against the facility, but it also helps gain community support which can facilitate the acquisition of

approvals and funding. Seeking the public's acceptance of REST[ES] was achieved by building trust through consultation, transparency and dissemination of information. University administration, partners, law enforcement, municipal committees, regional catholic diocese and local residents were routinely consulted throughout the process in order to avoid unintended disrespect or conflicts. Holding regular meetings with these groups, especially early in the conception of REST[ES], allowed for the easy resolution of public disagreement or apprehension. Discussions with officials also helped reveal important regulations and procedures relevant to the construction and operation of REST[ES].

Being transparent about the activities, projects and protocols of a HTF can reduce the development of potentially damaging suspicions or rumours. Acceptance is more readily received when the public understands the purpose and importance of HTFs and the impact of carrying out both experimental and social research relating to death and decomposition. Information concerning REST[ES] was disseminated to the public by various methods including a website, media coverage, public presentations and information sessions. Extensive local media coverage and the sharing of information took place significantly before the establishment and opening of REST[ES] (> 1 year before). This provided sufficient time for the public to react and have their questions, opinions and concerns properly addressed.

Fortunately, the public of the city of Trois-Rivières, Bécancour, and surroundings were extremely receptive to REST[ES] and its activities. The decision to construct REST[ES] in a largely unoccupied section of an industrial park resolved the majority of concerns raised, which were often related to decomposition odor, increased insect and scavenger activity, criminal behaviour and environmental contamination. Otherwise, REST[ES] received an overwhelmingly positive reception with many citizens enquiring about donor registration. In the future,

REST[ES] researchers wish to additionally evaluate, through surveys and focus groups, the local population's perception and attitude towards death and decomposition in an effort to better understand the sociocultural factors involved in the social acceptability of HTFs in Québec and other regions of Canada. The ongoing promotion of REST[ES] to the general public is equally important and is being achieved through a dedicated website, regular media coverage, and public presentations by the Director and team members.

3.0 Conclusion

The research and training that takes place at HTFs are imperative to the advancement of methods, techniques and practices involved in suspicious death investigations and victim recovery in regionally distinct environments and terrain. The establishment of REST[ES] is providing the first opportunity to study human decomposition in a temperate Canadian setting and explore the impact of extreme seasonal conditions (i.e.: +40°C/104°F in the summer to -40°C/-40°F in the winter) on decomposition processes. Projects aimed at evaluating insect succession, odour generation, soil microbiology, fingermarks, facial reconstruction, DNA degradation, biochemical markers, and vegetation changes are already in progress at REST[ES]. Due to the novelty of the facility and research in Canada, donors are currently only surface deposited, unclothed and in a prone position, in an effort to reduce variability and collect baseline data. Other arrangements involving clothing, shallow graves and alternate body positions will be studied in subsequent years once a general understanding of human decomposition at REST[ES] is achieved. Human remains detection (HRD) dog training for provincial and federal police K-9 units has already commenced at REST[ES]. Exposing

Canadian HRD dogs to scent profiles that better reflect realistic scenarios will help to improve detection accuracy and field performance [30].

The success of REST[ES] serves as a proof-of-concept that HTFs can effectively be established in Québec given the current laws, regulations and sociocultural climate. The experience of REST[ES] ultimately highlighted the many challenges of obtaining all mandatory approvals. The uncommon needs and activities of HTFs, more often than not, do not fall within the scope of pre-existing government, regulatory and construction procedures. This can lead to lengthy delays and unforeseen expenditures, particularly with regards to requested environmental impact assessment studies. However, the adopted project team and partners, facility infrastructure, body donation program and social acceptability initiatives ultimately assisted positively in the establishment and operation of REST[ES]. Although every HTF is its own unique enterprise, many commonalities occur between facilities, especially since already established facilities are willing to share advice and recommendations on undertaking such an endeavour. The realisation of REST[ES] and the sharing of its experience is intended to help the establishment of future Canadian HTFs by providing foresight on the processes and potential challenges involved. Any contribution to the global expansion of the HTF network will fundamentally help to bring peace and justice to victims of crime, war, accidents or mass disasters.

5.0 Tables and Figures

Table 1 *– Human decomposition facilities that are in operation as of 2020.*

Name	Location	Affiliation	Opening
Anthropology Research Facility (ARF) / Forensic Anthropology Center (FAC)	Knoxville, Tennessee, USA	University of Tennessee, Knoxville	1981
Forensic Osteology Research Station (FOREST)	Cullowhee, North Carolina, USA	Western Carolina University	2007
Forensic Anthropology Research Facility (FARF)	San Marcos, Texas, USA	Texas State University	2008
Southeast Texas Applied Forensic Science (STAFS)	Huntsville, Texas, USA	Sam Houston State University	2008
Complex for Forensic Anthropology Research (CFAR)	Carbondale, Illinois, USA	Southern Illinois University	2010
Forensic Investigation Research Station (FIRS)	Whitewater, Colorado, USA	Colorado Mesa University	2012
Australian Facility for Taphonomic Experimental Research (AFTER)	Sydney, New South Wales Australia	University of Technology Sydney	2016
Forensic Research Outdoor Station (FROST)	Marquette, Michigan, USA	Northern Michigan University	2017
Amsterdam Research Initiative for Sub-surface Taphonomy and Anthropology (ARISTA)	Amsterdam, Netherlands	Amsterdam Medical Center	2018
Buckingham Environmental Forensics Facility	Fort Meyers, Florida, USA	Florida Gulf Coast University	2018
Recherche en Sciences Thanatologiques [Expérimentales et Sociales] (REST[ES]) Facility	Trois-Rivières, Québec, Canada	Université du Québec à Trois-Rivières	2020
Florida's Forensic Institute for Research, Security, and Tactics (F1RST)	Land O' Lakes, Florida, USA	Pasco Sheriff's Office and Florida Gulf Coast University (FGCU)	2020

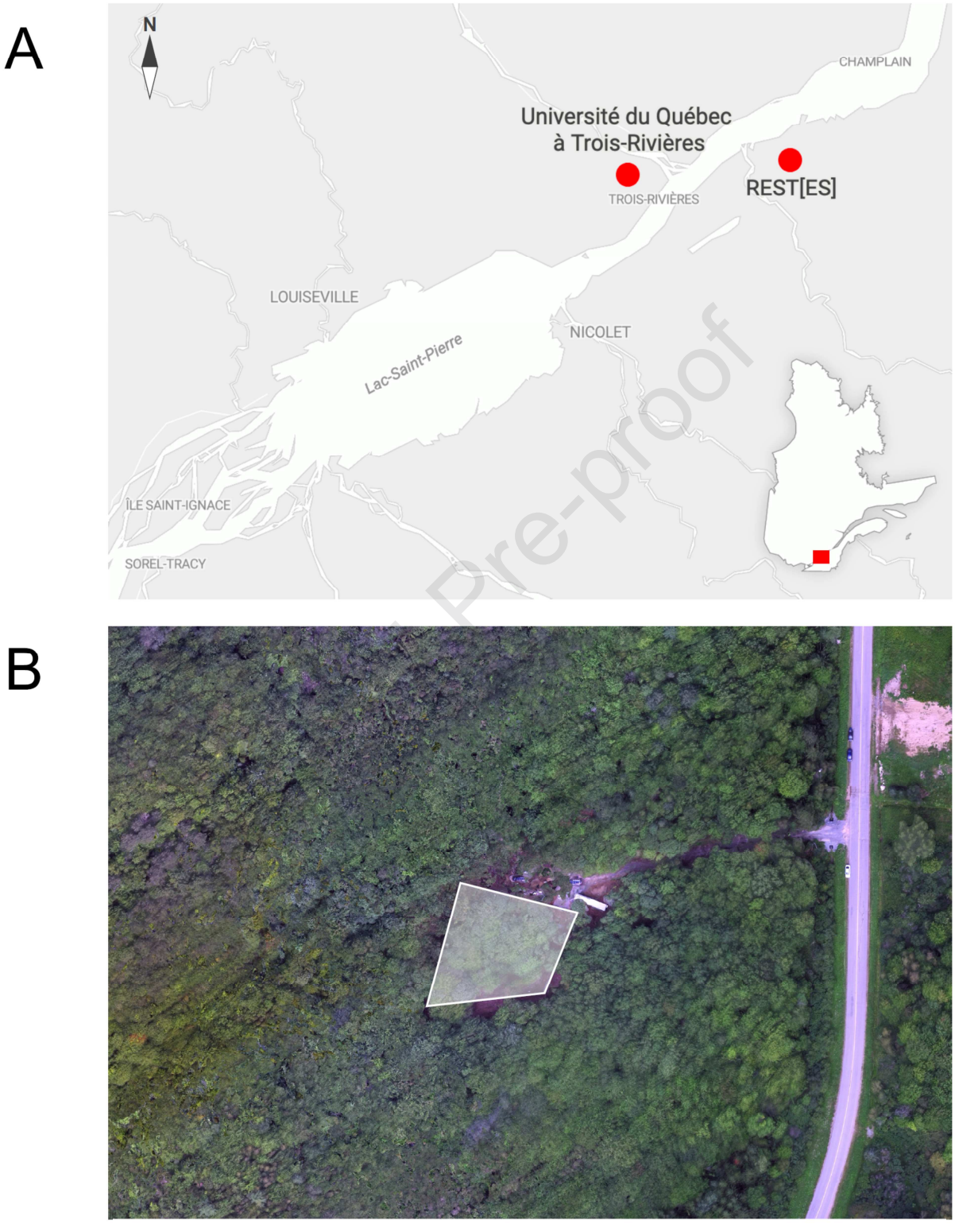


Figure 1 – A) Approximate location of REST[ES] and the affiliated *Université du Québec à Trois-Rivières* within the province of Québec, Canada. B) Drone image of the forested area in which the high-security, fenced terrain for REST[ES] is situated (white box). Image courtesy of: Maxime Clermont.

6.0 Funding Sources & Competing Interests

This research was financially supported by: Canada 150 Research Chair in Forensic Thanatology [C150-2017-12], The Natural Science and Engineering Research Council (NSERC) Discovery Grant Program [RGPIN-2019-06098, 2019], Les Fonds de Recherche du Québec (FRQ) AUDACE Program [2019-AUDC-262767, 2018] and La Fondation UQTR [2018]. The funding agencies had no role in the writing of this manuscript or the decision to submit this article for publication. The authors have no competing interests to declare.

7.0 References

[1] G.M. Vidoli, D.W. Steadman, J.B. Devlin, L.M. Jantz, History and Development of the First Anthropology Research Facility, Knoxville, Tennessee, in: Taphonomy of Human Remains: Forensic Analysis of the Dead and the Depositional Environment, John Wiley & Sons, Ltd, 2017: pp. 461–475. https://doi.org/10.1002/9781118953358.ch35.

[2] R.W. Mann, W.M. Bass, L. Meadows, Time Since Death and Decomposition of the Human Body: Variables and Observations in Case and Experimental Field Studies, J. Forensic Sci. 35 (1990) 103–111. https://doi.org/10.1520/JFS12806J.

[3] A.M. Sears, Decomposition in Central Texas and Validity of a Universal Postmortem Interval Formula, Unpublished Thesis, Texas State University, 2013. https://digital.library.txstate.edu/handle/10877/4621 (accessed October 13, 2019).

[4] J.K. Suckling, M.K. Spradley, K. Godde, A Longitudinal Study on Human Outdoor Decomposition in Central Texas, J. Forensic Sci. 61 (2016) 19–25. https://doi.org/10.1111/1556-4029.12892.

[5] S. Forbes, Body Farms, Forensic Sci Med Pathol. 13 (2017) 477–479. https://doi.org/10.1007/s12024-017-9924-z.

[6] R.M. Johnston, The Operation of Body Farms - Learning Points for Setting up a Human Taphonomy Facility in the UK, Winston Churchill Memorial Trust, 2017. https://www.wcmt.org.uk/fellows/reports/operation-body-farms-learning-points-setting-human-taphonomy-facility-uk (accessed March 31, 2020).

[7] A. Dautartas, M.W. Kenyhercz, G.M. Vidoli, L. Meadows Jantz, A. Mundorff, D.W. Steadman, Differential Decomposition Among Pig, Rabbit, and Human Remains, J. Forensic Sci. 63 (2018) 1673–1683. https://doi.org/10.1111/1556-4029.13784.

[8] K.L. Stokes, S.L. Forbes, M. Tibbett, Human Versus Animal: Contrasting Decomposition Dynamics of Mammalian Analogues in Experimental Taphonomy, J. Forensic Sci. 58 (2013) 583–591. https://doi.org/10.1111/1556-4029.12115.

[9] B. Ehrenfellner, A. Zissler, P. Steinbacher, F.C. Monticelli, S. Pittner, Are Animal Models Predictive for Human Postmortem Muscle Protein degradation?, Int J Legal Med. 131 (2017) 1615–1621. https://doi.org/10.1007/s00414-017-1643-1.

[10] G.E. McClearn, The Relevance of Animal Models for Human Populations, in: Cells and Surveys: Should Biological Measures Be Included in Social Science Research?, National Academies Press (US), Washington, DC, 2001.

[11] M. Connor, C. Baigent, E.S. Hansen, Testing the Use of Pigs as Human Proxies in Decomposition Studies, J. Forensic Sci. 63 (2018) 1350–1355. https://doi.org/10.1111/1556-4029.13727.

[12] A. Goldman, Bone-dry Dreams of a Body Farm, Las Vegas Sun. (2008). https://lasvegassun.com/news/2008/mar/24/bone-dry-dreams/ (accessed October 17, 2019).

[13] S. Lane, Planting a Body Farm, Chico News & Review. (2017). https://www.newsreview.com/chico/planting-a-body-farm/content?oid=459061 (accessed October 17, 2019).

[16] J.A. Bytheway, M. Connor, G.R. Dabbs, C.A. Johnston, M. Sunkel, The Ethics and Best Practices of Human Decomposition Facilities in the United States, Forensic Sci. Policy Manage. 6 (2015) 59–68. https://doi.org/10.1080/19409044.2015.1064190.

[17] P. Cross, T. Simmons, R. Cunliffe, L. Chatfield, Establishing a Taphonomic Research Facility in the United Kingdom, Forensic Sci. Policy Manage. 1 (2010) 187–191. https://doi.org/10.1080/19409041003653095.

[14] 2018 Annual Climate Trends and Variations Bulletin, Environment and Climate Change Canada, 2019. https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations/annual-2018-bulletin.html (accessed March 31, 2020).

[15] M. Amani, S. Mahdavi, M. Afshar, B. Brisco, W. Huang, S. Mohammad Javad Mirzadeh, L. White, S. Banks, J. Montgomery, C. Hopkinson, Canadian Wetland Inventory Using Google Earth Engine: The First Map and Preliminary Results, Remote Sens. 11 (2019) 842. https://doi.org/10.3390/rs11070842.

[18] N.S. Klein, A Comparative Study of Human DecompositionResearch Facilities in the United States: The Role of"Body Farms" in Forensic Applications, LSU Masters Theses, Louisiana State University, 2014. https://digitalcommons.lsu.edu/gradschool_theses/2487 (accessed March 31, 2020).

[19] J. Żychowski, T. Bryndal, Impact of Cemeteries on Groundwater Contamination by Bacteria and Viruses - A Review, J Water Health. 13 (2015) 285–301. https://doi.org/10.2166/wh.2014.119.

[20] A.L. Spongberg, P.M. Becks, Inorganic Soil Contamination from Cemetery Leachate, Water, Air, & Soil Pollution. 117 (2000) 313–327. https://doi.org/10.1023/A:1005186919370.

[21] W. Gwenzi, Autopsy, Thanatopraxy, Cemeteries and Crematoria as Hotspots of Toxic Organic Contaminants in the Funeral Industry Continuum, Science of The Total Environment. (2020) 141819. https://doi.org/10.1016/j.scitotenv.2020.141819.

[22] A.S. Üçisik, P. Rushbrook, The Impact of Cemeteries on the Environment and Public Health: An Introductory Briefing, World Health Organization, Copenhagen, Denmark, 1998. https://apps.who.int/iris/handle/10665/108132 (accessed March 31, 2020).

[23] O. Morgan, M. Tidball-Binz, D. van Alphen, Management of Dead Bodies after Disasters: A Field Manual for First Responders (2ed.), Pan American Health Organisation, Washington, DC, 2006. https://www.paho.org/disasters/index.php?option=com_content&view=article&id=673:management-of-dead-bodies-after-disasters&Itemid=924&lang=en (accessed March 31, 2020).

[24] Regulation respecting the application of the Act respecting medical laboratories and organ and tissue conservation, R.R.Q., 1981, c. P-35, r. 1, s. 99; O.C. 1557-87, s. 16; S.Q. 2013, c. 28, s. 204; O.C. 670-2017, s. 5. http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/L-0.2,%20r.%201 (accessed August 31, 2020)

[25] Funeral Operations Act, SQ 2016, A-5.02., c. 1, a. 64. http://legisquebec.gouv.qc.ca/en/ShowDoc/cs/A-5.02 (accessed August 30, 2020).

[26] Civil Code of Quebec, CQLR CCQ-1991, c. 64, a. 42; I.N. 2014-05-01; 2016, c. 4, s. 6. http://legisquebec.gouv.qc.ca/en/showdoc/cs/ccq-1991 (accessed August 30, 2020).

[27] C. Zhou, R.W. Byard, Factors and Processes Causing Accelerated Decomposition in Human Cadavers - An Overview, J Forensic Leg Med. 18 (2011) 6–9. https://doi.org/10.1016/j.jflm.2010.10.003.

[28] M.T. Ferreira, E. Cunha, Can We Infer Post Mortem Interval on the Basis of Decomposition Rate? A Case from a Portuguese Cemetery, Forensic Sci. Int. 226 (2013) 298.e1-298.e6. https://doi.org/10.1016/j.forsciint.2013.01.006.

[29] Regulation respecting the application of the Funeral Operations Act. CQLR c A-5.02, r, O.C. 1194-2018, s. 126. http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/A-5.02,%20r.%201(accessed August 30, 2020).

[30] D. Natasha & V. Brian. (2017). Human Remains Detection: Validity of RCMP Dog Training Using Donated Human Remains Through the Nova Scotia Medical Examiner Service. Journal of Forensic Identification. 67. 498-518.