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Digitising Legacy Field Survey Data: A Methodological Approach Based on Student Internships

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Abstract: In the Mediterranean, field survey has been the most widely used method to detect archaeological sites in arable fields since the 1970s. Through survey, data about the state of preservation of ancient settlements have been extensively mapped by archaeologists over large rural landscapes using paper media (e.g., topographical maps) or GPS and GIS technologies. These legacy data are unique and irreplaceable for heritage management in landscape planning, territorial monitoring of cultural resources, and spatial data analysis to study past settlement patterns in academic research (especially in landscape archaeology). However, legacy data are at risk due to often improper digital curation and the dramatic land transformation that is affecting several regions. To access this vast knowledge production and allow for its dissemination, this paper presents a method based on student internships in data digitisation to review, digitise, and integrate archaeological primary survey data. A pilot study for Central–Southern Italy and the Iberian Peninsula exemplifies how the method works in practice. It is concluded that there are clear benefits for cultural resource management, academic research, and the students themselves. This method can thus help us to achieve large-scale collection, digitisation, integration, accessibility, and reuse of field survey datasets, as well as compare survey data on a supranational scale.

Keywords: field survey; GIS; map; landscape archaeology; heritage management; internship; digitisation; Mediterranean; regional comparative analysis

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1. Introduction

The rural landscape is a very vulnerable type of cultural heritage [1]. The traces impressed by past human dwellings on the natural environment are fragile evidence of the ability and intellectual creativity of their former builders. Relicts of settlements, field systems, and other infrastructures (e.g., roads, channels) can be detected while walking in the field through survey. These sites provide important data about the communities living in the countryside over time and their endeavours to adapt to new challenges and exploit the land for survival and growth. The Mediterranean area is exceptionally rich in agrarian landscapes with archaeological sites, but several are at risk of destruction by natural processes, climate change, or human transformations through development, combined with other threats, such as the destruction of sites by environmental disasters and wars [2–5]. In this paper, a methodological solution is presented to unlock the power of legacy survey data for archaeological research and heritage management in landscape planning. The method presented is based on student internships for the digitisation of primary field survey data and is demonstrated with two practical case studies in Central–Southern Italy and the Iberian Peninsula.

The field survey conducted consists of walking in large rural regions, usually in teams following regular lines [6–9] (Figure 1). By observing the soil surface, archaeologists can detect ruins or concentrations of artefacts, the remains of walls or floors that have surfaced by ploughing, and/or erosion from (buried) archaeological sites. These finds are a sound indicator of the presence of archaeological heritage located underneath or in the surroundings of their discovery. Since the 1970s, data about the state of preservation of ancient settlements have been massively mapped by archaeologists during field surveys over large rural landscapes in the Mediterranean [10,11]. These raw data are important for both territorial monitoring of cultural resources in heritage management (by showing where archaeological remains are located, the future impact of landscape changes to sites can be better anticipated, managed, and guided [12–19]) and landscape archaeology (these data underpin ancient settlement patterns and can be used in regional analyses of large-scale/long-term cultural phenomena, such as colonisation, migration, land-use, environmental changes, and economic production (e.g., Refs. [20–37]; for an overview of Mediterranean surveys: Ref. [11]).

Figure 1. Archaeologists during a field walking survey in Molise (Central–Southern Italy). Picture by Rogier Kalkers.

The dramatic soil consumption affecting the Mediterranean in recent decades (e.g., Ref. [38]) has called for action to map ancient ruins to preserve archaeological sites at least by record before it is too late (see the discussion on anthropogenic impact to rural landscapes in Refs. [39,40]). The growing urbanisation and use of mechanized intensive agriculture in recent decades have had detrimental effects on both heritage management and landscape archaeology. First, field surveyors have attempted to map as many archaeological remains/sites as possible before (or while) sites being destroyed or damaged by tractors, bulldozers, deep-ploughing, and construction works [10,41–43]. This rescue operation has yielded unique information about the location and characteristics of buried sites, which is vital for territorial monitoring of archaeological resources in planning sustainable landscape developments [44,45]. Second, this call for action has activated a flourishing and still-ongoing season of methodological experiments of field survey techniques for landscape archaeology specifically tailored to the investigation of ancient Mediterranean occupation patterns [8,9,11].

The method presented in this paper does not try to halt landscape changes. Instead, it supports adaptable, context-specific landscape planning and management strategies for cultural heritage through the use of survey data [46]. More precisely, this method allows access to and sharing of (legacy) survey data, with special attention to those originally collected in regions that have witnessed drastic transformations in recent decades. Considering the extent of destruction that has recently occurred in several regions, these data are likely the best and only data available to study past settlement patterns in historical research. Primary legacy data of previous now-transformed landscapes offer a touchstone for the assessment of archaeological loss that other Mediterranean landscapes could soon be facing, thus providing strategic foresight for future heritage management and landscape planning [16,47–49].

Moreover, the method presented here may boost a new wave of field-survey campaigns targeting the preserved marginal landscapes of the Mediterranean for the collection of fresh data that may help to anticipate future scenarios in heritage management, thus stimulating critical thinking about change, emerging opportunities, and challenges. In places with little urbanisation and intense farming, archaeologists can produce digital reports and GIS maps that anticipate the opportunities, risks, and impacts of future transformation or preservation decisions for heritage practitioners (e.g., ministries of culture and environment, UNESCO, ICCROM, FAO) by performing systematic (re-)surveys on a large scale. This is timely considering the fast deterioration of the surface archaeological record and will be beneficial for academic research (i.e., new data and analyses), not to mention the contribution to the scholarly discussion questioning legacy data produced by "old-fashioned" field-survey techniques against the allegedly more reliable data registered by present-day intensive field-survey methods (cf., discussion in Refs. [50,51]).

2. How to Unlock Legacy Survey Data

The method presented in this section is based on student internships in the digital humanities and aims to unlock the primary, first-hand legacy survey data (from source published material and grey reports) for research purposes and heritage management in landscape planning. Field survey is defined as fieldwalking by archaeologists to locate material concentrations and structures belonging to archaeological sites. Legacy survey data consist of maps and catalogues of finds and site characteristics registered in the field by archaeologists using paper media (e.g., topographic prints, notebooks) or, in recent decades, GPS and GIS digital technologies [52].

There exists an enormous and variegated amount of legacy survey data, but they are very difficult to access [53]. The open data movement is gaining followers in archaeology but, contrary to other domains, has not yet succeeded in breaking through [54]. This and the time required to render datasets into the right digital shape for deposition prevent the sharing of the original information; hence, access is still very limited. Moreover, a large amount of data was recorded decades ago using obsolete media formats (e.g., floppy disks, internal drives of old computers) or using vendor-specific software with old, discontinued versions and thus will be unreadable in the near future. As scholars retire or pass away, the knowledge of where these data are stored (and how) is potentially lost. Often, the only memory of these data is the final publication produced by the survey team (i.e., published reports, articles, or books), which often presents only a stark reduction of the original information.

However, another problem is in regard to the dispersion of the final publications. Except for the most famous survey projects, which can be easily found in several (digital) libraries, the publications of survey results are often only kept locally, in the local archives or libraries of the territory/region where the fieldwork was conducted or at the university/institute that sponsored it or has an interest in the investigated area. Visits to local libraries are necessary to access, scan, or acquire these source publications. For economic or time-related reasons, this is not always possible: for example, the COVID-19 pandemic posed restrictions on travelling abroad for more than two years and limited the mobility of researchers; therefore, visits to local libraries, archives, and museums for data collection had to be postponed.

Sometimes, survey result publications and grey reports may be dispersed throughout the Academia.edu or ResearchGate profiles of field directors or can be found through intense web browsing. The fallback option is to ask for the publication directly by contacting the data producer (field director). However, success is not guaranteed, and, even when the article, book, or report is obtained, the information remains locked within the published form. Only digitisation can make these data machine-readable and thus usable. Converting data with GIS digitisation into sustainable, long-lived digital formats can enable the processing, display, dissemination, interoperability, reuse, and comparison of knowledge for current and future large-scale analyses (see discussion in Ref. [10]), thus breathing new life into "old" data.

In times of crisis dictated by the problems listed above, we tried to absorb these adversities and find a resilient solution to cope with them. These challenges triggered the implementation of a novel collaborative method to ease access to these important legacy data. This method is grounded in the nichesourcing principle [55,56]. As with crowdsourcing, it is a means to collect large data using the internet and handle high digitisation workloads with the help of interested communities. In nichesourcing, however, only groups of domain experts are involved (e.g., researchers, professionals, or graduate students), whereas crowdsourcing usually entails the participation of amateurs and volunteers from the general public as well. Crowdsourcing can be successfully employed for simple annotations or digitisations. However, for solving knowledge-intensive tasks (e.g., complex descriptions of metadata, geospatial analysis) that require a significant level of expertise (e.g., knowledge of domain terminologies and issues, specific digital skills), it may be more efficient to outsource these tasks to a niche community of experienced, motivated contributors [57]. It is important to highlight that, different from crowdsourcing, nichesourcing projects are not aimed at public engagement but rather at obtaining high-quality contributions to be handed over to other students, scholars, or heritage professionals for their scientific and social research.

Online international internships in the digital humanities for university students are a nichesourcing solution for the collection and digitisation of archaeological legacy survey data. As exemplified below, it works well in times of crisis because it is a resilient education formula that has been adapted to train students in the face of pandemics [58,59]. Students and their supervisors, with good background knowledge and command of GIS and digital archaeological data archiving, form a powerful crowd for the task of unlocking legacy survey data. Acquiring transferable skills for their future career and credits for their degree (ECTS) is what intrinsically motivates students to pursue an internship. In the internship presented below, students expanded their experience in digital archaeology, GIS, semantic ontology, and comparative data analysis, all of which are important skills for an archaeologist. They also engaged in collaborative research with an international team and with what constitutes good practice around open data publication, citation, and reuse [60–63]. Generally, this education gain and the monetary incentives (e.g., cost reimbursement for book scans and travels to local libraries, or a volunteer allowance) or rewards (e.g., sponsored study trips, certificates, and recognition on social media platforms or publications) ensured student commitment for the entire internship duration.

In practice, teams of selected graduate students in archaeology at a master or PhD level, from different countries and universities, are remotely supervised by professionals (e.g., postdoc researchers or professors). Through distance mentoring, they learn to collaborate in searching, collecting, and digitising in databases and in GIS the data/metadata stored in publications of previous survey projects. The final result of their digitisations can be defined as converted legacy survey data. To produce digitally converted data, students engage in seven internship phases:

1 Phase one focuses on knowledge acquisition, updating or upgrading skills through supervisor guidance, and self-study of the relevant bibliography, also by means of online tutorials. Depending on the student level, this phase allows the transfer or consolidation of specific expert knowledge to the student niche; students, however, should already have familiarity with the subject and be skilled in performing specific digital tasks; otherwise, there is a risk that the work of the supervisor (who also has other job duties and can reserve only limited time to teaching for the internships) becomes too demanding and time-consuming.
2 The identification of survey projects and bibliographic references of survey project publications by studying relevant literature and surfing the web.
3 The collection or acquisition of publications online and in local libraries located in the students' home country/university, which should be easily reachable with public transport.

4 Description of the methodology and terminologies of the survey projects using standardized forms. If the information on survey design and recording method is not stated in the publications or is only partially disclosed, reflection and source criticism are performed by the students guided by the supervisor to extract such information whenever possible. This is essential to allow future comparison of datasets.
5 The georeferencing of raster maps; the importation of spatial coordinates; the digitisation as vector files in GIS of the research area, the surveyed units (if available; e.g., graphic representations of the fields/agricultural parcels walked during the survey that have been investigated), and site locations; and the systematisation in digital spreadsheets of the chronological and typological information for the respective attribute tables (e.g., types and periods of occupation for sites, from Prehistory onwards; the descriptions of collected material; the visibility conditions, sampling method/coverage percentage for surveyed units). This allows data interoperability and querying of the data in GIS for regional pattern analysis.
6 The annotation of metadata in standardized forms reporting indications and descriptions of the procedures used by the students for the manipulation of the original legacy data during the creation of the digitally converted legacy data. This phase safeguards the long-term re-usability of the datasets for future research.
7 The deposition of these converted legacy survey data (and metadata) in online open access WebGIS platforms/repositories, with proper citation of the source and the original data, and with permalinks. This safeguards both the long-term availability and re-usability of these datasets for future research.

2.1. The Pilot Study

A pilot study is presented in this section to show how the proposed method works in practice and to test its efficiency for wider applications. This pilot study regards the legacy data of previous field walking surveys in Central–Southern Italy and in the Iberian Peninsula (especially in Portugal) and was conducted mostly online (with short stays at the KNIR institute in Rome) from 2020 until 2022 during three yearly internship editions, for about eight months in total. The internship title is "*Digital Field Survey Archaeology*"; the past three editions were supported by the KNIR-Royal Netherlands Institute in Rome, Leiden University, and the University of Groningen, and sponsored by the Prins Bernhard Cultuurfonds as part of a larger research project (PI Dr. Tesse D. Stek) whose goal is twofold [64]: first, to guarantee digital preservation and accessibility of survey datasets in the Western Mediterranean; second, to use these datasets for studying rural settlement patterns in relation to the Roman expansion in Italy, Portugal, and Spain. By comparing these patterns in a Western Mediterranean perspective, differences and similarities in settlement strategies and land-use organisation can be identified, thus shedding light on the interactions between Iron Age communities and the early rise and expansion of Rome in the West.

After a selective procedure based on the curriculum vitae and motivation, eleven master- and PhD-level students from Dutch, Italian, and Portuguese universities were recruited as our nichesourcing members. They worked in teams of two to three members and were supervised by the postdoc researcher within the project (the author). The internships focused on two levels: one was urgency, which involved the targeting of survey projects by giving priority to those in highly deteriorated landscapes (cf., Section 1); the other was the project research interest, the investigation of rural settlement patterns in the countryside around early Roman towns in Italy, Portugal, and Spain, and their relation to local pre-existent systems in the period between the 4th and 1st century BC. These two factors determined the selection of case studies (i.e., survey projects). For the data sharing between project members and data archiving during the internship, we used Google Drive, specifically a shared folder with subfolders organised in a standard way for each case study. Online meetings and remote teamwork were conducted via Google Meet. Moreover, the KNIR offered students the possibility to spend three weeks together at the institute in Rome to discuss their work in person and present it to the KNIR community. The software used for data digitisation was the QGIS and the Office suite.

Teamwork and collaborative spirit were essential factors for the success of these internships, as well as the ability of the students to work autonomously, creatively, and approach problems critically. The working schedule was flexible and working part-time was possible. The interns defined their working schedules independently but were asked to be available for online group work and weekly meetings. After a trial period, it became clear what each student performed best. Some students were more skilled in literary research in libraries; others had a technical attitude in solving practical digital issues, for instance, with QGIS or Excel databases. However, to enhance international cross-fertilisation between different expertise and scholarships, we realised that the best strategy for task division consisted in assigning case studies to each team rather than to each team member. This activated synergies between students and teams, who became familiar with discussing how to approach tasks together and taught one another how to tackle issues according to their own experience. Moreover, this approach permitted them to confront the research agendas of their home universities and acknowledge similarities as well as divergences in national field traditions and methodologies.

This internship formula educates the future generation of archaeologists to be responsible with their field data, describe data precisely, and make data openly available whenever possible. Student interns became passionate about the questions dealt with during the internships because they became aware of the urgency, the need, and the importance of safeguarding legacy survey data with their digitisations. They also developed an altruistic attitude, namely that they felt they were doing something good for the benefit of other researchers and students, and perceived their work as a mission to help future historical studies in the service of current research agendas. Student interns learned that attention must be paid to future data comparability just as much as data sharing: poor documentation on data creation may hamper the use of survey datasets and limit their potential uses for future analysis. It is likely that, if these student interns became field directors in the future, they would consider data stewardship and responsible preservation as essential components of good research practice in their survey projects and would think reflexively about how their methodologies and terminologies could impact future usage of their survey data. As the researchers of the future, they can put this pilot's methods into natural practice and further disseminate this knowledge.

Results of the Pilot Study

Following the stages described in Section 2, our students were able to collect and digitise the information of 73 survey projects corresponding to ca. 2,350,356 ha of Mediterranean territory; 30 of these survey projects were for Italy (413,023 ha of territory and 8342 sites), and 43 for the Iberian Peninsula (respectively 34 for Portugal and 9 for Spain, corresponding to 1,937,333 ha of territory and 5787 sites) (for more details, see Tables A1 and A2 in Appendix A and Figures 2 and 3). This results in an average of 0.6 archaeological sites per sq. km when the extent of all research areas is considered, or 2 and 0.3 sites per sq. km when the extent of the Italian and Iberian research areas are considered, respectively. Some human errors in student digitisations are to be expected; nevertheless, the discrepancy in site density between countries is interesting, especially if we compare the overall data of each region from a large-scale Western Mediterranean perspective. This divergent site density may reflect a real difference in archaeological potential between countries, the fact that more systematic intensive field surveys have been conducted in Central–Southern Italy than in the Iberian Peninsula (especially in Portugal where non-systematic extensive explorations are abundant (cf. Ref. [11])), the variable landscape morphologies and visibility conditions covered by these surveys, or a combination of these factors. More research into this aspect is necessary to assess how different methodologies or landscape geomorphologies may affect the number of discovered sites in the surveys analysed during our internships and how possible research biases may alter our perception of the heritage potential of a given region or country [65–71].

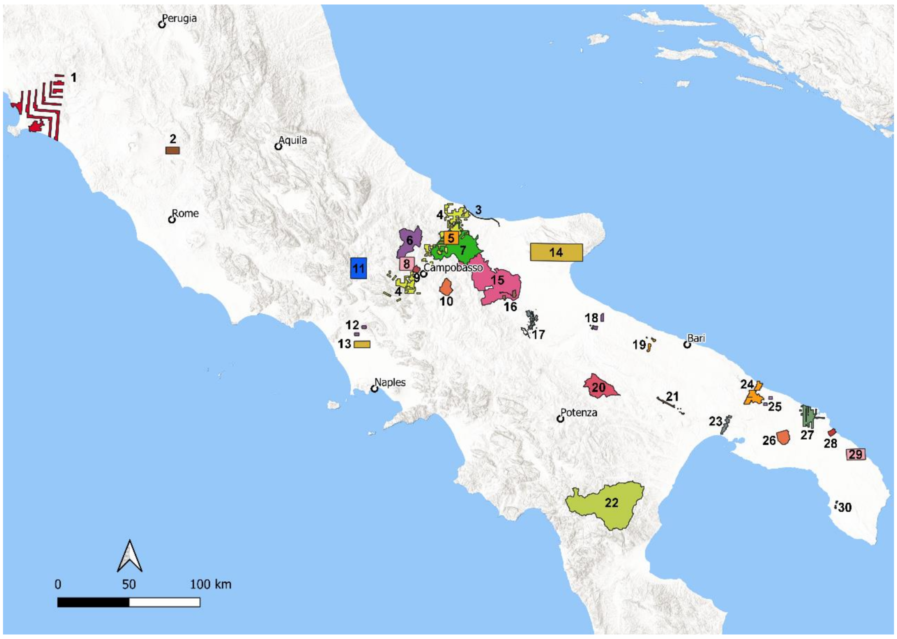


Figure 2. Research areas of the survey projects digitised during the internships for Central–Southern Italy (numbers 1–30 in Table A1). Basemap: ESRI World Hillshade, accessed on 8 August 2022. Figure by author.

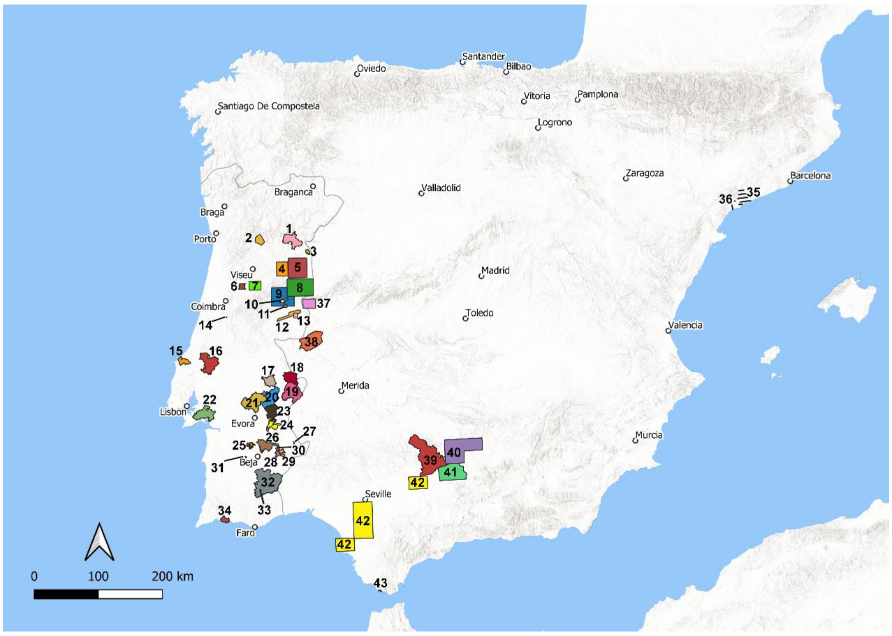
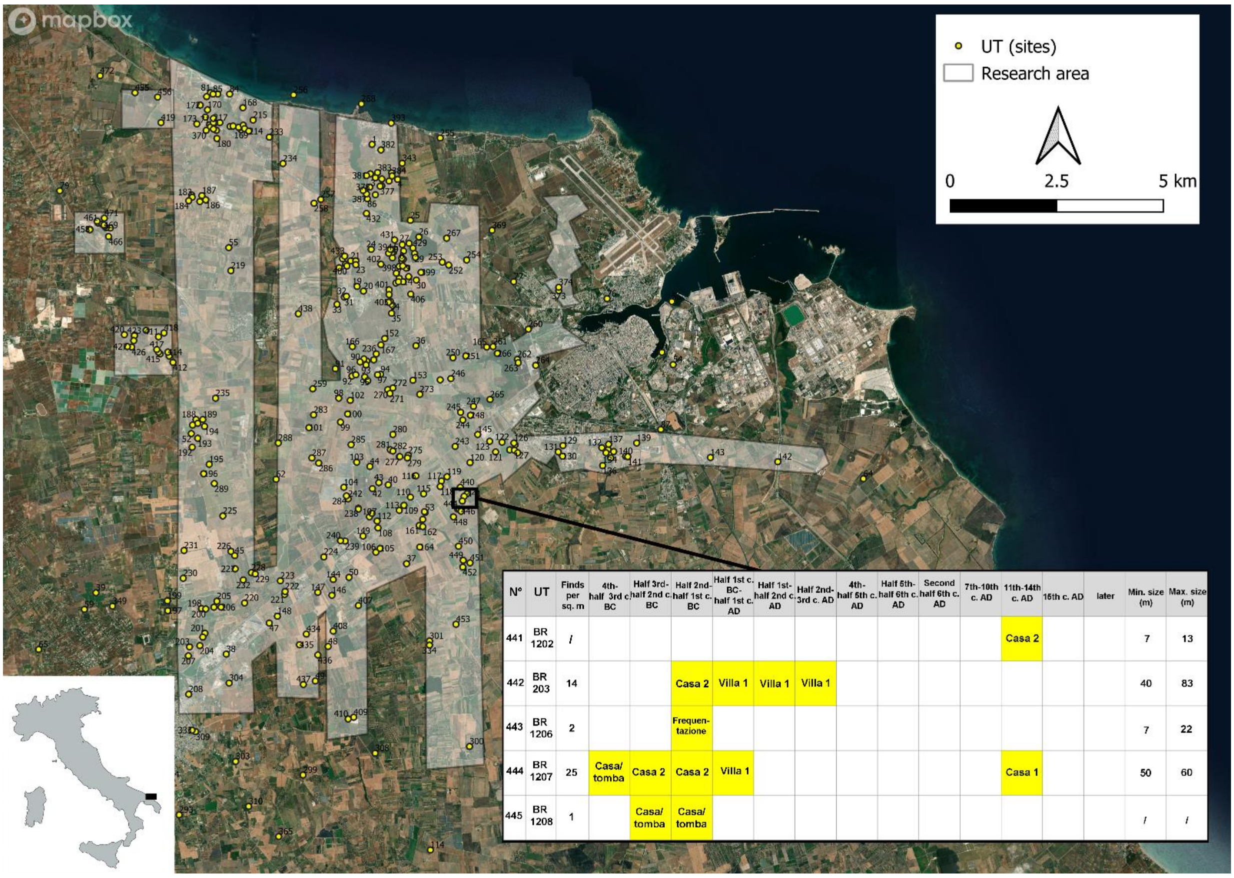


Figure 3. Research areas of the survey projects digitised during the internships for the Iberian Peninsula (numbers 1–43 in Table A2). Basemap: ESRI World Hillshade, accessed on 11 August 2022. Figure by author.

For these 73 case studies, all metadata were systematized and the research areas digitised (displayed in Figures 2 and 3). For several of the case studies (see below), students first imported spatial coordinates of the site locations from the source publications or georeferenced scanned maps to mark in QGIS the surveyed units (if represented in the source publications) and site distributions, thus producing shapefiles/GeoJSON files, and then created spreadsheets to be associated to the attribute tables of the respective vector files in Excel (for an example, see Figure 4). These datasets underwent the supervisor's quality check: the quality measures for both individual results and overall student team production were evaluated for the seven internship phases (see Section 2) and focused on a high degree of clarity and completeness in describing the metadata and procedures, and that there was well-ordered systematisation of the data storage in our shared drive.



N°	UT	Finds per sq. m	4th-half 3rd c BC	Half 3rd-half 2nd c. BC	Half 2nd-half 1st c. BC	Half 1st c. BC-half 1st c. AD	Half 1st-half 2nd c. AD	Half 2nd-3rd c. AD	4th-half 5th c. AD	Half 5th-half 6th c. AD	Second half 6th c. AD	7th-10th c. AD	11th-14th c. AD	15th c. AD	later	Min. size (m)	Max. size (m)
441	BR 1202	/											Casa 2			7	13
442	BR 203	14			Casa 2	Villa 1	Villa 1	Villa 1								40	83
443	BR 1206	2			Frequen-tazione											7	22
444	BR 1207	25	Casa/ tomba	Casa 2	Casa 2	Villa 1							Casa 1			50	60
445	BR 1208	1		Casa/ tomba	Casa/ tomba											/	/

Figure 4. Survey project number 27 (Table A1) published in [72,73]: the field campaigns were conducted in the years 1990–1994 in the Brindisi region, Apulia, Italy (basemap: Mapbox Satellite, accessed on 9 August 2022). In this figure, the site locations and research area are displayed. The example of the attribute table represented in the figure reports the main characteristics of the sites enclosed by the black rectangle (i.e., find density, type, chronology, size). Data digitisation during the internships by Paolo Cremisini and Flavia Palazzini (from Ref. [73]). Figure by author.

Out of 73 case studies, the students completed 36 data digitisations with variable quality (see below). Namely, the research areas, the surveyed units walked within the research areas (if represented in the original publications), and all the sites discovered/located by previous surveys were digitised, along with the attribute tables that reported the respective characteristics (e.g., for sites: coordinates, type, chronology, size, and observed material; for units: area, visibility, and land-use conditions). However, of these 73 case studies, only 60 student digitisations can be considered of high quality (and, of these, 24 are unfinished) and usable by the project for studying ancient settlement patterns in the Western Mediterranean. This results in 6884 archaeological sites (3698 for Italy and 3186 for Iberia) and 113,104 ha of walked survey units (47,271 ha for Italy and 65,833 for Iberia) properly digitised through the internships.

High-quality converted data can enter the web and be shared with others for reuse. Students have begun entering these converted legacy data into online digital platforms, giving proper citation to the source publications (i.e., surveys 3–11; 14–17; 19–30 in Figure 2, Table A1). Specifically, students used the Fasti Online Survey platform [74], which is an open source WebGIS application and online database of archaeological field surveys developed by the KNIR and AIAC (International Association for Classical Archaeology), with the MAGIS project (DePauw University) as a springboard [75–78]. Since 2016, the Fasti Online Survey platform permits researchers and students to publish open access data and metadata of survey projects with citable permalinks and a CC BY-SA 4.0 license [79]. The web data entry phase of the data digitised during the internships is not completed and will continue in the future. Future entry may potentially include other online portals and be carried out through new internship editions, our collaborators, or the researchers themselves.

Legacy survey data are intrinsically important considering their high value for heritage management in landscape planning, especially when data were collected in now disappeared landscapes as they constitute their only archaeological memory. This information is a major source of historical knowledge, and its digitisation is thus very necessary. Additionally, these data are extremely significant for landscape archaeology [29], but, to realise their full potential, it is necessary to first understand the dataset structure and the terminologies used. Previous surveys usually did not employ common standards in the description of their methodologies (when made explicit) and in the classification of sites and finds. This may lead to inconsistent categories between surveys, namely the same typology of a site being used in different ways by different surveys, or the same concept being used in different surveys to describe different types of archaeological sites (e.g., the terms 'villa', 'farm', or 'site').

This variability in semantic ontologies represents an obstacle to the integration, comparison, and analysis of legacy survey datasets. To deal with this issue, the student interns also engaged in critical analysis of field survey terminologies used in various case studies. Namely, through the deep study of the available documentation and group discussions based on source criticism, we tried to describe the divergent typological and methodological terms and concepts used by previous field surveys. Students also compared site definitions to the classification scheme that is being developed in the context of the Roman Hinterland Project—RHP [36,80,81] to find parallels and synchronize the legacy datasets according to the RHP standardized framework. The results of this semantic harmonisation of different terminologies are promising (and will be discussed in a forthcoming article), but only for certain legacy surveys, namely those that provided sufficient data documentation and methodological explanations of the survey design (i.e., metadata) in their final publications. Instead, for those field surveys that lack such information, the comparison and synchronization with existing vocabularies were impossible to carry out by our students, or, alternatively, were based on confidence levels using lists of descriptors.

2.2. Discussion of Methodological Challenges

The digitisation, integration, and comparison of legacy survey datasets through the GIS medium has its challenges [10], such as the variability of data formats, the differences in terminologies between surveys, and the lack of context on survey methodologies. Standardisation models (e.g., controlled vocabularies, fixed protocols, CIDOC-CRM ontology) currently being developed by scholars for the collection, synchronization, and reuse of survey data generally encounter problems when it comes to the integration of legacy datasets [81,82]. In the internships, we also experienced the same difficulties (see above). Namely, we realised first-hand that earlier surveys were methodologically and semantically very different, varying greatly from region to region, as well as regarding the data they produced. The lack of a shared pattern of argumentation and common reference and the often poor availability of documentation on survey designs and recording methods (i.e., metadata) implies that several legacy datasets cannot be aggregated with new survey datasets using the existing standardisation models.

Instead, reworking legacy datasets that provide enough metadata to comply with current standards may be possible. However, this operation entails a critical discussion and is time-consuming. This is precisely why student internships may be helpful. Testing and developing standardisation models for synchronising legacy survey datasets requires a great deal of experimentation on large heterogeneous data-samples. Therefore, a critical mass of diverse legacy data first needs to be collected, described in detail, and then digitised.

These operations can be performed by student interns supervised by professionals. Only when these operations are fulfilled can scholars—or the students themselves—develop and test standardisation models on a large scale, choose suitable ones to combine multiple individual datasets, and eventually analyse them side-by-side.

Through student internships and online open access platforms, a large number of legacy datasets from different regions and periods can be made available (see Section 2.1). This is key because it would enable cross-comparisons of data trends on an interregional and/or regional level, which is necessary to identify patterns of complex social phenomena (e.g., past migrations, colonisation, economic exchange, land-use strategies) and analyse their evolution over time. The increased availability of digitised legacy survey datasets resulting from these and future internships may also trigger new data-mining to analyse these data and discover patterns, ultimately producing novel knowledge [83,84]. Additionally, researchers interested in standardisation models and semantic ontology for surveys will likewise benefit greatly from these student internships. The data samples from different regions that were collected, described, and digitised through these internships will allow scholars to experiment with classification schemes on a large scale, which is necessary to determine solutions to integrate and make legacy data comparable to new survey data.

3. Conclusions

An urgent issue in heritage management and landscape archaeology is how we can preserve legacy survey data, especially considering that archaeological sites are increasingly in danger of being lost forever due to urbanization, agriculture, and digital obsolescence, rendering new data impossible to collect. As a result, these data represent the only memory remaining of destroyed sites and landscapes for several regions of the world. Legacy survey data also constitute a major source of archaeological knowledge, providing crucial information, such as the location of sites, and aiding in the understanding of ancient settlement patterns. Therefore, if we are unable to secure and disseminate such data, this will disadvantage strategic foresight for heritage management or spatial rural planning and archaeological landscape analysis. The method presented in this paper offers a solution to counteract this situation: as demonstrated by the pilot study, not only is the method capable of bringing to light legacy survey data that are sometimes difficult to access and improving their preservation; it also assists their translation into FAIR data [85]. Indeed, by applying this method, legacy survey data may become more easily findable, accessible, interoperable, and reusable.

This can be achieved sustainably and resiliently by means of crowdsourcing (i.e., nichesourcing) based on student internship programs in data digitisation. Student internships, besides being a successful formula (also in times of crisis) for improving the accessibility and comparability of legacy survey datasets on a supranational scale, are also a way to train future generations of archaeologists in responsible digital data stewardship, open data, and comparative analysis of international survey traditions.

The use of WebGIS platforms powered by collaborative-mapping software for the digitisation, dissemination, and exchange of these data will play an increasingly vital role in the future (e.g., the Fasti Online Survey format, but also see other examples: Refs. [11,86–91]). Using these platforms, heritage professionals and scholars or students from various universities and institutes will be able to compare survey datasets across landscapes, thus gaining insight into past cultural processes (e.g., migration, colonisation, and land-use), opening a number of new research lines and directions that were hidden before. At a social level, these portals can facilitate heritage management in landscape planning. By having access through online platforms to survey data, stakeholders (e.g., local planners and engineers) and policymakers (e.g., UNESCO, cultural and environmental ministries, ICCROM, FAO) will be able to anticipate the impact of future developments on rural heritage, thus minimizing risks of heritage destruction in rural landscapes or, alternatively, developing plans for construction/agricultural works that take into account the archaeological record as sustainably as possible.

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Informed Consent Statement: Not applicable.

Data Availability Statement: A portion of the survey projects and data presented in this article is openly available from Fasti Online Survey (https://www.fastionline.org/survey/ accessed on 21 September 2022).

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Conflicts of Interest: The author declares no conflict of interest.

Appendix A

This Appendix reports the list of survey projects identified and digitally converted during the internships (both completed and partially digitised) for Central–Southern Italy (Table A1) and the Iberian Peninsula (Table A2). The list comprises topographic, extensive, and intensive field-surveys, and surveys where hybrid methods were employed (cf., the bibliographic references in the fourth column of Tables A1 and A2 for information on the survey designs, survey project years, and field directors; for an overview of the different survey traditions, see Ref. [11]). The term 'sites' is used loosely and generally in the tables below; it includes all possible categories, of all prehistoric and/or historical periods and functions that were considered by the original survey projects, displayed as points, polygons, or lines in the source publications. 'Sites' may indicate site categories, such as huts, farms, villas, tombs, necropolis, villages, towns, etc.; ancient (infra)structures (e.g., remains of walls, floors, roads, aqueducts, etc.); or concentrations of archaeological materials (e.g., flint and other lithic tools, pottery sherds, fragments of bricks and tiles) belonging to archaeological sites discovered at the surface level by previous surveys. These previous surveys used different terms for site discoveries in the field (e.g., site, unità topografica, scatter, area di frammenti fittili, yacimientos, jaciments, dispersión de restos constructivos, mancha de ocupação, vestígios de superfície, etc.) and/or during interpretation of these remains in the laboratory (e.g., settlement, house, farm, villa, hut, habitat, tomb, necropolis, village, town, uncertain, etc.).

Table A1. Survey projects digitised during the student internships for Central–Southern Italy (Figure 2).

Number in Figure 2	Region	Survey Project	Source Publication(s) Used by Students for Data Digitisation	Research Area (ha)	Surveyed Units (ha)	Number of Sites	Digitisation Completed by Student Interns
1	Valle dell'Albegna, Grosseto, Tuscany, Italy	Paesaggi d'Etruria	[92]	33,217	n/a	1621	yes
2	Magliano Sabina—Collevecchio—Stimigliano, Lazio, Italy	Ager Foronovanus I	[93]	4674	n/a	103	yes
3	Termoli (CB)—Lesina (FG), Italy	R.F.I Termoli-Lesina survey	[94]	909	909	61	no
4	Biferno valley, Molise, Italy	Biferno Valley Archaeological Survey	[95,96]	41,869	41,869	1164	no
5	Campobasso, Molise, Italy	Larinum—Forma Italiae	[97]	9616	n/a	305	no
6	Campobasso, Molise, Italy	Carta archeologica della media Valle del Trigno	[98]	22,898	n/a	63	no
7	Campobasso, Molise, Italy	Carta del Rischio Archeologico nell'area del Cratere	[99]	56,985	n/a	380	no
8	Castropignano, Campobasso, Molise, Italy	Esperienze di survey a Castropignano	[100]	9502	n/a	101	no
9	Oratino, Campobasso, Molise, Italy	Esperienze di survey a Oratino	[101]	1842	n/a	30	no
10	Riccia, Campobasso, Molise, Italy	Esperienze di survey a Riccia	[102]	6968	n/a	16	no
11	Isernia, Molise, Italy	San Vincenzo al Volturno survey	[103]	16,220	yes	195	no
12	Caserta, Campania, Italy	Ager Calenus	[104]	1301	n/a	29	yes
13	Santa Maria Capua Vetere, Caserta, Campania, Italy	Ricognizioni archeologiche nel territorio ad Ovest di Capua	[105,106]	5179	n/a	63	yes
14	Apulia, Italy	Survey nella fascia pedemontana del Promontorio del Gargano	[107]	8000	yes	258	no

Table A1. *Cont.*

Number in Figure 2	Region	Survey Project	Source Publication(s) Used by Students for Data Digitisation	Research Area (ha)	Surveyed Units (ha)	Number of Sites	Digitisation Completed by Student Interns
15	Foggia, Apulia, Italy	Progetto Ager Lucerinus	[108,109]	10,430	n/a	1122	no
16	Foggia, Apulia, Italy	Progetto Valle del Celone	[110,111]	3500	n/a	264	no
17	Faragola—Ascoli Satriano (FG), Apulia, Italy	Ricerche sistematiche nella valle del Carapelle	[112,113]	4040	yes	117	no
18	Valle dell'Ofanto, Foggia and Barletta-Andria-Trani, Apulia, Italy	Progetto Valle dell'Ofanto	[114–116]	1892	n/a	113	yes
19	Bari, Apulia, Italy	Ricognizioni sistematiche nel territorio di Terlizzi	[117–119]	1350	n/a	41	no
20	Genzano di Lucania—Banzi—Irsina, Basilicata, Italy	Basentello Valley Archaeological Research Project	[120–126]	21,606	4015	216	yes
21	Bari—Taranto, Italy	Ricognizioni della Via Appia tra Gravina in Puglia e Taranto	[127]	1516	n/a	33	no
22	Valle del Sinni, Basilicata, Italy	Carta archeologica della Valle del Sinni	[128]	107,800	n/a	1078	yes
23	Taranto, Apulia, Italy	L'Amastuola field surveys	[129,130]	2937	yes	52	no
24	Brindisi, Apulia, Italy	Murge Tableland project (MUR) e redazione Carta Archeologica di Cisternino	[131]	10,129	yes	78	no
25	Brindisi, Apulia, Italy	Ostuni field survey	[132]	243	243	36	no
26	Brindisi, Apulia	Oria field survey	[133]	6240	yes	96	no
27	Brindisi, Apulia, Italy	Archeologia dei paesaggi a Brindisi dalla romanizzazione al Medioevo	[72,73]	10,129	n/a	475	yes
28	Brindisi, Apulia, Italy	Valesio Field Survey	[134–137]	1777	yes	79	no
29	Lecce, Apulia, Italy	Portus Lupiae survey project	[138,139]	10,019	n/a	150	no
30	Lecce, Apulia, Italy	Field survey at Alezio	[140,141]	235	235	3	no

Table A2. Survey projects digitised during the student internships for the Iberian Peninsula (Figure 3).

Number in Figure 3	Region	Survey Project	Source Publication(s) Used by Students for Data Digitisation	Research Area (ha)	Surveyed Units (ha)	Number of Sites	Digitisation Completed by Student Interns
1	Vila Nova de Foz Côa, Guarda, Portugal	Carta Arqueológica do Concelho de Vila Nova de Foz Côa	[142]	39,809	n/a	195	no
2	Concelho de Lamego e Tarouca, Viseu, Portugal	Povoamento Romano dos Vales do Varosa e Balsemão	[143]	15,451	n/a	29	yes
3	Figueira de Castelo Rodrigo, Portugal	Torre de Almofala (civitas Cobelcorum)	[144]	3850	3850	62	no
4	Celorico da Beira, Portugal	Bacia de Celorico	[145]	39,323	115	74	yes
5	Middle Coa River region, Portugal	Bacia média do rio Côa	[146,147]	89,370	n/a	44	no
6	Santa Comba Dão, Viseu district, Portugal	Dinâmicas de Povoamento no Concelho de Santa Comba Dão	[148]	8304	n/a	34	yes
7	Oliveira do Hospital, Portugal	O Povoamento Rural Romano Entre o Mondego e o Cobral	[149]	25,649	n/a	50	yes
8	Sabugal, Portugal	Alto Côa	[150]	109,723	n/a	60	yes
9	Cova da Beira, Portugal	Cova da Beira survey	[151]	103,915	n/a	320	yes
10	Fundão, Castelo Branco, Portugal	Povoamento rural romano ao longo da Ribeira da Meimoa	[152]	4345	n/a	77	yes
11	Quintas da Torre, Vale Prazeres, Fundão, Portugal	Torre dos Namorados survey	[153]	2381	n/a	37	yes
12	Monfortinho, Castelo Branco, Portugal	Entre Monfortinho e Castelo Branco	[154]	17,550	n/a	28	yes
13	Idanha-a-Velha, Portugal	Civitas Igaeditorum	[155,156]	4443	n/a	99	yes
14	Aljazede, Ansião, Leiria district, Portugal	Aljazede survey	[157]	53	yes	72	no
15	Óbidos, Portugal	Carta Arqueológica do Concelho de Óbidos	[158]	13,921	1787	411	no
16	Santarém, district of Santarém, Portugal	Carta Arqueológica do Concelho de Santarém	[159]	56,020	655	37	no
17	Fronteira, Portugal	Carta arqueológica do concelho de Fronteira	[160]	24,861	6186	222	yes
18	Arronches, Portalegre, Portugal	Contributo para a Carta Arqueológica do Concelho de Arronches	[161]	31,460	n/a	177	no

Table A2. *Cont.*

Number in Figure 3	Region	Survey Project	Source Publication(s) Used by Students for Data Digitisation	Research Area (ha)	Surveyed Units (ha)	Number of Sites	Digitisation Completed by Student Interns
19	Elvas, Portalegre, Portugal	Ocupação rural romana no actual concelho de Elvas	[162]	63,110	n/a	75	yes
20	Estremoz, Évora, Portugal	Carta Arqueológica do Concelho de Estremoz	[163]	51,377	n/a	218	no
21	Arraiolos, Évora, Alentejo, Portugal	LAPA: Levantamento Arqueológico e Patrimonial de Arraiolos	[164,165]	68,408	1336	199	no
22	Palmela, Portugal	Carta Arqueológica do Concelho de Palmela	[166]	46,087	n/a	102	yes
23	Redondo, Évora, Portugal	Carta Arqueológica do Concelho de Redondo	[167]	36,942	n/a	505	no
24	Reguengos de Monsaraz, Évora, Portugal	EIA Reguengos	[168]	15,871	3391	45	yes
25	Cuba, Beja, Portugal	EIA Cuba Odivelas	[169]	5655	1612	4	yes
26	Vidigueira, Beja, Portugal	Carta Arqueológica do Concelho de Vidigueira	[170]	31,594	n/a	185	yes
27	Amareleja, Beja, Portugal	EIA Amareleja	[171]	244	244	26	yes
28	Pias, Beja, Portugal	EIA Pias	[172]	4805	2909	78	yes
29	Moura, Beja, Portugal	EIA Moura 1	[173]	6456	2081	39	yes
30	Moura, Beja, Portugal	EIA Moura 2	[174]	2626	n/a	15	yes
31	Ferreira do Alentejo, Beja, Portugal	EIA Penedrão	[175]	326	298	8	yes
32	Mértola, Beja, Alentejo, Portugal	Carta Arqueológica do Concelho de Mértola	[176–178]	127,940	n/a	415	no
33	São Miguel do Pinheiro, Mértola, Beja, Portugal	EIA São Miguel do Pinheiro	[179]	2280	n/a	21	yes
34	Lagoa, Algarve, Portugal	Carta Arqueológica do Concelho de Lagoa	[180]	8825	n/a	184	no
35	Tarragona, Catalonia, Spain	The survey of the territory of Tarragona	[181]	5370	1131	49	yes
36	Tarragona, Catalonia, Spain	Project Ager Tarraconensis (PAT)	[182]	1543	414	9	no
37	Valverde valley, Sierra de Gata, Cáceres, Spain	Sierra de Gata	[183]	28,008	n/a	57	yes

Table A2. *Cont.*

Number in Figure 3	Region	Survey Project	Source Publication(s) Used by Students for Data Digitisation	Research Area (ha)	Surveyed Units (ha)	Number of Sites	Digitisation Completed by Student Interns
38	Alcántara, Extremadura, Spain	Alcántara survey	[184]	70,907	47,211	46	yes
39	Córdoba, Spain	Ager Cordubensis survey	[185]	168,986	n/a	112	yes
40	Bujalance, Montoro, Andújar, Spain	Bas-Guadalquivir—volume III	[186]	165,920	n/a	407	yes
41	Campiña de Córdoba, Spain	Prospecciones Arqueológicas en la Campiña de Córdoba	[187]	148,062	n/a	316	no
42	Ejica, Dos Hermanas, Los Palacios, Villafranca, Lebrija, Sanlúcar de Barrameda, Spain	Bas-Guadalquivir—volume IV	[188]	285,034	n/a	607	yes
43	Bolonia, Tarifa, Cadiz, Spain	Territorium de Baelo Claudia	[189]	529	n/a	37	no

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