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Map Development: Tool for Local People's Perception Survey at Village Level, Chumphon Province, Thailand

Umaporn Muneenam*, Noparat Bamroongragsa, Ratana Tongyoi

Faculty of Environmental Management, Prince of Songkla University, Hat Yai 90110, Thailand

Corresponding Author Email: umaporn.m@psu.ac.th

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ABSTRACT

This practical research aims to demonstrate the process and the results of map development as a tool, especially for local people's perception survey at village level, in a case study in Thailand. Researchers, cartographers, free GPS applications on smart mobile phones, and geographic information system (GIS) maps were the key research materials of this study. The results demonstrate map as a tool for local people's perception survey at village level, and in this study, the map was developed and revised into three versions as follows. The 1st version was the free map presenting sub-district level; the 2nd version was triangulated with village level map from the local government organization, especially adding the village boundary. The 3rd version was triangulated with GPS records from local people's perception survey, and is the most spatially consistent version based on field verification, especially as regards the village boundary and the sample sizes marked at the right places. This practical research confirmed that the process of map development can be applied in the future by similar local people's perception surveys at village level. Besides, the process adopted in this study developed the most effective and correct map serving as a tool for summarizing a local people's perception survey at village level.

1. INTRODUCTION

Geographic information system (GIS) is a technology useful for effective environmental management, such that can represent a large amount of information and help summarize and explain it. GIS applies computer technology to systematically manage large scale spatial data—from various sources such as satellite and aerial pictures—and non-spatial data. Spatial data are geo-referenced in the forms of points, lines, and areas. Examples of spatial data are points or places of villages, roads and routes as lines, and areas of mangrove forest in the current study. Non-spatial data contribute information about qualifications or attributes of the area, such as land use, soil type, and other attribute data. A GIS system provides tools for data input, data storage and retrieval, data manipulation and analysis, and visual display of information flexibly, adjustably, and allowing to quickly update the information [1, 2].

GIS has a long history, having been first used in Canada in 1963 to survey natural resources for management; that system in Canada was called CGIS. After this, similar systems have been adopted in many other countries, such as the USA, France, England, China, Japan, Indonesia, the Philippines, Malaysia, India, and Thailand. Thailand has used GIS since 1985, first for World Bank in land policy analysis, and after that it has been widely used by various organizations and studies; for example, in the contexts of deforestation, land use planning, rubber farm management, urban and environmental management, public services and administration, and coral reef monitoring [3-5].

The wide adoption of GIS is indicative of its many benefits. For example, GIS data can be pooled, with reduced data similarity, correct standardization, integrating both spatial and non-spatial data, at a low cost of data storage and retrieval, adjustably and effectively for multiple purposes, with convenient data retrieval, analysis and display, and quick system development [6]. This current research study applied GIS as an effective thematic mapping tool to survey local people's perception at village level, in Chumphon province, Thailand.

A survey is one of the quantitative methods to assess selected samples as concerns the proposed objective(s) [7]. If it is applied to human research, such as in a local people's perception or perception survey, map development via GIS is a very helpful tool for the survey, enabling to triangulate whether the data collected are associated with the right places or not.

An earlier map for human data collection surveys was a topographic paper-based map (size 1: 50,000) from the Royal Thai Survey Department, Royal Thai Armed Forces Headquarters. Using this kind of map alone is fine in case of no choice, but the map reader can see roughly the topography of the area with only very few details until entering the field and verifying real data with the map. Fortunately, lately map development has become comparatively easy, allowing to produce corrected paper-based or digital maps with GIS, for

example, by using a free GPS mobile application [4] and a public participatory geographic information systems (PPGIS) as presented in this article [8-10].

A map developed, as in this case, is useful especially when the researcher is not entirely familiar with the study area. During data collection, especially in a rural area where the internet connection is unstable, the surveyor may assess the wrong field or village that is nearby. Prepared map taken with the surveyor will be very useful to avoid wasting time or having data associated with the wrong place. Besides, some research sponsorship also requires presenting survey results in a map format, which is simple, understandable, and able to communicate facts to different types of audience [11] showing village names with area, population and household sizes, size and boundary of village, roads and transportation routes, number of survey respondents, local geography, and environment as well as natural resources nearby [1].

This practical research seeks to demonstrate methodology, results, and limitations of map development via GIS for managing and summarizing a local people survey at village level, in Chumphon province, Thailand, from the researcher's point of view. Results from this practical research study can be applied to any human survey research.

2. METHODOLOGY

This practical research article applied map development survey from the case study of "local people's perception of 1,057 Rai (about 169.12 hectares) mangrove forest plantation as a carbon sink, Chumphon Islands National Park, Thailand" [12] during 2018 to 2022, organised by Electricity Generating Authority of Thailand (EGAT), that were in the same field, same target people's population and samples. This research designed data collection during the daytime on the weekends from February to March in 2024, to make sure that the possible respondents were at home as well as to get full response rates; in addition, this survey period did not overlap with the monsoon season, for convenient and comfortable data collection. The overall research process is illustrated schematically below (see Figure 1).

Besides, before entering the field, secondary data were reviewed especially for the study area, boundary of the study, population, and household sizes. During data collection, apart from the questionnaire forms used in PPGIS [8-10] verifying the villager's location, every single surveyor at least must have the free GPS application on a smart mobile phone called "My GPS coordinates" to record the point of data collection (UTM/Universal Transverse Mercator) in order to make sure that the samples are associated with the right places in data collection. All the surveyors had been trained in using the GPS that provides an accuracy of 16 meters. After finishing the data collection survey, the recorded places of data collection were transferred to the map via QGIS (version 3.30.3-'s-Hertogenbosch), and finally the results were visualized.

This practical article contributes the initiation, processing, and the results of map development for data collection and final presentation; while the earlier mentioned article presented the results of local people's perception of mangrove forest plantation as a carbon sink. All map figures in this article have been produced for this current report only.

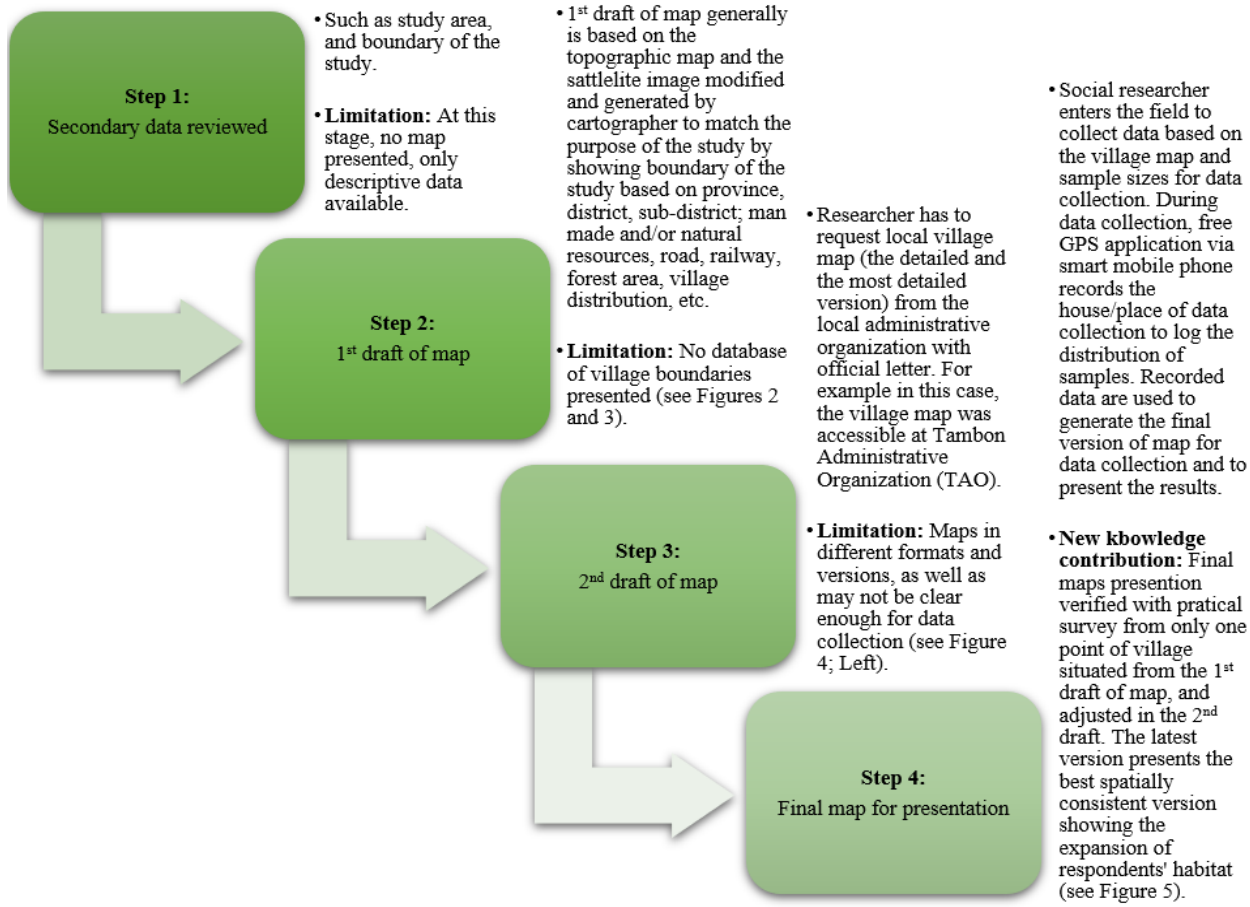


Figure 1. Steps of research methodology in this practical research study
Source: The authors' elaboration

3. RESULTS AND DISCUSSION

3.1 Step 1: Secondary data review

As mentioned earlier, this practical research study applied map development survey in the case study on "local people's perception of a mangrove forest plantation as a carbon sink, Chumphon Islands National Park, Thailand" [12]. Therefore, the first step was the collection of prior data on the study area, the boundary of the study, population, and household and sample sizes.

This study applied the concept of basic social impact assessment, which typically surveys local people in about a five-kilometer radius around the project. However, the boundary can be expanded if the impacts are stronger such as impacts from onshore wind energy that can be surveyed by the local people in a 2 to 40 kilometers radius around the project [13].

Figure 2 presents the study area with places of mangrove forest plantation in the five years from 2018 to 2022, all inside the Chumphon Islands National Park, Chumphon province, Thailand.

Figure 2. Study area
Source: The authors' elaboration

3.2 Step 2: 1st draft of map development

After knowing the study area, the five-kilometer radius around the project was drawn. Then the data on population, household, and sample sizes were reviewed.

1st draft of this kind of map is generally based on free maps from two sources—topographic baseline map (size 1: 50,000) from the Royal Thai Survey Department, Royal Thai Armed Forces Headquarters and the satellite image--modified and generated by a cartographer to match the purpose of the study by showing boundary of the study based on district, sub-district; manmade and/or natural resources including road, railway, conservation area, places of village, etc. However, the map on village level is almost ready for data collection. At this stage, the study continued to seek information on population and households based on district, sub-district, and village levels to draw the sample sizes (see Table 1 and Figure 3).

In this case, the total count of households in 2021 was 2,898. From this one estimated the sample sizes with 95% confidence level and a ± 5% confidence interval. The sample size required was n = 339 representatives from stratified convenience sampling.

Table 1. Statistics of population and household sizes in 2021, as well as sample sizes (n = 339)

Sub-District [Source]	Village Code	Population (Persons)	Households (Houses)	Sample Size (Persons)
SD1 [14]	V1-1	888	277	32
	V1-3	320	101	12
SD2 [15]	V2-2	668	103	12
	V2-3	430	84	10
	V2-4	676	131	15
	V2-5	793	147	17
	V2-6	632	147	17
	V2-7	623	118	14
	V2-9	504	66	8
	V2-10	567	136	16
	V2-11	435	75	9
SD3 [16]	V3-8	651	227	27
	V3-9	673	218	26
	V3-11	2,317	198	23
SD4 [17]	V4-2	352	151	18
	V4-9	696	262	31
SD5 [18]	V5-5	538	105	12
SD6 [19]	V6-2	606	85	10
	V6-3	506	12	1
	V6-4	446	183	21
	V6-5	652	72	8
SUM	**21**	**13,973**	**2,898**	**339**

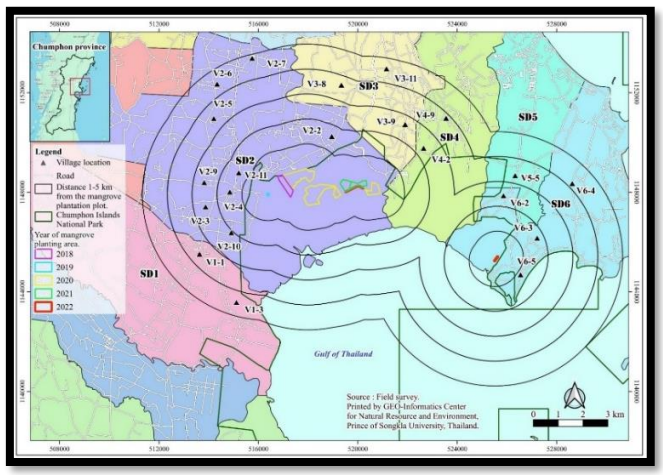


Figure 3. Study area from using a five-kilometer radius around the project
Source: The authors' elaboration

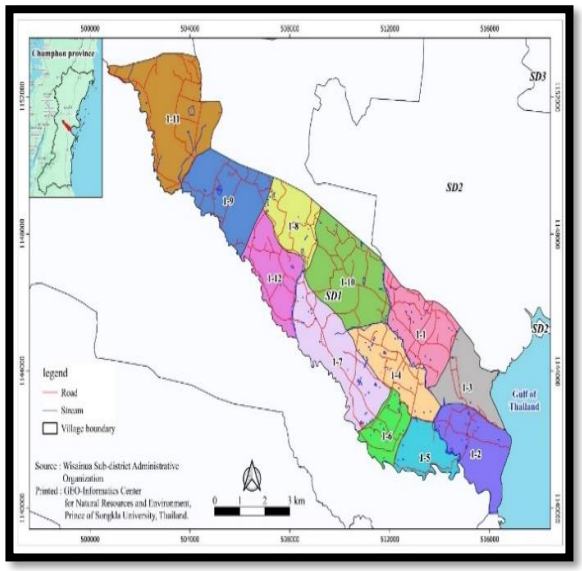
However, the map developed at this second stage did not clearly present boundaries at village level due to there being no data of village boundaries in the topographic baseline map or the satellite image. Only basic man-made and/or natural resources were shown, such as rivers, roads, railways, and places of villages.

3.3 Step 3: 2nd draft of map development

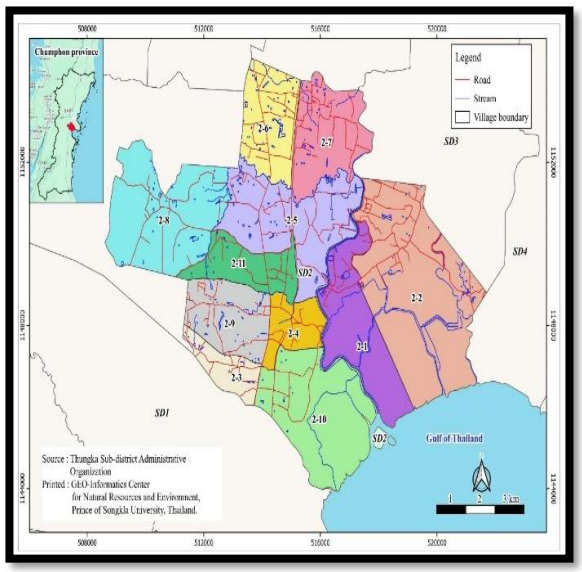
To make sure that surveyor enters the right location, a village level map was requested from the local administrative organization--the smallest decentralized organization by law; it can be paper-based or digital. For example, in this case, the village map was accessible at Tambon Administrative Organization together with in-depth interviews for verification of village boundaries with local TAO staff, as in SD2 and SD5 (see Figure 4; Left). The village boundaries map was requested

because there are no village boundaries on the previous draft maps in step two, which made it difficult for outsider surveyors to collect data. However, the sub-district level map (Tambon Administrative Organization) presenting village locations and boundaries had been internally and participatory produced and maintained for sub-district and village level needs.

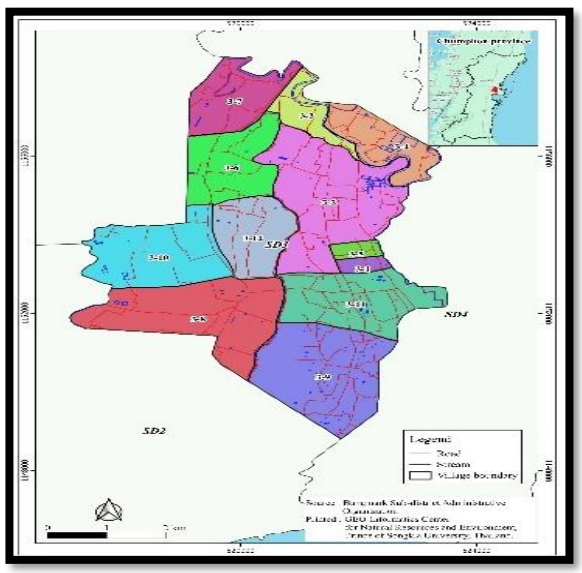
SD1 [14]



SD2 [15]



SD3 [16]



SD4 [17]

SD5 [18]

SD6 [19]

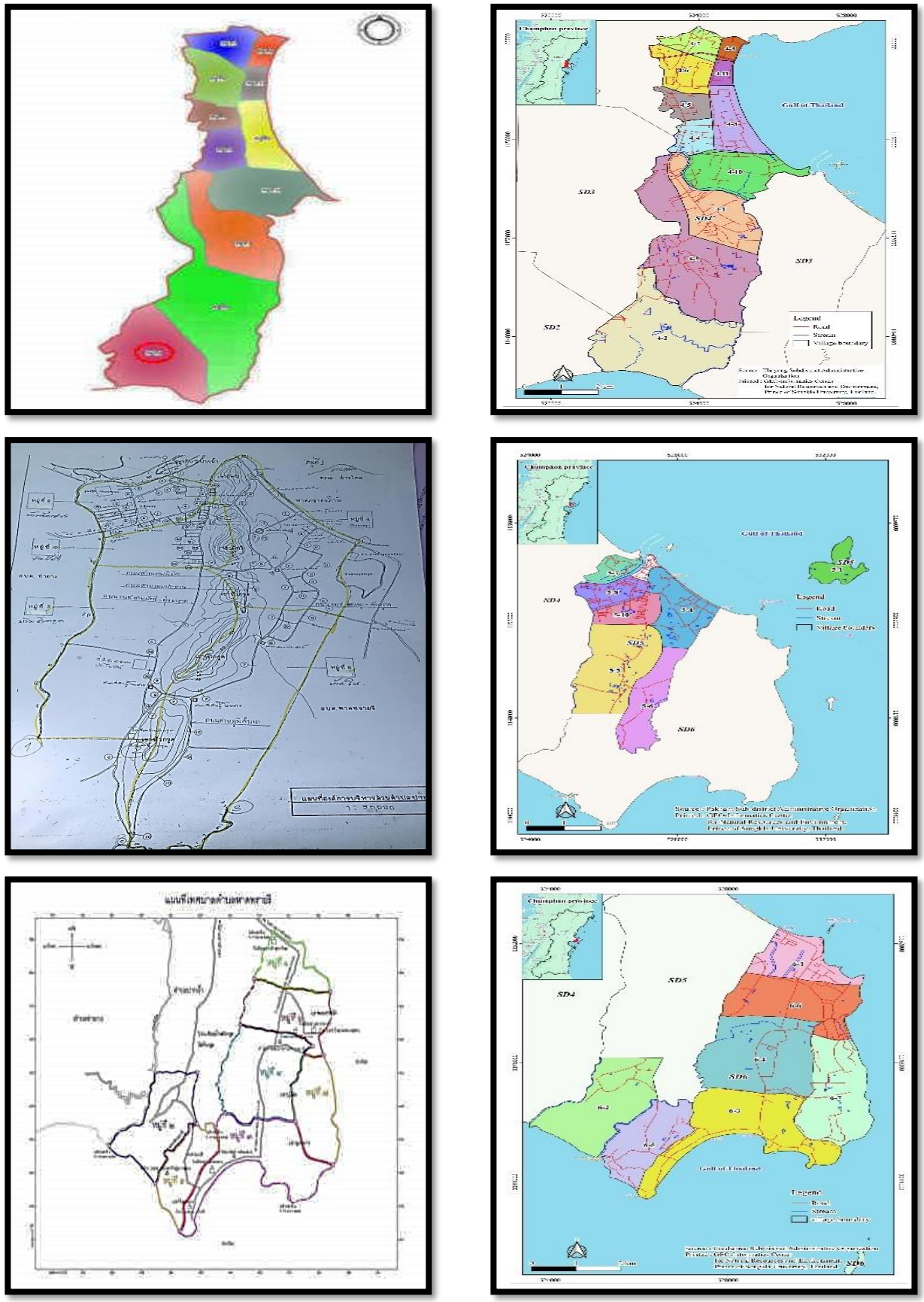


Figure 4. Village map provided by the local administrative organization (left), compared to the 2nd draft version (right)
Source: Left = [14-19]; Right = The authors' elaboration

After that, the map received from TAO, together with the 1st draft of the map, was carefully overlaid with the sub-district boundaries (see Figure 4), including the village boundaries divided by road and/or river, ready for data collection. This was similar to adding important areas into the public green space mapping from verities of sources including local city organization [20]. This is the strength of QGIS [4] that it allows adjusting the position by hand and/or via GIS.

With this zoomed-in version of the village map (see Figure 4; Right), the surveyor was able to follow the road route, and collect questionnaires at the right point of the village from the required number of respondents.

3.4 Step 4: Map verified with field notes

During data collection in the field using the 1st and the 2nd drafts of village map as guidelines, the free GPS application installed in a smart mobile phone recorded information about the UTM at the house/place of data collection to enable study of the spatial distribution of samples. The GPS recorded locations were given to the cartographer to generate the final version of map for representing survey data in a presentable format.

From the 1st draft of the map to the final version, Figure 5 presents the spread of respondents' habitats or where the surveyors met respondents representing one to two zones from the project center. Compared to the 1st draft of the map (see Figure 3) presenting the village centers only as points on the map, when the surveyors directly went to that point to collect the questionnaire data they might not meet anyone, as the map did not show people's housing. However, the changes have not affected the sample sizes since the total population from all the villages remains unchanged. Besides, the number of recorded points matched the sample size targets inside each village boundary (see Table 1; Figures 5 and 6). The comparative designations of villages between the first draft and the final survey map are summarized in Table 2.

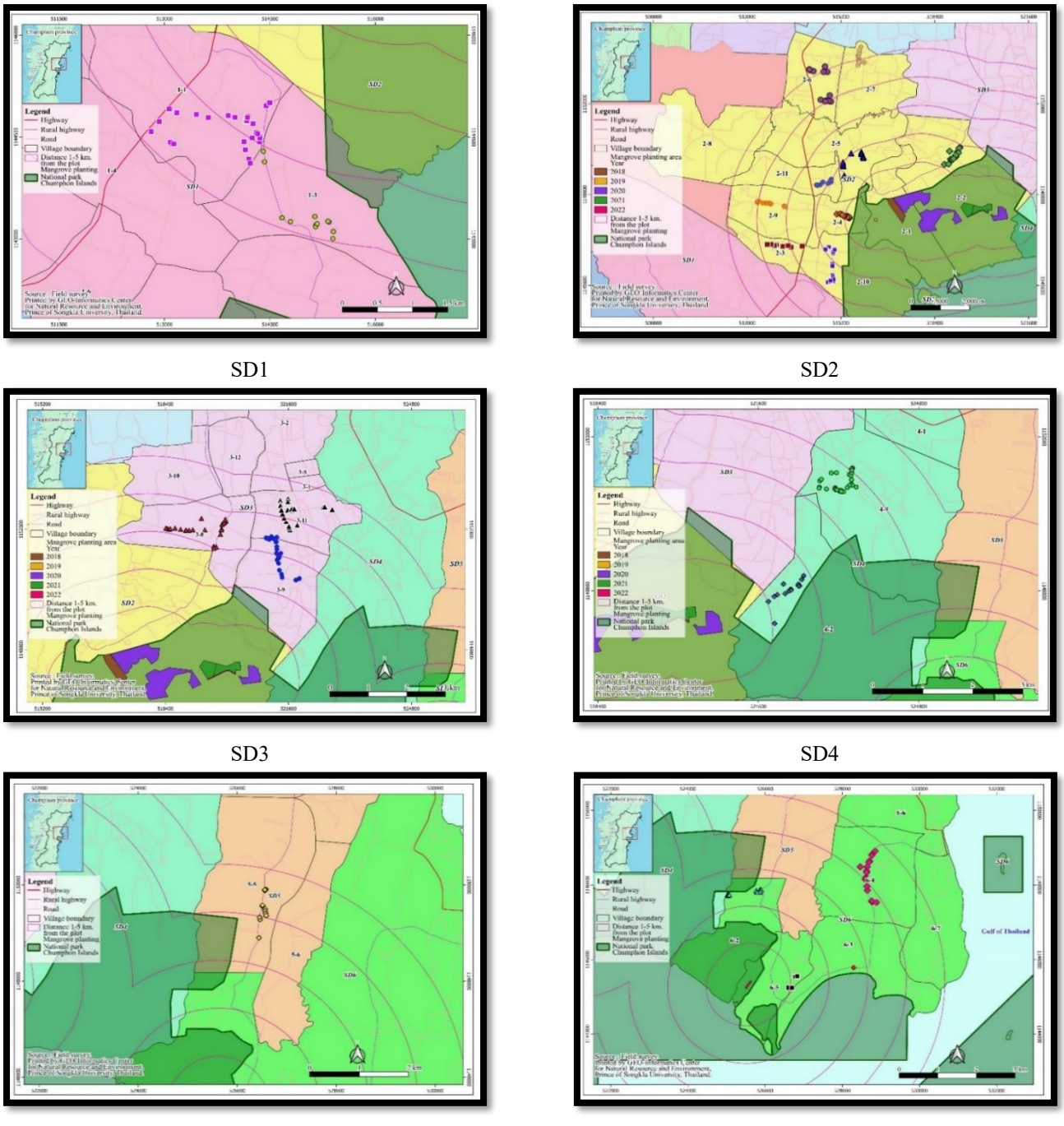


Figure 5. Evolution of the map development to the final version
Source: The authors' elaboration

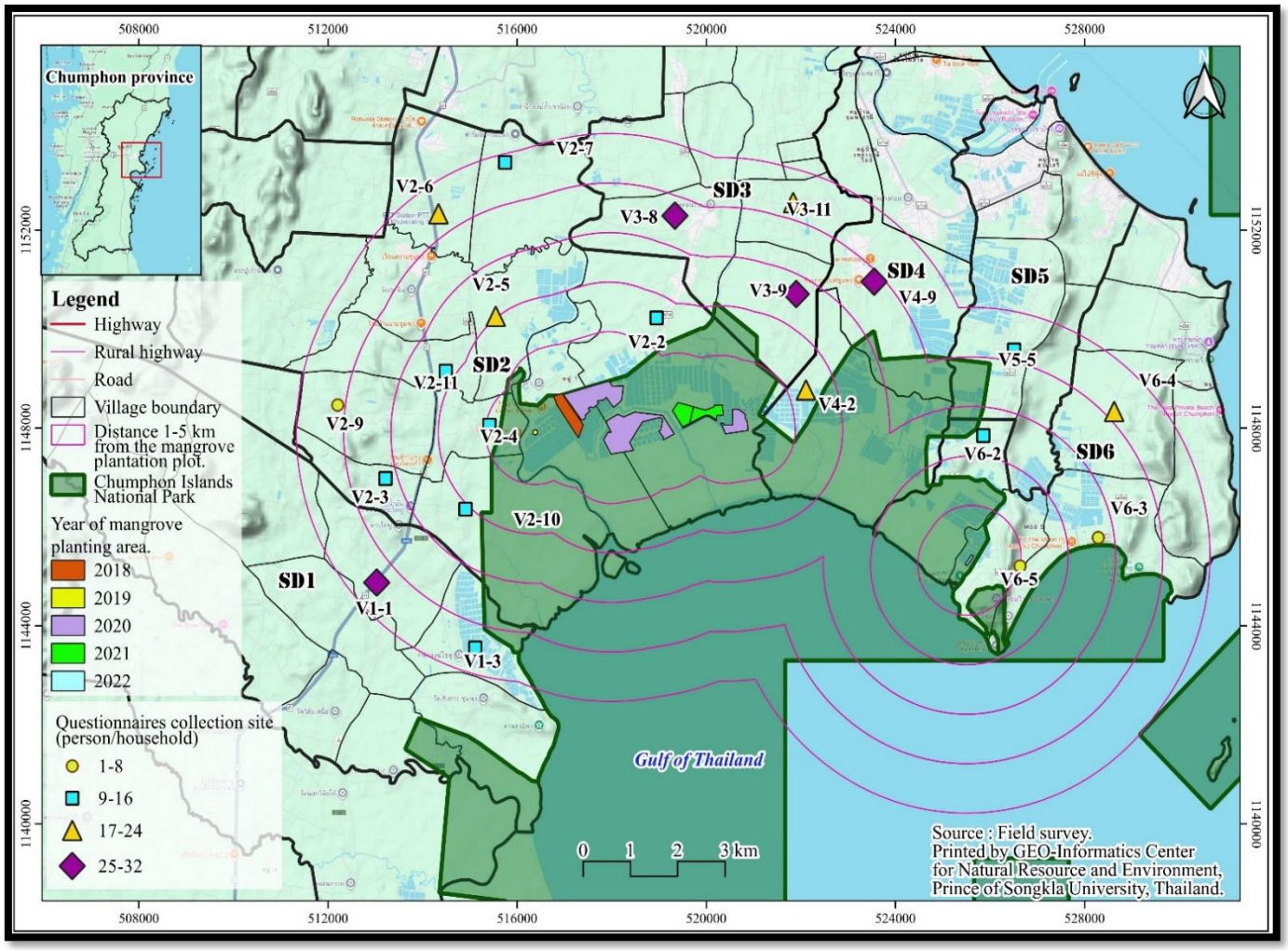


Figure 6. Final version of map development after collecting questionnaires
Source: The authors' elaboration

Table 2. Comparative village designations between the 1st draft and the final version of the survey map

Sub-District	Villages in Five-Kilometer Radius (1st Draft)					Villages in Five-Kilometer Radius (Figure 5)
	1	**2**	**3**	**4**	**5**	
SD1				V1-1		4 and 5
					V1-3	5
SD2		V2-2				2
			V2-3			3 and 4
		V2-4				1 and 2
				V2-5		2
					V2-6	4 and 5
					V2-7	5
			V2-9			4 and 5
			V2-10			2 and 3
		V2-11				2 amd 3
SD3				V3-8		4
			V3-9			3 and 4
					V3-11	4 and 5
SD4			V4-2			2
				V4-9		4 and 5
SD5				V5-5		4 and 5
			V6-2			3
SD6		V6-3				3
					V6-4	4 and 5
		V6-5				1 and 2
SUM	**0**	**5**	**6**	**5**	**5**	

This is concordant with the increasing use of mobile GIS applications for environmental field surveys [4], and similar to the research in geo-information technology for environmental management of Buddhist temples according to Sappaya in Mueang Nan and Phu Phiang districts, Nan province [2], as well as the environmental health factors and dengue risk mapping in Nakhon Nayok Province [21], Thailand, collecting and analyzing both baseline data on a map together with survey data. In addition, some studies have stated that this is a public participatory mapping approach [8-10].

4. CONCLUSIONS

This practical research demonstrated GIS as an effective tool for data collection, as well as for final presentation of results in a developed map, as part of a local people's perception survey at village level, in Chumphon province, Thailand. The study started with review of relevant prior documents on the important issues for map development such as scope and boundary of the survey project, and population and household sizes, to produce the 1st draft of the map. After that the village level map acquired from the Tambon Administrative Organization was overlaid on the 2nd draft of the map. The final map for results presentation became accurate based on the mobile GPS location records from the face-to-face questionnaire collection by the surveyors. On comparing the final developed map to the 1st draft of the map, the results show clearly a great improvement. Finally, procedures and results from this study can be applied to similar studies in practice, such as zoom-in or zoom-out of map versions, presentation of maps detailing habitat distribution on the local village level as done here. Without the map development as presented in this case study, questionnaire collection is difficult with waste of time and wrong locations. The final map developed summarizes the survey outcomes in a manner that is easy to understand by the target audience. This could be shared to the relevant stakeholders and/or revised if needed.

A technical difficulty encountered in this study was the unstable internet connection, when recording the location of the face-to-face questionnaire collection. However, the approach adopted supported data triangulation in this case study survey. Besides, results from this study are presented in descriptive statistics, as well as on map with dot symbols, to present the spread of the survey samples of each village and sub-district boundaries; however, boundaries on maps for districts and sub-districts have been unaffected.

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