



BUILDING SOME MAPS FOR TEACHING, LEARNING, AND RESEARCHING LOCAL GEOGRAPHY IN AN GIANG PROVINCE, VIETNAM

Tran The Dinhⁱ

Faculty of Geography,
An Giang University,
Vietnam

Vietnam National University Ho Chi Minh City,
Vietnam

Abstract:

Through field surveys, data collection and processing, and the use of GIS (Geographic Information System), we have constructed geographic maps of An Giang province to serve teaching, learning, and researching local geography. The research results have built 3 geographic maps of An Giang province at a scale of 1:400,000, including soil, flood, and population maps. These maps will be a necessary addition to the map system of An Giang province to serve the needs of teaching, learning, and researching local geography.

Keywords: soil map, flood map, population map, An Giang province

1. Introduction

Maps are an essential tool in teaching, learning, and researching geography. In teaching, maps are regarded as the "second language" of geography (Salisev, 2006), serving as an important visual channel for teachers to analyze and illustrate information about objects and phenomena in a territory (Tho *et al.*, 2017). In learning, maps provide a basis for students to effectively exploit knowledge through content, color, and the system of symbols in geographical maps. In scientific geographical research, maps are indispensable in representing the spatial distribution of research subjects, as geographical studies often express research results through maps (Doc & Dinh, 2005).

Currently, the teaching and learning of general geography, regional geography, and Vietnamese geography have relatively complete map systems compiled in geographical atlases. However, for teaching and learning local geography and topics related to An Giang Province, both teachers and students still have to rely heavily on maps constructed with general content for the entire country. These maps lack the detail

ⁱ Correspondence: email tt dinh@agu.edu.vn

required to meet the needs of teaching and learning local geography in An Giang Province.

Additionally, research on the An Giang Province region is becoming increasingly abundant and diverse, with many studies requiring geographical maps to represent the scope of research and the spatial differentiation of objects and phenomena. However, there is still a lack of detailed local maps that can fully convey this content.

Given this practical demand, the topic aims to construct several geographical maps of An Giang Province, to utilize the features of Geographic Information System (GIS) software to update local data and create maps that serve the teaching, learning, and research needs of An Giang's local geography for both teachers and students.

2. Literature Review

In the current period, with the rapid development of science and technology, particularly in aerial and ground surveying, mapping, editing, and map production have become convenient, fast, and accurate. Maps are becoming increasingly diverse and rich in both content and form. At present, there are many scientific projects related to the application of GIS in map construction.

The most prominent research directions include:

- The direction of using GIS (Geographic Information Systems) to create world, national, and local maps. Some applications of GIS for map creation include:
 - The “Atlas” project published in 2001 in the UK is one of the most comprehensive and detailed collections of maps in the fields of natural and socio-economic geography. In addition to maps, information and data about countries worldwide are also presented. Currently, it is used as a teaching resource in geography in many countries such as the UK, the US, Germany, Australia, and India.
 - Furthermore, publications such as "Atlas: A Pocket Guide to the World Today" (Kindersley, 2015) and "Children's World Atlas" (Adams, 2011) by the publishing company Dorling Kindersley (DK) are also detailed map collections about the world and different countries. These materials include geographical guides that make studying geography and related sciences easier.
- The direction of using GIS to create maps for monitoring and managing resources and the environment, including assessing the impact of production and living activities on the environment such as:
 - Compiling map books for research purposes like the "World Atlas of Natural Disaster Risk" (Shi *et al.*, 2015) which describes vulnerability, resilience, adaptation, and risk from natural disasters worldwide, presented in a combination of map language and written text, and "The Water Atlas" (Clarke & King, 2004) - a unique visual analysis of water resources in the form of a map book and written boxes conveying various water issues globally.

- Digital map forms for resource management such as the "Digital Soil Map of the World" (Sanchez *et al.*, 2009) – a collection of global soil resource maps presented in a WebGIS format; and the "World Ocean Atlas 2001: Objective Analyses, Data Statistics, and Figures" (Conkright *et al.*, 2002) – a series of data, information, and global ocean maps stored in digital format.

In summary, both globally and in Vietnam, the mapping system has been relatively well-established, serving well for learning, research, and addressing practical production issues. However, in An Giang, the mapping system primarily serves the purpose of state management regarding local resources and population, and the socio-economic situation of the area; there is a lack of maps specifically designed for teaching, studying, and researching issues related to local geography. Therefore, the creation of maps for the subject as outlined above has practical significance.

3. Material, Scope and Methods

3.1. Research Materials

3.1.1 Spatial Data

Maps of soil units from the Faculty of Agriculture, An Giang University; land use status map for 2015 from the Department of Natural Resources and Environment; and the 1:100,000 scale socio-economic development planning map by the Provincial People's Committee.

3.1.2 Attribute Data

Includes accompanying tables related to spatial data and attribute data such as statistical information on natural conditions, socio-economic aspects, the development status of agriculture and forestry in the province, ecological requirements for agricultural production, and relevant provincial development guidelines.

3.2. Research Scope

3.2.1 Territorial Limitation

The research focuses on the entire territory of An Giang province according to administrative divisions, with a total natural area of 3,536.68 km², consisting of 11 administrative units (An Giang Provincial Statistics Department, 2023).

3.2.2 Content Limitation

We focus on creating three geographic maps at a scale of 1:400,000 for different fields in An Giang province (soil map, flood zoning map, and population map).

3.2.2.1 Time Limitation

The data used for creating the maps are from before 2024.

3.3. Research Methods

3.3.1. Data Collection, Processing, and Analysis Methods

3.3.1.1 Collection of Documents and Secondary Data

Secondary documents and data on the natural and socio-economic conditions of An Giang province are collected from research projects and summary reports from the Statistics Bureau and provincial departments. Additionally, secondary data includes base maps and remote sensing images collected from domestic mapping and remote sensing agencies. These secondary documents form the basis for constructing the geographic maps of An Giang province.

3.3.1.2 Data Processing and Analysis

Statistical data are presented in various forms such as text, tables, charts, and maps. The collected data come from different sources, so inconsistencies may arise. Therefore, data processing must be conducted through interpolation and data management software. This allows for the selection of the most suitable and accurate information to incorporate into the maps.

3.3.2. Field Survey Methods

During the process of developing geographic maps of An Giang province, we conducted two field surveys in the study area:

3.3.2.1 First Field Survey

Conducted in April 2023, after the base map was completed, a preliminary survey was carried out to identify landmarks and locate positions in the field to ensure the geographic map's boundary accuracy.

3.3.2.2 Second Field Survey

Conducted in December 2023, after the specialized geographic maps were drafted, the survey aimed to compare the actual situation with the drafted maps, enabling adjustments as necessary.

3.3.3. Mapping and GIS (Geographic Information System) Methods

Maps are considered the "second language" of geography. During map drafting, we used the best methods for representing map content, such as cartogram, map-chart, and symbol methods. These methods were applied consistently during drafting to ensure the maps' scientific, aesthetic, and educational qualities.

To develop geographic maps, we utilized the functions of GIS tools such as MapInfo and ArcGIS software to update, process data, and draft geographic maps.

4. Results and Discussion

4.1. The process of Building a Geographical Map of An Giang Province

The construction of geographic maps of An Giang province was carried out in three phases: preparation, fieldwork, and office work.

4.1.1 Preparation Phase

This phase includes preparing documents and data on the natural conditions, socio-economic conditions, and population of the area; base map data and remote sensing images; tools and methods for field investigation; and detailed planning for map construction.

4.1.2 Fieldwork Phase

This includes preliminary field surveys to verify the boundary accuracy compared to the base map; and a detailed investigation of changes in the objects on the ground that need to be depicted on the map. Any changes must be recorded and updated on the map.

4.1.3 Office Work Phase

This involves updating and processing data; using GIS tools to draft maps; classifying and describing mapped objects; and writing map explanations.

4.2. Building Some Geographic Maps of An Giang Province

4.2.1. Soil Map

This is a thematic map that shows the location, spatial distribution, and scale of each soil unit. A soil map must present the following basic information:

- The name of the soil unit is usually represented by symbols according to national or international soil classification systems.
- On the soil map, each soil unit is also depicted with a unique color, helping to differentiate it from other soil units on the map.

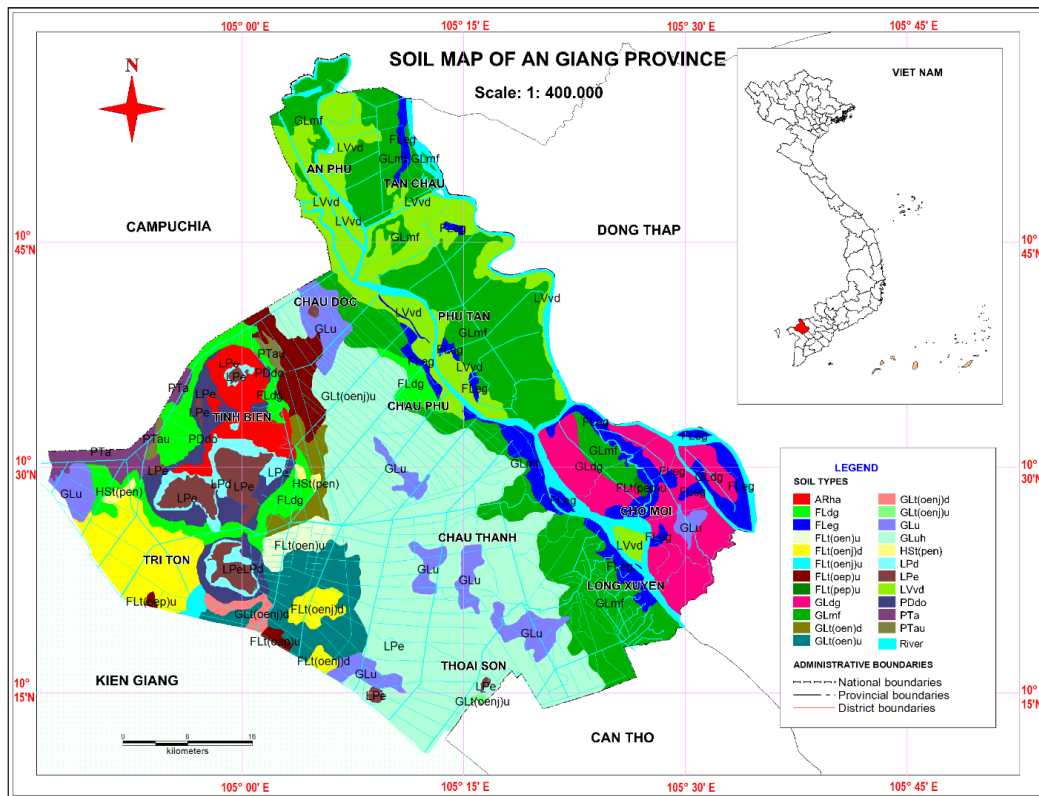
The paper constructed a soil map of An Giang province at a scale of 1:400,000 and identified 7 soil groups with 24 different soil types (An Giang Provincial People's Committee, 2018).

Table 1: The Major Great Soil Groups of An Giang Province, Vietnam

Soil groups	Soil types	Distribution	Area (ha)	Percentage (%)
Histosols	HSt(pen)	Found in wetland forest area in Tri Ton district	984	0.28
Leptosols	LPd, Lpe	Mostly in highland regions (Seven Mountains region)	22,675	6.41
Plinthosols	Pta, Ptau, Ptauf, Pddo	Hill and upland regions in Tinh Bien and Tri Ton districts	14,618	4.13
Thionic Fluvisols, Thionic Gleysols	Fleg, FLdg, GLt(oen)d, GLt(oen)j)d, GLt(oen)u, GLt(oen)j)u, GLmf, Glu, Gluh, GLdg	The low-lying area is far from the Tien and Hau rivers, located behind the upland along rivers	226,866	64.15
Salic Fluvisols	FLt(pep)u, FLt(oep)u, FLt(oen)j)d, FLt(oen)u, FLt(oen)j)u,	Adjacent to Kien Giang province	44,687	12.64
Fluvisols	LVvd	Mainly in low-lying areas and along the Tien and Hau rivers	30,793	8.71
Arenosols	ARha	Scattered throughout the province	13,044	3.69
Total			353,668	100

Source: Based on the Soil Classification System of the FAO.

Figure 1: Soil Map of An Giang Province, Vietnam



Data sources: Sub-National Institute of Agricultural Planning and Projection

4.2.2. Flood Map

The flood map is a map that defines the boundaries of areas affected by a specific flood event, as represented on the map. The boundaries of flooded areas depend on floodwater levels and the area's topography; since topographical features change little, the flood zone boundaries primarily depend on changes in floodwater levels (Hoang Thai Binh, 2009). The flood map often includes information such as the areas where flooding occurs and the depth of flooding in each area. In addition to geographic features, the flood map may also include factors such as hydrological networks and levee systems.

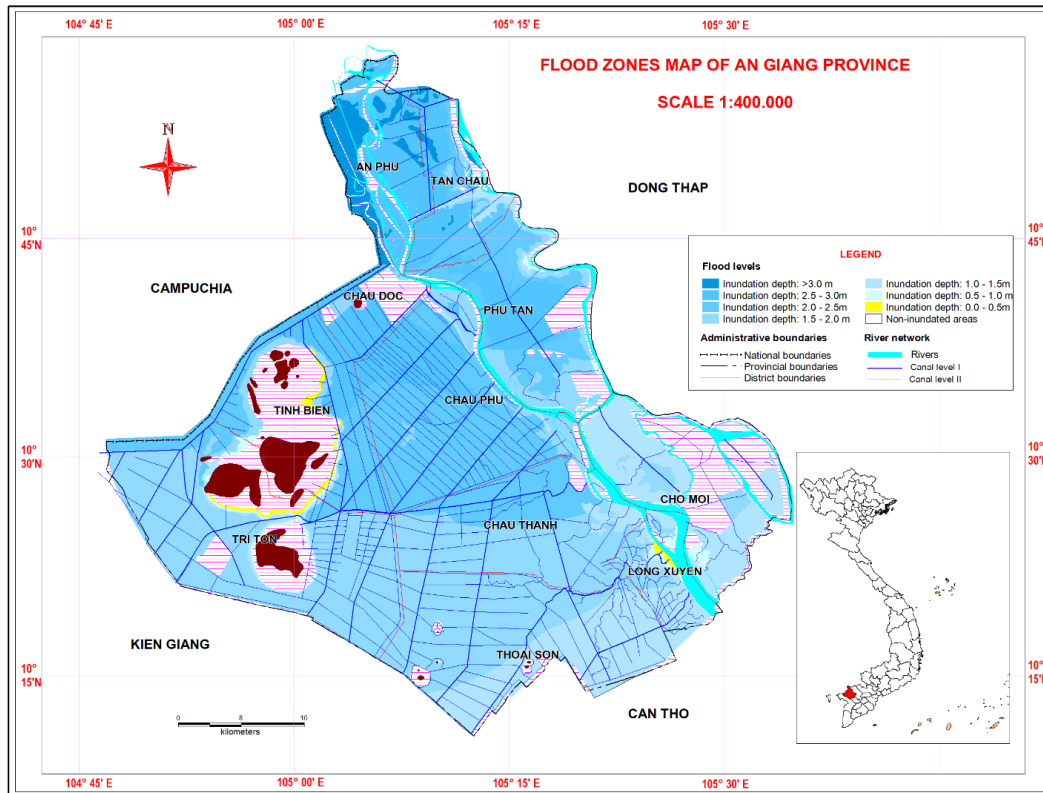
Currently, various methods are used to create flood maps (De Moel, *et al.* 2009; Rincón, *et al.*, 2018; Mudashiru, *et al.*, 2021). In this paper, the flood map is constructed using traditional methods, relying on hydrological and topographic surveys to recreate the flooding status as a basis for comparative evaluation among different areas.

Data used to construct the An Giang flood map includes topographic maps, hydrological network maps, meteorological and hydrological data, and remote sensing images from years with significant floods. An Giang experiences prolonged flood seasons each year, with about 70% of the natural area being flooded from 1.0m to 3.0m deep, with flood duration lasting from 2.5 to 6 months (An Giang Provincial People's Committee, 2008).

Based on the distribution and depth of flooding, the study divides An Giang into the following flood zones:

- Flood zones from 2.5 to >3m: located at the headwaters where the Mekong River flows into Vietnam, mainly concentrated in An Phu district, Tan Chau town, Chau Doc city, and part of Phu Tan district. These are divided into two subzones: the subzone with 2.5 to 3m of flooding and the subzone with more than 3m of flooding.
- Flood zones from 1.5 to 2.5m: low-lying areas in Long Xuyen Quadrangle, including Chau Phu, Chau Thanh, Tri Ton, and Thoai Son districts. These are divided into two subzones: the subzone with 1.5 to 2.0m of flooding and the subzone with 2.0 to 2.5m of flooding.
- Flood zones from 0 to 1.5m: post-levee floodplains in Cho Moi and Thoai Son districts, Long Xuyen City, and part of Phu Tan district. These are divided into three subzones: the subzone with 0 to 0.5m of flooding, the subzone with 0.5 to 1.0m of flooding, and the subzone with 1.0 to 1.5m of flooding.
- Non-flooded zone: The "Seven Mountains" region in Tinh Bien and Tri Ton districts.

Figure 2: Flood Levels in the An Giang province, Vietnam



Data sources: Southern Institute for Water Resources Planning

4.2.3. Population Map

Currently, there are three types of population maps commonly represented: maps showing population distribution, maps showing ethnic composition, and maps showing population fluctuations (Tran Thi Phung Ha, 2010).

In this paper, we focus on the map showing population distribution.

To represent the population distribution map, we used the following methods:

- The cartogram method represents population density.
- The chart method represents the urban and rural population structure.
- The symbol method represents administrative and transportation centers.

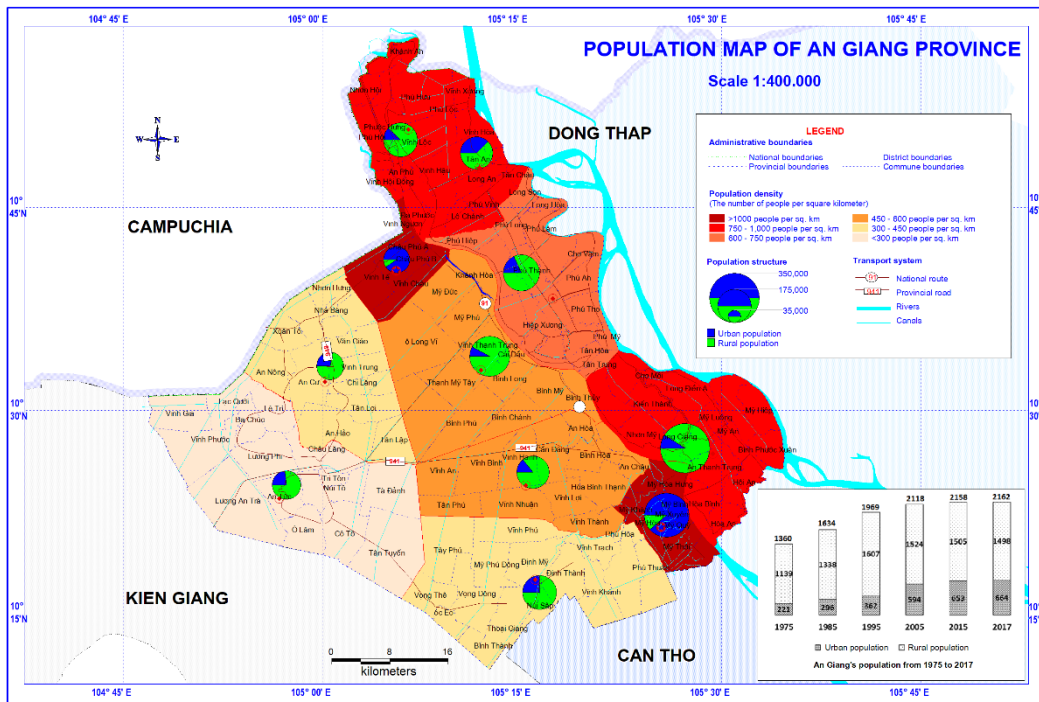
According to statistics from An Giang Statistics Bureau, An Giang's population was 2,161,713 people (as of December 31, 2023), ranking 6th in the country. The average population density of An Giang province is quite high at 611 people/km², nearly 2.16 times the national average density (283 people/km²). The province's natural population growth rate has been decreasing, from 2.11% in 1990 to 0.934% in 2015, and down to 0.93% in 2023, lower than the national growth rate (1.03%). The population distribution is uneven, primarily concentrated in rural areas (69.25%), while urban areas account for only 30.75% (An Giang Provincial Statistics Department, 2023).

Table 3: Area, Population, and Population Density of An Giang Province, Vietnam

	Area (km ²)	Population (people)	Population density (people/km ²)
Total	3.536,680	2.161.713	611
Long Xuyen	115,364	286.287	2.482
Chau Doc	105,231	111.577	1.060
An Phu	226,171	179.803	795
Tan Chau	176,437	172.226	976
Phu Tan	313,136	207.818	664
Chau Phu	450,713	246.591	547
Tinh Bien	354,679	122.019	344
Tri Ton	600,238	134.808	225
Chau Thanh	354,830	170.791	481
Cho Moi	369,061	347.750	942
Thoai Son	470.820	182.043	387

Source: People's Committee of An Giang province, 2023.

Figure 3: Population Map of An Giang Province, Vietnam



Data sources: People's Committee of An Giang province.

5. Conclusion

In our country, the geographic map system has been relatively complete, serving well for learning, research, and solving practical production issues. However, in An Giang, the maps that have been developed primarily serve government management purposes related to resources, socio-economics, and population; maps specifically for teaching, learning, and studying issues related to local geography are still limited.

Therefore, using both traditional and modern methods, the research project has created three geographic maps of An Giang province (soil map, flood zoning map, and population map). The research results are expected to be a useful supplement for studies using geographic maps in An Giang province, providing supplementary reference material for teachers and students studying local geography, and helping provide reference maps for managing natural resources and territorial planning in An Giang province.

Conflict of Interest Statement

The author declares no conflicts of interest.

About the Author(s)

Tran The Dinh is a PhD in Natural Geography. The author is a working faculty of Geography at An Giang University, Vietnam National University, Ho Chi Minh City, Vietnam.

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