

GEO-INFORMATION TECHNOLOGY FOR ENVIRONMENTAL MANAGEMENT OF BUDDHIST TEMPLES ACCORDING TO SAPPAYA IN MUEANG NAN AND PHU PHIANG DISTRICTS, NAN PROVINCE

Phramaha Piya Theerunguro Moontha,^{a*} Siripun Taweesuk,^a Phrachayanunthamunee^b

^a Thammasat University, Thailand

^b Mahachulalongkornrajavidyalaya University, Thailand

* Author for correspondence email; P.1.theerunguro@hotmail.com

ARTICLE INFO

Research Article

Keywords

Buddhist Temples,
Geo-Information,
Technology Sappaya Index

Received:

2023-05-08

Revised:

2023-06-19

Accepted:

2023-06-21

ABSTRACT

This study emphasizes the use of geo-information technology for environmental management of Buddhist temples according to the concept of 'beneficial or advantageous conditions to mental development' (Sappaya) in Mueang Nan and Phu Phiang District, Nan Province. It aims to analyze Buddhist temple layout and initiated a Buddhist Temple Sappaya Index model (BTSI) which was informed by the five supporting components for Buddhist monks' practice of Dhamma education (Ganthadhura) and religious activities in meditation (Vipassanadhura). The study involves the analysis of the data gathered from the Tipitaka, commentaries, field surveys, questionnaires, online Google Maps, vector spatial data, textbooks, documents, and very high-resolution digital imagery from WorldView-3 satellite. The obtained data are processed using Open source QGIS Version 3.22.9 Białowieża geospatial software. The Buddhist temple layout accentuates the construction of the Buddhāvāsa area. On the Buddhāvāsa ground, 50.0 percent of temples under royal monastery and 50.0 percent of temples under community monastery have principal senāsana /buildings such as Uposatha hall, Vihāra, Chedi, drum tower/belfry, and preaching halls. Overall, three temples under royal monastery receive a high BTSI score between 94.9 to 80.3 percent. Five of temples under community monastery also have a high BTSI scores between 93.2 to 81.3 percent. In addition, forty-four temples under community monastery have a moderate BTSI, with scores range from 79.6 to 51.4 percent. Finally, forty-three temples under community monastery receive a BTSI with a score of less than 50.0 percent.

Introduction

The Buddhist religion has three main institutions: the Buddha (The Enlightened One), the *Dhamma* (The Doctrine), and the *Saṅgha* (The Order), also known as the *Ratanattaya* (The Triple Gem). They are highly respected and form the spiritual foundation of all Buddhists. The temple in Buddhism is a religious site built for the benefit of being a location where the *Ratanattaya* resides. It normally consists of *Uposatha* hall, *Vihāra*, Chedi, and monks who live there practicing the Order. It is a place of joy, cleanliness, and peacefulness. The conditions of the temple are considered *Sappāya* (beneficial or advantageous) for the practice of *Samaḍadhamma* (monastic observances), morality, concentration, wisdom, and rituals of the Buddhist monks and community. According to the *Tipiṭaka*, Volume 4, the first part of the Greater Section in the Vinaya-pitaka (the Basket of Discipline), the first temple in Buddhism originated when King Bimbisara offered a royal bamboo garden near *Vebhārapabbate* hill outside the ancient city of Rajgarh to become the first Buddhist temple, named "*Venuvana Maha Vihāra*." Additionally, a wealthy businessman, Anathapindika, purchased a garden of Prince Chet to build another temple to offer in the Buddhist religion, named "*Jetavana Maha Vihāra*." The temple featured monastic cubicles, a circular-shaped cloister, a lotus pond, a place for walking meditation, etc. Since then, the Buddha has granted permission for monks to accept the offering of land for the construction of temples.¹ As a result, in the areas where Buddhism has spread, many Buddhist communities with a strong faith have come together to build temples for the purpose of worship. The designs, however, could be vary depending on times, community's believes and the objectives of the builders (Buddhist communities) which are included lay practitioners and the residents (monks) which will based on according to geographical matters. So, we can witness many varieties in designs since the Buddha's time.

The original characteristics of the temple during Buddha's time were evident in the royal procession of King Bimbisara before presenting the royal bamboo garden of *Venu Vana* to the Buddha. He said, "Where the Blessed Buddha is enshrined, it should be a place that is not far from the village, with convenient transportation for people who wish to visit during the day without disturbance, and quiet at night without noise, free from the wind caused by people entering and leaving."² It should be a suitable place for those who seek peacefulness and should be respected according to the tradition of the monks."³ This vision was in accordance with the principles of *sappāya* and *senāsana* (Lodging), which consist of the five principles in the *Senāsana Sutta*. The *Sutta* (Discourse) mentions that by practicing with the five principles of the *senāsana*, one can also practice mindfulness with the use of the five principles of *Sappāya*. Any place with the five mentioned principles is suitable for a dwelling for the purpose of study and practice of the monks. That is to say, the location is not too close or too far away, with few disturbing crawling creatures, adequate factors that support livelihood, easy access during the day without disturbance, and few sounds and disturbances at night. The place is home to the disciplined and virtuous Senior monks (*Thera Bhikkhu*) who abides by this set of principles. It is where one who can unveil the unrevealed matters and explaining difficult concepts for easy comprehension resides.⁴

¹ Vi.M. Tti. 4/13/70.

² Ibid., 4/13/71.

³ Ang. TSK. Tti. 24/1/17-18.

⁴ Ang .TSK. Tti. 24/1/17-18.

The term '*Sappàya*' refers to favorable environment that is suitable, supportive, and helpful in achieving successful Buddhist cultivation, which in turn helps to establish unwavering mindfulness and prevent regression.⁵ In Thai, it is equivalent to the word 'comfortable,' but in Buddhism, it specifically refers to something that supports and sustains life in the creation of goodness or merit.⁶ The state of *Sappàya* is mentioned in the *Tipiṭaka* and *Atthakatha Visuddhimagga* scriptures, particularly in the *Senāsana Sutta* in the *Suttapiṇṇaka* (the Basket of Discourses) of *Anguttara-nikāya Desakanipāṭa*.⁷

This study aims to investigate the suitability of Buddhist temples according to the five principles of *Sappàya* that can be analyzed and communicated in physical form. The investigation will promote support for two important *Dhura* (Duties) activities of monks, namely *Ganthadhura* (the duties of study or task of learning) and *Vipassanādhura* (the duties of insight development or task of meditation practice). The study focuses on temples of *Theravāda* Buddhism, which are under the supervision of the *Mahānikāya* Sect with the *Visumgāmasimā*. They can be classified into two types: royal monastery (Wat Luang) and community monastery (Wat Raad), as recorded in the National Office of Buddhism's temple registry database for the year 2019⁸. The study applies geo-information technology, which is an integration of science and technology related to remote sensing (RS), geographic information systems (GIS), and global positioning systems (GPS), in order to serve as a guideline for managing the environment within Buddhist temples and improving the efficiency of various tasks performed in those religious sites.⁹

The analysis of layout and Buddhist Temple *Sappàya* Index (BTSI) demonstrate the model that simplified representation of *Sappàya* phenomenon in Buddhist temples¹⁰. This study interprets, compiles, and visualizes the BTSI using the five principles of *senāsana*^{11,12}, which are the practices of *Ganthadhura* and *Vipassanādhura* of Buddhist monks in Buddhism. The study uses index values and vector data to analyze temple *Sappàya* in Mueang Nan and Phu Phiang Districts, Nan Province. By applying geoinformation technology to the physical aspects of Buddhist studies, this study marks the beginning of integrating Buddhist studies with modern technology in a new dimension. It will lead to the development and benefits of environmental management in temples suitable for the practice of Buddhist monks. The study aligns with the resolution of *Mahātherasamāgama* (the Sangha Supreme Council)¹³ on the "Temple, Community, and State for Happiness" project, which supports the participation of all sectors of society in the development of temples. Moreover, surveys, temple layout, and spatial analysis will provide systematic information for the development of temples in the future.

⁵ Phrabrahmagunabhorn (P.A. Payutto), *Dictionary of Buddhism*, 18th edition, (Bangkok: Permsap Printing House, 2010).

⁶ Phramahaphoṭhiwongsachārya (Thongdee Suratecho), *Thai -Pali Dictionary*, (Bangkok: Phanyamit Printing Co., Ltd., 2016), 675.

⁷ Ang .TSK. Tti. 24/1/17-18.

⁸ National Office of Buddhism, *Temple Registry Information*, Accessed March 3, 2019, <https://www.onab.go.th/th/page/item/index/id/1>.

⁹ Geo-Informatics and Space Technology Development Agency, *Space Technology and Geoinformatics Textbook*, (Bangkok: Amarin Printing Pub Co., Ltd, 2009), 1.

¹⁰ Kang T. Chang, *Introduction Geographic Information Systems*, 9th edition, (New York: McGraw-Hill Publishing Company Limited, 2019), 408, 412.

¹¹ Vi.M. Tti. 4/13/70.

¹² Somdetphraputhajarn (Arj Asabhummathera), *Visuddhimagga*, 12th edition, (Bangkok: Thana Press Co., Ltd., 2017), 212.

¹³ The Sangha Supreme Council Resolution Meeting at the 20/2561, Resolution No. 430/2561. Temple, Community, and State for Happiness Project, 2018.

Research Methodology

The study “Geo-information technology for environmental management of Buddhist temples according to *Sappāya* in Mueang Nan and Phu Phiang Districts, Nan Province, has an overview of the study process (Figure 1) as follows.

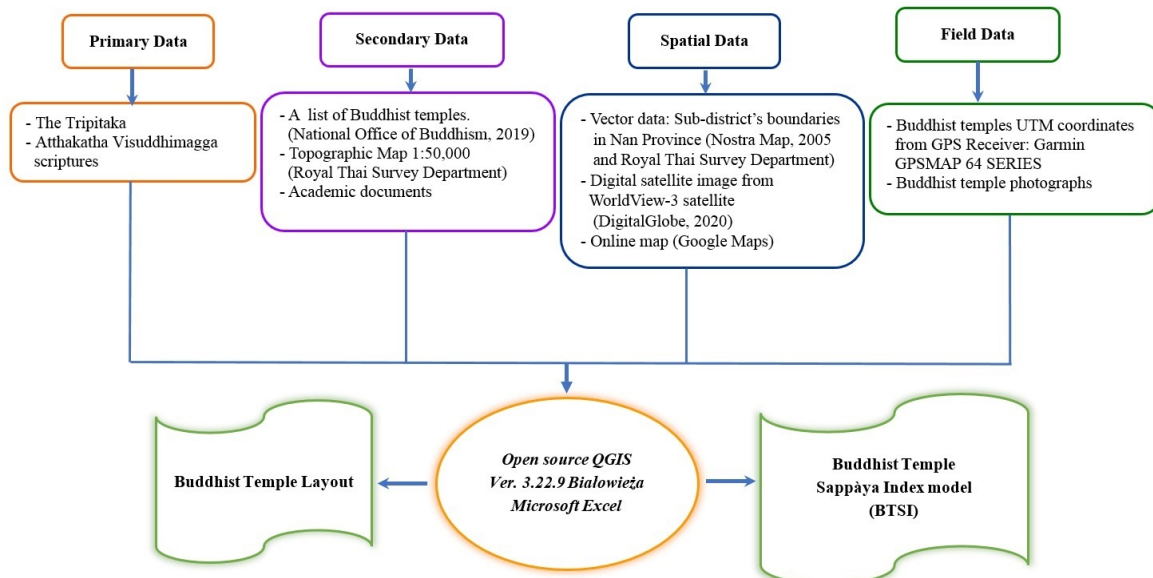


Figure 1 Overview of the study process

1. Collect primary and secondary data of temples in *Theravāda* Buddhism under the jurisdiction of the Sangha Supreme Council of *Mahānikāya* Sect, consisting of the temples under royal monastery and temples under community monastery. They have received the *Visumgāmasimā*, according to the temple registry database of the National Office of Buddhism (2019)¹⁴ in Mueang Nan and Phu Phiang districts, Nan Province, totaling 95 temples. The primary data also includes the volume 8¹⁵ of historical books of temples throughout the kingdom, and high-resolution digital satellite imagery from WorldView-3 satellite, with a resolution of 50x50 centimeters¹⁶.

2. Conduct a field survey to collect coordinate data of the temples by using the main entrance position of each temple, all 95 temples, with a GPS receiver: GPSMAP 64 SERIES, Universal Transverse Mercator (UTM) Zone 47N coordinates and WGS 84 horizontal datum, along with a 1:50,000 scale topographic map of the Royal Thai Survey Department, L7018 series, sheets 5146 I to IV, 5147 II and III. Additionally, photographs were taken from December 2019 to March 2020.

3. Study the Buddhist temple layout by determining the sample size which included three temples under royal monastery and thirty temples under community monastery, selected by stratified random sampling¹⁷, with a Buddhist century (BC) of temple building classification, out of 92 temples under community monastery. The size of the sample group was calculated using equation 1.

¹⁴ National Office of Buddhism, *Buddhist Register Database*, Accessed March 3, 2019, <https://www.onab.go.th/th/page/item/index/id/1>.

¹⁵ Department of Religious Affairs, *History of Temples throughout the Kingdom*, (Bangkok: Religious Printing House, 1989).

¹⁶ Digital Globe. U.S.A., *World View-3 Data Sheet*, Accessed October 24, 2022, <https://www.digitalglobe.com>.

¹⁷ Watcharaporn Suriyaphiwat, *Statistics for Biological Science*, (Bangkok: Chulalongkorn University Press, 2009).

$$n = \frac{1}{\frac{e^2}{z^2 (cv)^2} + \frac{1}{N}} \quad \text{Equation for calculating the sample size}^{18} \quad (1)$$

where $e = 3\%$, $z = 1.96$ (at 95% confidence level), and $cv = 10\%$.

3.1 Create a vector data point shapefile layer from the field survey and a vector polygon shapefile layer of temples layout using high-resolution WorldView-3 satellite imagery, with visual interpretation¹⁹. Then, digitize the temples layout on a computer screen²⁰. The digitized spatial layout data from the WorldView-3 satellite were used to show the details of the intended *senāsana* /buildings features, including the *Buddhāvāsa* area (residence of the Buddha), the *Sanghāvāsa* area (living quarters of the monks), and the area of utility²¹ within the temple walls' boundary. This also included the location and direction of the front gate of the *Uposatha* hall, with the UTM coordinates zone 47N and WGS 84 horizontal datum, using the open-source software QGIS Version 3.22.9 Białowieża²².

3.2 Study the Buddhist temple layout, the presence of dwelling (*senāsana*) and building within the *Buddhāvāsa* area, the *Sanghāvāsa* area, and the area of utility of temples. The results of the study are presented in the form of the layout map of temples in Buddhism and descriptive narration.

4. Buddhist Temples *Sappāya*. The level of *Sappāya* in Buddhist temples was determined based on the 95 temples located in the Mueang Nan and Phu Phiang Districts, Nan Province, including 3 royal monasteries and 92 community monasteries.

4.1 Interpret, arrange, and embody the meaning of the five principles of *senāsana* as presented in the *Senāsana Sutta* of *Sutta-pitaka*, by examining the *Tiṭṭhaka*, *Atthakatha* *Visuddhimagga* scriptures, and documents that related to the components of the *Sappāya* foundation of Buddhist temples. The examination emphasized the *sappāya* elements that support the *Ganthadhura* and *Vipassanādhura* of the monks, as described in the *Senāsana Sutta* of the *Suttantapiṇṇaka Anguttara-nikāya*, which is a scripture that deals with the five principles of *Sappāya* characteristics of the place for practicing meditation and achieving mindfulness for the monks. The five principles are as follows²³.

- *The place should not be too close or too far away, should be convenient for transportation, and should not be noisy during the day with few sounds and disturbances at night. There may be least discomfort caused by horseflies, mosquitoes, wind, heat, and crawling creatures.*
- *When a monk resides in that place, the four requisites of Cāvara (robes; clothing), Pindapata (alms-gathering), Senāsana (lodging), and Gilānapaccaya Bhesajja Parikkhāra (support for the sick; requisites for the sick; medicine) arise without any difficulty.*

¹⁸ Steven K. Thompson, *Sampling*, (USA: John Wiley & Sons, Inc, 1992).

¹⁹ Thomas M. Lillesand, Ralph W. Kiefer, and John Wiley, *Remote Sensing and Image Interpretation*, 4th edition, (New York: John Wiley & Sons, 2000).

²⁰ Sanjai Klindao, *Spatial Management Concepts and Methodology*, (Bangkok: O.S. Printing House, 2012).

²¹ Crown P. Bureau, *Handbook for the Maintenance and Preservation of Religious Sites*, (Bangkok: Crown Property Bureau, 2016).

²² QGIS.org. 2022. QGIS Geographic Information System. QGIS Association.

²³ Vi.M. Tti. 4/13/70

- Senior monks (*Thera Bhikkhu*) in that place (*Senàsana*) are one who has great knowledge (*Bahussuta*); expert on the scripture (*Gantha*), expert on the Discipline; and expert on the Pàli language (*Màtikà*).
- Monks may approach those mentioned senior monks (*Thera Bhikkhu*) at an appropriate time and ask, "What are the words of the Buddha? What is the essence of the words of the Buddha?"
- Those senior monks shall reveal what has not yet been revealed, make difficult points understandable, and alleviate doubts about the Dhamma that have troubled those monks.

4.2 Verify the physical characteristics as described in the Thai version of the *Tipitaka*, Mahachulalongkornrajavidyalaya University Edition, 2539 B.E.²⁴ and the Royal Edition, 2518 B.E.²⁵, together with the commentary of *Atthakatha Visuddhimagga* Scriptures by *Buddhaghosa Thera* ²⁶ along with consultation with three expert monks who specialized in Buddhist canonical and doctrinal studies.

4.3 Establish indicators based on physical characteristics that were interpreted and arranged from the five principles of *senàsana* as presented in the *Senàsana Sutta of Sutta-pitaka* in order to analyze the validity of *sappàya* measurements in Buddhism that support the practice of *Ganthadhura* and *Vipassanàdhura* by the monks according to the mentioned five principles, as shown in Table 1.

4.4 Create a questionnaire that examined the content validity, which was validated by three expert monks, and analyzed the index of Item-Objective Congruence (IOC). Then, try out the questionnaire on the 30 Buddhist temples in Wiang Sa District, Nan province, to determine whether the questions accurately and appropriately conveyed factual data.²⁷

4.5 Import data from the online map analysis tool, Google Maps²⁸, and the questionnaire using Microsoft Excel software.

²⁴ Ibid., 4/13/70-71

²⁵ Aang.TSK. Tti. 24/1/17-18

²⁶ Somdetphraputhajarn (Arj Asabhummathera), *Visuddhimagga*, 212.

²⁷ Utumporn Jamornmann, *Questionnaire: Construction and Use*, 6th edition, (Bangkok: Funny Publishing Limited, 2001), 8-13.

²⁸ Google Maps, 2022 *Google Map*, Accessed October 24, 2022, <http://www.google.co.th/maps/dir/>.

Table 2 Analysis of the *Sappaya* of Buddhist temples that support the practice of *Ganthadhura* and *Vipassanadhura* according to the five principles of *Senāsana*

<i>Senāsana</i> Consisting of the 5 Principles ²⁹	Explanation According to Footnotes in the <i>Tiṭṭakā</i> ³⁰	Commentary in <i>Atthakatha Visuddhimagga</i> Scriptures ³¹	Physical Interpretation Characteristics	Indicators	Scores	Descriptions
<p>Principle 1:</p> <p>The place should not be too close or too far away, should be convenient for transportation, and should not be noisy during the day with few sounds and disturbances at night. There may be least discomfort caused by horseflies, mosquitoes, wind, heat, and crawling creatures.</p>	<p>- <i>Senāsana</i> that is far away, when a monk lives, it is difficult to go on an alms round. Their restless mind is unable to meditate</p> <p>- <i>Senāsana</i> that is near will be crowded with people, noisy and unable to meditate.</p> <p>- It is disturbed by poisonous crawling creatures and insects; however, it is unable to meditate.</p>	<p>1. Monks <i>senāsana</i> in this religion is indeed a place that is not too far away, not too close, however, it is line with a convenient way to travel, (I) safe (II)</p>	(I) Existence of the village	Location of the village / communities surrounding the temple	0	> 2 km.
					1	1 – 2 km.
					2	0.5 – 1 km.
					3	< 0.5 km.
			(II) The number of incidents that impact the alms-gathering	Safety in alms	0	≥ 3 times/year
					1	2 times/year
					2	1 time/year
					3	Never happened
			Translation and interpretation according to the characteristics of the temple that are not conducive to 18 meditation practices, shown in the <i>Atthakatha Visuddhimagga</i> Scriptures ³²	Characteristics of the temple that are not conducive to 18 meditation practices	0	Have 18 characteristics of the temple that are not conducive to meditation.
					1	Less than 18 characteristics of temples that are not conducive to meditation development (1-17 items).
					2	Characteristics of temples that are not conducive to meditation. But the temple has a specific location that is conducive to meditation.
					3	No characteristics of temples that are not conducive to meditation.

Table 2 (Cont.)

<i>Senāsana</i> Consisting of the 5 Principles ²⁹	Explanation According to Footnotes in the <i>Tipitaka</i> ³⁰	Commentary in <i>Atthakatha Visuddhimagga</i> Scriptures ³¹	Physical Interpretation Characteristics	Indicators	Scores	Descriptions
Principle 1 The place should not be too close or too far away, should be convenient for transportation, and should not be noisy during the day with few sounds and disturbances at night. There may be least discomfort caused by horseflies, mosquitoes, wind, heat, and crawling creatures.	<p>- <i>Senāsana</i> that is far away, when a monk lives, it is difficult to go on an alms round. Their restless mind is unable to meditate</p> <p>- <i>Senāsana</i> that is near will be crowded with people, noisy and unable to meditate.</p> <p>- It is disturbed by poisonous reptiles and insects; however, it is unable to meditate.</p>	<p>3. No insects, mosquitoes, and crawling creatures bite (I) No touch caused by wind and sunshine (II)</p>	(I) <i>Senāsana</i> management according to public health measures by temples and communities	Public health measures within the temple	0	No management
					1	Chemical fogging is carried out to prevent the occurrence of adult mosquitoes.
					2	Environmental improvement has been made inside the temple to ensure cleanliness and prevent insects and crawling animals from disturbing, by providing a bright and clean environment.
					3	There are measures taken to prevent mosquitoes and insects that carry diseases.
					0	No specific place for practicing meditation
					1	There is a space for meditation practice, either a meditation hall or a courtyard/walking path for walking meditation.
			(II) Suitable conditions and environment for practicing meditation	Specific place for practicing meditation	2	Both meditation areas, sitting and walking meditations, are in the same area.
					3	Both meditation areas, sitting and walking meditations, are in the separated area.

Table 2 (Cont.)

<i>Senāsana</i> Consisting of the 5 Principles ²⁹	Explanation According to Footnotes in the <i>Tīptaka</i> ³⁰	Commentary in <i>Athakatha Visuddhimagga</i> Scriptures ³¹	Physical Interpretation Characteristics	Indicators	Scores	Descriptions
Principle 2 When a monk resides in that place, the four requisites of <i>Cāvara</i> (robes; clothing), <i>Pindapata</i> (alms-gathering), <i>Senāsana</i> (lodging), and <i>Gīlānapaccaya Bhesajja Parikkhāra</i> (support for the sick; requisites for the sick; medicine) arise without any difficulty.	<p>This refers to the four necessities of life which include <i>Civara</i> (robes; clothing), <i>Pindapata</i> (alms-gathering), <i>Senāsana</i> (lodging), and <i>Gīlānapaccaya Bhesajja Parikkhāra</i> (support for the sick; requisites for the sick; medicine; and medical equipment).</p>	<p>4. So, those who reside in that place shall not encounter the inadequacy of the four necessities of life which are <i>Civara</i> (I), <i>Pindapata</i>, <i>Senāsana</i> (II), and medicine (III).</p>	(I) There are 'Kathin' annual merit-making ceremony (<i>Kaṭhina</i>) and 'Pha Pa' Forest Robe (<i>Assāmika-vattha</i>) offering ceremonies.	The temple has a 'Kathin' merit-making ceremony and 'Pha Pa' forest robe offering during the year.	0	No 'Kathin' annual merit-making ceremony and 'Pha Pa' Forest-Robe offering ceremonies
					1	There is 'Pha Pa' Forest-Robe offering ceremonies.
					2	There is 'Kathin' annual merit-making ceremony.
					3	There are 'Kathin' annual merit-making ceremony and 'Pha Pa' Forest-Robe offering ceremonies.
			(II) Characteristics of the 'Kuti' (<i>Kuṇḍā</i>), which is a Buddhist monk's lodging	Characteristics of monk's lodging 'Kuti'	0	No monk's lodging 'Kuti'
					1	Combined monk's lodging, 'Kuti'
					2	Separated lodging 'Kuti' between monks and novices.
					3	Separated monk's lodging 'Kuti', per one monk
			(III) Receiving prompt and appropriate medical treatment from a physician in case of emergency illness	Time taken to transport emergency patients to the nearest hospital	0	> 60 minutes
					1	30-60 minutes
					2	15-30 minutes
					3	<15 minutes

Table 2 (Cont.)

<i>Senāsana</i> Consisting of the 5 Principles ²⁹	Explanation According to Footnotes in the <i>Tīpitaka</i> ³⁰	Commentary in <i>Athakatha Visuddhimagga</i> Scriptures ³¹	Physical Interpretation Characteristics	Indicators	Scores	Descriptions
Principle 3 -Senior monks (<i>Thera Bhikkhu</i>) in that place (<i>Senāsana</i>) are one who has great knowledge the scripture (<i>Gantha</i>), expert on the Discipline; and expert on the <i>Pāli</i> language (<i>Mātikā</i>). (Teacher Qualifications)	Senior monk, Buddhist monks of senior rank, of at least ten years' standing. who is scholar, expert on the <i>Pāli</i> language (<i>Mātikā</i>), <i>Tīpitaka</i> scripture, and know the Fundamental Precepts (<i>Pātimokkha</i>) etc.	5. So, in <i>Senāsana</i> there are senior monks (I) scholar who has accomplished the study of the Scriptures (<i>Pariyatti Dhamma</i>) (II), expert on the scripture, expert on the Discipline; and expert on the <i>Pāli</i> language.	(I) There are senior monks in the temple.	Senior monks (<i>Thera Bhikkhu</i>)	0	No senior monk
					1	1 Senior monk
					2	2-5 Senior monks
					3	> 5 Senior monks
			(II) The highest educational qualification in Dharma, Dharma Department, of senior monks	<i>Dhamma</i> level (<i>Dhammika</i>) (Level I-III)	0	No degree
					1	<i>Dhamma</i> level: I
					2	<i>Dhamma</i> level: II
					3	<i>Dhamma</i> level: III
			(II) The highest educational qualification in Dharma, <i>Pāli</i> Department, of senior monks	Graduates of Pāli	0	No degree
					1	Graduates of Pāli III
					2	Graduates of Pāli IV-VI
					3	Graduates of Pāli VII- IX
			(II) The highest educational qualification in secular education, of senior monks	Secular educational qualification	0	No degree
					1	Elementary education
					2	Secondary education
					3	University education

Table 2 (Cont.)

<i>Senāsana</i> Consisting of the 5 Principles ²⁹	Explanation According to Footnotes in the <i>Tīpitakā</i> ³⁰	Commentary in <i>Atthakatha Visuddhimagga</i> Scriptures ³¹	Physical Interpretation Characteristics	Indicators	Scores	Descriptions
Principle 4 Monks may approach those mentioned senior monks (<i>Thera Bhikkhu</i>) at an appropriate time and ask, "What are the words of the Buddha? What is the essence of the words of the Buddha?"	Monks in that temple have opportunities to engage in Dhamma inquiry (<i>Paripucchā</i>), questioning about the Dhamma that they are doubtful about to the senior monk, at the appropriate time.	5. These topics of discipline are learned by those who ask, "What is the meaning of this chapter?" "How is there an explanation?" at the appropriate time (I).	(I) Young monks meet and discuss Dhamma with the senior monks*	Frequency of Dhamma inquiry of young monks	0 1 2 3	No inquiry Inquire only on one occasion out of three. Inquire only on two occasions out of three. Inquire all three occasions
* The three occasions to inquire about Dhamma are: The Fundamental Precepts (<i>Pātimokkha</i>) The Buddhist holy day (<i>Uposathadivasa</i>) After morning-evening chanting (<i>Sāyabhāḍa</i>)						
Principle 5: Those senior monks will reveal what has not yet been revealed, make difficult points understandable, and alleviate doubts about the Dhamma that have troubled those monks. (Teaching methods)	The senior monk can answer (<i>Visajjana</i>) any questions about Dhamma that the monks may have. He can also recommend the appropriate scripture or even a teacher who can resolve any doubts the monk may have about a particular topic of Dhamma.	5. Those senior monks are willing to reveal what has not yet been revealed, which will clarify, what has not yet been clarified (I) and help alleviate doubts (II).	(I) The teacher uses the Buddhist approaches to make it easy for the students to understand. (II) The teacher can recommend textbooks or teachers who can help clarify the student's understanding by answering questions related to Dhamma.	Teaching methods according to the Buddhist approaches ³³ Recommendation of textbooks and teachers	0 1 2 3 0 1 2 3	Do not use Buddhist teaching methods. Using any one of Buddhist teaching methods. Using combination of two Buddhist teaching methods. Using combination of three Buddhist teaching methods. No recommendation. Recommendation of documents and textbooks. Recommendation of teachers. Recommendation of documents textbooks and teachers.

²⁹ Ang. TSK. Tti. 24/17-18.³⁰ Ang. TSK. Tti. 24/17/18³¹ Somdephraputhajarn (Arj Asabhummathera), *Visuddhimagga*, 212.³² Ibid., 204-211.³³ Phrakhruphiphithamaporn (Boontae Srithong), "An Application of Buddha's Style of Teaching of Moral Teaching Monks in Schools at Phichit Province," (Master's Thesis, Mahachulalongkornrajavidyalaya University, 2013).

5. Buddhist Temple *Sappàya* Index Analysis

5.1 Define the indicators for measuring the level of *Sappàya* in Buddhist temples according to Table 2, using a total of 15 indicators. Each indicator has 4 score levels ranging from 0 to 3. Use the indicator scores, with assigned weight values, to create a vector data layer for each principle (1 to 5). Calculate the *Sappàya* index of Buddhist temples using equations^{34, 35} (equation 2).

$$BTSI = \frac{\sum_{i=1}^n W_i X_i}{\sum W_i} \quad (2)$$

Where
 BTSI = Buddhist Temple *Sappàya* Index (BTSI)
 n = The number of indicators
 W_i = The weight assigned to indicator i
 X_i = The score assigned to indicator i, ranging from 0 to 3

5.2 Create vector layer from the indicators scores of the five principles of *senàsana*, as a percentage value of 1-100. Next, classify the attributes data of the *Sappàya* percentage value into three levels (high, moderate, and low) based on the obtained scores. Finally, create BTSI vector layer using the open-source QGIS software. (Table 3)

Table 3: Buddhist Temple *Sappàya* Index (BTSI)

Buddhist Temples <i>Sappàya</i> Scores (Percentage)	<i>Sappàya</i> Levels	Buddhist Temple <i>Sappàya</i> Index (BTSI)
> 80.0	High	1
50.0 – 80.0	Moderate	2
< 50.0	Low	3

5.3 Present the results of analyzing of Buddhist Temple *Sappàya* Index with a BTSI map and descriptive narration.

³⁴ Kang T. Chang, *Introduction Geographic Information Systems*, 9th edition, 408, 409.

³⁵ Sanjai Klindao, *Spatial Management Concepts and Methodology*, 2012.

Results and discussion

Theravada Buddhist temples under the *Mahānikāya* Sect, 95 temples were investigated, out of which sixty-three temples were in eighteen sub-districts of Mueang Nan District, and thirty-two were in Phu Phiang District. The highest temple density, 24 temples, was observed in the Nai Wiang sub-district, Mueang Nan District, with a density of 4.2 temples per square kilometer. In contrast, the sub-districts of Sanian in Mueang Nan and Namkian in Phu Phiang District had the lowest density of temples, with only one temple each (Figure 2).

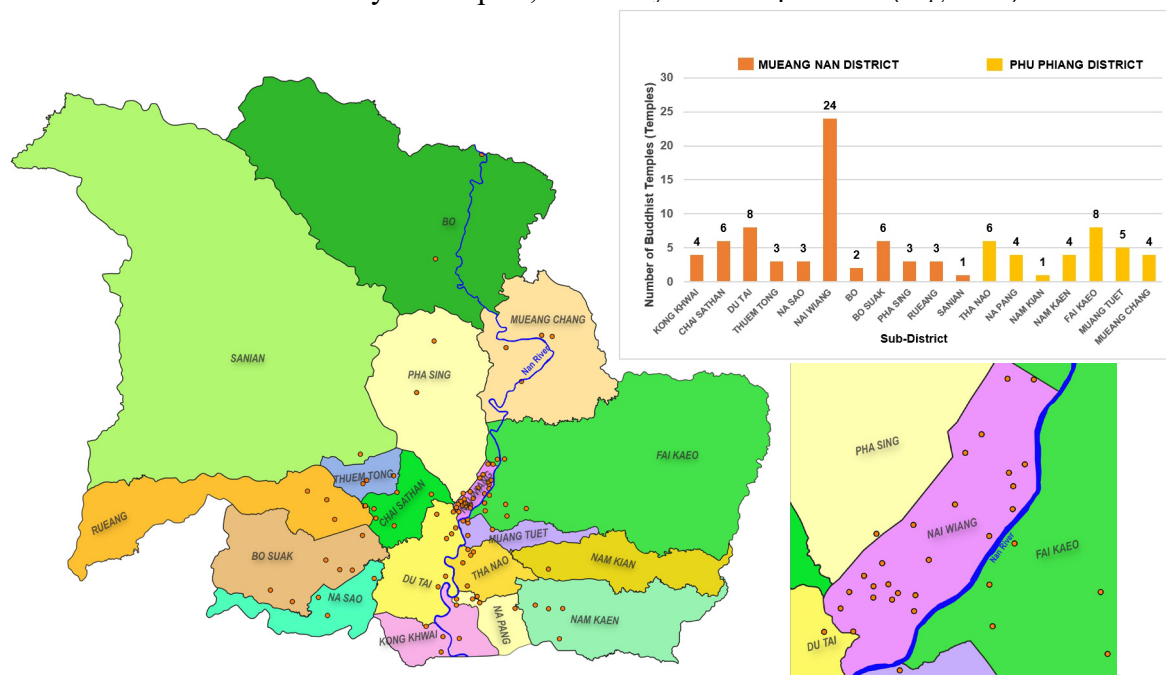


Figure 2 The Buddhist temples as categorized by sub-district in Mueang Nan and Phu Phiang district, Nan Province

1. Buddhist Temples Layout

1.1 Royal monastery: Wat Phrathat Chae Haeng, Wat Phrathat Chang Kham, and Wat Phraya Phu, have a long history that is closely related to the history and founding of Nan city. Within the Royal monastery, the layout of the *senāsana* /buildings is clearly zoning. The *Buddhāvāsa* (residence of the Buddha) is located the in the front or middle zone of temple area and is surrounded by the *Sanghāvāsa* building (the monastic precincts) and usable area. The principal structures in *Buddhāvāsa* area consist of Phra *Uposatha* hall, Phra Chedi, Phra *Vihāra*, Drum/Bell tower and sermon halls. Additionally, a Phra *Uposatha* as the main lodging (*Senāsana*) and Phra *Vihāra* are built to enshrine various sacred objects such as the "Phra *Vihāra* Phra Chao Tan Chai" at Wat Phrathat Chang Kham and Wat Phrathat Chae Haeng and the "Phra *Vihāra* Phra Norn" (the reclining Buddha image) at Wat Phrathat Chae Haeng. The monastic precincts area of three royal monastery are not only living quarters for the monks but also an enormous monk's scriptures classroom building. Wat Phrathat Chang Kham has the largest scriptures classroom building being able to accommodate up to 400 monk's students. Also, Wat Phrathat Chae Haeng and Wat Phraya Phu have a scriptures classroom building individually being able to accommodate 200 monk's students (Figure 3).



Figure 3 Royal monastery temple layout, Mueang Nan and Phu Phiang Districts, Nan Province

1.2 Community monastery

A study of 30 temples under community monastery indicates that they could be classified into two groups, based on their main *senāsana* /buildings in the *Buddhāvāsa* area.

1. The first group consists of temples that have main *senāsana* /buildings in the *Buddhāvāsa* area according to the handbook for the maintenance and preservation of religious sites, with ten temples clearly defined zoning and five temples unclearly defined zoning temple layouts. Ten temples, the *Buddhāvāsa* area is in the front or central zone of the temple area and is surrounded by *senāsana* /buildings of the *Sanghāvāsa* and utility area. Another five temples that have an unclearly defined zoning due to the limitation of space within the temple walls boundary, with the average area 4.38 rai (0.7 hectare). (Figures 4 and 5)

2. The second group consists of temples that have some *senāsana* /buildings in the *Buddhāvāsa* area according to the handbook for the maintenance and preservation of religious sites, with five clearly defined zoning and ten unclearly defined zoning temple layouts. Twelve Buddhist temples do not have pagodas (Chedi), as these temples do not contain any relics of the Buddha's relics or those whose relics should be enshrined. Five Buddhist temples do not have separate shrines apart from the *Uposatha* hall and *Vihāra* due to the space constraints. Typically, the *Uposatha* hall is used for *Saṅgha* activities, which are prescribed in the Buddhist scriptures to be performed within the *Simā* (consecrated area) boundary. 'Simā', refers to designated area within the *Uposatha* hall district³⁶. Buddhist discipline, 'Simā' is considered more important than *Uposatha* hall, as it prescribes the area for *Saṅgha* activities. *Uposatha* hall or *Vihāra* is simply built on the *Simā* area to provide shelter from the sun and rain³⁷. Therefore, the Buddhist temples in this group has *Vihāra* built on the *Simā* area, which serve two purposes: as a place for monks to perform religious activities according to the Doctrine and the Discipline, and as a temple for traditional merit-making activities for Buddhists. (Figures 6 and 7).

³⁶ Phrabrahmagunabhorn (P.A. Payutto), *Dictionary of Buddhism*, 2010.

³⁷ Phramahaphothiwiwongsachārya (Thongdee Suratecho), *Thai -Pali Dictionary*, 675.



Figure 4 Community monastery layout with the main *senàsana* /buildings in the *Buddhāvāsa* area with clearly defined zoning.

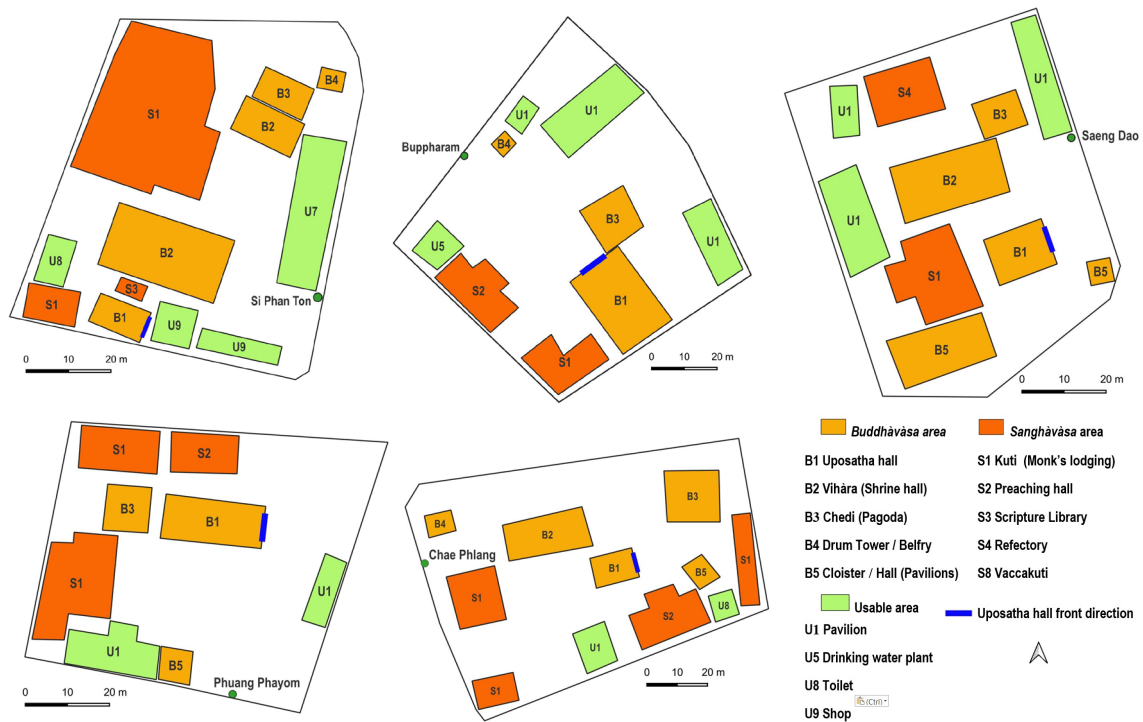


Figure 5 Community monastery layout with the main *senāsana* /buildings in the *Buddhāvāsa* area with unclearly defined zoning.



Figure 6 Community monastery layout with some *senāsana* /buildings in the *Buddhāvāsa* area with clearly defined zoning.



Figure 7 Community monastery layout with some *senāsana* /buildings in the *Buddhāvāsa*

2. Buddhist Temples *Sappàya* Index (BTSI)

Overall, it was found that Buddhist temples with a high level of *sappàya* index, which have a score of over 80.0 percent, amounted to eight temples, including three temples under royal monastery and five temples under community monastery. Meanwhile, there were forty-four temples that had a moderate level of *sappàya* index score ranging from 50.0 to 80.0 percent, which were all temples under community monastery. Additionally, there were forty-three temples that had a low level of *sappàya* index score, below 50.0 percent. They were all temples under community monastery (Table 4 and Figure 8).

All three temples under royal monastery (Wat Luang) have a high level of *Sappàya* index, accounting for 100 percent of the temples classified as such in the study area. Among them, Wat Phraya Phu had the highest level of *sappàya* index with a score of 94.9 percent, followed by Wat Phrathat Chae Haeng with a score of 92.7 percent, and Wat Phrathat Chang Kham with a score of 80.3 percent, respectively.

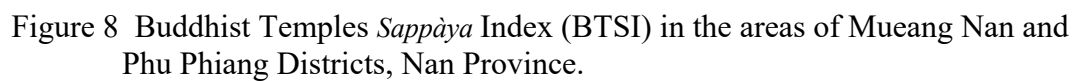
Five community monasteries (Wat Raad) have a high level of *Sappàya* index, accounting for 5.5 percent of the total number of community monasteries, with the *Sappàya* scores ranging from 93.2 to 81.3 percent. It was found that all these temples are in Mueang Nan District where *Saigha* administrative of Nan Province residing within, except Wat Pa Kho Wang which is the 99th temple of Wat Nong Pah Pong (Luang Pu Chah *Subhaddo*). Therefore, the internal management of Wat Pa Kho Wang is managed according to the principles of the parent temple, which prioritize the practice of *Ganthadhura* and *Vipassanādhura*. Forty temples with a moderate level of *sappàya* index were identified, with a total *sappàya* index score ranging from 50.0 to 80.0 percent, accounting for 47.8 percent of the total number of the community monasteries. The low level of *sappàya* index, with a total *sappàya* index score of less than 50.0 percent, were found in forty-three temples, accounting for 46.7 percent of the community monasteries in the study area. (Table 5 and Figure 8).

Table 4 Buddhist Temples *Sappàya* Index according to the five principles of *senāsana*.

Types of Temples	Buddhist Temples <i>Sappàya</i> Index (Temples)		
	High	Moderate	Low
Royal monastery	3	-	-
Community monastery	5	44	43
Total	8	44	43

Table 5 Buddhist Temples *Sappàya* Index of temples under community monastery.

Buddhist Temples <i>Sappàya</i> Index	<i>Sappàya</i> Scores (Percentage)	Numbers of Buddhist Temples	Percentage of the number of community monastery
High	> 80.0	5	5.5
Moderate	50.0 – 80.0	44	47.8
Low	< 50.0	43	46.7
Total		92	100



Conclusions and Recommendations

Buddhist Temples Layout

The Buddhist temples in Mueang Nan and Phu Phiang districts, Nan Province, are classified into two groups, based on their main *senāsana* /buildings in the *Buddhāvāsa* area.

1. A group of Buddhist temples that have main *senāsana* /buildings in the *Buddhāvāsa* area. All three temples under royal monastery are in this group, In addition, there are 15 other temples under community monastery in this group, with ten temples clearly defined zoning and five temples unclearly defined zoning temple layouts. The main *senāsana* /buildings in the *Buddhāvāsa* area include Phra *Upasatha* Hall/*Upasatha* hall, Phra chedi/Chedi, *Vihāra*, Drum tower/Belfry, and various pavilions.

2. A group of Buddhist temples that have some of their main *senāsana* /buildings located in the *Buddhāvāsa* area. Within this group, there are fifteen temples under community monastery, which five temples are clearly defined zoning and others are unclearly defined zoning temple layouts. These temples have *Upasatha* hall, drum towers/belfry, and various pavilions in the *Buddhāvāsa* area. However, only two temples have Chedi while the remaining do not. Furthermore, nine temples have *Vihāras*, while the others do not.

Buddhist Temples *Sappāya* Index of (BTSI)

There are eight Buddhist temples with a high level of the *sappāya* index, with the score of *sappāya* greater than 80 percent. Three of these temples are in the group of royal monasteries. They have the *sappāya* score ranging from 94.9 to 80.3 percent (High *sappāya*). In addition, this group includes five temples under community monastery, with the *sappāya* score ranging from 93.2 to 81.3 percent (High *sappāya*).

There are forty-four Buddhist temples with a moderate level of the *Sappāya* index, scoring from 79.6 to 51.4 percent (Moderate *sappāya*). Additionally, there are forty-three temples with a low level of the *sappāya* index, scoring from 49.9 to 16.8 percent (Low *sappāya*). Most of the Buddhist temples with a moderate or low *sappāya* index have zero score for the indicator on the fifth principle of the *senāsana*, which is the presence of senior monks (*Thera Bhikkhu*) in the temple. This accounts for 29.8 percent of all the community monastery examined in this study.

Recommendations

1. Studying the fundamental teachings of Buddhism through the physical characteristics of temples, as a place of worship, is the way to assist the public or those involved in the management of Buddhist temples in understanding the context of constructing or arranging the layout of new or existing Buddhist artifacts within the temple. This arrangement should be aligned with the principles of *Dhamma* in Buddhism to benefit the monks, who are the primary residents of the temple and one of the three gem of Buddhism alongside Buddha and *Dhamma*.

2. To improve the level of *sappāya* in Buddhist temples where there are no senior monks or only one resident monk, and to align with the five principles of *senāsana*, it is necessary to implement short and long-term management measures to increase the number of senior monks and monks in these temples. This includes supporting the education of existing monks, especially in the areas of *Dhamma* and Pali studies, that are essential components of the current education system for Thai Buddhist monks.

3. The Buddhist Temples *Sappaya* Index (BTSI) obtained from this study is considered as one technique/method of study that interprets, compiles, and physicalizes the five principles of *senāsana* into a physical characteristic in the form of “Buddhist Temple *Sappaya* Index (BTSI)”. It is integrated with the application of geo-information technology which can be used for managing, organizing, and making decisions for environmental management of Buddhist temples in accordance with the principles of Buddhism. Moreover, Buddhist monks who are interested in *Dhamma* studies and practicing *Dhamma* can use it as a preliminary guideline for making decisions on residing in a particular temple for the sake of practicing and propagating *Dhamma*.

Bibliography

- Bureau, Crown P. *Handbook for the Maintenance and Preservation of Religious Sites*. Bangkok: Crown Property Bureau, 2016.
- Chang, Kang T. *Introduction Geographic Information Systems*. 9th edition. New York: McGraw-Hill Publishing Company Limited, 2019.
- Department of Religious Affairs. *History of Temples throughout the Kingdom*. Bangkok: Religious Printing House, 1989.
- Digital Globe. *U.S.A. World View-3 Data Sheet*. Accessed October 24, 2022. <https://www.digitalglobe.com>.
- Geo-Informatics and Space Technology Development Agency. *Space Technology and Geoinformatics Textbook*. Bangkok: Amarin Printing Pub Co., Ltd, 2009.
- Google Maps. *2022 Google Map*. Accessed October 24, 2022. <http://www.google.co.th/maps/dir/>.
- Jamornmann, Utumporn. *Questionnaire: Construction and Use*. 6th edition. Bangkok: Funny Publishing Limited, 2001.
- Klindao, Sanjai. *Spatial Management Concepts and Methodology*. Bangkok: O.S. Printing House, 2012.
- Lillesand, Thomas M., Ralph W. Kiefer, and John Wiley. *Remote Sensing and Image Interpretation*. 4th edition, New York: John Wiley & Sons, 2000.
- Mahachulalongkornrajavidyalaya. *Tipitaka in Thai Mahachulalongkornrajavidyalaya Edition*. Bangkok: Mahachula Printing Press, 1996.
- National Office of Buddhism. *Buddhist Register Database*. Accessed March 3, 2019. <https://www.onab.go.th/th/page/item/index/id/1>.
- Phrabrahmagunabhorn (P.A. Payutto). *Dictionary of Buddhism*. 18th edition. Bangkok: Permsap Printing House, 2010.
- Phrakhruphiphitthammaporn (Boontae Srithong). *An Application of Buddha's Style of Teaching of Moral Teaching Monks in Schools at Phichit Province*. Ayutthaya: Mahachulalongkornrajavidyalaya University, 2013.
- Phramahaphothiwongsachārya (Thongdee Suratecho). *Thai-Pali Dictionary*. Bangkok: Phanyamit Printing Co., Ltd., 2016.

Somdetphraputhajarn (Arj Asabhummathera). *Visuddhimagga. 12th edition*. Bangkok: Thana Press Co., Ltd., 2017.

Suriyaphiwat, Watcharaporn. *Statistics for Biological Science*. Bangkok: Chulalongkorn University Press , 2009.

Thompson, Steven K. *Sampling*. USA: John Wiley & Sons, Inc, 1992.