

Research on building a set of criteria to evaluate the effectiveness of environmental protection management of Vietnam's natural heritage sites

Nguyen Thi Thanh An^{1*}, Phung Van Khoa¹, Kieu Thi Duong¹, Phi Dang Son¹,
Do Anh Tuan¹, Bui Chinh Nghia², Nguyen Quoc Hieu², Hoang Thi Thanh Nhan²,
Nguyen Thanh Vinh², Tran Thi Kim Tinh², Dang Thi Tuoi², Nguyen Quang Huy³

¹Vietnam National University of Forestry

²Ministry of Agriculture and Environment

³Center for Green Growth and Sustainable Nature Conservation

Nghiên cứu đề xuất xây dựng bộ tiêu chí đánh giá hiệu quả quản lý bảo vệ môi trường khu di sản thiên nhiên của Việt Nam

Nguyễn Thị Thanh An^{1*}, Phùng Văn Khoa¹, Kiều Thị Dương¹, Phí Đăng Sơn¹,
Đỗ Anh Tuấn¹, Bùi Chính Nghĩa², Nguyễn Quốc Hiệu², Hoàng Thị Thanh Nhân²,
Nguyễn Thành Vĩnh², Trần Thị Kim Tinh², Đặng Thị Tươi², Nguyễn Quang Huy³

¹Trường Đại học Lâm nghiệp

²Bộ Nông nghiệp và Môi Trường

³Trung tâm Tăng trưởng xanh và Bảo tồn thiên nhiên bền vững

*Corresponding author: anntt@vnuf.edu.vn

<https://doi.org/10.55250/jo.vnuf.10.1.2025.042-051>

ABSTRACT

Developing a set of criteria to evaluate the effectiveness of environmental protection management of natural heritage sites is extremely necessary in the context that Vietnam's heritage sites are facing many risks and are increasingly degrading. The set of criteria was researched and developed specifically for natural heritage sites, which are proposed conservation areas based on data collection results at two natural heritage sites, Bach Ma National Park and Than Sa - Phuong Hoang Nature Reserve. The main methods used in this study include the method of inheriting domestic and foreign research documents combined with the Delphi method through 3 rounds of interviews based on quantitative assessment results through statistical values and experiences of a group of 20 experts including scientists working at research agencies, policy-making agencies, and managers of conservation areas. Through the process of eliminating and supplementing the results based on statistical values and opinions of the expert group, a set of criteria and indicators was formed. The set of criteria and indicators consists of 2 parts (1) Basic information table; (2) Evaluation criteria and indicators table including 35 criteria based on 5 management activities. Each criterion has 4 answers corresponding to points from 0 to 3 options for answers a to d.

TÓM TẮT

Xây dựng bộ tiêu chí đánh giá hiệu quả quản lý bảo vệ môi trường của các khu di sản thiên nhiên là hết sức cần thiết trong điều kiện các khu di sản của Việt Nam đang phải đối mặt với nhiều rủi ro và ngày càng xuống cấp. Bộ tiêu chí được nghiên cứu và hình thành dành riêng cho các khu di sản thiên nhiên là các khu bảo tồn được đề xuất dựa trên kết quả thu thập dữ liệu tại 2 khu di sản thiên nhiên đó là Vườn quốc gia Bạch Mã và Khu Bảo tồn thiên nhiên Thần Sa – Phương Hoàng. Các phương pháp chính được sử dụng trong nghiên cứu này bao gồm phương pháp kế thừa tài liệu nghiên cứu trong và ngoài nước kết hợp với phương pháp Delphi qua 3 vòng phỏng vấn dựa vào kết quả đánh giá định lượng thông qua các giá trị thống kê và kinh nghiệm của nhóm chuyên gia gồm 20 người bao gồm các nhà khoa học làm việc tại cơ quan nghiên cứu, cơ quan hoạch định chính sách, và các nhà quản lý của các khu bảo tồn. Trải qua quá trình loại bỏ và bổ sung kết quả dựa vào các giá trị thống kê và các ý kiến của nhóm chuyên gia đã hình thành nên bộ tiêu chí và chỉ số. Bộ tiêu chí và chỉ số gồm 2 phần (1) Bảng thông tin cơ bản; (2) Bảng tiêu chí và chỉ số đánh giá gồm 35 tiêu chí dựa trên 5 hoạt động quản lý. Mỗi tiêu chí có 4 câu trả lời tương ứng điểm từ 0 đến 3 lựa chọn cho đáp án a đến d.

Article info:

Received: 21/02/2025

Revised: 26/03/2025

Accepted: 21/04/2025

Keywords:

Conservation areas, criteria, delphi method, natural heritage sites.

Từ khóa:

Khu bảo tồn, khu di sản thiên nhiên, phương pháp delphi, tiêu chí.

1. INTRODUCTION

Vietnam is a country with rich natural heritage (NH) potential, encompassing forest resources, important wetlands, unique natural landscapes and vital marine ecosystems that are important to our lives. The NH sites provides not only livelihoods for people and revenues for eco-tourism industry but also embody national pride, reflecting the country's historical and cultural identity. According to the Law on Environmental Protection No. 72/2020/QH14, Section 4 of the Law on Environmental Protection, a NH site is defined as, "*National parks, nature reserves, species - habitat conservation areas, landscape protection areas are established according to the provisions of the law on biodiversity, forestry and fisheries; scenic spots recognized as cultural heritage are established according to the provisions of the law on cultural heritage*". And according to the provisions of Clause 1, Article 16, Section 1, Chapter III of the Law on Biodiversity, as the mentioned NH sites are formally defined as conservation areas (CA). This study focuses on NH sites designated as conservation areas (CAs) under these legal provisions.

As of 2024, Vietnam has 8 world heritage sites, including two 2 natural heritage sites Phong Nha - Ke Bang National Park and Cat Ba Archipelago - Ha Long Bay [1]. While Vietnam's protected areas are quite rich and diverse, contributing to the conservation and development of natural heritages, challenges persist due to inconsistent management practices and a lack of standardized tools to assess the effectiveness of environmental protection efforts of natural heritage sites. This gap threatens the core ecological and cultural values of these sites; therefore, development of unified criteria and indicators framework for evaluating the effectiveness of environmental protection management of the natural heritage sites is essential. In the world, to evaluate the effectiveness of existing conservation area management, it has been proposed to evaluate the effectiveness of conservation area management and consider it as the main factor in the work of "Evaluating the level of good management of existing conservation areas"

[2]. In this article, the assessment of management effectiveness will be understood as "*The assessment of how well protected areas (NH sites) are being managed – primarily the extent to which management is protecting values and achieving goals and objectives*" [2].

The objective of this study is to develop a set of criteria to help evaluate the management effectiveness of system of NH sites and to evaluate each NH site separately over time, thereby providing the current status of management activities including completeness, suitability and proposing recommendations to achieve the set goals of the NH sites [2, 3].

2. RESEARCH METHODS

2.1. Study sites

The article is based on data collected in two the protected areas, Bach Ma National Park (Hue city) and Than Sa - Phuong Hoang Nature Reserve (Thai Nguyen province). The selection of research sites is based on the following criteria: (1) Regarding the type of natural heritage: Bach Ma National Park and Than Sa - Phuong Hoang Nature Reserve represent different levels of the protected area system in Vietnam. (2) Regarding regional characteristics: Bach Ma National Park in the Central region and Than Sa - Phuong Hoang Nature Reserve in the Northern region. (3) Regarding biodiversity: Bach Ma National Park and Than Sa - Phuong Hoang Nature Reserve have high biodiversity and conservation value with many endangered, precious and rare species. (4) Regarding ecological landscape: These CAs not only have beautiful ecological landscapes that attract tourists but also have cultural and historical values. Bach Ma National Park was established in 1986, with an area of 37,423.10 hectares, and is one of six national parks under the Ministry of Agriculture and Rural Development. While, established on December 1, 1999 Than Sa - Phuong Hoang Nature Reserve is managed by Thai Nguyen province. Than Sa - Phuong Hoang Nature Reserve has the total area of 18,704.89 hectares of a typical rocky mountain forest ecosystem with many beautiful and majestic natural landscapes and high

conservation value of very rich and diverse flora and fauna.

2.2. Methods

Data collection methods

* *Consultation method*: Consulting with officers of the two CAs on the management activities currently being implemented at the NH sites and collecting available the data sources of the NH sites and reports on the NH sites management effectiveness assessment. The consultation activities were conducted at Bach Ma National Park in early August 2024 and at the Than Sa - Phuong Hoang Nature Reserve in October 2024.

* *Secondary data collection method*: In addition to an reviewing the international criteria and indicators commonly applied in the world number of criteria and indicators, scoring methods, evaluation methods and notes, the some additional contents are adjusted and added to be suitable for the practical situation in Vietnam aligned with the instructions in Article 21 of Decree No. 08/2022/ND-CP dated January 10, 2022 detailing a number of articles of the Law on Environmental Protection. Documents were collected at the 2 CAs, including legal basis of the CAs; management plans of the CA; Activities related to environmental protection management; The resources of the CA, e.g. financial resources, annual revenue and expenditure, infrastructure, other funding sources, equipment, human resources (payroll, contract labor), quality of human resources, etc.; Activities related to conservation and development of biological resources; Activities related to forest development, restoration of forest ecosystems; Activities related to management and use of natural ecosystem services (forest environmental services); Activities related to investigation and monitoring of resources; Activities related to scientific research, training and annual professional development of staff of the CA; Activities related to identifying threats from local socio-economic development projects, disasters and response solutions; Activities related to propaganda and education of the

law, awareness raising and environmental education; Community support activities; the CA reports on activities of forest rangers, propaganda and environmental education activities, etc., and activities to evaluate the management effectiveness of the CA that have been implemented so far.

Method of developing criteria and indicators - Delphi method

The Delphi method aims to collect opinions from members who are experts in different fields, managers of the CAs until a consensus can be reached. The careful selection of experts participating in the interview rounds is a very important factor. At the end of each interview round in the form of a questionnaire, experts will be provided with a summary table of the members participating in the previous interview round. This shows that during the processing process, some criteria may be eliminated and new criteria may be added. Finally, the process will stop after the opinions of the experts are relatively consistent through the average, median and change of opinions of the experts. Generally, it is hardly to get consensus from a group of experts from different fields, especially when they have many different views and opinions [4]. To overcome these problems, Delphi is a suitable method for collecting knowledge from experts in different fields and at different times. This method allows the systematic collection of assessments of experts on a topic, a reliable qualitative research method for decision making and achieve group consensus at different scales. Murry and Hammors [5] pointed out four important features when using the Delphi method: (1) Anonymity of expert group members; (2) The interactive process takes place through rounds allowing experts to change their views; (3) Feedback control: Informing participants about the views of other members through a summary table of the results from the previous interview round and providing opportunities for the expert group to clarify or change their views; (4) Group feedback results will be statistically processed: The results will allow quantitative analysis and interpretation of the data.

Forming a team of experts:

The total number of scientists/managers working directly in the selected conservation areas was 20 people to form a group including:

Scientists in the fields of Forest Resource Management, Biodiversity, Silviculture, Tourism, Law, Economics: 8 people. These people were from Ministry of Agriculture and Rural Development (MARD), Ministry of Natural Resources and Environment (MONRE), University of Forestry (UF), Thai Nguyen University of Agriculture and Forestry.

There were 12 management staff at the NH areas including: Bach Ma National Park, Cuc Phuong National Park, Than Sa - Phuong Hoang Nature Reserve, Nam Xuan Lac Species and Habitat Conservation Area, Hang Kia - Pa Co Nature Reserve, Ngoc Son - Ngo Luong Nature Reserve, Bac Huong Hoa Nature Reserve, Dakrong Nature Reserve, Phong Nha - Ke Bang National Park, Bidoup - Nui Ba National Park, Vu Quang National Park, Bac Kan Provincial Forest Protection Department.

Delphi research process: A 3-round questionnaire was sent to the expert group. The experts were asked to rate the criteria on a 5-point Likert scale, where: 1 – very irrelevant criteria; 5 – very relevant criteria.

Round 1 interview: Using a questionnaire listing the expected criteria sent to the expert group. If the experts rated ≤ 3 , they were asked to answer why they gave a low score and at the end of the questionnaire there was a section for the experts to add the currently missing criteria to evaluate the effectiveness of the management of the NH area. The results in round 1 were analyzed, synthesized, collected, and arranged into a questionnaire for the second round.

Round 2 interview: The goal of round 2 was to use the revised questionnaire after round 1 to achieve consensus or stability among the experts. The format of the second round interview questionnaire included the first round interview questions and the additions and amendments after the first round and the average and columns on statistical values.

Round 3 interview: The purpose of this

round was to see whether the experts had changed their opinions or not. Thus, at the end of round 3, a set of criteria for evaluating the effectiveness of management and protection of natural heritage environment has been established.

Statistical analysis method: Descriptive statistics: Calculate the mean, median, standard deviation and interquartile range (IQR) through quartiles. Cronbach's Alpha test to test, analyze and evaluate the reliability of the scale. The purpose of this test is to find out whether the observed variables measure the same concept to be measured. If the Cronbach's Alpha coefficient is from 0.9 or higher: the measurement scale is very good (excellent); From 0.8 to 0.9: good measurement scale; From 0.7 to 0.8: good measurement scale. This coefficient is from 0.6 or more to be a qualified measurement scale. Intra-class Correlation Coefficient (ICC) to assess the consistency or appropriateness of measurements performed by many people. This coefficient is from 0.6 or more to be a qualified measurement scale. Intra-class Correlation Coefficient (ICC) to assess the consistency or appropriateness of measurements performed by many people. This coefficient described the tightness of units in the same group. The absolute value of the ICC coefficient is in the range of 0 - 1. Cicchetti (1994) proposed the scale for the ICC index as follows: < 0.40 - poor; From 0.40 to 0.59 - Moderate; From 0.60 to 0.74 - Good; From 0.75 to 1.00 - Very good [6].

Thus, the criteria retained satisfy the following statistical values: mean value was greater than 4; Standard deviation was greater than 1 and IQR was greater than 1. In addition, Cronbach's alpha coefficient must be 0.6 or higher and ICC coefficient - this was an index showing that the average value was reliable when using many people for calculation - was 0.6 or higher.

3. RESULTS AND DISCUSSION

3.1. Building interview questionnaire

The questionnaire was developed based on documents collected at the two protected

areas and a unified framework for assessing protected area management effectiveness proposed by the IUCN World Commission on Protected Areas (WCPA) with the aim of providing general guidance in developing assessment systems and promoting basic standards for assessment and reporting [7].

The initial questionnaire consisted of 2 parts: (1) General information: including information related to the research topic, interview objectives and information of interviewees; (2) Interview content: (2) Interview content: covering 6 management contents with a total of 54 criteria.

Table 1. Management activities and criteria

No	Management activities	Criteria
1	Context	9
2	Planning	6
3	Inputs	5
4	Management process	7
5	Output	16
6	Outcome	11
Sum		54

After the research team proposed the questionnaire as shown in Table 1, a workshop was held to provide feedback on the questionnaire with the participation of forestry, tourism experts and conservation area

managers. The workshop resulted in suggestions to revise the questionnaire including 6 management activities and 51 criteria (Table 2).

Table 2. Criteria for first interview round

No	Management activities	Criteria
1	Management Status	8
2	Planning	7
3	Inputs	7
4	Management process	9
5	Output	9
6	Outcome	11
Sum		51

3.2. Synthesize and analyze interview forms through the interviewing rounds

Round 1 interview:

The summary of the expert group's assessment results was given in the Table 3. In

this table, the AV column is the average score of the experts, MD is the median value, SD is the standard deviation and IQR is the interquartile range.

Table 3. Summary of expert group's evaluation results after first interview round

No	Management activities	AV		TV		SD		IQR	
		Min	Max	Min	Max	Min	Max	Min	Max
1	Management Status	4.35	4.55	4	5	0.22	0.67	1	1
2	Planning	3.95	4.90	4	5	0.31	0.68	0	1
3	Inputs	3.45	4.40	3.5	5	0.59	1.39	1	2
4	Management process	4.25	4.65	4	5	0.50	0.91	1	1
5	Output	3.70	4.70	4	5	0.47	1.35	1	2
6	Outcome	4.05	4.44	4	4	0.50	0.83	1	1

The results of the synthesis of 20 interview questionnaires indicated that the average score of the criteria ranges from 3.45 to 4.9, the highest was the criteria of the NH sites with

long-term planning (5 years or more); the lowest was the criteria of "Carrying capacity assessments have been conducted to determine resource use and ecosystem services". The

results of the median show that the values of 4 and 5 were the most scored values in all criteria. The standard deviation between the assessment scores ranges from 0.22 to 1.39. The results of the interquartile spread showed that it ranges from 0 to 2.

The Cronbach's Alpha coefficient was used to test the reliability of the scoring method of the interviewed experts on the internal consistency of the elements in the scale and of the whole scale. The Intra-class Correlation

Coefficient (ICC) was used to assess the reliability of using the average value of the experts' ratings for each criterion. The result of calculating the Cronbach's Alpha coefficient is 0.919. The Cronbach's Alpha value was used to evaluate whether the use of the Likert scale is appropriate or not. The result showed that the index = $0.92 > 0.9$ or in other words, the scale was very good. The next step is to calculate the ICC value, the results are given in the following Table 4.

Table 4. Results of calculating the ICC correlation coefficient of round 1 interview

	Intra-class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.170	0.099	0.315	12.425	19	950	0.000
Average Measures	0.913	0.849	0.959	12.425	19	950	0.000

Using the ICC correlation coefficient to evaluate the reliability of using the average value of experts evaluating each criterion, the coefficient showed that the ICC value (Average Measures) = $0.913 > 0.75$ was very good or it

could be said that the average value could be trusted when using many people to participate in scoring. Table 5 below summarized the criteria eliminated after the first interview round.

Table 5. Summary of criteria eliminated after first interview round

No	Management activities	Criteria	Reason for removal
1	2	2.7	AV < 4
2	3	3.2	AV < 4 and SD > 1
		3.7	AV < 4; SD > 1 and IQR = 2
3	5	5.7	AV < 4; SD > 1 and IQR = 2

The main reasons given include that not all natural heritage sites have ecotourism activities so the related criteria would not be suitable. The criteria on carrying capacity could be a new area that requires staff and budget resources to implement.

After considering the comments of the expert

group, revised criteria were proposed including the removal of some criteria, the addition of some new criteria and sending them to the expert group for a second round of interviews. A summary of the comments and the order of criteria sent for the second round of interviews were given in the following Table 6.

Table 6. Summary of criteria sent for round 2 interviews

No	Management activities	Criteria	Notes
1	Management Status	11	Added new criteria I.4; I.7; I.11; criterion 5.2 changes to I.3; criterion 6.4 changes to I.5; criterion 5.6 changes to I.8
2	Planning	4	Removed criteria 2.2; 2.4; 2.7
3	Inputs	7	Edited criteria 1.6 into additional criteria III.2; III.3; III.4; removed criteria 3.2 and 3.7
4	Management process	9	Edited criterion 5.5 into criterion IV.2; Removed criteria 4.9
5	Outcome	7	Edited criteria 6.1; 6.2; 6.6; 6.7; 6.8; 6.10; 6.11 into criteria V.1; V.2; V.3; V.4; V.5;
Sum		38	

The biggest change in the questionnaire sent to the second expert group for comments was

the change from 6 to 5 management activities and the number of remaining criteria was 38.

Round 2 interview:

The form sent for the second interview round had the order number of the first round criteria, the order number of the second round criteria, the average score of the criteria after

the first round, the median of the first round criteria and the column for the scores of the experts in the second round. The calculation results of the second round interview criteria were given in the following Table 7.

Table 7. Summary of expert group's evaluation results after round 2 interviews

No	Management activities	AV		TV		SD		IQR	
		Min	Max	Min	Max	Min	Max	Min	Max
1	Management Status	4.20	4.80	4	5	0.41	0.65	0	1
2	Planning	4.15	4.70	4	5	0.47	0.55	0	1
3	Inputs	4.30	4.55	4	5	0.50	0.70	1	1
4	Management process	4.20	4.90	4	5	0.31	0.61	0	1
5	Outcome	4.15	4.45	4	4.5	0.47	0.60	0	1

The synthesis results showed that the average score of the criteria ranged from 4.15 to 4.9 the highest is the criterion of Management process (Propaganda activities, awareness raising, disseminating laws and environmental education for local communities are carried out according to annual plan), the lowest is the criterion of outcome (Awareness of the environment/natural resources of the local community (buffer zone) of the NH sites). The results of the median showed that the values of 4 and 5 were the most scored values in all criteria. The standard deviation between

the assessment scores ranged from 0.31 to 0.70. The results of IQR showed that the range was from 0 to 1.

Use Cronbach's Alpha value to evaluate whether the use of Likert scale is appropriate or not (number of criteria is 40 cases). The test results showed that the coefficient = 0.973 > 0.9 or in other words, the scale is very good.

The study used the Intra-class Correlation Coefficient (ICC) to assess the reliability of using the mean value of the experts' ratings for each criterion. The results of the ICC coefficient calculation were given in the following Table 8.

Table 8. Results of calculating the ICC correlation coefficient of round 2 interview

	Intra-class Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.437	0.302	0.629	37.597	19	703	0.000
Average Measures	0.967	0.943	0.985	37.597	19	703	0.000

The coefficient showed that the ICC value (Average Measures) = 0.967 > 0.75 was very good or it could be said that the average value could be trusted when using many people to participate in scoring.

Round 3 interview:

The expert group's evaluation opinions combined with the workshop results, the research group proposed a third set of interview

questions, which was also the last time to reaffirm the management content and criteria to build the indicators. For this interview, the main goal was to find out whether the experts' opinions have changed or not (mainly interested in a downward trend). If the score of a criterion had more than 3 experts (> 15%) changing to a lower score, it was necessary to consider re-evaluating the appearance of that criteria.

Table 9. Summary table of the number of criteria sent for round 3 interviews

No	Management activities	Criteria
1	Management Status	10
2	Planning	4
3	Database	5
4	Management process	10
5	Outcome	6
Sum		35

Similar to round 2 interview but here there were columns related to the average score of each criterion, the second assessment score of the experts corresponding to each criterion and the last column will be the column for the experts' scores on each criterion. After sending the third interview to the expert group, the results were obtained, all criteria satisfied the average score > 4, the indexes of standard deviation and spread all met the requirements, no criterion had more than 3 experts changing their opinions, so the research group finalized the number of criteria according to 5 management activities as shown in Table 9. The next task of the research group was to propose criteria to evaluate the effectiveness of management and environmental protection of NH sites.

3.3. Proposing a set of criteria and indicators to evaluate the effectiveness of environmental protection management of NH

The development of a set of criteria and indicators to assess the effectiveness of environmental management and protection of NH sites was based on reference to criteria such as the WWF's Rapid Assessment and Prioritization Method (RAPPAM) [8] to identify important protected areas that are threatened in the protected area system, to detailed monitoring systems such as the EoH system developed for UNESCO's world NH sites [9] and especially the application of the METT index [2, 3, 7, 10]. The criteria for assessing effectiveness of environmental protection management were arranged to be completed as easily as possible to assess the management effectiveness of the NH site. When developing this system of criteria and indicators, it was necessary to integrate the legal documents and regulations for the special-use forest system management and integrate with the regulations in the Law on Environmental Protection 2020, Decree 08/2022/ND-CP dated January 10, 2022 of the Government on detailing a number of articles of the Law on Environmental Protection. In addition, in Official Dispatch No. 1225/BTNMT-TCMT the Ministry of Natural Resources and Environment had provided instructions on organizing the

implementation of the content of management and environmental protection of NH sites in the Law on Environmental Protection. Therefore, to develop a set of criteria on environmental management and protection effectiveness, the research team relied on the management activities of the CAs that had been operating up to now, integrating with the guidance in the legal documents as presented above. Thus, developing a set of criteria for assessing environmental protection management effectiveness would help: (1) Providing a consistent data system to assess effectiveness of environmental protection management of NH system; (2) Easy for NH facility staff to implement with no need of additional funding or other resources; (3) Flexible to suit specific conditions; (4) Easy to understand for non-experts; (5) Ability to provide scores if required – used to classify between NH sites within the same system; (6) Based on a 4-item written response (index) scoring system, questions must be answered (unless not applicable) and require the selection of a single answer. Thus, a 4-point scale was chosen. The indicators selected here, if possible, will be quantitative criteria, while in other cases qualitative criteria may be used. However, to minimize the bias of the assessors, the criteria set is designed to provide evidence for why the above answer was chosen. This section helps the assessors make additional comments and provide the basis on which the assessor has based his/her choice. For example, the current system assumes that all questions include issues of equal importance, while in reality this is not necessarily the case. Therefore, the scores provide a better assessment of effectiveness if calculated as a percentage for each of the 5 elements of management activities.

The criteria and indicators set consists of two main parts: (1) Basic information table including basic information about the NH sites, characteristics and management objectives; (2) Criteria and assessment index table including 35 criteria based on 5 management activities. For each criterion, just tick, choose one answer option from 4 answers from a to d (simple scoring system

from 0 for answer a and 3 for answer d). The score is 0 (poor) to 3 (excellent). In addition, there are instructions explaining more clearly about the main contents in each criterion, providing more information and confirming the assessment score. After completing the assessment, calculate the total score for the criterion of each management content and (if) the question is not relevant/not assessed, the maximum total score for the

management content is also adjusted and deducted accordingly. The final assessment score is calculated as a percentage and will be divided by the maximum score to assess management competency.

Table 10 presents the set of proposed criteria for evaluating the effectiveness of environmental management and protection of NH sites that has been developed by this research.

Table 10. The set of criteria for evaluating the effectiveness of environmental protection management of NH sites

No	Management activities	Criteria
1	MANAGEMENT STATUS	Management activities of the NH Management Board are carried out in accordance with the provisions of law.
2		Improved work on demarcating natural heritage sites
3		Management activities ensure effectiveness according to the zoning functions of the NH sites.
4		Resolving conflicts over resource uses and land disputes
5		Control illegal activities
6		Benefit sharing mechanism with stakeholders
7		Collaborate with stakeholders in managing NH sites
8		The organizational structure of the NH site ensures the completion of assigned functions and tasks.
9		The management board of the NH site has a report evaluating the proposed activities according to regulations.
10		The management board of the NH site has internal regulations and operating rules of the unit that meet the requirements of environmental management and protection.
11	PLANNING	Stakeholders are provided with full information on the objectives and management plans of the Natural Heritage site.
12		The management board of the NH site implements the annual plan in accordance with the approved plan.
13		The management plan of the NH site has integrated the results of the NH site's scientific investigation/research program.
14		The management plan of the NH site has been implemented and is consistent with local/regional development programs and projects.
15	DATABASE	The management board of the NH site has data on inventory and assessment of environmental changes and natural values that need to be preserved and protected (according to the criteria for establishing the site) every 5 years.
16		The management board of NH sites has inventory data and socio-economic development activities assessment data that have negative impacts on the NH environment every 5 years.
17		The management board of NH sites has data on investigation and evaluation of exploitation and use of NH resources and ecosystem services every 5 years.
18		The management board of the NH site has data to investigate and evaluate the activities of restoring the natural ecosystem, protecting and conserving the natural values and biodiversity of the NH site every 5 years.
19	MANAGEMENT PROCESS	Participation of organizations/communities/individuals in environmental protection management activities of NH sites
20		Propaganda activities, raising awareness, disseminating laws and environmental education for local communities are carried out according to the annual plan.
21		Programs and documents for conservation education and awareness raising, and dissemination of laws in environmental education are developed and updated.
22		Scientific research cooperation programs and projects are implemented at NH sites.
23		Training, capacity building, professional skills
24		Activities to protect and preserve the values of nature and biodiversity
25		Natural ecosystem restoration activities

No	Management activities	Criteria
26	OUTCOME	Activities of exploiting and using resources and ecosystem services of NH sites
27		Carry out the tasks of constructing, maintaining and repairing infrastructure serving the management of NH sites according to plan.
28		Repair and equip necessary equipment to serve the management of NH sites according to plan.
29		Ensure budget for management activities according to established objectives
30		The management objectives of the NH site have been achieved.
31		threats to NH site have been controlled
32		The non-monetary values of the NH sites are maintained and improved.
33		Awareness of the environment/natural resources of the local community (buffer zone) of the NH site is raised
34		The lives of employees of the NH sites are improved.
35		The benefits from the NH site to the local community are improved.

4. CONCLUSIONS

Building a set of criteria to evaluate the effectiveness of management to evaluate the effectiveness of management and environmental protection of NH sites classified as CAs is essential because it not only shows the effectiveness of management and environmental protection of the system of CAs nationwide but also demonstrates the connectivity and integration between legal documents to better management of the NH sites. After studying documents and collecting data at 2 NH sites, Bach Ma National Park and Than Sa - Phuong Hoang Nature Reserve, applying the Dephil process through 3 rounds of interviews and organizing consultation workshops, the research team proposed a set of criteria based on 5 groups of the NH management activities with 35 criteria for evaluating the effectiveness of management and environmental protection. When developing a set of assessment criteria, the following principles will be followed: simplification easy to apply, easy to implement, no need of additional funding, repeatability (assessment at different NH sites and the same site at different time), flexibility in using criteria if appropriate, and a scoring system to demonstrate the level of effectiveness compared to the optimal management level. However, to have a comprehensive view and fully implement an assessment, it is necessary to have assessment guidelines that include requirements, assessment teams and explanations as well as providing evidence and conducting trial assessments at NH sites that are conservation

areas, after this proposed criteria and indicator set was verified and adjusted, it could be used for the assessment of the CAs national-wide.

Acknowledgment

This work was built on the research results of the topic entitled: "Research on scientific and practical bases to propose and test a set of criteria for evaluating the effectiveness of management and environmental protection of natural heritages in Vietnam". The authors would like to express their deep gratitude to the Ministry of Natural Resources and Environment, the Forestry University, and the two management boards of the protected areas, Bach Ma National Park and Than Sa - Phuong Hoang Nature Reserve, for their support and coordination in helping the research team carry out the contents.

REFERENCES

- [1]. World Heritage Centre (2025). World Heritage List.
- [2]. Marc Hockings (2006). Evaluating Effectiveness: A framework for assessing management effectiveness of protected areas. IUCN.
- [3]. Fiona Leverington, Marc Hockings & Katia Lemos Costa (2008). Management effectiveness evaluation in protected areas: a global study. World Commission on Protected Areas Brisbane, Australia.
- [4]. Wu-Yuin Hwang, Nian-Shing Chen & Rueng-Lueng Hsu (2006). Development and evaluation of multimedia whiteboard system for improving mathematical problem solving. Computers & Education. 46(2): 105-121.
- [5]. John W Murry Jr & James O Hammons (1995). Delphi: A versatile methodology for conducting qualitative research. The review of higher education. 18(4): 423-436.
- [6]. Dante Cicchetti, Fred A Rogosch & Sheree L Toth (1994). A developmental psychopathology perspective on depression in children and adolescents. In: Handbook of depression in children and adolescents. Springer. 123-141.
- [7]. Marc Hockings, Sue Stolton & Nigel Dudley (2000). Evaluating effectiveness: a framework for assessing the management of protected areas. IUCN.